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# Deploying Oracle<sup>®</sup> Business Intelligence Enterprise Edition on Oracle's Sun Systems

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## Introduction

In today's hyper-competitive environment, companies are looking to manage corporate performance. Matching strategic goals with key business objectives requires the ability to analyze cross-departmental data in data warehouses and other repositories to get the right information to the right people at the right time. While many organizations use business intelligence (BI) software to gain some strategic insight, they also want to track customer behavior and internal and external business trends in order to perform better on a daily basis. With enterprises conducting business on a global scale, keeping these critical BI solutions up and running around the clock is essential to success.

This technical white paper describes an enterprise deployment architecture for Oracle® Business Intelligence Enterprise Edition using Oracle's Sun servers running the Oracle Solaris operating system and Oracle's Sun Storage 7000 Unified Storage Systems. Designed to empower employees in organizations in any industry—from customer service, shipping, and finance to manufacturing, human resources, and more—to become potential decision makers, the architecture brings fault tolerance, security, resiliency, and performance to enterprise deployments. Taking advantage of key virtualization technologies, the architecture can be used to consolidate multiple tiers onto a single system to help reduce cost and complexity. A short discussion of the performance characteristics of the architecture using a realistic workload also is included.

## Deployment Architecture

The deployment architecture consists of two Sun SPARC Enterprise T5140 servers from Oracle running the Oracle Solaris 10 operating system configured with three Brocade FastIron LS Series switches and the Oracle Business Intelligence Cluster and Oracle Clusterware software to create a highly available cluster configuration (Figure 1). One switch provides a private interconnect between the two servers, and another switch provides general switching for the larger environment. A third switch provides access to a Sun Storage 7410 system that stores the underlying Oracle Database 11g with Real Application Cluster Technology and provides the shared NFS storage for Oracle Business Intelligence components. A Brocade ServerIron 4G Application Switch performs load balancing on the cluster. All systems in the configuration are connected via Gigabit Ethernet connections using one port on each server.

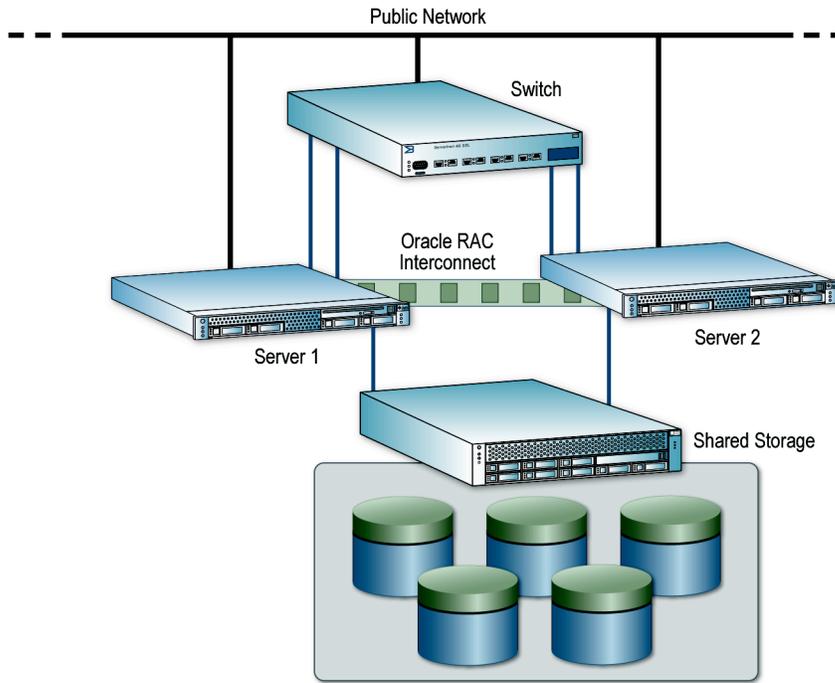


Figure 1. Two Sun SPARC Enterprise T5140 servers form the foundation of the deployment architecture.

### Sun Storage 7410 System

Sun Storage 7410 systems incorporate an open-source operating system, commodity hardware, and industry-standard technologies. These low-cost, fully functional NAS storage devices feature an easy-to-use management interface, along with a comprehensive analytics environment to help isolate and resolve issues. The systems support NFS, Common Internet File System (CIFS), and iSCSI data access protocols, mirrored and parity-based data protection, local point-in-time (PIT) copy, remote replication, data checksum, data compression, and data reconstruction. In the deployment architecture, data on the Sun Storage 7410 system is striped and mirrored to provide increased throughput and

reliability. In the deployment architecture, Oracle database files were created using the iSCSI data protocol, and data is mounted using raw mount points for faster performance.

### Sun SPARC Enterprise T5140 Servers from Oracle

Oracle's Sun SPARC Enterprise T5140 servers with CoolThreads technology blend the performance and scalability of midrange servers with the economies of energy-efficient chip multithreading (CMT) designs. With up to 16 cores and up to 128 execution threads, large memory, cryptographic acceleration, and integrated on-chip I/O technology, these servers provide the massive thread-level parallelism and performance enhancements needed by many database workloads.

Both Sun SPARC Enterprise T5140 servers in the deployment architecture run the entire software stack in a clustered environment, enabling the BI applications to failover from one server to another in the event of a hardware or software failure (Figure 2). Each server is configured with two domains. The primary domain, `1dom0`, runs the Oracle Solaris 10 operating system. The second domain, `1dom1`, contains the Oracle Database 11g with Real Application Cluster (RAC) Technology software. Three Oracle Solaris Containers house the Oracle Business Intelligence Enterprise Edition, Oracle Directory Server, and Oracle WebLogic software.

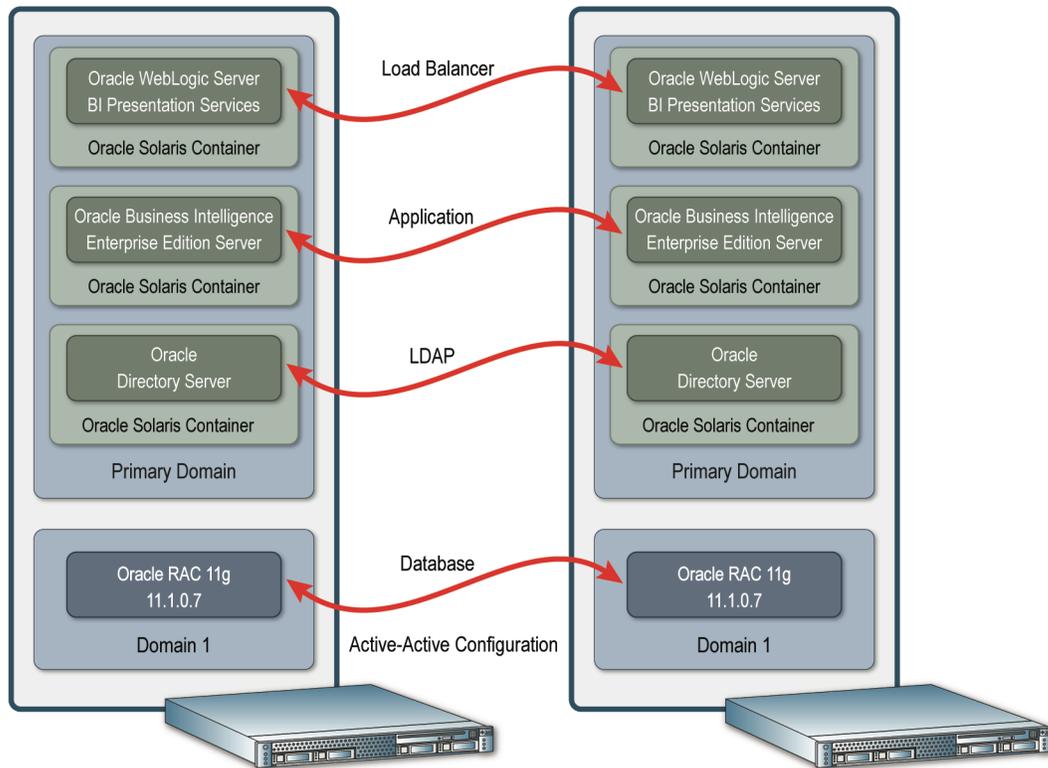


Figure 2. Both servers run the entire software stack, enabling one system to take over processing in the event the other system experiences disruption.

## Brocade FastIron LS Switch

The Brocade FastIron LS Series access switch family provides enterprises with a flexible and feature-rich solution for building a secure, high-value, intelligent network edge. It delivers the scalability, quality of service assurance, features and advanced security needed to implement an intelligent high-value solution that can scale to meet future growth at the network edge. Enterprises can initially deploy a standalone FastIron LS switch and upgrade to IronStack stacking to scale the installation from one to eight stacked units to meet growing user requirements.

## Brocade ServerIron

To enable intelligent application delivery and traffic management, Brocade's ServerIron platform provides Layer 4 through Layer 7 switching performance in a modular or fixed form factor. The switches efficiently distribute unified application services by measuring server utilization and connection load in real time. These health checks effectively enable policy-based automation of application performance management, security, and service delivery.

In the deployment architecture, the ServerIron provides a front-end to the Oracle WebLogic cluster using a Virtual IP address. The VIP, which provides a single point of entry to the cluster, masks the real servers from users and performs load balancing of incoming users and session persistence. Periodic health checks are performed to ensure traffic is routed in the event of a server failure.

## Oracle VM Server for SPARC

Designed to work with the unique characteristics of Oracle servers with chip multithreading technology, Oracle VM Server for SPARC domain technology (previously called Sun Logical Domains) brings partitioning capabilities to entry-level servers. A single physical system can be split into multiple, independent virtual systems. One virtual machine—the governing primary domain—contains a host operating system and a Logical Domain Manager with the intelligence to work with the embedded hypervisor in the server to create and reconfigure other logical domains and allocate resources.

The hypervisor located in the server does most of the work. It abstracts the hardware, exposes resources to other domains, and creates communication channels between domains that provide a conduit for services, such as networks and shared devices. With this technology, users can allocate various system resources, such as memory, CPUs, and devices into logical groupings and create multiple discrete systems, each with their own operating system, resources, and identity within a single computer system. By careful architecture, an environment incorporating Oracle VM Server for SPARC can help companies achieve greater resource utilization, better scaling, and increased security and isolation.

In the deployment architecture, domains are used to create a secure environment in which the Oracle database software runs.

## Oracle Solaris Containers

On all Oracle platforms, architecture-independent operating system-level virtualization is made possible by Oracle Solaris Containers technology. Oracle Solaris Containers utilize features in Oracle Solaris to provision compute power into secure, isolated runtime environments for individual applications using flexible, software-defined boundaries. Each environment holds a unique identity and maintains resource and name space isolation. In addition, administrators can configure separate network connections with exclusive IP stacks and allocate disk and storage for individual containers. Applications can be managed independently of each other, even while running in the same instance of the Oracle Solaris OS. Oracle Solaris Containers work in concert with Oracle VM Server for SPARC technology, and can run within domains to provide further granularity to the virtualized environment.

In this deployment architecture, Oracle Solaris Containers technology is used to create Oracle Solaris Zones, a virtual operating system abstraction that provides a protected environment in which applications run isolated from other applications on the same system. In the deployment architecture, the Oracle Business Intelligence Enterprise Edition, Oracle WebLogic, and Oracle Directory Server software are placed in separate zones to take advantage of the application isolation provided by the technology.

## Oracle Directory Server

Oracle Directory Server serves as the backbone to an enterprise identity infrastructure, enabling applications to access consistent, accurate, and reliable identity data. More than a simple directory server, the Oracle Directory Server delivers the key capabilities of security, interoperability, availability, scalability, and manageability that define a directory service. In the deployment architecture, the software provides an LDAP repository for storing information, such as profiles, user credentials (public key certificates, passwords, and pin numbers), access privileges, and application and network resource information.

## Oracle Database 11g with Real Application Cluster Technology

Oracle Database 11g with Real Application Cluster (RAC) Technology is a cluster database with a shared cache and a shared disk architecture that overcomes the limitations of traditional shared-nothing approaches to provide highly scalable and available database solutions for business applications. A proven technology that allows multiple low cost servers to perform like a single large server, Oracle Database 11g with RAC forms a key foundation for business-critical database environments. Even very high-end systems can be constructed of small, very low cost clusters made from standard, commodity systems.

In the deployment architecture, running Oracle Database 11g with RAC provides high levels of database availability along with flexibility in scaling. If a node in the cluster fails, the Oracle software continues running on the remaining node. If more processing power is necessary, new nodes can be added easily to the cluster. As a result, organizations can deploy low cost solutions while reaping the benefits of high availability and adaptability.

## Oracle Business Intelligence Suite Enterprise Edition

Many enterprises take advantage of the innovative and enabling technology in Oracle Business Intelligence Suite Enterprise Edition to standardize and simplify enterprise-wide business intelligence. Oracle Business Intelligence Suite Enterprise Edition is a family of enterprise business intelligence (BI) products that delivers a wide range of capabilities, including interactive dashboards, full ad hoc queries, proactive intelligence and alerts, enterprise and financial reporting, real-time predictive intelligence, disconnected analytics, and more.

## Oracle WebLogic Server

Oracle WebLogic Server 10 Release 3 is a scalable, enterprise-ready Java™ Platform, Enterprise Edition (Java EE platform) application server. The Oracle WebLogic Server infrastructure supports the deployment of many types of distributed applications and is an ideal foundation for building business-critical applications. A complete implementation of the Java EE 5.0 specification, Oracle WebLogic Server provides a standard set of APIs for creating distributed Java applications that can access a wide variety of services, such as databases, messaging services, and connections to external enterprise systems.

## Architecture Implementation

The following sections provide an overview of the steps needed to implement the deployment architecture.

### Selecting Hardware Platforms

The first step in deploying a highly available BI solution is selecting the right server and storage components. The size and configuration of the servers and storage is dictated by the resources needed to store, process, and analyze current and future business information. Table 1 lists suggested server and storage configurations for the deployment architecture.

Once the hardware components are obtained, it is important to verify the systems are using the latest server firmware to support Oracle VM Server for SPARC technology. Server firmware downloads can be found at [sun.com/downloads](http://sun.com/downloads); a service contract is currently required for access.

TABLE 1. SERVER AND STORAGE CONFIGURATION RECOMMENDATIONS

---

<b>SMALL (&lt; 2,000 USERS)</b>
<ul style="list-style-type: none"><li>• Sun SPARC Enterprise T5140 server (2) with 2 processors, 128 threads, 32 GB memory, 4 Gigabit Ethernet ports</li><li>• Sun Storage 7110 system, 2 TB disk storage</li><li>• Oracle Solaris ZFS file system</li></ul>
<b>MEDIUM (&lt; 25,000 USERS)</b>
<ul style="list-style-type: none"><li>• Sun SPARC Enterprise T5440 server (1) with 4 processors, 256 threads, 128 GB memory</li><li>• Sun Storage 7410 system</li><li>• Additional storage arrays as needed</li></ul>
<b>ENTERPRISE (&gt; 25,000 USERS)</b>
<ul style="list-style-type: none"><li>• Sun Oracle Database Machine, Half-Rack<ul style="list-style-type: none"><li>• 4 Database Nodes, 32 CPU cores, 288 GB memory</li><li>• 7 Exadata Storage Servers, 50 TB raw space with SAS drives</li></ul></li><li>• Additional storage needed for shared file systems</li><li>• Server configuration and storage capacity is dependent on customer-specific requirements</li></ul>

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## Configuring the Load Balancer

The deployment architecture uses a Brocade ServerIron 4G Application Switch for traffic management and load balancing between two Oracle WebLogic instances. The following steps explain how to configure the Brocade ServerIron switch. While the use of SSL and redundancy is not used in the example below, it can be configured for the switch. See the ServerIron documentation located at <https://kp.foundrynet.com/Portal/login.asp> for more information.

1. Enter the following command at the opening CLI prompt.

```
ServerIron> enable
```

2. Access the configuration level of the CLI.

```
ServerIron> configure terminal
ServerIron (config)#
```

3. Assign an IP address to the ServerIron switch.

```
ServerIron (config)# ip add 10.1.18.21 255.255.255.0
```

- Assign a default gateway.

```
ServerIron (config)# ip default-gateway 10.1.18.1
ServerIron (config)# hostname OBIEE_1
ServerIron (config)# enable super-user-password brocade
ServerIron (config)# no enable aaa console
ServerIron (config)# telnet server
ServerIron (config)# username OBIEE_1 nopassword
```

- Exit the configuration level of the CLI.

```
SP1 (config)# end
```

- Save the configuration to NVRAM.

```
SP1# write memory
```

- Configure the ServerIron port so that oracle WebLogic Server can access port 7001. This port is needed for the Oracle WebLogic Server main Web page.

```
ServerIron (config)# server port 7001
ServerIron (config)# tcp
```

- Configure the servers behind the VIP. Enter the following commands at the configuration level of the CLI prompt.

```
server real r1 10.1.18.151
    port 7001
    port 7001 keepalive
server real r3 10.1.18.152
    port 7001
    port 7001 keepalive
```

- Configure the server source NAT for the real servers to session back to the clients. Enter the following commands at the configuration level of the CLI prompt.

```
server source-nat
server source-nat-ip 10.1.18.22 255.255.255.0 10.1.18.1 port-range 2
```

- Configure the VIP and bind the real servers for the VIP. The load balancer predictor can be used globally or on the individual VIP. The example below places the load balancing predictor on the VIP. Sticky persistence is set to ensure that users continue to connect to the same real server. Enter the following commands at the configuration level of the CLI prompt.

```
server virtual vip1 10.1.18.23
    predictor round-robin
    port 7001 sticky
    bind 7001 r1 7001 r3 7001
```

## Installing the Oracle Solaris 10 Operating System

All servers in the deployment architecture run the Oracle Solaris 10 OS 05/09 release. Instructions on performing a full install of Oracle Solaris 10 can be found in the Oracle Solaris 10 Installation Guide: Basic Installations located at [docs.sun.com/app/docs/doc/817-0544](http://docs.sun.com/app/docs/doc/817-0544). Users needing to perform more advanced installations or wishing to use an Oracle Solaris JumpStart server can find instructions in the Oracle Solaris 10 Installation Guide: Custom JumpStart and Advanced Installations guide located at [docs.sun.com/app/docs/doc/817-5506](http://docs.sun.com/app/docs/doc/817-5506).

Be sure to configure large pages for the process heap and ISM by setting the following */etc/system* parameters on all the nodes where Oracle Business Intelligence Enterprise Edition and Oracle Database 11g with RAC components are running.

```
# Set the heap size
set max_uheap_lpsize=0x10000000
# Set the number of pages for ISM
set mmu_ism_pagesize=0x10000000
```

## Setting Up Domains

Once the operating system is installed, domains can be configured on each server. The following steps explain how to install the necessary software and create a domain on each of the two servers in the deployment architecture.

1. Download the Oracle VM Server for SPARC software. The software is available at <http://www.sun.com/servers/coolthreads/ldoms/get.jsp>
2. Run the Oracle VM Server for SPARC installation script. The *install-ldm* script asks several questions as part of the installation process. Most of these questions can be answered with the default value. Consult the administration guide for more information.

```
# install-ldm
```

3. Create the default services: the virtual disk server, virtual switch service, and virtual console concentrator service. Once the options below are set, the primary domain must be rebooted to allow the delayed reconfigurations to take effect. After the configuration completes, be sure to configure and plumb the interfaces using the *ifconfig* command.

```
# ldm add-vds primary-vds primary
# ldm add-vsw net-dev=nxge0 primary-vsw0 primary
# ldm add-vsw net-dev=nxge3 primary-vsw1 primary
# ldm set-vcpu 72 primary
# ldm set-mem 18g primary
# ldm set-vcc port-range=15000-15100 primary-vcc0 primary
# reboot
```

4. Create a guest domain. The following example creates a guess domain named `ldom01`.

```
# ldm add-domain ldom01
```

5. Assign virtual CPUs to the newly created domain. The following example assigns 56 virtual CPUs to the domain named `ldom01`.

```
# ldm set-vcpu 56 ldom01
```

6. Assign memory to the newly created domain. The following example assigns 12 GB of memory to the domain named `ldom01`.

```
# ldm set-memory 12G ldom01
```

7. Configure a virtual network (vnet) for the domain. The following example configures two virtual networks named `vnet1` and `vnet2` using the virtual switch services named `primary-vsw0` and `primary-vsw1`.

```
# ldm add-vnet vnet1 primary-vsw0 ldom01
# ldm add-vnet vnet2 primary-vsw1 ldom01
```

8. Add a virtual disk device to the new domain. The example below assigns the entire `/dev/dsk/c0t2d0` disk device to the `ldom01` domain for its use.

```
# ldm add-vdsdev /dev/dsk/c0t2d0s2 vol1@primary-vds0
# ldm add-vdisk vdisk1 vol1@primary-vds0 ldom01
```

9. Set the boot parameters for the domain. Turn off autobooting and set the boot device to be the virtual disk device.

```
# ldm add-variable auto-boot\?=false ldom01
# ldm add-variable boot-device=/virtual-disk@100/channel-devices@200/disk@0
ldom01
```

10. Bind the resources to the domain.

```
# ldm bind-domain ldom01
```

11. Verify the settings for the domain. The following example output shows the settings for the domain named `ldom01`.

```
# ldm list-bindings ldom01
NAME      STATE    FLAGS    CONS    VCPU    MEMORY    UTIL    UPTIME
ldom01    active   -t----- 15000   56     12G     1.8%    18m
MAC
      00:14:4f:f8:75:52
HOSTID
      0x84f87552
VCPU
```

```

VID      PID      UTIL  STRAND
0        16        100%  100%
...
54       70        0.0%  100%
55       71        0.0%  100%
MEMORY
RA              PA              SIZE
0xe000000      0x20e000000    12G
VARIABLES
auto-boot?=false
boot-device=vdisk1
NETWORK
NAME  SERVICE              DEVICE  MAC              MODE  PVID  VID
vnet1 primary-vsw0@primary network@0 00:14:4f:f9:e7:f4 1
PEER  SERVICE              DEVICE  MAC              MODE  PVID  VID
primary-vsw0@primary 00:14:4f:f8:f0:a5 1
DISK
NAME  VOLUME              TOUT  DEVICE  SERVER  MPGROUP
vdisk1 voll1@primary-vds0 disk@0 primary
VCONS
NAME  SERVICE              PORT
ldom01 primary-vcc0@primary 15000

```

12. Start the newly created domain and connect it to the virtual console service. The commands are issued in the primary domain to start and access the `ldom01` guest domain.

```

# ldm start-domain ldom01
# telnet localhost 15000
{0} ok

```

13. Save the configuration.

```

# ldm add-spconfig name

```

14. Use a JumpStart server to install an appropriate operating environment in the domain. A JumpStart server is needed since the disk image assigned to `ldom01` does not have Oracle Solaris installed. The steps below assume a suitable JumpStart environment is configured. Consult the Oracle Solaris administration guides for more details. Selecting option a) copied the device name into the buffer. At this point, a device alias can be created using the following command.

```

{0} ok boot net - install

```

At this point in the process, domains exist on each server in the architecture, and the Oracle Solaris OS is running on both systems. Applications can be installed and run from the virtual disk assigned to the domains. Figure 3 depicts the server configuration after the domains are created on both servers.

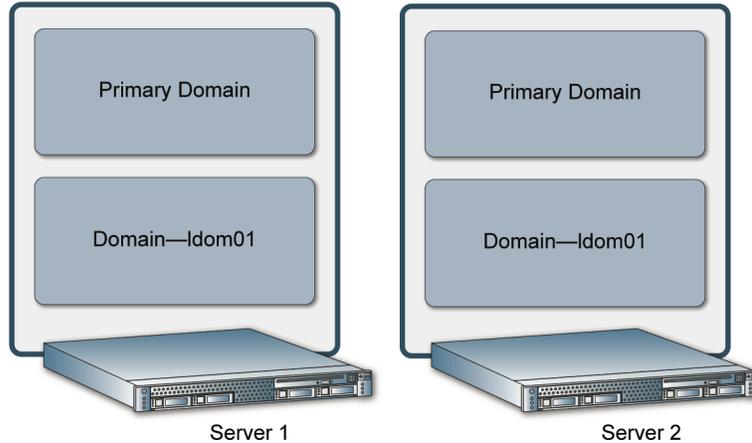


Figure 3. The server configuration after domains are created.

## Configuring Zones

The next step in the implementation process focuses on creating a zone on each server to house the Oracle Business Intelligence Enterprise Edition and Oracle Directory Server software.

1. Create a zone on one server in the deployment architecture by executing the following commands.

```
# mkdir -p /zones/zone01
# chmod 700 /zones/zone01
# zonecfg -z zone01
zone01: No such zone configured
Use 'create' to begin configuring a new zone.
zonecfg:zone01> create
zonecfg:zone01> set zonepath=/zones/zone01
zonecfg:zone01> set autoboot=true
zonecfg:zone01> exit
```

2. Configure the zone with the `zonecfg` command. The following example configures the network and shared file system support for the zone.

```
# zonecfg -z zone01
zonecfg:zone01> add net
zonecfg:zone01:net> set address=10.1.XX.XX
zonecfg:zone01:net> set physical=nxge0
zonecfg:zone01:net> end
zonecfg:zone01> add fs
zonecfg:zone01:fs> set dir=/orabishared
zonecfg:zone01:fs> set special=/orabishared
zonecfg:zone01:fs> set type=lofs
zonecfg:zone01:fs> add options [rw]
zonecfg:zone01:fs> end
zonecfg:zone01> verify
```

3. Reboot the zone to enable the configuration.

```
# zoneadm -z zone01 reboot
```

The next step is to clone the zone so that it can be replicated on the second server in the deployment architecture.

1. Export the configuration information for the newly created zone.

```
# zonecfg -z zone01 export > /tmp/zone01.config
```

2. Edit the `/tmp/zone01.config` configuration file to change the IP address and network interface configurations for the second zone.
3. Create the root directory for the second zone. In this example, the second zone is named `zone02`.

```
# mkdir /zones/zone02  
# chmod 700 /zones/zone02
```

4. Create the new zone using the edited configuration file.

```
# zonecfg -z zone02 -f /tmp/zone01.config
```

5. Clone the first zone, `zone01`, to create the second zone, `zone02`.

```
# zoneadm -z zone01 halt  
# zoneadm -z zone02 clone zone01
```

6. Build the services for the newly cloned zone.

```
# zlogin -C zone02
```

Repeat this process to create two additional zones on each server in the architecture. Figure 4 depicts the server configuration after the zones are created on both servers.

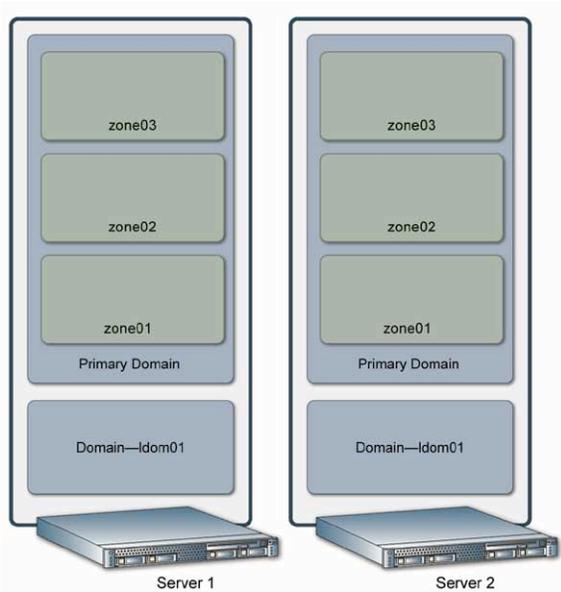


Figure 4. The server configuration after the zones are created on both servers.

### Installing Oracle Database 11g with RAC

The next step in the process is to install Oracle Database 11g with RAC in the domain on each server. Instructions can be found in the Deploying Oracle Real Application Clusters (RAC) on Solaris Zone Clusters article located at [wikis.sun.com/display/BluePrints/Deploying+Oracle+Real+Application+Clusters+%28RAC%29+on+Solaris+Zone+Clusters](http://wikis.sun.com/display/BluePrints/Deploying+Oracle+Real+Application+Clusters+%28RAC%29+on+Solaris+Zone+Clusters). Figure 5 depicts the server configuration after the Oracle Database 11g with RAC software is installed on both servers.

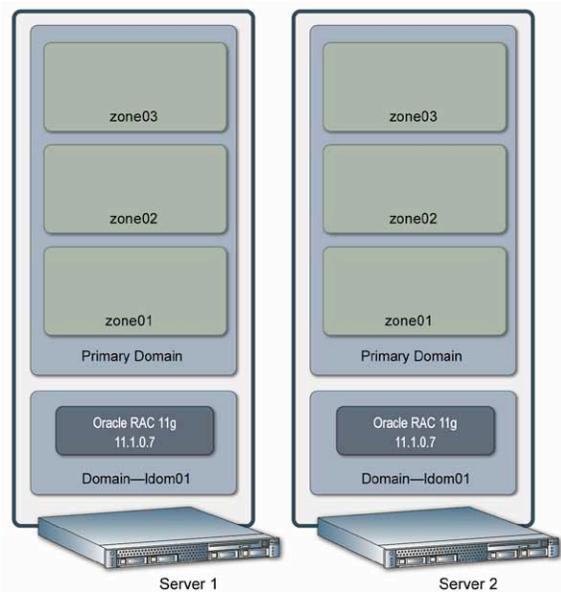


Figure 5. The server configuration after the Oracle Database 11g with RAC software is installed on both servers.

## Installing Oracle Business Intelligence Server

The following steps provide an overview of the Oracle Business Intelligence Server software installation process. Repeat these steps on the second server in the deployment architecture.

1. Login to the zone in which the software is to be installed.
2. Create a directory named *software* in the root directory.
3. Create directories named *oraclebi* and *oraclebidata* in the newly created *software* directory. Change the owner and group settings for the newly created directories.

```
$ chown orabi software
$ chgrp other software
$ chown orabi oraclebi
$ chgrp other oraclebi
$ chown orabi oraclebidata
$ chgrp other oraclebidata
```

4. Verify that the settings match the output below.

```
# pwd
/software
# ls -al
total 8
drwxr-xr-x  4 orabi  other  512 Aug  5 11:33 .
drwxr-xr-x 21 root   root   512 Aug  5 11:33 ..
drwxr-xr-x  2 orabi  other  512 Aug  5 11:33 oraclebi
drwxr-xr-x  2 orabi  other  512 Aug  5 11:33 oraclebidata
```

5. Install the Oracle Business Intelligence Enterprise Edition software in the *oraclebi* directory. This document assumes the software is downloaded to the */downloads* directory.
6. Run the *UnixChk.sh* script and specify the Oracle BI software installation location to make sure the UNIX® environment is properly set. The *UnixChk.sh* script is located in the */downloads/obiee\_101341/Solaris/Server/Oracle\_Business\_Intelligence* directory.

```
$ ./UnixChk.sh /software/oraclebi
SUCCESS!! - This machine is configured for Oracle BI EE 10.1.3.4
```

7. Make sure the home directory location has user or group write permissions for the user installing Oracle Business Intelligence Enterprise Edition software.

```
$ chmod -R a+rwX /export/home/orabi
```

8. Run the commands below to enable the user interface display in the X Window environment.

```
$ ksh
$ export DISPLAY=172.16.2.180:0
$ /usr/openwin/bin/xclock
```



Figure 6 depicts the server configuration after the Oracle Business Intelligence Enterprise Edition software is installed on both servers.

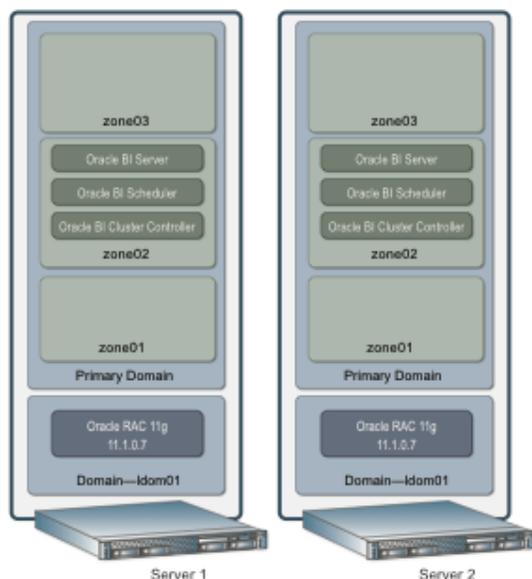


Figure 6. The server configuration after the Oracle Business Intelligence Enterprise Edition software is installed on both servers.

## Shared Storage Configuration

The Oracle Business Intelligence Enterprise Edition software needs to share certain files and directories. Follow the best practices below to help ensure data is readily accessible.

- **Presentation Catalog.** Because the Presentation Services utilize a common Presentation Catalog when running in a cluster, the catalog must be placed on a shared NAS or SAN device. All instances of the Presentation Services must have read and write access to the shared storage. The Presentation Catalog tends to utilize a large number of heavily accessed small files. Extend the number of files allowed in the file system, if needed. Limit the amount of backup activity on the shared file system to help ensure operational performance.
- **Repository publishing directory.** The Oracle Business Intelligence Servers in the cluster share a repository publishing directory that holds the master copies of repositories edited in online mode. Make sure the master Oracle Business Intelligence Server has read and write access to this directory. All other Oracle Business Intelligence Servers only need read access.
- **Cluster-aware cache.** Make sure all Oracle Business Intelligence Servers in the cluster have read and write access to the global cache directory.
- **Scheduler scripts.** Create a network share for the scheduler scripts and make sure the Scheduler servers have read and write access.

Information on configuring shared storage can be found in the Oracle Business Intelligence Enterprise Edition Deployment Guide located at [download.oracle.com/docs/cd/E10415\\_01/doc/bi.1013/b40058.pdf](http://download.oracle.com/docs/cd/E10415_01/doc/bi.1013/b40058.pdf).

The following steps can be used to prepare the storage system.

1. Determine the device type.

```
# uname -a
SunOS maa01 5.10 Generic_141414-01 sun4v sparc SUNW,T5140
```

2. Add elements to the array.

```
# iscsiadm add discovery-address 10.1.18.111
```

3. Verify the discovery mode and enable static discovery.

```
# iscsiadm list discovery
bash-3.00
Discovery:
    Static: enabled
    Send Targets: disabled
    iSNS: disabled
bash-3.00# iscsiadm modify discovery --sendtargets enable

bash-3.00# iscsiadm list discovery-address -v
Discovery Address: 10.1.18.111:3260
    Target name: iqn.1986-03.com.sun:02:fc23c454-3a65-4d90-ff4b-
f216ee20b10e
...
```

4. Add the static addresses.

```
# iscsiadm add static-config iqn.1986-03.com.sun:02:2694cebb-349d-c724-d1d3-
ed700a3e60cb,10.1.18.111
#iscsiadm add static-config iqn.1986-03.com.sun:02:ba9a975a-994f-46c6-a1c6-
ce057fb8da5f,10.1.18.111
# iscsiadm add static-config iqn.1986-03.com.sun:02:ac590f73-8f66-6eac-a11c-
c59b411b7c06,10.1.18.111
...
```

5. Verify the LUN list.

```
# iscsiadm list static-config
Static Configuration Target: iqn.1986-03.com.sun:02:f6e51901-38c4-65ea-fac6-
caaddcaf942c,10.1.18.111:3260
Static Configuration Target: iqn.1986-03.com.sun:02:4fdb5384-c549-6f84-bd73-
8da3713d3b00,10.1.18.111:3260
Static Configuration Target: iqn.1986-03.com.sun:02:99d22865-a881-c66f-ba42-
9edaa09bb82c,10.1.18.111:3260
...
```

6. List the target.

```
# iscsiadm list target -S
Target: iqn.1986-03.com.sun:02:93e33368-469b-cfeb-ddb8-eaca2024da7c
  Alias: pool-0/local/OBIEE/crs02
  TPGT: 1
  ISID: 4000002a0000
  Connections: 1
  LUN: 0
    Vendor: SUN
    Product: SOLARIS
    OS Device Name: /dev/rdisk/c1t600144F04A9516C50000144F8D56B200d0s2
  ...
```

7. Label the disks.

```
# format
Searching for disks...
```

8. Refer to *Deploying Oracle ASM Using iSCSI on Sun Storage 7000 System* located at [sun.com/bigadmin/features/articles/7000\\_oracle\\_iscsi\\_asm.pdf](http://sun.com/bigadmin/features/articles/7000_oracle_iscsi_asm.pdf) for more details.

## Oracle Business Intelligence Scheduler Configuration

Follow the instructions in the *Oracle Business Intelligence Infrastructure Installation and Configuration Guide* for installing the Business Intelligence Scheduler. Perform all configuration steps on both servers in the deployment. In addition, the Business Intelligence Scheduler instances must be configured to participate in the cluster and communicate with multiple Presentation Services instances and Business Intelligence Javahost instances, as well as use the shared location for the Scheduler scripts.

More information on configuring the Scheduler can be found in the *Oracle Business Intelligence Enterprise Edition Deployment Guide* located at [download.oracle.com/docs/cd/E10415\\_01/doc/bi.1013/b40058.pdf](http://download.oracle.com/docs/cd/E10415_01/doc/bi.1013/b40058.pdf).

## Cluster-Aware Business Intelligence Server Cache

Oracle Business Intelligence Server maintains a local, disk-based cache of query result sets called the query cache that allows many query requests to be satisfied without accessing backend databases to improve query response time. To optimize use of the query cache, follow the guidelines outlined in the *Oracle Business Intelligence Enterprise Edition Deployment Guide* located at [download.oracle.com/docs/cd/E10415\\_01/doc/bi.1013/b40058.pdf](http://download.oracle.com/docs/cd/E10415_01/doc/bi.1013/b40058.pdf).

## Installing Oracle Business Intelligence Enterprise Edition Presentation Services

The next step in the process is to install and configure the Oracle Business Intelligence Enterprise Edition presentation services software on both servers. The following steps describe the installation and configuration process for one server. Repeat this process on the second server.

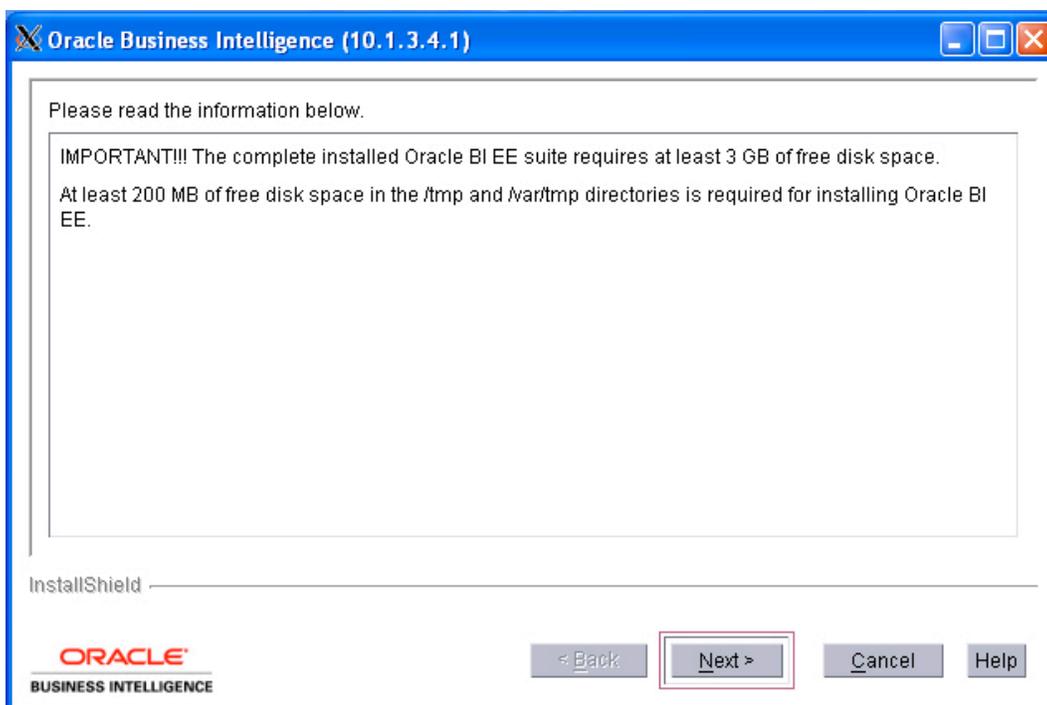
1. Login to the zone on the first server that was created for the application software.
2. Run the *UnixChk.sh* script to configure the system.

```
$ ./UnixChk.sh /software/oraclebiweb  
SUCCESS!! - This machine is configured for Oracle BI EE 10.1.3.4
```

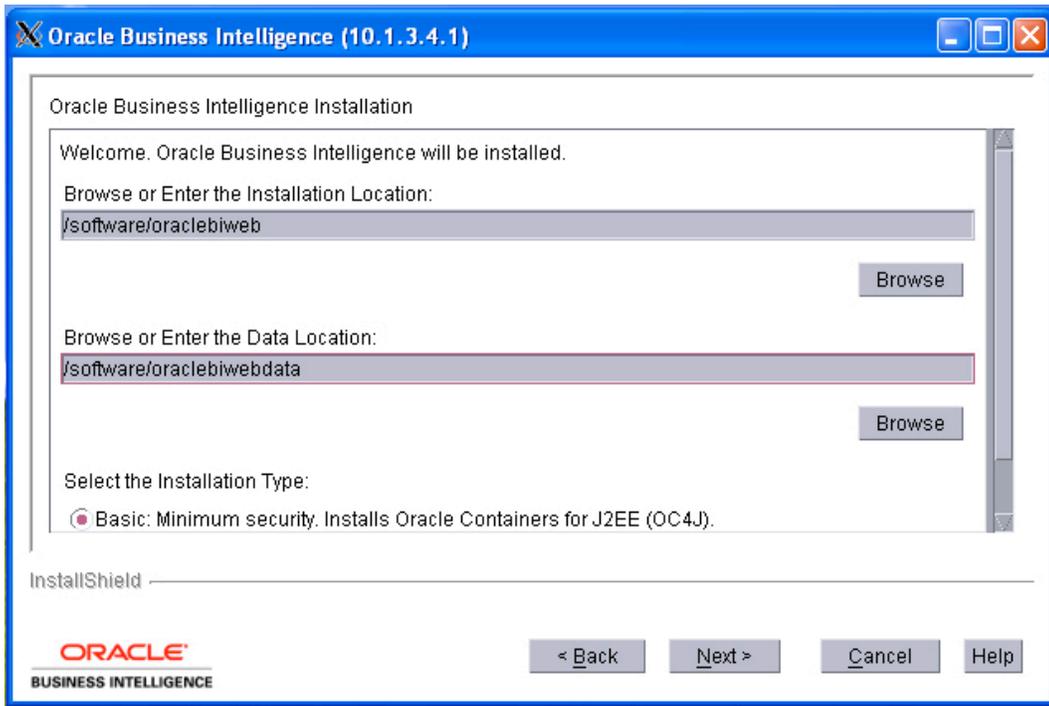
3. Set the DISPLAY environment variable so that the graphical user interface can be displayed.

```
$ ksh  
$ export DISPLAY=172.16.2.180:0
```

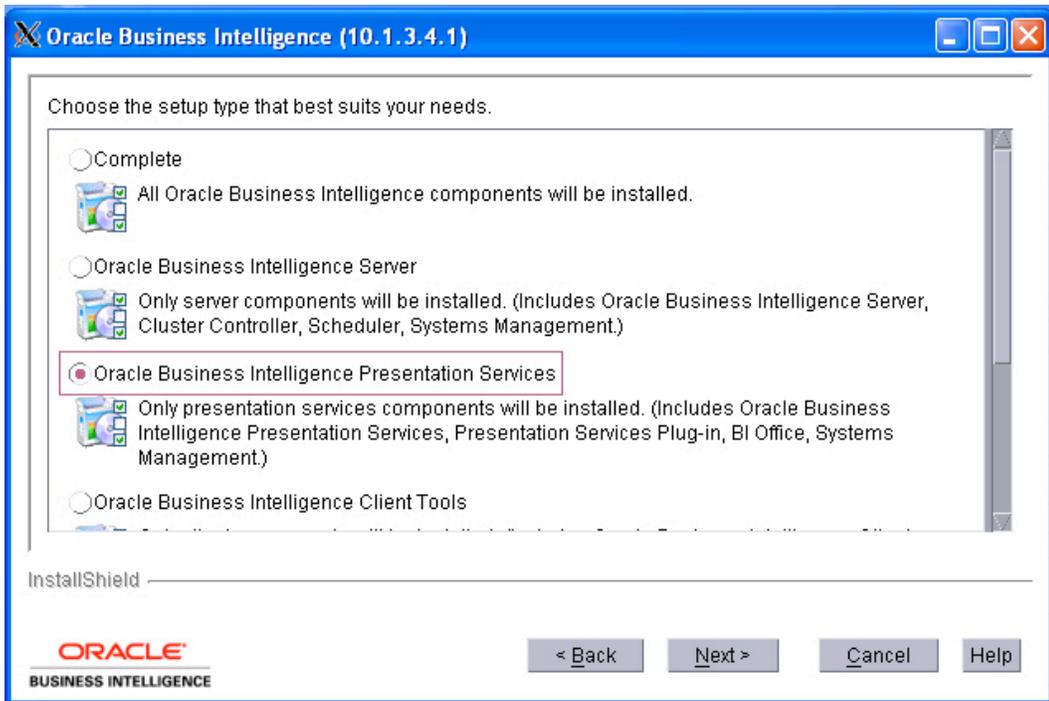
4. Invoke the startup script. The following window is displayed.



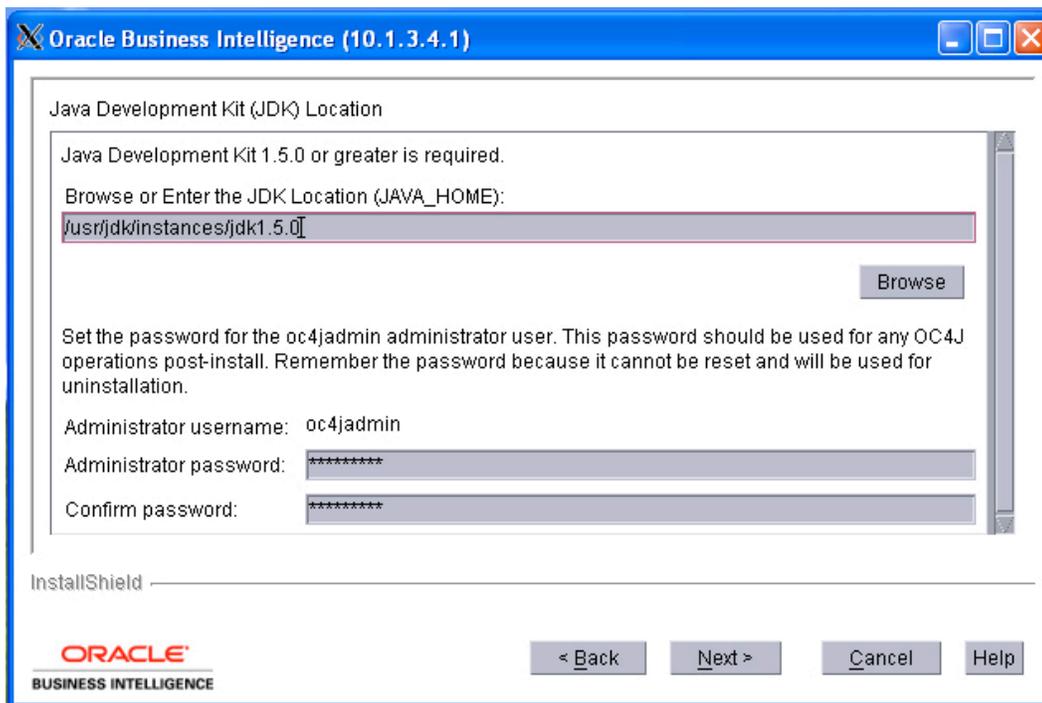
5. Enter the location for the Oracle BI Server and the data. Choose the basic option, which installs the Oracle BI Server Web components on the Oracle WebLogic application server.



6. Select the appropriate option. The following example installs the Oracle Business Intelligence Enterprise Edition presentation services on the system. The Oracle Business Intelligence server resides on a different machine.



- Specify the Java Development Kit installation location, username, and password (oc4jadmin).



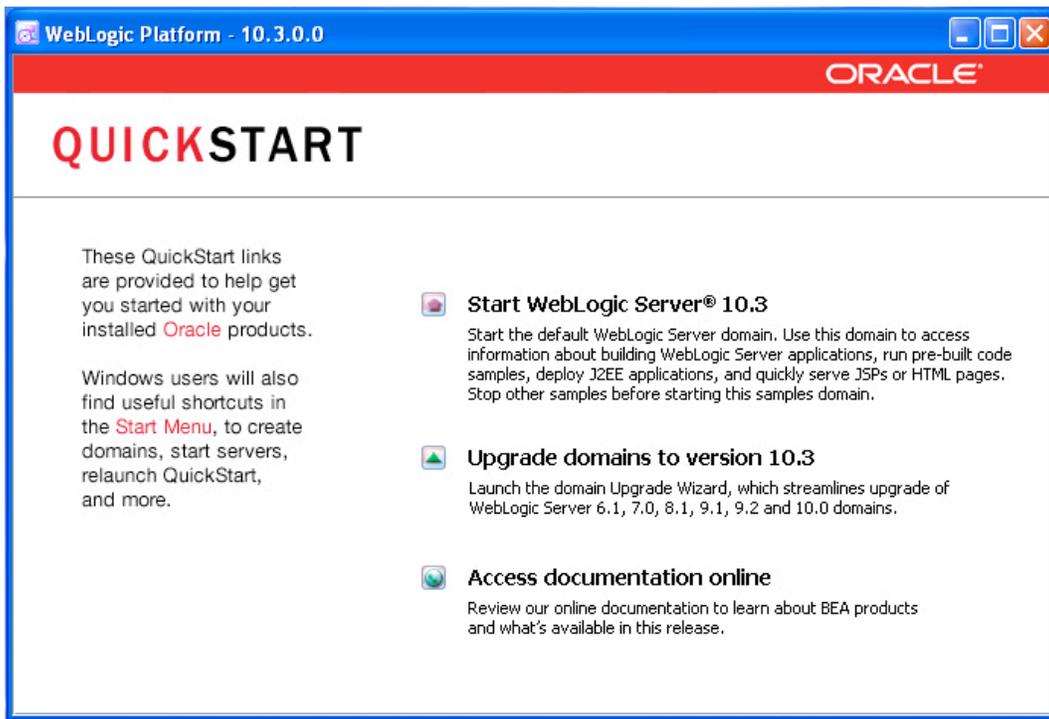
- Select the language for the system.
- Read the summary before proceeding to the installation process.
- Complete the installation of the Oracle Business Intelligence presentation services.

## Installing the Oracle Business Intelligence Enterprise Edition Presentation Services Plug-in

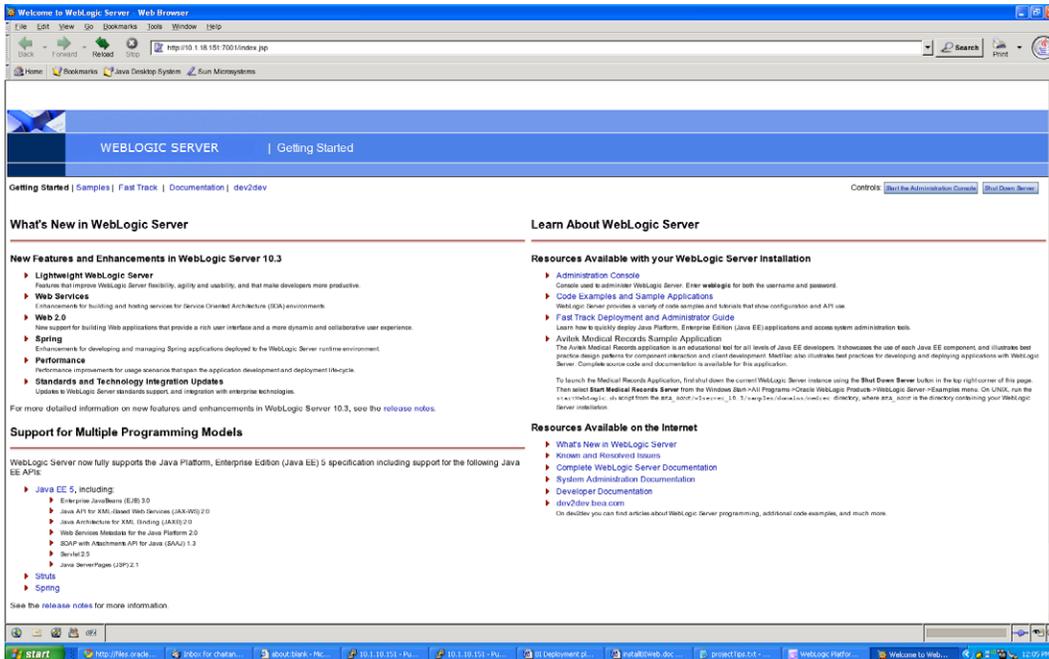
The presentation services plug-in component can be installed on any Java EE compliant Web server or IIS server. The example below uses the Oracle WebLogic server in the deployment stack. It is assumed that the Oracle WebLogic Server is installed and configured on the two servers. Installing the presentation services plug-in involves the deployment of the *analytics.war* file that comes with the presentation services installation.

Before deploying the *analytics.war* file, change the *web.xml* file if the Web server and the Oracle presentation services are running on different machines. The file assumes the Web server is local and is called *localhost*. Do not change the entry if the Web server and presentation services are located on the same machine.

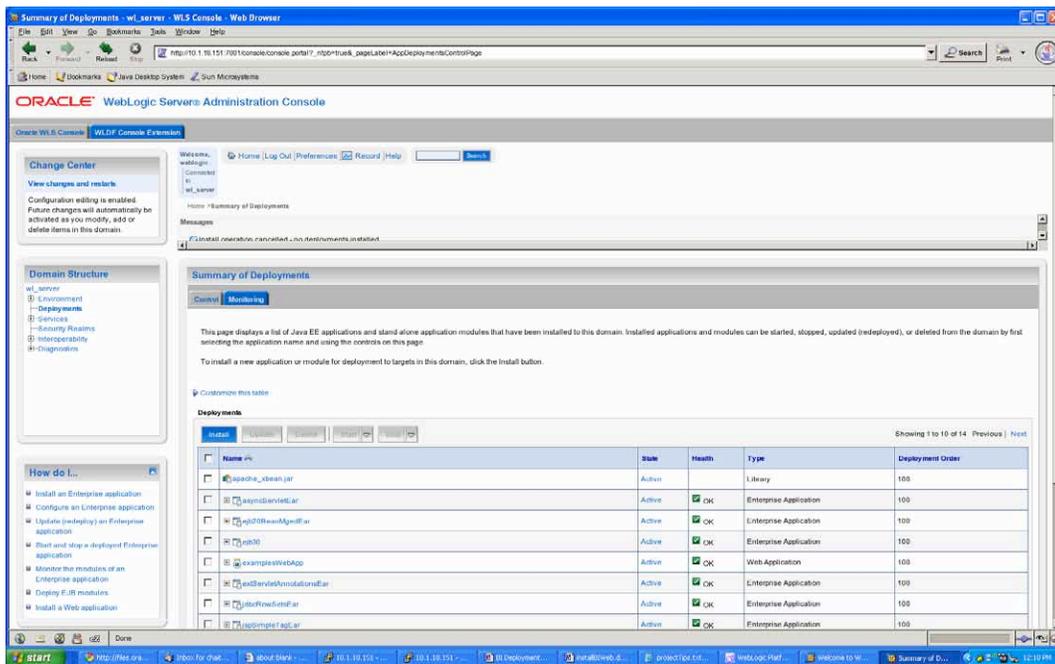
- Start the Oracle WebLogic Server quickstart script to begin deploying the BI software to the Oracle WebLogic Server. The QuickStart window appears.
- Start the WebLogic Server. A browser window appears.



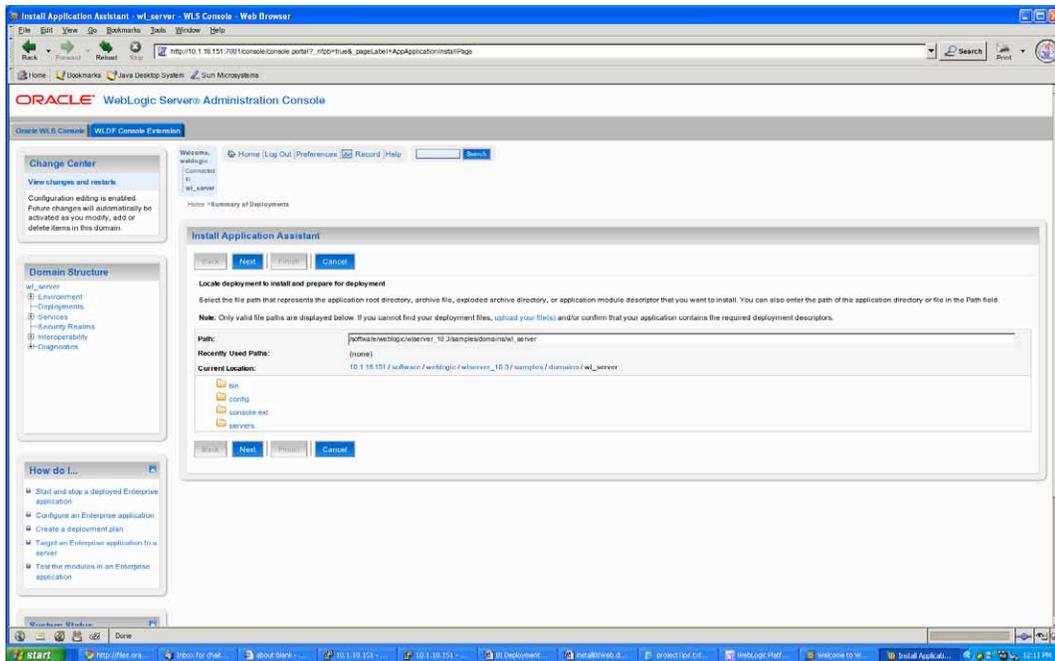
3. Start and login to the administrative console using the login *weblogic* with the password *weblogic*.



4. Select the resources that are deployed in your environment.

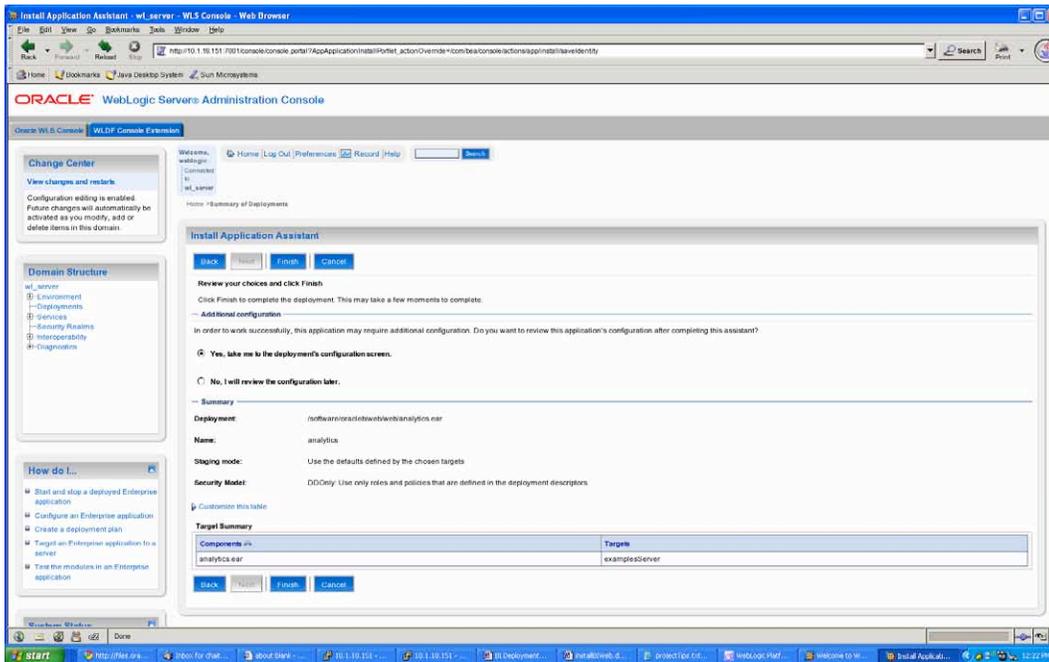


5. Click on *Install*.
6. Change the path to the path containing the *.ear* file. Click on *Next*.

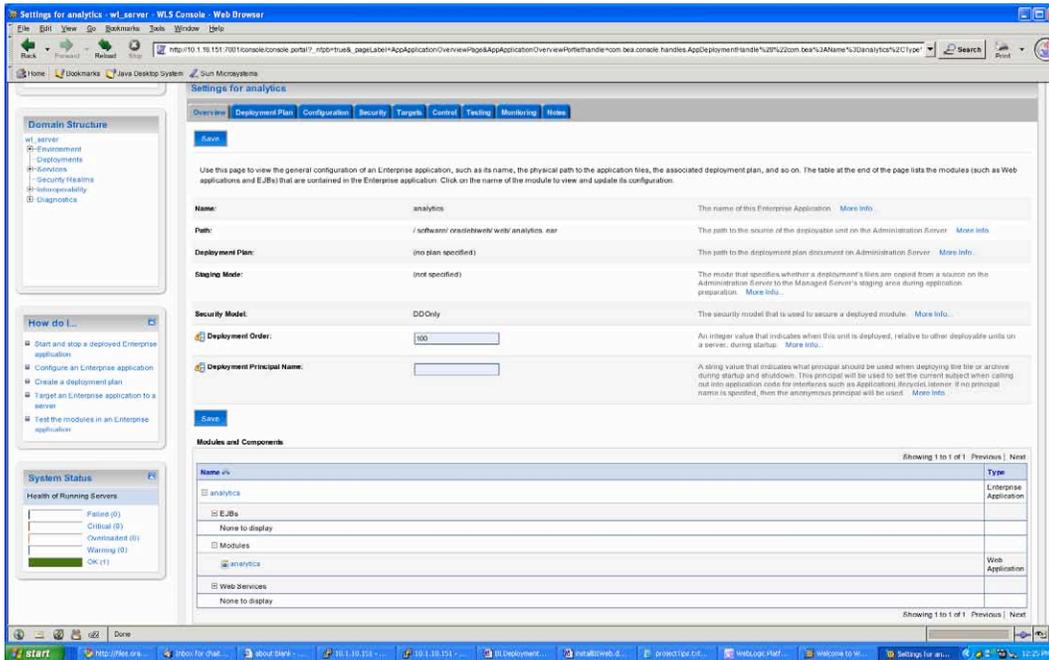


7. Indicate that the installation is to be deployed as an applied.





10. A new page opens that contains the configuration information for the deployment named *analytics*.



11. Modify the *odbc.ini* file to reflect a configuration in which the presentation services and the Oracle BI server reside on different machines.

12. Locate the Analytics Web section in the *odbc.ini* file.

13. Change the server machine name to the IP address of the machine on which the Oracle BI server is running. If a port is already specified, leave it as the default.
14. Once the deployment is done, login to the BI software using the URL *http://10.1.18.151:7001/analytics/saw.dll?Dashboard*
15. Login using the login Administrator with the password *Administrator*. The Dashboard page appears.

Figure 7 depicts the server configuration after the presentation services are installed on both servers.

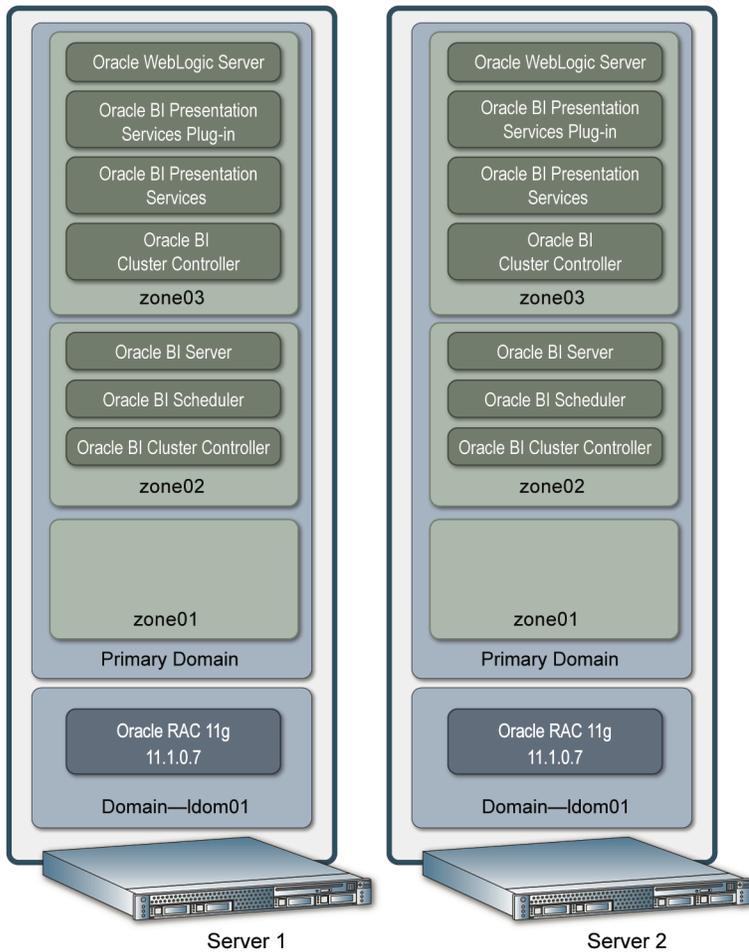


Figure 7. The server configuration after the Oracle WebLogic Server software is installed on both servers.

### Configuring the Oracle Business Intelligence Cluster Controller

Configuring the cluster controller requires editing the *NQSClusterConfig.INI* file on both servers to create an active-passive configuration. One of the servers acts as the primary cluster controller. The other server acts as the secondary cluster controller. Table 2 lists the parameters and settings to set in the *NQSClusterConfig.INI* file.

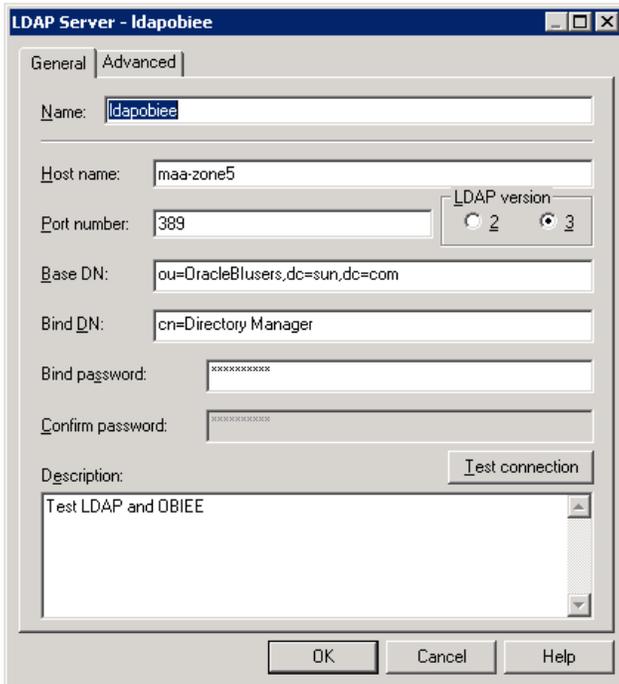
TABLE 2. CLUSTER CONTROLLER CONFIGURATION SETTINGS

PARAMETER	SETTING
ENABLE_CONTROLLER	YES
PRIMARY_CONTROLLER	Set to the primary controller
SECONDARY_CONTROLLER	Set to the secondary controller
SERVERS	Specifies a list of Oracle Business Intelligence Enterprise Edition servers in the cluster
MASTER_SERVER	Specifies the master BI server
SERVER_POLL_SECONDS	5 seconds (default)
CONTROLLER_POLL_SECONDS	5 seconds (default)
CLIENT_SERVER_PORT	Set to the same value as the RPC_SERVICE_OR_PORT setting in the NQSConfig.INI file (default 9703)
CLIENT_CONTROLLER_PORT	9706 (default)
MONITOR_CONTROLLER_PORT	9700 (default)
MONITOR_SERVER_PORT	9701 (default)

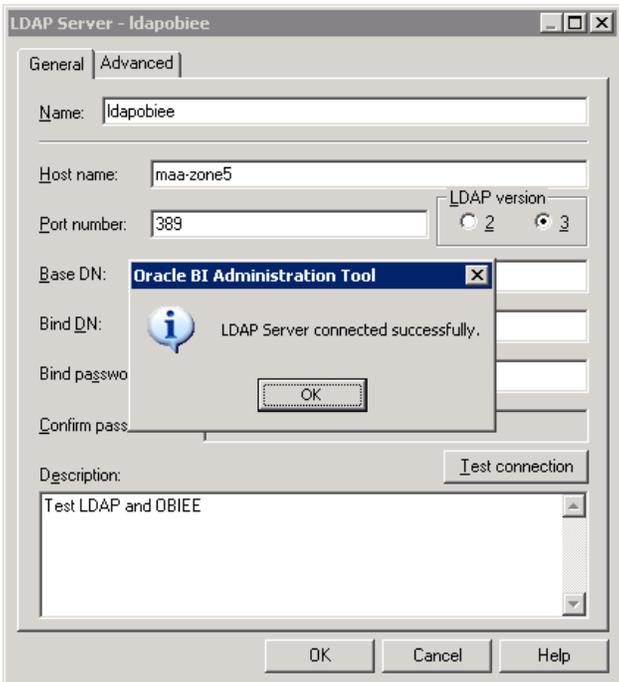
## Configuring Oracle Directory Server

Both servers in the deployment architecture use the Oracle Directory Server to supply an LDAP server. Instructions for installing the Oracle Directory Server and migrating user systems to the LDAP server can be found in the product documentation located at [docs.sun.com/app/docs/doc/820-2486](http://docs.sun.com/app/docs/doc/820-2486).

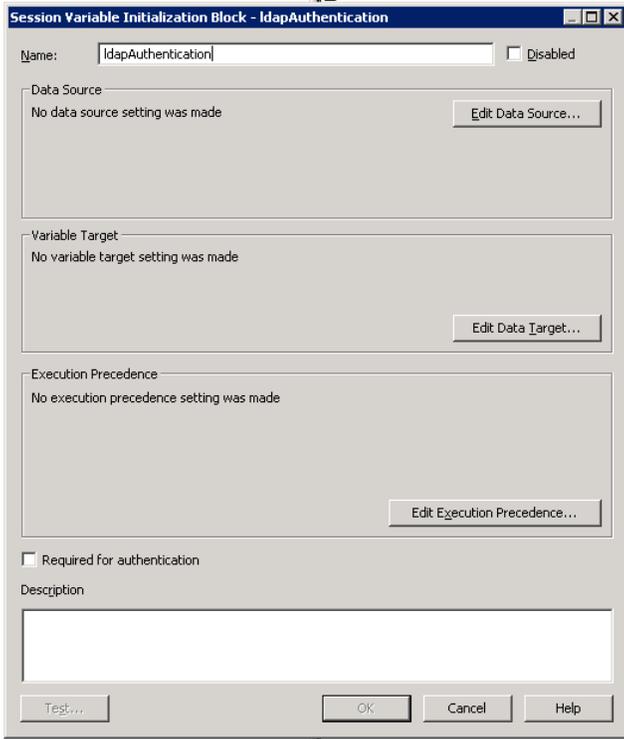
1. Open the repository from the Oracle Business Intelligence Administration Tool.
2. Go to *Manage->Security* to open the Security Manager.
3. Add a new LDAP server. Click *Action->New->LDAP Server*.
4. Enter the LDAP server hostname, port number, base Dn, Bind Dn, Bind Password.



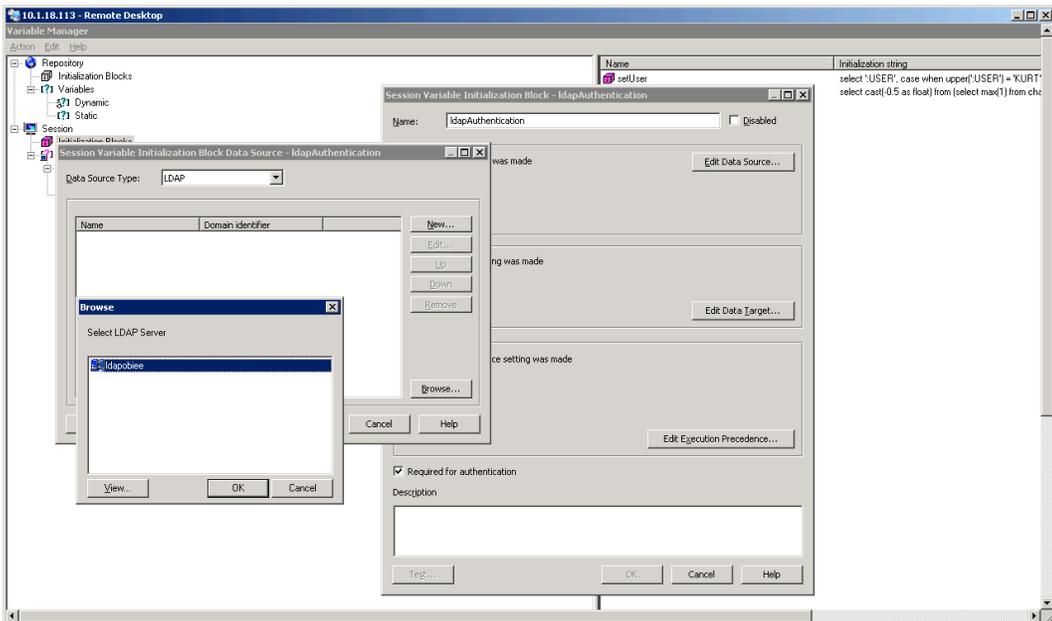
5. Test connectivity by clicking on the *Test Connection* button.



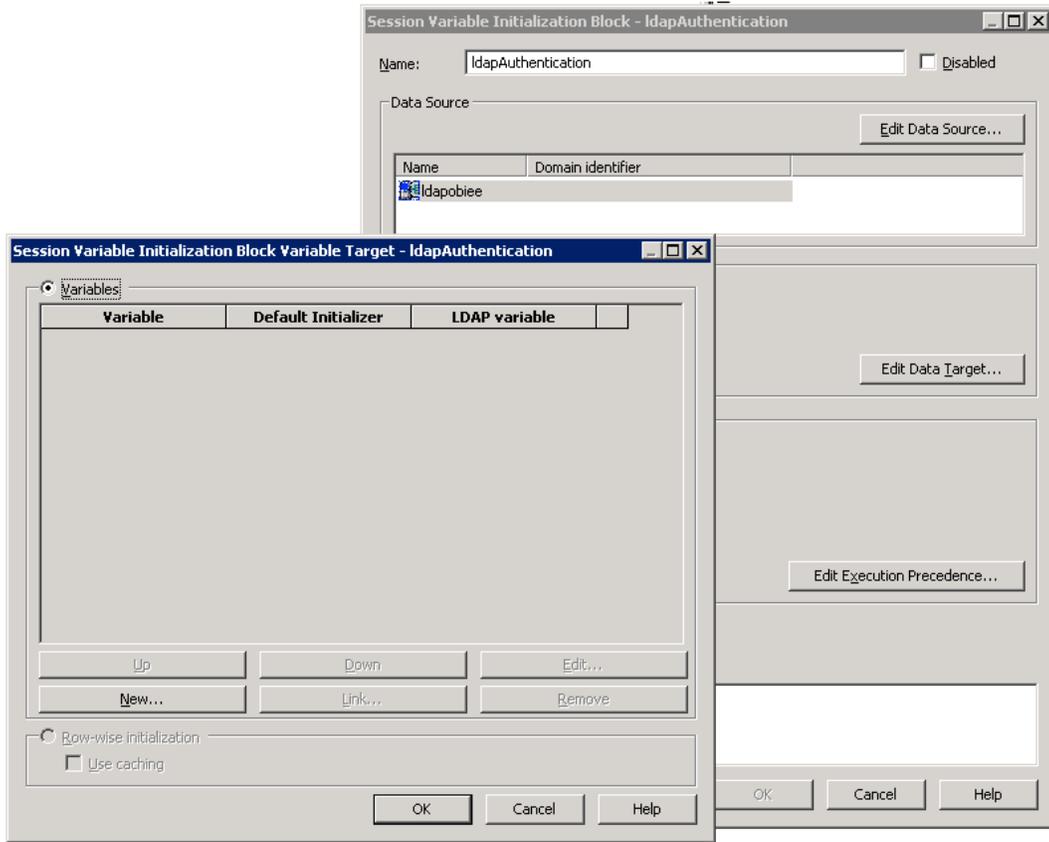
6. Configure the initialization block for user authentication. Open the Variable Manager and click on *Administration Tool->Manage->Variables*.
7. Click *Action->New->Session->Initialization Block*.



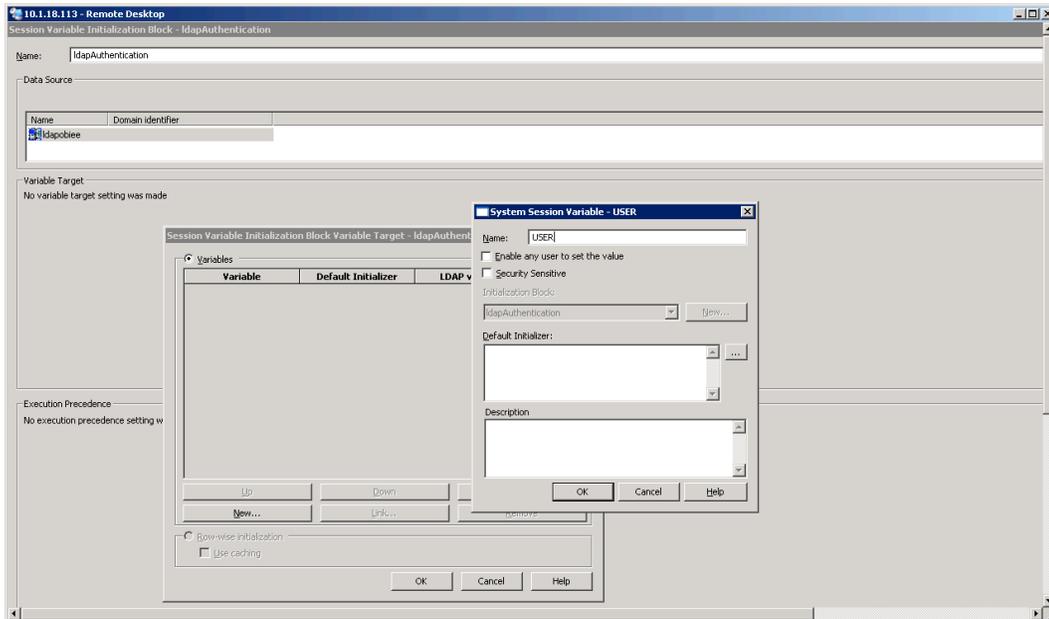
8. Enter the name for the session variable and check the *Require for Authentication* check box. Add the previously created LDAP server.



9. Click *OK*.
10. Click the *Edit Data Target* button on the Session Variable Initialization Block screen.



11. Click *New*. Enter the name USER in the System Session Variable. Click *OK*.



12. Test the setup by clicking the *Test* button. Enter a valid username and password.

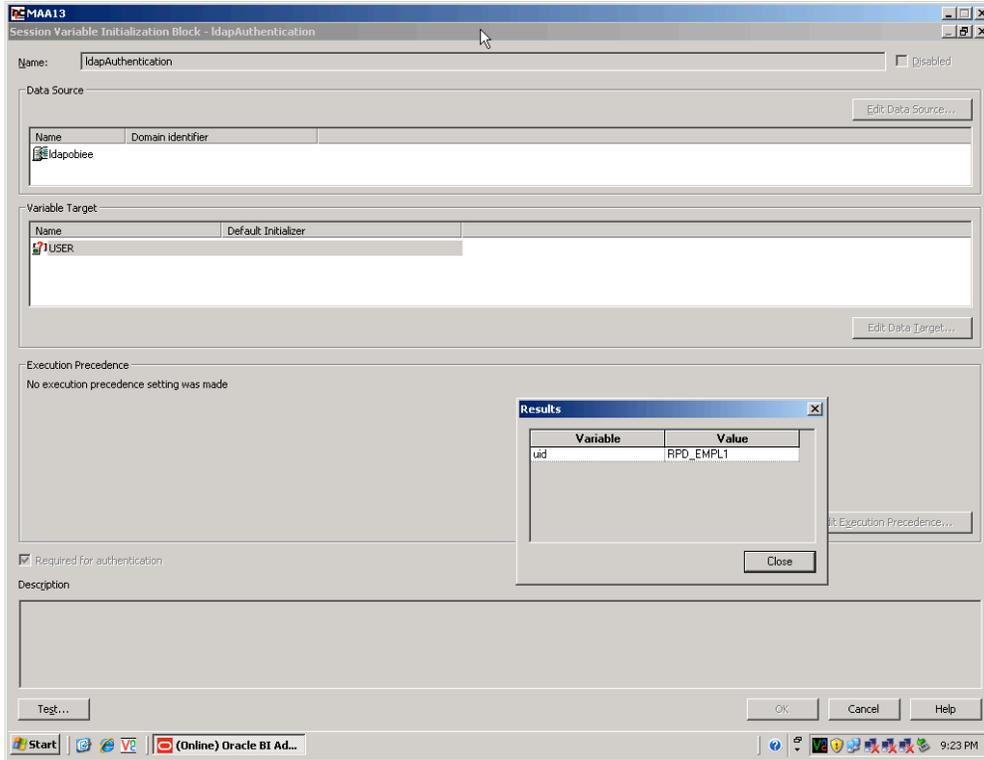
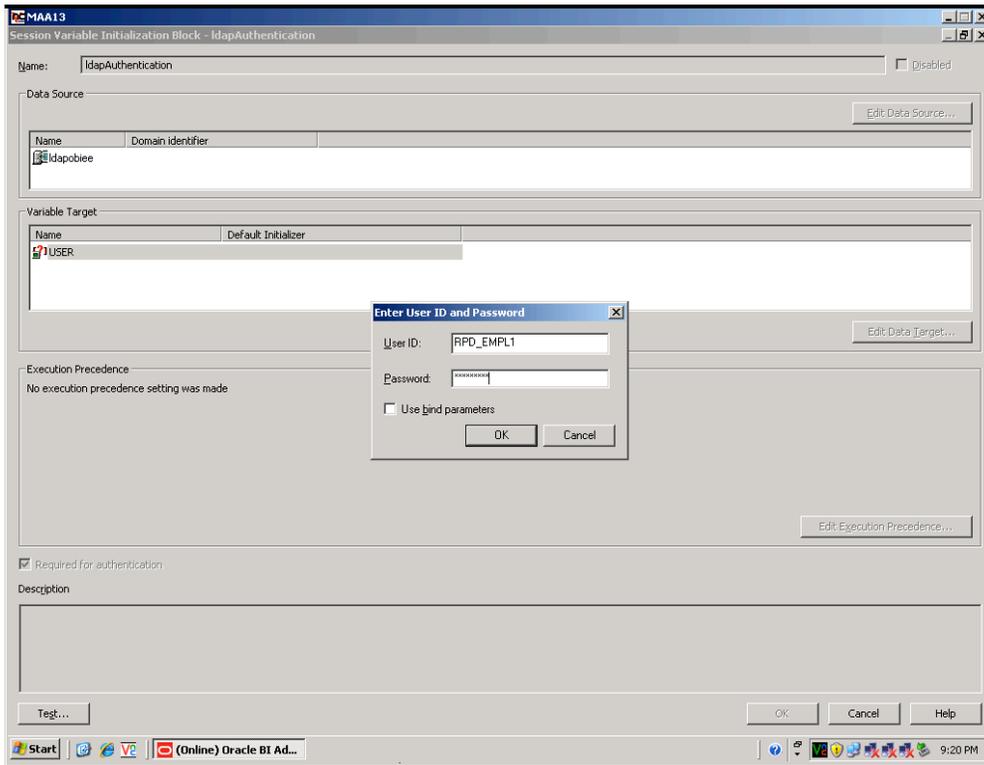


Figure 8 depicts the server configuration after Oracle Directory Server is installed on both servers.

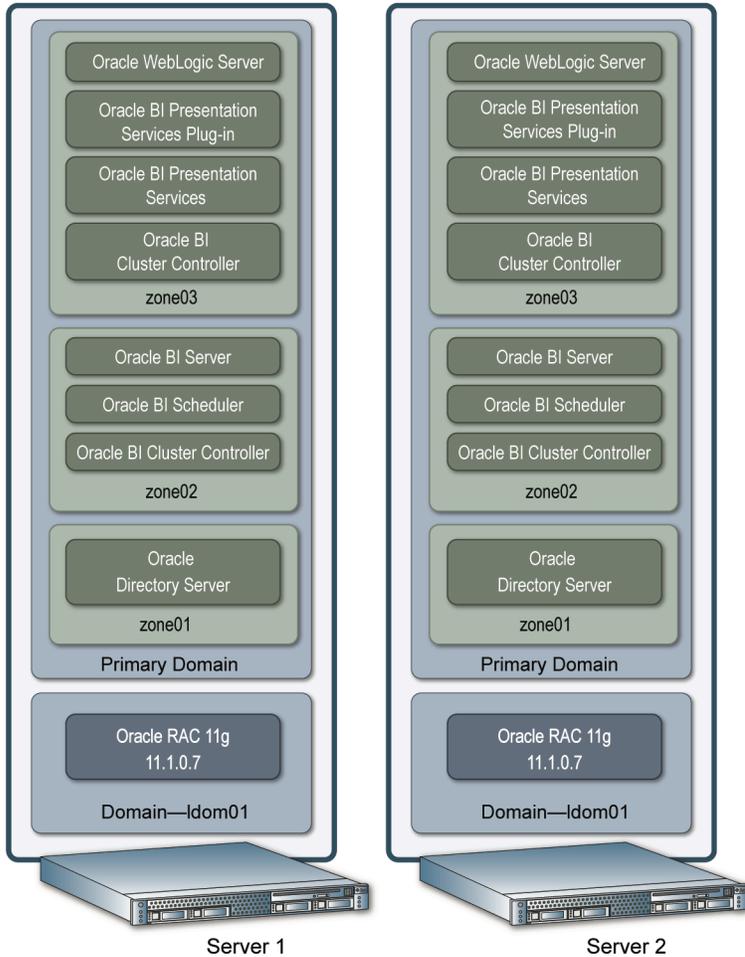


Figure 8. The server configuration after the Oracle Directory Server software is installed on both servers.

## Performance Characteristics and Best Practices

In order to demonstrate the performance characteristics of the deployment architecture, Oracle engineers ran a series of tests that used an HP Load Runner script to simulate 2,500 users accessing business intelligence dashboards and underlying data. Load drivers generated the workload to drive the BI applications, and sit outside the deployment architecture. Two Sun Fire X4240 servers from Oracle running Microsoft Windows Server 2003 Enterprise Edition (32-bit) were used to run the HP Load Runner software. Each system incorporated two four-core AMD Opteron™ processors and 4 GB of memory. Table 3 lists the non-default Load Runner parameters used for the testing effort.

TABLE 3. LOAD RUNNER PARAMETER SETTINGS

	DESCRIPTION	VALUE
<b>RECORDING SETTINGS</b>	Protocol	Siebel-Web
	HTTP- or HTML-based	HTML-based script
<b>RUNTIME SETTINGS</b>	Multithreading	Run Vuser as a thread
	Automatic transaction	Define each action as a transaction
	Simulate browser cache	True
	Simulate a new user on each iteration	True
	Clear cache on each iteration	True
	HTTP request connec timeout	360
	HTTP request receive timeout	360
	Accept server-side compression	Gzip, Deflate
	Step download timeout	360
	Network buffer size	98304
	Support activex controls	Yes
	Support activex objects	Yes

A Load Runner script was created to stress the system. Several scenarios were tested, with the number of users increasing to a peak of 2,500 concurrent users. The test script was designed to run for several minutes when run individually, and to access as many screens as possible. Each user performed the following transactions:

```

login
sales trends country managers is the default tab.
click on country region americas
click on return
click on asia country region
click on return
click on country region Europe
click on return
click on category sales tab
The default selection in drop down is % chg Amount Sold MAgO
click on sales details tab - the default selection for country is europe-germany
click on category sales tab - choose the column pick view as prod name
choose the column pick view as share of gross profit
click on sales details tab - choose the selection as Europe-italy
click on category sales tab - choose the column pick view as rank gross profit
within category
click on sales details tab - choose the selection as Europe-france
click on category sales tab - choose the column pick view as # of customers
click on sales details tab - choose the selection as Europe-denmark
click on category sales tab - choose the column pick view as average sales per
customer
    
```

```
click on product profitability tab
click on peripherals and accessories
click on monitors
click on 256 MB Memory card
click on return to return to previous screen
click on product Y box
click on return to return to the previous screen
click on Mini DV comcoredr with 3.5" swivel LCD
click on sales trends
click on product category tab
click on sales trends tab
click on logout
```

Ten user names and password were created and parameterized. Each iteration of the script used a different username and password, and then cycled through the list of users repeatedly throughout the test. The test ran for 22 minutes and 1 second, and resulted in a 262,443 total hits, total throughput of 7,664,447,703 bytes, an average throughput of 5,797,616 bytes/sec, and 198.52 hits/sec.

Other tests were conducted to validate and verify the high availability aspects of the deployment architecture. The tests revealed:

- Shutting down one instance of Oracle WebLogic Server resulted in the load balancer server continuing to respond to requests by directing the requests to the other instance of the Oracle WebLogic Server.
- Shutting down one instance of the Oracle BI Presentation Services did not hinder availability. The Oracle WebLogic Server automatically transferred requests to the other presentation server instance.
- Shutting down one instance of the Oracle BI Server did not impact availability. The cluster controller handled requests from the presentation server and directed the requests to the other Oracle BI Server instance.
- Shutting down the cluster controller for the Oracle software resulted in the second cluster controller waking up and handling requests from the scheduler and presentation server.
- Shutting down the Oracle Database 11g with RAC server disrupted the connected sessions from the BI Server. New connections to the database continued, since the new Oracle BI Server requests were redirected to the other Oracle Database 11g with RAC node in the cluster.

## Best Practices for Deployment

Several best practices can help ensure a smooth deployment of a highly available solution.

- Add another server to the cluster and run the middleware on this system in order to optimize throughput and further increase availability.
- Run the LDAP server outside the rest of the software stack to simplify deployment.

- Configure the Sun Storage 7410 system with two internal systems for greater clustering and availability of storage and data resources.
- Use the same directory structure on all nodes in the cluster to simplify deployment, debugging, and management.
- Configure an entire system first and verify the software is installed correctly and then replicate the *.INI* files to other nodes in the cluster.
- Inspect the log files for each software component for errors.
- Synchronize the clocks on systems in the cluster, ensuring they are no more than 5 to 10 seconds apart.
- Use domain accounts rather than local system accounts for accessing shared storage on Microsoft Windows systems.
- Extend file limits on the shared storage, particularly for the Presentation Catalog.

## About the Authors

Maqsood Alam is a seasoned software professional with 15 years of experience working with Oracle technologies, specializing in databases, maximum availability, data warehousing and business intelligence. His current initiatives are focused towards Oracle's hardware platform partners and publishing Oracle reference architectures and blueprints targeting Oracle's high availability architectures and best practices. He has also been involved in evangelizing and training on Oracle Exadata and promoting best practices for migrations into Exadata from third-party technologies. He is an Oracle Certified Professional and holds a Masters and a Bachelors degree in Computer Science.

Luoqia Chen is a software engineer specializing in integrating Oracle's Sun technologies with ISV applications. She focuses on benchmarks, performance monitoring, optimization, and scalability to help applications run at peak performance on Oracle's Sun platforms.

Ron Graham has 20 years experience in the computing industry, and serves as Oracles Principal Applications Solutions Manager. He works closely with customers on implementations, solutions, and reference architectures, and specializes in enterprise solutions and working with engineering on product features, bug fixes, and customer problem solving. Ron has worked on numerous benchmarks and published many white papers and reference architectures on virtualization, Oracle BIEE, and datacenter deployments.

Chaitanya Kadaru is an Oracle software professional with 8 years of experience working with Oracle technologies, Java EE platform and .NET application development, and Siebel CRM development. His current initiatives are focused on Oracle BI products and developing reference architectures for disaster recovery management using Oracle's Sun platforms. He has also been involved in evangelizing and training on Oracle content management and security products. With interests in Oracle databases and high availability Web architectures, Chaitanya is a Siebel Certified Professional and holds a Masters degree in information systems from Carnegie Mellon University.

Giri Mandalika is a software engineer and works with partners and ISVs to make Oracle the preferred vendor of choice for deploying enterprise applications. Currently, Giri is focused on standard benchmarks, optimization, and scalability of enterprise applications on Oracle platforms.

## Acknowledgments

The authors would like to thank Steve Smith of Brocade and Kevin Thuan Thai for their help in setting up the hardware for the reference deployment.

## References

To learn more about Oracle hardware and software products and services, see the references listed in Table 4.

**TABLE . REFERENCES FOR MORE INFORMATION**

REFERENCE	URL
Oracle's Sun Servers	<a href="http://www.oracle.com/us/products/servers-storage/servers">www.oracle.com/us/products/servers-storage/servers</a>
Oracle Solaris Operating System	<a href="http://www.oracle.com/us/products/servers-storage/solaris">www.oracle.com/us/products/servers-storage/solaris</a>
Oracle's Sun Storage 7000 Unified Storage Systems	<a href="http://www.oracle.com/us/products/servers-storage/storage/open-storage">www.oracle.com/us/products/servers-storage/storage/open-storage</a>
Oracle Database 11g with RAC	<a href="http://oracle.com/technology/products/database/clustering">oracle.com/technology/products/database/clustering</a>
Oracle Business Intelligence Suite, Enterprise Edition	<a href="http://oracle.com/appserver/business-intelligence/enterprise-edition.html">oracle.com/appserver/business-intelligence/enterprise-edition.html</a>



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