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WebSphere software

IBM WebSphere DataPower XC10 – Lab exercise – Time estimate: 1 hour 45 minutes

Dynamic cache configuration

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What this exercise is about

The objective of this lab is to provide you with an understanding of how to configure Dynamic cache to use the IBM WebSphere DataPower XC10 Appliance. Additionally, you are provided with a set of tools to compare your current WebSphere DynaCache approach to a solution using the DataPower XC10 Appliance.

This lab is provided **AS-IS**, with no formal IBM support.

Lab requirements

List of system and software required to complete the lab.

Hardware requirements

- IBM WebSphere DataPower XC10 Appliance with supported firmware level
    - **For example, 2.0.0.1-cf31124.67080** (fix pack 1)

Software requirements

You must install the WebSphere eXtreme Scale client for DataPower XC10 on top of a supported WebSphere Application Server. See the **Supported software** section below for software levels that were used in the creation and testing of this lab.

- This lab requires **Jakarta Jmeter** or a similar HTTP load generator installed on the WebSphere Application Server or on another computer or laptop which has web access to your WebSphere Application Server. Jakarta JMeter can be downloaded from http://jakarta.apache.org/jmeter/

Web browser requirements

The DataPower XC10 administrative console supports the following web browsers:

- Mozilla Firefox, version 3.5 and later
- Mozilla Firefox, version 3.6 and later
- Microsoft Internet Explorer, version 7 or 8

Supported software

The following software levels are recommended when running this lab:

- WebSphere Application Server Version 6.1.0.35 or later
- WebSphere Application Server Version 7.0.0.13 or later
- WebSphere eXtreme Scale Client Version 7.1 with supported client fix pack
- Recommended software setup:
    - WebSphere Application server v 7.0.0.13 or later.
    - WebSphere eXtreme Scale 7.1 client installed on WebSphere Application Server binaries
    - Deployment manager profile and at least one WebSphere Application Server profile

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What you should be able to do

At the end of this lab you should be able to:

- Configure WebSphere DynaCache APIs to use the DataPower XC10 Appliance for both object and servlet cache instances.
- Test the cache configuration using the simple applications provided and track the results on the DataPowerXC10 Appliance
- Utilize some tools and techniques mentioned in the lab which can help you compare your current dynamic cache provider with the DataPower XC10 dynamic caching solution

Introduction

WebSphere Application Server provides a default shared dynamic cache within the server's JVM memory or optionally within a disk cache which can be used as an object cache instance where any Java EE application can store, distribute, and share data. The IBM WebSphere DataPower XC10 appliance and its associated client provides a dynamic data cache mechanism which allows WebSphere Application Server applications using the DynaCache API to use the DataPower XC10 Appliance as a distributed cache, instead of caching data in local memory or in a disk cache. IBM provides the necessary client code and administrative plug-ins to allow applications to access dynamic cache data caches on the appliance. Once the client and plug-ins are installed, the interface is activated by performing configuration changes within the WebSphere Application Server, similar to the changes required for IBM WebSphere eXtreme Scale V6.1 and higher for its DynaCache support.

You can use the IBM WebSphere DataPower XC10 Appliance to store data from your WebSphere Application Server Dynamic Cache. By setting up this capability, you can enable applications that are written with the DynaCache APIs or applications using container-level caching (such as servlets) to use the features and performance capabilities of the appliance

Exercise instructions

Some instructions in this lab are Windows® operating-system specific. If you plan to run the lab on an operating-system other than Windows, you will need to run the appropriate commands and use appropriate files (.sh or .bat) for your operating system. The directory locations are specified in the lab instructions using symbolic references, as follows:

Reference variable	Windows location	AIX® or UNIX® location
<WAS_HOME>	C:\WebSphere\AppServer	/usr/WebSphere/AppServer /opt/WebSphere/AppServer
<LAB_FILES>	C:\Labfiles	/tmp/Labfiles
<TEMP>	C:\temp	/tmp

Note for Windows users: When directory locations are passed as parameters to a Java™ program such as EJBdeploy or wsadmin, replace the backslashes with forward slashes to follow the Java convention. For example, replace C:\LabFiles\ with C:/LabFiles/

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Labfiles provided

- DynamicCacheTest.ear
- DynaCacheTestWeb.jmx

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Part 1: Dynamic caching: Object cache instance

An object cache instance is a location, in addition to the default shared dynamic cache, where any Java EE application can store, distribute, and share data. This gives applications greater flexibility and better tuning of the cache resources.

Before you can get started in setting up dynamic cache, you must tell WebSphere how to communicate with the catalog service that is running on the appliance. The DataPower XC10 Appliance uses the catalog service to track how data is partitioned within the appliance and across a collective. You configure the catalog service through the WebSphere Application Server administrative console by creating a catalog service domain.

Section 1: Setup

This section will show you how to set up dynamic caching on WebSphere Application Server for an object cache instance to the use XC10 DataPower XC10 Appliance.

____ 1. Create a catalog service domain.

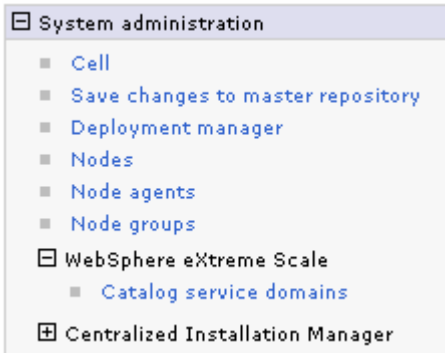
Learn: Before you can get started in setting up dynamic cache, you must tell WebSphere how to communicate with the catalog service that is running on the appliance. The DataPower XC10 Appliance uses the catalog service to track how data is partitioned within the appliance and across a collective. You configure the catalog service through the WebSphere Application Server administrative console by creating a catalog service domain.

__ a. Start the DataPower XC10 Appliance if it is not already running.

__ b. Start the WebSphere Application Server deployment manager and the WebSphere Application Server.

__ c. Start and login into WebSphere Administrative console.

__ **d.** Expand **System Administration** -> **WebSphere eXtreme Scale**



__ e. Click **Catalog service domains,** then click "**New"** to create a new catalog service domain.

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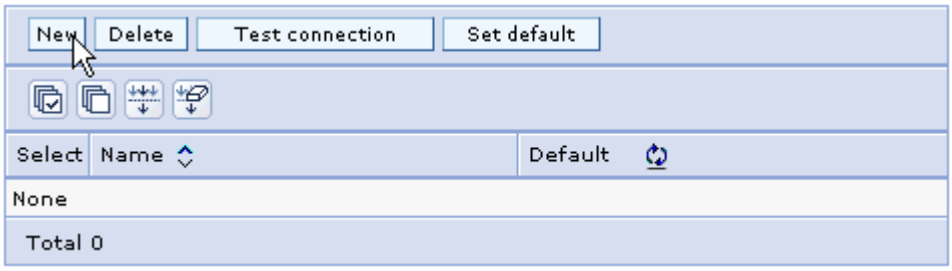


__ f. Supply the administrative name of your choice to identify your appliance collective.

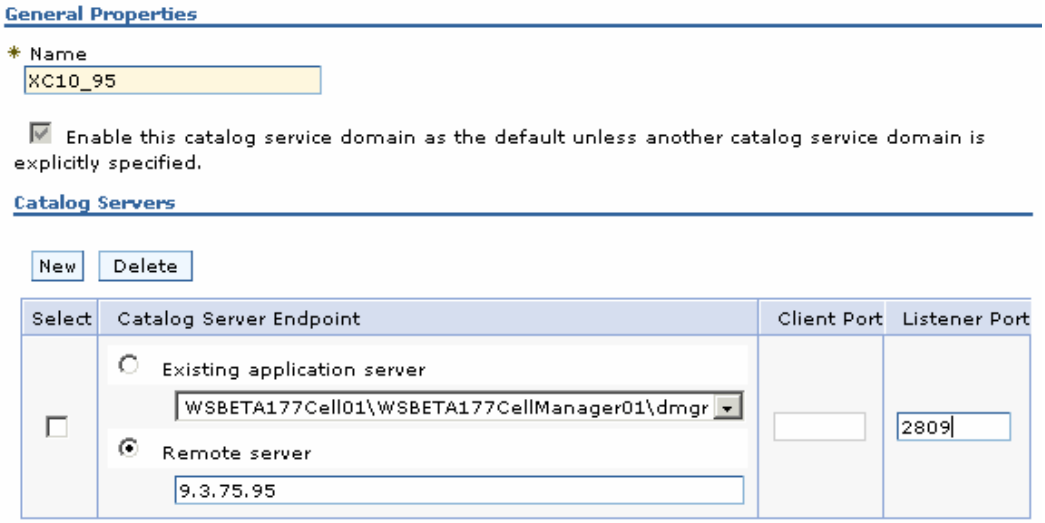
__ g. If you want this catalog service domain to be the default, check the box "**Enable this catalog service domain as the default unless another catalog service domain is explicitly specified**".

Note: The JMX authentication credentials are optional, but if provided should correspond to a user defined on the appliance with Appliance monitoring permission.

__ **h.** Add catalog server endpoints under **Catalog servers.**

1) Click the radio button for **Remote server** and type the host name or IP address of the DataPower XC10 Appliance.

2) For the Listener Port type 2809**.**



3) Click "**Ok**" then click "**Save**".

Note: If you are configuring a collective, there is more than one catalog server listed for the collective. You must create a separate entry for each one by clicking "**New**" under "**Catalog Servers**". To view the catalog servers that are running in the collective, log into the DataPower XC10 Appliance and click the menu **Collective → Members → *<member_name>***. The Catalog servers field lists the catalog servers that are running in the collective.

__ i. Test the connection to catalog service domain.

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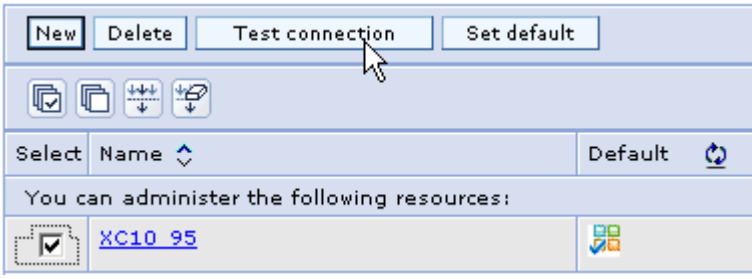
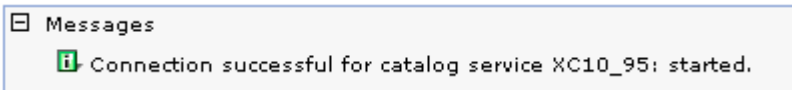
1) Click **System Administration → WebSphere eXtreme Scale → Catalog service domains.**

2) Select the catalog service domain you created and click "**Test connection**". You can also click the name of your domain which will open the domain page and you can click the "**Test connection**" button from there as well.



Learn: When you click the "**Test connection**" button, all of the defined catalog service domain end points are queried one by one. If any one end point is available, it returns a message that indicates that the connection to the catalog service domain was successful.

3) Test connection should be successful and the status icon should be green, if the DataPower XC10 Appliance is up and running.



____ 2. Create dynamic data cache grid.

Learn: The next step is to create dynamic data cache grid. There are two ways to create dynamic cache data grid: one is by using the DataPower XC10 appliance web console and the other is to run the **dynaCfgToAppliance** script provided with the DataPower XC10 client. This script is installed in the *bin* directory of the deployment manager when you install the client. The dynaCfgToAppliance script is the preferred way, since it not only creates the grid on the DataPower XC10 Appliance, but also updates the WebSphere cell configuration by adding required user ID and password cell custom properties for each data grid. For this exercise, you will use the script.

__ a. Ensure the DataPower XC10 Appliance is running. If it is not running, start it.

__ b. Start the WebSphere Application Server deployment manager and the WebSphere Application Server, if not already started.

__ c. Open a command window and go to <WAS_HOME>/profiles/Dmgr/bin directory.

__ d. Execute the dynaCfgToAppliance script as follows (replacing the <appliance admin> and <admin_pw> with the credentials supplied by IBM for you to use in the Early Program Cloud):

For Windows

```
dynaCfgToAppliance.bat <XC10_appliance_ip_address> <cache_name> <appliance_admin> <admin_pw> <SOAP_port> <sas.client.props>
```

Where the <SOAP_port> and <sas.client.props> options are optional.

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Example: `dynaCfgToAppliance.bat test12.ibm.com mydynacachegrid testadmin testadmin 8879`

For UNIX

`./dynaCfgToAppliance.sh <XC10_appliance_ip_address> <grid_name> <appliance_admin> <admin_pw> <SOAP_port> <sas.client.props>`
Where the <SOAP_port> and <sas.client.props> options are optional.

Note: if you are prompted with an "SSL SIGNER EXCHANGE PROMPT", click **Y** to add the signer to the trust store. Also, if you wait longer than a minute before replying **Y** to the prompt, the script will fail and you must rerun the dynaCfgToAppliance script again.

Learn: If you get the following exception while running the **dynaCfgToAppliance** command, then your system may have multiple installations of WebSphere.

com.ibm.websphere.management.exception.ConnectorException: ADMC0016E:

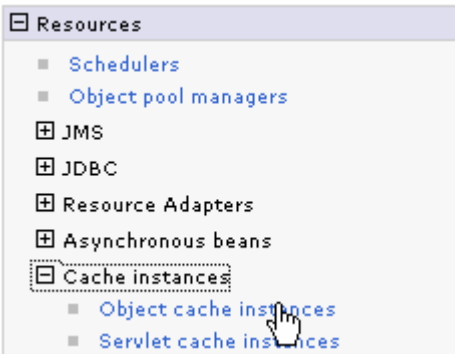
The system cannot create a SOAP connector to connect to host localhost at port 8879. To avoid port conflicts with other WebSphere installs, the installation you are using may not use the default port of 8879. Therefore, you should specify the SOAP_port and sas.client.props options to successfully run the dynaCfgToAppliance script. See this information center page for additional information:

http://publib.boulder.ibm.com/infocenter/wdpxc/v1r0/index.jsp?topic=/com.ibm.websphere.datapower.xc.doc/tdyncache.html

---

____ 3. Define an object cache instance on the WebSphere Application Server console.

__ **a.** On the WebSphere console, go to **Resources → Cache instances → Object Cache instances.**



__ b. Specify the **scope** for the cache instance.

Note: Cell scope makes the cache instance available to all servers within the cell. Node scope makes the cache instance available to all servers on the particular node. Cluster scope makes the cache instance available to all members in a specified cluster. Server scope makes the cache instance available to only the selected server. You can mix scopes, if necessary.

__ c. To create a new cache instance, you must select a scope. For this test, you can select **Cell**.

__ d. Click "**New**" button to create a new cache instance.

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__ e. On the General properties page, type the required **name** of your object cache instance

__ f. Type the JNDI name in the JNDI field.

Note: The JNDI name should be the name of the grid you specified when you ran the dynacCfgToAppliance script. As an example mentioned earlier, the JNDI would be `mydynacachegrid.` Also note that some products, use cache instance names with a / in the JNDI name. If a JNDI with a slash is specified to the dynaCfgToAppliance script, it will create the grid but the slash is replaced by a dash in the grid name.

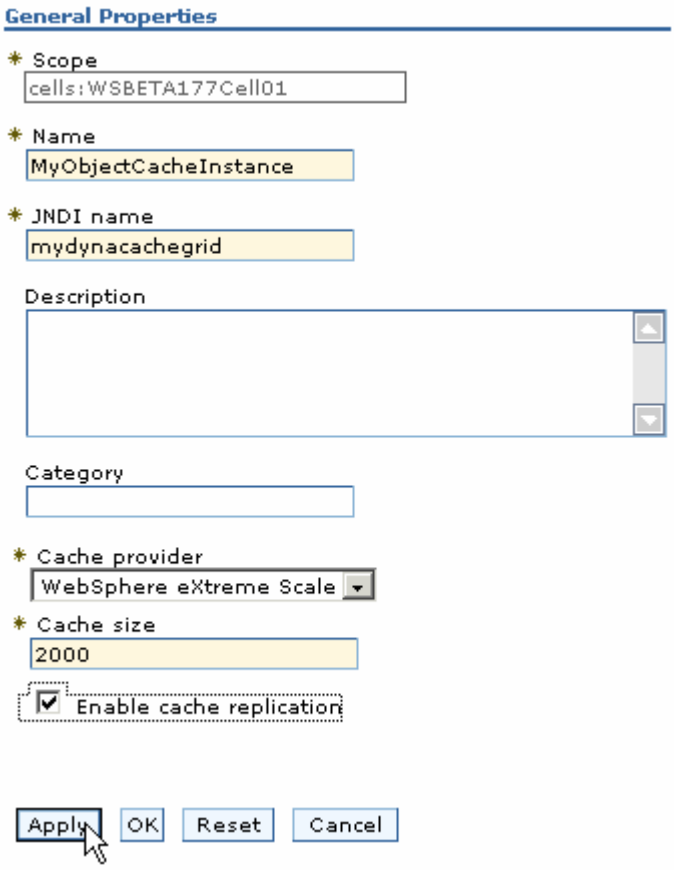
__ g. For the Cache provider field select **WebSphere eXtreme scale** as the cache provider.

__ h. The cache size is at a default of 2000.

Note: The **cache size** entry affects how many entries can be stored on the appliance. The appliance defines 47 partitions for each Dynamic data cache, and each partition can hold **cache size** entries. So the number of entries that can be stored on the appliance is 47 multiplied by the number that is set here as the cache size. As an example, with the default cache size of 2000, the maximum number of cached entries that can be stored in the appliance is 94000 (47 * 2000).

__ i. Check **Enable cache replication**.

Note: Enabling cache replication allows for cached data to be sent to the DataPower XC10 Appliance**. If you do not check this entry, the DataPower XC10 client will provide a local cache only.**



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__ j. Click "**Apply**", then click "**Save**" to save the object cache instance.

____ 4. Define Topology settings.

When you use the DataPower XC10 Appliance to store cache data, you are using a **remote** topology. You must set a custom property on the dynamic cache instance in the WebSphere Application Server administrative console to notify the dynamic cache provider of this fact.

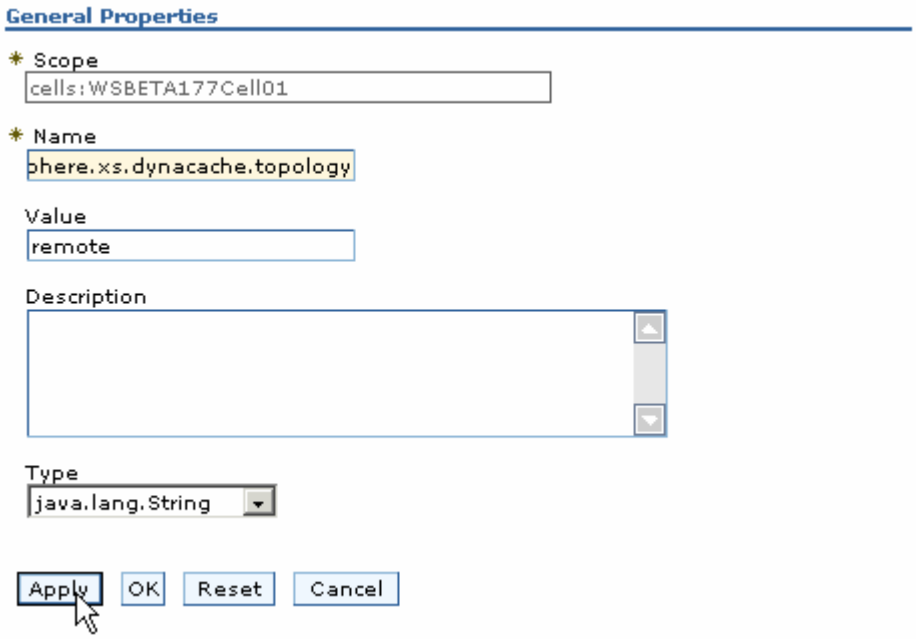
__ ***a. In the WebSphere administrative console, click Resources → Cache instances → Object Cache instances → <name_of_your_cache instance>.***

__ b. Click **Custom properties** under the additional properties section, then click "**New**".

__ c. For the name type com.ibm.websphere.xs.dynacache.topology.

__ **d.** For the value **enter remote.**

__ **e.** Allow **Type** to default to **java.lang.String**



__ f. Click "**Apply**", then click "**Save"** to save the property.

____ 5. Restart the deployment manager and the application server.

Section 2: Testing

In this section you will use a test application to test dynamic caching with the DataPower XC10 Appliance for the object cache instance you set up in section 1.

The DynamicCacheTest.ear file provided with the lab contains two web applications: MaxCacheWeb.war and DynacacheTestWeb.war.

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The MaxCache application provided for this lab is a simple WebSphere application that allows you to create cache entries of a specified size on an *object cache* instance. It also allows you to retrieve and invalidate previously cached entries.

____ 6. Install the provided DynamicCacheTest.ear file through the WebSphere administrative console as a WebSphere enterprise application. Take the defaults during the installation.

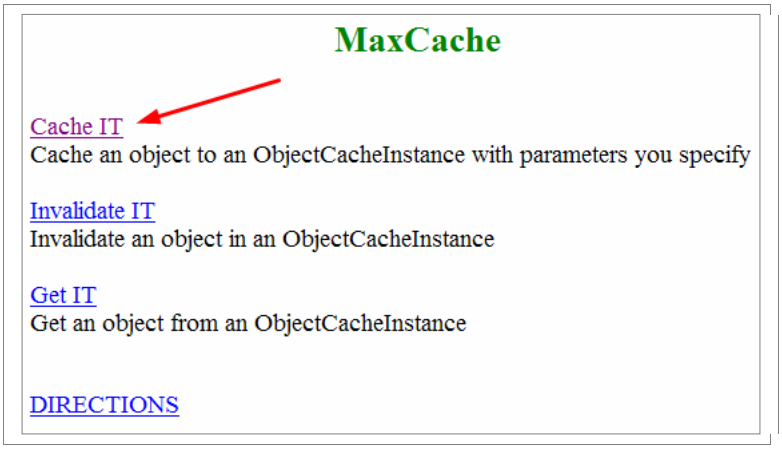
____ 7. Once the application is successfully installed, start the application and ensure it starts successfully

____ 8. Start a web browser and type the following URL to access the MaxCache application:

http://<host:port>/MaxCacheWeb

Example: `http://test2.austin.ibm.com:9080/MaxCacheWeb/`

____ **9.** Click the link **CacheIT.**



Clicking on the Cache IT link, calls a JSP that presents a page with attributes whose values are to be entered by a user.

____ 10. A new CacheIT page will open. Enter the following values for **size, key, priority timeToLive,** and **dependency** and most importantly JNDI name. The JNDI name must the name of the grid you specified when you created objectCacheInstance.

____ 11. Here are some example values to start with:

__ a. size:..... 5

__ b. key..... key1

__ c. priority:..... **8** (must be an integer)

__ d. ttl: ..... **0** (the zero value ensures that it will never time out)

__ e. sharing: ..... N/A

__ **f.** dependencyID1..... **dep1**

__ g. dependencyID2..... (blank)

__ **h.** cache JNDI:..... **`mydynacachegrid`**

__ **i.** Output to SystemOut.**`log ... true`**

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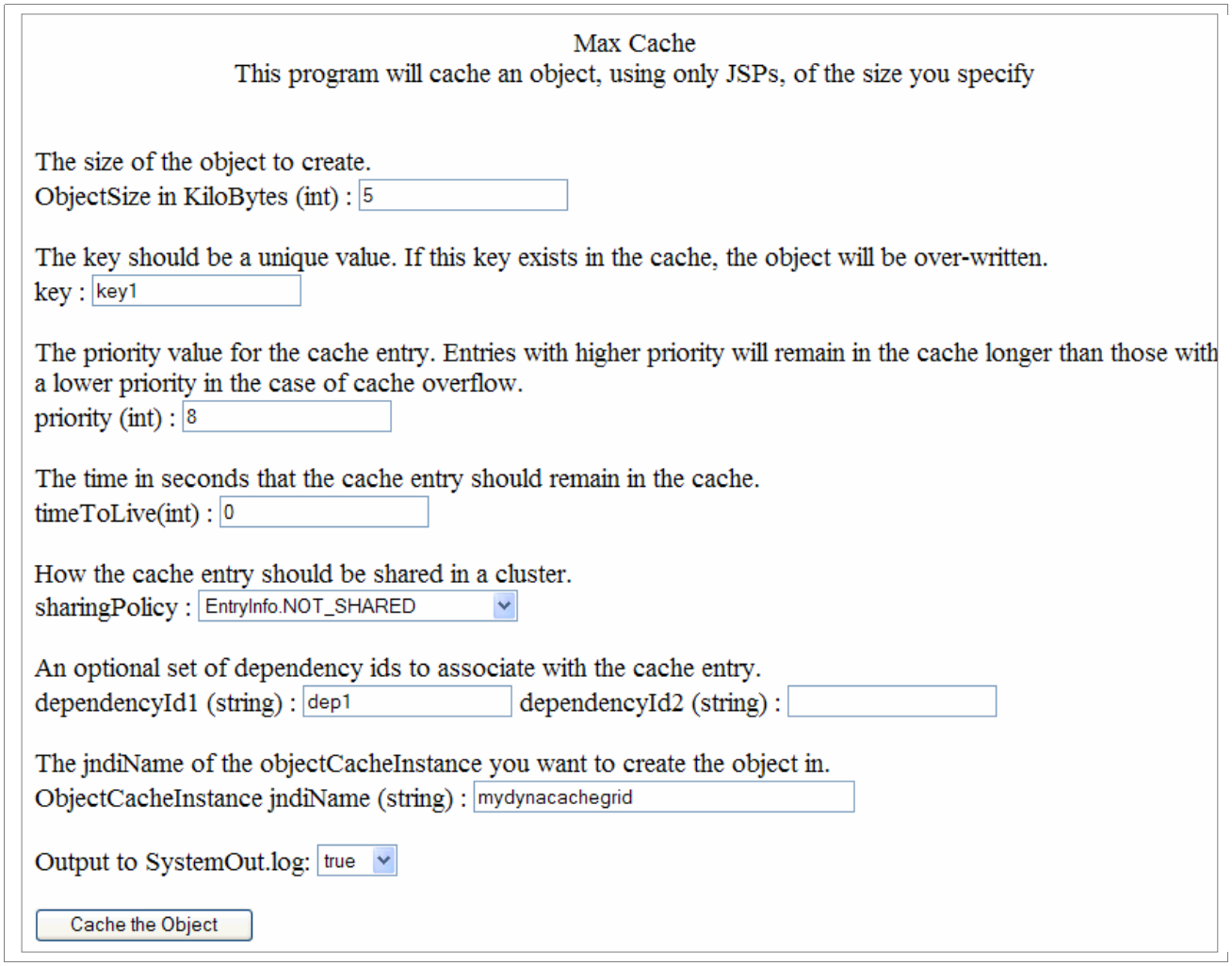
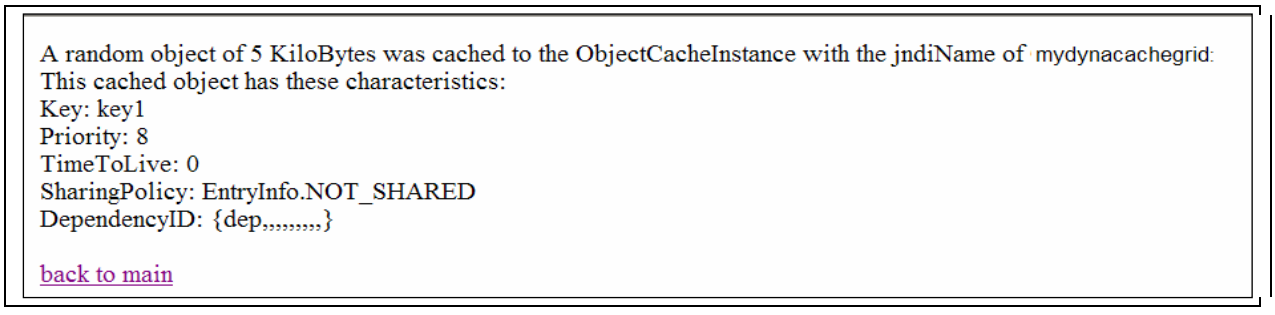


____ 12. Click **Cache the Object**.

This will call a second JSP that reads the arguments passed in from the first JSP, places an entry into the cache instance (grid), and then displays the status.

____ 13. Results will be displayed in a new page as follows:



____ 14. You can click the "**back to main**" link to enter different values and to run again.

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____ 15. View your server logs to verify that you are using the correct provider.

Here are some WebSphere Application Server messages that you will see in the SystemOut.log. Note the provider, the grid created and the topology.

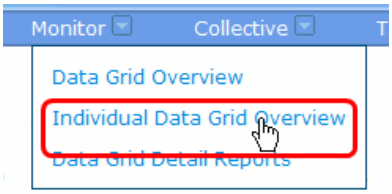
```
ObjectGridImp I   CWOBJ4700I: The map name IBM_DC_PARTITIONED_mydynacachegrid
        matched the regular expression of template map IBM_DC_PARTITIONED_.*.  The
        IBM_DC_PARTITIONED_ mydynacachegrid map has been created for ObjectGrid my-
        dynacachegrid.
CacheProvider I   CWOBJ4508I: The WebSphere eXtreme Scale provider has created a Dy-
        namic Cache instance with name mydynacachegrid using topology remote.
ServerCache   I   DYNA1001I: WebSphere Dynamic Cache instance named mydynacachegrid
        initialized successfully.
ServerCache   I   DYNA1071I: The cache provider
        "com.ibm.ws.objectgrid.dynacache.CacheProviderImpl" is being used.
```

You are now ready to view the results of your cached objects in the DataPower XC10 Appliance console.

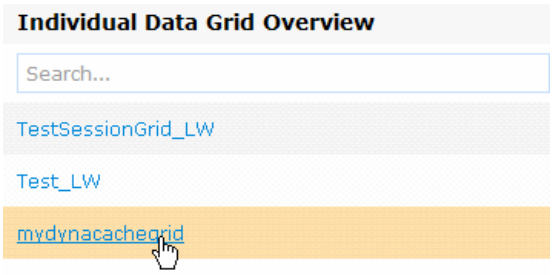
Section 3: Monitoring cache from the DataPower XC10 Appliance console

____ 16. Log into the DataPower XC10 Appliance console, if not already logged on.

____ **17.** To view your results, click the **Monitor** dropdown on the top bar, and click **Individual Data Grid Overview.**



____ 18. The individual data grid overviews are displayed at the left. Click **mydynacachegrid**.



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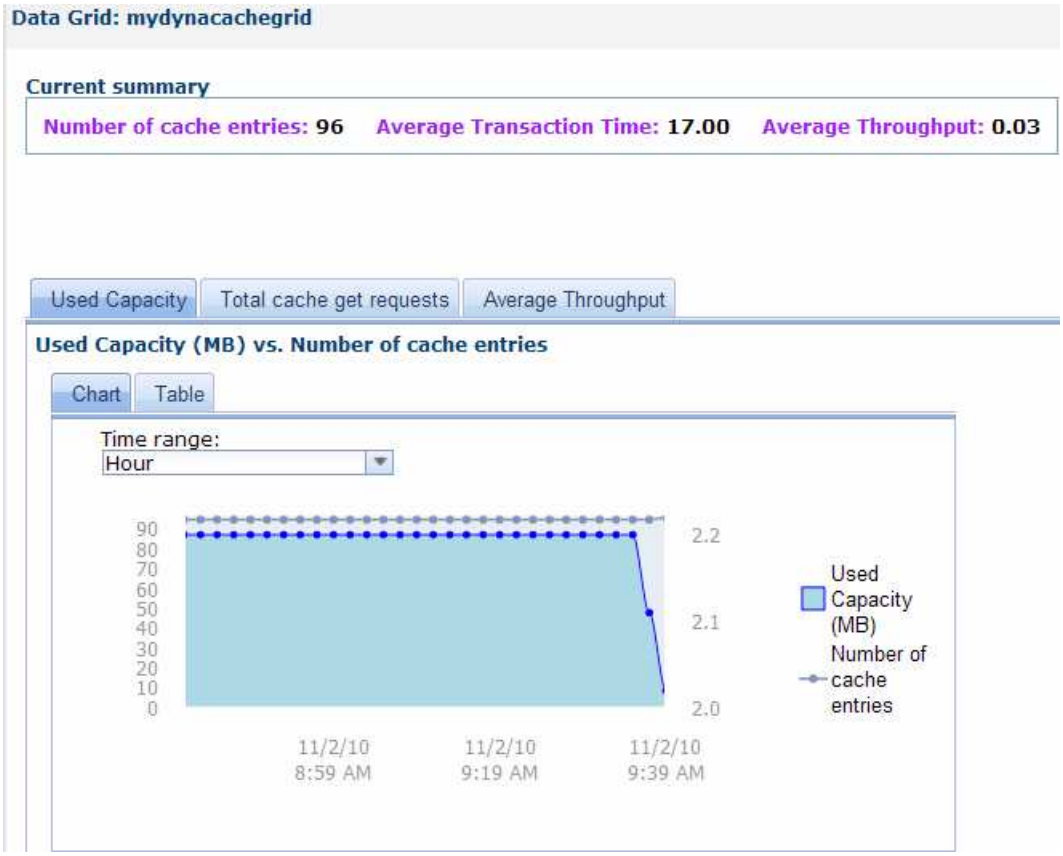

Learn: Recall, an appliance has 47 partitions defined. Two entries are automatically created for each partition. This means that for dynamic cache, there are 94 cache entries created by default for every dynamic cache data grid. These cache entries contain dynamic cache provider statistics and the dynamic cache configuration for WebSphere Application Server. Therefore, 95 cache entries are displayed in the monitoring panel when you add one cache entry. Once you add new cache entries that number should change. For the example shown, the number of cache entries added is 2.

The **average transaction time** is the average time elapsed for transactions within a certain time period.

Average throughput is the throughput acquired over that time and it's measured in transactions per second.

__ a. Click the **Total cache get requests** tab.

The total cache get requests tab shows you the total number of get requests and the number of requests successfully fulfilled by the data cache on the appliance. This chart helps you visualize the number of successful queries to the cache. Note that you can change the time range through the drop down menu to see the results, by day, by week or by month.

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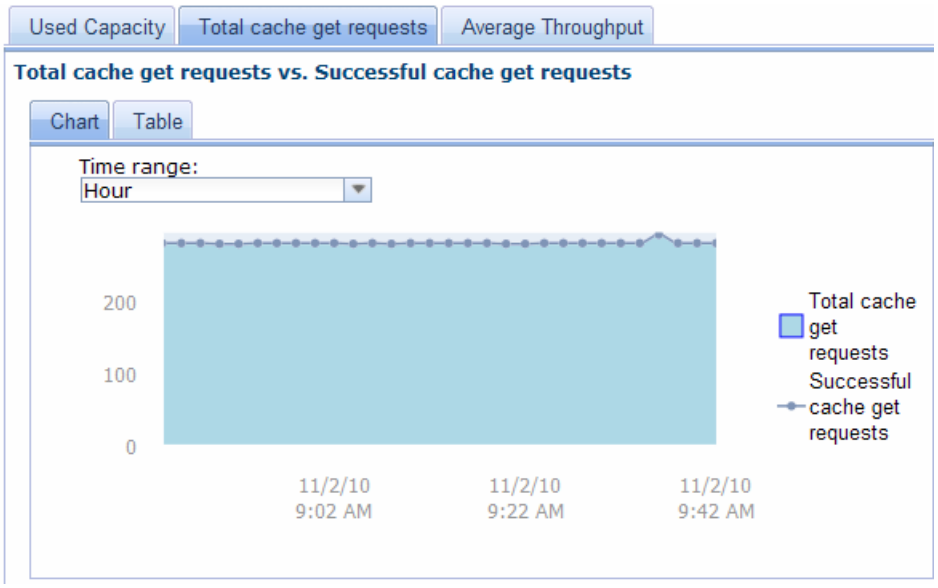
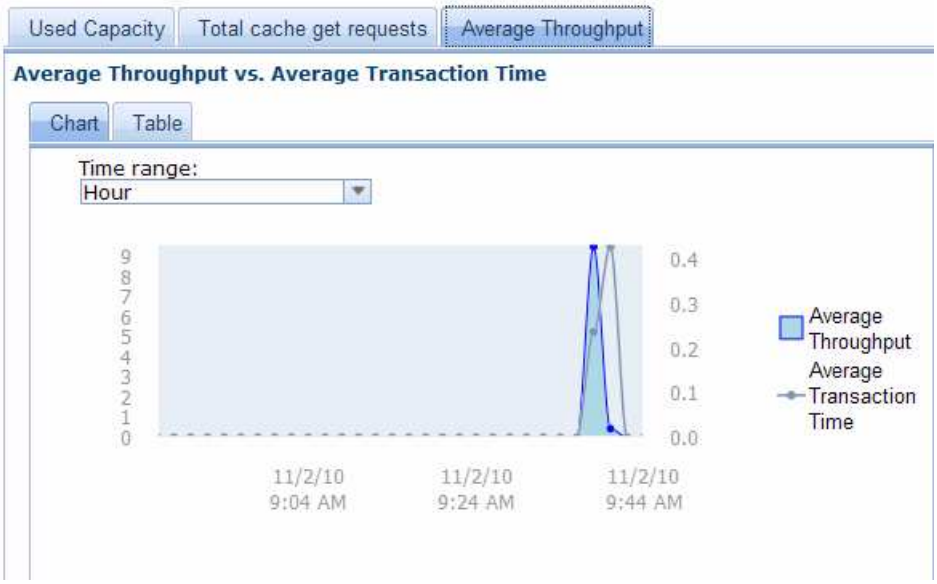


__ b. Click the **Average Throughput** tab.



Learn: Recall, each dynamic cache has 47 partitions defined. Two entries are automatically careated for each partition. This means that for dynamic cache, there are 94 cache entries created by default for every dynamic cache data grid. These cache entries contain dynamic cache provider statistics and the dynamic cache configuration for WebSphere Application Server. Therefore, when you add one cache entry 95 cache entries are displayed in the monitoring panel. As you add additional cache entries that number should change. For the example shown, the number of cache entries added is 2.

The **Average Transaction Time** is the average time elapsed for transactions since the previously reported value.

A**verage Throughput** is the throughput acquired over that time, measured in transactions per second.

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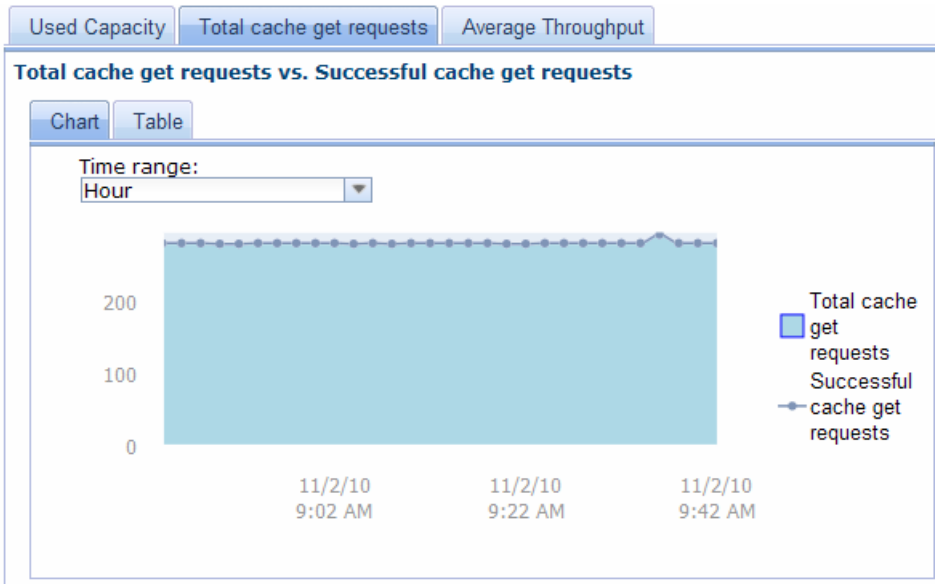
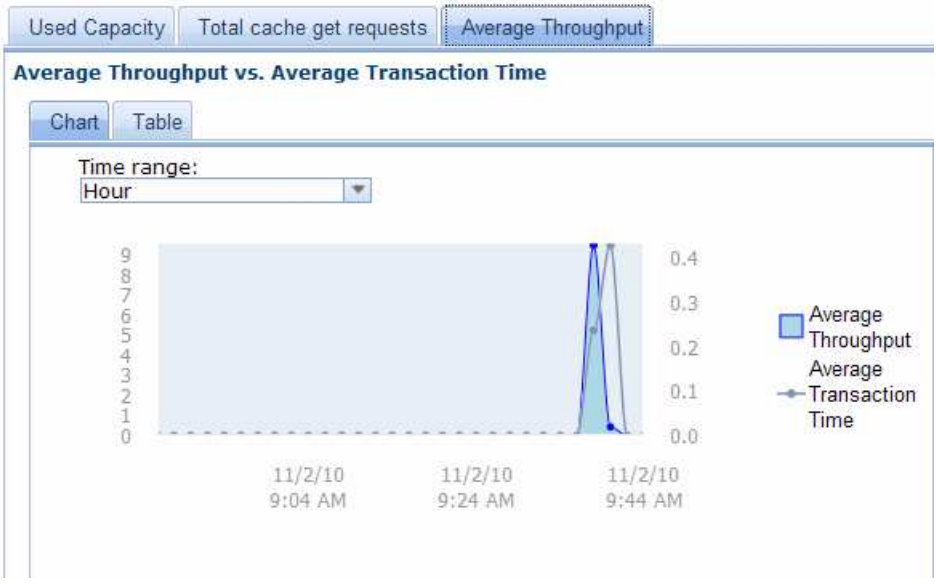
__ c. Click the **Total cache get requests** tab.



The total cache get requests tab shows you the total number of get requests and the number of requests successfully fulfilled by the data cache on the appliance. This chart helps you visualize the number of successful queries to the cache. Note that you can change the time range through the drop down menu to see the results, by day, by week or by month.

__ d. Click the **Average Throughput** tab.



The **Average Throughput** chart displays the throughput and the transaction time averaged between updates.

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Part 2: Dynamic Caching: Servlet cache instance

A servlet cache instance is a location in addition to the default dynamic cache where the dynamic cache service can store, distribute, and share the output and the side effects of an invoked servlet. By configuring a servlet cache instance, your applications have greater flexibility and better tuning of cache resources. The JNDI name specified for the cache instance is mapped to the name attribute in the <*cache-instance*> tag in the *cachespec.xml* configuration file included with your application.

Section 1: Setup

This part will show you how to set up caching for a servlet cache instance using the DataPower XC10 Appliance.

____ **1.** Create a catalog service domain if one does not exist yet. Follow the steps detailed in **part 1, section 1, step 1.**

____ **2.** Create the grid using dynaCfgToAppliance script described in part 1. Execute the script with the grid name of baseCache**.**

```
Example: dynaCfgToAppliance.bat test12.ibm.com baseCache testadmin testadmin
8879
```

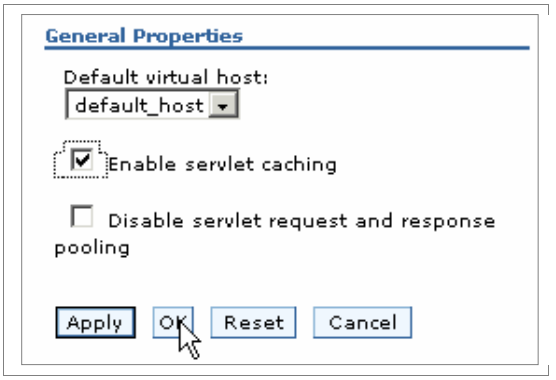
Learn: baseCache: When the dynamic cache function was first added it only had one default servlet cache instance which was called baseCache. When servlet caching is enabled and the cachespec.xml file for an application does not include the <cache-instance> tag to dictate which cache instance to use, the name defaults to baseCache. Thus, when a servlet cache is enabled on the web container, the baseCache is automatically created. Therefore the expected JNDI name for the servlet cache instance is baseCache which means that when creating the grid for it, it has to be named baseCache. The DataPower XC10 appliance does not include a baseCache instance by default, so it must be explicitly created.

____ 3. Enable servlet caching on WebSphere Application Server.

__ **a.** On WebSphere integrated solution console, Expand **Servers → Server Types → WebSphere application servers → server1.**

__ **b.** Under container settings, expand **Web Container Settings → Web container.**

__ **c.** Check the box **Enable servlet caching.**



__ d. Click "**Ok**" and "**Save**".

__ e. Set the cache provider and replication settings.

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Note: The cache provider, replication setting and the topology property on the baseCache instance are not set at the same location as the object cache instances. The settings for the baseCache are set in the WebSphere Application Server managed server instance under the Dynamic Cache Service.

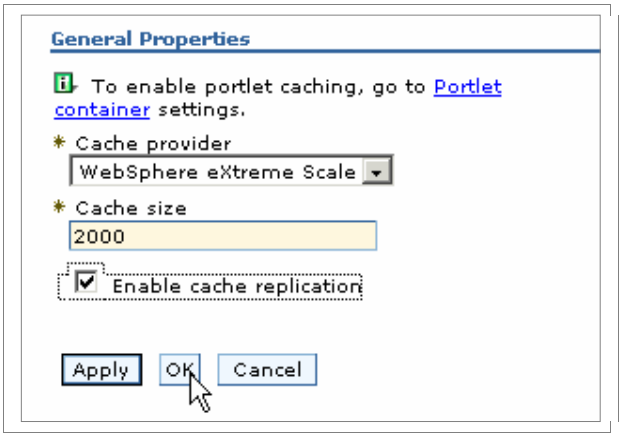
__ **f.** Expand **Servers → Server Types → WebSphere application servers → server1.**

__ **g.** Under **Container Settings** on the right, expand **Container Services → Dynamic cache service.**

__ h. Under the **General Properties**, **Cache provider**, select **WebSphere eXtreme scale** provider from the drop down list.

__ i. Allow **Cache size** to default to 2000.

__ j. Select **Enable cache replication** just like you did with the object cache instance.



__ k. Click "**Ok**" and "**Save**".

____ 4. Set the topology.

Note: The property com.ibm.websphere.xs.dynacache.topology has to be set at the **application server JVM level** for the servlet. This is unlike where this property is set up in the object cache instance.

__ **a.** Expand **Servers → Server Types → WebSphere application servers → server1.**

__ **b.** Under **Server Infrastructure** on the right, expand **Java and Process Management.** Click "**Process definition**".

__ **c.** Under Additional properties on the right, click **Java Virtual Machine.**

__ d. Under Additional properties on the right, click **Custom properties**. Click "**New**" to add the topology property.

1) Enter **com.ibm.websphere.xs.dynacache.topology** for the name.

2) Enter **remote** for the value.

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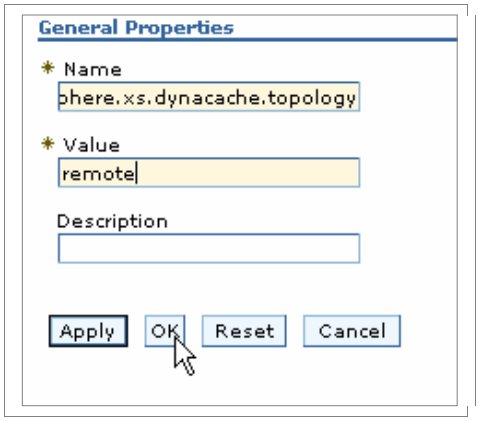

3) Click "**Ok**" and "**Save**".

____ 5. Restart your WebSphere Application Server.

1) You are now ready to test your servlet cache instance application.

Section 2: Testing

The DynamicCacheTest.ear file provided with the lab contains two web applications: MaxCacheWeb.war and DynacacheTestWeb.war.

The DynacacheTestWeb application is a simple test application that will display and cache a time value for 10 seconds. If the application server is properly configured it will generate dynamic cache servlet cache entries in a DataPower XC10 dynamic cache grid.

____ 6. If you have not already done so, install the provided DynamicCacheTest.ear file through the WebSphere integrated console as a WebSphere enterprise application.

Start the Network deployment manager, if not already started.

__ a. Start the WebSphere Application Server, if not already started.

__ b. Login to the WebSphere integrated console.

__ **c.** Expand **Applications → Application Types → WebSphere enterprise applications.**

__ d. Click "**Install**".

__ e. Browse to <LAB_FILES> to locate the Dyna**micC**acheTest.ear.

__ f. Install the EAR file taking the defaults during the installation.

____ 7. Once the application is successfully installed, start the application and ensure it starts successfully.

__ **a.** Expand **Applications → Application Types → WebSphere enterprise applications.**

__ b. Select **DynamicCacheTest** and click "**Start**".

____ 8. Start a web browser and type the following URL to access the DynacacheTest application:

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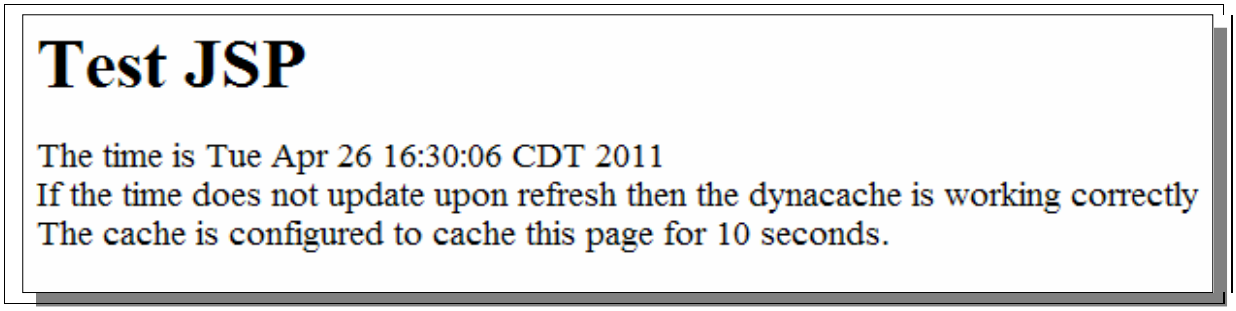
http://<host:port>/DynacacheTestWeb/Test.jsp

where *host* is the name or ip address of the system where you have a WebSphere Application Server installed and the port is the default host port for that application server.

Example: http://test2.austin.ibm.com:9080/DynacacheTestWeb/Test.jsp

Expected results:

____ 9. This is the page that you will see. The application displays the current time and caches it for 10 seconds. If you refresh the browser after 10 seconds, you should see a time change.



____ 10. Look at the WebSphere log messages to confirm baseCache is being used.

__ a. Go into <WAS_HOME>/profiles/AppSrv01/logs/server1.

__ b. Open the SystemOut.log file.

__ c. View this file for the following messages:

```
ObjectGridImp I   CWOBJ4700I: The map name IBM_DC_PARTITIONED_baseCache
         matched the regular expression of template map
         IBM_DC_PARTITIONED_.*.  The IBM_DC_PARTITIONED_baseCache map has
         been created for ObjectGrid baseCache.
CacheProvider I   CWOBJ4508I: The WebSphere eXtreme Scale provider has cre-
         ated a Dynamic Cache instance with name baseCache using topology re-
         mote.
ServerCache   I   DYNA1001I: WebSphere Dynamic Cache instance named baseCache
         initialized successfully.
ServerCache   I   DYNA1071I: The cache provider
         "com.ibm.ws.objectgrid.dynacache.CacheProviderImpl" is being used.
ServletCacheS I   DYNA1055I: Dynamic Cache (servlet cache) initialized suc-
         cessfully.
```

__ d. If you see the message "*DYNA1071I: The cache provider "default" is being used.*" then the server is not configured to use the DataPower XC10 appliance.

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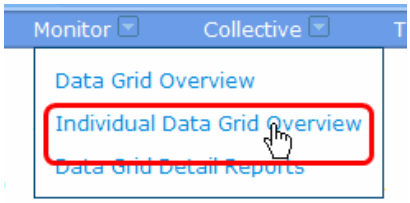
Section 3: Monitoring cache from the DataPower XC10 Appliance console

____ 11. You can view the results of the baseCache on the DataPower XC10 Appliance in a similar way as you did with the object cache in section 1.

____ 12. Log into the DataPower XC10 Appliance console, if not already logged on.

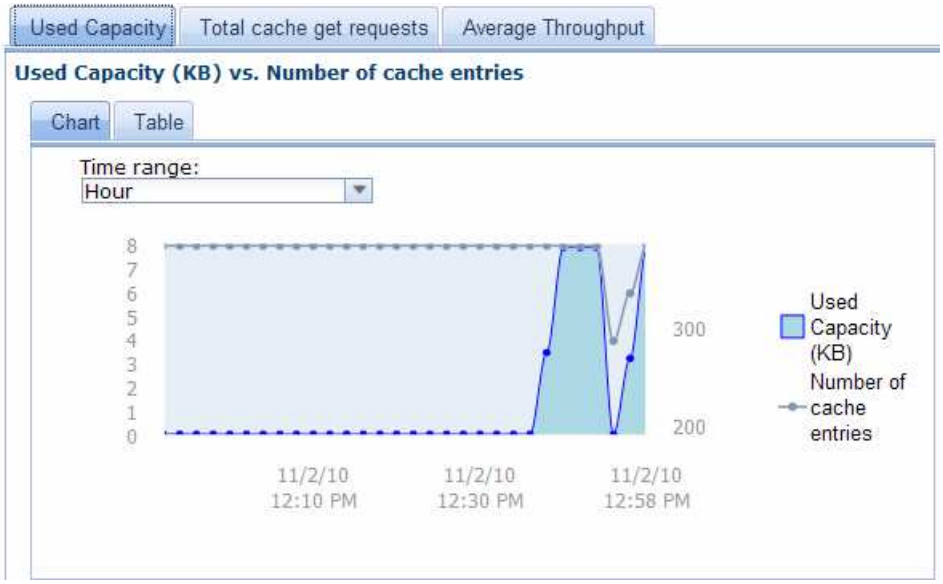
____ 13. Go into the Monitor menu option from the top bar to view your results.

__ **a.** Click **Monitor → Individual Data Grid Overview**



__ b. Select **baseCache** from the available list of grids on the left hand-side.

__ c. baseCache results should be displayed on the charts similar to those you saw in the object cache in section 1.



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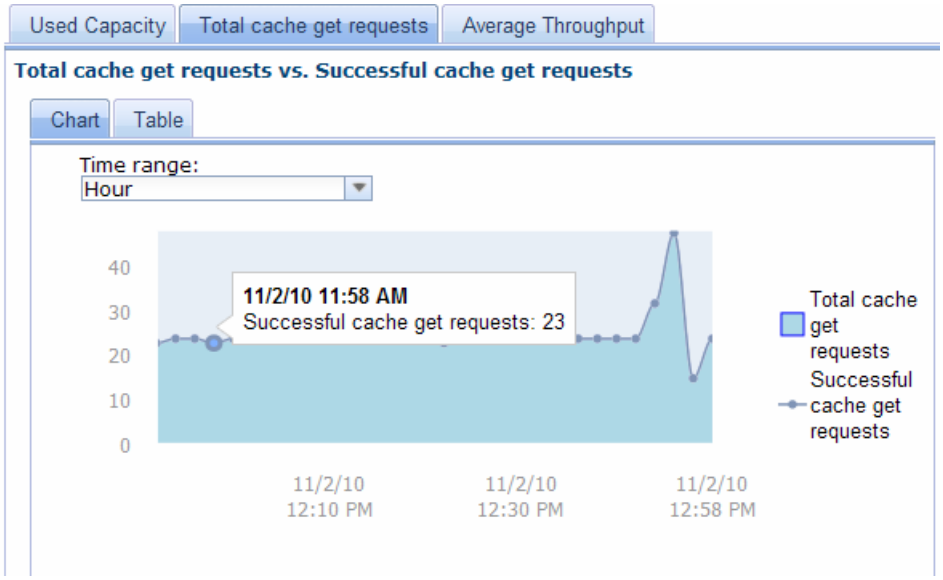
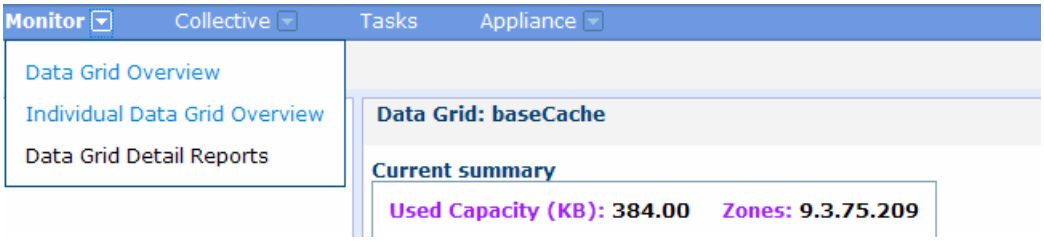


Note: You can click any of the plot points on the graph for a specific data point. As an example, this plot point shows 23 successful cache get requests.

You can also look at the data grid details by going to the menu **Monitor → Data Grid Detail Report → <Grid_name>.**

This will show you more specifics of the grid.



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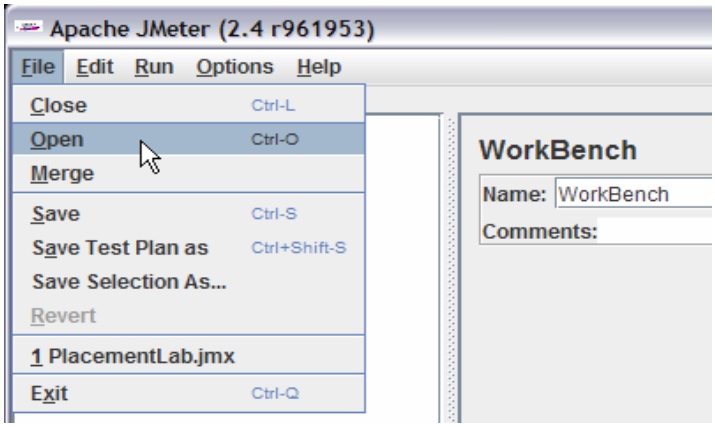
Part 3: Load test

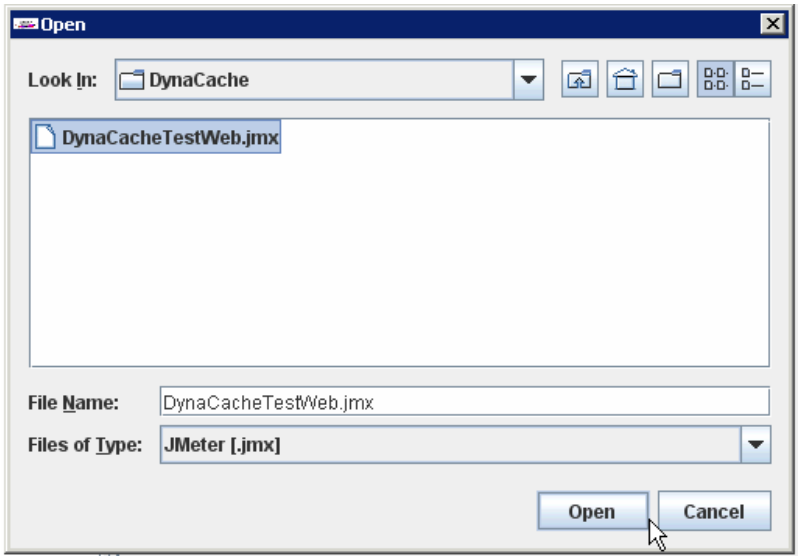
Note: In this lab you will use Apache JMeter to generate a simulated load on the test application. This tool is freely available from http://jakarta.apache.org/JMeter/. For windows you will want to download the <level>.zip file (for example 2.4.zip).

____ 14. Start JMeter on your client machine. For the Early Program Cloud system, open a command window and navigate to **C:\JMeter**. Start it by invoking **jmeter.bat**.

__ a. On the JMeter interface select File → Open



__ b. Navigate to the location of the lab source files **(C:\LabFilesXC10\DynaCache)** and select the **DynaCacheTestWeb.jmx** file. Click Open.



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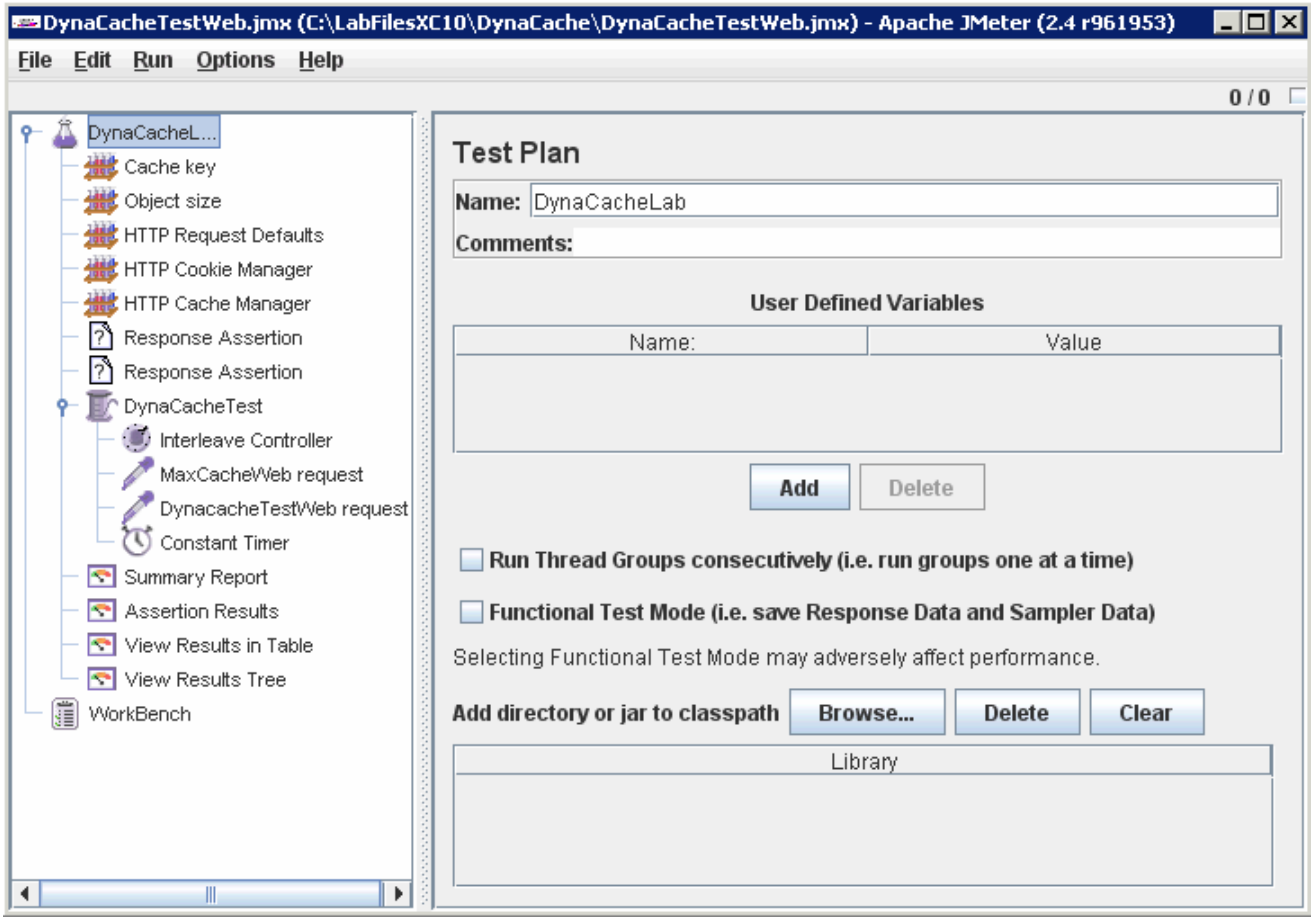
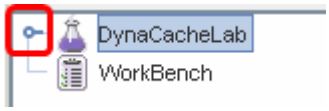
__ c. You will see something similar to this in the GUI.



__ d. If the plan is “collapsed”, click this graphical symbol in the left pane to expand the plan so that it looks like the previous example:



This plan will drive a moderate amount of load against each of your web modules.

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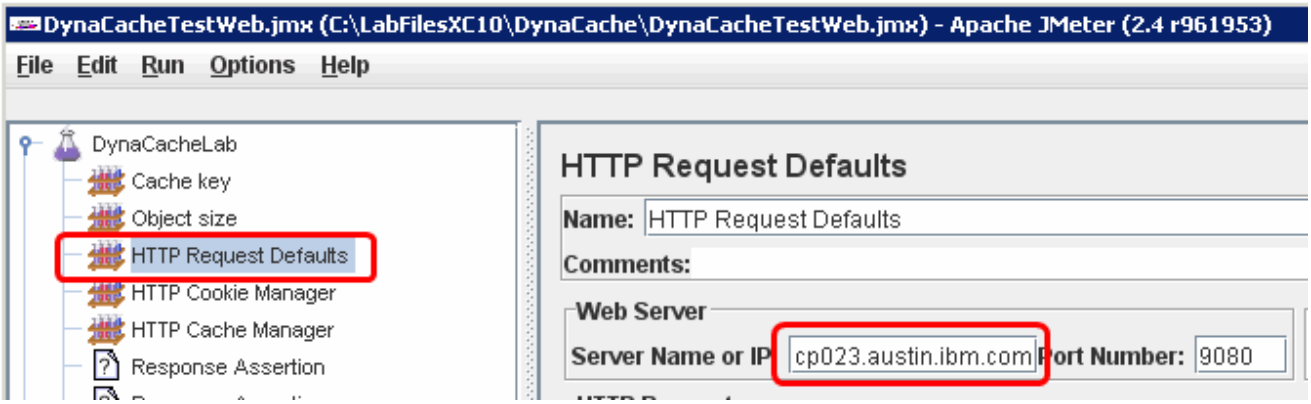
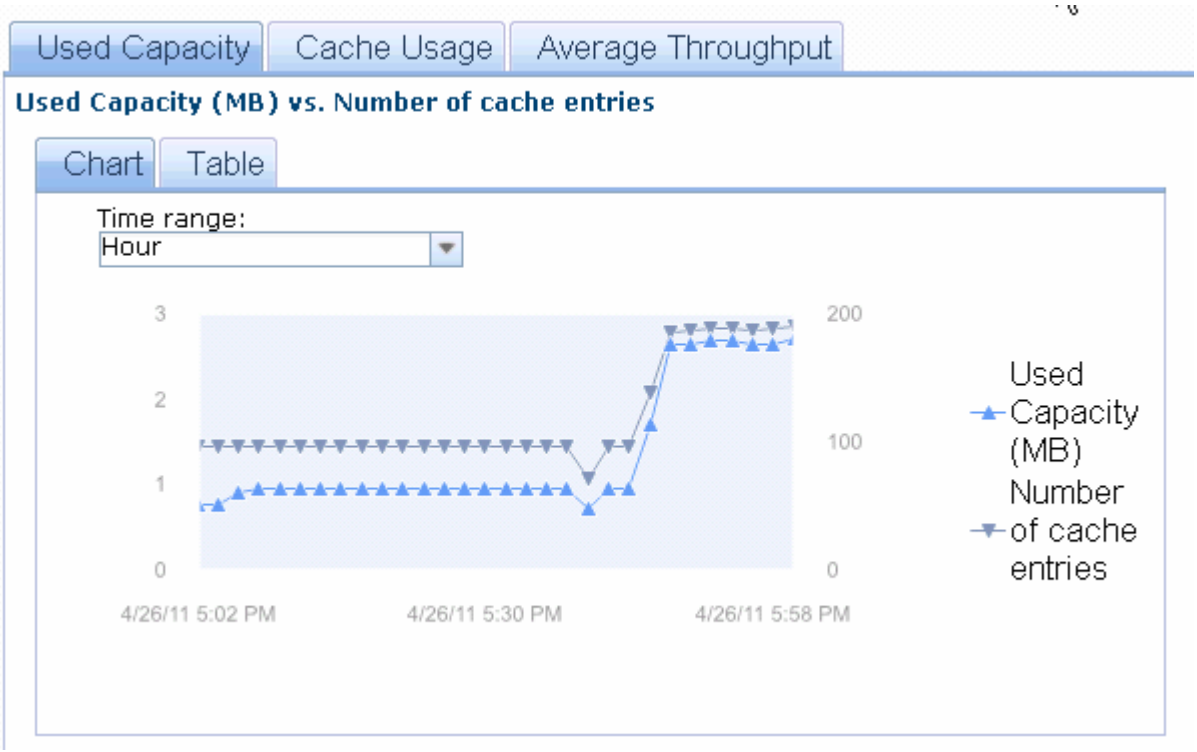
__ e. Click **HTTP Request Defaults**. Overtype the "Server name or IP" field with your WebSphere Application server node name.



__ f. Click **Run** then click **Start** to start the stress tool using these plan settings.

__ g. Observe the application Average ThroughPut times in the DataPower XC10 appliance administrative console. Navigate to **Monitor > Individual Data Grid Overview** and click **mydynacachegrid** in the left pane.

__ h. You will see the **Used Capacity** chart for mydynacachegrid, expressed in Megabytes. If you review this chart within an hour of starting the JMeter load generator, you can probably see where you started JMeter in the chart by the increase in activity. Hover over any of the data points to see the date, time, and used capacity. Click the **Table** tab to see a table of these values.



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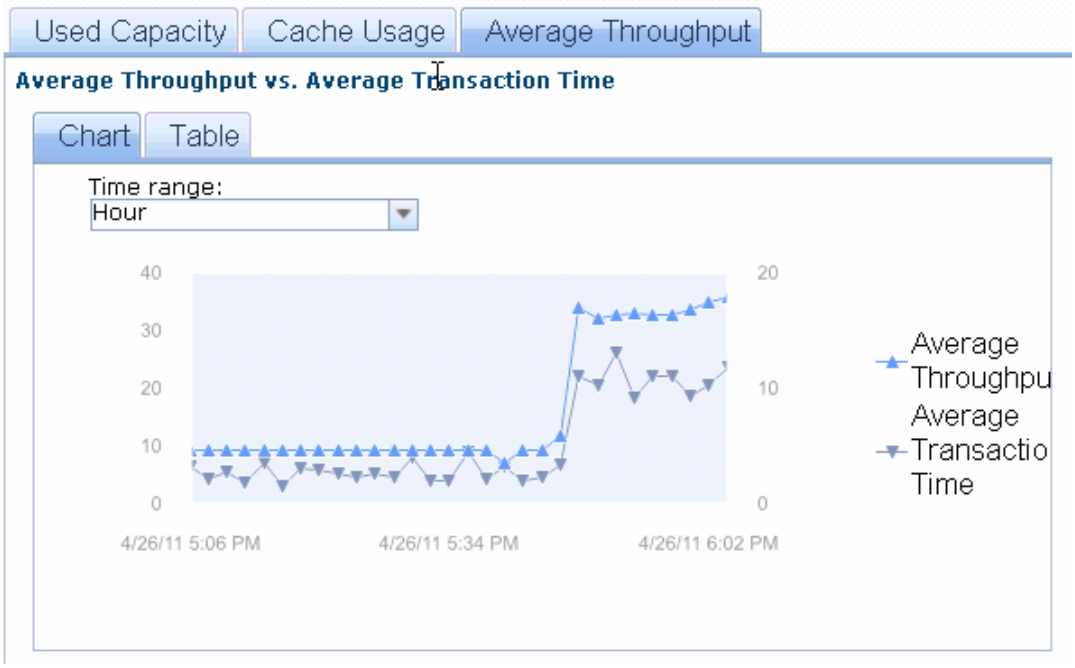
__ i. Click the **Average Throughput** tab at the upper right of the chart.

__ j. You can now see the graphing of the Average Throughput and Average Transaction Time over a period of time. If you review this chart within an hour of starting the JMeter load generator, you can probably see where you started JMeter in the chart by the increase in activity. Hover over any of the data points to see the date, time, and average throughput or average transaction time. Click the **Table** tab to see a table of these values.



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Part 4: Comparing dynamic cache solutions

As you saw in parts 1 and 2 of the lab, WebSphere Application Server allows the DataPower XC10 to act as the core caching engine using DynaCache APIs. This section provides some of the tools needed to evaluate a DataPower XC10 cache provider solution.

DISCLAIMER: Performance tuning and evaluation is a specialist profession in its own right and it takes experience to know what “normal” performance looks like when looking at a system’s performance characteristics. If your company does not have a specialist performance practitioner on its staff, it is recommended you engage a consultant throughout the project life cycle.

Section 1: Feature comparison

This section of the lab will compare the default cache engine service provider for the DynaCache APIs that is built into WebSphere Application Server with the dynamic cache feature of the DataPower XC10 Appliance. A large WebSphere clustered environment will be discussed, because it is the common use case and the most inclusive scenario. If your environment is less complex, some of the features discussed in this section may not apply to you.

With the default dynamic cache service provider, caches are stored in the JVM heap memory and DynaCache supports overflow to disk, if enabled. The servers are joined together into a cluster and benefits are derived from caching objects requested by one client for later retrieval by another client. In this clustered environment, if an object is not stored in local memory, one server can request the item from a neighboring cache member. The Data Replication Service (DRS) is a system of replicating and synchronizing caches between local servers to copy data from one node to another to facilitate this approach. This process guarantees that repeated requests for the same information can be handled faster and reduces the need to fetch objects directly from the source of origin.

Caching as close to the client as possible, the previous approach reduces the number of network hops needed, but there is a limit to the in-memory cache size. The default dynamic cache provider relies on the use of a disk cache to allow cache instances to grow beyond the size of a single process. With 160GB of storage per unit, the DataPower XC10 Appliance offers a larger, scalable, server-side cache than what you have in your local server memory. Creating a collective, by grouping more than one DataPower XC10 Appliances together, allows you to further increase your cache capacity with consistent performance as your data transaction needs grow. The larger cache afforded by the use of the DataPower XC10 Appliance can store more data which can eliminate the need for a disk cache and the expensive disk storage systems needed to make them perform. Also, depending on the configuration of your environment, going to the DataPower XC10 Appliance to retrieve an object might be faster than retrieving an object from the disk cache.

Rather than replicating and synchronizing caches between local servers like you would with the data replication service (DRS) provided with the WebSphere default dynamic cache engine, you can create a data cache on the DataPower XC10 appliance which holds a collection of data from one or more clients that can be shared by multiple dynamic cache service providers. Furthermore, DRS replication ensures failover support, but using a collective of DataPower XC10 Appliances will also guarantee high availability and fault tolerance. If an appliance housing the primary data cache fails, a replica on another appliance in the collective is automatically promoted to be the primary. Multiple replicas can be supported and are transparent to the application that uses the DataPower XC10 Appliance to store data. The collective lowers risk of data loss through automatic replication of data. The result is business application data is available whenever the client needs it.

With the WebSphere default dynamic cache provider, the cache is maintained locally within the JVM. So when a new client or cluster member JVM is added, the local in-memory cache will start empty and need to be "warmed up" before it is truly useful as a cache. Whereas, with the dynamic cache provider using a

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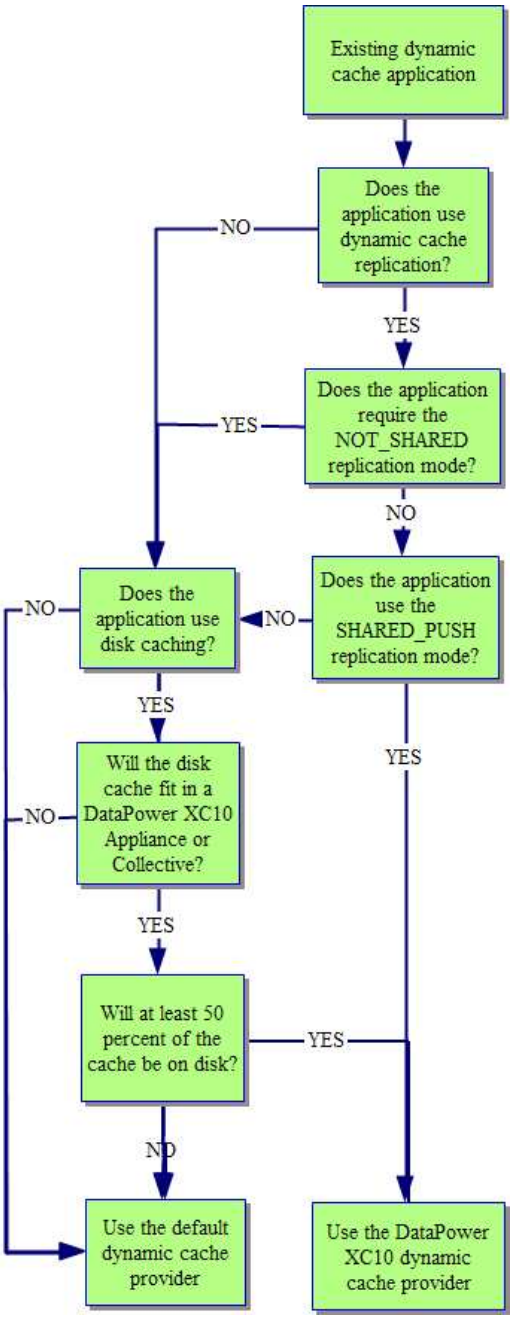
remote eXtreme Scale grid (such as what is resident in a DataPower XC10 Appliance), new client or cluster members will immediately attach and run with the fully loaded and functional grid on the DataPower XC10 Appliance.

Section 2: Decision models

The advantages mentioned in section 1 do not mean that the DataPower XC10 dynamic caching solution is the right choice for every application. Therefore, some sample decision trees are provided to assist you in evaluating the DataPower XC10 dynamic cache capabilities.

Decision tree for migrating existing dynamic cache applications



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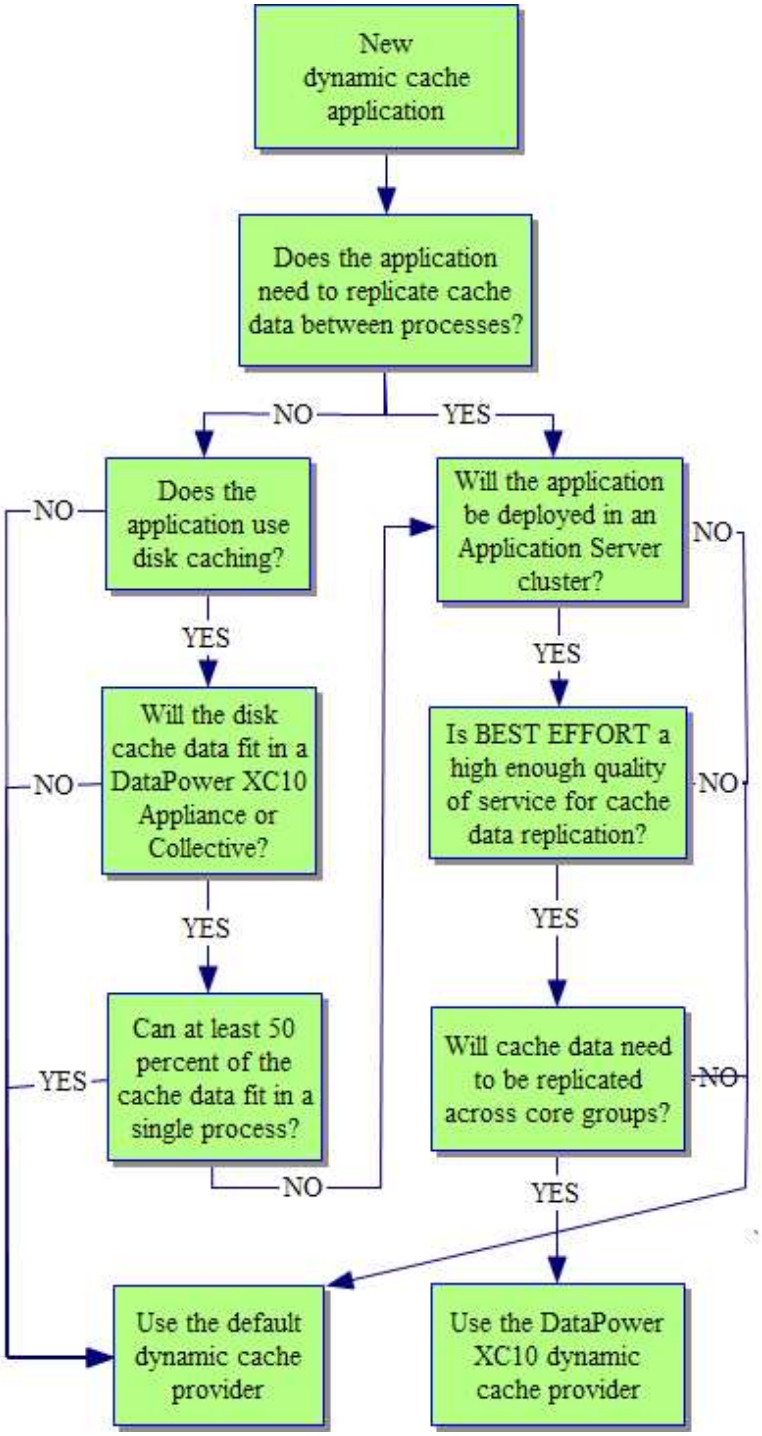
Decision tree for choosing a cache provider for a new application



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Sample decision tree for migrating existing dynamic cache applications

Another way to approach the DataPower XC10 product evaluation is to create a performance based decision tree. This decision tree model represents two dynamic caching scenarios. The top side of the tree … DataPower XC10 data cache miss goes out to the back-end data store. The cache offload miss does too.

DISCLAIMER: The tree provided and the example equations shown below contain fictional values that are provided as an example ONLY to show how to calculate your unique performance data. Use this decision tree and formula calculation in conjunction with your own dynamic caching application. If the tree does not accurately represent your environment, then modify it and the formula to match your system.

Use this decision tree and formula calculation in conjunction with your unique own dynamic caching application. First, run your candidate dynamic caching application in your current WebSphere Application Server environment. Dynamic cache statistics are reported by the CacheMonitor application or the dynamic cache MBean for the WebSphere default dynamic cache provider. Once the benchmark performance data has been obtained for the current system, measure the DataPower XC10 system to establish a new baseline. Follow the lab instructions in part 1 or part 2 to configure your own dynamic caching application to cache data in the DataPower XC10 Appliance. Then use the monitoring tools discussed in this lab to performance test the completed system and input statistics into the decision tree. Finally, use the formula provided to quantify the effectiveness of DataPower XC10 dynamic caching on system performance.

Note 1: Consider a long running test, so that numbers recorded in the decision tree will accurately reflect the performance of your current DynaCache data caching system and the DataPower XC10 Appliance configuration.

Note 2: Before you engage in any DynaCache performance exercise, ensure there are no bottlenecks in the network. You should check that:

- Server network cards are configured correctly, meaning they are set to a fixed address, and not auto detect.
- All components (routers, switches, IP sprayers, and so forth) are configured and capable of running at the correct network speed.
- TCP/IP has been configured correctly, for example, with appropriate time-out and keep-alive settings.
- You are not competing with other traffic, such as a WAN, on this network.
- The servers are on a separate subnet.

Note 3: The reusability of objects cached should also be considered in terms of whether an object is specific to a user, session, store, or if it is a site-wide or publicly reusable object that is reusable across requests. If your application does not cache objects that are reused frequently, then there will be fewer realized performance improvements.

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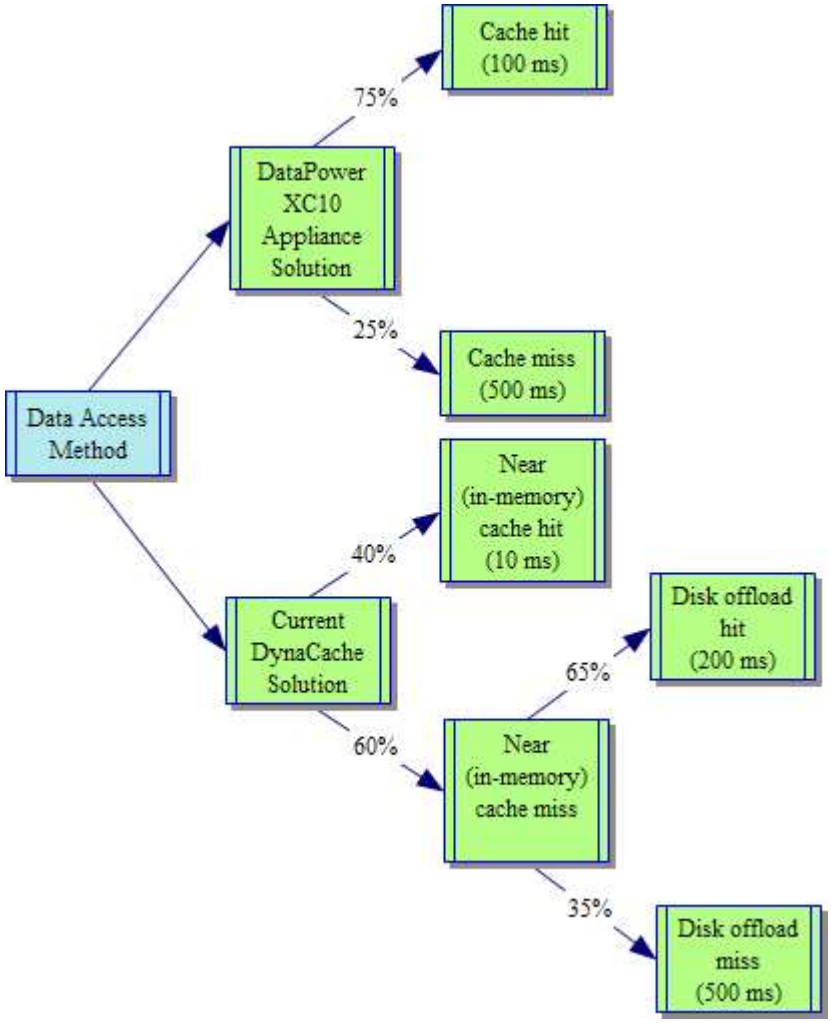

DISCLAIMER: The tree provided here and the example equations shown below contain fictional values that are provided as an example ONLY to show how to calculate your unique performance data.

____ 1. Once you have assessed the probabilities of each outcome and accurately recorded the values of the outcomes, insert them into a decision tree that represents your dynamic caching system options.

____ 2. Start with your current dynamic cache solution. In this example, it is the WebSphere Application Server default dynamic cache provider environment. In this sample tree, it is represented by the bottom branch of the tree.

____ 3. Start on the far right side of the decision tree and begin to calculate the value of the furthest out node.

__ a. 0.65(probability of a cache offload hit) x 200ms = 130ms

__ b. 0.35(probability of a cache offload miss or call to the backend data store) x 500ms = 175ms

__ c. 140ms + 150ms = 305ms = the value of the average time needed to retrieve an object when it is not in the in-memory JVM heap of an application server

____ 4. Calculate your current dynamic cache environment benchmark time value.

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__ a. 0.4(probability of a near cache hit) x 10ms = 4ms

__ b. 0.6(probability of a near cache miss) x 305ms = 183ms

__ c. 4ms + 183ms = 187ms = the value of the average amount of time needed to retrieve an object in your current dynamic cache environment.

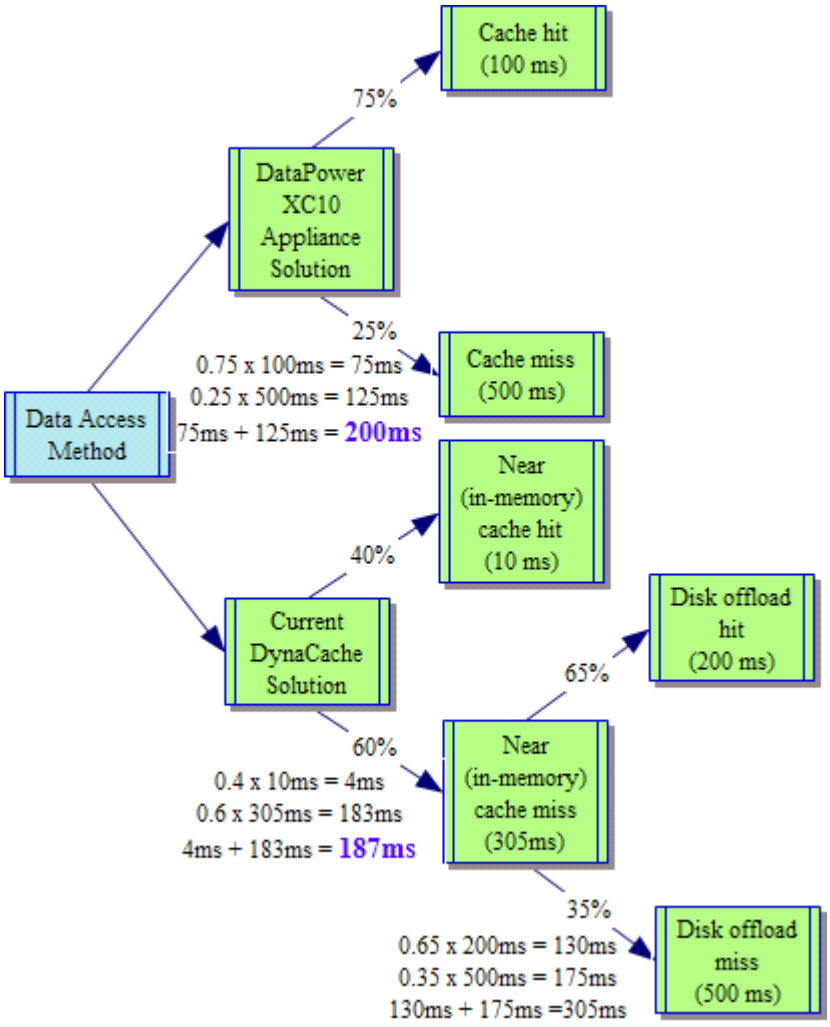
____ 5. Now calculate the time value for the DataPower XC10 Appliance dynamic cache solution. In this sample tree, it is represented by the top branch of the tree.

__ a. 0.75(probability of a DataPower XC10 appliance dynamic cache hit) x 100ms = 75ms

__ b. 0.25(probability of a DataPower XC10 cache miss or call to the backend data store) x 500ms = 125ms

__ c. 75ms + 125ms = 200ms = the value of the average time needed to retrieve an object in the DataPower XC10 Appliance dynamic caching environment.

____ 6. You can then compare the results to help you to make your product decision.



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What you did in this exercise

In this lab, you learned how to set up dynamic caching to use the IBM WebSphere DataPower XC10 Appliance for both the object and servlet cache instances. You were also able to test the cache configuration and track the results on the DataPower XC10 Appliance using the simple applications provided. Finally, you saw some tools that should assist you in comparing your current dynamic cache provider with the DataPower XC10 dynamic caching solution. Consider not just the performance implications, but the features mentioned in Section one and the costs associated with them when evaluating the DataPower XC10 as a viable solution for your company. Compared to disk offload, the DataPower XC10 scales cost effectively with consistent performance. The DataPower XC10 provides the ability to use transactional support, improved scalability, and high availability without making changes to your existing DynaCache caching code.

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Appendix: CacheMonitor application

Also provided is an optional application called CacheMonitor. This application enables you to see information about dynamic caches. This application is an enhancement to the cache monitor that is shipped with WebSphere. With previous versions of the CacheMonitor, server statistics were collected from one server at a time and this caused some results to be mis-represented. This enhancement provides more consistent results when working with a data grid that can be accessed by multiple servers, like with the WebSphere eXtreme scale or DataPower XC10 cache provider solution. For this exercise, you will need to install the CacheMonitor.ear that comes with WebSphere before applying the enhancement.

____ 1. Install CacheMonitor.ear that is shipped with WebSphere Application Server through the WebSphere integrated console. This application is located in <WAS_HOME>/installableApps.

__ a. On the integrated console, expand **Applications → Application Types → WebSphere enterprise applications**.

__ b. Click "**Install**".

__ c. Select the **Remote file system** radio button.

__ d. Click the Dmgr node to navigate its file system.

__ e. Navigate to <WAS_HOME>/installableApps.

__ f. Select CacheMonitor.ear and click "**OK**" to install it.

__ g. Take the defaults during installation.

__ h. Once the application is installed click "**Save**".

____ 2. The next step is to install the enhancement extension.

__ a. Go to this URL: http://www.ibm.com/developerworks/websphere/downloads/cache_monitor.html

__ b. On the bottom of the page, click download link. You will be presented with a license agreement and a download login page.

__ c. Accept the license agreement and login into the download page.

__ d. Download **cachemonitor7_package.zip**.

__ e. Follow the instructions on how to install at this link: http://www.ibm.com/developerworks/websphere/downloads/cache_monitor.html

____ 3. Once installed, invoke the application through this URL: *http://<host>:<port>/cachemonitor* where host is the name or IP address of the system where you have a WebSphere Application Server installed and the port is the default host port for that application server.

Example: `http://test2.austin.ibm.com:9080/cachemonitor/`

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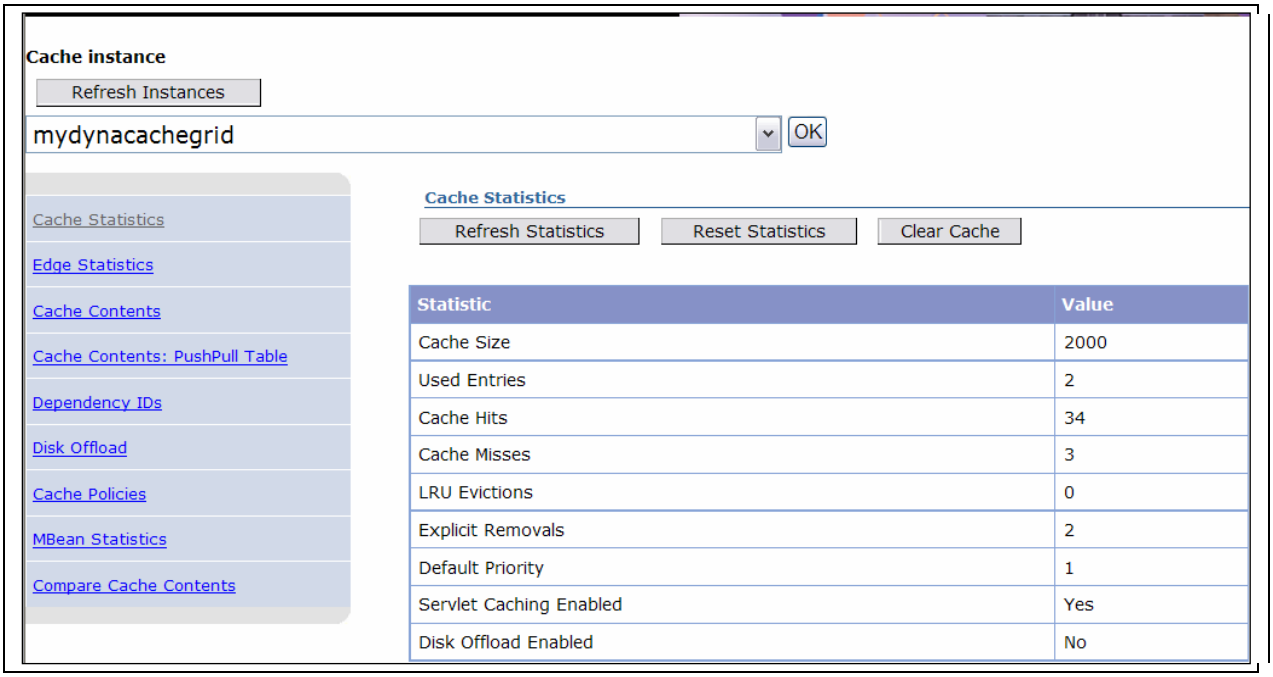

____ 4. Select the grid you want to view from the drop down list on the left hand-side and click '**OK**'. This should display information about your grid. Similar results to those displayed on this page should be observed.

Learn: The CacheMonitor has several links to display different contents of the grid. The Cache Statistics panel displays the summary of everything. You can access the other links to see specific content of the cache entries. You can also reset and refresh the contents using the buttons provided.

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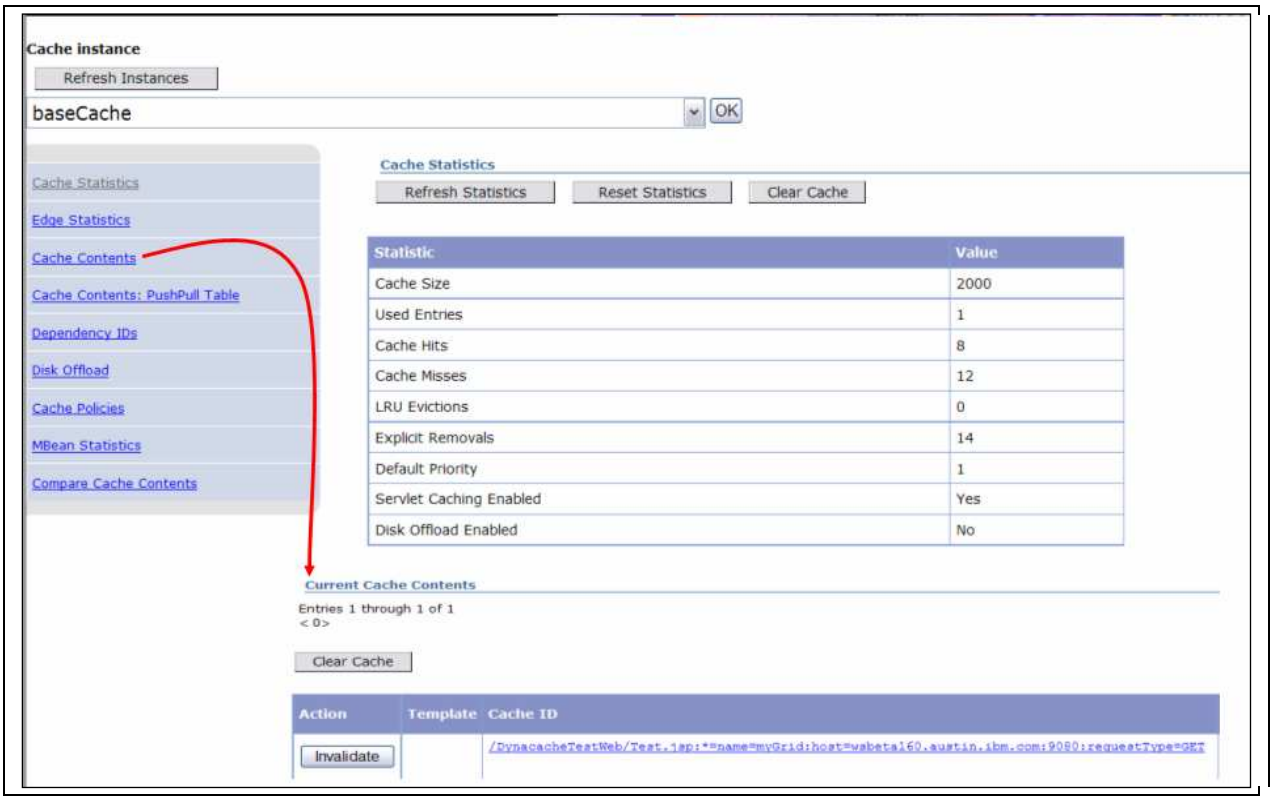
____ 5. Note that when you click the **Cache Contents** link you should be able to see the cache ID with the GET request.



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