IBM WebSphere Application Server - Express for Distributed Platforms, Version 8.5

Monitoring

Note

Before using this information, be sure to read the general information under “Notices” on page 271.

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Contents

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- To send comments on articles in the WebSphere Application Server Information Center
  1. Display the article in your Web browser and scroll to the end of the article.
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Print sections directly from the information center navigation

PDF books are provided as a convenience format for easy printing, reading, and offline use. The information center is the official delivery format for IBM WebSphere Application Server documentation. If you use the PDF books primarily for convenient printing, it is now easier to print various parts of the information center as needed, quickly and directly from the information center navigation tree.

To print a section of the information center navigation:

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Chapter 1. Overview and new features for monitoring

Use the links provided in this topic to learn about monitoring capabilities.

New for administrators: Improved monitoring and performance tuning
A section of this topic describes what is new in the area of performance tuning.

Performance: Resources for learning

Use the following links to find relevant supplemental information about performance. The information resides on IBM® and non-IBM Internet sites, whose sponsors control the technical accuracy of the information.

These links are provided for convenience. Often, the information is not specific to the IBM WebSphere® Application Server product, but is useful for understanding the product. When possible, links are provided to technical papers and Redbooks® that supplement the broad coverage of the release documentation with in-depth examinations of particular product areas. The following sections are covered in this reference:

View the following links for additional information:

- "Request metrics "
- "Monitoring performance with third-party tools"
- "Tuning performance"
- "Java™ performance resource"

Request metrics

- Systems Management: Application Response Measurement (ARM)

  The Open Group ARM specifications.

Monitoring performance with third-party tools

- IBM Search Solutions.

  Use IBM's Global Solution Directory to find a list of IBM's business partners that offer performance monitoring tools compliant with WebSphere Application Server.

Tuning performance

- Hints on Running a high-performance web server

  Read hints about running Apache on a heavily loaded web server. The suggestions include how to tune your kernel for the heavier TCP/IP load, and hardware and software conflicts.
- Performance Analysis for Java websites

  Offers clear explanations and expert practical guidance on performance analysis for Java-based websites. It offers extensive appendices, including worksheets for capacity planning, checklists to help you prepare for different stages of performance testing, and a list of performance-test tool vendors.
- AIX AIX® documentation

  View the entire AIX software documentation library for releases 4.3, 5.1, and 5.2.
- WebSphere Application Server Development Best Practices for Performance and Scalability

  Describes development best practices for web applications with servlets, JavaServer Pages files, JDBC connections, and enterprise applications with Enterprise JavaBeans components.
- WebSphere Application Server V6 Scalability and Performance Handbook
- WebSphere tuning for the impatient: How to get 80% of the performance improvement with 20% of the effort

Java™ performance resource

- IBM developerWorks®

Search the IBM developerWorks website for a list of garbage collection documentation, including “Understanding the IBM Java Garbage Collector”, a three-part series. To locate the documentation, search on “sensible garbage collection” in the developerWorks search application.

Review “Understanding the IBM Java Garbage Collector” for a description of the IBM verbose:gc output and more information about the IBM garbage collector.

Chapter 2. Monitoring the Liberty profile

You can use the `monitor-1.0` feature to monitor the server runtime environment.

About this task

To enable monitoring for yourLiberty profile, you add `monitor-1.0` server feature in the `server.xml` file.

The `monitor-1.0` feature provides monitoring support for user runtime components.

- JVM
- Web applications
- Thread pool

For more details, see Liberty profile: Server features.

Procedure

1. Add the `monitor-1.0` feature and the monitoring starts.
2. Monitoring data is reported as standard MXBeans.
3. You can use JConsole to connect to JVM and look at the performance data by clicking each attribute of the MXBean.

   The MXBeans for monitoring are as following:

   - `WebSphere:type=JvmStats`
   - `WebSphere:type=ServletStats,name=*`
   - `WebSphere:type=ThreadPoolStats,name=DefaultExecutor`
4. Optional: The same data is available with traditional PMI Mbean (Perf MBean).

Liberty profile: JVM monitoring

This topic provides an overview of `JvmStats` MXBean for JVM monitoring in the Liberty profile.

EachLiberty profile instance has one `JvmStats` MXBean.

The `ObjectName` for identifying JVM MXBean is:
`WebSphere:type=JvmStats`

Available Instances = 1

This MXBean is responsible for reporting performance of JVM. Following attributes are available for JVM.

Heap Information

- Amount of free heap available (in Bytes)
- Total used memory by JVM for from heap (in Bytes)
- Heap size (in Bytes)

.

CPU Information

- Percentage of CPU consumed by this JVM

.

Garbage Collection (GC)Information

- Number of times that GC happened since JVM started

- Total time taken by GC activity

.

General Information

- Time in milliseconds since JVM has started.

.

Counter definitions (Attributes to MXBean)

- `Heap`: Heap size used for current JVM.
- `FreeMemory`: Free heap available for current JVM.
- `UsedHeap`: Used heap for current JVM.
- `ProcessCPU`: Percentage of CPU used by JVM process.
- `GcCount`: Number of times GC has happened since JVM starts.
- `GcTime`: Total accumulated value of GC time.
- `UpTime`: Time in milliseconds, since JVM has started.

.

Methods Summary for JvmMXBean

Table 1. Methods Summary for JvmMXBean. This table describes all available methods of `JvmMXBean`. The first column lists each method and the second column explains the meaning of the method.

Method	Description
`long getFreeMemory()`	Returns Free memory in Bytes.
`long getGcCount()`	Return count, specifying number of times that GC has triggered since JVM starts.
`long getGcTime()`	Returns total collection time in milliseconds.
`long getHeap()`	Returns Total Heap Size Bytes.
`double getProcessCPU()`	Returns percentage CPU Consumed by JVM.
`long getUpTime()`	Reports time in milliseconds, since JVM has started.
`long getUsedMemory()`	Returns Used Heap in Bytes.

Liberty profile: Web application monitoring

This topic provides an overview of servlet MXBean for web application monitoring of the Liberty profile.

Performance data is available for each Servlet in the Web Application. Each servlet has its own MX Bean.

The `ObjectName` for identifying each servlet MXBean is:

```
WebSphere:type=ServletStat,name=<AppName>.<ServletName>
```

For example:

```
WebSphere:type=ServletStat,name=snoop.Alpine Snoop Servlet
WebSphere:type=ServletStat,name=MyApp.MyServlet
```

This MXBean is responsible for reporting `ServletStats` for each servlet. Following key data is available for `ServletStats` MXBean:

- Request Count
- Response Time
- Servlet Name

- Application Name

Counter definitions (Attributes to MXBean)

- `AppName`: Name of the application.
- `ServletName`: Name of the servlet.
- `RequestCount`: Number of hits to this servlet.
- `ResponseTime`: Average response time (nano-seconds).
- `Description`: Description of counter.
- `RequestCountDetails`: `RequestCount` details including last time stamp..
- `ResponseTimeDetails`: `ResponseTime` details including number of snapshot taken, min, max values and so on.

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Methods Summary for ServletStatsMXBean

Table 2. Methods Summary for ServletStatsMXBean. This table describes all available methods of `ServletStatsMXBean`. The first column lists each method and the second column explains the meaning of the method.

Method	Description
`public String getDescription()`	Returns description.
`public long getRequestCount()`	Returns Request Count for specified servlet.
`public double getResponseTime()`	Returns Response Time for specified servlet.
`public String getServletName()`	Returns name of the servlet.
`public String getAppName()`	Returns name of the application.

Liberty profile: ThreadPool monitoring

This topic provides an overview of `ThreadPool` MXBean for thread pool monitoring in the Liberty profile.

All Web Requests executes in thread pool, named **Default Executor** thread pool. You can monitor usage of **Default Executor** threadpPool using `ThreadPoolMXBean`.

The `ObjectName` for identifying MXBean for thread pool is :

```
<p>WebSphere:type=ThreadPoolStats,name=Default Executor
```

Key Performance data available for ThreadPool are:

- Threads in the pool which represents the pool size.
- Active threads which are serving requests.

Attributes for ThreadPool

- `ActiveThread`
- `PoolSize`
- `PoolName` (Only supports Default Executor thread pool)

.

Methods Summary for ThreadPoolMXBean

Table 3. Methods Summary for ThreadPoolMXBean. This table describes all available methods of `ThreadPoolMXBean`. The first column lists each method and the second column explains the meaning of the method.

Method	Description
`public String getPoolName()`	Returns name of the thread pool, which is **`Default Executor`** at present.

Table 3. Methods Summary for ThreadPoolMXBean (continued). This table describes all available methods of `ThreadPoolMXBean`. The first column lists each method and the second column explains the meaning of the method.

Method	Description
`public int getActiveThreads()`	Returns number of active threads.
`public int getPoolSize()`	Return size of the thread pool.

Chapter 3. How do I monitor?

Follow these shortcuts to get started quickly with popular tasks.

When you visit a task in the information center, look for the **IBM Suggests** feature at the bottom of the page. Use it to find available tutorials, demonstrations, presentations, developerWorks articles, Redbooks, support documents, and more.

Enable PMI using the administrative console

Monitor performance with Tivoli® Performance Viewer

Use request metrics to measure application flow

Chapter 4. Monitoring end user response time

To analyze website response from a client viewpoint, use Tivoli Monitoring for Transaction Performance.

About this task

Monitoring system response time provides an external perspective of how the overall website responds and performs from a client viewpoint. It is important to understand the load and response time on your site. You have some options when monitoring at this level.

Procedure

- Use Tivoli Monitoring for Transaction Performance to enable you to inject and monitor synthetic transactions, helping you identify when your website experiences a problem.
- You might also use other performance monitoring tools.

Chapter 5. Monitoring overall system health

Monitoring overall system health is fundamentally important to understanding the health of every system involved with your system. This includes web servers, application servers, databases, back-end systems, and any other systems critical to running your web site.

Before you begin

If any system has a problem, it might cause the `servlet is slow` message to appear. IBM and several other business partners leverage the WebSphere APIs to capture performance data and to incorporate it into an overall 24-by-7 monitoring solution. WebSphere Application Server provides Performance Monitoring Infrastructure (PMI) data to help monitor the overall health of the WebSphere Application Server environment. PMI provides average statistics on WebSphere Application Server resources, application resources, and system metrics. Many statistics are available in WebSphere Application Server, and you might want to understand the ones that most directly measure your site's resources to detect problems.

About this task

Table 4. Monitoring overall system health. To monitor overall system health, monitor the following statistics at a minimum:

Metric	Meaning
Average response time	Include statistics, for example, servlet or enterprise beans response time. Response time statistics indicate how much time is spent in various parts of WebSphere Application Server and might quickly indicate where the problem is (for example, the servlet or the enterprise beans).
Number of requests (transactions)	Enables you to look at how much traffic is processed by WebSphere Application Server, helping you to determine the capacity that you have to manage. As the number of transactions increase, the response time of your system might be increasing, showing the need for more system resources or the need to retune your system to handle increased traffic.
Number of live HTTP sessions	The number of live HTTP sessions reflects the concurrent usage of your site. The more concurrent live sessions, the more memory is required. As the number of live sessions increase, you might adjust the session time-out values or the Java virtual machine (JVM) heap available.
Web server thread pools	Interpret the web server thread pools, the web container thread pools, and the Object Request Broker (ORB) thread pools, and the data source or connection pool size together. These thread pools might constrain performance due to their size. The thread pools setting can be too small or too large, therefore causing performance problems. Setting the thread pools too large impacts the amount of memory that is needed on a system or might cause too much work to flow downstream if downstream resources cannot handle a high influx of work. Setting thread pools too small might also cause bottlenecks if the downstream resource can handle an increase in workload.
The web and Enterprise JavaBeans (EJB) thread pools	
Database and connection pool size	
Java virtual memory (JVM)	Use the JVM metric to understand the JVM heap dynamics, including the frequency of garbage collection. This data can assist in setting the optimal heap size. In addition, use the metric to identify potential memory leaks.
CPU	You must observe these system resources to ensure that you have enough system resources, for example, CPU, I/O, and paging, to handle the workload capacity.
I/O	
System paging	

To monitor several of these statistics, WebSphere Application Server provides the Performance Monitoring Infrastructure to obtain the data, and provides the Tivoli Performance Viewer in the administrative console to view this data.

Procedure

1. Enable PMI through the administrative console to begin data collection.
2. Use Tivoli Performance Viewer, IBM Tivoli Optimizer for WebSphere Application Server, or some other third-party performance monitoring and management solutions to monitor performance.
3. Extend monitoring capabilities by developing your own monitoring applications or extending PMI.

Performance Monitoring Infrastructure (PMI)

Use this page to learn about Performance Monitoring Infrastructure and other tools to help monitor the overall health of the application server.

A typical web system consists of a web server, application server, and a database. Monitoring and tuning the application server is critical to the overall performance of the web system. Performance Monitoring Infrastructure (PMI) is the core monitoring infrastructure for WebSphere Application Server and WebSphere family products like Portal, Commerce, and so on. The performance data provided by WebSphere PMI helps to monitor and tune the application server performance.

When tuning the WebSphere Application Server for optimal performance, or fixing a poorly performing Java Platform, Enterprise Edition (Java EE) application, it is important to understand how the various run time and application resources are behaving from a performance perspective. PMI provides a comprehensive set of data that explains the runtime and application resource behavior. For example, PMI provides database connection pool size, servlet response time, Enterprise JavaBeans (EJB) method response time, Java virtual machine (JVM) garbage collection time, CPU usage, and so on. This data can be used to understand the runtime resource utilization patterns of the thread pool, connection pool, and so on, and the performance characteristics of the application components like servlets, JavaServer Pages (JSP), and enterprise beans.

Using PMI data, the performance bottlenecks in the application server can be identified and fixed. For instance, one of the PMI statistics in the Java DataBase Connectivity (JDBC) connection pool is the *number of statements discarded from prepared statement cache*. This statistic can be used to adjust the prepared statement cache size in order to minimize the discards and to improve the database query performance. PMI data can be monitored and analyzed by Tivoli Performance Viewer , other Tivoli tools, your own applications, or third party tools. Tivoli Performance Viewer is a graphical viewer for PMI data that ships with WebSphere Application Server. Performance advisors use PMI data to analyze the run-time state of the application server, and provide tuning advice to optimize the application server resource utilization.

PMI data can also be used to monitor the health of the application server. Some of the health indicators are CPU usage, Servlet response time, and JDBC query time. Performance management tools like Tivoli Monitoring for Web Infrastructure and other third party tools can monitor the PMI data and generate alerts based on some predefined thresholds.

PMI architecture

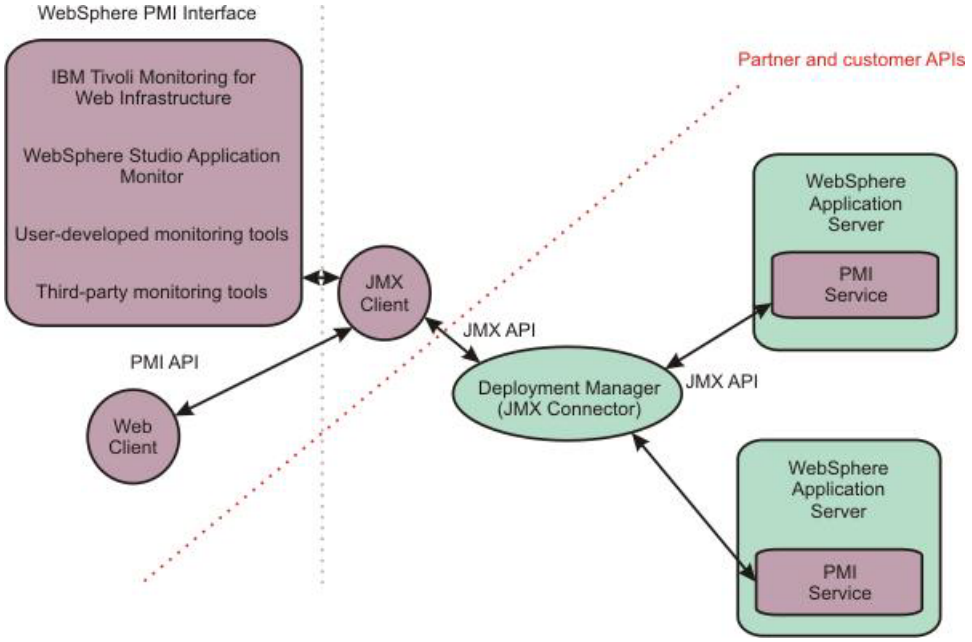
The Performance Monitoring Infrastructure (PMI) uses a client-server architecture.

The server collects performance data from various WebSphere Application Server components. A client retrieves performance data from one or more servers and processes the data. WebSphere Application Server, Version 6 supports the Java Platform, Enterprise Edition (Java EE) Management Reference Implementation (JSR-77).

In WebSphere Application Server, Version 6 and later, PMI counters are enabled, based on a monitoring or instrumentation level. The levels are None, Basic, Extended, All, and Custom. These levels are specified in the PMI module XML file. Enabling the module at a given level includes all the counters at the given level plus counters from levels following the given level. So, enabling the module at the extended level enables all the counters at that level plus all the basic level counters as well.

JSR-077 defines a set of statistics for Java EE components as part of the StatisticProvider interface. The PMI monitoring level of Basic includes all of the JSR-077 specified statistics. PMI is set to monitor at a *Basic* level by default.

As shown in the following figure, the server collects PMI data in memory. This data consists of counters such as servlet response time and data connection pool usage. The data points are then retrieved using a web client, a Java client, or a Java Management Extensions (JMX) client. WebSphere Application Server contains Tivoli Performance Viewer, a Java client which displays and monitors performance data. See the "Monitoring performance with Tivoli Performance Viewer" on page 223, "Third-party performance monitoring and management solutions" on page 178, and "Developing your own monitoring applications" on page 195 topics for more information on monitoring tools.



The figure shows the overall PMI architecture. On the right side, the server updates and keeps PMI data in memory. The left side displays a web client, a Java client, and a JMX client retrieving the performance data.

PMI and Java Platform, Enterprise Edition 1.4 Performance Data Framework

Java Platform, Enterprise Edition (Java EE) 1.4 includes a Performance Data Framework that is defined as part of JSR-077 (Java 2 Platform, Enterprise Edition Management Specification).

This framework specifies the performance data that must be available for various Java EE components. WebSphere PMI complies with Java EE 1.4 standards by implementing the Java EE 1.4 Performance Data Framework.

In addition to providing statistics that are defined in Java EE 1.4, PMI provides additional statistics about the Java EE components, for example, servlets and enterprise beans, and WebSphere Application Server-specific components, for example, and thread pools.

The following diagram shows how the PMI and Java EE Performance Data Framework fit into WebSphere Application Server.

PMI data classification

This topic describes the Performance Monitoring Infrastructure (PMI) data classification.

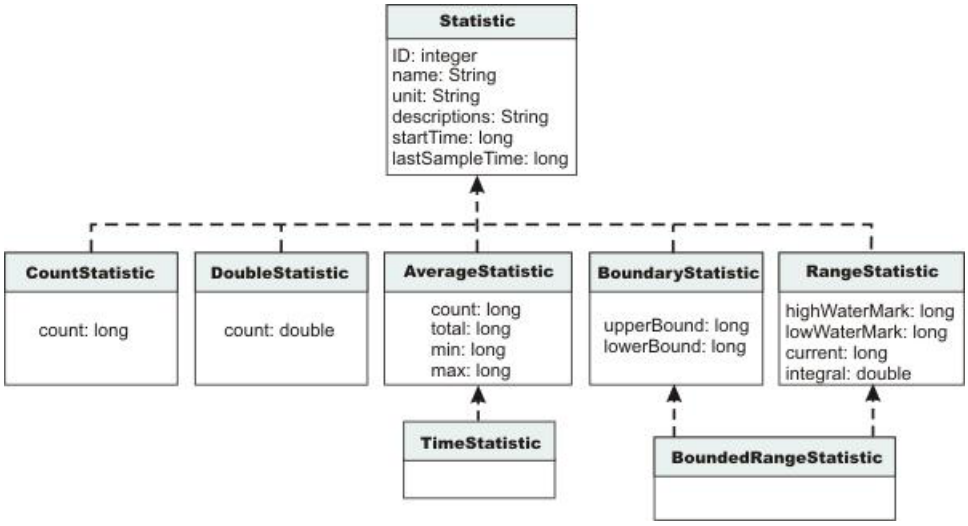
The static component consists of a name, ID and other descriptive attributes to identify the data. The dynamic component contains information that changes over time, such as the current value of a counter and the time stamp associated with that value.

The PMI data can be one of the following statistic types (these statistic types follow the J2EE 1.4 Performance Data Framework):

Table 5. PMI data statistic types. PMI must be enabled before the server starts. If PMI is enabled after the server is started, the server needs to be restarted to start the PMI.

Statistic type	Description	Example
CountStatistic	Represents a running count of a given value.	Number of Servlet requests
AverageStatistic	Represents a simple average. Keeps track of total, count, min, and max. The average can be derived by total and count. (This type is WebSphere extension to J2EE Performance Data Framework)	Average HttpSession size in bytes.
TimeStatistic	Same as AverageStatistic, except that the unit of measure is milliseconds or seconds.	Average Servlet response time.
RangeStatistic	Represents a time-weighted average. Keeps track of current, low water mark, high water mark, time-weight total, and integral.	Number of concurrent Servlet requests.
BoundedRangeStatistic	Same as RangeStatistic, with lower bound and upper bound.	JDBC connection pool size.

The following diagram shows the statistic class hierarchy:



Statistic

ID A unique ID that identifies the Statistic within the given Stats (WebSphere PMI extension)

name Statistic name

unit Unit of measurement for the statistic

description
Textual description of the statistic

startTime
Time the first measurement was taken

lastSampleTime
Time the most recent measurement was taken

CountStatistic

count Count since the measurement started

DoubleStatistic

count Value since the measurement started

AverageStatistic
(WebSphere PMI extension. This is the same as the TimeStatistic defined in J2EE 1.4, except that it is used to track non-time-related measurements like byte size, etc.)

count Number of measurements

total Sum of the values of all the measurements

min Minimum value

max Maximum value

BoundaryStatistic

upperBound
Upper limit of this attribute

lowerBound
Lower limit of this attribute

RangeStatistic

current
Current® value of this attribute

lowWaterMark
Lowest value of this attribute

upperWaterMark
Highest value of this attribute

integral
Time-weighted sum of this attribute [time-weighted average = integral / (lastSampleTime - startTime] (WebSphere PMI extension)

In WebSphere Application Server, Version 4, PMI data was classified with the following types:
- Numeric: Maps to CountStatistic in the J2EE 1.4 specification. Holds a single numeric value that can either be a long or a double. This data type is used to keep track of simple numeric data, such as counts.
- Stat: Holds statistical data on a sample space, including the number of elements in the sample set, their sum, and sum of squares. You can obtain the mean, variance, and standard deviation of the mean from this data.
- Load: Maps to the RangeStatistic or BoundedRangeStatistic, based on J2EE 1.4 specification. This data type keeps track of a level as a function of time, including the current level, the time that level was reached, and the integral of that level over time. From this data, you can obtain the time-weighted average of that level. For example, this data type is used in the number of active threads and the number of waiters in a queue.

These PMI data types continue to be supported through the PMI client API. Statistical data types are supported through both the PMI API and Java Management Extension (JMX) API.

In WebSphere Application Server, Version 4 and Version 5, CountStatistic data require a `low` monitoring level, and TimeStatistic data require a `medium` monitoring level. RangeStatistic and BoundedRangeStatistic

require a high monitoring level. There are a few counters that are exceptions to this rule. The average method response time, the total method calls, and active methods counters require a high monitoring level. The Java virtual machine counters, SerializableSessObjSize, and data tracked for each individual method (method level data) require a maximum monitoring level. Also, the level maximum enables synchronized update to all the statistic types.

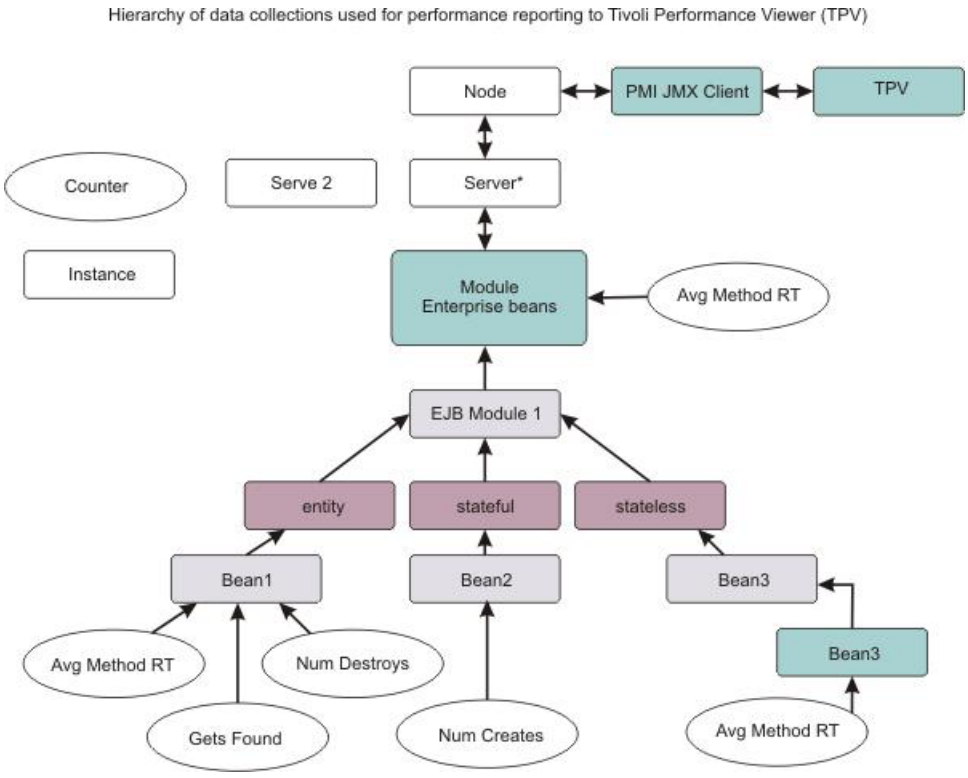
WebSphere Application Server Versions 6.0 and later deprecate the monitoring levels (Low, Medium, High, and Max) and introduces fine-grained control to enable/disable statistics individually. The fine-grained control is available under the custom option. Refer to “Enabling PMI using the administrative console” on page 182 for more details.

In order to reduce the monitoring overhead, updates to CountStatistic, DoubleStatistic, AverageStatistic, and TimeStatistic are not synchronized. Since this data tracks the total and average, the extra accuracy is generally not worth the performance cost. RangeStatistic and BoundedRangeStatistic are very sensitive; therefore, they are always synchronized. To enable synchronized updates for all the statistic types enable the “Use sequential update”option. Refer to “Enabling PMI using the administrative console” on page 182 for details.

PMI data organization

Use this page as a general overview of monitoring, data collection, and counters using Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer.

Performance Monitoring Infrastructure (PMI) provides server-side monitoring and a client-side API to retrieve performance data. PMI maintains statistical data within the entire WebSphere Application Server domain, including multiple servers. Each server organizes PMI data into modules and submodules.



Tivoli Performance Viewer, formerly Resource Analyzer, organizes performance data in a centralized hierarchy of the following objects:

- Node. A node represents a physical machine in the WebSphere Application Server administrative domain.
- Server. A server is a functional unit that provides services to clients over a network. No performance data is collected for the server itself.
- Module.

  A module represents one of the resource categories for which collected data is reported to the performance viewer. Each module has at least one configuration file in XML format. These files determine organization and lists a unique identifier for each performance data in the module. Modules include enterprise beans, JDBC connection pools, J2C connection pool, Java virtual machine (JVM) run time (including Java Virtual Machine Tool Interface (JVMTI)), servlet session manager, thread pools, transaction manager, web applications, Object Request Broker (ORB), web services gateway (WSGW), and dynamic cache.
- Submodule. A submodule represents a fine granularity of a resource category under the module. For example, ORB thread pool is a submodule of the thread pool category. Submodules can contain other submodules.
- Counter. A counter is a data type used to hold performance information for analysis. Each resource category (module) has an associated set of counters. The data points within a module are queried and distinguished by the MBean ObjectNames or PerfDescriptors. Examples of counters include the number of active enterprise beans, the time spent responding to a servlet request and the number of kilobytes of available memory.

Tivoli Performance Viewer is a thin client integrated into the WebSphere Application Server administrative console. It provides a simple viewer for the performance data provided by Performance Monitoring Infrastructure (PMI), and allows users to view and manipulate the data for counters. A particular counter type can appear in several modules. For example, both the servlet and enterprise bean modules have a response time counter. In addition, a counter type can have multiple instances within a module. In the previous figure, both the Enterprise beans module and Bean1 have an Avg Method RT counter.

Counters are enabled at the module level and can be enabled or disabled for elements within the module. For example, in the figure, if the enterprise beans module is enabled, its Avg Method RT counter is enabled by default. However, you can then disable the Avg Method RT counter even when the rest of the module counters are enabled. You can also, if desired, disable the Avg Method RT counter for Bean1, but the aggregate response time reported for the whole module no longer includes Bean1 data.

As part of a fine-grained control feature, WebSphere Application Server provides statistic sets which are pre-defined, fixed server-side sets, based on the PMI statistic usage scenarios. The PMI specification levels include: none, basic, extended, all, or custom. If you choose none, all PMI modules are disabled. Choosing basic provides the J2EE and the essential set of statistics to give you a basic level of monitoring. Selecting extended gives you the basic level of monitoring plus Work Load Monitor, Performance Advisor, and Tivoli resource models for a more robust monitoring set. Choosing `all` enables all statistics. Choosing `custom` gives you fine-grained control to enable or disable statistics individually.

There are only two states for a statistic: enabled or disabled. To provide an option to enable synchronized updates, WebSphere Application Server, provides a configuration parameter, synchronizedUpdate, at the PMI service level. When this attribute is true, all the statistic updates are synchronized. By default, the synchronizedUpdate parameter is set to false. You can select the **`Use sequential counter updates`** check box in the administrative console to enable synchronized updates.

Data collection can affect performance of the application server. The impact depends on the number of counters enabled, the type of counters enabled and the monitoring level set for the counters.

The following PMI modules are available to provide statistical data:

Enterprise bean module, enterprise bean, methods in a bean

Data counters for this category report load values, response times, and life cycle activities for enterprise beans. Examples include the average number of active beans and the number of times bean data is loaded or written to the database. Information is provided for enterprise bean methods and the remote interfaces used by an enterprise bean. Examples include the number of times a method is called and the average response time for the method. In addition, the Tivoli Performance Viewer reports information on the size and use of a bean objects cache or enterprise bean object pool. Examples include the number of calls attempting to retrieve an object from a pool and the number of times an object is found available in the pool.

JDBC connection pools

Data counters for this category contain usage information about the JDBC connection pools for a database. Examples include the number of managed connections or physical connections and the total number of connections or connection handles.

Java 2 Connector (J2C) connection pool

Data counters for this category contain usage information about the Java 2 Platform, Enterprise Edition (J2EE) Connector architecture that enables enterprise beans to connect and interact with procedural back-end systems, such as Customer Information Control System (CICS®), and Information Management System (IMS™). Examples include the number of managed connections or physical connections and the total number of connections or connection handles.

Java virtual machine API (JVM)

Data counters for this category contain memory used by a process as reported by JVM run time. Examples are the total memory available and the amount of free memory for the JVM. JVM run time also includes data from the JVMTI. This data provides detailed information about the JVM running the application server.

Servlet session manager

Data counters for this category contain usage information for HTTP sessions. Examples include the total number of accessed sessions, the average amount of time it takes for a session to perform a request, and the average number of concurrently active HTTP sessions.

Thread pool

Data counters for this category contain information about the thread pools for Object Request Broker (ORB) threads and the web container pools used to process HTTP requests. Examples include the number of threads created and destroyed, the maximum number of pooled threads allowed, and the average number of active threads in the pool.

Java Transaction API (JTA)

Data counters for this category contain performance information for the transaction manager. Examples include the average number of active transactions, the average duration of transactions, and the average number of methods per transaction.

Web applications, servlet

Data counters for this category contain information for the selected server. Examples include the number of loaded servlets, the average response time for completed requests, and the number of requests for the servlet.

Object Request Broker (ORB)

Data counters for this category contain information for the ORB. Examples include the object reference lookup time, the total number of requests, and the processing time for each interceptor.

OSGi Applications

Data counters for this category contain information for services and for bundle methods. Examples include the number of service or bundle method invocations, and the average response time of the service or bundle method.

Web services gateway (WSGW)

Data counters for this category contain information for WSGW. Examples include the number of synchronous and asynchronous requests and responses.

System data
Data counters for this category contain information for a machine (node). Examples include the CPU utilization and memory usage.

Dynamic cache
Data counters for this category contain information for the dynamic cache service. Examples include in-memory cache size, the number of invalidations, and the number of hits and misses.

Web services
Data counters for this category contain information for the Web services. Examples include the number of loaded web services, the number of requests delivered and processed, the request response time, and the average size of requests.

Alarm manager
Data counters for this category contain information for the Alarm Manager.

Object pool
Data counters for this category contain information for Object Pools.

Scheduler
Data counters for this category contain information for the Scheduler service.

You can access PMI data through the getStatsObject and the getStatsArray method in the PerfMBean. You need to pass the MBean ObjectName(s) to the PerfMBean.

Use the following MBean types to get PMI data in the related categories:

- DynaCache: dynamic cache PMI data
- EJBModule*: Enterprise JavaBeans (EJB) module PMI data (BeanModule)
- EntityBean*: specific EJB PMI data (BeanModule)
- JDBCProvider*: JDBC connection pool PMI data
- J2CResourceAdapter*: Java 2 Connectivity (J2C) connection pool PMI data
- JVM: Java virtual machine PMI data
- MessageDrivenBean*: specific EJB PMI data (BeanModule)
- ORB: Object Request Broker PMI data
- Server: PMI data in the whole server, you must pass recursive=true to PerfMBean
- SessionManager*: HTTP Sessions PMI data
- StatefulSessionBean*: specific EJB PMI data (BeanModule)
- StatelessSessionBean*: specific EJB PMI data (BeanModule)
- SystemMetrics: system level PMI data
- ThreadPool*: thread pool PMI data
- TransactionService: JTA Transaction PMI data
- WebModule*: Web application PMI data
- Servlet*: servlet PMI data
- WebServicesService: Web services PMI data
- WSGW*: Web services gateway PMI data

To use the AdminClient API to query the MBean ObjectName for each MBean type. You can either query all the MBeans and then match the MBean type or use the query String for the type only: `String query = "WebSphere:type=mytype,node=mynode,server=myserver,*";`

Set the mytype, mynode, and myserver values accordingly. You get a Set value when you call the AdminClient class to query MBean ObjectNames. This response means that you can get multiple ObjectNames.

In the previous example, the MBean types with a star (*) mean that there can be multiple ObjectNames in a server for the same MBean type. In this case, the ObjectNames can be identified by both type and name (but mbeanIdentifier is the real UID for MBeans). However, the MBean names are not predefined. They are decided at run time based on the applications and resources. When you get multiple ObjectNames, you can construct an array of ObjectNames that you are interested in. Then you can pass the ObjectNames to PerfMBean to get PMI data. You have the recursive and non-recursive options. The recursive option returns Stats and sub-stats objects in a tree structure while the non-recursive option returns a Stats object for that MBean only. More programming information can be found in “Developing your own monitoring applications” on page 195.

Enterprise bean counters

Use this page as a reference for properties of enterprise bean counters.

Counter definitions:

Table 6. Counter definitions. These counters report load values, response times, and life cycle activities for enterprise beans.

Name	Key	EJB Type	ID	Description	Type	Level	Overhead	Troubleshooting
CreateCount	beanModule.creates	Stateless Stateful Entity MDB	1	The number of times that beans were created.	CountStatistic	Basic	Low	Stateless, MDB: When this value is higher than expected, reference FreedCount and DiscardCount.
RemoveCount	beanModule.removes	Stateless Stateful Entity MDB	2	The number of times that beans were removed.	CountStatistic	Basic	Low	None.
ActivateCount	beanModule.activates	Stateful Entity	3	The number of times that beans were activated.	CountStatistic	All	Low	Stateful: When this value is higher than expected and not using failover, consider changing activation policy to ONCE. Entity: When this value is higher than expected with option A or B caching, the container cache size could be too small.
PassivateCount	beanModule.passivates	Entity	4	The number of times that beans were passivated.	CountStatistic	Basic	Low	None.
InstantiateCount	beanModule.instantiates	Stateful Entity	5	The number of times that bean objects were instantiated.	CountStatistic	All	Low	None.
FreedCount	beanModule.destroys	Stateful Entity	6	The number of times that bean objects were freed.	CountStatistic	All	Low	None.
LoadCount	beanModule.loads	Entity	7	The number of times that bean data was loaded from persistent storage.	CountStatistic	All	Low	None.
StoreCount	beanModule.stores	Entity	8	The number of times that bean data was stored in persistent storage.	CountStatistic	All	Low	If this value is higher than expected, consider using read-only setting.
ReadyCount	beanModule.readyCount	Entity	9	The number of bean instances in ready state.	RangeStatistic	Basic	High	None.

Table 6. Counter definitions (continued). These counters report load values, response times, and life cycle activities for enterprise beans.

Name	Key	EJB Type	ID	Description	Type	Level	Overhead	Troubleshooting
LiveCount	beanModule.concurrentLives	Stateless Stateful Singleton Entity MDB	10	The average number of concurrently live beans.	RangeStatistic	Extended	High	Stateless, MDB: If this value is consistently higher than pool size, consider increasing the pool size. Stateful: If this value is higher than expected, the application might be missing calls to remove method.
MethodCallCount	beanModule.totalMethodCalls	Stateless Stateful Singleton Entity MDB	11	The number of calls to the business methods of the bean.	CountStatistic	Basic	High	None.
MethodResponseTime	beanModule.avgMethodRt	Stateless Stateful Singleton Entity MDB	12	The average response time in milliseconds on the business methods of the bean.	AverageStatistic	Basic	High	None.
CreateTime	beanModule.avgCreateTime	Stateless Stateful Entity MDB	14	The average time in milliseconds for instantiate and PostConstruct.	AverageStatistic TimeStatistic	All	Max	None.
RemoveTime	beanModule.avgRemoveTime	Stateless Stateful Entity MDB	15	The average time in milliseconds for PreDestroy (including the time at the database, if any).	AverageStatistic TimeStatistic	All	Max	None.
ActiveMethodCount	beanModule.activeMethods	Stateless Stateful Singleton Entity MDB	18	The number of concurrently active methods (that is, the number of methods called at the same time).	RangeStatistic	All	High	None.
RetrieveFromPoolCount	beanModule.getsFromPool	Stateless Entity MDB	19	The number of calls retrieving object from the pool.	CountStatistic	All	Low	None.
RetrieveFromPoolSuccessCount	beanModule.getsFound	Stateless Entity MDB	20	The number of times that a retrieve found an object available in the pool.	CountStatistic	All	Low	If this value is considerably lower than RetrieveFromPoolCount, consider increasing the pool size.
ReturnsToPoolCount	beanModule.returnsToPool	Stateless Entity MDB	21	The number of calls returning an object to the pool.	CountStatistic	Extended	Low	None.

Table 6. Counter definitions (continued). These counters report load values, response times, and life cycle activities for enterprise beans.

Name	Key	EJB Type	ID	Description	Type	Level	Overhead	Troubleshooting
ReturnsDiscardCount	beanModule.returnsDiscarded	Stateless Entity MDB	22	The number of times that the returning object was discarded because the pool was full.	CountStatistic	Extended	Low	If this value is larger than expected, consider increasing the pool size.
DrainsFromPoolCount	beanModule.drainsFromPool	Stateless Entity MDB	23	The number of times that the daemon found the pool was idle and attempted to clean it.	CountStatistic	All	Low	None.
DrainSize	beanModule.avgDrainSize	Stateless Entity MDB	24	The average number of objects discarded in each drain.	AverageStatistic	All	Medium	None.
PooledCount	beanModule.poolSize	Entity MDB	25	The current number of objects in the pool.	RangeStatistic	Basic	High	None.
MessageCount	beanModule.messageCount	MDB	26	The number of messages delivered to the onMessage method of the bean.	CountStatistic	Basic	Low	None.
MessageBackoutCount	beanModule.messageBackoutCount	MDB	27	The number of backed out messages that failed to be delivered to the onMessage method of the bean.	CountStatistic	All	Low	None.
WaitTime	beanModule.avgSrvSessionWaitTime	MDB	28	The average time in milliseconds required to obtain a server session from the pool.	AverageStatistic TimeStatistic	All	Medium	None.
ServerSessionPoolUsage	beanModule.serverSessionUsage	MDB	29	The percentage of the server session pool in use.	RangeStatistic	All	High	None.
ActivationTime	beanModule.activationTime	Stateful Entity	30	The average time in milliseconds for activating a bean object.	AverageStatistic TimeStatistic	All	Medium	None.
PassivationTime	beanModule.passivationTime	Stateful Entity	31	The average time in milliseconds for passivating bean object.	AverageStatistic TimeStatistic	All	Medium	None.
LoadTime	beanModule.loadTime	Entity	32	The average time in milliseconds for loading the bean data from persistent storage.	AverageStatistic TimeStatistic	All	Medium	None.
StoreTime	beanModule.storeTime	Entity	33	The average time in milliseconds for storing the bean data to persistent storage.	AverageStatistic TimeStatistic	All	Medium	None.

Table 6. Counter definitions (continued). These counters report load values, response times, and life cycle activities for enterprise beans.

Name	Key	EJB Type	ID	Description	Type	Level	Overhead	Troubleshooting
PassivationCount	beanModule.passivationCount	Stateful	34	The number of beans that are in a passivated state.	RangeStatistic	Basic	Low	Stateful: When this value is higher than expected and not using failover, consider changing activation policy to ONCE.
ReadyCount	beanModule.methodReadyCount	Stateless Stateful	35	The number of bean instances in ready state.	RangeStatistic	Basic	High	When this value is lower than expected, consider increasing pool size.
ReadLockTime	beanModule.readLockTime	Singleton	36	The average time in milliseconds that threads wait for a read lock prior to the invocation of the Singleton methods.	TimeStatistic	Basic	Medium	WRITE is the default container-managed concurrency demarcation for all Singleton methods. If this value is higher than expected, ensure that all methods are changed to READ concurrency unless WRITE concurrency is required.
WriteLockTime	beanModule.writeLockTime	Singleton	37	The average time in milliseconds that threads wait for a write lock prior to the invocation of Singleton methods.	TimeStatistic	Basic	Medium	WRITE is the default container-managed concurrency demarcation for all Singleton methods. If this value is higher than expected, ensure that all methods are changed to READ concurrency unless WRITE concurrency is required.

Table 6. Counter definitions (continued). These counters report load values, response times, and life cycle activities for enterprise beans.

Name	Key	EJB Type	ID	Description	Type	Level	Overhead	Troubleshooting
LockCancelCount	beanModule.LockCancelCount	Singleton	38	The total number of Singleton method invocations that were canceled because they exceeded the specified Access Timeout value.	CountStatistic	Basic	Low	If this value is higher than expected, increase the Access Timeout value for this Singleton type, or change the design of the Singleton method to reduce the ReadLockTime and WriteLockTime values.
AsyncWaitTime	beanModule.asyncWaitTime	Stateless Stateful Singleton	39	The average time asynchronous methods wait on the work manager queue prior to the methods run.	TimeStatistic	Basic	High	If this value is higher than expected, increase maximum number of threads in work manager.
AsyncQSize	beanModule.asyncQSize	Stateless Stateful Singleton	40	The average size of the work manager queue for asynchronous methods.	RangeStatistic	Basic	High	If this value is higher than expected, increase maximum number of threads in work manager.
AsyncCancelCount	beanModule.asyncCancelCount	Stateless Stateful Singleton	41	The number of canceled fire and return results asynchronous methods.	CountStatistic	Basic	Low	If this value is higher than expected, review application design along with system and error logs to identify cause of method cancellation.
AsyncFNFFailCount	beanModule.asyncFNFFailCount	Stateless Stateful Singleton	42	The number of failed fire and forget asynchronous methods.	CountStatistic	Basic	Low	Review system and error logs to identify the cause of method failures.

Table 6. Counter definitions (continued). These counters report load values, response times, and life cycle activities for enterprise beans.

Name	Key	EJB Type	ID	Description	Type	Level	Overhead	Troubleshooting
AsyncFutureObjectCount	beanModule.asyncFutureObjectCount	Stateless Stateful Singleton	43	The number of server-side Future objects from fire and return results asynchronous methods. This statistic is only collected for asynchronous remote business interface methods.	CountStatistic	Basic	High	Review your application to ensure all client-side Future objects are tracked and the Future.get() method is called, where all the resources associated with the future object are released. Alternatively, reduce the futureTime attributes of the EJBAsync configuration object. Default value: 86400 (24 hours).
DiscardCount	beanModule.discards	Stateless Stateful Singleton Entity MDB	44	The number of bean instances that have been discarded.	CountStatistic	Basic	Low	Review the system and error logs to identify why the bean instances have been discarded.
MethodCalls	beanModule.methods.methodCalls	Stateless Stateful Singleton MDB	51	The number of method invocations.	CountStatistic	Basic	High	None.
MethodRt	beanModule.methods.methodRt	Stateless Stateful Singleton MDB	52	The average method response time in milliseconds. For Singleton beans this does not include any time elapsed waiting for a lock.	AverageStatistic TimeStatistic	All	Maximum	None.
MethodLoad	beanModule.methods.methodLoad	Stateless Stateful Singleton MDB	53	The number of concurrent calls to invoke the same method.	RangeStatistic	All	Maximum	None.
MethodLevelCallCount	beanModule.methodLevelCallCount	Stateless Stateful Singleton MDB	54	The number of method invocations made by WebSphere Application Server on the enterprise bean. For message driven beans, this is the number of attempts to deliver messages to the bean onMessage method of the bean.	CountStatistic	Basic	Low	None.

The EJB home object is the scope for counters, unless specified otherwise. The following table lists other possible scopes for counters, along with a list of counters that have that scope:

Table 7. Counter scopes. Other possible counter scopes

EJB Scope	Counters
EJB home object and pool object	RetrieveFromPoolCount RetrieveFromPoolSuccessCount ReturnsToPoolCount ReturnsDiscardCount DrainsFromPoolCount DrainSize PooledCount
EJB bean type	MessageCount MessageBackoutCount WaitTime ServerSessionPoolUsage PassivationCount ReadyCount AsyncWaitTime AsyncQSize AsyncCancelCount AsyncFNFFailCount AsyncFutureObjectCount DiscardCount MethodCalls MethodRt MethodLoad MethodLevelCallCount

Some of the counters can be retrieved with the use of java.management.j2ee.statistics API. The following table lists the available counters, bean type, and API.

Table 8. Enterprise bean counters statistics API. Available java.management.j2ee.statistics API for enterprise bean counters

Counter	Bean type	java.management.j2ee.statistics API
CreateCount	All	EJBStats.getCreateCount()
RemoveCount	All	EJBStats.getRemoveCount()
ReadyCount	Entity	EntityBeanStats.getReadyCount()
PooledCount	Entity	EntityBeanStats.getPooledCount()
MessageCount	MDB	MessageDrivenBeanStats.getMessageCount()
PassiveCount	Stateful	StatefulSessionBBeanStats.getPassiveCount()
MethodReadyCount	All	SessionBeanStats.getMethodReadyCount()

JDBC connection pool counters

This topic defines the JDBC connection pool counters that are used to monitor the performance of JDBC data sources

Performance Monitoring Infrastructure (PMI) collects performance data for 4.0 and 5.0 Java Database Connectivity (JDBC) data sources. For a 4.0 data source, the data source name is used. For a 5.0 data source, the Java Naming and Directory Interface (JNDI) name is used.

The JDBC connection pool counters are used to monitor the performance of JDBC data sources.

Note: With the instrumentation level set to anything other than MAX, the values may be less accurate for TimeStatistics and CountStatistics (and in the case of CountStatistics, such as numConnectionHandles, can even be negative). This is due to counters not being synchronized. Synchronizing counters is very expensive in terms of resources, so it is only done when the instrumentation level is set to MAX.

Counter definitions:

Table 9. Counter definitions. Use these counters to monitor the performance of JDBC data sources.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
CreateCount	connectionPoolModule.numCreates	1	The total number of connections created	Per connection pool	CountStatistic	All	Low
CloseCount	connectionPoolModule.numDestroys	2	The total number of connections closed.	Per connection pool	CountStatistic	All	Low
AllocateCount	connectionPoolModule.numAllocates	3	The total number of connections allocated	Per connection pool	CountStatistic	All	Low
ReturnCount	connectionPoolModule.numReturns	4	The total number of connections returned	Per connection pool	CountStatistic	All	Low
PoolSize	connectionPoolModule.poolSize	5	The size of the connection pool	Per connection pool	BoundedRangeStatistic	All	High
FreePoolSize	connectionPoolModule.freePoolSize	6	The number of free connections in the pool (apply to 5.0 DataSource only)	Per connection pool	BoundedRangeStatistic	Basic	High
WaitingThreadCount	connectionPoolModule.concurrentWaiters	7	The number of threads that are currently waiting for a connection	Per connection pool	RangeStatistic	All	High
FaultCount	connectionPoolModule.faults	8	The total number of faults, such as timeouts, in the connection pool	Per connection pool	CountStatistic	All	Low
PercentUsed	connectionPoolModule.percentUsed	9	The average percent of the pool that is in use	Per connection pool	RangeStatistic	Basic	High
PercentMaxed	connectionPoolModule.percentMaxed	10	The average percent of the time that all connections are in use	Per connection pool	RangeStatistic	All	High

Table 9. Counter definitions (continued). Use these counters to monitor the performance of JDBC data sources.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
UseTime	connectionPoolModule.avgUseTime	12	The average time a connection is used (apply to 5.0 DataSource only). Difference between the time at which the connection is allocated and returned. This value includes the JDBC operation time.	Per connection pool	TimeStatistic	All	Medium
WaitTime	connectionPoolModule.avgWaitTime	13	The average waiting time in milliseconds until a connection is granted	Per connection pool	TimeStatistic	All	Medium
ManagedConnectionCount	connectionPoolModule.numManagedConnections	14	The number of ManagedConnection objects in use for a particular connection pool (applies to V5.0 DataSource objects only)	Per connection factory	CountStatistic	All	Low
ConnectionHandleCount	connectionPoolModule.numConnectionHandles	15	The number of Connection objects in use for a particular connection pool (apply to 5.0 DataSource only)	Per connection factory	CountStatistic	All	Low
PrepStmtCacheDiscardCount	connectionPoolModule.prepStmtCacheDiscards	21	The total number of statements discarded by the least recently used (LRU) algorithm of the statement cache	Per connection pool	CountStatistic	All	Low

Table 9. Counter definitions (continued). Use these counters to monitor the performance of JDBC data sources.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
JDBCTime	connectionPoolModule.jdbcOperationTimer	22	The amount of time in milliseconds spent running in the JDBC driver which includes time spent in the JDBC driver, network, and database (apply to 5.0 DataSource only)	Per data source	TimeStatistic	All	Medium

J2C connection pool counters

Use this page as a reference for properties of J2C connection pool counters.

The Java 2 Connector (J2C) connection pool counters are used to monitor J2C connection pool performance. You can find the data using the Tivoli performance viewer and clicking ***application_server*** > **J2C connection pool**.

Counter definitions:

Table 10. Counter definitions. Use these counters to monitor J2C connection pool performance.

Name	Key	Description	Version	Granularity	Type	Level	Overhead	ID
ManagedConnectionCount	j2cModule.numManagedConnections	The number of ManagedConnection objects in use	5.0	Per connection factory	CountStatistic	All	Low	14
ConnectionHandleCount	j2cModule.numConnectionHandles	The number of connections that are associated with ManagedConnections (physical connections) objects in this pool	5.0	Per connection factory	CountStatistic	All	Low	15
CreateCount	j2cModule.numManagedConnectionsCreated	The total number of managed connections created	5.0	Per connection factory	CountStatistic	Basic	Low	1
CloseCount	j2cModule.numManagedConnectionsDestroyed	The total number of managed connections destroyed	5.0	Per connection factory	CountStatistic	Basic	Low	2
AllocateCount	j2cModule.numManagedConnectionsAllocated	The total number of times that a managed connection is allocated to a client (the total is maintained across the pool, not per connection).	5.0	Per connection factory	CountStatistic	All	Low	3
FreedCount	j2cModule.numManagedConnectionsReleased	The total number of times that a managed connection is released back to the pool (the total is maintained across the pool, not per connection).	5.0	Per connection factory	CountStatistic	All	Low	4
FaultCount	j2cModule.faults	The number of faults, such as timeouts, in the connection pool	5.0	Per connection factory	CountStatistic	All	Low	8
FreePoolSize	j2cModule.freePoolSize	The number of free connections in the pool	5.0	Per connection factory	BoundedRangeStatistic	Basic	High	6
PoolSize	j2cModule.poolSize	Average number of managed connections in the pool.	5.0	Per connection factory	BoundedRangeStatistic	Basic	High	5
WaitingThreadCount	j2cModule.concurrentWaiters	Average number of threads concurrently waiting for a connection	5.0	Per connection factory	RangeStatistic	Basic	High	7

Table 10. Counter definitions (continued). Use these counters to monitor J2C connection pool performance.

Name	Key	Description	Version	Granularity	Type	Level	Overhead	ID
PercentUsed	j2cModule.percentUsed	Average percent of the pool that is in use. The value is determined by the total number of configured connections in the ConnectionPool, not the current number of connections.	5.0	Per connection factory	RangeStatistic	All	High	9
PercentMaxed	j2cModule.percentMaxed	Average percent of the time that all connections are in use	5.0	Per connection factory	RangeStatistic	All	High	10
WaitTime	j2cModule.avgWait	Average waiting time in milliseconds until a connection is granted	5.0	Per connection factory	TimeStatistic	Basic	Medium	13
UseTime	j2cModule.useTime	Average time in milliseconds that connections are in use	5.0	Per connection factory	TimeStatistic	Basic	Medium	12

Note: In the JMS Connection Factories section of the Tivoli performance viewer all the entries with the $ sign, for example, `JMS$AdviceQCF`, represent managed connections to external resources for that connection pool, which for `JMS$AdviceQCF` would be **jms/AdviceQCF**. Connection pools are registered with PMI under the name, **jmsConnections**. The J2C component provides the Performance Monitoring Infrastructure with the details of the managed connections created for each connection pool. PMI collates this under one module with the name **JMS$QCF**. This is the entry that is seen in Tivoli performance viewer under the JMS Connection Factories section.

Java virtual machine counters

You can use the Java virtual machine (JVM) counters that the Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer (TPV) collect to monitor JVM performance.

The total, used, and free heap size counters are available without any additional configuration settings. The remaining counters are available only when a Java virtual machine profiler is enabled.

Counter definitions:

Table 11. Counter definitions. The following table describes JVM counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
FreeMemory	jvmRuntimeModule.freeMemory	The free memory in the JVM run time	Per JVM	CountStatistic	Extended	Low	2
HeapSize	jvmRuntimeModule.totalMemory	The total memory in the JVM run time	Per JVM	BoundedRangeStatistic. The upperBound and lowerBound are not implemented for the Total memory counter.	Basic	High	1
ProcessCpuUsage	jvmRuntimeModule.cpuUsage	The CPU Usage (in percent) of the Java virtual machine.	Per JVM	CountStatistic	Basic	Low	5
UpTime	jvmRuntimeModule.upTime	The amount of time that the JVM is running	Per JVM	CountStatistic	Basic	Low	4
UsedMemory	jvmRuntimeModule.usedMemory	The used memory in the JVM run time	Per JVM	CountStatistic	Basic	Low	3
GCcount	jvmRuntimeModule.numGcCalls	The number of garbage collection calls. This counter is not available unless the JVM profiler is enabled.	Per JVM	CountStatistic	All	Max	11
GCIntervalTime	jvmRuntimeModule.avgTimeBetweenGcCalls	The average garbage collection value in milliseconds between two garbage collections. This counter is not available unless the JVM profiler is enabled.	Per JVM	TimeStatistic	All	Max	12
GCTime	jvmRuntimeModule.avgGcDuration	The average time duration in milliseconds of a garbage collection. This counter is not available unless the JVM profiler is enabled.	Per JVM	TimeStatistic	All	Max	13
WaitsForLockCount	jvmRuntimeModule.numWaitsForLock	The number of times that a thread waits for a lock. This counter is not available unless the JVM profiler is enabled.	Per JVM	CountStatistic	All	Max	19
WaitForLockTime	jvmRuntimeModule.avgTimeWaitForLock	The average time that a thread waits for a lock. This counter is not available unless the JVM profiler is enabled.	Per JVM	TimeStatistic	All	Max	20
ThreadStartedCount	jvmRuntimeModule.numThreadsStarted	The number of threads started. This counter is not available unless the JVM profiler is enabled.	Per JVM	CountStatistic	All	Max	17

Table 11. Counter definitions (continued). The following table describes JVM counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
ThreadEndedCount	jvmRuntimeModule.numThreadsDead	The number of failed threads. This counter is not available unless the JVM profiler is enabled.	Per JVM	CountStatistic	All	Max	18
ObjectAllocateCount	jvmRuntimeModule.numObjectsAllocated **depfeat:** This counter only applies to Versions 4.0 - 6.0.x. It was deprecated in Version 6.1.	The number of objects that are allocated in the heap. This counter is not available unless the -XrunpmiJvmpiProfiler option is set when starting the JVM.	Per JVM	CountStatistic	All	Max	14
ObjectMovedCount	jvmRuntimeModule.numObjectsMoved **depfeat:** This counter only applies to Versions 4.0 - 6.0.x. It was deprecated in Version 6.1.	The number of objects in the heap. This counter is not available unless the -XrunpmiJvmpiProfiler option is set when starting the JVM.	Per JVM	CountStatistic	All	Max	16
ObjectFreedCount	jvmRuntimeModule.numObjectsFreed **depfeat:** This counter only applies to Versions 4.0 - 6.0.x. It was deprecated in Version 6.1.	The number of objects freed in the heap. This counter is not available unless the -XrunpmiJvmpiProfiler option is set when starting the JVM.	Per JVM	CountStatistic	All	Max	15

gotcha: The statistics that are gathered through the JVM Tool Interface (JVMTI) are different for the JVM provided by IBM than the statistics that are gathered are for the Sun HotSpot-based JVM, including Sun HotSpot JVM on Solaris and the JVM provided by Hewlett-Packard for HP-UX.

Object Request Broker counters

You can use the Object Request Broker (ORB) counters that the Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer (TPV) collect to monitor ORB operations.

Counter definitions:

Table 12. Counter definitions. The following table describes ORB counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
ConcurrentRequestCount	orbPerfModule.concurrentRequests	The number of requests that are concurrently processed by the ORB	ORB	RangeStatistic	All	High	3
LookupTime	orbPerfModule.referenceLookupTime	The amount of time, in milliseconds, (normally < 10 milliseconds) that it takes to look up an object reference before a method dispatch can be completed. An excessively long time might indicate that there is an EJB container lookup problem.	Object Request Broker (ORB)	TimeStatistic	All	Medium	1
RequestCount	orbPerfModule.totalRequests	The total number of requests sent to the ORB	ORB	CountStatistic	All	Low	2
ProcessingTime	orbPerfModule.interceptors.processingTime	The time (in milliseconds) it takes a registered portable interceptor to run	Per interceptor	TimeStatistic	All	Medium	11

Servlet session counters

Use this page as a reference for properties of servlet session counters.

Data counters for this category contain usage information for HTTP sessions.

Counter definitions:

Table 13. Servlet session counter definitions.. This table displays properties for Servlet session counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
CreateCount	servletSessionsModule.createdSessions	1	The number of sessions that were created	Per web application	CountStatistic	All	Low
InvalidateCount	servletSessionsModule.invalidatedSessions	2	The number of sessions that were invalidated	Per web application	CountStatistic	All	Low
LifeTime	servletSessionsModule.sessionLifeTime	4	The average session life time in milliseconds (time invalidated - time created)	Per web application	TimeStatistic	Extended	Medium
ActiveCount	servletSessionsModule.activeSessions	6	The number of concurrently active sessions. A session is active if the WebSphere Application Server is currently processing a request that uses that session.	Per web application	RangeStatistic	All	High
LiveCount	servletSessionsModule.liveSessions	7	The number of local sessions that are currently cached in memory from the time at which this metric is enabled.	Per web application	RangeStatistic	Basic	High
NoRoomForNewSessionCount	servletSessionsModule.noRoomForNewSession	8	Applies only to session in memory with AllowOverflow=false. The number of times that a request for a new session cannot be handled because it exceeds the maximum session count.	Per web application	CountStatistic	Extended	Low
CacheDiscardCount	servletSessionsModule.cacheDiscards	9	The number of session objects that have been forced out of the cache. A least recently used (LRU) algorithm removes old entries to make room for new sessions and cache misses. Applicable only for persistent sessions.	Per web application	CountStatistic	All	Low

Table 13. Servlet session counter definitions. (continued). This table displays properties for Servlet session counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
ExternalReadTime	servletSessionsModule.externalReadTime	10	The time (milliseconds) taken in reading the session data from the persistent store. For multirow sessions, the metrics are for the attribute; for single row sessions, the metrics are for the entire session. Applicable only for persistent sessions. When using a JMS persistent store, you can choose to serialize the replicated data. If you choose not to serialize the data, the counter is not available.	Per web application	TimeStatistic	Extended	Medium
ExternalReadSize	servletSessionsModule.externalReadSize	11	Size of the session data read from persistent store. Applicable only for (serialized) persistent sessions; similar to external Read Time.	Per web application	TimeStatistic	Extended	Medium
ExternalWriteTime	servletSessionsModule.externalWriteTime	12	The time (milliseconds) taken to write the session data from the persistent store. Applicable only for (serialized) persistent sessions. Similar to external Read Time.	Per web application	TimeStatistic	Extended	Medium
ExternalWriteSize	servletSessionsModule.externalWriteSize	13	The size of the session data written to persistent store. Applicable only for (serialized) persistent sessions. Similar to external Read Time.	Per web application	TimeStatistic	Extended	Medium

Table 13. Servlet session counter definitions. (continued). This table displays properties for Servlet session counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
AffinityBreakCount	servletSessionsModule.affinityBreaks	14	The number of requests that are received for sessions that were last accessed from another web application. This value can indicate failover processing or a corrupt plug-in configuration.	Per web application	CountStatistic	All	Low
TimeSinceLastActivated	servletSessionsModule.timeSinceLastActivated	15	The time difference in milliseconds between previous and current access time stamps. Does not include session time out.	Per web application	TimeStatistic	All	Medium
TimeoutInvalidationCount	servletSessionsModule.invalidatedViaTimeout	16	The number of sessions that are invalidated by timeout.	Per web application	CountStatistic	All	Low
ActivateNonExistSessionCount	servletSessionsModule.activateNonExistSessions	17	The number of requests for a session that no longer exists, presumably because the session timed out. Use this counter to help determine if the timeout is too short.	Per web application	CountStatistic	All	Low
SessionObjectSize	servletSessionsModule.serializableSessObjSize	18	The size in bytes of (the serializable attributes of) in-memory sessions. Only session objects that contain at least one serializable attribute object is counted. A session can contain some attributes that are serializable and some that are not. The size in bytes is at a session level.	Per web application	TimeStatistic	All	Max

Transaction counters

Use this page as a reference for properties of transaction counters.

Counter definitions:

Table 14. Transaction counter definitions. The table lists different transaction counter properties along with information on the following: key, ID, description, granularity, type, level and overhead.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
GlobalBegunCount	transactionModule.globalTransBegun	1	The total number of global transactions started on the server	Per transaction manager or server	CountStatistic	Extended	Low
GlobalInvolvedCount	transactionModule.globalTransInvolved	2	The total number of global transactions involved on the server (for example, begun and imported)	Per transaction manager or server	CountStatistic	All	Low
LocalBegunCount	transactionModule.localTransBegun	3	The total number of local transactions started on the server	Per transaction manager or server	CountStatistic	Extended	Low
ActiveCount	transactionModule.activeGlobalTrans	4	The number of concurrently active global transactions	Per transaction manager or server	CountStatistic	Basic	Low
LocalActiveCount	transactionModule.activeLocalTrans	5	The number of concurrently active local transactions	Per transaction manager or server	CountStatistic	All	Low
GlobalTranTime	transactionModule.globalTranDuration	6	The average duration of global transactions	Per transaction manager or server	TimeStatistic	Extended	Medium
LocalTranTime	transactionModule.localTranDuration	7	The average duration of local transactions	Per transaction manager or server	TimeStatistic	Extended	Medium
GlobalBeforeCompletionTime	transactionModule.globalBeforeCompletionDuration	8	The average duration of before_completion for global transactions	per transaction manager or server	TimeStatistic	All	Medium
GlobalPrepareTime	transactionModule.globalPrepareDuration	9	The average duration of prepare for global transactions	Per transaction manager or server	TimeStatistic	All	Medium
GlobalCommitTime	transactionModule.globalCommitDuration	10	The average duration of commit for global transactions	Per transaction manager or server	TimeStatistic	All	Medium
LocalBeforeCompletionTime	transactionModule.localBeforeCompletionDuration	11	The average duration of before_completion for local transactions	Per transaction manager or server	TimeStatistic	All	Medium
LocalCommitTime	transactionModule.localCommitDuration	12	The average duration of commit for local transactions	Per transaction manager or server	TimeStatistic	All	Medium
OptimizationCount	transactionModule.numOptimization	13	The number of global transactions converted to single phase for optimization	Per transaction manager or server	CountStatistic	All	Low

Table 14. Transaction counter definitions (continued). The table lists different transaction counter properties along with information on the following: key, ID, description, granularity, type, level and overhead.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
CommittedCount	transactionModule.globalTransCommitted	14	The total number of global transactions committed	Per transaction manager or server	CountStatistic	Basic	Low
LocalCommittedCount	transactionModule.localTransCommitted	15	The number of local transactions committed	Per transaction manager or server	CountStatistic	All	Low
RolledbackCount	transactionModule.globalTransRolledBack	16	The total number of global transactions rolled back	Per transaction manager or server	CountStatistic	Basic	Low
LocalRolledbackCount	transactionModule.localTransRolledBack	17	The number of local transactions rolled back	Per transaction manager or server	CountStatistic	All	Low
GlobalTimeoutCount	transactionModule.globalTransTimeout	18	The number of global transactions timed out	Per transaction manager or server	CountStatistic	Extended	Low
LocalTimeoutCount	transactionModule.localTransTimeout	19	The number of local transactions timed out	Per transaction manager or server	CountStatistic	Extended	Low

Thread pool counters

You can use the thread pool counters that the Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer (TPV) collect to monitor your thread pool activity.

Counter definitions:

Table 15. Counter definitions. The following table describes thread pool counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
CreateCount	threadPoolModule.threadCreates	The total number of threads created	Per thread pool	CountStatistic	All	Low	1
DestroyCount	threadPoolModule.threadDestroys	The total number of threads destroyed	Per thread pool	CountStatistic	All	Low	2
ActiveCount	threadPoolModule.activeThreads	The number of concurrently active threads **Note:** The ActiveCount value can include a count for a long-running thread that is used for asynchronous I/O. Under these circumstances, it is possible that even when there is no apparent activity on the thread pool, the ActiveCount value will never reach zero	Per thread pool	BoundedRangeStatistic	Extended	High	3
PoolSize	threadPoolModule.poolSize	The average number of threads in pool	Per thread pool	BoundedRangeStatistic	Basic	High	4
PercentMaxed	threadPoolModule.percentMaxed	The average percent of the time that all threads are in use	Per thread pool	BoundedRangeStatistic	All	High	5
DeclaredthreadHungCount	threadPoolModule.declaredThreadHung	The number of threads declared hung	Per thread pool	CountStatistic	All	Max	6
ClearedThreadHangCount	threadPoolModule.declaredThreadHangCleared	The number of thread hangs cleared	Per thread pool	CountStatistic	All	Max	7
ConcurrentHungThreadCount	threadPoolModule.concurrentlyHungThreads	The number of concurrently hung threads	Per thread pool	BoundedRangeStatistic	All	Max	8
ActiveTime	threadPoolModule.activeTime	The average time in milliseconds the threads are in active state	Per thread pool	TimeStatistic	All	Max	9

Web application counters

Data counters for this category contain information for the selected server.

Counter definitions:
Web application counters

Table 16. Web application counter definitions. This table displays properties for web application counters.

Name	Key	Description	Granularity	Type	Level	Overhead
LoadedServletCount	webAppModule.numLoadedServlets	The number of loaded servlets.	Per web application	CountStatistic	All	Low
ReloadCount	webAppModule.numReloads	The number of reloaded servlets.	Per web application	CountStatistic	All	Low

Servlet counters

Table 17. Servlet counter definitions. This table displays properties for Servlet counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
RequestCount	webAppModule.servlets.totalRequests	11	The total number of requests that a servlet processed.	Per servlet	CountStatistic	Basic	Low
ConcurrentRequests	webAppModule.servlets.concurrentRequests	12	The number of requests that are concurrently processed.	Per servlet	RangeStatistic	Extended	High
ServiceTime	webAppModule.servlets.responseTime	13	The response time, in milliseconds, of a servlet request.	Per servlet	TimeStatistic	Basic	Medium
ErrorCount	webAppModule.servlets.numErrors	14	Total number of errors in a servlet or JavaServer Page (JSP).	Per servlet	CountStatistic	Extended	Low
ResponseTime	webAppModule.servlets.asyncContextResponseTime	18	The response time (in milliseconds) for an AsyncContext associated with a servlet to complete.	Per servlet	TimeStatistic	Extended	Medium

URL counters

Table 18. URL counter definitions. This table displays properties for URL counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
RequestCount	webAppModule.url.totalRequests	15	The total number of requests processed for an URI associated with a servlet.	Per URI	CountStatistic	Basic	Low
ConcurrentRequests	webAppModule.url.concurrentRequests	16	The number of requests processing concurrently for a URI associated with a servlet.	Per URI	RangeStatistic	Extended	High
ServiceTime	webAppModule.url.responseTime	17	The average service response time, in milliseconds, for an URI associated with a servlet.	Per URI	TimeStatistic	Basic	Medium
ResponseTime	webAppModule.url.asyncContextResponseTime	19	The response time (in milliseconds) for an AsyncContext associated with a URI to complete.	Per URI	TimeStatistic	Medium	All

Asynchronous request dispatcher counter

Table 19. Asynchronous request dispatcher counter definitions. This table displays properties for Asynchronous request dispatcher counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
ServiceTime	ard.averageResponseTime	1	The average response time, in milliseconds, in which an asynchronous request dispatcher (ARD) request is completed. This metric also processes asynchronous servlet and JavaServer Pages (JSP) requests that are cached by the dynamic cache service.	Per URI	TimeStatistic	Basic	Medium

System counters

You can use the system counters that the Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer collect to monitor how efficiently your system a specific machine (node) is running.

Counters for this category contain information for a machine (node).

Counter definitions:

Table 20. Counter definitions. The following table describes system counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
CPUUsageSinceLastMeasurement	systemModule.cpuUtilization	The average system CPU utilization taken over the time interval since the last reading. Because the first call is required to perform initialization, a value such as 0, which is not valid, will be returned. All subsequent calls return the expected value. On SMP machines, the value returned is the utilization averaged over all CPUs.	Per node	CountStatistic	Basic	Low	1
CPUUsageSinceServerStarted	systemModule.avgCpuUtilization	The average percent CPU Usage that is busy once the server is started.	Per node	TimeStatistic	Extended	Medium	2
FreeMemory	systemModule.freeMemory	The amount of real free memory available on the system. Real memory that is not allocated is only a lower bound on available real memory, since many operating systems take some of the otherwise unallocated memory and use it for additional I/O buffering. The exact amount of buffer memory which can be freed up is dependent on both the platform and the application(s) running on it.	Per node	CountStatistic	All	Low	3

Dynamic cache counters

Use this page as a reference for properties of dynamic cache counters.

You can use the Performance Monitoring Infrastructure (PMI) data for dynamic cache to monitor the behavior and performance of the dynamic cache service. For information on the functions and usages of dynamic cache, refer to Task overview: Using the dynamic cache service to improve performance.

Use the dynamic cache MBean to access the related data and display it under dynamic cache in the Tivoli Performance Viewer (TPV).

Counter definitions:

Table 21. Dynamic cache counter definitions.. This table displays properties for Dynamic cache counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
MaxInMemoryCacheEntryCount	cacheModule..maxInMemoryCacheEntryCount	1	The maximum number of in-memory cache entries. Locate it under servlet instance or object instance.	Per Server	CountStatistic	All	Low
InMemoryCacheEntryCount	cacheModule.inMemoryCacheEntryCount	2	The current number of in-memory cache entries. Locate it under servlet instance and object instance.	Per Server	CountStatistic	All	Low
HitsInMemoryCount	cacheModule.hitsInMemoryCount	21	The number of requests for cacheable objects that are served from memory. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
HitsOnDiskCount	cacheModule.hitsOnDiskCount	22	The number of requests for cacheable objects that are served from disk. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
ExplicitInvalidationCount	cacheModule.explicitInvalidationCount	23	The number of explicit invalidations. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
LruInvalidationCount	cacheModule.lruInvalidationCount	24	The number of cache entries that are removed from memory by a Least Recently Used (LRU) algorithm. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low

Table 21. Dynamic cache counter definitions. (continued). This table displays properties for Dynamic cache counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
TimeoutInvalidationCount	cacheModule.timeoutInvalidationCount	25	The number of cache entries that are removed from memory and disk because their timeout has expired. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
InMemoryAndDiskCacheEntryCount	cacheModule.inMemoryAndDiskCacheEntryCount	26	The current number of used cache entries in memory and disk. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
RemoteHitCount	cacheModule.remoteHitCount	27	The number of requests for cacheable objects that are served from other Java virtual machines within the replication domain. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
MissCount	cacheModule.missCount	28	The number of requests for cacheable objects that were not found in the cache. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low

Table 21. Dynamic cache counter definitions. (continued). This table displays properties for Dynamic cache counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
ClientRequestCount	cacheModule.clientRequestCount	29	The number of requests for cacheable objects that are generated by applications running on this application server. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
DistributedRequestCount	cacheModule.distributedRequestCount	30	The number of requests for cacheable objects that are generated by cooperating caches in this replication domain. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
ExplicitMemoryInvalidationCount	cacheModule.explicitMemoryInvalidationCount	31	The number of explicit invalidations that result in the removal of an entry from memory. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
ExplicitDiskInvalidationCount	cacheModule.explicitDiskInvalidationCount	32	The number of explicit invalidations that result in the removal of an entry from disk. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low

Table 21. Dynamic cache counter definitions. (continued). This table displays properties for Dynamic cache counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
LocalExplicitInvalidationCount	cacheModule.localExplicitInvalidationCount	34	The number of explicit invalidations that are generated locally, either programmatically or by a cache policy. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
RemoteExplicitInvalidationCount	cacheModule.remoteExplicitInvalidationCount	35	The number of explicit invalidations that are received from a cooperating Java virtual machine in this replication domain. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
RemoteCreationCount	cacheModule.remoteCreationCount	36	The number of cache entries that are received from cooperating dynamic caches. For servlet instance, locate it under template group. For object instance, locate it under object group.	Per Server	CountStatistic	All	Low
ObjectsOnDisk	cacheModule.objectsOnDisk	4	The current number of cache entries on disk. locate it under disk group.	Per Server	CountStatistic	All	Low
HitsOnDisk	cacheModule.hitsOnDisk	5	The number of requests for cacheable objects that are served from disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
ExplicitInvalidationsFromDisk	cacheModule.explicitInvalidationFromDisk	6	The number of explicit invalidations that result in the removal of entries from disk. Locate it under disk group.	Per Server	CountStatistic	All	Low

Table 21. Dynamic cache counter definitions. (continued). This table displays properties for Dynamic cache counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
TimeoutInvalidationsFromDisk	cacheModule.timeoutInvalidationsFromDisk	7	The number of disk timeouts. Locate it under disk group.	Per Server	CountStatistic	All	Low
PendingRemovalFromDisk	cacheModule.pendingRemovalFromDisk	8	The current number of pending entries that are to be removed from disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
DependencyIDsOnDisk	cacheModule.dependencyIdsOnDisk	9	The current number of dependency ID that are on disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
DependencyIDsBufferedForDisk	cacheModule.dependencyIdsBufferedForDisk	10	The current number of dependency IDs that are buffered for the disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
DependencyIDsOffloadedToDisk	cacheModule.dependencyIdsOffloadedToDisk	11	The number of dependency IDs that are offloaded to disk. It is located under disk group.	Per Server	CountStatistic	All	Low
DependencyIDBasedInvalidationsFromDisk	cacheModule.dependencyIdBasedInvalidationsFromDisk	12	The number of dependency ID-based invalidations. Locate it under disk group.	Per Server	CountStatistic	All	Low
TemplatesOnDisk	cacheModule.templatesOnDisk	13	The current number of templates that are on disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
TemplatesBufferedForDisk	cacheModule.templatesBufferedForDisk	14	The current number of templates that are buffered for the disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
TemplatesOffloadedToDisk	cacheModule.templatesOffloadedToDisk	15	The number of templates that are offloaded to disk. Locate it under disk group.	Per Server	CountStatistic	All	Low
TemplateBasedInvalidationsFromDisk	cacheModule.templateBasedInvalidationsFromDisk	16	The number of template-based invalidations. Locate it under disk group.	Per Server	CountStatistic	All	Low

Table 21. Dynamic cache counter definitions. (continued). This table displays properties for Dynamic cache counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
GarbageCollectorInvalidationsFromDisk	cacheModule.garbageCollectorInvalidationsFromDisk	17	The number of garbage collector invalidations that result in the removal of entries from disk cache due to high threshold has been reached. Locate it under disk group.	Per Server	CountStatistic	All	Low
OverflowInvalidationsFromDisk	cacheModule.overflowInvalidationsFromDisk	18	The number of invalidations that result in the removal of entries from disk due to exceeding the disk cache size or disk cache size in GB limit. Locate it under disk group.	Per Server	CountStatistic	All	Low

MBean cache statistics

Use this page as a reference for properties of MBean cache statistics.

You can use the Performance Monitoring Infrastructure (PMI) data for dynamic cache to monitor the behavior and performance of the dynamic cache service. For information on the functions and usages of dynamic cache, refer to Task overview: Using the dynamic cache service to improve performance.

MBean cache statistics:

Table 22. MBean cache statistics.. Displays references for MBean cache statistics properties.

MBean attributes	Description
CacheHits	The total number of cache hits.
CacheLruRemoves	The number of memory-based least recently used (LRU) evictions. These correspond to the number of objects that are evicted from the memory cache, based on the LRU policy.
CacheMisses	The total number of cache misses.
CacheRemoves	The total number of cache removes.
DependencyIdsOnDisk	Metric that captures the total number of dependency identifiers that are currently on disk.
DependencyIdsBufferedForDisk	Metric that captures the number of dependency identifiers that are buffered in memory for the disk.
DependencyIdsOffloadedToDisk	Metric that captures the number of dependency IDs that are off-loaded to disk since the server startup. This is a cumulative count.
DependencyIdBasedInvalidationsFromDisk	Metric that captures the number of dependency ID-based invalidations that have occurred since server startup.
DiskCacheSizeInMB	The total size of data objects in MB.
ExplicitInvalidationsFromMemory	Metric that captures the number of explicit invalidations that result in an entry being removed from memory.
ExplicitInvalidationsFromDisk	Metric that captures the number of explicit invalidations that result in an entry being removed from disk.
ExplicitInvalidationsLocal	Metric that captures the number of explicit invalidations that are generated locally.
ExplicitInvalidationRemote	Metric that captures the number of explicit invalidations that generate from a cooperating Java virtual machine (JVM) in the cluster.
GarbageCollectorInvalidationsFromDisk	This counter increments when the garbage collector evicts entries from the disk. If an entry is not expired, this counter increments. If an entry is expired, the TotalTimeoutInvalidationsFromDisk increments.
MemoryCacheEntries	The number of cache entries in memory.
ObjectsDeleteFromDisk	Metric that captures the number of cached objects that are deleted from disk.
ObjectsDeleteFromDisk4K	Metric that captures the number of objects that have been deleted from disk and are smaller than 4K.
ObjectsDeleteFromDisk40K	Metric that captures the number of objects that have been deleted from disk and are between 4K and 40K.
ObjectsDeleteFromDisk400K	Metric that captures the number of objects that have been deleted from disk and are between 40K and 400K.
ObjectsDeleteFromDisk4000K	Metric that captures the number of objects that have been deleted from disk and are between 400K and 400K.
ObjectsDeleteFromDiskSize	Metric that captures the cumulative size of cached objects that are deleted from disk.
ObjectsOnDisk	Metric that captures the number of cache entries that are currently on disk.
ObjectsReadFromDisk	Metric that captures the number of cached objects that are read from disk.
ObjectsReadFromDisk4K	Metric that captures the number of objects that have been read from disk and are smaller than 4K.
ObjectsReadFromDisk40K	Metric that captures the number of objects that have been read from disk and are between 4K and 40K.
ObjectsReadFromDisk400K	Metric that captures the number of objects that have been read from disk and are between 40K and 400K.
ObjectsReadFromDiskSize	Metric that captures the cumulative size of cached objects that are read from disk.
ObjectsWriteToDisk	Metric that captures the number of cached objects that are written to disk.
ObjectsWriteToDisk4K	Metric that captures the number of objects that are written to disk and are smaller than 4K.
ObjectsWriteToDisk40K	Metric that captures the number of objects that are written to disk and are between 4K and 40K.
ObjectsWriteToDisk400K	Metric that captures the number of objects that are written to disk and are between 40K and 400K.
ObjectsWriteToDisk4000K	Metric that captures the number of objects that are written to disk and are between 400K and 4000K.

Table 22. MBean cache statistics. (continued). Displays references for MBean cache statistics properties.

MBean attributes	Description
ObjectsWrittenToDiskSize	Metric that captures the cumulative size of cached objects that are written to disk.
OverflowInvalidationsFromDisk	This counter increments when the limit of disk cache size or disk cache size in GB is reached. It may be removed from memory and not offloaded to disk. In addition, when performing write entry to disk, write dependency ID to disk, write template to disk, if the total disk cache files in GB is over disk cache size in GB, the entry will not write to disk. This counter increments.
PendingRemovalFromDisk	Metric that captures the number of objects that have been invalidated due to an explicit event, such as an invalidation, or some implicit event, such as a timeout or eviction policy, but are yet to be removed from disk.
PushPullTableSize	Metric that captures the size of the current PushPullTable.
RemoteInvalidationNotifications	The number of remote invalidation notifications from other servers since server startup.
RemoteObjectFetchSize	The size of requests for cacheable objects that are served from other JVMs in the cluster. (PushPull mode)
RemoteObjectHits	The number of requests for cacheable objects that are served from other JVMs in the cluster. (PushPull mode)
RemoteObjectMisses	The number of requests for cacheable objects that were not found from other JVMs in the cluster. (PushPull mode)
RemoteObjectUpdates	The number of cacheable objects that are received from other JVMs in the cluster. (Push mode)
RemoteObjectUpdateSize	The size of cacheable objects that are received from other JVMs in the cluster. (Push mode)
RemoteUpdateNotifications	The number of notifications that identify that an object is updated at another server. (The number of entries in the push-pull table).
TemplateBasedInvalidationsFromDisk	Number of template-based invalidations since the server startup.
TemplatesBufferedForDisk	Number of templates that are buffered for the disk.
TimeoutInvalidationFromDisk	Metric that captures the number of timeout invalidations that result in an entry being removed from disk.
TimeoutInvalidationsFromMemory	Metric that captures the number of timeout invalidations that result in an entry being removed from memory.
TemplatesOffloadedToDisk	Number of templates that are off-loaded to disk since the server startup.
TemplatesOnDisk	Metric that captures the number of templates on disk.

Web services counters

Use this page as a reference for properties of web services counters.

You can use the web services counters that the Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer (TPV) collect to monitor the performance of your web services.

Table 23. Counter definitions. This table describes the properties of Web services counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
DispatchedRequestCount	webServicesModule.services.numberDispatched	12	The number of requests the service dispatched or delivered	Per web service	CountStatistic	All	Low
DispatchResponseTime	webServicesModule.services.dispatchResponseTime	16	The average response time, in milliseconds, to dispatch a request	Per web service	TimeStatistic	All	Medium
LoadedWebServiceCount	webServicesModule.numLoadedServices	1	The number of loaded web services	Per web service	CountStatistic	All	Low
PayloadSize	webServicesModule.services.size	18	The average payload size in bytes of a received request or reply	Per web service	AverageStatistic	All	Medium
ProcessedRequestCount	webServicesModule.services.numberSuccessfull	13	The number of requests the service successfully processed.	Per web service	CountStatistic	All	Low
ReceivedRequestCount	webServicesModule.services.numberReceived	11	The number of requests the service received	Per web service	CountStatistic	All	Low
ReplyPayloadSize	webServicesModule.services.replySize	20	The average payload size in bytes of a reply.	Per web service	AverageStatistic	All	Medium
ReplyResponseTime	webServicesModule.services.replyResponseTime	17	The average response time, in milliseconds, to prepare a reply after dispatch	Per web service	TimeStatistic	All	Medium
RequestFailedEndpoint	webServiceEndpoint.numberFailed	32	The number of requests that have failed processing for the endpoint	Per web service endpoint	CountStatistic	All	Low
RequestPayloadSize	webServicesModule.services.requestSize	19	The average payload size in bytes of a request	Per web service	AverageStatistic	All	Medium
RequestReceivedEndpoint	webServiceEndpoint.numberReceived	30	The number of requests received for the endpoint	Per web service endpoint	CountStatistic	All	Low
RequestResponseTime	webServicesModule.services.requestResponseTime	15	The average response time, in milliseconds, to prepare a request for dispatch	Per web service	TimeStatistic	All	Medium
RequestSizeEndpoint	webServiceEndpoint.requestSize	36	The average size, in bytes, of the request payload for the endpoint	Per web service endpoint	AverageStatistic	All	High
RequestSizeLastEndpoint	webServiceEndpoint.requestSizeLast	38	The last size, in bytes, recorded of the request payload for the endpoint	Per web service endpoint	CountStatistic	All	High
RequestSizeMaxEndpoint	webServiceEndpoint.requestSizeMax	37	The maximum size, in bytes, recorded of the request payload for the endpoint	Per web service endpoint	AverageStatistic	All	High

Table 23. Counter definitions (continued). This table describes the properties of Web services counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
RequestSuccessfulEndpoint	webServiceEndpoint.numberSuccessful	31	The number of requests that have successfully been processed for the endpoint	Per web service endpoint	CountStatistic	All	Low
ResponseSizeEndpoint	webServiceEndpoint.responseSize	39	The average size, in bytes, of the response payload for the endpoint	Per web service endpoint	AverageStatistic	All	High
ResponseSizeLastEndpoint	webServiceEndpoint.responseSizeLast	41	The last size, in bytes, recorded of the response the payload for the endpoint	Per web service endpoint	CountStatistic	All	High
ResponseSizeMaxEndpoint	webServiceEndpoint.responseSizeMax	40	The maximum size, in bytes, recorded of the response payload for the endpoint	Per web service endpoint	AverageStatistic	All	High
ResponseTime	webServicesModule.services.responseTime	14	The average response time, in milliseconds, for a successful request	Per web service	TimeStatistic	All	High
ResponseTimeEndpoint	webServiceEndpoint.responseTime	33	The average amount of time, in milliseconds, between the request arrival and the response reply back to the client for the endpoint	Per web service endpoint	TimeStatistic	All	Medium
ResponseTimeLastEndpoint	webServiceEndpoint.responseTimeLast	35	The last value, in milliseconds, recorded between the request arrival and the response reply back to the client for the endpoint	Per web service endpoint	TimeStatistic	All	Medium
ResponseTimeMaxEndpoint	webServiceEndpoint.responseTimeMax	34	The maximum value, in milliseconds, recorded between the request arrival and the response reply back to the client for the endpoint	Per web service endpoint	TimeStatistic	All	Medium

Alarm Manager counters

Use this page as a reference for properties of alarm manager counters.

Counters for this category contain information for the Alarm Manager.

Counter definitions:

Table 24. Alarm Manager counter definitions.. This table displays properties for Alarm Manager counters.

Name	Key	ID values	Description	Granularity	Type	Level	Overhead
AlarmsCreatedCount	alarmManagerModule.numCreates.name	1	The total number of alarms created by all asynchronous scopes for this WorkManager	Per WorkManager	CountStatistic	All	High
AlarmsCancelledCount	alarmManagerModule.numCancelled.name	2	The number of alarms cancelled by the application	Per WorkManager	CountStatistic	All	High
AlarmsFiredCount	alarmManagerModule.numFired.name	3	The number of alarms fired	Per WorkManager	CountStatistic	All	High
AlarmLatencyDuration	alarmManagerModule.latency.name	4	The latency of alarms fired in milliseconds	Per WorkManager	RangeStatistic	All	High
AlarmsPendingSize	alarmManagerModule.alarmsPending.name	5	The number of alarms waiting to fire	Per WorkManager	RangeStatistic	All	High
AlarmRate	alarmManagerModule.alarmsPerSecond.name	6	The number of alarms firing per second	Per WorkManager	RangeStatistic	All	High

Object Pool counters

Use this page as a reference for properties of Object Pool counters.

Counters for this category contain information for Object Pools.

Counter definitions:

Table 25. Object Pool counter definitions.. This table displays properties for Object Pool counters.

Name	Key	ID values	Description	Granularity	Type	Level	Overhead
ObjectsCreatedCount	objectPoolModule.numCreates.name	1	The total number of objects created	Per ObjectPool	CountStatistic	All	High
ObjectsAllocatedCount	objectPoolModule.numAllocates.name	2	The number of objects requested from the pool	Per ObjectPool	CountStatistic	All	High
ObjectsReturnedCount	objectPoolModule.numReturns.name	3	The number of objects returned to the pool	Per ObjectPool	CountStatistic	All	High
IdleObjectsSize	objectPoolModule.poolSize.name	4	The average number of idle object instances in the pool	Per ObjectPool	RangeStatistic	All	High

Scheduler counters

Use this page as a reference for properties of Scheduler counters.

Counters for this category contain information for the Scheduler service.

Counter definitions:

Table 26. Scheduler counter definitions.. This table displays properties for Scheduler counters.

Name	Key	ID value	Description	Granularity	Type	Level	Overhead
TaskFailureCount	schedulerModule.failedTasks.name	1	The number of tasks that failed to run	Per Scheduler	CountStatistic	All	High
TaskFinishCount	schedulerModule.executedTasks.name	2	The number of tasks ran successfully	Per Scheduler	CountStatistic	All	High
PollCount	schedulerModule.totalPolls.name	11	The number of poll cycles completed for all daemon threads	Per Scheduler	CountStatistic	All	High
TaskFinishRate	schedulerModule.tasksPerSec.name	3	The number of tasks run per second	Per Scheduler	RangeStatistic	All	High
TaskCollisionRate	schedulerModule.collisionsPerSec.name	4	The number of collisions encountered per second between competing poll daemons	Per Scheduler	RangeStatistic	All	High
PollQueryDuration	schedulerModule.queryTime.name	5	The start time in milliseconds for each poll daemon thread's database poll query	Per Scheduler	RangeStatistic	All	High
RunDuration	schedulerModule.execTime.name	6	The time in milliseconds taken to run a task.	Per Scheduler	RangeStatistic	All	High
TaskExpirationRate	schedulerModule.taskLoadPerPoll.name	7	The number of tasks in a poll query	Per Scheduler	RangeStatistic	All	High
TaskDelayDuration	schedulerModule.execLatency.name	8	The period of time in seconds that the task is delayed	Per Scheduler	RangeStatistic	All	High
PollDuration	schedulerModule.pollTime.name	9	The number of seconds between poll cycles	Per Scheduler	RangeStatistic	All	High
TaskRunRate	schedulerModule.taskExecPerPoll.name	10	The number of tasks run by each poll daemon thread. (Multiply this by the number of poll daemon threads to get the tasks run per effective poll cycle.)	Per Scheduler	RangeStatistic	All	High

Distribution and consistency services (DCS) stack counters

You can use the Distribution and Consistency Services (DCS) counters that the Performance Monitoring Infrastructure (PMI) and Tivoli Performance Viewer (TPV) collect to monitor communication between core groups.

Counter definitions:

Table 27. Counter definitions. The following table describes DCS counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
CoalesceTime	DCSStats.coalesceTime	Amount of time that it actually takes to coalesce a view	Per DCS stack	TimeStatistic	All	Medium	1
HighSeverityCongestionEventCount	DCSStats.transmitterCongestedCounter	Number of times that a high severity congestion event for outgoing messages was raised.	Per DCS stack	CountStatistic	All	Medium	2
IncomingMessageSize	DCSStats.incomingMessageSize	Minimal, maximal and average size (in bytes) of the messages that were received by the DCS stack	Per DCS stack	AverageStatistic	All	High	3
MessageBufferReallocationCount	DCSStats.numOfReallocs	Number of message buffer reallocations due to inadequate buffer size. If this number is larger than 20 percent of the number of sent messages, you may want to contact IBM Support	Per DCS stack	CountStatistic	All	Medium	6
OutgoingMessageSize	DCSStats.outgoingMessageSize	Minimal, maximal, and average size (in bytes) of the messages that were sent through the DCS stack	Per DCS stack	AverageStatistic	All	High	7
ReceivedMessageCount	DCSStats.incomingMessageCounter	Number of messages received by the DCS stack	Per DCS stack	CountStatistic	All	High	8
RemoveViewChangeTime	DCSStats.splitTime	Amount of time that is consumed when splitting a group. The DCS stack is blocked during this time.	Per DCS stack	TimeStatistic	All	High	9
SentMessageCount	DCSStats.outgoingMessageCounter	Number of messages that were sent through the DCS stack	Per DCS stack	CountStatistic	All	High	10
SuspicionCount	DCSStats.suspectCounter	Number of times that the local member is suspected by other members	Per DCS stack	CountStatistic	All	High	11
SynchronizationCompleteTime	DCSStats.vsCompleteCurrentTime	Amount of time that is needed to guarantee that all view members are synchronized.	Per DCS stack	TimeStatistic	All	High	12
ViewChangeCount	DCSStats.viewCounter	Number of times that this member underwent view changes.	Per DCS stack	CountStatistic	All	Medium	14
ViewChangeTimeoutCount	DCSStats.mbrAlarmTimeoutCounter	Number of times that the view change procedure timed out.	Per DCS stack	CountStatistic	All	Medium	15

Table 27. Counter definitions (continued). The following table describes DCS counters.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
ViewGroupSize	DCSStats.groupSize	The size of the group to which the local member belongs.	Per DCS stack	AverageStatistic	All1	Medium	16

PortletContainer PMI counters

Use this page as a reference for properties of PortletContainer PMI counters.

Counter definitions

These counters are the PMI measurement points for a portlet and a portlet application.

Table 28. PortletContainer PMI counter definitions.. This table displays properties for PortletContainer PMI counters.

Name	Key	ID	Description	Unit	Type	Level	Overhead
totalRequests	portletModule.totalRequests	115	The number of requests made to the portlet module.	unit.none	CountStatistic	All	Low
numErrors	portletModule.numErrors	119	The number of errors reported from the portlet module.	unit.none	CountStatistic	All	Low
concurrentRequests	portletModule.concurrentRequests	116	The number of concurrent requests.	unit.none	CountStatistic	All	High
renderResponseTime	portletModeule.renderResponseTime	117	The render response time.	unit.ms	CountStatistic	All	Medium
actionResponseTime	portletModule.actionResponseTime	118	The action response time.	unit.ms	CountStatistic	All	Medium
numLoadedPortlets	portletAppModule.numLoadedPortlets		The number of portlets loaded.	unit.none	CountStatistic	All	Low
resourceResponseTime	portletModule.resourceResponseTime	121	Response time of a JSR 286 portlet serveResource request.	unit.ms	CountStatistic	All	Medium
eventResponseTime	portletModule.eventResponseTime	120	Response time of a JSR 286 portlet processEvent request.	unit.ms	CountStatistic	All	Medium

Extension registry counters

Use this page as a reference for properties of extension registry counters.

Data counters for this category contain usage information for the extension registry.

Counter definitions:

Table 29. Extension registry counters.. Displays usage information for the extension registry.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
RequestCount	ExtensionRegistryStats.numRequests	1	The total number of cache read requests served	Per server	CountStatistic	Basic	Low
HitCount	ExtensionRegistryStats.numHits	2	The number of cache hits out of the total requests	Per server	CountStatistic	Basic	Low
HitRate	ExtensionRegistryStats.hitRate	3	The rate for cache hits	Per server	TimeStatistic	Basic	Low
DisplacementCount	ExtensionRegistryStats.numDisplaces	4	The number of cache displacements	Per server	CountStatistic	Basic	Low

Service integration bus counters

These service integration bus counters are part of the performance monitoring infrastructure (PMI), which provides server-side monitoring and a client-side API to retrieve performance information.

To see lists of available PMI counters, use the administrative console to navigate to **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** > ***resource_name*** > **[General Properties] Custom**.

For information about service integration bus PMI counters, see the following articles:

- "Message store counters"
- "Mediation framework counters" on page 94
- "Message processor counters" on page 97
- "Communications counters" on page 110
- "Web services gateway counters" on page 153

Message store counters:

These service integration bus message store counters are part of the performance monitoring infrastructure (PMI), which provides server-side monitoring and a client-side API to retrieve performance information.

Counter definitions: To see lists of available PMI counters, use the administrative console to navigate to **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** > ***server_name*** > **[General Properties] Custom**.

The headings for each table show how to navigate to the counters in the administrative console.

Table 30. Message store counter definitions: Cache. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **Cache**

Name	Key	ID	Description	Granularity	Type	Level
CacheAddNotStoredCount	MessageStoreStats.CacheAddNotStoredCount	1502	The number of items that have been added to the message store during the current session that are not persistent	Per Messaging Engine	CountStatistic	High
CacheAddStoredCount	MessageStoreStats.CacheAddStoredCount	1501	The number of items that have been added to the message store during the current session that are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheCurrentNotStoredByteCount	MessageStoreStats.CacheCurrentNotStoredByteCount	1511	The current total of the declared sizes of all items in the dynamic memory cache that are never persisted	Per Messaging Engine	CountStatistic	High
CacheCurrentNotStoredCount	MessageStoreStats.CacheCurrentNotStoredCount	1509	The number of items currently in the dynamic memory cache that are never persisted	Per Messaging Engine	CountStatistic	High
CacheCurrentStoredByteCount	MessageStoreStats.CacheCurrentStoredByteCount	1510	The total of the declared sizes of all items currently in the dynamic memory cache that are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheCurrentStoredCount	MessageStoreStats.CacheCurrentStoredCount	1508	The number of items currently in the dynamic memory cache that are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheNotStoredDiscardByteCount	MessageStoreStats.CacheNotStoredDiscardByteCount	1519	The total of the declared sizes of all items that have been added to the dynamic memory cache during the current session which are never persisted	Per Messaging Engine	CountStatistic	High
CacheNotStoredDiscardCount	MessageStoreStats.CacheNotStoredDiscardCount	1517	The total number of items that have been discarded from the dynamic memory cache during the current session which are never persisted	Per Messaging Engine	CountStatistic	High
CacheNotStoredRefusalCount	MessageStoreStats.CacheNotStoredRefusalCount	1521	The total number of items that have been refused entry to the dynamic memory cache during the current session which are never persisted	Per Messaging Engine	CountStatistic	High
CacheRemoveNotStoredCount	MessageStoreStats.CacheRemoveNotStoredCount	1506	The number of items that have been removed from the message store during the current session that are not persistent	Per Messaging Engine	CountStatistic	High
CacheRemoveStoredCount	MessageStoreStats.CacheRemoveStoredCount	1505	The number of items that have been removed from the message store during the current session that are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheRestoreCount	MessageStoreStats.CacheRestoreCount	1507	The number of items restored to memory from persistence during the current session	Per Messaging Engine	CountStatistic	High

Table 30. Message store counter definitions: Cache (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **Cache**

Name	Key	ID	Description	Granularity	Type	Level
CacheStoredDiscardByteCount	MessageStoreStats.CacheStoredDiscardByteCount	1518	The total of the declared sizes of all items that have been added to the dynamic memory cache during the current session which are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheStoredDiscardCount	MessageStoreStats.CacheStoredDiscardCount	1516	The total number of items that have been discarded from the dynamic memory cache during the current session which are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheStoredRefusalCount	MessageStoreStats.CacheStoredRefusalCount	1520	The total number of items that have been refused entry to the dynamic memory cache during the current session which are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheStreamSpillingCount	MessageStoreStats.CacheStreamSpillingCount	1522	Number of streams currently spilling potentially persistent items	Per Messaging Engine	CountStatistic	High
CacheTotalNotStoredByteCount	MessageStoreStats.CacheTotalNotStoredByteCount	1515	The total of the declared sizes of all items that have been added to the dynamic memory cache during the current session which are never persisted in cache	Per Messaging Engine	CountStatistic	High
CacheTotalNotStoredCount	MessageStoreStats.CacheTotalNotStoredCount	1513	The total number of items that have been added to the dynamic memory cache during the current session which are never persisted in cache	Per Messaging Engine	CountStatistic	High
CacheTotalStoredByteCount	MessageStoreStats.CacheTotalStoredByteCount	1514	The total of the declared sizes of all items that have been added to the dynamic memory cache during the current session which are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheTotalStoredCount	MessageStoreStats.CacheTotalStoredCount	1512	The total number of items that have been added to the dynamic memory cache during the current session which are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High
CacheUpdateNotStoredCount	MessageStoreStats.CacheUpdateNotStoredCount	1504	The number of items that have been updated in the message store during the current session that not persistent	Per Messaging Engine	CountStatistic	High
CacheUpdateStoredCount	MessageStoreStats.CacheUpdateStoredCount	1503	The number of items that have been updated in the message store during the current session that are either persistent or potentially persistent	Per Messaging Engine	CountStatistic	High

Table 31. Message store counter definitions: Expiry. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **Expiry**

Name	Key	ID	Description	Granularity	Type	Level
ExpiryIndexItemCount	MessageStoreStats.ExpiryIndexItemCount	1532	Current number of items in the expiry index. These are items created with an expiry time in the future and that have not yet been consumed.	Per Messaging Engine	CountStatistic	High

Table 32. Message store counter definitions: Data Store. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **Data Store**

Name	Key	ID	Description	Granularity	Type	Level
ItemDeleteBatchCount	MessageStoreStats.ItemDeleteBatchCount	1548	Item table delete batches	Per Messaging Engine	CountStatistic	High
ItemInsertBatchCount	MessageStoreStats.ItemInsertBatchCount	1547	Item table insert batches	Per Messaging Engine	CountStatistic	High
ItemUpdateBatchCount	MessageStoreStats.ItemUpdateBatchCount	1549	Item table update batches	Per Messaging Engine	CountStatistic	High
JDBCItemDeleteCount	MessageStoreStats.JDBCItemDeleteCount	1545	JDBC Item table deletes	Per Messaging Engine	CountStatistic	High
JDBCItemInsertCount	MessageStoreStats.JDBCItemInsertCount	1544	JDBC Item table inserts	Per Messaging Engine	CountStatistic	High
JDBCItemUpdateCount	MessageStoreStats.JDBCItemUpdateCount	1546	JDBC Item table updates	Per Messaging Engine	CountStatistic	High
JDBCOpenCount	MessageStoreStats.JDBCOpenCount	1540	JDBC connections open	Per Messaging Engine	CountStatistic	High
JDBCTransactionAbortCount	MessageStoreStats.JDBCTransactionAbortCount	1542	JDBC local transactions aborted	Per Messaging Engine	CountStatistic	High
JDBCTransactionCompleteCount	MessageStoreStats.JDBCTransactionCompleteCount	1541	JDBC local transactions completed	Per Messaging Engine	CountStatistic	High
JDBCTransactionDeleteCount	MessageStoreStats.JDBCTransactionDeleteCount	1551	JDBC transaction table deletes	Per Messaging Engine	CountStatistic	High
JDBCTransactionInsertCount	MessageStoreStats.JDBCTransactionInsertCount	1550	JDBC transaction table inserts	Per Messaging Engine	CountStatistic	High
JDBCTransactionTime	MessageStoreStats.JDBCTransactionTime	1543	Total execution time of internal batches	Per Messaging Engine	TimeStatistic	High
JDBCTransactionUpdateCount	MessageStoreStats.JDBCTransactionUpdateCount	1552	JDBC transaction table updates	Per Messaging Engine	CountStatistic	High

Table 32. Message store counter definitions: Data Store (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **Data Store**

Name	Key	ID	Description	Granularity	Type	Level
PersistentDispatcherAvoidanceCount	MessageStoreStats.PersistentDispatcherAvoidanceCount	1530	Measures the number of operations on reliable persistent data dispatched for writing to the data store but whose writing was subsequently unnecessary.	Per Messaging Engine	AverageStatistic	High
PersistentDispatcherAvoidanceSize	MessageStoreStats.PersistentDispatcherAvoidanceSize	1531	Measures the number of bytes associated with operations on reliable persistent data that were dispatched for writing to the data store but whose writing was subsequently unnecessary.	Per Messaging Engine	AverageStatistic	High
PersistentDispatcherBatchSize	MessageStoreStats.PersistentDispatcherBatchSize	1528	Measures the batching of operations on reliable persistent data dispatched for writing to the data store.	Per Messaging Engine	AverageStatistic	High
PersistentDispatcherCancellationCount	MessageStoreStats.PersistentDispatcherCancellationCount	1529	Counts the number of global transaction completion phases whose operations cancelled out prior to being written to the data store.	Per Messaging Engine	AverageStatistic	High
PersistentDispatcherRequestSize	MessageStoreStats.PersistentDispatcherRequestSize	1527	Measures the number of operations on reliable persistent data dispatched for writing to the data store.	Per Messaging Engine	AverageStatistic	High
SpillDispatcherAvoidanceCount	MessageStoreStats.SpillDispatcherAvoidanceCount	1525	Measures the number of operations on nonpersistent data dispatched for spilling to the data store but whose spilling was subsequently unnecessary.	Per Messaging Engine	AverageStatistic	High
SpillDispatcherAvoidanceSize	MessageStoreStats.SpillDispatcherAvoidanceSize	1526	Measures the number of bytes associated with operations on nonpersistent data dispatched for spilling to the data store but whose spilling was subsequently unnecessary.	Per Messaging Engine	AverageStatistic	High
SpillDispatcherBatchSize	MessageStoreStats.SpillDispatcherBatchSize	1524	Measures the batching of operations on nonpersistent data dispatched for spilling to the data store.	Per Messaging Engine	AverageStatistic	High

Table 32. Message store counter definitions: Data Store (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **Data Store**

Name	Key	ID	Description	Granularity	Type	Level
SpillDispatcherRequestSize	MessageStoreStats.SpillDispatcherRequestSize	1523	Measures the number of operations on nonpersistent data dispatched for spilling to the data store.	Per Messaging Engine	AverageStatistic	High
TransactionDeleteBatchCount	MessageStoreStats.TransactionDeleteBatchCount	1554	Transaction table delete batches	Per Messaging Engine	CountStatistic	High
TransactionInsertBatchCount	MessageStoreStats.TransactionInsertBatchCount	1553	Transaction table insert batches	Per Messaging Engine	CountStatistic	High
TransactionUpdateBatchCount	MessageStoreStats.TransactionUpdateBatchCount	1555	Transaction table update batches	Per Messaging Engine	CountStatistic	High

Table 33. Message store counter definitions: File Store. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Storage Management** > **File Store**

Name	Key	ID	Description	Granularity	Type	Level
FileStoreLogSpace	MessageStoreStats.FileStoreLogSpace	1556	Space in bytes remaining in the file store log.	Per Messaging Engine	AverageStatistic	High
FileStorePermanentObjectStoreSpace	MessageStoreStats.FileStorePermanentObjectStoreSpace	1557	Space in bytes remaining in the file store permanent store.	Per Messaging Engine	AverageStatistic	High
FileStoreTemporaryObjectStoreSpace	MessageStoreStats.FileStoreTemporaryObjectStoreSpace	1558	Space in bytes remaining in the file store temporary store.	Per Messaging Engine	AverageStatistic	High

Table 34. Message store counter definitions: Transactions. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***bus_name*** > **Storage Management** > **Transactions**

Name	Key	ID	Description	Granularity	Type	Level
GlobalTransactionAbortCount	MessageStoreStats.GlobalTransactionAbortCount	1538	Global transactions cancelled	Per Messaging Engine	CountStatistic	High
GlobalTransactionCommitCount	MessageStoreStats.GlobalTransactionCommitCount	1539	Global transactions committed	Per Messaging Engine	CountStatistic	High
GlobalTransactionInDoubtCount	MessageStoreStats.GlobalTransactionInDoubtCount	1537	Global transactions in doubt	Per Messaging Engine	CountStatistic	High
GlobalTransactionStartCount	MessageStoreStats.GlobalTransactionStartCount	1536	Global transactions started	Per Messaging Engine	CountStatistic	High
LocalTransactionAbortCount	MessageStoreStats.LocalTransactionAbortCount	1534	Local transactions aborted	Per Messaging Engine	CountStatistic	High
LocalTransactionCommitCount	MessageStoreStats.LocalTransactionCommitCount	1535	Local transactions committed	Per Messaging Engine	CountStatistic	High
LocalTransactionStartCount	MessageStoreStats.LocalTransactionStartCount	1533	Local transactions started	Per Messaging Engine	CountStatistic	High

Mediation framework counters:

These service integration bus mediation framework counters are part of the performance monitoring infrastructure (PMI), which provides server-side monitoring and a client-side API to retrieve performance information.

Counter definitions: To see lists of available PMI counters, use the administrative console to navigate to **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** > ***server_name*** > **[General Properties] Custom**.

The headings for each table show how to navigate to the counters in the administrative console.

Table 35. Mediation framework counter definitions: Mediations. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Mediations** > ***mediation_name***

Name	Key	ID	Description	Granularity	Type	Level
ThreadCount	Mediation.ThreadCount	1001	The number of messages being mediated concurrently at a mediation.	per mediation	RangeStatistic	High

Table 36. Mediation framework counter definitions: Mediated destinations. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Mediations** > ***mediation_name*** > ***destination_name***

Name	Key	ID	Description	Granularity	Type	Level
MediatedMessagesCount	Mediation.MediatedMessageCount	1002	The number of messages that have been mediated at a mediated destination.	per mediated destination	CountStatistic	Low
MediationTime	Mediation.MediationTime	1003	The amount of time in milliseconds taken to mediate a message at a mediated destination.	per mediated destination	TimeStatistic	Low

Message processor counters:

These service integration bus message processor counters are part of the performance monitoring infrastructure (PMI), which provides server-side monitoring and a client-side API to retrieve performance information.

Counter definitions: To see lists of available PMI counters, use the administrative console to navigate to **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** > ***server_name*** > **[General Properties] Custom**.

The headings for each table show how to navigate to the counters in the administrative console.

Table 37. Message processor counter definitions: Queues. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Queues**

Name	Key	ID	Description	Granularity	Type	Level
AggregateMessageWaitTime	QueueStats.AggregateMessageWaitTime	18	The time spent by messages in the bus at consumption. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	Per destination	CountStatistic	Low
AssuredPersistentMessagesConsumedCount	QueueStats.AssuredPersistentMessagesConsumedCount	16	The number of Assured Persistent messages consumed, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
AssuredPersistentMessagesProducedCount	QueueStats.AssuredPersistentMessagesProducedCount	10	The number of Assured Persistent messages produced, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
AvailableMessageCount	QueueStats.AvailableMessageCount	21	The number of messages available for a queue for consumption. If this number is close to the destination high messages value then review the high messages value.	Per destination	CountStatistic	Low

Table 37. Message processor counter definitions: Queues (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Queues**

Name	Key	ID	Description	Granularity	Type	Level
BestEffortNonPersistentMessagesConsumedCount	QueueStats.BestEffortNonPersistentMessagesConsumedCount	12	The number of Best Effort Non-persistent messages consumed, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
BestEffortNonPersistentMessagesProducedCount	QueueStats.BestEffortNonPersistentMessagesProducedCount	6	The number of Best Effort Non-persistent messages produced, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
ExpressNonPersistentMessagesConsumedCount	QueueStats.ExpressNonPersistentMessagesConsumedCount	13	The number of Express Non-persistent messages consumed, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
ExpressNonPersistentMessagesProducedCount	QueueStats.ExpressNonPersistentMessagesProducedCount	7	The number of Express Non-persistent messages produced, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
LocalConsumerAttachesCount	QueueStats.LocalConsumerAttachesCount	3	The number of times an attachment has been made to this queue by local consumers. The lifetime of this value is the lifetime of the messaging engine.	Per destination	CountStatistic	Low
LocalConsumerCount	QueueStats.LocalConsumerCount	4	The number of currently attached local consumers.	Per destination	CountStatistic	Low

Table 37. Message processor counter definitions: Queues (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Queues**

Name	Key	ID	Description	Granularity	Type	Level
LocalMessageWaitTime	QueueStats.LocalMessageWaitTime	19	The time spent by messages on this queue at consumption. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	Per destination	CountStatistic	Low
LocalOldestMessageAge	QueueStats.LocalOldestMessageAge	20	The longest time any message has spent on this queue. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	Per destination	CountStatistic	Low
LocalProducerAttachesCount	QueueStats.LocalProducerAttachesCount	1	The number of times an attachment has been made to this queue by local producers. The lifetime of this value is the lifetime of the messaging engine.	Per destination	CountStatistic	Low
LocalProducerCount	QueueStats.LocalProducerCount	2	The number of currently attached local producers.	Per destination	CountStatistic	Low

Table 37. Message processor counter definitions: Queues (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Queues**

Name	Key	ID	Description	Granularity	Type	Level
ReliableNonPersistentMessagesConsumedCount	QueueStats.ReliableNonPersistentMessagesConsumedCount	14	The number of Reliable Non-persistent messages consumed, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
ReliableNonPersistentMessagesProducedCount	QueueStats.ReliableNonPersistentMessagesProducedCount	8	The number of Reliable Non-persistent messages produced, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
ReliablePersistentMessagesConsumedCount	QueueStats.ReliablePersistentMessagesConsumedCount	15	The number of Reliable Persistent messages consumed, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
ReliablePersistentMessagesProducedCount	QueueStats.ReliablePersistentMessagesProducedCount	9	The number of Reliable Persistent messages produced, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
ReportEnabledMessagesExpiredCount	QueueStats.ReportEnabledMessagesExpiredCount	17	The number of report enabled messages that expired while on this queue.	Per destination	CountStatistic	Low
TotalMessagesConsumedCount	QueueStats.TotalMessagesConsumedCount	11	The total number of messages consumed from this queue, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low

Table 37. Message processor counter definitions: Queues (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Queues**

Name	Key	ID	Description	Granularity	Type	Level
TotalMessagesProducedCount	QueueStats.TotalMessagesProducedCount	5	The total number of messages produced to this queue, for the lifetime of this messaging engine.	Per destination	CountStatistic	Low
UnavailableMessageCount	QueueStats.UnavailableMessageCount	22	The number of messages locked or uncommitted, this means messages that have been added or removed but the transaction has not been committed yet. If this number is high then check which messages are locked and why.	Per destination	CountStatistic	Low

Table 38. Message processor counter definitions: Topic spaces. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces**

Name	Key	ID	Description	Granularity	Type	Level
AssuredPersistentLocalSubscriptionHitCount	TopicspaceStats.AssuredPersistentLocalSubscriptionHitCount	116	The cumulative total of subscriptions that have matched Assured Persistent publications.	Per destination	CountStatistic	Low
AssuredPersistentMessagesPublishedCount	TopicspaceStats.AssuredPersistentMessagesPublishedCount	110	The number of Assured Persistent messages published	Per destination	CountStatistic	Low
BestEffortNonPersistentLocalSubscriptionHitCount	TopicspaceStats.BestEffortNonPersistentLocalSubscriptionHitCount	112	The cumulative total of subscriptions that have matched Best Effort Non-persistent publications.	Per destination	CountStatistic	Low
BestEffortNonPersistentMessagesPublishedCount	TopicspaceStats.BestEffortNonPersistentMessagesPublishedCount	106	The number of Best Effort Non-persistent messages published	Per destination	CountStatistic	Low
DurableLocalSubscriptionCount	TopicspaceStats.DurableLocalSubscriptionCount	104	The number of durable subscriptions.	Per destination	CountStatistic	Low
ExpressNonPersistentLocal SubscriptionHitCount	TopicspaceStats.ExpressNonPersistentLocalSubscriptionHitCount	113	The cumulative total of subscriptions that have matched Express Non-persistent publications.	Per destination	CountStatistic	Low
ExpressNonPersistentMessagesPublishedCount	TopicspaceStats.ExpressNonPersistentMessagesPublishedCount	107	The number of Express Non-persistent messages published	Per destination	CountStatistic	Low

Table 38. Message processor counter definitions: Topic spaces (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces**

Name	Key	ID	Description	Granularity	Type	Level
IncompletePublicationCount	TopicspaceStats.IncompletePublicationCount	119	The number of publications not yet received by all current subscribers. If this number is unexpected then view the publication in the administrative console to take any actions.	Per destination	CountStatistic	Low
LocalOldestPublicationAge	TopicspaceStats.LocalOldestPublicationAge	118	The longest time any publication has spent on this topicspace. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	Per destination	TimeStatistic	max
LocalPublisherAttachesCount	TopicspaceStats.LocalPublisherAttachesCount	100	The number of times an attachment has been made to this topicspace by local producers. The lifetime of this value is the lifetime of the messaging engine.	Per destination	CountStatistic	Low
LocalPublisherCount	TopicspaceStats.LocalPublisherCount	101	The number of local publishers to topics in this topicspace.	Per destination	CountStatistic	Low
NonDurableLocalSubscriptionCount	TopicspaceStats.NonDurableLocalSubscriptionCount	103	The number of non-durable subscriptions.	Per destination	CountStatistic	Low

Table 38. Message processor counter definitions: Topic spaces (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces**

Name	Key	ID	Description	Granularity	Type	Level
ReliableNonPersistentLocalSubscriptionHitCount	TopicspaceStats.ReliableNonPersistentLocalSubscriptionHitCount	114	The cumulative total of subscriptions that have matched Reliable Non-persistent publications.	Per destination	CountStatistic	Low
ReliableNonPersistentMessagesPublishedCount	TopicspaceStats.ReliableNonPersistentMessagesPublishedCount	108	The number of Reliable Non-persistent messages published	Per destination	CountStatistic	Low
ReliablePersistentLocalSubscriptionHitCount	TopicspaceStats.ReliablePersistentLocalSubscriptionHitCount	115	The cumulative total of subscriptions that have matched Reliable Persistent publications.	Per destination	CountStatistic	Low
ReliablePersistentMessagesPublishedCount	TopicspaceStats.ReliablePersistentMessagesPublishedCount	109	The number of Reliable Persistent messages published	Per destination	CountStatistic	Low
ReportEnabledPublicationExpiredCount	TopicspaceStats.ReportEnabledPublicationsExpiredCount	117	The number of report enabled incomplete publications that expired while on this topicspace.	Per destination	CountStatistic	Low
TotalLocalSubscriptionCount	TopicspaceStats.TotalLocalSubscriptionCount	102	The number of local subscriptions to topics in this topicspace. Each subscription is counted once, even if the topic includes wildcards.	Per destination	CountStatistic	Low

Table 38. Message processor counter definitions: Topic spaces (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces**

Name	Key	ID	Description	Granularity	Type	Level
TotalLocalSubscriptionHitCount	TopicspaceStats.TotalLocalSubscriptionHitCount	111	The cumulative total of subscriptions that have matched topicspace publications.	Per destination	CountStatistic	Low
TotalMessagesPublishedCount	TopicspaceStats.TotalMessagesPublishedCount	105	The total number of publications to this topicspace.	Per destination	CountStatistic	Low

Table 39. Message processor counter definitions: Durable subscriptions. ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces** > ***topic_name*** > **DurableSubscriptions**

Name	Key	ID	Description	Granularity	Type	Level
AggregateMessageWaitTime	DurableSubscriptionStats.AggregateMessageWaitTime	206	The time spent by messages in the bus at consumption. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	per mediated destination	TimeStatistic	High
AssuredPersistentMessagesConsumedCount	DurableSubscriptionStats.AssuredPersistentMessagesConsumedCount	205	The number of Assured Persistent messages consumed, for the lifetime of this messaging engine.	per mediated destination	CountStatistic	Low
AvailabeMessageCount	DurableSubscriptionStats.AvailableMessageCount	209	The number of messages waiting to be consumed.	per mediated destination	CountStatistic	Low
BestEffortNonPersistentMessagesConsumedCount	DurableSubscriptionStats.BestEffortNonPersistentMessagesConsumedCount	201	The number of Best Effort Non-persistent messages consumed, for the lifetime of this messaging engine.	per mediated destination	CountStatistic	Low
ExpressNonPersistentMessagesConsumedCount	DurableSubscriptionStats.ExpressNonPersistentMessagesConsumedCount	202	The number of Express Non-persistent messages consumed, for the lifetime of this messaging engine.	per mediated destination	CountStatistic	Low

Table 39. Message processor counter definitions: Durable subscriptions (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces** > ***topic_name*** > **DurableSubscriptions**

Name	Key	ID	Description	Granularity	Type	Level
LocalMessageWaitTime	DurableSubscriptionStats.LocalMessageWaitTime	207	The time spent by messages on this durable subscription at consumption. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	per mediated destination	TimeStatistic	High
LocalOldestPublicationAge	DurableSubscriptionStats.LocalOldestPublicationAge	208	The longest time any message has spent on this subscription. If this time is not what was expected then view the message in the administrative console to decide what action needs to be taken.	per mediated destination	TimeStatistic	Max
ReliableNonPersistentMessagesConsumedCount	DurableSubscriptionStats.ReliableNonPersistentMessagesConsumedCount	203	The number of Reliable Non-persistent messages consumed, for the lifetime of this messaging engine.	per mediated destination	CountStatistic	Low
ReliablePersistentMessagesConsumedCount	DurableSubscriptionStats.ReliablePersistentMessagesConsumedCount	204	The number of Reliable Persistent messages consumed, for the lifetime of this messaging engine.	per mediated destination	CountStatistic	Low

Table 39. Message processor counter definitions: Durable subscriptions (continued). ***server_name*** > **SIB Service** > **SIB Messaging Engines** > ***messaging_engine_name*** > **Destinations** > **Topicspaces** > ***topic_name*** > **DurableSubscriptions**

Name	Key	ID	Description	Granularity	Type	Level
TotalMessagesConsumedCount	DurableSubscriptionStats.TotalMessagesConsumedCount	200	The total number of messages consumed from this durable subscription.	per mediated destination	CountStatistic	Low

Communications counters:

These service integration bus communications counters are part of the performance monitoring infrastructure (PMI), which provides server-side monitoring and a client-side API to retrieve performance information. Communications counters are maintained across all components of WebSphere Application Server.

Counter definitions: To see lists of available PMI counters, use the administrative console to navigate to **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** > ***resource_name*** > **[General Properties] Custom**.

The headings for each table show how to navigate to the counters in the administrative console.

Table 40. Communications counter definitions: Clients Standard Statistics. ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
APIConnectionsCount	ClientStats.APIConnections	552	The number of API sessions being used by clients that are currently network connected to this application server. Some of these API connections might be being by internal system processes on behalf of a client.	current clients/connections connected to this application server	CountStatistic	Low
BufferedReadBytesCount	ClientStats.BufferedReadBytes	561	Number of bytes of data that have been received from the network and are held pending further processing. Large values might indicate that the application server is unable to process data fast enough to keep up with the clients attached.	All clients connected or that have been connected to this application server	CountStatistic	Low
BufferedWriteBytesCount	ClientStats.BufferedWriteBytes	560	Number of bytes of data being held pending transmission. Large values might indicate network congestion or clients that are unable to process data fast enough to keep up with the application server.	All clients connected or that have been connected to this application server	CountStatistic	Low
ClientsAttachedCount	ClientStats.ClientsAttached	551	The number of distinct client processes currently network connected to this application server.	Current clients/connections connected to this application server	CountStatistic	Low
ErrorsCount	ClientStats.Errors	553	Communication errors that have occurred and resulted in a network connection to a client being disconnected.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessageBytesReadCount	ClientStats.MessageBytesRead	563	Number of bytes of message data received from client processes over network connections. This does not include data used to negotiate the transmission of messages	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesBytesWrittenCount	ClientStats.MessageBytesWritten	562	Number of bytes of message data sent to client processes over network connections. This does not include data used to negotiate the transmission of messages	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 40. Communications counter definitions: Clients Standard Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MulticastSendMessageCount	ClientStats.MulticastSendMessage	559	Number of messages transmitted that use multicast protocols.	All clients connected or that have been connected to this application server	CountStatistic	Low
MulticastWriteBytesCount	ClientStats.MulticastWriteBytes	558	Number of bytes transmitted that use multicast protocols.	All clients connected or that have been connected to this application server	CountStatistic	Low
ReadsBlockedCount	ClientStats.ReadsBlocked	557	Number of read operations that could not be completed immediately. For IBM Service use.	All clients connected or that have been connected to this application server	CountStatistic	Low
ReadsCount	ClientStats.Reads	555	Number of read operations used to receive data from client processes across network connections.	All clients connected or that have been connected to this application server	CountStatistic	Low
TotalBytesReadCount	ClientStats.TotalBytesRead	565	Number of bytes of data received from client processes. This includes both message data and data used to negotiate the transmission of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
TotalBytesWrittenCount	ClientStats.TotalBytesWritten	564	Number of bytes of data sent to client processes. This includes both message data and data used to negotiate the transmission of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
WritesBlockedCount	ClientStats.WritesBlocked	556	Number of write operations that could not be completed immediately. For IBM Service use.	All clients connected or that have been connected to this application server	CountStatistic	Low
WritesCount	ClientStats.Writes	554	Number of write operations used to transmit data to client processes across network connections.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics. ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtHighPriorityCount	ClientDetailedStats.BytesReceivedAtHighPriority	719	Number of bytes of data received at a high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtHighestPriorityCount	ClientDetailedStats.BytesReceivedAtHighestPriority	717	Number of bytes of data received at the highest possible priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS0PriorityCount	ClientDetailedStats.BytesReceivedAtJMS0Priority	729	Number of bytes of data received at the priority used by JMS priority 0 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS1PriorityCount	ClientDetailedStats.BytesReceivedAtJMS1Priority	728	Number of bytes of data received at the priority used by JMS priority 1 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS2PriorityCount	ClientDetailedStats.BytesReceivedAtJMS2Priority	727	Number of bytes of data received at the priority used by JMS priority 2 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** **> SIB Service > SIB Communications > Clients > Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS3PriorityCount	ClientDetailedStats.BytesReceivedAtJMS3Priority	726	Number of bytes of data received at the priority used by JMS priority 3 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS4PriorityCount	ClientDetailedStats.BytesReceivedAtJMS4Priority	725	Number of bytes of data received at the priority used by JMS priority 4 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** **> SIB Service > SIB Communications > Clients > Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS5PriorityCount	ClientDetailedStats.BytesReceivedAtJMS5Priority	724	Number of bytes of data received at the priority used by JMS priority 5 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS6PriorityCount	ClientDetailedStats.BytesReceivedAtJMS6Priority	723	Number of bytes of data received at the priority used by JMS priority 6 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS7PriorityCount	ClientDetailedStats.BytesReceivedAtJMS7Priority	722	Number of bytes of data received at the priority used by JMS priority 7 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS8PriorityCount	ClientDetailedStats.BytesReceivedAtJMS8Priority	721	Number of bytes of data received at the priority used by JMS priority 8 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** **> SIB Service > SIB Communications > Clients > Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS9PriorityCount	ClientDetailedStats.BytesReceivedAtJMS9Priority	720	Number of bytes of data received at the priority used by JMS priority 9 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtLowPriorityCount	ClientDetailedStats.BytesReceivedAtLowPriority	730	Number of bytes of data received at a low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtLowestPriorityCount	ClientDetailedStats.BytesReceivedAtLowestPriority	732	Number of bytes of data received at the lowest possible priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtVeryHighPriorityCount	ClientDetailedStats.BytesReceivedAtVeryHighPriority	718	Number of bytes of data received at a very high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtVeryLowPriorityCount	ClientDetailedStats.BytesReceivedAtVeryLowPriority	731	Number of bytes of data received at a very low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtHighPriorityCount	ClientDetailedStats.BytesSentAtHighPriority	703	Number of bytes of data transmitted at a high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtHighestPriorityCount	ClientDetailedStats.BytesSentAtHighestPriority	701	Number of bytes of data transmitted at the highest possible priority for transmission. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS0PriorityCount	ClientDetailedStats.BytesSentAtJMS0Priority	713	Number of bytes of data transmitted at the priority used by JMS priority 0 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS1PriorityCount	ClientDetailedStats.BytesSentAtJMS1Priority	712	Number of bytes of data transmitted at the priority used by JMS priority 1 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** **> SIB Service > SIB Communications > Clients > Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS2PriorityCount	ClientDetailedStats.BytesSentAtJMS2Priority	711	Number of bytes of data transmitted at the priority used by JMS priority 2 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS3PriorityCount	ClientDetailedStats.BytesSentAtJMS3Priority	710	Number of bytes of data transmitted at the priority used by JMS priority 3 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS4PriorityCount	ClientDetailedStats.BytesSentAtJMS4Priority	709	Number of bytes of data transmitted at the priority used by JMS priority 4 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS5PriorityCount	ClientDetailedStats.BytesSentAtJMS5Priority	708	Number of bytes of data transmitted at the priority used by JMS priority 5 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** **> SIB Service > SIB Communications > Clients > Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS6PriorityCount	ClientDetailedStats.BytesSentAtJMS6Priority	707	Number of bytes of data transmitted at the priority used by JMS priority 6 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS7PriorityCount	ClientDetailedStats.BytesSentAtJMS7Priority	706	Number of bytes of data transmitted at the priority used by JMS priority 7 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS8PriorityCount	ClientDetailedStats.BytesSentAtJMS8Priority	705	Number of bytes of data transmitted at the priority used by JMS priority 8 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS9PriorityCount	ClientDetailedStats.BytesSentAtJMS9Priority	704	Number of bytes of data transmitted at the priority used by JMS priority 9 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtLowPriorityCount	ClientDetailedStats.BytesSentAtLowPriority	714	Number of bytes of data transmitted at a low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtLowestPriorityCount	ClientDetailedStats.BytesSentAtLowestPriority	716	Number of bytes of data transmitted at the lowest possible priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtVeryHighPriorityCount	ClientDetailedStats.BytesSentAtVeryHighPriority	702	Number of bytes of data transmitted at a very high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtVeryLowPriorityCount	ClientDetailedStats.BytesSentAtVeryLowPriority	715	Number of bytes of data transmitted at a very low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS0PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS0Priority	752	Number of messages received at JMS priority 0.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS1PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS1Priority	751	Number of messages received at JMS priority 1.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessagesReceivedAtJMS2PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS2Priority	750	Number of messages received at JMS priority 2.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS3PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS3Priority	749	Number of messages received at JMS priority 3.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS4PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS4Priority	748	Number of messages received at JMS priority 4.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS5PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS5Priority	747	Number of messages received at JMS priority 5.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS6PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS6Priority	746	Number of messages received at JMS priority 6.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS7PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS7Priority	745	Number of messages received at JMS priority 7.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS8PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS8Priority	744	Number of messages received at JMS priority 8.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessagesReceivedAtJMS9PriorityCount	ClientDetailedStats.MessagesReceivedAtJMS9Priority	743	Number of messages received at JMS priority 9.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS0PriorityCount	ClientDetailedStats.MessagesSentAtJMS0Priority	742	Number of messages transmitted at JMS priority 0.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS1PriorityCount	ClientDetailedStats.MessagesSentAtJMS1Priority	741	Number of messages transmitted at JMS priority 1.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS2PriorityCount	ClientDetailedStats.MessagesSentAtJMS2Priority	740	Number of messages transmitted at JMS priority 2.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS3PriorityCount	ClientDetailedStats.MessagesSentAtJMS3Priority	739	Number of messages transmitted at JMS priority 3.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS4PriorityCount	ClientDetailedStats.MessagesSentAtJMS4Priority	738	Number of messages transmitted at JMS priority 4.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS5PriorityCount	ClientDetailedStats.MessagesSentAtJMS5Priority	737	Number of messages transmitted at JMS priority 5.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 41. Communications counter definitions: Clients Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Clients** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessagesSentAtJMS6PriorityCount	ClientDetailedStats.MessagesSentAtJMS6Priority	736	Number of messages transmitted at JMS priority 6.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS7PriorityCount	ClientDetailedStats.MessagesSentAtJMS7Priority	735	Number of messages transmitted at JMS priority 7.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS8PriorityCount	ClientDetailedStats.MessagesSentAtJMS8Priority	734	Number of messages transmitted at JMS priority 8.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS9PriorityCount	ClientDetailedStats.MessagesSentAtJMS9Priority	733	Number of messages transmitted at JMS priority 9.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 42. Communications counter definitions: Messaging Engine Standard Statistics. ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
APIConnectionsCount	MEStats.APIConnections	502	The number of sessions being used by messaging engines that are currently network connected to this application server.	current applications servers hosting messaging engines/connections connected to this application server.	CountStatistic	Low
BufferedReadBytesCount	MEStats.BufferedReadBytes	511	Number of bytes of data that have been received from the network and are held pending further processing. Large values might indicate that the application server is unable to process data fast enough to keep up with the other application server processes hosting messaging engines that it is network attached.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
BufferedWriteBytesCount	MEStats.BufferedWriteBytes	510	Number of bytes of data being held pending transmission. Large values might indicate network congestion or application server processes hosting messaging engines that are unable to process data fast enough to keep up with the application server.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
ErrorsCount	MEStats.Errors	503	Communication errors that have occurred and resulted in a network connection to a messaging engine being disconnected.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
MEAttachedCount	MEStats.MEAttached	501	The number of distinct application server processes hosting messaging engines currently network connected to this application server.	current applications servers hosting messaging engines/connections connected to this application server.	CountStatistic	Low

Table 42. Communications counter definitions: Messaging Engine Standard Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessageBytesReadCount	MEStats.MessageBytesRead	513	Number of bytes of message data received from application server processes hosting messaging engines over network connections. This does not include data used to negotiate the transmission of messages	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
MessageBytesWrittenCount	MEStats.MessageBytesWritten	512	Number of bytes of message data sent to application server processes hosting messaging engines over network connections. This does not include data used to negotiate the transmission of messages	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
ReadsBlockedCount	MEStats.ReadsBlocked	507	Number of read operations that could not be completed immediately. For IBM Service use.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
ReadsCount	MEStats.Reads	505	Number of read operations used to receive data from application server processes hosting messaging engines across network connections.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
TotalBytesReadCount	MEStats.TotalBytesRead	515	Number of bytes of data received from application server processes hosting messaging engines.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
TotalBytesWrittenCount	MEStats.TotalBytesWritten	514	Number of bytes of data sent to application server processes hosting messaging engines.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low
WritesBlockedCount	MEStats.WritesBlocked	506	Number of write operations that could not be completed immediately. For IBM Service use.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low

Table 42. Communications counter definitions: Messaging Engine Standard Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
WritesCount	MEStats.Writes	504	Number of write operations used to transmit data to application server processes hosting messaging engines across network connections.	All messaging engines connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics. ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtHighPriorityCount	MEDetailedStats.BytesReceivedAtHighPriority	619	Number of bytes of data received at a high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected, or that have been connected, to this application server	CountStatistic	Low
BytesReceivedAtHighestPriorityCount	MEDetailedStats.BytesReceivedAtHighestPriority	617	Number of bytes of data received at the highest possible priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS0PriorityCount	MEDetailedStats.BytesReceivedAtJMS0Priority	629	Number of bytes of data received at the priority used by JMS priority 0 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS1PriorityCount	MEDetailedStats.BytesReceivedAtJMS1Priority	628	Number of bytes of data received at the priority used by JMS priority 1 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS2PriorityCount	MEDetailedStats.BytesReceivedAtJMS2Priority	627	Number of bytes of data received at the priority used by JMS priority 2 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS3PriorityCount	MEDetailedStats.BytesReceivedAtJMS3Priority	626	Number of bytes of data received at the priority used by JMS priority 3 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS4PriorityCount	MEDetailedStats.BytesReceivedAtJMS4Priority	625	Number of bytes of data received at the priority used by JMS priority 4 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS5PriorityCount	MEDetailedStats.BytesReceivedAtJMS5Priority	624	Number of bytes of data received at the priority used by JMS priority 5 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS6PriorityCount	MEDetailedStats.BytesReceivedAtJMS6Priority	623	Number of bytes of data received at the priority used by JMS priority 6 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS7PriorityCount	MEDetailedStats.BytesReceivedAtJMS7Priority	622	Number of bytes of data received at the priority used by JMS priority 7 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtJMS8PriorityCount	MEDetailedStats.BytesReceivedAtJMS8Priority	621	Number of bytes of data received at the priority used by JMS priority 8 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtJMS9PriorityCount	MEDetailedStats.BytesReceivedAtJMS9Priority	620	Number of bytes of data received at the priority used by JMS priority 9 messages. Typically this is an accurate measure of the number of bytes of message data received at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All MEs connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtLowPriorityCount	MEDetailedStats.BytesReceivedAtLowPriority	630	Number of bytes of data received at a low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtLowestPriorityCount	MEDetailedStats.BytesReceivedAtLowestPriority	632	Number of bytes of data received at the lowest possible priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesReceivedAtVeryHighPriorityCount	MEDetailedStats.BytesReceivedAtVeryHighPriority	618	Number of bytes of data received at a very high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesReceivedAtVeryLowPriorityCount	MEDetailedStats.BytesReceivedAtVeryLowPriority	631	Number of bytes of data received at a very low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtHighPriorityCount	MEDetailedStats.BytesSentAtHighPriority	603	Number of bytes of data transmitted at a high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtHighestPriorityCount	MEDetailedStats.BytesSentAtHighestPriority	601	Number of bytes of data transmitted at the highest possible priority for transmission. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS0PriorityCount	MEDetailedStats.BytesSentAtJMS0Priority	613	Number of bytes of data transmitted at the priority used by JMS priority 0 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS1PriorityCount	MEDetailedStats.BytesSentAtJMS1Priority	612	Number of bytes of data transmitted at the priority used by JMS priority 1 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS2PriorityCount	MEDetailedStats.BytesSentAtJMS2Priority	611	Number of bytes of data transmitted at the priority used by JMS priority 2 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS3PriorityCount	MEDetailedStats.BytesSentAtJMS3Priority	610	Number of bytes of data transmitted at the priority used by JMS priority 3 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS4PriorityCount	MEDetailedStats.BytesSentAtJMS4Priority	609	Number of bytes of data transmitted at the priority used by JMS priority 4 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS5PriorityCount	MEDetailedStats.BytesSentAtJMS5Priority	608	Number of bytes of data transmitted at the priority used by JMS priority 5 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS6PriorityCount	MEDetailedStats.BytesSentAtJMS6Priority	607	Number of bytes of data transmitted at the priority used by JMS priority 6 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS7PriorityCount	MEDetailedStats.BytesSentAtJMS7Priority	606	Number of bytes of data transmitted at the priority used by JMS priority 7 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtJMS8PriorityCount	MEDetailedStats.BytesSentAtJMS8Priority	605	Number of bytes of data transmitted at the priority used by JMS priority 8 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtJMS9PriorityCount	MEDetailedStats.BytesSentAtJMS9Priority	604	Number of bytes of data transmitted at the priority used by JMS priority 9 messages. Typically this is an accurate measure of the number of bytes of message data transmitted at this priority level. However, from time to time, control transmissions used to negotiate the flow of messages might be transmitted at this priority level.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtLowPriorityCount	MEDetailedStats.BytesSentAtLowPriority	614	Number of bytes of data transmitted at a low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BytesSentAtLowestPriorityCount	MEDetailedStats.BytesSentAtLowestPriority	616	Number of bytes of data transmitted at the lowest possible priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtVeryHighPriorityCount	MEDetailedStats.BytesSentAtVeryHighPriority	602	Number of bytes of data transmitted at a very high priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
BytesSentAtVeryLowPriorityCount	MEDetailedStats.BytesSentAtVeryLowPriority	615	Number of bytes of data transmitted at a very low priority. Message data cannot be transmitted with this priority, so typically these bytes of data will comprise control transmissions used to negotiate the flow of messages.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS0PriorityCount	MEDetailedStats.MessagesReceivedAtJMS0Priority	652	Number of messages received at JMS priority 0.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS1PriorityCount	MEDetailedStats.MessagesReceivedAtJMS1Priority	651	Number of messages received at JMS priority 1.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessagesReceivedAtJMS2PriorityCount	MEDetailedStats.MessagesReceivedAtJMS2Priority	650	Number of messages received at JMS priority 2.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS3PriorityCount	MEDetailedStats.MessagesReceivedAtJMS3Priority	649	Number of messages received at JMS priority 3.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS4PriorityCount	MEDetailedStats.MessagesReceivedAtJMS4Priority	648	Number of messages received at JMS priority 4.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS5PriorityCount	MEDetailedStats.MessagesReceivedAtJMS5Priority	647	Number of messages received at JMS priority 5.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS6PriorityCount	MEDetailedStats.MessagesReceivedAtJMS6Priority	646	Number of messages received at JMS priority 6.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS7PriorityCount	MEDetailedStats.MessagesReceivedAtJMS7Priority	645	Number of messages received at JMS priority 7.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesReceivedAtJMS8PriorityCount	MEDetailedStats.MessagesReceivedAtJMS8Priority	644	Number of messages received at JMS priority 8.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessagesReceivedAtJMS9PriorityCount	MEDetailedStats.MessagesReceivedAtJMS9Priority	643	Number of messages received at JMS priority 9.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS0PriorityCount	MEDetailedStats.MessagesSentAtJMS0Priority	642	Number of messages transmitted at JMS priority 0.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS1PriorityCount	MEDetailedStats.MessagesSentAtJMS1Priority	641	Number of messages transmitted at JMS priority 1.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS2PriorityCount	MEDetailedStats.MessagesSentAtJMS2Priority	640	Number of messages transmitted at JMS priority 2.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS3PriorityCount	MEDetailedStats.MessagesSentAtJMS3Priority	639	Number of messages transmitted at JMS priority 3.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS4PriorityCount	MEDetailedStats.MessagesSentAtJMS4Priority	638	Number of messages transmitted at JMS priority 4.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS5PriorityCount	MEDetailedStats.MessagesSentAtJMS5Priority	637	Number of messages transmitted at JMS priority 5.	All clients connected or that have been connected to this application server	CountStatistic	Low

Table 43. Communications counter definitions: Messaging Engine Detailed Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

Name	Key	ID	Description	Granularity	Type	Level
MessagesSentAtJMS6PriorityCount	MEDetailedStats.MessagesSentAtJMS6Priority	636	Number of messages transmitted at JMS priority 6.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS7PriorityCount	MEDetailedStats.MessagesSentAtJMS7Priority	635	Number of messages transmitted at JMS priority 7.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS8PriorityCount	MEDetailedStats.MessagesSentAtJMS8Priority	634	Number of messages transmitted at JMS priority 8.	All clients connected or that have been connected to this application server	CountStatistic	Low
MessagesSentAtJMS9PriorityCount	MEDetailedStats.MessagesSentAtJMS9Priority	633	Number of messages transmitted at JMS priority 9.	All clients connected or that have been connected to this application server	CountStatistic	Low

server_name > **SIB Service** > **SIB Communications** > **Messaging Engines** > **Detailed Statistics**

The same set of detailed statistics are available for messaging engines as is described for MEs.

Table 44. Communications counter definitions: WebSphere MQ Links Standard Statistics. ***server_name*** > **SIB Service** > **SIB Communications** > **WMQ Links** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
BatchesReceivedCount	MQLinkStats.BatchesReceived	802	Number of batches of messages received from network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
BatchesSentCount	MQLinkStats.BatchesSent	801	Number of batches of messages sent to network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
CommsErrorsCount	MQLinkStats.CommsErrors	811	Number of communication errors that resulted in a network connection to a WebSphere MQ Queue Manager being disconnected.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
LongRetriesCount	MQLinkStats.LongRetries	810	Number of long retries. This indicates the number of times channels were disconnected and could not be re-established for longer periods of time.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
MessagesReceivedCount	MQLinkStats.MessagesReceived	804	Number of messages received from network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
MessagesSentCount	MQLinkStats.MessagesSent	803	Number of messages sent to network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
QMAttachedCount	MQLinkStats.QMAttached	812	Total number of WebSphere MQ Queue Managers currently network attached to this application server	WebSphere MQ Queue Managers that are currently attached	CountStatistic	Low
ReadsBlockedCount	MQLinkStats.ReadsBlocked	814	Number of read operations that could not be completed immediately. For IBM Service use.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
ReceiverBytesReceivedCount	MQLinkStats.ReceiverBytesReceived	808	Number of bytes of data received by receiver channels from network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low

Table 44. Communications counter definitions: WebSphere MQ Links Standard Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **WMQ Links** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
ReceiverBytesSentCount	MQLinkStats.ReceiverBytesSent	807	Number of bytes of data sent by receiver channels to network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
SenderBytesReceivedCount	MQLinkStats.SenderBytesReceived	806	Number of bytes of data received by sender channels from network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
SenderBytesSentCount	MQLinkStats.SenderBytesSent	805	Number of bytes of data sent by sender channels to network attached WebSphere MQ Queue Managers.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
ShortRetriesCount	MQLinkStats.ShortRetries	809	Number of short retries. This indicates the number of times channels were disconnected and could not be re-established for short periods of time.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low
WritesBlockedCount	MQLinkStats.WritesBlocked	813	Number of write operations that could not be completed immediately. For IBM Service use.	All WebSphere MQ Queue Managers that are or have been connected to this application server	CountStatistic	Low

Table 45. Communications counter definitions: WebSphere MQ Client Links Standard Statistics. ***server_name*** **> SIB Service > SIB Communications > WMQ Client Links > Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
APICallsServicedCount	MQClientLinkStats.APICallsServiced	906	The number of MQ API call requests serviced on behalf of WebSphere MQ JMS clients.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
BatchesSentCount	MQClientLinkStats.BatchesSent	901	Number of batches of messages sent to network attached MQJMS clients.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
BytesReceivedCount	MQClientLinkStats.BytesReceived	905	Number of bytes of data received from network attached WebSphere MQ JMS clients. This includes bytes of message data as well as bytes of data used to control the flow of messages.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
BytesSentCount	MQClientLinkStats.BytesSent	904	Number of bytes of data sent to network attached WebSphere MQ JMS clients. This includes bytes of message data as well as bytes of data used to control the flow of messages.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
ClientsAttachedCount	MQClientLinkStats.ClientsAttached	908	The current number of WebSphere MQ JMS clients attached to this application server.	WebSphere MQ JMS clients that are currently attached.	CountStatistic	Low
CommsErrorsCount	MQClientLinkStats.CommsErrors	907	The number of errors that have cause connections to WebSphere MQ JMS clients to be dropped.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
MessagesReceivedCount	MQClientLinkStats.MessagesReceived	903	Number of messages received from network attached WebSphere MQ JMS clients.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
MessagesSentCount	MQClientLinkStats.MessagesSent	902	Number of messages sent to network attached WebSphere MQ JMS clients.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low

Table 45. Communications counter definitions: WebSphere MQ Client Links Standard Statistics (continued). ***server_name*** > **SIB Service** > **SIB Communications** > **WMQ Client Links** > **Standard Statistics**

Name	Key	ID	Description	Granularity	Type	Level
ReadsBlockedCount	MQClientLinkStats.ReadsBlocked	910	Number of read operations that could not be completed immediately. For IBM Service use.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low
WritesBlockedCount	MQClientLinkStats.WritesBlocked	909	Number of write operations that could not be completed immediately. For IBM Service use.	All WebSphere MQ JMS clients that are or have been connected to this application server	CountStatistic	Low

Web services gateway counters:

These service integration bus web services gateway counters are part of the performance monitoring infrastructure (PMI), which provides server-side monitoring and a client-side API to retrieve performance information. Examples of web services gateway counters are the number of synchronous and asynchronous requests and responses.

To see lists of available PMI counters, use the administrative console to navigate to **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** > ***resource_name*** > **[General Properties] Custom**.

Table 46. Counter definitions. This table describes the properties of Web services gateway counters.

Name	Key	ID	Description	Granularity	Type	Level	Overhead
AsynchronousRequestCount	wsgwModule.asynchronousRequests	3	The number of asynchronous requests made.	Per web service	CountStatistic	All	Low
AsynchronousResponseCount	wsgwModule.asynchronousResponses	4	The number of asynchronous responses made.	Per web service	CountStatistic	All	Low
SynchronousRequestCount	wsgwModule.synchronousRequests	1	The number of synchronous requests made.	Per web service	CountStatistic	All	Low
SynchronousResponseCount	wsgwModule.synchronousResponses	2	The number of synchronous responses made.	Per web service	CountStatistic	All	Low

SIP PMI counters

The Session Initiation Protocol (SIP) provides the following counters in the WebSphere Performance Monitoring Infrastructure (PMI) to monitor the performance of SIP.

Counter definitions:

Table 47. SIP container module.

This table lists the SIP container module

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Incoming traffic	incoming.traffic	Average number of messages handled by the container calculated over configurable period	Per server	CountStatistic	All	Low	3
New SIP App sessions	new.sip.app.session	Average number of new SIP application sessions created in the container and calculated over configurable period	Per server	CountStatistic	All	Low	4
Response Time	response.time	The average amount of time that it takes between when a message gets into the container and when a response is sent from the container.	Per server	CountStatistic	All	Low	5
Queue Size	queue.size	Size of the invoke queue in WebSphere Application Server	Per server	CountStatistic	All	Low	6

Table 48. Session module.

This table lists the session module

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of active SIP sessions	active.sip.sessions	The number of SIP sessions belongs to each application	Per application	CountStatistic	All	Low	11
Number of active SIP application sessions	active.sip.app.sessions	The number of SIP application sessions belongs to each application	Per application	CountStatistic	All	Low	12

Table 49. Inbound request module.

This table lists the inbound request module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound NOT SIP STANDARD requests	inbound.request.other	The number of inbound NOT SIP STANDARD requests that belong to each application	Per application	CountStatistic	All	Low	60
Number of Inbound REGISTER requests	inbound.request.register	The number of inbound REGISTER requests that belong to each application	Per application	CountStatistic	All	Low	61
Number of Inbound INVITE requests	inbound.request.invite	The number of inbound INVITE requests that belong to each application	Per application	CountStatistic	All	Low	62
Number of Inbound ACK requests	inbound.request.ack	The number of Inbound ACK requests that belong to each application	Per application	CountStatistic	All	Low	63
Number of Inbound OPTIONS requests	inbound.request.options	The number of Inbound OPTIONS requests that belong to each application	Per application	CountStatistic	All	Low	64
Number of Inbound BYE requests	inbound.request.bye	The number of Inbound BYE requests that belong to each application	Per application	CountStatistic	All	Low	65
Number of Inbound CANCEL requests	inbound.request.cancel	The number of Inbound CANCEL requests that belong to each application	Per application	CountStatistic	All	Low	66
Number of Inbound PRACK requests	inbound.request.prack	The number of Inbound PRACK requests that belong to each application	Per application	CountStatistic	All	Low	67
Number of Inbound INFO requests	inbound.request.info	The number of Inbound INFO requests that belong to each application	Per application	CountStatistic	All	Low	68
Number of Inbound SUBSCRIBE requests	inbound.request.subscribe	The number of Inbound SUBSCRIBE requests that belong to each application	Per application	CountStatistic	All	Low	69
Number of Inbound NOTIFY requests	inbound.request.notify	The number of Inbound NOTIFY requests that belong to each application	Per application	CountStatistic	All	Low	70
Number of Inbound MESSAGE requests	inbound.request.message	The number of Inbound MESSAGE requests that belong to each application	Per application	CountStatistic	All	Low	71
Number of Inbound PUBLISH requests	inbound.request.publish	The number of Inbound PUBLISH requests that belong to each application	Per application	CountStatistic	All	Low	72
Number of Inbound REFER requests	inbound.request.refer	The number of Inbound REFER requests that belong to each application	Per application	CountStatistic	All	Low	73

Table 49. Inbound request module (continued).

This table lists the inbound request module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound UPDATE requests	inbound.request.update	The number of Inbound UPDATE requests that belong to each application	Per application	CountStatistic	All	Low	74

Table 50. Inbound info response module.

This table lists the inbound info response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 100 responses	inbound.response.info.100	The number of Inbound 100 (Trying) responses that belong to each application	Per application	CountStatistic	All	Low	1100
Number of Inbound 180 responses	inbound.response.info.180	The number of Inbound 180 (Ringing) responses that belong to each application	Per application	CountStatistic	All	Low	1180
Number of Inbound 181 responses	inbound.response.info.181	The number of Inbound 181 (Call being forwarded) responses that belong to each application	Per application	CountStatistic	All	Low	1181
Number of Inbound 182 responses	inbound.response.info.182	The number of Inbound 182 (Call Queued) responses that belong to each application	Per application	CountStatistic	All	Low	1182
Number of Inbound 183 responses	inbound.response.info.183	The number of Inbound 183 (Session Progress) responses that belong to each application	Per application	CountStatistic	All	Low	1183

Table 51. Inbound success response module.

This table lists the inbound success response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of successful Inbound 200 responses	inbound.response.success.200	The number of Inbound 200 (OK) responses that belong to each application	Per application	CountStatistic	All	Low	1200
Number of successful Inbound 202 responses	inbound.response.success.202	The number of Inbound 202 (Accepted) responses that belong to each application	Per application	CountStatistic	All	Low	1202

Table 52. Inbound redirect response module.

This table lists the inbound redirect response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 300 responses	inbound.response.redirect.300	The number of Inbound 300 (Multiple choices) responses that belong to each application	Per application	CountStatistic	All	Low	1300
Number of Inbound 301 responses	inbound.response.redirect.301	The number of Inbound 301 (Moved Permanently) responses that belong to each application	Per application	CountStatistic	All	Low	1301
Number of Inbound 302 responses	inbound.response.redirect.302	The number of Inbound 302 (Moved Temporarily) responses that belong to each application	Per application	CountStatistic	All	Low	1302
Number of Inbound 305 responses	inbound.response.redirect.305	The number of Inbound 305 (Use Proxy) responses that belong to each application	Per application	CountStatistic	All	Low	1305
Number of Inbound 380 responses	inbound.response.redirect.380	The number of Inbound 380 (Alternative Service) responses that belong to each application	Per application	CountStatistic	All	Low	1380

Table 53. Inbound fail response module.

This table lists the inbound fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 400 responses	inbound.response.fail.400	The number of Inbound 400 (Bad Request) responses that belong to each application	Per application	CountStatistic	All	Low	1400
Number of Inbound 401 responses	inbound.response.fail.401	The number of Inbound 401 (Unauthorized) responses that belong to each application	Per application	CountStatistic	All	Low	1401
Number of Inbound 402 responses	inbound.response.fail.402	The number of Inbound 402 (Payment Required) responses that belong to each application	Per application	CountStatistic	All	Low	1402
Number of Inbound 403 responses	inbound.response.fail.403	The number of Inbound 403 (Forbidden) responses that belong to each application	Per application	CountStatistic	All	Low	1403
Number of Inbound 404 responses	inbound.response.fail.404	The number of Inbound 404 (Not Found) responses that belong to each application	Per application	CountStatistic	All	Low	1404
Number of Inbound 405 responses	inbound.response.fail.405	The number of Inbound 405 (Method Not Allowed) responses that belong to each application	Per application	CountStatistic	All	Low	1405
Number of Inbound 406 responses	inbound.response.fail.406	The number of Inbound 406 (Not Acceptable) responses that belong to each application	Per application	CountStatistic	All	Low	1406
Number of Inbound 407 responses	inbound.response.fail.407	The number of Inbound 407 (Proxy Authentication Required) responses that belong to each application	Per application	CountStatistic	All	Low	1407
Number of Inbound 408 responses	inbound.response.fail.408	The number of Inbound 408 (Request Timeout) responses that belong to each application	Per application	CountStatistic	All	Low	1408
Number of Inbound 410 responses	inbound.response.fail.410	The number of Inbound 410 (Gone) responses that belong to each application	Per application	CountStatistic	All	Low	1410
Number of Inbound 413 responses	inbound.response.fail.413	The number of Inbound 413 (Request Entity Too Large) responses that belong to each application	Per application	CountStatistic	All	Low	1413

Table 53. Inbound fail response module (continued).

This table lists the inbound fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 414 responses	inbound.response.fail.414	The number of Inbound 414 (Request URI Too Long) responses that belong to each application	Per application	CountStatistic	All	Low	1414
Number of Inbound 415 responses	inbound.response.fail.415	The number of Inbound 415 (Unsupported Media Type) responses that belong to each application	Per application	CountStatistic	All	Low	1415
Number of Inbound 416 responses	inbound.response.fail.416	The number of Inbound 416 (Unsupported URI Scheme) responses that belong to each application	Per application	CountStatistic	All	Low	1416
Number of Inbound 420 responses	inbound.response.fail.420	The number of Inbound 420 (Bad Extention) responses that belong to each application	Per application	CountStatistic	All	Low	1420
Number of Inbound 421 responses	inbound.response.fail.421	The number of Inbound 421 (Extention Required) responses that belong to each application	Per application	CountStatistic	All	Low	1421
Number of Inbound 423 responses	inbound.response.fail.423	The number of Inbound 423 (Interval Too Brief) responses that belong to each application	Per application	CountStatistic	All	Low	1423
Number of Inbound 480 responses	inbound.response.fail.480	The number of Inbound 480 (Temporarly Unavailable) responses that belong to each application	Per application	CountStatistic	All	Low	1480
Number of Inbound 481 responses	inbound.response.fail.481	The number of Inbound 481 (Call Leg Done) responses that belong to each application	Per application	CountStatistic	All	Low	1481
Number of Inbound 482 responses	inbound.response.fail.482	The number of Inbound 482 (Loop Detected) responses that belong to each application	Per application	CountStatistic	All	Low	1482
Number of Inbound 483 responses	inbound.response.fail.483	The number of Inbound 483 (Too Many Hops) responses that belong to each application	Per application	CountStatistic	All	Low	1483
Number of Inbound 484 responses	inbound.response.fail.484	The number of Inbound 484 (Address Incomplete) responses that belong to each application	Per application	CountStatistic	All	Low	1484

Table 53. Inbound fail response module (continued).

This table lists the inbound fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 485 responses	inbound.response.fail.485	The number of Inbound 485 (Ambiguous) responses that belong to each application	Per application	CountStatistic	All	Low	1485
Number of Inbound 486 responses	inbound.response.fail.486	The number of Inbound 486 (Busy Here) responses that belong to each application	Per application	CountStatistic	All	Low	1486
Number of Inbound 487 responses	inbound.response.fail.487	The number of Inbound 487 (Request Terminated) responses that belong to each application	Per application	CountStatistic	All	Low	1487
Number of Inbound 488 responses	inbound.response.fail.488	The number of Inbound 488 (Not Acceptable Here) responses that belong to each application	Per application	CountStatistic	All	Low	1488
Number of Inbound 491 responses	inbound.response.fail.491	The number of Inbound 491 (Request Pending) responses that belong to each application	Per application	CountStatistic	All	Low	1491
Number of Inbound 493 responses	inbound.response.fail.493	The number of Inbound 493 (Undecipherable) responses that belong to each application	Per application	CountStatistic	All	Low	1493

Table 54. Inbound server fail response module.

This table lists the inbound server fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 500 responses	inbound.response.serverFail.500	The number of Inbound 500 (Server Internal Error) responses that belong to each application	Per application	CountStatistic	All	Low	1500
Number of Inbound 501 responses	inbound.response.serverFail.501	The number of Inbound 501 (Not Implemented) responses that belong to each application	Per application	CountStatistic	All	Low	1501
Number of Inbound 502 responses	inbound.response.serverFail.502	The number of Inbound 502 (Bad Gateway) responses that belong to each application	Per application	CountStatistic	All	Low	1502
Number of Inbound 503 responses	inbound.response.serverFail.503	The number of Inbound 503 (Service Unavailable) responses that belong to each application	Per application	CountStatistic	All	Low	1503
Number of Inbound 504 responses	inbound.response.serverFail.504	The number of Inbound 504 (Server Timeout) responses that belong to each application	Per application	CountStatistic	All	Low	1504
Number of Inbound 505 responses	inbound.response.serverFail.505	The number of Inbound 505 (Version Not Supported) responses that belong to each application	Per application	CountStatistic	All	Low	1505
Number of Inbound 513 responses	inbound.response.serverFail.513	The number of Inbound 513 (Message Too Large) responses that belong to each application	Per application	CountStatistic	All	Low	1513

Table 55. Inbound global fail response module.

This table lists the inbound global fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Inbound 600 responses	inbound.response.globalFail.600	The number of Inbound 600 (Busy Everywhere) responses that belong to each application	Per application	CountStatistic	All	Low	1600
Number of Inbound 603 responses	inbound.response.globalFail.603	The number of Inbound 603 (Decline) responses that belong to each application	Per application	CountStatistic	All	Low	1603
Number of Inbound 604 responses	inbound.response.globalFail.604	The number of Inbound 604 (Does Not Exit Anywhere) responses that belong to each application	Per application	CountStatistic	All	Low	1604
Number of Inbound 606 responses	inbound.response.globalFail.606	The number of Inbound 606 (Not Acceptable Anywhere) responses that belong to each application	Per application	CountStatistic	All	Low	1606

Table 56. Outbound request module.

This table lists the outbound request module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound NOT SIP STANDARD requests	outbound.request.other	The number of Outbound NOT SIP STANDARD requests that belong to each application	Per application	CountStatistic	All	Low	80
Number of Outbound REGISTER requests	outbound.request.register	The number of Outbound REGISTER requests that belong to each application	Per application	CountStatistic	All	Low	81
Number of Outbound INVITE requests	outbound.request.invite	The number of Outbound INVITE requests that belong to each application	Per application	CountStatistic	All	Low	82
Number of Outbound ACK requests	outbound.request.ack	The number of Outbound ACK requests that belong to each application	Per application	CountStatistic	All	Low	83
Number of Outbound OPTIONS requests	outbound.request.options	The number of Outbound OPTIONS requests that belong to each application	Per application	CountStatistic	All	Low	84
Number of Outbound BYE requests	outbound.request.bye	The number of Outbound BYE requests that belong to each application	Per application	CountStatistic	All	Low	85
Number of Outbound CANCEL requests	outbound.request.cancel	The number of Outbound CANCEL requests that belong to each application	Per application	CountStatistic	All	Low	86
Number of Outbound PRACK requests	outbound.request.prack	The number of Outbound PRACK requests that belong to each application	Per application	CountStatistic	All	Low	87
Number of Outbound INFO requests	outbound.request.info	The number of Outbound INFO requests that belong to each application	Per application	CountStatistic	All	Low	88
Number of Outbound SUBSCRIBE requests	outbound.request.subscribe	The number of Outbound SUBSCRIBE requests that belong to each application	Per application	CountStatistic	All	Low	89
Number of Outbound NOTIFY requests	outbound.request.notify	The number of Outbound NOTIFY requests that belong to each application	Per application	CountStatistic	All	Low	90
Number of Outbound MESSAGE requests	outbound.request.message	The number of Outbound MESSAGE requests that belong to each application	Per application	CountStatistic	All	Low	91
Number of Outbound PUBLISH requests	outbound.request.publish	The number of Outbound PUBLISH requests that belong to each application	Per application	CountStatistic	All	Low	92
Number of Outbound REFER requests	outbound.request.refer	The number of Outbound REFER requests that belong to each application	Per application	CountStatistic	All	Low	93

Table 56. Outbound request module (continued).

This table lists the outbound request module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound UPDATE requests	outbound.request.update	The number of Outbound UPDATE requests that belong to each application	Per application	CountStatistic	All	Low	94

Table 57. Outbound info response module.

This table lists the outbound info response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 100 responses	outbound.response.info.100	The number of Outbound 100 (Trying) responses that belong to each application	Per application	CountStatistic	All	Low	2100
Number of Outbound 180 responses	outbound.response.info.180	The number of Outbound 180 (Ringing) responses that belong to each application	Per application	CountStatistic	All	Low	2180
Number of Outbound 181 responses	outbound.response.info.181	The number of Outbound 181 (Call being forwarded) responses that belong to each application	Per application	CountStatistic	All	Low	2181
Number of Outbound 182 responses	outbound.response.info.182	The number of Outbound 182 (Call Queued) responses that belong to each application	Per application	CountStatistic	All	Low	2182
Number of Outbound 183 responses	outbound.response.info.183	The number of Outbound 183 (Session Progress) responses that belong to each application	Per application	CountStatistic	All	Low	2183

Table 58. Outbound success response module.

This table lists the outbound success response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 200 responses	outbound.response.success.200	The number of Outbound 200 (OK) responses that belong to each application	Per application	CountStatistic	All	Low	2200
Number of Outbound 202 responses	outbound.response.success.202	The number of Outbound 202 (Accepted) responses that belong to each application	Per application	CountStatistic	All	Low	2202

Table 59. Outbound redirect response module.

This table lists the outbound redirect response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 300 responses	outbound.response.redirect.300	The number of Outbound 300 (Multiple choices) responses that belong to each application	Per application	CountStatistic	All	Low	2300
Number of Outbound 301 responses	outbound.response.redirect.301	The number of Outbound 301 (Moved Permanently) responses that belong to each application	Per application	CountStatistic	All	Low	2301
Number of Outbound 302 responses	outbound.response.redirect.302	The number of Outbound 302 (Moved Temporarily) responses that belong to each application	Per application	CountStatistic	All	Low	2302
Number of Outbound 305 responses	outbound.response.redirect.305	The number of Outbound 305 (Use Proxy) responses that belong to each application	Per application	CountStatistic	All	Low	2305
Number of Outbound 380 responses	outbound.response.redirect.380	The number of Outbound 380 (Alternative Service) responses that belong to each application	Per application	CountStatistic	All	Low	2380

Table 60. Outbound fail response module.

This table lists the outbound fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 400 responses	outbound.response.fail.400	The number of Outbound 400 (Bad Request) responses that belong to each application	Per application	CountStatistic	All	Low	2400
Number of Outbound 401 responses	outbound.response.fail.401	The number of Outbound 401 (Unauthorized) responses that belong to each application	Per application	CountStatistic	All	Low	2401
Number of Outbound 402 responses	outbound.response.fail.402	The number of Outbound 402 (Payment Required) responses that belong to each application	Per application	CountStatistic	All	Low	2402
Number of Outbound 403 responses	outbound.response.fail.403	The number of Outbound 403 (Forbidden) responses that belong to each application	Per application	CountStatistic	All	Low	2403
Number of Outbound 404 responses	outbound.response.fail.404	The number of Outbound 404 (Not Found) responses that belong to each application	Per application	CountStatistic	All	Low	2404
Number of Outbound 405 responses	outbound.response.fail.405	The number of Outbound 405 (Method Not Allowed) responses that belong to each application	Per application	CountStatistic	All	Low	2405
Number of Outbound 406 responses	outbound.response.fail.406	The number of Outbound 406 (Not Acceptable) responses that belong to each application	Per application	CountStatistic	All	Low	2406
Number of Outbound 407 responses	outbound.response.fail.407	The number of Outbound 407 (Proxy Authentication Required) responses that belong to each application	Per application	CountStatistic	All	Low	2407
Number of Outbound 408 responses	outbound.response.fail.408	The number of Outbound 408 (Request Timeout) responses that belong to each application	Per application	CountStatistic	All	Low	2408
Number of Outbound 410 responses	outbound.response.fail.410	The number of Outbound 410 (Gone) responses that belong to each application	Per application	CountStatistic	All	Low	2410
Number of Outbound 413 responses	outbound.response.fail.413	The number of Outbound 413 (Request Entity Too Large) responses that belong to each application	Per application	CountStatistic	All	Low	2413

Table 60. Outbound fail response module (continued).

This table lists the outbound fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 414 responses	outbound.response.fail.414	The number of Outbound 414 (Request URI Too Long) responses that belong to each application	Per application	CountStatistic	All	Low	2414
Number of Outbound 415 responses	outbound.response.fail.415	The number of Outbound 415 (Unsupported Media Type) responses that belong to each application	Per application	CountStatistic	All	Low	2415
Number of Outbound 416 responses	outbound.response.fail.416	The number of Outbound 416 (Unsupported URI Scheme) responses that belong to each application	Per application	CountStatistic	All	Low	2416
Number of Outbound 420 responses	outbound.response.fail.420	The number of Outbound 420 (Bad Extention) responses that belong to each application	Per application	CountStatistic	All	Low	2420
Number of Outbound 421 responses	outbound.response.fail.421	The number of Outbound 421 (Extention Required) responses that belong to each application	Per application	CountStatistic	All	Low	2421
Number of Outbound 423 responses	outbound.response.fail.423	The number of Outbound 423 (Interval Too Brief) responses that belong to each application	Per application	CountStatistic	All	Low	2423
Number of Outbound 480 responses	outbound.response.fail.480	The number of Outbound 480 (Temporarly Unavailable) responses that belong to each application	Per application	CountStatistic	All	Low	2480
Number of Outbound 481 responses	outbound.response.fail.481	The number of Outbound 481 (Call Leg Done) responses that belong to each application	Per application	CountStatistic	All	Low	2481
Number of Outbound 482 responses	outbound.response.fail.482	The number of Outbound 482 (Loop Detected) responses that belong to each application	Per application	CountStatistic	All	Low	2482
Number of Outbound 483 responses	outbound.response.fail.483	The number of Outbound 483 (Too Many Hops) responses that belong to each application	Per application	CountStatistic	All	Low	2483
Number of Outbound 484 responses	outbound.response.fail.484	The number of Outbound 484 (Address Incomplete) responses that belong to each application	Per application	CountStatistic	All	Low	2484

Table 60. Outbound fail response module (continued).

This table lists the outbound fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 485 responses	outbound.response.fail.485	The number of Outbound 485 (Ambiguous) responses that belong to each application	Per application	CountStatistic	All	Low	2485
Number of Outbound 486 responses	outbound.response.fail.486	The number of Outbound 486 (Busy Here) responses that belong to each application	Per application	CountStatistic	All	Low	2486
Number of Outbound 487 responses	outbound.response.fail.487	The number of Outbound 487 (Request Terminated) responses that belong to each application	Per application	CountStatistic	All	Low	2487
Number of Outbound 488 responses	outbound.response.fail.488	The number of Outbound 488 (Not Acceptable Here) responses that belong to each application	Per application	CountStatistic	All	Low	2488
Number of Outbound 491 responses	outbound.response.fail.491	The number of Outbound 491 (Request Pending) responses that belong to each application	Per application	CountStatistic	All	Low	2491
Number of Outbound 493 responses	outbound.response.fail.493	The number of Outbound 493 (Undecipherable) responses that belong to each application	Per application	CountStatistic	All	Low	2493

Table 61. Outbound server fail response module.

This table lists the outbound server fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 500 responses	outbound.response.serverFail.500	The number of Outbound 500 (Server Internal Error) responses that belong to each application	Per application	CountStatistic	All	Low	2500
Number of Outbound 501 responses	outbound.response.serverFail.501	The number of Outbound 501 (Not Implemented) responses that belong to each application	Per application	CountStatistic	All	Low	2501
Number of Outbound 502 responses	outbound.response.serverFail.502	The number of Outbound 502 (Bad Gateway) responses that belong to each application	Per application	CountStatistic	All	Low	2502
Number of Outbound 503 responses	outbound.response.serverFail.503	The number of Outbound 503 (Service Unavailable) responses that belong to each application	Per application	CountStatistic	All	Low	2503
Number of Outbound 504 responses	outbound.response.serverFail.504	The number of Outbound 504 (Server Timeout) responses that belong to each application	Per application	CountStatistic	All	Low	2504
Number of Outbound 505 responses	outbound.response.serverFail.505	The number of Outbound 505 (Version Not Supported) responses that belong to each application	Per application	CountStatistic	All	Low	2505
Number of Outbound 513 responses	outbound.response.serverFail.513	The number of Outbound 513 (Message Too Large) responses that belong to each application	Per application	CountStatistic	All	Low	2513

Table 62. Outbound global fail response module.

This table lists the outbound global fail response module.

Name	Key	Description	Granularity	Type	Level	Overhead	ID
Number of Outbound 600 responses	outbound.response.globalFail.600	The number of Outbound 600 (Busy Everywhere) responses that belong to each application	Per application	CountStatistic	All	Low	2600
Number of Outbound 603 responses	outbound.response.globalFail.603	The number of Outbound 603 (Decline) responses that belong to each application	Per application	CountStatistic	All	Low	2603
Number of Outbound 604 responses	outbound.response.globalFail.604	The number of Outbound 604 (Does Not Exit Anywhere) responses that belong to each application	Per application	CountStatistic	All	Low	2604
Number of Outbound 606 responses	outbound.response.globalFail.606	The number of Outbound 606 (Not Acceptable Anywhere) responses that belong to each application	Per application	CountStatistic	All	Low	2606

PMI data collection

PMI data collection can occur in three different interfaces, Java Management Extension (JMX) interface (J2EE MBeans and WebSphere Application Server Perf MBean), Performance Servlet, or PMI client API (deprecated).

JMX Interface

JMX interface is part of the J2EE specification and the recommended way to gather WebSphere Application Server performance data. PMI data can be gathered from the J2EE managed object MBeans or the WebSphere Application Server PMI Perf MBean. While the J2EE MBeans provide performance data about the specific component, the Perf MBean acts as a gateway to the WebSphere Application Server PMI service, and provides access to the performance data for all the components.

Performance Servlet

Performance Servlet provides a way to use an HTTP request to query the PMI data for the entire WebSphere Application Server administrative domain. Since the servlet provides the performance data through HTTP, issues such as firewalls are trivial to resolve. The performance servlet outputs the PMI data as an XML document.

PMI client API (deprecated)

PMI client API provides a wrapper class to deliver PMI data to a client. The PMI client API uses the JMX infrastructure and the Perf MBean to retrieve the PMI data. PMI client provides the data using a WebSphere Application Server-specific data structure.

PMI client API provides a wrapper class to deliver PMI data to a client. The PMI client API uses the JMX infrastructure and the Perf MBean to retrieve the PMI data. PMI client provides the data using a WebSphere Application Server-specific data structure.

Third-party performance monitoring and management solutions

Several performance monitoring, problem determination, and management solutions are available that can be used with WebSphere Application Server.

These products use WebSphere Application Server interfaces, including:

- Performance Monitoring Infrastructure (PMI)
- Java Management Extensions (JMX)
- Request metrics Application Response Measurement (ARM)

See the Performance: Resources for learning information for a link to IBM business partners providing monitoring solutions for WebSphere Application Server.

Custom PMI API

You can create specific statistics to best meet your monitoring interests by using custom PMI API.

PMI can be extended using the Custom PMI API to create application specific statistics. For example, a stock trading application can use Custom PMI API to create business specific statistics like “number of stock sell transactions” and “number of stock buy transactions”.

Note that PMI provides detailed performance data about various runtime and application components. Starting with WebSphere Application Server Version 6.0, PMI offers approximately 180 or more performance statistics. Before creating new statistics, it is important to make sure that the same data is not captured by PMI already.

With WebSphere PMI, application developers can add their own application-specific instrumentation. The Custom PMI API simplifies the process of “PMI enabling” an application by providing an easy to use API.

The statistics created via the Custom PMI can be accessed via the standard PMI and JMX interfaces that are used by monitoring tools including the Tivoli Performance Viewer.

PMI instrumentation is based on the Java Platform, Enterprise Edition (Java EE) 1.4 standard. As a result, Custom PMI supports all the Statistic types (CountStatistic, TimeStatistic, RangeStatistic, and BoundedRangeStatistic) defined in the JSR-77 Performance Data Framework. Custom PMI does not support user-defined Statistic types.

What you need to know

PMI collects performance data on runtime applications and provides interfaces that allow external applications to monitor the performance data.

With server side PMI, application developers can add their own instrumentation to their applications to help monitor their own predefined performance metrics.

Key features of Custom PMI:

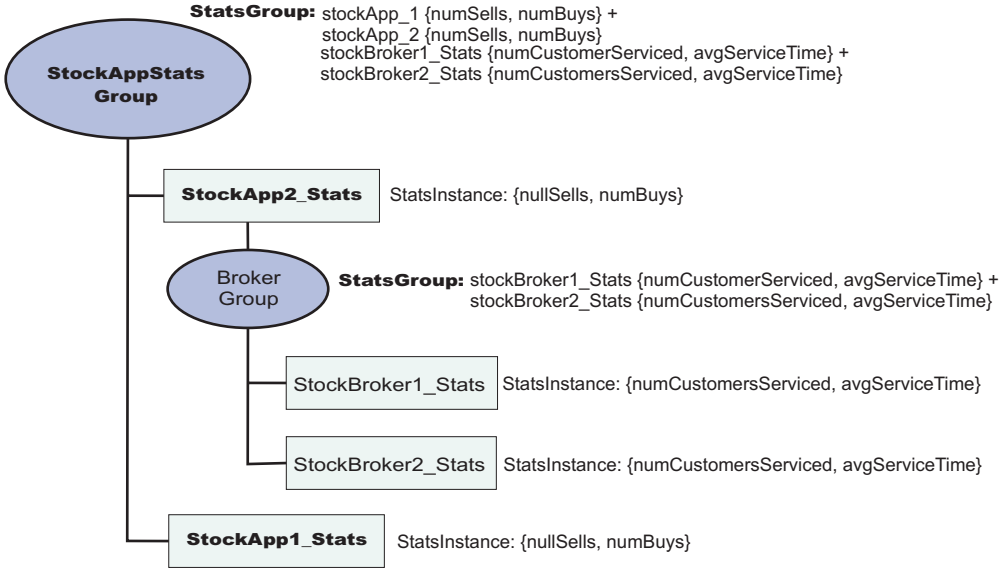
- Create a custom Stats or PMI (Stats is Java EE terminology) module using an XML template.
- Used by the application to instrument code.
- Statistics in the custom Stats module can be accessed via the standard PMI and JMX interfaces that are used by monitoring tools, including the Tivoli Performance Viewer.
- PMI instrumentation is based on the Java EE 1.4 standard. As a result, Custom PMI supports all the Statistic types (CountStatistic, TimeStatistic, RangeStatistic, and BoundedRangeStatistic) defined in the JSR-77 Performance Data Framework.
- Custom PMI does not support user-defined Statistic types.

PMI is for application server performance monitoring, and the data collected by PMI is used to tune the application server resources such as pools, queues, and caches, etc. Since performance instrumentation and statistics can have considerable impact on the application server performance, it is necessary that every statistic added via Custom PMI is relevant towards solving a performance problem. When designing statistics, consider the following issues:

- Significance of the statistic with respect to solving performance problems.
- Relevance to tuning or configuring the application.
- Avoiding data redundancy and unnecessary frequent data updates.

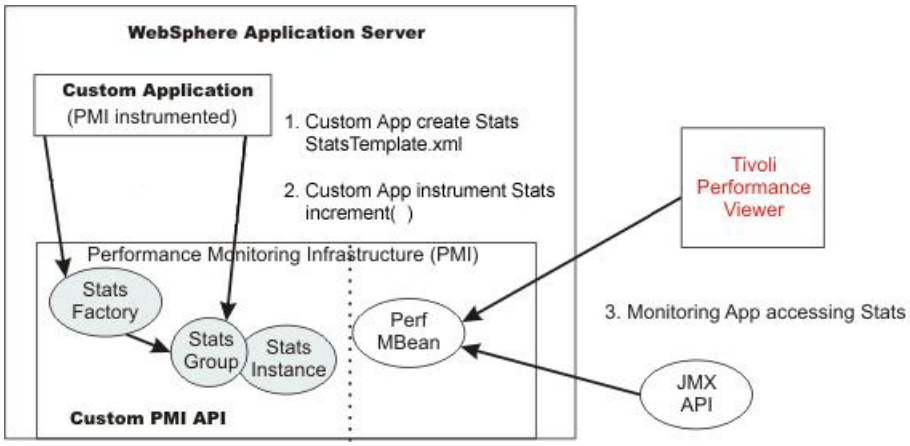
Example: Implementing custom PMI

The following diagram shows the custom PMI environment:



The following steps are required to instrument an application using Custom PMI:

1. Define a Stats module template. An XML document is used to define a set of statistics for a given application component. This XML document is used as a template to create the PMI data. The XML document should follow the DTD WAS_HOME/plugins\com.ibm.ws.runtime.jar\com\ibm\websphere\pmi\xml\perf.dtd file.
2. Create a Stats object using StatsFactory. The StatsFactory is used to create an instance (StatsInstance) or group (StatsGroup) of the Stats template. The StatsInstance object represents a single instance of the Stats template and contains all the statistics defined in the template. The StatsGroup is a logical collection of similar Stats instances. Custom PMI provides the flexibility to arrange the groups and instances in a tree structure.



The previous illustration shows two instances of stock applications that are grouped under a StockAppStats group. The StockAppStats group can have multiple Stock applications, and each Stock application instance can have a StockBroker group. In this case, the StockAppStats group aggregates the statistics from StockApp1 and StockApp2, and the StockBroker group aggregates the statistics from all the StockBroker instances in their respective groups.

3. Instrument the application by updating the Stats object. To instrument, the application should call the Stats module for PMI service to maintain the raw counts. For example, to instrument the `number of`

`sells` processed by the Stock application, create a Stats module with a statistic of type CountStatistic. When a sell transaction is processed, increment the `number of sells` statistic by calling: NumSellsCountStatistic.increment ();

Enabling PMI data collection

Enable PMI data collection to diagnose problems and tune application performance.

Before you begin

Performance Monitoring Infrastructure (PMI) must be enabled (by default PMI is enabled) before collecting any performance data. PMI should be enabled before the server starts. If PMI is enabled after the server is started, the server needs to be restarted to start the PMI.

About this task

When PMI service is enabled, the monitoring of individual components can be enabled or disabled dynamically. PMI provides four predefined statistic sets that can be used to enable a set of statistics. The following table provides details about the statistic sets. If the predefined statistic sets does not meet your monitoring requirement, the **Custom** option can be used to selectively enable or disable individual statistics.

Table 63. Statistic set. Enable PMI using the administrative console, wsadmin tool, or Java Virtual Machine Tool Interface (JVMTI).

Statistic set	Description
None	All statistics are disabled.
Basic	Statistics specified in J2EE 1.4, as well as top statistics like CPU usage and live HTTP sessions are enabled. This set is enabled *out-of-the-box* and provides basic performance data about runtime and application components.
Extended	Basic set plus key statistics from various WebSphere Application Server components like WLM, and dynamic caching are enabled. This set provides detailed performance data about various runtime and application components.
All	All statistics are enabled.
Custom	Enable or disable statistics selectively.

Custom setting

WebSphere Application Server Version 6.0 introduces fine-grained control to enable/disable statistics individually. The fine-grained control is available under the custom statistic set.

Sequential Update

In order to minimize the monitoring overhead, the updates to CountStatistic, AverageStatistic, and TimeStatistic are not synchronized. Since these statistic types track total and average, the extra accuracy is generally not worth the performance cost. The RangeStatistic and BoundedRangeStatistic are very sensitive; therefore, they are always are synchronized. If needed, updates to all the statistic types can be synchronized by checking the **Use sequential update** check box.

Procedure

Enable PMI using one of the following methods:

- “Enabling PMI using the administrative console” on page 182
- “Enabling PMI using the wsadmin tool” on page 184

• “Enabling the Java virtual machine profiler data” on page 194

Enabling PMI using the administrative console

When PMI service is enabled, the monitoring of individual components can be enabled or disabled dynamically.

About this task

To monitor performance data through the Performance Monitoring Infrastructure (PMI), you must first enable PMI through the administrative console.

Procedure

1. Open the administrative console.
2. Click **Servers** > **Server Types** > **WebSphere application servers** > ***server_name***.
3. Click the **Configuration** tab.
4. Click **Performance Monitoring Infrastructure (PMI)** under Performance.
5. Select the **Enable Performance Monitoring Infrastructure (PMI)** check box.
6. Optionally, select the check box **Use sequential counter updates** to enable precise statistic update.
7. Optionally, choose a statistic set that needs to be monitored under **Currently Monitored Statistic Set**.
8. Optionally, click on **Custom** to selectively enable or disable statistics. Choose a component from the left side tree and enable or disable statistics on the right side table. Go back to the main PMI configuration page by clicking the **Performance Monitoring Infrastructure** link.
9. Click **Apply** or **OK**.
10. Click **Save**.
11. Restart the application server. The changes you make will not take effect until you restart the application server.

What to do next

When in the **Configuration** tab, settings apply after the server is restarted.

Performance Monitoring Infrastructure settings

Use this page to specify settings for performance monitoring, including enabling performance monitoring, selecting the Performance Monitoring Infrastructure (PMI) module and setting monitoring levels.

To view this administrative console page, click **Servers** > **Server Types** > **WebSphere application servers** > ***server_name*** > **Performance Monitoring Infrastructure (PMI)**.

Enable Performance Monitoring Infrastructure (PMI):

Specifies whether the application server attempts to enable Performance Monitoring Infrastructure (PMI). If an application server is started when the PMI is disabled, you have to restart the server in order to enable it.

Use sequential counter updates:

Specifies whether access to PMI counters (for example, updates to the counters) is sequential. There is some performance overhead associated with enabling sequential update. The default setting is false.

Persist my changes:

Specifies whether changes to the runtime are also persisted for use on subsequent server startups, and not just the current server runtime. The default setting is false.

Selecting the Persist my changes option ensures that the counter settings are retained after you restart the server.

gotcha:

- Do not select this option until after you have made all of the changes that need to be persisted. After you select this option, click **Apply** and **Save**.
- This option does not remain selected. If you use the administrative console to make additional changes to the counter settings, and you want these changes retained when you restart the server, you must reselect this option.

Currently monitored statistic set:

Specifies a pre-defined set of Performance Monitoring Infrastructure (PMI) statistics for all components in the server.

As part of fine-grained control feature, WebSphere Application Server provides new statistic sets, which are pre-defined, fixed server-side sets based on the PMI statistic usage scenarios. This enhancement allows a set of statistics to be enabled via a single action or call. The following statistic sets are defined:

None All statistics are disabled.

Basic Provides basic monitoring for application server resources and applications. This includes J2EE components, HTTP session information, CPU usage information, and the top 36 statistics. This is the default setting.

Extended
Provides extended monitoring, including the basic level of monitoring plus workload monitor, performance advisor, and Tivoli resource models. Extended provides key statistics from frequently used WebSphere Application Server components.

All Enables all statistics.

Custom
Provides fine-grained control with the ability to enable and disable individual statistics.

Custom monitoring level

Use this page to enable and disable specific PMI counters for individual PMI statistics.

To view this administrative console page, click **Servers** > **Server Types** > **WebSphere application servers** > ***server_name*** > **Performance Monitoring Infrastructure (PMI)** > **Custom**.

Custom monitoring level:

Click on the individual PMI statistic in the list on the left. The counters available for that module appear in the table on the right along with the counter type, a description of the counter, and its current status (Enabled or Disabled).

You can enable or disable each individual counter by selecting the counter and clicking the Enable or Disable button, respectively.

Custom monitoring level:

Click on the individual PMI module in the list on the left. The counters available for that statistic appear in the table on the right along with the counter type, a description of the counter, and its current status (Enabled or Disabled).

You can enable or disable each individual counter by selecting the counter and clicking the Enable or Disable button, respectively.

Note: Enabling or disabling a statistic set that contains subsets will affect the configuration of all the counters contained in the subsets. The parent statistic set that is selected passes down the current configuration set to its subsets, which can disable any counters that were individually selected within specific subsets. For best results, configure the parent statistic first, and then select specific counters within its subsets.

Performance Monitoring Infrastructure collection

Use this page to configure Performance Monitoring Infrastructure (PMI).

To view this administrative console page, click **Monitoring and Tuning** > **Performance Monitoring Infrastructure (PMI)** .

Name:

Specifies the logical name of the server.

The Name property is read only.

Node:

Specifies the name of the node holding the server.

The Node name property is read only.

Version:

Specifies the version of the WebSphere Application Server product on which the server runs.

The Version property is read only.

Enabling PMI using the wsadmin tool

Use this page to learn how to enable Performance Monitoring Infrastructure using command line instead of the administrative console.

About this task

You can use the command line to enable Performance Monitoring Infrastructure (PMI).

Procedure

Run the **wsadmin** command. Using **wsadmin**, you can invoke operations on Perf Mbean to obtain the PMI data, set or obtain PMI monitoring levels, and enable data counters.

Note: If PMI data are not enabled yet, you need to first enable PMI data by invoking setInstrumentationLevel operation on PerfMBean.

The following operations in Perf MBean can be used in **wsadmin**:

```
/** Get performance data information for stats */
public void getConfig (ObjectName mbean);

/** Returns the current statistic set */
public void getStatisticSet ();

/** Enable PMI data using the pre-defined statistic sets.
    Valid values for the statistic set are "basic", "extended", "all", and "none" */
```

```
public void setStatisticSet (String statisticSet);

/** Returns the current custom set specification as a string */
public void getCustomSetString ();

/** Customizing PMI data that is enabled using fine-grained control.
    This method allows to enable or disable statistics selectively.
    The format of the custom set specification string is STATS_NAME=ID1,ID2,ID3 seperated by ':',
   where STATS_NAME and IDs are defined in WS*Stat interfaces in com.ibm.websphere.pmi.stat package.
    Use * to enable all the statistics in the given PMI module. For example, to enable all the statistics
   for JVM and active count, pool size for thread pool use: jvmRuntimeModule=*:threadPoolModule=3,4.
    The string jvmRuntimeModule is the value of the constant WSJVMStats.NAME and threadPoolModule is the
   value of WSThreadPoolStats.NAME.
 */
public void setCustomSetString (String customSpec, Boolean recursive);

/** Get stats for an MBean*/
public void getStatsObject (ObjectName mbean, Boolean recursive);

/** Set instrumentation level using String format.
    This should be used by scripting for an easy String processing.
    The level STR is a list of moduleName=Level connected by ":".
    NOTE: This method is deprecated in Version 6.0
 */
public void setInstrumentationLevel(String levelStr, Boolean recursive);


/** Get instrumentation level in String for all the top level modules.
    This should be used by scripting for an easy String processing.
    NOTE: This method is deprecated in Version 6.0
 */
public String getInstrumentationLevelString();

/** Return the PMI data in String
    NOTE: This method is deprecated in Version 6.0
 */
public String getStatsString(ObjectName on, Boolean recursive);

/** Return the PMI data in String
    Used for PMI modules/submodules without direct MBean mappings.
    NOTE: This method is deprecated in Version 6.0
 */
public String getStatsString(ObjectName on, String submoduleName, Boolean recursive);

/** Return the submodule names if any for the MBean
    NOTE: This method is deprecated in Version 6.0
 */
public String listStatMemberNames(ObjectName on);

/** Get performance data information for stats */
public void getConfig (ObjectName mbean);

/** Returns the current statistic set */
public void getStatisticSet ();

/** Enable PMI data using the pre-defined statistic sets.
    Valid values for the statistic set are "basic", "extended", "all", and "none" */
public void setStatisticSet (String statisticSet);

/** Returns the current custom set specification as a string */
public void getCustomSetString ();

/** Customizing PMI data that is enabled using fine-grained control.
    This method allows to enable or disable statistics selectively.
    The format of the custom set specification string is STATS_NAME=ID1,ID2,ID3 seperated by ':',
  where STATS_NAME and IDs are defined in WS*Stat interfaces in com.ibm.websphere.pmi.stat package.
    Use * to enable all the statistics in the given PMI module. For example, to enable all the statistics
  for JVM and active count, pool size for thread pool use: jvmRuntimeModule=*:threadPoolModule=3,4.
```

```
    The string jvmRuntimeModule is the value of the constant WSJVMStats.NAME and threadPoolModule is the
value of WSThreadPoolStats.NAME.
 */
public void setCustomSetString (String customSpec, Boolean recursive);

/** Get stats for an MBean*/
public void getStatsObject (ObjectName mbean, Boolean recursive);

/** Set instrumentation level using String format.
    This should be used by scripting for an easy String processing.
    The level STR is a list of moduleName=Level connected by ":".
    NOTE: This method is deprecated in Version 8.5
 */
public void setInstrumentationLevel(String levelStr, Boolean recursive);


/** Get instrumentation level in String for all the top level modules.
    This should be used by scripting for an easy String processing.
    NOTE: This method is deprecated in Version 8.5
 */
public String getInstrumentationLevelString();

/** Return the PMI data in String
    NOTE: This method is deprecated in Version 8.5
 */
public String getStatsString(ObjectName on, Boolean recursive);

/** Return the PMI data in String
    Used for PMI modules/submodules without direct MBean mappings.
    NOTE: This method is deprecated in Version 8.5
 */
public String getStatsString(ObjectName on, String submoduleName, Boolean recursive);

/** Return the submodule names if any for the MBean
    NOTE: This method is deprecated in Version 8.5
 */
public String listStatMemberNames(ObjectName on);
```

If an MBean is a StatisticProvider, and if you pass its ObjectName to getStatsObject, you get the Statistic data for that MBean. MBeans with the following MBean types are statistic providers:

- DynaCache
- EJBModule
- EntityBean
- JDBCProvider
- J2CResourceAdapter
- JVM
- MessageDrivenBean
- ORB
- Server
- SessionManager
- StatefulSessionBean
- StatelessSessionBean
- SystemMetrics
- ThreadPool
- TransactionService
- WebModule
- Servlet
- WLMAppServer
- WebServicesService
- WSGW

Example

Use the following sample Jacl commands with the wsadmin tool to obtain PMI data:

Obtain the Perf MBean ObjectName

```
wsadmin>set perfName [$AdminControl completeObjectName type=Perf,*]
wsadmin>set perfOName [$AdminControl makeObjectName $perfName]
```

Invoke getStatisticSet operation

Use this method to find the statistic set that is currently in effect:

```
wsadmin> $AdminControl invoke $perfName getStatisticSet
```

This method returns one of the following values: basic, extended, all, none.

Invoke setStatisticSet operation

Use this method to enable monitoring using a statistic set.

The valid statistic set values are: basic, extended, all, none.

```
wsadmin> set params [java::new {java.lang.Object[]} 1]
wsadmin> $params set 0 [java::new java.lang.String extended]
wsadmin> set sigs  [java::new {java.lang.String[]} 1]
wsadmin> $sigs set 0 java.lang.String
wsadmin> $AdminControl invoke_jmx $perfOName setStatisticSet
$params $sigs
```

Invoke getConfig operation

Use this method to find information about the statistics for a given component.

```
wsadmin> set jvmName [$AdminControl completeObjectName type=JVM,*]

wsadmin> set params [java::new {java.lang.Object[]} 1]
wsadmin> $params set 0 [java::new javax.management.ObjectName $jvmName]
wsadmin> set sigs  [java::new {java.lang.String[]} 1]
wsadmin> $sigs set 0 javax.management.ObjectName

wsadmin> $AdminControl invoke_jmx $perfOName getConfig $params
$sigs
```

This method returns the following:

```
    Stats type=jvmRuntimeModule, Description=The performance data from
the Java virtual machine run time.

    {name=UpTime, ID=4, type=CountStatistic, description=The amount of
time (in seconds) that the Java virtual machine has been running.,
unit=SECOND, level=low, statisticSet=basic, resettable=false,
aggregatable=true}

    {name=UsedMemory, ID=3, type=CountStatistic, description=The amount
of used memory (in KBytes) in the Java virtual machine run time.,
unit=KILOBYTE, level=low,
    statisticSet=basic, resettable=false, aggregatable=true}

    {name=FreeMemory, ID=2, type=CountStatistic, description=The free
memory (in KBytes) in the Java virtual machine run time.,
unit=KILOBYTE, level=low, statisticSet=all, resettable=false,
aggregatable=true}
```

```
    {name=HeapSize, ID=1, type=BoundedRangeStatistic, description=The
total memory (in KBytes) in the Java virtual machine run time.,
unit=KILOBYTE, level=high, statisticSet=basic, resettable=false,
aggregatable=true}
```

Invoke getCustomSetString operation

This operation provides the current monitoring specification in a string format:

```
wsadmin> $AdminControl invoke $perfName getCustomSetString
```

The output looks similar to the following:

```
    jvmRuntimeModule=4,3,1:systemModule=2,1:threadPoolModule=4,3:thread
PoolModule>HAManager.thread.pool=4,3:threadPoolModule>MessageListenerTh
readPool=4,3:threadPoolModule>ORB.thread.pool=4,3:threadPoolModule>Serv
let.Engine.Transports=4,3:threadPoolModule>TCS_DEFAULT=4,3:transactionM
odule=4,19,16,18,3,7,6,1,14
```

This output indicates that statistic ID's 1, 3, and 4 are enabled in the JVM component. The description of the statistic IDs can be found using the above getConfig operation or using the API documentation. The output contains the current monitoring specification for the entire server. The individual modules are separated by a **:**, and **>** is used as a separator within the module.

Invoke setCustomSetString operation

This operation can be used to enable or disable statistics selectively. In the following command the statistic IDs 1, 2, 3, and 4 are enabled for the JVM module. To enable all the statistic IDs use an asterisk (*****).

```
    wsadmin> set params [java::new {java.lang.Object[]} 2]
    wsadmin> $params set 0 [java::new java.lang.String
jvmRuntimeModule=1,2,3,4]
    wsadmin> $params set 1 [java::new java.lang.Boolean false]

    wsadmin> set sigs  [java::new {java.lang.String[]} 2]
    wsadmin> $sigs set 0 java.lang.String
    wsadmin> $sigs set 1 java.lang.Boolean


    wsadmin> $AdminControl invoke_jmx $perfOName setCustomSetString
$params $sigs
```

Invoke getStatsObject operation

This operation is used to get the statistics for a given MBean. The following example gets the statistics for the JVM:

```
    wsadmin> set jvmName [$AdminControl completeObjectName type=JVM,*]
    wsadmin> set params [java::new {java.lang.Object[]} 2]
    wsadmin> $params set 0 [java::new javax.management.ObjectName
$jvmName]
    wsadmin> $params set 1 [java::new java.lang.Boolean false]
    wsadmin> set sigs  [java::new {java.lang.String[]} 2]
    wsadmin> $sigs set 0 javax.management.ObjectName
    wsadmin> $sigs set 1 java.lang.Boolean
    wsadmin> $AdminControl invoke_jmx $perfOName getStatsObject $params
$sigs
    Stats name=jvmRuntimeModule, type=jvmRuntimeModule#
    {
    name=HeapSize, ID=1, description=The total memory (in KBytes) in
the Java virtual machine run time., unit=KILOBYTE, type=BoundedRangeStatistic, lowWaterMark=51200,
highWaterMark=263038, current=263038, integral=2.494158617766E12, lowerBound
=51200, upperBound=262144
```

```
    name=FreeMemory, ID=2, description=The free memory (in KBytes) in
the Java virtual machine run time., unit=KILOBYTE, type=CountStatistic,
count=53509

    name=UsedMemory, ID=3, description=The amount of used memory (in KBytes) in
the Java virtual machine run time., unit=KILOBYTE,
type=CountStatistic, count=209528

    name=UpTime, ID=4, description=The amount of time (in seconds) that
the Java virtual machine has been running., unit=SECOND,
type=CountStatistic, count=83050
}
```

Invoke getInstrumentationLevelString operation

Use *invoke*, because it has no parameter.

```
wsadmin>$AdminControl invoke $perfName
getInstrumentationLevelString
```

This command returns the following:

```
beanModule=H:cacheModule=H:connectionPoolModule=H:j2cModule=H:jvmRu
ntimeModule=H:orbPerfModule=H:servletSessionsModule=H:systemModule=
H:threadPoolModule=H:transactionModule=H:webAppModule=H
```

Note: You can change the level (n, l, m, h, x) in the above string and then pass it to setInstrumentationLevel method.

Invoke setInstrumentationLevel operation - enable/disable PMI counters

- sSet parameters ("pmi=l" is the simple way to set all modules to the low level).

  ```
  wsadmin>set params [java::new {java.lang.Object[]} 2]

  wsadmin>$params set 0 [java::new java.lang.String pmi=l]
      wsadmin>$params set 1 [java::new java.lang.Boolean true]
  ```

- Set signatures.

  ```
  wsadmin>set sigs  [java::new {java.lang.String[]} 2]

  wsadmin>$sigs set 0 java.lang.String
      wsadmin>$sigs set 1 java.lang.Boolean
  ```

- Invoke the method. Use **invoke_jmx**, because it has a parameter.

  ```
  wsadmin>$AdminControl invoke_jmx $perfOName
  setInstrumentationLevel $params $sigs
  ```

This command does not return anything.

Note: The PMI level string can be as simple as *pmi=level* (where level is n, l, m, h, or x), or something like *module1=level1:module2=level2:module3=level3* with the same format shown in the string returned from `getInstrumentationLevelString`.

Invoke getStatsString(ObjectName, Boolean) operation

If you know the MBean ObjectName, you can invoke the method by passing the right parameters. As an example, JVM MBean is used here.

- Get MBean query string. For example, JVM MBean.

  ```
   wsadmin>set jvmName [$AdminControl completeObjectName
  type=JVM,*]
  ```

- Set parameters.

  ```
  wsadmin>set params [java::new {java.lang.Object[]} 2]

  wsadmin>$params set 0 [$AdminControl makeObjectName $jvmName]
  wsadmin>$params set 1 [java::new java.lang.Boolean true]
  ```

- Set signatures.

```
wsadmin>set sigs  [java::new {java.lang.String[]} 2]
    wsadmin>$sigs set 0 javax.management.ObjectName wsadmin>$sigs
    set 1 java.lang.Boolean
```

- Invoke method.

```
 wsadmin>$AdminControl invoke_jmx $perfOName getStatsString
$params $sigs
```

This command returns the following:

```
{Description jvmRuntimeModule.desc} {Descriptor {{Node wenjianpc}
{Server server
1} {Module jvmRuntimeModule} {Name jvmRuntimeModule} {Type
MODULE}}} {Level 7} {
Data {{{Id 4} {Descriptor {{Node wenjianpc} {Server server1}
{Module jvmRuntimeM
odule} {Name jvmRuntimeModule} {Type DATA}}} {PmiDataInfo {{Name
jvmRuntimeModul
e.upTime} {Id 4} {Description jvmRuntimeModule.upTime.desc} {Level
1} {Comment {
The amount of time in seconds the JVM has been running}}
{SubmoduleName null} {T
ype 2} {Unit unit.second} {Resettable false}}} {Time 1033670422282}
{Value {Coun
t 638} }} {{Id 3} {Descriptor {{Node wenjianpc} {Server server1}
{Module jvmRunt
imeModule} {Name jvmRuntimeModule} {Type DATA}}} {PmiDataInfo
{{Name jvmRuntimeM
odule.usedMemory} {Id 3} {Description
jvmRuntimeModule.usedMemory.desc} {Level 1
} {Comment {Used memory in JVM runtime}} {SubmoduleName null} {Type
2} {Unit uni
t.kbyte} {Resettable false}}} {Time 1033670422282} {Value {Count
66239} }} {{Id
2} {Descriptor {{Node wenjianpc} {Server server1} {Module
jvmRuntimeModule} {Nam
e jvmRuntimeModule} {Type DATA}}} {PmiDataInfo {{Name
jvmRuntimeModule.freeMemor
y} {Id 2} {Description jvmRuntimeModule.freeMemory.desc} {Level 1}
{Comment {Fre
e memory in JVM runtime}} {SubmoduleName null} {Type 2} {Unit
unit.kbyte} {Reset
table false}}} {Time 1033670422282} {Value {Count 34356} }} {{Id 1}
{Descriptor
{{Node wenjianpc} {Server server1} {Module jvmRuntimeModule} {Name
jvmRuntimeMod
ule} {Type DATA}}} {PmiDataInfo {{Name
jvmRuntimeModule.totalMemory} {Id 1} {Des
cription jvmRuntimeModule.totalMemory.desc} {Level 7} {Comment
{Total memory in
JVM runtime}} {SubmoduleName null} {Type 5} {Unit unit.kbyte}
{Resettable false}
}} {Time 1033670422282} {Value {Current 100596} {LowWaterMark
38140} {HighWaterM
ark 100596} {MBean 38140.0} }}}}
```

Invoke getStatsString (ObjectName, String, Boolean) operation

This operation takes an additional String parameter, and it is used for PMI modules that do not have matching MBeans. In this case, the parent MBean is used with a String name representing the PMI module. The String names available in an MBean can be found by invoking listStatMemberNames. For example, *beanModule* is a logic module aggregating PMI data over all Enterprise JavaBeans, but there is no MBean for beanModule. Therefore, you can pass server MBean ObjectName and a String (*beanModule*) to get PMI data in beanModule.

- Get MBean query string. For example, server MBean

```
wsadmin>set mySrvName [$AdminControl completeObjectName
    type=Server,name=server1,
    node=wenjianpc,*]
```

- Set parameters.

```
wsadmin>set params [java::new {java.lang.Object[]} 3]

wsadmin>$params set 0 [$AdminControl makeObjectName $mySrvName]

wsadmin>$params set 1 [java::new java.lang.String beanModule]
    wsadmin>$params set 2 [java::new java.lang.Boolean true]
```

- Set signatures.

```
wsadmin>set sigs  [java::new {java.lang.String[]} 3]

wsadmin>$sigs set 0 javax.management.ObjectName

wsadmin>$sigs set 1 java.lang.String
    wsadmin>$sigs set 2 java.lang.Boolean
```

- Invoke method.

```
wsadmin>$AdminControl invoke_jmx $perfOName getStatsString
$params $sigs
```

This command returns PMI data in all the Enterprise JavaBeans within the BeanModule hierarchy because the recursive flag is set to true.

Note: This method is used to get stats data for the PMI modules that do not have direct MBean mappings.

Invoke listStatMemberNames operation

- Get MBean queryString. For example, Server.

```
wsadmin>set mySrvName [$AdminControl completeObjectName
    type=Server,name=server1,

node=wenjianpc,*]
```

- Set parameter.

```
wsadmin>set params [java::new {java.lang.Object[]} 1]
wsadmin>$params set 0 [$AdminControl makeObjectName
$mySrvName]
```

- Set signatures.

```
wsadmin>set sigs  [java::new {java.lang.String[]} 1]
wsadmin>$sigs set 0 javax.management.ObjectName
    wsadmin>$AdminControlinvoke_jmx $perfOName
    listStatMemberNames $params $sigs
```

This command returns the PMI module and submodule names, which have no direct MBean mapping. The names are seperated by a space " ". You can then use the name as the String parameter in getStatsString method. For example:

```
beanModule connectionPoolModule j2cModule servletSessionsModule
threadPoolModule
webAppModule
```

Customize and run the following example Jython script with the wsadmin tool to obtain PMI data:

```
print "\n------------------------------------------------------------------------------------------------------- "
print "Obtain the Perf MBean ObjectName"
print "------------------------------------------------------------------------------------------------------- "
perfName = AdminControl.completeObjectName ('type=Perf,*')
perfOName = AdminControl.makeObjectName (perfName)
print perfOName
print "------------------------------------------------------------------------------------------------------- \n"


print "\n------------------------------------------------------------------------------------------------------- "
print "Invoke getStatisticSet operation "
print "------------------------------------------------------------------------------------------------------- "
print AdminControl.invoke (perfName, 'getStatisticSet')
```

```
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke setStatisticSet operation"
print "------------------------------------------------------------------------------------------------------------ "
params = ['extended']

sigs  = ['java.lang.String']

print AdminControl.invoke_jmx (perfONname, 'setStatisticSet', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke getConfig operation"
print "------------------------------------------------------------------------------------------------------------ "
jvmName = AdminControl.completeObjectName ('type=JVM,*')

params = [AdminControl.makeObjectName (jvmName)]

sigs = ['javax.management.ObjectName']

print AdminControl.invoke_jmx (perfONname, 'getConfig', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke getCustomSetString operation"
print "------------------------------------------------------------------------------------------------------------ "
print AdminControl.invoke (perfName, 'getCustomSetString')
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke setCustomSetString operation"
print "------------------------------------------------------------------------------------------------------------ "
params = ['jvmRuntimeModule=1,2,3,4', java.lang.Boolean ('false')]

sigs  = ['java.lang.String', 'java.lang.Boolean']

print AdminControl.invoke_jmx (perfONname, 'setCustomSetString', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke getStatsObject operation"
print "------------------------------------------------------------------------------------------------------------ "
jvmName = AdminControl.completeObjectName ('type=JVM,*')

params = [AdminControl.makeObjectName (jvmName), java.lang.Boolean ('false')]

sigs = ['javax.management.ObjectName', 'java.lang.Boolean']

print AdminControl.invoke_jmx (perfONname, 'getStatsObject', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke getInstrumentationLevelString operation"
print "------------------------------------------------------------------------------------------------------------ "
print AdminControl.invoke (perfName, 'getInstrumentationLevelString')
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke setInstrumentationLevel operation - enable/disable PMI counters "
```

```
print "------------------------------------------------------------------------------------------------------------ "
params = ['pmi=l', java.lang.Boolean ('true')]

sigs = ['java.lang.String', 'java.lang.Boolean']

print AdminControl.invoke_jmx (perfONname, 'setInstrumentationLevel', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke getStatsString(ObjectName, Boolean) operation"
print "------------------------------------------------------------------------------------------------------------ "
jvmName = AdminControl.completeObjectName ('type=JVM,*')

params = [AdminControl.makeObjectName (jvmName), java.lang.Boolean ('true')]

sigs = ['javax.management.ObjectName', 'java.lang.Boolean']

print AdminControl.invoke_jmx (perfONname, 'getStatsString', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke getStatsString (ObjectName, String, Boolean) operation"
print "------------------------------------------------------------------------------------------------------------ "
mySrvName = AdminControl.completeObjectName ('type=Server,name=server1,node=wcsNode,*')

params = [AdminControl.makeObjectName (mySrvName),
          'beanModule',
          java.lang.Boolean ('true')]

sigs = ['javax.management.ObjectName',
        'java.lang.String',
        'java.lang.Boolean')

print AdminControl.invoke_jmx (perfONname, 'getStatsString', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"


print "\n------------------------------------------------------------------------------------------------------------ "
print "Invoke listStatMemberNames operation"
print "------------------------------------------------------------------------------------------------------------ "
mySrvName = AdminControl.completeObjectName ('type=Server,name=server1,node=wcsNode,*')

params = [AdminControl.makeObjectName (mySrvName)]

sigs = ['javax.management.ObjectName']

print AdminControl.invoke_jmx (perfONname, 'listStatMemberNames', params, sigs)
print "------------------------------------------------------------------------------------------------------------ \n"
```

Obtaining a list of performance counters from the command line

Obtain a list of performance counters from the command line.

Before you begin

The application server must be running when you obtain a list of performance counters from the command line.

About this task

You can obtain a list of performance counters from the command line.

Procedure

1. Bring up a command line window.
2. Type the following commands:

```
set perf [$AdminControl completeObjectName type=Perf,*]
set perfON [$AdminControl makeObjectName $perf]
set params [java::new {java.lang.Object[]} 1]
$params set 0 [java::new java.util.Locale "en-US"]
set sigs  [java::new {java.lang.String[]} 1]
$sigs set 0 java.util.Locale
set out [java::cast {com.ibm.websphere.pmi.PmiModuleConfig[]}
[$AdminControl invoke_jmx $perfON getConfigs $params $sigs]]
for {set i 0} {$i < [$out length]} {incr i 1} { puts [[$out get $i] toString] }
```

3. Results similar to the following example are returned:

```
Stats type=systemModule, Description=The system performance data from
the operating system.

{name=FreeMemory, ID=3, type=CountStatistic, description=A
snapshot of
free memory (in KB)., unit=N/A, level=low, statisticSet=all,
resettable=false, aggregatable=true, zosAggregatable=true}

{name=CPUUsageSinceServerStarted, ID=2, type=AverageStatistic,
description=The average CPU utilization since the server was
started.,
unit=N/A, level=medium, statisticSet=extended, resettable=true,
aggregatable=true, zosAggregatable=true}

{name=CPUUsageSinceLastMeasurement, ID=1, type=CountStatistic,
description=The average CPU utilization since the last query.,
unit=N/A,
level=low, statisticSet=basic, resettable=false,
aggregatable=true,
zosAggregatable=true
```

Enabling the Java virtual machine profiler data

Use the Java virtual machine profiler to enable the collection of information.

About this task

Use the Java Virtual Machine Tool Interface (JVMTI) to collect data about garbage collection and thread states from the JVM that runs the application server. When JVMTI is enabled, a collection of JVMTI-specific statistics can be enabled through the predefined All statistic set or through the use of a Custom statistic set.

To enable JVMTI data reporting for each individual application server:

Procedure

1. Open the administrative console.
2. Click **Servers > Server Types > WebSphere application servers** in the administrative console navigation tree.
3. Click the application server for the JVM profiler that needs enabling.
4. In the Server Infrastructure section, click **Java and process management > Process definition > Java virtual machine**.
5. Type *-agentlib:pmiJvmtiProfiler* in the **Generic JVM arguments** field.
6. Click **Apply** or **OK**.
7. Click **Save**.

8. Click **Servers > Server Types > WebSphere application servers** in the administrative console navigation tree.
9. Click the application server for the JVM profiler that needs enabling.
10. Click the **Configuration** tab. When in the **Configuration** tab, settings apply when the server is restarted. When in the **Runtime** Tab, settings apply immediately. Performance Monitoring Infrastructure (PMI) can be enabled only in the **Configuration** tab.
11. Click **Performance Monitoring Infrastructure** under Performance.
12. Select the **Enable Performance Monitoring Infrastructure (PMI)** check box.
13. Click **Custom** and select **JVM Runtime** on the left-side tree.
14. Click a JVM profiler group under **JVM Runtime** and enable or disable the statistic on the right-side table. Go back to the main PMI configuration page, by clicking PMI.
15. Click **Apply** or **OK**.
16. Click **Save**.
17. Start the application server, or restart the application server if it is currently running.
18. Refresh the Tivoli Performance Viewer if you are using it. The changes you make do not take effect until you restart the application server.

Java virtual machine profiling

Use Java virtual machine profiling to gather data about your system for performance analysis.

The Java virtual machine Tool Interface (JVMTI) is a native programming interface that provides tools the ability to inspect the state of the Java virtual machine (JVM).

JVMTI provides the ability to collect information about the JVM that runs the application server. The Tivoli Performance Viewer leverages these interfaces to enable more comprehensive performance analysis.

JVMTI is a two-way function call interface between the JVM and an in-process profiler agent. The JVM notifies the profiler agent of various events, for example, garbage collection and thread starts. The profiler agent activates or deactivates specific event notifications that are based on the needs of the profiler.

JVMTI supports partial profiling, by enabling you to choose which types of profiling information to collect and to select certain subsets of the time during which the JVM API is active. JVMTI moderately increases the performance impact. Therefore, it is recommended that you use JVMTI monitoring to help diagnose application problems only.

Developing your own monitoring applications

You can use the Performance Monitoring Infrastructure (PMI) interfaces to develop your own applications to collect and display performance information.

About this task

There are three such interfaces - a Java Machine Extension (JMX)-based interface, a PMI client interface, and a servlet interface. All three interfaces return the same underlying data.

The JMX interface is accessible through the WebSphere Application Server administartive client as described in “Using the JMX interface to develop your own monitoring application” on page 216. The PMI client interface is a Java interface that works with Version 3.5.5 and above. The servlet interface is perhaps the simplest, requiring minimal programming, as the output is XML.

Note: The PMI client interface is deprecated in Version 8.5. The JMX interface is the recommended way to collect PMI data.

Procedure

1. “Using PMI client to develop your monitoring application (deprecated)” on page 211.
2. “Retrieving performance data with PerfServlet” on page 212
3. “Compiling your monitoring applications” on page 220
4. “Running your new monitoring applications” on page 220
5. “Using the JMX interface to develop your own monitoring application” on page 216.
6. “Developing PMI interfaces (Version 4.0) (deprecated)” on page 219.

Example

This example provides code directly using Java Management Extension (JMX) API. For information on compiling your source code, see “Compiling your monitoring applications”.

```
package com.ibm.websphere.pmi;

import com.ibm.websphere.management.AdminClient;
import com.ibm.websphere.management.AdminClientFactory;
import com.ibm.websphere.management.exception.ConnectorException;
import com.ibm.websphere.management.exception.InvalidAdminClientTypeException;
import com.ibm.websphere.management.exception.*;

import java.util.*;
import javax.management.*;
import com.ibm.websphere.pmi.*;
import com.ibm.websphere.pmi.client.*;
import com.ibm.websphere.pmi.stat.*;

/**
 * Sample code using AdminClient API to get PMI data from PerfMBean
 * and individual MBeans.
 *
 * @ibm-api
 */

public class PmiJmxTest implements PmiConstants
{

    private AdminClient    ac = null;
    private ObjectName     perfOName   = null;
    private ObjectName     serverOName = null;
    private ObjectName     wlmOName    = null;
    private ObjectName     jvmOName    = null;
    private ObjectName     orbtpOName    = null;
    private boolean failed = false;
    private PmiModuleConfig[] configs = null;

    /**
     *  Creates a new test object
     *  (Need a default constructor for the testing framework)
     */
    public PmiJmxTest()
    {
    }

    /**
     * @param args[0] host
     * @param args[1] port, optional, default is 8880
     * @param args[2] connectorType, optional, default is SOAP connector
     *
     */
    public static void main(String[] args)
    {
        PmiJmxTest instance = new PmiJmxTest();
```

```
    // parse arguments and create AdminClient object
    instance.init(args);

    // navigate all the MBean ObjectNames and cache those we are interested
    instance.getObjectNames();

    boolean v6 = !(new Boolean(System.getProperty ("websphereV5Statistics"))).
 booleanValue();

    if( v6 )
    {
        // test V6 APIs
        instance.doTestV6();
    }
    else
    {

        // set level, get data, display data
        instance.doTest();

        // test for EJB data
        instance.testEJB();

        // how to use JSR77 getStats method for individual MBean other than PerfMBean
        instance.testJSR77Stats();
    }

}

/**
 * parse args and getAdminClient
 */
public void init(String[] args)
{

    try
    {
        String  host    = null;
        String  port    = "8880";
        String  connector = AdminClient.CONNECTOR_TYPE_SOAP;
        if(args.length < 1) {
            System.err.println("ERROR: Usage: PmiJmxTest <host> [<port>] [<connector>]");
            System.exit(2);
        }
        else
        {
            host = args[0];

            if (args.length > 1)
                port = args[1];

            if (args.length > 2)
                connector = args[2];
        }

        if(host == null) {
            host = "localhost";
        }
        if(port == null) {
            port = "2809";
        }
        if (connector == null) {
            connector = AdminClient.CONNECTOR_TYPE_SOAP;
        }
        System.out.println("host=" + host + " , port=" + port + ",connector=" + connector);

        //--------------------------------------------------------------------
```

```
            // Get the ac object for the AppServer
            //-------------------------------------------------------------------
            System.out.println("main: create the adminclient");
            ac = getAdminClient(host, port, connector);

        }
        catch (Exception ex)
        {
            failed = true;
            new AdminException(ex).printStackTrace();
            ex.printStackTrace();
        }
    }

    /**
     * get AdminClient using the given host, port, and connector
     */
    public AdminClient getAdminClient(String hostStr, String portStr, String
    connector) {
        System.out.println("getAdminClient: host=" + hostStr + " , portStr=" + portStr);
        AdminClient ac = null;
        java.util.Properties props = new java.util.Properties();
        props.put(AdminClient.CONNECTOR_TYPE, connector);
        props.put(AdminClient.CONNECTOR_HOST, hostStr);
        props.put(AdminClient.CONNECTOR_PORT, portStr);

        /* set the following properties if security is enabled and using SOAP
    connector */
        /* The following shows how to set properties for SOAP connector when
    security is enabled.
           See AdminClient javadoc for more info.
        Properties props = new Properties();
       props.setProperty(AdminClient.CONNECTOR_HOST, "localhost");
       props.setProperty(AdminClient.CONNECTOR_PORT, "8880");
       props.setProperty(AdminClient.CONNECTOR_TYPE, AdminClient.CONNECTOR_
    TYPE_SOAP);
       props.setProperty(AdminClient.CONNECTOR_SECURITY_ENABLED, "true");
       props.setProperty(AdminClient.USERNAME, "test2");
      props.setProperty(AdminClient.PASSWORD, "user24test");
        props.setProperty("javax.net.ssl.trustStore",
   "C:/WebSphere/AppServer/etc/DummyClientTrustFile.jks");
     props.setProperty("javax.net.ssl.keyStore",
   "C:/WebSphere/AppServer/etc/DummyClientKeyFile.jks");
     props.setProperty("javax.net.ssl.trustStorePassword", "WebAS");
     props.setProperty("javax.net.ssl.keyStorePassword", "WebAS");
        */

        try {
            ac = AdminClientFactory.createAdminClient(props);
        }
        catch(Exception ex) {
            failed = true;
            new AdminException(ex).printStackTrace();
            System.out.println("getAdminClient: exception");
        }
        return ac;
    }


    /**
     * get all the ObjectNames.
     */
    public void getObjectNames() {

        try {

            //-------------------------------------------------------------------
```

```
        // Get a list of object names
        //--------------------------------------------------------------------
        javax.management.ObjectName on = new javax.management.ObjectName
("WebSphere:*");

        //--------------------------------------------------------------------
        // get all objectnames for this server
        //--------------------------------------------------------------------
       Set objectNameSet= ac.queryNames(on, null);

        //--------------------------------------------------------------------
        // get the object names that we care about: Perf, Server, JVM, WLM (only applicable in ND)
        //--------------------------------------------------------------------
        if(objectNameSet != null) {
            Iterator i = objectNameSet.iterator();
            while (i.hasNext()) {
                on = (ObjectName)i.next();
                String type = on.getKeyProperty("type");

                // uncomment it if you want to print the ObjectName for each MBean
                // System.out.println("\n\n" + on.toString());

                // find the MBeans we are interested
                if(type != null && type.equals("Perf")) {
                    System.out.println("\nMBean: perf =" + on.toString());
                    perfOName = on;
                }
                if(type != null && type.equals("Server")) {
                    System.out.println("\nMBean: Server =" + on.toString());
                    serverOName = on;
                }
                if(type != null && type.equals("JVM")) {
                    System.out.println("\nMBean: jvm =" + on.toString());
                    jvmOName = on;
                }
                if(type != null && type.equals("WLMAppServer")) {
                    System.out.println("\nmain: WLM =" + on.toString());
                    wlmOName = on;
                }
                if(type != null && type.equals("ThreadPool"))
                {
                    String name = on.getKeyProperty("name");
                    if (name.equals("ORB.thread.pool"))
                        System.out.println("\nMBean: ORB ThreadPool =" + on.toString());
                    orbtpOName = on;
                }
            }
        }
        else {
            System.err.println("main: ERROR: no object names found");
            System.exit(2);
        }

        // You must have Perf MBean in order to get PMI data.
        if (perfOName == null)
        {
            System.err.println("main: cannot get PerfMBean. Make sure PMI is enabled");
            System.exit(3);
        }
    }
    catch(Exception ex)
    {
        failed = true;
        new AdminException(ex).printStackTrace();
        ex.printStackTrace();
    }
```

```
}

/** Test V6 APIs */
public void doTestV6 ()
{
    System.out.println ("\ndoTestV6() output:\n");

    // the following methods are specific to V6 and demonstrates the V6 API..so set the flag to false
    String v5PropFlag = System.setProperty ("websphereV5Statistics", "false");
    try
    {
        Object[] params;
        String[] signature;

        // get current statistic set that is used for monitoring
        System.out.println ("\nCurrent statistic set: " + ac.invoke(perfOName, "getStatisticSet", null, null));


        // get all statistics from the server using Perf MBean
        System.out.println ("\nGet all statistics in PMI tree");
        signature = new String[]{"[Lcom.ibm.websphere.pmi.stat.StatDescriptor;","java.lang.Boolean"};
        params = new Object[] {new StatDescriptor[]{new StatDescriptor(null)}, new Boolean(true)};

        com.ibm.websphere.pmi.stat.WSStats[] wsStats = (com.ibm.websphere.pmi.stat.WSStats[])
        ac.invoke(perfOName, "getStatsArray", params, signature);
        System.out.println (wsStats[0].toString());


        // get statistics from one JVM MBean using J2EE JMX
        System.out.println ("\nGet JVM statistics using JVM MBean");
        javax.management.j2ee.statistics.Stats j2eeStats = (javax.management.j2ee.statistics.Stats)
        ac.getAttribute(jvmOName, "stats");
        System.out.println (j2eeStats.toString());


        // get statistics from a specific thread pool -- WebContainer thread pool
        System.out.println ("\nGet statistics for a specific thread pool");
        signature = new String[]{"[Lcom.ibm.websphere.pmi.stat.StatDescriptor;","java.lang.Boolean"};

        StatDescriptor webContainerPoolSD = new StatDescriptor (new String[] {WSThreadPoolStats.NAME,
 "WebContainer"});
        params = new Object[] {new StatDescriptor[]{webContainerPoolSD}, new Boolean(true)};

        wsStats = (com.ibm.websphere.pmi.stat.WSStats[])
        ac.invoke(perfOName, "getStatsArray", params, signature);
        System.out.println (wsStats[0].toString());


        // set monitoring to statistic set "extended"
        System.out.println ("\nSet monitoring to statistic set 'Extended'");
        signature = new String[]{"java.lang.String"};
        params = new Object[] {StatConstants.STATISTIC_SET_EXTENDED};

        ac.invoke(perfOName, "setStatisticSet", params, signature);

        // get current statistic set that is used for monitoring
        System.out.println ("\nCurrent statistic set: "+ ac.invoke(perfOName, "getStatisticSet", null, null));


        // selectively enable statistics for all thread pools
        System.out.println ("\nSelectively enable statistics (ActiveCount and PoolSize statistics)
  for thread pool -- fine grained control");

        StatDescriptor threadPoolSD = new StatDescriptor (new String[]
{WSThreadPoolStats.NAME});
            // create a spec object to enable ActiveCount and PoolSize on the thread pool
        StatLevelSpec[] spec = new StatLevelSpec[1];
```

```
        spec[0] = new StatLevelSpec (threadPoolSD.getPath(), new int[]
{WSThreadPoolStats.ActiveCount, WSThreadPoolStats.PoolSize});

        signature = new String[]{"[Lcom.ibm.websphere.pmi.stat.StatLevelSpec;","java.lang.Boolean"};
        params = new Object[] {spec, new Boolean(true)};

        ac.invoke(perfOName, "setInstrumentationLevel", params, signature);


        // get current statistic set that is used for monitoring
        System.out.println ("\nCurrent statistic set: "+ ac.invoke(perfOName, "getStatisticSet", null, null));

        // get statistics from all thread pools
        System.out.println ("\nGet statistics from all thread pools");
        signature = new String[]{"[Lcom.ibm.websphere.pmi.stat.StatDescriptor;","java.lang.Boolean"};
        params = new Object[] {new StatDescriptor[]{threadPoolSD},new Boolean(true)};

        wsStats = (com.ibm.websphere.pmi.stat.WSStats[])
        ac.invoke(perfOName, "getStatsArray", params, signature);
        System.out.println (wsStats[0].toString());

    }
    catch (Exception e)
    {
        e.printStackTrace();
    }

    // set the property to original value
    System.setProperty ("websphereV5Statistics", v5PropFlag);
}

/**
 * Some sample code to set level, get data, and display data. (V5)
 * @deprecated Use 6.0 APIs.
 */
public void doTest()
{
    try
    {
        // first get all the configs  - used to set static info for Stats
        // Note: server only returns the value and time info.
        //       No description, unit, etc is returned with PMI data to reduce communication cost.
        //       You have to call setConfig to bind the static info and Stats data later.
        configs = (PmiModuleConfig[])ac.invoke(perfOName, "getConfigs", null, null);

        // print out all the PMI modules and matching mbean types
        for (int i=0; i<configs.length; i++)
            System.out.println("config: moduleName=" + configs[i].getShortName() +
   ", mbeanType=" + configs[i].getMbeanType());

        // set the instrumentation level for the server
        setInstrumentationLevel(serverOName, null, PmiConstants.LEVEL_HIGH);

        // example to use StatDescriptor.
        // Note WLM module is only available in ND.
        StatDescriptor sd = new StatDescriptor(new String[] {"wlmModule.server"});
        setInstrumentationLevel(wlmOName, sd, PmiConstants.LEVEL_HIGH);

        // example to getInstrumentationLevel
        MBeanLevelSpec[] mlss = getInstrumentationLevel(wlmOName, sd, true);
        // you can call getLevel(), getObjectName(), getStatDescriptor() on mlss[i]

        // get data for the server
        Stats stats = getStatsObject(serverOName, true);
        System.out.println(stats.toString());

        // get data for WLM server submodule
```

```
        stats = getStatsObject(wlmONname, sd, true);
        if (stats == null)
            System.out.println("Cannot get Stats for WLM data");
        else
            System.out.println(stats.toString());

        // get data for JVM MBean
        stats = getStatsObject(jvmONname, true);
        processStats(stats);

        // get data for multiple MBeans
        ObjectName[] onames = new ObjectName[]{orbtpONname, jvmONname};
        Object[] params = new Object[]{onames, new Boolean(true)};
        String[] signature = new String[]{"[Ljavax.management.ObjectName;",
  "java.lang.Boolean"};
        Stats[] statsArray = (Stats[])ac.invoke(perfONname, "getStatsArray",
  params, signature);
        // you can call toString or processStats on statsArray[i]

        if (!failed)
            System.out.println("All tests passed");
        else
            System.out.println("Some tests failed");
    }
    catch(Exception ex)
    {
        new AdminException(ex).printStackTrace();
        ex.printStackTrace();
    }
}


/**
 * Sample code to get level
 */
protected MBeanLevelSpec[] getInstrumentationLevel(ObjectName on, StatDescriptor sd, boolean recursive)
{
    if (sd == null)
        return getInstrumentationLevel(on, recursive);
    System.out.println("\ntest getInstrumentationLevel\n");
    try {
        Object[] params = new Object[2];
        params[0] = new MBeanStatDescriptor(on, sd);
        params[1] = new Boolean(recursive);
        String[] signature= new String[]{ "com.ibm.websphere.pmi.stat.MBeanStatDescriptor", "java.lang.Boolean"};
        MBeanLevelSpec[] mlss = (MBeanLevelSpec[])ac.invoke(perfONname, "getInstrumentationLevel", params, signature);
        return mlss;
    }
    catch(Exception e) {
        new AdminException(e).printStackTrace();
        System.out.println("getInstrumentationLevel: Exception Thrown");
        return null;
    }
}

/**
 * Sample code to get level
 */
protected MBeanLevelSpec[] getInstrumentationLevel(ObjectName on,
 boolean recursive) {
    if (on == null)
        return null;
    System.out.println("\ntest getInstrumentationLevel\n");
    try {
        Object[] params = new Object[]{on, new Boolean(recursive)};
        String[] signature= new String[]{ "javax.management.ObjectName",
 "java.lang.Boolean"};
```

```
        MBeanLevelSpec[] mlss = (MBeanLevelSpec[])ac.invoke(perfOName,
 "getInstrumentationLevel", params, signature);
        return mlss;
    }
    catch(Exception e) {
        new AdminException(e).printStackTrace();
        failed = true;
        System.out.println("getInstrumentationLevel: Exception Thrown");
        return null;
    }
}

/**
 * Sample code to set level
 * @deprecated Use 6.0 APIs.
 */
protected void setInstrumentationLevel(ObjectName on, StatDescriptor sd,
 int level) {
    System.out.println("\ntest setInstrumentationLevel\n");
    try {
        Object[] params       = new Object[2];
        String[] signature    = null;
        MBeanLevelSpec[] mlss = null;
        params[0] = new MBeanLevelSpec(on, sd, level);
        params[1] = new Boolean(true);

        signature= new String[]{ "com.ibm.websphere.pmi.stat.MBeanLevelSpec","java.lang.Boolean"};
        ac.invoke(perfOName, "setInstrumentationLevel", params, signature);
    }
    catch(Exception e) {
        failed = true;
        new AdminException(e).printStackTrace();
        System.out.println("setInstrumentationLevel: FAILED: Exception Thrown");
    }
}

/**
 * Sample code to get a Stats object
 * @deprecated Use 6.0 APIs.
 */
public Stats getStatsObject(ObjectName on, StatDescriptor sd, boolean
 recursive) {

    if (sd == null)
        return getStatsObject(on, recursive);

    System.out.println("\ntest getStatsObject\n");
    try {
        Object[] params    = new Object[2];
        params[0] = new MBeanStatDescriptor(on, sd);  // construct MBeanStatDescriptor
        params[1] = new Boolean(recursive);
        String[] signature = new String[] { "com.ibm.websphere.pmi.stat.MBeanStatDescriptor", "java.lang.Boolean"};
        Stats stats  = (Stats)ac.invoke(perfOName, "getStatsObject", params, signature);

        if (stats == null) return null;


        // find the PmiModuleConfig and bind it with the data
        String type = on.getKeyProperty("type");
        if (type.equals(MBeanTypeList.SERVER_MBEAN))
            setServerConfig(stats);
        else
            stats.setConfig(PmiClient.findConfig(configs, on));

        return stats;

    } catch(Exception e) {
```

```
            failed = true;
            new AdminException(e).printStackTrace();
            System.out.println("getStatsObject: Exception Thrown");
            return null;
        }
    }

    /**
     * Sample code to get a Stats object
     */
    public Stats getStatsObject(ObjectName on, boolean recursive) {
        if (on == null)
            return null;

        System.out.println("\ntest getStatsObject\n");

        try {
            Object[] params  = new Object[]{on, new Boolean(recursive)};
            String[] signature = new String[] { "javax.management.ObjectName",
     "java.lang.Boolean"};
            Stats stats  = (Stats)ac.invoke(perfOName, "getStatsObject", params,
     signature);


            // find the PmiModuleConfig and bind it with the data
            String type = on.getKeyProperty("type");
            if (type.equals(MBeanTypeList.SERVER_MBEAN))
                setServerConfig(stats);
            else
                stats.setConfig(PmiClient.findConfig(configs, on));

            return stats;

        }
        catch(Exception e) {
            failed = true;
            new AdminException(e).printStackTrace();
            System.out.println("getStatsObject: Exception Thrown");
            return null;
        }
    }

    /**
     * Sample code to navigate and get the data value from the Stats object.
     */
    private void processStats(Stats stat) {
        processStats(stat, "");
    }

    /**
     * Sample code to navigate and get the data value from the Stats and
    Statistic object.
     * @deprecated Use 6.0 APIs.
     */
    private void processStats(Stats stat, String indent) {
        if(stat == null)  return;

        System.out.println("\n\n");

        // get name of the Stats
        String name = stat.getName();
        System.out.println(indent + "stats name=" + name);

        // list data names
        String[] dataNames = stat.getStatisticNames();
        for (int i=0; i<dataNames.length; i++)
            System.out.println(indent + "    " + "data name=" + dataNames[i]);
```

```
        System.out.println("");

        // list all datas
        //com.ibm.websphere.management.statistics.Statistic[] allData =
    stat.getStatistics();

        // cast it to be PMI's Statistic type so that we can have get more
        // Also show how to do translation.
        //Statistic[] dataMembers = (Statistic[])allData;
        Statistic[] dataMembers = stat.listStatistics();
        if(dataMembers != null) {
            for(int i=0; i<dataMembers.length; i++)  {
                System.out.print(indent + "    " + "data name=" +
    PmiClient.getNLSValue(dataMembers[i].getName())
                                + ", description=" + PmiClient.getNLSValue
    (dataMembers[i].getDescription())
                                + ", startTime=" + dataMembers[i].getStartTime()
                                + ", lastSampleTime=" + dataMembers[i].getLastSampleTime());
                if(dataMembers[i].getDataInfo().getType() == TYPE_LONG) {
                    System.out.println(", count=" + ((CountStatisticImpl)dataMembers[i]).getCount());
                }
                else if(dataMembers[i].getDataInfo().getType() == TYPE_STAT) {
                    TimeStatisticImpl data = (TimeStatisticImpl)dataMembers[i];
                    System.out.println(", count=" + data.getCount()
                                       + ", total=" + data.getTotal()
                                       + ", mean=" + data.getMean()
                                       + ", min=" + data.getMin()
                                       + ", max=" + data.getMax());
                }
                else if(dataMembers[i].getDataInfo().getType() == TYPE_LOAD) {
                    RangeStatisticImpl data = (RangeStatisticImpl)dataMembers[i];
                    System.out.println(", current=" + data.getCurrent()
                                       + ", integral=" + data.getIntegral()
                                       + ", avg=" + data.getMean()
                                       + ", lowWaterMark=" + data.getLowWaterMark()
                                       + ", highWaterMark=" + data.getHighWaterMark());
                }
            }
        }

        // recursively for sub-stats
        Stats[] substats = (Stats[])stat.getSubStats();
        if(substats == null || substats.length == 0)
            return;
        for(int i=0; i<substats.length; i++) {
            processStats(substats[i], indent + "    ");
        }
    }

    /**
     * The Stats object returned from server does not have static config info.
    You have to set it on client side.
     */
    public void setServerConfig(Stats stats) {
        if(stats == null) return;
        if(stats.getType() != TYPE_SERVER) return;

        PmiModuleConfig config = null;

        Stats[] statList = stats.getSubStats();
        if (statList == null || statList.length == 0)
            return;
        Stats oneStat = null;
        for(int i=0; i<statList.length; i++) {
            oneStat = statList[i];
            if (oneStat == null) continue;
            config = PmiClient.findConfig(configs, oneStat.getStatsType());
```

```
 //getName
        if(config != null)
            oneStat.setConfig(config);
        else
        {
            config = getStatsConfig (oneStat.getStatsType());
            if (config != null)
                oneStat.setConfig(config);
            else
                System.out.println("Error: get null config for " + oneStat.getStatsType());
        }
    }
}

/**
 * sample code to show how to get a specific MBeanStatDescriptor
 * @deprecated Use 6.0 APIs.
 */
public MBeanStatDescriptor getStatDescriptor(ObjectName oName, String name) {
    try {
        Object[] params = new Object[]{serverOName};
        String[] signature= new String[]{"javax.management.ObjectName"};
        MBeanStatDescriptor[] msds = (MBeanStatDescriptor[])ac.invoke
(perfOName, "listStatMembers", params, signature);
        if (msds == null)
            return null;
        for (int i=0; i<msds.length; i++) {
            if (msds[i].getName().equals(name))
                return msds[i];
        }
        return null;
    }
    catch(Exception e) {
        new AdminException(e).printStackTrace();
        System.out.println("listStatMembers: Exception Thrown");
        return null;
    }

}

/**
 * sample code to show you how to navigate MBeanStatDescriptor via
listStatMembers
 * @deprecated Use 6.0 APIs.
 */
public MBeanStatDescriptor[] listStatMembers(ObjectName mName) {
    if (mName == null)
        return null;

    try {
        Object[] params = new Object[]{mName};
        String[] signature= new String[]{"javax.management.ObjectName"};
        MBeanStatDescriptor[] msds = (MBeanStatDescriptor[])ac.invoke
 (perfOName, "listStatMembers", params, signature);
        if (msds == null)
            return null;
        for (int i=0; i<msds.length; i++) {
            MBeanStatDescriptor[] msds2 = listStatMembers(msds[i]);
        }
        return null;
    }
    catch(Exception e) {
        new AdminException(e).printStackTrace();
        System.out.println("listStatMembers: Exception Thrown");
        return null;
    }
```

```
}


/**
 * Sample code to get MBeanStatDescriptors
 * @deprecated Use 6.0 APIs.
 */
public MBeanStatDescriptor[] listStatMembers(MBeanStatDescriptor mName) {
    if (mName == null)
        return null;

    try {
        Object[] params = new Object[]{mName};
        String[] signature= new String[]{"com.ibm.websphere.pmi.stat.MBeanStatDescriptor"};
        MBeanStatDescriptor[] msds = (MBeanStatDescriptor[])ac.invoke(perfOName, "listStatMembers",
  params, signature);
        if (msds == null)
            return null;
        for (int i=0; i<msds.length; i++) {
            MBeanStatDescriptor[] msds2 = listStatMembers(msds[i]);
            // you may recursively call listStatMembers until find the one you want
        }
        return msds;
    }
    catch(Exception e) {
        new AdminException(e).printStackTrace();
        System.out.println("listStatMembers: Exception Thrown");
        return null;
    }

}

/**
 * sample code to get PMI data from beanModule
 * @deprecated Use 6.0 APIs.
 */
public void testEJB() {

    // This is the MBeanStatDescriptor for Enterprise EJB
    MBeanStatDescriptor beanMsd = getStatDescriptor(serverOName,
 PmiConstants.BEAN_MODULE);
    if (beanMsd == null)
        System.out.println("Error: cannot find beanModule");

    // get the Stats for module level only since recursive is false
    Stats stats = getStatsObject(beanMsd.getObjectName(), beanMsd.
getStatDescriptor(), false); // pass true if you wannt data from individual beans

    // find the avg method RT
    TimeStatisticImpl rt = (TimeStatisticImpl)stats.getStatistic
(EJBStatsImpl.METHOD_RT);
    System.out.println("rt is " + rt.getMean());

    try {
        java.lang.Thread.sleep(5000);
    } catch (Exception ex) {
        ex.printStackTrace();
    }

    // get the  Stats again
    Stats stats2 = getStatsObject(beanMsd.getObjectName(), beanMsd.
getStatDescriptor(), false); // pass true if you wannt data from individual beans

    // find the avg method RT
    TimeStatisticImpl rt2 = (TimeStatisticImpl)stats2.getStatistic
(EJBStatsImpl.METHOD_RT);
    System.out.println("rt2 is " + rt2.getMean());
```

```
        // calculate the difference between this time and last time.
        TimeStatisticImpl deltaRt = (TimeStatisticImpl)rt2.delta(rt);
        System.out.println("deltaRt is " + rt.getMean());

    }

    /**
     * Sample code to show how to call getStats on StatisticProvider MBean
   directly.
     * @deprecated Use 6.0 APIs.
     */
    public void testJSR77Stats() {
        // first, find the MBean ObjectName you are interested.
        // Refer method getObjectNames for sample code.

        // assume we want to call getStats on JVM MBean to get statistics
        try {

            com.ibm.websphere.management.statistics.JVMStats stats =
                    (com.ibm.websphere.management.statistics.JVMStats)ac.
    invoke(jvmOName, "getStats", null, null);

            System.out.println("\n get data from JVM MBean");

            if (stats == null) {
                System.out.println("WARNING: getStats on JVM MBean returns null");
            } else {

                // first, link with the static info if you care
                ((Stats)stats).setConfig(PmiClient.findConfig(configs, jvmONname));

                // print out all the data if you want
                //System.out.println(stats.toString());

                // navigate and get the data in the stats object
                processStats((Stats)stats);

                // call JSR77 methods on JVMStats to get the related data
                com.ibm.websphere.management.statistics.CountStatistic upTime =
      stats.getUpTime();
                com.ibm.websphere.management.statistics.BoundedRangeStatistic
      heapSize = stats.getHeapSize();

                if (upTime != null)
                    System.out.println("\nJVM up time is " + upTime.getCount());
                if (heapSize != null)
                    System.out.println("\nheapSize is " + heapSize.getCurrent());
            }
        } catch (Exception ex) {
            ex.printStackTrace();
            new AdminException(ex).printStackTrace();
        }
    }


    /**
     Get PmiModuleConfig from server
     */
    public PmiModuleConfig getStatsConfig (String statsType)
    {
       try
       {
            return (PmiModuleConfig)ac.invoke(perfONname, "getConfig",
                                              new String[]{statsType},
                                              new String[]{"java.lang.String"});
       }
```

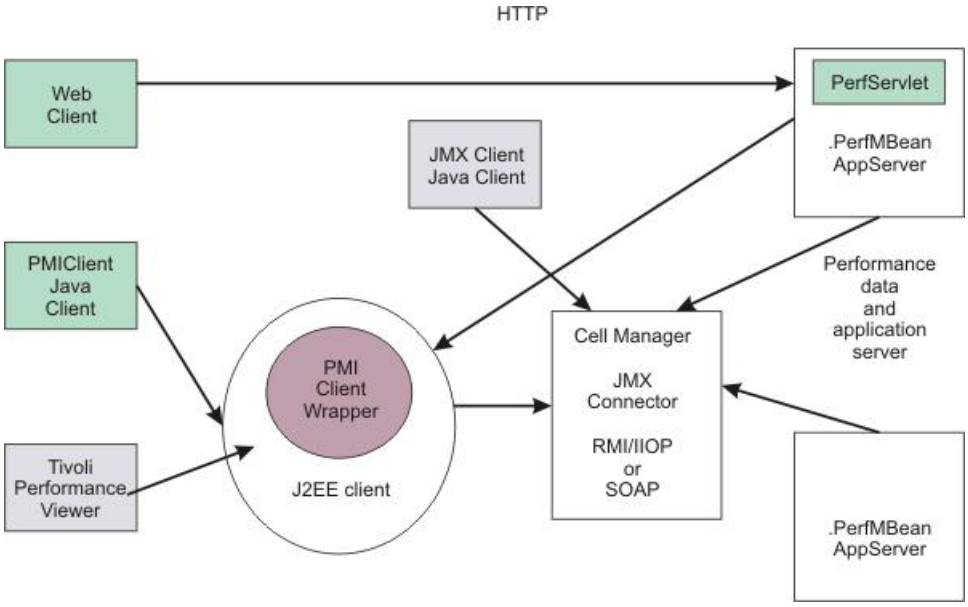
```
        catch(Exception e)
        {
             e.printStackTrace();
             return null;
        }
    }

    /**
     * Get PmiModuleConfig based on MBean ObjectName
      @deprecated Use com.ibm.websphere.pmi.client.PmiClient.findConfig()
     */
    public PmiModuleConfig findConfig(ObjectName on) {
        if (on == null) return null;

        String type = on.getKeyProperty("type");
        System.out.println("findConfig: mbean type =" + type);

        for (int i=0; i<configs.length ; i++) {

            if (configs[i].getMbeanType().equals(type))
                return configs[i];
        }
        System.out.println("Error: cannot find the config");
        return null;

    }

    /**
     * Get PmiModuleConfig based on PMI module name
     @deprecated Use com.ibm.websphere.pmi.client.PmiClient.findConfig()
     */
    public PmiModuleConfig findConfig(String moduleName) {
        if (moduleName == null) return null;

        for (int i=0; i<configs.length ; i++) {

            if (configs[i].getShortName().equals(moduleName))
                return configs[i];
        }
        System.out.println("Error: cannot find the config");
        return null;

    }
}
```

PMI client interface (deprecated)

The data provided by the Performance Monitoring Infrastructure (PMI) client interface is documented here.

Access to the PMI client interface data is provided in a hierarchical structure. Descending from the object are node information objects, module information objects, CpdCollection objects and CpdData objects. Using Version 5.0, you will get Stats and Statistic objects. The node and server information objects contain

no performance data, only static information.



Each time a client retrieves performance data from a server, the data is returned in a subset of this structure; the form of the subset depends on the data retrieved. You can update the entire structure with new data, or update only part of the tree, as needed.

The JMX statistic data model is supported, as well as the existing CPD data model from Version 4.0. When you retrieve performance data using the Version 5.0 PMI client API, you get the Stats object, which includes Statistic objects and optional sub-Stats objects. When you use the Version 4.0 PMI client API to collect performance data, you get the CpdCollection object, which includes the CpdData objects and optional sub-CpdCollection objects.

The following are additional Performance Monitoring Infrastructure (PMI) interfaces:
- BoundaryStatistic
- BoundedRangeStatistic
- CountStatistic
- MBeanStatDescriptor
- MBeanLevelSpec
- New Methods in PmiClient
- RangeStatistic
- Stats
- Statistic
- TimeStatistic

The following PMI interfaces introduced in Version 4.0 are also supported:
- CpdCollection
- CpdData
- CpdEventListener and CpdEvent
- CpdFamily class
- CpdValue
  - CpdLong
  - CpdStat
  - CpdLoad
- PerfDescriptor
- PmiClient class

The CpdLong maps to CountStatistic; CpdStat maps to Time Statistic; CpdCollection maps to Stats; and CpdLoad maps to RangeStatistic and BoundedRangeStatistic.

Note: Version 4.0 PmiClient APIs are supported in this version, however, there are some changes. The data hierarchy is changed in some PMI modules, notably the enterprise bean module and HTTP sessions module. If you have an existing PmiClient application, and you want to run it against Version 5.0, you might have to update the PerfDescriptor(s) based on the new PMI data hierarchy. Also, the getDataName and getDataId methods in PmiClient are changed to be non-static methods in order to support multiple WebSphere Application Server versions. You might have to update your existing application which uses these two methods.

Using PMI client to develop your monitoring application (deprecated)

You can use the Performance Monitoring Infrastructure (PMI) interfaces to develop your own applications to collect and display performance information.

About this task

The following is the programming model for Performance Monitoring Infrastructure (PMI) client:

Procedure

1. Create an instance of PmiClient. This is used for all subsequent method calls.
2. Optional: You can create your own MBeans. See the extending the WebSphere Application Server administrative system with custom MBeans for more information.
3. Call the listNodes() and listServers(nodeName) methods to find all the nodes and servers in the WebSphere Application Server domain. The PMI client provides two sets of methods: one set in Version 5.0 and the other set inherited from Version 4.0. You can only use one set of methods. Do not mix them together.
4. Call listMBeans and listStatMembers to get all the available MBeans and MBeanStatDescriptors.
5. Call the getStats method to get the Stats object for the PMI data.
6. Optional: The client can also call setStatLevel or getStatLevel to set and get the monitoring level. Use the MBeanLevelSpec objects to set monitoring levels.

What to do next

If you prefer to use the Version 4.0 interface, the model is essentially the same, but the object types are different:

1. Create an instance of PmiClient.
2. Call the listNodes() and listServers(nodeName) methods to find all the nodes and servers in the WebSphere Application Server domain.
3. Call listMembers to get all the perfDescriptor objects.
4. Use the PMI client's get or gets method to get CpdCollection objects. These contain snapshots of performance data from the server. The same structure is maintained and its update method is used to refresh the data.
5. (Optional) The client can also call setInstrumentationLevel or getInstrumentationLevel to set and get the monitoring level.

Performance Monitoring Infrastructure client (WebSphere Version 4.0)

A Performance Monitoring Infrastructure (PMI) client is an application that receives PMI data from servers and processes this data.

In WebSphere Application Server Version 4.0, PmiClient API takes PerfDescriptor(s) and returns PMI data as a CpdCollection object. Each CpdCollection could contain a list of CpdData, which has a CpdValue of the following types:

- CpdLong

- CpdStat
- CpdLoad

Version 4.0 PmiClient APIs are supported in this version, however, there are some changes. The data hierarchy is changed in some PMI modules, notably the enterprise bean module and HTTP sessions module. If you have an existing PmiClient application, and you want to run it against WebSphere Application Server Version 5.0 or later, you might have to update the PerfDescriptor(s) based on the new PMI data hierarchy. Also, the getDataName and getDataId methods in PmiClient are changed to be non-static methods in order to support multiple WebSphere Application Server versions. You might have to update your existing application which uses these two methods.

Retrieving performance data with PerfServlet

The PerfServlet is used for simple end-to-end retrieval of performance data that any tool, provided by either IBM or a third-party vendor, can handle.

Before you begin

The servlet provides a way to use an HTTP request to query the performance metrics for an entire WebSphere Application Server administrative domain. Because the servlet provides the performance data through HTTP, issues such as firewalls are trivial to resolve.

The PerfServlet provides the performance data output as an XML document, as described in the provided document type description (DTD). In the XML structure, the leaves of the structure provide the actual observations of performance data and the paths to the leaves that provide the context.

bprac: The PerfServlet is a sample monitoring tool that uses WebSphere Application Server administration and monitoring interfaces to expose performance data. Using the PerfServlet is not intended for real-time performance monitoring in production environments or for use in large topologies. For these environments you should use the Tivoli Performance Viewer for WebSphere Application Server.

Specific best practices for the PerfServlet are the following:

- **PerfServlet overhead:** The PerfServlet is not designed to run concurrently. Being a single threaded servlet, it would collect the data sequentially from available servers. This single threaded operation can cause higher response times when the PerfServlet is used in larger deployments.
- **PerfServlet in large deployments:**
  - By default, when the PerfServlet is first initialized, it retrieves the list of nodes and servers within the cell in which it is deployed. Because collecting this data costs in system processing time, the PerfServlet holds this information as a cached list. To force the servlet to refresh its configuration, you can use the option "refreshconfig=true". However, using this option is not recommended unless required, because this option adds extra overhead to the PerfServlet processing.
  - Use option, node and server, if you are looking for a specific server's performance data.
- **PerfServlet response time:** The PerfServlet responsiveness depends on the following factors:
  - Numbers of application servers that exist in the cell.
  - Number of resources configured in the cell (including applications).
- **PerfServlet alternative:** If you are looking for an alternative to using the PerfServlet to capture data programmatically, refer to the Perf MBean programming interfaces documentation, which exists in the **Reference > Programming Interfaces > MBean interfaces** section of the WebSphere Application Server information center..

Starting with version 6.0, the PerfServlet in WebSphere Application Server uses the JMX Perf MBean interface to retrieve the PMI data and outputs an XML document that uses the Java Platform, Enterprise

Edition (Java EE) 1.4 Performance Data Framework to describe the statistics. The PerfSerlvet in can also provide an output that is compatible with the PerfServlet 5.0. To provide PerfServlet 5.0 compatible output it uses the PMI client interface.

The performance servlet .ear file PerfServletApp.ear is located in the `WAS_HOME/installableApps` directory, where *WAS_HOME* is the installation path for WebSphere Application Server.

Starting with version 6.1, you must enable application security to get the PerfServlet working.

About this task

The performance servlet is deployed exactly as any other servlet. To use it, follow these steps:

Procedure

1. Deploy the servlet on a single application server instance within the domain.
2. After the servlet deploys, you can invoke it to retrieve performance data for the entire domain. Invoke the performance servlet by accessing the following default URL:

   `http://hostname/wasPerfTool/servlet/perfservlet`

Results

The performance servlet provides performance data output as an XML document, as described by the provided document type definition (DTD). The DTD is located inside the PerfServletApp.ear file.

PerfServlet input

The PerfServlet input and output is used for simple end-to-end retrieval of performance data that any tool, provided by either IBM or a third-party vendor, can handle

The PerfServlet is deployed in one of the application server instance within the domain. By default, the PerfServlet collects all of the performance data across a WebSphere Application Server cell. However, it is possible to limit the data returned by the servlet to either a specific node, server, or PMI module:

Node .The servlet can limit the information it provides to a specific host by using the node parameter. For example, to limit the data collection to the node ‘rjones’, invoke the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?node=rjones
```

Server

The servlet can limit the information it provides to a specific server by using the server parameter. For example, in order to limit the data collection to the ‘testserver’ server on all nodes, invoke the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?server=testserver
```

To limit the data collection to the ‘testserver’ server located on the host ‘rjones’, invoke the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?node=rjones&server=testserver
```

Module

The servlet can limit the information it provides to a specific PMI module by using the module parameter. You can request multiple modules by using the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?module=beanModule+jvmRuntimeModule
```

For example, to limit the data collection to the beanModule on all servers and nodes, invoke the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?module=beanModule
```

To limit the data collection to the beanModule on the server 'testserver' on the node rjones, invoke the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?node=rjones&server=testserver&module=beanModule
```

To find the list of the modules, invoke the PerfServlet help with the following URL:

```
http://hostname/wasPerfTool/servlet/perfservlet?action=help
```

When the performance servlet is first initialized, it retrieves the list of nodes and servers within the domain in which it is deployed. Because the collection of this data is expensive, the performance servlet holds this information as a cached list. If a new node is added to the domain or a new server is started, the performance servlet does not automatically retrieve the information about the newly created element. To force the servlet to refresh its configuration, you must add the refreshConfig parameter to the invocation as follows:

```
http://hostname/wasPerfTool/servlet/perfservlet?refreshConfig=true
```

You may want to configure other parameters of the performance servlets according to your specific needs. You can define the host, port number, connector type, and a user name and password.

- **Host**. This defines the host name where the server is running. The default value is "localhost." For base installations, use "localhost" or "host" where application server is running.
- **Port**. This is the port through which the server will connect. The default value is '8880' (SOAP connector port in base installation). In a base installation, use the application server SOAP or RMI connector port.

  Note: The port numbers for SOAP/RMI connector can be configured in the administrative console under **Servers** > **Application Servers** > *server_name* > **End Points**.
- **Connector**. The connector type can be either SOAP or RMI. The default value is SOAP.
- **Username**. If security is enabled provide the user name.
- **Password**. If security is enabled provide the password.

PerfServlet output

The PerfServlet input and output is used for simple end-to-end retrieval of performance data that any tool, provided by either IBM or a third-party vendor, can handle.

The performance servlet .ear file PerfServletApp.ear is located in the `WAS_HOME/installableApps` directory.

The PerfServlet 6.0 provides output using the J2EE 1.4 Performance Data Framework. By default, the PerfServlet output is in 6.0 format. PerfServlet can provide the output in 5.0 format using the version parameter:

```
http://hostname/wasPerfTool/servlet/perfservlet?version=5
```

Refer to "PMI data classification" on page 13 for details about the Performance Data Framework.

PerfServlet 5.0 output details: The following section describes the PerfServlet 5.0 output. There are three types of leaves or output formats within the XML structure: PerfNumericInfo, PerfStatInfo, and PerfLoadInfo.

PerfNumericInfo:

When each invocation of the performance servlet retrieves the performance values from Performance Monitoring Infrastructure (PMI), some of the values are raw counters that record the number of times a specific event occurs during the lifetime of the server. If a performance observation is of the type PerfNumericInfo, the value represents the raw count of the number of times this event has occurred since the server started. This information is important to note because the analysis of a single document of data provided by the performance servlet might not be useful for determining the current load on the system. To

determine the load during a specific interval of time, it might be necessary to apply simple statistical formulas to the data in two or more documents provided during this interval.

The PerfNumericInfo type has the following attributes:

time Specifies the time when the observation was collected (Java System.currentTimeMillis)

uid Specifies the PMI identifier for the observation

val Specifies the raw counter value

The following document fragment represents the number of loaded servlets. The path providing the context of the observation is not shown:

```
<numLoadedServlets>
     <PerfNumericData time="988162913175" uid="pmi1" val="132"/>
</numLoadedServlets>
```

PerfStatInfo:

When each invocation of the performance servlet retrieves the performance values from PMI, some of the values are stored as statistical data. Statistical data records the number of occurrences of a specific event, as the PerfNumericInfo type does. In addition, this type has sum of squares, mean, and total for each observation. This value is relative to when the server started.

The PerfStatInfo type has the following attributes:

time Specifies the time when the observation was collected (Java System.currentTimeMillis)

uid Specifies the PMI identifier for the observation

num Specifies the number of observations

sum_of_squares
Specifies the sum of the squares of the observations

total Specifies the sum of the observations

mean Specifies the mean (total number) for this counter

The following fragment represents the response time of an object. The path providing the context of the observation is not shown:

```
<responseTime>
     <PerfStatInfo mean="1211.5" num="5" sum_of_squares="3256265.0"
                   time="9917644193057" total="2423.0" uid="pmi13"/>
</responseTime>
```

PerfLoadInfo:

When each invocation of the performance servlet retrieves the performance values from PMI, some of the values are stored as a load. Loads record values as a function of time; they are averages. This value is relative to when the server started.

The PerfLoadInfo type has the following attributes:

time Specifies the time when the observation was collected (Java System.currentTimeMillis)

uid Specifies the PMI identifier for the observation

currentValue
Specifies the current value for this counter

integral
Specifies the time-weighted sum

timeSinceCreate
Specifies the elapsed time in milliseconds since this data was created in the server

mean Specifies time-weighted mean (integral/timeSinceCreate) for this counter

The following fragment represents the number of concurrent requests. The path providing the context of the observation is not shown:

```
<poolSize>
     <PerfLoadInfo currentValue="1.0" integral="534899.0" mean="0.9985028962051592"
                   time="991764193057" timeSinceCreate="535701.0" uid="pmi5"/>
</poolSize>
```

Using the JMX interface to develop your own monitoring application

You can use AdminClient API to get Performance Monitoring Infrastructure (PMI) data by using either PerfMBean or individual MBeans.

Before you begin

You can invoke methods on MBeans through the AdminClient Java Management Extension (JMX) interface. You can use AdminClient API to get Performance Monitoring Infrastructure (PMI) data by using either PerfMBean or individual MBeans. See information about using individual MBeans at bottom of this article.

Individual MBeans provide the Stats attribute from which you can get PMI data. The PerfMBean provides extended methods for PMI administration and more efficient ways to access PMI data. To set the PMI module instrumentation level, you must invoke methods on PerfMBean. To query PMI data from multiple MBeans, it is faster to invoke the getStatsArray method in PerfMBean than to get the Stats attribute from multiple individual MBeans. Perf MBean can provide PMI data from multiple MBeans using a single JMX call, but multiple JMX calls have to be made through individual MBeans.

See the topic “Developing an administrative client program” for more information on AdminClient JMX.

About this task

After the performance monitoring service is enabled and the application server is started or restarted, a PerfMBean is located in each application server giving access to PMI data. To use PerfMBean:

Procedure

1. Create an instance of AdminClient. When using AdminClient API, you need to first create an instance of AdminClient by passing the host name, port number and connector type.

   The example code is:

```
AdminClient ac = null;
java.util.Properties props = new java.util.Properties();
props.put(AdminClient.CONNECTOR_TYPE, connector);
props.put(AdminClient.CONNECTOR_HOST, host);
props.put(AdminClient.CONNECTOR_PORT, port);
try {
    ac = AdminClientFactory.createAdminClient(props);
}
catch(Exception ex) {
    failed = true;
    new AdminException(ex).printStackTrace();
    System.out.println("getAdminClient: exception");
}
```

2. Use AdminClient to query the MBean ObjectNames. After you get the AdminClient instance, you can call queryNames to get a list of MBean ObjectNames depending on your query string. To get all the ObjectNames, you can use the following example code. If you have a specified query string, you will get a subset of ObjectNames.

```
javax.management.ObjectName on = new javax.management.ObjectName("WebSphere:*");
     Set objectNameSet= ac.queryNames(on, null);
 // you can check properties like type, name, and process to find a specified ObjectName
```

   After you get all the ObjectNames, you can use the following example code to get all the node names:

```
  HashSet nodeSet = new HashSet();
        for(Iterator i = objectNameSet.iterator(); i.hasNext(); on =
(ObjectName)i.next()) {
            String type = on.getKeyProperty("type");
            if(type != null && type.equals("Server")) {
  nodeSet.add(servers[i].getKeyProperty("node"));
            }
 }
```

   Note: This will only return nodes that are started.
   To list running servers on the node, you can either check the node name and type for all the ObjectNames or use the following example code:

```
     StringBuffer oNameQuery= new StringBuffer(41);
        oNameQuery.append("WebSphere:*");
        oNameQuery.append(",type=").append("Server");
        oNameQuery.append(",node=").append(mynode);

        oSet= ac.queryNames(new ObjectName(oNameQuery.toString()), null);
        Iterator i = objectNameSet.iterator ();
    while (i.hasNext ()) {
    on=(objectName) i.next();
   String process= on[i].getKeyProperty("process");
   serversArrayList.add(process);
  }
```

3. Get the PerfMBean ObjectName for the application server from which you want to get PMI data. Use this example code:

```
for(Iterator i = objectNameSet.iterator(); i.hasNext(); on = (ObjectName)i.next()) {
     // First make sure the node name and server name is what you want
     // Second, check if the type is Perf
            String type = on.getKeyProperty("type");
     String node = on.getKeyProperty("node");
     String process= on.getKeyProperty("process");
            if (type.equals("Perf") && node.equals(mynode) &
& server.equals(myserver)) {
  perfOName = on;
            }
 }
```

4. Invoke operations on PerfMBean through the AdminClient. After you get the PerfMBean(s) in the application server from which you want to get PMI data, you can invoke the following operations on the PerfMBean through AdminClient API:

```
- setStatisticSet: Enable PMI data using the pre-defined statistic sets.
 Object[] params = new Object[] { com.ibm.websphere.pmi.stat.StatConstants.STATISTIC_SET_EXTENDED};
 String[] signature = new String[] {"java.lang.String"};
 ac.invoke (perfOName, "setStatisticSet", params, signature);

- getStatisticSet: Returns the current statistic set.
 String setname = (String) ac.invoke (perfOName, "getStatisticSet", null, null);

- setCustomSetString: Customizing PMI data that is enabled using fine-grained control.
This method allows to enable or disable statistics selectively. The format of the custom
set specification string is STATS_NAME=ID1,ID2,ID3 seperated by ':', where STATS_NAME
and IDs are defined in WS*Stat interfaces in com.ibm.websphere.pmi.stat package.
 params[0] = new String (WSJVMStats.NAME + "=" + WSJVMStats.HeapSize);
```

```
 params[1] = new Boolean (false);
 signature = new String[] {"java.lang.String", "java.lang.Boolean"};
 ac.invoke (perfOName, "setCustomSetString", params, signature);

  Note: Statistics that are not listed in the set string are not changed.

- getCustomSetString: Returns the current custom set specification as a string
 String setstring = (String) ac.invoke (perfOName, "getCustomSetString", null, null);


- setInstrumentationLevel: set the instrumentation level
            params[0] = new MBeanLevelSpec(objectName, new int[]{WSJVMStats.HEAPSIZE});
            params[1] = new Boolean(true);
            signature= new String[]{ "com.ibm.websphere.pmi.stat.MBeanLevelSpec",
"java.lang.Boolean"};
            ac.invoke(perfOName, "setInstrumentationLevel", params, signature);

- getInstrumentationLevel: get the instrumentation level
            params[0] = objectName;
            params[1] = new Boolean(recursive);
            String[] signature= new String[]{
"javax.management.ObjectName", "java.lang.Boolean"};
            MBeanLevelSpec[] mlss = (MBeanLevelSpec[])ac.invoke(perfOName,
     "getInstrumentationLevel", params, signature);

- setInstrumentationLevel: set the instrumentation level (deprecated in V6.0)
            params[0] = new MBeanLevelSpec(objectName, optionalSD, level);
            params[1] = new Boolean(true);
            signature= new String[]{ "com.ibm.websphere.pmi.stat.MBeanLevelSpec",
     "java.lang.Boolean"};
            ac.invoke(perfOName, "setInstrumentationLevel", params, signature);

- getInstrumentationLevel: get the instrumentation level (deprecated in V6.0)
            Object[] params = new Object[2];
            params[0] = new MBeanStatDescriptor(objectName, optionalSD);
            params[1] = new Boolean(recursive);
            String[] signature= new String[]{
     "com.ibm.websphere.pmi.stat.MBeanStatDescriptor", "java.lang.Boolean"};
            MBeanLevelSpec[] mlss = (MBeanLevelSpec[])ac.invoke(perfOName,
     "getInstrumentationLevel", params, signature);

- getConfigs: get PMI static config info for all the MBeans
            configs = (PmiModuleConfig[])ac.invoke(perfOName, "getConfigs", null, null);

- getConfig: get PMI static config info for a specific MBean
     ObjectName[] params = {objectName};
     String[] signature= { "javax.management.ObjectName" };
            config = (PmiModuleConfig)ac.invoke(perfOName, "getConfig", params,
signature);

- getStatsObject: you can use either ObjectName or MBeanStatDescriptor
            Object[] params    = new Object[2];
            params[0] = objectName;  // either ObjectName or or MBeanStatDescriptor
            params[1] = new Boolean(recursive);
            String[] signature = new String[] { "javax.management.ObjectName",
     "java.lang.Boolean"};
            Stats stats  = (Stats)ac.invoke(perfOName, "getStatsObject", params,
     signature);

  Note: The returned data only have dynamic information (value and time stamp).
See PmiJmxTest.java for additional code to link the configuration information with the
returned data.

- getStatsArray: you can use either ObjectName or MBeanStatDescriptor
            ObjectName[] onames = new ObjectName[]{objectName1, objectName2};
            Object[] params = new Object[]{onames, new Boolean(true)};
            String[] signature = new String[]{"[Ljavax.management.ObjectName;",
```

```
     "java.lang.Boolean"};
            Stats[] statsArray = (Stats[])ac.invoke(perfOName, "getStatsArray",
     params, signature);

  Note: The returned data only have dynamic information (value and time stamp).
See PmiJmxTest.java for additional code to link the configuration information with the
returned data.

- listStatMembers: navigate the PMI module trees

            Object[] params = new Object[]{mName};
            String[] signature= new String[]{"javax.management.ObjectName"};
            MBeanStatDescriptor[] msds = (MBeanStatDescriptor[])ac.invoke(perfOName,
     "listStatMembers", params, signature);

or,

            Object[] params = new Object[]{mbeanSD};
            String[] signature= new String[]
{"com.ibm.websphere.pmi.stat.MBeanStatDescriptor"};
            MBeanStatDescriptor[] msds = (MBeanStatDescriptor[])ac.invoke
(perfOName, "listStatMembers", params, signature);

Refer the API documentation for deprecated classes
```

- **To use an individual MBean:** You need to get the AdminClient instance and the ObjectName for the individual MBean. Then you can simply get the Stats attribute on the MBean.

Developing PMI interfaces (Version 4.0) (deprecated)

You can use the Performance Monitoring Infrastructure (PMI) interfaces to develop your own applications to collect and display performance information.

Before you begin

The Version 4.0 APIs are supported in this release, however, some data hierarchy changes have occurred in the PMI modules, including the enterprise bean and HTTP sessions modules. If you have an existing PmiClient application and you want to run it against Version 5.0, you might have to update the PerfDescriptor(s) based on the new PMI data hierarchy.

The getDataName and getDataId methods in PmiClient have also changed. They are now non-static methods in order to support multiple WebSphere Application Server versions. You might have to update your existing application which uses these two methods.

About this task

This section discusses the use of the Performance Monitoring Infrastructure (PMI) client interfaces in applications. Read the basic steps in the programming model:

Procedure

1. Retrieve an initial collection or snapshot of performance data from the server. A client uses the CpdCollection interface to retrieve an initial collection or snapshot from the server. This snapshot, which is called Snapshot in this example, is provided in a hierarchical structure as described in data organization and hierarchy, and contains the current values of all performance data collected by the server. The snapshot maintains the same structure throughout the lifetime of the CpdCollection instance.
2. Process and display the data as specified. The client processes and displays the data as specified. Processing and display objects, for example, filters and GUIs, can register as CpdEvent listeners to data of interest. The listener works only within the same Java virtual machine (JVM). When the client receives updated data, all listeners are notified.

3. Display the new CpdCollection instance through the hierarchy. When the client receives new or changed data, the client can simply display the new CpdCollection instance through its hierarchy. When it is necessary to update the Snapshot collection, the client can use the update method to update Snapshot with the new data.

```
Snapshot.update(S1);
// ...later...
Snapshot.update(S2);
```

Results

Steps 2 and 3 are repeated through the lifetime of the client.

Compiling your monitoring applications

Use this page to find the JAR files required to compile your Performance Monitoring Infrastructure (PMI).

Procedure

To compile your Performance Monitoring Infrastructure (PMI) code, you must have the following JAR file in your class path:

- %WAS_HOME%/plugins/com.ibm.ws.runtime_6.1.0.jar

What to do next

If your monitoring applications use APIs in other packages, also include those packages on the class path. If any WebSphere Application Server class is not found with the above set of jars, then you can include all the WebSphere jars using:

```
javac -classpath %WAS_HOME%\plugins\com.ibm.ws.runtime_6.1.0.jar myclass.java
```

Running your new monitoring applications

Use this page to learn about the steps you must follow in order to run monitoring applications.

About this task

Follow these steps to run your monitoring applications.

Procedure

1. You need a WebSphere Application Server installation or WebSphere Application Server Java Platform, Enterprise Edition (Java EE) client package to run a PMI application.
2. Use a PMI client API to write your own application.
3. Compile the newly-written PMI application and place it on the class path. (The jar files under %WAS_HOME%\lib and %WAS_HOME%\classes folder will be placed in the class path by the following script.)
4. To run a PMI application you need a WebSphere Application Server runtime environment (the application server installation or a Java EE client package). Using the following script to run the application:

   Note: The following is formatted for Windows based systems. You may need to adjust the script depending on your operating system.

```
@echo off
@setlocal

call "%~dp0setupCmdLine.bat"
```

```
"%JAVA_HOME%\bin\java" "%CLIENTSAS%" "%CLIENTSOAP%" -DwebsphereV5Statistics=false
-Dwas.install.root="%WAS_HOME%" -Dws.ext.dirs="%WAS_EXT_DIRS%" -classpath "%WAS_CLASSPATH%"
com.ibm.ws.bootstrap.WSLauncher com.ibm.websphere.pmi.PmiJmxTest %*
```

Performance Monitoring Infrastructure client package

Use this page to learn how to use the PmiClient application and JMX connector to communicate to the Perf MBean in an application server.

A Performance Monitoring Infrastructure (PMI) client package provides a PmiClient wrapper class to deliver PMI data to a client. As shown in the following figure, the PmiClient API uses the AdminClient API to communicate to the Perf MBean in an application server.

Performance Monitoring Infrastructure and Java Management Extensions:

The PmiClient API does not work if the Java Management Extensions (JMX) infrastructure and Perf MBean are not running. If you prefer to use the AdminClient API directly to retrieve PMI data, you still have a dependency on the JMX infrastructure.

When using the PmiClient API, you have to pass the JMX connector protocol and port number to instantiate an object of the PmiClient. Once you get a PmiClient object, you can call its methods to list nodes, servers and MBeans, set the monitoring level, and retrieve PMI data.

The PmiClient API creates an instance of the AdminClient API and delegates your requests to the AdminClient API. The AdminClient API uses the JMX connector to communicate with the Perf MBean in the corresponding server and then returns the data to the PmiClient, which returns the data to the client.

Running your monitoring applications with security enabled

You can opt to run a Performance Monitoring Infrastructure client application with security enabled.

About this task

In order to run a Performance Monitoring Infrastructure (PMI) client application with security enabled, you must have %CLIENTSOAP% properties defined on your Java virtual machine command line for a SOAP connector, and %CLIENTSAS% properties defined for a RMI connector. The %CLIENTSOAP% and %CLIENTSAS% properties are defined in the `setupCmdLine.bat` or `setupCmdline.sh` files.

Procedure

- If you are configuring security for a SOAP connector:
  1. Set com.ibm.SOAP.securityEnabled to **`True`** in the soap.client.props file for the SOAP connector. The soap.client.props property file is located in the *profile_root*`/properties` directory.
  2. Set `com.ibm.SOAP.loginUserid` and `com.ibm.SOAP.loginPassword` as the user ID and password for login.
- If you are configuring security for a RMI connector, set the `sas.client.props` file or type the user ID and password in the window, if you do not put them in the property file for Remote Method Invocation (RMI) connector. A common mistake is to leave extra spaces at the end of the lines in the property file. Do not leave extra spaces at the end of the lines, especially for the user ID and password lines.

Creating a custom PMI using StatsFactory

You can update your application to call methods defined using A Stats/PMI template (Performance Monitoring Infrastructure), resource bundle, Stats/PMI module and methods to update custom statistics.

About this task

You can update your application to call methods defined using A Stats/PMI template, resource bundle, Stats/PMI module and methods to update custom statistics. The following process is required to instrument a component using a custom PMI:

- Define a Stats/PMI template (xml file).
- Define the resource bundle (properties file).
- Define the Stats/PMI module and create the Stats/PMI object using StatsFactory.
- Define methods that your application will use to update custom statistics.
- Update your application to call methods (defined in the preceding step) appropriately.
- Access the application.
- Connect to the Tivoli Performance Viewer (TPV) and view the Custom PMI statistics.

Procedure

1. Define the Stats/PMI template. StatsFactory allows a runtime component to create a custom Stats/PMI module using an XML template. The template should follow the DTD com/ibm/websphere/pmi/xml/stats.dtd. The following is an example of a template used in a sample application.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE Stats SYSTEM "stats.dtd">

<Stats type="com.stats.MyStats">
    <description>MyStats.desc</description>
    <resourceBundle>com.stats.MyStatsResourceBundle</resourceBundle>

    <CountStatistic ID="1" name="MyStats.NumRequests">
        <level>low</level>
        <unit>MyStats.unit.none</unit>
        <description>MyStats.NumRequests.desc</description>
        <statisticSet>basic</statisticSet>
    </CountStatistic>


    <BoundedRangeStatistic ID="2" name="MyStats.expensiveStat ">
        <level>high</level>
        <unit>MyStats.unit.none</unit>
        <description>MyStats.expensiveStat.desc</description>
        <updateOnRequest>true</updateOnRequest>
    </BoundedRangeStatistic>
</Stats>
```

2. Define the resource bundle The resource bundle allows you to define the name of statistic and its description in proper language/wording. A sample resource bundle would look like this:

```
MyStats.desc=My View PMI Module

MyStats.NumRequests=Request Count
MyStats.NumRequests.desc=Total number of My view requests served.
MyStats.unit.none=None


MyStats.expensiveStat = Expensive Stat
MyStats. expensiveStat.desc = Number of Expensive stats

MyStats.Group= My Group
MyStats.Instance=My Instance
```

3. Define the Stats/PMI module and create the Stats/PMI object using StatsFactory.
   a. Create a class which extends StatisticActions

```
public class MyStatisticsModule extends StatisticActions
```

   b. Declare count variables of type SPI*, such as SPICountStatistc and SPIBoundedRangeStatistic.

```
private SPICountStatistic           numReqs;
 private SPIBoundedRangeStatistic    expensiveStat;
```

c. Create StatsGroup of type StatsGroup and StatsInstance of type StatsInstance

```
private static StatsGroup stocksStatisticsGroup = null;
 private StatsInstance stocksStatistics = null;


MyStatisticsGroup = StatsFactory.createStatsGroup("MyStats.Group", template, null);
MyStatistics = StatsFactory.createStatsInstance("MyStats.Instance",MyStatisticGroup,null,this);
```

where the template would be the path in the application where the xml file is located. An example of this follows:

```
String template = "/com/stats/MyStats.xml";
```

4. Once the statistics are created in the StatsInstance, statisticCreated is called to indicate that a statistic is created in the Stats instance. You can assign statistics declared above to the appropriate statistic; for example:

```
public void statisticCreated (SPIStatistic s)      --> Called when the Statistics are
 created in the Stats Instance
     {
     if (s.getId() == MyStats.NUMREQS)
         {
             numReqs = (SPICountStatistic)s;       ---> Assign Statistic
        }
}
```

5. Define methods which your application will use to update custom statistics.

```
public void onRequestArrival(){
     if (numReqs != null)
        {
            numReqs.increment();         ---> Increment/Decrement Statistic as per Req
}
```

6. You can also implement the updateStaisticRequest method to update statistics on a specific request by the client or any other monitoring application.

```
public void updateStatisticOnRequest (int dataId)
  {
if (dataId == MyStats.expensiveStat)
         {
          expensiveStat.set(xxxxx);
  }

}
```

In the above example, `dataId` would be the id of the statistic that is to be updated.

7. Update your application to call methods (defined in above steps) appropriately.
8. Access the application.
9. Connect Tivoli Performance Viewer and view the custom PMI statistics.

Monitoring performance with Tivoli Performance Viewer

Tivoli Performance Viewer enables administrators and programmers to monitor the overall health of WebSphere Application Server from within the administrative console.

Before you begin

In Version 4.0, Tivoli Performance Viewer was named the Resource Analyzer. In Version 5.0, Tivoli Performance Viewer is a stand-alone Java application. In Versions 6.0.x and later, Tivoli Performance Viewer is embedded in the administrative console. From Tivoli Performance Viewer, you can view current activity and summary reports, or log Performance Monitoring Infrastructure (PMI) performance data. Tivoli

Performance Viewer provides a simple viewer for the performance data collected by the Performance Monitoring Infrastructure.

About this task

By viewing Tivoli Performance Viewer data, administrators can determine which part of the application and configuration settings to change in order to improve performance. For example, you can view the servlet summary reports, enterprise beans, and Enterprise JavaBeans (EJB) methods in order to determine what part of the application to focus on. Then, you can sort these tables to determine which of these resources has the highest response time. Focus on improving the configuration for those application resources taking the longest response time.

Procedure

1. Optional: Adjust the Performance Monitoring Infrastructure (PMI) settings for the servers that you want to monitor. The PMI service is enabled by default with a basic set of counters enabled.
2. Monitor current server activity. You can view real-time data on the current performance activity of a server using Tivoli Performance Viewer in the administrative console.
   - Use the performance advisors to examine various data while your application is running. The performance advisor in Tivoli Performance Viewer provides advice to help tune systems for optimal performance by using collected PMI data.
   - Configure user and logging settings for Tivoli Performance Viewer. These settings may affect the performance of your application server.
   - View summary reports on servlets, Enterprise JavaBeans (EJB) methods, connections pools and thread pools in WebSphere Application Server.
   - View performance modules that provide graphs and of various performance data on system resources such as CPU utilization, on WebSphere pools and queues such as database connection pools, and on customer application data such as servlet response time. In addition to providing a viewer for performance data, Tivoli Performance Viewer enables you to view data for other products or customer applications that have implemented custom PMI.
3. View server performance logs. You can record and view data that has been logged by Tivoli Performance Viewer in the administrative console. Be sure to configure user and logging settings for Tivoli Performance Viewer.
4. Log performance data. You can record real-time data for later retrieval and analysis.

Why use Tivoli Performance Viewer?

Administrators and programmers can monitor the overall health of WebSphere Application Server from within the administrative console by using Tivoli Performance Viewer.

From Tivoli Performance Viewer, you can view current activity or log Performance Monitoring Infrastructure (PMI) performance data for the following:
- System resources such as CPU utilization
- WebSphere pools and queues such as a database connection pool
- Customer application data such as average servlet response time

You can also view data for other products or customer applications that implement custom PMI by using Tivoli Performance Viewer. For more information on custom PMI, refer to “Enabling PMI data collection” on page 181.

By viewing PMI data, administrators can determine which part of the application and configuration settings to alter in order to improve performance. For example, in order to determine what part of the application to focus on, you can view the servlet summary report, enterprise beans and Enterprise JavaBeans (EJB) methods, and determine which of these resources has the highest response time. You can then focus on improving the configuration for those application resources with the longest response times.

Tivoli Performance Viewer is used to help manage configuration settings by viewing the various graphs or using the Tivoli Performance Advisor. For example, by looking at the summary chart for thread pools, you can determine whether the thread pool size needs to be increased or decreased by monitoring the percent (%) usage. After configuration settings are changed based on the data provided, you can determine the effectiveness of the changes. To help with configuration settings, use the Tivoli Performance Advisor. The Advisor assesses various data while your application is running, and provides configuration setting advice to improve performance.

Tivoli Performance Viewer topologies and performance impacts

The Tivoli Performance Viewer enables administrators and programmers to monitor the overall health of WebSphere Application Server from within the administrative console.

The following two topologies exist for the Tivoli Performance Viewer:

- Tivoli Performance Viewer running in a single server environment
- Tivoli Performance Viewer running in a WebSphere Application Server, Network Deployment environment

When the Tivoli Performance Viewer is running in a single server environment, the collection and viewing of the data occurs in the same Java virtual machine. Because the collection and viewing of data occurs in the application server, performance may be affected depending on Tivoli Performance Viewer settings. "Viewing Data with the Tivoli Performance Viewer" on page 229 describes the various Tivoli Performance Viewer settings and their effect on performance.

Viewing current performance activity

You can view the current performance activity of a server using the Tivoli Performance Viewer in the administrative console.

Before you begin

Once monitoring is enabled, Tivoli Performance Viewer monitors the performance activity of all servers on a node, which includes the associated application servers.

About this task

Tivoli Performance Viewer enables administrators and programmers to monitor the current health of WebSphere Application Server. Because the collection and viewing of data occurs in the application server, performance may be affected. To minimize performance impacts, monitor only those servers whose resources need to be optimized.

Procedure

1. Click **Monitoring and Tuning > Performance Viewer > Current Activity** in the console navigation tree. The Tivoli Performance Viewer current activity collection is displayed.
2. Start monitoring the current activity of a server in either of two ways:
   - Under **Server**, click the name of the server whose activity you want to monitor. Clicking on the name starts the monitoring for the server and displays the activity page for the server.
   - Select the check box for the server whose activity you want to monitor, and click **Start Monitoring**.

   A Tivoli Performance Viewer console panel is displayed, providing a navigation tree on the left and a view of real-time data on the current performance activity of a server on the right.
3. From the navigation tree, select the server activity data that you want to view.

Option	Description
Advisor	Use the Performance Advisor to examine various data while your application is running. The Performance Advisor provides advice to help tune systems for optimal performance and gives recommendations on inefficient settings by using collected PMI data.
Settings	Configure user and logging settings for Tivoli Performance Viewer. These settings can affect the performance of your application server.
Summary Reports	View summary reports on servlets, enterprise beans (EJBs), EJB methods, connections pools and thread pools in WebSphere Application Server.
Performance Modules	View performance modules that provide graphics and charts of various performance data on system resources such as CPU utilization, on WebSphere pools and queues such as database connection pools, and on customer application data such as servlet response time. In addition to providing a viewer for performance data, Tivoli Performance Viewer enables you to view data for other products or customer applications that have implemented custom PMI.

What to do next

When you finish monitoring a server, select the server and click **Stop Monitoring**. Tivoli Performance Viewer automatically stops monitoring a server if the browser window is closed or if the user logs out.

Note: When using Mozilla Firefox Version 3.5.16, the Tivoli® Performance Viewer graphical charts do not render correctly. When viewing performance data, you might see an empty graph or missing data, even though you selected counters to display in the chart. Use Firefox Version, 3.6.13 or higher, to resolve this problem.

Selecting a server and changing monitoring status

Use this page to start and stop monitoring for each server and to select a server for Tivoli Performance Viewer. You can also view the collection status for each server.

On this page, you can view the collection status of each server. When the collection status is **Monitored**, Tivoli Performance Monitor is enabled. If the collection status is **Available**, the server is ready to be enabled. If the collection status is **Unavailable, server stopped, or PMI not enabled**, you must restart your server before you can start monitoring. Click on any server to view the current activity for that server. Lastly, **Performance Data Collection Not Supported** means that the server is not version 6.0.x or later.

Maximum rows: Specifies the maximum number of rows that displays when the collection is large. The rows that are not displayed appear on the next page.

Retain filter criteria: Specifies whether to use the same filter criteria entered in the show filter function to display this page the next time you visit it.

Start monitoring:

Select one or more servers from the list and press Start monitoring to start the Tivoli Performance Monitor for the selected servers.

Stop monitoring:

Select one or more servers from the list and press Stop monitoring to stop the Tivoli Performance Monitor for the selected servers.

Configuring Tivoli Performance Viewer settings

You can configure user and logging settings of the Tivoli Performance Viewer. Configuring the Tivoli Performance Viewer settings affects the performance of your application server.

About this task

Tivoli Performance Viewer monitors the performance activity of all servers on a node.

You can configure the activity monitoring of Tivoli Performance Viewer on a per-user basis. Any changes made to Tivoli Performance Viewer settings are only for the server being monitored and only affect the user viewing the data.

You can change the user and log Tivoli Performance Viewer settings in the administrative console.

Procedure

- Configure the Tivoli Performance Viewer user settings.
  1. Click **Monitoring and Tuning > Performance Viewer > Current Activity >** *server_name* **> Settings > User** in the console navigation tree. To see the **User** link on the Tivoli Performance Viewer page, expand the **Settings** node of the Tivoli Performance Viewer navigation tree on the left side of the page. After clicking **User**, the Tivoli Performance Viewer user settings are displayed on the right side of the page.
  2. Change the values as needed for the user settings. The settings are described briefly below and in more detail in the Tivoli Performance Viewer settings.

Setting	Description
Refresh Rate	Specifies how frequently Tivoli Performance Viewer collects performance data for a server from the Performance Monitoring Infrastructure (PMI) service provided by that server. The default is 30 seconds. To collect performance data for the server more frequently, set the refresh rate to a smaller number. To collect performance data less frequently, set the refresh rate to a larger number. The allowed range is 5 to 500 seconds.
Buffer Size	Specifies the number of entries to be stored for a server. Data displayed in Tivoli Performance Viewer is stored in a short in-memory buffer. After the buffer is full, each time a new entry is retrieved the oldest entry is discarded. The default buffer size is 40 entries. Supported values are 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. The larger the buffer size, the more memory is consumed. Thus, specify a buffer size that allows you capture enough monitoring data for analysis without wasting memory storing unneeded data.

Setting	Description
View Data As	Specifies how counter values are displayed. Viewing options include the following: **Raw Value** Displays the absolute value. If the counter represents load data, such as the average number of connections in a database pool, then Tivoli Performance Viewer displays the current value followed by the average. For example, `18 (avg:5)`. **Change in Value** Displays the change in the current value from the previous value. **Rate of Change** Displays the ratio `change/(T1 - T2)`, where *change* is the change in the current value from the previous value, *T1* is the time when the current value was retrieved, and *T2* is the time when the previous value was retrieved.

The refresh rate and buffer size settings combine to control how much temporal history you have for the application server. The default values for **Refresh Rate** (30 seconds) and **Buffer Size** (40 entries) provide you with a 20-minute history of the application server's performance. Changing one of these parameters affects the length of the temporal history.

The values you set for **Refresh Rate** and **Buffer Size** depend on your use of Tivoli Performance Viewer. To diagnose a known problem on a test machine, you might poll data more frequently while having a decreased buffer size. To monitor a production server, you might poll data less frequently and specify a buffer size depending on how much history you want. However, Tivoli Performance Viewer is not intended to be a full-time monitoring solution.

3. Click **Apply**.

- Configure the Tivoli Performance Viewer log settings. The log settings control what happens when **Start Logging** is clicked in, for example, a summary report on the performance of a servlet, enterprise bean (EJB), EJB method, connection pool or thread pool.
  1. Click **Monitoring and Tuning > Performance Viewer > Current Activity >** *server_name* **> Settings > Log** in the console navigation tree. To see the **Log** link on the Tivoli Performance Viewer page, expand the **Settings** node of the Tivoli Performance Viewer navigation tree on the left side of the page. After clicking **Log**, the Tivoli Performance Viewer log settings are displayed on the right side of the page.
  2. Change the values as needed for the log settings. The settings are described below and in the Tivoli Performance Viewer settings.

Setting	Description
Duration	Specifies the length of time, in minutes, that logging continues, unless **Stop Logging** is clicked first. Tivoli Performance Viewer is not intended as a full-time logging solution.
Maximum File Size	Specifies the maximum size, in megabytes, of a single file. Note that Tivoli Performance Viewer automatically zips log files to save space and this parameter controls the pre-zipped file size and not the post-zipped, which is smaller.

Setting	Description
Maximum Number of Historical Files	Specifies the number of files Tivoli Performance Viewer writes before stopping. If Tivoli Performance Viewer reaches the maximum file size before the logging duration ends, it continues logging in another file, up to the maximum. If Tivoli Performance Viewer reaches the maximum number of historical files before the logging duration ends, Tivoli Performance Viewer deletes the oldest historical file and continues logging in a new file. The total amount of data that is stored is constrained by the **Maximum File Size** and **Maximum Number of Historical Files** parameters.
File Name	Specifies the name of the log file. The server name and the time at which the log is started is appended to the log name to help users identify a log file.
Log Output Format	Specifies whether Tivoli Performance Viewer writes log files as XML or in a binary format. Binary format provides a smaller log file when uncompressed and is recommended if space is a consideration.

3. Click **Apply**.

Viewing Data with the Tivoli Performance Viewer

Use this page to view and refresh performance data for the selected server, change user and log settings, view summary reports, and information on specific performance modules.

To view this administrative console page, click **Monitoring and Tuning** > **Performance Viewer** > **Current Activity** > *server*.

Click the server name to view the current activity for that server. In this view, the Tivoli Performance Viewer has two main parts, which include the navigation panel located beside the administrative console navigation tree, and the data viewing panel located to the right of the Tivoli Performance Viewer navigation panel.

Refresh:

Click **Refresh** to rebuild the navigation tree. Refreshing is helpful when the available Performance Monitoring (PMI) Infrastructure data has changed, and the tree does not reflect those changes.

View Module(s):

Click **View Module** after one or more performance modules are selected in the tree to display the information for these modules in the data viewing panel.

The Data Monitoring panel enables the selection of multiple counters and displays the resulting performance data for the associated resources. It consists of two panels:

- Viewing Counter panel
- Counter Selection panel. If necessary, you can change the scaling factors by editing the default values in the scale field.

Deselect all items:

Select **Deselect all items** to quickly deselect all modules that are selected in the navigation tree.

Navigation tree:

Use the navigation tree to view advisor output, configure Tivoli Performance Viewer, and select PMI modules for viewing.

- Click the **Advisor** node to have the advisor display the data in the viewing panel.
- Expand the **Settings** node to select and configure either the **User** or **Log** settings.
- Expand the **Performance Modules** node to view one or more PMI modules.

Advisor:

Click **Advisor** to examine various data while your application is running. The Performance Advisor provides advice to help tune systems for optimal performance using the PMI data collected.

The first table represents the number of requests per second and the response time in milliseconds for the web container.

The pie graph displays the CPU activity as a percentage of busy and idle.

The third table displays average thread activity for the different resources, for example, Default, Object Request Broker, and web container. Activity is expressed as the number of threads or connections busy and idle.

To view detailed information about the advice, select the message you want to view. This view provides additional information about the advice message, severity, description, user action, and detail.

User settings:

Change the values as needed for the following user settings:

Information	Value
Refresh Rate	Specifies how frequently Tivoli Performance Viewer collects performance data for a server from the Performance Monitoring Infrastructure (PMI) service provided by that server. The default is 30 seconds. To collect performance data for the server more frequently, set the refresh rate to a smaller number. To collect performance data less frequently, set the refresh rate to a larger number. The allowed range is 5 to 500 seconds.
Buffer Size	Specifies the amount of data to be stored for a server. Data displayed in Tivoli Performance Viewer is stored in a short in-memory buffer. After the buffer is full, each time a new entry is retrieved the oldest entry is discarded. The default buffer size is 40. Allowed values are 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. The larger the buffer size, the more memory is consumed. Thus, specify a buffer size that allows you capture enough monitoring data for analysis without wasting memory storing unneeded data.

Information	Value
View Data As	Specifies how counter values are displayed. Viewing options include the following: **Raw Value** Displays the absolute value. If the counter represents load data, for example, the average number of connections in a database pool, then Tivoli Performance Viewer displays the current value. **Change in Value** Displays the change in the current value from the previous value. **Rate of Change** Displays the ratio `change/(T1 - T2)`, where *change* is the change in the current value from the previous value, *T1* is the time when the current value was retrieved, and *T2* is the time when the previous value was retrieved.

Log settings:

The log settings control what happens when **Start Logging** is clicked in, for example, a summary report on the performance of a servlet, enterprise bean (EJB), EJB method, connection pool or thread pool.

Change the value as needed for the following log settings:

Information	Value
Duration	Specifies the length of time, in minutes, that logging continues, unless **Stop Logging** is clicked first. Tivoli Performance Viewer is not intended as a full-time logging solution.
Maximum File Size	Specifies the maximum size, in megabytes, of a single file. Note that Tivoli Performance Viewer automatically zips log files to save space and this parameter controls the pre-zipped file size and not the post-zipped, which is smaller.
Maximum Number of Historical Files	Specifies the number of files Tivoli Performance Viewer writes before stopping. If Tivoli Performance Viewer reaches the maximum file size before the logging duration ends, it continues logging in another file, up to the maximum. If Tivoli Performance Viewer reaches the maximum number of historical files before the logging duration ends, Tivoli Performance Viewer deletes the oldest historical file and continues logging in a new file. The total amount of data that is stored is constrained by the **Maximum File Size** and **Maximum Number of Historical Files** parameters.
File Name	Specifies the name of the log file. The server name and the time at which the log is started is appended to the log name to help users identify a log file.
Log Output Format	Specifies whether Tivoli Performance Viewer writes log files as XML or in a binary format. Binary format is recommended as it provides a smaller log file when not compressed.

View summary reports:

Summary reports are available for each application server.

Before viewing reports, make sure data counters are enabled and monitoring levels are set properly.

The standard monitoring level enables all reports except the report on Enterprise JavaBeans (EJB) methods. To enable an EJB methods report, adjust the PMI level to include EJB method data.

Tivoli Performance Viewer provides the following summary reports for each application server:

Servlets

The servlet summary lists all servlets that are running in the current application server. Use the servlet summary view to quickly find the servlet that consumes the most time and the applications that use them, and to determine which servlets are invoked most often. You can sort the summary table by any of the columns.

Tips:

- Sort by **Avg Response Time** to find the slowest servlet or JavaServer page (JSP). The **Avg Response Time** is specified in milliseconds.
- Sort by **Total Requests** to find the servlet or JSP used the most.
- Sort by **Total Time** to find the servlet or JSP with the highest response times.

Enterprise JavaBeans

The Enterprise JavaBeans (EJB) summary lists all enterprise beans running in the server, the amount of time spent in their methods, the number of EJB invocations, and the total time spent in each enterprise bean.

```
total_time = number_of_invocations * time_in_methods
```

Sort the various columns to find the most expensive enterprise bean. Also, if the PMI counters are enabled for individual EJB methods, select the check box next to the EJB name see statistics for each of the methods.

Tips

- Sort by **Avg Response Time** to find the slowest enterprise beam.
- Sort by **Method Calls** to find the enterprise bean used the most.
- Sort by **Total Time** to find the enterprise bean with the slowest response time.

EJB Methods

The EJB method summary shows statistics for each EJB method. Use the EJB method summary to find the most costly methods of your enterprise beans.

Tips

- Sort by **Avg Response Time** to find the slowest EJB method.
- Sort by **Method Calls** to find the EJB method used the most.
- Sort by **Total Time** to find the EJB method with the slowest response time.

Connection pools

The connection pool summary lists all data source connections that are defined in the application server and shows their usage over time.

Tip

- When the application is experiencing normal to heavy usage, the pools used by that application should be nearly fully utilized. Low utilization means that resources are being wasted by maintaining connections or threads that are never used. Consider the order in which work progresses through the various pools. If the resources near the end of the pipeline are under utilized, it might mean that resources near the front are constrained or that more resources than necessary are allocated near the end of the pipeline.

Thread pools

The thread pool summary shows the usage of all thread pools in the application server over time.

Tip

- When the application is experiencing normal to heavy usage, the pools used by that application should be nearly fully utilized. Low utilization means that resources are being wasted by maintaining connections or threads that are never used. Consider the order in which work progresses through the various pools. If the resources near the end of the pipeline are under utilized, it might mean that resources near the front are constrained or that more resources than necessary are allocated near the end of the pipeline.

Performance module:

View performance modules that provide graphics and charts of various performance data on system resources such as CPU utilization, on WebSphere Application Server pools and queues such as database connection pools, and on customer application data such as servlet response time. In addition to providing a viewer for performance data, Tivoli Performance Viewer enables you to view data for other products or customer applications that have implemented custom PMI.

Each performance module has several counters associated with it. These counters are displayed in a table underneath the data chart or table. Selected counters are displayed in the chart or table. You can add or remove counters from the chart or table by selecting or deselecting the check box next to them. By default, the first three counters for each module are shown.

In Version 8, the Tivoli Performance Viewer graph uses Dojo Technology for plotting the performance activity rather than the Scalable Vector Graphics (SVG) format. The Dojo format provides a better user experience and is more processor and memory efficient for the application server. The SVG format is still supported but is deprecated in Version 8 of this product. To use the SVG format and image format, set the JVM property to `false`; for example: `com.ibm.websphere.tpv.DojoGraph=false`. If the property is set to `false`, Dojo is disabled and Tivoli Performance Viewer displays interactive graphics using the SVG format or non-interactive graphics using the JPG format. When you specify to use the SVG format by setting `com.ibm.websphere.tpv.DojoGraph=false`, if you do not have the Adobe SVG browser plug-in installed, you are prompted to download and install it. If you select not to install the plug-in (by selecting **Cancel**), Tivoli Performance Viewer displays the static image. If your browser is Internet Explorer 7, the Adobe SVG installation prompt might be inaccessible. To resolve the problem, reinstall Adobe SVG. By default, this property is set to a value of `true` to use the Dojo format.

In the performance module, you view current activity. This is a real time operation where the state of various system resources and their usage is displayed. Unless logging is turned on, data generated in this scenario will not be saved and is unavailable for subsequent viewing and analysis. To monitor behavior and system resources, click **Start Logging**. The user can replay and analyze the file at a later time.

Start Logging/Stop Logging

Use this to start or stop logging performance data. Once you start monitoring for your server, you will be able to view real time operation in the Tivoli Performance Viewer panels.

Reset to Zero

This sets a new baseline using the current counter readings at the instant the button is clicked. Future data points are plotted on the graph relative to their position at the time **Reset to Zero** is clicked. Data points gathered prior to the time **Reset to Zero** is clicked are not displayed, although they are still held in the Tivoli Performance Viewer buffer. If **Undo Reset to Zero** is clicked again, Tivoli Performance Viewer displays all data currently in the buffer from their original baseline, not from the **Reset to Zero** point.

View Table/View Graph

To view the data in a table, click **View Table** on the counter selection table. To toggle back to a chart, click **View Graph**.

Show Legend/Hide Legend

To view the legend for a chart, click **Show Legend**. To hide the legend, click **Hide Legend**.

Clear Buffer

To clear values from the table or chart, click **Clear Buffer** beneath the chart or table. This removes all PMI data.

Viewing Tivoli Performance Viewer summary reports

The Tivoli Performance Viewer provides five different summary reports that make important data quickly and easily accessible. View summary reports to help you find performance bottlenecks in your applications and modules. The Tivoli Performance Viewer summary reports are generated upon request and are not dynamically refreshed.

Before you begin

This article assumes that one or more applications or modules are deployed and running on one or more servers.

About this task

In order to prepare a specific summary report, you must enable the minimum level of PMI data collection, or utilize the **custom** level of monitoring and enable specific counters.

Use the administrative console to view Tivoli Performance Viewer summary reports.

Procedure

1. Click **Monitoring and Tuning > Performance Viewer > Current Activity >** *server_name* **> Summary Reports** in the console navigation tree.
2. Select the code artifact or pool for which you want a summary report. Expand the **Summary Reports** node of the Tivoli Performance Viewer navigation tree on the left side of the Tivoli Performance Viewer page to see links for the types of summary reports. After clicking on a link for an artifact or pool, a list of artifacts or pools on the server is displayed on the right side of the page.
3. Select the artifact or pool for which you want to view a summary report.

Tivoli Performance Viewer summary report types:

Servlets

The servlet summary lists all servlets that are running in the current application server. Use the servlet summary view to quickly find the most time intensive servlets and the applications that use them, and to determine which servlets are invoked most often. You can sort the summary table by any of the columns.

Tips:

- Sort by **Avg Response Time** to find the slowest servlet or JavaServer page (JSP).
- Sort by **Total Requests** to find the servlet or JSP used the most.
- Sort by **Total Time** to find the most costly servlet or JSP.

Enterprise beans

The Enterprise JavaBeans (EJB) summary lists all enterprise beans running in the server, the amount of time spent in their methods, the number of EJB invocations, and the total time spent in each enterprise bean.

```
total_time = number_of_invocations * time_in_methods
```

Sort the various columns to find the most expensive enterprise bean. Also, if the PMI counters are enabled for individual EJB methods, there is a check box next to the EJB name that you can select to see statistics for each of the methods.

Tips:
- Sort by **Avg Response Time** to find the slowest enterprise beam.
- Sort by **Method Calls** to find the enterprise bean used the most.
- Sort by **Total Time** to find the most costly enterprise bean.

EJB methods

The EJB method summary shows statistics for each EJB method. Use the EJB method summary to find the most costly methods of your enterprise beans.

Tips:
- Sort by **Avg Response Time** to find the slowest EJB method.
- Sort by **Method Calls** to find the EJB method used the most.
- Sort by **Total Time** to find the most costly EJB method.

Connection pools

The connection pool summary lists all data source connections that are defined in the application server and shows their usage over time.

Tip:
- When the application is experiencing normal to heavy usage, the pools used by that application should be nearly fully utilized. Low utilization means that resources are being wasted by maintaining connections or threads that are never used. Consider the order in which work progresses through the various pools. If the resources near the end of the pipeline are under utilized, it might mean that resources near the front are constrained or that more resources than necessary are allocated near the end of the pipeline.

Thread Pools

The thread pool summary shows the usage of all thread pools in the application server over time.

Tip:
- When the application is experiencing normal to heavy usage, the pools used by that application should be nearly fully utilized. Low utilization means that resources are being wasted by maintaining connections or threads that are never used. Consider the order in which work progresses through the various pools. If the resources near the end of the pipeline are under utilized, it might mean that resources near the front are constrained or that more resources than necessary are allocated near the end of the pipeline.

PMI levels and counters required

In order to view Tivoli Performance Viewer summary reports, the minimum PMI level must be enabled. Otherwise, you must use the **custom** monitoring level, and enable the PMI level counters required for the specific report you want to view.

Table 64. Required properties for Tivoli Performance Viewer summary reports. The Tivoli Performance Viewer summary reports are generated upon request and are not dynamically refreshed

Summary Report	PMI level required	Custom PMI counters required
Servlets	Basic	Web Applications.RequestCount Web Applications.ServiceTime

Table 64. Required properties for Tivoli Performance Viewer summary reports (continued). The Tivoli Performance Viewer summary reports are generated upon request and are not dynamically refreshed

Summary Report	PMI level required	Custom PMI counters required
Enterprise beans	Basic	Enterprise Beans.MethodCallCount Enterprise Beans.MethodResponseTime
EJB methods	All	WSEJBStats.MethodStats.MethodLevelCallCount WSEJBStats.MethodStats.MethodLevelResponseTime
Connection pools	Extended	JDBC Connection Pools.PoolSize JDBC Connection Pools.AllocateCount JDBC Connection Pools.ReturnCount
Thread pools	Extended	Thread Pools.PoolSize Thread Pools.ActiveCount

Viewing PMI data with Tivoli Performance Viewer

You can use the Tivoli Performance Viewer to view Performance Monitoring Infrastructure (PMI) data in chart or table form.

Before you begin

Tivoli Performance Viewer monitors the performance activity of all servers on a node. This topic assumes that one or more servers have been created and are running on the node, and that PMI is enabled.

Note: Tivoli Performance Viewer displays graphics in either the Scalable Vector Graphics (SVG) format or as a static image in the JPG format. If you do not have the Adobe SVG browser plug-in installed, you are prompted to download and install it. If you select not to install the plug-in (by selecting Cancel), Tivoli Performance Viewer displays the static image. Installing the Adobe SVG plug-in is advantageous for several reasons. First, the SVG format provides interactive graphics that provide additional information when you hover your mouse over a point, line, or legend item. The SVG format also enables you to click a point and see details for it. Secondly, using the SVG format provides a performance benefit because the work to display the SVG image is done on the client side. When viewing a static image, the application server must convert the SVG image into a static image, which is a processor and memory intensive operation. If your browser is Internet Explorer 7, the Adobe SVG installation prompt might be inaccessible. To resolve the problem, reinstall Adobe SVG.

In Version 8*x*, the Tivoli Performance Viewer graph uses Dojo technology for plotting the performance activity rather than the Scalable Vector Graphics (SVG) format. The Dojo format provides a better user experience and is more processor and memory efficient for the application server. The SVG format is still supported but is deprecated in Version 8 of this product. To use the SVG format and image format, set the JVM property to `false`; for example: `com.ibm.websphere.tpv.DojoGraph=false`. If the property is set to `false`, Dojo is disabled and Tivoli Performance Viewer displays interactive graphics using the SVG format or non-interactive graphics using the JPG format. When you specify to use the SVG format by setting `com.ibm.websphere.tpv.DojoGraph=false`, if you do not have the Adobe SVG browser plug-in installed, you are prompted to download and install it. If you select not to install the plug-in (by selecting **Cancel**), Tivoli Performance Viewer displays the static image. If your browser is Internet Explorer 7, the Adobe SVG installation prompt might be inaccessible. To resolve the problem, reinstall Adobe SVG. By default, this property is set to a value of `true` to use the Dojo format.

About this task

You view performance modules when your server is experiencing performance problems. For example, a common performance problem occurs when individual sessions are too large. To help view data on a

session, you can view the Servlet Session Manager PMI module and monitor the **SessionObjectSize** counter to make sure that **Session Object Size** is not too large.

Performance modules are shown in the Tivoli Performance Viewer current activity settings in the administrative console.

Note: When you create a second application server under WebSphere Application Server, Tivoli Performance Viewer cannot display the PMI data for the second application server such as WebSphere Portal Server. For more information, refer to the technote at: http://www.ibm.com/support/docview.wss?rs=180&=swg21247170.

Procedure

- Select PMI data to view.
  1. Click **Monitoring and Tuning > Performance Viewer > Current Activity >** *server_name* **> Performance Modules** in the console navigation tree.
  2. Place a check mark in the check box beside the name of each performance module that you want to view. Expand the tree by clicking **+** next to a node and shrink it by clicking **–** next to a node.

     If you do not see all the PMI counters you expect, or a PM you are interested in is visible but cannot be selected, PMI is not enabled for that particular counter or for any counter in that PM. Go to the PMI control area of the administrative console and enable PMI for any counters you wish to view, then return to Tivoli Performance Viewer and select those PMs. To view the PMI page, click on **Monitoring and Tuning > Performance Monitoring Infrastructure >** *server_name*.
  3. Click on **View Modules**. A chart or table providing the requested data is displayed on the right side of the page. Charts are displayed by default.

     Each module has several counters associated with it. These counters are displayed in a table underneath the data chart or table. Selected counters are displayed in the chart or table. You can add or remove counters from the chart or table by selecting or deselecting individual counters. By default, the first three counters for each module are shown.

     You can select up to 20 counters and display them in the Tivoli Performance Viewer in the **Current Activity** mode. The data from all the PMI counters that are currently enabled in each PM for all active instances of the PM can be recorded and captured in a Tivoli Performance Viewer log file. Refer to “Logging performance data with Tivoli Performance Viewer” on page 238 for more information on the Tivoli Performance Viewer log file. You can view the Tivoli Performance Viewer log file for a particular time period multiple times, selecting different combinations of up to 20 counters each time. You have the flexibility to observe the relationships among different performance data in a server during a particular period of time.
  4. Optional: To remove a module from a chart or table, deselect the check box next to the module and click **View Modules** again.
  5. Optional: To view the data in a table, click **View Table** on the counter selection table. To toggle back to a chart, click **View Graph**.
  6. Optional: To view the legend for a chart, click **Show Legend**. To hide the legend, click **Hide Legend**.
- Scale the PMI data. You can manually adjust the scale for each counter so that the graph displays meaningful comparisons of different counters.
  1. Find the counter whose scale you want to modify in the table beneath the chart.
  2. Change the value for **Scale** as needed. **Tips:**
     – When the scale is set to 1 the true value of the counter is displayed in the graph.
     – A value greater than 1 indicates that the value is amplified by the factor shown.
     – A value less than 1 indicates that the variable is decreased by the factor shown.

     For example, a scale setting of .5 means that the counter is graphed as one-half its actual value. A scale setting of 2 means that the counter is graphed as twice its actual value. Scaling only applies to the graphed values and has no effect on the data displayed when viewing it in table form.

3. Click **Update**.

- Clear values from tables and charts.
  1. Ensure that one or more modules are selected under **Performance Modules** in the Tivoli Performance Viewer navigation tree
  2. Click **Clear Buffer** beneath the chart or table. The PMI data is removed from a table or chart.
- Reset counters to zero (0).
  1. Ensure that one or more modules are selected under **Performance Modules** in the Tivoli Performance Viewer navigation tree
  2. Click **Reset to Zero** beneath the chart or table. **Reset to Zero** sets a new baseline using the current counter readings at the instant the button is clicked. Future datapoints are plotted on the graph relative to their position at the time **Reset to Zero** is clicked. Datapoints gathered prior to the time **Reset to Zero** is clicked are not displayed, although they are still held in the Tivoli Performance Viewer buffer. If **Undo Reset to Zero** is clicked again, Tivoli Performance Viewer displays all data recorded from the original baseline, not from the **Reset to Zero** point.

     For information on how Tivoli Performance Viewer displays the data, see "Configuring Tivoli Performance Viewer settings" on page 227.

Scalable Vector Graphics problems:

Consult this topic for problems and solutions for Scalable Vector Graphics.

Using Tivoli Performance Viewer without Scalable Vector Graphics (SVG)

In Version 8.*x*, the Tivoli Performance Viewer graph uses Dojo Technology for plotting the performance activity rather than the Scalable Vector Graphics (SVG) format. The Dojo format provides a better user experience and is more processor and memory efficient for the application server. The SVG format is still supported but is deprecated in Version 8 of this product. To use the SVG format and image format, set the JVM property to `false`; for example: `com.ibm.websphere.tpv.DojoGraph=false`. If the property is set to `false`, Dojo is disabled and Tivoli Performance Viewer displays interactive graphics using the SVG format or non-interactive graphics using the JPG format. When you specify to use the SVG format by setting `com.ibm.websphere.tpv.DojoGraph=false`, if you do not have the Adobe SVG browser plug-in installed, you are prompted to download and install it. If you select not to install the plug-in (by selecting **Cancel**), Tivoli Performance Viewer displays the static image. If your browser is Internet Explorer 7, the Adobe SVG installation prompt might be inaccessible. To resolve the problem, reinstall Adobe SVG. By default, this property is set to a value of `true` to use the Dojo format.

When you specify to use the SVG format by setting `com.ibm.websphere.tpv.DojoGraph=false` and you are viewing performance data in Tivoli Performance Viewer on a browser that does not support Scalable Vector Graphics (SVG) graphics, either using the Adobe SVG plug-in or through native support, complex graphs might take a long time to refresh. Eventually an out of memory error may occur.

When Tivoli Performance Viewer detects a browser that does not support SVG, it uses Apache Batik to transcode the SVG into a binary image format. The transcoding process is highly memory intensive. The complexity of the graph is affected by two things: the Tivoli Performance Viewer buffer size, which dictates how many points are in each line that is drawn, and the number of selected data points, which dictates how many lines are drawn.

To avoid long refresh times or the out of memory errors, use a browser that supports SVG, either with a plug-in, like the Adobe SVG plug-in, or natively, which is included in some Mozilla builds. If this is not possible, keep the graph simple by limiting the size of the buffer and the number of selected data points.

Logging performance data with Tivoli Performance Viewer

The Tivoli Performance Viewer provides an easy way to store real-time data for system resources, WebSphere Application Server pools and queues, and applications in log files for later retrieval. You can

start and stop logging while viewing current activity for a server, and later replay this data. Logging of performance data captures performance data in windows of time so you can later analyze the data.

Before you begin

This article assumes that one or more servers have been created and are running on the node, and that you have configured the Tivoli Performance Viewer log settings. The log settings may affect performance and are described in detail in “Viewing Data with the Tivoli Performance Viewer” on page 229. The Tivoli Performance Viewer logging feature is not intended to be a full-time monitoring solution, but instead for selective data recording for subsequent replay and analysis.

About this task

You can study the sequence of events that led to a peculiar condition in the application server.

First, enable Tivoli Performance Viewer logging so performance data generated in the application server persists in a log file stored at a specific location. Later, using the replay feature in Tivoli Performance Viewer, view the performance data that was generated in exactly the same chronological order as it was generated in real time, enabling you to analyze a prior sequence of events.

You do not need to know the syntax and format in which log files are generated and stored. Do not edit log files generated by Tivoli Performance Viewer; doing so will irrecoverably corrupt or destroy the performance data stored in the log files.

You can create and view logs in the administrative console.

In Version 8.*x*, the Tivoli Performance Viewer graph uses Dojo Technology for plotting the performance activity rather than the Scalable Vector Graphics (SVG) format. The Dojo format provides a better user experience and is more processor and memory efficient for the application server. The SVG format is still supported but is deprecated in Version 8 of this product. To use the SVG format and image format, set the JVM property to `false`; for example: `com.ibm.websphere.tpv.DojoGraph=false`. If the property is set to `false`, Dojo is disabled and Tivoli Performance Viewer displays interactive graphics using the SVG format or non-interactive graphics using the JPG format. By default, this property is set to a value of `true` to use the Dojo format.

Note: If the custom property, `com.ibm.websphere.tpv.DojoGraph` is set to `false`, specifying to use the SVG format, performance degradation can occur when you use the Mozilla Firefox browser and Tivoli Performance Viewer to monitor the application server. Additionally, a memory leak problem occurs when you use Tivoli Performance Viewer for an extended period of time with the Mozilla Firefox browser. Use Microsoft® Internet Explorer with Tivoli Performance Viewer to monitor the application server. To use Internet Explorer, you must have a Scalable Vector Graphics (SVG) Viewer installed as a plug-in. The Mozilla Firefox browser provides a build-in plug-in. It is recommended that you use Internet Explorer when you are using the Tivoli Performance Viewer for long-term or extended monitoring.

Procedure

- Create logs.
  1. Click **Monitoring and Tuning > Performance Viewer > Current Activity >** *server_name* **> Settings > Log** in the console navigation tree. To see the **Log** link on the Tivoli Performance Viewer page, expand the **Settings** node of the Tivoli Performance Viewer navigation tree on the left side of the page. After clicking **Log**, the Tivoli Performance Viewer log settings are displayed on the right side of the page.
  2. Click on **Start Logging** when viewing summary reports or performance modules.

3. When finished, click **Stop Logging** . Once started, logging stops when the logging duration expires, **Stop Logging** is clicked, or the file size and number limits are reached. To adjust the settings, see step 1.

By default, the log files are stored in the *profile_root*/`logs/tpv` directory on the node on which the server is running. Tivoli Performance Viewer automatically compresses the log file when it finishes writing to it to conserve space. At this point, there must only be a single log file in each `.zip` file and it must have the same name as the `.zip` file.

- View logs.
  1. Click **Monitoring and Tuning > Performance Viewer > View Logs** in the console navigation tree.
  2. Select a log file to view using either of the following options:
     Explicit Path to Log File
     Choose a log file from the machine on which the browser is currently running. Use this option if you have created a log file and transferred it to your system. Click **Browse** to open a file browser on the local machine and select the log file to upload.
     Server File
     Specify the path of a log file on the server.

     In a stand-alone application server environment, type in the path to the log file. The *profile_root*`\logs\tpv` directory is the default on a Windows system.
  3. Click **View Log**. The log is displayed with log control buttons at the top of the view.
  4. Adjust the log view as needed. Buttons available for log view adjustment are described below. By default, the data replays at the **Refresh Rate** specified in the user settings. You can choose one of the **Fast Forward** modes to play data at rate faster than the refresh rate.

Table 65. Log view adjustment. You can choose one of the **Fast Forward** *modes to play data at rate faster than the refresh rate.*

Button	Description
Rewind	Returns to the beginning of the log file.
Stop	Stops the log at its current location.
Play	Begins playing the log from its current location.
Fast Forward	Loads the next data point every three (3) seconds.
Fast Forward 2	Loads ten data points every three (3) seconds.

You can view multiple logs at a time. After a log has been loaded, return to the View Logs panel to see a list of available logs. At this point, you can load another log.

Tivoli Performance Viewer automatically compresses the log file when finishes writing it. The log does not need to be decompressed before viewing it, though Tivoli Performance Viewer can view logs that have been decompressed.

Viewing Data Recorded by Tivoli Performance Viewer

Use this page to view logged data from Tivoli Performance Viewer.

To view this administrative console page, click **Monitoring and Tuning** > **Performance Viewer** > **View Logs**.

Explicit path to log file:

Select explicit path to a log file, specify the path name, and click **View Log** to display the stored data.

Server file:

Select server file, specify the path name, and click **View Log** to display the stored data.

Chapter 6. Monitoring application flow

Monitoring, optimizing, and troubleshooting WebSphere Application Server performance can be a challenge. This article gives you a basic strategy for monitoring with an understanding of the application view.

About this task

This information includes understanding the application flow that satisfies the end user request. This perspective provides the views of specific servlets that access specific session beans, entity container-managed persistence beans, and a specific database. This perspective is important for the in-depth internal understanding of who is using specific resources. Typically at this stage, you deploy some type of trace through the application, or thread analysis under load condition techniques to isolate areas of the application and particular interactions with the back-end systems that are especially slow under load. In this case, WebSphere Application Server provides request metrics to help trace each individual transaction as it flows through the application server, recording the response time at different stages of the transaction flow (for example, request metrics records the response times for the web server, the web container, the Enterprise JavaBeans container, and the back-end database). In addition, several IBM development and monitoring tools that are based on the request metrics technology (for example, Tivoli Monitoring for Transaction Performance) are available to help view the transaction flow.

Why use request metrics?

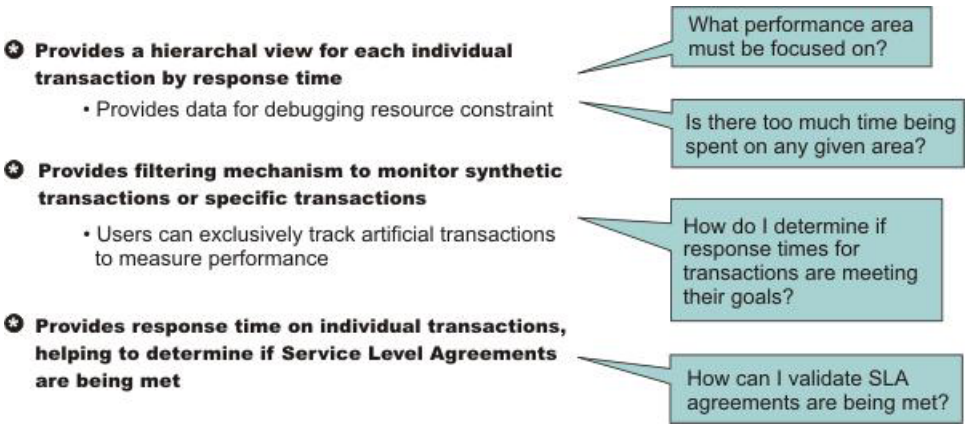
Request metrics is a tool that enables you to track individual transactions, recording the processing time in each of the major WebSphere Application Server components.

Before you begin

The information that is tracked by request metrics might either be saved to log files for later retrieval and analysis, be sent to Application Response Measurement (ARM) agents, or both.

As a transaction flows through the system, request metrics includes additional information so that the log records from each component can be correlated, building up a complete picture of that transaction. The result looks similar to the following example:

```
HTTP request/trade/scenario ------------------------------> 172 ms
     Servlet/trade/scenario  ------------------------------> 130 ms
         EJB TradeEJB.getAccountData ---------------------->  38 ms
              JDBC select ------------------------------->   7 ms
```



This transaction flow with associated response times can help you target performance problem areas and debug resource constraint problems. For example, the flow can help determine if a transaction spends most of its time in the web server plug-in, the web container, the Enterprise JavaBeans (EJB) container or the back end database. The response time that is collected for each level includes the time spent at that level and the time spent in the lower levels. For example, the response time for the servlet, which is 130 milliseconds, also includes 38 milliseconds from the enterprise beans and Java Database Connectivity. Therefore, 92 ms can be attributed to the servlet process.

Request metrics tracks the response time for a particular transaction. Because request metrics tracks individual transactions, using it imposes some performance implications on the system. However, this function can be mitigated by the use of the request filtering capabilities.

For example, tools can inject synthetic transactions. Request metrics can then track the response time within the WebSphere Application Server environment for those transactions. A synthetic transaction is one that is injected into the system by administrators to take a proactive approach to testing the performance of the system. This information helps administrators tune the performance of the website and take corrective actions. Therefore, the information that is provided by request metrics might be used as an alert mechanism to detect when the performance of a particular request type goes beyond acceptable thresholds. The filtering mechanism within request metrics might be used to focus on the specific synthetic transactions and can help optimize performance in this scenario.

About this task

When you have the isolated problem areas, use request metrics filtering mechanism to focus specifically on those areas. For example, when you have an isolated problem in a particular servlet or EJB method, use the uniform resource identifier (URI) algorithms or EJB filter to enable the instrumentation only for the servlet or EJB method. This filtering mechanism supports a more focused performance analysis.

Five types of filters are supported:
- Source IP filter
- URI filter
- EJB method name filter
- JMS parameters filter
- Web services parameters filter

When filtering is enabled, only requests that match the filter generate request metrics data, create log records, call the ARM interfaces, or all. You can inject the work into a running system (specifically to generate trace information) to evaluate the performance of specific types of requests in the context of a normal load, ignoring requests from other sources that might be hitting the system.

Note: Filters are only applicable where the request first enters WebSphere Application Server.

Procedure

- Learn more about request metrics by reviewing detailed explanations in this section.
- Configure and enable request metrics.
- Retrieve performance data and monitor application flow.
- Extend monitoring to track applications that might require additional instrumentation points.

Example

Learn how to use request metrics by viewing the following example.

In this example, the `HitCount` servlet and the `Increment` enterprise bean are deployed on two different application server processes. As shown in the following diagram, the web container tier and Enterprise JavaBeans (EJB) container tiers are running in two different application servers. To set up such a

configuration, install WebSphere Application Server, Network Deployment.

Assume that the web server and the web container tier both run on machine 192.168.0.1, and the Enterprise JavaBeans (EJB) container tier runs on a second machine 192.168.0.2. The client requests might be sent from a different machine; 192.168.0.3, for example, or other machines.

To illustrate the use of source IP filtering, one source IP filter (192.168.0.3) is defined and enabled. You can trace requests that originate from machine 192.168.0.3 through http://192.168.0.1/hitcount?selection=EJB&lookup=GBL&trans=CMT. However, requests that originate from any other machines are not traced because the source IP address is not in the filter list.

By only creating a source IP filter, any requests from that source IP address are effectively traced. This tool is effective for locating performance problems with systems under load. If the normal load originates from other IP addresses, then its requests are not traced. By using the defined source IP address to generate requests, you can see performance bottlenecks at the various hops by comparing the trace records of the loaded system to trace records from a non-loaded run. This ability helps focus tuning efforts to the correct node and process within a complex deployment environment.

Make sure that request metrics is enabled using the administrative console. Also, make sure that the trace level is set to at least hops (writing request traces at process boundaries). Using the configuration previously listed, send a request http://192.168.0.1/hitcount?selection=EJB&lookup=GBL&trans=CMT through the `HitCount` servlet from machine 192.168.0.3.

In this example, at least three trace records are generated:

- A trace record for the web server plug-in is displayed in the plug-in log file (default location is (*plugins_root*/`logs`/*web_server_name*/`http_plugin.log`) on machine 192.168.0.1.
- A trace record for the servlet displays in the application server log file (default location is *profile_root*/`logs/appserver/SystemOut.log`) on machine 192.168.0.1.
- A trace record for the increment bean method invocation displays in the application server log file (default location is *profile_root*/`logs/appserver/SystemOut.log`) on machine 192.168.0.2.

Note: This topic references one or more of the application server log files. As a recommended alternative, you can configure the server to use the High Performance Extensible Logging (HPEL) log and trace infrastructure instead of using `SystemOut.log` , `SystemErr.log`, `trace.log`, and `activity.log` files on distributed and IBM i systems. You can also use HPEL in conjunction with your native z/OS logging facilities. If you are using HPEL, you can access all of your log and trace information using the LogViewer command-line tool from your server profile bin directory. See the information about using HPEL to troubleshoot applications for more information on using HPEL.

The two trace records that are displayed on machine 192.168.0.1 are similar to the following example:

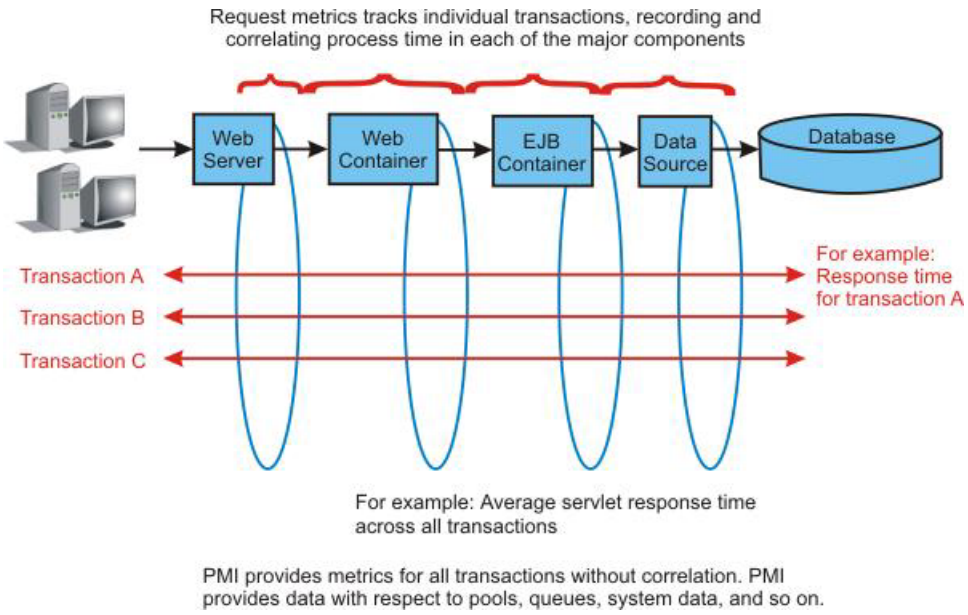
```
PLUGIN:
parent:ver=1,ip=192.168.0.1,time=1016556185102,pid=796,reqid=40,event=0
- current:ver=1,ip=192.168.0.1,time=1016556185102,pid=796,reqid=40,event=1
type=HTTP detail=/hitcount elapsed=90 bytesIn=0 bytesOut=2252

Application server (web container tier)
PMRM0003I: parent:ver=1,ip=192.168.0.1,time=1016556185102,pid=796,reqid=40,event=0
- current:ver=1,ip=192.168.0.1,time=1016556186102,pid=884,reqid=40,event=1
type=URI detail=/hitcount elapsed=60
```

The trace record that is displayed on machine 192.168.0.2 is similar to the following example:

```
PMRM0003I:
parent:ver=1,ip=192.168.0.1,time=1016556186102,pid=884,reqid=40,event=1
-
current:ver=1,ip=192.168.0.2,time=1016556190505,pid=9321,reqid=40,event=1
type=EJB
detail=com.ibm.defaultapplication.Increment.increment elapsed=40
```

Data you can collect with request metrics

Typically, different components of the enterprise application might be hosted across several nodes in a distributed system. For example, the servlets might be hosted on one node, while the enterprise beans on which these servlets depend might be hosted on an entirely different node. When a request comes to a process, the process might send the request to one or more downstream processes, as shown in the following figure:



Trace records might be generated for each process with associated elapsed times for that process. These trace records might be correlated together to build a complete picture of the request flow through the distributed system, similar to the diagram in “Why use request metrics?” on page 241.

You can view the process response time that is monitored by request metrics through the Application Response Measurement (ARM) interface and system log files. When a request is sent to the application server, request metrics captures response times for the initiating request and any related downstream invocations. Request metrics are instrumented in the following components as the request, for example, transaction, travels through the web server, Proxy Server and the application server:

- the web server plug-in which is only available when using the web server port.
- the Proxy Server, instrumented as servlet and web services requests.
- the web container, including servlet and servlet filters.
- the Enterprise JavaBeans (EJB) container.
- Java DataBase Connectivity (JDBC) calls.
- Java EE Connector Architecture (JCA).
- Web services, both on the server and the client side.
- the Java Message Service (JMS) engine.
- Service Integration Bus (SIB).
- Portlet container, including the portlet requests.

- Asynchronous Beans.

Select the components that you want to instrument. For example, if you want instrumentation data only for the web container and the JMS API, select this data in the administrative console and the detailed instrumentation data is generated only for the components that you select. The edge transactions are traced for the other components that are not specified for instrumentation.

When filtering is enabled, only requests that match the filter generate request metrics data, create log records, or call the ARM interfaces. You can add work into a running system specifically to generate trace information to evaluate the performance of specific types of requests in the context of normal load, ignoring requests from other sources that might affect the system. If the request matches any filter with a trace level greater than None, trace records are generated for that request.

Differences between Performance Monitoring Infrastructure and request metrics

Performance Monitoring Infrastructure (PMI) provides information about average system resource usage statistics, with no correlation between the data across different WebSphere Application Server components. For example, PMI provides information about average thread pool usage. Request metrics provides data about each individual transaction, correlating this information across the various WebSphere Application Server components to provide an end-to-end picture of the transaction, as shown in the following diagram:

Getting performance data from request metrics

This topic describes how to enable request metrics.

About this task

Request metrics is a tool that enables you to track individual transactions, recording the processing time in each of the major WebSphere Application Server components.

You can enable request metrics from the following locations:

- The administrative console. To enable request metrics in the administrative console, refer to the instructions under the Steps for this task section that follows.
- Command line. Java Management Extensions (JMX) interfaces are exposed for enabling request metrics through external tools. For more details on the exposed interfaces, refer to the request metrics API documentation.

To enable request metrics in the administrative console:

Procedure

1. Open the administrative console.
2. Click **Monitoring and Tuning** > **Request Metrics** in the console navigation tree.
3. Verify that **Prepare servers for request metrics collection** check box is selected. If **Prepare servers for request metrics collection** check box is not selected, you will have to select it, save the change, and restart the server.
4. Select All, None, or Custom under **Components to be instrumented** to specify the request metrics components. If you select **Custom**, be sure to select the components you would like to enable.
5. Specify the components that are instrumented by request metrics.
6. Specify how much data to collect.
7. Enable and disable logging.

8. Enable Application Response Measurement (ARM) Agent.
9. Specify which ARM type to use.
10. Specify the name of the ARM transaction factory implementation class.
11. Isolate performance for specific types of requests.
    a. Add and remove request metrics filters.
12. Click **Apply** or **OK**.
13. Click **Save**.

Results

The request metrics is enabled.

What to do next

To ensure that the web server plug-in recognizes the changes you made for the request metrics configuration, follow the steps in “Regenerating the web server plug-in configuration file” on page 260, if logging time spent in the web server.

Request metrics

Use this page to enable request metrics, select the components that are instrumented by request metrics, set trace levels, enable standard logs, enable Application Response Measurement (ARM), specify the type of ARM agent, and specify the ARM transaction factory implementation class name.

To view this administrative console page, click **Monitoring and Tuning** > **Request Metrics**.

Prepare Servers for request metrics collection

Turns on the request metrics feature.

When unchecked, the request metrics function is disabled. To enable request metrics, check the box, save the change, and restart the server. When it is checked, the server is ready to enable request metrics and you will not need to restart the server. Depending on what option is selected under **Components to be instrumented**, request metrics instrumentation will be enabled/disabled in various components.

Note: This selection process differs from the **Enable Request Metrics** check box in WebSphere Application Server Version 6.0.x. You now have the option of selecting All, None, or Custom. If you select **Custom**, you must specify which components you would like to enable.

Enable request metrics

This turns on the request metrics feature. When disabled, the request metrics function is disabled.

Components to be instrumented

Selects the components that are instrumented by request metrics.

When **None** is selected, no request metrics instrumentation will be enabled. When **All** is selected, request metrics instrumentation will be enabled in all the components listed under **Custom**. When **Custom** is selected, request metrics instrumentation will be enabled in the selected components.

Note: An edge transaction, which is defined as the first transaction that enters the application server without a parent correlator, will always be instrumented even if the corresponding component is disabled for instrumentation.

Trace level

Specifies how much trace data to accumulate for a given transaction. Note that **Trace level** and **Components to be instrumented** work together to control whether or not a request will be instrumented.

Including one of the following values:

None No instrumentation.

Hops Generates instrumentation information on process boundaries only. When this setting is selected, you see the data at the application server level, not the level of individual components such as enterprise beans or servlets.

Performance_debug
Generates the data at Hops level and the first level of the intra-process servlet and Enterprise JavaBeans (EJB) call (for example, when an inbound servlet forwards to a servlet and an inbound EJB calls another EJB). Other intra-process calls like naming and service integration bus (SIB) are not enabled at this level.

Debug
Provides detailed instrumentation data, including response times for all intra-process calls.

Note: Requests to servlet filters will only be instrumented at this level.

Standard logs
Enables the request metrics logging feature.

Select this check box to trigger the generation of request metrics logs in the `SystemOut.log` file.

Note: Since enabling the request metrics logging feature will increase processor usage, it is recommended using this feature together with filters so that only selected requests are instrumented.

Note: This topic references one or more of the application server log files. As a recommended alternative, you can configure the server to use the High Performance Extensible Logging (HPEL) log and trace infrastructure instead of using `SystemOut.log` , `SystemErr.log`, `trace.log`, and `activity.log` files on distributed and IBM i systems. You can also use HPEL in conjunction with your native z/OS logging facilities. If you are using HPEL, you can access all of your log and trace information using the LogViewer command-line tool from your server profile bin directory. See the information about using HPEL to troubleshoot applications for more information on using HPEL.

Application Response Measurement (ARM) agent
Enables request metrics to call an underlying Application Response Measurement (ARM) agent.

Before enabling ARM, you need to install an ARM agent and configure it to the appropriate classpath and path, following the instructions of the ARM provider.

Specify ARM agent
Specifies the type of ARM agent that you want to use.

The ARM 4.0 agent and Tivoli ARM 2.0 agent are supported.

ARM transaction factory implementation class name
Specifies the ARM transaction factory implementation class name in the package that is supplied by your provider. This field is required when ARM 4.0 agent is selected, but it is not required when Tivoli ARM agent is selected.

In this field, type the name of the ARM transaction factory implementation class that is present in the ARM library. Be sure to follow the instructions of the ARM provider and understand the name of the ARM transaction factory class for the installed ARM agent.

For more information, read the description of Transaction.ArmTransactionFactory.

Filters
When filtering is enabled, only requests matching the specified filter will generate request metrics data. Filters exist for source IP address, URI name, EJB method name, JMS parameters, and the WebServices parameters.

Application Response Measurement
Request metrics information might be either saved to the log file for later retrieval and analysis, be sent to Application Response Measurement (ARM) agents, or both. Request metrics provides response time for each of the major WebSphere Application Server components through ARM APIs.

ARM is an Open Group standard. Request metrics helps you to plug in an ARM agent to collect response time measurements.

WebSphere Application Server does not ship an ARM agent. However, it supports the use of agents adhering to ARM 4.0 and ARM 2.0 standards.

You can choose your own ARM implementation providers to obtain the ARM implementation libraries. Follow the instruction from the ARM provider, and ensure that the ARM API Java archive (JAR) files found in the ARM provider are on the class path so that the WebSphere Application Server can load the needed classes. In the case of Tivoli Monitoring Transaction Performance, V5.3, copy the `armjni.jar` and `core_util.jar` files from the Tivoli Monitoring Transaction Performance *<tmtp_install_root>*`/lib` installation root directory to the *app_server_root*`/lib` directory, which is the WebSphere Application Server installation root directory. If the underlying ARM implementation is ARM 4.0, you need to specify the ARM transaction factory class name. Otherwise, this specification is not required.

See the Performance: Resources for learning information about the ARM specifications.

ARM application properties and transaction context data
Request metrics provides build-in instrumentation to monitor transaction flows. The data that is collected by request metrics can be sent to a supported Application Response Measurement (ARM) agent.

ARM application properties

The following tables show the ARM application properties when request metrics initializes an ARM 4.0 agent.

Table 66. Identity property names and value. The following table shows the ARM application properties when request metrics initializes an ARM 4.0 agent.

Identity property names	Value
Cell Name	The cell name that the server belongs to.
Version	The version of WebSphere Application Server.

Table 67. Application properties and value. The following table shows the ARM application properties when request metrics initializes an ARM 4.0 agent.

Application properties	Value
Registered application name	WebSphere:<server_type> The <server_type> can be APPLICATION_SERVER, ONDEMAND_ROUTER, or PROXY_SERVER.
Application group	<server_name>
Application instance	<node_name>.<server_name>

The following code sample displays how WebSphere Application Server creates an ARM application.

```
String serverType; // the server type like APPLICATION_SERVER
String version; // WebSphere version
String sCellName; // the cell name of dMgr
String sAppInstance. // <short_node_name>.<short_server_name>
String sServerInstance; // short server name
String sWasName = "WebSphere:" + serverType;
String[] IDNAMES = new String[]{"Cell Name", "Version"};
ArmIdentityProperties appIdentity = txFactory.newArmIdentityProperties(IDNAMES, new String[]{sCellName,
version}, null);
ArmApplicationDefinition appDef = txFactory.newArmApplicationDefinition( sWasName, appIdentity, null );
ArmApplication app = txFactory.newArmApplication(appDef, sServerInstance, sAppInstance, null );
```

ARM transaction types

You can use the following code sample to create an instance of ARM transaction.

```
String[] contextNames; // the names for the context data like Port, QueryString, URI, EJBName
String tranIdentityName; // the transaction types shown in the following table like URI, EJB.
String appDef; // defined and created in above code snippet under ARM application properties
String app; // defined and created in above code snippet under ARM application properties
ArmIdentityPropertiesTransaction props = armFactory.newArmIdentityPropertiesTransaction( null, null,
contextNames, null );
ArmTransactionDefinition atd = armFactory.newArmTransactionDefinition(appDef, identityName, props, (ArmID)null);
ArmTransaction at = txFactory.newArmTransaction(app, atd );
```

The sections later in this section show all ARM transaction types and their corresponding context names. Some types of transactions are not instrumented unless the trace level is set to DEBUG. In addition, not every transaction is available in all types of servers. All transaction types and context names are case sensitive.

Uniform resource identifier (URI)

This transaction type is the uniform resource identifier (URI) for servlet and JavaServer Page (JSP) requests. All of the following transaction types and context names are available in all types of servers.

Table 68. Transaction type: URI. All the following transaction types and context names are available in all types of servers.

Transaction type: URI	
Context name	**Description**
Port	The TCP/IP port where the request arrived, specified as a string representation of the decimal value. Example: 9080
QueryString	The portion of the dynamic URI that contains the search parameters of the request in the query segment of the URI string, excluding the question mark (?) character. Example: selection=EJB&lookup=GBL&trans=CMT
URI	The incoming request URI of the servlet and JSP file used. Example: /hitcount

Enterprise JavaBeans (EJB)

This EJB transaction type and context names are only available in application servers.

Table 69. Transaction type: EJB. This EJB transaction type and context names are only available in application servers.

Transaction Type: EJB	
Context name	**Description**
EJBName	The fully qualified EJB class name, followed by method name with a period (.) to connect them. For example, com.mypackge.MyEJBClass.mymethod. Example: com.ibm.defaultapplication.IncrementBean.create
ApplicationName	The Java™ 2 Platform, Enterprise Edition (J2EE) application name that contains the enterprise bean. Example: DefaultApplication
ModuleName	The J2EE module name that contains the enterprise bean. Example: Increment.jar

Servlet filter

The servlet filter transaction type is only available at the DEBUG trace level. For other levels, servlet filters are not instrumented. This transaction type and context names are only available in application servers.

Table 70. Transaction type: Servlet filter. This transaction type and context names are only available in application servers.

Transaction Type: Servlet filter	
Context name	**Description**
FilterName	The servlet filter name for the servlet. Example: ALoginFilter

Java Database Connectivity (JDBC)

The JDBC transaction type is only available at the DEBUG trace level. For other levels, JDBC is a block call. This transaction type and context names are only available in application servers.

Table 71. Transaction type: JDBC. This transaction type and context names are only available in application servers.

Transaction type: JDBC	
Context name	**Description**
ClassName	The interface name for the JDBC call. This name is not the actual class name. Example: java.sql.PreparedStatement
MethodName	The method name for the JDBC call. Example: executeUpdate()

Java EE Connector Architecture (JCA)

The JCA transaction type is available only at the DEBUG trace level. For other levels, JCA is a block call. This transaction type and context names are only available in application servers.

Table 72. Transaction type: JCA. This transaction type and context names are only available in application servers.

Transaction type: JCA	
Context name	**Description**
ClassName	The class name for the JCA call. Example: javax.resource.spi.ManagedConnection
MethodName	The method name for the JCA call. Example: getConnection(Subject, ConnectionRequestInfo)

Web Services Provider

The web services provider transaction type is for server-side web services requests. This transaction type and the `Wsdlport` and `Operation` context names are available in all types of servers. The `Transport`, `NameSpace`, and `InputMessage` context names are only available in application servers.

Table 73. Transaction type: Web Services Provider. This transaction type and the `Wsdlport` and `Operation` context names are available in all types of servers. The `Transport`, `NameSpace`, and `InputMessage` context names are only available in application servers.

Transaction type: Web Services Provider	
Context name	**Description**
WsdlPort	The WSDL port name that is associated with the web service. Example: AccountManager
Operation	The operation name that is associated with the web service. Example: createNewAccount

Table 73. Transaction type: Web Services Provider (continued). This transaction type and the `Wsdlport` and `Operation` context names are available in all types of servers. The `Transport`, `NameSpace`, and `InputMessage` context names are only available in application servers.

Transaction type: Web Services Provider	
Context name	**Description**
Transport	The transport name that is associated with the web service. Example: http
NameSpace	The name space that is associated with the Web service. Example: http://accountmanager.mycorp.com
InputMessage	The input message name that is associated with the web service. Example: createNewAccountRequest

Web Services Requestor

The web services requestor transaction type is available only at DEBUG trace level. For other levels, web services requestor is a block call. This transaction type and context names are only available in application servers.

Table 74. Transaction type: Web Services Requestor. This transaction type and context names are only available in application servers.

Transaction type: Web Services Requestor	
Context name	**Description**
WsdlPort	The Web Services Description Language (WSDL) port name that is associated with the web service. Example: AccountManager
Operation	The operation name that is associated with the web service. Example: createNewAccount
Transport	The transport name that is associated with the web service. Example: http
Parameters	The parameters for the web service request. Example: customerName,addressStreet,addressCity,addressState,addressZip

Java Message Service (JMS)

The JMS transaction type is only for message-driven bean (MDB) scenarios in default messaging, including the System Integration Bus (SIB) layer and MQ. This transaction type and context names are only available in application servers.

Table 75. Transaction type: JMS. This transaction type and context names are only available in application servers.

Transaction type: JMS	
Context name	**Description**
DestinationName	The destination queue name or topic name for the Java Message Service (JMS). Example: MyBusiness.Topic.Space
MessageSelector	The message selector for JMS.
Provider	Provider refers to either default messaging, SIB, or MQ. Example: Default Messaging

JMS send and receive

The JMS send and receive transaction type is only available at the DEBUG trace level. For other levels, JMS send and receive is a block call. This transaction type and context names are only available in application servers.

Table 76. Transaction type: JMS send/receive. This transaction type and context names are only available in application servers.

Transaction type: JMS send/receive	
Context name	**Description**
ClassName	The class name in the JMS provider that makes the call. Example: com.ibm.ws.sib.api.jms.impl.JmsTopicPublisherImpl
MethodName	The method name in the JMS provider that makes the call. Example: sendMessage

Service Integration Bus (SIB) send and receive

The SIB send and receive transaction type is only available at the DEBUG trace level. For other levels, SIB send and receive is a block call. This transaction type and context names are only available in application servers.

Table 77. Transaction type: SIB send/receive. This transaction type and context names are only available in application servers.

Transaction type: SIB send/receive.	
Context name	**Description**
ClassName	The class name in the SIB layer that makes the call. Example: com.ibm.ws.sib.processor.impl.ProducerSessionImpl
MethodName	The method name in the SIB layer that makes the call. Example: send
BusName	The name of the Service Integration Bus that this call is made on.
DestinationName	The name of the Service Integration Destination that this call is made on.

SIB message-driven bean (MDB)

The SIB MDB transaction type is only available in application servers.

Table 78. Transaction type: SIB MDB. The SIB MDB transaction type is only available in application servers.

Transaction type: SIB MDB.	
Context name	**Description**
BusName	The name of the SIB that the Destination the MDB is listening on is located.
DestinationName	The name of the SIB that this MDB is listening too.
MessageSelector	The message selector used by this MDB.
MdbDiscriminator	The Discriminator used by this MDB.
Provider	The type of provider that this MDB is for. Example: Default Messaging or SIB

SIB mediate

The SIB mediation transaction type and context names are only available in application servers.

Table 79. Transaction type: SIB mediate. The SIB mediation transaction type and context names are only available in application servers.

Transaction type: SIB mediate	
Context name	**Description**
ClassName	The class name in which the call is made.
MethodName	The method name in which the call is made.
MediationName	The mediation name for the JMS. Example: myMediation
BusName	The service integration bus name for the JMS. Example: thisBusName
DestinationName	The destination name for the JMS. Example: myMessageQueue

Asynchronous beans

The asynchronous beans transaction type is for asynchronous beans timers, alerts, and deferred starts. This transaction type and context names are only available in application servers.

Table 80. Transaction type: Asynchronous beans. This transaction type and context names are only available in application servers.

Transaction type: Asynchronous beans	
Context name	**Description**
Type	The type of asynchronous beans task. Example: COMMONJ_TIMER

Table 80. Transaction type: Asynchronous beans (continued). This transaction type and context names are only available in application servers.

Transaction type: Asynchronous beans	
Context name	**Description**
ClassName	The class name that executes the asynchronous beans task. Example: com.mycorp.MyTaskClass

Java Naming and Directory Interface (JNDI)

The JNDI transaction type is only available at DEBUG trace level. For other trace levels, JNDI calls will not be instrumented. This transaction type and context names are only available in application servers.

Table 81. Transaction type: JNDI. This transaction type and context names are only available in application servers.

Transaction type: JNDI	
Context name	**Description**
JNDIName	The JNDI lookup name. Example: ejbJndiName

Portlet

The portlet transaction type is and context names are only available in application servers.

Table 82. Transaction type: Porlet. The portlet transaction type and context names are only available in application servers.

Transaction type: Portlet	
Context name	**Description**
Method	The method of the portlet that is currently utilized, which can be either action or render.
WindowID	The window identifier of the portlet that is currently utilized.
URI (This is an ARM transaction context property name, and not to be confused with the explicit ARM transaction URI property as specified on WebSphere servlet transactions, and in particular not to be confused with the Enterprise Workload Manager (EWLM) “EWLM: URI”policy filter.)	The context path of the current portlet request.

ARM correlators via HTTP and SOAP protocols

For HTTP inbound, WebSphere Application Server checks the case sensitive HTTP header “ARM_CORRELATOR” for the incoming ARM correlator. The application server does not allow the flow of ARM correlators via HTTP outbound.

For SOAP inbound, WebSphere Application Server checks the SOAP header for an element as follows:

- element =“arm_correlator”;
- namespace URI = “http://websphere.ibm.com”,
- prefix = “reqmetrics”;
- actor URI = “reqmetricsURI”;

For SOAP outbound, WebSphere Application Server creates a new SOAP header and passes the ARM correlator string as a text node in the header. For example:

- element =“arm_correlator”;
- namespace URI = “http://websphere.ibm.com”,
- prefix = “reqmetrics”;
- actor URI = “reqmetricsURI”;

The following is an example SOAP header with an ARM correlator. Note that the ARM correlator must be passed in hex string format of the ARM correlator byte array despite whether HTTP or SOAP protocol is used.

```
<soapenv:Header xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<reqmetrics:arm_correlator soapenv:actor="reqmetricsURI" xmlns:reqmetrics="http://websphere.ibm.com">
37000000000000000000
</reqmetrics:arm_correlator>
</soapenv:Header>
```

Isolating performance for specific types of requests

This topic describes how to enable request metrics filters.

About this task

Request metrics compares each incoming request to a set of known filters, but you need to enable these filters.

Procedure

1. Open the administrative console.
2. Click **Monitoring and Tuning** > **Request Metrics** in the administrative console navigation tree.
3. Click **Filters**.
4. Click *filter type*.
5. Select the check box in the **Enable** field under the Configuration tab.
6. Click **Apply** or **OK**.
7. Click **Save**. You can enable or disable a filter group. If the group is enabled, you can enable or disable individual filters.

Results

The request metrics filters are enabled according to your configuration. For example, if you enabled source IP, only requests whose source IP matches the one specified in the filter will be instrumented.

Note: Filters will only be checked for edge transactions. An edge transaction is the transaction that first enters an instrumented system. For example, if a servlet calls an Enterprise JavaBean, the servlet is the edge transaction, assuming it is not instrumented at the web server plug-in, and the URI and SOURCE_IP filters will be checked for the servlet request. However, when the request comes to EJB container, EJB filter will not be checked because it is no longer an edge transaction.

What to do next

You must regenerate the web server plug-in configuration file as described in the “Regenerating the web server plug-in configuration file” on page 260 topic after modifying the request metrics configuration.

Adding and removing request metrics filters

This topic summarizes how to add and remove request metrics filter.

About this task

To add or remove request metrics filters, perform the following steps:

Procedure

1. Open the administrative console.
2. Click **Monitoring and Tuning** > **Request Metrics** in the console navigation tree.
3. Click **Filters**.
4. Choose a filter type.
   a. Click **Filter values**.
   b. You can edit, add, and delete a filter value. To edit, click a filter value and change its value. To add, click **New** and type in the value and optionally check the **Enable filter** box. To delete, select a filter value and click **Delete**.
5. Click **Apply** or **OK**.
6. Click **Save**.

Results

Adding or removing request metrics filters is complete.

What to do next

You must regenerate the web server plug-in configuration file as described in the “Regenerating the web server plug-in configuration file” on page 260 topic after modifying the request metrics configuration.

Request metrics filters

Use this page to view a list of request metrics filters.

To view this administrative console page, click **Monitoring and Tuning** > **Request Metrics** > **Filters**.

Maximum rows: Specifies the maximum number of rows that displays when the collection is large. The rows that are not displayed appear on the next page.

Retain filter criteria: Specifies whether to use the same filter criteria entered in the show filter function to display this page the next time you visit it.

Type:

Specifies the type of request metrics filter.

Enable:

Specifies whether this filter is enabled. This option must be enabled to enable the filter values under this filter type.

Request metrics filter settings

Use this page to specify filters that define whether or not trace is enabled for inbound requests. Note that the filters will only be checked for inbound requests. For intra-process and outbound calls, filters will not be checked. If an inbound request passes the relevant filters, the request will be instrumented as it moves through WebSphere Application Server. If an inbound request does not pass the relevant filters, the request will not be instrumented for its entire code path in WebSphere Application Server.

To view this administrative console page, click **Monitoring and Tuning** > **Request Metrics** > **Filters** > *filter_type*.

Type:

Specifies the type of request metrics filter.

Enable:

Specifies whether this filter is enabled.

Filter values:

Specifies the value(s) of the request metrics filter type and enablement for the value(s).

Filter values collection

Use this page to specify the values for source IP, URI, web services, Java Message Service (JMS), or Enterprise JavaBeans (EJB) request metrics filters. When multiple filter values are enabled, a request will pass the filter as long as it matches one of the filter values.

To view this administrative console page, click **Monitoring and Tuning** > **Request Metrics** > **Filters** > *filter_type* > **Filter values**.

Maximum rows: Specifies the maximum number of rows that displays when the collection is large. The rows that are not displayed appear on the next page.

Retain filter criteria: Specifies whether to use the same filter criteria entered in the show filter function to display this page the next time you visit it.

Value:

Specifies a source IP, URI, web services, JMS, or EJB value based on the type of filter.

For example, for URI filters, the value might be "/servlet/snoop".

Enable filter:

Specifies whether a filter value is enabled.

Filter values settings

Use this page to specify the values for source IP, URI, web services, Java Message Service (JMS), or Enterprise JavaBeans (EJB) method name request metrics filters.

To view this administrative console page, click **Monitoring and Tuning** > **Request Metrics** > **Filters** > *filter_type* > **Filter values** > *filter_value*.

Value:

Specifies a source IP, URI, web services, JMS, or EJB value based on the type of filter.

For example, for URI filters, the value can be `/servlet/snoop`. When needed, the wildcard (*) can be appended at the end of the value. For example, `/servlet/s*` is a valid URI filter value.

For JMS and web services filter values, the wildcard can be used at the end of one or more name/value pairs.

Enable filter:

Specifies whether this filter value is enabled.

Specifying how much data to collect

This topic describes how to set the trace level to generate trace records in the administrative console.

About this task

Trace level specifies how much trace data to accumulate for a given transaction. You should choose the one of the following values when setting the trace level in the administrative console.

None No instrumentation.

Hops Generates instrumentation information on process boundaries only. When this setting is selected, you see the data at the application server level, not the level of individual components such as enterprise beans or servlets.

Generates instrumentation information on process boundaries only. When this setting is selected, you see the data at the application server level, not the level of individual components such as enterprise beans or servlets.

Performance_debug

Generates one additional level of instrumentation data, whereas debug generates detailed instrumentation data.

Generates the data at Hops level and the first level of the intra-process servlet and Enterprise JavaBeans (EJB) call (for example, when an inbound servlet forwards to a servlet and an inbound EJB calls another EJB). Other intra-process calls like naming and service integration bus (SIB) are not enabled at this level.

Debug

Provides detailed instrumentation data, including response times for all intra-process servlet and Enterprise JavaBeans (EJB) calls.

Provides detailed instrumentation data, including response times for all intra-process calls.

Note: Requests to servlet filters will only be instrumented at this level.

Procedure

1. Open the administrative console.
2. Click **Monitoring and Tuning** > **Request Metrics** in the administrative console navigation tree.
3. Find **Trace level** in the Configuration tab.
4. Select a trace level from the drop down list box. To set the request metrics trace level to generate records, make sure that the trace level is set to a value greater than `None`.
5. Click **Apply** or **OK**.
6. Click **Save**.

Results

Information are generated to reflect the trace level you selected.

What to do next

You must regenerate the web server plug-in configuration file as described in the “Regenerating the web server plug-in configuration file” on page 260 topic after modifying the request metrics configuration.

Request metrics trace filters

When request metrics is active, trace filters control which requests get traced. The data is recorded to the system log file or sent through Application Response Measurement (ARM) for real-time and historical analysis.

Incoming HTTP requests

HTTP requests that arrive at WebSphere Application Server might be filtered based on the URI or the IP address or both of the originator of the request.

.

- **Source IP address filters.** Requests are filtered based on a known IP address. You can specify a mask for an IP address using the asterisk (*). If used, the asterisk must always be the last character of the mask, for example 127.0.0.*, 127.0.*, 127*. For performance reasons, the pattern matches character by character, until either an asterisk is found in the filter, a mismatch occurs, or the filters are found to be an exact match.

  Only addresses that are entered in one of the following addressing formats are acceptable as the source IP addresses:
  - The IPv4 addressing format:

    ```
    ^(\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.(\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.
    (\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.(\d{1,2}|1\d\d|2[0-4]\d|25[0-5])$
    ```
  - The IPv6 addressing format:

    ```
    ^([0-9a-fA-F]*[0-9a-fA-F]*[0-9a-fA-F]*[0-9a-fA-F]*:){1,7}([0-9a-fA-F]*
    [0-9a-fA-F]*[0-9a-fA-F]*[0-9a-fA-F]*)$
    ```
  - The IPv4 compatiable IPv4 addressing format:

    ```
    ^([0]*[0]*[0]*[0]*:){1,7}((\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.
    (\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.(\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.
    (\d{1,2}|1\d\d|2[0-4]\d|25[0-5]))$/<constant-value>
    ```
  - The IPv4MappedIPv6 addressing format:

    ```
    ^([0]*[0]*[0]*[0]*:){1,6}([fF][fF][fF][fF]:){1}((\d{1,2}|1\d\d|2[0-4]
    \d|25[0-5])\.(\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.(\d{1,2}|1\d\d|2[0-4]\d|25[0-5])\.
    (\d{1,2}|1\d\d|2[0-4]\d|25[0-5]))$
    ```

  Note: If the client machine is a dual stack machine and its IP address is specified as the source IP address that is filtered by the request metrics filter, you must specify the IPv4 addressing format rather than the IPv6 addressing format. Only if the client machine is a single stack IPv6 machine, can you specify it as the IPv6 addressing format
- **URI filters.** Requests are filtered, based on the URI of the incoming HTTP requests. The rules for pattern matching are the same as for matching source IP address filters.
- **Filter combinations.** If both URI and source IP address filters are active, request metrics requires a match for both filter types. If neither is active, all requests are considered a match.

Incoming enterprise bean requests

Incoming enterprise bean requests

- Requests are filtered based on the full name of the EJB method. As with IP address and URI filters, the asterisk (*) might be used in the mask. If used, the asterisk must always be the last character of a filter pattern.

Because the ability to track the request response times comes with a cost, filtering helps optimize performance when using request metrics.

The web services filter and the Java Message Service (JMS) filter was added to the WebSphere Application Server, Version 6 product. The filter values for web services are a combination of a Web Services Description Language (WSDL) port name, operation name, and transport name. The filter value for JMS is the destination name.

Regenerating the web server plug-in configuration file

This topic describes the steps to regenerate the web server plug-in configuration file after you modify the request metrics configuration.

About this task

After modifying the request metrics configuration, you must complete the following steps to regenerate the web server plug-in configuration file. Regeneration ensures that the web server plug-in recognizes the changes that you made for the request metrics configuration. If you make multiple changes to request metrics, then regenerate the plug-in configuration files when you complete all the changes.

Important: You must complete this step after you change the request metrics configuration. If you do not, the Web server plug-in might have different request metrics configuration data than the application server. This difference in configuration data might cause inconsistent behaviors for request metrics between the web server plug-in and the application server.

Procedure

1. Open the administrative console.
2. Click **Servers > Server Types > Web Servers** .
3. Select one of the listed web servers, and click **Generate Plug-in**

Results

The regeneration of the web server plug-in configuration file is complete.

Enabling and disabling logging

This topic describes how to enable and disable logging through the administrative console.

About this task

You can enable and disable logging through the administrative console to start the generation of request metrics logs in the `SystemOut.log` file in the following directory:

profile_root`/logs/`*server_name*

Note: This topic references one or more of the application server log files. As a recommended alternative, you can configure the server to use the High Performance Extensible Logging (HPEL) log and trace infrastructure instead of using `SystemOut.log` , `SystemErr.log`, `trace.log`, and `activity.log` files on distributed and IBM i systems. You can also use HPEL in conjunction with your native z/OS logging facilities. If you are using HPEL, you can access all of your log and trace information using the LogViewer command-line tool from your server profile bin directory. See the information about using HPEL to troubleshoot applications for more information on using HPEL.

Procedure

1. Open the administrative console.
2. Click **Monitoring and Tuning > Request Metrics**.
3. Under **Request Metrics Destination**, select the **Standard Logs** check box to enable the logging feature. To disable the logging, clear the **Standard Logs** check box.

Results

The logging feature is enabled. You can view the generated request metrics logs in the `SystemOut.log` file.

Request metrics performance data

Use this page to learn how to interpret performance data for request metrics in trace record format.

The trace records for request metrics data are output to two log files: the web server plug-in log file and the application server log file. The default names for the log files are `SystemOut.log` and `http_plugin.log`. You might, however, specify these log file names and their locations. The default directories for these log files are:

- plugin_install_root/logs/web_server_name/http_plugin.log and install_root/profiles/profile_name/logs/server_name

and

In the WebSphere Application Server log file the trace record format is:

```
PMRM0003I: parent:ver=n,ip=n.n.n.n,time=nnnnnnnnnn,pid=nnnn,reqid=nnnnnn,event=nnnn
-
current:ver=n,ip=n.n.n.n,time=nnnnnnnnnn,pid=nnnn,reqid=nnnnnn,event=nnnn
           type=TTT detail=some_detail_information elapsed=nnnn
```

In the web server plug-in log file the trace record format is:

```
PLUGIN:
parent:ver=n,ip=n.n.n.n,time=nnnnnnnnnn,pid=nnnn,reqid=nnnnnn,event=nnnn
- current:ver=n,ip=n.n.n.n,time=nnnnnnnnnn,pid=nnnn,reqid=nnnnnn,event=nnnn
           type=TTT detail=some_detail_information elapsed=nnnn bytesIn=nnnn
           bytesOut=nnnn
```

The trace record format is composed of two correlators: a parent correlator and current correlator. The parent correlator represents the upstream request and the current correlator represents the current operation. If the parent and current correlators are the same, then the record represents an operation that occurs as it enters WebSphere Application Server.

To correlate trace records for a particular request, collect records with a message ID of PMRM0003I from the appropriate application server log files and the `PLUGIN` trace record from the web server plug-in log file. Records are correlated by matching current correlators to parent correlators. You can create the logical tree by connecting the current correlators of parent trace records to the parent correlators of child records. This tree shows the progression of the request across the server cluster. Refer to “Why use request metrics?” on page 241 for an example of the transaction flow.

The parent correlator is denoted by the comma separating fields following the keyword, parent:. Likewise, the current correlator is denoted by the comma separating fields following, current:.

The fields of both parent and current correlators are:

- **ver:**The version of the correlator. For convenience, it is duplicated in both the parent and current correlators.
- **ip:**The IP address of the node of the application server that generated the correlator. If the system has multiple IP addresses, request metrics uses one of the IP addresses to identify the system.
- **pid:**The process ID of the application server that generated the correlator.
- **time:**The start time of the application server process that generated the correlator.
- **reqid:**An ID that is assigned to the request by request metrics, unique to the application server process.
- **event:**An event ID that is assigned to differentiate the actual trace events.

Following the parent and current correlators, the metrics data for timed operation are:

- type: A code that is represents the type of operation being timed. Supported types include HTTP, URI, EJB, JDBC, JMS, COMMONJ_WORK_POOLED, COMMONJ_TIMER, web services requester, and web services provider.
- detail: Identifies the name of the operation being timed (See the following description of Universal Resource Identifier (URI), HTTP, EJB, JDBCJ, JMS, asynchronous beans, and Web services.)
- elapsed: The measured elapsed time in <units> for this operation, which includes all sub-operations called by this operation. The unit of elapsed time is milliseconds.
- bytesIn: The number of bytes from the request that is received by the web server plug-in.

- bytesOut: The number of bytes from the reply that is sent from the web server plug-in to the client.

The type and detail fields that are described include:
- HTTP: The web server plug-in generates the trace record. The detail is the name of the URI that is used to invoke the request.
- URI: The trace record is generated by a web component. The URI is the name of the URI that is used to invoke the request.
- EJB: The fully qualified package and the method name of the enterprise bean.
- JDBC The interface name and method name for that JDBC call.
- JMS: JMS includes the particulars of various JMS parameters
- Asynchronous beans: The detail specifies the name of the asynchronous beans. Asynchronous beans include two types: COMMONJ_WORK_POOLED and COMMONJ_TIMER.
- Web services: Web services include the particulars of various web services parameters. Web services include two types: Web services requestor and web services provider.
- SIB: Used for instrumentation in service integration bus including message send/receive and mediation.
- JCA: J2EE Connector Architecture. The detail specifies the class name in which the JCA call is made.
- JNDI: Used for JNDI naming look up. The detail specifies the JNDI name.
- JMS send and receive: Generates the trace record by JMS sending and receiving messages.
- SIB send and receive: Generates the trace record by SIB sending and receiving messages.

Note: This topic references one or more of the application server log files. As a recommended alternative, you can configure the server to use the High Performance Extensible Logging (HPEL) log and trace infrastructure instead of using `SystemOut.log` , `SystemErr.log`, `trace.log`, and `activity.log` files on distributed and IBM i systems. You can also use HPEL in conjunction with your native z/OS logging facilities. If you are using HPEL, you can access all of your log and trace information using the LogViewer command-line tool from your server profile bin directory. See the information about using HPEL to troubleshoot applications for more information on using HPEL.

Request metric extension

Certain applications might require additional instrumentation points within the request metrics flow. For example, you might want to understand the response time to a unique back-end system as seen in the following call graph:

```
HTTP request /trade/scenario             ------------------------------> 172 ms
Servlet/trade/scenario          ------------------------------> 130 ms
Servlet/call to unique back-end system -------------------------->38 ms
```

Request metrics uses a “token” or “correlator” when tracing the flow of each request through the system. To create the call graph above with this instrumentation, you must plug into that flow of the request and issue the appropriate Application Response Measurement (ARM) API for an ARM agent to collect the data and for the ARM vendor to create the call graph.

Request metrics exposes the Correlation Service API for you to plug into the flow of the request. The following example is one of the typical flows that might be followed by an instrumented application to plug into the request metrics flow:

1. Create a new ArmTransaction object, which runs various instrumentation calls such as start or stop. The Correlation Service Arm wrapper (PmiRmArmTx) encapsulates this object before being inserted into the request metrics flow.
2. Populate the ArmTransaction object with an appropriate ArmCorrelator object. This object encapsulates the actual ARM correlator bytes.
3. Run the start method on the ArmTransaction object, marking the beginning of the instrumented method.
4. Instantiate a PmiRmArmTx object using the static method on the PmiRmArmTxFactory class, and populate the PmiRmArmTx object with the ArmTransaction preceding object.

5. Pass the PmiRmArmTx preceding object to the Correlation Service by pushing it onto the Correlation Service stack using exposed methods on the PmiRmArmStack class.
6. Perform the tasks that need to be done by the method being instrumented. The Correlation Service takes care of flowing the ArmTransaction object as necessary, which eventually results in the call graph view of the transaction times.
7. At the end of the instrumented method, access the PmiRmArmTx object from the Correlation Service using exposed methods on the PmiRmArmStack class, access the ArmTransaction object and perform a stop to indicate the end of the transaction.

Consult this information when utilizing the ARM API with the correlation service as part of a servlet instrumentation.

The arm40 binaries should be installed in accordance with the installation instructions supplied by the implementation provider. Once this is done, restart the server. This causes trace records to be generated in the SystemOut.log file indicating the instantiation of the appropriate ARM implementation. The following example illustrates one of the typical workflows of using the ARM API in conjunction with the correlation service as part of a servlet instrumentation:

```
public void doGet(HttpServletRequest request, HttpServletResponse response)
  throws ServletException, IOException {

PmiRmArmTx artrax =
// The factory detects the currently active ARM implementation (specified by user through
// admin console) and instantiates an appropriate ARM wrapper object

    PmiRmArmTxFactory.createPmiRmArmTx();
ArmTransaction at = newArmTx();
if (null == at)
            out.println("Got a null ArmTransaction");
ArmCorrelator arc = newArmCorr();
at.start(arc);
try {
 artrax.setArmTransaction(at);
 PmiRmArmStack.pushTransaction(artrax);
} catch (Exception e) {
 System.out.println("Caught 1 exception" + e);
}

PmiRmArmTx atxwrp = PmiRmArmStack.peekTransaction();

if (atxwrp == null)
 out.println("Armtransaction is null");

//getArmType
try {
 out.println("ARMTYPE is"+ PmiRmArmTx.getARMType());
} catch (Exception e) {
 out.println(e);
}
//getting correlator bytes
try {
 if (null == atxwrp.getCorrelatorBytes())
  out.println("Got a null Correlator");
} catch (Exception e) {
 out.println(e);
}

//blocked/unblocked
long blkid = 0;
try {
 out.println(blkid = atxwrp.blocked());
} catch (Exception e) {
 out.println(e);
}
```

```
try {
 out.println(atxwrp.unblocked(blkid));
} catch (Exception e) {
 out.println(e);
}
try {
 atxwrp = PmiRmArmStack.popTransaction();
 ArmTransaction art = (ArmTransaction) atxwrp.getArmTransaction();
 art.stop(ArmConstants.STATUS_GOOD);
} catch (Exception e) {
 out.println(e);
}

}



private ArmTransaction newArmTx() {

 ArmTransactionFactory txFactory = null;
try {
 String sWasName = "WebSphere";
 String appName = "t23xpimage/t23xpimage/server1";
 String sCellName = appName.substring(0, appName.indexOf("/"));
 String sNodeInstance =
   appName.substring(appName.indexOf("/") + 1, appName.length());
 sNodeInstance = sNodeInstance.replace('/', '.');
 txFactory = (ArmTransactionFactory)
 newObjectInstance("org.opengroup.arm40.sdk.ArmTransactionFactoryImpl");
 ArmApplication app = null; // 149297
 ArmApplicationDefinition appDef = null; //LIDB3207
 appDef =    txFactory.newArmApplicationDefinition(sWasName, null, null);
 app = txFactory.newArmApplication(appDef, sCellName, sNodeInstance, null);

 String[] idnames = { "request_type" };
 String[] idvalues = { "URI" };
 String[] ctxnames = { "URI" };
 ArmIdentityPropertiesTransaction props =
   txFactory.newArmIdentityPropertiesTransaction(
     idnames,
     idvalues,
     ctxnames,
     null);
 ArmTransactionDefinition atd =
    txFactory.newArmTransactionDefinition(
     appDef,
     "URI",
     props,
     (ArmID) null);
 ArmTransaction at = txFactory.newArmTransaction(app, atd);
 return at;
} catch (Exception e) {
 System.out.println(e);
 return null;
}

}

private ArmCorrelator newArmCorr() {

 ArmTransactionFactory txFactory = null;
try {
 String sWasName = "WebSphere";
 String appName = "t23xpimage/t23xpimage/server1";
 txFactory =
 (ArmTransactionFactory) newObjectInstance("org.opengroup.arm40.sdk.ArmTransactionFactoryImpl");
```

```
 ArmCorrelator arc =txFactory.newArmCorrelator(
     PmiRmArmStack.peekTransaction().getCorrelatorBytes());
 return arc;
} catch (Exception e) {
 System.out.println(e);
 return null;
}

}
```

Note: This topic references one or more of the application server log files. As a recommended alternative, you can configure the server to use the High Performance Extensible Logging (HPEL) log and trace infrastructure instead of using `SystemOut.log` , `SystemErr.log`, `trace.log`, and `activity.log` files on distributed and IBM i systems. You can also use HPEL in conjunction with your native z/OS logging facilities. If you are using HPEL, you can access all of your log and trace information using the LogViewer command-line tool from your server profile bin directory. See the information about using HPEL to troubleshoot applications for more information on using HPEL.

There are several potential scenarios for using the PmiRmArmStack. This example shows a scenario where code accesses an existing PmiRmArmTx on the stack, extracts the correlator, and calls blocked and unblocked. This is a typical scenario when sending a correlator along an unsupported protocol. In this scenario, the Arm transaction is already on the stack.

```
1   PmiRmArmTx artrax =
2    PmiRmArmStack.peekTransaction();
3   if( artrax != null )
4                          {
5                                      try
6                                      {
7        byte[] cbytes = artrax.getCorrelatorBytes();
8                                         stuffBytesIntoOutboundMessage( msg, cbytes);
9                                         long blockedId = 0;
10                                        try
11                                        {
12                                           blockedId = artrax.blocked();
13                                        }
14                                        catch( NoSuchMethodException nsme )
15                                        {
16                                            // must not be running ARM4 or eWLM
17                                        }
18                                           sendMsg( msg );
19                                        try
20                                        {
21                                           artrax.blocked( blockedId );
22                                        }
23                                        catch( NoSuchMethodException nsme )
24                                        {
25                                            // must not be running ARM4 or eWLM
26                                        }
27
28                                     }
29                                     catch( Exception e )
30                                     {
31                                        report a problem;
32                                     }
33  }
```

Chapter 7. Directory conventions

References in product information to *app_server_root*, *profile_root*, and other directories imply specific default directory locations. This article describes the conventions in use for WebSphere Application Server.

Default product locations (distributed)

The following file paths are default locations. You can install the product and other components or create profiles in any directory where you have write access. Multiple installations of WebSphere Application Server - Express products or components require multiple locations. Default values for installation actions by root and nonroot users are given. If no nonroot values are specified, then the default directory values are applicable to both root and nonroot users.

app_client_root

Table 83. Default installation root directories for the Application Client for IBM WebSphere Application Server.

This table shows the default installation root directories for the Application Client for IBM WebSphere Application Server.

User	Directory
Root	AIX `/usr/IBM/WebSphere/AppClient` (Java EE Application client only) HP-UX Linux Solaris `/opt/IBM/WebSphere/AppClient` (Java EE Application client only) Windows `C:\Program Files\IBM\WebSphere\AppClient`
Nonroot	AIX HP-UX Linux Solaris *user_home*`/IBM/WebSphere/AppClient` (Java EE Application client only) Windows `C:\IBM\WebSphere\AppClient`

app_server_root

Table 84. Default installation directories for WebSphere Application Server.

This table shows the default installation directories for WebSphere Application Server - Express.

User	Directory
Root	AIX `/usr/IBM/WebSphere/AppServer` HP-UX Linux Solaris `/opt/IBM/WebSphere/AppServer` Windows `C:\Program Files\IBM\WebSphere\AppServer`
Nonroot	AIX HP-UX Linux Solaris *user_home*`/IBM/WebSphere/AppServer` Windows *user_home*`\IBM\WebSphere\AppServer`

component_root
: The component installation root directory is any installation root directory described in this article. Some programs are for use across multiple components—in particular, the Web Server Plug-ins, the Application Client, and the IBM HTTP Server. All of these components are part of the product package.

gskit_root
: IBM Global Security Kit (GSKit) can now be installed by any user. GSKit is installed locally inside the installing product's directory structure and is no longer installed in a global location on the target system.

Table 85. Default installation directories for GSKit.

This table shows the default installation root directory for Version 8 of the GSKit, where product_root is the root directory of the product that is installing GSKit, for example IBM HTTP Server or the web server plug-in.

User	Directory
Root and nonroot	AIX HP-UX Linux Solaris *product_root*/gsk8 Windows *product_root*\gsk8

profile_root

Table 86. Default profile directories.

This table shows the default directories for a profile named profile_name on each distributed operating system.

User	Directory
Root	AIX /usr/IBM/WebSphere/AppServer/profiles/*profile_name* HP-UX Linux Solaris /opt/IBM/WebSphere/AppServer/profiles/*profile_name* Windows C:\Program Files\IBM\WebSphere\AppServer\profiles*profile_name*
Nonroot	AIX HP-UX Linux Solaris *user_home*/IBM/WebSphere/AppServer/profiles Windows *user_home*\IBM\WebSphere\AppServer\profiles

plugins_root

Table 87. Default installation root directories for the Web Server Plug-ins.

This table shows the default installation root directories for the Web Server Plug-ins for WebSphere Application Server.

User	Directory
Root	AIX /usr/IBM/WebSphere/Plugins HP-UX Linux Solaris /opt/IBM/WebSphere/Plugins Windows C:\Program Files\IBM\WebSphere\Plugins
Nonroot	AIX HP-UX Linux Solaris *user_home*/IBM/WebSphere/Plugins Windows C:\IBM\WebSphere\Plugins

wct_root

Table 88. Default installation root directories for the WebSphere Customization Toolbox.

This table shows the default installation root directories for the WebSphere Customization Toolbox.

User	Directory
Root	AIX /usr/IBM/WebSphere/Toolbox HP-UX Linux Solaris /opt/IBM/WebSphere/Toolbox Windows C:\Program Files\IBM\WebSphere\Toolbox
Nonroot	AIX HP-UX Linux Solaris *user_home*/IBM/WebSphere/Toolbox Windows C:\IBM\WebSphere\Toolbox

web_server_root

Table 89. Default installation root directories for the IBM HTTP Server.

This table shows the default installation root directories for the IBM HTTP Server.

User	Directory
Root	AIX `/usr/IBM/HTTPServer` HP-UX Linux Solaris `/opt/IBM/HTTPServer` Windows `C:\Program Files\IBM\HTTPServer`
Nonroot	AIX HP-UX Linux Solaris *user_home*`/IBM/HTTPServer` Windows `C:\IBM\HTTPServer`

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Index

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