

with Oracle Real Application Cluster Concepts

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**PortaBilling® with Oracle Real Application Cluster, September 2021
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V1.95.01**

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Preface

This document provides PortaBilling® with Oracle Real Application Cluster users with information about system architecture, basic concepts, and other matters required in order to deploy it to manage and rate communication services.

Where to get the latest version of this guide

The hard copy of this guide is updated upon major releases only, and does not always contain the latest material on enhancements that occur in-between minor releases. The online copy of this guide is always up to date, and integrates the latest changes to the product. You can access the latest copy of this guide at: www.portaone.com/support/documentation/.

Conventions

This publication uses the following conventions:

- Commands and keywords are given in **boldface**.
- Terminal sessions, console screens, or system file names are displayed in `fixed width font`.



Exclamation mark draws your attention to important actions that must be taken for proper configuration.

NOTE: Notes contain additional information to supplement or accentuate important points in the text.



Timesaver means that you can save time by taking the action described here.



Tips provide information that might help you solve a problem.



Gear points out that this feature must be enabled on the Configuration server.

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Hardware and software requirements

Server system recommendations

- Nine servers with Intel Xeon or AMD Opteron/Epyc CPUs. Multi-CPU servers are recommended – there is no licensing limit on the number of CPUs or cores. Each server must be equipped with a DVD drive or USB port (at least temporarily, during installation). Please also see the hardware requirements below:
 - Database servers (3 units):
 - At least 32 GB of RAM, 64 GB recommended.
 - Two Gigabit network ports (can be two separate network adapters or a single dual-port adapter).
 - If a disk array with fiber-channel connectivity is used for data storage, each server should be equipped with a fiber-channel adapter card.
 - At least 500 GB of local storage.
 - OCS servers (3 units):
 - At least 16 GB of RAM, 32 GB recommended.
 - Two Gigabit network ports (can be two separate network adapters or a single dual-port adapter).
 - Minimum 500 GB of available disk storage, 1TB is recommended..
 - Web servers (2 units):
 - 32 GB of RAM.
 - Two Gigabit network ports (can be two separate network adapters or a single dual-port adapter).
 - Minimum 500 GB of available disk storage, 1TB is recommended.
 - Configuration server (1 unit):
 - 32 GB of RAM (64GB for heavily loaded systems).
 - Two Gigabit network ports (can be two separate network adapters or a single dual-port adapter).
 - 2TB of available disk space.

When choosing a specific server model, please ask your vendor about its compatibility with Linux compatibility.

- RAID is recommended in order to improve performance and reliability.
- Shared disk storage for the Oracle RAC database and other related data can be either direct attached storage, iSCSI, or FC Storage Area Network (SAN). Please see the Oracle Verified configuration on the

Oracle website for examples of supported storage solutions. A minimum of 500 GB of free disk space should be available.

- All servers must have remote access controllers with remote console access like Dell iDRAC Enterprise/ HP iLO Advanced/IBM IPMI..

For additional details and configuration advice, see the *Hardware Recommendations* topic on our website:

<http://www.portaone.com/support/hw-requirements/>

For information about whether particular hardware is supported by Oracle Enterprise Linux used as the operating system in PortaSwitch®, consult the related document on the Oracle or RedHat website:

<https://catalog.redhat.com/hardware/>.

Client system recommendations

- **OS:** MS Windows 7 or above, Linux/BSD, macOS Sierra (version 10.12) or above.
- **Web browser:**
 - Google Chrome 84 or above, Mozilla Firefox 78 ESR, Mozilla Firefox 80 or above.
 - JavaScript and cookies must be enabled. In addition, Java must be enabled on end user self-care interfaces.
- **Spreadsheet processor:** MS Excel, OpenOffice Calc, LibreOffice Calc, Google Sheets.
- **Display settings:** A minimum screen resolution of 1366 × 768.

What is new in maintenance release 95?

Updated:

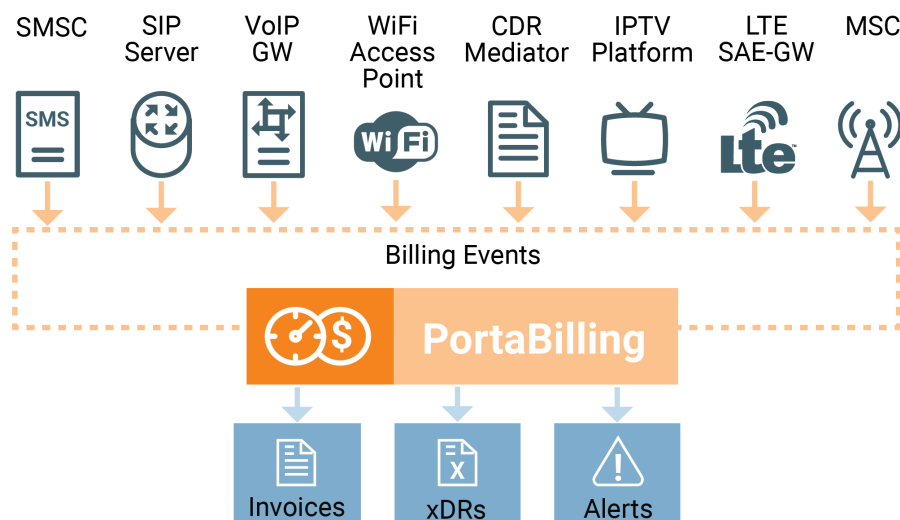
- Are there any restrictions associated with the supplied Oracle license?

1 ■ System Concepts

Basic information

Purpose

PortaBilling® with Oracle Real Application Cluster is a carrier-grade converged billing/provisioning system for communication service providers. It communicates with elements of your network (such as VoIP switches, IP TV streaming servers, or messaging gateways), provides these nodes with authentication or authorization (determining whether a customer should be admitted and provided with a service), and gathers billing events (i.e. data about services rendered to your customers). Based on this information, it performs rating for services, creates transaction records (also called xDRs - eXtensible Detail Records¹), and modifies customers' balances accordingly.



All this happens in real time, so that billing data is updated as soon as a session is completed (e.g., the customer hangs up his phone, or an SMS message is sent). PortaBilling® with Oracle Real Application Cluster provides a unified platform for multiple services, which allows you to use it to charge clients for their voice calls, text messages, and data transfers, thus effectively deploying triple-play on your network.

PortaBilling® with Oracle Real Application Cluster acts as the nerve center of your network. After you enter information about your services, rates, customers, and so on via the web interface, PortaBilling® with Oracle Real Application Cluster communicates in real time with elements of your network to supply information regarding which customers a service should be provided to (and which not), as well as exactly how it

¹ For xDRs for telephony services, the previous term CDRs (Call Details Records) is often used.

should be provided. Customers whose balance has run out will be disconnected immediately after exceeding the maximum session duration and (because billing happens in real time) funds will be withdrawn from their account and service denied if they make another attempt to use the service.

PortaBilling® with Oracle Real Application Cluster vs. PortaBilling®

PortaBilling® with Oracle Real Application Cluster provides exactly the same functionality as PortaBilling® in terms of customer management, service provisioning, rating, billing, and so on. In fact, they share the same “core” functions of the billing engine, XML API, and other important modules. Also, their web front-end looks basically the same, thus significantly simplifying migration to PortaBilling® with Oracle Real Application Cluster for current PortaBilling® users.

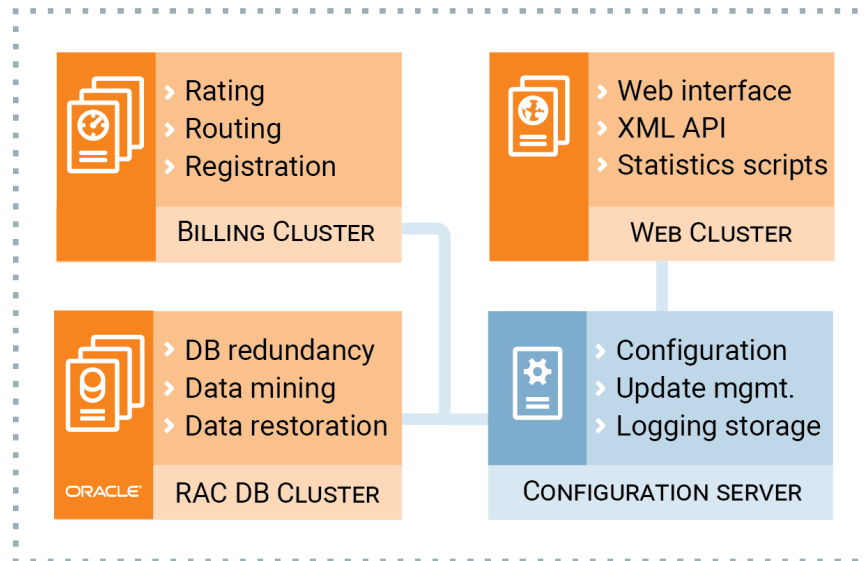
Therefore, in the rest of this document the term **PortaBilling®** will be used to describe the general functionality shared by both products, while **PortaBilling® with Oracle Real Application Cluster** will be used to refer to a specific product.

The fundamental difference lies in the architecture of **PortaBilling® with Oracle Real Application Cluster**:

- The database back-end deploys multiple servers in the Oracle Real Application Cluster (RAC). This means that, in case one of the servers should fail, the database will continue to operate. Also, if more performance is required, additional servers may be added to the cluster to linearly increase capacity. For more details regarding the Oracle Real Application Cluster, see the [Oracle website](#).
- Similarly, the billing engine (the code that performs communication with the network, real-time rating, etc.) runs in a distributed fashion on several servers, which are organized as a cluster. This provides fault-tolerance (if one of the servers in the billing cluster goes down, this does not affect the service provided to customers, since the remaining servers will carry on), and allows easy expansion of capacity by adding more servers.
- Administrative functions (administrator web, self-care web, XML API, etc.) run on several servers, enabling load-sharing and quick disaster recovery.
- Finally, there is a separate server which is used to maintain and manage the configuration of all the other servers. This greatly simplifies tasks such as adding a new server to your PortaBilling® with Oracle Real Application Cluster installation, relocating

components (e.g., one of the billing servers) to a new physical machine, or changing some other parameters.

PortaBilling with Oracle RAC



Converged billing

PortaBilling supports multiple services and service types. This means that as different types of services (e.g., voice calls, Internet access, WiFi connectivity and messaging) are provided to your users, PortaBilling collects data about all of them, processing and rating it according to the billing configuration. It then provides your customers with a consolidated bill, and your administrators with a unified customer management interface.

Billing events

The main unit of billing information is a billing event – a notification that a service has been provided to a customer in the outside world, and that this customer should be charged for the service.

For many services (such as SMS messaging), a single billing event is represented by a single notification message to billing, while for others information about one event (e.g., a completed phone call) is split into multiple notifications from different network elements.

Oracle licensing

PortaBilling® with Oracle Real Application Cluster is supplied with a bundled (also called ASFU - Application Specific Full Use) license for all the necessary Oracle software – the Oracle Database Server Enterprise Edition (with Advanced Data Guard and Partitioning options) and the Oracle Real Application Cluster. This means that PortaBilling® with Oracle Real Application Cluster covers the costs of both PortaOne-developed software and Oracle licenses, thus providing you with significant savings compared to the purchase of separate licenses directly from Oracle.

Just consider that without the bundled license, for the standard installation of PortaBilling® with Oracle Real Application Cluster consisting of (three database servers, each server containing two eight-core CPUs), you would need licenses for the Oracle Database Server Enterprise Edition, plus the Real Application Cluster and Partitioning option. The price of the Oracle license costs in this case would be (number of servers) * (number of CPUs * (number of cores per CPU/2)) * (license cost):

Licenses:

Oracle Database Server Enterprise Edition	\$47,500
Real Application Cluster	\$23,000
Partitioning option	<u>\$11,500</u>
<i>Subtotal:</i>	<i>\$82,000</i>

Multiplied by:

Number of servers:	3
Number of CPUs	2
Number of cores per CPU/2	4/2

Total *hypothetical* cost of Oracle licenses: \$984,000

If you were to purchase the Oracle licenses on your own, you would need to spend the above amount. With PortaBilling® with Oracle Real Application Cluster you basically save this amount, since all these licenses are included in the price of the PortaBilling® with Oracle Real Application Cluster license (which is much lower).

Are there any restrictions associated with the supplied Oracle license?

1. As PortaBilling® with Oracle Real Application Cluster is provided with an AFSU **Oracle** license, you are permitted to directly access data in the PortaBilling® with Oracle Real Application Cluster database from your own applications (for instance, a reporting system, data export tool, or external web portal). You can even add new objects to the database schema (e.g., create a new table to hold the usage summary per customer). The only limitation here is that data from the database must be used solely in connection with PortaBilling® with Oracle Real Application Cluster, e.g., you cannot create new tables to store payroll data for your company.
2. PortaOne has a non-standard agreement with Oracle for the ASFU licenses. In particular, the ASFU licenses aren't subject to standard Oracle metrics, such as the limit on CPU cores and database users.
3. The ASFU licenses related to your PortaBilling® with Oracle Real Application Cluster are not subject to local audit: if a local Oracle distributor or representative performs an audit of your company and inquires about the ASFU licenses, refer them to **PortaOne**, as PortaOne is the party responsible for maintaining compliance.

What does the PortaBilling® with Oracle Real Application Cluster license give you?

The PortaBilling® with Oracle Real Application Cluster license entitles you to install and operate the following:

- 3 servers running the “billing engine” software package (OCS server, real-time billing engine, etc.).
- 3 servers running the database cluster software (Oracle database server, Oracle RAC and other database options).
- 2 servers for web administration, statistics calculations, XML API, and so on.
- 1 server for PortaBilling® with Oracle Real Application Cluster configuration and management.

See the section below regarding extension possibilities for your PortaBilling® with Oracle Real Application Cluster.

Which version of Oracle RAC will I receive?

As of PortaBilling® with Oracle Real Application Cluster Maintenance Release 95 the version of the Oracle RAC software included is 12c. PortaBilling® with Oracle Real Application Cluster uses Oracle

Enterprise Linux 7.5 for application servers (such as billing RADIUS) and for RAC servers.

PortaBilling® with Oracle Real Application Cluster is compatible with the Oracle Exadata Database Machine and the Oracle Exadata Database Appliance (ODA); the Oracle Exadata solution can be used instead of constructing the RAC infrastructure from database servers, disk arrays, switches, etc.

Scaling up

The standard PortaBilling® with Oracle Real Application Cluster installation includes three servers in the database cluster and three servers in the billing cluster. If more performance is required, you may purchase an extra license for a single billing server (to be added to the billing cluster) and a single database server (to be added to the Oracle database cluster).

If you wish to add more servers for web administration (e.g., a dedicated server for your end user web self-care), no extra licenses are required. The only condition is that this server must be added to your existing PortaCare contract.

2. Installation

Servers installation and interconnection

Management network

Each PortaBilling® with Oracle Real Application Cluster server should be connected to the local management network, which is used by servers in the cluster to exchange information. Since this network will be used by Oracle RAC servers to exchange large portions of data, it must be Gigabit Ethernet.

Public network

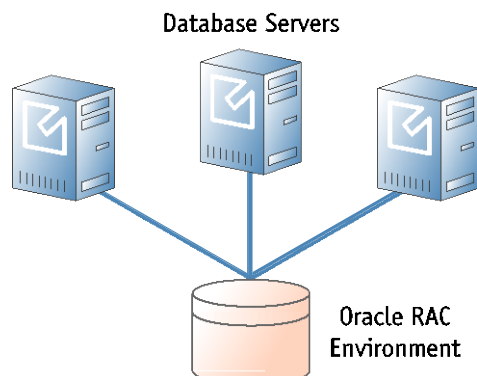
Each server will be connected to the public network. This is the network which provides a “real” IP address that can be used to access it via the Internet.

Do I need a firewall to protect my servers?

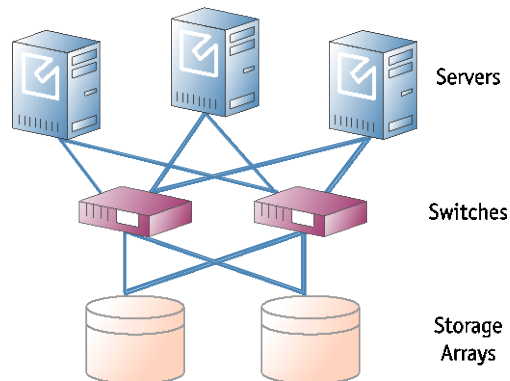
Each PortaBilling® with Oracle Real Application Cluster server contains a built-in firewall and runs only those services which need to be accessed from the Internet (e.g., the web interface). So, strictly speaking, a separate firewall in front of the servers will yield little additional benefit. However, you may certainly use one if this is required by your security policies.

Database disk storage

The Oracle RAC environment requires shared disk access, so that all the database servers have concurrent access to the same storage. The method of connecting storage to the database servers is usually either iSCSI or fiber-channel (NFS options are not recommended, and therefore not covered here.)



In order to avoid a situation where disk storage becomes the single point of failure, it is recommended that you use several redundant storage arrays, connected via separate fiber-channel or network switches.



Installation

Proper network configuration is the most important aspect of the PortaBilling® with Oracle Real Application Cluster configuration performed before software installation. This includes the configuration for the public (network for services), private (network for PortaSwitch® servers' management) and the Oracle RAC Interconnect networks, setting up DNS servers and allocating virtual IP addresses, etc.

Once the network is configured you may start the PortaBilling® with Oracle Real Application Cluster software installation process using the jump-start installation DVD provided with PortaBilling® with Oracle Real Application Cluster. This DVD contains installation media for Oracle Enterprise Linux, supplementary packages needed for convenient system administration and maintenance and PortaBilling® with Oracle Real Application Cluster software packages.

After the installation is complete you will assign roles (e.g., RADIUS, web interface, etc.) to individual servers using the Configuration server tool – this will automatically enable the required components of PortaBilling® with Oracle Real Application Cluster software on each server.

The whole commissioning process (including network configuration, installation of Oracle software, configuring disk array access and further cluster configuration and testing) may take about 5-7 business days.

For detailed installation instructions, please refer to the **PortaBilling® Oracularius Installation Guide**.

Maximizing DB availability using Oracle Data Guard

Data and database are the most important and critical parts of the system that must be adequately protected.

The only way to eliminate a single point of failure is to have a completely independent copy of a primary database already running on different hardware and ideally deployed at another location. This copy will be used to provide services if the primary database becomes unavailable for any reason.

If your Oracle database is stored only in one SAN (Storage Area Network), then there are two methods to make your system more reliable.

Using one method, you could build a fully redundant architecture using 2 SANs with a double set of switches, etc. It would be possible, but quite expensive.

Using a second method, you could use the Data Guard node to replicate the data from your primary SAN. We suggest this solution because it is cheaper and more effective.

What is the Data Guard node?

Data Guard is a solution from Oracle that creates and maintains database replicas and standby databases. It provides site redundancy (or replication to the secondary site) or database redundancy in the cloud deployments. It is one of the most effective solutions available today for maximizing the availability of Oracle databases and for protecting data from disasters in case of hardware failure and/or data corruption.

Data Guard can also be used as a separate reporting database, where massive data queries can be performed without putting stress on the main database.

Therefore, this is an additional solution to your existing main Oracle Real Application Cluster (RAC).

With the Data Guard solution, you are **allowed**:

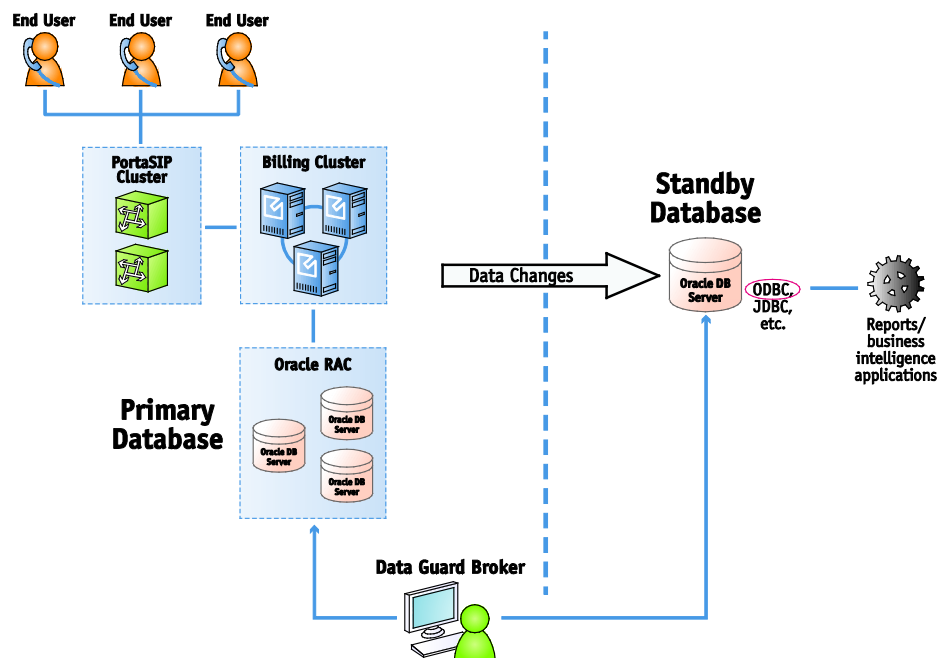
- the use of the standby database as the primary if the primary database drops;
- the running of backup jobs on the standby database instead of on the primary one;
- the use of the standby database for the generation of various reports.

How it works

Data Guard maintains a copy of your data in a standby database. It is continuously updated with changes from the primary database. It validates all of the changes before they are applied to the standby database, preventing data loss caused by corruption.

The standby database can be located in the same city or even in the same building with the main data center. If the primary database becomes unavailable (e.g., due to hardware failure), it is possible to switch to the standby database, thus minimizing the downtime associated with the outage and preventing any data loss.

Additionally, if the primary database detects a block corruption event, it automatically attempts to repair the corrupted block in real time by obtaining an uncorrupted version of the same block from a standby database. Therefore, block corruptions are transparently resolved by the administrator.



Furthermore, the same Data Guard node solution can be used when your standby database is located at a remote secondary site, miles away from your main data center.

Benefits from using the Data Guard node

By implementing the Data Guard node solution, you obtain the following benefits:

1. *Rapid recovery after a SAN crash or data corruption* – the switchover and failover capabilities of this solution allow role reversals

- between primary and standby databases. This increases the reliability of your services by increasing data storage reliability.
2. *Additional data protection* – a guaranteed up-to-date binary copy of the primary database.
 3. *Reduction of the primary database workload* – the standby database can be used for other tasks such as backup operations, reporting, summations, queries, data mining, etc.
 4. *Cost reductions* – the replica database can be run on a normal server and does not require an additional SAN.

Deploying PortaSwitch® on an Extended Distance Oracle RAC

To meet customers' expectations regarding the quality of communication services, the service provider needs to introduce an extra degree of reliability within the network and its applications to ensure that the service is not interrupted – even if disasters like a local power outage, fire in the datacenter or server room flooding were to occur.

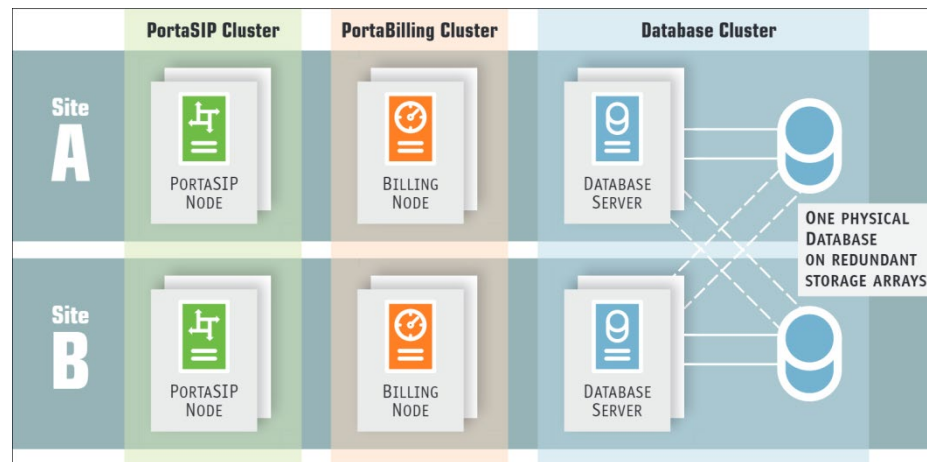
An excellent way to address this concern is to have another set of servers in a different location which can provide uninterrupted service in case of an outage at one of the sites.

The multiple site solution presumes that both sites are equipped with the same number of servers which are always active and running their sets of applications. The sites are located at a close distance from each other (usually within the limits of a city). Under normal circumstances, the load is equally shared among them. In the event of a disaster, each site can accommodate the entire load at once.

Distributed database cluster

Since classic Oracle RAC implementation is primarily designed for data centers that reside in a single location, another approach must be considered which allows the placement of individual RAC nodes in these separate buildings.

Oracle RAC on Extended Distance Clusters perfectly suits this purpose. It supports a deployment scenario in which database servers reside in physically separated locations yet continue to function if one location fails.



Components and design considerations

Oracle RAC on an Extended Distance Cluster is very similar to an Oracle RAC implementation at a single site.

To configure an Oracle RAC database on an Extended Distance Cluster environment you will need to:

- Place one set of nodes at site A.
- Place the other set of nodes at site B. Note that the distance between the sites must not exceed 50 km.
- Add a third voting disk away from the main sites. It will act as an arbitrator for deciding which site will keep running or become suspended in the case of a communication failure between the sites.
- Use host-based mirroring to host all the data on both sites and keep them simultaneously mirrored.
- Use fast and dedicated connectivity between the sites. Note that both sites must be deployed on the same local area network (either physical or logical).

Although this configuration provides a higher degree of protection from some disasters, bear in mind that it is expensive to set up and might be challenging to maintain. If you choose to deploy this configuration, first assess whether it is suitable for your business, especially with regard to the distance and the degree of protection it provides. The Extended Distance Cluster provides great protection for some disasters, but not for all. It will not protect you from cataclysms such as earthquakes, hurricanes or regional floods.

Benefits of deploying PortaSwitch® on an Extended Distance Oracle RAC

Deploying PortaSwitch® on an Extended Distance Oracle RAC gives service providers the following advantages:

- The ability to provide uninterrupted service to their customers in case one site fails. Once an outage is detected at one of the sites, the full workload is routed to the other site with almost no interruption.
- The ability to fully use all available resources. Because both sites always run in active mode, the full workload is equally shared among them, allowing all the resources to be utilized at all times.