Cloud Data Center Service Guide

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Table of Contents

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Service Description

Cloud Data Center is a cloud compute service that provides customers the use of virtual servers (vServers), storage area network services (SAN), hosting area network (HAN) services, and managed security services in a multi-tenant self-service virtual data center environment. CenturyLink provides the infrastructure including data center space and power, compute resources, storage resources, virtualization system licenses, vServer operating system license (where applicable), hosting area network connectivity, security service licensing, management and monitoring of the vServer and infrastructure, and use of the cloud Portal or API for management and automated provisioning. The Service Level Agreement ("SLA") for this Service is covered by the "Symphony Cloud Data Center Availability SLA" found at www.centurylinktechnology.com/legal/sla.

The following table provides a summary of the available features:

Service Feature	Description
Compute/Memory	Combinations Of CPU and RAM scaled independently
SAN Storage	SAN Attached with 3 performance tiers
Data Retention	A daily SNAP copy with 7-Day Retention
Security	Perimeter Firewall IPSec VPN site-to-site
Networking	Internet Bandwidth (Data Transferred and 95th Percentile) Server Load Balancing Private and Public IP Addresses vLANs Network Address Translation (NAT)

Supported vServers

The Cloud Data Center Service ("Service") offers the ability to purchase virtual servers while CenturyLink maintains the underlying cloud infrastructure. Customers have access to the virtual server and operating environment. The operating environment for each virtual server includes the storage, network and security configuration. Each virtual server can include an operating system, allocated virtual CPU (vCPU) and Memory (vRAM) resources.

Each virtual server is partitioned from other vServers to segregate each customer's data from those of other customers.

Available Compute vServers

The following vServer vCPU and vRAM sizes are available:

vServer Sizes*	
vCPU	**1**
	2
	4
	8
	16
vRAM	**1GB**
	2GB
	4GB
	8GB
	16GB
	32GB
	64GB

*May vary due to capacity at each site

vServer Infrastructure Management

Each virtual server resides on the cloud infrastructure compute cluster. This includes a physical group of server clusters that are networked together into a resource group with VMware vSphere® High Availability (HA) and Dynamic Resource Balancing (DRS). CenturyLink manages the cloud infrastructure compute cluster.

Cloud Data Center vServers are persistent, where the vServer, data and operating environment are maintained after the vServer is shut down or after a vServer failover across hosts. In the event of a vServer failover, Cloud Data Center vServers are designed to restart automatically across the compute cluster. Cloud Data Center also uses DRS to automatically balance load across the underlying physical compute pool, improving the performance of our cloud.   While most applications are compatible, any applications not compatible with VMware VMotion®, DRS or HA may experience intermittent issues when these automated capabilities perform their functions. Cloud Data Center users should consult their application provider for information on VMotion compatibility.

Cloud Server Monthly Maximum

A customer may build up to 20 vServers globally consuming a maximum of 200 GB RAM total in a month. If a customer wishes to consume resources beyond this limit, they must open a ticket with CenturyLink to confirm that additional infrastructure resources are available to fulfill their request within their desired timeframe.

Operating System Images

The Service also includes the option to build vServers from the CenturyLink provided operating system Images, listed in the below table. See the *Cloud Data Center User Guide* for details of which OS versions are offered.

| CentOS |
| Debian GNU |
| Red Hat Enterprise Linux |
| Ubuntu |
| Windows Server |

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Customer Provided Images

Customers also have the option to upload their own vServer Image (Customer Provided Image). This image must be listed by VMware as compatible with the current Cloud Data Center version of VMware software. This image will be supported by the Customer. CenturyLink will manage the cloud infrastructure.

Due to Microsoft and Red Hat licensing requirements, Cloud Data Center customers must register their Windows systems with CenturyLink's Microsoft Key Management Service (KMS) server or the Red Hat systems CenturyLink Red Hat Update Infrastructure (RHUI) server. The Customer Provided Windows and Red Hat vServers price will be the same as the equivalent Unmanaged CenturyLink Provided vServers.

CenturyLink does not guarantee that all cloud functions or supplemental CenturyLink products will be compatible with Customer Provided Images (CPI). All CPI's must include the appropriate version of VMware tools deployed as specified in the *Cloud Data Center User Guide*. While CenturyLink does not provide support for CPI creation, the CenturyLink help desk can help with the CPI upload process**.**

Supported Data Storage and Data Retention for vServers

Supported virtual disk (VMDK) configuration reflects VMware vSphere capabilities. In summary:

The Boot Drive size for CenturyLink provided images varies according to the operating system type. The boot drive size is fixed.

Additional "data drives" can be added up to the maximums defined by VMware.

- Total Virtual Disks (VMDKs) maximum per virtual machine - 60
- Virtual disk size maximum - 2TB minus 512 bytes

Three storage profile/configurations are available within this environment. Storage performance varies by profile. Each vServer may only have one storage profile.

The defined storage profiles, starting with the highest performing, are: Optimized, Balanced and Essential.

Our SAN storage fabric connectivity is fully redundant with failover capabilities for reliability and performance.

The Service includes the ability to roll back to a previous state of your cloud server through automated crash consistent data store SNAP shots.

To restore from a data store SNAP shot please open a ticket with the CenturyLink service desk.

Network, IP and Security Services

The Cloud Data Center service provides customers the ability to self-design their network services. Within the product, customers may define their own virtual network architecture including VLANs and IP Allocation. Customers may also choose to deploy additional network services, including perimeter firewalls, load balancers, internal traffic firewalls, NAT, and DHCP.

Supported Network and IP Configurations

Cloud Data Center includes customer-defined private IP allocations and network configuration. The network topology is defined by the customer. By default, the customer receives two networks with the service. A public, internet-facing network and a private network dedicated to delivering other CenturyLink services. The Customer may choose to use these networks, or may choose to deploy new networks within the Service.

For public IP addressing, CenturyLink will use good faith efforts to assign Internet address space for the benefit of Customer during the Service Term. Any IP addresses and space provided to Customer by CenturyLink are solely for Customer's use with the Service, and are non-portable and non-transferable. Neither Customer, nor any End Users, will own or route any IP addresses or space provided by CenturyLink and upon any termination of Service, Customer's access to such IP addresses and space will cease.

Supported Security Features

The Service includes two types of firewalls, Edge and Server. By default, neither service is enabled. The customer may deploy these services as needed, see following table:

Feature	Edge FW	Server FW
Source/Destination IP, Port & Protocol	x	X
NAT 1:1	x	X
NAT N:1	x	X
NAT: Port Forwarding	x	X

Log Deny	x
Custom Syslog	x
IPSec	x
Static Route	x

Supported Server Load Balancer Features

The Service includes Load Balancer configuration. By default, Load Balancing is not enabled. The customer may deploy this service as needed.

Configuration Options:

- Create or remove a server pool
- Enable or disable a server pool
- Configuration of the following:
  - Health check
  - Stickiness/Persistence
  - Traffic Logging
  - Predictors
- Add or removal of real servers into the server pool
- VIP, listening port and translate port assignment/configuration

Interfaces

Cloud Data Center has three interfaces: The SavvisStation cloud portal, vCloud Director API and the vCloud Director native portal. Customers may use native VMware functions at the VMware-defined Organization level virtual Data Center and below through the vCloud® API and the native vCloud Director portal. These two interfaces are considered advanced VMware interfaces and may require VMware training for use. A sub-set of these features are provided through the SavvisStation cloud portal to general cloud users in an intuitive, easy-to-use manner.

API

The Service includes Customer access to the API to provide Customer with the ability to build and manage its Cloud Data Center. CenturyLink provides access to native VMware vCloud® API functions exposed as REST web services. CenturyLink Cloud API specific details and instructions can be found in the CenturyLink Cloud API programmer's guide. The API may be accessed through the URL: **https://api.savvis.net**.

Monitoring and Support

CenturyLink proactively monitors and maintains the infrastructure that supports the Cloud Data Centers, including the repair and replacement of defective or failed hardware and the installation of hardware upgrades, as needed. CenturyLink may subcontract any hardware support to the manufacturer or other vendor in order to expedite repairs.

Below are the descriptions of monitoring and support for each cloud image type and support option:

CenturyLink Provided and Customer Provided Operating System Images

CenturyLink provides Operating System (OS) Images when building a cloud server. Customers also may upload their own OS Images to Cloud Data Center. CenturyLink and customer provided images include standard cloud support, where Customers may call the CenturyLink 24x7 help desk for assistance with cloud functions. Examples include how to create a firewall rule, configure the VPDC load balancer, clone or gain access to a CenturyLink provided image.

Customers can monitor their cloud servers and load their own software applications. CenturyLink does not provide any monitoring or management of Customer-provided software or services.

Image Management Option

Customers may select the Image Management option when building cloud servers based on CenturyLink provided Windows and Red Hat Images. See the *Cloud Data Center User Guide* for details on which versions of these OS's are available for CenturyLink Image Management.

In addition to standard cloud support, customers may call the CenturyLink 24x7 support desk for questions or issues with their cloud server Operating System images with the Image Management option. CenturyLink proactively monitors cloud servers and OS with the Image Management Option.

The Savvis CenturyLyink Intelligent Agent (CIA) monitoring system is enabled as part of Image Management Option. This provides CenturyLink's ' proactive monitoring capability. CIA can also be configured to provide customer alerts based on cloud server resource utilization thresholds. CenturyLink Image Management does not include monitoring or support for customer provided applications or software.

Software and Security Patch Deployment – Managed Images

Standard CenturyLink Provided Images

CenturyLink maintains the patch level of standard CenturyLink provided Operating System images provided to the Customer at the time of vServer build. These standard images are updated on a regular basis with CenturyLink approved security patches, service packs and hot-fixes in order to maintain the overall integrity and performance of the virtual servers. After vServer build, Customers are responsible for maintaining the patch level of their vServers.

If any third party software, including any corresponding documentation, is provided to Customer by CenturyLink in connection with the Service, Customer agrees to use such third party software strictly in accordance with all applicable licensing terms and conditions. CenturyLink makes no representations or warranties whatsoever with regard to such third party software.

Patching with the Image Management Option

For CenturyLink Provided Images with the Image Management option, Operating System Patches will be deployed on production servers in coordination with Customer's requirements. The SavvisStation portal displays available Windows patches under the server detail section. Sometimes a reboot is necessary when a patch is distributed and installed, which CenturyLink will conduct as coordinated with the Customer.

Operating System Service Packs

All service packs are evaluated and tested on the standard CenturyLink provided images. CenturyLink will integrate the service pack into the CenturyLink provided image build only after testing has demonstrated its stability and performance benefits. All applicable new servers will be automatically configured with this new base build. Customers with existing Cloud Data Center virtual servers with the Image Management Option may request an upgrade during maintenance windows that will be coordinated with the Customer.

Premier Hot-Fixes and Patches

All hot-fixes and non-security patches are evaluated for impact and urgency and follow the same testing and integration guidelines as service pack upgrades. Non-critical patches and hot-fixes are typically incorporated into the CenturyLink standard system build on a quarterly basis.

CenturyLink uses third-party anti-virus software in conjunction with centralized management tools to maintain AV policy control and regular signature file updates. Anti-virus technology provides reasonable protection against malware, including viruses, spyware and trojans, however such technology cannot ensure the prevention of such malware. Should disruption or changes occur due to malware, CenturyLink will use commercially reasonable efforts to promptly remedy the situation after being notified of the problem, however CenturyLink will not be responsible for any damages due to worms, phishing attacks, rootkits, trojan horses or other such malware, including infection of end-user devices or lost or corrupted data/messages. Standard practice has Anti-Virus software included with Windows OS and by request only for Red Hat OS.

User Privileges

CenturyLink provides virtual system, hardware and operating system management to the Customer for the services. Customers receive full Root or Administrator access for standard CenturyLink Provided Images. For servers with the Image Management option, CenturyLink maintains full Root or Administrator access on Cloud Data Center virtual servers. Customers are granted a limited Administrator and regular user level account after the automated provisioning is complete. It is CenturyLink's security policy that root logins be limited to console access only and any such access is logged. In certain situations,

Customer may require higher level access in order to effectively manage certain applications that are running on virtual servers. In such cases, Customer may request such higher level access and CenturyLink will grant such access subject to Customer acknowledging in writing that any Service to which Customer is granted root or any similar level of access shall be excluded from any otherwise applicable SLA and CenturyLink shall have no responsibility whatsoever to the extent the applicable Service incurs any incident, outage or other service issues caused by any act or omission of Customer.

Linux/Unix-Based Servers

If Customer is running Red Hat Linux with the Image Management option, privileges will be set by CenturyLink's system engineering to provide Customer with the appropriate level of authorization on the system in order to manage its applications. CenturyLink provides "pseudo" access, which permits specifically authorized users to execute certain privileged commands without explicitly being root on the system. This recommended practice limits access to the system level configuration and resources that CenturyLink will maintain. CenturyLink also provides a regular user level account to Customer's with Unix-based servers.

vServer Quantity Restrictions

Each Cloud Data Center Org vDC and vApp is designed to scale to a high number of vServers. The actual limits on the size of a vDC or vApp are determined by VMware software limitations.

Each org supports a maximum of 3,000 vApps

Each vApp holds a maximum of 128 vServers

*Similarly, we have a limit of 100 Networks per VDC.

Compatibility

CenturyLink will update all Cloud Data Center infrastructure firmware and software. Any incompatibility caused by Customer controlled component software, tools, or OS versions not aligned with CenturyLink defined standards, may result in the inability of Cloud Data Center automation to function, for CenturyLink to support the vServer and voids Cloud Data Center SLA's for affected system components.

Locations

 Cloud Data Center is available at the following CenturyLink Datacenters:

Region	City	Data Center Name
US West	Santa Clara, CA	SC9
US East	Herndon, VA	DC4
EMEA West	Slough, UK	LO1

Definitions

API is defined to mean an Application Programmable Interface implemented by a software program which enables it to interact with other software.

HAN means CenturyLink Hosting Area Network.

High Availability (HA) means that active physical or virtual hardware elements will fail over to standby physical or virtual hardware elements in the case of failure, with minimal system downtime.

Hypervisor is defined to mean the hardware virtualization software used with CenturyLink Cloud Data Center that allows multiple Operating Systems to run concurrently on a host computer.

Storage means Cloud Data Center Storage Area Network (SAN) Storage with dual paths and multi-path software functioning for automatic failover.

Term of Service is the period of time a cloud resource is in existence.

vCPU means the virtual compute processor core allocated to a virtual machine during a Cloud Data Center design and build process. The size and speed of the vCPU is based on the selection made by the Customer and the level of service.

vRAM means the virtual random access memory allocated to a virtual machine during a Cloud Data Center design and build process. The amount of vRAM is based on the selection made by the customer and the level of service.

vServer means a virtual cloud server with a CenturyLink provided Operating System image running within a Cloud Data Center vDC.

vDC means a Customer's Virtual Data Center within the Cloud Data Center**.**

CDC Infrastructure is the physical and virtual infrastructure that underlies Cloud Data Center services. The CDC Infrastructure is not visible or accessible to customers. This infrastructure includes Internet Bandwidth, Hypervisors & Server Clusters, Hosting Area Network (HAN), Storage Area Network (SAN), and Power that supports Customer's vDCs