IBM® WebSphere® Extended Deployment V6.1

Dynamic operations overview

This presentation will give an overview of the dynamic operations features in WebSphere Extended Deployment Version 6.1.

Agenda

- Dynamic operations overview
  - ▶ Example scenario
  - ▶ Benefits
- Key concepts

This presentation will begin by illustrating the main ideas behind dynamic operations using a simple example scenario that highlights the benefits of a dynamic WebSphere Extended Deployment environment. It will then introduce some of the key concepts involved in creating a dynamic operations-based WebSphere Extended Deployment environment.

Section

Overview

This section will give an overview of dynamic operations.

Dynamic operations overview

- Virtualized, policy-based, dynamic workload management

- On-demand router
  - Enhanced version of the Network Deployment proxy server
  - Controls request prioritization, flow, and routing in an Extended Deployment environment

- Dynamic application placement
  - Enables starting and stopping server instances based on application load and user-defined goals

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The dynamic operations features of WebSphere Extended Deployment gives you the capability to build a dynamic, virtualized, goal-oriented environment for workload management. The two major features that enable these capabilities are the on demand router and dynamic application placement. The on demand router is an intelligent HTTP proxy server that manages request prioritization, flow control and dynamic routing of requests to your application servers.

Dynamic application placement enables starting and stopping additional server instances to accommodate changes in load, balancing processing power among your applications to best meet your defined performance goals.
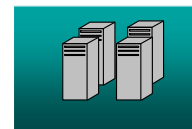
Example scenario

- Multiple critical applications, each with dedicated resources
  - ▸ Supply chain management
  - ▸ Inventory reporting
  - ▸ Retail sales (browsing, purchasing, and so on)
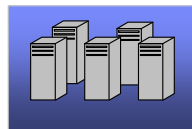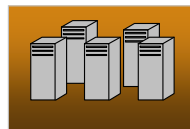
**Supply chain**   **Inventory**   **Retail**

Picture an example scenario in which there are three critical applications deployed to a typical WebSphere Application Server cell. Each of these applications is deployed to its own cluster.

Challenges

- Each application must be sized to support peak load
  - Idle resources during non-peak times

- Inability to use idle resources to handle extra load
  - Quality of service may suffer during periods of exceptional load

6:00a.m.

Supply chain   **Inventory**   **Retail**

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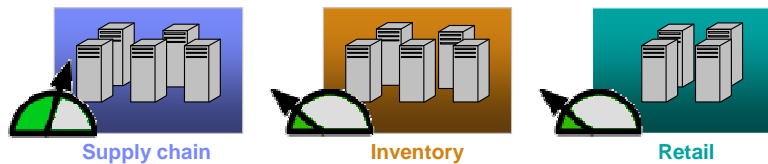
Each of these clusters must be individually sized to support its expected peak load. The hardware resources allocated to each application sits idle during non peak times, and these idle resources cannot be used to handle extra load if other applications are overloaded. Not only does this situation leave you unable to take full advantage of your hardware investment, but the quality of service for each application may suffer during periods of exceptional load.

Challenges

- Each application must be sized to support peak load
  - ▶ Idle resources during non-peak times

- Inability to use idle resources to handle extra load
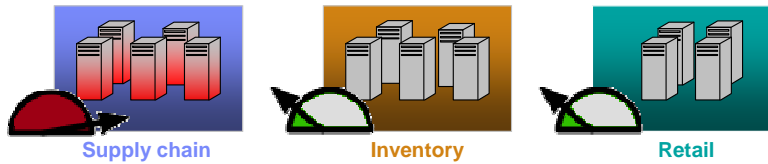 - ▶ Quality of service may suffer during periods of exceptional load

6:30a.m.

Supply chain   **Inventory**   **Retail**

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In this example scenario, the supply chain application is heavily loaded early in the day, and it is completely utilizing its available processing power for a while, leading to lower response times. During this time, the other two applications are not heavily used, but the hardware dedicated to them cannot be used to improve the quality of service for the supply chain application.

After low mid-day traffic, the same situation arises when the inventory reporting application becomes overloaded later.

Dynamic operations

- Resources are treated as virtualized pools of resources

- User-defined policies specify operational goals and relative importance of applications

- Pooled resources are dynamically allocated to meet the defined goals

Supply Chain   Inventory   Retail

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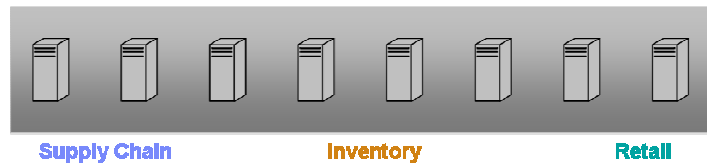
In a WebSphere Extended Deployment environment, rather than statically allocating hardware resources, hardware is treated as a single virtual pool of resources, known as a Dynamic Cluster. Resources can be dynamically allocated within the Dynamic Cluster to meet the operational goals that you have defined for your applications.

Dynamic operations

- Resources are treated as virtualized pools of resources

- User-defined policies specify operational goals and relative importance of applications

- Pooled resources are dynamically allocated to meet the defined goals

6:30a.m.

Supply Chain   **Inventory**   **Retail**

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Dynamic operations overview

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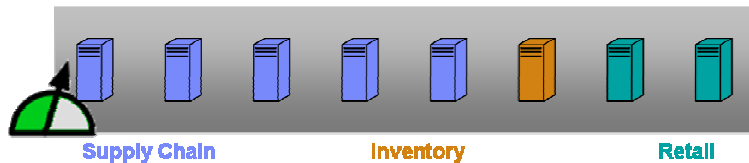
If the example environment were turned into a virtualized WebSphere Extended Deployment environment, the supply chain application could be dynamically started on more servers to maintain a consistent quality of service despite the increased load.
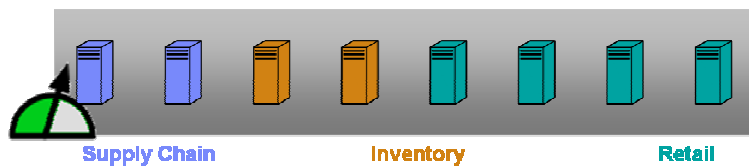
The currently low mid-day retail load has plenty of room for growth, and the inventory reporting application can take advantage of several servers later in the day to maintain its high quality of service. Each physical node can run multiple applications at the same time, so the division of workload can be more fine-grained than this example demonstrates, because multiple applications may be sharing the same hardware resource.
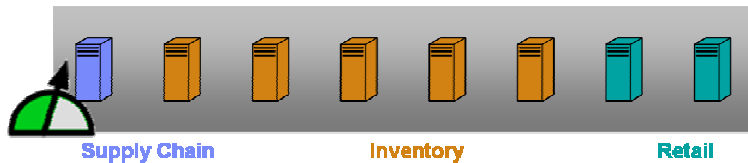
WebSphere Extended Deployment monitors hardware utilization to carefully balance application needs against the capabilities of each node.

Benefits

- Enables more efficient hardware utilization
  - ▶ Dynamic allocation of resources to handle variations in traffic
    - Takes advantage of differing peak times
  - ▶ Server consolidation reduces total cost of ownership

- Helps ensure a consistent level of service for critical applications
  - ▶ Decisions are based on user-defined policies
  - ▶ In times of contention, more important requests will perform better than less important requests

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By taking advantage of differing peak times in application load, hardware can be utilized much more efficiently in a dynamic operations environment, resulting in lower overall hardware costs. A dynamic operations environment also helps ensure a consistent quality of service for your applications with less administrative monitoring. WebSphere Extended Deployment can allocate hardware resources to help ensure that applications meet their defined goals and route work accordingly. This allows the most important requests to perform better than less important requests when there is contention for resources.

Section

Key concepts

This section will cover the key concepts and components of a dynamic operations environment.

Dynamic clusters

- A dynamic group of servers to which applications can be deployed

- Similar to a static cluster, but the number of active servers can be resized dynamically at run-time

- Each dynamic cluster has a template that defines settings for member servers
  - ▶ Modifying this template affects all servers in the dynamic cluster
  - ▶ Static clusters require changing each individual server to achieve the same effect

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A dynamic cluster is similar to the familiar concept of a 'cluster' from WebSphere Application Server, but can be resized dynamically at run-time. As demand for applications running on a dynamic cluster increases or decreases, instances of that dynamic cluster can be started or stopped on nodes within the cluster to accommodate the changes in load. Each node in the set of defined cluster members has a configured instance of the dynamic cluster that is ready to be started dynamically when needed. These server instances are configured based on a server template that defines the configuration for all of the cluster members. This template is used as a single point of configuration for all members of the dynamic cluster. A template is not created if a dynamic cluster is created from existing servers.

Dynamic cluster membership methods

- A membership method determines which servers can join the dynamic cluster

- You can choose to manually define dynamic cluster members from existing servers

- You can select to automatically define dynamic cluster members with rules
  - Create a membership expression in the administrative console (sub-expression builder tools are available)
  - Each existing node is evaluated against the expression. If it is a match, the node will be considered a candidate to host a cluster member.

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When you create a dynamic cluster, you must specify which nodes can host members of the dynamic cluster. WebSphere Extended Deployment version 6.1 allows two methods to determine which nodes can join the dynamic cluster. You can identify pre-existing servers as members of your dynamic cluster or you can specify a "membership policy", which is a rule that specifies the set of nodes that can host dynamic cluster members.

Before WebSphere Extended Deployment version 6.1, members of a dynamic cluster were scoped explicitly by node group. In version 6.1 you have more options available to delimit your dynamic cluster. In addition to node group, you can define membership rules based on node name, node host name, and node property values. You can create complex rules using Boolean operators and, or, and not.

The membership policy is evaluated against the nodes in your cell when the dynamic cluster is created. WebSphere Extended Deployment will create servers for the dynamic cluster using nodes that match the membership policy that you define. If new nodes are added to your environment, they will automatically be added to the dynamic cluster if they match the defined membership policy. Similarly, if you change a membership policy, it is reevaluated and new server instances are created or removed based on the new policy definition. If you change a node's properties such that it should be added to or removed from an existing dynamic cluster the corresponding server instances are added or removed on that node when you save your changes.

The default membership policy includes all nodes in the cell that have been augmented for WebSphere Extended Deployment version 6.1 operations optimization.

Dynamic cluster isolation

- Dynamic clusters can be defined with isolation
    - ▶ Useful when you want particular nodes to run certain applications isolated from other applications
    - ▶ No isolation requirements - Default setting
        - Instances of the dynamic cluster can be co-located with any other running process on a particular node
    - ▶ Strict isolation
        - Denotes that an instance of dynamic cluster cannot be co-located with any other running instance of other dynamic clusters
        - It can be co-located with other vertically stacked instances of itself
    - ▶ Associate with isolation group
        - An easy way to specify a collection of one or more dynamic clusters whose running instances can be co-located with one another.

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At times you may have applications that should not run on the same node as other applications. Dynamic cluster isolation allows you to specify to the application placement controller which dynamic cluster instances can coexist on the same node. WebSphere Extended Deployment version 6.1 provides three options for configuring the dynamic cluster isolation requirements: no isolation requirements, strict isolation, and associate with isolation group.

"No isolation requirements" is the default isolation policy. It specifies that instances of the dynamic cluster can be co-located with any other running process when placed on a node. This is the same behavior as previous versions of WebSphere Extended Deployment.

"Strict isolation" specifies that when an instance of the dynamic cluster is placed on a node, it must not be co-located with running instances of any other dynamic clusters. In other words, it can only be co-located with other vertically stacked instances of itself.

"Associate with isolation group" is a convenient way to specify a collection of one or more dynamic clusters whose running instances can be co-located with each other. The application placement controller can place running instances of a dynamic cluster with an isolation policy of "associate with isolation group" on the same node as other running dynamic cluster instances, so long as their dynamic clusters are members of the same isolation group.

Note that when a dynamic cluster is in manual mode it is up to the administrator of that
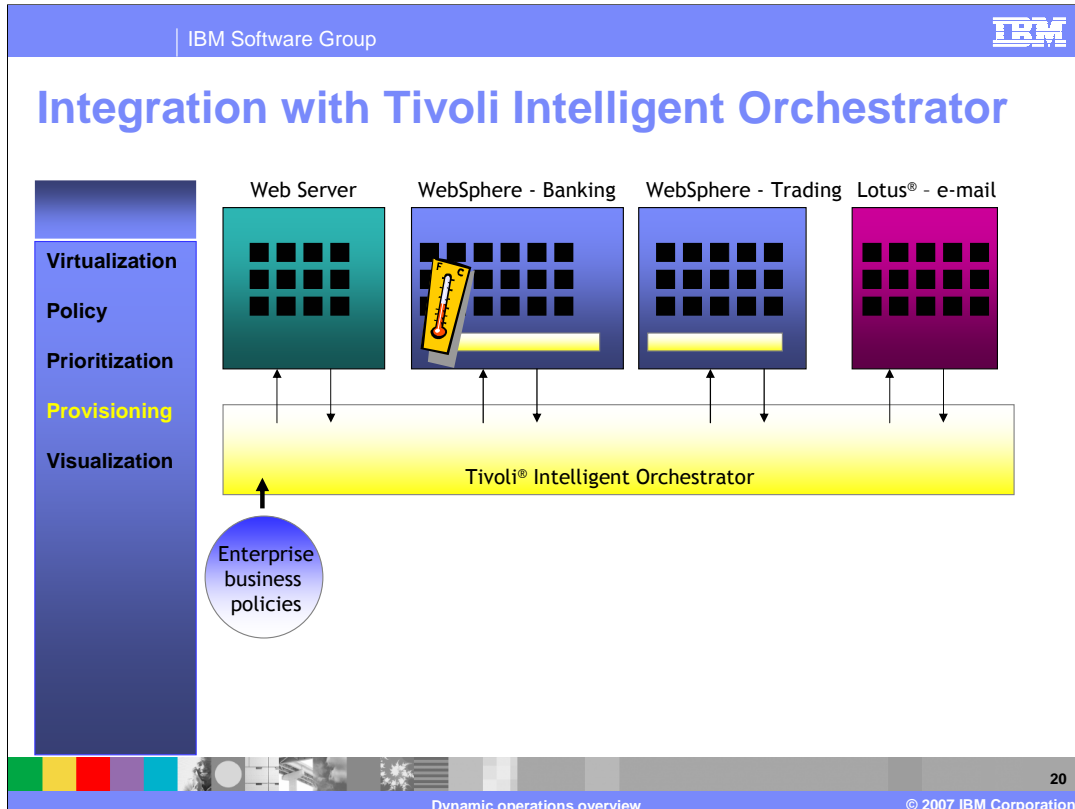
On-demand router

- Intelligent HTTP proxy server

- Enhanced version of the proxy server from Network Deployment 6.1

- Can replace or complement the HTTP server plug-in

- Prioritizes requests and controls traffic flow according to operational policy
  - Ensures consistent quality of service
  - Enables more elegant degradation of performance when all resources are consumed

- Integrates with application placement to route requests to dynamic cluster members

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The on demand router is an intelligent HTTP proxy server that is provided with WebSphere Extended Deployment. It is the point of entry into a WebSphere Extended Deployment environment, and is responsible for request prioritization, flow control, and request distribution to application servers. It can momentarily queue requests for less important applications in order to allow requests for more important applications to be handled more quickly. It is aware of the current location of dynamic cluster instances, so that requests can be routed to the correct endpoint. The on demand router can also dynamically adjust the amount of traffic sent to each individual server instance based on processor utilization and response times. These and other advanced features distinguish the on demand router from the HTTP server plug-in, and give the on demand router the ability to ensure a more consistent quality of service for your enterprise applications. It can be used in place of, or together with the HTTP server plug-in, depending on your needs.

Application placement controller

- Decides how many instances of each dynamic cluster should run, and where they should run

- Determines the available capacity (memory, processor) of each node
  - ▶ Aware of the capacity in use by other processes and subtracts from available capacity
  - ▶ Isolation Policy is taken into account

- One application placement controller per cell
  - ▶ This change accommodates overlapping node groups

The application placement controller is the component that decides how many instances of each dynamic cluster should be running to most effectively handle the current amount of traffic. It determines the available processor and memory capacity of each node, including resources that are in use by other processes. It uses this information to determine the optimal placement of each application to best meet your defined performance goals. The dynamic cluster's isolation policy requirements are also considered when the application placement controller determines where to place instances of a dynamic cluster. Each cell has one application placement controller, which is a highly available singleton service that runs inside one of the node agents within the cell.

Integration with Tivoli Intelligent Orchestrator

Web Server | WebSphere - Banking | WebSphere - Trading | Lotus® – e-mail

Virtualization

Policy

Prioritization

Provisioning

Visualization

Tivoli® Intelligent Orchestrator

Enterprise business policies

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WebSphere Extended Deployment can be integrated with Tivoli Intelligent Orchestrator for server provisioning in a larger, heterogeneous environment. Tivoli Intelligent Orchestrator is a product that provides the capability to dynamically allocate hardware resources across products within an enterprise. Business policies dictate the allocation of enterprise-wide server resources, which can be reallocated based on need.

For example, if a WebSphere Extended Deployment cell has exhausted all of the resources available to it, servers that were previously part of an underutilized Lotus e-mail environment can be reprovisioned as WebSphere Extended Deployment servers, and be added into the WebSphere Extended Deployment cell to begin hosting Dynamic Cluster instances. WebSphere Extended Deployment provides the required hooks for operating within a Tivoli Intelligent Orchestrator environment.

Summary

- WebSphere Extended Deployment creates a dynamic, virtualized, goal-based environment for application hosting
  - ▶ The environment can adapt to varying traffic levels and allocate server resources as necessary

- Dynamic clusters are similar to clusters, but the number of active servers can be resized dynamically at run-time
  - ▶ The application placement controller decides when this should take place

In summary, WebSphere Extended Deployment enables you to create a dynamic, virtualized, goal-based environment for hosting your enterprise applications. This environment can adapt to varying traffic levels and allocate server resources as necessary to help meet the performance goals of your applications. Applications are installed to dynamic clusters, which can be dynamically resized within the virtual pool of resources. The application placement controller is the component that is responsible for making placement decisions based on current load levels and user-defined performance goals.

Summary

- The on-demand router is a new component provided by WebSphere Extended Deployment
    - ▶ On-demand router is an intelligent HTTP proxy server
    - ▶ Performs request classification, flow control, and dynamic workload management

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Finally, the on demand router is the point of entry for HTTP requests into a dynamic operations environment. It performs request classification based on user-defined rules, ensures that more important requests flow through to the back end more quickly than less important requests, and dynamically routes requests to application servers and dynamic cluster members running in the application server tier.

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