

BEST PRACTICES

Nutanix on HPE® ProLiant®

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1. Executive Summary

Nutanix runs on HPE® ProLiant® rack-mount and integrated systems and general-purpose servers. Intended for datacenter administrators responsible for procuring, designing, installing, and operating Nutanix on HPE ProLiant, this best practice document can help steer the decision-making process when deploying Nutanix. This guide doesn't specifically provide guidance on technical issues solely related to HPE ProLiant systems.

Nutanix and HPE announced their partnership in April 2019 and jointly launched HPE® ProLiant® DX integrated systems targeting datacenter and edge environments. Prior to this partnership, Nutanix also maintained a Hardware Compatibility List (HCL) of supported general-purpose HPE® ProLiant® DL Gen10 servers. For all new HPE deployments, we recommend HPE ProLiant DX integrated systems. Unless otherwise stated, the information in this document applies to both models.

Organizations can procure Nutanix on HPE ProLiant DX in two ways:

1. A Nutanix-led traditional sales process, where the customer purchases an integrated system up front with a Nutanix software subscription.
2. By signing up for HPE GreenLake, an HPE-led usage-based model for consuming infrastructure, where the customer pays on a monthly basis.

In either case, Nutanix and HPE collaborate behind the scenes to engineer, support, deploy, and offer advice for this joint solution.

HPE ProLiant systems provide infrastructure that supports business objectives and growth. The Nutanix enterprise cloud software streamlines the datacenter by integrating server and storage resources into a turnkey system. When running Nutanix on HPE ProLiant, you no longer need a storage area network (SAN), which reduces the number of devices to purchase, deploy, and maintain and increases speed and agility.

In this document, we address system life cycle operations that require special handling in the ProLiant environment, such as network cabling, firmware upgrades, and node replacement. Where multiple options are available, we

provide the information you need to decide between them. We also highlight configurations and features that might be common in the field but that we don't recommend for Nutanix environments.

The [Nutanix Field Installation Guide for HPE ProLiant Servers](#) offers step-by-step installation instructions; this guide supplements those instructions. We do not, however, intend to supplant or supersede any guidance, instructional manuals, or directives from HPE regarding ProLiant servers. Contact HPE directly for any issues that don't relate to Nutanix software systems.

Document Version History

Version Number	Published	Notes
1.0	June 2017	Original publication.
2.0	February 2018	Gen10 updates.
2.1	February 2019	Updated Nutanix overview.
3.0	March 2020	Updates throughout.
3.1	November 2020	Updated Nutanix overview and load balancing recommendations.
3.2	March 2022	Minor updates throughout.
3.3	August 2022	Updated links.

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2. HPE ProLiant Integrated Systems

HPE ProLiant DX integrated systems combine compute, memory, and storage in several different form factors. Because they come integrated with Nutanix software, these systems empower organizations to deliver public cloud--like agility and functionality with the control of private cloud.

Nutanix maintains a list of [supported HPE ProLiant](#) DX integrated systems and HPE ProLiant DL general-purpose servers (select HPE in the Select your preferred Platform Providers field). The HPE ProLiant DX and DL platforms support Nutanix AHV, VMware vSphere, and Microsoft Hyper-V. Customers who have deployed Nutanix on general-purpose HPE ProLiant DL servers can expand their existing clusters with HPE ProLiant DX integrated systems.

Network Topology

HPE ProLiant DX integrated systems operate much like other Nutanix-enabled appliance models, such as Nutanix NX, Dell EMC XC, Lenovo HX, Fujitsu XF, and Inspur InMerge. Most HPE ProLiant DX integrated systems connect to a top-of-rack switch through redundant 10 or 25 GbE cables. A single 1 GbE cable for out-of-band (OOB) management connects to the dedicated integrated Lights-Out (iLO) connector port, similar to the IPMI management interface on Nutanix NX appliances, and provides a web and SSH interface for monitoring and managing the physical components.

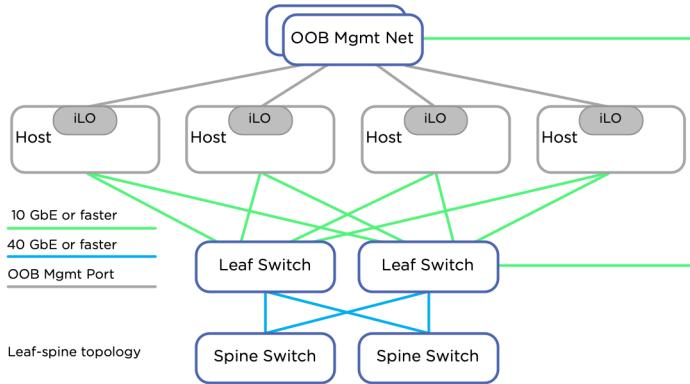


Figure 1: HPE ProLiant Network Topology

The dedicated iLO port can connect either to the same top-of-rack switches or to a set of dedicated management switches. Nutanix recommends separating the management network from the data network as shown in the preceding figure, but this configuration isn't required. HPE Composable Fabric can also help simplify network deployment, management, and performance optimization.

HPE Composable Fabric for Nutanix

Traditional enterprise networks were designed to focus on north-south workload traffic between clients and servers; they weren't designed to handle the distributed and varied nature of modern scale-out applications that require machine-to-machine communication over the network.

With traditional networks, bandwidth is the same for all workloads. However, in the modern datacenter, workloads vary in their performance and bandwidth needs, often requiring modifications to the network.

HPE Composable Fabric is designed for today's highly virtualized, software-defined infrastructure environments. It combines intelligent control software with state-of-the-art Ethernet switching hardware (fabric modules) to deliver a unique high-bandwidth and low-latency fabric that enables orchestrated, direct workload-to-workload network connectivity across the datacenter. HPE Composable Fabric delivers the physical switching infrastructure, virtualization software, centralized fabric management, and APIs for deploying a complete, highly scalable datacenter fabric that delivers optimum operational agility and workload performance for Nutanix environments.

With HPE Composable Fabric, organizations can use Nutanix Prism Central (a multicluster view) as their primary configuration interface—offering benefits such as:

- Deploy in 60 minutes or less. IT teams can start small, typically with just three servers (nodes), and easily scale capacity (storage, compute, and network) without limits.
- 100 percent linear scaling. Each node adds a proportionate amount of storage and server capacity with no guesswork. To double the overall capacity of a Nutanix deployment, just double the number of nodes. This scale-out design extends to the HPE Composable Fabric as well. With each top-of-rack Fabric Module (switch), the total performance capacity of the fabric grows. Organizations enjoy the same experience whether they deploy a single rack or multiple HPE ProLiant DX racks of nodes.
- Upgrade the entire software stack with a single click and without disruption to the live environment.

HPE Composable Fabric for Nutanix is an ideal solution for enterprises to quickly configure and cost-effectively manage their Nutanix enterprise cloud infrastructure as an alternative to the traditional networking approach of connecting HPE ProLiant DX nodes across clusters.

We have adapted this information from the HPE business white paper HPE Composable Fabric Software-defined network fabric for the composable infrastructure, the HPE white paper HPE Composable Fabric for Nutanix Enterprise Clouds, and the ESG white paper HPE Composable Fabric: Scaling Nutanix-based HPE ProLiant DX integrated systems.

For additional detail, refer to the HPE technical white paper [HPE Composable Fabric: Data Center Fabric Explained](#).

HPE ProLiant DX Management, Monitoring, and Upgrades

HPE ProLiant DX systems have been extensively tested and certified jointly by Nutanix and HPE to have a seamless end-to-end experience. Administrators can easily upgrade Nutanix AOS, their hypervisor, and HPE Service Pack for ProLiant (SPP) firmware in a nondisruptive way using life cycle manager (LCM)

through Nutanix Prism. With Prism, you can manage your entire HPE ProLiant DX infrastructure as a single entity. Firmware updates can either reside in the Nutanix LCM repository or in a customer's on-site repository. In either location, firmware updates are in-band, without HPE iLO network access. Connecting to a server's iLO web interface allows you to manage each server independently and view details such as fan speed, temperature, and hardware logs. You can also access the remote console through the iLO interface to view the on-screen state of the server.

3. General Best Practices

HPE ProLiant DX systems come from the HPE factory with AHV installed as the hypervisor. If you want to use a different hypervisor or an earlier version of AHV, you can use the Nutanix Foundation provisioning tool.

When you use Foundation to image a cluster with VMware ESXi, use the HPE-customized ESXi ISO image that includes HPE-specific device drivers. Nutanix nodes use an allowlist of hypervisor ISOs based on the file hash, and this allowlist includes the custom HPE ESXi ISO. You can view the hypervisor allowlist under the [Foundation downloads page](#) on the Nutanix Support Portal. Refer to the [Field Installation Guide](#) for step-by-step instructions for installing ESXi on Nutanix.

Follow the LCM workflows and best practices to determine and update the correct firmware and BIOS versions. From version 2.3.1 onward, LCM supports appliance firmware management for both HPE ProLiant DL servers and DX integrated systems. LCM automatically downloads the firmware bundle from www.nutanix.com (if reachable), or a local web server can host it on-site.

HPE ProLiant DX integrated systems ship from the factory with the appropriate firmware and AOS software. Nutanix doesn't recommend using HPE tools such as SUM or OneView for firmware management and upgrades. As in any other Nutanix deployment, administrators should typically perform hypervisor, AOS, and firmware upgrades through the Nutanix Prism interface.

There are some situations that may require SUM and OneView, such as downgrading firmware to meet a corporate mandate or applying an urgent security patch not covered in an existing SPP bundle. When performing physical server maintenance in such cases, shut down no more than one node in a Nutanix cluster at a time. Because HPE tools, and not Nutanix tools, conduct host management operations, the process needs coordination between the hardware and software layers. Unlike Nutanix LCM, HPE tools (like SUM) are not cluster-aware.

Common Networking Best Practices

In all Nutanix deployments, the Controller Virtual Machine (CVM) and hypervisor management network adapters must share the same network broadcast domain and subnet. You must have connectivity in the same layer 3 network between all CVMs and hypervisors in the same Nutanix cluster. The host management adapters don't have to be in this same subnet, but placing them in the same network simplifies network address design.

Storage Traffic Between CVMs in ESXi

In ESXi hosts, you can create a port group named CVM Network that prefers vmnic0 as active and vmnic1 as standby to ensure minimal latency between Nutanix CVMs. Connect vmnic0 in all physical servers to Switch-A. Connect vmnic1 in all servers to Switch-B. In this configuration, traffic between CVM nodes in the same rack moves over the same switch without needing to traverse the upstream switches. You can configure traffic for additional port groups and VMs to use the other switch (B on vmnic1) as active to separate CVM traffic from user VM traffic at the physical switch level. You can also select other port group configuration options, such as load-based teaming or originating virtual port ID for guest traffic, depending on the VM requirements.

The following vSphere networking configuration diagram shows the CVM Network failover order.

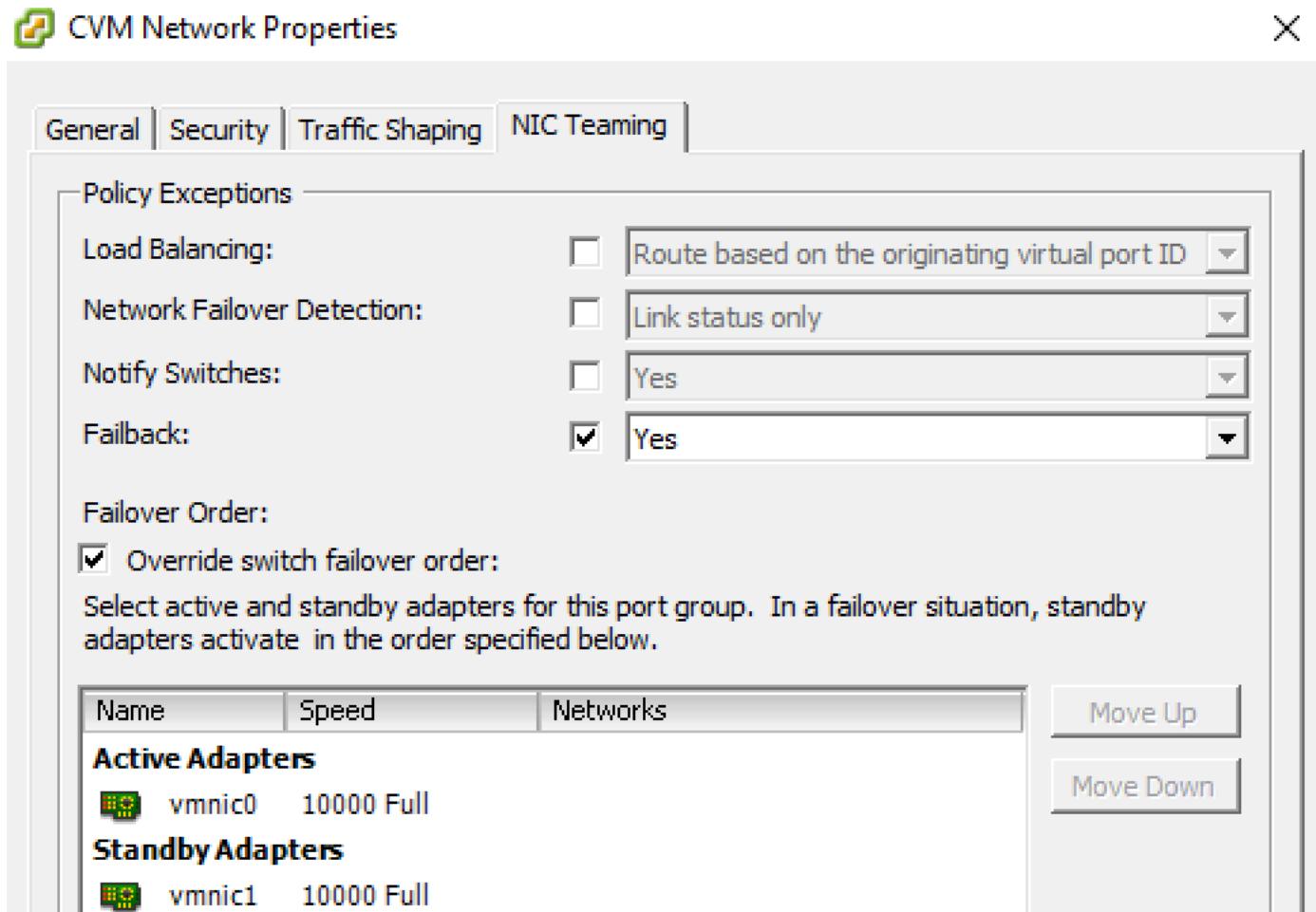


Figure 2: CVM Network Active Adapter Selection

Configure the Guest Network as shown in the following diagram or use any other suitable teaming strategy for this port group.

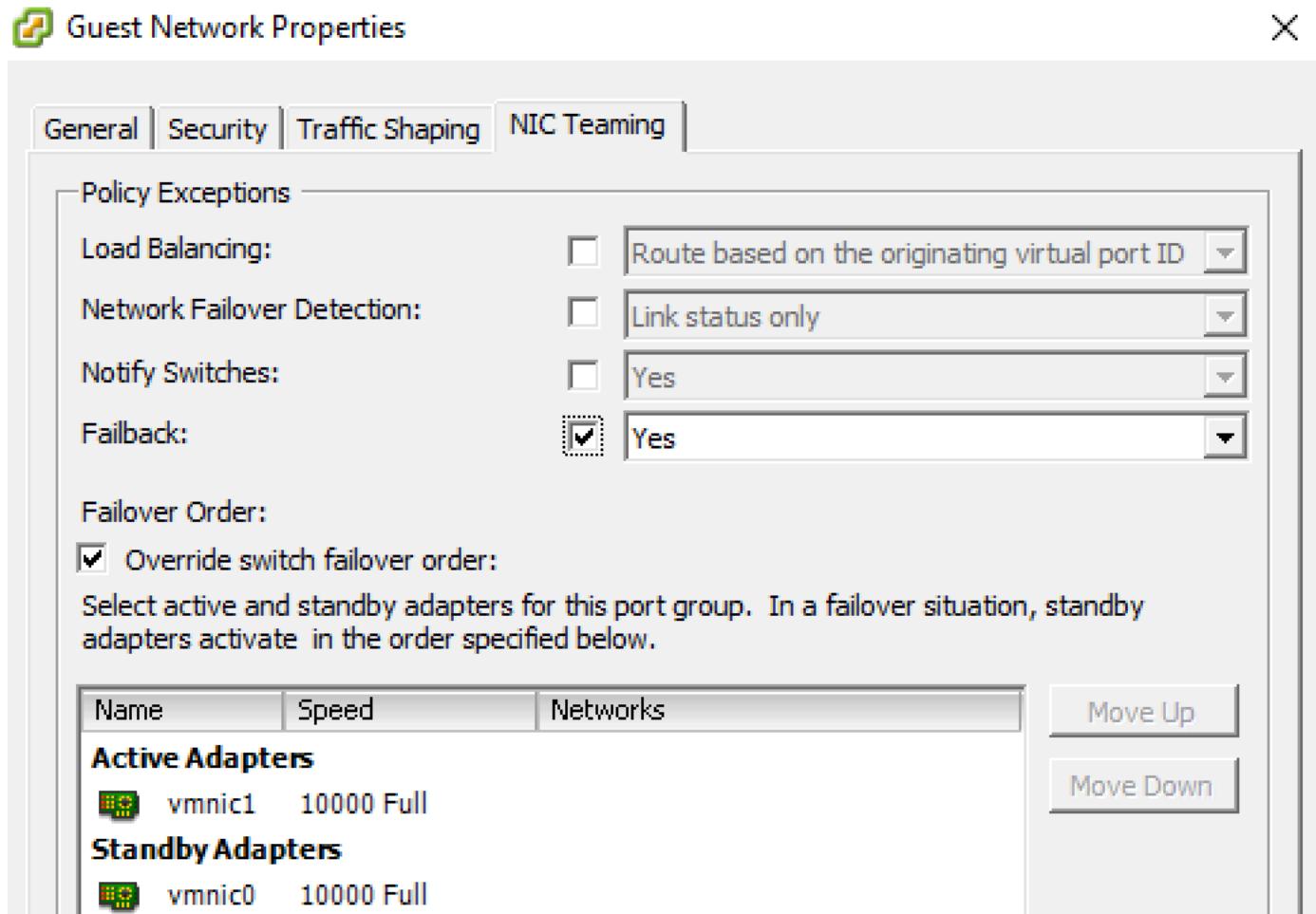


Figure 3: Guest Network Active Adapter Selection

Use the following commands from any CVM to set the active and standby adapters of all ESXi hosts in a Nutanix cluster for the CVM Network and Guest Network port groups:

```
for i in `hostips`; do echo $i; ssh root@$i 'esxcli network vswitch standard portgroup policy failover set -a=vmnic0 -p="CVM Network" -s=vmnic1';done
for i in `hostips`; do echo $i; ssh root@$i 'esxcli network vswitch standard portgroup policy failover set -a=vmnic1 -p="Guest Network" -s=vmnic0';done
```

Refer to the [vSphere Administration Guide for Acropolis](#) on the Nutanix Support Portal for specific configuration considerations related to ESXi.

Storage Traffic Between CVMs in AHV

In the default AHV network configuration with two uplinks, configure one adapter from the AHV host as active and one as backup. You can't select the active adapter in such a way that it persists between host reboots. When multiple uplinks from the AHV host connect to multiple switches, ensure that adequate bandwidth exists between these switches to support Nutanix CVM replication traffic between nodes. Nutanix recommends redundant 40 Gbps or faster connections between switches, which you can achieve with a leaf-spine configuration or direct interswitch link. Refer to the [AHV Networking Recommendations](#) section in the AHV Administration Guide for further best practices when bonding 10 GbE NICs together.

Cluster Expansion

Cluster expansion with HPE ProLiant DX systems is simple and straightforward. HPE ProLiant DX nodes come from the HPE factory with Nutanix software preinstalled. When the node arrives, connect it to the cluster's network so that the CVM is reachable. Then use Prism to perform a cluster expansion operation as you would with Nutanix NX systems. If the factory-installed versions of the AOS and hypervisor software on the new node differ from the versions running on the cluster, this process installs the versions running on the cluster on the new node.

Expanding a Nutanix cluster on HPE ProLiant DL systems currently requires two steps:

1. If the new server has not already been imaged, use the standalone Foundation VM to image it with the correct hypervisor and AOS version. Image the node, but don't add it to any cluster during the Foundation process.
2. Use Prism or the Nutanix command line interface (nCLI) in the existing ProLiant cluster to discover the newly imaged node and add it to the cluster. Node discovery uses IPv6 multicast traffic between Nutanix CVMs, so configure the upstream network devices to allow this traffic between nodes. Additionally, Nutanix recommends placing the CVMs and hypervisor hosts

in the native, or default, untagged VLAN. If the CVMs are in a tagged VLAN, place the node you want to add in this same VLAN before discovery.

Note: With HPE ProLiant systems, you must use the Foundation VM instead of CVM-based cluster expansion to support bare-metal imaging. For ease of use, deploy the Foundation VM on the existing Nutanix cluster before adding nodes.

Node Replacement

Node replacement consists of node addition and node removal:

- Node addition: Node addition for HPE ProLiant DL servers uses the same process described in the cluster expansion section above.
- Node removal: To remove the old node from the cluster, follow the [Nutanix Prism Web Console Guide](#).

4. HPE ProLiant Best Practices

The following best practices apply to HPE ProLiant systems.

Perform all firmware, BIOS, and iLO upgrades using LCM in Prism.

The following table summarizes where you perform various tasks in HPE ProLiant on Nutanix deployments. Basic hardware monitoring consists of simple values such as system performance and system alerts. Basic hardware management involves tasks such as simple server restarts. Advanced management and logging monitors values such as fan speed, temperature, or detailed hardware boot logs. You perform these tasks in the Prism web interface, in the hypervisor interface, or directly in the iLO.

Table: Management Responsibilities

Responsibilities	Prism	Hypervisor	iLO
Basic hardware monitoring and alerts	X	X	X
Basic hardware management		X	X
Advanced hardware management and logs			X

NICs connect to two separate top-of-rack switches. A separate OOB connection to the dedicated iLO connector port provides access to iLO for management. Administrators can create this connection either through a dedicated set of management switches or through the same top-of-rack switch that the 10 or 25 GbE ports use. Nutanix recommends using a separate OOB management network for fault tolerance and high availability.

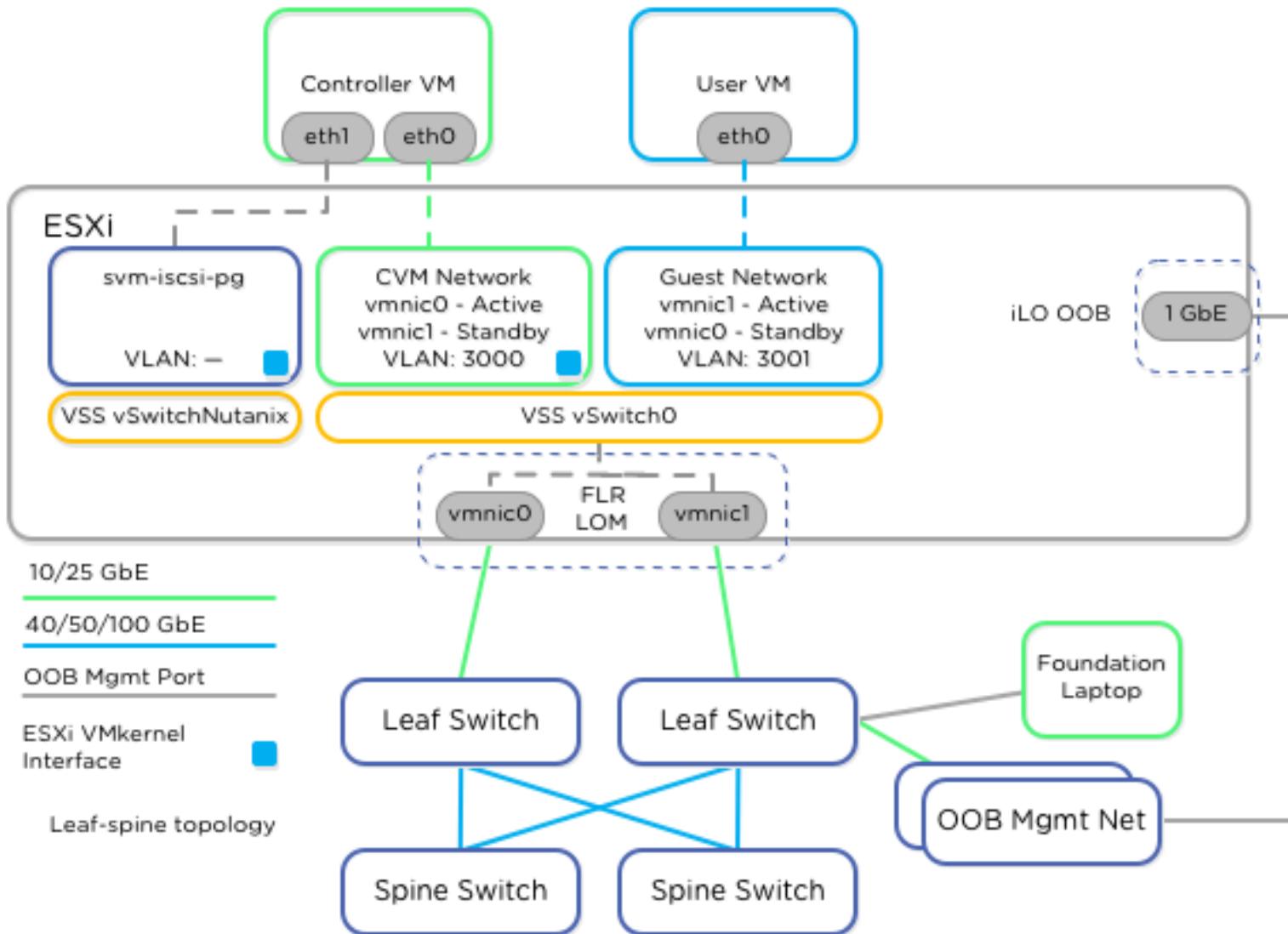


Figure 4: ProLiant ESXi Network Detail

We recommend a leaf-spine network architecture to eliminate oversubscription and provide maximum throughput and scalability for east-west traffic. Choose a line-rate, nonblocking top-of-rack switch that provides high throughput and low latency between nodes in the Nutanix cluster.

Configure the top-of-rack switch ports facing the HPE ProLiant servers using the vendor-recommended configuration for server ports. Use a configuration like portfast or edge to ensure that the server-facing port transitions immediately to the spanning tree forwarding state. Additionally, configure ports to automatically detect and negotiate speed and duplex. Configure the CVM and hypervisor VLAN of the Nutanix nodes as untagged or native in the top-of-rack switch.

AHV networking is similar to ESXi networking, as shown in the following diagram. The cabling for the ProLiant servers is identical, and all the same management recommendations apply.

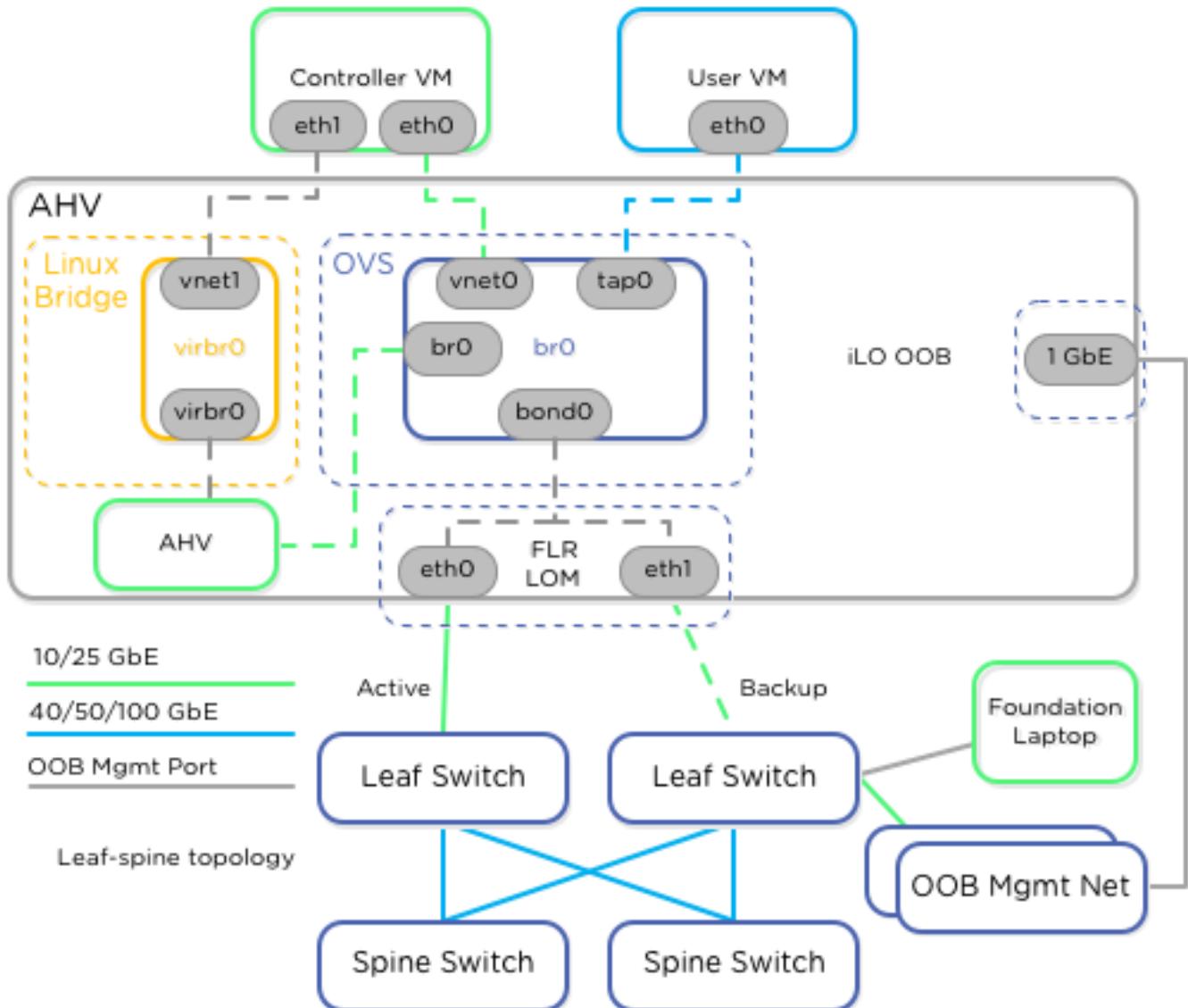


Figure 5: HPE ProLiant AHV Network Detail

The recommended and default bond mode is active-backup. To combine the bandwidth of multiple links, consider using link aggregation with LACP and balance-tcp instead of balance-slb. Nutanix doesn't recommend balance-slb because of issues with multicast traffic. For more information, review the [AHV Networking best practice guide](#).

5. Conclusion

Nutanix can turn your existing compute into web-scale storage. Nutanix enterprise cloud software allows a clustered pool of HPE ProLiant DX integrated systems and DL general-purpose servers to act as a centrally managed compute and storage system that offers high performance, redundancy, and ease of management not found in traditional SAN-based infrastructures.

With these best practices for Nutanix on HPE ProLiant deployments, administrators have the tools they need to generate successful, error-free designs for their environments. Combining HPE ProLiant rack-mount servers with the Nutanix enterprise cloud gives administrators the flexibility to build a compute and storage infrastructure on the hardware of their choice.

6. Appendix

Best Practice Checklist

General Best Practices

- For HPE ProLiant DL general-purpose servers, refer to the [Nutanix HPE ProLiant HCL](#) to find a complete set of compatible hardware, firmware, and software to use in a Nutanix on HPE ProLiant deployment.
 - › Contact Nutanix Support before using firmware versions not on the HCL.
- Upgrade firmware versions.
 - › Nutanix recommends using Nutanix LCM, which is cluster-aware.
 - › If you use HPE utilities such as SUM, shut down no more than one Nutanix node at any given time.
- Perform hypervisor and AOS upgrades through Prism.
- For HPE ProLiant DX integrated systems, expand a Nutanix cluster by connecting the new HPE ProLiant DX node to the network and using Prism.
- For HPE ProLiant DL general-purpose servers, expand the Nutanix cluster using a two-step process:
 - › Image the node using a Foundation VM.
 - › Add the new node through Prism.
- Replace nodes using the node removal and node addition processes.

Common Networking Best Practices

- Allow IPv6 multicast traffic between nodes.

- Place CVM network adapters in the same subnet and broadcast domain as the hypervisor management network adapter.
 - › Placing the iLO in this same network is optional but can simplify network design.
- Place the Nutanix CVM adapter and hypervisor host adapters in the native or default untagged VLAN.
- In ESXi, create a port group for all CVMs that prefers the same top-of-rack switch.
 - › For all other port groups, use Route based on originating virtual port ID for the standard vSwitch and Route based on physical NIC load for the distributed vSwitch.
- In AHV, use the default active-backup mode for simplicity.
 - › Refer to the [AHV Networking best practice guide](#) for more advanced networking configurations.

HPE ProLiant Best Practices

- Perform physical server hardware configuration using iLO.
- Perform day-to-day server management using Prism and the hypervisor interface.
- Use iLO for hardware-specific management and monitoring for items such as fan speed, temperature, and detailed hardware logs.

Networking

- Connect two NIC ports to two separate top-of-rack switches for fault tolerance.
- Use a leaf-spine network that provides a line-rate, nonblocking connection between all Nutanix nodes.
- Configure top-of-rack switches as edge or server ports using a configuration similar to that demonstrated in [KB 2455](#).

- Configure top-of-rack switch ports to carry the CVM and hypervisor VLAN as untagged, or native.
 - Connect the iLO interface for OOB management access using iLO.
 - Use a dedicated OOB management network if possible.
 - › This management network must connect to the primary data network for Foundation to work properly.
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References

1. [Nutanix Field Installation Guide for HPE ProLiant Servers](#)
 2. [Nutanix HPE ProLiant Hardware Compatibility List](#)
 3. [Nutanix Prism Web Console Guide](#)
 4. [Nutanix AHV Best Practice Guide](#)
 5. [Nutanix AHV Networking Best Practice Guide](#)
 6. [Nutanix vSphere Administration Guide for Acropolis](#)
 7. [Nutanix vSphere Networking Best Practice Guide](#)
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Nutanix is a global leader in cloud software and a pioneer in hyperconverged infrastructure solutions, making clouds invisible and freeing customers to focus on their business outcomes. Organizations around the world use Nutanix software to leverage a single platform to manage any app at any location for their hybrid multicloud environments. Learn more at www.nutanix.com or follow us on Twitter [@nutanix](https://twitter.com/nutanix).

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