Clustering EJB Objects

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

- ✓ Understand EJB clustering capabilities
- ✓ Configure clusterable EJBs
- ✓ Understand EJB clustering best practices

Road Map

1. **EJB Clustering Capabilities**
   - Levels of Clustering
   - Load Balancing Algorithms
   - Replica Aware Stubs
2. Clustering Session EJBs
3. Clustering Entity EJBs

WebLogic Server EJB Clustering Capabilities

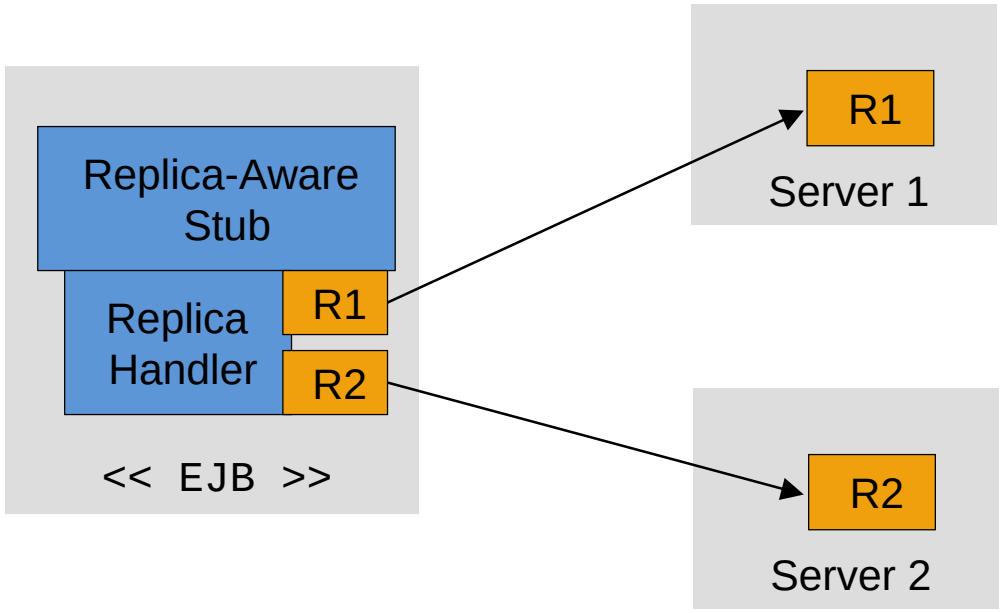
- WebLogic server allows load balancing and failover of EJBs.
- EJB clustering is transparent to:
  - The Bean developer
  - The client application developer
- WLS EJBs can be clustered by configuring them in `weblogic-ejb-jar.xml`.

Levels of Clustering for EJB

- Load balancing determines which server:
  - Processes the initial lookup
  - Is used to create or locate an EJB
  - Is used for calling the business methods
- Failover:
  - For a home skeleton, it determines how method calls are routed in a cluster
  - For a remote skeleton, it determines whether to re-execute a business operation on a different server

Replica-Aware Stub

- Failover and load-balancing of EJBs is done with *replica-aware stubs*.
- Replica-aware stubs are generated at compile time for clusterable EJBs.



Load Balancing Clustered EJB Objects

- WebLogic Server clusters support several algorithms for load balancing clustered EJB objects:
  - Round-robin
  - Weight-based
  - Random
  - Parameter-based routing (programmatic)
- Server Affinity minimizes the number of IP sockets opened between clients and servers in a cluster.

Failure Situations

- A replica-aware stub has to detect an invocation failure from the exceptions it receives:
  - Application exception
  - System exception
  - Network / communication exception

These are not indicative of a critical failure, as your application handles them.

A network exception would occur if a server, container, or skeleton crashed.

Note: If a communication exception occurs, the stub does not know if the method started, was currently executing, or finished, but was unable to return a response.

Calling Sequence

- A replica-aware stub uses a selection process to implement fault tolerance.

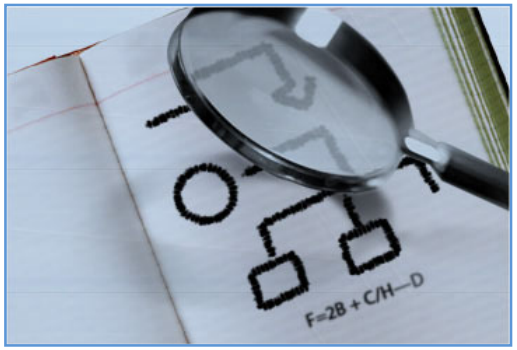
The calling sequence of a replica-aware stub:

1. Client calls a method on the stub.
2. The stub calls replica-handler to choose server-replica. Load balancing can occur here.
3. The stub calls a method on the replica, (which sends the method to the server).
   - A. If no exception occurs, the stub returns successfully.
   - B. If an application or system exception occurs, the stub propagates the exception to the client.
   - C. If a network or communication exception occurs, the stub calls the replica-handler to choose another replica IF the method is marked as being idempotent.
   - D. If a network or communication exception occurs, the stub propagates the exception IF the method is not marked as being idempotent.

Section Review

In this section, we learned how to:

- ✓ Understand the different levels of clustering EJBs
- ✓ Understand how the replica aware stub handles clustering



Road Map

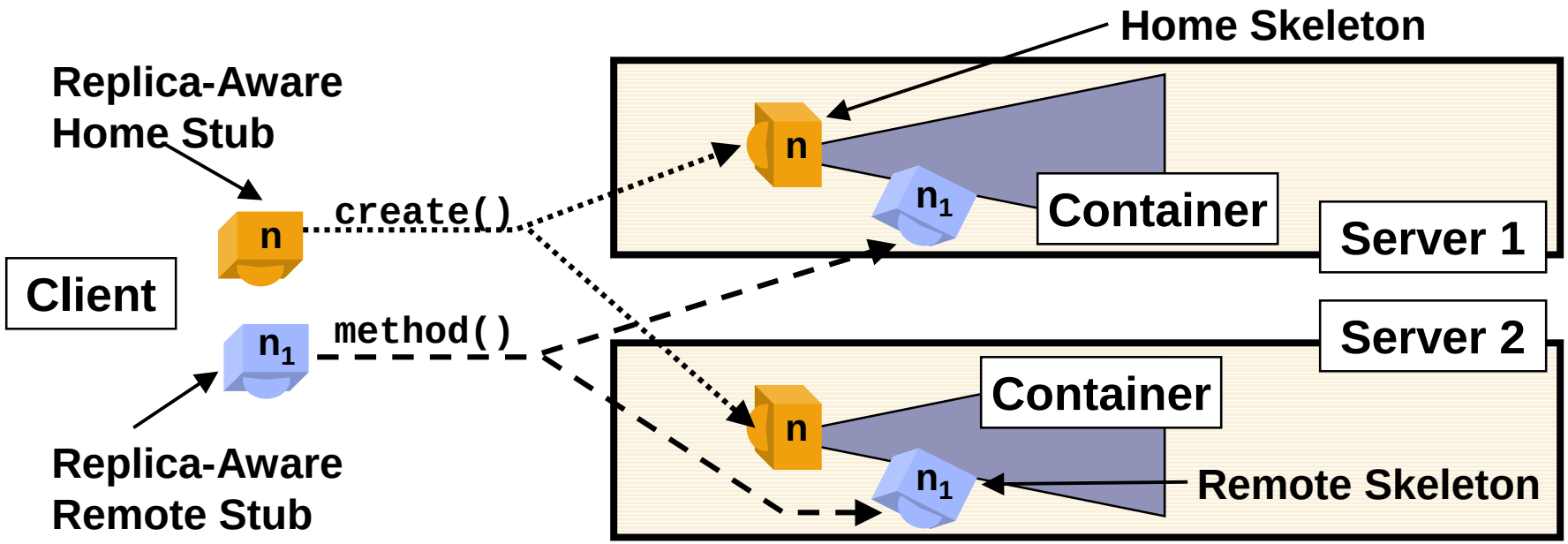
1. EJB Clustering Capabilities
2. **Clustering Session EJBs**
   - Stateless Session EJBs
   - Stateful Session EJBs
3. Clustering Entity EJBs

Stateless Session Bean Load Balancing and Failover

- Since stateless session beans of the same type are identical and they hold no state:
  - Beans in different servers are still the same
  - Separate method invocations can be sent to different servers
- This does *not* apply to stateless session bean methods that fail during execution.

Stateless Session EJB Replica Aware Home and Remote Stubs

- Home and remote stubs that are replica-aware:
  - Are “cluster aware”
  - Can send separate method invocation requests to skeletons on different servers

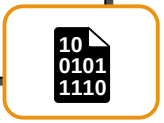


Configuring Clusterable Stateless Session EJBs…

- The WLS-specific deployment descriptor has a tag for configuring stateless session EJB clustering parameters.

Snippet from `META-INF\weblogic-ejb-jar.xml`:

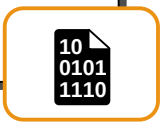
```
<!-- Other Tags As Appropriate Here… -->
<stateless-session-descriptor>
<!-- Other Tags As Appropriate Here… -->
  <stateless-clustering>
    <stateless-bean-is-clusterable>True</stateless-bean-is-
clusterable>
    <stateless-bean-load-algorithm>random</stateless-bean-load-
algorithm>
    <stateless-bean-call-router-class-
name>beanRouter</stateless-bean-call-router-class-name>
    <stateless-bean-methods-are-idempotent>True</stateless-bean-
methods-are-idempotent>
  </stateless-clustering>
```



...Configuring Stateless Session Clusterable EJBs

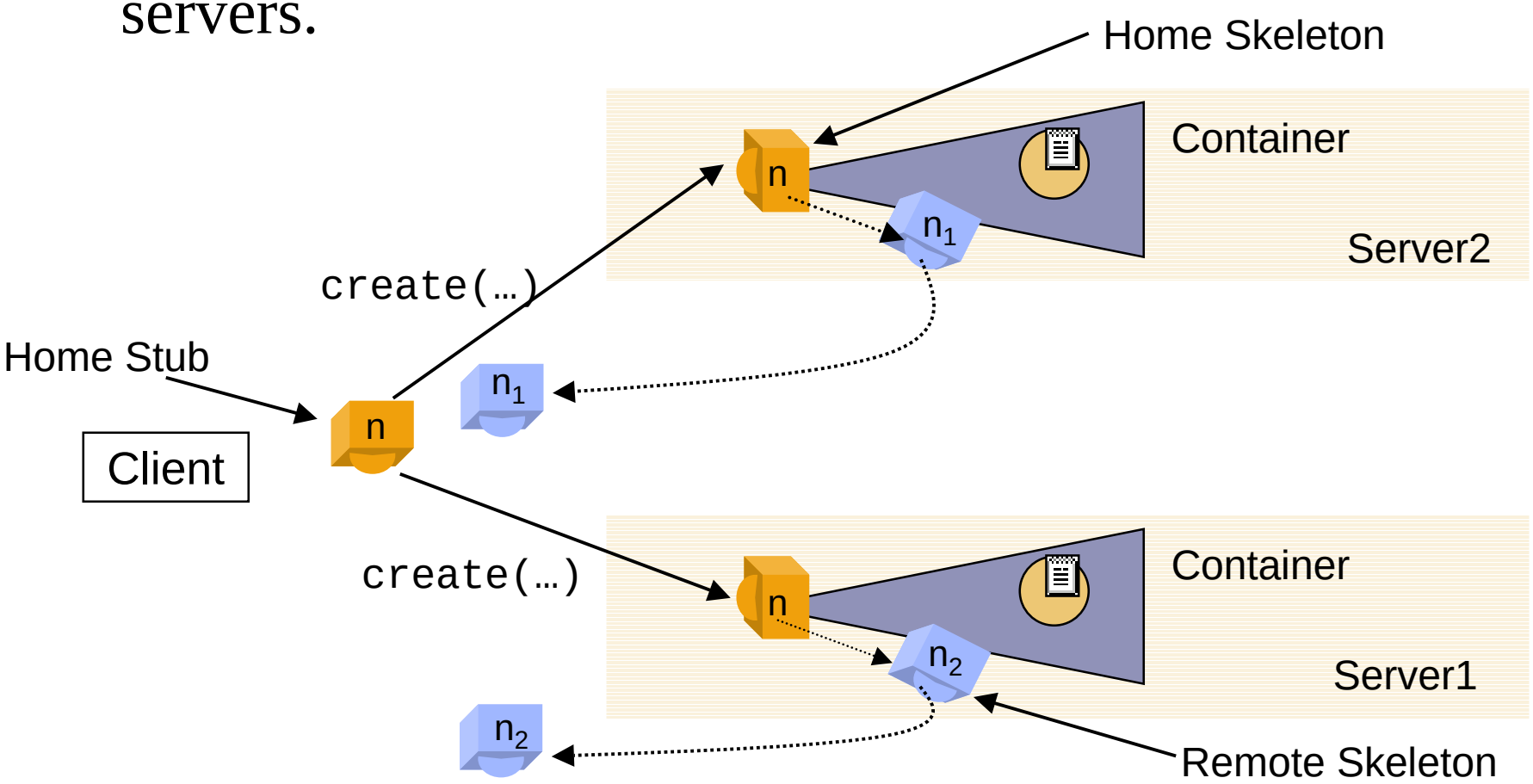
Example of a clustered stateless session EJB, continued:

```
<!-- LAST TAG inside <weblogic-ejb-jar> -->

  <idempotent-methods>
    <method> <!-- can be repeated -->
      <ejb-name>exampleSession</ejb-name>
      <method-intf>Remote</method-intf>
      <method-name>processUser</method-name>
      <method-params>
        <method-param>java.lang.String</method-param>
      </method-params>
    </method>
  </idempotent-methods>

</weblogic-ejb-jar>
```



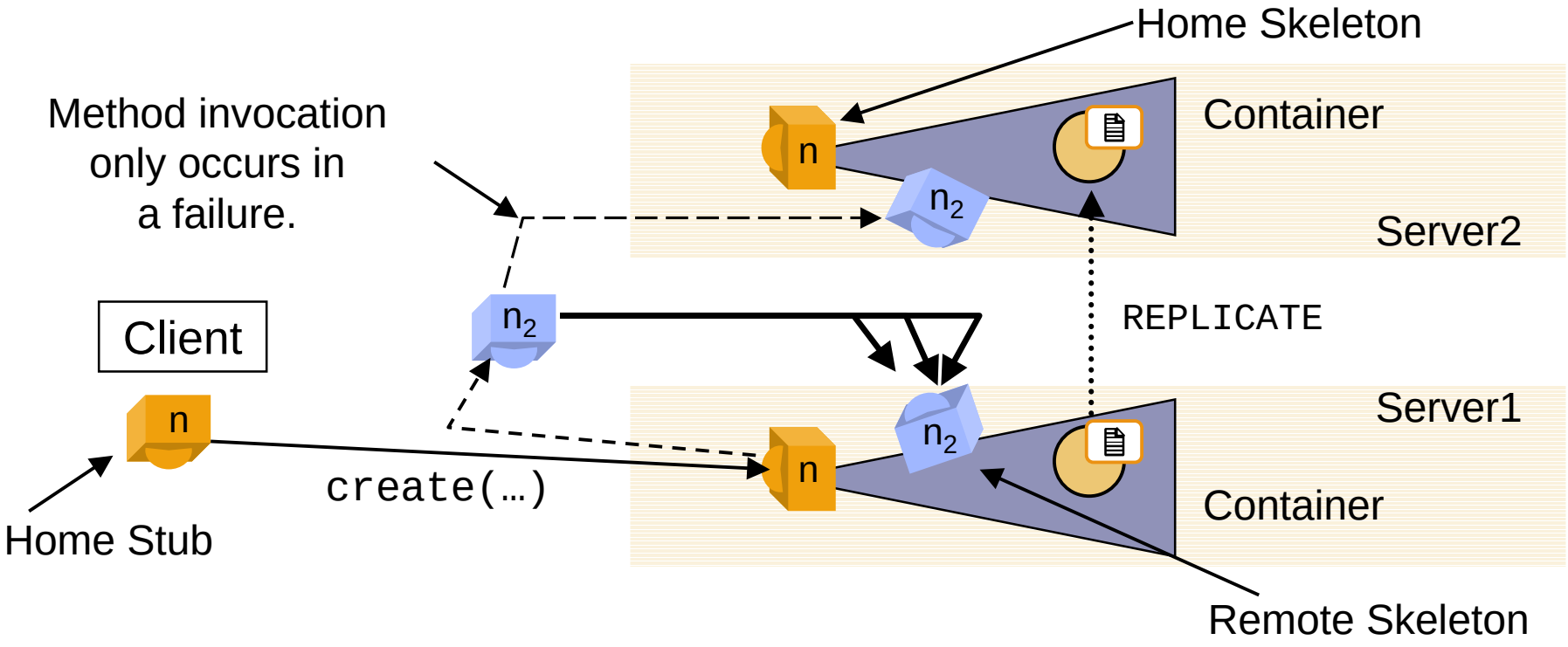
Stateful Session Bean Load Balancing

- A home stub can load balance all `create<METHOD>(…)` invocations to different servers.



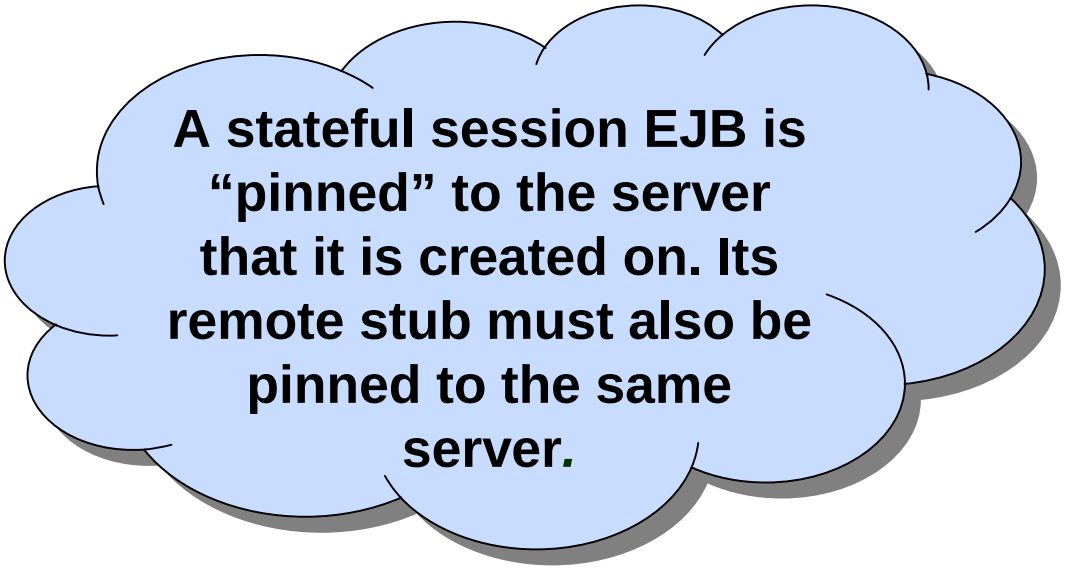
Stateful Session Bean Failover

- Stateful session beans:
  - Can be replicated to a “backup” server
  - Will automatically have remote stubs failover to a backup bean if a network/communication failure occurs



The Issue with Stateful Session Beans

- Since each stateful session EJB is unique, all calls on a remote stub must be directed to the server that contains the EJB.

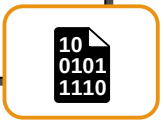


Configuring Clusterable Stateful Session EJBs

- The WLS-specific deployment descriptor has a tag for configuring stateful session EJB clustering parameters.

Snippet from `META-INF\weblogic-ejb-jar.xml`:

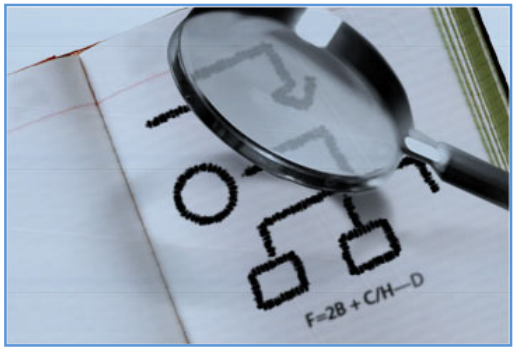
```
<!-- Other Tags As Appropriate Here… -->
<stateful-session-descriptor>
<!-- Other Tags As Appropriate Here… -->
  <stateful-session-clustering>
    <home-is-clusterable>              true
    </home-is-clusterable>
    <home-load-algorithm>              random
    </home-load-algorithm>
    <home-call-router-class-name>      common.QARouter
    </home-call-router-class-name>
    <replication-type>                 InMemory
    </replication-type>
  </stateful-session-clustering>
```



Section Review

In this section, we learned how to:

- ✓ Configure clustering for stateless session EJBs
- ✓ Configure clustering for stateful session EJBs



Road Map

1. EJB Clustering Capabilities
2. Clustering Session EJBs
3. **Clustering Entity EJBs**
   - Cluster Aware Home Stubs
   - Load Balancing
   - Best Practices

Read-Write vs. Read-Only

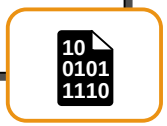
- There are two types of entity beans to consider:
  - Read-write
  - Read-only
- For read-write entity beans, load balancing and failover occur only at the home level.
- For read-only entity beans, the replica-aware stub:
  - Load balances on every call
  - Does not automatically failover in the event of a recoverable call failure

Entity Bean Cluster-Aware Home Stubs

- Entity beans can have cluster-aware home stubs that have knowledge of EJB Home objects on all WLS instances in the cluster.
- The `home-is-clusterable` deployment element in the `weblogic-ejb-jar.xml` file determines if a home stub is cluster-aware.

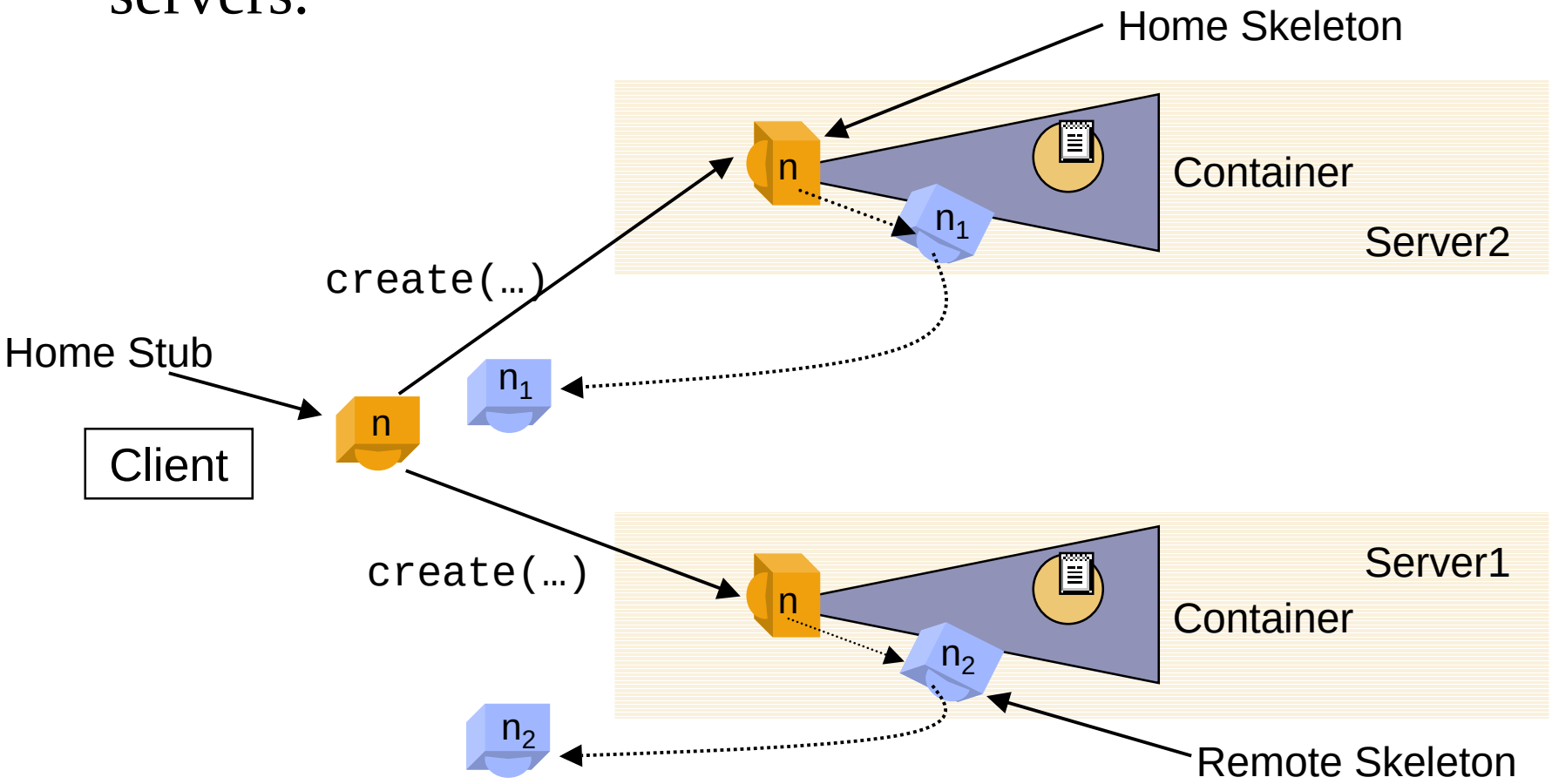
Example of setting an entity EJB home stub as cluster-aware:

```
<entity-clustering>
   <home-is-clusterable>True</home-is-clusterable>
   <home-load-algorithm>random</home-load-algorithm>
   <home-call-router-class-name>beanRouter
   </home-call-router-class-name>
</entity-clustering>
```



Entity Bean Load Balancing

- A home stub can load balance all `create<METHOD>(…)` invocations to different servers.



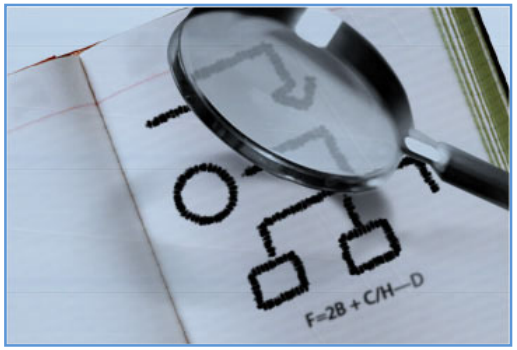
EJB Best Practices

- Set pool and cache sizes in accordance with anticipated load and execute threads per server.
- Understand that cache sizes equally affect all nodes in the cluster.
- Mark bean methods that can be called multiple times with impunity as idempotent in their deployment descriptors.

Section Review

In this section, we learned how to:

- ✓ Configure clusterable Entity EJBs



Exercise

EJB Load Balancing and Failover

- 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:

- ✓ Understand how EJBs interact with clusters
- ✓ Configure clusterable session EJBs
- ✓ Configure clusterable entity EJBs