

Integrating Oracle's Exadata Database Machine with a Data Center LAN Using Oracle Ethernet Switch ES2-64 and ES2-72

ORACLE WHITE PAPER | MARCH 2015





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Introduction

This white paper outlines the physical connectivity solutions supported by Oracle's engineered systems and the next-generation Oracle Ethernet Switch ES2-64 and ES2-72 switches for connecting to a data center's 10/40 GbE network infrastructures.

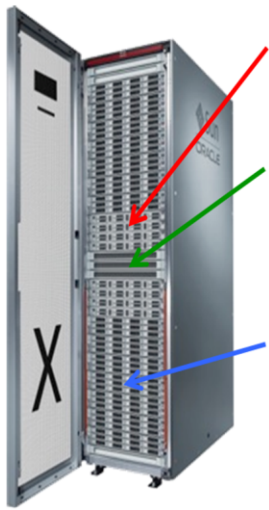
The Oracle Ethernet Switch ES2 family of high-density switches eliminates the need for complex tier 1 connectivity, simplifying IT infrastructure and reducing costs with fewer cables and simplified management. Oracle Ethernet Switch ES2-64 and Oracle Ethernet Switch ES2-72 are the latest 10/40 GbE switches from Oracle, supporting industry standards designed for cloud-enabled software defined data centers (SDDCs). The 10GBase-T ports on Oracle Ethernet Switch ES2-64 connect directly to the onboard LAN-on-Motherboard (LOM) on Oracle's engineered systems, servers, and storage products, which enables the reuse of the existing cabling infrastructure.

Oracle Ethernet Switch ES2-72 is an enterprise-class switch featuring 18x QSFP+ ports, and Oracle Ethernet Switch ES2-64 features 6x QSFP+ and 40x 10GBase-T ports. Designed to harness the full capabilities of Oracle's high-performance systems, the Oracle Ethernet Switch ES2 family of switches provides up to 72 ports of nonblocking, wire-rate, low-latency, cut-through 10 GbE switching to Oracle's engineered systems, servers, and storage products.

Oracle Ethernet Switch ES2-64 and ES2-72 are designed as ideal network attachment switches for all Oracle's engineered systems, servers, and storage products. This paper outlines only the connectivity to a data center's network for Oracle's Exadata Database Machine.

Integrating Exadata Database Machine X5 with a Data Center LAN

Oracle's Exadata Database Machine X5 model is the latest offering from Oracle and is the best platform for running Oracle Database workloads. This advanced hardware comprises fully scaled-out servers, intelligent storage with unified InfiniBand connectivity, and PCI flash. It comes with unique software that is optimized for delivering the best performance for Oracle Database. The hardware specifications are given in Figure 1.



- **Scale-Out 2-Socket Database Servers**
 - Fastest Xeon chips, 18 cores, 256 GB to 768 GB DRAM
- **Unified Ultra-Fast InfiniBand Network**
 - 40 Gb InfiniBand internal connectivity
 - 10 Gb or 1 Gb Ethernet data center connectivity
- **Scale-Out 2-Socket Storage Servers**
 - 16 Xeon cores per server enables DB offload to storage
 - Extreme Flash (EF) Storage ➡ 12.8 TB Ultra-Fast PCI Flash Drives
 - or
 - High Capacity (HC) Storage ➡ 6.4 TB Ultra-Fast PCI Flash Cards + 48 TB SAS disks

Figure 1: Exadata Database Machine X5 hardware overview

Exadata Database Machine comes in standard eighth-rack, quarter-rack, half-rack, and full-rack configurations. The eighth-rack configuration has two database servers and three storage servers. Servers can be incrementally added online to scale it to a full-rack configuration until a maximum of 22 servers or 38U of rack space is reached. Each Exadata rack has 2U available at the top of the rack that could be used to install the Ethernet Switches to provide external connectivity to the Exadata Database Machine.

Exadata Database Machine Data Center Connectivity for 10/40 GbE with Oracle Ethernet Switch ES2-64

Data center network connectivity for Exadata Database Machine X5 can be achieved with either Oracle Ethernet Switch ES2-72 or ES2-64.

Oracle Ethernet Switch ES2-64 is a high port density switch with 40x 10GBase-T ports, and it is ideal for taking advantage of the 10GBase-T LOM on the database servers inside the rack. The data sheet and product-related information for Oracle Ethernet Switch ES2-64 is available [here](#).

For providing high availability in case of switch or link failure, a pair of Oracle Ethernet Switch ES2-64 switches are deployed and connected to Exadata Database Machine X5. The 10GBase-T ports on the LOM from each of the database servers are connected to the 10GBase-T ports on the switches using RJ45 cables. Either Cat 6 cables (up to 55 meters) or Cat 6a cables (up to 100 meters) can also be used. The 10GBase-T ports on the database servers can be bonded together using host-based bonding. There is no need for extra transceivers or cables, which reduces the TCO significantly. For uplink connectivity, one or more QSFP+ ports from each of the Oracle Ethernet Switch ES2-64 switches are connected to upstream switches.

If the upstream switch supports QSFP+ 40 GbE connectivity, the QSFP+ port on Oracle Ethernet Switch ES2-64 can be plugged to the QSFP+ port on the upstream switch using either copper or optical cabling. However, if the upstream switch supports only 10 GbE ports, the QSFP+ ports on the switch should be connected using splitter cables. Oracle has both copper and optical splitter cables in various lengths (see Table 1). Figure 2 shows the connectivity for the eighth-rack configuration of Exadata Database Machine X5.

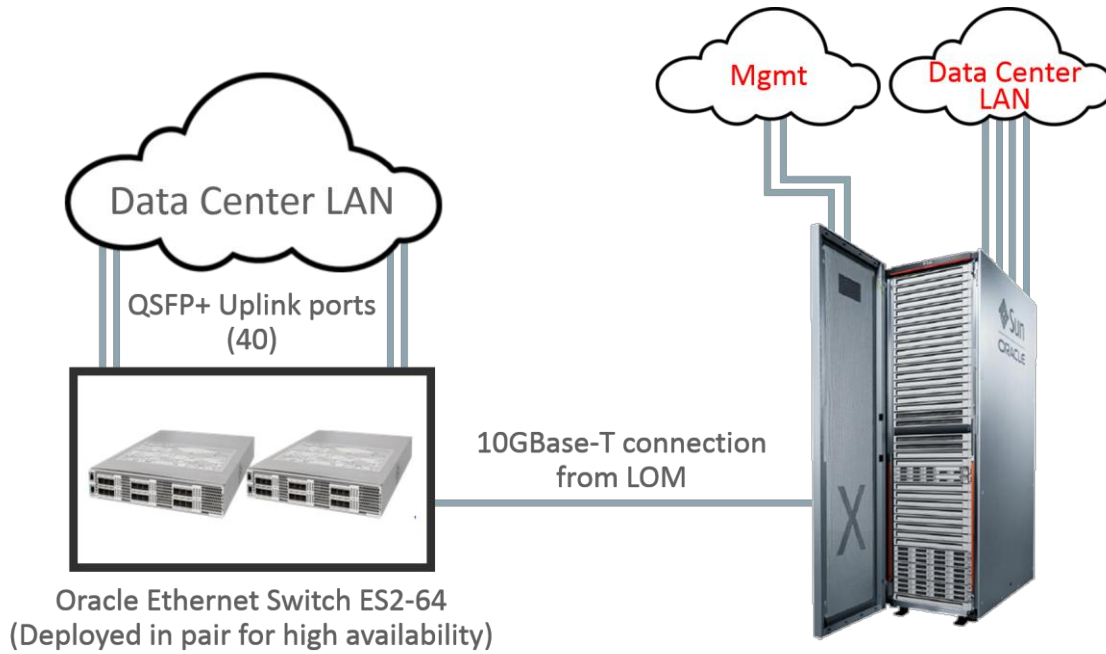


Figure 2: Exadata Database Machine X5 eighth-rack configuration's network connectivity

The components required for connecting an eighth-rack Exadata Database Machine X5 to a 10 GbE and 40 GbE network using Oracle Ethernet Switch ES2-64 are provided in Table 1.

TABLE 1: REQUIRED COMPONENTS

Quantity	Part Number	Description
2	7110614	Oracle Ethernet Switch ES2-64 with 40 ports of 1/10GBase-T and 6 QSFP ports. Includes 2 AC power supply units and rack rail kit. Requires one option: 1) fans with "Front-to-rear" or "Rear-to-front" airflow direction
Connections for Oracle Ethernet Switch ES2-64 to database servers in Exadata Database Machine X5		
		RJ45 cables
Connections for Oracle Ethernet Switch ES2-64 QSFP+ port to 10 GbE uplink switch (copper)		
2	X2125A-1M-N, Or X2125A-3M-N, Or X2125A-5M-N	Direct-attach cables without the need for optical transceivers QSFP to 4 SFP+ passive copper splitter cable, 1 meter QSFP to 4 SFP+ passive copper splitter cable, 3 meters QSFP to 4 SFP+ passive copper splitter cable, 5 meters
Connections for Oracle Ethernet Switch ES2-64 QSFP+ port to 10 GbE uplink switch (optical)		
2	X2124A-N	QSFP Optical SR (supports multimode cables, MPO connector up to 100m)
2	X2127A-10M, Or X2127A-20M, Or X2127A-50M	MPO to 4LC Optical splitter cable, 10 meters, multimode MPO to 4LC Optical splitter cable, 20 meters, multimode MPO to 4LC Optical splitter cable, 50 meters, multimode

Quantity	Part Number	Description
Connections for Oracle Ethernet Switch ES2-64 QSFP+ port to 40 GbE uplink switch (copper)		
2	X2121A-1M-N, Or X2121A-1M-N, Or X2121A-1M-N, Or X2121A-1M-N	QSFP to QSFP passive copper cable, 1 meter QSFP to QSFP passive copper cable, 2 meters QSFP to QSFP passive copper cable, 3 meters QSFP to QSFP passive copper cable, 5 meters
Connections for Oracle Ethernet Switch ES2-64 QSFP+ port to 40 GbE uplink switch (optical)		
2	X2124A-N	QSFP Optical SR (supports multimode cables, MPO connector up to 100m)
2	7105199, Or 7102869, Or 7102870, Or 7102871, Or 7105206	High-bandwidth QSFP optical cable: 5 meters, MPO to MPO High-bandwidth QSFP optical cable: 10 meters, MPO to MPO High-bandwidth QSFP optical cable: 20 meters, MPO to MPO High-bandwidth QSFP optical cable: 50 meters, MPO to MPO High-bandwidth QSFP optical cable: 100 meters, MPO to MPO

Exadata Database Machine Data Center Connectivity for 10/40 GbE with Oracle Ethernet Switch ES2-72

Data center network connectivity for Exadata Database Machine X5 can also be achieved with Oracle Ethernet Switch ES2-72. Oracle Ethernet Switch ES2-72 is a high port density switch with 18x QSFP+ ports. Each of the database servers inside the rack has two 10 GbE SFP+ ports. With Oracle Ethernet Switch ES2-72 supporting up to seventy-two 10 GbE ports, it is ideal for this configuration. The data sheet and product-related information for Oracle Ethernet Switch ES2-72 is available [here](#).

For providing high availability in case of switch or link failure, a pair of Oracle Ethernet Switch ES2-72 switches are deployed and connected to Exadata Database Machine X5. Splitter cables are required for connecting the QSFP+ ports on the switches to the 10 GbE SFP+ ports on the servers. Oracle has both copper and optical splitter cables in various lengths (see Table 2). If copper splitter cables are used, there is no necessity for transceivers. The 10 GbE SFP+ ports on the database servers can be bonded together using host-based bonding.

For uplink connectivity, one or more QSFP+ ports from each of the Oracle Ethernet Switch ES2-72 switches are connected to upstream switches. If an upstream switch supports QSFP+ 40 GbE connectivity, the QSFP+ port on Oracle Ethernet Switch ES2-72 can be plugged into the QSFP+ port on the upstream switch using either copper or optical cabling. However, if the upstream switch supports only 10 GbE ports, the QSFP+ ports on Oracle Ethernet Switch ES2 should be connected using splitter cables.

The components required for connecting an eighth-rack Exadata Database Machine X5 to a 10 GbE and 40 GbE network using Oracle Ethernet Switch ES2-72 are provided in Table 2.

TABLE 2: COMPONENTS REQUIRED

Quantity	Part Number	Description
2	7110593	Oracle Ethernet Switch ES2-72 with 18 QSFP ports. Includes 2 AC power supply units and rack rail kit. Requires one option: 1) fans with "Front-to-rear" or "Rear-to-front" airflow direction
Connections for Oracle Ethernet Switch ES2-72 to database servers in Exadata Database Machine X5 (copper)		
2	X2125A-1M-N, Or X2125A-3M-N, Or X2125A-5M-N	Direct-attach cables without the need for optical transceivers QSFP to 4 SFP+ passive copper splitter cable, 1 meter QSFP to 4 SFP+ passive copper splitter cable, 3 meters QSFP to 4 SFP+ passive copper splitter cable, 5 meters
Connections for Oracle Ethernet Switch ES2-72 QSFP+ port to 10 GbE uplink switch (optical)		
2	X2124A-N	QSFP Optical SR (supports multimode cables, MPO connector up to 100m)
2	X2127A-10M, Or X2127A-20M, Or X2127A-50M	MPO to 4LC Optical splitter cable, 10 meters, multimode MPO to 4LC Optical splitter cable, 20 meters, multimode MPO to 4LC Optical splitter cable, 50 meters, multimode
Connections for Oracle Ethernet Switch ES2-72 QSFP+ port to 10 GbE uplink switch (copper)		
2	X2125A-1M-N, Or X2125A-3M-N, Or X2125A-5M-N	Direct-attach cables without the need for optical transceivers QSFP to 4 SFP+ passive copper splitter cable, 1 meter QSFP to 4 SFP+ passive copper splitter cable, 3 meters QSFP to 4 SFP+ passive copper splitter cable, 5 meters
Connections for Oracle Ethernet Switch ES2-72 QSFP+ port to 10 GbE uplink switch (optical)		
2	X2124A-N	QSFP Optical SR (supports multimode cables, MPO connector up to 100m)
2	X2127A-10M, Or X2127A-20M, Or X2127A-50M	MPO to 4LC Optical splitter cable, 10 meters, multimode MPO to 4LC Optical splitter cable, 20 meters, multimode MPO to 4LC Optical splitter cable, 50 meters, multimode
Connections for Oracle Ethernet Switch ES2-72 QSFP+ port to 40 GbE uplink switch (copper)		
2	X2121A-1M-N, Or X2121A-1M-N, Or X2121A-1M-N, Or X2121A-1M-N	QSFP to QSFP passive copper cable, 1 meter QSFP to QSFP passive copper cable, 2 meters QSFP to QSFP passive copper cable, 3 meters QSFP to QSFP passive copper cable, 5 meters
Connections for Oracle Ethernet Switch ES2-72 QSFP+ port to 40 GbE uplink switch (optical)		
2	X2124A-N	QSFP Optical SR (supports multimode cables, MPO connector up to 100m)
2	7105199, Or 7102869, Or 7102870, Or 7102871, Or 7105206	High-bandwidth QSFP optical cable: 5 meters, MPO to MPO High-bandwidth QSFP optical cable: 10 meters, MPO to MPO High-bandwidth QSFP optical cable: 20 meters, MPO to MPO High-bandwidth QSFP optical cable: 50 meters, MPO to MPO High-bandwidth QSFP optical cable: 100 meters, MPO to MPO

Conclusion

There are many variables when connecting and configuring Oracle's Exadata engineered systems to a data center network. This document is an attempt to simplify the connection process and reduce risk for Oracle customers by providing information for how to use Oracle's networking products with Oracle's Exadata Database Machine.

References





For more information, visit the web resources listed in Table 3.

TABLE 3: WEB RESOURCES FOR FURTHER INFORMATION

Web Resource Description	Web Resource URL
<i>Exadata Database Machine</i>	https://www.oracle.com/engineered-systems/exadata/index.html
<i>Oracle Switch ES2-64</i>	https://www.oracle.com/networking/switch-es2-64/index.html
<i>Oracle Switch ES2-72</i>	https://www.oracle.com/networking/switch-es2-72/index.html
<i>Ethernet Fabric Operating System CLI Base Reference Manual</i>	http://docs.oracle.com/cd/E19934-01/html/E26513/



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Hardware and Software, Engineered to Work Together

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January 2015, Version 1.0
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