Exadata Cloud@Customer Technical Architecture

ORACLE

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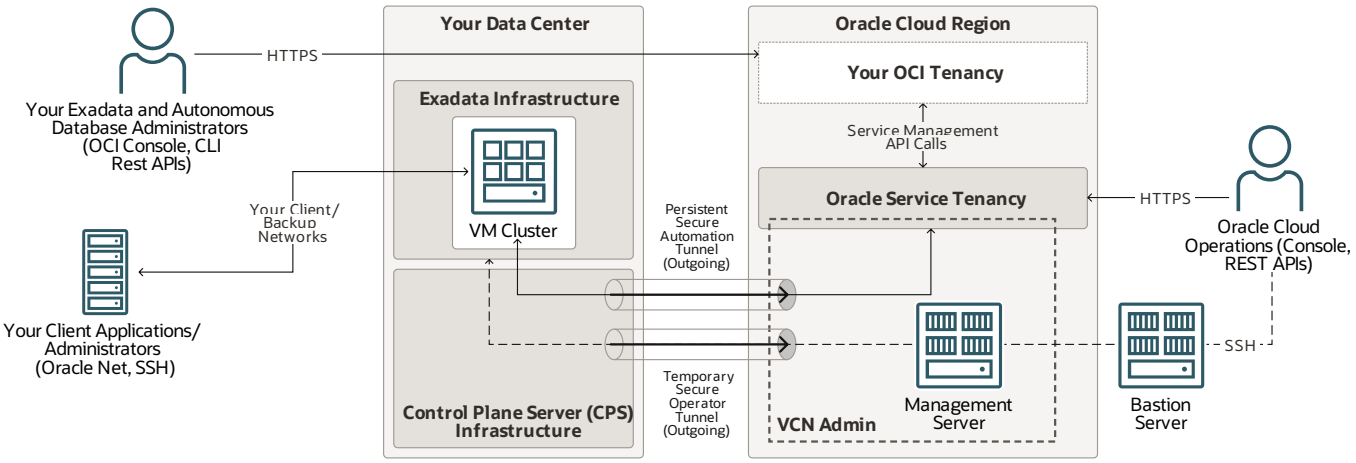
Exadata Cloud@Customer Architecture Overview



Notes

Oracle Exadata Cloud@Customer runs Oracle Exadata Database Service and Oracle Autonomous Database Service with Oracle-owned and managed infrastructure located in your data center.

Your databases run on one or more virtual machine (VM) clusters that reside on Exadata infrastructure in your data center. Exadata Cloud@Customer also includes control plane server (CPS) infrastructure that connects to an OCI region for cloud automation and administration.

Your client applications and administrators connect to the VM clusters through client and backup networks that you create. You access your databases through standard Oracle database connection methods, such as Oracle Net. You access the VM clusters through standard Oracle Linux methods, such as token-based Secure Shell (SSH).

Your Exadata and Autonomous Database administrators can use the web-based OCI Console, command-line interface (CLI), and REST APIs to connect to your OCI tenancy over an HTTPS connection. Your tenancy sends service management API calls to the Oracle service tenancy. The Oracle service tenancy connects to the Oracle-managed admin virtual cloud network (VCN). An outgoing, persistent, secure automation tunnel connects the CPS infrastructure in your data center to the Oracle-managed admin VCN in the OCI region for delivering cloud automation commands to

the VM clusters.

For Autonomous Database, separate persistent automation and temporary operator tunnels are created, targeting separate service tenancy administrative VCNs. If you're using both Oracle Exadata Database Service and Oracle Autonomous Database Service, you'll have two persistent tunnels and, as required, up to two temporary tunnels. These separate tunnels enforce a strict separation of duties for developer operations personnel, who only have authorization to take action on specific VM cluster resources, segregated by service type.

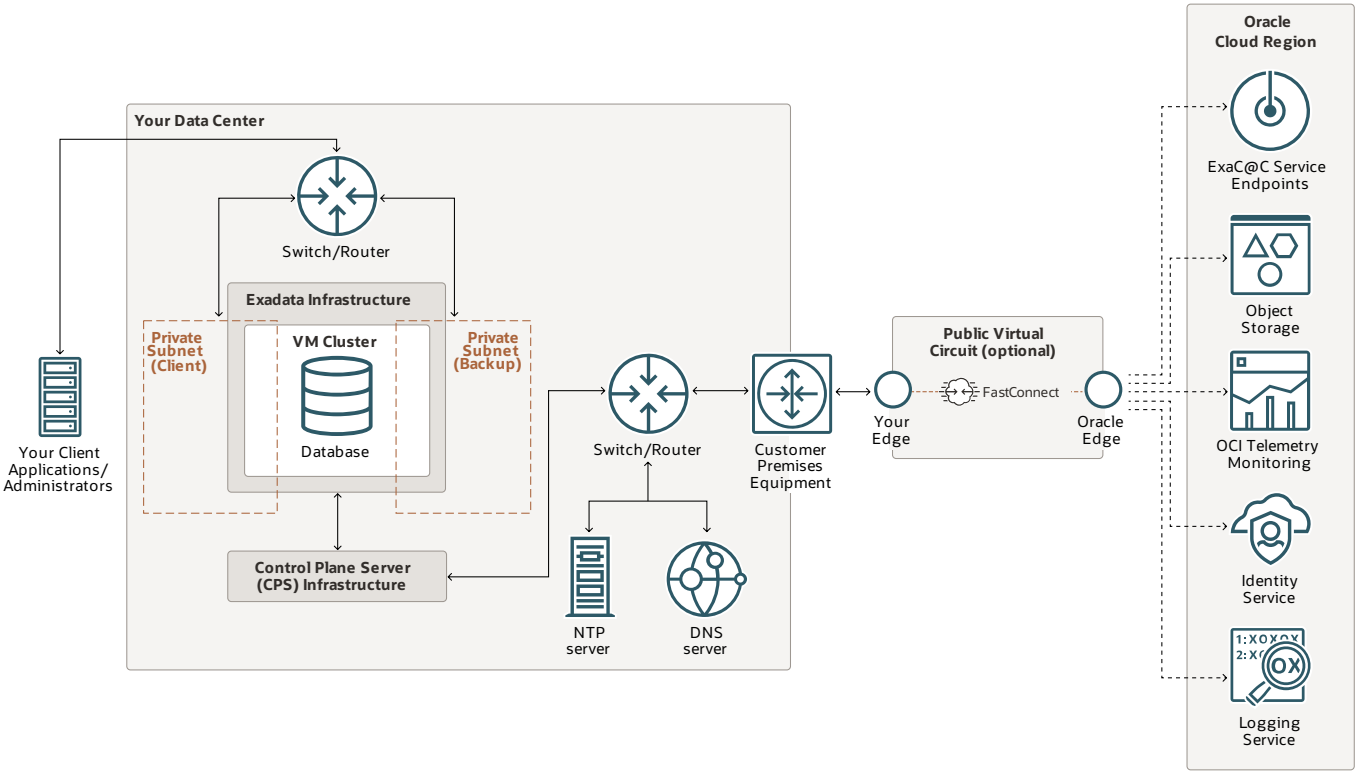
Oracle Cloud Operations can use a console or REST APIs over an HTTPS or SSH connection to manage the infrastructure. Oracle operator SSH connections travel through bastion and management servers, the admin VCN, and an outgoing, temporary, secure operator tunnel from the CPS to the admin VCN. Oracle operator HTTPS connections travel to the infrastructure through the Oracle service tenancy, admin VCN, and the outgoing, persistent, secure automation tunnel.

Oracle operator SSH connections travel through bastion and management servers; the admin VCN; and an outgoing, temporary, secure operator tunnel from the CPS to the admin VCN. You can optionally control authorization of SSH access by Oracle operators by registering infrastructure resources with a separate Operator Access Control.

Related Resources

- Autonomous Database on Dedicated Exadata Infrastructure
- Exadata Database Service on Cloud@Customer Overview
- Network Requirements
- Oracle Operator Access Control
- VM Clusters

Exadata Cloud@Customer Network



Notes

Your databases run on one or more virtual machine (VM) clusters that reside on Exadata infrastructure in your data center. Exadata Cloud@Customer also includes control plane server (CPS) infrastructure that connects to an Oracle Cloud Infrastructure (OCI) region for cloud automation and administration.

Your data center connects to the OCI region to access Exadata Cloud@Customer (ExaC@C) service endpoints, Object Storage, OCI telemetry monitoring, identity service, and logging service.

You can optionally connect your data center to the OCI region with FastConnect. This option uses a

public virtual circuit to connect the edge of your network to the Oracle edge in the OCI region. Your edge connects to customer-premises equipment (CPE) in your data center.

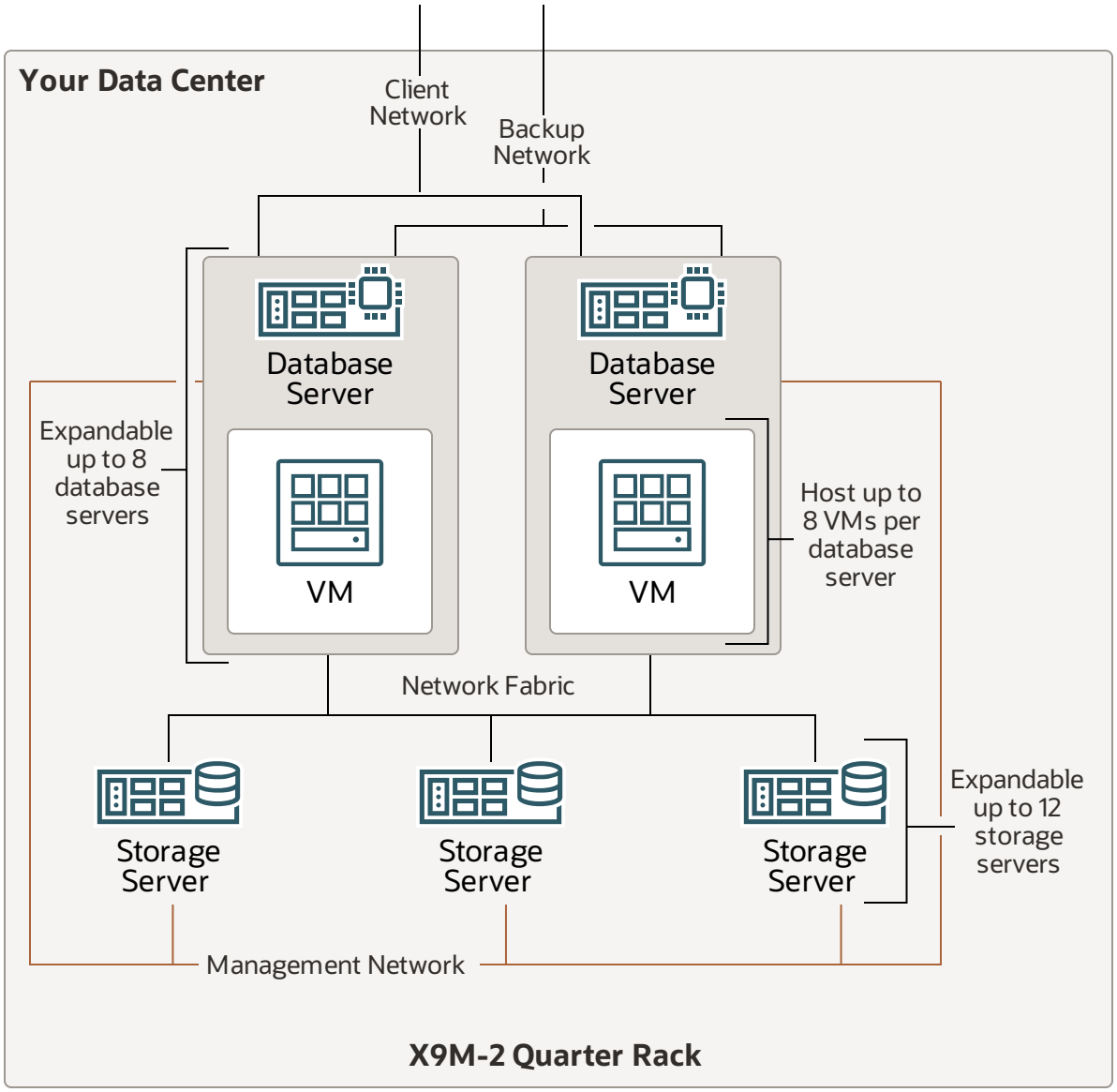
The CPE connects to a switch or router, which directs traffic to and from the CPS, network time protocol (NTP) server, domain name system (DNS) server. If you're not using FastConnect, your network should also include a proxy server (not shown in the diagram).

Your client applications and administrators connect to your VM clusters and databases over the private client and backup subnets that you access through a switch or router in your data center. You create and manage the client and backup subnets.

Related Resources

- Autonomous Database on Dedicated Exadata Infrastructure
- Exadata Cloud@Customer Security Controls (PDF)
- Exadata Database Service on Cloud@Customer
- Network Requirements
- VM Clusters

Rack Overview



Notes

Oracle Exadata Cloud@Customer includes multiple database servers and Exadata storage servers connected by high-speed, low-latency network fabric. The Exadata rack resides in your data center.

You can choose from two elastic system shapes: elastic base and elastic. Each system shape can be scaled with additional database and storage servers.

The diagram shows a rack with two database and three storage servers.

On X9M-2 systems, you can host up to 8 VMs per database server.

With Elastic Compute and Storage Expansion, you can dynamically expand the compute capacity with up to 8 database servers and the storage capacity with up to 12 total storage servers.

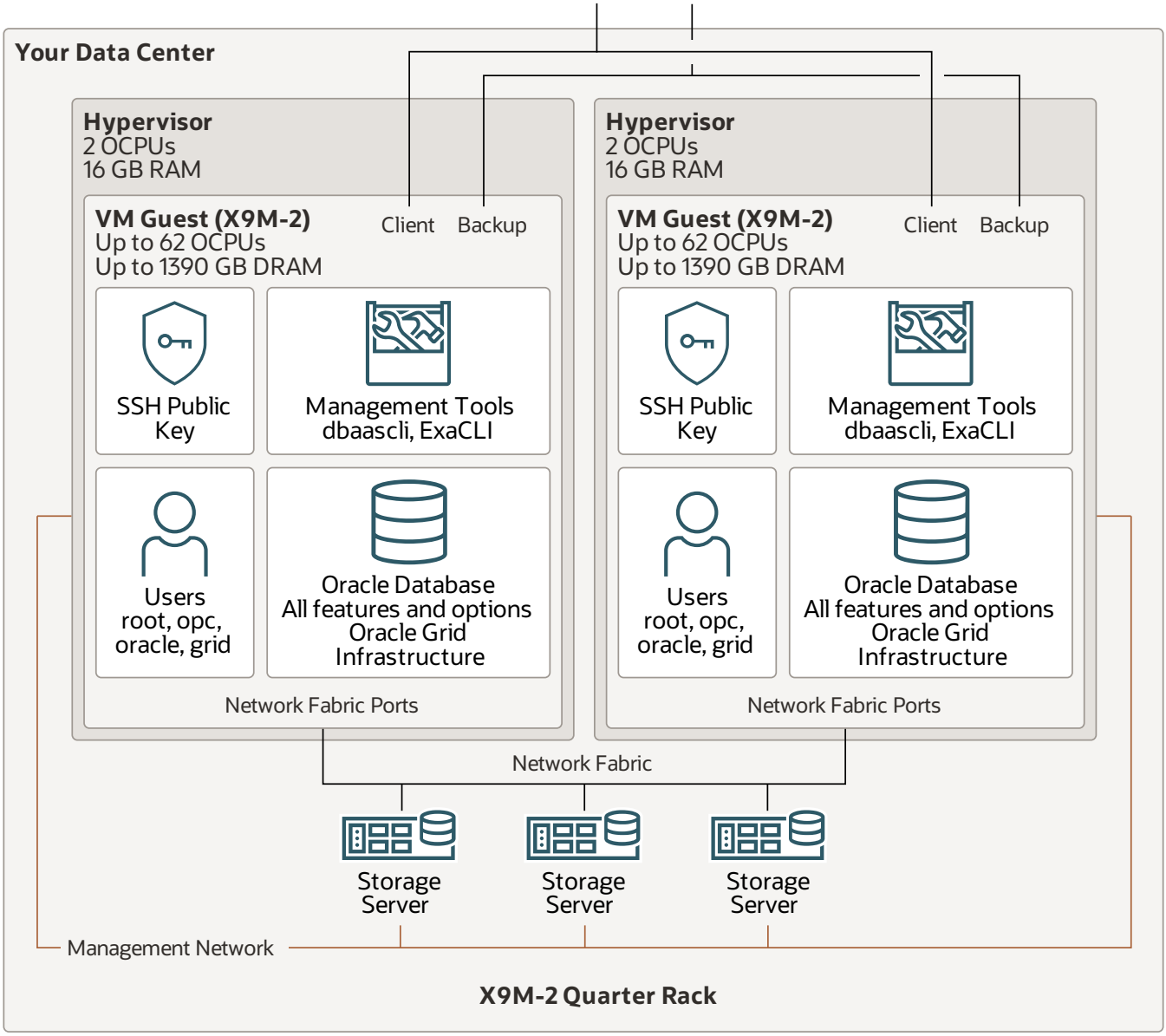
Note: Today, when deploying Autonomous Database VM clusters, you can't elastically expand the VM clusters after provisioning, so if you need larger clusters, first expand your infrastructure and then provision the Autonomous Database VM cluster.

The client and backup networks provide access to your virtual machine (VM) clusters on the database servers. Oracle manages the infrastructure through the management network, which connects the database and storage server hardware.

Related Resources

- Elastic Storage Expansion
- Storage Configuration Requirements
- System and Shape Configuration Options
- VM Clusters

VM Clusters and Database Servers



Notes

Each Oracle Exadata Cloud@Customer database server contains one or more virtual machine (VM) guests running on a hypervisor and you can designate each VM to host either Exadata Database or Autonomous Database Service instances. This configuration ensures a distinct separation between the Oracle-managed and customer-managed components for the Exadata Cloud@Customer platform.

Oracle manages the hypervisors through the management network. Each hypervisor uses minimal resources: only 2 CPU cores (OCPUs) and 16 GB of RAM.

The client and backup networks connect to the VM guests through bonded network interfaces to maximize performance and availability.

If you include Oracle Database software licenses in your Exadata Database Service or Autonomous Database subscription, each VM guest has a complete Oracle Database installation that includes all the features of Oracle Database Enterprise Edition plus all the database enterprise management packs and all the Enterprise Edition options, such as Oracle Database In-Memory and Oracle Real Application Clusters (RAC), as well as Oracle Grid Infrastructure. Alternatively, you can use Oracle Database software licenses that you already own.

Note: Autonomous Database Service prevents customer access to the VM guests because Oracle manages these as part of the service. Administrative actions against the database are limited to protect the service configuration for availability and security. Given that SSH access to VM guests is removed, customer administrative actions in Autonomous Database are performed by an ADMIN user, not by the standard SYSTEM/SYSDBA users, and they're limited to the service-defined APIs, console, and CLI.

Exadata Database Service allows customer access to the VM guests. VM guests require an SSH public/private key pair for operating system security. You register a public key in each guest, and you retain the private key that enables access to the VM operating system. VM guests include standard user accounts, such as oracle, opc, grid, and root.

As a result of this configuration, Exadata Database Service customers manage the VM guests and all the software they contain, including the Oracle-provided management tools, including dbaascli for database lifecycle management and ExaCLI for monitoring and managing your Exadata storage servers.

Each X9M-2 database server can have up to 62 OCPUs and 1390 GB of DRAM. The diagram shows a quarter rack with two database and three storage servers.

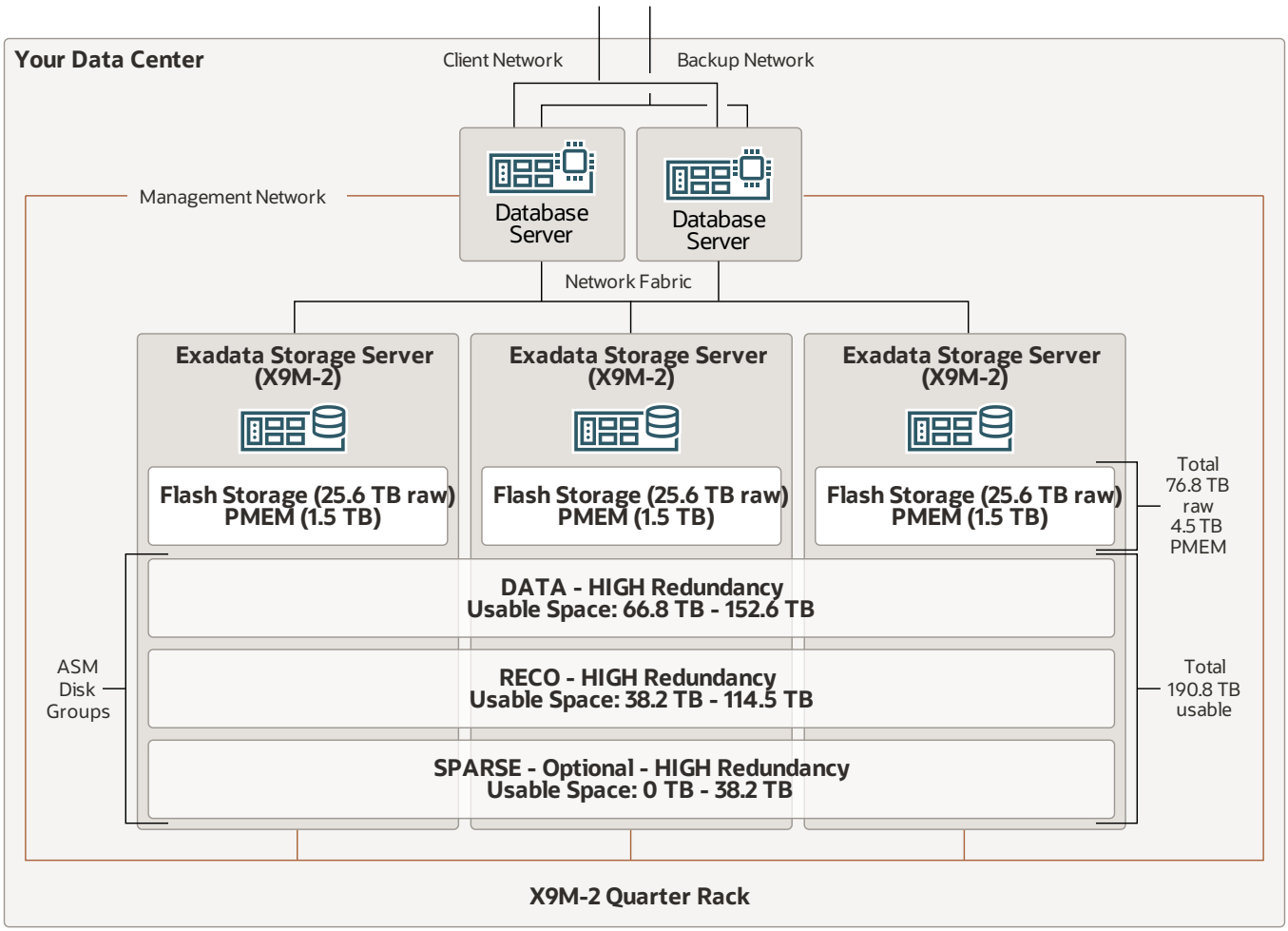
The database servers connect to the Exadata storage servers through network fabric ports. The Exadata infrastructure resides in your data center.

Oracle manages the infrastructure and, for Autonomous Database, the VM guests and database, through the service-specific management network that connects the database and storage server hardware.

Related Resources

- Exadata Cloud Management Interfaces
- System and Shape Configuration Options
- VM Clusters

Storage Servers



Notes

When you configure Oracle Exadata Cloud@Customer, Oracle Automatic Storage Management (ASM) provisions the storage space inside the Exadata storage servers. By default, ASM creates the following disk groups:

- The DATA disk group stores Oracle Database data files.
- The RECO disk group stores the Fast Recovery Area (FRA), which is an area of storage where Oracle Database can create and manage various files that are related to backup and recovery.

Only on Exadata Database Service, you can optionally create the SPARSE disk group to support

Exadata snapshots. If you create the SPARSE disk group, ASM allocates less space to the DATA and RECO disk groups.

Exadata Cloud@Customer platform customers also need to decide whether to allocate storage to perform local backups to your Exadata storage. If you choose this option, ASM allocates more space to the RECO disk group and less to the DATA disk group.

To learn more about how ASM allocates space to disk groups, see .

In X9M-2 systems, each Exadata storage server has 25.6 TB of raw flash storage and 1.5 TB of persistent memory (PMEM). The total for three storage servers is 76.8 TB of raw flash storage and 4.5 TB of PMEM.

Three storage servers have a total of 190.8 TB of usable ASM storage capacity. With this configuration the ASM disk groups have the following usable space allowances:

- DATA: 66.8 - 152.6 TB
- RECO: 38.2 - 114.5
- (Optional) SPARSE: 0 - 38.2 TB

The usable storage capacity is the storage available for Oracle Database files after taking into account high-redundancy ASM mirroring (triple mirroring), which provides highly resilient database storage on all Exadata Cloud@Customer configurations. The usable storage capacity does not factor in the use of Exadata compression capabilities, which can increase the effective storage capacity.

The database servers connect to the Exadata storage servers through network fabric ports with active bonding. The Exadata infrastructure resides in your data center. The diagram shows an X9M-2 quarter rack with two database and three storage servers.

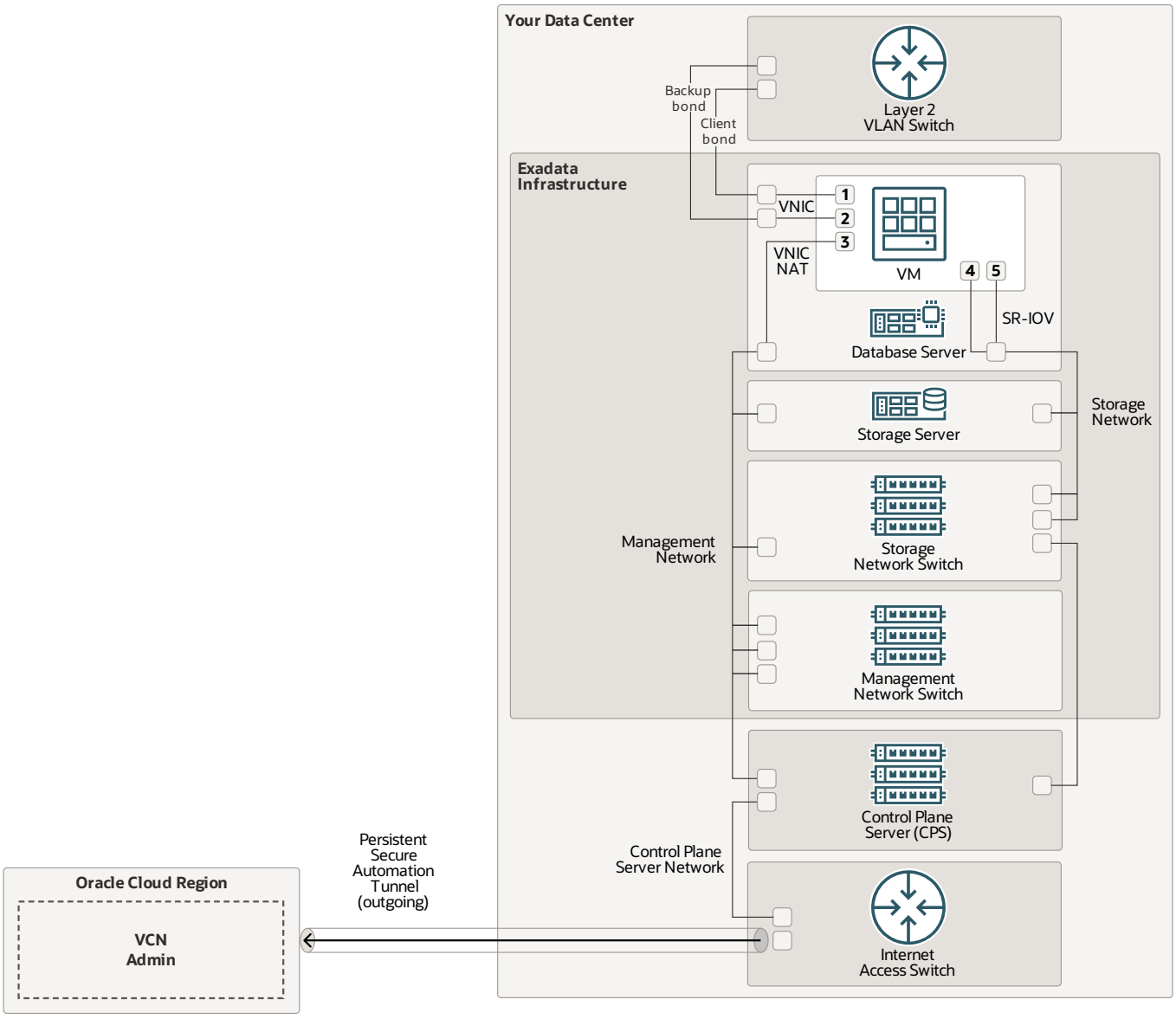
Oracle manages the infrastructure through the management network, which connects the database and storage server hardware.

The client and backup networks provide access to your virtual machine (VM) clusters on the database servers. Oracle manages the infrastructure through the management network, which connects the database and storage server hardware.

Related Resources

- Storage Configuration Requirements
- System and Shape Configuration Options

Network Interfaces



Notes

Your databases run on one or more virtual machine (VM) clusters that reside on Exadata infrastructure in your data center. Exadata Cloud@Customer also includes two control plane servers (CPS) that connect to an Oracle Cloud Infrastructure (OCI) region for cloud automation and administration.

Note: For clarity, the diagram displays only one database server, storage server, and CPS.

The client and backup networks provide access to your VM clusters on database servers through a layer 2 virtual local area network (VLAN) switch that you manage and bonded virtual network

interface cards (VNICs).

Your VMs access your dedicated Exadata storage servers through a private, nonrouted interconnect network with SR-IOV mapped interfaces. Each physical Exadata database server and storage server has a highly available (HA) (active/standby) connection to a pair of redundant storage networking switches.

The database and storage servers are interconnected through a layer 2 management network and switches. There is no direct access from the management network to your client and backup networks. A subset of Oracle cloud automation functionality accesses your VMs through the management network by using a VNIC interface and a network address translation (NAT) address.

The CPS connects to the storage servers through the storage network switch, and it connects to the management network switch through the control plane network. An outgoing, persistent, secure automation tunnel connects the CPS to the Oracle-managed admin VCN in the OCI region through an internet access switch that you manage.

The following interfaces connect the various networks to the VM:

1. bondeth0 for the client network
2. bondeth1 for the backup network
3. eth0 for the management network
4. re0 for a storage/Real Application Clusters (RAC) interconnect (isolated through VLAN)
5. re1 for a storage/RAC interconnect (isolated through VLAN)

Related Resources

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- Exadata Cloud@Customer Security Controls (PDF)
- Exadata Database Service on Cloud@Customer
- Network Requirements