



IBM Software Group

IBM® WebSphere® Application Server V6

Hung Thread Detection



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This presentation will focus on the hung thread detection feature of WebSphere Application Server V6.

Goals

- Explain the hung thread detection feature of WebSphere Application Server V6
 - ▶ Functionality
 - ▶ Configuration



The goal of this presentation is to explain how hung thread detection works in WebSphere Application Server V6, and how you can customize the hang detection policy.

Hung Thread Detection

- Hung threads can be hard to diagnose
- Often not noticed until enough threads have hung to cause an end-user problem
- The thread monitor architecture monitors managed threads
 - ▶ Enabled by default
 - ▶ Introduced in V5.1.1



Hung threads have traditionally been hard to diagnose. This is usually because hung threads will go unnoticed until enough threads have hung to cause a problem for your users, such as an application not responding even though it appears to be running. The thread monitor architecture, which was introduced in version 5.1.1, monitors managed threads, meaning threads that belong to a thread pool, and issues a notification if it detects any hung threads. Threads created by application code cannot be monitored by the thread monitor.

Hung Thread Detection (cont.)

- No action taken to kill the thread. Only a notification mechanism
- When a thread is suspected to be hung, notification is sent 3 ways:
 - ▶ Java™ Management Extensions (JMX) notification for JMX listeners
 - ▶ ThreadPool metric for Performance Monitoring Infrastructure (PMI) clients
 - ▶ Message written to SystemOut.log:

```
[7/15/04 15:03:11:502 EDT] 3c3b4e37 ThreadMonitor W WSVR0605W:  
Thread "Servlet.Engine.Transports : 0" (37c18e37) has been active  
for 68,839 milliseconds and may  
be hung. There are 1 threads in total in the server that may be  
hung.
```

The thread monitor doesn't try to deal with the hung threads, it just issues notifications, so that you can then take action to resolve the issue.

When a hung thread is detected, three notifications are sent: a JMX notification for JMX listeners, PMI Thread Pool data is updated for tools like the Tivoli® Performance Viewer, and a message is written to the SystemOut log to indicate the name and ID of the hung thread, as well as the time for which it has been hung.

Hung Thread Detection: Internals

- When the thread pool gives work to a thread, it notifies the thread monitor
 - ▶ Thread monitor notes thread ID and timestamp
- Thread monitor compares active threads to timestamps
 - ▶ Threads active longer than the time limit are marked “potentially hung”
- Performance impact is minimal (< 1%)



When the thread pool issues work to a thread, it sends a notification to the thread monitor, which notes the thread ID and the time in a list.

At user-configurable intervals, the thread monitor looks at the active threads, and compares them to the list, to determine how long each thread has been active. If a thread has been active longer than the user-specified threshold, the thread is marked as “potentially hung”, and the notifications are sent as discussed on the previous slide.

The performance impact of this monitoring is less than 1%.

Hung Thread Detection: Internals (cont.)

- What about false alarms?
 - ▶ e.g., a thread that takes several minutes to complete a long-running query
- If a thread previously reported to be hung completes its work, a notification is sent:

```
[7/15/04 15:03:47:684 EDT] 37c18e37 ThreadMonitor W WSVR0606W: Thread "Servlet.Engine.Transports : 0" (37c18e37) was previously reported to be hung but has completed. It was active for approximately 105,021 milliseconds. There are 0 threads in total in the server that still may be hung.
```

- The monitor has a self-adjusting system to make a best effort to deal with false alarms



It's possible that a thread could actually be running for longer than the specified threshold for legitimate reasons. For example, a thread could be executing a large database query that takes several minutes to return.

The thread monitor is built to recognize false alarms and adjust itself automatically. When a thread that was previously marked as "potentially hung" completes its work and exits, a notification is sent. After a certain number of false alarms, the threshold is automatically increased by 50% to account for these long-running threads. The idea is that if there are several threads that are routinely active for 20 minutes, the threshold will eventually adjust itself to be higher than 20 minutes, so as to not mark those threads as hung.

Hung Thread Detection: Configuration

- Create custom properties on the application server:

Property	Units	Default	Description
com.ibm.websphere.threadmonitor.interval	secs.	180	interval at which the thread pools will be polled for hung threads
com.ibm.websphere.threadmonitor.threshold	secs.	600	the length of time that a thread can be active before being marked as "potentially hung"
com.ibm.websphere.threadmonitor.false.alarm.threshold	N/A	100	the number of false alarms that can occur before automatically increasing the threshold by 50%.

- Can also be configured on the fly using wsadmin
 - ▶ Information Center shows an example of this



The hang detection policy can be configured by creating custom properties for the application server.

`com.ibm.websphere.threadmonitor.interval` is the interval at which the thread pools will be polled for hung threads (in seconds). It defaults to 180 seconds, which is 3 minutes.

`com.ibm.websphere.threadmonitor.threshold` is the length of time that a thread can be active before being marked as "potentially hung". The default value is ten minutes.

`com.ibm.websphere.threadmonitor.false.alarm.threshold` is the number of false alarms that can occur before automatically increasing the threshold by 50%. The default value is 100. Automatic adjustment can be disabled altogether by setting this property to zero.

The application server must be restarted for these changes to take effect. To adjust the hang detection policy on the fly, use `wsadmin`. The WebSphere Application Server Information Center has detailed instructions on adjusting the policy with `wsadmin`.

Further Investigation

- A Java thread dump will show the stack traces for all threads
 - ▶ Find the hung threads using the thread ID
 - ▶ Use the stack trace to investigate the cause of the hang



After being notified of a hung thread problem, the most logical next step is to trigger a Java thread dump. Use the thread ID from the notification to find the hung thread in the dump, and use the stack trace information to begin investigating the cause of the problem.

Summary

- WebSphere Application Server V6 can detect hung threads
 - ▶ Produces notifications via JMX, PMI, and log file
 - ▶ Hang detection policy can be configured using custom properties



In summary, this presentation has focused on the new hung thread detection feature of WebSphere Application Server V6. The thread monitor monitors thread pools in an Application Server and notifies you of hung threads via JMX, PMI, and the SystemOut.log file. The policy that governs the behavior of the thread monitor can be configured using custom properties.

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