

Service Description

CXD Compute Nodes

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1. Introduction

Cyxtera provides an on-demand IT infrastructure built on CXD Compute Nodes. The Compute Nodes provide all the benefits of traditional infrastructure deployed in colocation – dedicated hardware and control of the entire stack, plus no large capital outlay or long-term leases – in an on-demand and scalable consumption model, previously offered only in the cloud.

Compute Nodes are a cornerstone offering on the Cyxtera extensible data center platform (CXD). CXD is a software defined architecture combining a software defined network fabric and service provisioning system to provide a revolutionary way of easily procuring and consuming data center services.

Compute Nodes include:

- Colocated compute and storage capacity delivered in an on-demand model
- Physically isolated on-demand hyperconverged infrastructure (HCI)
- Seamless extension of customer colocation cabinet or cage
- Connectivity via layer 2 network throughout the data center over the CXD platform
- Access to CXD enabled network providers with direct connections to private or public cloud

Through the CXD Command Center or API interface customers configure and deploy nodes, inclusive of compute, memory, storage, and network resources. Cyxtera has partnered with best of breed hyperconverged infrastructure technology providers to create Compute Nodes. Compute Nodes provide dedicated hardware for each customer upon which they can deploy their hypervisor of choice. Customers then configure and manage the resources and virtual machines (VMs) needed to run their mission critical workloads.

Key Terms

- **Compute Node:** single-tenant, dedicated self-contained HCI unit that combines compute (CPU cores), memory (RAM), and storage (hard disk drive and/or solid-state disk) into a pre-configured integrated appliance. A group of nodes forms a cluster.
- **Cluster:** single, logical organizational unit which groups three or more physical Compute Nodes configured with the same logical network(s) and hypervisor.
- **Hypervisor:** virtualization software that abstracts and pools the physical resources of the host Compute Nodes so that the resources can be consumed by one or more guest virtual machines deployed on those Compute Nodes. The hypervisor is used to manage and monitor the virtual machines.
- **Network:** user-defined Virtual Local Area Network (VLAN) that can be configured for use solely within the compute network to connect Compute Nodes, between CXD Compute Nodes and users' colocation environments or other Cyxtera services, and/or solely between other Cyxtera services.

1.1 Portal, Tools, & APIs

Self-Service Administrative Tools

The Service includes access to three self-service tools:

- **Cyxtera Customer Portal** provides access to subscription status, integrating navigation, viewing, and management of all Cyxtera products, entitlements, and customer support under a single account.
- **CXD Command Center** is the primary tool for access, consumption, and management of CXD enabled products purchased from Cyxtera, including Compute Node management and configuration of network services.

- **Nutanix Prism** provides a web console for access and management of Compute Nodes infrastructure resources, including sites, clusters, Compute Nodes, hypervisor, virtual machines and associated resources, as well as resource monitoring.

Cyxtera will provide users with access to Application Programming Interfaces (API) for programmatic resource management.

- **Cyxtera APIs** allow you to create scripts that run system administration commands against your CXD resources, such as Compute Nodes and networks, equivalent to those actions that can be taken from the CXD Command Center.
- **Nutanix APIs** allow you to create scripts that run system administration commands against your Nutanix resources, including Compute Node clusters, hypervisor, virtual machines and associated resources, equivalent to those actions that can be taken from within the Nutanix Prism portal.

1.2 Connectivity

Connection to CXD Compute Nodes

There are two methods for establishing connectivity to Compute Nodes:

- **CXD IP Connect** a Cyxtera-delivered blended Internet bandwidth service comprised of multiple top tier, upstream IP Transit providers, allowing connectivity from outside the data center where the Compute Nodes reside. The service provides a high availability, 'always on' connection to the Internet to which customers can connect at speeds ranging from 10Mbps to 1,000Mbps. IP addresses are provided by Cyxtera and routed via Static Route or Border Gateway Protocol (BGP). Two licenses of AppGate SDP are provided to CXD Compute Node customers for connectivity over IP Connect, or customers may also create their own virtual appliance to provide VPN for connectivity over IP Connect.
- **CXD Port** a physical network connection deployed to a colocation customer's cage or cabinet, across which one or more layer 2 networks can be stretched connecting your colocation environment to your Compute Nodes within the same data center where the Compute Nodes reside.

2. Operations

The following outlines Cyxtera's roles and responsibilities in the service delivery of Compute Nodes. While specific roles and responsibilities have also been identified as being owned by you, any roles or responsibilities not contained in this document are either not provided with the Service or assumed to be your responsibility.

2.1 Support

Cyxtera will provide or broker support for problems that you report and selected additional Services to assist with adoption of Compute Nodes. Support may be provided in any country in which Cyxtera or its agents maintain facilities. To the extent you provide your information and/or data in connection with support, we will handle your information and/or data in any such country in accordance with the applicable service agreement, Cyxtera policies and all applicable laws.

2.2 Provisioning

Cyxtera will provide the following provisioning Services:

- Granting CXD Command Center access to administrative users using default administrator privileges

and system preferences.

- Implementation of physical Compute Nodes with initial IP address, IPMI address, and any associated network configuration.
- Deploying initial hypervisor onto physical Compute Nodes when applicable.

You will be responsible for the following provisioning:

- Creating and configuring applicable hypervisors, networks, and VMs.
- Installing and configuring any additional custom or third-party hypervisors, operating systems, and applications on deployed physical Compute Nodes and VMs.

2.3 Data Recovery

Cyxtera will provide the following Services with respect to data recovery:

- Data protection, such as routine backups, for the CXD Compute Node management infrastructure, including top-layer management applications and user-management interfaces owned and operated by Cyxtera.
- Data and infrastructure restoration for the Cyxtera management infrastructure, including top-layer management application and user-management interfaces owned and operated by Cyxtera.

You will be responsible for the following services with respect to data recovery:

- Data protection, such as routine backups, for the data and content accessed or stored on Compute Nodes, virtual machines, configuration settings, etc.
- Data, content, physical Compute Node, virtual machine, and configuration restorations for assets accessed or stored in your Cyxtera account.

2.4 Monitoring

Cyxtera will provide the following Services with respect to monitoring:

- Monitoring the Compute Node management infrastructure, infrastructure networks, top-layer management applications and user-management interfaces, and computing, storage, and network hardware for availability.

You are responsible for the following with respect to monitoring:

- Monitoring the assets deployed or managed within your Compute Node environment, including, but not limited to physical Compute Nodes, hypervisors, virtual machines, operating systems, applications, specific network configurations, operating system or application vulnerabilities, etc.

2.5 Incident and Problem Management

Cyxtera will provide incident and problem management Services (e.g., detection, severity classification, recording, escalation, and return to service) pertaining to:

- Infrastructure over which Cyxtera has direct, administrative, and/or physical access and control, such as Cyxtera data center, physical Compute Nodes, management servers, and network devices.
- Service software over which Cyxtera has direct administrative access and control, such as the Cyxtera

Customer portal, CXD Command Center, and other Cyxtera-owned APIs and applications that Cyxtera uses in delivery of the Service.

You are responsible for incident and problem management (e.g., detection, severity classification, recording, escalation, and return to service) pertaining to:

- User-deployed and configured assets such as hypervisors, virtual machines, operating systems, custom developed or third-party applications, network configuration settings, and user accounts.
- Hypervisor and operating system administration including the hypervisor and operating system itself or any features or components contained within it.
- Performance of deployed hypervisors, virtual machines, custom or third-party applications, your databases, operating systems, or other assets deployed and administered by you.

2.6 Change Management

Cyxtera will provide the following change management elements:

- Processes and procedures to maintain the health and availability of the Compute Nodes hardware, Cyxtera customer portal, CXD Command Center, Cyxtera APIs, and CXD platform.
- Processes and procedures to release new code versions, hot fixes, and service packs related to the Cyxtera customer portal, CXD Command Center, Cyxtera APIs, and CXD platform.

You are responsible for:

- Management of change to your physical Compute Nodes, hypervisors, virtual machines, operating systems, custom or third-party applications, databases, and administration of general network changes within your control.
- Administration of self-service features provided through the Cyxtera user portals, up to the highest permission levels granted to you, including, but not limited to, Compute Nodes and network functions, backup administration, user configuration and role management, general account management, etc.

2.7 Security

The end-to-end security of Compute Nodes is shared between Cyxtera and you. Cyxtera will provide security for the aspects of the Service over which it has sole physical, logical, and administrative level control. You are responsible for the aspects of the Service over which you have administrative level access or control. The primary areas of responsibility between Cyxtera and you are outlined below.

Cyxtera will use commercially-reasonable efforts to provide:

- **Physical Security:** Cyxtera will protect the data centers, cages, and cabinets housing the Compute Nodes from physical security breaches.
- **Information Security:** Cyxtera will protect the information systems used to deliver the Service for which it has sole administrative level control.
- **Network Security:** Cyxtera will protect the networks containing its information systems up to the point where you have some control, permission, or access to modify your networks.
- **Security Monitoring:** Cyxtera will monitor for security events involving the underlying infrastructure hardware, networks, and information systems used in the delivery of the Service for which it has sole administrative level control over. This responsibility stops at any point where you have some control, permission, or access to modify an aspect of the Service.

- Patching & Vulnerability Management:** Cyxtera will maintain the systems it uses to deliver the Service, including the application of patches it deems critical for its target management systems. Cyxtera will perform routine vulnerability scans to surface critical risk areas for the systems it uses to deliver the Service. Critical vulnerabilities will be addressed in a timely manner.

You should address:

- Information Security:** You are responsible for ensuring adequate protection of the information systems, data, content or applications that you deploy and/or access on the Service. This includes, but is not limited to, any level of patching, security fixes, data encryption, access controls, roles and permissions granted to your internal, external, or third-party users, etc.
- Network Security:** You are responsible for the security of the networks over which you have administrative level control. This includes, but is not limited to, maintaining effective firewall rules, exposing communication ports that are only necessary to conduct business, locking down promiscuous access, etc.
- Security Monitoring:** You are responsible for the detection, classification, and remediation of all security events that are isolated with your account, associated with Compute Nodes, hypervisor, virtual machines, operating systems, applications, data, or content, surfaced through vulnerability scanning tools, or required for a compliance or certification program in which you are required to participate, and which are not serviced under another Cyxtera security program.

3. Compute Nodes

3.1 Node Types

There are multiple Nutanix node types available for provisioning from the Compute Node catalog. Cyxtera may add, change, or remove available node types at any time. Sample node configurations are as follows:

Sample Node Configurations		Node Capacities			
Nodes	Description	No. Cores	RAM (GB)	HDD (TB) Storage	SSD (TB) Storage
NXT1	NX-3060-G6 (hybrid)	24	256	8.0	3.8
NXT2.2	NX-3060-G6 (hybrid)	24	512	8.0	3.8
NXT3.2	NX-3060-G6 (all flash)	28	512	-	11.5
NXT4	NX-8155-G6 (hybrid)	40	768	48.0	7.7
NXT5	NX-8035-G6 (hybrid)	24	512	32.0	3.8

3.2 Compute

Compute Nodes contain high density CPU and memory which includes:

- CPU/Processor** each node has two sockets with an Intel Xeon processor, ranging from 12 to 14 cores per socket, for a minimum of 24 and maximum of 40 cores per node. The processor speeds range from 2.1GHz to 2.4GHz.
- Memory** each node includes multiple modules of DDR4 RAM, with capacity ranging from 256GB to 768GB.

3.3 Storage

Compute Nodes are inclusive of local, directly attached software defined storage within the appliance. Storage is delivered via SSD and HDD storage drives, and all nodes are either:

- **Hybrid** nodes containing a combination of both SSD and HDD storage drives. The SSD storage serves as a staging area for the filesystem journal, handling bursts of random writes, coalescing them and sequentially drains them to the extent store (HDD). This provides higher write I/O performance, especially for random I/O workloads.
- **All Flash** nodes containing only SSD storage drives.

The core of the software defined storage is the Nutanix Distributed Storage Fabric (NDSF). All drives in the cluster are pooled together. The Distributed Storage Fabric (DSF) appears to the hypervisor like any centralized storage array, however all of the I/Os are handled locally to provide the highest performance. The NDSF is comprised of the following high-level structure:

- **Storage Pool**
 - **Key Role:** Group of physical storage devices.
 - **Description:** A storage pool is a group of physical storage devices including SSD and HDD devices for the cluster. The storage pool can span multiple Compute Nodes and is expanded as the cluster scales. In most configurations, only a single storage pool is leveraged.
- **Container**
 - **Key Role:** Group of VMs/files.
 - **Description:** A container is a logical segmentation of the Storage Pool and contains a group of VMs or files (vDisks). Some configuration options (e.g., RF) are configured at the container level but are applied at the individual VM/file level. Containers typically have a 1 to 1 mapping with a datastore.
- **vDisk**
 - **Key Role:** vDisk
 - **Description:** A vDisk is any file over 512KB on DSF including VMDKs and VM hard disks. vDisks are composed of extents which are grouped and stored on disk as an extent group.

The following figure shows how these map between DSF and the hypervisor:

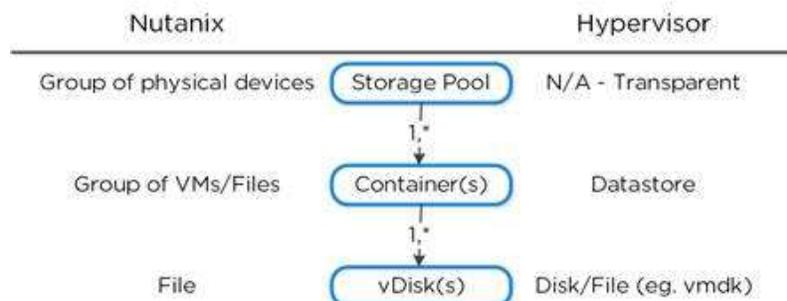


Figure 1 - Source: Steven Poitras and NutanixBible.com - ©Nutanix 2018

The SSD's are used for many of the software defined storage functions:

- Nutanix Home (CVM Core)
- Cassandra (Metadata Storage)

- OpLog (Persistent write buffer)
- Unified Cache (SSD cache portion)
- Extent Store (persistent storage)

The HDD's are used primarily for bulk storage and have the following functions:

- Curator Reservation (Curator Storage)
- Extent Store (persistent storage)

The following illustration show an overview of the I/O path:

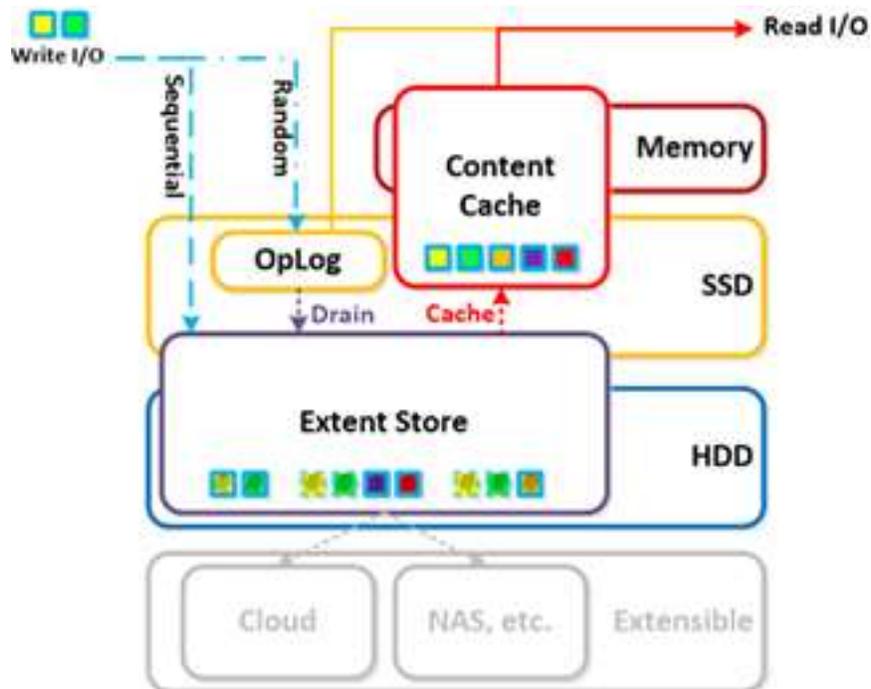


Figure 2 – Source: Steven Poitras and NutanixBible.com - ©Nutanix 2018

3.4 Local Networking

Compute Nodes each contain a total of two available 10Gb ports that may be configured for use on desired user-defined networks.

Customers will also have access to each Compute Node's Intelligent Platform Management Interface (IPMI) for management and monitoring of each Compute Node.

3.5 Hypervisors

Cyxtera will provide installation of a subset of supported hypervisors that may be deployed onto your Compute Nodes during the provisioning process. The deployment and use of these hypervisors will be subject to any Third Party T&Cs as applicable. You are responsible for deploying and configuring any additional hypervisors.

You may import and install from your own hypervisor installation media so long as you have the legal right to deploy and use the software contained in such media.

Hypervisors that are provided by Cyxtera and infrequently used, out-of-date, or no longer supported may be removed at any time.

Cyxtera-Provided Hypervisors

- VMware ESXi
- Nutanix AHV

Supported Hypervisors

- Microsoft Hyper-V
- OpenStack
- None – bare metal
- After initial deployment customers may install the hypervisor of their choice

3.6 Cluster

Compute Nodes may be grouped into a cluster to allow the sharing of compute, storage, and network resources within a single pool. Compute Nodes may be clustered by Cyxtera at the customer's request at the time of Compute Node ordering and provisioning. Customers can also add or remove nodes from a cluster at any time, as well as create new clusters and manage existing clusters from Nutanix Prism console or API.

3.7 Networks

Networks are user-defined Virtual Local Area Networks (VLAN). Networks may be created and assigned at the time of Compute Node ordering and provisioning. Additional new networks and management of existing networks can be executed from the CXD Command Center or API for common use cases such as configuration and Compute Node network assignment.

Networks can be used for, but not limited to, use cases such as:

- Local networks for communication between Compute Nodes within a cluster, or communication between clusters of Compute Nodes.
- Communication between a cluster of Compute Nodes and the public Internet through the IP Connect service.
- Communication between a cluster of Compute Nodes and a colocation environment via a CXD port.

4. Business Operations

This section summarizes processes for ordering your Compute Nodes.

4.1 Ordering

Compute Node Ordering

- Orders for Compute Nodes can be initiated via Service Order or the CXD Command Center/API. Orders for Compute Nodes are inclusive of:

- Data center space and power
- Core network and top of rack switches
- Compute and storage hardware platform
- Nutanix Acropolis Pro and Prism Starter software licenses
- Hardware and software maintenance
- 24 x7 data center operations and support
- There is a minimum order of 3 Compute Nodes for any new cluster
- Compute Nodes may be ordered by the Compute Node to any existing cluster