Managing Clusters

At the end of this module, you will be able to:

- ✓ Deploy applications to a cluster
- ✓ Manage session state in a cluster
- ✓ Troubleshoot a cluster

Road Map

1. **Deploying Applications to Clusters**
   - Packaging applications
   - Two-phase and side-by-side deployment
   - Deployment best practices
2. Session Management
3. Troubleshooting a Cluster

Packaging Applications

- When deploying applications to a single managed server, they can be deployed in exploded format.
- When deploying applications to a cluster of managed servers, they must be packaged into a .war, .ear or .jar.

Two-phase Deployment

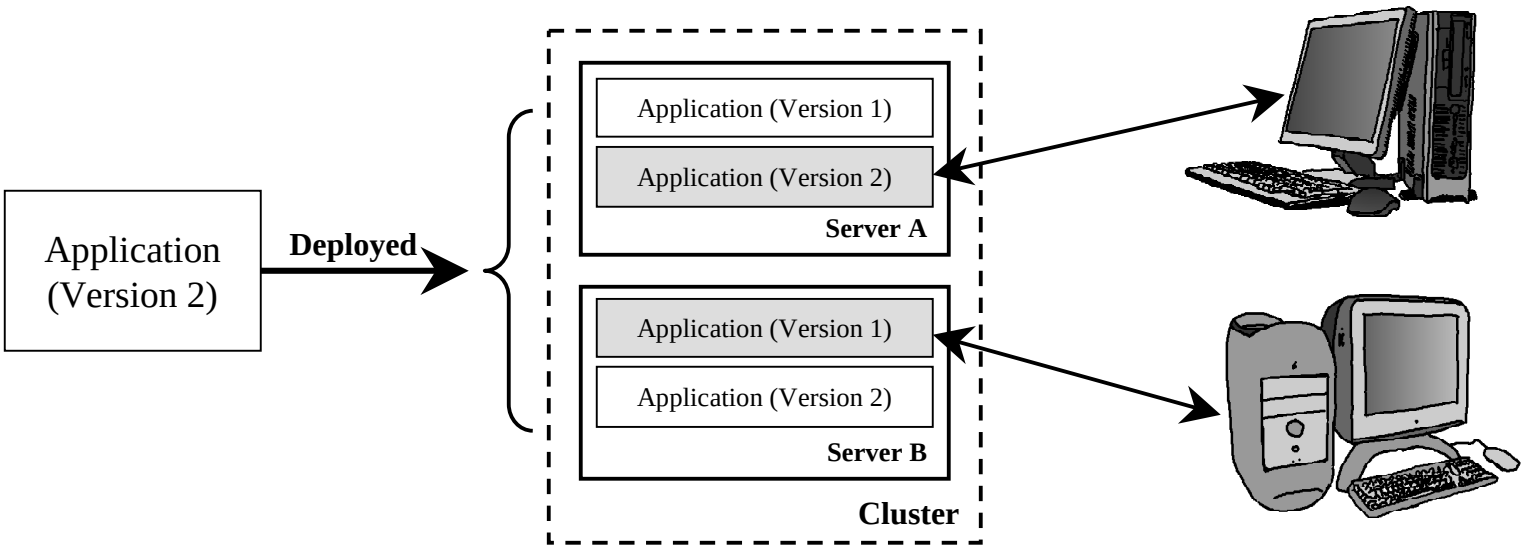
- Applications are deployed using two-phase deployment (TPD).
- Applications are copied to the cluster and activated in two phases:
  - Phase 1: distributes application components and modules to the server
  - Phase 2: deploys the application if phase 1 is successful and permits client access
- This ensures that an application is available and active on each node before clients can access them

Deploying Applications to a Cluster

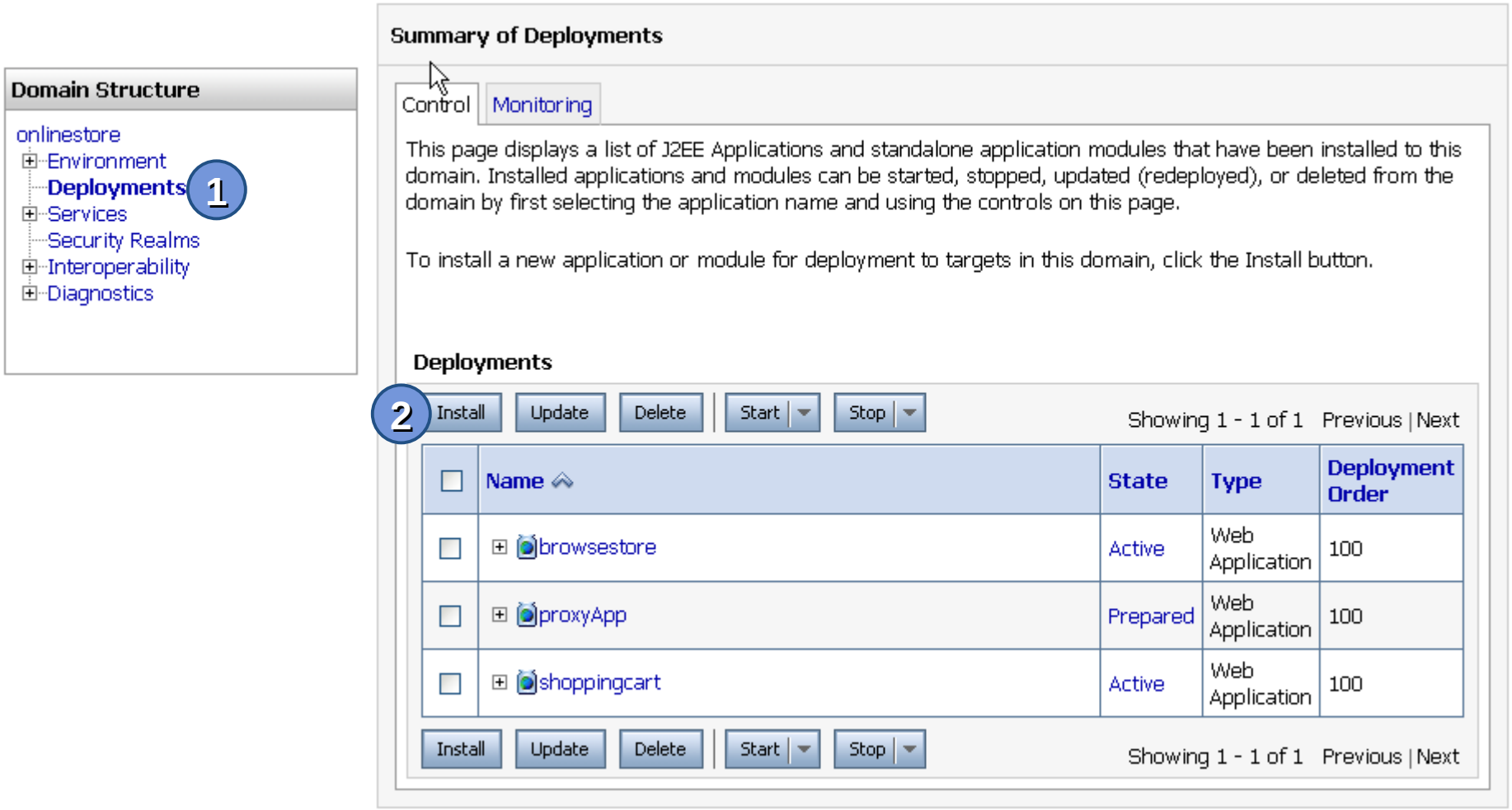
- All nodes must be running before an application can be deployed to a cluster.
- If phase 2 of two-phase deployment fails, the application will still be deployed to other nodes in the cluster.
- WebLogic allows partial deployment of applications to a partitioned server.
- Session replication for deployed applications may fail if a node was partitioned at the time of deployment.
  - Avoid this by using the enforceClusterConstraints tag with weblogic.Deployer
  - Or check the Enable Cluster Constraints box in the console
- Do not change cluster membership while deploying applications to the cluster.

Side-by-Side Redeployment in a Cluster

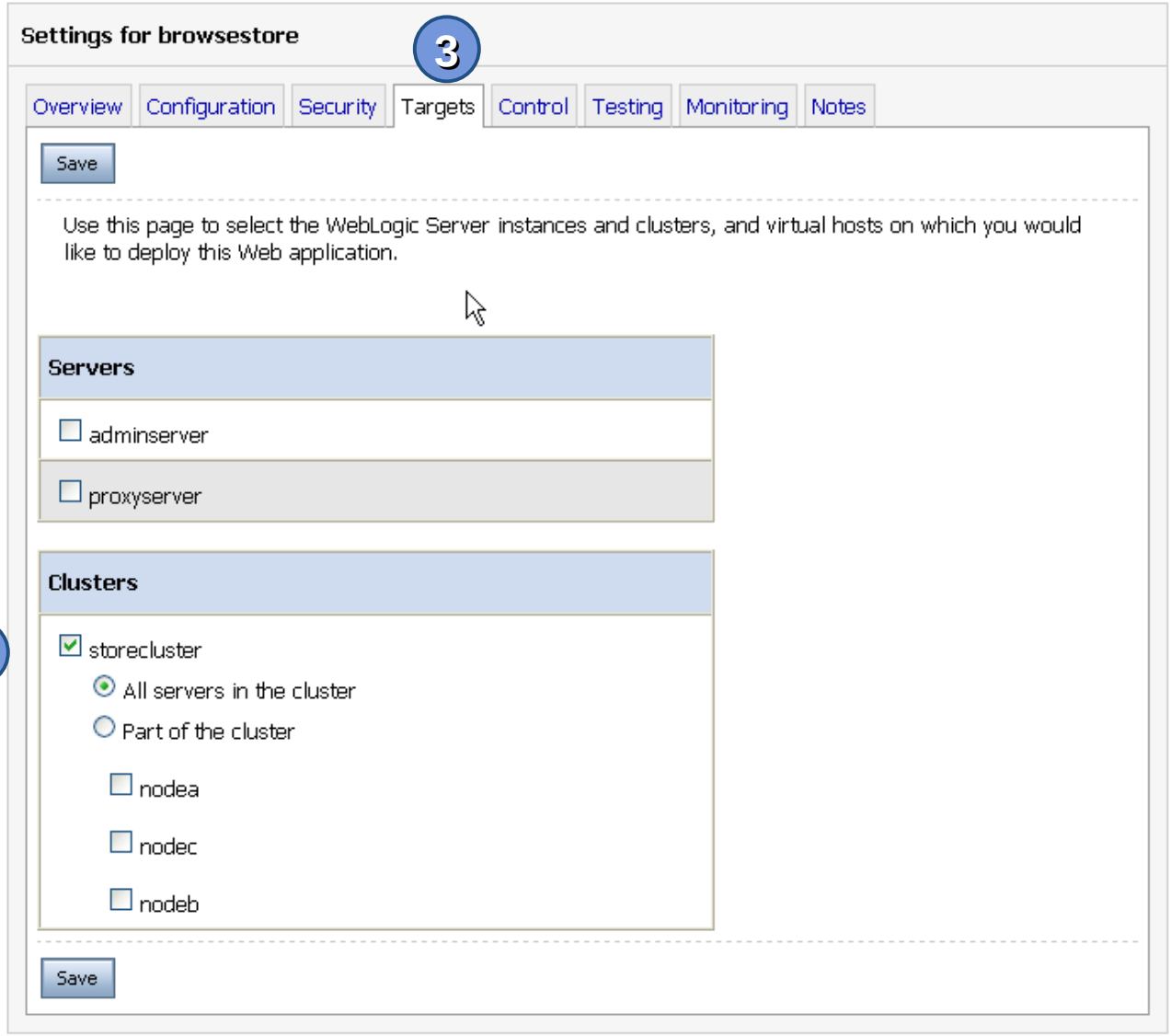
- When using production redeployment of an application in a cluster, each server instance in the cluster will retire the old version when work is complete on that server.
  - Therefore, different servers may be running different versions for a period of time



Deploying Applications to a Cluster...



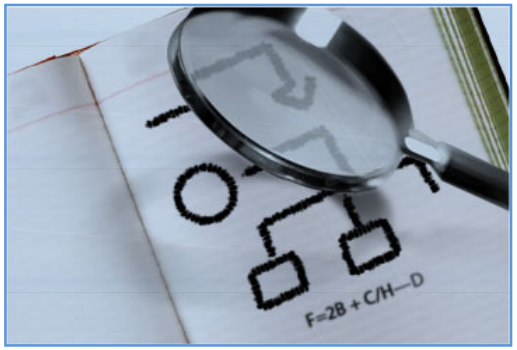
...Deploying Applications to a Cluster



Section Review

In this section, we learned how to:

- ✓ Package applications for deployment in a cluster
- ✓ Deploy applications in a cluster



Road Map

1. Deploying Applications to Clusters
2. **Session Management**
   - HTTP session clustering
   - Replication groups
   - In-memory replication
   - Persistent replication
   - Replication within a MAN or WAN
3. Troubleshooting a Cluster

HTTP Session State Replication

- WebLogic Server provides clustering support for JSPs and Servlets by replicating HTTP session state.
- To benefit from HTTP session state clustering, you must ensure that the session state is persistent, by configuring:
  - In-memory replication
  - JDBC replication
  - File system replication
- You must also access the cluster via a collection of Web servers with identically configured proxy plug-ins or load balancing hardware.
- Session persistence is configured using the `<session-descriptor>` element in the weblogic.xml deployment descriptor file.
  - Each persistence method has its own set of configurable parameters.

Machines

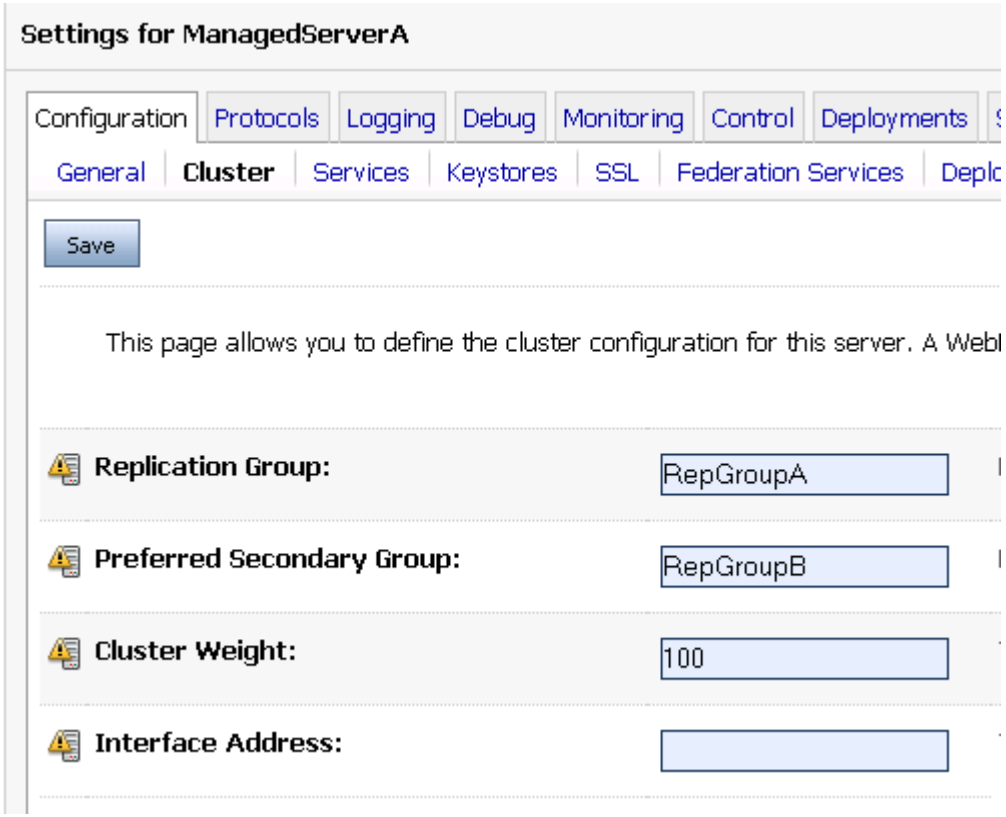
- In WebLogic server, machines names are used to indicate that a managed server runs on a particular piece of hardware.
- Machine definitions are one of the factors WebLogic takes into account when it chooses another server as its backup for session information.

Replication Groups

- A *replication group* is a logical grouping of related servers in a cluster.
- WLS lets you determine where to put backup objects, using replication groups.
- WLS attempts to:
  - Send backup objects to a *preferred secondary replication group*, if it is configured
  - Send backup objects to a different machine
  - *Avoid* sending backup objects to servers in the *same* replication group

Configuring Replication Groups

- Select each server in a cluster, and assign each a pair of replication groups.



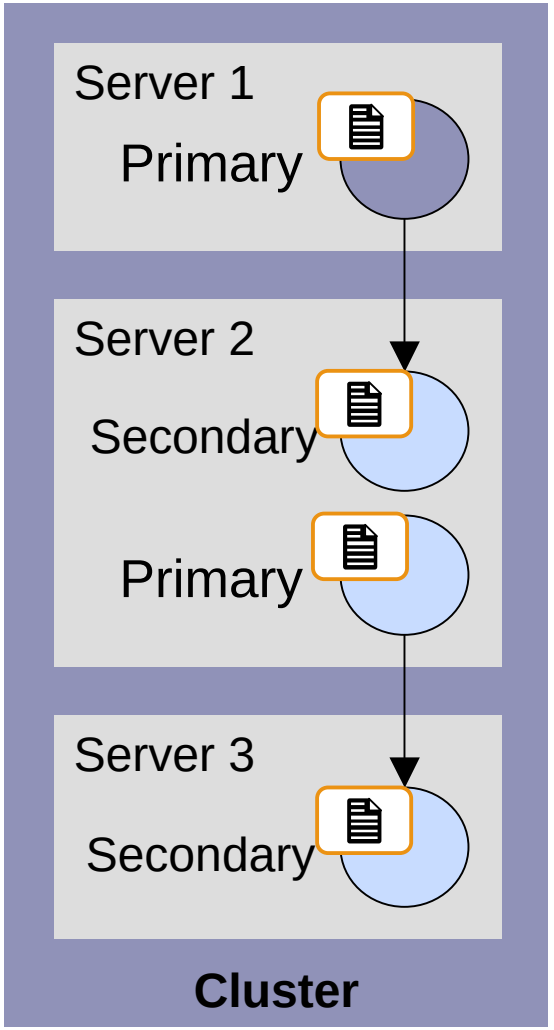
Ranking Servers

- WebLogic Server ranks the servers in a cluster, to determine which server to use as the backup.

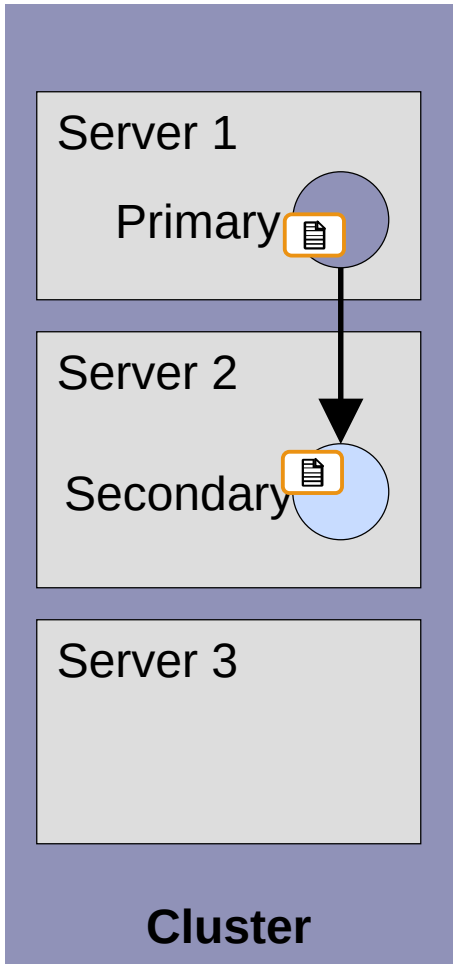
Is the Server a Member of a Preferred Secondary Group?	Does the Server Reside on a Different Machine?	Server Rank
Yes	Yes	1
Yes	No	2
No	Yes	3
No	No	4

In-Memory Replication

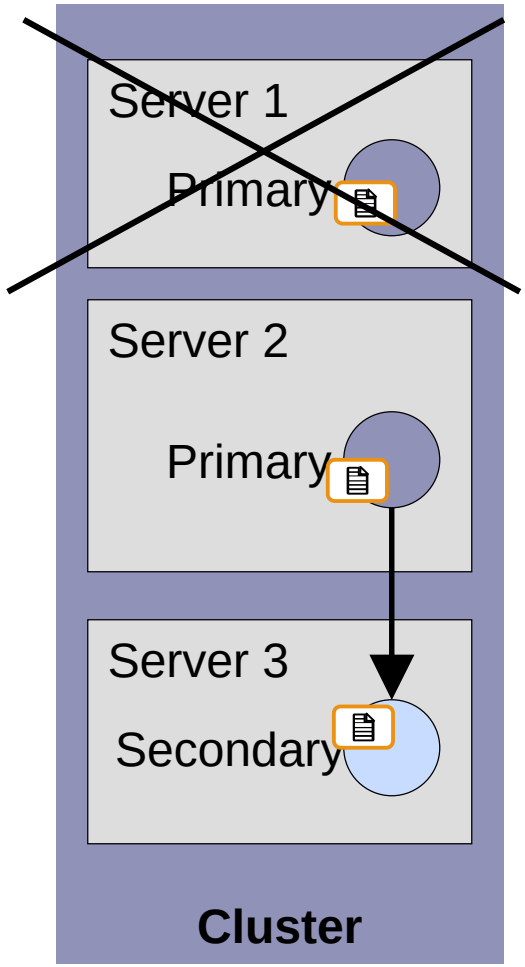
- WLS can replicate:
  - `HttpSession` objects
  - Stateful session EJBs
- Session objects exist on only two servers.
- Secondary:
  - The server is determined by the replication group and machine definition
  - The object is created immediately after the primary object is created
- Primary failure makes the backup object the primary object.



In-Memory Replication

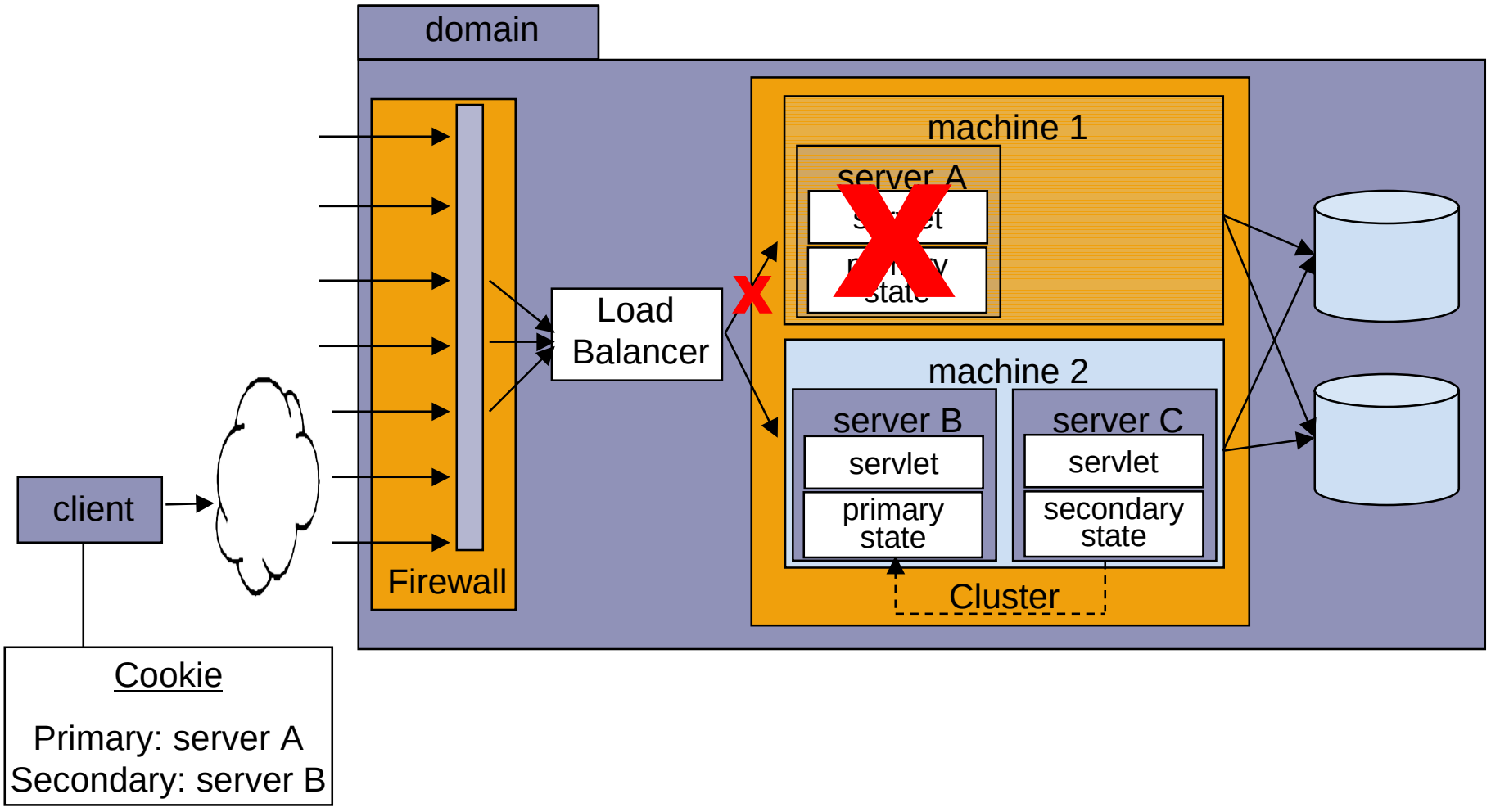


Before



After

Failover with Replication Groups



Requirements for In-Memory Replication

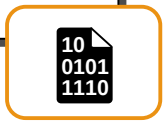
- Subsequent requests from the same client must have access to the same primary object.
- To utilize in-memory replication for HTTP session state, clients must access the cluster using either:
  - load-balancing hardware (WLS aware)
  - a collection of Web servers, or a single Web server, with WebLogic proxy plug-ins (configured identically)
  - WebLogic server configured with HTTPClusterServlet

Configuring In-Memory Replication

- To configure in-memory replication:
  1. Configure a proxy server (if applicable).
  2. Configure replication groups and/or machines (optional).
  3. Specify the persistence type in the `weblogic.xml` deployment descriptor:

Configuring In-Memory Replication Session Persistence:

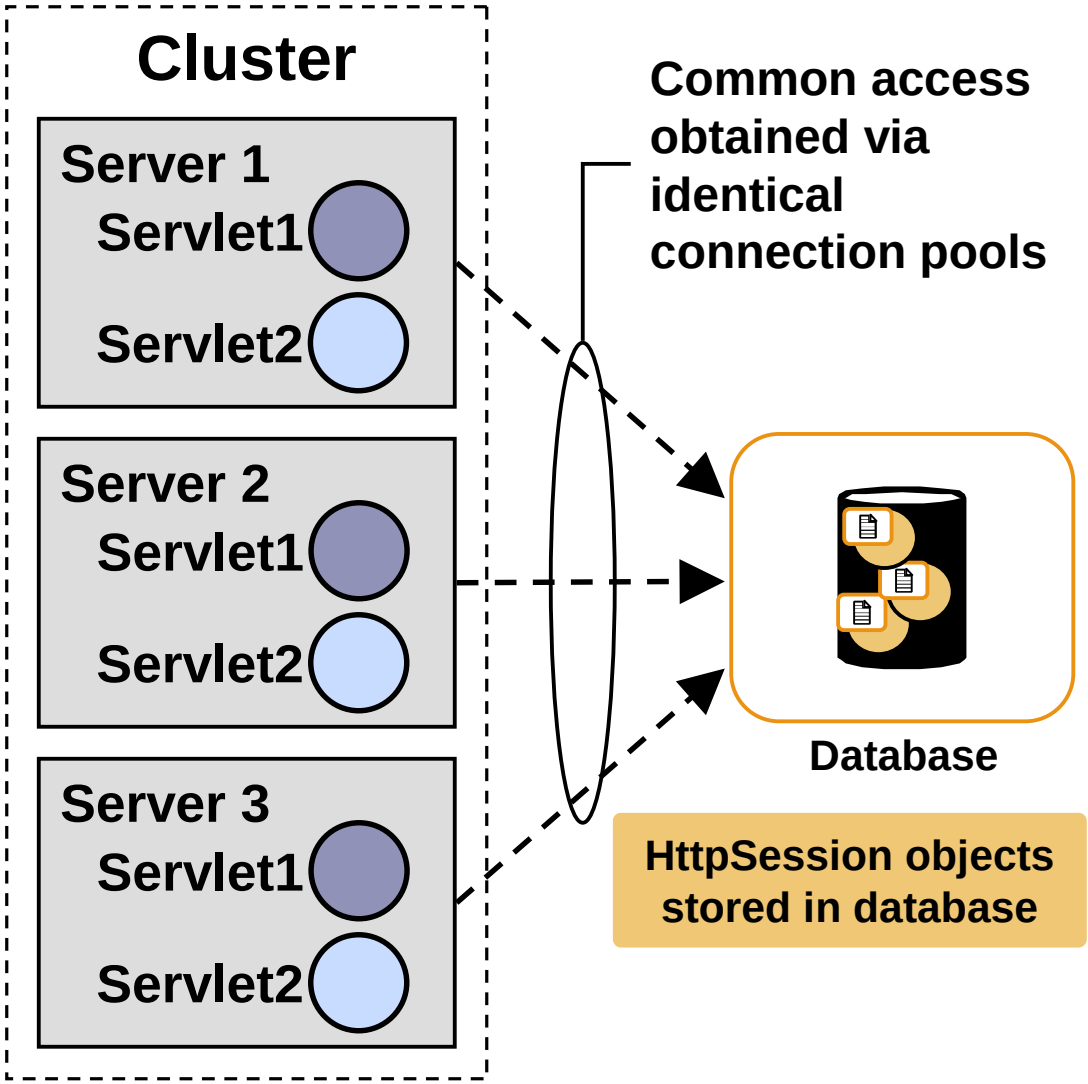
```
<session-descriptor>
   <persistent-store-type>replicated</persistent-store-type>
</session-descriptor>
```



<weblogic.xml>

Persistent JDBC Replication

- ALL server instances have access to ALL sessions.
- Subsequent requests from same client can be handled by ANY server.
- Changing session objects causes (slow) DB synchronization.
- Great failover capability.
- Significant performance reduction.

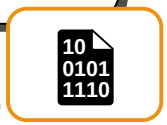


Configuring JDBC Replication

- To configure JDBC replication:
  1. Create a table in the database.
  2. Create a connection pool that has read/write privileges for your database.
  3. Configure your session persistence in the `weblogic.xml` deployment descriptor.

Example of Configuring Session Persistence:

```
<session-descriptor>
  <persistent-store-type>jdbc</persistent-store-type>
  <persistent-store-pool>SessionDS</persistent-store-pool>
  <persistent-store-table>WL_SERVLET_SESSIONS</persistent-
store-table>
</session-descriptor>
```



<weblogic.xml>

JDBC Persistent Table Configuration

- A database table named `WL_SERVLET_SESSIONS` must exist with read/write access:

	Column Head	Column Data Type
Prim. Key	`WL_ID`	char, 100 variable width char
Prim. Key	`WL_CONTEXT_PATH`	
	`WL_CREATE_TIME`	numeric, 20 digits
	`WL_IS_VALID`	char, 1 character
	`WL_SESSION_VALUES`	BLOB, very large
	`WL_ACCESS_TIME`	numeric, 20 digits
	`WL_IS_NEW`	numeric, 20 digits

File Persistence

- Session state may also be stored in a file
- For file-base persistence:
  - You must create the directory in which to store the file
  - The file must have the appropriate access privileges

Configuring File Persistence

- To configure file-based session persistence for a Web application:
  1. Create a folder shared by all servers on the cluster.
  2. Specify the `file` persistence type in the `weblogic.xml` deployment descriptor:

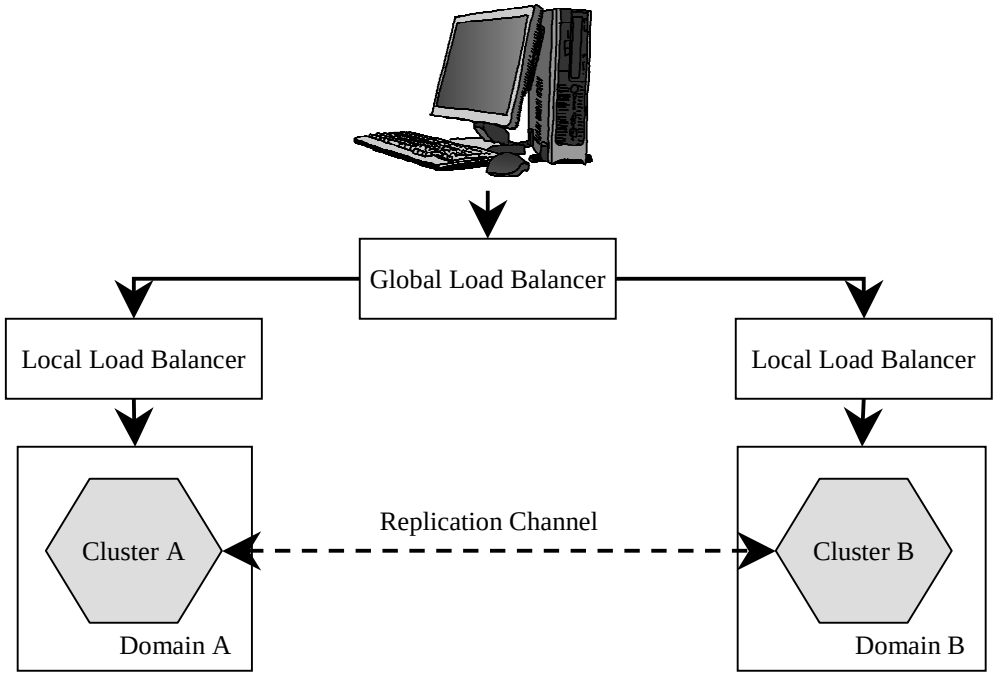
Example of Configuring Session Persistence:

```
<session-descriptor>
 <persistent-store-type>file</persistent-store-type>
 <persistent-store-dir>shared folder location</persistent-
store-dir>
</session-descriptor>
```

<weblogic.xml>

Session State Replication Across Clusters

- HTTP session state across clusters improves high-availability and fault tolerance.
- Cross-cluster replication is achieved using global and local hardware load balancers.



Session Replication in a MAN

- In the case of a MAN, if you want session replication between two cluster instances because they are relatively close together, you can replicate session states *synchronously*.
  - Assumes there is a high-speed, low-latency connection between the two clusters
  - Uses in-memory replication
- MAN replication relies on a global load balancer to maintain cluster affinity and a local load balancer to maintain server affinity.

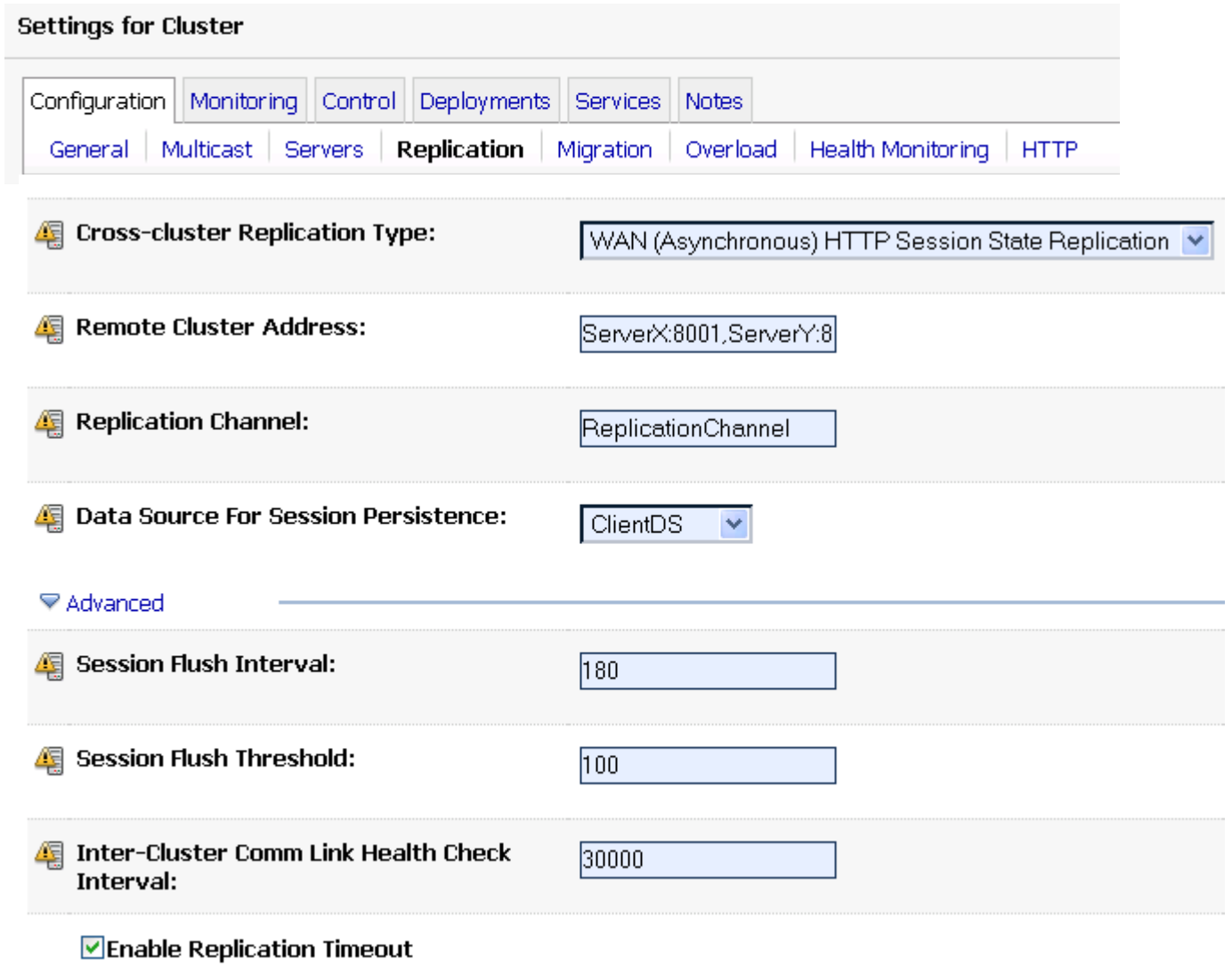
Session Replication in a WAN

- If you want to failover requests from one cluster to another across a WAN in the event that one of the clusters completely dies, you can use the *WAN session state replication*.
- WAN session state replication entails:
  - In-memory replication of the session state to a local server instance
  - Asynchronous JDBC persistence to a remote cluster instance

Configuration Requirements for Cross-Cluster Replication

- Load balancers must be installed
  - They must be able to maintain session ids
  - The cluster failover timeout should not be set too high
  - They must know which backup cluster to use when a primary cluster or server fails
- Domains must be configured
  - Each domain must be configured identically
  - Application deployment must be identical
  - The domains need to trust each other
- In a WAN environment, there must be a data source setup to maintain session state.
- The cluster must be configured for cross-cluster replication.

Configuring a Cluster for Cross-Cluster Replication



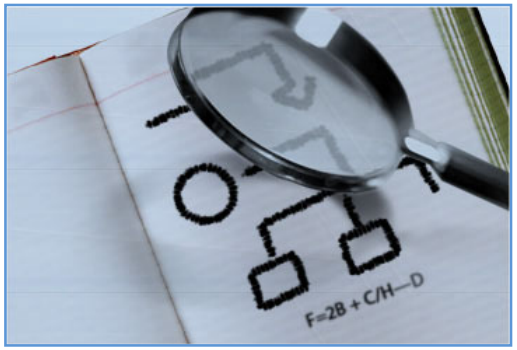
State Management Best Practices

- Create WLS machines if you are replicating state across servers on different physical machines.
- Use Replication Groups to define failover strategy.
- Choose the most apropos replication strategy depending upon application needs and architecture.
- Use the ServerDebugConfig MBean to track session replication problems.
- Ensure that objects placed in replicated sessions are serializable.

Section Review

In this section, we learned how to:

- ✓ Configure HTTP session clustering
- ✓ Configure replication groups
- ✓ Configure in-memory replication
- ✓ Configure JDBC and file persistent replication
- ✓ Replicate session state within a MAN or WAN



Road Map

1. Deploying Applications to Clusters
2. Session Management
3. **Troubleshooting a Cluster**
   - Invalid license
   - Server versions
   - Multicast
   - CLASSPATH
   - Thread Count
   - Garbage collection

Invalid License

- If a valid cluster-enabled license is not found in `license.bea` when WebLogic Server starts it will not join a cluster.
  - You will see the error message "Unable to find a license for clustering"

Server Version

- All servers in a cluster must have the same major version number.
  - Servers can have different minor version numbers and service packs
- The administration server should also have the same major version number

Multicast

- If there is an IP multicast problem, WLS starts but does not join a cluster.
- To verify that multicast is working, run the utility `utils.MulticastTest`.

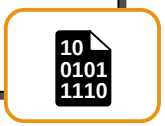
Valid IP Multicast Addresses:

```
224.0.0.0 to 239.255.255.255
```

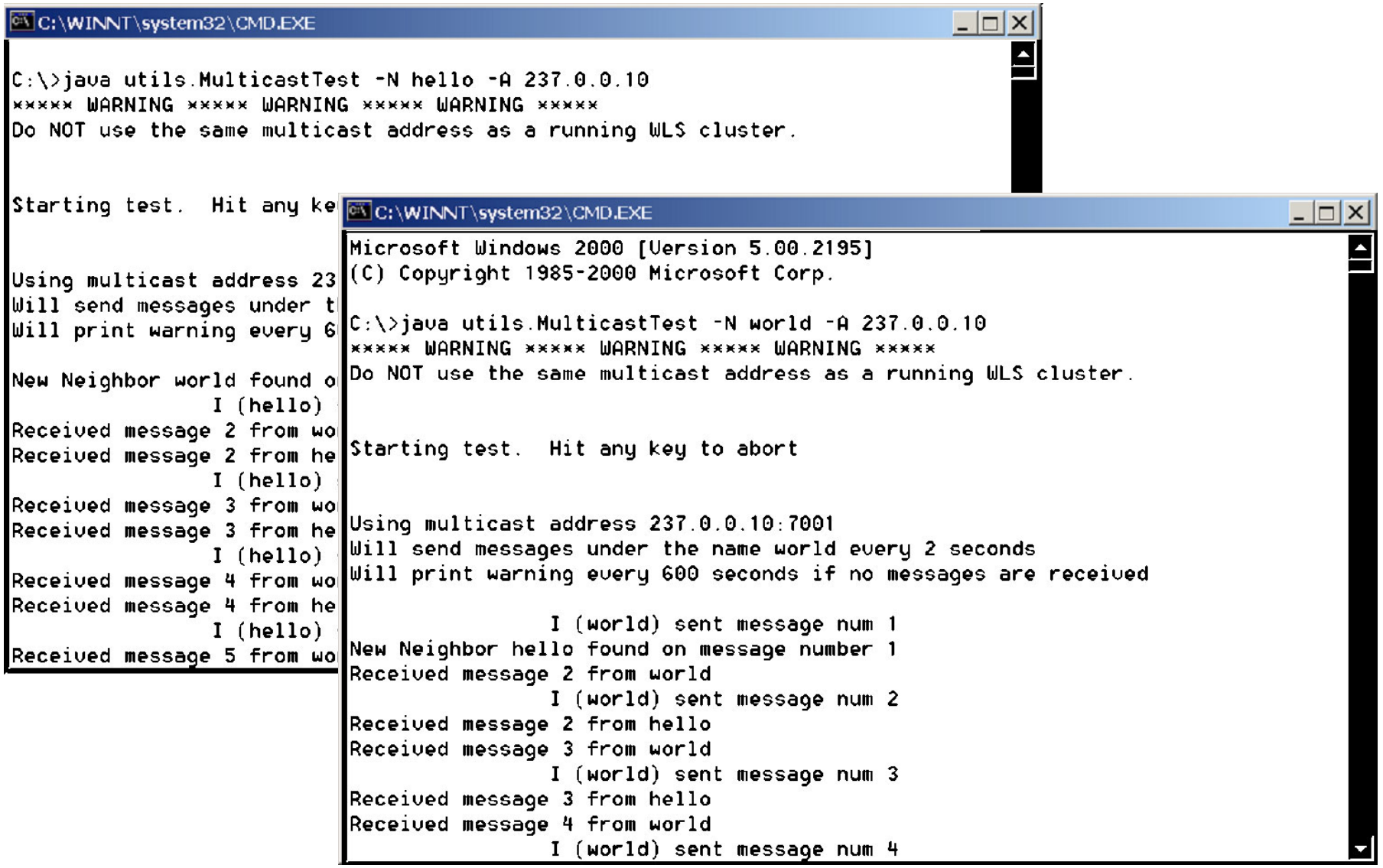
IP Multicast Test Utility:

```
java utils.MulticastTest -N <name> -A <multicastAddress>
```

```
-N name (REQUIRED)          -A address (REQUIRED)
-P port number              -T timeout in seconds
-S send pause               -L time to live
```



Example: Test Multicast



CLASSPATH

- The CLASSPATH value must be the same on all managed servers in the cluster.
- The CLASSPATH is set by the setEnv script when the startManagedWebLogic file is run.

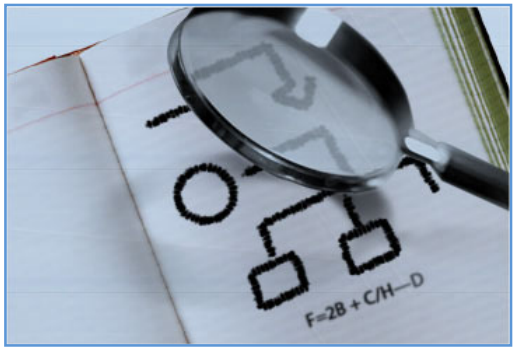
Garbage Collection

- The frequency and length of the garbage collection can effect a cluster.
- If garbage collection is taking too long, the servers will not be able to make the heartbeat signals.
- Heap allocation can be tuned to adjust the length of garbage collection.
  - This can be changed using the –ms and –mx parameters in the server startup script

Section Review

In this section, we learned how to:

- ✓ Troubleshoot common issues with starting a cluster of servers



Exercise

Manage HTTP Session States

- For details on the exercise, refer to the Lab Guide.
- If questions arise, ask the instructor.
- The instructor will determine the stop time.

Module Review

In this module, we learned how to:

- ✓ Deploy applications to a cluster
- ✓ Manage and configure session state in a cluster
- ✓ Troubleshoot common issues in a cluster