



July 2014

# Scalability and Performance

## Oracle WebCenter Portal®

## Goal

This white paper provides benchmark results for Oracle WebCenter Portal 11.1.1.8.0. These results are meant to assist readers in sizing hardware requirements for their own deployments.

## Executive Summary

Customers have frequently requested WebCenter Portal performance benchmarking to assist them with:

1. Determining hardware requirements for a particular deployment.
2. Assessing hardware requirements for a given number of users.

In the absence of benchmarking, customers have had to adopt a size-by-experience methodology or rely on a sizing tool, running the risk of the tool's imperfect representation of the customer's specific requirements.

Given the significant performance improvements introduced in 11.1.1.8.0, it's a good time to roll out some reliable performance benchmarks.

We started the performance testing with a size-by-example approach, realizing results would be close to real-world deployment.

A predictably large variation in customer deployments obviates the impossibility of a one-size-fits-all reference deployment. So we took the approach of testing on a single use case that accurately reflects how that customer uses the product.

The use case was selected to reflect a typical, large, corporate intranet with no integration or services, like Discussion Forums, SOA/BPM, etc.--all dependent on an individual customer's implementation. The focus was the core use case that is common across customers, including page navigation, content updates, and content reads.

This white paper outlines the use case, deployment topology, best practices, configurations/optimizations, and recommended hardware employed in our benchmark testing.

Results are based on varied user loads and common use flows for employee and manager activities on an intranet. We tested against loads of 400, 800, and 1600. We found that transactions-per-second scaled linearly with the number of users and the number of managed servers. Average server response time increased as the number of users went up.

## Scope

The scope of this document covers the results from performance benchmarking on a reference deployment of a large corporate intranet created with the 11.1.1.8.0 release of WebCenter Portal.

## Use Case

A corporate intranet provides a landing page with informational articles, announcement portlets, and similar types of content. The landing page can be viewed by all employees--whether logged in or not. Additionally, each department has its own section that can be accessed and edited only by that line of business (LOB). Only authenticated users (people who are logged in) from a given LOB can create content and branded pages for that LOB. Once logged in, users can see a customized page with various content, documents, and the like.

The Intranet portal setup has a landing page. The preview of the landing page is as indicated below:

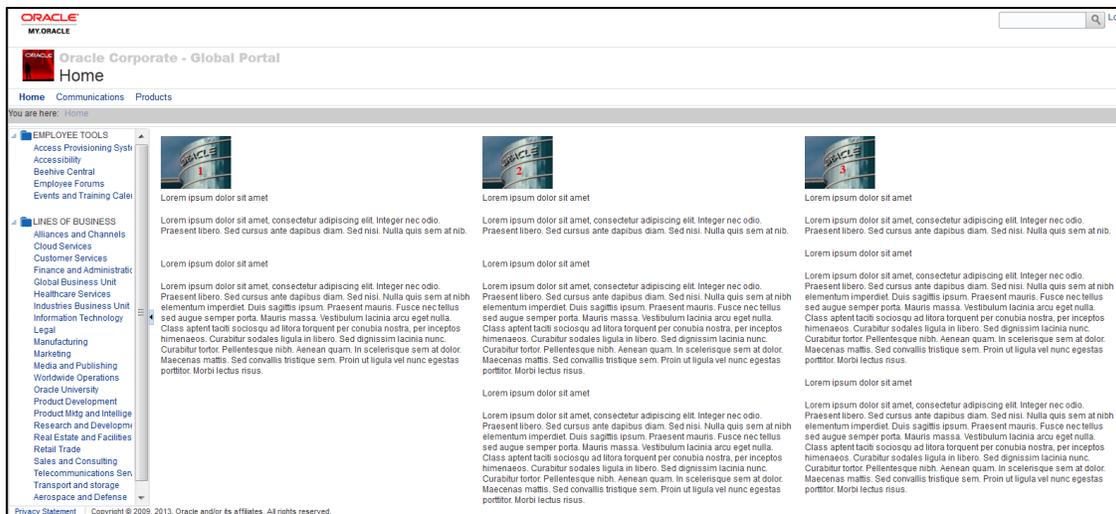


Figure 1 - Intranet Landing Page

- Department Specific Site
  - Menu navigation and page content changes as users navigate to a department-specific site. Each LOB has its own document set that is organized into folders and sub-folders.

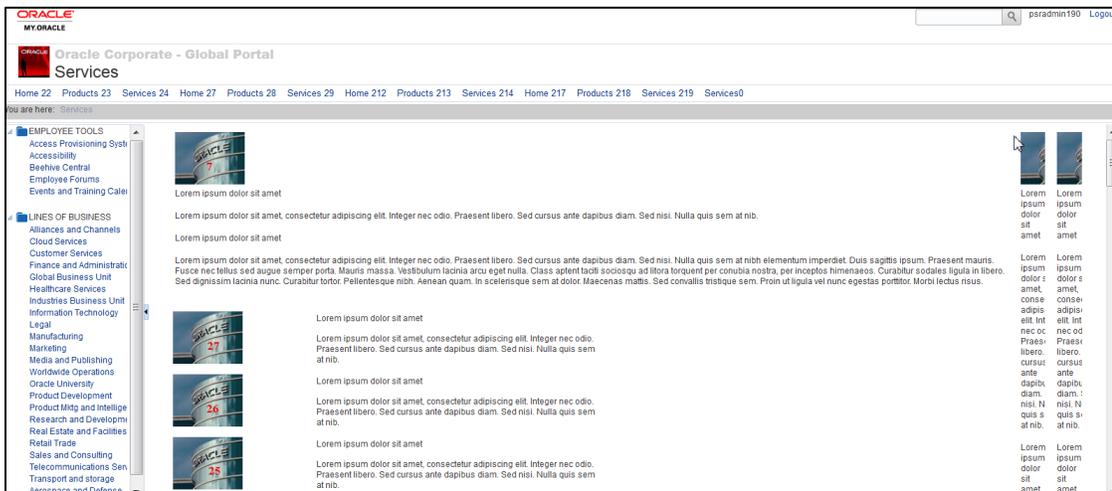
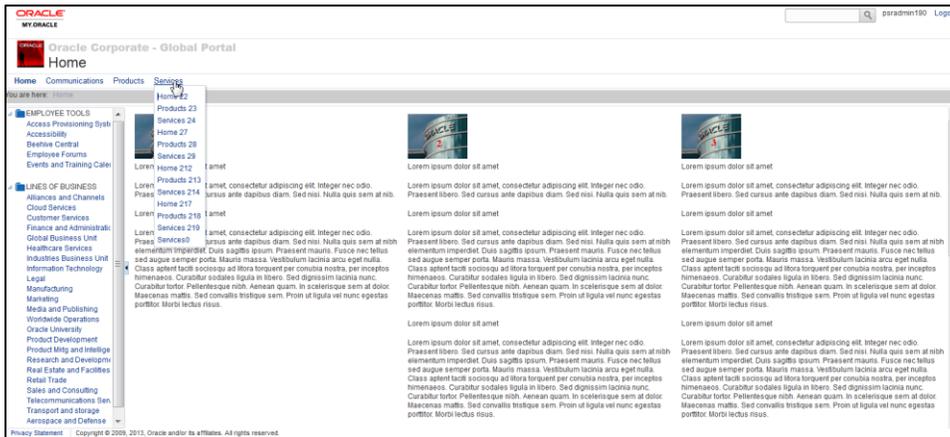


Figure 2- Department Page

If the user has permissions, s/he can contribute content to the site as well.

- Intranet Portal Structure
  - There are a total of 25 departments in the company.
  - Intranet Portal has a set of 1001 pages per department.
  - Each department has a portal of its own and is represented in the navigation model of the Main Intranet Portal.
  - It is possible to navigate from anywhere in the Departmental Portal to the Main portal.

- Each department has a home page, which is different from the intranet's landing page. It has a different set of pages and navigations.
- Each departmental portal has typically a set of 1001 pages.
- Pages have a page hierarchy. The page hierarchy can be 3 levels deep.
- There are 100,000 documents in the system.
  - There are 25 departments, each with 4000 documents. The documents are organized into eight folders, each with 500 documents. Each folder has

Document Type	Number of Documents	Size of Each Document
100KB .doc	100	100KB
1000KB .doc	138	1MB
.mp4	25	20MB
.pdf	137	1MB
.xls	100	100KB

- Each document has meta-data attached for searching. We devised some simple metadata fields and values viz. author name, document name, and the like.
- Anonymous Landing page of Intranet Portal
  - Every user lands first on the landing page--the Home Page.
  - The Home Page has a custom look and feel and reflects the company brand.
  - Branding is uniform across the portal.
- Home Page
 

The home page consists of the following components:

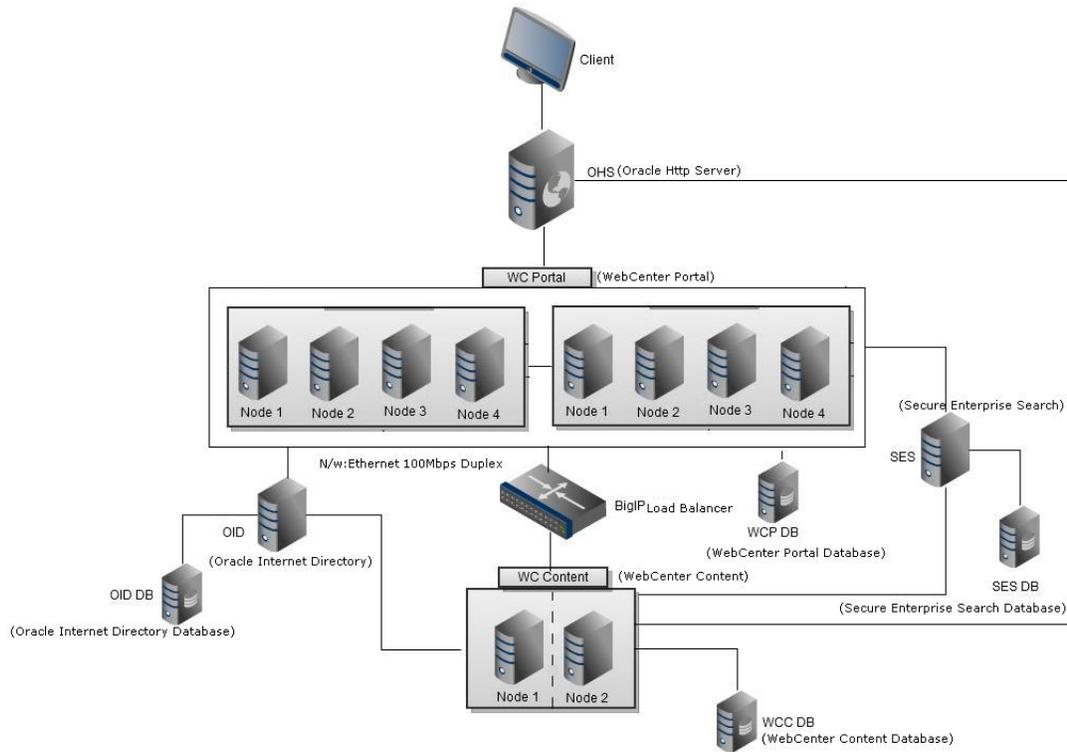
  - Content presenter items that show news articles and industry-relevant topics. Some of these include images.
  - Navigation is both horizontal and vertical. Some links jump to external systems while maintaining the Portal look and feel.
  - Ability to search content in the Portal.
  - It is possible to have multiple horizontal navigation models on the Portal.
  - The user can choose to login to the Portal.
  - Post Login
    - Upon login, the horizontal navigation model changes to reflect the user's access level.
    - The user sees the various departments that s/he is part of.
    - The navigation model reflects the pages contained in the department and the page hierarchy and can contain images.
- Departmental Portals
  - Each department has a portal of its own and is represented in the navigation model of the Main Intranet Portal.
  - It is possible to navigate from anywhere in the Departmental Portal to the Main portal.

- Each department has a home page which is different from the home page of the Intranet Portal.
- Each departmental portal has typically a set of ~1001 pages.
- Pages have a page hierarchy. The page hierarchy can be 3 levels deep.
- Hierarchy of Pages
  - Class A
    - Department Home Page
    - Home page consists of navigation to other pages
  - Class B
    - Top level pages of the departmental portal.
    - These pages can also consist of pages similar to Department specific site.
  - Class C
    - These pages can also consist of pages similar to Department specific site.
    - Few pages have content that can be edited inline.
    - Few pages are available to all who belong to the department.
    - Few pages are available only to a few department employees.
    - Remaining pages are accessible to all viz. public pages.
  - Class D
    - Few pages are available to all who belong to the department.
    - Few pages are available to just a few department employees.
  - Content on Class A, B or C or D Page
    - Typically a page would consist of a list of documents, news articles, press releases and images.
    - The content of this is presented using content presenter (a feature WebCenter Portal provides to display content of type news articles, releases or images etc.). For further details, [please refer to WebCenter Portal documentation on Content Presenter](#).
    - Each piece of content rendered by content presenter has text (around 2,200 words), images, and formatting, such as bullets, italics, and the like. Each content set in content presenter is different.
    - Each page has [Content Presenter\(s\)](#).
    - On an average, each departmental portal contains to 4000 documents.
- These pages are represented via a navigation model (2 level), which further lead to various pages specific to the department.
- Both global and departmental searches are possible. Departmental searches yield results from the user's department; global searches yield results from globally available documents.

# Benchmarks Specifics and Methodology

## Topology

The following figure shows the hardware deployment topology and includes the hardware configuration of each of the nodes running in the system.



## Hardware

### Topology Details

1. Each Node is a JVM running a managed server.
2. Clustering is done between two physical machines.
3. Internally each of these JVMs are clustered by the managed servers.
4. All setup is in one Network domain.
5. There are 4 WCPortal nodes (Managed Servers) on one physical machine, and 4 more WCPortal nodes on another machine. Hence, there are 8 nodes in 2 physical machines.
6. BigIP was configured as per "Round Robin" algorithm.
7. The Database was NFS Mount.
8. WebCenter Portal is running on Weblogic server.

This table depicts the hardware running on each node in our topology.

**Table 1- Machine Details used in Performance Testing**

Hardware details are for 1 physical machine	CPU				Memory	OS	Used As	Local Disk	Type
	Type	Processors	Cores/ CPU	Speed					
2 physical machines with 4 JVMs each for WebCenter Portal.	Intel(R) Xeon(R) CPU	24(2 CPU*6 cores*2(Hyper Threaded))	6	3.07 GHz	142 GB	RHEL 5.8	WC Mid-Tier	3.7 TB	Westmere(2 physical CPU with 6 cores each and Hyper Multi Threaded)
1 physical machine with 2 JVMs for WebCenter Content	Intel(R) Xeon(R) CPU	24	6	3.07 GHz	142 GB	RHEL 5.8	WC Mid-Tier	3.7 TB	Westmere
WebCenter Portal/WebCenter Content Database	Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz	32(4 CPU)	8	2.9 GHz	264 GB	RHEL 5.8	Portal/UCM DB	2 TB	Westmere
Oracle Internet Directory/DB	Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz	32(4 CPU)	8	2.9 GHz	264 GB	RHEL 5.8	OID/OID DB	2 TB	Westmere
Oracle Http Server(1)	Intel® Xeon® CPU	2	2	2.33 GHz	32 GB	RHEL 5.4	OHS2	133 GB	WoodCrest
Secure Enterprise Search	Intel(R) Xeon(R) CPU	4	4	2.27 GHz	71 GB	RHEL 5.8	SES	103 GB	Harpertown

## Software

This table outlines the software we used for testing.

Name	Version
WebCenter Portal	11.1.1.8.0
WebCenter Content	11.1.1.8.0
WebCenter Portal/WebCenter Content Database	11.2.0.4.0
Oracle Internet Directory/Oracle Internet Directory Database	11.2.0.4.0
Secure Enterprise Search(SES)	11.2.2.2.0

## Performance Benchmarking Methodology

1. Software installed and configured for optimal performance
2. Executed the user flows in parallel with a base set of users. Increased the number of users until response time goes beyond 3 sec or 80% of CPU utilization.
3. Obtained results.

## User Flows

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We define "user flows" as typical scenarios a user would normally execute during a work day.

### User Flow #1(Employee)

1. Users land on the landing page or home page.
2. User logs in.
3. On login, the user navigates to a home page with additional accessible information or LOB specific information. User waits on the page for 'x' minutes.
4. User searches for a document using the global search box. The user waits for the search results to appear. Clicks on a result and views it. The user waits on the page for 'x' minutes.
5. User logs out.

### User Flow #2(Public Anonymous)

1. User does not log in.
2. The user visits the home page of the Intranet Portal. User waits on the page for 'x' minutes.
3. The user navigates to visit a particular public page in the Department Portal. The departmental portal is randomly selected. User waits on the page for 'x' minutes.
4. The user navigates randomly in the page hierarchy. User waits on the page for 'x' minutes.
5. User performs a departmental search for a document using the Search box. The user waits for the search results to appear. User clicks one of the search results and views it. The user waits on the page for 'x' minutes.
6. User logs out.

### User Flow #3(Manager)

1. User logs in to the Home Page.
2. The user visits the public pages in a department. User waits on the page for 'x' minutes.
3. The user visits pages in that department accessible only to employees belonging to that department. The departmental portal is randomly selected. User waits on the page for 'x' minutes.
4. The user visits a page in the departmental portal accessible only to that particular user in the department. User waits on the page for 'x' minutes.
5. User logs out.

#### User Flow #4(Admin)

1. User logs in to the Home Page.
2. The user visits the public pages in a department. User waits on the page for 'x' minutes.
3. The user visits pages in that department accessible only to employees belonging to that department. The departmental portal is randomly selected. User waits on the page for 'x' minutes.
4. The user has privileges to create a page in the department. The user creates a page. The user edits and composes the page. User waits on the page for 'y' minutes.
5. The user also uploads/downloads a document of size 1 MB.
6. User logs out.

\*Note that the Oracle WebCenter Content's inbound refinery was not configured on the system and hence instead of viewing the preview of documents, only document properties were viewed.

#### User Loads

##### Pre-testing Configuration Steps

1. The scenario was setup.
2. It was validated for a single user run.
3. As per the scenario all the relevant data was examined and manually validated to check if updates are happening on Database and SES.

The distribution of the user flow for 1600 users is:

User Flow	User Type	% of Users
User Flow #1	Employee	25% = 400
User Flow #2	Anonymous	45% = 720
User Flow #3	Manager	15% = 240
User Flow #4	Admin	15% = 240

Note (Refer to above user flows for 'x' and 'y'):

1. 'x' = 1 minute wait on different pages
2. 'y' = 5 minute wait on different pages.
3. In user flows where no wait time is mentioned the wait time is 30 sec.

## Benchmarks Results

### Test Software

We used HP LoadRunner® for these tests.

### Performance Tunings

1. Think Time = 30s Random Think Time (Between two transactions of the user flow)
2. Cold Session - User login/logout b/w sessions
3. JVM Settings for each node for WCP

```
JVM arguments: "-server -Dweblogic.ProductionModeEnabled=true -
Dweblogic.SocketReaders=1 -Xms20G -Xmx20G -Xns5G -Xgc:genpar -
XXcompaction:maxReferences=4000000 -XX:+UseLargePagesForHeap -noverify -
Djrookit.codegen.newlockmatching=true -Xverbose:gc,compaction -
Djps.auth.debug=false -Djps.subject.cache.key=5 -
Djps.policystore.grantee.cache=false -
Xverboselog:/scratch/aime1/WCP_WC8Stg8/user_projects/domains/wc_domain/lo
g/WC_GC_1.log -Doracle.mds.bypassCustRestrict=true -
Dweblogic.security.SSL.trustedCAKeyStore="/scratch/aime1/WCP_WC8Stg8/wlserv
er 10.3/server/lib/cacerts" ${JAVA_OPTIONS}"
```

4. OHS Tunings

```
<IfModule mpm_worker_module>
    StartServers      10
    ThreadLimit       50
    ServerLimit       500
    MaxClients        25000
    MinSpareThreads   25
    MaxSpareThreads   75
    ThreadsPerChild   50
    MaxRequestsPerChild 0
    AcceptMutex       fcntl
    LockFile           "${ORACLE_INSTANCE}/diagnostics/logs/${COMPONENT_TYPE}/${
COMPONENT_NAME}/http_lock"
</IfModule>
```

5. JDK Version: java version "1.6.0\_37" Java(TM) SE Runtime Environment (build 1.6.0\_37-b06 Oracle JRockit(R) (build R28.2.5-50-153520-1.6.0\_37-20121220-0843-linux-x86\_64, compiled mode)
6. Steady state: 30 mins (60mins - 90mins) (Out of a total system run time for 2 hours)
7. Server logging set to default values (log level set to ERROR in logging.xml)
8. Session timeout - (default)
9. Heap set to 20 GB
10. 3GB MDS Cache with 0 TTL.
11. OJSP cache tunings.

Add the following <init-param> under  
<servlet>

```

    <servlet-name>
      oraclejsp
    </servlet-name>

    <init-param>
      <param-name>
        jsp_idle_entry_count
      </param-name>
      <param-value>
        2000
      </param-value>
    </init-param>
  </init-param>

```

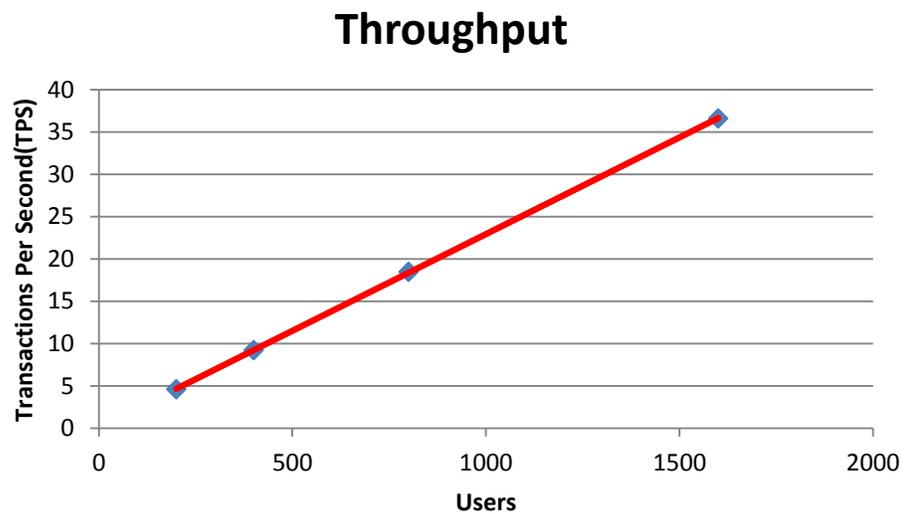
12. contentDelivery="lazy" (ADF Parameter to control content delivery)
13. JDBC pool set to max 400
14. JVM argument included : "-XXcompaction:maxReferences=40000000"
15. Coherence Cache configured(Please refer to:  
[http://docs.oracle.com/cd/E21764\\_01/webcenter.1111/e12405/wcadm\\_documents.htm#BABHFCJH](http://docs.oracle.com/cd/E21764_01/webcenter.1111/e12405/wcadm_documents.htm#BABHFCJH))
16. It is recommended to apply the WebCenter Portal BP3 (11.1.1.8.3) bundle patch.

### Transactions/second (TPS) and CPU Utilization and Memory Utilization

Users / Managed Servers	% CPU Utilization (Portal Server)	TPS(Transactions per second)	Memory	Average Server Response time(sec)
200/1	11.32	4.59	5.23	0.81
400/2	12.33	9.21	6.27	0.87
800/4	24.8	18.46	6.51	0.9
1600/8	64.75	36.59	6.90	1.29

For this test, we defined "transaction" as one user click in execution of one operation such as login, navigate from one portal to another, navigate from one page to another in a portal, create a portal, create a page, etc.

The throughput is linear w.r.t the number of users.

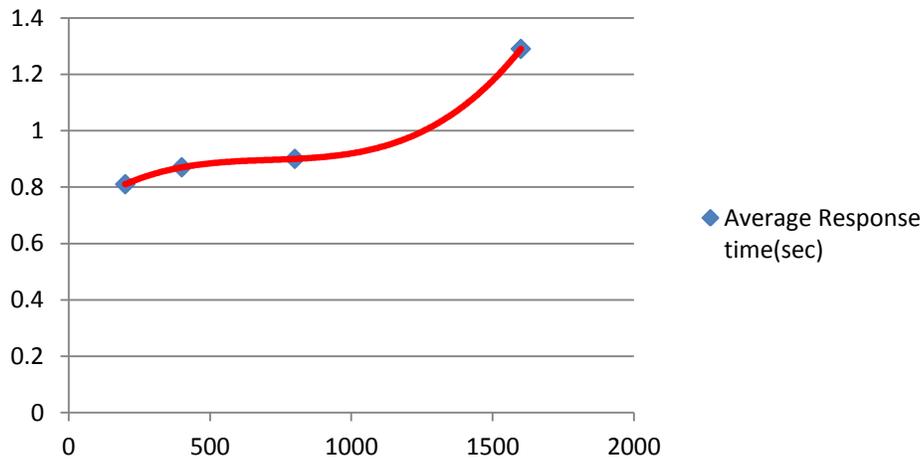


The number of managed servers required to maintain the average server response time scales up as number of users increases.

### TPS vs Managed Servers



### Average Server Response time(sec)



The average server response time increases with the number of users.

## Client Response Times

### Test Setup

- Desktop: Windows 7 / Internet Explorer 9
- Mobile: Apple iPad3 / iOS 6.1.3
- Background load of 20 users was present during testing

### Desktop Browser Results

	Overall Response time(seconds)
User Flow 1(A user with an employee role searches for and views documents. For details refer previous section on User Flows)	2.5
User Flow 2(A non-logged in navigates the portal and searches/views documents. For details refer previous section on User Flows)	2.1
User Flow 3(A user with a manager role logs in and navigates the portal and searches/views documents. For details refer previous section on User Flows)	2.2
User Flow 4(A portal administrator logs in, navigates the portal, and creates/edits portal content. For details refer previous section on User Flows)	2.3
<b>Overall</b>	2.3

### iPad Results

	Overall Response time(seconds)
User Flow 1(A user with an employee role searches for and views documents. For details refer previous section on User Flows)	2.8
User Flow 2(A non-logged in navigates the portal and searches/views documents. For details refer previous section on User Flows)	2.3
User Flow 3(A user with a manager role logs in and navigates the portal and searches/views documents. For details refer previous section on User Flows)	2.5
User Flow 4(A portal administrator logs in, navigates the portal, and creates/edits portal content. For details refer previous section on User Flows)	2.3
<b>Overall</b>	2.5

## Measurements for User Flows

The following tables illustrate the measurements for various operations involved in the user flows described earlier. The measurements are server side response times only.

### User Flow #1: Authenticated Content Access

The following table lists the average server response time in seconds for operations carried out in User flow 1.

Average Server Response time (sec):

Concurrent Users/Managed Servers	200/1	400/2	800/4	1600/8
Invoke URL	.49	.55	.56	.83
Login page	.18	.18	.20	.35
DoLogin	0.52	.60	.63	.96
GotouserLOB	.81	.90	.93	1.43
Search Doc	1.44	1.51	1.61	2.07
ViewDoc	.68	.72	.73	1.02
Close	1.08	1.17	1.17	1.67

### User Flow #2: Public Content Access

The following table lists the average server response time in seconds for operations carried out in User flow 2.

Concurrent Users/Managed Servers	200/1	400/2	800/4	1600/8
Invoke	0.50	0.52	0.57	0.84
UserSelectsRandomLOB	0.65	0.74	0.79	1.19
UserVisitsPublicPages1	0.38	0.42	0.46	0.74
UserNavigatesRandomlyinPageHierarchy	0.38	0.44	0.47	0.72
UserSearchesForDocument	1.40	1.47	1.51	2.05
UserClicksonSearchResult	0.63	0.67	0.68	0.99
CloseDocumentViewDialogueBox	1.01	1.07	1.12	1.61

### User Flow #3: Secure Content Access

The following table lists the average server response time in seconds for operations carried out in User flow 3.

Concurrent Users/Managed Servers	200/1	400/2	800/4	1600/8
InvokeURL	0.50	0.52	0.55	0.85
LoginPage	0.17	0.21	0.20	0.38
DoLogin	0.52	0.56	0.59	0.98
GoToRandomLOB	0.74	0.86	0.87	1.40
PublicPage1	0.43	0.43	0.52	0.77
PublicPage2	0.41	0.44	0.47	0.78
GoToUserLOB	1.49	1.61	1.66	2.56
EmployeePage1	0.43	0.51	0.55	0.88
EmployeePage2	0.43	0.50	0.56	0.88
ManagerPage	0.50	0.57	0.59	0.88
Logout	0.84	0.92	0.99	1.64

#### User Flow #4: Administrator Content Access

The following table lists the average server response time in seconds for operations carried out in User flow 4.

Concurrent Users/Managed Servers	200/1	400/2	800/4	1600/8
InvokeURL	0.48	0.52	0.52	0.8
LoginPage	0.19	0.18	0.2	0.34
DoLogin	0.51	0.56	0.59	0.96
GoToRandomLOB	0.8	0.85	0.88	1.37
PublicPage1	0.42	0.43	0.52	0.76
PublicPage2	0.43	0.44	0.46	0.8
GoToUserLOB	1.48	1.67	1.75	2.58
EmployeePage1	0.43	0.51	0.61	0.89
EmployeePage2	0.41	0.52	0.53	0.91
GoToUserLOBHome	0.65	0.73	0.77	1.16
EditPortal	0.89	1.03	1.06	1.67
NewPageLink	0.8	0.9	1.05	1.24
UseBlankTemplate	0.88	0.88	0.96	1.17
ClickCreateButton	7.14	7.07	6.87	8.29
EditPage	2.38	2.51	2.34	2.98
AddContent	1.1	1.2	1.34	1.82
OpenContentManagement	0.46	0.46	0.46	0.66
AddContentPresenter	0.52	0.54	0.54	0.82
CloseAddContentPopup	0.4	0.44	0.42	0.64
EditContentPresenter	0.79	0.81	0.84	1.15
ContentTab	0.41	0.42	0.47	0.66
Browse	0.54	0.56	0.55	0.87
GoUpOneLevel	0.47	0.45	0.47	0.69
Openmoc1	1.3	1.38	1.42	2.12
OpenImages	0.92	0.94	1.08	1.4
ClickImage	1.2	1.25	1.42	1.94
SelectImage	0.72	0.78	1	1.24
SaveContent	0.84	0.9	0.89	1.34
SavePage	1.03	1.06	1.02	1.38
DocumentTab	1.33	1.52	1.54	2.39
UploadPage	0.29	0.3	0.31	0.56
SelectFile	0.05	0.07	0.07	0.12
UploadDoc	0.67	0.69	0.68	1.03
DownloadDoc	0.19	0.19	0.21	0.31
Logout	0.87	1.23	1.1	1.67

## Sizing Guide

Our performance testing resulted in the following sizing guidance. Note that this is to be considered as a guide only and will differ from use case to use case. These numbers and calculations are based on executing the use case we have described for the dot8 release of WebCenter Portal and a think time of 30 seconds for 1600 concurrent users.

Portal TPS / core	PortalTPSPerCore	1.52 (TPS/core)
Concurrent Users / core	UsersPerCore	66.65 (Users/core)
Memory (GB) / core	MemoryPerCore	7 (GB/core)
Corresponding DB cores	DBCORERatio	0.05 core for DB / portal core
Corresponding SES cores	SESCoreRatio	0.08 core for SES / portal core
Other components cores	CompCoreRatio	0.02 core for other components / portal core

Example - 10,000 concurrent users for content scenario

The following table illustrates a user population of 100K. Assumption is 10% of users are active.

WC Cores needed	$WC_{Cores} = \frac{UsersPerCore}{PortalTPSPerCore}$	180	4 CPU & 6 cores/CPU
Machine needed for WC midtier		10	10 WC server machines
Machine Memory Spec	$= WC_{Cores} * MemoryPerCore / machines$	128	GB
DB Core needed	$= WC_{Cores} * DBCORERatio$	9	2 CPU & 6 cores/CPU
SES Core needed	$= WC_{Cores} * SESCoreRatio$	14	2 CPU & 8 cores/CPU
Components Core needed	$= WC_{Cores} * CompCoreRatio$	4	2 CPU & 2 cores/CPU

## Conclusion

The results indicate:

- The TPS/Hits per seconds show a linear pattern with the proportional users volume.
- Avg Full GC duration increases with the load but does not cause instability.
- The number of managed servers required to maintain an average response time scales up as the number of users scales up.



Scalability and Performance

Oracle WebCenter® Portal

July 2014

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