

Oracle® Insurance Policy Administration

Coherence

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OVERVIEW

Oracle Coherence provides Oracle Insurance Policy Administration (OIPA) with replicated and distributed (partitioned) data management and caching services on top of a reliable, highly scalable peer-to-peer clustering protocol. Coherence has no single points of failure. It automatically and transparently fails over and redistributes its clustered data management services when a server becomes inoperative or is disconnected from the network. When a new server is added, or when a failed server is restarted, it automatically joins the cluster and Coherence fails back services to it; transparently redistributing the cluster load. Coherence includes network-level fault tolerance features and transparent soft re-start capability to enable servers to self-heal.

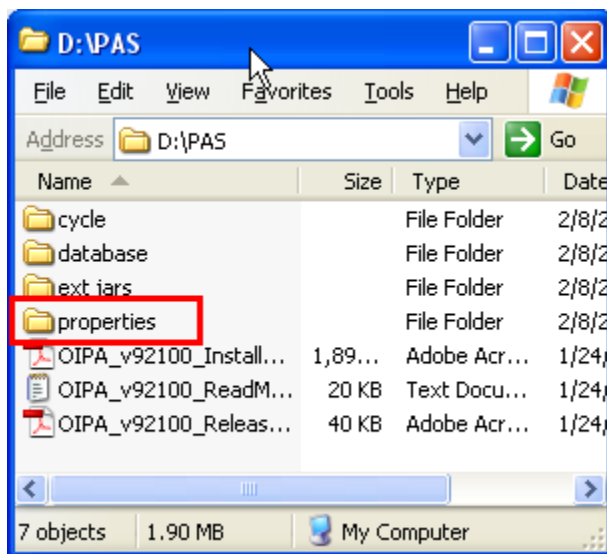
There are three different scenarios where OIPA employs Oracle Coherence. They are as follows:

1. Caching
2. Cycle Messaging
3. Application Profiling

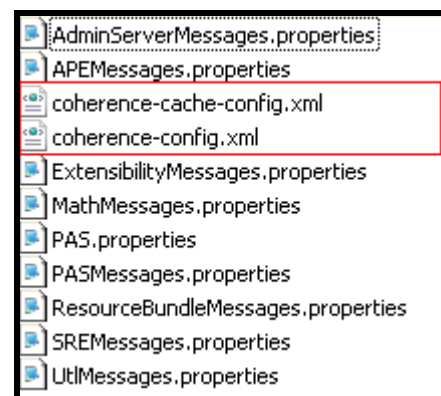
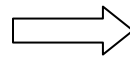
LOCATING CONFIGURABLE COHERENCE FILES

To locate the coherence configuration files for caching and application profiling, open the properties file in the OIPA deployable for E-Delivery. For caching in cycle, the files are located in each one of the cycle sub folders.

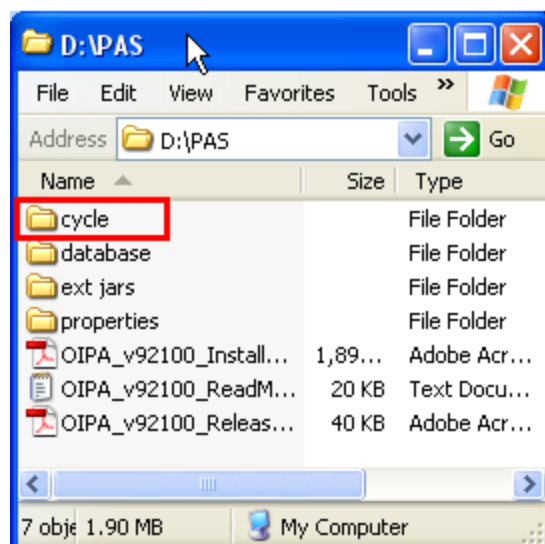
The two coherence configuration files are called coherence-cache-config.xml and coherence-config.xml. These files will be explained later in the document.



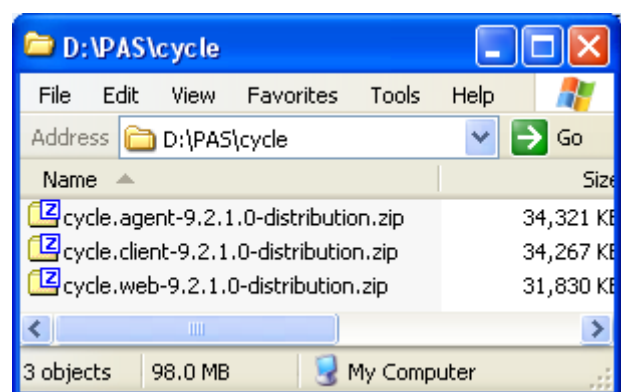
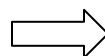
OIPA deployable folder structure



properties folder contents



OIPA deployable folder structure



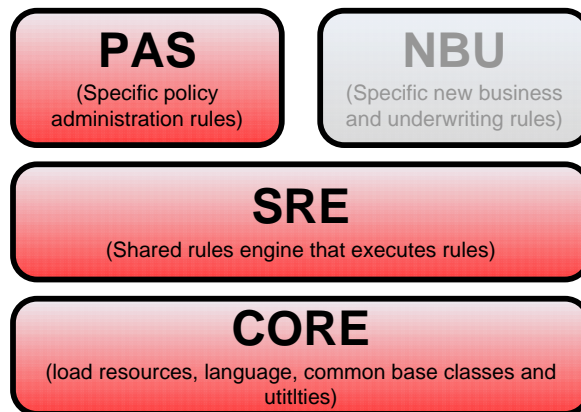
Each cycle zip folder has its own set of coherence files

CACHING

OIPA caches static configuration data and other data that rarely change. There are three cache regions in the system, each for a different module. Every cache region is configured separately, allowing each one to be configured differently. By implementing this model, the integration of new applications is simplified and only one new region must be added. The core and shared functionality regions will remain the same.

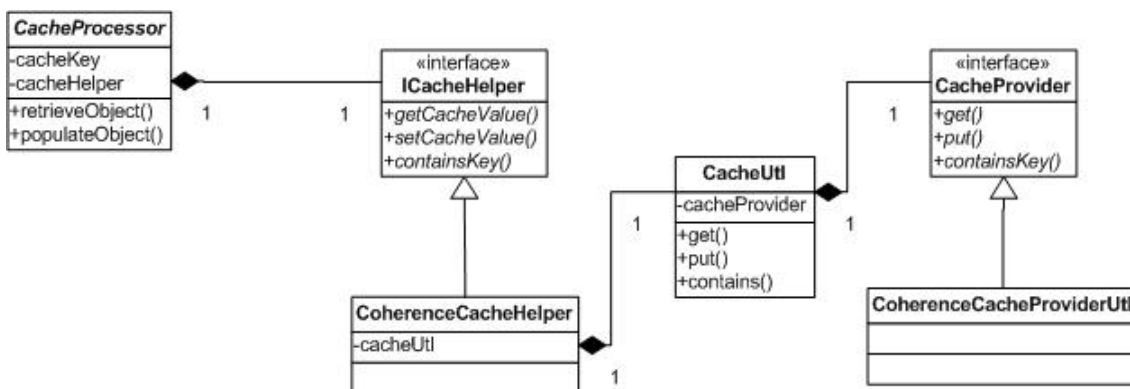
The three cache regions are:

1. region CORE for INSURANCE.SHARED module
2. region SRE for INSURANCE.SRE module
3. region PAS for INSURANCE.PAS module



Cache Regions

The following figure demonstrates how caching works in the system:



Cache Diagram

CACHEPROVIDER AND ICACHEHELPER INTERFACES

CacheProvider interface defines all methods a caching provider must implement in order to manage cached objects in OIPA. Coherence is one of the caching providers employed by OIPA.

ICacheHelper interface defines all methods required by caching access in the system, including getting and setting values for a caching key and method checking if the cache contains a given caching key.

Using CacheProvider and ICacheHelper interfaces allows OIPA to change actual caching technology that is used for caching without impacting any client code.

CACHEPROCESSOR ABSTRACT CLASS

The abstract class, CacheProcessor, retrieves the object for the caching key from the ICacheHelper in every CacheProcessor instance. An abstract method populateObject() is declared for every CacheProcessor subclass to implement what value object to be put into the cache associated with the caching key. An updateCache() method is also available for use when a cached value object needs to be updated for the caching key, such as when the system date is advanced from cycle processing. In that case, a new value is updated in the cache.

The following is the pseudo-code of the retrieveObject() provided by CacheProcessor.

```
IF cacheHelper contains cacheKey THEN
  get cache value of cacheKey from cacheHelper

ELSE

  invoke populateObject() to get cache value
  put cache value into cacheHelper associated with cacheKey
```

ACCESSING CACHE

Wherever a piece of data as cache candidate is requested, one anonymous inner class that extends CacheProcessor is defined and instantiated to determine how the value object is created when it is not yet in the cache. The value returned from CacheProcessor retrieveObject() method will be used by the client code. It could be found from the cache region for that module with the caching key, or, newly created and put into the cache region associated with the caching key. This is transparent so the difference is not visible to the client code.

The following is an example of code used for caching companyDcl for every companyGuid.

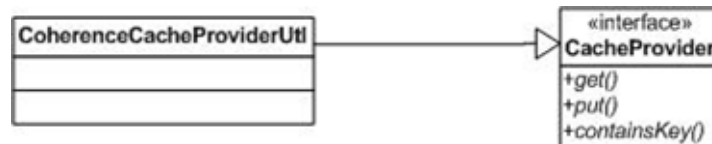
```
String key = "CompanyDcl[CompanyGUID=\"\" + companyGuid + "\"]";
CacheProcessor cacheProcessor = new CacheProcessor( cacheHelper, key ) {

    @Override
    protected Object populateObject() {

        CompanyDcl companyDcl = findByPrimaryKey( CompanyDcl.class, companyGuid );
        return companyDcl;
    }
};
return cacheProcessor.retrieveObject();
```


COHERENCECACHEPROVIDERUTL AND CACHEUTL

The utility class `CoherenceCacheProviderUtl` implements the `CacheProvider` interface. It enforces the convention for interacting with Coherence. Every `CoherenceCacheProviderUtl` instance gets a cache region for a given name from the Coherence `CacheFactory`, which creates a clustered `NamedCache` instance when necessary. The `CoherenceCacheProviderUtl` object delegates all caching accesses to its Coherence `NamedCache` object.



Coherence CacheProviderUtl

Every instance of utility class `CacheUtl` wraps a `CacheProvider` object. `CacheUtl` also maintains a class level map of mappings from cache region name and cache provider type to a `CacheUtl` instance. This guarantees only one `CacheProvider` per cache region per cache provider type.

THREE COHERENCECACHEHELPER CLASSES

`CoherenceCacheHelper` classes are `ICacheHelper` implementations that use Coherence for caching. There are three `CoherenceCacheHelper` classes in packages. They are as follows:

1. `com.adminserver.dal.helper`
2. `com.adminserver.sre.helper`
3. `com.adminserver.pas.dal.helper`

Each class corresponds to cache region CORE, SRE, and PAS respectively.



CoherenceCacheHelper

These three `CoherenceCacheHelper` classes have almost identical code, except that each declares its own unique cache region name (i.e., "CORE", "SRE", "PAS") and each register at Spring with a different bean name.

Every `CoherenceCacheHelper` has its own unique `CacheUtl` instance, which is mapped from the cache region name for the Coherence cache provider type.

COHERENCE CLUSTER CONFIGURATION

When configuring the Coherence Cluster, it is essential that **every** JVM that will participate in the Cluster is identified in the well-known-address list of the coherence-config.xml file.

Example of Coherence Cluster Configuration in OIPA Version 9

This file can be found in the properties folder in the OIPA deployable from E-Delivery. Open the properties folder and you will see the coherence-config.xml.

```
<coherence xml-override="/tangosol-coherence-override.xml">
  <cluster-config>
    <member-identity>
      <cluster-name>PRODCLUSTER</cluster-name>
      <member-name>OIPAMEMBER1</member-name>
    </member-identity>
    <unicast-listener>
      <address>123.456.78.9</address>
      <port>42222</port>
      <port-auto-adjust>false</port-auto-adjust>
    <well-known-addresses>
      <socket-address id="1">
        <address>123.456.78.9</address>
        <port>42222</port>
      </socket-address>
      <socket-address id="2">
        <address>123.456.78.10</address>
        <port>42222</port>
      </socket-address>
    </well-known-addresses>
  </unicast-listener>
</cluster-config>
<logging-config>
  <destination>stdout</destination>
  <!--
    0      - only output without a logging severity level specified will be
logged
    1      - all the above plus errors
    2      - all the above plus warnings
    3      - all the above plus informational messages
    4-9    - all the above plus internal debugging messages (the higher the
number, the more the messages)
    -1     - no messages
  -->
  <severity-level>3</severity-level>
</logging-config>
</coherence>
```

The following are guidelines for configuring the Coherence cluster:

1. Every member of the OIPA installation, including Cycle Agents and Cycle Clients, must be accounted for in the well-known-addresses list.
2. Every member of the OIPA installation, including Cycle Agents, Cycle Clients, and OIPA instances, must share the **exact same** well-known-addresses list.
3. If using the member-identity section, make sure that the cluster-name is **exactly the same** across all members of the OIPA installation.
4. If using the member-identity section, make sure that the member-name for each member is **unique across all members of the OIPA installation.**
5. In the logging-config section, the destination is configurable. If not specified, Coherence will log Coherence messages to stderr.

COHERENCE CONFIGURATION FOR CACHING

There are three cache mappings defined in the Coherence caching scheme mapping configuration for the cache name that are "CORE", "SRE", "PAS". The mapped schemes can be different or the same. In the example below each region name is identified along with an associated scheme map. Refer to the Oracle Coherence documentation on the Oracle Technology Network (OTN) for a full list of available configuration parameters. The documentation can be found by typing "coherence" in the Search field on the OTN home page.

Example of Coherence Configuration for Caching in OIPA Version 9

This file can be found in the properties folder and is named coherence-cache-config.xml.

```
<cache-config

xmlns:processing="class:com.oracle.coherence.patterns.processing.configuration.ProcessingPatternNamespaceHandler">
  <processing:cluster-config pof="true"/>
  <!-- ===== -->
  <!-- Map Caches to the NearScheme -->
  <!-- ===== -->
  <coherence-scheme-mapping>
    <cache-mapping>
      <cache-name>CORE</cache-name>
      <scheme-name>SampleNearScheme</scheme-name>
    </cache-mapping>
    <cache-mapping>
      <cache-name>PAS</cache-name>
      <scheme-name>SampleNearScheme</scheme-name>
    </cache-mapping>
    <cache-mapping>
      <cache-name>SRE</cache-name>
      <scheme-name>SampleNearScheme</scheme-name>
    </cache-mapping>
    <cache-mapping>
      <cache-name>CYCLE</cache-name>
      <scheme-name>SampleNearScheme</scheme-name>
    </cache-mapping>
```

```

    <cache-mapping>
      <cache-name>cacheForAsProfiler</cache-name>
      <scheme-name>SampleLimitedPartitionedScheme</scheme-name>
    </cache-mapping>
  </caching-scheme-mapping>

<caching-schemes>

  <!-- ===== -->
  <!-- Local In-memory Cache -->
  <!-- ===== -->
    <local-scheme>
      <scheme-name>SampleMemoryScheme</scheme-name>
    </local-scheme>

  <!-- ===== -->
  <!-- Size limited Local In-memory Cache -->
  <!-- ===== -->
    <local-scheme>
      <scheme-name>SampleMemoryLimitedScheme</scheme-name>
      <low-units>1000</low-units>
      <high-units>5000</high-units>
    </local-scheme>

  <!-- ===== -->
  <!-- Distributed In-memory Cache -->
  <!-- ===== -->
    <distributed-scheme>
      <scheme-name>SamplePartitionedScheme</scheme-name>
      <backing-map-scheme>
        <local-scheme>
          <scheme-ref>SampleMemoryScheme</scheme-ref>
        </local-scheme>
      </backing-map-scheme>
    </distributed-scheme>

  <!-- ===== -->
  <!-- Distributed Limited In-memory Cache -->
  <!-- ===== -->
    <distributed-scheme>
      <scheme-name>SampleLimitedPartitionedScheme</scheme-name>
      <backing-map-scheme>
        <local-scheme>
          <scheme-ref>SampleMemoryLimitedScheme</scheme-ref>
        </local-scheme>
      </backing-map-scheme>
    </distributed-scheme>

  <!-- ===== -->
  <!-- Cache Cluster Definition -->
  <!-- ===== -->
    <near-scheme>
      <scheme-name>SampleNearScheme</scheme-name>
      <front-scheme>
        <local-scheme>
          <scheme-ref>SampleMemoryLimitedScheme</scheme-ref>
        </local-scheme>
      </front-scheme>
      <back-scheme>
        <distributed-scheme>
          <scheme-ref>SamplePartitionedScheme</scheme-ref>
        </distributed-scheme>
      </back-scheme>
    </near-scheme>
  </caching-schemes>

```

```
</near-scheme>

<!-- ===== -->
<!-- Cycle Invocation -->
<!-- ===== -->
  <invocation-scheme>
    <scheme-name>CycleMessagingService</scheme-name>
    <service-name>InvocationService</service-name>
    <autostart>true</autostart>
  </invocation-scheme>

</caching-schemes>

</cache-config>
```

WORKLOAD MANAGEMENT

OIPA provides a subsystem for batch processing for insurance transactions called Cycle. Cycle is a high performance distributed subsystem designed to process as many pending transactions as possible in the shortest amount of time. The cycle subsystem drives processing of transactions through a cycle group, which is comprised of a set of cycle agents.

Each cycle agent exists in its own JVM process. Cycle agents may be spread across multiple machines. Besides batch processing pending transactions, OIPA also leverages Cycle agents to facilitate long running background processes. This allows OIPA to offload processing to cycle agents, freeing up the OIPA application to service user requests. All of the Cycle agents together form a **processing grid**.

OIPA cycle uses the Coherence Incubator Processing Pattern for workload management of processing across the grid. Using the Processing Pattern and Coherence provides OIPA with the following benefits:

1. **No single point of failure** - coherence manages the failover of data for failed nodes in the cluster. Work that is queued or processing in a Node when it fails will automatically be reassigned to other nodes in the cluster for processing. This ensures that no work is lost (barring catastrophic failure of the entire cluster).
2. **No single bottleneck** - since processing is distributed evenly across the entire cluster, no single node represents a bottleneck for processing.
3. **State Management** - the Processing Pattern leverages Coherence caching for maintaining the state of the work that is processing in the grid. There is no need to track the work that is happening in the grid.
4. **JMX Support** - the Processing Pattern provides JMX MBeans that provide visibility into how processing is performing in the grid.

TASKS

Processing is executed on the grid using tasks. A task represents some kind of processing that needs to take place. Conceptually, there are two different kinds of tasks:

- **Monitoring tasks** – these tasks govern a long running process. They typically wake up on an interval, check some processing, and go back to sleep. Monitoring tasks are not typically processing intensive.
- **Processing tasks** – these tasks execute some unit of work and are typically short lived. Processing tasks typically are processing intensive, examples include:
 - Cycle task, which will process all pending activities on a policy.
 - Scheduled Valuation task, which will value a policy, generate, and store valuation records in the database.

All task processing is accomplished via the Coherence Processing Pattern. A task is submitted by a grid client in different ways, including:

- The cycle client submits a Cycle monitoring task to execute a cycle level.
- An OIPA instance submits a scheduled valuation task to run scheduled valuation on policies on a plan.

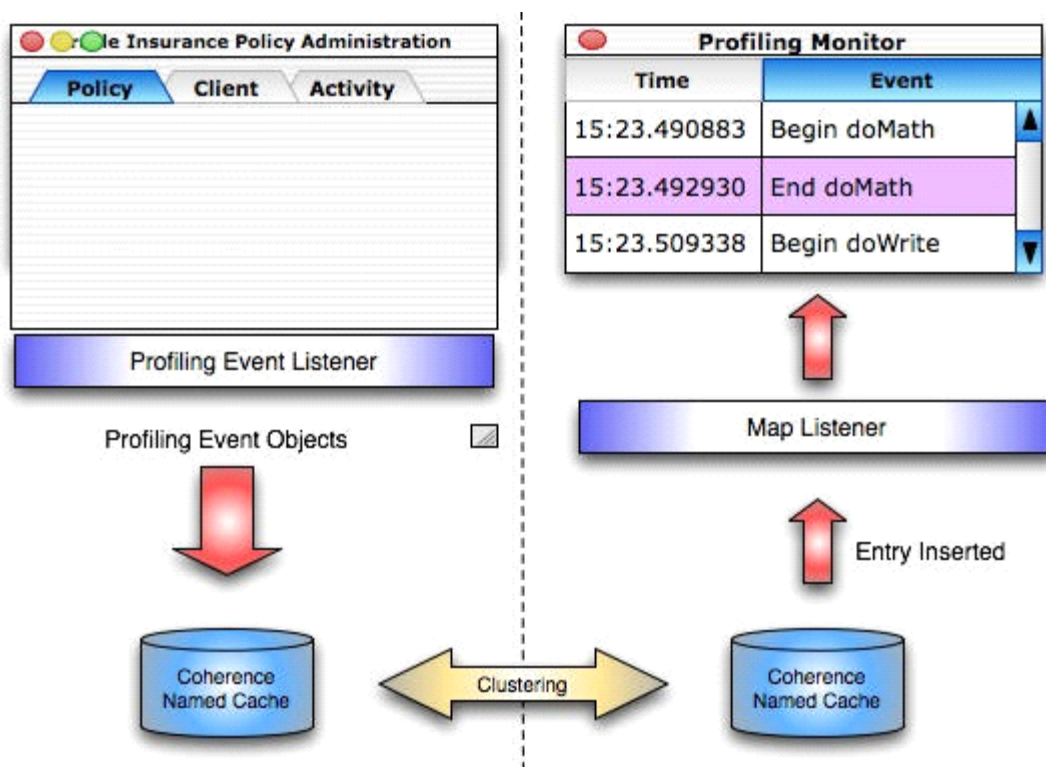
When tasks are submitted for processing, they arrive on a queue at one of the cycle agents connected to the grid. Task scheduling is by default achieved using a Round Robin algorithm. When they arrive in the partitioned cache of an agent, they are put into a queue and scheduled for processing in a Thread Pool. The thread pool size is controlled via the coherence-cache-config file of the cycle agent.

Processing tasks have short life cycles, where they will execute and then be complete. Monitoring tasks have an extended life cycle, and potentially intermediate state. When a monitoring task is executed, it processes, and has the ability to **yield** processing. When it yields, it will be re-dispatched to the cycle grid for processing.

APPLICATION PROFILING

OIPA provides a profiling subsystem that gathers information for the purposes of providing insights into system execution. The OIPA profiling subsystem sends lifecycle events of request processing and transaction processing to registered listeners. Profiling event information can be used for performance analysis and improvement, system optimization, auditing and reports.

OIPA provides one profiling listener implementation that uses Coherence cache to pass profiling event information to a separated profiling application that runs in the same Coherence cluster.



Profiling Diagram

PROFILINGEVENTCACHEBLL AND PROFILINGEVENTCACHEENTRYKEY

Class `ProfilingEventCacheBll` provides methods to save a profiling event object or a list of profiling event objects into a Coherence `NamedCache`. Every cache entry of an event object or an event object list is associated with a caching key of `ProfilingEventCacheEntryKey` instance, which has a time stamp and a string UUID.

Right now the provided Coherence based profiling listener implementation saves screen profiling events individually and saves lists of transaction profiling events at a fixed one second interval.

PROFILINGEVENTCACHEHELPER

ProfilingEventCacheHelper extends ProfilingEventCacheBll. It creates the Coherence NamedCache with a default cache region name "cacheForAsProfiler". All access to this Coherence cache in the provided profiling listener is through ProfilingEventCacheHelper.

COHERENCE CONFIGURATION FOR PROFILING EVENT CACHE

The Coherence cache configuration for OIPA profiling is similar to that for static data caching. It can be configured differently if necessary.

EXTERNAL PROFILING APPLICATION

An external profiling application is not part of OIPA. In order to access information from the profiling event listener through Coherence cache, the external profiling application must be in the same Coherence cluster and use the same cache name. Typically, a map listener is configured to be invoked whenever a new cache entry is inserted that has a profiling event object, or a list of profiling event objects, so the profiling event data can be captured for the monitoring application to use.

COHERENCE CLUSTER CONFIGURATION

Coherence cluster configuration defines all the nodes in the cluster, along with a pointer to the cache factory configuration file. This is necessary in order for coherence to run. During the configuring of the application server, an argument must be passed to the JVM to define the location of this coherence configuration file, coherence-config.xml. The argument to be passed is “tangosol.coherence.override”, along with the absolute path to the configuration file.

Example: “-Dtangosol.coherence.override=/opt/oracle/oipa/properties/coherence-config.xml”

Sample Coherence Cluster Configuration

This file can be found in the properties folder and is named coherence-cache-config.xml.

```
<coherence>
  <cluster-config>
    <unicast-listener>
      <well-known-addresses>
        <socket-address id="1">
          <address>localhost</address>
          <port>8080</port>
        </socket-address>
      </well-known-addresses>
    </unicast-listener>
  </cluster-config>
  <logging-config>

    <severity-level>5</severity-level>
  </logging-config>
  <configurable-cache-factory-config>
    <init-params>
      <init-param>
        <param-type>java.lang.String</param-type>
        <param-value>/opt/oracle/oipa/properties/coherence-cache-
config.xml</param-value>
      </init-param>
    </init-params>
  </configurable-cache-factory-config>
</coherence>
```