

Oracle's Netra Modular System

A Product Concept Introduction





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Introduction

Today, organizations face a myriad of challenges that impact their ability to improve revenues and margins while deploying new infrastructure to support new services and meet the increasing but variable compute and network demands driven by these new services. Business challenges include increasing operating costs, resource constraints, and time to roll out new services. In order to address these challenges, organizations are searching for new on-premise and cloud architectures that can easily scale virtually and physically while providing breakthrough improvements in operational time and cost. To achieve these breakthroughs, organizations are turning to DevOps methodologies, OpenStack, and IT virtualization technologies. Oracle's Netra Modular System introduces a new data center architecture that helps organizations bring new services to market faster, lower business risks, and improve business agility.

Netra Modular System is a transformative platform for organizations looking to build out their communications on-premise and cloud infrastructures. With extreme agility and scale in a platform that can be completely virtualized, organizations benefit from accelerated development, rapid bring-up, and low-cost maintenance. Netra Modular System takes today's traditional bladed and rackmount architectures and merges them to create a new innovative best-of-breed next-generation platform. This integrated system is designed to handle compute, networking, and storage evolution without forklift upgrades. Netra Modular System provides the service and business agility required in today's fast-paced market.

Blades Versus Rackmount Servers

Blade server advantages are relative to an equivalent rack and stack configuration of servers, storage, and networking. Rackmount servers, on the other hand, have the advantage of being more accommodating to new compute, storage, and networking architectures and technologies; allowing them to be deployed more quickly.

Unfortunately the shared common system components in bladed servers also lead to lock-in via proprietary form factors, and they hinder the evolution toward new hardware architectures and technologies. Table 1 shows the trade-offs between the two architectures.

TABLE 1: RACKMOUNT SERVERS VERSUS BLADE SERVERS

Rackmount Servers	Blade Servers
Small-scale deployments	Large-scale deployments
Lowest cost of first subscriber	High density for scalability
Plug-and-play components (disk drives, power, DVD)	Plug-and-play servers
Large storage and I/O capacity	Centralized out-of-band management within chassis
Rack/chassis-independent	Simplified cable management, given most interconnects are provided via chassis backplane
Power supply-independent	Power, fans, and networking shared within blade enclosure
	Proprietary chassis leads to a physically proprietary form factor
	Blade form factor constraints (power, cooling, I/O)

Traditional Server Architectures Merged

Netra Modular System merges the best features of rackmount and blade server configurations while avoiding the shortcomings of both approaches.

Netra Modular System leverages general-purpose rackmount servers i.e. compute nodes as blades allowing a single, qualified application configuration to be deployed on a standalone compute node for small deployments and in Netra Modular System for large deployments requiring enhanced serviceability. This lowers application qualification cycles and also simplifies sparing pool management because only one type of compute node is needed in the spare pool.

The Netra Modular System approach removes the need for a blade chassis given there are no shared resources (power, cooling, networking) at the enclosure level, only at the rack level. The compute nodes provide the same hot-swap serviceability as blades, while using the same DVD, power supply and disks as used in all of our general purpose rackmount servers.

As previously stated, the shared power, cooling, and network resources in a blade chassis—as well as the form factor constraints can limit the ability to quickly move to the latest upgrade of CPU, memory, and I/O in a compute node. Blade chassis provide fixed power, cooling, and I/O to a blade slot. These limitations can limit moving to higher performance CPUs requiring more power or different cooling profiles. Signal integrity issues in backplanes can stop deployment of higher speed I/O technologies (1 GbE, 10 GbE, 100 GbE).

Table 2 summarizes the Netra Modular System's bladed system benefits, which come without shortcomings.

TABLE 2: NETRA MODULAR SYSTEM VERSUS BLADED SYSTEMS

	Bladed Systems	Netra Modular System
Cable simplification	Chassis level	Rack level
Enclosure networking	Chassis level	Multirack level
Plug-and-play servers	Chassis level	Rack level
Management	Chassis level	Multirack level
Proprietary enclosure	Yes	No
Power limitations	Yes	No
Blade airflow restrictions	Yes	No
Networking restrictions	Yes	No
Evolution risk	Yes	No

Plug-and-Play Integrated System

Netra Modular System is a preintegrated rack-level system designed for continuous availability, which is achieved by supporting blade-style plug-and-play (hot-swap) of general-purpose compute nodes. Netra Modular System can be viewed as a blade system turned on its side. Its major components include the following:

- » An alarm panel showing the overall alarm state of the rack and its components
- » 1U 10/40GbE switches or optical patch panels, 1 pass-through patch panel
- » 1U compute nodes
- » Frame monitoring module

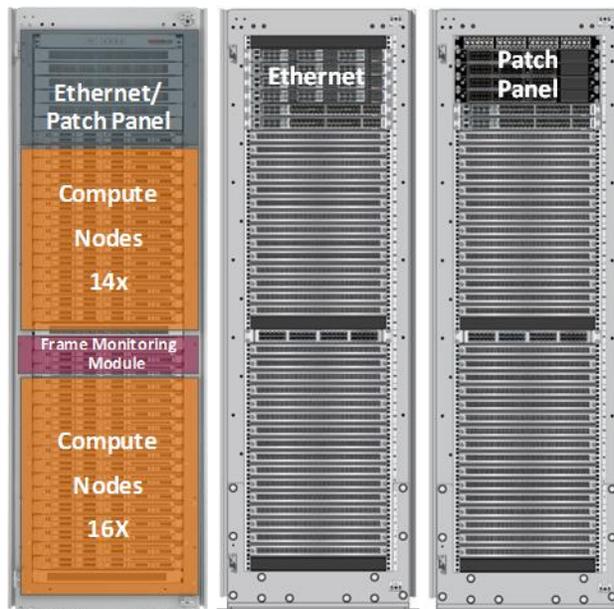


Figure 1: Netra Modular System key components shown along with the front and back view of the system

Netra Modular System supports up to six physically separate networks (can be configured as three redundant), one pass through, and seven 10 GbE links per compute node. The frame monitoring module in the center of the rack is responsible for out-of-band management (environmental monitoring and control; hot-swap) via the service processors in compute node and Ethernet switches.

Plug-and-play ability is enabled by taking general compute nodes and adding an adapter, called a *frame backplane adapter* that aggregates all I/O and power to known locations. The design ensures support for multiple generations and types of compute nodes. The frame backplane adapter mates to a frame backplane segment where all the networking, management, and power connect.

The frame backplane segment is connected to the back of the slide component permanently attached to the rack. It terminates power, Ethernet, and inter-integrated circuit (I²C) cables connected to the frame monitoring module, patch panel, and Ethernet switches. The frame backplane segment's blind-mate connectors and guides are always in the same position on the frame backplane segments similar to the fixed location of zone connectors in a bladed system backplane slot. The frame backplane segment is what allows Netra Modular System to be deployed with a standard 42U, 1000mm deep frame without modifications.

The frame backplane segment is the equivalent of an empty slot in a bladed system. It is completely connected and ready to accept the insertion of the compute node. The frame backplane segment has a small active component that informs the compute node of its position within the rack shortly after the post-insertion power-on. As compute nodes are inserted into the rack, they are automatically verified and connected to the rack management for bring-up. Networking, power, and management interfaces are blind-mate connected, removing the need to manually connect cables and removing the faults associated with incorrect cable connections.



Figure 2: Frame backplane segment

The frame backplane adapter is connected to the back of the slide component permanently attached to the compute node. It terminates power, Ethernet, and I²C cables connected to the back of the compute node. The frame backplane adapter blind-mate connectors and guides are always in the same position on the frame backplane adapters, similar to the fixed location of zone connectors on a blade. The power and I/O ports on the compute nodes are not usually aligned with the frame backplane segment blind-mate connectors, so it is the frame backplane adapters' role to provide that alignment.



Figure 3: Frame backplane adapter

Multirack-Level System Management and Software

A common management interface is provided for the rack controlling the various hardware and software components in the system.

In Netra Modular System, hardware support for systems management is provided by the frame monitoring module, which provides the single point of contact for out-of-band (OoB) monitoring and control of all hardware components in a Netra Modular System rack. This includes the following:

- » Environmental monitoring
- » Reset control
- » Alarm notification
- » Remote console interface to Oracle Integrated Lights Out Manager (Oracle ILOM) in each compute and network node
- » Remote lights-out manageability of the compute nodes in the rack
- » Policy-based compute node's host power control

Monitoring and control information from the frame monitoring module can be accessed via command-line interface (CLI), Simple Network Management Protocol (SNMP), Remote Management Control Protocol (RMCP), and Hardware Platform Interface (HPI) interfaces.

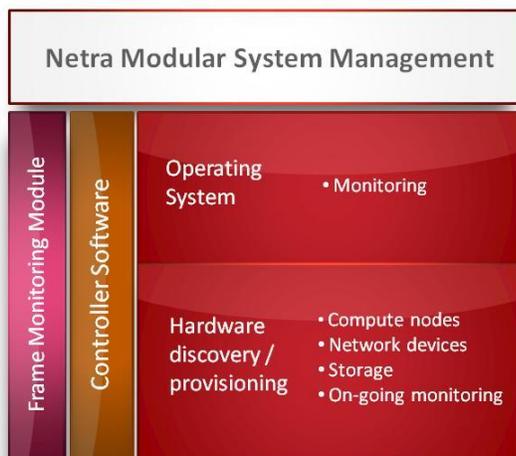


Figure 4: System Management Stack

The frame system agent is responsible for overall management of the rack components, consolidating both OoB and in-band (host CPU) management data in a single point of access. The frame system agent runs in a virtual machine environment on two specific compute nodes at the bottom of the rack. The frame system agent provides the following:

- » Automatic hardware bring-up to operating system availability
- » Single point for external rack management
- » Compute node hot swap management
- » GUI for at-a-glance hardware status monitoring (Oracle Fabric Manager)
- » Policy-based preactivation, recognition, and validation
 - » Point-to-point (P2P)—physical link topology validation

- » Node type and configuration validation
- » Power on, install, and configure:
 - » Compute, networking, and storage hardware
 - » Virtual networking and machines
- » Multiple rack (up to eight) setup and control

The frame system agent makes managing Netra Modular System similar to managing a very large bladed system as opposed to managing a rack-and-stack of compute servers that are each managed separately.

Netra Modular System is a general-purpose integrated system that uses standard platform components, open hardware and software interfaces, and plug-and-play blade-system type management. The system allows a choice of operating systems and virtualization technologies including Oracle Linux, Oracle Solaris, Red Hat Enterprise Linux, Microsoft Windows, Oracle VM, KVM, Hyper-V, and VMware.

System Management GUI (Oracle Fabric Manager)

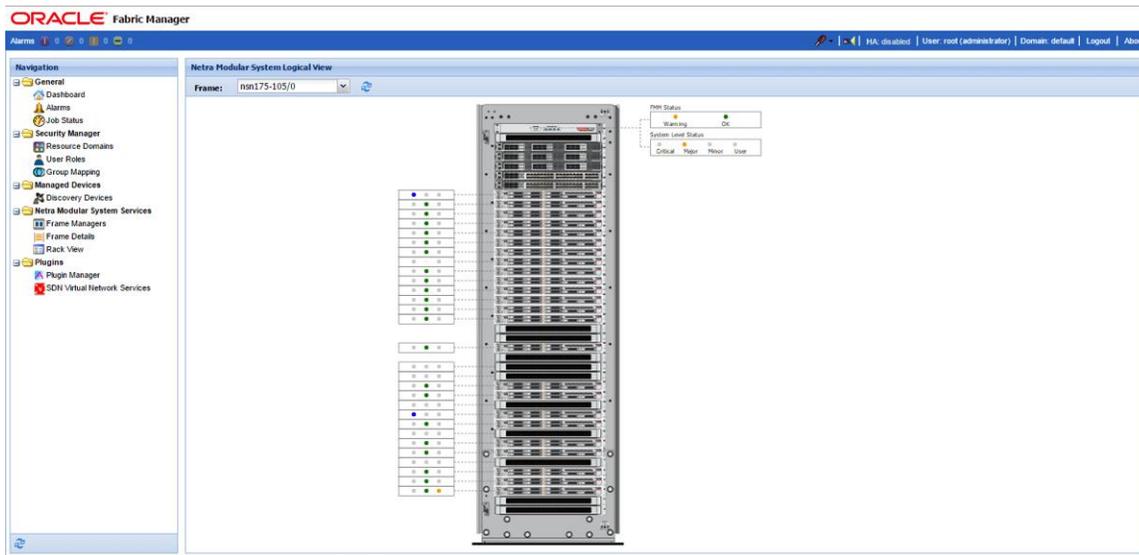


Figure 5: System Management GUI

The Oracle Fabric Manager provides single management framework for:

Bare metal:

- » Firmware updates
- » Inventory Management
- » Pre-activation audits of infrastructure components and interconnects
- » Point-to-point cable connection verification

Network Fabric:

- » Provisioning, configuring, and management

Virtual Network Services:

- » Load balancer, Firewall, VPN, Router, NAT (Network Address Translator)

Key Hardware Components for Netra Modular System

Compute Nodes

The compute nodes are currently Oracle Server X6-2M, which is a standard general purpose server, powered by two Intel Xeon processor E5-2600 v4 product family CPUs. With up to 22 cores per socket, this server supports the highest-performing processor and delivers extreme compute density in a compact 1U enclosure. Each Oracle Server X6-2M includes the frame backplane adapter to give it the plug-and-play capability and eight small form factor drive bays, four of which can support hot-swappable, high-bandwidth NVM Express–based flash. Each compute node can be added and removed without any downtime. Netra Modular System will automatically bring up and configure each node as it is inserted. Netra Modular System supports from 2 to 30 nodes scaling to 1,320 cores/2,640 threads aggregate. Each compute node can support a choice of operating systems and virtualization technologies and can now be configured with different CPUs, memory, and drive options. Note: the system can interoperate with the previous generation node, Oracle Server X5-2M within the same rack.



Figure 6: Oracle Server X6-2M

The compact 1U Oracle Server X6-2M enterprise-class server in Netra Modular System has the following features:

- » Two Intel Xeon E5-2600 v4 processors
- » Up to forty-four cores (83 threads)
- » 24 DIMM slots
- » Eight drive bays
- » Four 10GBase-T ports

Networking Nodes

Netra Modular System currently supports two to six Oracle 10/40 Gb/sec Ethernet switches. The latest 1U Oracle Ethernet Switch ES2-64 and ES2-72 switches from Oracle come complete with industry-standard layer 2 and layer 3 features. These switches enable high-speed, low-latency networking among all components and integrate with existing Ethernet and storage networks. Netra Modular System can support up to three physically isolated redundant networks and one pass through.

Oracle Ethernet Switch ES2-64 features:

- » High-performance low-cost 1U 10/40 Gb/sec Ethernet switch
- » Forty 10GBase-T and up to 6 QSFP+ or 24 SFP+ ports (using splitter cables) in both AC and DC chassis
- » Extremely low latency and highly scalable with 1.28 Tb/sec bandwidth

- » Overlay and virtualization technologies for software defined networking at no extra license cost
- » Industry-standard layer 2 and layer3 features
- » Six QSFP ports with line rate of 10 GbE and 40 GbE
- » Forty 10GBase-T ports with RJ45 connectors
- » Each QSFP port has four LEDs for 10 GbE and one LED for 40 GbE modes
- » One billion packets per second with layer 2 and layer 3 forwarding at wire speed
- » One management port and one console port
- » 2N+1 redundant AC/DC power supplies
- » Five modular fans

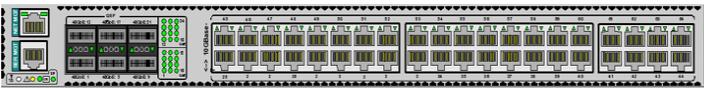


Figure 7: Oracle Ethernet Switch ES2-64

Oracle Ethernet Switch ES2-72 features:

- » High-performance, low-cost 1U 10/40 Gb/sec Ethernet switch
- » Eighteen QSFP+ ports or 72 SFP+ ports (using splitter cables) in both AC and DC chassis
- » Extremely low latency and highly scalable with 1.44 Tb/sec bandwidth
- » Overlay and virtualization technologies for software defined networking at no extra license cost
- » Industry-standard layer 2 and layer3 features
- » Eighteen QSFP+ ports with line rate of 10 GbE and 40 GbE
- » Each QSFP+ port has four LEDs for 10 GbE and one LED for 40 GbE modes
- » 950 million packets per second with layer 2 and layer 3 forwarding at wire speed
- » One management port and 1 console port
- » 2N+1 redundant AC/DC power supplies
- » Five modular fans



Figure 8: Oracle Ethernet Switch ES2-72

Patch Panel

Netra Modular System provides an option for one to four optical patch panels used in place of the optional Oracle Ethernet switches. This allows the system to interface with SAN networks via external connections into Fibre Channel switches. The patch panel also provides an interface into external InfiniBand or Ethernet switches.

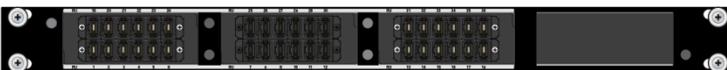


Figure 9: Patch Panel



Storage

Netra Modular System provides large storage capacity using the local storage within the compute node. This takes advantage of the server infrastructure and reduces cost. If additional storage capacity is required, customers can take advantage of Oracle ZFS Storage Appliance or Oracle FS1 Flash Storage System (with the patch panel option). NAS or SAN connections to other third party storage can be used as well.

Summary

Oracle's Netra Modular System minimizes product and vendor complexity with a platform design that includes compute, networking, storage, and management, dramatically reducing operational time and expense with a flexible plug-and-play blade-like architecture. It enables lower development and business risk with an integrated and qualified hardware and software platform that supports technology evolution with ease and is designed to support "5+ nines" reliable deployments.



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