What’s New in VMware vCloud™ Director 1.5

TECHNICAL WHITE PAPER
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Introduction

VMware vCloud™ Director is a software solution that enables enterprises and service providers to build clouds delivering Infrastructure-as-a-Service (IaaS), giving end users the agility they demand, and giving IT the efficiency they require. Only VMware vCloud Director offers the cloud without compromise—the ability to run an efficient cloud securely within a datacenter, and the option to bridge to an ecosystem of over 3,000 service-provider partners.

By building secure and cost-effective clouds with VMware vSphere™ 5.0 (“vSphere”) and VMware vCloud Director 1.5, IT organizations act as true service providers for the businesses they support, driving innovation and agility while increasing IT efficiency and enhancing security. This solution provides a pragmatic path to cloud computing by giving customers the power to leverage existing investments and the flexibility to extend capacity among clouds.

Integrated VMware vShield™ Edge technologies, such as perimeter protection, port-level firewalling, network-address translation, and DHCP services, offer virtualization-aware security, simplify application deployment, and enforce boundaries required by compliance standards in the private cloud.

VMware vCloud Director 1.5 introduces powerful new features to help accelerate the customer’s evolutionary journey to cloud computing. This paper presents the new capabilities that help customers to improve the agility of workloads in the cloud, simplify management, and build a true secure hybrid cloud infrastructure.
Improving Agility in the Cloud

VMware vCloud Director 1.0 helped customers to build agile IaaS cloud environments that greatly accelerated the time-to-market for applications and responsiveness of IT organizations. VMware vCloud Director 1.5 adds the following new features, which accelerate application delivery in the cloud:

• Fast provisioning using linked clones
• Third-party distributed switch support
• vSphere vApp custom guest properties

Fast Provisioning Using Linked Clones

In VMware vCloud Director 1.0, virtual machine provisioning operations resulted in the creation of full clones, delivered to users within minutes through a simple Web portal. The enablement of linked clones in VMware vCloud Director 1.5 means that users no longer have to wait for a full copy each time they deploy a vSphere® vApp (vApp). VMware vCloud Director links clones together so that common elements are stored only once. This improves agility in the cloud by reducing provisioning time, from minutes down to seconds, and reducing the cost of storage by up to 10x.

Figure 2. VMware vCloud Director Fast Provisioning Using Linked Clones
Behind the Scenes

Let’s start with a virtual machine in the catalog or a virtual machine that has been deployed by the user in their cloud. We would like to make a linked clone of this virtual machine.

Typically in a virtual machine, writes go to the VMDK and reads come from the same VMDK. In Figure 3, Virtual Machine 1 is a normal virtual machine in which reads and writes go to the same VMDK. When a new virtual machine is provisioned, a small 16MB VMDK, or empty delta disk, is created. This takes very little time to create and occupies very little space on the disk. In Figure 3, the writes go to the new delta disk, which grows to accommodate the writes. Reads, on the other hand, traverse up the chain until the desired block is found.

Cross Datastore–Linked Clone Management

VMware vCloud Director leverages linked clones available in the vSphere platform that are limited to a single datastore. To enable linked clones to be deployed across datastores in the cloud, VMware vCloud Director uses a mechanism called shadow copying. When VMware vCloud Director determines that it would be more advantageous (for space or performance reasons) to place a clone on a different datastore than that on which the source resides, a shadow copy is created. A shadow copy is a full clone on the destination datastore from which other linked clones can be built. Such a copy happens without user intervention, and substantially reduces the storage management overhead inherent in using linked clones. In Figure 4, a shadow virtual machine (VM S) is first created when a linked clone must be placed on a different datastore than the source. This shadow copying is made regardless of whether the destination resides in the same VMware vCenter Server or a different VMware vCenter Server. If the request is made to a different VMware vCenter Server, VMware vCloud Director uses its image-transfer service to make a copy to the new VMware vCenter Server. Again, no special configuration is required from the VMware vCloud administrator for this to happen. After the shadow virtual machine is created, subsequent linked clones (VM L in Figure 4) are as fast as linked clones from the original virtual machine.
Use Cases

There are many interesting use cases and applications for fast provisioning in VMware vCloud Director 1.5. Test and development users can employ linked clones to spin up multiple copies of vApps to save time and storage footprint. When a new build is available, QA users can use linked clones to deploy builds quickly and run their tests. Systems engineers in the field can demonstrate their products by quickly deploying copies of an entire application stack in the cloud. Support engineers can quickly replicate customer configurations to root cause and troubleshoot customer issues.

Third-Party Distributed Switch Support

VMware vCloud Director 1.0 supported the use of third-party distributed virtual switches for provisioning portgroup-based network pools.

Using VMware vCloud Director 1.5, customers can now use third-party distributed switches to programmatically create VLAN-based and, in some cases, VMware vCloud Director network isolation-based network pools in a VMware vCloud environment.
VMware vCloud Director leverages VMware vShield Manager to automate the creation of isolated networks on the third-party distributed virtual switch. When a new layer 2-isolated network must be created in the cloud, VMware vShield Manager makes an API call to create a portgroup on the third-party distributed switch, with the appropriate isolation mechanism. When virtual machines are attached to this portgroup by VMware vCloud Director, they now communicate on a layer 2-isolated segment that is isolated using VLANs or using VMware vCloud Director network-isolation technology.

Leveraging third-party distributed switches with VMware vCloud Director is completely transparent to the users in the cloud. Cloud administrators, however, can now use third-party tools to gain insight into, and manage virtual networking inside, a cloud environment.

**vApp Custom Guest Properties**

Users can pass custom data into the guest operating system (OS) of vApps that are deployed in VMware vCloud Director. For application developers or application owners, this opens up many new avenues for customization beyond what was available with the limited OS customization in VMware vCloud Director 1.0.

**Behind the Scenes**

The vApp template author declares Open Virtualization Format (OVF) properties when creating the template. The author installs guest software and scripts, and exports the template as an OVF package.

During deployment, the vApp prompts the user for deployment-time values. After populating custom values, the user powers on the vApp.

After the vApp is powered on, the OVF environment is automatically generated by VMware vCenter and published into the virtual machine on either a “virtual ISO” or the guestinfo variables. Software running within the guest can then consume this data to customize applications or reconfigure software deployment options.
Arbitrary key/value pairs can now be passed into the guest operating systems using the OVF environment variables. The data can be defined at the vApp level and at the virtual machine level. Data defined at the vApp level is propagated to all virtual machines in the vApp. Data defined at the virtual machine level takes precedence if the same key is defined at both the vApp and virtual machine levels.

Use Cases
The guest’s ability to initialize the virtual machine with user-specified parameters is critical to use cases involving personalization for purposes of secure access, enabling configuration management, and customization bootstrapping.

A cloud user can parameterize their guest virtual machines for a variety of purposes including:

• Initializing personalization procedures, such as Kickstart or Windows Automated Installation Kit
• Establishing security keys/authorization credentials for remote access, for instance, for SSH keys
• Providing configuration/identity to bootstrap configuration management systems/automation systems, for instance, configuring Chef, Software Configuration Management (SCM), and so on
• Passing executable scripts to virtual machines to enable further customization

IT administrators can personalize a virtual machine before handing it off to their users. They can build a turn-key virtual machine provisioning system that meets their requirements for security and manageability, such as with the following:

• Initializing a virtual machine in such a way that it is started from a common (multitenant) template, but on instantiation is securely associated with a single tenant (for example, installing SSH keys and setting initial passwords)
• Providing a virtual machine-specific configuration to enable management services, such as a webmin console, and so on
• Passing on information about which virtual datacenter a virtual machine is running in—for example, an application can be instructed to read the “location” variable and connect to the “Dev” database when running in a development virtual datacenter, or it can connect to the “PrepProd” database when running in a staging virtual datacenter
Simplifying Management

VMware vCloud Director 1.5 introduces new features that help to reduce the cost of deploying an IaaS cloud offering and simplify the management of the VMware vCloud environment. The following new features are discussed in this section:

- VMware vCloud messages
- Expanded VMware vCloud SDK and API
- vSphere 5.0 support
- Microsoft SQL Server support

VMware vCloud Messages

The VMware vCloud messages feature introduces the capability to connect a VMware vCloud Director deployment with existing IT management tools in the enterprise, such as CMDB, IPAM and ticketing systems.

![Figure 6. VMware vCloud Messages Enable IT to Connect VMware vCloud Director to External Systems](image)
Behind the Scenes
VMware vCloud Director can be configured to post notifications or messages to AMQP-based enterprise messaging brokers. A notification consumer is also needed to retrieve messages from the messaging system, and to connect to the external IT system.

![Diagram](image.png)

**Figure 7.** VMware vCloud Director Posts Messages to an Enterprise Message Bus That Can Be Consumed by a Notification Consumer

There are over 100 tasks for which VMware vCloud Director posts messages to the AMQP messaging system. These messages are notifications that the event has occurred. These notifications help provide visibility into the VMware vCloud environment, and allow enterprises to integrate actions happening within their cloud to a global CMDB or other management data repository. A subset of these tasks can be configured to wait for a reply to the notification. VMware vCloud Director will publish the message to the same message bus, then wait for a reply to either abort or proceed.

Use Cases
Interesting use cases are unlocked when connecting VMware vCloud Director with external IT systems. For example, when a user or application owner makes changes to virtual machines in a vApp, VMware vCloud Director can post a message on the message bus that the change has been made. The notification consumer can take that message and make an update in the CMDB.

If tasks are configured to wait for a reply, external approval mechanisms can be integrated. When a user makes a request to deploy a vApp, VMware vCloud Director posts a message on the message bus and waits for a reply. The notification consumer receives the message and sends an approval request to an approver. When the approval is received, VMware vCloud Director continues the task and deploys the vApp. If the request is rejected, VMware vCloud Director does not provision the vApp.

Other use cases include asset tracking and inventory management (for example, license consumption), audit logging, configuration of physical infrastructure adjacent to VMware vCloud Director (for instance, DNS updates, or server/storage/network provisioning), and compliance checking for content moved in or out of the cloud.

Expanded VMware vCloud SDK and API
Hybrid clouds are impossible without both cross-cloud standards and management interfaces. The VMware vCloud API is a rich interface that provides for the consumption of resources in the cloud. It enables deployment and management of virtualized workloads in private, public, and hybrid clouds. The VMware vCloud API enables the upload and download of vApps along with their instantiation, deployment, and operation.

VMware vCloud Director 1.5 continues to add functionality to the VMware vCloud API and now includes all GUI-accessible actions. Additionally, 1.5 makes a number of changes to enable broader integration and scripting using the API. Many of the new commands make it easier for developers to build functionally complete applications. For example, VMware vCloud Director 1.5 also introduces a VMware vCloud API query service, which can significantly improve developer efficiency, by minimizing the number of API requests and the amount of data transferred for an API client to obtain needed information. Example query parameters include sorting and ordering, pagination, filtering, projection, and expressions.

To support the new features of VMware vCloud Director 1.5, the VMware vCloud SDKs for Java, PHP, and .Net have been updated with new classes, functions, and sample code, to allow programmers to take full advantage of the cloud platform.
Use Cases
Here are some example use cases for using the improved VMware vCloud SDK and VMware vCloud API:

• Building a front-end VMware vCloud portal UI using the API
  - Simplifying construction of table views in a UI
  - Simplifying code required to navigate the Org vDCs, networks, and so on
• Building inventory-related integrations (CMDB, billing, and so on)
  - Simplifying construction of an inventory of the cloud
  - Simplifying the process of zeroing-in on specific objects in the inventory using the API query service
• Building better scripting/automation tools
  - Selecting sets of objects to iterate over
  - Searching and filtering for specific properties of an object
  - Presenting data in a manageable format using the API query service

vSphere 5.0 Support
VMware vCloud Director 1.5 adds support for the vSphere 5.0 platform. This enables cloud operators to take advantage of major feature improvements in the world’s leading virtualization platform, including the following:

• Support for virtual hardware version 8 that enables virtual machines to scale up to 32 vCPU and 1TB vRAM; this enables users to run the most demanding applications in the cloud
• Support for vSphere® Auto Deploy (Auto Deploy) support, which decreases the time required for VMware® ESXi™ installation and configuration of VMware ESXi resources for cloud consumption

Microsoft SQL Server Support
VMware vCloud Director 1.5 adds support for Microsoft SQL Server databases in addition to Oracle databases. This enables organizations to leverage existing investments and database skill sets and to reduce the cost of building and operating the cloud. For a list of supported database versions, refer to the vCloud Director Installation and Configuration Guide.

Globalization
VMware vCloud Director 1.0.1 complies with Internationalization Level 1, meaning that VMware vCloud Director can run on non-English operating systems and can handle non-English text. VMware vCloud Director 1.5 now complies with Internationalization Level 2, meaning that it can handle locale-specific items, such as date/time format, number format, time zone, currency, calendar differences, and so on. Moreover, VMware vCloud Director 1.5 adds localization support for six additional languages – Japanese, simplified Chinese, French, German, Spanish, and Italian – providing users around the globe with easy access to a VMware vCloud Director Web console that is fully translated into their native languages.
Deploying a Secure Hybrid Cloud Infrastructure

VMware vCloud Director 1.5 expands on the embedded security and networking features in VMware vCloud Director 1.0, and adds powerful features to programmatically set up secure connections in cloud environments. The following features are discussed in this section:

1. VMware vShield Integration
   a. Five-tuple firewall services
   b. IPSec VPN services

VMware vShield Integration

VMware vCloud Director 1.0 delivered unprecedented agility and embedded security by allowing users to programmatically deploy software firewalls and NAT and DHCP services at the network edge. VMware vCloud Director 1.5 expands on this by delivering full five-tuple firewall and IPSec VPN capabilities.

Five-Tuple Firewall Services

VMware vCloud Director 1.0 delivered integrated VMware vShield Edge firewall technologies, which allowed customers to deploy software firewalls at the network edge in an agile and flexible fashion. Customers could control the traffic based on destination address, destination port, and protocol (TCP/UDP).

VMware vCloud Director 1.5 expands on the integrated vShield Edge cloud security capabilities to include full five-tuple firewalls (destination IP, destination port, protocol, source IP, and source port). The five-tuple firewalls enable users to control network access using source and destination information, significantly increasing network edge security.

IPSec VPN Services

Only VMware vCloud offers the cloud without compromise, and the flexibility to run workloads internally or with any VMware vCloud partner. The vShield VPN functionality available with VMware vCloud Director establishes a secure site-to-site VPN tunnel between clouds.

With VMware vCloud Director 1.5, organization administrators can start to establish VPN tunnels in a self-service manner using the VMware vCloud Director UI or API, without waiting for a system administrator or IT provider to set it up for them. This reduces the time and cost of establishing a VPN tunnel to the cloud for both consumer and provider. Interesting cloud deployment models are unlocked when using programmatic IPSec VPN tunnels in a VMware vCloud environment.
In Figure 9, an organization has capacity in two clouds. One cloud is a private cloud and the cloud on the right is a public cloud from which the user has leased capacity. The organization has resources in both clouds and plans to connect the resources together. Users with the appropriate permissions can now, in a self-service fashion, establish a secure VPN connection between the organization networks in the two clouds.

![Figure 9. VPN Connections Across Clouds](image)

Inside a private cloud or public cloud, an organization can create a tunnel between two of its organization networks.

![Figure 10. VPN Connections Between Organization Networks in the Same Cloud](image)

Users can also create a tunnel to a remote third-party VPN end point.

![Figure 11. VPN Connections Between Organization Networks and Third-Party VPN Endpoint](image)
Use Cases
The programmatic IPSec VPN creation feature truly enables hybrid cloud architecture.
For example, organization administrators can create IPSec VPN connections for data or workload transfer within clouds or across clouds. Other examples might include the creation of VPN tunnels for applications which run in a public cloud but must be authenticated or connect to resources remaining inside the corporate datacenter.

Conclusion and Next Steps
VMware vCloud Director helps customers build private and public Infrastructure-as-a-Service clouds on top of the industry leading vSphere platform. VMware vCloud Director provides increased agility and efficiency in the datacenter and also improves security and control.

This paper presented the exciting new features in VMware vCloud Director 1.5 that dramatically increase agility and deliver improved cost savings, simplify management, and secure isolation in the cloud, enabling users to build a true hybrid cloud infrastructure by programmatically connecting clouds in a secure manner.

VMware Contact Information
For additional information or to purchase VMware vCloud Director, VMware’s global network of solutions providers is ready to assist. If you would like to contact VMware directly, you can reach a sales representative at 1-877-4VMWARE (650-475-5000 outside North America) or email sales@vmware.com. When emailing, please include the state, country, and company name from which you are inquiring. You can also visit http://www.vmware.com/vmwarestore/ to purchase VMware vCloud Director online.

Providing Feedback
We appreciate your feedback on the material included in this guide. In particular, we would be grateful for any guidance on the following topics:
• How useful was the information in this guide?
• What other specific topics would you like to see covered?
• Overall, how would you rate this guide?

Please send your feedback to the following address: tmdocfeedback@vmware.com, with “VMware vCloud Director 1.5 What’s New Guide” in the subject line. Thank you for your help in making this guide a valuable resource.