NaviCloud Director

Service Level Description (SLD)

October 19, 2017

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1. PURPOSE

This service description details Navisite's NaviCloud Director service. Modern enterprises expect their compute solutions to enable greater business innovation and agility by creating a harmony between the speed and performance of a dynamic cloud with the stability of a traditional data center. NaviCloud Director drives business growth by enabling rapid deployment of business-critical resources in a usable, scalable and efficient manner, while enabling transparent access to cloud or physical workloads. When aligned with Navisite's comprehensive suite of enterprise-class solutions, NaviCloud Director empowers preparation for the future, rather than adapting to the past.

This document is not a legal or binding agreement; instead, it is intended to be an operational description of a Navisite service.

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2. SERVICE DESCRIPTION

NaviCloud Director is unique in the marketplace – mixing the scalability and rapid provisioning of a cloud computing platform with the enterprise-level controls and architectures that Navisite has perfected through years of hosting large and small customers. The major differences between Director and other solutions on the market lie in the innovative NaviCloud architectural platform:

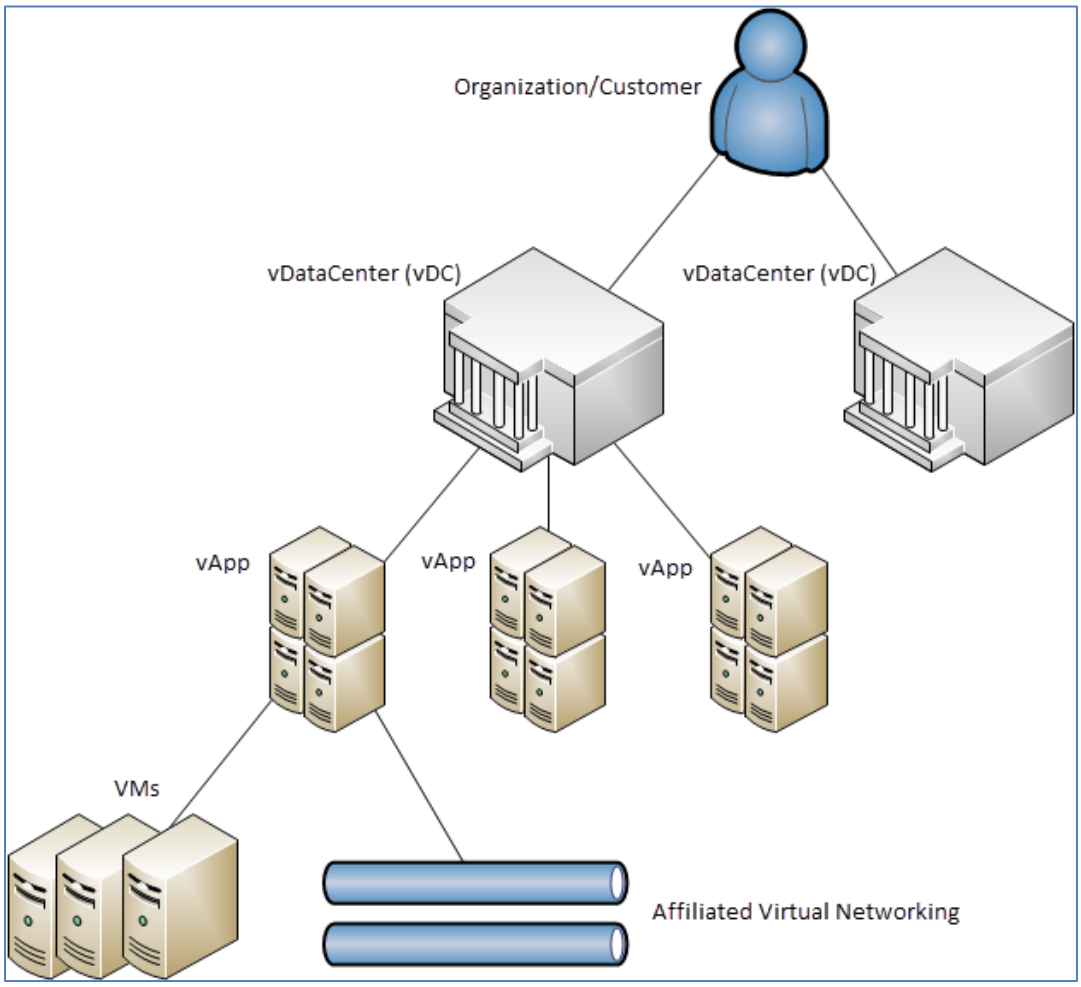
- **Enterprise-class resources** – Rather than utilize low cost components, Navisite uses the same hardware and software used in many physical implementations. Storage is provided via a high performance storage area network (SAN) units; compute is provided by Intel-based server blades; and virtualization is handled by the VMware hypervisor.
- **Software Defined Networking -** Routing, switching, load balancing and firewall services are delivered via components built in to the VMware hypervisor. By providing all of these services via software as opposed to physical solutions, NaviCloud Director allows for customers to build, alter, or destroy customized networking environments without manual intervention from Navisite engineers.
- **Security** – Modern computing environments are beholden to an ever evolving host of regulations such as PCI DSS, HIPAA, and NIST 800-53. NaviCloud Director was designed not to adhere to a single security framework, but to allow our customers to choose their own framework and build accordingly. Inherent functionality such as auditing of user activities and easy export of configuration data coupled with numerous third party solutions from Navisite partners provide a rich feature set from which a compliant environment can be built.
- **Flexible Architectures** – Rather than dictate the network or VM configuration for customer environments, NaviCloud provides a framework, enabling customers to allocate VMs to as many network segments as needed and allocate VM resources (e.g. CPU,

memory, and disk space) independently rather than in small/medium/large configurations. Navisite also recognizes that not all applications run well in a virtual environment, and allows for hybrid environments where one leg of a firewall may run to physical hosting environment at Navisite or to a VPN back to the customer's location.

- **Availability** – Despite the ease of creating and destroying virtual machines in a cloud environment, servers are generally created for hosting an application that needs to stay accessible to end-users. Navisite hosts all VMs on highly available server nodes to meet the 99.999% SLA for cloud resources.
- **Performance** – By utilizing enterprise-class components, NaviCloud VMs have access to as much CPU and memory as is required for the client application. 10 Gigabit connections between all hardware components further ensure that I/O and network contention does not become a hindrance to application performance.

The remainder of this document details these attributes and their workings in NaviCloud.

2.1. Basic Terminology



- Navisite maintains multiple pools of cloud resources known as vClouds. Each vCloud may be in different geographic locations or multiple vClouds may exist within a single location but with isolated resources. Customers are able to access all vClouds and may use whichever one is appropriate for their business needs.
- Each NaviCloud Director customer has a single Director account with access to one or more vClouds. Within each vCloud, the customer can create multiple Virtual Data Centers (vDCs). A vDC is a group of resources within a vCloud that can be separated based on geographic location (one vDC on the east coast and one on the west coast) or on consumption models (one vDC can have a fixed amount of resources for budgetary purposes while another has unlimited resources).
- Within each vDC, there are one or more virtual applications (vApps). A vApp is a collection of virtual machines and networks that make up an application. These could range from a simple file sharing application on a flat network up to an application with over 100 VMs on multiple networks. By combining the VMs and requisite networking functionality into a single package, it is much easier to manage and manipulate the application as a whole.

2.2. NaviCloud Resources

The core components of the NaviCloud platform are the computing resources that are used to create virtual machines. These resources can be added or removed from VMs -- via Director -- by the customer as the need arises. The resources are:

- CPU – This is the basic processing power that is utilized by VMs to perform computing tasks. The underlying virtualization technologies allow for the abstraction of a physical processor in a manner that allows it to be utilized by many virtual machines. When a VM is created, the customer has the ability to allocate the desired number of virtual CPUs and can modify the number at a later time without rebuilding the VM.
- Memory – With the great advances in the speed of CPUs, memory has become the limiting factor for most servers. As with vCPU, customers can allocate the amount of memory needed to a VM at time of creation and change it as business needs change. Navisite does not oversubscribe the cloud platform in terms of memory, meaning that VMs never have to worry about not receiving all of the resources they have been allocated.
- Disk – All NaviCloud storage is on an enterprise-class Storage Area Network (SAN) that provides multiple paths to high-performance disk. Unlike CPU and memory, disk does not ebb and flow, but stays more constant. Additional storage can be allocated to running VMs without the need for a reboot.
- Bandwidth – All bandwidth comes from the Internet into the vClouds for accessing the individual VMs and vApps. While traffic within each vCloud does not incur charges, any communication outside the vCloud will incur charges based on the rate card in Director.

2.3. vApp Provisioning

NaviCloud Director customers are given access to Director, which provides the following capabilities:

- vApp creation – Virtual applications can be created based on pre-configured Navisite templates, or customer-specific templates. Individual VMs can be created from existing templates, customer-supplied images, or uploaded installation media. The customer is able to specify the amount of CPU, memory, disk, networking information and hostname. Networking information can come from either a DHCP range or a static address pool depending on customer requirements.
- vApp Modification – Once a vApp has been created, there may be a need to add or remove managed services, VMs, or computing resources. Director provides functionality for changing the number of virtual CPUs or memory allocated to a particular VM, as well as adding disk space. Networking functionality such as adding or removing virtual network interface cards (vNICs) and adjusting firewall or load balancing rules can also be performed.
- Creation of templates – When a vApp has been built up to a point where it embodies all of the key attributes of an application or server that may need to be replicated, it can be copied into a template for future use. During this process, the vApp or VM will be copied into the list of available customer templates and will be added to the total amount of disk space allocated to the environment.

2.4. NaviCloud Director Networking

NaviCloud Director provides for a much more dynamic networking model by utilizing software based networking instead of traditional physical devices. This differentiator allows for far more creativity and flexibility on the part of the customer in determining exactly how their environment is laid out. The customer has the ability to provision public IP addresses and internal network segments (with addresses of their choosing) within each vDC. Additional network segments can also be provisioned within the individual vApps. Traffic flows within the vApps and out to the larger vDC and Internet are still controlled by firewalls, but easy to use wizards have been created to simplify the sometimes confusing task of setting up the appropriate ACLs and NAT configurations. These wizards allow for much shorter durations to set up complex environments. By keeping all relevant networking constructs within the vApp, it becomes much easier to troubleshoot and clone applications for scaling purposes.

2.5. Access Methodologies

Navisite has designed the Director portal to provide most of the functionality required to provision and maintain a virtual environment, but also recognizes that customers may have additional functionality requests or need to interact with the environment programmatically. To that end, customers also have the ability to access the environment through the VMware vCloud Navisite portal that can be launched from within Director. The vCloud Navisite portal allows for more fine-grained control of some aspects of a vApp that have not yet been added into the Director platform but are still capabilities of the underlying platform.

For those customers who wish to utilize third party provisioning tools or a direct programmatic interface, Navisite also makes available the vCloud API which has been extended to also include other functionality that has been built into the NaviCloud Director platform. Both Director and vCloud Navisite portal interface through this API, so our customers can be sure that they get the same level of direct access as the provisioning portals. More information and the URL for the API can be found within the Director portal.

2.6. Billing Model

As an agile and dynamic product, NaviCloud Director is designed for the rapid creation and deployment of new features and functionality. In order to keep up with the rapid pace of innovation, the billing system must also be dynamic. Navisite has created a point based system with all rates and tracking within the Director portal to ensure that customers have access to pricing and utilization for all features without the need to sign another sales order or to call their account team. The primary components of this system are the points, the rate card, Director reporting, and the monthly bill.

2.6.1. Points

Rather than assign specific dollar amounts to each of the NaviCloud Director services, points are assigned for purposes of aggregation and consolidation. Each service has a unique point value for a stated time period; for example virtual CPUs have a point value per hour, memory is measured in GB-hours, etc. Each resource is tracked independently and aggregated into a point total for the individual VM, vApp, or other construct. Projected point consumption is displayed when creating a VM or vApp, maximum point values are shown when setting limits on a vDC, and past consumption can be shown for each construct from the billing tab of Director.

To determine the cost of an individual VM, a simple calculation can be done for each resource:

- Number of vCPUs times points per vCPU per hour
- Amount of memory times points per GB of memory per hour
- Amount of disk times points per GB of disk per hour

These values can be added up to determine the cost of the VM per hour or per month. This is performed automatically in Director and is displayed on the individual VM screens with a cost for when the VM is running (all resources) or when it is powered off (just the disk). These values roll up to vApp screens as well.

2.6.2. Rate Card

On the billing tab, the most recent rate card can be found. Each line has the name of the resource, the point value, and then the unit being measured. For example, the CPU line indicates a point value and then states that it is measured in vCPUs per hour. As new services become available they will be automatically added to the rate card at the same time that the functionality becomes available in Director. This negates the need to sign a new sales order each time services are added.

2.6.3. Director reporting

Within the billing tab of Director, point totals are displayed for the current and past months. By default these are shown at a vDC level, but the customer also has the ability and click on each item to drill down into the vApp or VM to determine the cost of each component. As with all lists in Director, these can be downloaded as a CSV (comma separated value) for independent analysis by the customer.

Additionally, because NaviCloud Director services may change over time, each month displayed within the billing section will also contain the rate card at the end of that month as a reference. This allows our customers to verify their bill with the same data used for calculations even after the rate card changes.

2.6.4. Monthly Bill

At the end of the month, all points consumed by the customer are aggregated. This aggregation occurs across resource types (CPU, memory, etc.), virtual data centers, and even geographies. This point total is then sent to the Navisite billing engine where it is converted into the customer's currency as reflected on their sales order, and has automatic discounting applied based on total consumption. By discounting based on total consumption, not consumption of individual resources, Navisite is able to reward our partners who continue to grow their business on NaviCloud without the need for additional price negotiations. This is one less thing for our busy customers to worry about.

2.7. Supported Operating Systems and Software

Navisite provides basic operating system templates within Director for a select grouping of operating systems. While some templates are available free of charge, others may have special licensing fees that will be reflected on the rate card and referenced from the template. Any licensed software provided by Navisite may not be removed from Navisite unless the license keys are removed prior to export.

Customers are welcome to provide their own licenses for operating systems or applications beyond what Navisite provides. Customers are responsible for maintaining compliance with their own vendor software agreements.

2.8. Additional Services

As a dynamic platform, additional functionality will be added to NaviCloud Director on a regular basis. The most recent documentation regarding features and pricing will always be found within the Director portal itself and should be regarded as the authoritative source for feature, functionality, and pricing information. NaviCloud Director is designed to allow customers to pick and choose additional services on a VM by VM basis based on specific business needs. The following services are currently available within the Director portal.

2.8.1. Anti-Virus Services

Protecting computer systems from malware is a critical requirement for any computing environment, and Navisite is pleased to help mitigate these threats on our NaviCloud Director platform through our Anti-Virus (AV) services. Our AV service utilizes a leading enterprise AV platform to protect Windows VMs at a hypervisor level so that our customers do not need to install agent software within their VMs. This leads to a much more streamlined user experience and eliminates the need to use VM resources for protection from malware.

When a customer requests access to the AV service through the NCD interface, an individual Trend Micro console is automatically provisioned within the customer environment and can be accessed under the “Services” section of Director. Within the AV console, customers are able to select VMs to be protected, review alerts, and remediate any malware events. AV signatures are automatically updated daily.

2.8.2. OS Patching Services

In order to keep customer virtual machines (VMs) up to date with the most recent critical patches, we are pleased to provide operating system patching (OS patching) services for Microsoft Windows VMs. This service utilizes an enterprise class OS patching platform. The service has been designed and implemented so that our customers have the ability to install the software agent on their own from binaries already within the Navisite VM templates or through a link in the Navisite portal. VMs that have the agent installed and patching services enabled through the Navisite portal will receive new patch updates as they become available. All installation instructions will be provided through a website link when the service is enabled.

The Navisite engineering team will maintain a master list of all critical and security patches from Microsoft. Upon first subscribing to the patching service and installing the software agent, each VM will be updated with all of the patches currently in the master set. The Navisite engineering team will update the master set on a monthly basis and those patches will be automatically delivered to and installed on all VMs subscribed to the service at a predefined, after-hours time. For those patches that require a reboot to take effect, the VM will be rebooted automatically. The patch window is not adjustable by the customer. Customers will be provided notice of the patches to be deployed prior to the delivery window and can choose to remove any VMs from the patching service if there are concerns about the impact of individual patches. In the event of emergency patches released by Microsoft outside of the regular monthly cycle, a special notice will be provided to all subscribing customers and the patch will be distributed and installed in a more timely fashion.

2.8.3. OS Monitoring Service

Even the most well designed and implemented compute services are always susceptible to unexpected events that could affect the integrity or availability of an application. Workloads should be monitored at an operating system level to ensure that applications can run in a predictable manner. In order to provide this functionality to workloads running on the NaviCloud Director (NCD) platform, we are pleased to offer monitoring services for NCD.

These monitoring services unite the ability of cloud to gather information through the VMware tools agent with the tried and true Navisite Custom Application Monitoring (CAM) system. When the customer enables monitoring services on a VM, a record of that VM is automatically added to the Navisite customer device database and can be viewed through the existing NaviWeb portal. Alerts generated from the monitoring will be sent to the Navisite Service Center (NSC) where they can be distributed or remediated through existing SSAE16 certified processes. By integrating into the same system used for physical and other managed services, this provides customers with a consistent user experience no matter what Navisite service is being monitored.

2.8.4. Managed VM Services

In addition to providing a robust suite of tools for customers to use for management of their VMs, Navisite can also utilize those same tools to manage the VM on the customer's behalf. Navisite will provide not only management of the above referenced services, but also OS hardening, troubleshooting, and modifications via well-defined and auditable change control processes. This service is provided on a VM by VM basis and allows our customers to offload the OS management burden to Navisite for a subset of critical or production VMs while still maintaining responsibility for less critical machines.

Navisite recognizes that maintaining an operating system has many facets and can be performed with a variety of tools. For those customers who already have an investment of capital or customization time in existing tools, Navisite allows the concept of joint management responsibility wherein some aspects are owned by the customers, and some are owned by Navisite. As an example, a customer may have an enterprise license for a different AV package than used by Navisite. That customer could install and manage that AV package on their VMs while Navisite provides for the patching, monitoring, troubleshooting, and other functions. In this manner a customer can pick and choose only specific management components from Navisite in order to maximize existing investments and minimize cloud costs.

2.8.5. Replication Services

The NaviCloud Director platform allows for the simple replication of a VM or VMs from one node to another for purposes of migration or as the basis of a disaster recovery plan. Navisite provides several different tools for use in replicating workloads, and while they have individual differences in how they work, the basic use cases are the same. For VMs within an existing NCD environment, a very simple interface is provided through which the customer can select the VMs to be protected as well as setting a Recovery Point Objective (RPO) that meets their business needs. After the initial sync between sites, the interface will provide a real-time measurement of the best possible RPO that could be provided for the vApp to allow the customer to adjust the configured RPO to the optimal setting.

Once synchronized, a vApp test migration can be done to ensure that the underlying application behaves in an expected manner in the event of a disaster or planned migration. In this way, the customer knows what to expect post-migration rather than simply hoping it will work.

For customers using NCD as a target for replication from their premise, software is installed within their local VMware environment and Navisite is configured as the replication target. They are

similarly able to select the VMs to be replicated as well as various other configuration components. Recovery testing can be performed at Navisite without impacting the production environment at the customer site. This mechanism can be used either as a part of a larger DR strategy or as a means of migrating workloads to Navisite.

2.8.6. Backup Services

Backing up workloads is a basic component of maintaining production applications but it can be cumbersome to install and maintain backup agents across a variety of operating systems. In addition, backup agents rob precious performance from machines that could otherwise be used for providing end-user services. The NaviCloud Director platform provides backups at the infrastructure level so as not to interfere with the configuration or performance of the virtual machines.

3. SERVICE AVAILABILITY

Navisite's NaviCloud Director service is available at the following Navisite Data Center locations:

- Andover, MA
- Red Hill, UK
- Santa Clara, CA
- Woking, UK

3.1. Installation Services

As a self-service platform, NaviCloud Director can be quickly deployed for customer use. Upon sign up, customers are provided with credentials to log into the Director portal and can then use the Software Defined Networking and virtual data centers to build out their environment in whatever way they see fit. NaviCloud Director is built on the notion of empowering our customers to build an environment to meet their business needs, not the other way around; we simply provide the tools for quick infrastructure deployment on which our customer's applications can be built.

3.2. Bulk Data Migration

Navisite supports the bulk migration of data from customer premises via USB attached storage media only. The customer is responsible for procuring and shipping the media to Navisite where the drives will be scanned for malware and connected to a jump server. For self-service solutions, the customer will be given instructions for accessing the data for migration purposes. For fully managed solutions, Navisite will migrate the data based on customer specifications. Once the data has been successfully migrated and the integrity is confirmed by the customer, the media will be removed from the jump server and shipped back to the customer. Managed migrations or multiple media devices for self-service migrations may incur professional service fees.