Red Hat Reference Architecture Series

Red Hat Cloud Infrastructure:

Managing a Red Hat Enterprise Virtualization 3.2 Infrastructure Using Red Hat CloudForms 2.0

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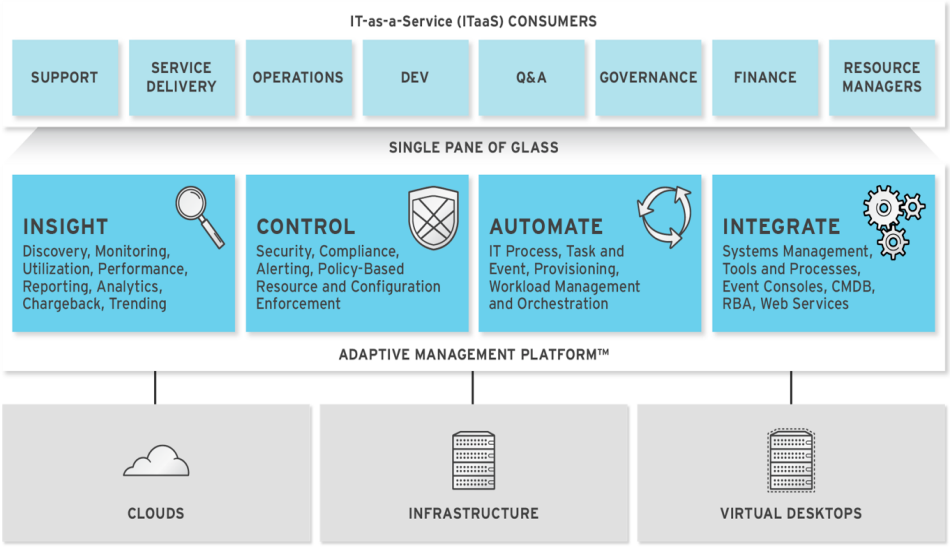
Table of Contents

1 Executive Summary

As the enterprise landscape continues to evolve and change, many IT leaders are faced with critical choices to meet current and future needs. One very important need always finds it's way to the top, how to optimize the management of their environment while reliably providing services to end-users.

Red Hat CloudForms 2.0 provides a set of Infrastructure-as-a-Service (IaaS) capabilities to orchestrate and manage both private and hybrid cloud environments helping to optimize existing infrastructure and plan for environment expansion using a comprehensive management platform. Capabilities include:

- automation
- provisioning
- reporting
- discovery
- trending
- compliance
- alerting
- utilization
- 3rd party integration



Although Red Hat CoudForms 2.0 offers almost limitless capabilities, the focus of this reference architecture is to demonstrate management and integration with Red Hat Enterprise Virtualization 3.2, in a private cloud setting, targeting five detailed use cases:

- Provisioning virtual machines through Pre-Boot Execution (PXE) and International Organization for Standardization (ISO) imaging
- Demonstrate Automation capabilities providing resiliency for a web server
- Integration with LDAP services to provide self-service user and group mappings along with self-service provisioning
- Demonstrate resiliency for CloudForms Management Engine (CFME) database services
- Demonstrate chargeback for managed resources

Disclaimer: Some features of this reference architecture may not be supported by Red Hat Global Support.

2 Components Overview

2.1 Red Hat CloudForms 2.0

A Continuum of Management Capability:

Whether you are focused on gaining control of your virtualization environment or seeking to put management capabilities in place to operate a private or hybrid cloud, CloudForms can meet your needs today with a comprehensive management platform to do both. The goal is to future proof your investment and eliminate multiple disparate tool sprawl which introduces problems of integration, multiple interfaces, and rising costs & training needs with multiple vendor point products. CloudForms allows organizations to address virtual environment problems like monitoring, tracking, capacity management, resource utilization/optimization, VM lifecycle management, and policies to govern access and usage, while allowing you to evolve, at your pace, to a private or hybrid cloud model without future management investment. If and when you want to operate a cloud model, CloudForms delivers self-service cataloging with policy-based control to agilely manage requests. We provide a single pane of glass across multiple virtualization providers, public cloud; giving you choice among providers and allowing you to leverage existing platform investments or introduce new more cost effective ones. CloudForms also equips you for quota enforcement, usage, chargeback and cost allocation, allowing you to truly evolve to IT as a Service (ITaaS). We provide all these capabilities with dashboards, reports, policies, approval workflows and alerts, to ensure you remain in control.

Virtual Environment	Private/Hybrid Cloud	Operational
• Monitoring/Tracking • Capacity Management/Planning • Resource Utilization/Optimization • VM Lifecycle Management • Policies to Govern Access/Usage	• Self-Service Portal/Catalog • Controls to Manage Request • Quota Enforcement/Usage • Chargeback/Cost Allocation • Automated Provisioning	• Dashboards • Reports • Policies • Alerts • Approval Workflows

Figure 2.1-1: CloudForms 2.0 Capabilities provides a depiction of CloudForms 2.0 capabilities and features.

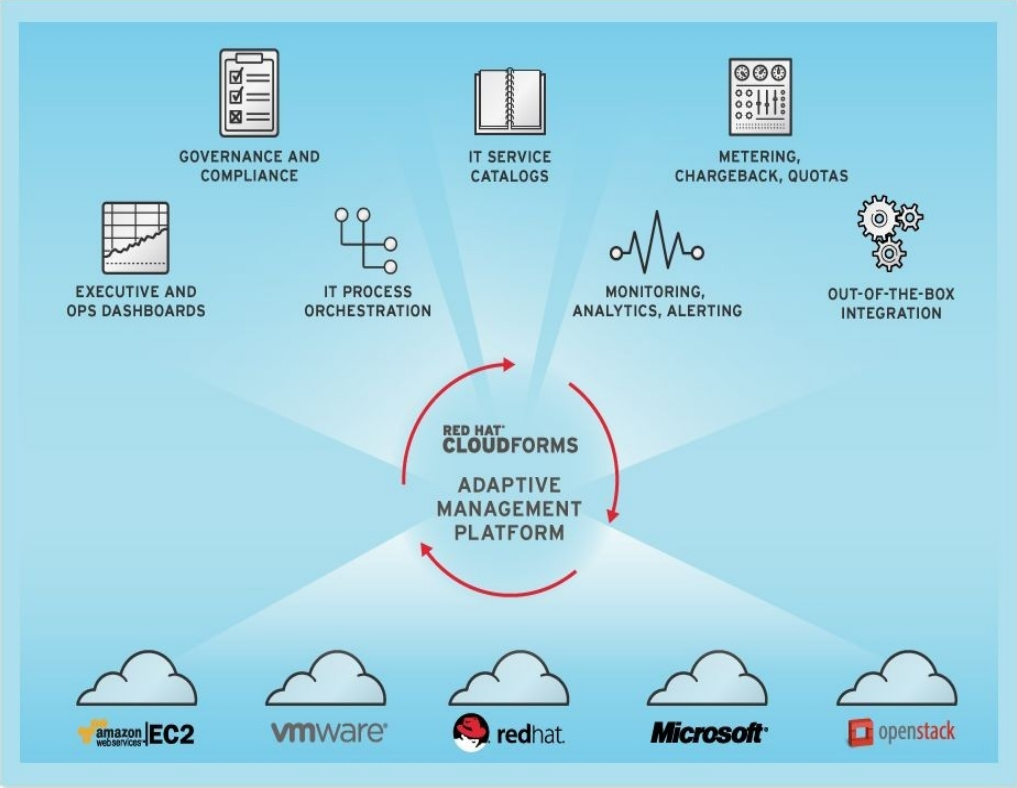


Figure 2.1-1: CloudForms 2.0 Capabilities

Key Product Messages:

- **Seamless user self-service portals** support service catalogs with role-delegated automated provisioning, quota enforcement and chargeback across Red Hat Enterprise Virtualization and other hypervisor and cloud platforms including VMware, Microsoft, OpenStack, and Amazon EC2.
- **Automated policy enforcement/control** for managed systems to reduce the delay, effort, cost and potential for errors involved in manually enforcing policies and changing system configurations or allocation of resources, while helping to assure security and compliance.
- **Executive management and governance** with comprehensive dashboards and reporting, policy-based standards enforcement, financial management, capacity forecasting, trend analysis and health and availability of Red Hat Enterprise Virtualization environments.
- **Intelligent workload management** to ensure resources are automatically and optimally utilized to ensure service availability and performance. This includes policy-based orchestration of workloads and resources, the ability to simulate allocation of resources for “what/if” planning and continuous insights into granular workload and

consumption levels to allow chargeback, showback and proactive planning and policy creation.

- **Capacity Planning** to anticipate and plan for future resource needs based on capacity, trending, data and analytics. This includes the abilities to classify resources based on configuration, performance, capacity, cost, acceptable use and locations.
- **Capacity Management** to dynamically and automatically assure the most efficient use of resources. This includes the ability to discover and track resource changes, provision and de-provision resources based on policies and demand, and identify the current condition of resources and the “best fit” for new workloads across compute, storage and network resources.
- **Federated management** of large and distributed Red Hat Enterprise Virtualization infrastructures from a single pane of glass, enabling enterprises to rapidly scale out their virtual and cloud deployments.
- **Red Hat Enterprise Virtualization certified** and optimized to run on Red Hat Enterprise Linux.

Key Business Messages:

- **Low Acquisition Cost** less than ½ the cost of other management technologies, over a 3 year period. Efficient subscription model allows for more of an annual rental model – no large upfront licensing fees. Tool consolidation and replacement can result in a zero net sum or even saving on current management spend.
- **Fastest Time to Value** installs rapidly as a Virtual Appliance and is agent-free, with no agents to license or maintain. Value is seen in hours versus days/weeks through auto-discovery of your environment. Operations specific use case implementations happen in days not months. One management system to learn vs multiple tools/interfaces, support costs, greater potential for vendor price hikes. Can integrate as needed with larger management systems (BMC, CA, HP, Microsoft, ServiceNow).
- **Increased Automation and Continuous Optimization** through policy based controls and automated responses allows you to maximize resource efficiency and control of IT capital costs by adaptively increasing utilization. Increased automation supports higher operational efficiency in build, test and automate sequences. Significantly reduce human interaction/errors and gain ability to manage with less people/labor costs.
- **Open/Flexible solution** prevents vendor lock-in and allows for choice of infrastructure by leverage low cost virtual platforms for your cloud. Leverages existing IT investments and supports seamless introduction of new lower cost platform alternatives. Choice among VMware, Red Hat, & Microsoft for virtualization platforms, Amazon as public cloud.
- **More efficient users and customers** through self service with web-based portals accompanied by fine-grained access control and support for request management, tracking and approval.

2.2 Red Hat Enterprise Virtualization

2.2.1 RHEV Hypervisor

A hypervisor is a computer software platform that allows multiple “guest” operating systems to run concurrently on a host computer. The guest virtual machine operating systems interact with the hypervisor which translates guest I/O, CPU, and memory requests into corresponding requests for resources on the host computer.

Running fully virtualized guests, i.e., virtual machine guests with unmodified operating systems, used to require complex hypervisors and previously incurred a performance penalty for emulation and translation of some system resource requests.

However, over the last few years CPU vendors Intel and AMD have been steadily adding CPU features that offer hardware enhancements to support virtualization. Most notable are:

1. First-generation hardware assisted virtualization: Removes the requirement for hypervisor to scan and rewrite privileged kernel instructions using Intel VT (Virtualization Technology) and AMD's SVM (Secure Virtual Machine) technology.

2. Second-generation hardware assisted virtualization: Offloads virtual to physical memory address translation to CPU/chip-set using Intel EPT (Extended Page Tables) and AMD RVI (Rapid Virtualization Indexing) technology. This provides significant reduction in memory address translation overhead in virtualized environments.

3. Third-generation hardware assisted virtualization: Allows PCI I/O devices to be attached directly to virtual machines using Intel VT-d (Virtualization Technology for directed I/O) and AMD IOMMU. Additionally, SR-IOV (Single Root I/O Virtualization), which allows special PCI devices to be split into multiple virtual devices, also provides significant improvement in guest I/O performance.

As the last decade has ushered in the creation and basic maturity of virtualization, it has also led to the creation of several different types of hypervisors. However, many of these pre-date hardware-assisted virtualization technologies (as noted above) and are by nature, generally considered more complex and less performant software platforms. Now, with the advent of the above noted hardware extensions, it is possible to gain the benefits of more advanced virtualization capabilities currently only available through existing open source projects and technologies.

Red Hat Enterprise Virtualization (RHEV) uses the Kernel-based Virtual Machine (KVM)[1] technology, which turns the Linux kernel into a virtualization hypervisor. Red Hat Enterprise Linux (RHEL) 5.4 provided the first commercial-strength implementation of KVM, which has been continually developed as part of the upstream Linux community, and continues to be an integrated part of the latest Red Hat Enterprise Linux operating system. The Red Hat Enterprise Virtualization Hypervisor is based on this same hardened and proven KVM hypervisor technology, resulting in native advanced features and capabilities such as, record-setting performance and scalability, an expansive line of certified hardware support, and advanced OS-level features, only found in Red Hat Enterprise Linux 6.

2.2.2 Red Hat Enterprise Virtualization

Virtualization offers tremendous benefits for enterprise IT organizations – server consolidation, hardware abstraction, and internal clouds deliver a high degree of operational efficiency.

Red Hat Enterprise Virtualization (RHEV) combines the KVM hypervisor with an enterprise grade, multi-hypervisor management platform that provides key virtualization features such, as automated load balancing, live migration, high availability, role-based administration control, and virtual machine life cycle management. Red Hat Enterprise Virtualization delivers a secure, robust virtualization platform with industry-leading performance and scalability for Red Hat Enterprise Linux and Windows guests.

Red Hat Enterprise Virtualization consists of the following two components:

- *RHEV MANAGER (RHEV-M)*: A feature-rich virtualization management suite that provides advanced capabilities for hosts, guests, and storage.
- *RHEV HYPERVISOR*: A modern, scalable, high performance hypervisor based on KVM. It can be deployed as RHEV-H, a small footprint secure hypervisor appliance included with the RHEV subscription, or as a RHEL server (purchased separately) managed by RHEV-M.

A *HOST* is a physical server which provides the CPU, memory, and connectivity to storage and networks that are used for the virtual machines (VM). The local storage of each host can be used for the RHEV-H executables, logs, and ISO uploads, as well as optionally for virtual machine data.

A *CLUSTER* is a group of host servers linked together to form a single resource pool. Virtual machines can be automatically or manually migrated from host to host within the cluster without having to shut down and restart the virtual machine. A cluster consists of one or more hosts, but a host can only be a member of one cluster.

A *DATA CENTER* is a collection of one or more clusters that have resources in common. Resources that have been allocated to a data center can be used only by the hosts belonging to that data center. The resources relate to storage and networks.

A *STORAGE DOMAIN* is a shared or local storage location for guest image files, import/export, or for ISO images. Storage domain types supported in RHEV 3 are NFS, iSCSI, Fibre Channel, and local disk storage.

1 http://www.linux-kvm.org/

The RHEV *NETWORK* architecture supports both guest traffic and traffic among RHEV hypervisors and the RHEV Manager server. All hosts have a network interface assigned to the logical network named *rhevm*. This network is used for the communications between the hypervisor and the manager. Additional logical networks are created on the data center and applied to one or more clusters. To become operational, the host attaches an interface to the local network. While the actual physical network can span across data centers, the logical network can only be used by the clusters and hosts of the creating data center.

Figure 2.2.2-1: RHEV Environment provides a graphical representation of a typical Red Hat Enterprise Virtualization environment with each component listed.

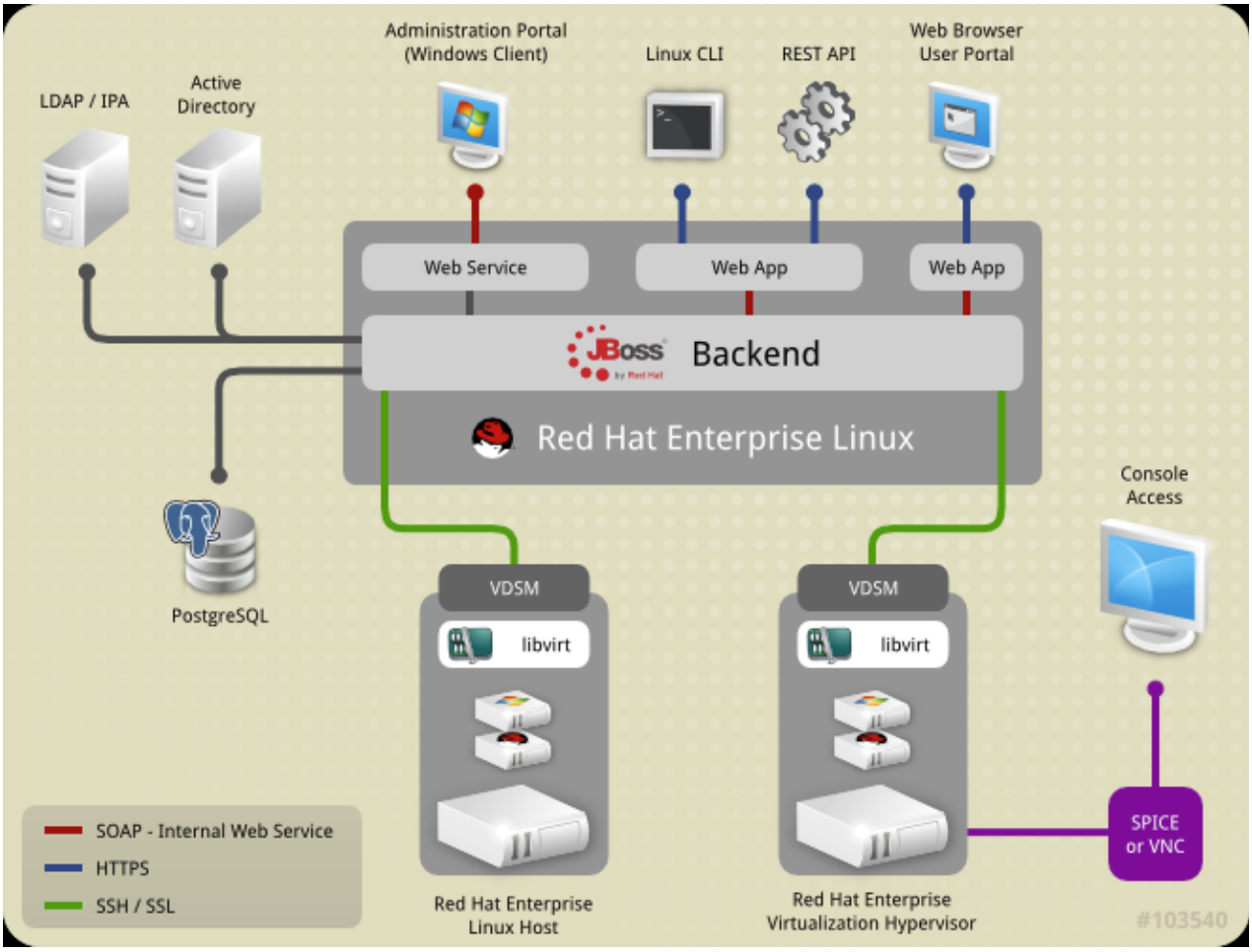


Figure 2.2.2-1: RHEV Environment

3 Environment

The following figure depicts the major components used in the reference environment. There are three CloudForms Management Engine appliances, two Red Hat Enterprise Virtualization environments utilizing iSCSI storage, Satellite Server to support provisioning and systems management, and a Windows Active Directory server supporting secure LDAP services for users and groups integrated within CloudForms.

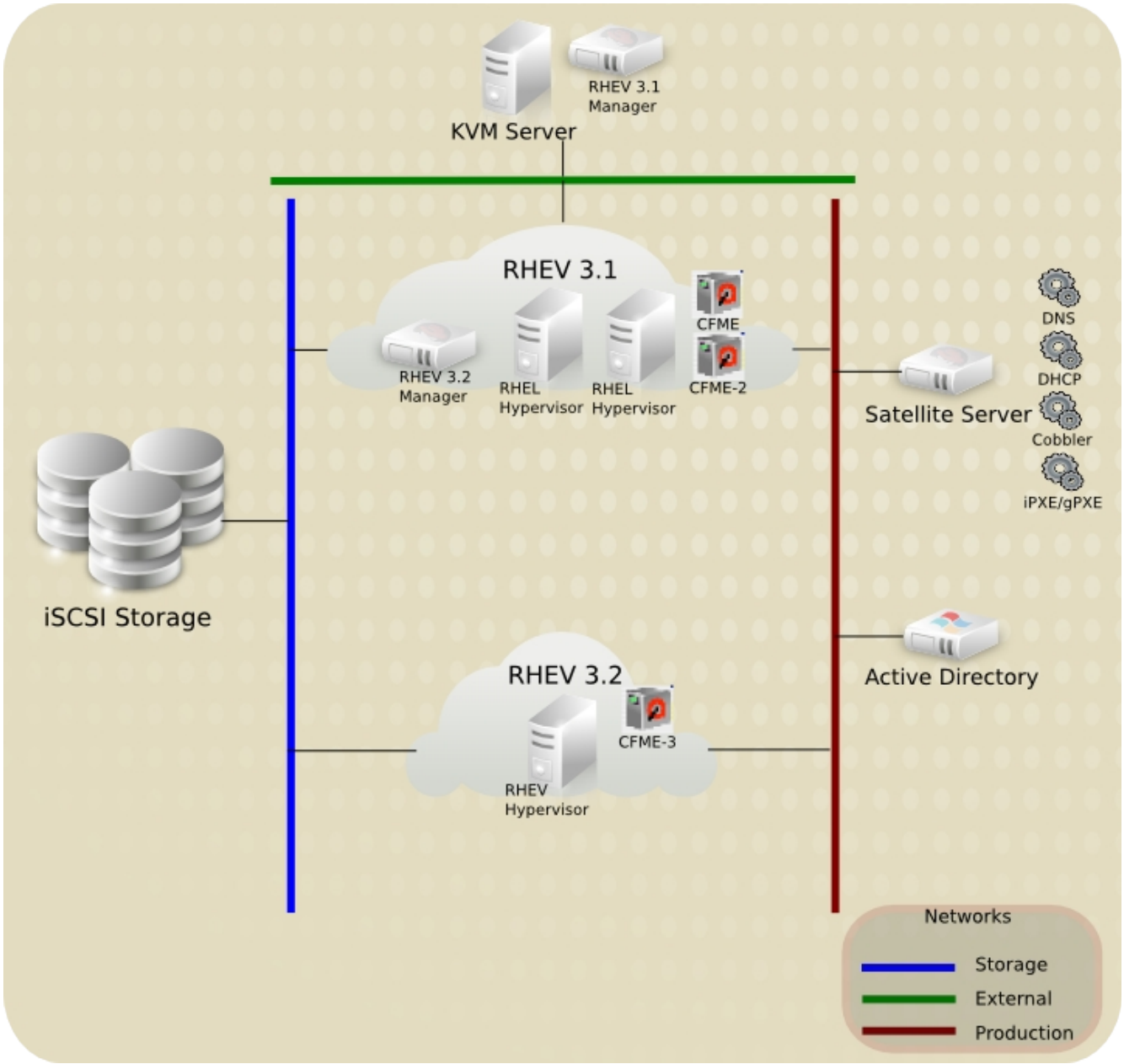


Figure 3-1: Reference Architecture Components

3.1 Software

The following section details the software versions used in the reference environment.

3.1.1 CloudForms Management Engine

The following table lists the software version used for CloudForms 2.0.

System	Software Version	Role(s)
CloudForms Management Engine cfme, cfme-2, and 3)	5.1.0.4.20130405163351_4745b08	Orchestration and Management

Table 3.1.1-1: CFME – Software Versions

3.1.2 Red Hat Enterprise Virtualization

The reference environment is configured to use both a Red Hat Enterprise Virtualization 3.1 and 3.2 Management Systems and Hosts.

Systems	Configuration	Software Versions	Role(s)
Red Hat Enterprise Virtualization (cf-rhevm, cf-rhevm-32)	RHEV 3.2 environment • One RHEV 6.4 Hypervisor RHEV 3.1 environment • Two RHEL 6.4 Hypervisors	• RHEV Manager (3.2): • 3.2.0-11.29.el6ev • Red Hat Enterprise Virtualization Hypervisor Host (RHEV-H): 6.4-20130508.1.el6ev • VDSM Version: 4.10.2-18.0.el6ev • RHEV Manager (3.1): • 3.1.0-50.el6ev • Red Hat Enterprise Linux Hypervisor Hosts (RHEL): 6.4 – 2.6.32-358.2.1.el6 • VDSM Version: 4.10.2-1.8.el6ev	Virtualization

Table 3.1.2-1: RHEV Environment – Software Versions

3.1.3 Red Hat Satellite Server

The following table lists the software version used for Red Hat Satellite Server.

System	Software Version	Role(s)
Satellite Server (sysman-rhel6)	5.5.0-20120911	Provisioning, DNS, DHCP

Table 3.1.3-1: Satellite Server – Software Versions

3.1.4 Microsoft Windows

The following table lists the software version used for Windows Server 2008 R2.

System	Software Version	Role(s)
Windows Server 2008 (cf-win-ad)	6.1.7601	Active Directory LDAP Authentication

Table 3.1.4-1: Windows Server – Software Versions

3.1.5 Red Hat Network

The following channels are used for each Red Hat Product Used.

Product	Parent Channel	Child Channel(s)
Red Hat CloudForms	Red Hat Enterprise Linux Server 5	Red Hat CloudForms (Management Engine) (RHEL5) 2
Red Hat Enterprise Virtualization	Red Hat Enterprise Linux Server 6	Red Hat Enterprise Virtualization Manager 3.2
		Red Hat Enterprise Virtualization Hypervisor 6
		Red Hat Enterprise Virtualization Agent for Server 6
		Red Hat JBoss Enterprise Application Platform 6
Red Hat Enterprise Linux	Red Hat Enterprise Linux Server 6	Red Hat Network Tools Server 6
		Red Hat Supplementary Server 6
Red Hat Satellite Server	Red Hat Enterprise Linux Server 6	Red Hat Network Satellite (RHEL6) 5.5

Table 3.1.5-1: RHN Product Channels

3.2 Systems

The following describes the physical and virtual machine configurations used in the reference environment.

3.2.1 Server Hardware

All four physical systems use the same hardware platform type:

Component	Details
Blade Chassis	IBM BladeCenter H - 8852HC1
Blade Server	IBM BladeServer – HS22 - 70870
CPU	(2) Intel Xeon X5680 (6 core @3.33 GHz)
Memory	52 GB
Network	(2) Broadcom Corporation NetXtreme II BCM5709S Gigabit Ethernet (2) Emulex Virtual Fabric Adapter (CFFh) 10GB Ethernet
Disk	2 x 146 GB SAS

Table 3.2.1-1: CloudForms 2.0 – Server Hardware Configuration

3.2.2 Infrastructure Virtual Machines

The following virtual machines provide infrastructure resources.

CloudForms Management Engine(s)

Component	Details
CPU	2
Memory	8192 MB
Network	*2 bridged virtIO
Disk	Disk 1 – 20 GB Disk 2 – 8 GB (OS) Disk 3 – 7 GB Disk 4 – 3 GB Disk 5 – 5 GB (Direct LUN for storage domain)

Table 3.2.2-1: CFME – Virtual Machine Configuration

Note: Disk configuration is set to default as the CFME appliance ships. Direct LUN access to the Data Domain provides SmartState[2] Analysis of running virtual machines.

Red Hat Satellite Server

2 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html-single/Management_Engine_5.1_Lifecycle_and_Automation_Guide/

Component	Details
CPU	2
Memory	4096 MB
Network	1 bridged virtIO
Disk	Disk 1 – 10 GB (OS) Disk 2 – 200GB (/var/satellite) Disk 3 – 20 GB (/rhnsat)

Table 3.2.2-2: Satellite Server – Virtual Machine Configuration

* - ***cfme-3*** utilizes a single network connection configured in a RHEV 3.2 environment.

Microsoft Windows Server 2008 R2

Component	Details
CPU	1
Memory	4096 MB
Network	1 bridged virtIO
Disk	Disk 1 – 20 GB (OS)

Table 3.2.2-3: Windows Server – Virtual Machine Configuration

RHEV Manager(s)

Component	Details
CPU	1
Memory	8192 MB
Network	1 bridged virtIO
Disk	*Disk 1 – 15 GB (OS)

Table 3.2.2-4: RHEV-M – Virtual Machine Configuration

* - ***cf-rhevm*** is configured with a 25 GB disk and hosted within a RHEL/KVM environment.

3.3 Storage

Non-local storage is provided by an EMC Celerra NS-120.

System	Disk Usage
RHEL Hypervisors (2)	488 GB
RHEV Hypervisor	488 GB
KVM Server (VM disks)	400 GB

Table 3.3-1: CloudForms 2.0 – Storage Configuration

4 Preparing the Infrastructure

This section describes the procedures used in preparing the infrastructure. This does not include installing each component from the ground up however discusses the specific configurations used for the reference environment.

4.1 Red Hat Enterprise Virtualization

Several items are configured within the Red Hat Enterprise Virtualization 3.2 environment to enable CloudForms 2.0 functionality and include:

- Capacity and Utilization[3] access via RHEV data collection and reports[4]
- iSCSI direct LUN hook for storage domain

Capacity and Utilization

In order for CFME to be able to capture capacity and utilization data, access to the RHEV history database and reporting is required. On the RHEV Manager system install and configure the history database and reporting feature.

```
# yum install rhevm-reports
```

Configure the history database. Choose "*yes*" when prompted to stop the `ovirt-engine` service.

```
# rhevm-dwh-setup
In order to proceed the installer must stop the ovirt-engine service
Would you like to stop the ovirt-engine service? (yes|no): yes
```

Configure the reporting feature. Choose "*yes*" when prompted to stop the `ovirt-engine` service. Also, provide a password for the *rhev-admin* and *superuser* users.

```
# rhevm-reports-setup
In order to proceed the installer must stop the ovirt-engine service
Would you like to stop the ovirt-engine service? (yes|no): yes

Please choose a password for the admin users (rhevm-admin and superuser):
```

With the reports and history database installed, configure PostgreSQL to allow remote connections to the database and configure a new user that is used to connect from a CFME appliance.

3 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Insight_Guide/sect-Capacity_and_Utilization_Collection.html

4 https://access.redhat.com/site/documentation/en-US/Red_Hat_Enterprise_Virtualization/3.2-Beta/html/Installation_Guide/chap-Data_Collection_Setup_and_Reports_Installation.html

Edit */var/lib/pgsql/data/pg_hba.conf* and add the following:

```
# CFME SmartSatate Analysis
host    all         all         0.0.0.0/0             md5
```

Modify **`iptables`** to allow port 5432 connectivity:

```
# iptables -A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport
5432 -j ACCEPT
# service iptables save
```

> **Note:** Specify the IP address of the CFME appliance to secure incoming traffic as needed.

Add a new user to PostgreSQL. The purpose of this user is to allow remote database authentication for the CFME appliance to capture reporting information from the RHEV environment.

```
# psql --username=postgres

=# CREATE ROLE cfme LOGIN UNENCRYPTED PASSWORD [REDACTED] SUPERUSER VALID
UNTIL 'infinity';
=# \q
```

Restart the PostgreSQL service:

```
# service postgresql restart
```

iSCSI Direct LUN hook

For SmartState[2] Analysis of virtual machines running within a RHEV environment using iSCSI as the Data Domain type, a Direct LUN hook must be configured on the CFME appliance running within the RHEV environment[5].

To configure a Direct LUN hook on the CFME appliance, perform a power down. Once the appliance is powered off, within the RHEV Management Portal click the **Virtual Machines** tab, select the CFME appliance and select the **Disks** tab in the bottom window pane. Click **Add** and choose **External (Direct Lun)**.

5 https://access.redhat.com/site/articles/372783

Under **Discover Targets** expand the **Target Name** and select the desired storage LUN. Check mark **Is shareable**. When complete click **OK** at the bottom.

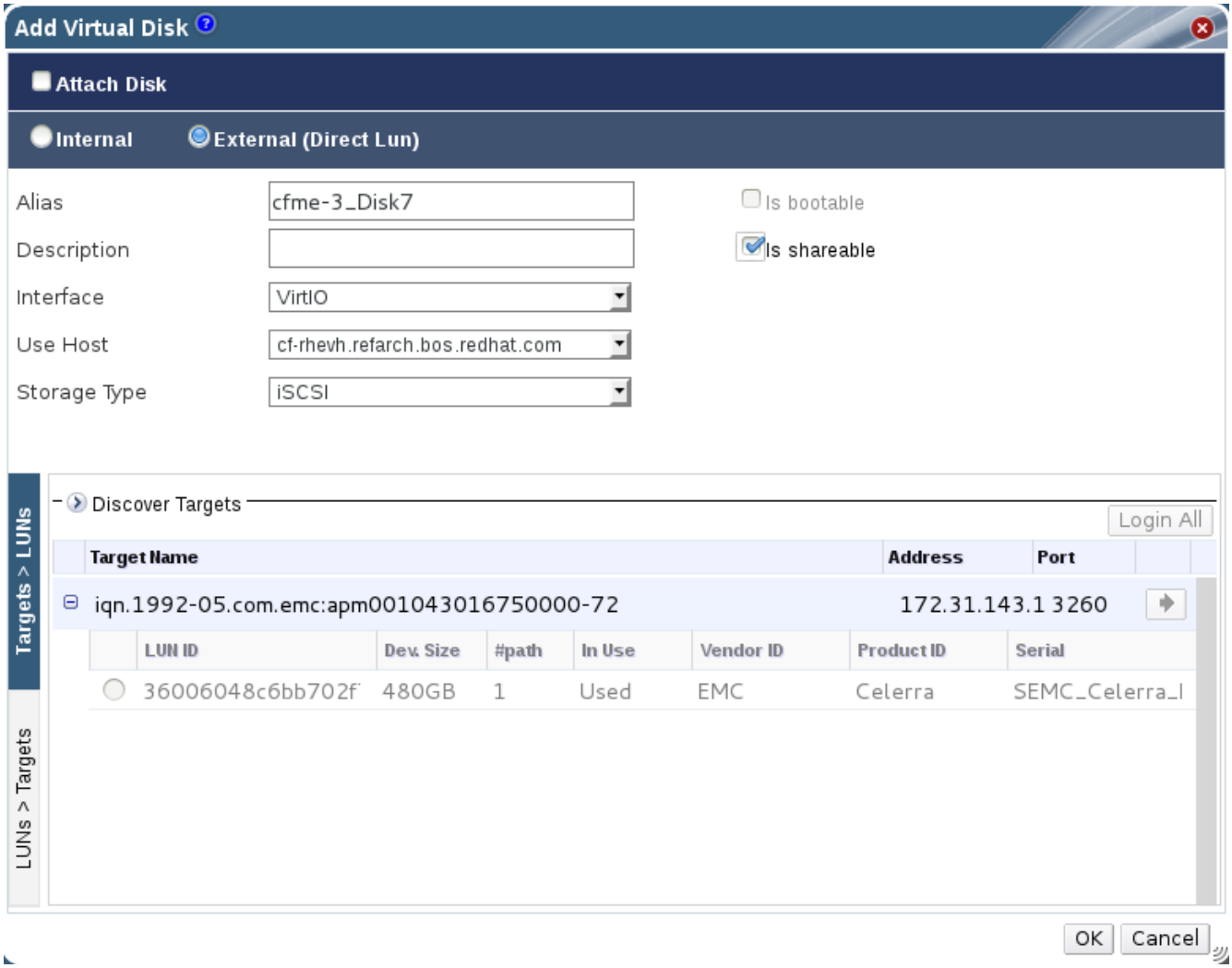


Figure 4.1-1: Direct LUN Hook

> **Note:** A warning will appear advising this disk is already in use. Proceed with adding the LUN. Only one CFME appliance is permitted to use a Direct LUN hook per Data domain.

Once complete, power on the CFME appliance.

4.2 Microsoft Active Directory

Microsoft Active Directory is used to provide secure LDAP user and group authentication for the reference environment. The following items are configured:

- Active Directory Users and Groups
- Active Directory Certificate Services for LDAPS support

Active Directory Users and Groups

The following users and groups are created and provide self-service functionality discussed in **Section 7: Self-Service**.

User	Group
cf-admin	admin
cf-dev	dev
cf-test	test
cf-prod	prod

Table 4.2-1: Active Directory Users and Groups

Active Directory Certificate Services

Active Directory Certificate Services is required to enable secure Lightweight Directory Access Protocol (LDAP) authentication. For the reference environment Active Directory Certificate Services (AD CS) is installed on the same system as the Active Directory Domain Controller.

> **Note:** Microsoft recommends a distributed environment using a stand alone certificate server[6].

To install AD CS on an existing Active Directory server, open **Server Manager** and select **Roles** on the left pane. Click **Add Roles** on the right pane.

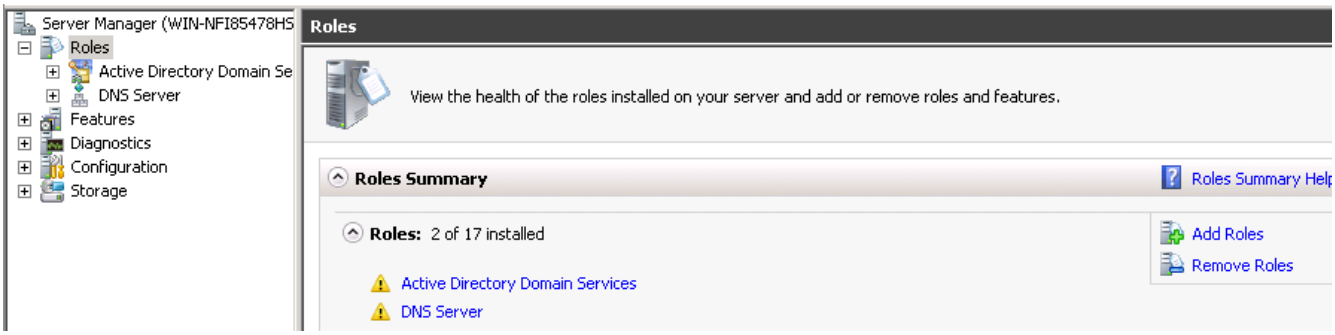


Figure 4.2-1: Windows Server – Add Roles

6 http://technet.microsoft.com/en-us/library/cc772393%28v=ws.10%29.aspx

Select the role for **Active Directory Certificate Services** and click **Next**.

Figure 4.2-2: Windows Server – AD CS Role Selection

Click **Next** again and choose **Certificate Authority** only. Click **Next** to proceed.

Figure 4.2-3: Windows Server – Certificate Authority

Choose **Enterprise** and click **Next**.

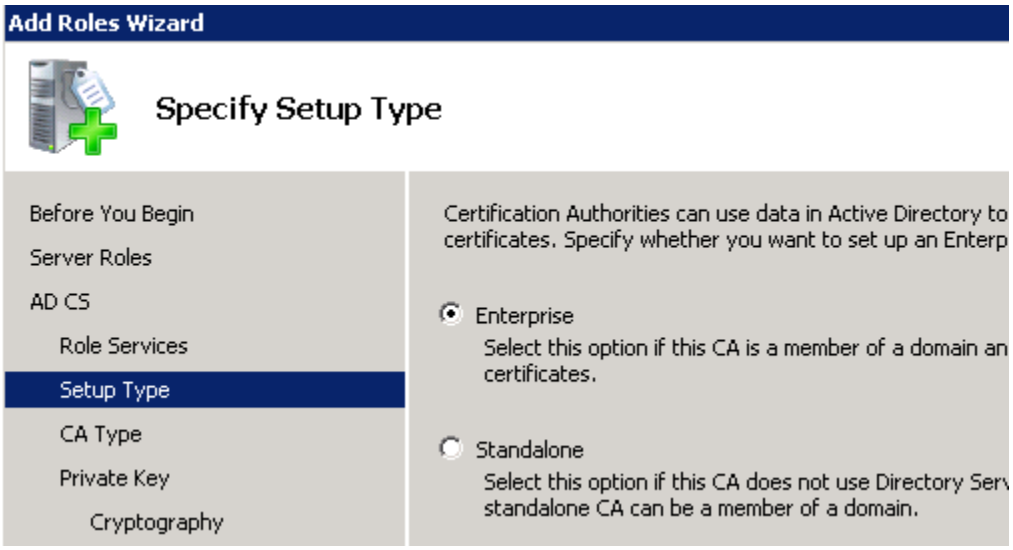


Figure 4.2-4: Windows Server – Enterprise CA

Select **Root CA** and click **Next**.

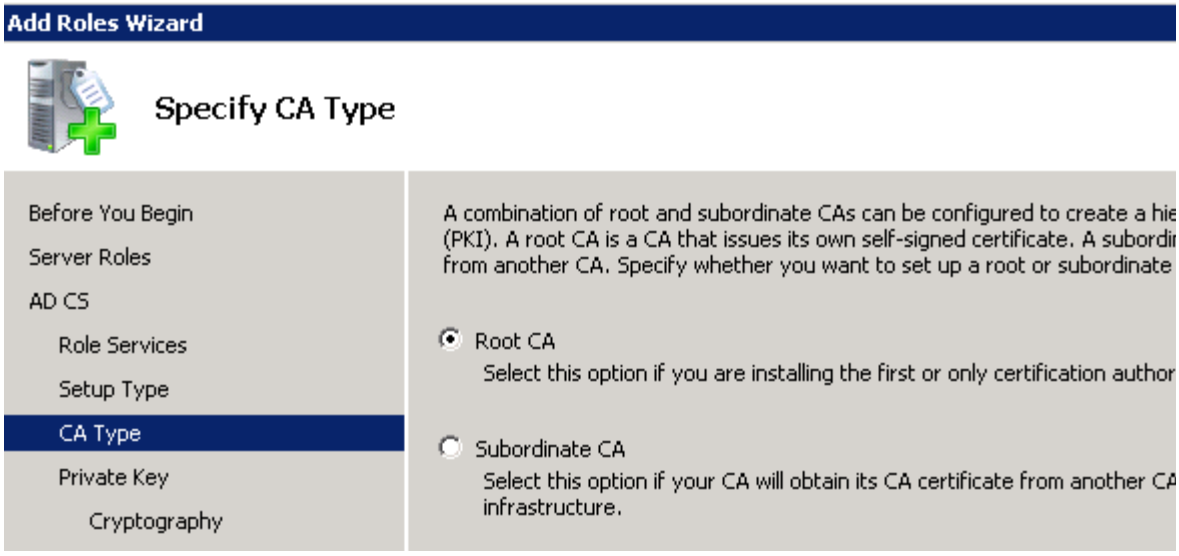


Figure 4.2-5: Windows Server – Root CA

Choose **Create a new private key** and click **Next**.

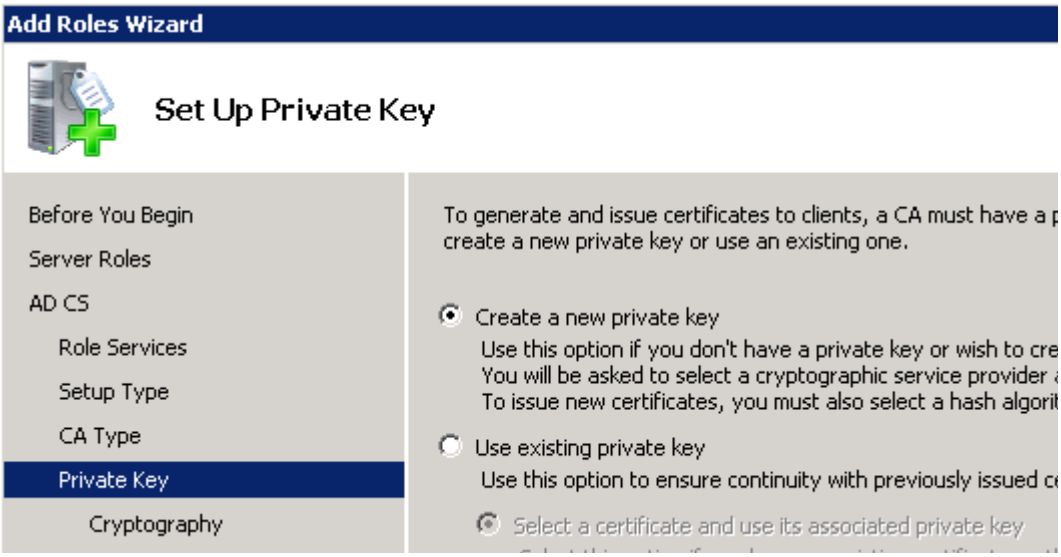


Figure 4.2-6: Windows Server – Private Key

Select the desired cryptographic service provider, key length, and hash algorithm. For the reference environment the following values are chosen:

Option	Value
Cryptographic service provider	RSA#Microsoft Software Key Storage Provider
Key character length	4096
Hash algorithm for certificate signing	MD5

Table 4.2-2: Windows Server – Cryptography Settings

Click **Next** to continue.

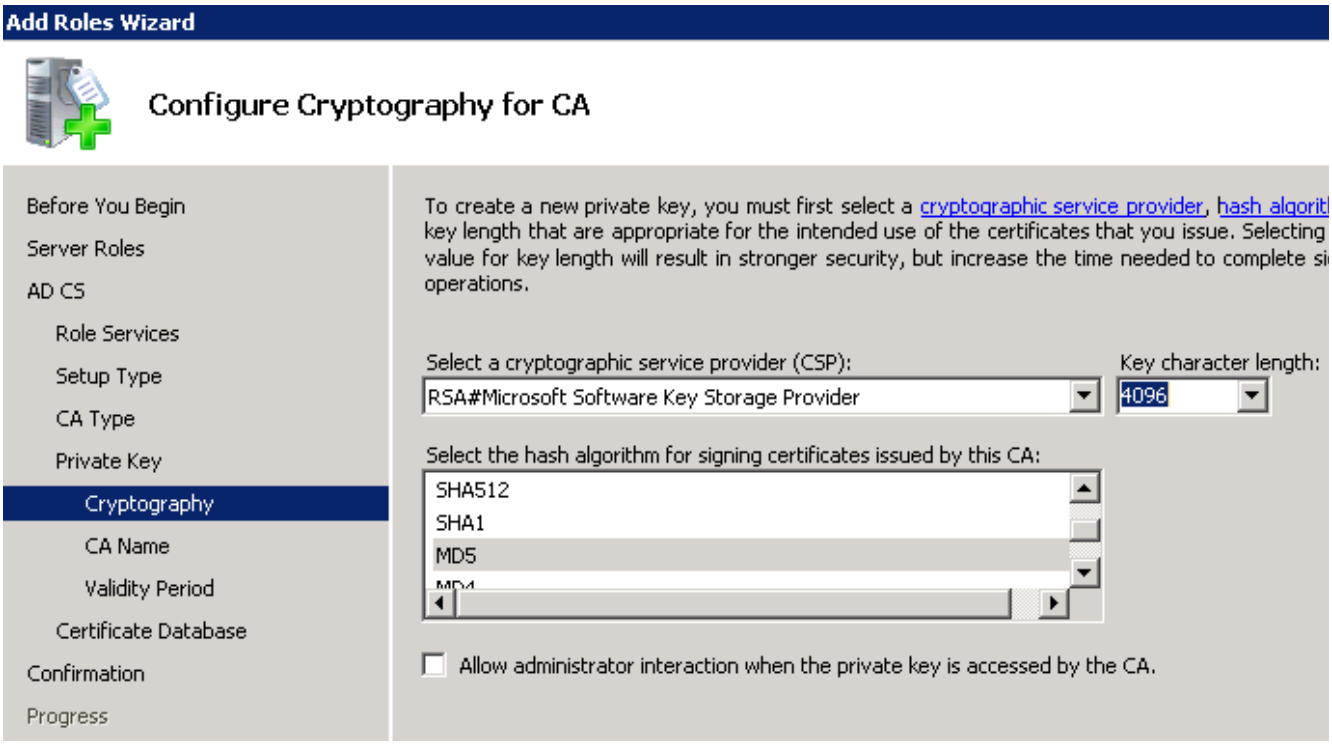


Figure 4.2-7: Windows Server – Cryptography Settings

Review the Certificate Authority Name details, make necessary changes, and click **Next** to proceed.

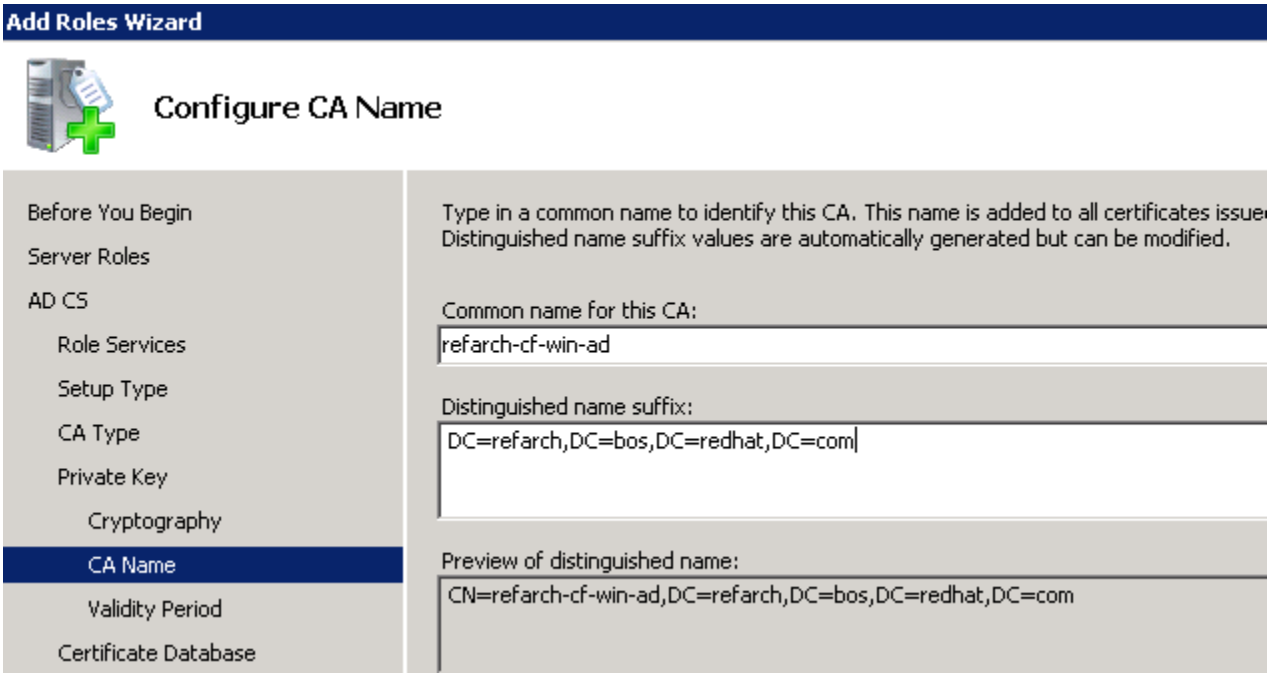


Figure 4.2-8: Windows Server – CA Name

Choose the amount of time the CA certificate is valid for and click **Next**.

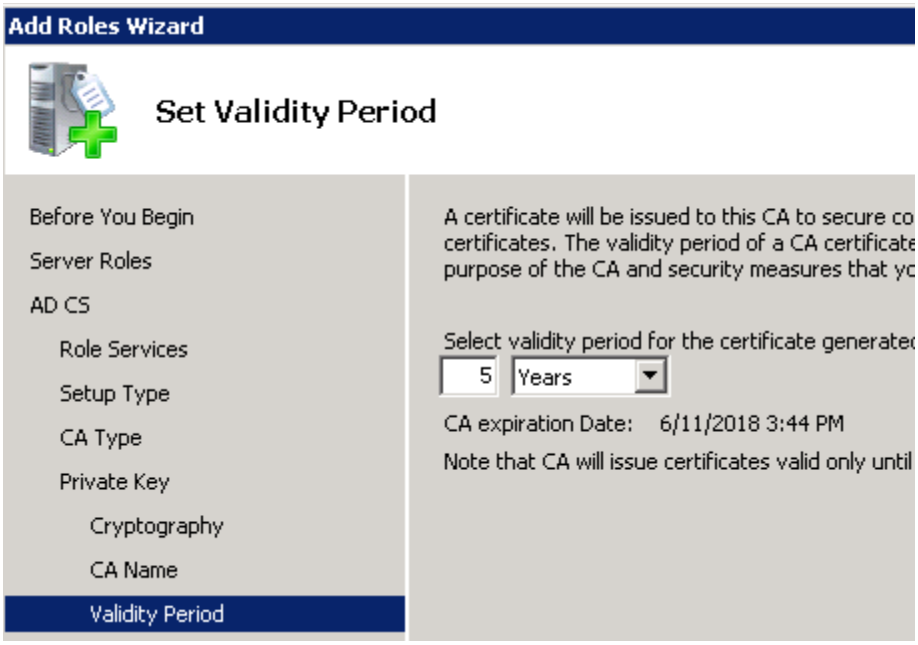


Figure 4.2-9: Windows Server – CA Certificate Validity Period

Select the location of the certificate database and log file. Click **Next** to continue.

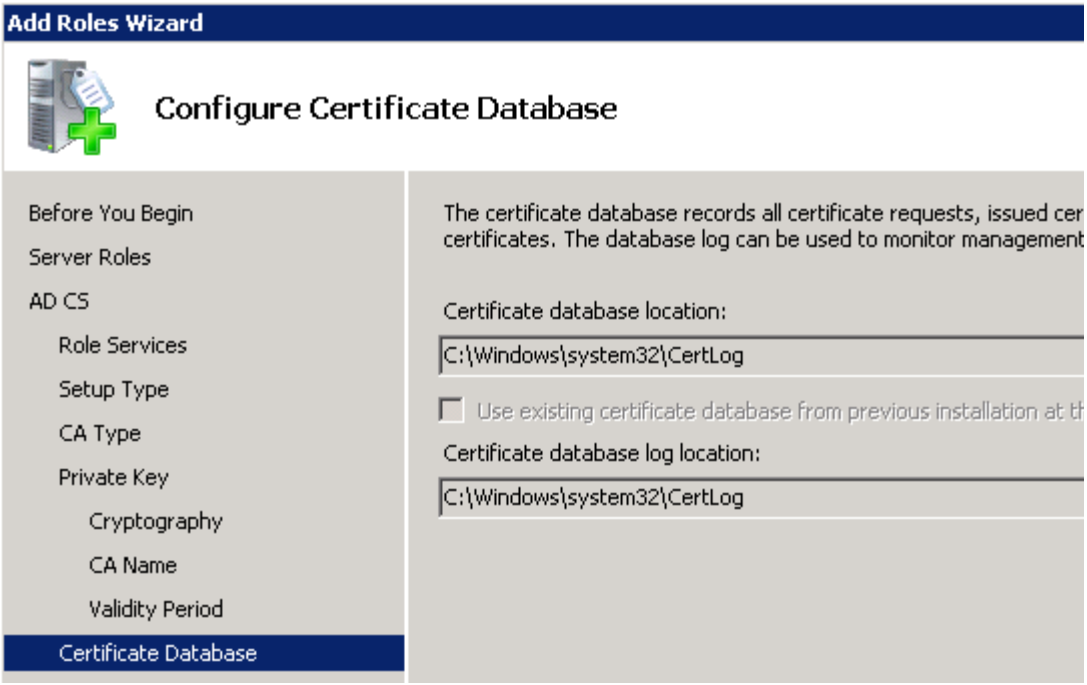


Figure 4.2-10: Windows Server – Certificate File Location

Review the settings chosen and click **Install** to finalize the installation for Active Directory Certificate Services. Review the installation status and click **Close** to complete.

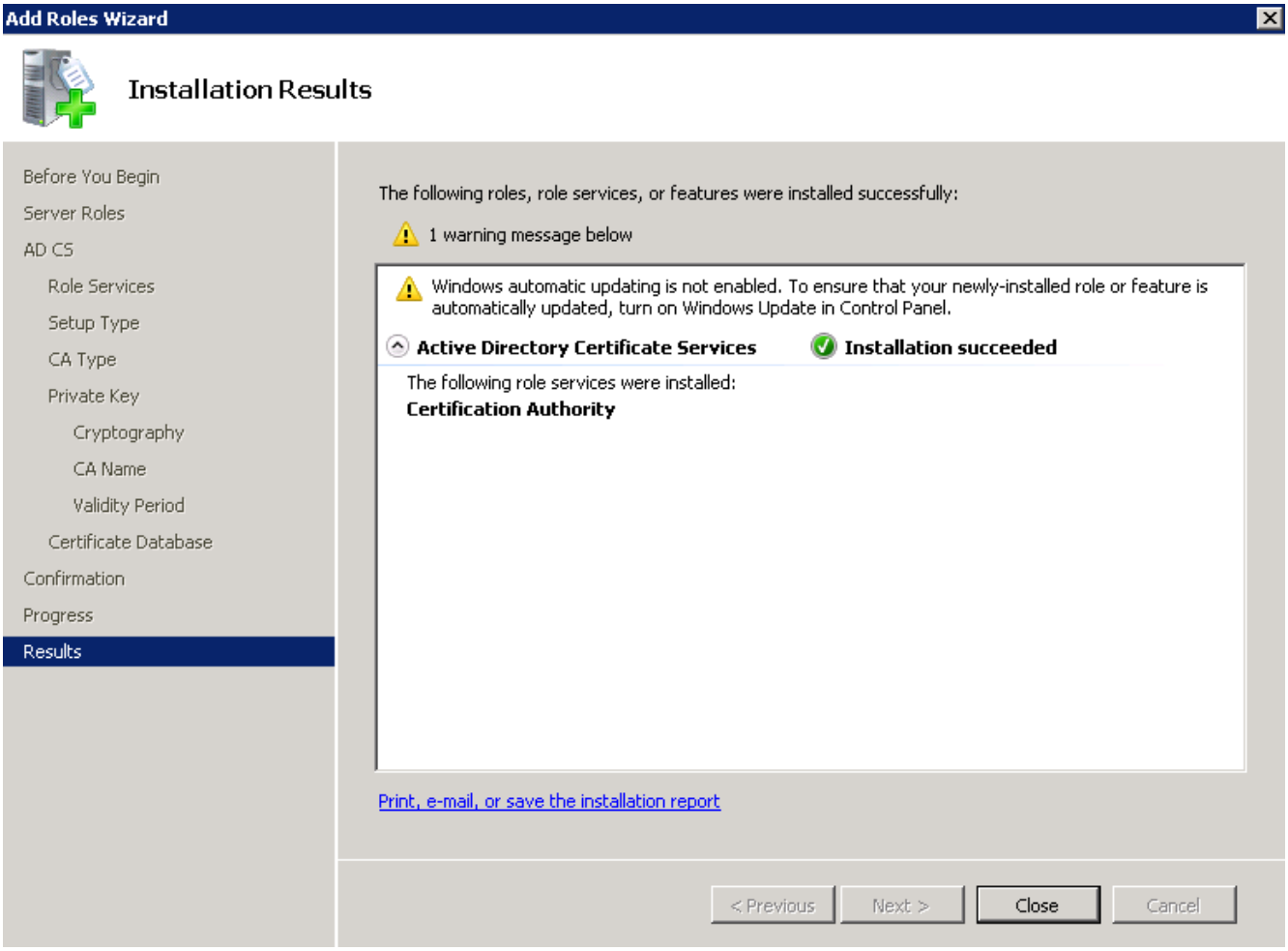


Figure 4.2-11: Windows Server – AD CS Installation Complete

The final step to enable secure LDAP requires a reboot of the system.

4.3 CloudForms Management Engine

For the reference environment, several items are configured on the CFME appliances to provide enhanced functionality and integration however, the expectation is environment discovery[7] is complete and therefore not covered. Items include configuring:

- Management Engine Relationship
- Regions and Zones
- Role Resiliency
- Lightweight Directory Access Protocol (LDAP) authentication
- Tags

4.3.1 Management Engine Relationship

In addition to configuring the direct LUN hook to support SmartState Analysis for virtual machines running within the RHEV 3.2 environment, the CFME appliance Management Server Relationship must be set.

For the managed RHEV 3.2 environment, configure the CFME appliance by logging into the CFME Console as the *admin* account, hover over **Services** and select **Virtual Machines**.

On the accordion menu in the left window pane select the RHEV 3.2 management system.

On the right window pane click the CFME appliance (*cfme-3*). Click **Configuration** and select the CloudForms server with pencil icon next to **Edit Management Engine Relationship**. In the **Servers** input box, from the drop down menu next to **Select Server**, choose the designated CFME appliance for the RHEV 3.2 environment. For the reference environment *sysman-cfme-3 (4)* is chosen. Click **Save** to complete.

Figure 4.3.1-1: CFME – Management Engine Relationship

7 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Insight_Guide/sect-Discovering_Hosts_and_Management_Systems.html

4.3.2 Regions and Zones

CloudForms 2.0 provides the capability to partition managed environments into **Regions** and **Zones**. Regions can represent a geographic location where zones may represent cities or separate environments within the region.

The top level region contains a centralized VMDB database for reporting. Subordinate regions can exist under the top level region which replicate to the top level region however they do not replicate databases to each other.

Zones are used to isolate traffic within a region. For example, one zone may contain a RHEV based management system and another zone contain a VMware based management system all within the same region.

Additional information regarding regions and zones can be found in the *CloudForms 2.0, Management Engine 5.1 Settings and Operations Guide*[8].

For the reference environment a single region and a custom zone are used. To create a new zone, login to the CFME Console as the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**.

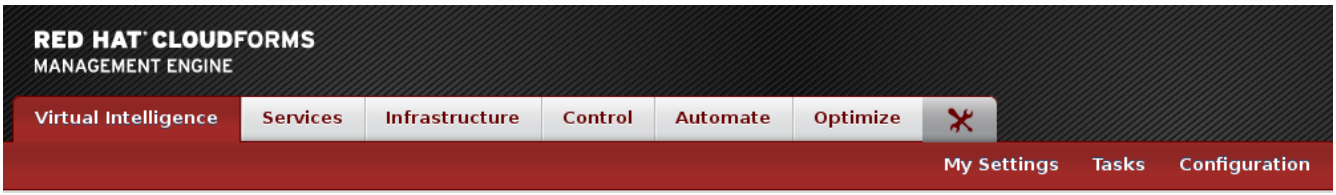


Figure 4.3.2-1: CFME – Settings and Operations

On the left window pane under **Settings** on the accordion menu, select **Zones**. Click the green plus button to add a new zone. Fill in the appropriate information for the input boxes.

Figure 4.3.2-2: CFME – New Zone Creation

8 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/index.html

For the reference environment the following inputs are provided:

Settings	Field	Value
Zone Information	Name	CloudForms
	Description	CF 2.0 RHEV Integration
	SmartProxy IP	10.16.140.106 (CFME IP)
NTP Servers	Servers	0.us.pool.ntp.org
		1.us.pool.ntp.org
		2.us.pool.ntp.org
Credentials – Windows Domain	UserID	administrator
	Password	<*password*>
	Verify Password	<*password*>
Settings	Max Active VM Scans	Unlimited

Table 4.3.2-1: CFME – New Zone Details

Click **Add** at the bottom of the window pane to create the new zone.

Once the new zone is created, CFME appliance settings need to be modified to place the appliance(s) within the new zone.

Click the CFME appliance on the accordion menu under **Settings**, **Zones**, **Default Zone**. On the right window pane within the **Server** tab, locate **Zone** under the **Basic Information** input box.

From the pull down menu select the newly created zone and click **Save** at the bottom. Perform this on all CFME appliances desired to be placed in the new zone.

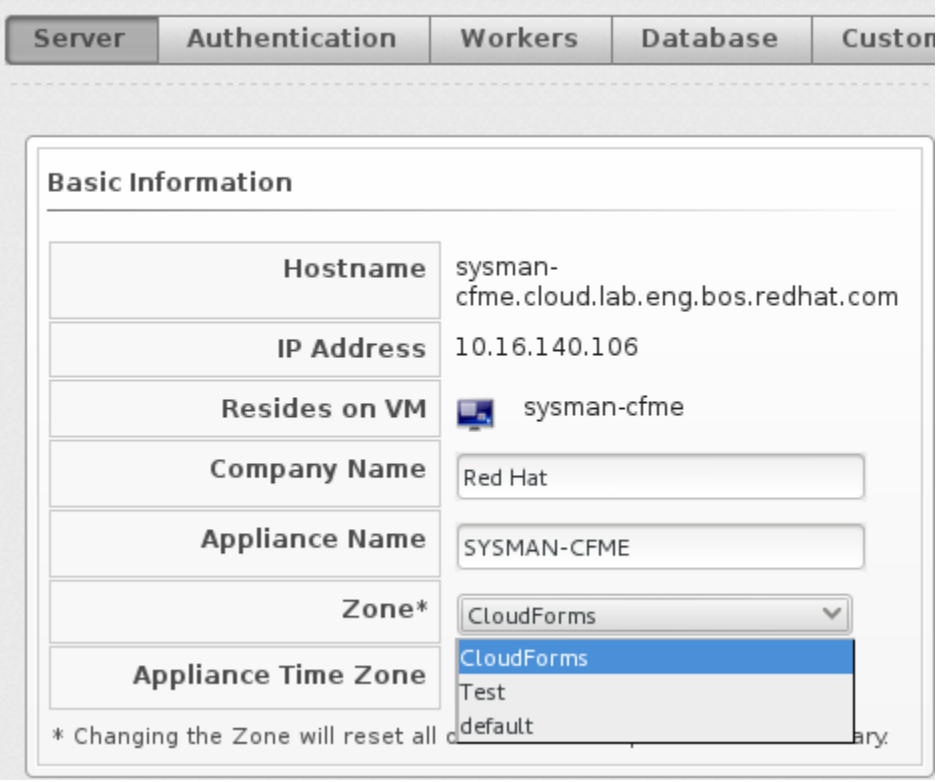


Figure 4.3.2-3: CFME – Zone Assignment

For the reference environment all CFME appliances are located in the *CloudForms* zone.

4.3.3 CloudForms Management Engine Role Resiliency

Several possibilities exist for CFME resiliency to include clustering an external PostgreSQL instance, by distributing server roles across multiple CFME appliances, or a combination of both. Distributing server roles consist of setting primary, secondary, and tertiary role assignments. For the reference environment role failover[9] is the method used for resiliency.

- Primary - There can only be one primary per zone per role. When an appliance is started, the system looks to see if any role is set to primary. If that is the case, the role is activated on that appliance and de-activated from the secondary.
- Secondary - This is the default priority. There can be multiple secondary CFME Appliances for a role. When an appliance is started, if no primary is found in the zone, the first appliance to start takes the role.
- Tertiary - If all appliances with primary roles or secondary roles are down, one of the tertiary would be activated.

9 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/Server_Roles.html

Prior to assigning roles, designate a CFME appliance as the master Virtual Management Database (VMDB) instance and configure each additional CFME appliance to point to the designated master.

Access the CFME Console on a subordinate appliance using the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize,** and select **Configuration**.

On the right window pane click the **Database** tab. Within the **Database** input box next to **Type**, click the pull down menu and change the setting from *Internal Database on this EVM Appliance* to *External Database on Another EVM Appliance*. Enter the hostname or ip address for the designated master in the **Hostname** field. Click the **Validate** button to verify settings and click **Save** to complete. For the reference environment *CFME* is set to the designated master with *CFME-2* and *CFME-3* configured as subordinates.

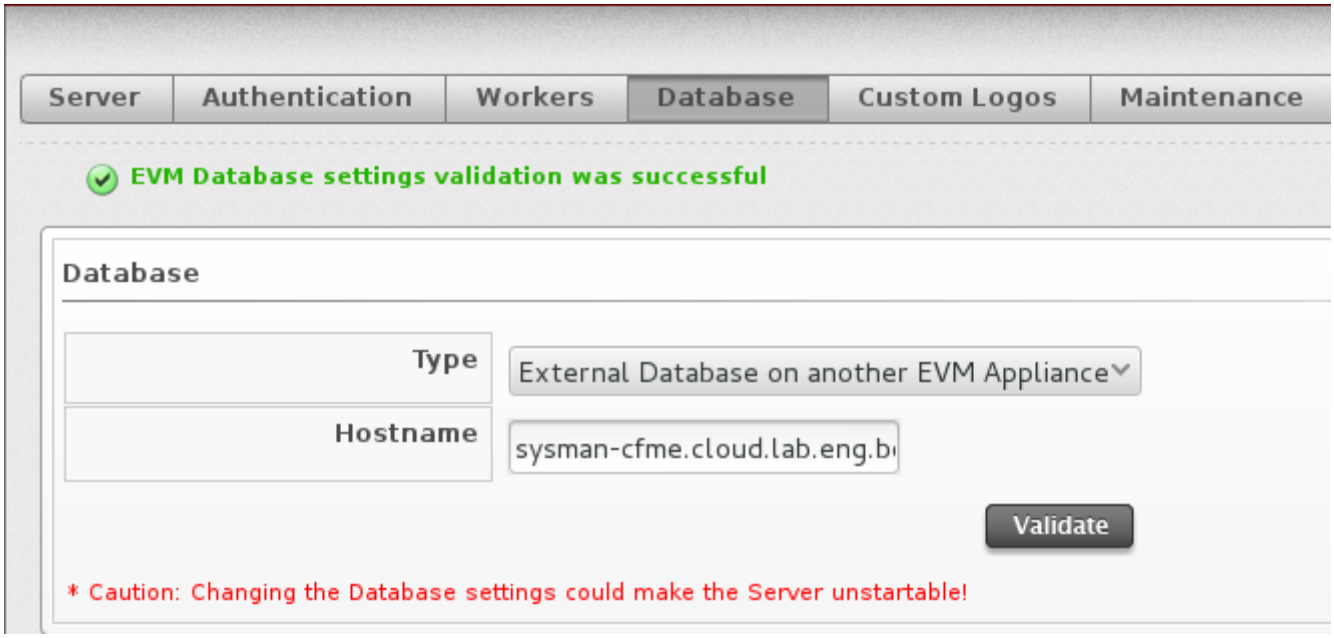


Figure 4.3.3-1: CFME – VMDB Settings

To assign server roles, access the CFME Console using the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**.

On the right window pane under the **Server** tab place a check mark next to the desired roles within the **Server Control** input box.

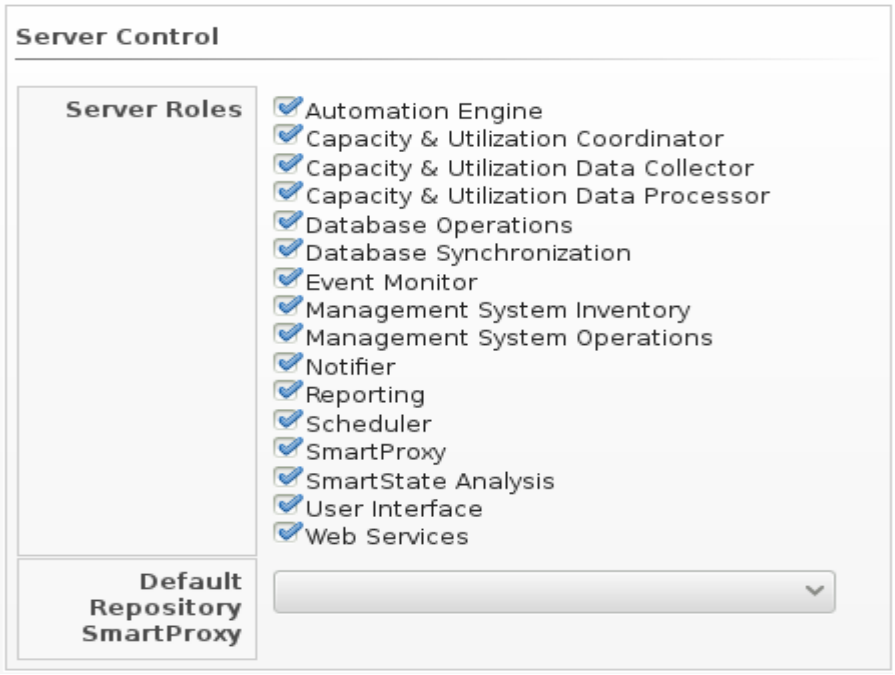


Figure 4.3.3-2: CFME – Role Assignments

Note: Not all roles are enabled by default and there may be some circumstances that require only certain roles be enabled on a CFME appliance. The requirements may include scaling and performance for the CFME appliance based on environment needs. Roles enabled by default are:

- Database Operations
- Event Monitor
- Reporting
- Scheduler
- SmartState Analysis
- User Interface
- Management System Inventory
- Management System Operations
- Web Services

The following server roles support failover:

Roles	Type
Notifier	Primary, Secondary, Tertiary
Capacity and Utilization Coordinator	Primary, Secondary, Tertiary
Database Synchronization	Primary, Secondary, Tertiary
Scheduler	Primary, Secondary, Tertiary
Management System Inventory	Primary, Secondary, Tertiary

Table 4.3.3-1: CFME Failover Roles

Additional roles exist on each CFME appliance however do not support failover. These roles work in conjunction amongst additional CFME appliances within the same zone to support increased capacity.

Roles	Type
Automation Engine	Distributed
Capacity and Utilization Data Collector	Distributed
Capacity and Utilization Data Processor	Distributed
Database Operations	Distributed
Management System Operations	Distributed
Event Monitor	Distributed
Reporting	Distributed
SmartProxy	Distributed
SmartState Analysis	Distributed
User Interface	Distributed
Web Services	Distributed

Table 4.3.3-2: CFME Distributed Roles

To define failover role priorities, access the CFME Console using the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**.

On the left window pane accordion menu select **Diagnostics**. Click the zone where the CFME appliance(s) reside.

Under **Roles by Servers** a status display provides a listing of each role and priority assigned to each CFME appliance. Select a role and either select the promote or demote button for the role. Primary role assignment is displayed in bold.

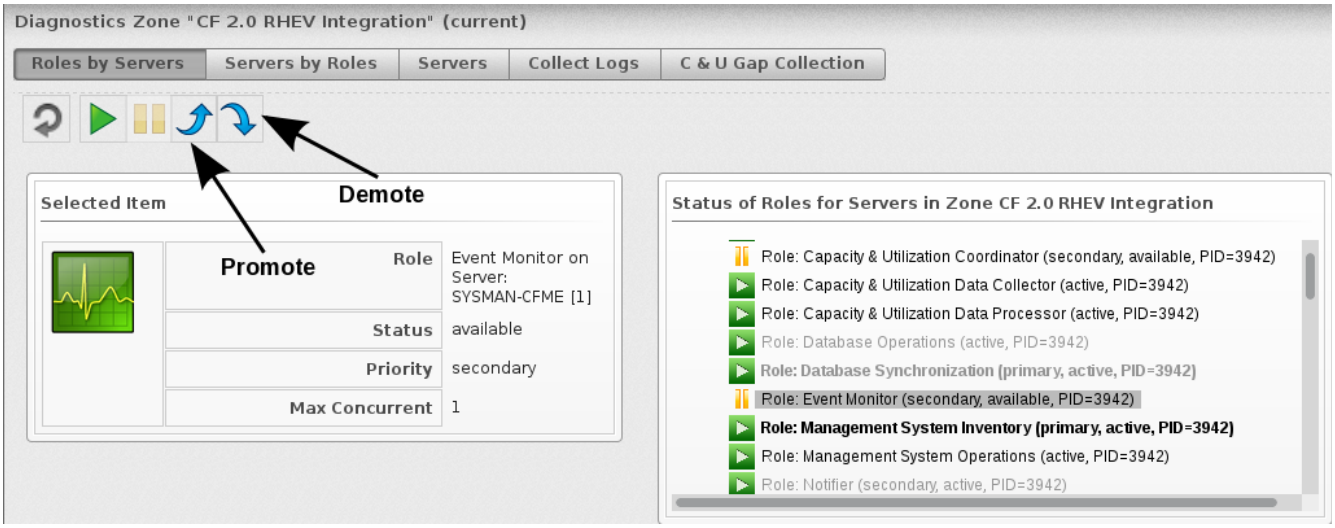


Figure 4.3.3-3: CFME – Role Priorities

Note: Roles that are grayed out are managed at the **Region** level.

For the reference environment the following roles are assigned for each CFME appliance:

Role	Primary	Secondary	Tertiary
*Notifier	CFME-3	CFME-2	CFME
Capacity and Utilization Coordinator	CFME-3	CFME-2	CFME
*Database Synchronization	CFME	CFME-3	CFME-2
*Scheduler	CFME-2	CFME	CFME-3
Management System Inventory	CFME	CFME-3	CFME-2
Event Monitor	CFME-2	CFME	CFME-3
°Virtual Environment to Storage Bridge	N/A	N/A	N/A
°Storage Inventory	N/A	N/A	N/A
°Storage Capacity and Utilization Coordinator	N/A	N/A	N/A
Automation Engine	CFME, CFME-2, CFME-3		
Capacity and Utilization Data Collector			
Capacity and Utilization Data Processor			
Database Operations			
Management System Operations			
Reporting			
SmartProxy			
SmartState Analysis			
User Interface			
Web Services			

Table 4.3.3-3: CFME – Assigned Roles

*Regional roles.

°Roles available for use with NetApp storage configurations.

4.3.4 Secure LDAP Authentication

As discussed in **Section 4.2 Microsoft Active Directory**, Microsoft Active Directory is used to provide user authentication and group mapping for the reference environment.

To enable secure LDAP authentication, login to the CFME Console with the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**.

Select the **Authentication** tab at the top. On the bottom window pane there is a single box labeled **Authentication** with a **Mode** set to *Database*. This is the default authentication level.

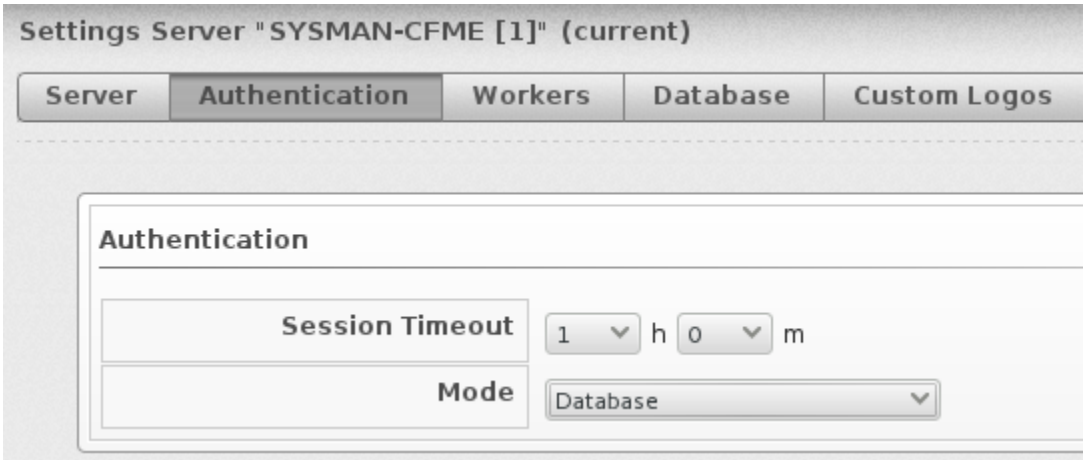


Figure 4.3.4-1: CFME – Authentication Mode – Database

To configure secure LDAP, set the **Mode** to *LDAPS*.

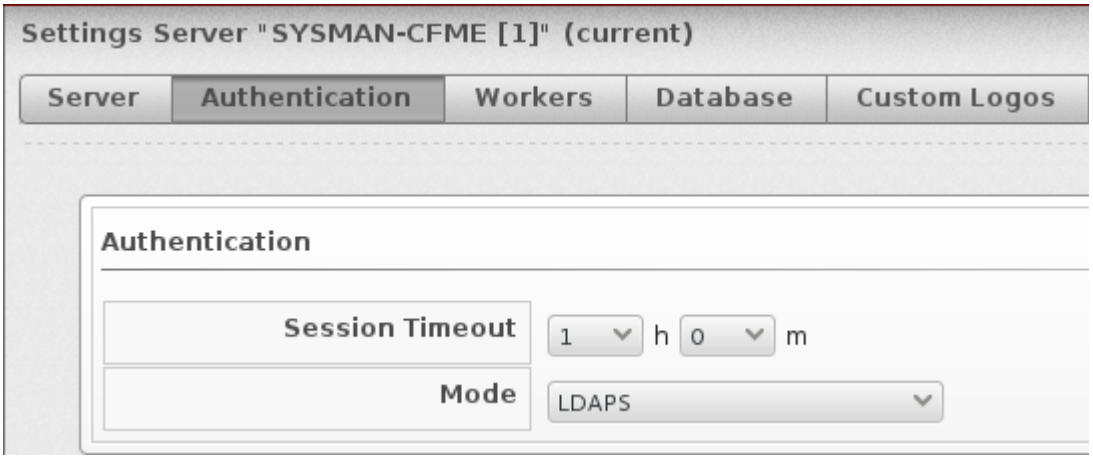


Figure 4.3.4-2: CFME – Authentication Mode – LDAPS

Once the **Mode** is set to *LDAPS*, additional input boxes are made available to provide details for the LDAP environment. For the reference environment the following inputs are provided:

Settings	Field	Value
LDAP	LDAP Host Names	cf-win-ad.refarch.bos.redhat.com
	LDAP Port	636
	User Type	User Principal Name
	User Suffix: <user@>	refarch.bos.redhat.com
Role	Get User Groups from LDAP	<checked>
	Get Roles from Home Forrest	<checked>
	Base DN	DC=refarch,DC=bos,DC=redhat,DC=com
	Bind DN	administrator@refarch.bos.redhat.com
	Bind Password	<password>

Table 4.3.4-1: CFME – LDAP Settings

With the desired values provided, click the **Validate** button to verify settings.

Figure 4.3.4-3: CFME – Authentication – Validate LDAPS Settings

Upon validation a success message is displayed at the top of the window pane.

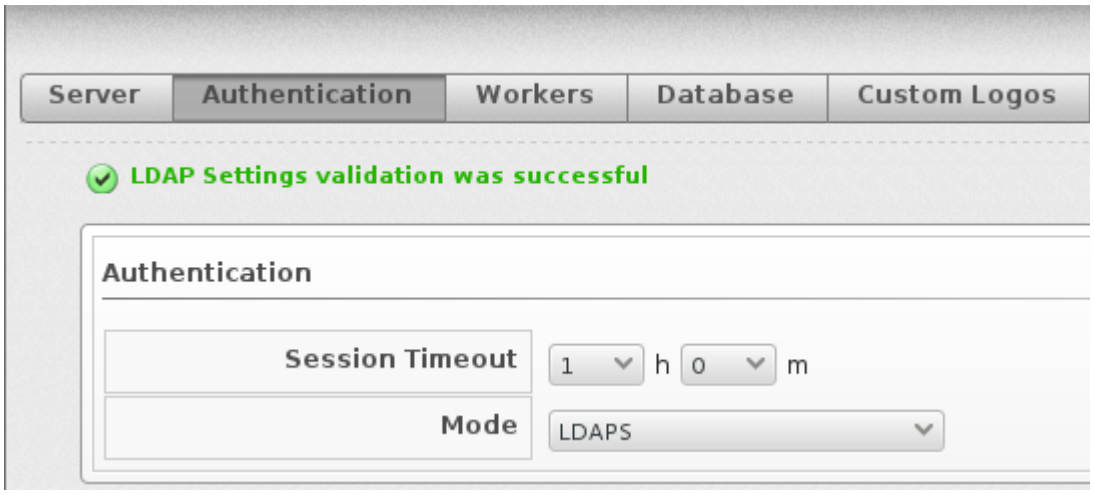


Figure 4.3.4-4: CFME – Authentication – Validate Success

Click **Save** at the bottom to complete the configuration.

4.3.5 Tags

The concept of using tags[10] within CloudForms 2.0 provides the capability to organize and manage resources from users, groups, and roles to management systems, hosts, virtual machines and more.

Tags are either system defined or custom created. For the reference environment a single custom tag is created and assigned to managed resources.

To create a custom tag, login to the CFME Console with the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**. On the left window pane under **Settings**, select the **Region**.

On the right window pane click the **Red Hat Tags** tab. Within the **Choose a Category** input box, click the drop down menu next to the **Category** field to choose a category to add a custom tag. For the reference environment, *Environment* is the category selected.

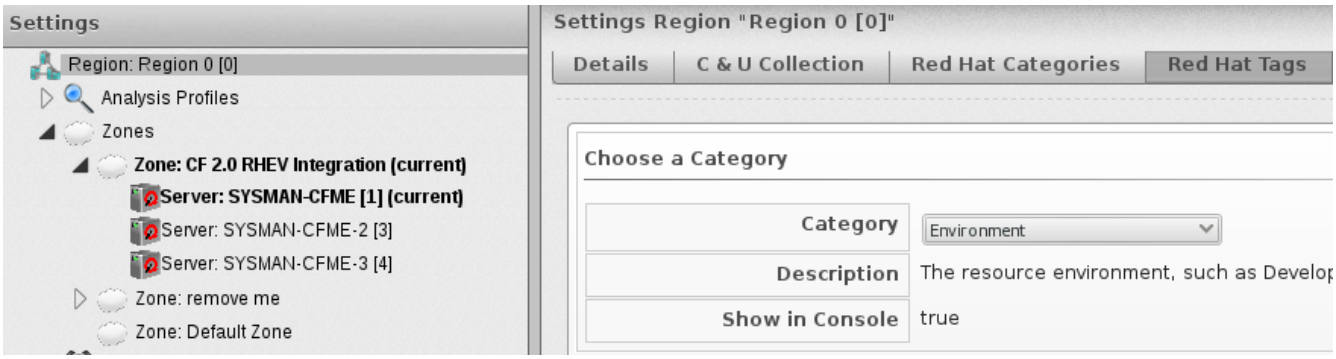


Figure 4.3.5-1: CFME – Custom Tag

10 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/sect-Tags.html

In the **Environment Entries** input box, click the green plus and provide a **Name** and **Display Name**. To complete click the server icon to the left of the input fields to add.

Figure 4.3.5-2: CFME – Add Custom Tag

Upon completion the new tag is listed. For the reference environment the new tag created is *Environment > cloudforms*.

Figure 4.3.5-3: CFME – Custom Tag Complete

Note: The **Name** field must be a single word, lower case.

4.4 Red Hat Satellite Server

Red Hat Satellite Server is utilized within the reference environment to provide provisioning, name resolution (DNS), and ip address management (DHCP) support. The following items are customized to support the reference environment:

- Custom channel and package
- iPXE

4.4.1 Custom Channel and Package

For the reference environment a custom RPM and channel on the Satellite Server are used. The custom RPM consists of installing several files to a machine hosting web services. The following *.spec* file is used to create the custom RPM:

web.spec

```
Name:           web
Version:        1
Release:        1
Summary:        Web server content
Group:          Applications/Internet
License:        GPLv2
URL:            http://www.redhat.com
```

```
Source0:        web.tar.gz
BuildRoot:      %(mktemp -ud %{_tmppath}/%{name}-%{version}-%{release}-
XXXXXX)

%description
Web content.

%prep
%setup -q

%install
rm -rf %{buildroot}
mkdir -p %{buildroot}/tmp/web
install -m 644 /home/bthurber/cfweb/{index.html,redhat.jpg} %
{buildroot}/tmp/web

%clean
rm -rf %{buildroot}

%files
%defattr(-,root,root,-)
%doc
/tmp/web/index.html
/tmp/web/redhat.jpg

%post
cp /tmp/web/{index.html,redhat.jpg} /var/www/html
 %changelog
*Tue May 21 2013 Brett Thurber bthurber@redhat.com
-1.0 Initial Release
```

Once the custom RPM is created, it needs to be signed using GPG. Begin by creating a GPG key. For the reference environment defaults are chosen.

```
$ gpg --gen-key
gpg (GnuPG) 2.0.14; Copyright (C) 2009 Free Software Foundation, Inc.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Please select what kind of key you want:
   (1) RSA and RSA (default)
   (2) DSA and Elgamal
   (3) DSA (sign only)
   (4) RSA (sign only)
Your selection? 1
RSA keys may be between 1024 and 4096 bits long.
What keysize do you want? (2048)
Requested keysize is 2048 bits
Please specify how long the key should be valid.
         0 = key does not expire
      <n>  = key expires in n days
      <n>w = key expires in n weeks
      <n>m = key expires in n months
      <n>y = key expires in n years
```

```
Key is valid for? (0)
Key does not expire at all
Is this correct? (y/N)

GnuPG needs to construct a user ID to identify your key.

Real name: Warren
Email address: bthurber@redhat.com
Comment: RPM Signing
You selected this USER-ID:
    "Warren (RPM Signing) <bthurber@redhat.com>"

Change (N)ame, (C)omment, (E)mail or (O)kay/(Q)uit? O
You need a Passphrase to protect your secret key.

gpg: problem with the agent: Not implemented
We need to generate a lot of random bytes. It is a good idea to perform
some other action (type on the keyboard, move the mouse, utilize the
disks) during the prime generation; this gives the random number
generator a better chance to gain enough entropy.
We need to generate a lot of random bytes. It is a good idea to perform
some other action (type on the keyboard, move the mouse, utilize the
disks) during the prime generation; this gives the random number
generator a better chance to gain enough entropy.
gpg: key A1B024B4 marked as ultimately trusted
public and secret key created and signed.
gpg: checking the trustdb
gpg: 3 marginal(s) needed, 1 complete(s) needed, PGP trust model
gpg: depth: 0  valid:   2  signed:   0  trust: 0-, 0q, 0n, 0m, 0f, 2u
pub   2048R/A1B024B4 2013-06-13
      Key fingerprint = 1B1E 7FA2 DA97 D2CB F7A8  98C2 8517 AD9D A1B0 24B4
uid                  Warren (RPM Signing) <bthurber@redhat.com>
sub   2048R/8AF2D17B 2013-06-13
```

Verify the key is listed in the key ring:

```
$ gpg --list-keys
/home/bthurber/.gnupg/pubring.gpg
---------------------------------
pub   2048R/A1B024B4 2013-06-13
uid                  Warren (RPM Signing) <bthurber@redhat.com>
sub   2048R/8AF2D17B 2013-06-13
```

Export the public key from the key ring to a text file. The public key is used during provisioning to verify the RPM package during installation.

```
$ gpg --export -a Warren > public_key.txt
```

Note: The **`cat`** command can be used to verify the contents of the public key file.

Use **scp** to secure copy the public key to the Satellite Server. **Appendix D.1 Post Install Scripts** provides an example post installation script where the public key is sourced during deployment.

```
$ scp public_ket.txt root@sysman-rhel6:/root
```

Next sign the custom RPM package using the newly created GPG key. Edit *.rpmmacros* and add the following lines:

/home/<user>/.rpmmacros

```
%_signature gpg
%_gpg_name A1B024B4  <----public signature ID derived from gpg --list-keys
```

Sign the custom RPM package:

```
$ rpm --resign web-1-1.x86_64.rpm
Enter pass phrase:
Pass phrase is good.
web-1-1.x86_64.rpm:
```

Use **scp** to secure copy the custom RPM package to the Satellite Server.

```
$ scp web-1-1.x86_64.rpm root@sysman-rhel6:/root
```

On the Satellite Server, create a new custom channel and import the custom RPM package into the channel using **rhnpush**.

```
# rhnpush -c web-server-content --server=localhost web-1-1.x86_64.rpm
```

Instructions for creating a new channel and uploading packages within Red hat Satellite Server can be found in *Red Hat Network Satellite 5.5, Channel Management Guide*[11]. For the reference environment the custom channel created and package used are:

- Channel – web-server-content
- Package – web-1-1.x86_64.rpm

Note: *web-server-content* is created as a child channel under *rhel-x86_64-server-6*

11 https://access.redhat.com/site/documentation/en-US/Red_Hat_Network_Satellite/5.5/html/Channel_Management_Guide/sect-Red_Hat_Network_Satellite-Channel_Management_Guide-Custom_Channel_and_Package_Management-Creating_a_Software_Channel.html

4.4.2 iPXE

iPXE is required by CloudForms 2.0 to provide provisioning for RHEV environments[12]. For the reference environment, iPXE is configured on the Satellite Server utilizing DHCP functions provided by cobbler.

> **Note:** iPXE is not available from Red Hat Network. Contact a Red Hat Sales Associate to obtain.

To configure iPXE on the Satellite Server extract the files under */var/www/html/pub*:

```
# cd /var/www/htmp/pub
# tar -xvzf evm-ixpe.tar
```

Resolve any permission and SELinux context issues:

```
# chown -R nfsnobody.nfsnobody  /var/www/html/pub/miq
# restorecon -vR /var/www/html/pub/miq
```

Modify the cobbler DHCP configuration to point clients to the iPXE chainloader. Add the following lines:

/etc/cobbler/dhcp.template

```
#
# DHCP Server Configuration file.
#   see /usr/share/doc/dhcp*/dhcpd.conf.sample
#
authoritive;
ddns-update-style interim;
ignore client-updates;

subnet 10.16.10.0 netmask 255.255.254.0 {
        option routers                  10.16.11.254;
        option subnet-mask              255.255.254.0;
        option domain-name              "refarch.bos.redhat.com";
        option domain-name-servers
10.16.11.248,10.16.143.247,10.16.255.2;
        option time-offset              -18000; # Eastern Standard Time
        option ntp-servers              10.16.255.2,10.16.255.3;
        filename "pxelinux.0";
        range dynamic-bootp 10.16.11.151 10.16.11.200;
        default-lease-time 21600;
        max-lease-time 43200;
        next-server 10.16.11.248;

                if exists user-class and option user-class = "iPXE" {
                    filename "http://10.16.11.248/pub/miq/ipxe/boot.php";
```

12 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Lifecycle_and_Automation_Guide/Requirements_for_Provisioning_Virtual_Machines_from_Red_Hat_Enterprise_Virtualization_Managers1.html

```
}
else if exists user-class and option user-class = "gPXE" {
    filename "http://10.16.11.248/pub/miq/gpxe/boot.php";
} else  {
   filename "pxelinux.0";
 }

      <content removed for brevity>
```

Note: Customization of cobbler is not supported by Red Hat Global Support Services[13].

CloudForms 2.0 supports either NFS or Samba as the **Depot Type** for the sharing of boot files. For the reference environment NFS is used.

To configure NFS sharing on the Satellite Server, modify */etc/exports* and add the following:

/etc/exports

```
/var/www/html/pub/miq       *(rw,sync,no_subtree_check)
```

Ensure NFS starts on boot:

```
# chkconfig nfs on
```

To configure samba, perform a yum install of samba and edit */etc/samba/smb.conf*.

```
# yum install samba
```

Add the following lines:

/etc/samba/smb.conf

```
#============================ Share Definitions==============================

[homes]
     comment = Home Directories
     browseable = no
     writable = yes
;    valid users = %S
;    valid users = MYDOMAIN\%S

[printers]
     comment = All Printers
     path = /var/spool/samba
     browseable = no
     guest ok = no
     writable = no
     printable = yes

[ipxe]
```

13 https://access.redhat.com/site/support/offerings/production/soc/

```
comment = iPXE Stuff
path = /var/www/html/pub/miq/ipxe
public = yes
writable = yes
printable = no
guest ok = yes
browsable = yes

                        <content removed for brevity>
```

Ensure samba starts on boot:

```
# chkconfig smb on
```

4.5 Security

RHEL/RHEV

`selinux` is enabled and set to enforcing on all systems where applicable. **`iptables`** is enabled on all systems and necessary ports open where applicable. Refer to **Appendix C iptables**.

Microsoft Windows Server

Microsoft Windows firewall is enabled for Domain, Private, and Public profiles. Standard rules are used.

5 Provisioning

CloudForms 2.0 supports two types of provisioning with Red Hat Enterprise Virtualization; PXE and ISO. For the reference environment several items are configured to support the provision process.

The first item requires a template[14] to exist within the virtualization environment whose virtual disk **Allocation Policy** is set to *Thin Provision*[15].

The second item requires an ISO storage domain, with the required image(s), to be attached to the RHEV environment.

The third item involves the installation of the RHEV agent for the newly deployed virtual machine(s). Although not required this provides more granular management.

5.1 PXE

PXE provisioning involves the following:

- Configuring the CFME appliance
- Executing the provisioning process

5.1.1 PXE Configuration

Configure PXE server settings for CloudForms Management Engine by logging into the CFME Console with the *admin* account, hover over the **Infrastructure** tab, and select **PXE**.

Click **Configuration** and select the green plus to **Add a New PXE Server**. Fill in the appropriate information for the PXE server configured in **Section 4.4 Red Hat Satellite Server**.

14 https://access.redhat.com/site/documentation/en-US/Red_Hat_Enterprise_Virtualization/3.2/html/Administration_Guide/index.html

15 https://access.redhat.com/site/documentation/en-US/Red_Hat_Enterprise_Virtualization/3.2/html/Technical_Reference_Guide/sect-Block_based_storage_provisioning_mechanics.html

For the reference environment the following settings are used:

Input Box	Field	Value
Basic Information	Name	cf-refarch
	Depot Type	NFS
	URI	<sat server IP>/var/www/html/pub/miq/ipxe/
	Access URL	http://<sat server ip>/pub/miq/ipxe
	PXE Directory	pxe
	Windows Images Directory	sources/microsoft
	Customization Directory	customization
PXE Image Menus	Filename	menu.php

Table 5.1.1-1: CFME – PXE Server Settings

Click **Add** to complete.

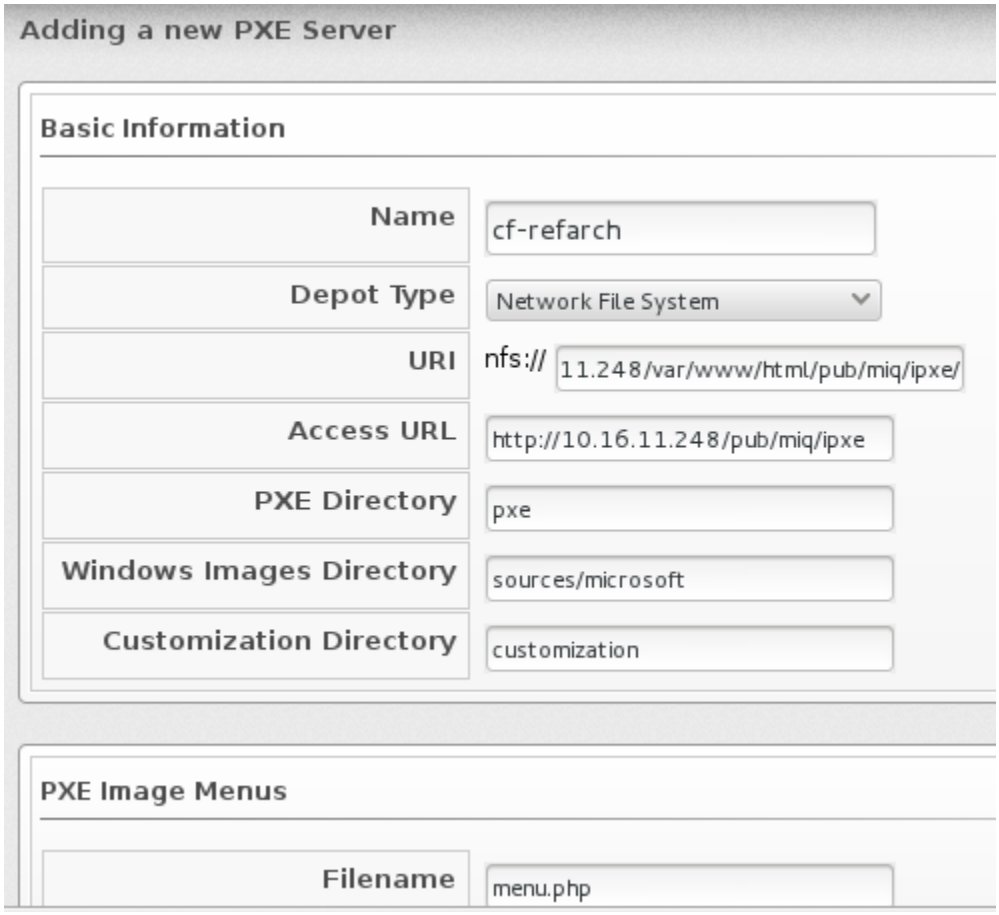


Figure 5.1.1-1: CFME – Add PXE Server

The PXE server will appear under the **PXE Servers** accordion menu in the left window pane. Refresh the **PXE Images** by selecting the PXE server, on the right window pane click **Configuration** and select **Refresh**. This populates a listing of available PXE images based on the *menu.php* file and may take several minutes to complete.

To modify the images presented via the PXE server, edit *menu.php* on the PXE server. The following *menu.php* file is used for the reference environment.

/var/www/html/pub/miq/ipxe/menu.php

```
#!ipxe

menu MTC iPXE Boot Menu

item --gap
item --gap --          -----MIQ Server Auto-Install:
item rhel63server    RHEL6.3 Server
item winpex64        WindowsPE_amd64
item devsrv     Development Server
item websrv     Deployable Web Server

item --gap
item --gap --          -----Other Stuff:
item reboot             Reboot the Machine
item local              Boot Local

choose --default local --timeout 60000 os && goto ${os}
#choose --default reboot --timeout 60000 os && goto ${os}

########## MIQ Desktop Images ##########



########## MIQ Server Images ##########

:rhel63server
kernel http://${next-server}/ks/dist/ks-rhel-x86_64-server-6-
6.3/images/pxeboot/vmlinuz ramdisk_size=10000 ks=http://${next-
server}/pub/miq/ipxe/customization/rhel63.ks.cfg
initrd http://${next-server}/ks/dist/ks-rhel-x86_64-server-6-
6.3/images/pxeboot//initrd.img
boot

:devsrv
kernel http://${next-server}/cobbler/images/ks-rhel-x86_64-server-6-
64/vmlinuz ramdisk_size=10000 ks=http://${next-
server}/cblr/svc/op/ks/profile/testapp1:1:RedHatGSS
initrd http://${next-server}/cobbler/images/ks-rhel-x86_64-server-6-
64/initrd.img
boot

:websrv
kernel http://${next-server}/cobbler/images/ks-rhel-x86_64-server-6-
64/vmlinuz ramdisk_size=10000 ks=http://${next-
server}/cblr/svc/op/ks/profile/websrv:1:RedHatGSS
```

```
initrd http://${next-server}/cobbler/images/ks-rhel-x86_64-server-6-
64/initrd.img
boot

:winpex64
kernel http://${next-server}/pub/miq/ipxe/sources/misc/memdisk iso raw
initrd http://${next-server}/pub/miq/ipxe/sources/microsoft/winpe_amd64.iso
boot


########## Other Stuff ##########

:reboot
reboot

:local
exit
```

Add a new system image type by clicking **System Image Types** on the accordion menu in the left window pane. On the right window pane click **Configuration** and select the green plus to **Add a new System Image Type**. In the **Basic Information** input box provide a **Name** and a **Type**. For type, *Vm* is chosen. Click **Add** to complete.

Figure 5.1.1-2: CFME – PXE System Image Type

Map the system image to the PXE image by selecting **PXE Servers** from the accordion menu in the left window pane. Choose the image under **PXE Images**.

On the right window pane click **Configuration** and select **Edit this PXE Image**.

In the **Basic Information** input box, click the pull down menu next to **Type** and choose the system image type.

Click **Save** to complete.

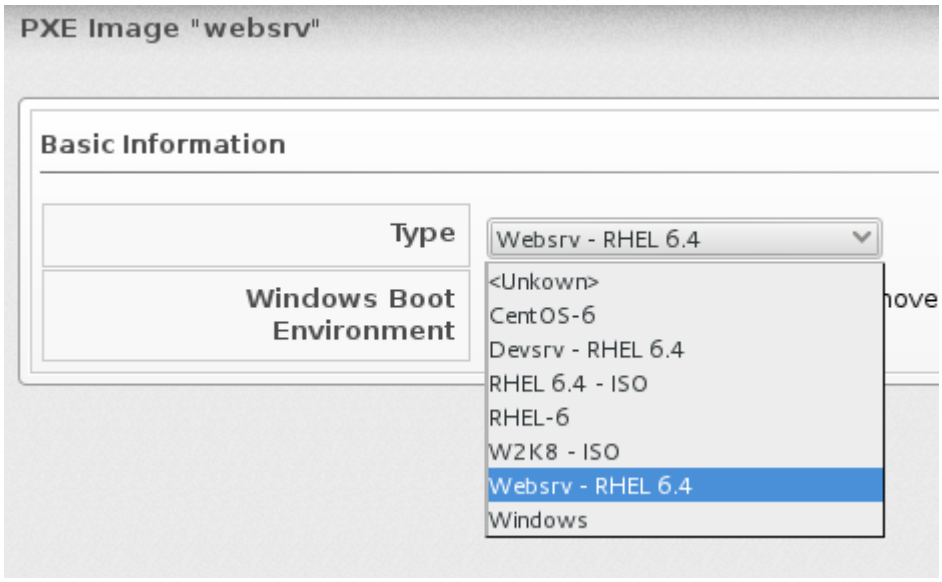


Figure 5.1.1-3: CFME – PXE Image Mapping to System Image Type

Note: The **Windows Boot Environment**[16] setting is not used for the reference environment.

The final step to complete the PXE configuration on the CFME appliance is to create a customization template that maps to the **System Image Type**. From the accordion menu in the left window pane click **Customization Templates** and select **All Customization Templates – System Image Types**.

On the right window pane click **Configuration** and select the green plus to **Add a New Customization Template**.

In the **Basic Information** input box provide a **Name**, **Description**, **Image Type**, **Type**, and **Script**. For the reference environment the following settings are used:

Input Box	Field	Value
Basic Information	Name	websrv
	Description	Websrv – RHEL 6.4 PXE
	Image Type	Websrv – RHEL 6.4
	Type	Kickstart
	Script	Refer to **Appendix D kickstart**

Table 5.1.1-2: CFME – PXE Customization Template Settings

16 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html-single/Management_Engine_5.1_Lifecycle_and_Automation_Guide/#sect-PXE_Provisioning

Click **Add** to complete.

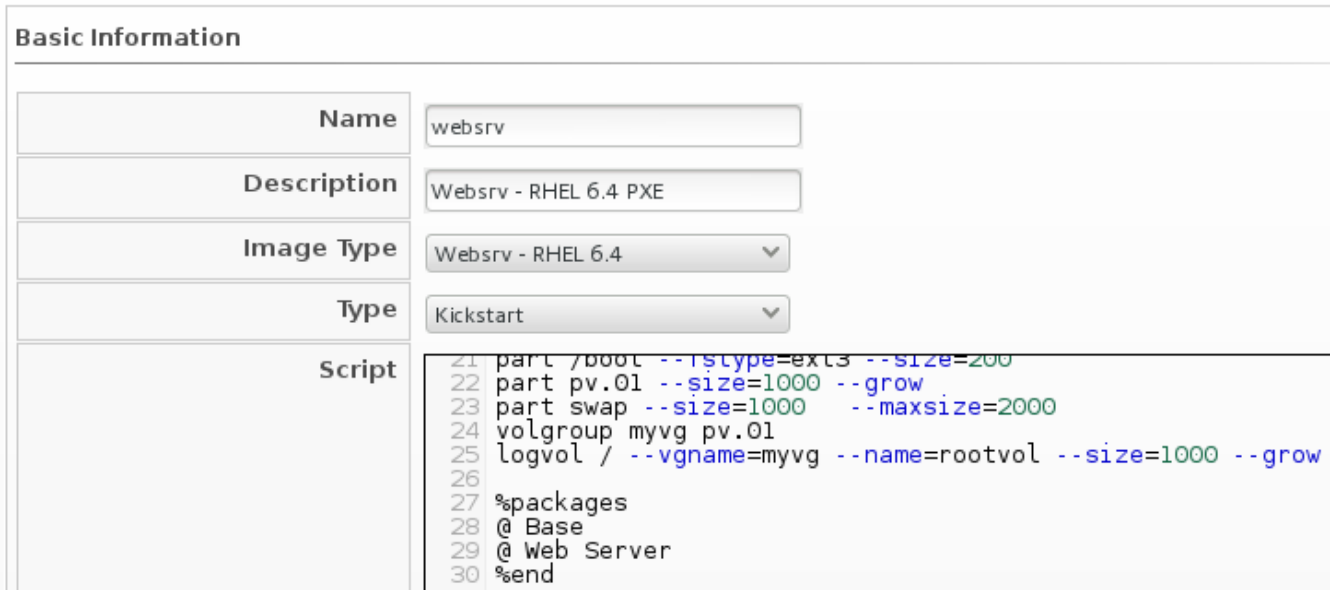


Figure 5.1.1-4: CFME – PXE Add Customization Template

The script used is copied directly from the Satellite Server. To obtain the script, login to the Red Hat Satellite Server using the *admin* account. Navigate to **Systems**, **Kickstart**, **Profiles**, and click the desired profile. Click **Kickstart File** and **Download Kickstart File**. Copy and paste the contents of this file into the **Script** field for the customization template.

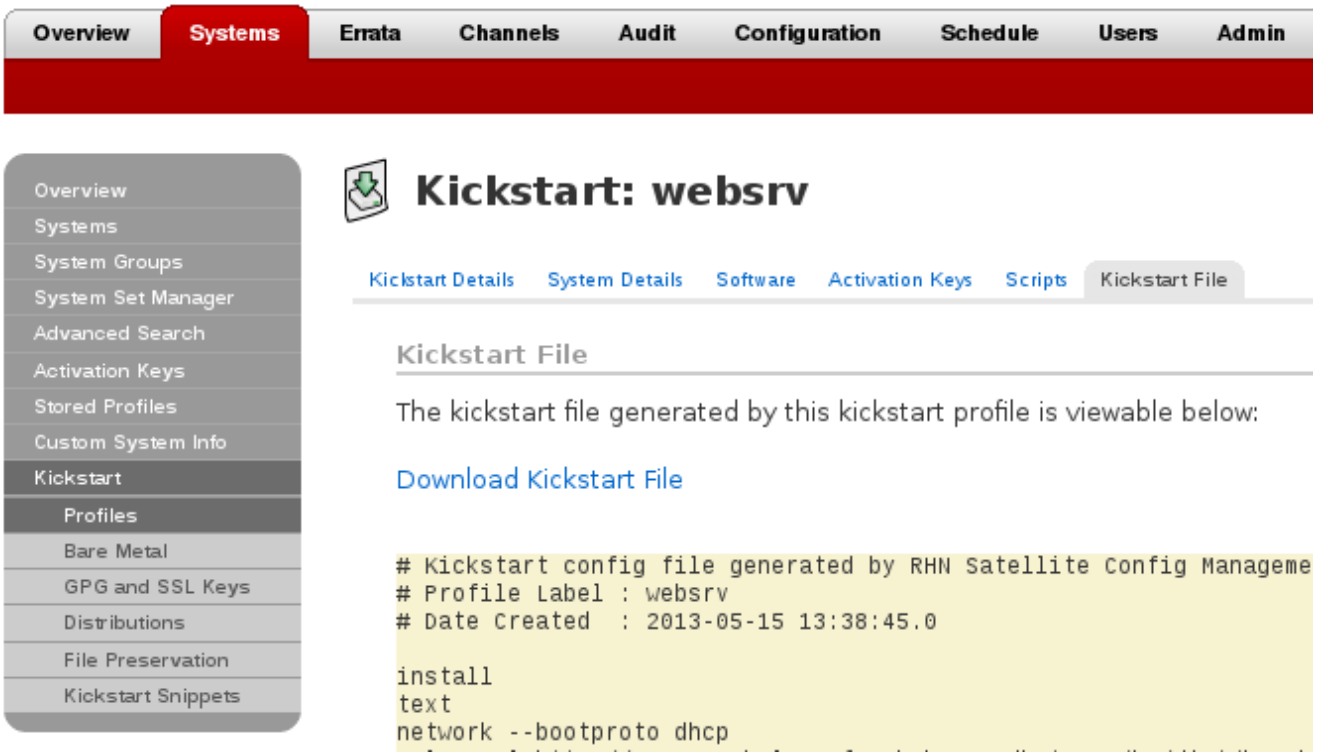


Figure 5.1.1-5: Satellite Server – Kickstart File

Note: For CloudForms support, the kickstart script contains a couple of modifications. The first modification is to change `reboot` to `poweroff`. The second change adds a call back to the CFME appliance for deployment status. This is placed in the *%post* section of the kickstart script.

```
%post
#CFME Deployment Status
wget --no-check-certificate <%= evm[:callback_url_on_post_install] %>
%end
```

5.1.2 PXE Provisioning

To provision a virtual machine, log into the CFME Console with the *admin* account, hover over the **Services** tab and select **Virtual Machines**. Click **Lifecycle** and select the green plus to **Provision VMs**.

Figure 5.1.2-1: CFME – Provision VM

Select the desired template from the list. For the reference environment *websrv* is chosen. Click **Continue** to proceed.

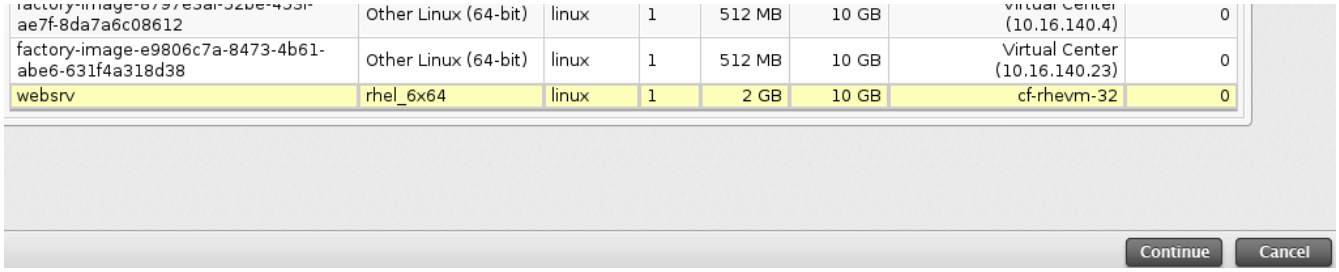


Figure 5.1.2-2: CFME – Provision Template

The next step presents a series of tabs for which information is provided to include virtual machine settings, where to provision the virtual machine, and customization templates to provision the virtual machine against. Complete the settings under each tab before clicking the **Submit** button at the bottom. The following settings are used for the reference environment:

Request

Input Box	Field	Value
Request Information	*E-mail	bthurber@redhat.com
	*First Name	cf-admin
	*Last Name	cf-admin
	Notes	PXE provision request.
Manager	Name	Brett Thurber

Table 5.1.2-1: CFME – PXE Provision Request Values

*Click the **Validate** button to automatically map the LDAP username settings to the supplied e-mail address. The LDAP user settings must have an e-mail address associated to the LDAP user account.

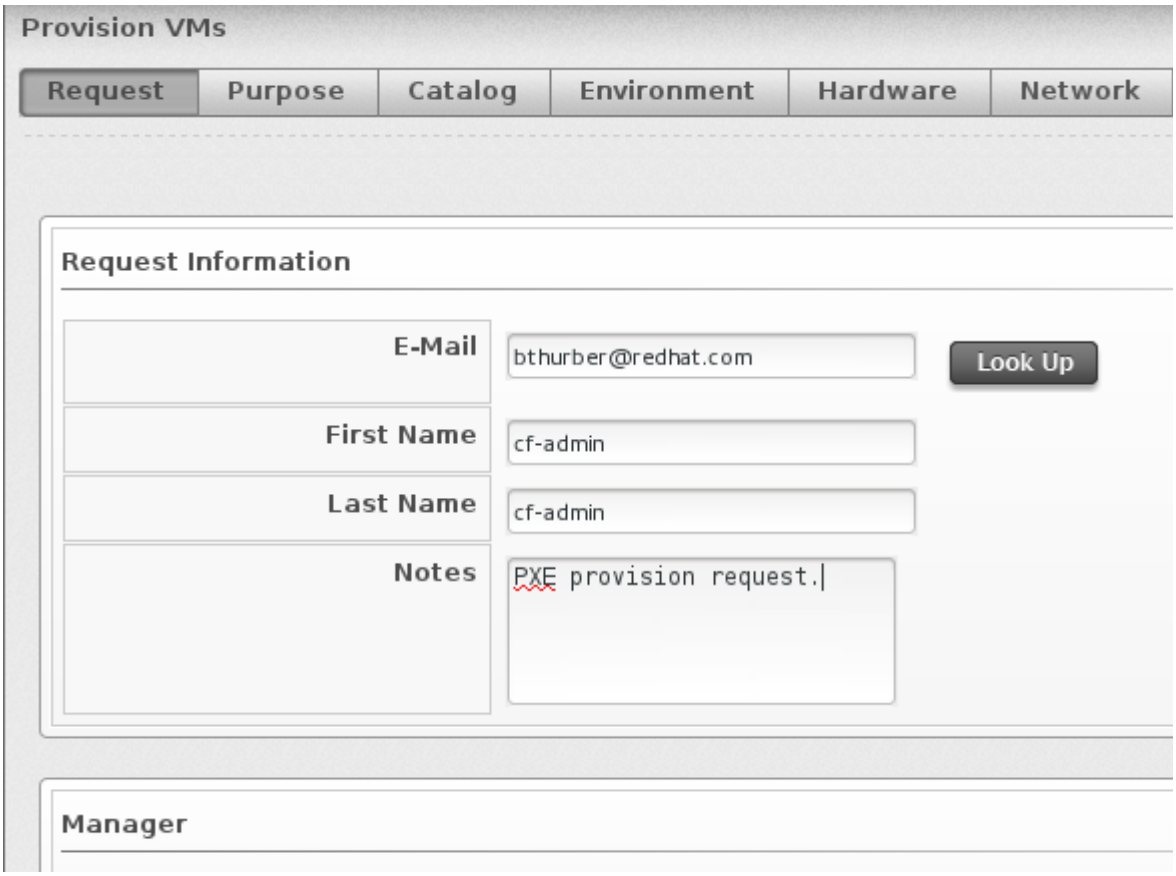


Figure 5.1.2-3: CFME – PXE Provision Request Settings

Purpose

Select the **Purpose** tab. Within the **Select Tags to apply** input box expand **Environment** and select the *CloudForms* tag. This is not a mandatory value however is used to assign tags specific to the environment.

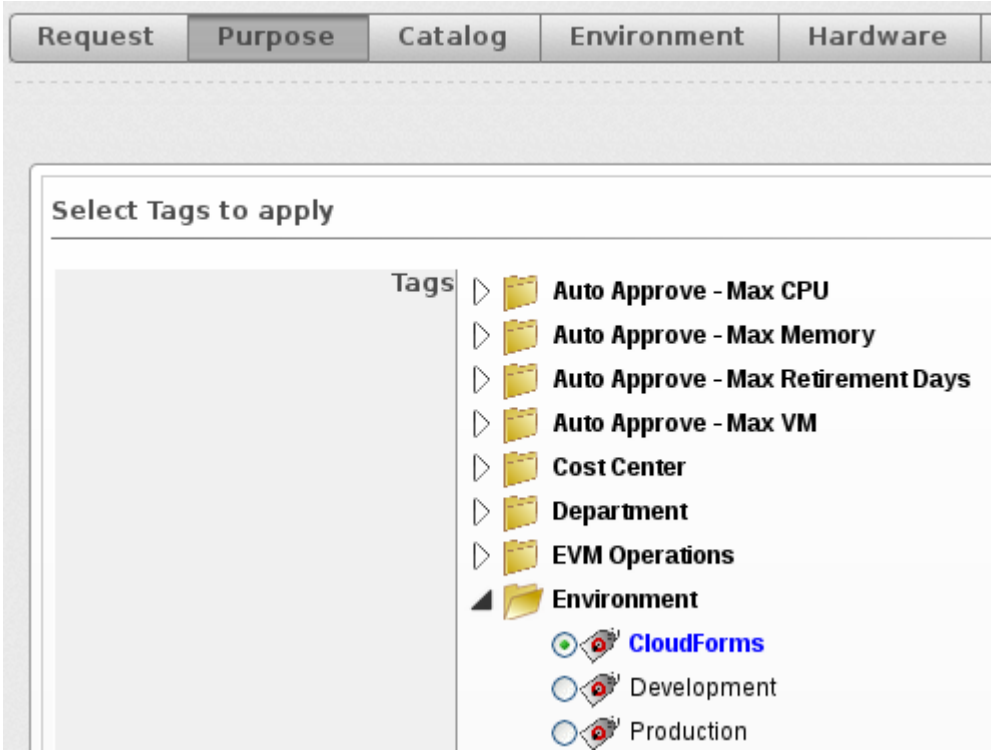


Figure 5.1.2-4: CFME – PXE Provision Purpose Settings

Catalog

The following settings are used under the **Catalog** tab and define the PXE server, image, virtual machine quantity, and name used.

Input Box	Field	Value
Selected VM	Name	websrv
	Provision Type	PXE
PXE	Server	cf-refarch
	Image	websrv
Number of VMs	Count	1
VM Naming	VM Name	pxe-websrv-deploy
	VM Description	PXE deployed websrv.

Table 5.1.2-2: CFME – PXE Catalog Values

The following displays the PXE **Catalog** settings.

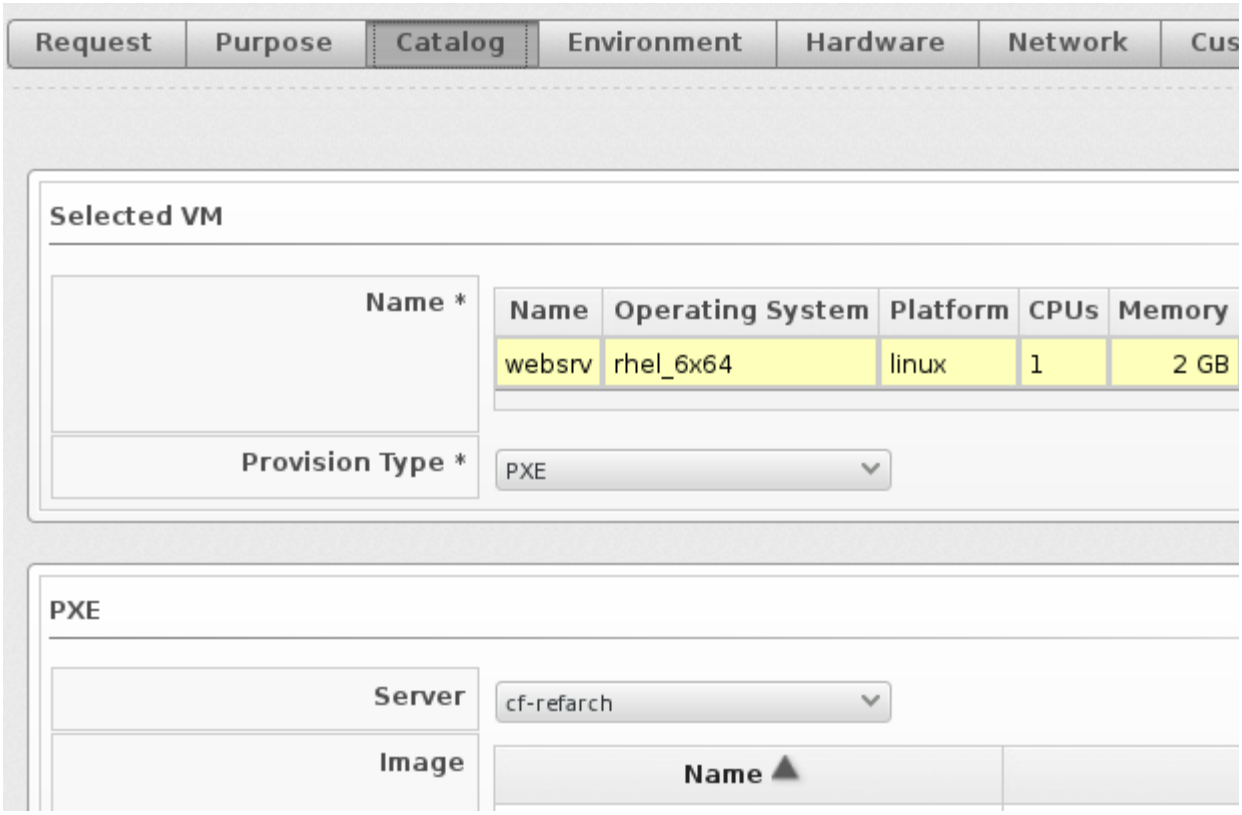


Figure 5.1.2-5: CFME – PXE Provision Catalog Settings

Environment

The following settings are used under the **Environment** tab and define where the newly created virtual machine is to be placed.

Input Box	Field	Value
VM Placement	Choose Automatically	Unchecked
Datacenter	Name	Default
Cluster	Name	Default
Host	Name	cf-rhevh.refarch.bos.redhat.com
Datastore	Name	cf-cfme-2

Table 5.1.2-3: CFME – PXE Environment Values

The following displays the PXE **Environment** settings.

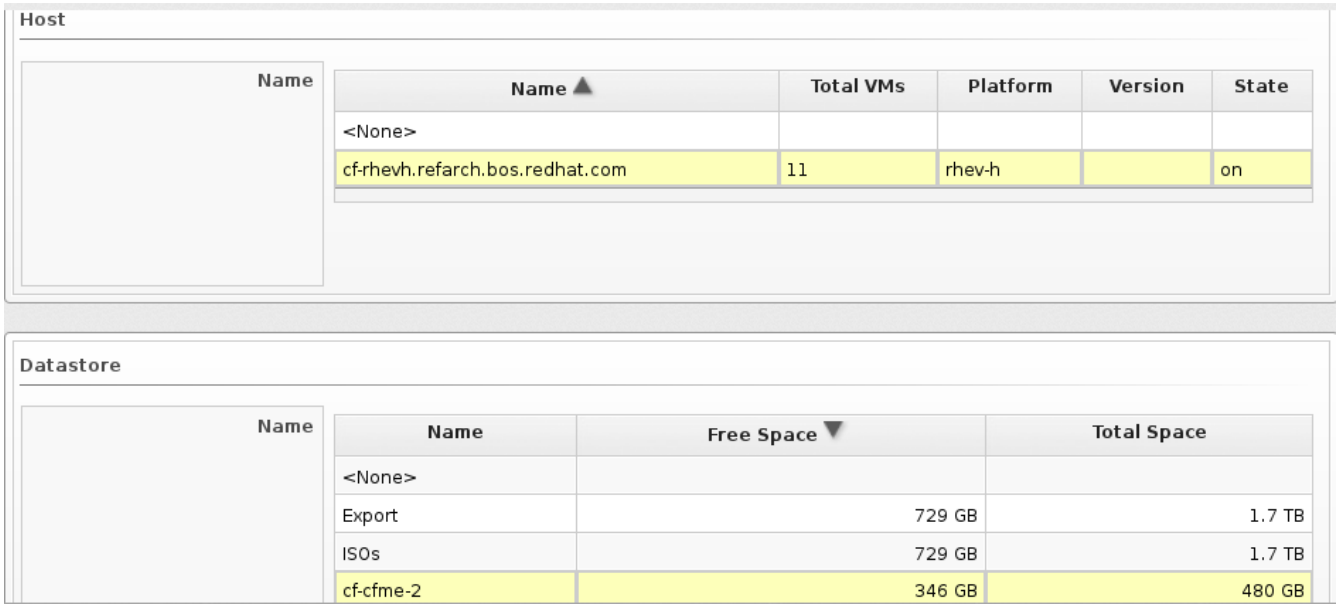


Figure 5.1.2-6: CFME – PXE Provision Environment Settings

Hardware

The **Hardware** tab contains hardware specifics for the virtual machine. The settings are automatically populated based on the selected template chosen. For the reference environment no changes were made.

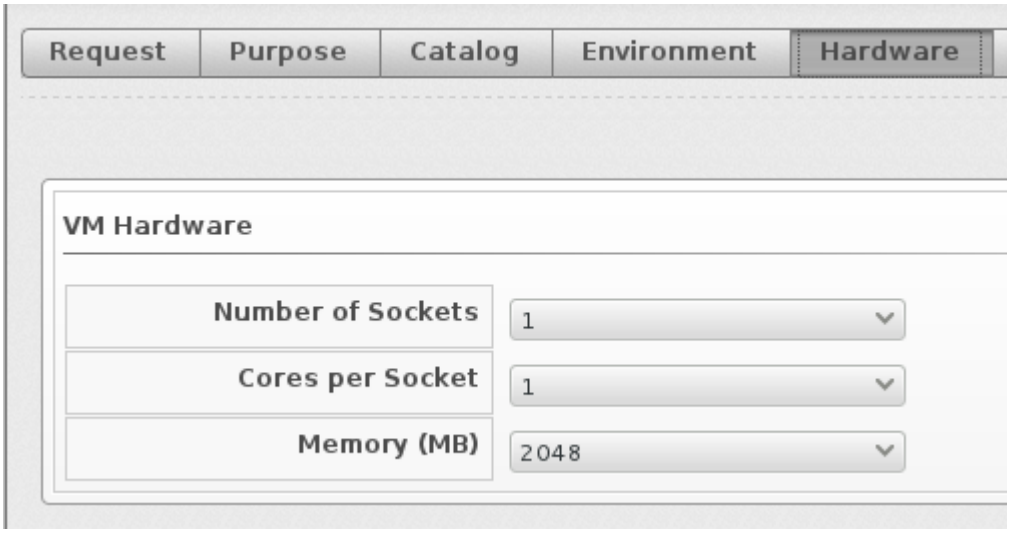


Figure 5.1.2-7: CFME – PXE Provision Hardware Settings

Network

The **Network** tab contains settings for the **vLan** value. This value is populated based on the template chosen. For the reference environment no changes were made.

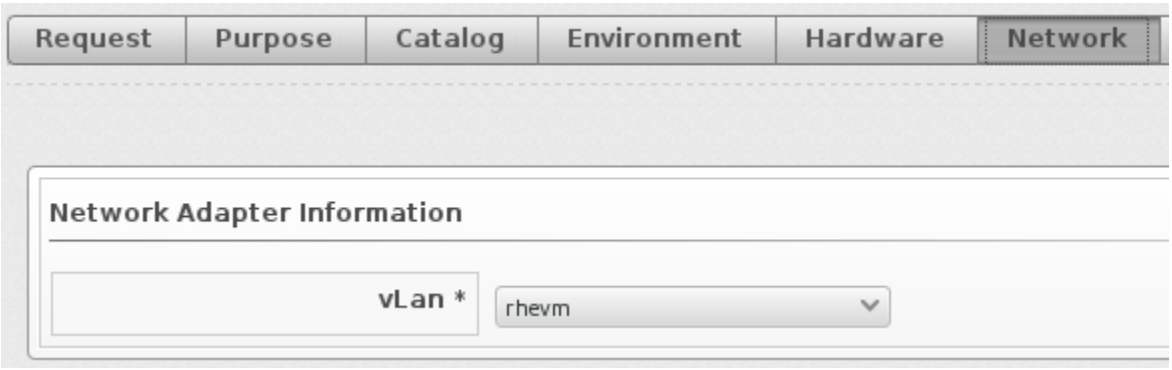


Figure 5.1.2-8: CFME – PXE Provision Network Settings

Customize

The **Customize** tab contains settings for credentials, IP address information, DNS, and specifying a customization template. Credentials, IP address, and DNS information provide a method to deviate from the template settings. Customization template is an option presented based on the image chosen from the PXE environment. For the reference environment, **Customization Template** is the only setting changed.

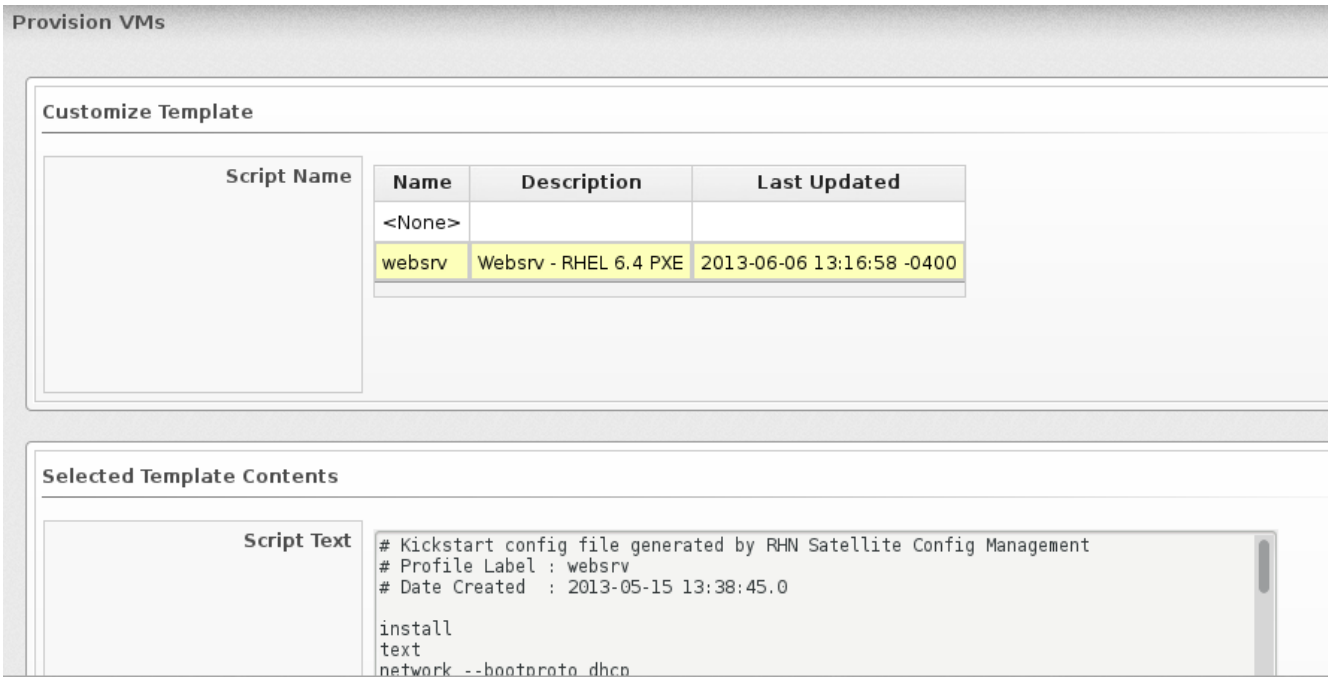


Figure 5.1.2-9: CFME – PXE Provision Customize Settings

Schedule

The **Schedule** tab contains settings for scheduling and lifespan for the virtual machine. For the reference environment default setting are used.

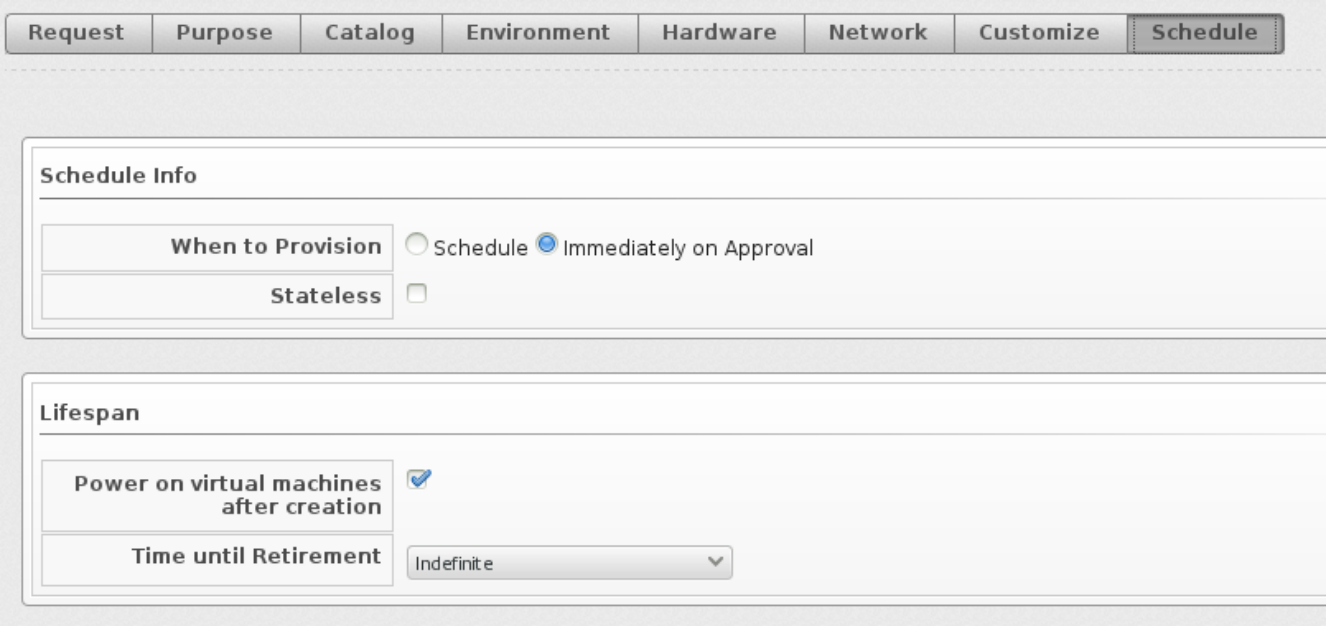


Figure 5.1.2-10: CFME – PXE Provision Schedule Settings

The final step to complete the VM Provision is to click the **Submit** button. Upon doing so, the logged in user is redirected to **Services**, **Requests** where a status is displayed for the provision status.

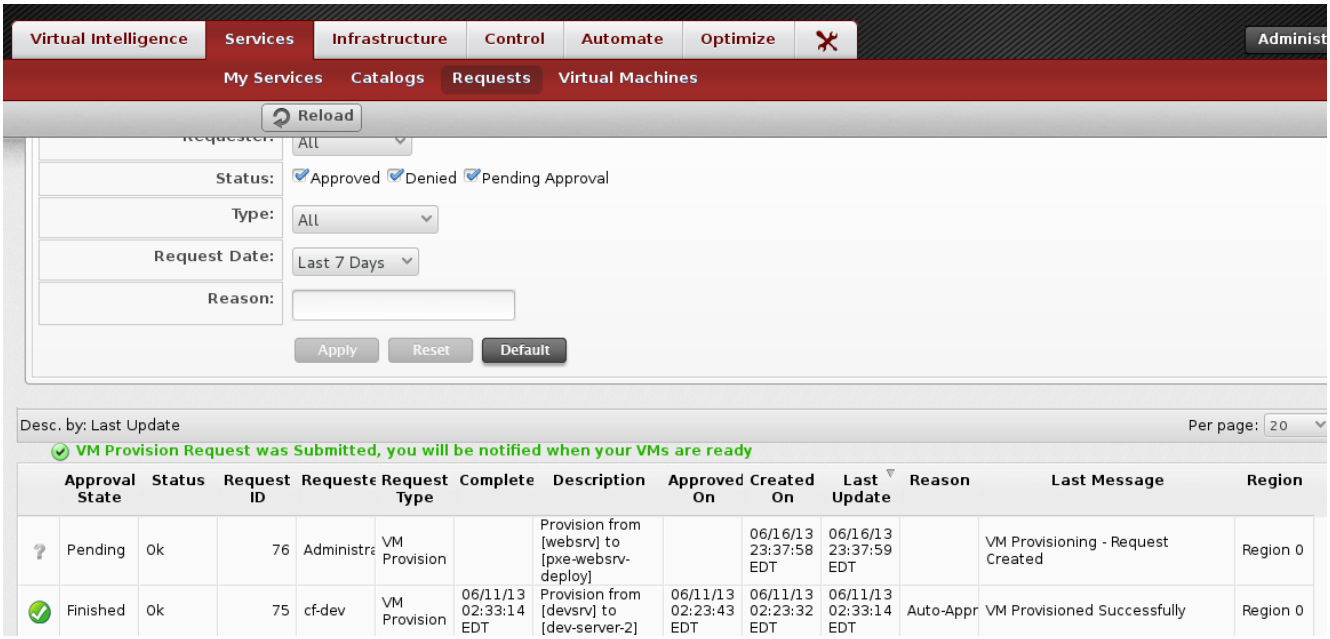


Figure 5.1.2-11: CFME – PXE Provision Status

Alternatively, on the CFME appliance the following log files can be monitored for status:

- */var/www/miq/vmdb/log/automate.log*
- */var/www/miq/vmdb/log/evm.log*

Note: If there are multiple CFME appliances in the same zone with the *Automation Engine* role enabled, it may be necessary to monitor the log files across each appliance.

A status e-mail is sent to the requester indicating a request was received, approved, and is pending quota validation.

```
Hello,
Your Virtual Machine Request was approved. If Quota validation is successful
you will be notified via email when the VM is available.

Approvers notes:

To view this Request go to: https://<CFME_appliance>/miq_request/show/76

Thank you,
Virtualization Infrastructure Team
```

Upon completion another e-mail is sent indicating the provision task has completed.

```
Hello,

Your request to provision a virtual machine was approved and completed on
Sunday, June 16, 2013 at 11:48PM.

Virtual machine pxe-websrv-deploy will be available in approximately 15
minutes.

For Windows VM access is available via RDP and for Linux VM access is
available via putty/ssh, etc. Or you can use the Console Access feature
found in the detail view of your VM. As the designated owner you will
receive expiration warnings at this email address: bthurber@redhat.com

If you are not already logged in, you can access and manage your virtual
machine here https://<CFME_appliance>/vm_or_template/show/102'

If you have any issues with your new virtual machine please contact Support.

Thank you,
Virtualization Infrastructure Team
```

Note: Outgoing SMTP e-mail settings[17] must be configured on the CFME appliance(s) to allow e-mail notifications to be sent.

17 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/sect-E-mail_Settings.html

Custom e-mail notifications can be configured in the Automate[18] model. To configure, hover over **Automate** and select **Explorer**. In the left window pane navigate to **Alert/Email Notifications (Email Notifications)**. Choose the desired method for the action and modify as needed.

Check the virtual machine functionality by accessing the CFME Console, hovering over **Services** and clicking **Virtual Machines**.

Under **VMs and Templates** on the left window pane accordion menu, locate and select the the RHEV 3.2 environment.

On the right window pane locate and click the newly deployed VM (*pxe-websrv-deploy*).

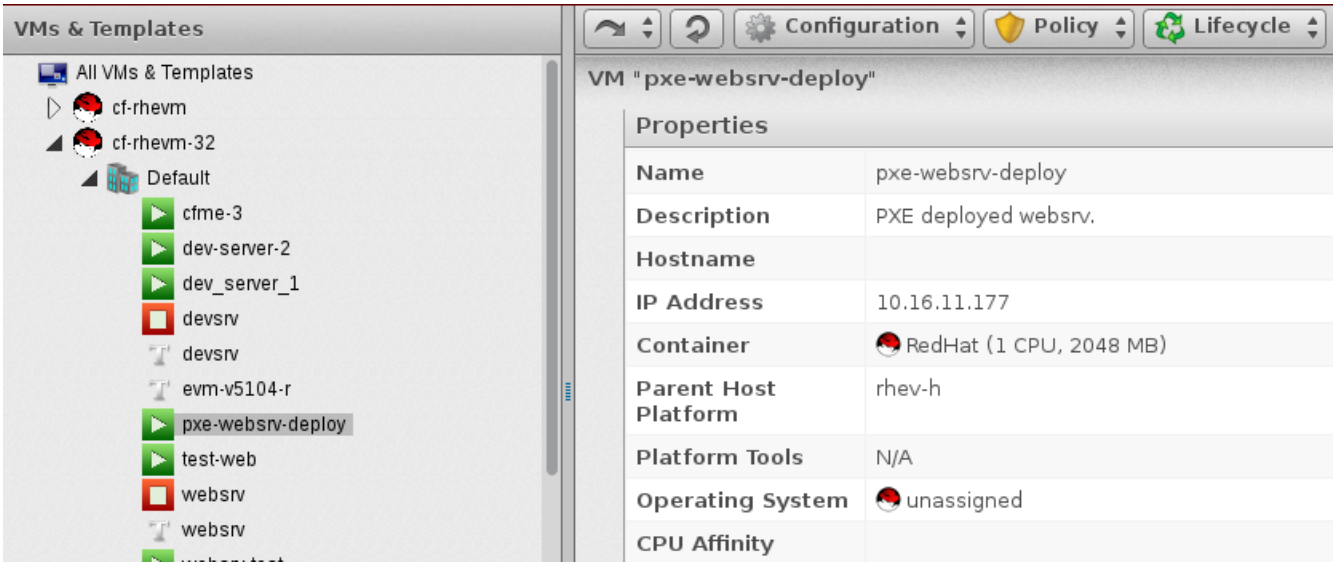


Figure 5.1.2-12: CFME – PXE Provision VM Settings

Notate the assigned IP address and access the system via a web browser.

Figure 5.1.2-13: CFME – PXE Provision VM Functionality

18 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Lifecycle_and_Automation_Guide/chap-Automate_Model.html

5.2 ISO

ISO provisioning involves the following:

- Configuring the CFME appliance
- Executing the provisioning process

5.2.1 ISO Configuration

For the reference environment, the first step in preparing for ISO provisioning is to prepare an ISO image with the required customization. PXE provisioning utilizes customization templates where ISO provisioning customization can be built into the ISO image. The reference environment utilizes a custom RHEL 6.4 ISO image.

To create a custom image, download the desired ISO to a RHEL based system. Mount the ISO image and copy it's contents to a temporary location.

```
# mount -o loop rhel-server-6.4-x86_64-dvd.iso /mnt/rhel
```

```
# rsync -avP /mnt/rhel /tmp/rhel
```

Create and populate a *ks.cfg* file in the top level directory where the *.iso* is copied to. The contents of this file are populated with the kickstart file generated from the Red Hat Satellite Server. Refer to **Section 5.1 PXE** for details on obtaining the contents. For the reference environment *websrv* is the kickstart file used for ISO provisioning. Refer to **Appendix D kickstart** for content details.

```
# vi /tmp/rhel/rhel/ks.cfg
```

Edit */tmp/rhel/rhel/isolinux/isolinux.cfg* and modify the append lines with **ks=cdrom:/ks.cfg**.

```
label linux
  menu label ^Install or upgrade an existing system
  menu default
  kernel vmlinuz
  append initrd=initrd.img ks=cdrom:/ks.cfg
label vesa
  menu label Install system with ^basic video driver
  kernel vmlinuz
  append initrd=initrd.img xdriver=vesa nomodeset ks=cdrom:/ks.cfg
label rescue
  menu label ^Rescue installed system
  kernel vmlinuz
  append initrd=initrd.img rescue ks=cdrom:/ks.cfg
```

With the customization complete, create an ISO that is uploaded into the ISO storage domain within the RHEV environment used.

```
# mkisofs -J -R -v -T -o /tmp/custom-rhel6.iso -b isolinux/isolinux.bin -c
isolinux/boot.cat -no-emul-boot -boot-load-size 4 -boot-info-table .
```

Use **scp** to securely copy the custom ISO to the RHEV Manager system.

```
# scp custom-rhel6.iso root@cf-rhevm-32.refarch.bos.redhat.com:/root
```

On the RHEV-M system upload the custom ISO to the ISO storage domain.

```
# rhevm-iso-uploader -i ISOs upload custom-rhel6.iso
```

Configure ISO server settings for CloudForms Management Engine by logging into the CFME Console with the *admin* account, hover over the **Infrastructure** tab, and select **PXE**.

On the left window pane, accordion menu, select **ISO Datastores**.

On the right window pane click **Configuration** and select the green plus to **Add a New ISO Datastore**.

In the **Basic Information** input box, click the pull down menu next to **Management System** and select the desired RHEV Manager. Click the **Add** button at the bottom to complete.

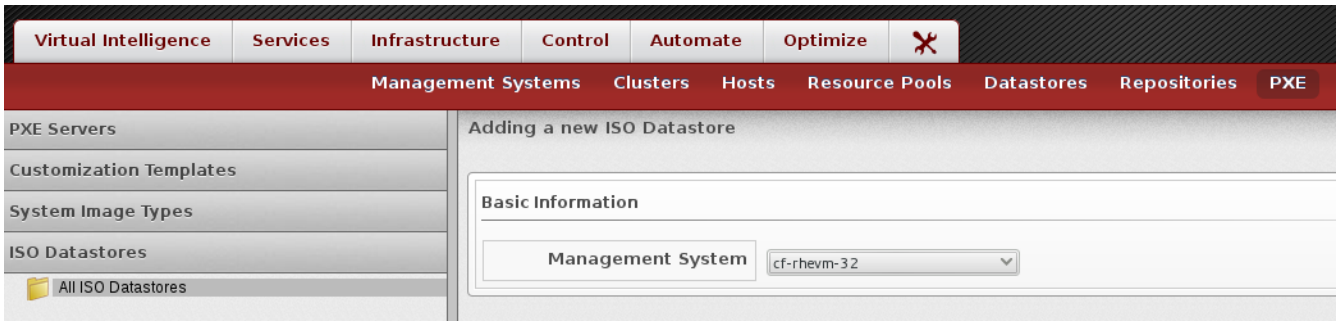


Figure 5.2.1-1: CFME – ISO Datastore

Note: An ISO domain must be attached to the RHEV environment.

Refresh the newly added ISO datastore by selecting the RHEV-M system under **ISO Datastores** under the accordion menu on the left window pane.

On the right window pane click **Configuration** and select **Refresh**. After several minutes click the **Reload current display** button next to **Configuration**.

On the right window pane a content listing of the datastore is displayed.

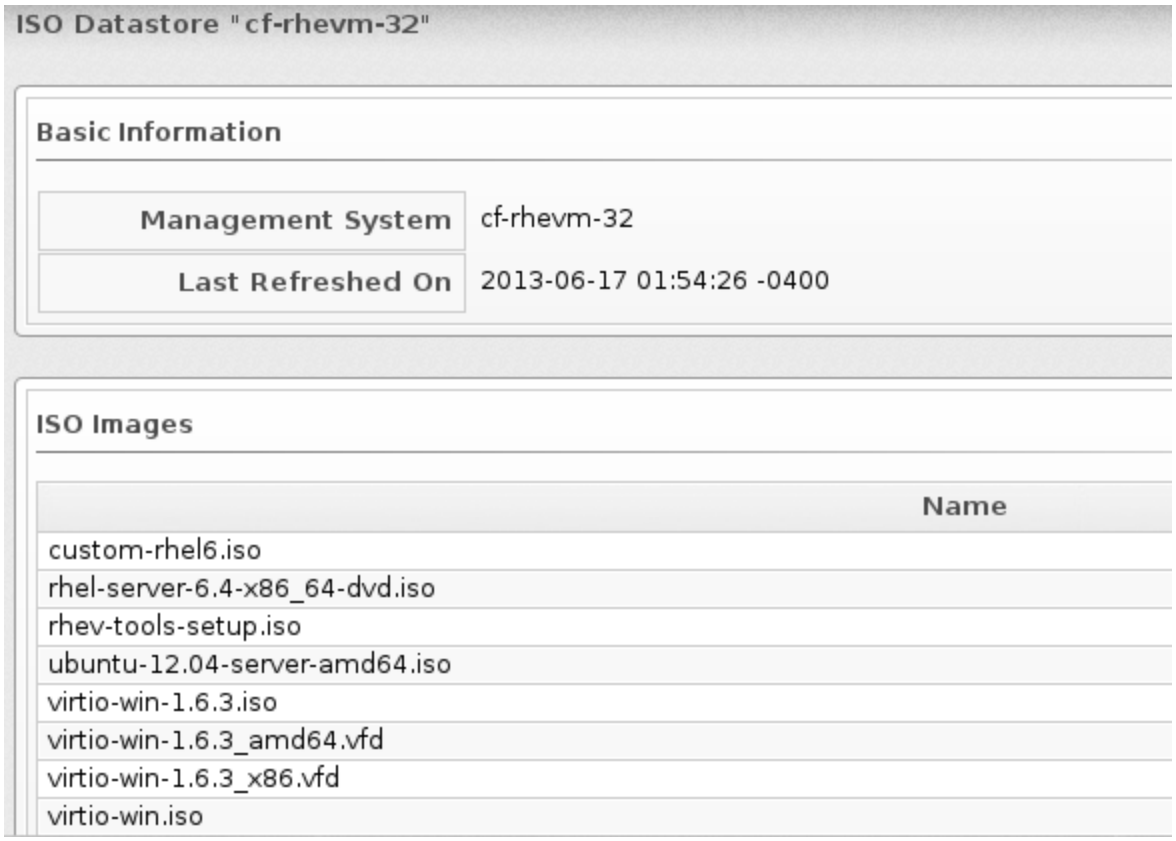


Figure 5.2.1-2: CFME – ISO Datastore Contents

Add a new system image type by selecting **System Image Types** from the accordion menu on the left window pane.

On the right window pane click **Configuration** and select the green plus to **Add a New System Image Type**.

In the **Basic Information** input box, provide a **Name** and set the **Type** to *Vm*. Click **Add** to complete.

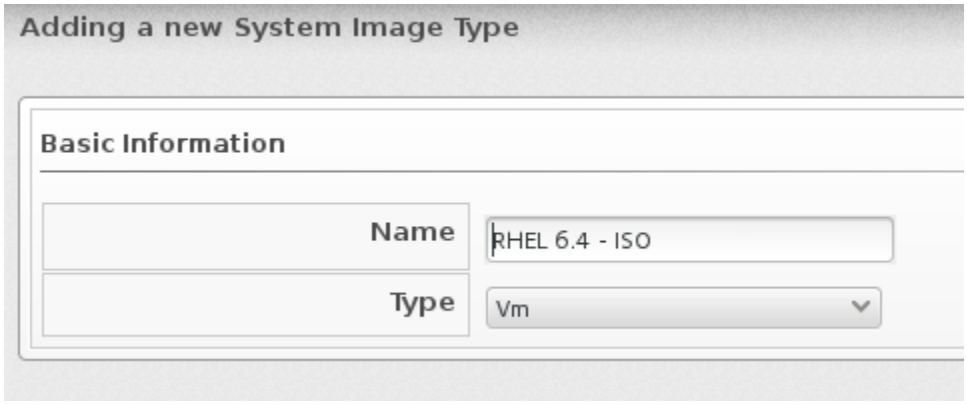


Figure 5.2.1-3: CFME – ISO System Image Type

Assign the system image type to the custom ISO. On the left window pane select **ISO Datastore** from the accordion menu. Expand **ISO Images** under the ISO domain and choose the custom ISO image.

On the right window pane click **Configuration** and select **Edit this ISO Image**.

In the **Basic Information** input box click the pull down menu next to **Type** and select the previously create system image type. Click **Save** to complete.

Figure 5.2.2-1: CFME – ISO System Image Type Assignment

5.2.2 ISO Provisioning

To provision a virtual machine, log into the CFME Console with the *admin* account, hover over the **Services** tab and select **Virtual Machines**. Click **Lifecycle** and select the green plus to **Provision VMs**.

> **Note:** The process to provision a VM from ISO is the same as provisioning via PXE with subtle changes. Only the differences are covered for the reference environment.

Request

The only change under the **Request** tab is the **Notes** dialogue.

Input Box	Field	Value
Request Information	Notes	ISO provision request.

Table 5.2.2-1: CFME – ISO Provision Request Values

Purpose

Same as PXE provisioning.

Catalog

The following changes are made.

Input Box	Field	Value
Selected VM	Provision Type	ISO
ISO	Image	custom-rhel6.iso
VM Naming	VM Name	iso-websrv-deploy
	VM Description	ISO deployed websrv.

Table 5.2.2-2: CFME – ISO Provision Catalog Values

Environment

Same as PXE provisioning.

Hardware

Same as PXE provisioning.

Network

Same as PXE provisioning.

Customize

The only change made under the **Customize** tab is the **Script Name** field.

Input Box	Field	Value
Customize Template	Script Name	None

Table 5.2.2-3: CFME – ISO Provision Customize Values

Schedule

Same as PXE provisioning.

Click the **Submit** button to initiate the deployment. Upon doing so, the logged in user is redirected to **Services**, **Requests** where a status is displayed for the provision status.

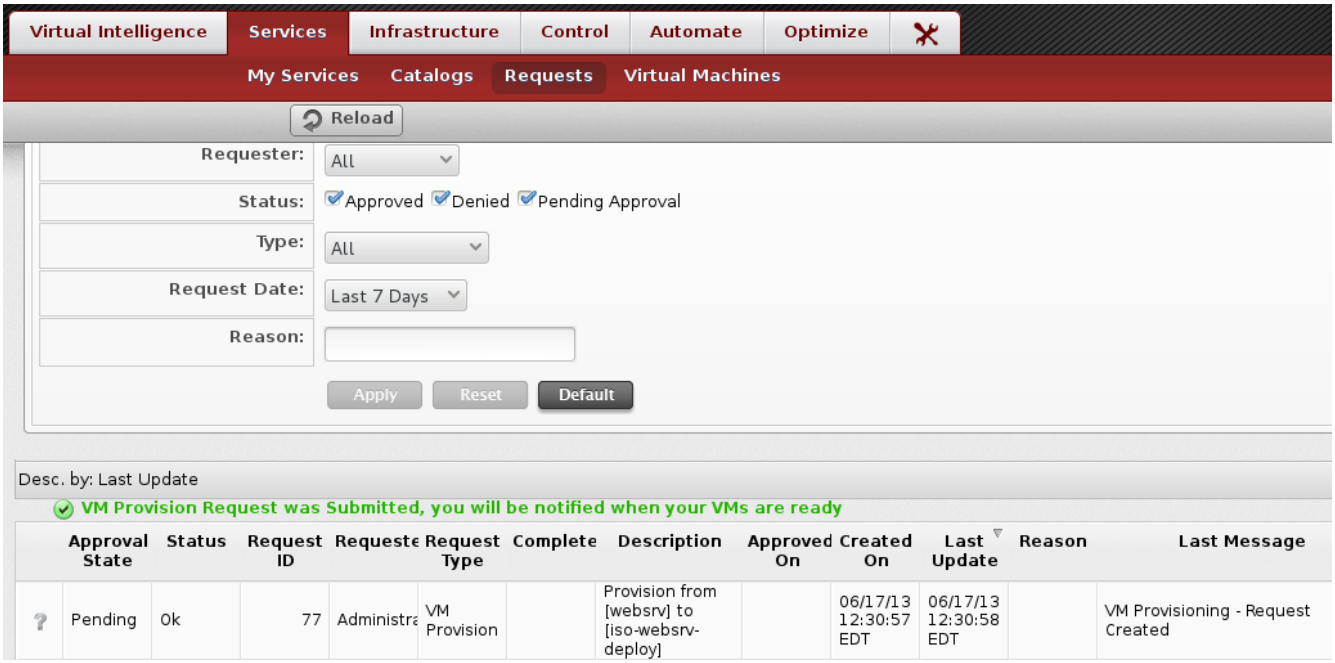


Figure 5.2.2-2: CFME – ISO Provision Status

> **Note:** Refer to PXE provisioning for additional location of log files to monitor during the provision process.

A status e-mail is sent to the requester indicating a request was received, approved, and is pending quota validation.

```
Hello,
Your Virtual Machine Request was approved. If Quota validation is successful
you will be notified via email when the VM is available.

Approvers notes:

To view this Request go to: https://<CFME_appliance>/miq_request/show/77

Thank you,
Virtualization Infrastructure Team
```

Upon completion another e-mail is sent indicating the provision task has completed.

```
Hello,

Your request to provision a virtual machine was approved and completed on
Monday, June 17, 2013 at 12:42PM.

Virtual machine iso-websrv-deploy will be available in approximately 15
```

```
minutes.

For Windows VM access is available via RDP and for Linux VM access is
available via putty/ssh, etc. Or you can use the Console Access feature
found in the detail view of your VM. As the designated owner you will
receive expiration warnings at this email address: bthurber@redhat.com

If you are not already logged in, you can access and manage your virtual
machine here https://<CFME appliance>/vm_or_template/show/103'

If you have any issues with your new virtual machine please contact Support.

Thank you,
```

Check the virtual machine functionality by accessing the CFME Console, hovering over **Services** and clicking **Virtual Machines**. Under **VMs and Templates** on the left window pane accordion menu, locate and select the RHEV 3.2 environment.

On the right window pane locate and click the newly deployed VM (*iso-websrv-deploy*).

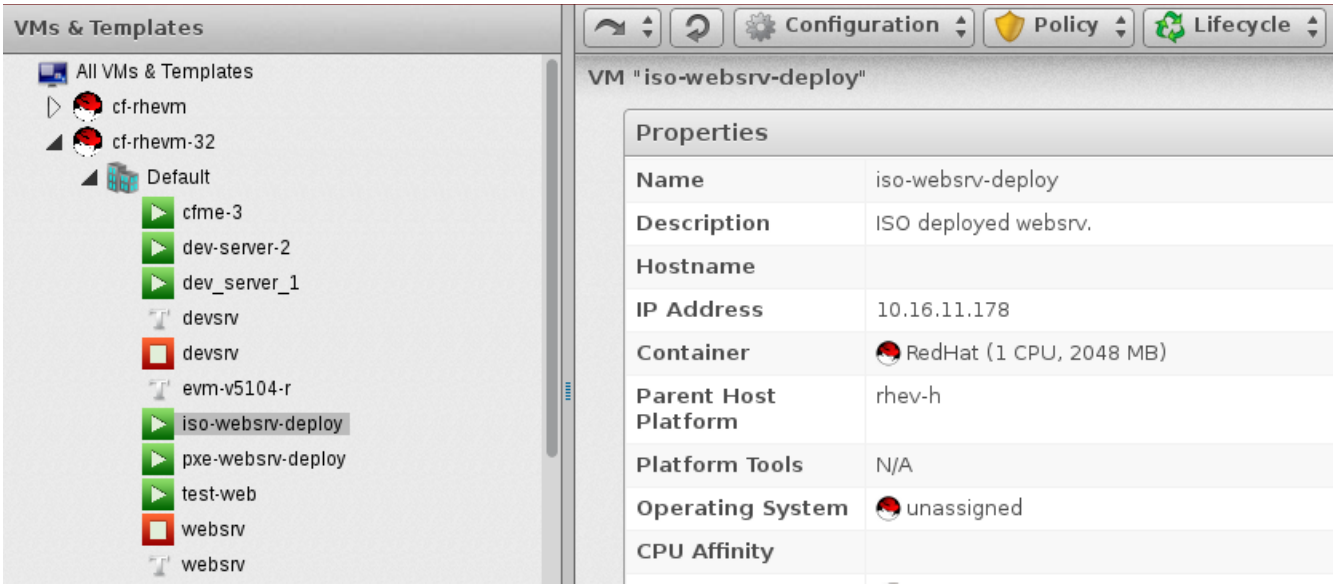


Figure 5.2.2-3: CFME – ISO Provision VM Settings

Notate the assigned IP address and access the system via a web browser.

Figure 5.2.2-4: CFME – ISO Provision VM Functionality

6 Automation

CloudForms 2.0 provides an Automation model[18] that allows for actions to take place based on events or by user and administrator manual invocation. Combined with Control policies[19], Automation becomes a powerful way to manage the infrastructure.

The reference environment is configured to generate an automation action based off an event and action assigned to a control policy. In this use case the goal is to provide resiliency for a web server running on a deployed virtual machine in the RHEV 3.2 environment managed by CloudForms.

To automate these actions the following steps are performed:

- Assign provisioning tags
- Create a control policy
- Create an automation action via the automation model
- Verify functionality

6.1 Provisioning Tags

The Provisioning Scope tag enables a defined set of resources the ability to service provisioning requests using the Automate model. If resources aren't assigned this tag, provisioning requests using the Automate model fail to execute.

To assign the Provisioning Scope tag to the Management System, Host, and Datastore for the RHEV 3.2 environment, hover over **Infrastructure** and select **Management Systems**. Locate the RHEV 3.2 Manager and place a check mark next to it.

On the menu bar click **Policy** and select **Edit Tags**. In the **Tag Assignment** input box next to **Select a customer tag to assign**, in the first pull down menu choose *Provisioning*. For the second pull down menu select *All*. The new tag assignment appears in the **Tag Assignment** input box. Click **Save** to continue.

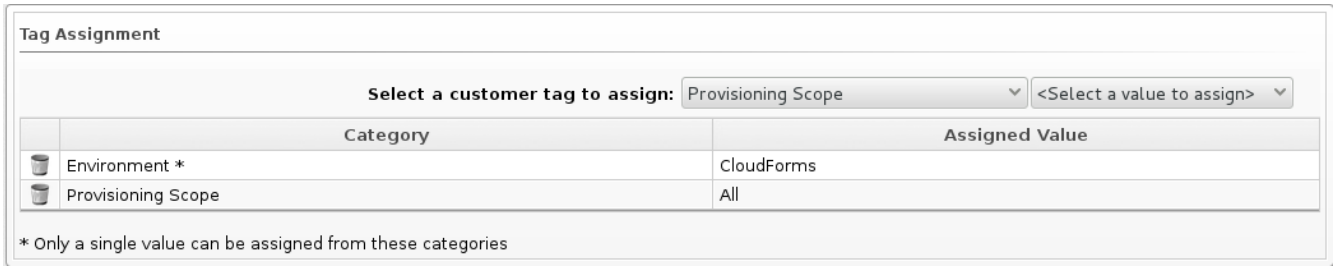


Figure 6.1-1: CFME – Management System Tag Assignment

Perform the same process for the RHEV 3.2 Host and Datastore.

19 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Control_Guide/chap-Control_Policies.html

The RHEV 3.2 infrastructure for the reference environment includes:

Component	Resource
Management System	cf-rhevm-32
Host	cf-rhevh
Datastore	cf-cfme-2

Table 6.1-1: CFME – RHEV 3.2 Managed Resources

6.2 Policies

Policies provide the capability to manage the environment. There are three types of policies to consider, alert, compliance, and control. Alert policies provide notification for significant environment events. Compliance policies provide the ability to check the environment for security compliance. Control policies provide the capability to take action based on an event or series of events that occur.

For the reference environment a control policy is used to take action based on a virtual machine event. The control policy invokes an automation action to deploy a virtual machine based on a virtual machine power off event. This provides resiliency for the web application running on the virtual machine.

6.2.1 Control Policy Creation

To create a control policy, log into the CFME Console with the *admin* account, hover over the **Control** tab and select **Explorer**.

On the accordion menu in the left window pane, select **Actions**.

On the right window pane click the **Configuration** button and select the green plus next to **Add a new Action**.

In the **Basic Information** input box provide a **Name** and choose *Invoke a Custom Automation* next to **Action Type**. This enables additional input boxes.

Under **Custom Automation**, **Object Details**, for **Message** enter *create* and for **Request** provide a name.

Note: The value for **Request** maps to an automate *Instance*[18].

Additional inputs for **Attribute/Value Pairs** are available however are not used in the reference environment. When complete click **Add**.

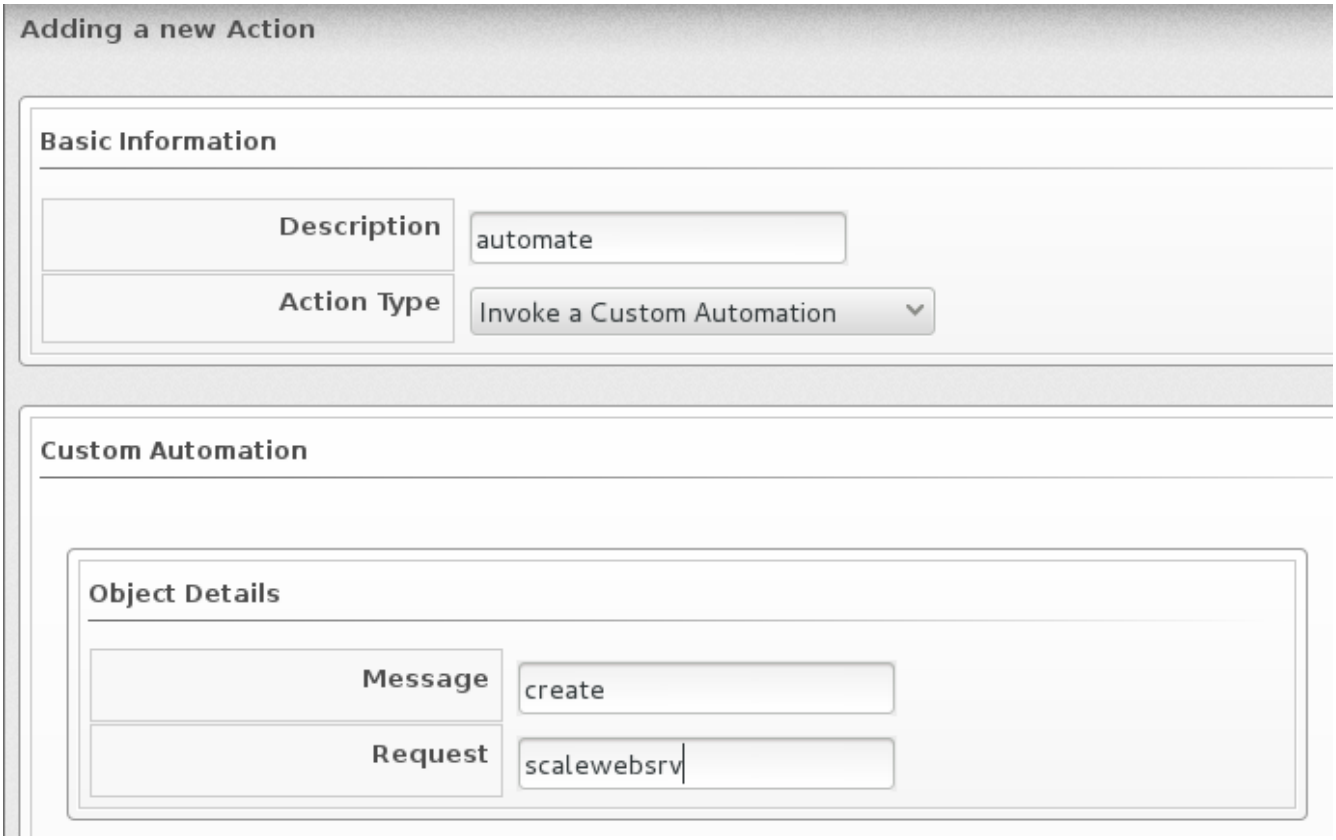


Figure 6.2.1-1: CFME – Control Policy Action

Under the accordion menu in the left window pane select **Policies**, expand **All Policies**, **Control Policies** and click **Vm Control Policies**.

On the right window pane click **Configuration** and select the green plus next to **Add a New Control Vm Policy**.

In the **Basic Information** input box provide a **Description** and leave a check mark next to **Active**. For the reference environment the other inputs are not configured. Click **Add** to complete.

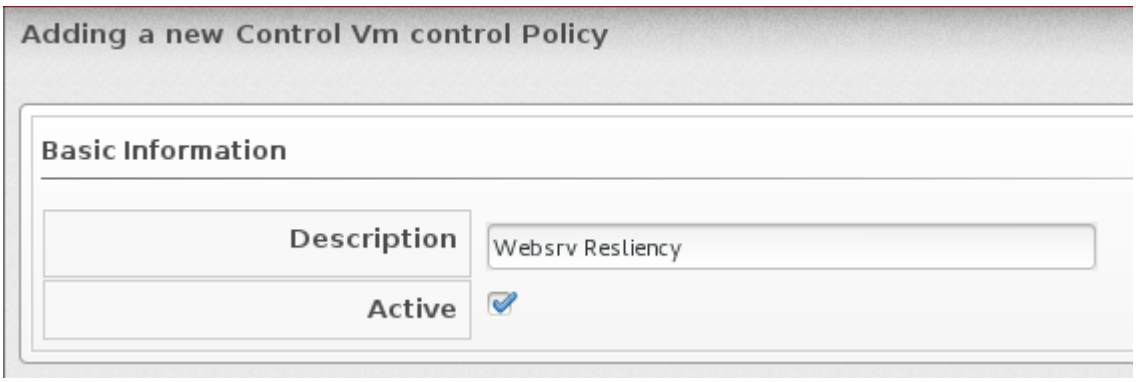


Figure 6.2.1-2: CFME – Control Policy Creation

Add an event to the newly created policy by selecting the policy from the accordion menu on the left window pane under **Policies**, **All Policies**, **Control Policies**, **Vm Control Policies**.

On the right window pane click **Configuration** and select the star and pencil icon next to **Edit this Policy's Event assignments**.

Under the **Event Selection**, **VM Operation** input box place a check mark next to *VM Power Off*. Click **Save** to complete.

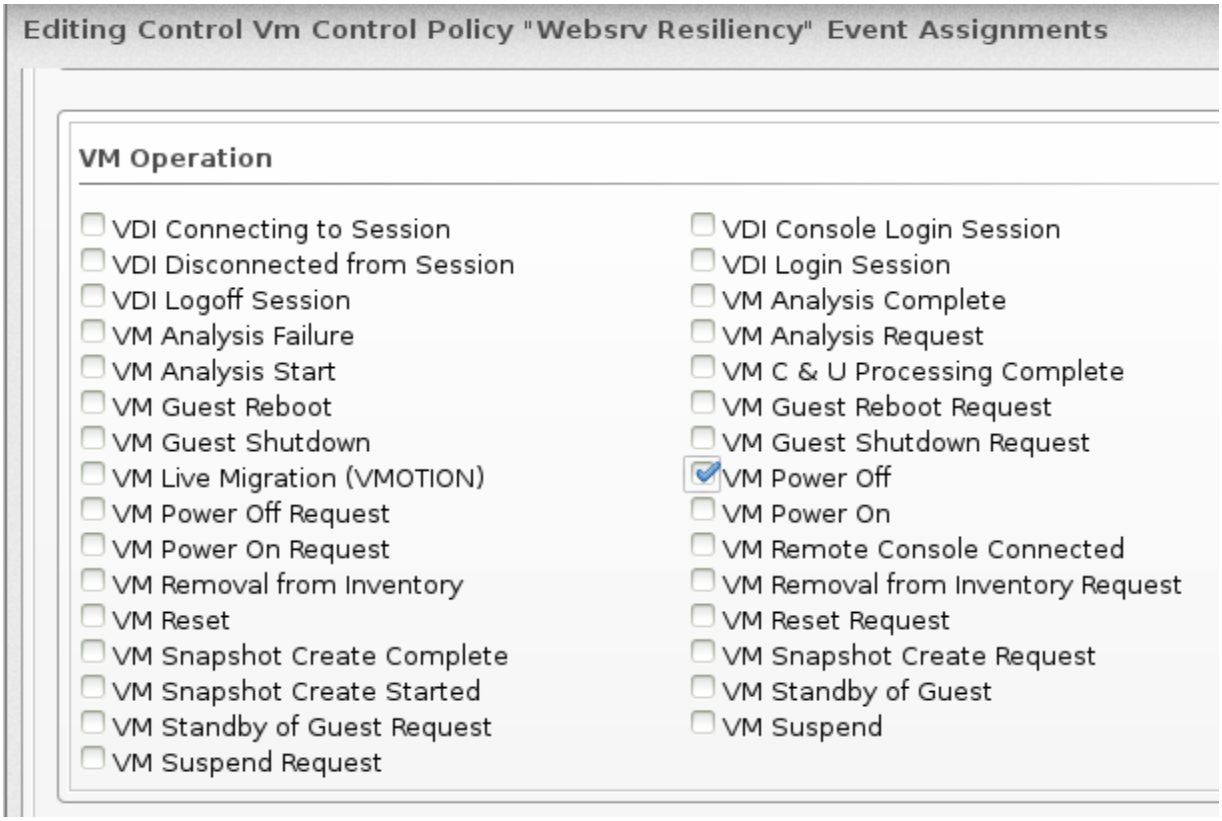


Figure 6.2.1-3: CFME – Control Policy Event Assignment

Note: *VM Power Off Request* is similar to *VM Power Off* however is initiated from the CFME Console vs. powering off the VM from the RHEV-M portal.

Assign an action to the event for the policy. On the accordion menu in the left window pane select the event under **Policies**, **All Policies**, **Control Policies**, *Websrv Resiliency.*

On the right window pane click **Configuration** and select the green running biped with the pencil next to **Edit Actions for this Policy Event**.

In the **Order of Actions if ALL Conditions are True** input box locate the previously created action, called *automate*, highlight, and click the right arrow to move it from **Available Actions** to **Selected Actions**. For the reference environment, no additional actions are assigned. Click **Save** to complete.

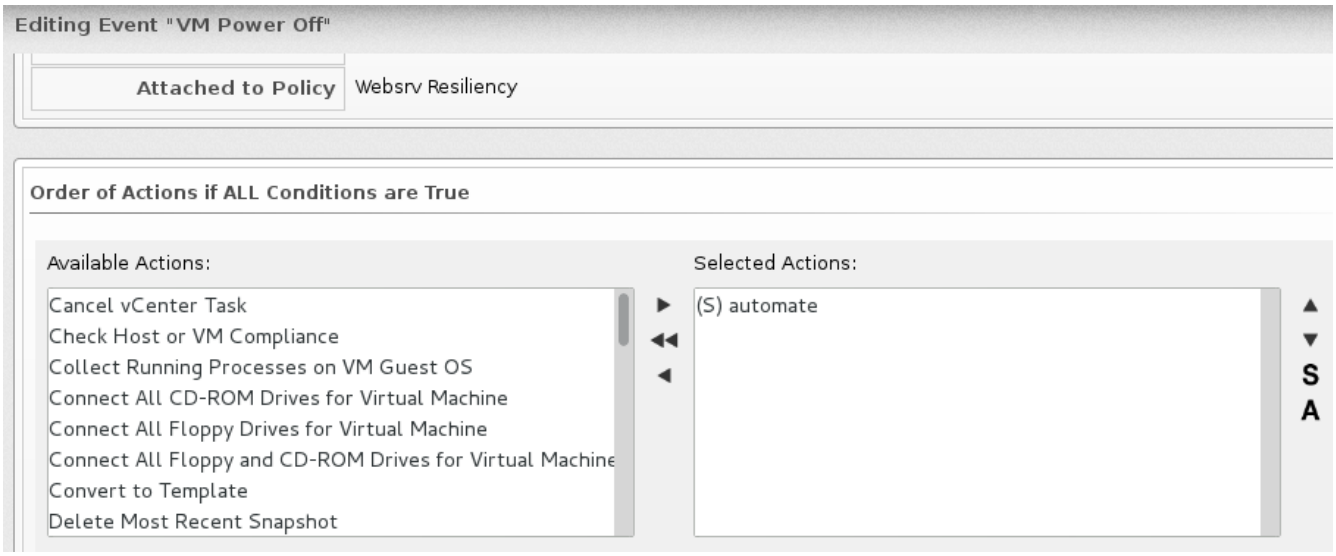


Figure 6.2.1-4: CFME – Control Policy Event Action Assignment

Note: The *(S)* next to *automate* indicates that the action is set to synchronous. If there are multiple actions assigned, the actions can be set to synchronous or asynchronous meaning they must execute in a specific order or can execute simultaneously or random based on dependencies or priorities.

The complete control policy listed below.

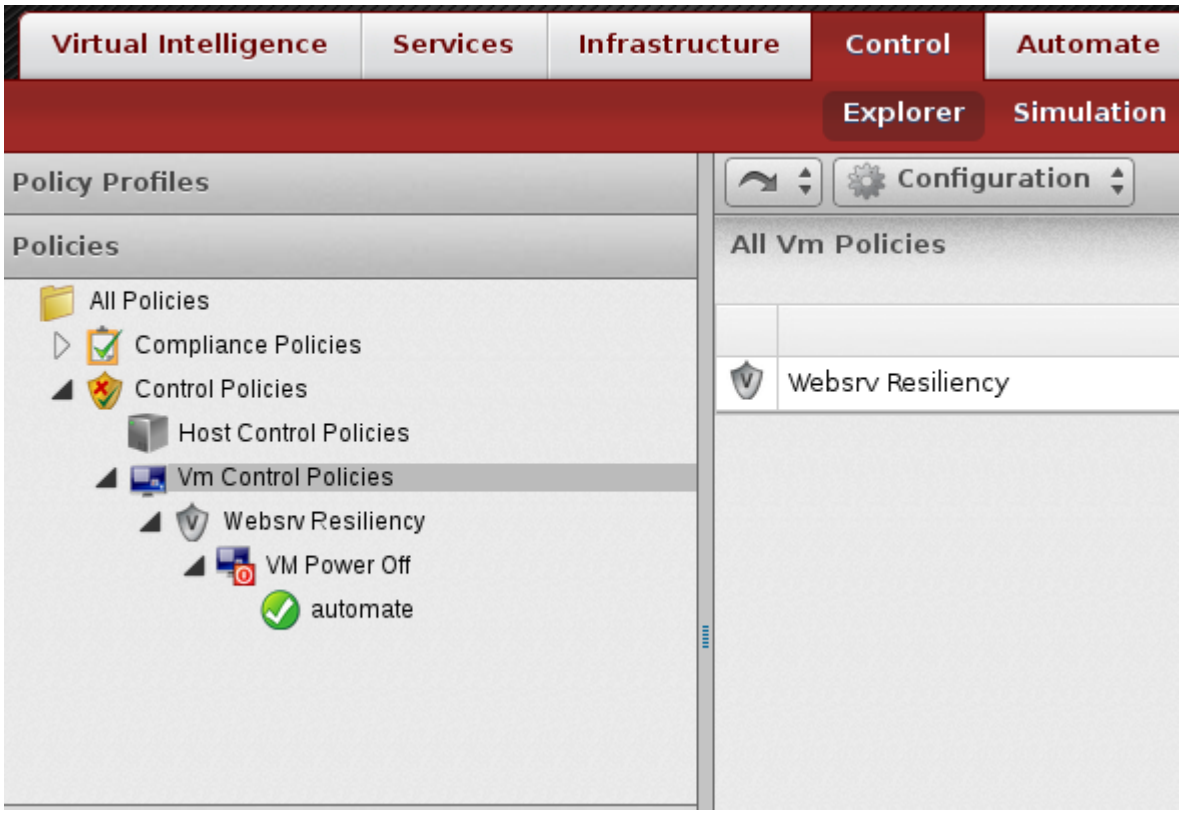


Figure 6.2.1-5: CFME – Control Policy Complete

Create a policy profile to map the created policy to infrastructure resources. On the accordion menu in the left window pane select **Policy Profiles**.

On the right window pane click **Configuration** and select the green plus next to **Add a New Policy Profile**.

In the **Basic Information** input box provide a **Description**.

In the **Policy Selection** input box highlight the desired policy, *VM Control: Websrv Resiliency*, and click the right arrow to move it from **Available Policies** to **Profile Policies**.

For the reference environment no additional inputs are provided. Click **Add** to complete.

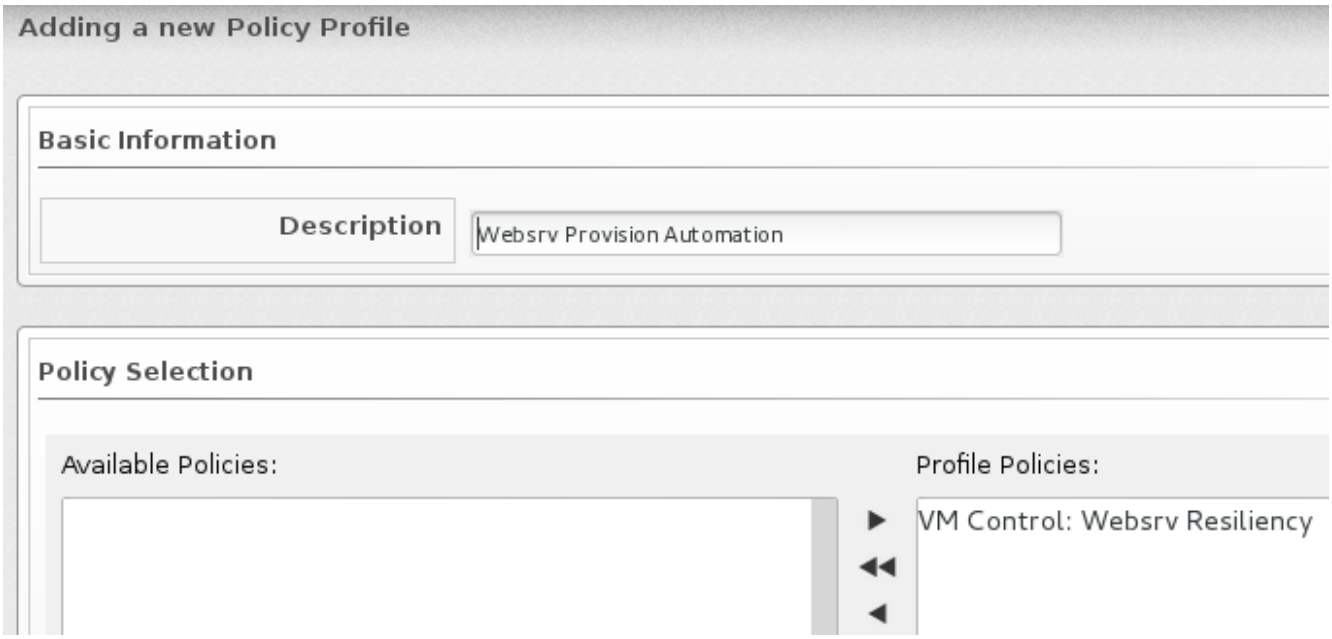


Figure 6.2.1-6: CFME – Control Policy, Policy Profile

6.2.2 Control Policy Testing

Test the new control policy by hovering over **Control** and selecting **Simulation**.

In the left window pane for the **Event Selection** input box select the **Type**. An additional input field for **Event** appears. Select the desired event. In the **VM Selection** input box choose the resource type. An additional input field for the resource selection appears. Click **Submit** to initiate the simulation. Results appear on the right window pane.

For the reference environment the following settings are used:

Input Box	Field	Value
Event Selection	Type	VM Operation
	Event	VM Power Off
VM Selection	Resource type	Single VM
	Resource selection	<target virtual machine>

Table 6.2.2-1: CFME – Control Policy Simulation values

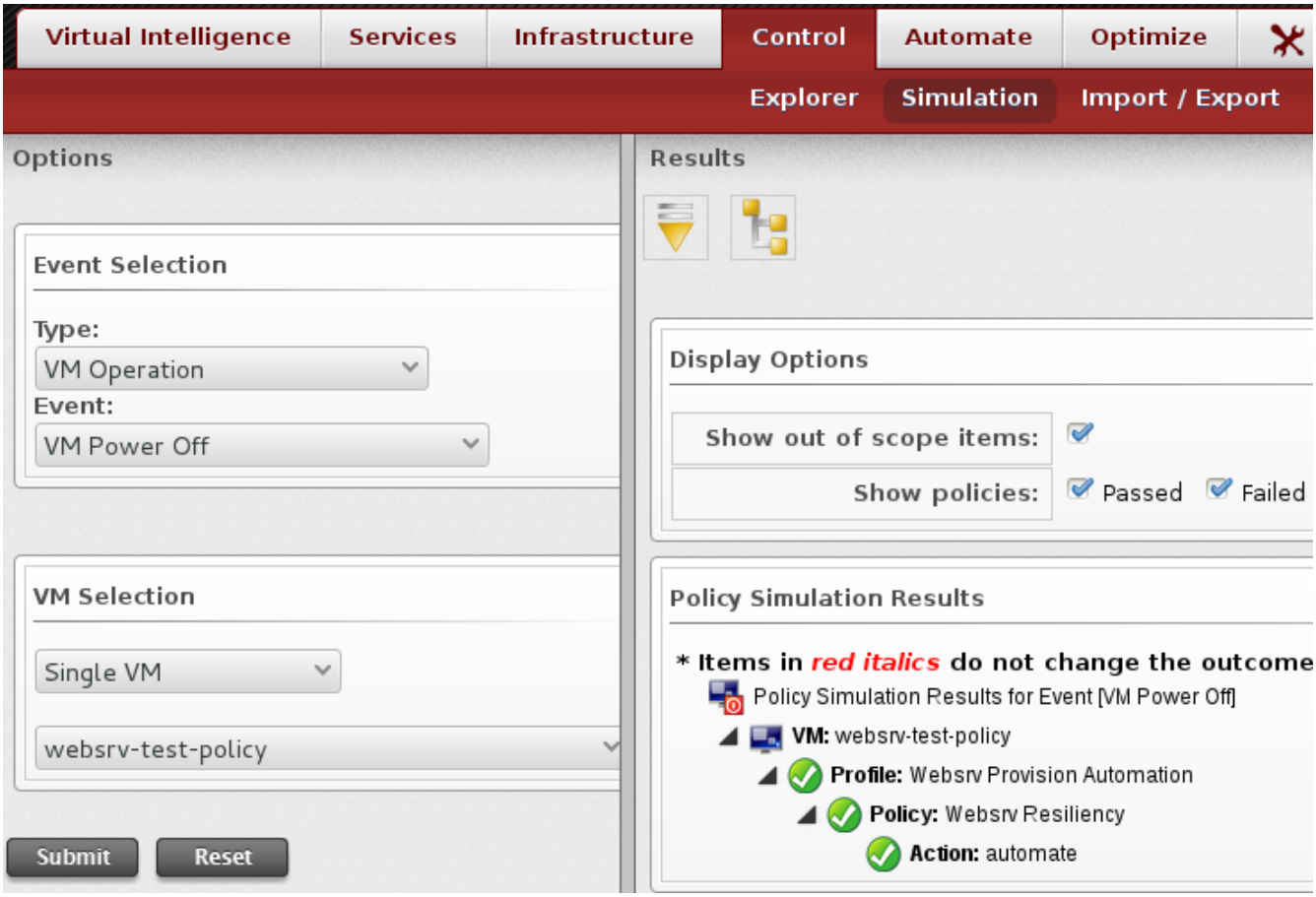


Figure 6.2.2-1: CFME – Control Policy Simulation

6.3 Automation Execution

The CloudForms 2.0 Automate model provides a mechanism to orchestrate actions within the managed environment. Specifics regarding the design and usage for the Automate model can be found in *CloudForms 2.0, Management Engine 5.1 Lifecycle and Automation Guide*[18]. For the reference environment a custom Class and Method are used. The process flow is outlined below.

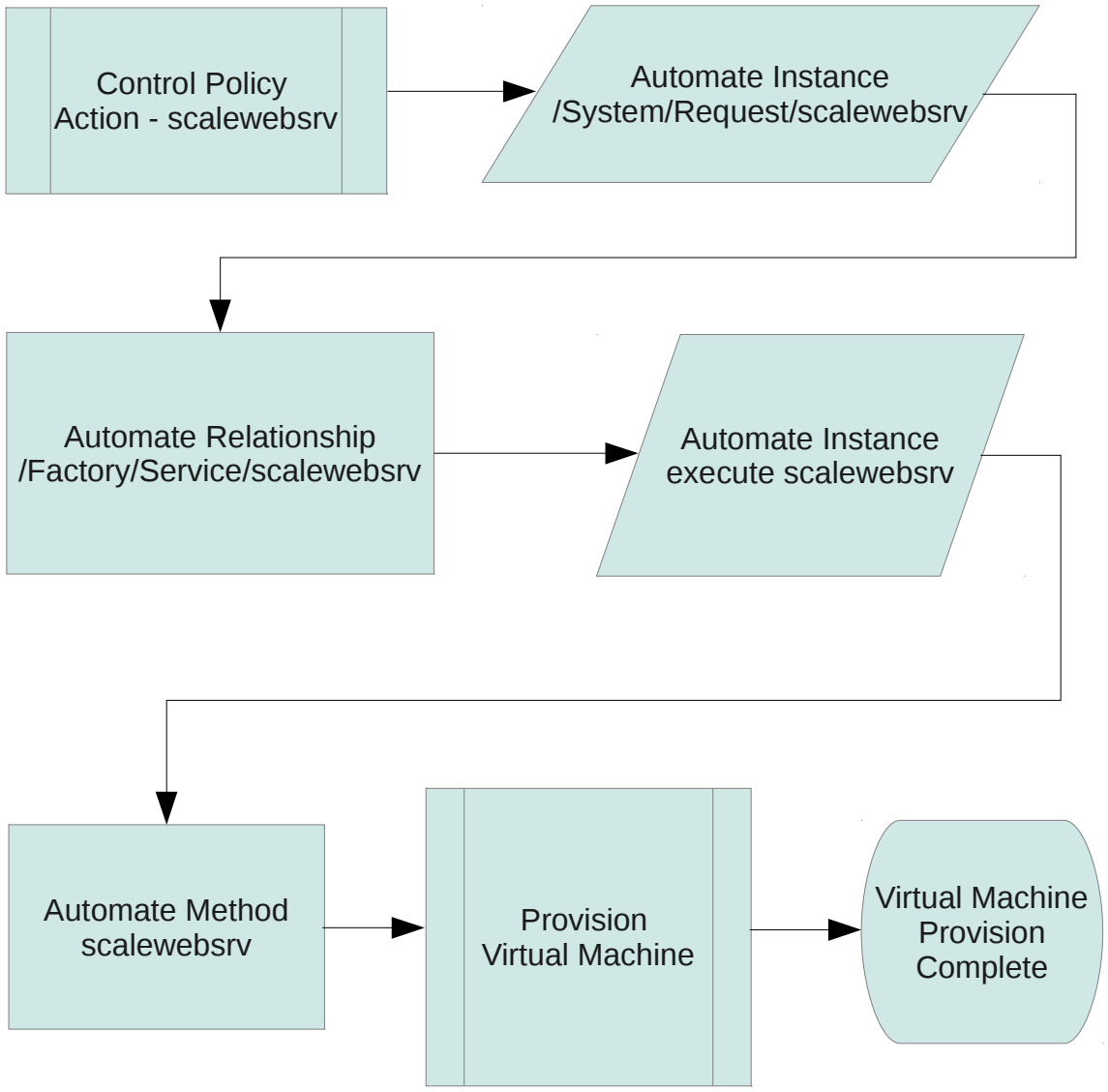


Figure 6.3-1: CFME – Automation Process

The *Invoke a Custom Automation* action configured for the control policy initiates the automation process when the event assigned to the control policy occurs. The entry point into the automate model is *System/Request/<defined instance>*.

6.3.1 Automate Model Configuration

To create the entry point in the automate model, log into the CFME Console with the *admin* account, hover over the **Automate** tab and select **Explorer**.

On the left window pane under *Datastore*, expand the *System* Namespace and *Automation Requests (Request)* Class.

Highlight *Automation Requests (Request),* on the right window pane click **Configuration** and select the document and green plus next to **Add a New Instance**.

In the **Main Info** input box enter the **Name**, **Display Name**, and **Description**. In the **Fields, Value** input box locate the first relationship entry and add a path to the location of the instance and subsequent method to execute. For the reference environment the following settings are used:

Input Box	Field	Value
Main Info	Name	scalewebsrv
	Display Name	scalewebsrv
	Description	scalewebsrv
Fields	rel1	Factory/Service/scalewebsrv

Table 6.3.1-1: CFME – Automate Request Values

Click **Add** to complete.

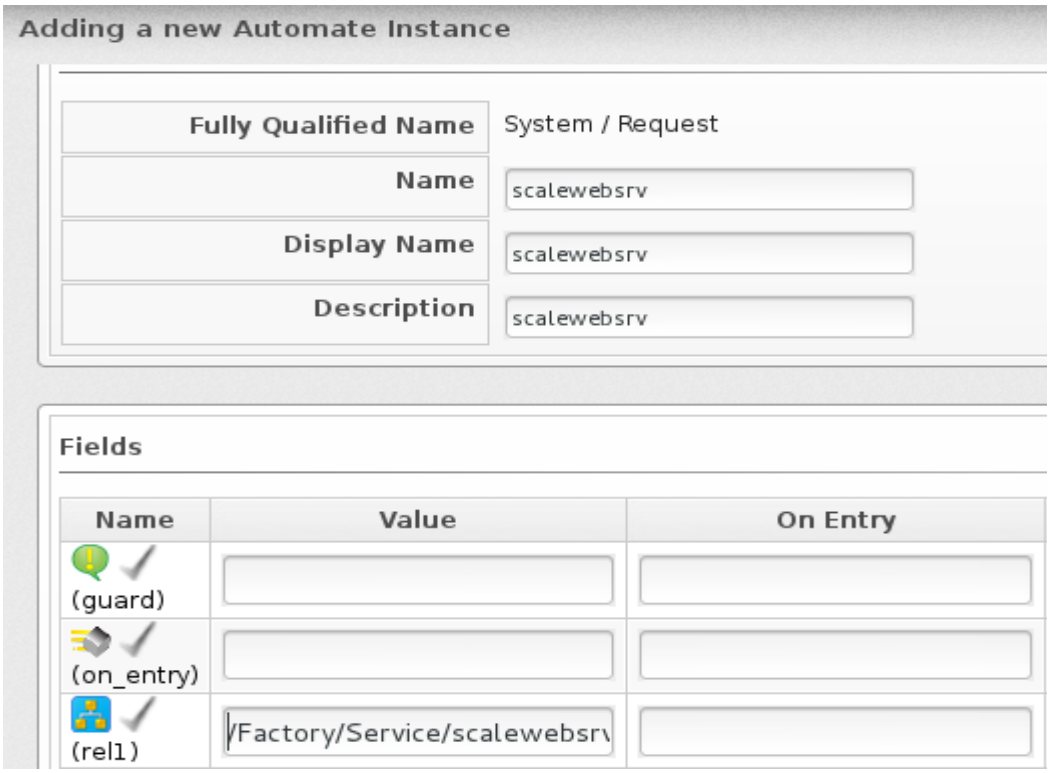


Figure 6.3.1-1: CFME – Automate Service Request Instance

Note: The combination of methods, assertions, state, attribute, and relationships comprise a Schema that define the values for a Class. Instances use the Schema to obtain the values. The Class is contained within a Namespace[18].

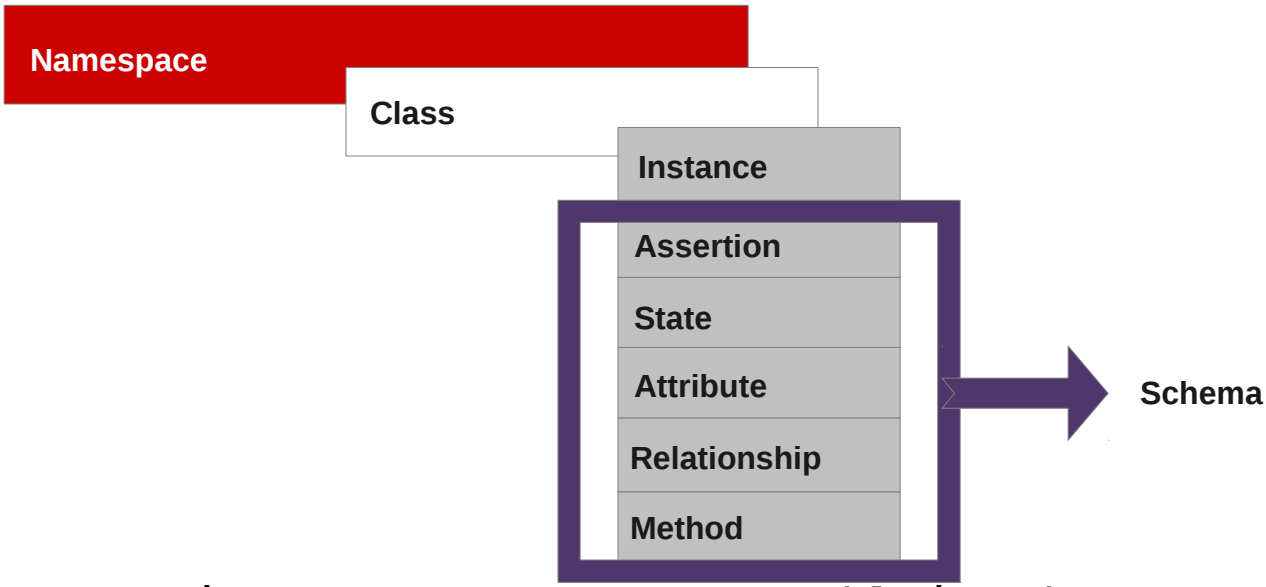


Figure 6.3.1-2: CFME – Automate Model Hierarchy

Create a new method and instance to execute the method under *Factory/Service*. On the left window pane under *Datastore*, expand the *Factory* Namespace and the *Service (Service)* Class.

Highlight *Service (Service),* on the right window pane select the **Methods** tab. Click **Configuration** and select the moving object with the green plus next to **Add a New Method**.

In the **Main Info** input box provide a **Name**, **Display Name**, select the **Location**, and within the **Data** area input the code to execute. Supported code formats include Ruby and perl. For the reference environment the following settings are used:

Input Box	Field	Value
Main Info	Name	scalewebsrv
	Display Name	scalewebsrv
	Location	Inline
	Data	<see **Appendix E Automate Method>**

Table 6.3.1-2: CFME – scalewebsrv Automate Method Values

To verify the **Data** code is formatted properly, click the **Validate** button. To complete the method creation click **Add**.

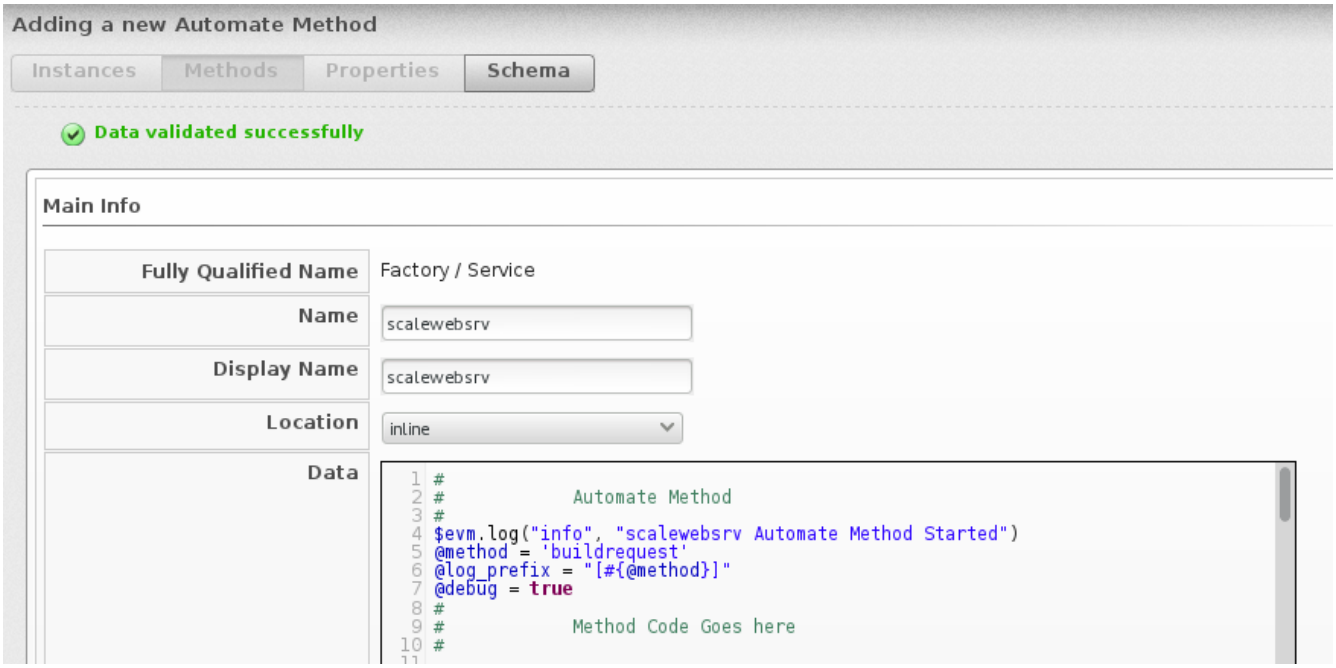


Figure 6.3.1-3: CFME – Automate Method

Create a new instance that executes the method under *Factory/Service* when called. Highlight *Service (Service),* on the right window pane click the **Instances** tab. Click **Configuration** and select the document with the green plus next to **Add a New Instance**.

In the **Main Info** input box provide a **Name**, **Display Name**, and **Description**. In the **Fields** input box next to (*execute)*, add the name of the method created <*scalewebsrv*>. Click **Add** to continue.

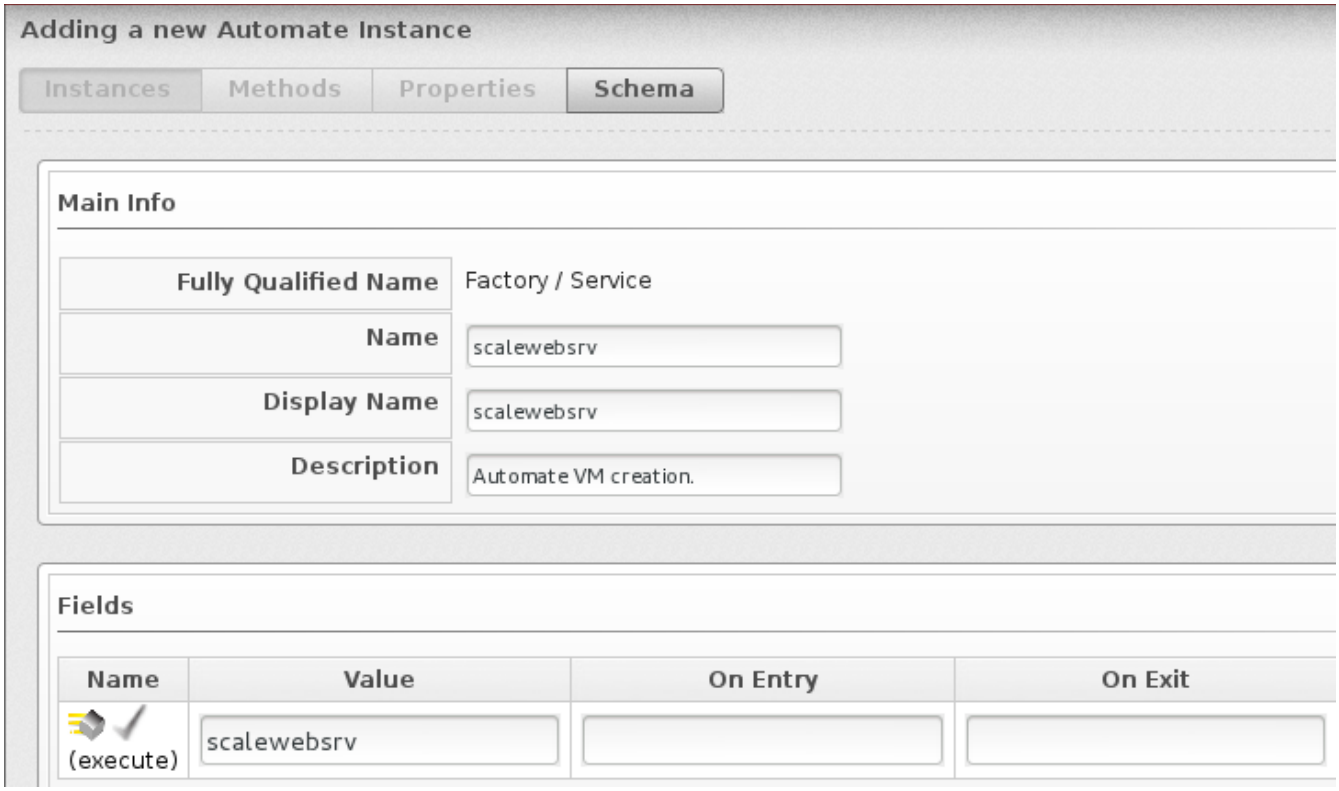


Figure 6.3.1-4: CFME – Automate Instance

Test the newly created Automate method by hovering over **Automate** and selecting **Simulation**.

On the left window pane, within the **Object Details** input box, provide a path to the instance for **System/Process**, a **Message** type, and **Request** to call. In the **Object Attribute** input box choose the **Type** and **Selection** object for the type. Click **Submit** to execute the simulation. Results appear on the right window pane.

For the reference environment the following settings are used:

Input Box	Field	Value
Object Details	System/Process	Request
	Message	Create
	Request	scalewebsrv
Object Attribute	Type	VM
	Selection	<target virtual machine>
Simulation Parameters	Execute Methods	checked
Attribute/Value Pairs	N/A	N/A

Table 6.3.1-3: CFME – Automate Simulate Object Details

Note: If the **Execute Methods** field is checked, the full process is tested meaning that the method executes. In this case, a virtual machine provisions. If no action is desired, un-check **Execute Methods**. Monitor */var/www/miq/vmdb/log/evm.log* and */var/www/miq/vmdb/log/automate.log* files on the CFME appliance(s) for status.

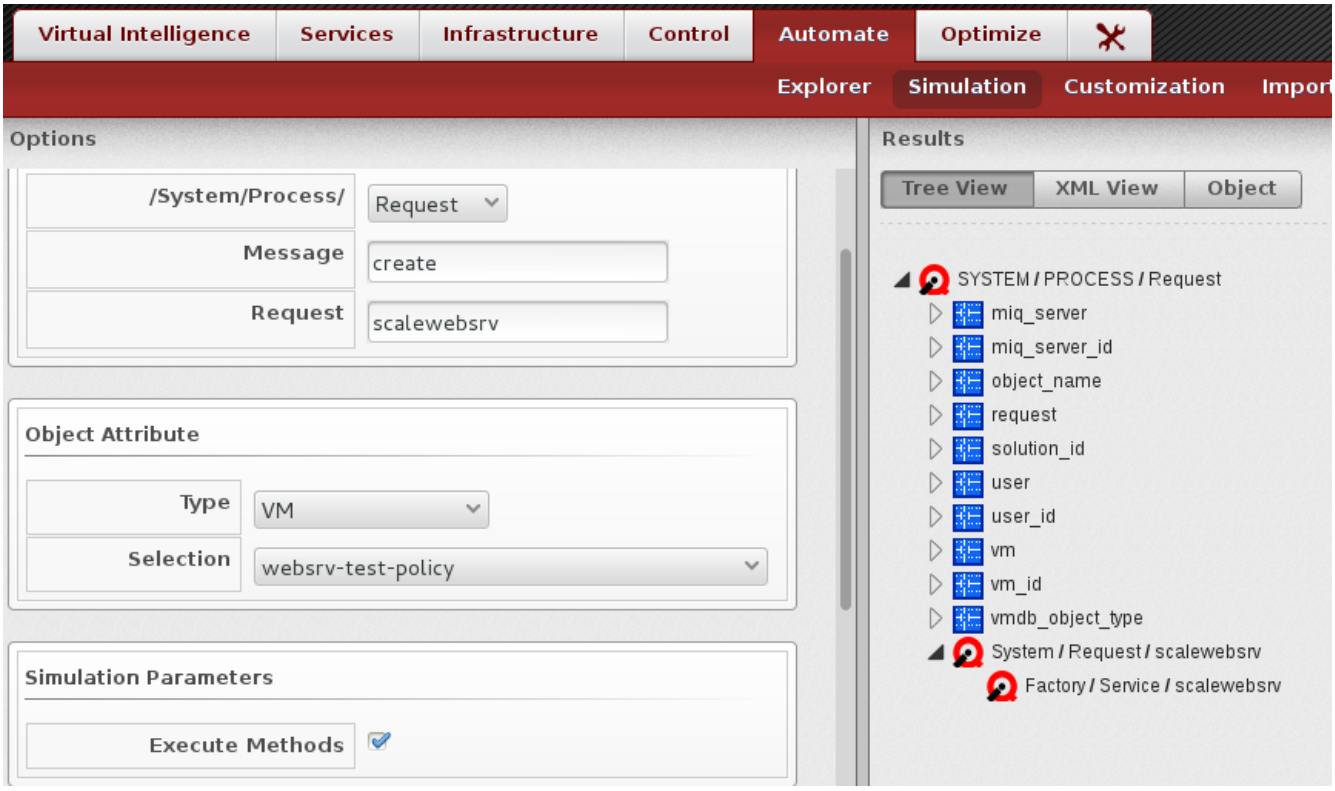


Figure 6.3.1-5: CFME – Automate Simulation

6.4 Testing Policy-based Automation

Assign the control policy to a managed asset. For the reference environment a single virtual machine running in the RHEV 3.2 managed environment is selected, however policies can be applied to Management Systems, Clusters, Hosts, and Resource Pools for example.

To assign a policy to a managed virtual machine, hover over **Services** and select **Virtual Machines**.

On the accordion menu in the left window pane under **VMs & Templates** select the desired *Management System* to narrow the virtual machine inventory.

On the right window pane locate the desired virtual machine and place a check mark next to it. Click **Policy** and **Manage Policies**.

In the **Select Policy Profiles** input box place a check mark next to the previously created control policy to assign it to the resource. Click **Save** to complete.

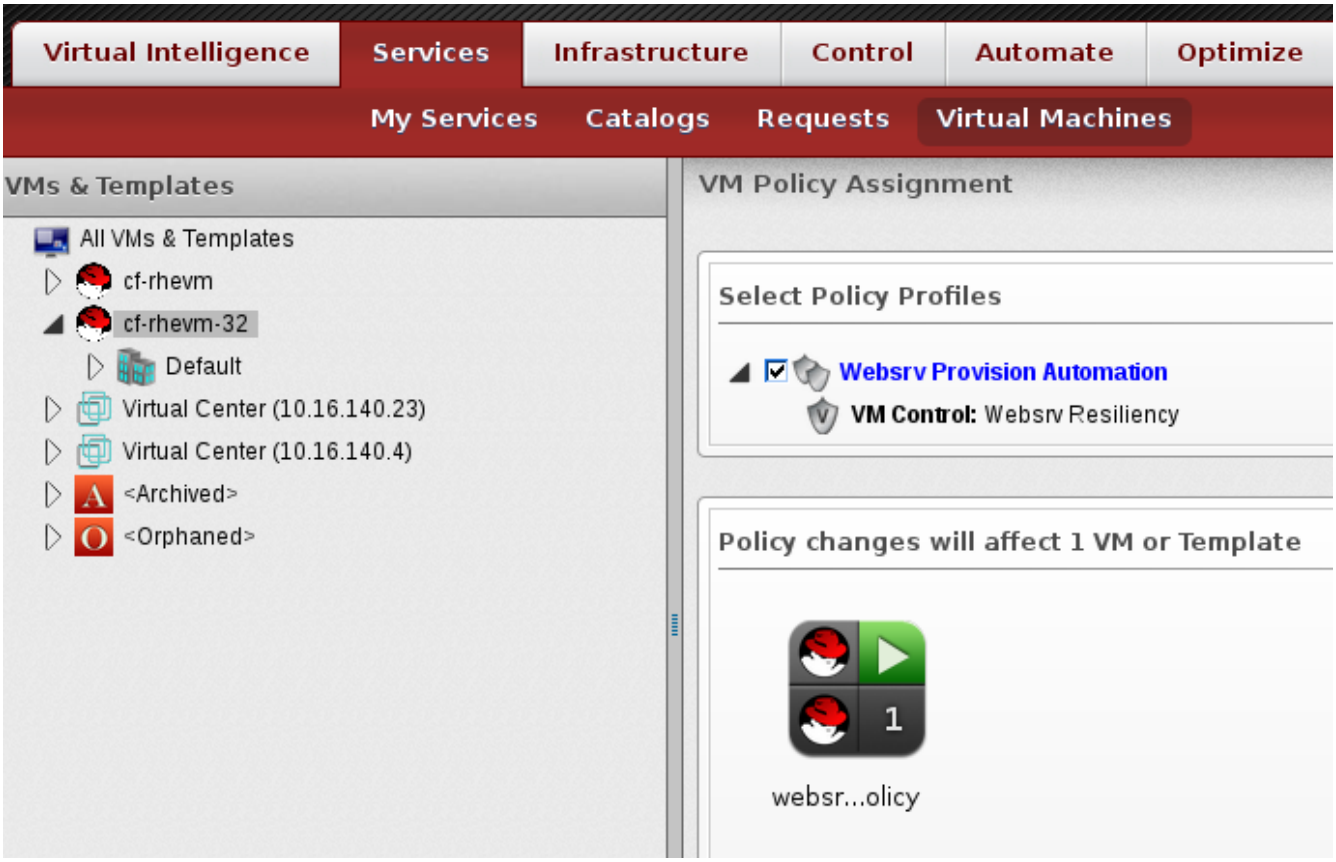


Figure 6.4-1: CFME – Policy Assignment

The virtual machine appears with a shield within the CFME Console indicating a policy is assigned.

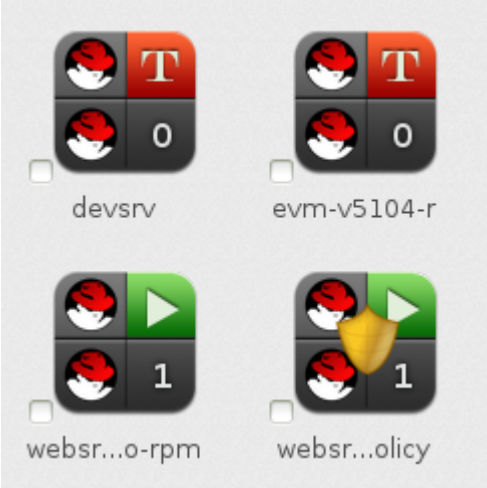


Figure 6.4-2: CFME – Policy Assigned

Test the assigned policy by powering off the targeted virtual machine from the RHEV-M Portal. The result should be a new virtual machine provisioned running the same web application. This can be tied back into a load balancer[20] for registration to maintain predictable uptime for a web service or application for example.

Log into the RHEV-M Portal and locate the target virtual machine for which the policy is assigned under the **Virtual Machines** tab. Highlight the virtual machine and click the shutdown icon on the action bar two times to force the virtual machine off.

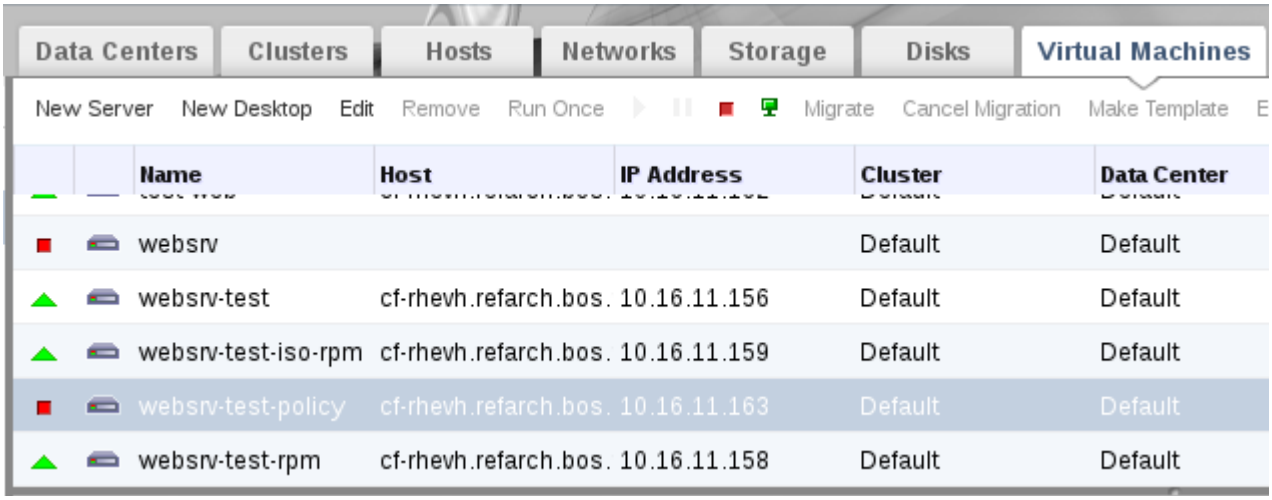


Figure 6.4-3: RHEV – Power Off Target VM

20 http://www.redhat.com/products/enterprise-linux-add-ons/load-balancing/

CloudForms Management Engine detects an event change for the managed virtual machine and executes the automation request which is called from the control policy assigned to the virtual machine.

- An e-mail notification is sent to the CFME admin indicating a Virtual Machine Request was received.
- A new virtual machine is provisioned to the RHEV environment and registers with Red Hat Satellite Server.
- The web server RPM is installed from the custom channel along with the RHEV agent.
- A **`yum update`** is performed and the newly provisioned virtual machine reboots. Upon reboot, the newly deployed virtual machine, serving the custom web content, is production ready.
- An e-mail notification is sent to the CFME admin advising the Virtual Machine Request completed.

The following displays the e-mail notification for the Virtual Machine Request:

```
Hello,
Your Virtual Machine Request was approved. If Quota validation is successful
you will be notified via email when the VM is available.

Approvers notes:

To view this Request go to: https://10.16.140.106/miq_request/show/80

Thank you,
Virtualization Infrastructure Team
```

The following displays the Satellite Server deployed VM registration:

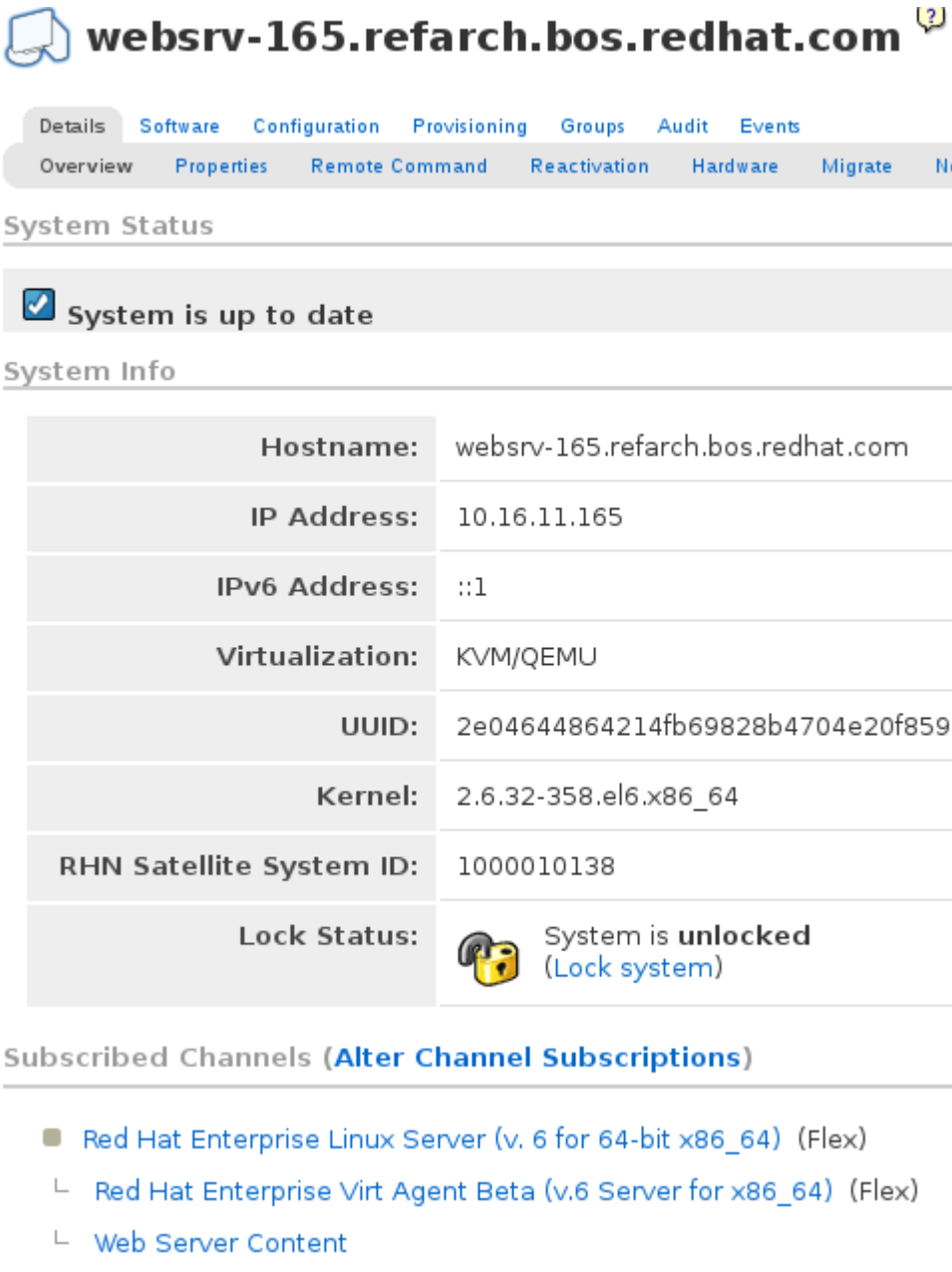


Figure 6.4-4: Satellite Server – VM Registration

The following displays the RHEV-M Portal deployed VM:

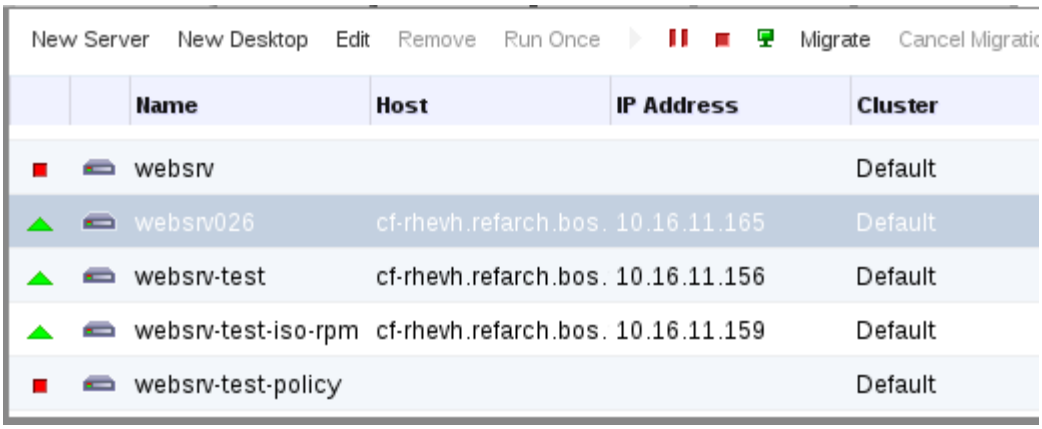


Figure 6.4-5: RHEV – Newly Provisioned VM

The following displays the CloudForms Management Engine Console deployed VM:

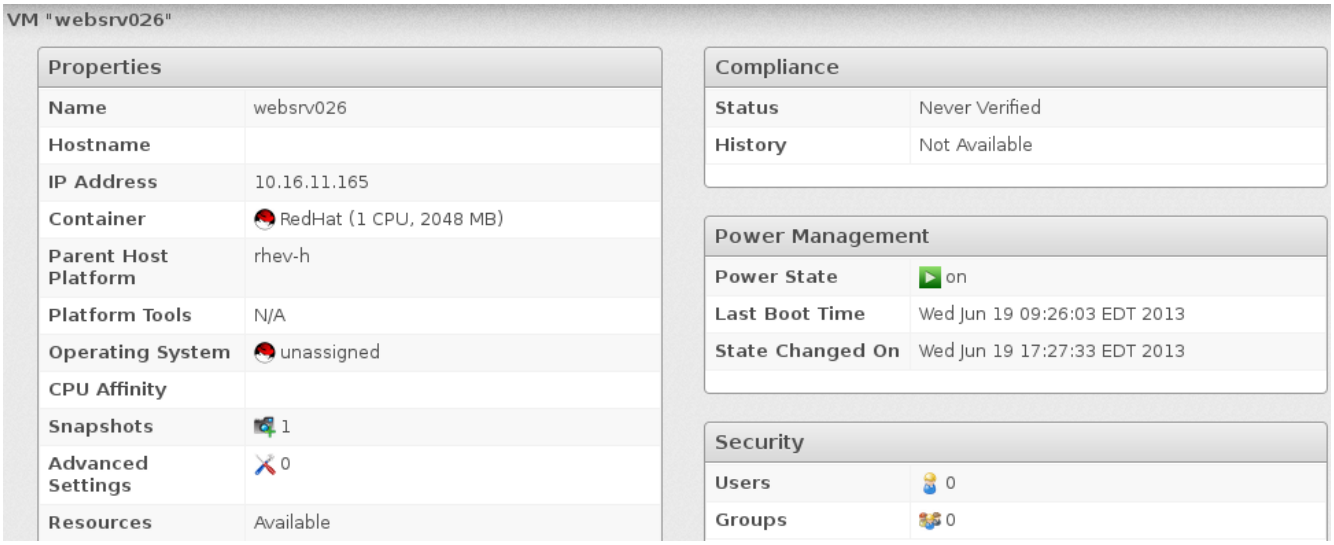


Figure 6.4-6: CFME – Deployed VM

The following displays the deployed VM web content:

Figure 6.4-7: Deployed VM Web Content

The following displays the e-mail notification advising the Virtual Machine Request is complete:

```
Hello,

Your request to provision a virtual machine was approved and completed on
Wednesday, June 19, 2013 at 05:26PM.

Virtual machine websrv026 will be available in approximately 15 minutes.

For Windows VM access is available via RDP and for Linux VM access is
available via putty/ssh, etc. Or you can use the Console Access feature
found in the detail view of your VM. As the designated owner you will
receive expiration warnings at this email address: bthurber@redhat.com

If you are not already logged in, you can access and manage your virtual
machine here https://10.16.140.106/vm_or_template/show/106'

If you have any issues with your new virtual machine please contact Support.

Thank you,
Virtualization Infrastructure Team
```

Note: Monitor */var/www/miq/vmdb/log/evm.log* and */var/www/miq/vmdb/log/automate.log* files on the CFME appliance(s) for status.

7 Self-Service

The targeted use case around self-service focuses on LDAP user and group integration along with self-service provisioning. The following items are configured for CloudForms Management Engine:

- LDAP user and group mappings
- Assigning quotas and environment resources
- Verify Functionality

7.1 LDAP User and Group Mappings

LDAP users are mapped to CloudForms Management Engine roles to provide role-based access control (RBAC). While custom roles may be defined, CloudForms Management Engine provides twelve read-only default roles. For the reference environment, self-service users are provided via secure LDAP from Windows Active Directory. The following LDAP users and groups are mapped to CloudForms Management Engine roles:

User	Group	Role
cf-admin	admin	administrator
cf-dev	dev	user_self_service
cf-test	test	user_self_service
cf-prod	prod	user_self_service

Table 7.1-1: CFME – LDAP Self-Service Users and Roles

Create groups to map to each LDAP users and group by logging into the CFME Console with the *admin* account. Hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**. From the accordion menu on the left window pane, click **Access Control** and select **Groups**.

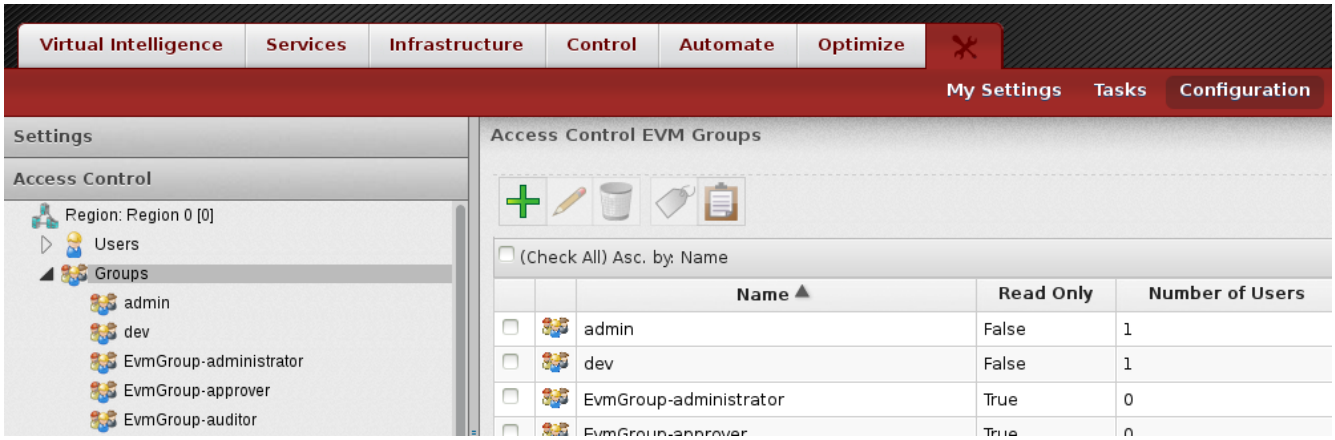


Figure 7.1-1: CFME – Groups

In the right window pane click the green plus button to add a new group. Provide a description and assign a **Role**. Refer to **Table 7.1-1: CFME – LDAP Self-Service Users and Roles** for assignments.

Place a check mark next to **(Look Up LDAP Groups)**. This action opens an additional input box for mapping an LDAP user to an LDAP group. In the **LDAP Group Look Up** input box enter the associated LDAP user in the **User to Look Up** field. Use an account that allows quiescing the LDAP directory where user and groups reside for the **User Id**. For the reference environment the *administrator* account is used.

Click the **Retrieve** button. Upon successful mapping, an additional drop-down choice is made available listing the LDAP group the LDAP user is a member of. To complete click **Add** at the bottom of the window pane.

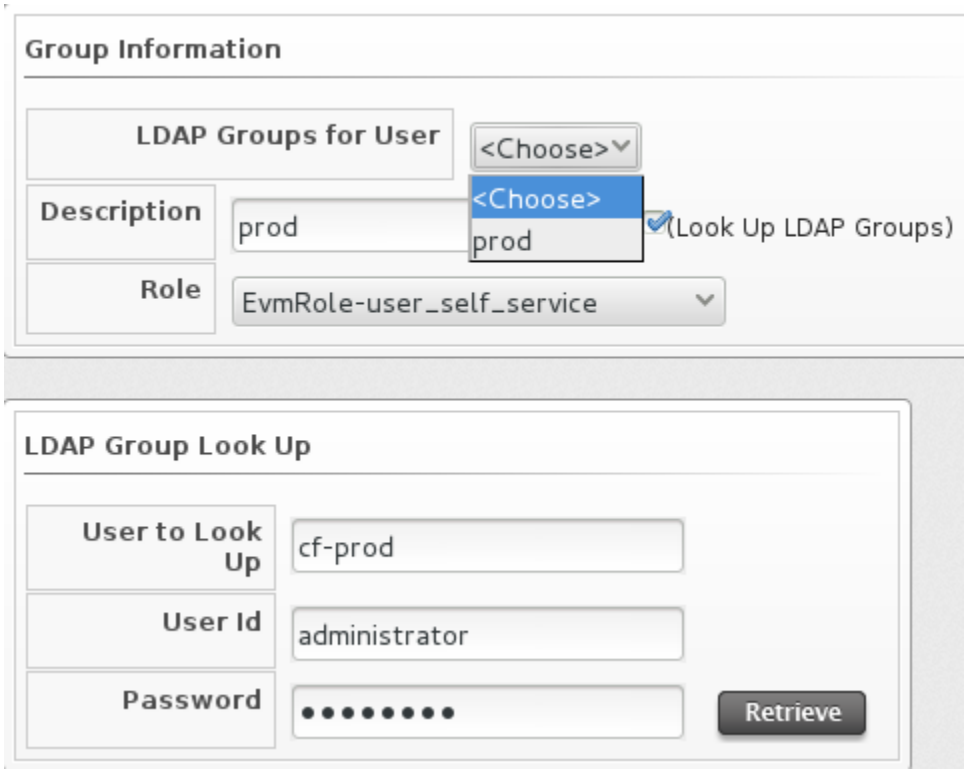


Figure 7.1-2: CFME – LDAP Group Look Up

Note: Although the newly created group maps to an LDAP user and LDAP group, the user account does not exist within the CFME VMDB database. To create the LDAP user account, login to a CFME appliance as the LDAP user.

7.2 Quotas and Resources

Quotas[21] establish maximum usage thresholds for a VM owner or group for provisioned virtual machines and are integrated into Provisioning Profiles. These maximums are checked after the approval but before the actual provision request is started. The quota is set for the group as a whole. Not defining the proper level of quotas can cause resource constraints potentially impacting production environments. CloudForms 2.0 provides a default set of quotas for self-service users however those defaults can be overridden with the use of tags.

Default quota settings for users and groups are located within the Automate model and are found under *Factory/StateMachines/ProvisionRequestQuota Verification/Default* .

For the reference environment tags are used to define quotas for each group. However the emphasis is centered around the *cf-dev* user and *dev* group.

To assign and set the max quota limits for a group using tags, login to the CFME Console with the *admin* account, hover over the **Settings and Operations** tab, depicted as a wrench icon located next to **Optimize**, and select **Configuration**.

On the accordion menu in the left window pane click **Access Control** and select the desired group. For the reference environment *dev* is the chosen group.

On the right window pane click the tag icon to **Edit Red Hat Tags for this Group**.

In the **Tag Assignment** input box next to **Select a customer tag to assign**, click the pull down menu and select **Quota – Max Memory**. On the <*Select a value to assign*> pull down menu choose the maximum amount of memory to assign. When complete, the tag with assigned value will appear in the **Tag Assignment** input box. Perform the same procedure for **Quota – Max Storage** and **Quota – Max CPUs**. For the reference environment the following settings are used:

Input Box	Field	Value
Tag Assignment	Quota – Max Memory	40GB
	Quota – Max Storage	100GB
	Quota – Max CPUs	20

Table 7.2-1: CFME – Group Assigned Quotas

21 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Lifecycle_and_Automation_Guide/sect-Quotas.html

Click **Save** to complete.

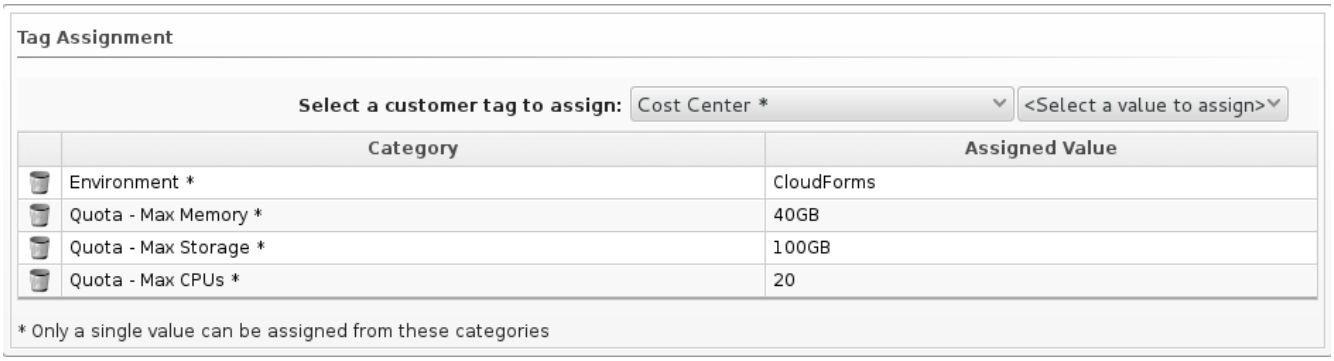


Figure 7.2-1: CFME – Group Quota Assignments

Additionally, a template used for provisioning must have the proper ownership set so that the self-service user is able to provision virtual machines.

To set ownership for a template hover over **Service** and select **Virtual Machines**.

Under **VMs & Templates** on accordion menu in the left window pane, highlight the appropriate Management System to narrow the virtual machine selection.

In the right window pane place a check mark next to the desired template. Click **Configuration** and select the green arrow with the user icon next to **Set Ownership**.

In the **Changes** input box next to **Select a Group**, from the pull down menu choose a group. For the reference environment the *devsrv* template is chosen and *dev* is the group selected for ownership. Click **Save** to complete.

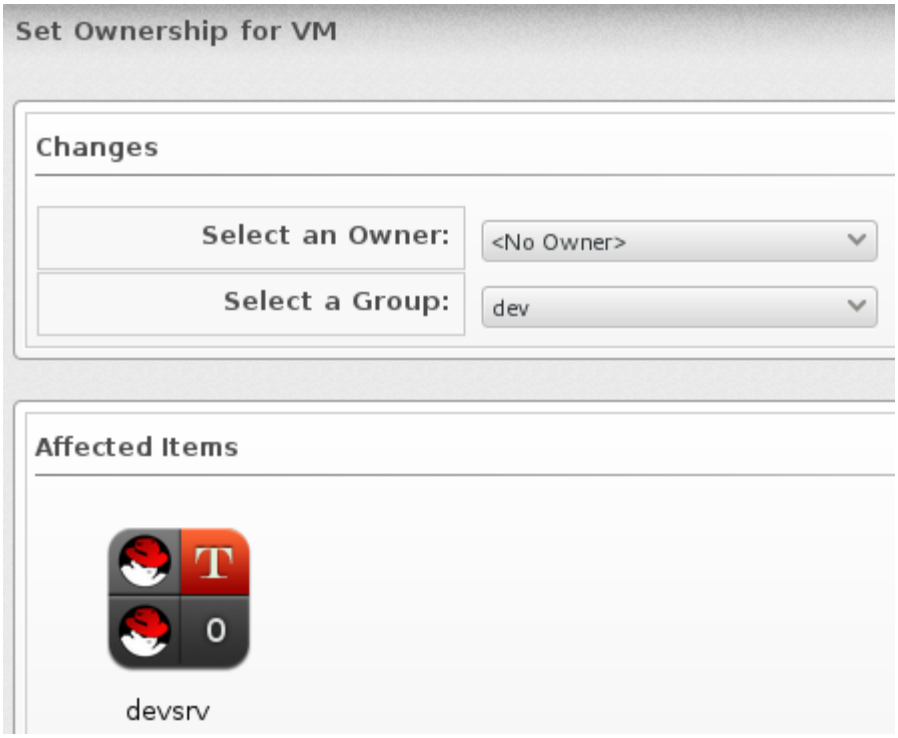


Figure 7.2-2: CFME – Template Ownership

7.3 Testing Self-Service Provisioning

To test functionality, login as a self-service user and deploy a virtual machine. Hover over **Services** and select **Virtual Machines**.

> **Note:** The self-service role limits the self-service user access to certain functionality. The tabs available are **Services** and **Settings and Operations**, depicted as a wrench icon located next to **Optimize**, with functions under each limited.

On the right window pane click **Lifecycle** and select the green plus next to **Provision VMs**.

Select the assigned template and click **Continue**. For the reference environment *devsrv* is chosen.

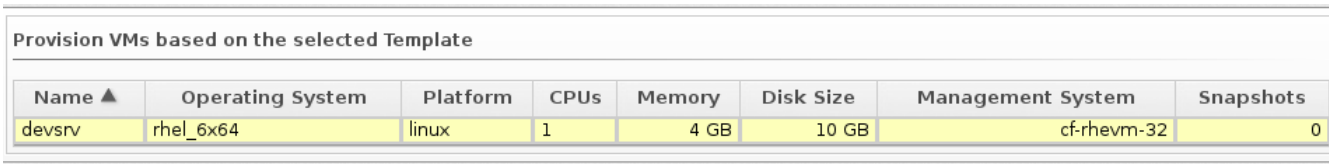


Figure 7.3-1: CFME – Self-Service Provision Template

The next step presents a series of tabs for which information is provided to include virtual machine settings, where to provision the virtual machine, and customization templates to provision the virtual machine against. Complete the settings under each tab before clicking the **Submit** button at the bottom.

The following settings are used for the reference environment:

Request

Input Box	Field	Value
Request Information	*E-mail	cf-dev@refarch.bos.redhat.com
	*First Name	cf-dev
	*Last Name	cf-dev
	Notes	Self-service provision request.
Manager	Name	Brett Thurber

Table 7.3-1: CFME – Self-Service Request Values

*Click the **Validate** button to automatically map the LDAP username settings to the supplied e-mail address. The LDAP user settings must have an e-mail address associated to the LDAP user account.

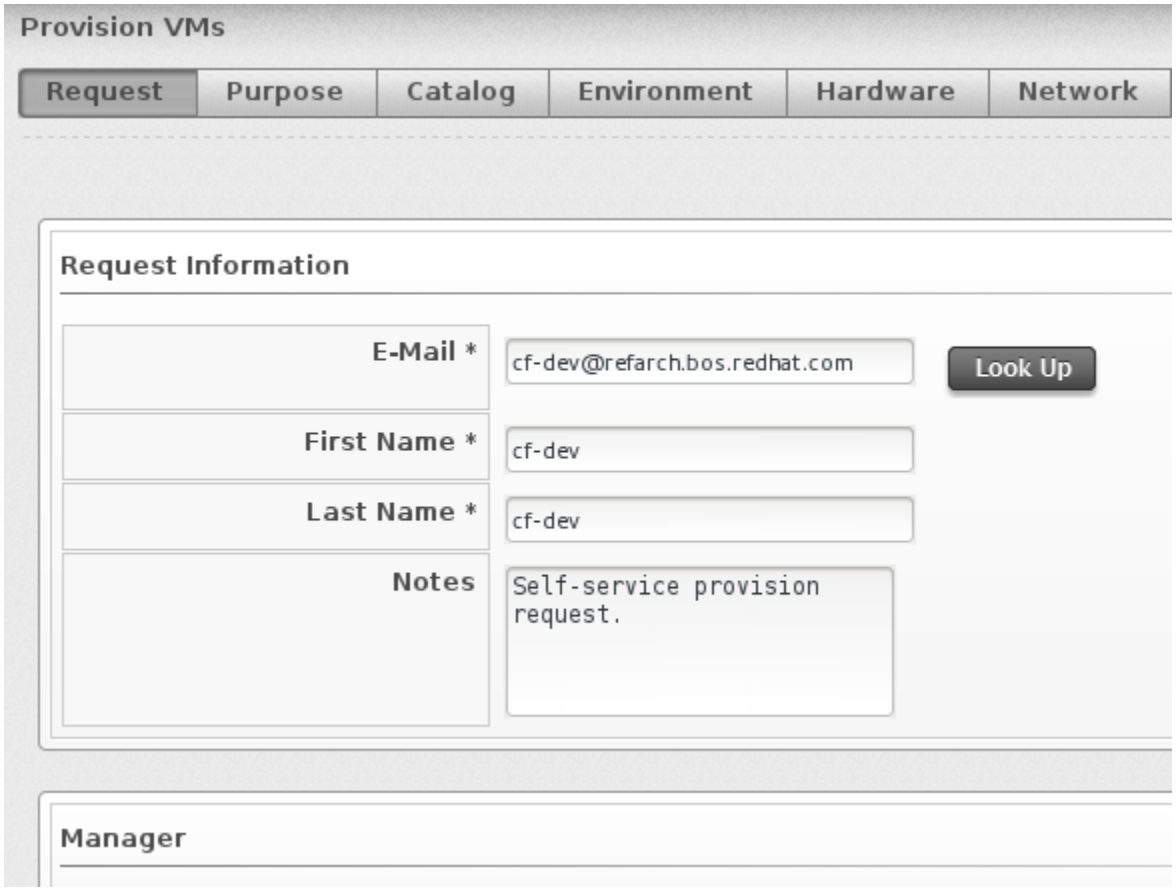


Figure 7.3-2: CFME – Self-Service Provision Request Settings

Purpose

Select the **Purpose** tab. Within the **Select Tags to apply** input box expand **Environment** and select the *CloudForms* tag. This is not a mandatory value but is used to assign tags specific to the environment.

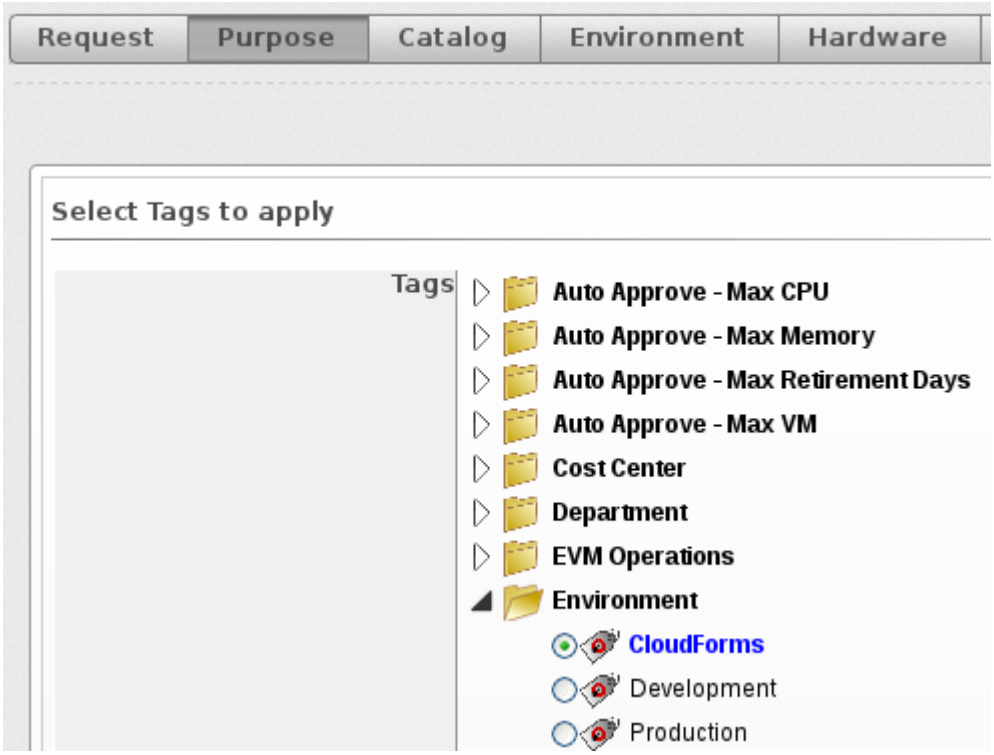


Figure 7.3-3: CFME – Self-Service Provision Purpose Settings

Catalog

The following settings are used under the **Catalog** tab and define the PXE server, image, virtual machine quantity, and name used.

Input Box	Field	Value
Selected VM	Name	devsrv
	Provision Type	PXE
PXE	Server	cf-refarch
	Image	devsrv
Number of VMs	Count	1
VM Naming	VM Name	devsrv-app
	VM Description	Development server.

Table 7.3-2: CFME – Self-Service Catalog Values

The following displays the self-service **Catalog** settings.

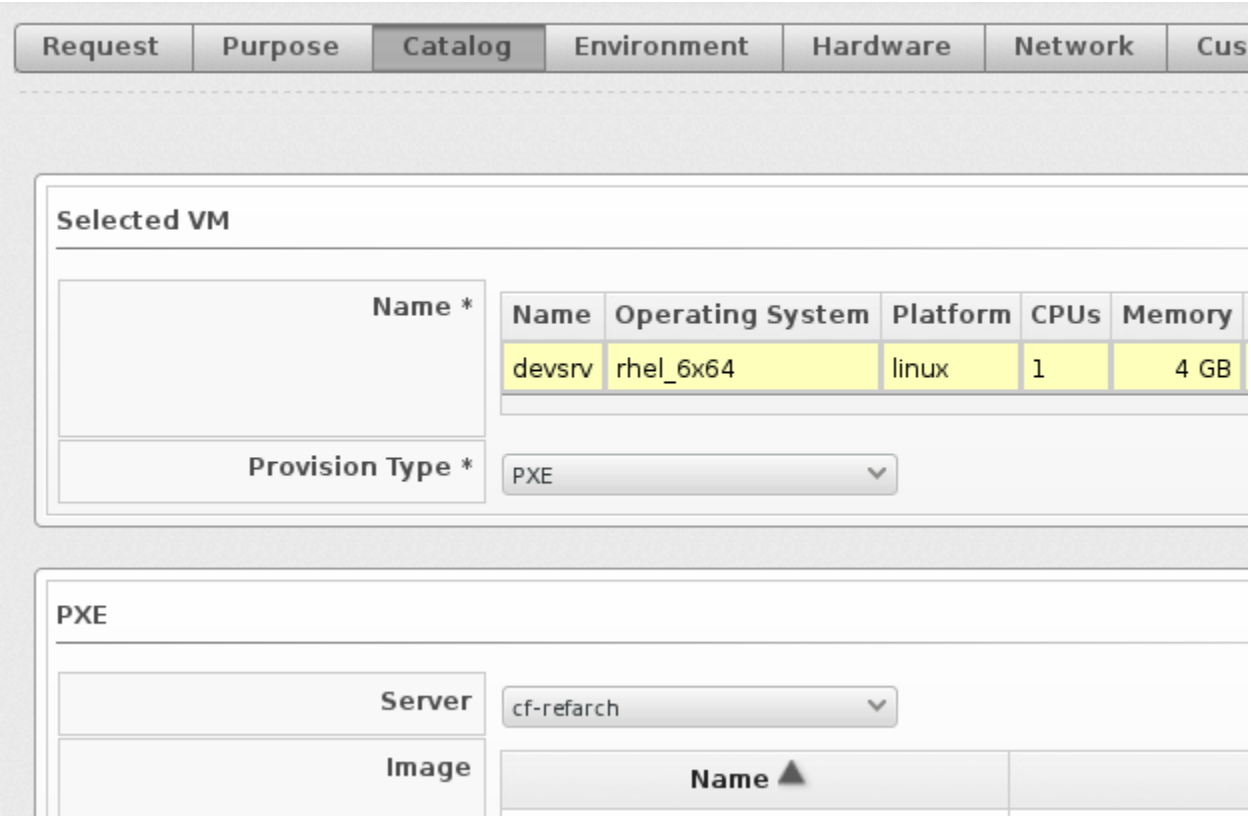


Figure 7.3-4: CFME – Self-Service Provision Catalog Settings

Environment

The following settings are used under the **Environment** tab and define where the newly created virtual machine is to be placed.

Input Box	Field	Value
VM Placement	Choose Automatically	Unchecked
Datacenter	Name	Default
Cluster	Name	Default
Host	Name	cf-rhevh.refarch.bos.redhat.com
Datastore	Name	cf-cfme-2

Table 7.3-3: CFME – Self-Service Environment Values

The following displays the self-service **Environment** settings.

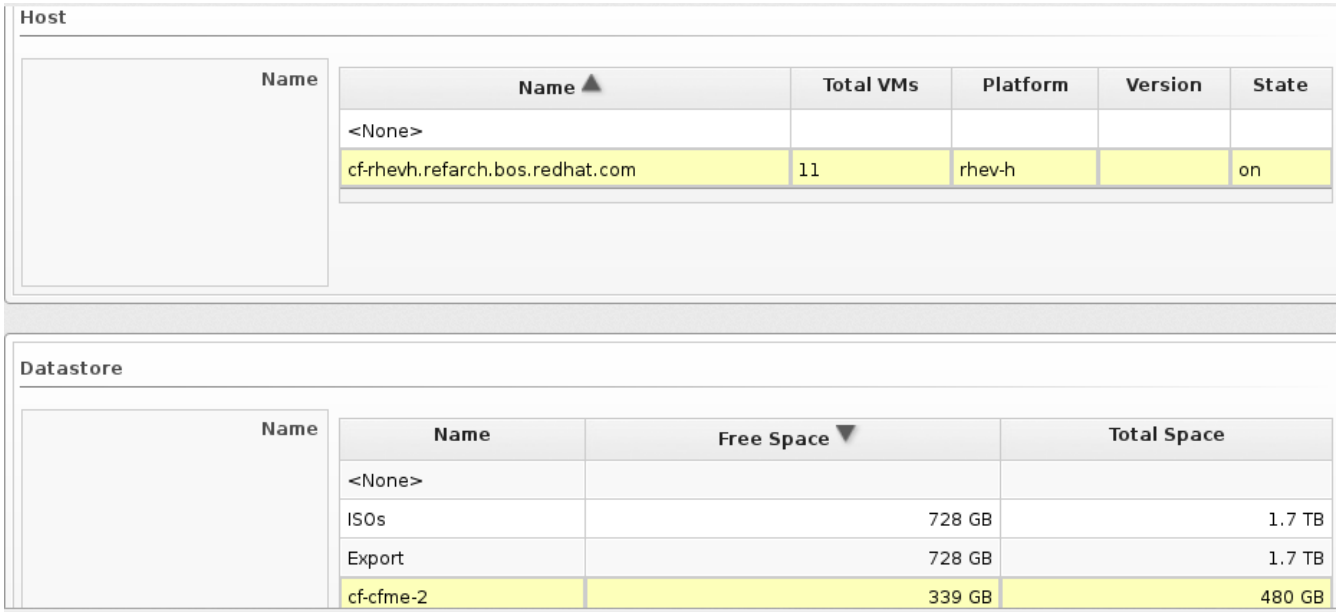


Figure 7.3-5: CFME – Self-Service Provision Environment Settings

Hardware

The **Hardware** tab contains hardware specifics for the virtual machine. The settings are automatically populated based on the selected template chosen. For the reference environment no changes were made.

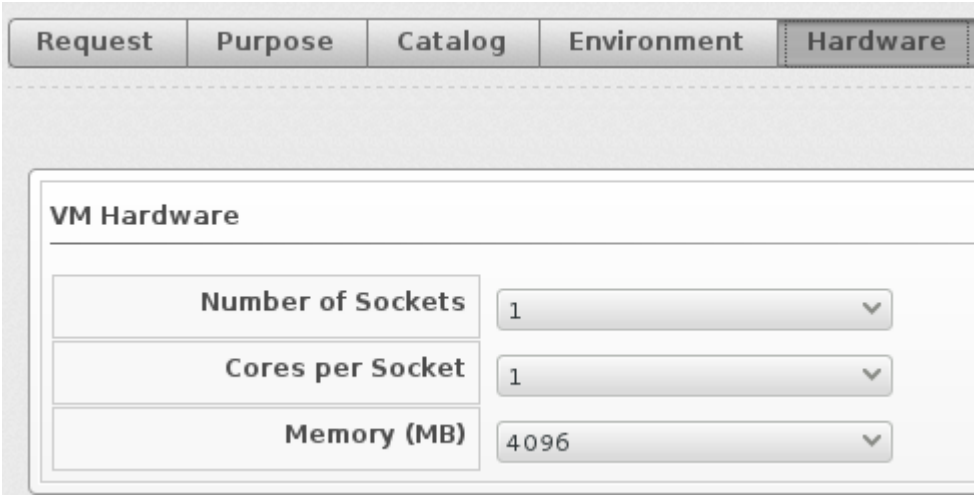


Figure 7.3-6: CFME – Self-Service Provision Hardware Settings

Network

The **Network** tab contains settings for the **vLan** value. This value is populated based on the template chosen. For the reference environment no changes were made.

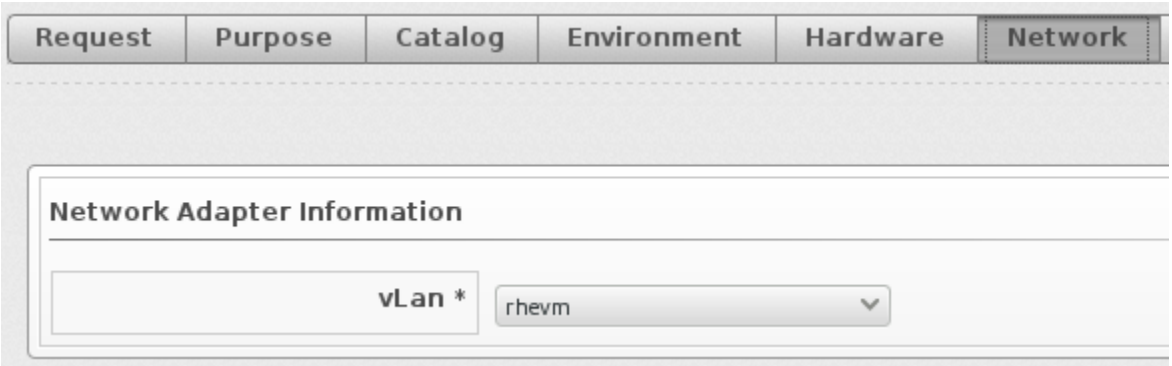


Figure 7.3-7: CFME – Self-Service Provision Network Settings

Customize

The **Customize** tab contains settings for credentials, IP address information, DNS, and specifying a customization template. Credentials, IP address, and DNS information provide a method to deviate from the template settings. Customization template is an option presented based on the image chosen from the PXE environment. For the reference environment, **Customization Template** is the only setting changed.

Figure 7.3-8: CFME – Self-Service Provision Customize Settings

Schedule

The **Schedule** tab contains settings for scheduling and lifespan for the virtual machine. For the reference environment default setting are used.

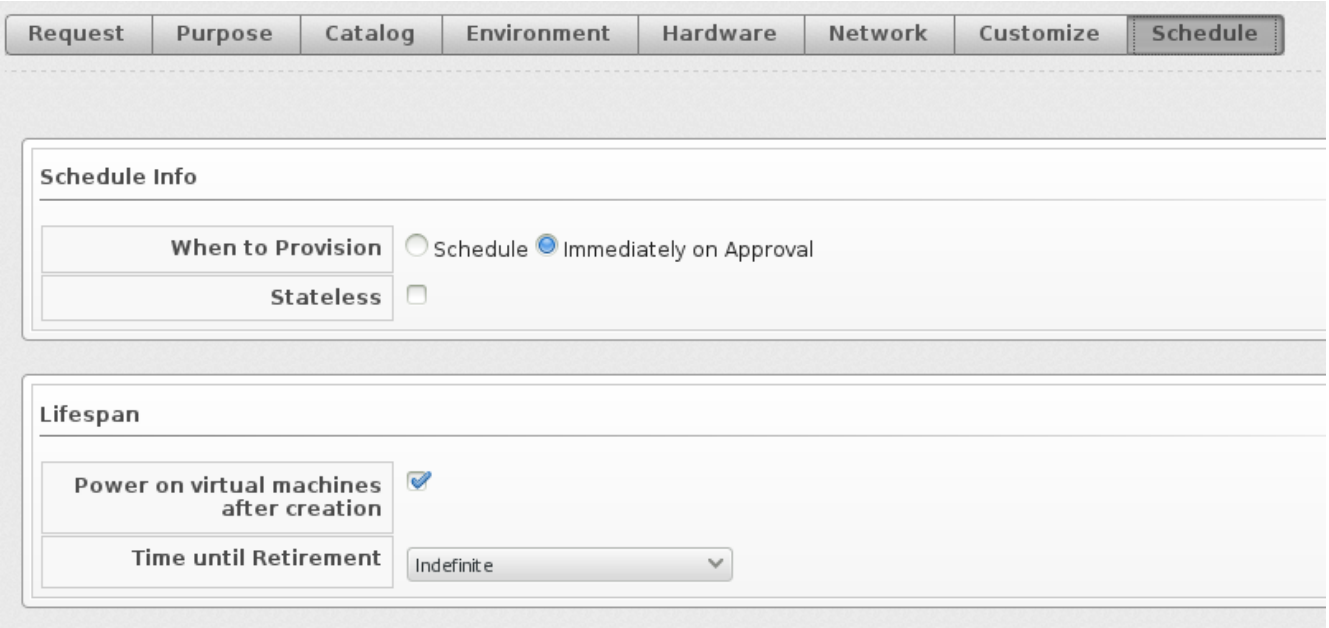


Figure 7.3-9: CFME – Self-Service Provision Schedule Settings

The final step to complete the self-service VM Provision is to click the **Submit** button. Upon doing so, the logged in user is redirected to **Services**, **Requests** where a status is displayed for the provision status.

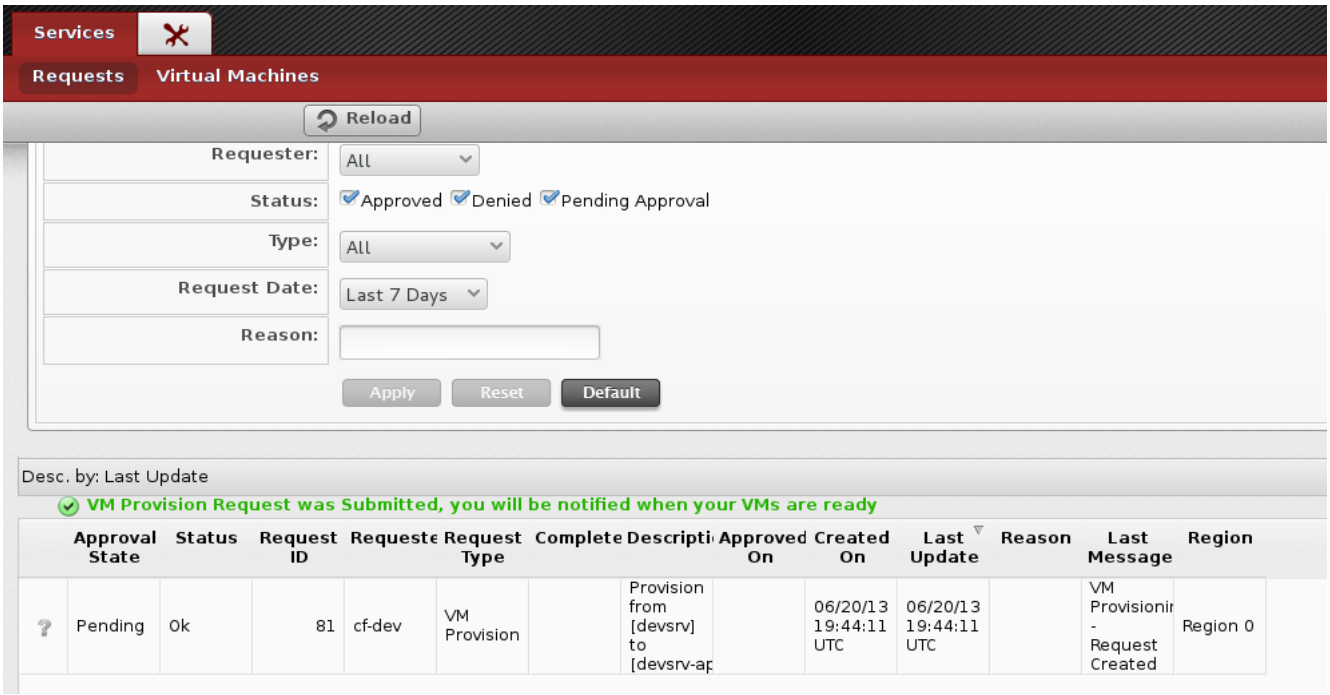


Figure 7.3-10: CFME – Self-Service Provision Status

Alternatively, on the CFME appliance the following log files can be monitored for status:

- */var/www/miq/vmdb/log/automate.log*
- */var/www/miq/vmdb/log/evm.log*

  Note: If there are multiple CFME appliances within the zone, it may be necessary to monitor the log files across each appliance.

Upon completion an e-mail is sent indicating the provision task has completed.

```
Hello,

Your request to provision a virtual machine was approved and completed on
Thursday, June 20, 2013 at 03:52PM.

Virtual machine devsrv-app will be available in approximately 15 minutes.

For Windows VM access is available via RDP and for Linux VM access is
available via putty/ssh, etc. Or you can use the Console Access feature
found in the detail view of your VM. As the designated owner you will
receive expiration warnings at this email address: cf-
dev@refarch.bos.redhat.com

If you are not already logged in, you can access and manage your virtual
machine here https://<CFME_appliance>/vm_or_template/show/107'

If you have any issues with your new virtual machine please contact Support.

Thank you,
Virtualization Infrastructure Team
```

The newly deployed virtual machine appears under **Services, Virtual Machines** and is ready for use.

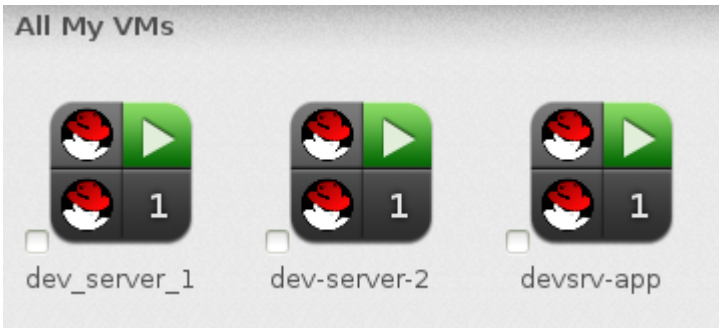


Figure 7.3-11: CFME – Self-Service Provision Complete

Note: In addition to using the default provisioning dialogs, a custom provisioning dialog[22] can be created and assigned to specific users and groups through a Provisioning Profile[23].

22 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Lifecycle_and_Automation_Guide/sect-Customizing_Provisioning_Dialogs.html

23 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Lifecycle_and_Automation_Guide/sect-Provisioning_Profiles.html

8 Chargeback

The chargeback feature provides the monetary calculation of virtual machine charges based on owner or company tag to include memory, storage, network, and CPU utilization. CloudForms Management Engine provides a default set of rates for calculating chargeback costs, however a custom set of rates can be created. To use this feature, capacity and utilization data collection must be enabled[24]. For the reference environment the following items are configured:

- Custom chargeback rates
- Custom reporting against the *CloudForms* environment tag

Note: The *CloudForms* tag creation and assignment is discussed in **Section 4.3 CloudForms Management Engine**.

8.1 Chargeback Rates

To create custom chargeback rates login to the CFME console with the *admin* account, hover over **Virtual Intelligence** and select **Chargeback**. Under the accordion menu in the left window pane select **Rates** and highlight **Compute**.

On the right window pane click **Configuration** and select the green plus next to **Add a New Chargeback Rate**.

In the **Basic Info** input box provide a **Description**. In the **Rate Details** input box define rates for each item. For the reference environment the following settings are used:

Input Box	Field	Value	Per Time	Per Unit
Basic Info	Description	CloudForms	N/A	N/A
Rate Details	CPU – Allocated CPU Count	0	Hourly	CPU
	CPU – Used CPU in MHz	.02	Hourly	MHz
	Disk I/O – Used disk I/O in KBps	.005	Hourly	KBps
	Fixed – Compute Cost 1	0	Daily	N/A
	Fixed – Compute Cost 2	0	Monthly	N/A
	Memory – Allocated Memory in MB	0	Daily	MB
	Memory – Used Memory in MB	.02	Hourly	MB
	Network I/O – Used Network I/O in KBps	.005	Hourly	KBps

Table 8.1-1: CFME – Custom Compute Chargeback Rate Values

24 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/sect-Capacity_and_Utilization_Collections.html

Click **Add** to complete.

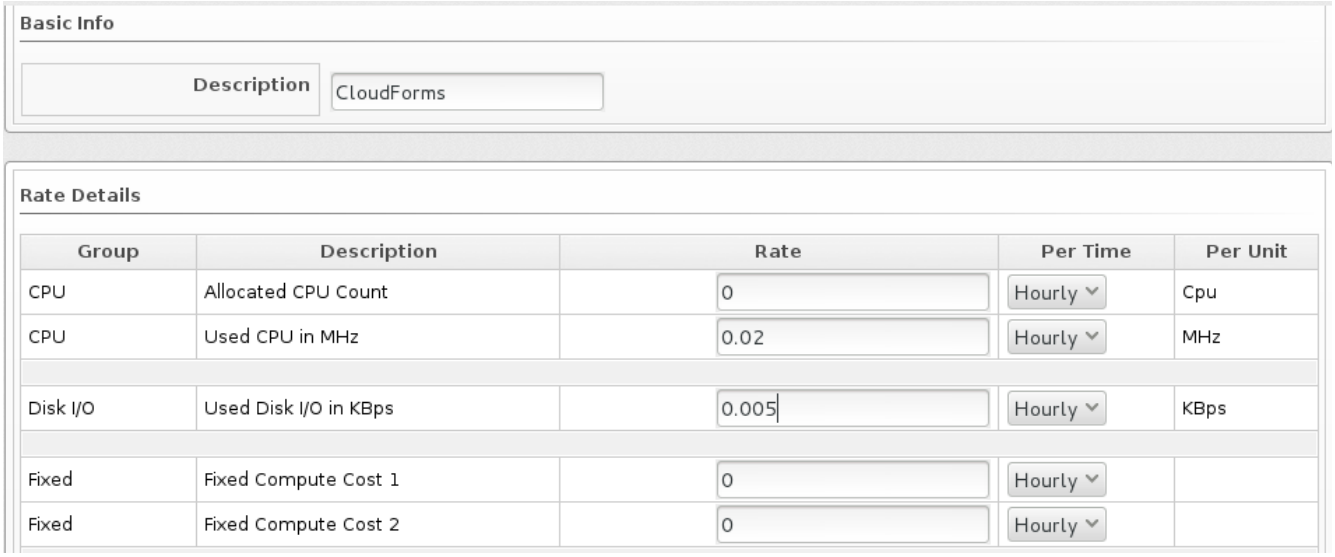


Figure 8.1-1: CFME – CloudForms Compute Chargeback Rates

On the left window pane highlight **Storage** under **Rates**.

On the right window pane click **Configuration** and select the green plus next to **Add a New Chargeback Rate**.

In the **Basic Info** input box provide a **Description**. In the **Rate Details** input box define rates for each item. For the reference environment the following settings are used:

Input Box	Field	Value	Per Time	Per Unit
Basic Info	Description	CloudForms	N/A	N/A
Rate Details	Fixed – Storage Cost 1	0	Hourly	N/A
	Fixed – Storage Cost 2	0	Hourly	N/A
	Storage – Allocated Disk Storage in Bytes	0	Hourly	GB
	Storage – Used Disk Storage in Bytes	2.0	Hourly	GB

Table 8.1-2: CFME – CloudForms Storage Chargeback Rate Values

Note: Rates are measured in dollars.

Click **Add** to complete.

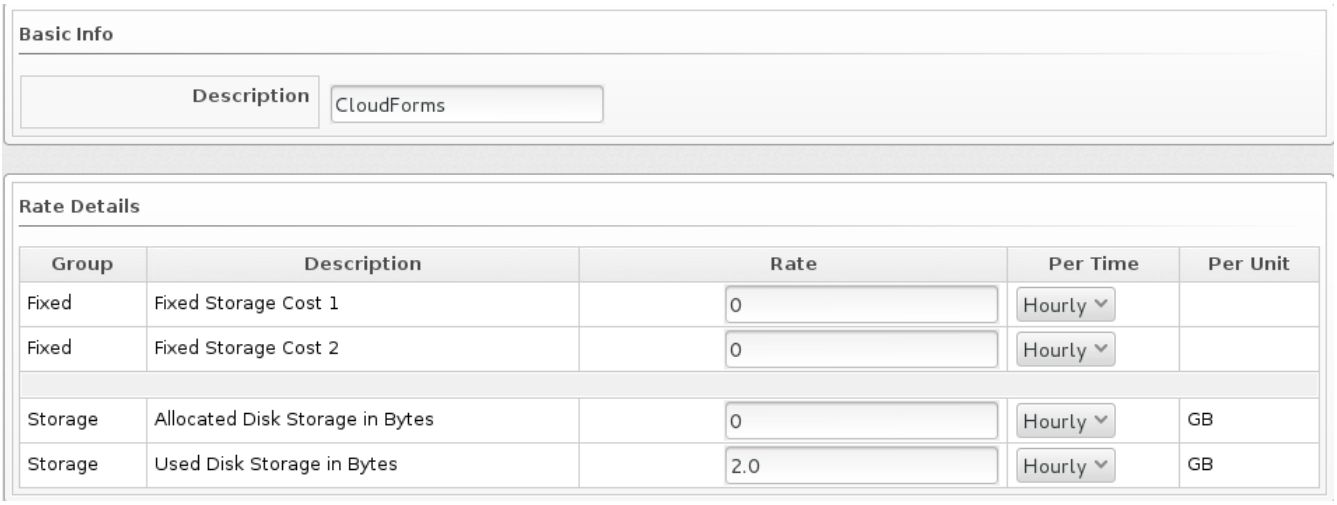


Figure 8.1-2: CFME – CloudForms Storage Chargeback Rates

Assign the custom chargeback rates to the environment

On the accordion menu in the left window pane select **Assignments** and highlight **Compute**.

On the right window pane in the **Basic Info** input box next to **Assign To**, click the pull down menu and select **Tagged VMs**. Next to **Tag Category**, click the pull down menu and choose *Environment*. For **Selections** next to **CloudForms**, click the pull down menu and choose *CloudForms* for the **Rate**. Click **Save** to complete.

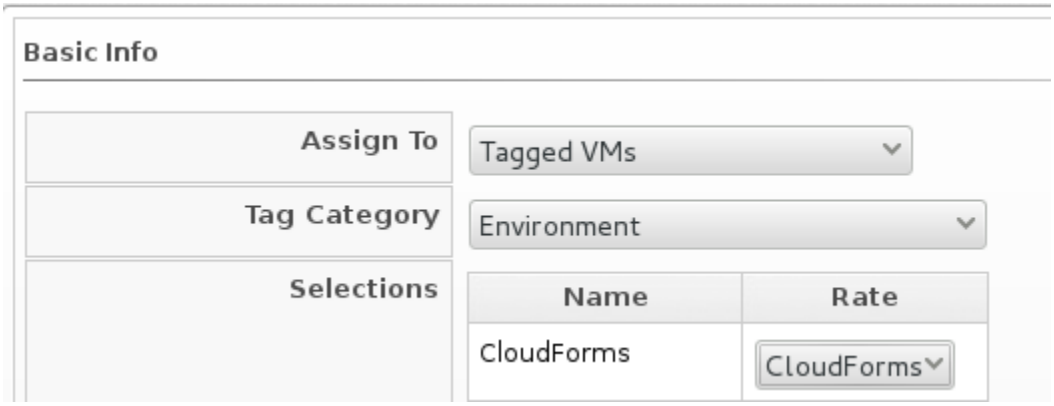


Figure 8.1-3: CFME – CloudForms Compute Chargeback Assignment

On the left window pane select **Storage** under **Assignments**.

On the right window pane in the **Basic Info** input box next to **Assign To**, click the pull down menu and select **Tagged Datastores**. Next to **Tag Category**, click the pull down menu and choose *Environment*. For **Selections** next to **CloudForms**, click the pull down menu and choose *CloudForms* for the **Rate**. Click **Save** to complete.

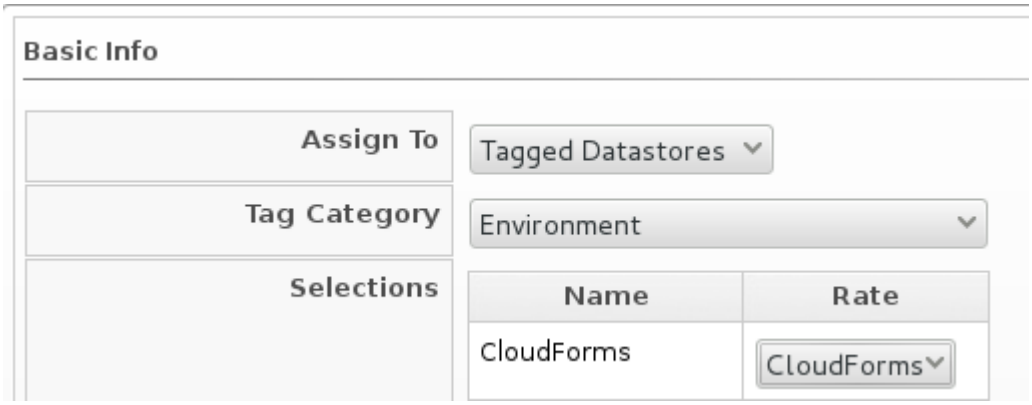


Figure 8.1-4: CFME – CloudForms Storage Chargeback Assignment

8.2 Reporting

Reporting is an integral piece to the chargeback model and provides a view into costing. This is helpful as both the consumer and the owner of resources by understanding demand, trends, and budgeting needs.

8.2.1 Chargeback Report Configuration

To configure reporting for chargeback, login to the CFME console with the *admin* account, hover over **Virtual Intelligence** and select **Reports**. On the accordion menu in the left window pane select **Reports**.

On the right window pane click the green plus, **Add a New Report**. A series of tabs is presented for which information is provided to include what information the report contains, format of the report, report interval, and more. Complete the settings under each tab before clicking the **Submit** button at the bottom. The following settings are used for the reference environment:

Columns

The values provided for the **Columns** tab determine what information the report contains. For the reference environment the following settings are used:

Input Box	Field	Value
Basic Report Info	Menu Name	CloudForms
	Title	Chargeback
Configure Report Columns	Base the report on	Chargebacks
	Selected Fields	CPU Used Cost
		Memory Used Cost
		Storage Used Cost
		Total Cost
Report Creation Timeout	Cancel after	<System Default>

Table 8.2.1-1: CFME – Chargeback Report Column Values

Chargeback report **Columns** settings.

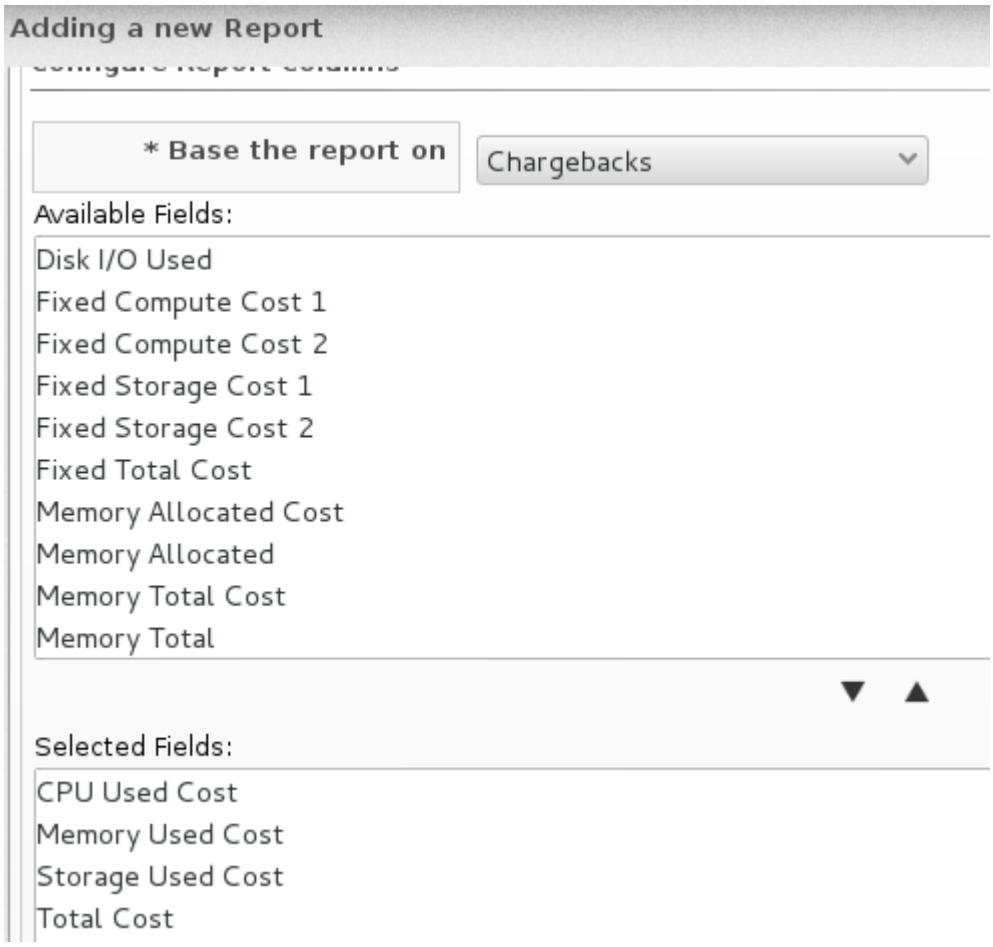


Figure 8.2.1-1: CFME – Chargeback Report Column Settings

Formatting

Settings under the **Formatting** tab determine how the information is displayed. For the reference environment defaults are used.

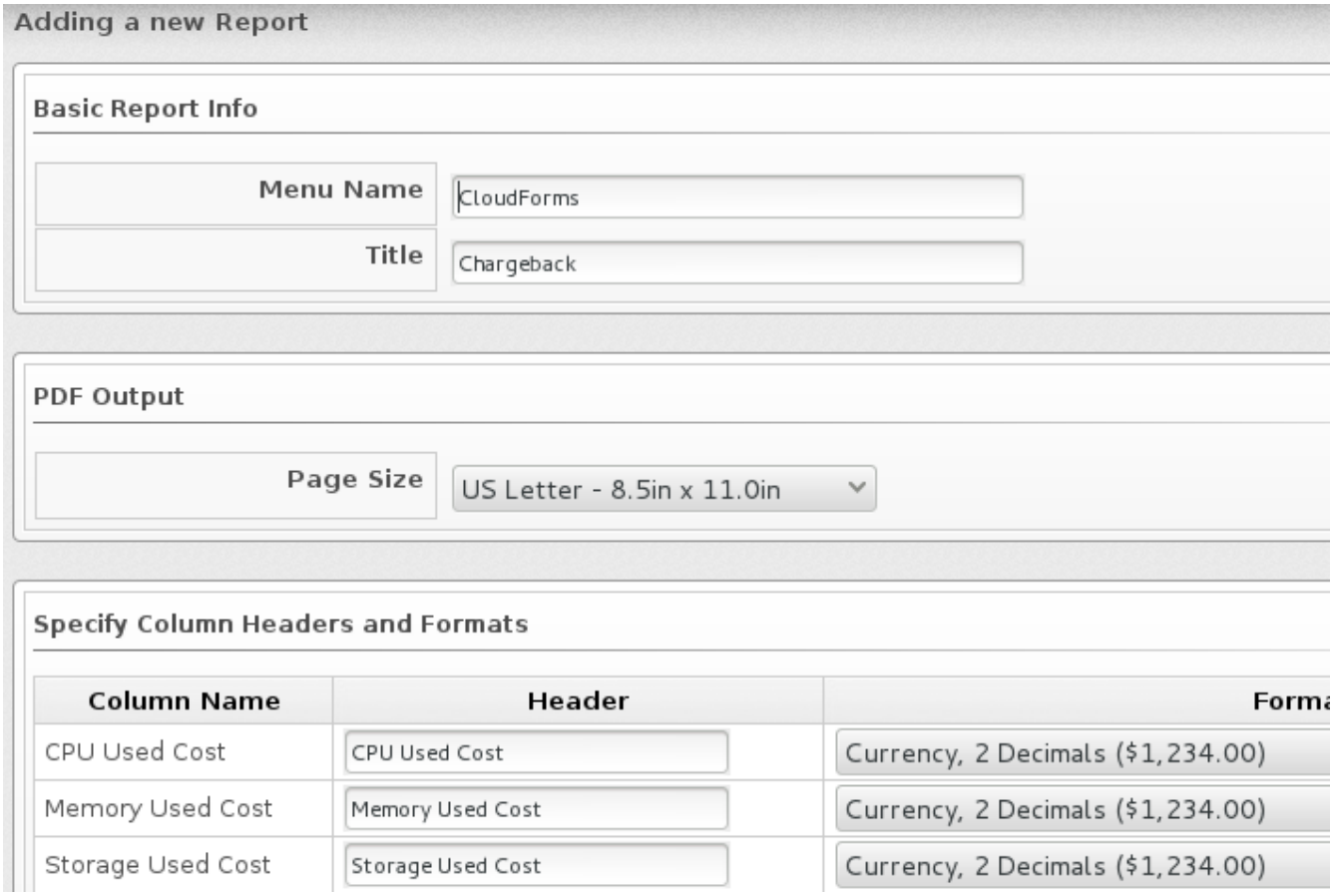


Figure 8.2.1-2: CFME – Chargeback Report Formatting Settings

Filter

Settings under the **Filter** tab are used to refine the data captured to include setting how far back captured data is displayed. The following settings are used for the reference environment:

Input Box	Field	Value
Basic Report Info	Menu Name	Chargeback
	Title	CloudForms
Chargeback Filters	Show Costs by	Red Hat Tag
	Tag Category	Environment
	Tag	CloudForms
	Group by	Date
Chargeback Interval	Show Costs by	Day
	Ending with	Yesterday going back 2 weeks
	Timezone	Eastern Time

Table 8.2.1-2: CFME – Chargeback Report Filter Values

Chargeback report **Filter** settings:

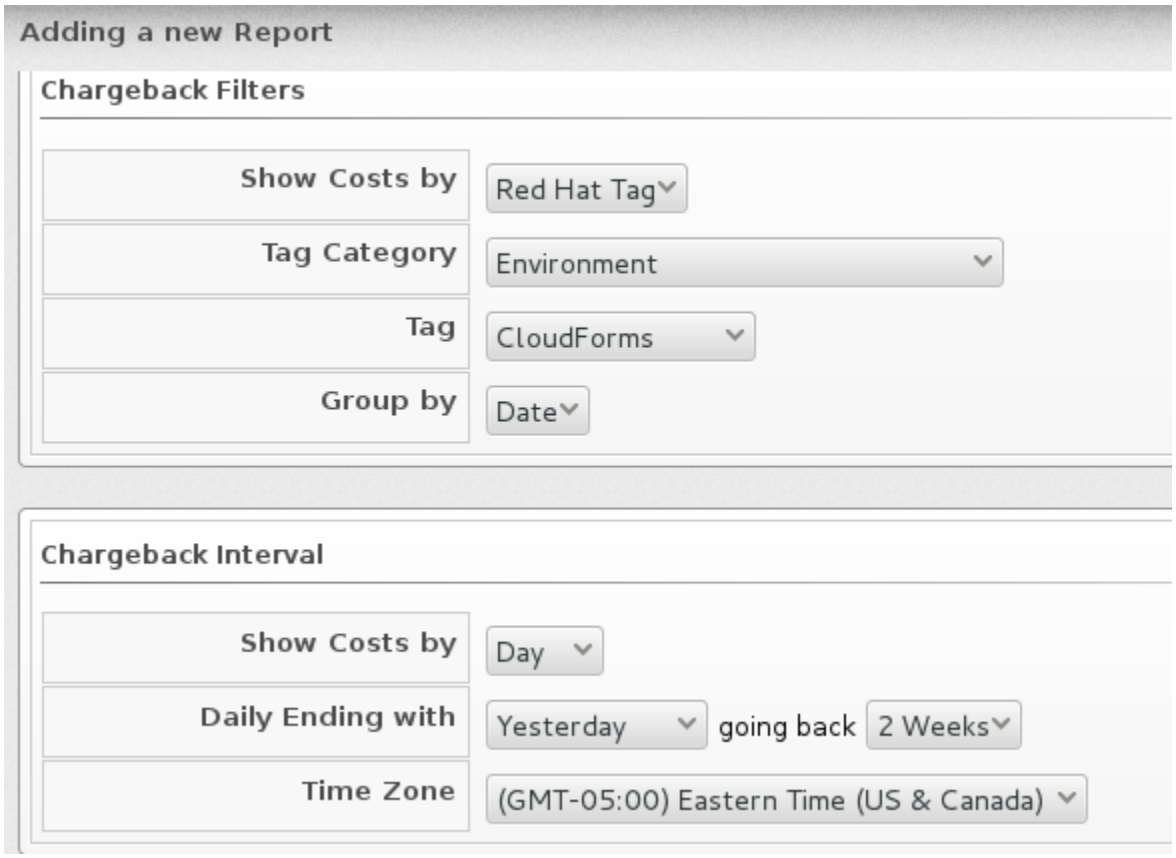


Figure 8.2.1-3: CFME – Chargeback Report Filter Settings

Preview

The **Preview** tab offers the ability to review the report as it would typically run before committing to adding the new report. Click the **Load** button to generate the preview. Click **Add** to complete the report creation.

Adding a new Report

Basic Report Info

Menu Name	CloudForms
Title	Chargeback

Report Preview (up to 50 rows)

Date Range	VM Name	CPU Used Cost	Memory Used Cost	Storage Used Cost	Total Cost
06/06/2013	websrv-test	$15.89	$267.88	$480.67	$764.44
06/06/2013	websrv-test-iso-rpm	$15.88	$201.81	$480.67	$698.36
06/06/2013	websrv-test-policy	$6.51	$69.97	$480.67	$557.15
06/06/2013	websrv-test-rpm	$13.58	$215.47	$480.67	$709.71
06/06/2013					
Totals:					**$2,729.66**
06/07/2013	dev_server_1	$33.00	$71.59	$160.22	$266.17
06/07/2013	websrv-test	$15.25	$276.48	$480.67	$772.39
06/07/2013	websrv-test-iso-rpm	$17.41	$204.80	$480.67	$702.88
06/07/2013	websrv-test-policy	$14.28	$135.75	$480.67	$630.70
06/07/2013	websrv-test-rpm	$11.71	$225.28	$480.67	$717.66

Figure 8.2.1-4: CFME – Chargeback Report Preview

The *CloudForms* chargeback report appears on the accordion menu in the left window pane under **Reports**, **All Reports**, **Red Hat (All EVM Groups)**, **Custom**.

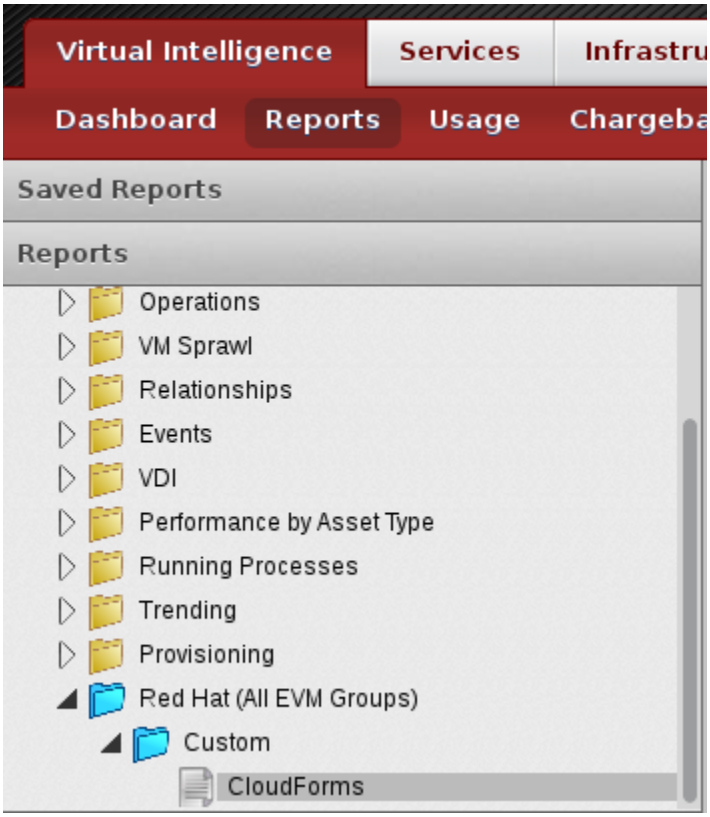


Figure 8.2.1-5: CFME – CloudForms Chargeback Report

8.2.2 Report Generation

Reports can be generated in two ways, by scheduling or by single instance manual invocation.

To schedule a report, on the accordion menu in the left window pane, select **Reports** and navigate to the *CloudForms* report under **All Reports**, **Red Hat (All EVM Groups)**, **Custom**.

Select *CloudForms* and on the right window pane and click the clock with green plus icon, **Add a new Schedule**.

In the **Timer** input box change the **Run** field to *Daily* every *Day*. Set the **Starting Date** and **Starting Time**.

In the **E-mail after Running** input box place a check mark next to **Send an E-mail**. Provide a **From** and **To** e-mail address.

In the **E-mail Options** input box place a check mark next to *Send if Report is Empty* and next to *PDF* for **Attachments**.

For the reference environment the scheduled report will run daily at 8PM EST. Click **Add** to complete.

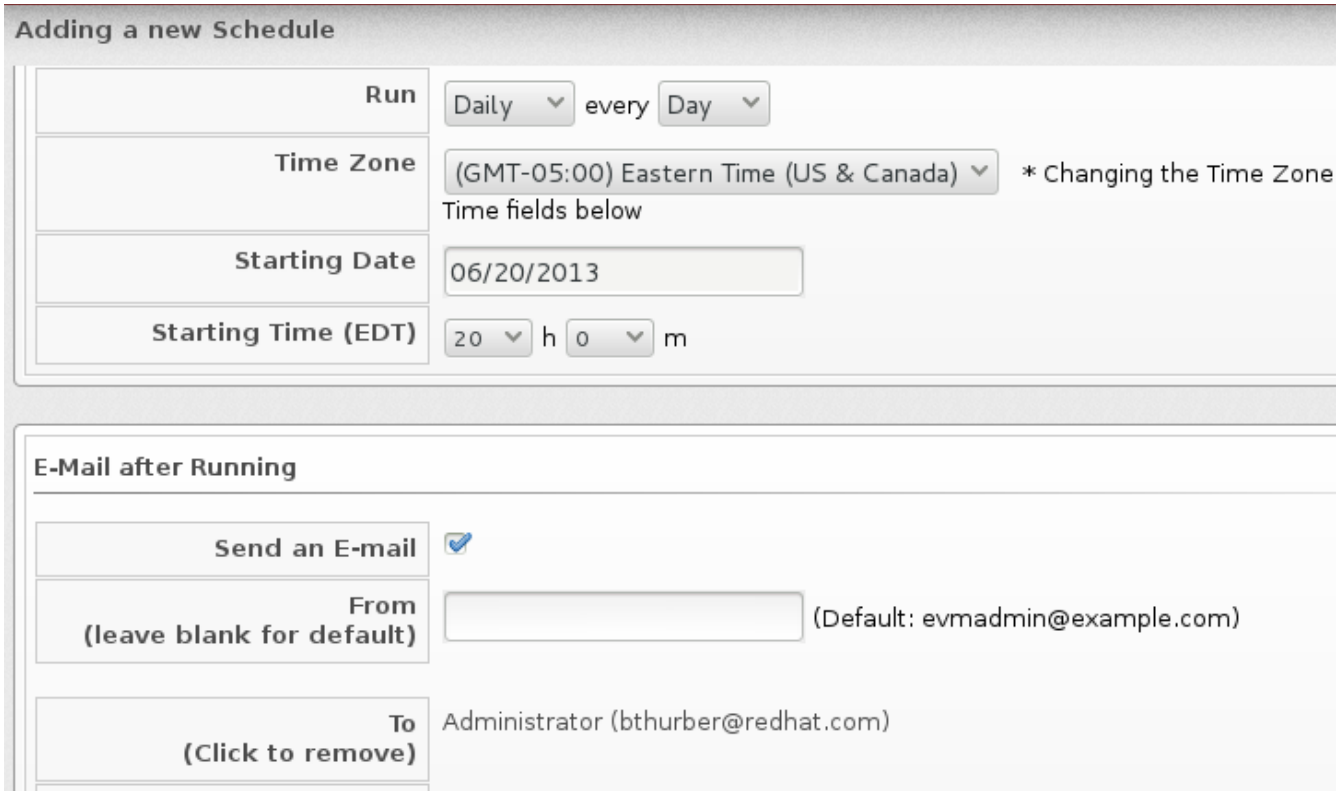


Figure 8.2.2-1: CFME – CloudForms Report Schedule

The schedule for the report is located on the accordion menu in the left window pane under **Schedules**, **All Schedules**.

Figure 8.2.2-2: CFME – Scheduled Report

To manually invoke the *CloudForms* report at any time, on the accordion menu in the left window pane select **Reports** and navigate to **All Reports**, **Red Hat (All EVM Groups)**, **Custom**.

Highlight the *CloudForms* report and on the right window pane click the gear cog icon, **Queue this Report to be generated**. Upon selection a status window is displayed on the right window pane.

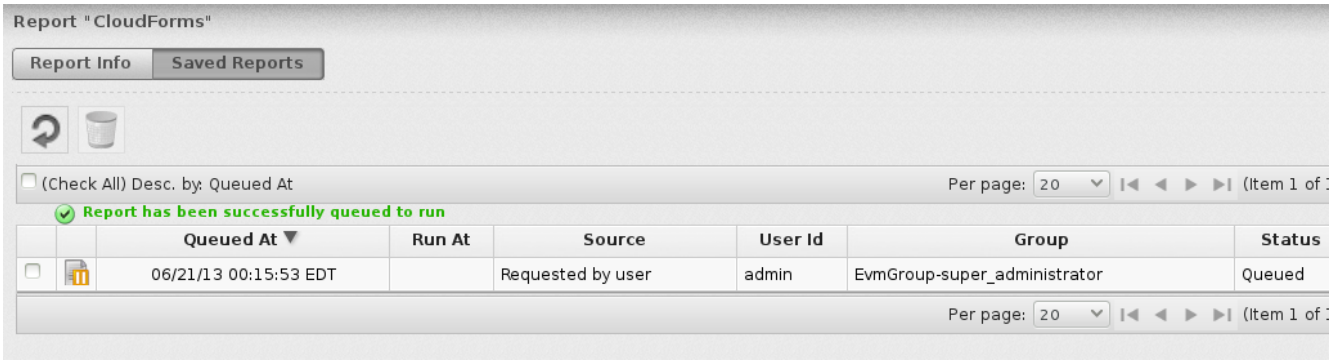


Figure 8.2.2-3: CFME – CloudForms Manual Report Invocation Status

Click the circular arrow icon to refresh the generation status.

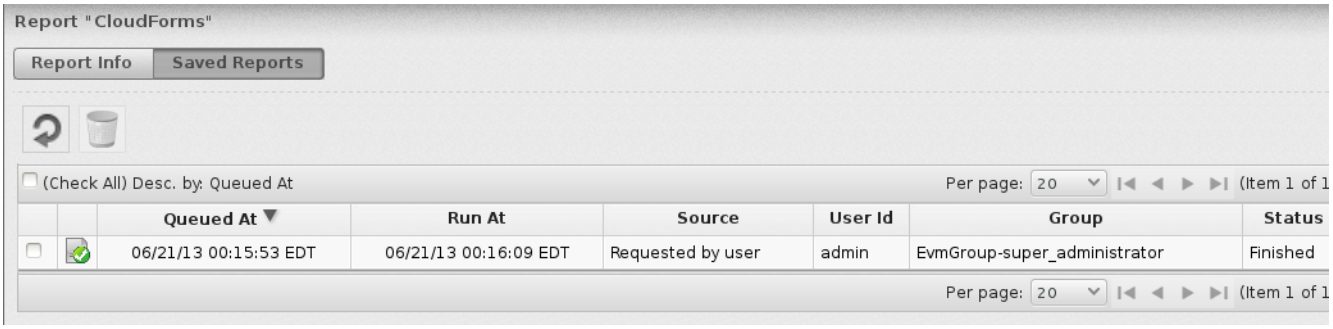
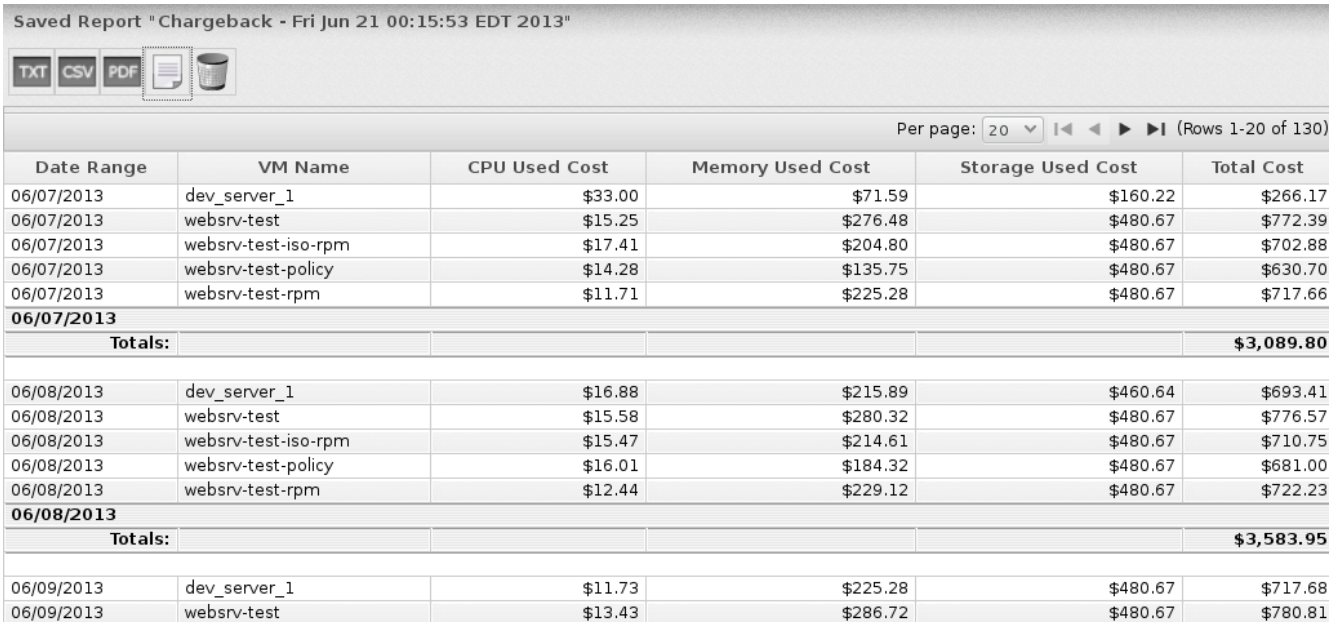


Figure 8.2.2-4: CFME – CloudForms Manual Report Invocation Complete

To access the report click the document with the green check mark or on the accordion menu in the left window pane, select **Saved Reports**, expand **CloudForms**, and click the report.

The completed report appears on the right window pane and can be saved to local disk as a *.txt*, *.csv*, or *.pdf* format. Optionally the report can be displayed in a full screen or deleted.



Saved Report "Chargeback - Fri Jun 21 00:15:53 EDT 2013"

Per page: 20 (Rows 1-20 of 130)

Date Range	VM Name	CPU Used Cost	Memory Used Cost	Storage Used Cost	Total Cost
06/07/2013	dev_server_1	$33.00	$71.59	$160.22	$266.17
06/07/2013	websrv-test	$15.25	$276.48	$480.67	$772.39
06/07/2013	websrv-test-iso-rpm	$17.41	$204.80	$480.67	$702.88
06/07/2013	websrv-test-policy	$14.28	$135.75	$480.67	$630.70
06/07/2013	websrv-test-rpm	$11.71	$225.28	$480.67	$717.66
06/07/2013					
Totals:					**$3,089.80**
06/08/2013	dev_server_1	$16.88	$215.89	$460.64	$693.41
06/08/2013	websrv-test	$15.58	$280.32	$480.67	$776.57
06/08/2013	websrv-test-iso-rpm	$15.47	$214.61	$480.67	$710.75
06/08/2013	websrv-test-policy	$16.01	$184.32	$480.67	$681.00
06/08/2013	websrv-test-rpm	$12.44	$229.12	$480.67	$722.23
06/08/2013					
Totals:					**$3,583.95**
06/09/2013	dev_server_1	$11.73	$225.28	$480.67	$717.68
06/09/2013	websrv-test	$13.43	$286.72	$480.67	$780.81

Figure 8.2.2-5: CFME – CloudForms Manual Report Output

9 Conclusion

Red Hat CloudForms 2.0 provides a feature rich, Infrastructure-as-a-Service (IaaS) platform giving customers a single interface needed to optimize and manage their environments. Whether needs revolve around virtual machine sprawl, costing for used resources, or a single management platform for distributed virtual environments, Red Hat CloudForms 2.0 has it covered.

The goal of this reference architecture focused on managing and integrating with Red Hat Enterprise Virtualization 3.2 in a private cloud environment. The following use cases were successfully executed:

- Provisioning virtual machines through Pre-Boot Execution (PXE) and International Organization for Standardization (ISO) imaging
- Demonstrate Automation capabilities providing resiliency for a web server
- Integration with LDAP services to provide self-service user and group mappings along with self-service provisioning
- Demonstrate resiliency for CloudForms Management Engine (CFME) database services
- Demonstrate chargeback for managed resources

Each use case executed contains the details necessary to provide Red Hat customers with the ability to reproduce in their own environments.

Appendix A: Revision History

Revision 1.0	Friday, June 28, 2013	Brett Thurber
Initial Release		
Revision 1.1	Monday, July 8, 2013	Brett Thurber
Minor Edits		
Revision 1.2	Wednesday, September 18, 2013	Brett Thurber
Title Change		
Revision 1.3	Thursday, October 24, 2013	Brett Thurber
Fixed URI path for Table 5.1.1-1 on page 44. Updated address for corporate offices.		
Revision 1.4	Thursday, January 10, 2014	Brett Thurber
Added Red Hat Global Support Services statements, support link, and minor edits.		

Appendix B: Contributors

Contributor	Title	Contribution
Roger Lopez	Sr. Software Engineer	Review
James Labocki	Principal Product Marketing Manager	Content and Review
Xavier Lecauchois	Principal Product Manager - Technical	Review
Aaron Weitekamp	Senior Quality Engineer	Content and Review
Vincent Valdez	Principal Architect	Content and Review
Tom Hennessy	Principal Software Engineer	Review

Appendix C: iptables

cfme, cfme-2, cfme-3 (CloudForms Management Engine)

/etc/sysconfig/iptables

```
# Generated by iptables-save v1.3.5 on Tue Oct  5 11:55:42 2010
*filter
:INPUT ACCEPT [12246:3938412]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [55985:245536782]
-A INPUT -i lo -j ACCEPT
-A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
```

```
-A INPUT -p tcp -m tcp --dport 22 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 80 -j ACCEPT
-A INPUT -p udp -m udp --dport 80 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 443 -j ACCEPT
-A INPUT -p udp -m udp --dport 443 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 5432 -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -m limit --limit 5/min --limit-burst 7 -j LOG --log-prefix
"**iptables drop**"
-A INPUT -j DROP
-A FORWARD -p icmp -j ACCEPT
-A OUTPUT -p icmp -j ACCEPT
COMMIT
# Completed on Tue Oct  5 11:55:42 2010
```

sysman-rhel6 (Satellite Server)

/etc/sysconfig/iptables

```
# Generated by iptables-save v1.3.5 on Tue Jan 11 09:19:06 2011
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [4418854:1249223840]
-A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 22 -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 53 -j ACCEPT
-A INPUT -p udp -m state --state NEW -m udp --dport 53 -j ACCEPT
-A INPUT -p udp -m state --state NEW -m udp --dport 67 -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 68 -j ACCEPT
-A INPUT -p udp -m state --state NEW -m udp --dport 68 -j ACCEPT
-A INPUT -p udp -m state --state NEW -m udp --dport 69 -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 69 -j ACCEPT
-A INPUT -p udp -m udp --dport 80 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 80 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 137 -j ACCEPT
-A INPUT -p udp -m udp --dport 137 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 138 -j ACCEPT
-A INPUT -p udp -m udp --dport 138 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 139 -j ACCEPT
-A INPUT -p udp -m udp --dport 139 -j ACCEPT
-A INPUT -p udp -m udp --dport 443 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 443 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 4545 -j ACCEPT
-A INPUT -p udp -m udp --dport 4545 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 5222 -j ACCEPT
-A INPUT -p udp -m udp --dport 5222 -j ACCEPT
-A INPUT -p udp -m udp --dport 25150 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 25151 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 111 -j ACCEPT
-A INPUT -p udp -m udp --dport 111 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 662 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 875 -j ACCEPT
```

```
-A INPUT -p udp -m udp --dport 875 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 892 -j ACCEPT
-A INPUT -p udp -m udp --dport 892 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 2049 -j ACCEPT
-A INPUT -p udp -m udp --dport 2049 -j ACCEPT
-A INPUT -p udp -m udp --dport 32769 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 32803 -j ACCEPT
#-A INPUT -j LOG --log-prefix "---FIREWALL REJECTS----"
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -j REJECT --reject-with icmp-host-prohibited
COMMIT
# Completed on Tue Jan 11 09:19:06 2011
```

cf-rhevm (RHEV 3.1 Manager)

/etc/sysconfig/iptables

```
# Generated by iptables-save v1.4.7 on Mon Apr  8 22:00:29 2013
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [364:91962]
:RH-Firewall-1-INPUT - [0:0]
-A INPUT -p tcp -m tcp --dport 5432 -j ACCEPT
-A INPUT -i virbr0 -p udp -m udp --dport 53 -j ACCEPT
-A INPUT -i virbr0 -p tcp -m tcp --dport 53 -j ACCEPT
-A INPUT -i virbr0 -p udp -m udp --dport 67 -j ACCEPT
-A INPUT -i virbr0 -p tcp -m tcp --dport 67 -j ACCEPT
-A INPUT -j RH-Firewall-1-INPUT
-A FORWARD -d 192.168.122.0/24 -o virbr0 -m state --state
RELATED,ESTABLISHED -j ACCEPT
-A FORWARD -s 192.168.122.0/24 -i virbr0 -j ACCEPT
-A FORWARD -i virbr0 -o virbr0 -j ACCEPT
-A FORWARD -o virbr0 -j REJECT --reject-with icmp-port-unreachable
-A FORWARD -i virbr0 -j REJECT --reject-with icmp-port-unreachable
-A FORWARD -j RH-Firewall-1-INPUT
-A RH-Firewall-1-INPUT -i lo -j ACCEPT
-A RH-Firewall-1-INPUT -p icmp -m icmp --icmp-type any -j ACCEPT
-A RH-Firewall-1-INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 22 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 80 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 443 -j
ACCEPT
-A RH-Firewall-1-INPUT -p udp -m state --state NEW -m udp --dport 111 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 111 -j
ACCEPT
-A RH-Firewall-1-INPUT -p udp -m state --state NEW -m udp --dport 892 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 892 -j
ACCEPT
-A RH-Firewall-1-INPUT -p udp -m state --state NEW -m udp --dport 875 -j
ACCEPT
```

```
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 875 -j
ACCEPT
-A RH-Firewall-1-INPUT -p udp -m state --state NEW -m udp --dport 662 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 662 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 2049 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 5432 -j
ACCEPT
-A RH-Firewall-1-INPUT -p tcp -m state --state NEW -m tcp --dport 32803 -j
ACCEPT
-A RH-Firewall-1-INPUT -p udp -m state --state NEW -m udp --dport 32769 -j
ACCEPT
-A RH-Firewall-1-INPUT -j REJECT --reject-with icmp-host-prohibited
COMMIT
# Completed on Mon Apr  8 22:00:29 2013
```

cf-rhevm-32 (RHEV 3.2 Manager)

/etc/sysconfig/iptables

```
# Generated by ovirt-engine installer
#filtering rules
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -i lo -j ACCEPT
-A INPUT -p icmp -m icmp --icmp-type any -j ACCEPT
-A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 22 -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 80 -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 443 -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 5432 -j ACCEPT
#drop all rule
-A INPUT -j REJECT --reject-with icmp-host-prohibited
COMMIT
```

cf-rhelh and cf-rhelhyp (RHEL Hypervisors)

/etc/sysconfig/iptables

```
# oVirt default firewall configuration. Automatically generated by vdsm
bootstrap script.
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT

-A INPUT -i lo -j ACCEPT
# vdsm
-A INPUT -p tcp --dport 54321 -j ACCEPT
# SSH
```

```
-A INPUT -p tcp --dport 22 -j ACCEPT
# snmp
-A INPUT -p udp --dport 161 -j ACCEPT


# libvirt tls
-A INPUT -p tcp --dport 16514 -j ACCEPT

# guest consoles
-A INPUT -p tcp -m multiport --dports 5634:6166 -j ACCEPT

# migration
-A INPUT -p tcp -m multiport --dports 49152:49216 -j ACCEPT

# Reject any other input traffic
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -m physdev ! --physdev-is-bridged -j REJECT --reject-with icmp-
host-prohibited
COMMIT
```

cf-rhevh (RHEV Hypervisor)

/etc/sysconfig/iptables

```
# oVirt automatically generated firewall configuration
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
# vdsm
-A INPUT -p tcp --dport 54321 -j ACCEPT
# libvirt tls
-A INPUT -p tcp --dport 16514 -j ACCEPT
# SSH
-A INPUT -p tcp --dport 22 -j ACCEPT
# guest consoles
-A INPUT -p tcp -m multiport --dports 5634:6166 -j ACCEPT
# migration
-A INPUT -p tcp -m multiport --dports 49152:49216 -j ACCEPT
# snmp
-A INPUT -p udp --dport 161 -j ACCEPT
#
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -m physdev ! --physdev-is-bridged -j REJECT --reject-with icmp-
host-prohibited
COMMIT
```

websrv (Virtual Machine)

/etc/sysconfig/iptables

```
# Firewall configuration written by system-config-firewall
```

```
# Manual customization of this file is not recommended.
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 80 -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 22 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -j REJECT --reject-with icmp-host-prohibited
COMMIT
```

devsrv (Virtual Machine)

/etc/sysconfig/iptables

```
# Firewall configuration written by system-config-firewall
# Manual customization of this file is not recommended.
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 80 -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 22 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -j REJECT --reject-with icmp-host-prohibited
COMMIT
```

Appendix D: kickstart

websrv (Virtual Machine)

```
# Kickstart config file generated by RHN Satellite Config Management
# Profile Label : websrv
# Date Created  : 2013-05-15 13:38:45.0

install
text
network --bootproto dhcp
url --url http://sysman-rhel6.refarch.bos.redhat.com/ks/dist/ks-rhel-x86_64-
server-6-6.4
lang en_US
keyboard us
zerombr
clearpart --all
bootloader --location mbr
timezone America/New_York
auth --enablemd5 --enableshadow
rootpw --iscrypted [REDACTED]
```

```
selinux --enforcing
poweroff
firewall --enabled --http --ssh
skipx
part /boot --fstype=ext3 --size=200
part pv.01 --size=1000 --grow
part swap --size=1000   --maxsize=2000
volgroup myvg pv.01
logvol / --vgname=myvg --name=rootvol --size=1000 --grow

%packages
@ Base
@ Web Server
%end

%pre

wget "http://sysman-
rhel6.refarch.bos.redhat.com/cblr/svc/op/trig/mode/pre/profile/websrv:1:RedH
atGSS" -O /dev/null

echo "Saving RHN keys..." > /dev/ttyS0
SYSTEM_ID=/etc/sysconfig/rhn/systemid
rhn_keys_found=no

mkdir -p /tmp/rhn

drives=$(list-harddrives | awk '{print $1}')
for disk in $drives; do
    DISKS="$DISKS $(fdisk -l /dev/$disk | grep -v "swap\|LVM\|Extended" |
awk '/^\/dev/{print $1}')"
done

# Try to find the keys on ordinary partitions
for disk in $DISKS; do
    name=test-$(basename $disk)
    mkdir -p /tmp/$name
    mount $disk /tmp/$name
    [ $? -eq 0 ] || continue # Skip to the next partition if the mount fails

    # Copy current RHN host keys out to be reused
    if [ -f /tmp/${name}$SYSTEM_ID ]; then
        cp -a /tmp/${name}$SYSTEM_ID /tmp/rhn
        rhn_keys_found="yes"
        umount /tmp/$name
        break
    fi
    umount /tmp/$name
    rm -r /tmp/$name
done

# Try LVM if that didn't work
if [ "$rhn_keys_found" = "no" ]; then
    lvm lvmdiskscan
    vgs=$(lvm vgs | tail -n +2 | awk '{ print $1 }')
```

```
    for vg in $vgs; do
        # Activate any VG we found
        lvm vgchange -ay $vg
    done

    lvs=$(lvm lvs | tail -n +2 | awk '{ print "/dev/" $2 "/" $1 }')
    for lv in $lvs; do
        tmpdir=$(mktemp -d findkeys.XXXXXX)
        mkdir -p /tmp/${tmpdir}
        mount $lv /tmp/${tmpdir} || continue # Skip to next volume if this
fails

        # Let's see if the keys are in there
        if [ -f /tmp/${tmpdir}$SYSTEM_ID ]; then
            cp -a /tmp/${tmpdir}$SYSTEM_ID /tmp/rhn/
            rhn_keys_found="yes"
            umount /tmp/${tmpdir}
            break # We're done!
        fi
        umount /tmp/${tmpdir}
        rm -r /tmp/${tmpdir}
    done

    # And clean up..
    for vg in $vgs; do
        lvm vgchange -an $vg
    done
fi


%end

%post --nochroot
mkdir /mnt/sysimage/tmp/ks-tree-copy
if [ -d /oldtmp/ks-tree-shadow ]; then
cp -fa /oldtmp/ks-tree-shadow/* /mnt/sysimage/tmp/ks-tree-copy
elif [ -d /tmp/ks-tree-shadow ]; then
cp -fa /tmp/ks-tree-shadow/* /mnt/sysimage/tmp/ks-tree-copy
fi
cp /etc/resolv.conf /mnt/sysimage/etc/resolv.conf
cp -f /tmp/ks-pre.log* /mnt/sysimage/root/ || :

%end

%post --nochroot --interpreter /usr/bin/python
try:
    import xmlrpclib
    import shutil
    import sys
    import os.path
    old_system_id = "/tmp/rhn/systemid"
    new_system_id = "/mnt/sysimage/root/systemid.old"

    new_keys = "1-0a0f4ef8d13b562899298b13379849a1"
    for key in new_keys.split(','):
```

```
        if key.startswith('re-'):
            sys.exit(0)
    if os.path.exists(old_system_id):
        client =  xmlrpclib.Server("http://sysman-
rhel6.refarch.bos.redhat.com/rpc/api")
        key =
client.system.obtain_reactivation_key(open(old_system_id).read())
        f = open("/mnt/sysimage/tmp/key","w")
        f.write(key)
        f.close()
        shutil.copy(old_system_id, new_system_id)
except:
    # xml rpc due to  a old/bad system id
    # we don't care about those
    # we'll register those as new.
    pass


%end

%post --log /root/ks-rhn-post.log
# --Begin RHN Satellite command section--
cat > /tmp/ssl-key-1 <<'EOF'
                        <content removed for brevity>

EOF
# ssl-key1
cat /tmp/ssl-key-* > /usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT
perl -pe 's/RHNS-CA-CERT/RHN-ORG-TRUSTED-SSL-CERT/g' -i
/etc/sysconfig/rhn/up2date

mkdir -p /tmp/rhn_rpms/optional
cd /tmp/rhn_rpms/optional
wget -P /tmp/rhn_rpms/optional http://sysman-
rhel6.refarch.bos.redhat.com/download/package/9de1af573ec5a107deb533595326d5
0f520b035d/0/1/5953/rhnlib-2.5.22-12.el6.noarch.rpm http://sysman-
rhel6.refarch.bos.redhat.com/download/package/8f77f155032b253f003aa27107b61c
5f8d99877f/0/1/2079/pyOpenSSL-0.10-2.el6.x86_64.rpm http://sysman-
rhel6.refarch.bos.redhat.com/download/package/b5397d7f2a005d985c32304ef5758d
f4e6b464f1/0/1/10095/libxml2-python-2.7.6-12.el6_4.1.x86_64.rpm
rpm -Uvh --replacepkgs --replacefiles /tmp/rhn_rpms/optional/pyOpenSSL*
/tmp/rhn_rpms/optional/rhnlib* /tmp/rhn_rpms/optional/libxml2-python*
perl -npe 's|^(\s*(noSSLS\|s)erverURL\s*=\s*[^:]+://)[^/]*/|${1}sysman-
rhel6.refarch.bos.redhat.com/|' -i /etc/sysconfig/rhn/up2date

# now copy from the ks-tree we saved in the non-chroot checkout
cp -fav /tmp/ks-tree-copy/* /
rm -Rf /tmp/ks-tree-copy
# --End RHN Satellite command section--

# begin cobbler snippet
# set default MOTD
echo "Kickstarted on $(date +'%Y-%m-%d')" >> /etc/motd

# begin Red Hat management server registration
```

```
mkdir -p /usr/share/rhn/
wget http://sysman-rhel6.refarch.bos.redhat.com/pub/RHN-ORG-TRUSTED-SSL-CERT
-O /usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT
perl -npe 's/RHNS-CA-CERT/RHN-ORG-TRUSTED-SSL-CERT/g' -i
/etc/sysconfig/rhn/*
if [ -f /etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release ]; then
    rpm --import /etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
fi
key=""
if [ -f /tmp/key ]; then
    key=`cat /tmp/key`
fi

if [ $key ]; then
    rhnreg_ks --serverUrl=https://sysman-rhel6.refarch.bos.redhat.com/XMLRPC
--sslCACert=/usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT --activationkey=$key,1-
0a0f4ef8d13b562899298b13379849a1
else
     rhnreg_ks --serverUrl=https://sysman-
rhel6.refarch.bos.redhat.com/XMLRPC --sslCACert=/usr/share/rhn/RHN-ORG-
TRUSTED-SSL-CERT --activationkey=1-0a0f4ef8d13b562899298b13379849a1
fi
# end Red Hat management server registration

# end cobbler snippet

rhn_check

# Start post_install_network_config generated code
# End post_install_network_config generated code

%end


%post
#Please edit this script on sysman-rhel6 under /scripts
wget -O - http://sysman-
rhel6.refarch.bos.redhat.com/cobbler/scripts/refarch-common-post.sh |
/bin/bash
%end

%post


# Start koan environment setup
echo "export COBBLER_SERVER=sysman-rhel6.refarch.bos.redhat.com" >
/etc/profile.d/cobbler.sh
echo "setenv COBBLER_SERVER sysman-rhel6.refarch.bos.redhat.com" >
/etc/profile.d/cobbler.csh
# End koan environment setup


wget "http://sysman-
rhel6.refarch.bos.redhat.com/cblr/svc/op/ks/profile/websrv:1:RedHatGSS"
-O /root/cobbler.ks
```

```
wget "http://sysman-
rhel6.refarch.bos.redhat.com/cblr/svc/op/trig/mode/post/profile/websrv:1:Red
HatGSS" -O /dev/null

%post
#CFME Deployment Status
wget --no-check-certificate <%= evm[:callback_url_on_post_install] %>
%end
```

devsrv (Virtual Machine)

```
# Kickstart config file generated by RHN Satellite Config Management
# Profile Label : testapp1
# Date Created  : 2013-05-02 17:23:34.0

install
text
network --bootproto dhcp
url --url http://sysman-rhel6.refarch.bos.redhat.com/ks/dist/ks-rhel-x86_64-
server-6-6.4
lang en_US
keyboard us
zerombr
clearpart --all
bootloader --location mbr
timezone America/New_York
auth --enablemd5 --enableshadow
rootpw --iscrypted [REDACTED]
selinux --enforcing
reboot
firewall --enabled
skipx
part /boot --fstype=ext3 --size=200
part pv.01 --size=1000 --grow
part swap --size=1000   --maxsize=2000
volgroup myvg pv.01
logvol / --vgname=myvg --name=rootvol --size=1000 --grow

%packages
@ Base
%end

%pre

wget "http://sysman-
rhel6.refarch.bos.redhat.com/cblr/svc/op/trig/mode/pre/profile/testapp1:1:Re
dHatGSS" -O /dev/null

echo "Saving RHN keys..." > /dev/ttyS0
SYSTEM_ID=/etc/sysconfig/rhn/systemid
rhn_keys_found=no

mkdir -p /tmp/rhn

drives=$(list-harddrives | awk '{print $1}')
```

```
for disk in $drives; do
    DISKS="$DISKS $(fdisk -l /dev/$disk | grep -v "swap\|LVM\|Extended" |
awk '/^\/dev/{print $1}')"
done

# Try to find the keys on ordinary partitions
for disk in $DISKS; do
    name=test-$(basename $disk)
    mkdir -p /tmp/$name
    mount $disk /tmp/$name
    [ $? -eq 0 ] || continue # Skip to the next partition if the mount fails

    # Copy current RHN host keys out to be reused
    if [ -f /tmp/${name}$SYSTEM_ID ]; then
        cp -a /tmp/${name}$SYSTEM_ID /tmp/rhn
        rhn_keys_found="yes"
        umount /tmp/$name
        break
    fi
    umount /tmp/$name
    rm -r /tmp/$name
done

# Try LVM if that didn't work
if [ "$rhn_keys_found" = "no" ]; then
    lvm lvmdiskscan
    vgs=$(lvm vgs | tail -n +2 | awk '{ print $1 }')
    for vg in $vgs; do
        # Activate any VG we found
        lvm vgchange -ay $vg
    done

    lvs=$(lvm lvs | tail -n +2 | awk '{ print "/dev/" $2 "/" $1 }')
    for lv in $lvs; do
        tmpdir=$(mktemp -d findkeys.XXXXXX)
        mkdir -p /tmp/${tmpdir}
        mount $lv /tmp/${tmpdir} || continue # Skip to next volume if this
fails

        # Let's see if the keys are in there
        if [ -f /tmp/${tmpdir}$SYSTEM_ID ]; then
            cp -a /tmp/${tmpdir}$SYSTEM_ID /tmp/rhn/
            rhn_keys_found="yes"
            umount /tmp/${tmpdir}
            break # We're done!
        fi
        umount /tmp/${tmpdir}
        rm -r /tmp/${tmpdir}
    done

    # And clean up..
    for vg in $vgs; do
        lvm vgchange -an $vg
    done
fi
```

```
%end

%post --nochroot
mkdir /mnt/sysimage/tmp/ks-tree-copy
if [ -d /oldtmp/ks-tree-shadow ]; then
cp -fa /oldtmp/ks-tree-shadow/* /mnt/sysimage/tmp/ks-tree-copy
elif [ -d /tmp/ks-tree-shadow ]; then
cp -fa /tmp/ks-tree-shadow/* /mnt/sysimage/tmp/ks-tree-copy
fi
cp /etc/resolv.conf /mnt/sysimage/etc/resolv.conf
cp -f /tmp/ks-pre.log* /mnt/sysimage/root/ || :

%end

%post --nochroot --interpreter /usr/bin/python
try:
    import xmlrpclib
    import shutil
    import sys
    import os.path
    old_system_id = "/tmp/rhn/systemid"
    new_system_id = "/mnt/sysimage/root/systemid.old"

    new_keys = "1-025a3d046a8e9cc06b34d4f4ac07b75c"
    for key in new_keys.split(','):
        if key.startswith('re-'):
            sys.exit(0)
    if os.path.exists(old_system_id):
        client =  xmlrpclib.Server("http://sysman-
rhel6.refarch.bos.redhat.com/rpc/api")
        key =
client.system.obtain_reactivation_key(open(old_system_id).read())
        f = open("/mnt/sysimage/tmp/key","w")
        f.write(key)
        f.close()
        shutil.copy(old_system_id, new_system_id)
except:
    # xml rpc due to  a old/bad system id
    # we don't care about those
    # we'll register those as new.
    pass


%end

%post --log /root/ks-rhn-post.log
# --Begin RHN Satellite command section--
cat > /tmp/ssl-key-1 <<'EOF'
                        <content removed for brevity>

EOF
# ssl-key1
cat /tmp/ssl-key-* > /usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT
```

```
perl -pe 's/RHNS-CA-CERT/RHN-ORG-TRUSTED-SSL-CERT/g' -i
/etc/sysconfig/rhn/up2date

mkdir -p /tmp/rhn_rpms/optional
cd /tmp/rhn_rpms/optional
wget -P /tmp/rhn_rpms/optional http://sysman-
rhel6.refarch.bos.redhat.com/download/package/9de1af573ec5a107deb533595326d5
0f520b035d/0/1/5953/rhnlib-2.5.22-12.el6.noarch.rpm http://sysman-
rhel6.refarch.bos.redhat.com/download/package/8f77f155032b253f003aa27107b61c
5f8d99877f/0/1/2079/pyOpenSSL-0.10-2.el6.x86_64.rpm http://sysman-
rhel6.refarch.bos.redhat.com/download/package/b5397d7f2a005d985c32304ef5758d
f4e6b464f1/0/1/10095/libxml2-python-2.7.6-12.el6_4.1.x86_64.rpm
rpm -Uvh --replacepkgs --replacefiles /tmp/rhn_rpms/optional/pyOpenSSL*
/tmp/rhn_rpms/optional/rhnlib* /tmp/rhn_rpms/optional/libxml2-python*
perl -npe 's|^(\s*(noSSLS\|s)erverURL\s*=\s*[^:]+://)[^/]*/|${1}sysman-
rhel6.refarch.bos.redhat.com/|' -i /etc/sysconfig/rhn/up2date

# now copy from the ks-tree we saved in the non-chroot checkout
cp -fav /tmp/ks-tree-copy/* /
rm -Rf /tmp/ks-tree-copy
# --End RHN Satellite command section--

# begin cobbler snippet
# set default MOTD
echo "Kickstarted on $(date +'%Y-%m-%d')" >> /etc/motd

# begin Red Hat management server registration
mkdir -p /usr/share/rhn/
wget http://sysman-rhel6.refarch.bos.redhat.com/pub/RHN-ORG-TRUSTED-SSL-CERT
-O /usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT
perl -npe 's/RHNS-CA-CERT/RHN-ORG-TRUSTED-SSL-CERT/g' -i
/etc/sysconfig/rhn/*
if [ -f /etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release ]; then
    rpm --import /etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release
fi
key=""
if [ -f /tmp/key ]; then
    key=`cat /tmp/key`
fi

if [ $key ]; then
    rhnreg_ks --serverUrl=https://sysman-rhel6.refarch.bos.redhat.com/XMLRPC
--sslCACert=/usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT --activationkey=$key,1-
025a3d046a8e9cc06b34d4f4ac07b75c
else
     rhnreg_ks --serverUrl=https://sysman-
rhel6.refarch.bos.redhat.com/XMLRPC --sslCACert=/usr/share/rhn/RHN-ORG-
TRUSTED-SSL-CERT --activationkey=1-025a3d046a8e9cc06b34d4f4ac07b75c
fi
# end Red Hat management server registration

# end cobbler snippet

rhn_check
```

```
# Start post_install_network_config generated code
# End post_install_network_config generated code

%end


%post
#Please edit this script on sysman-rhel6 under /scripts
wget -O - http://sysman-
rhel6.refarch.bos.redhat.com/cobbler/scripts/refarch-devel-post.sh |
/bin/bash
%end

%post


# Start koan environment setup
echo "export COBBLER_SERVER=sysman-rhel6.refarch.bos.redhat.com" >
/etc/profile.d/cobbler.sh
echo "setenv COBBLER_SERVER sysman-rhel6.refarch.bos.redhat.com" >
/etc/profile.d/cobbler.csh
# End koan environment setup


wget "http://sysman-
rhel6.refarch.bos.redhat.com/cblr/svc/op/ks/profile/testapp1:1:RedHatGSS" -O
/root/cobbler.ks
wget "http://sysman-
rhel6.refarch.bos.redhat.com/cblr/svc/op/trig/mode/post/profile/testapp1:1:R
edHatGSS" -O /dev/null

%post
#CFME Deployment Status
wget --no-check-certificate <%= evm[:callback_url_on_post_install] %>
%end
```

D.1 Post Install Scripts

refarch-common-post.sh

```
#!/bin/bash
#
# Call this script from a kickstart post, for example in Satellite
# Just add this one line as your script:
# wget -O - http://sysman-
thel6.refarch.bos.redhat.com/cobbler/scripts/refarch-common-post.sh |
/bin/bash

LOGFILE=/root/refarch-common-post-`hostname -s`-`date +%F_%T`.log
(

# get redeploy for future use
if [ ! -d /usr/local/bin ]
then
  echo making /usr/local/bin
```

```
  mkdir -p /usr/local/bin
fi
wget http://sysman-rhel6.refarch.bos.redhat.com/cobbler/scripts/redeploy
-O /usr/local/bin/redeploy
chmod +x /usr/local/bin/redeploy

# Adding group bashrc
wget http://sysman-rhel6.refarch.bos.redhat.com/cobbler/scripts/bashrc -O
/etc/profile.d/refarch-bashrc.sh

# Fix SELinux issues with the /root/.ssh directory and files.
restorecon -r /root/.ssh

# Importing gpg key for custom RHN channel/packages
wget http://sysman-
rhel6.refarch.bos.redhat.com/cobbler/scripts/public_key.txt -O
/root/public_key.txt
rpm --import /root/public_key.txt

# Adding packages that should always be installed
# echo -Adding vital packages
spacewalk-channel --add -c rhel-x86_64-rhev-agent-6-server-beta -c web-
server-content --user admin --password [REDACTED]
yum -y install screen firefox nfs-utils xorg-x11-xauth autofs sg3_utils
policycoreutils-python rhevm-guest-agent web-1-1
yum -y groupinstall @network-file-system-client
chkconfig httpd on
# full system update
echo -Running full update ...
yum -y update

) 2>&1 | tee ${LOGFILE}
echo Done with [refarch-common-post]. Wrote logfile: ${LOGFILE}
```

refarch-devel-post.sh

```
#!/bin/bash
#
# Call this script from a kickstart post, for example in Satellite
# Just add this one line as your script:
# wget -O - http://sysman-
thel6.refarch.bos.redhat.com/cobbler/scripts/refarch-common-post.sh |
/bin/bash

LOGFILE=/root/refarch-devel-post-`hostname -s`-`date +%F_%T`.log
(

# get redeploy for future use
if [ ! -d /usr/local/bin ]
then
  echo making /usr/local/bin
  mkdir -p /usr/local/bin
fi
wget http://sysman-rhel6.refarch.bos.redhat.com/cobbler/scripts/redeploy
```

```
-O /usr/local/bin/redeploy
chmod +x /usr/local/bin/redeploy

# Adding group bashrc
wget http://sysman-rhel6.refarch.bos.redhat.com/cobbler/scripts/bashrc -O
/etc/profile.d/refarch-bashrc.sh

# Fix SELinux issues with the /root/.ssh directory and files.
restorecon -r /root/.ssh

# Adding packages that should always be installed
# echo -Adding vital packages
spacewalk-channel --add -c rhel-x86_64-rhev-agent-6-server-beta --user admin
--password [REDACTED]
yum -y install screen firefox nfs-utils xorg-x11-xauth autofs sg3_utils
policycoreutils-python rhevm-guest-agent
yum -y groupinstall @network-file-system-client

# full system update
echo -Running full update ...
yum -y update

) 2>&1 | tee ${LOGFILE}
echo Done with [refarch-devel-post]. Wrote logfile: ${LOGFILE}
```

Appendix E: Automate Method

```
#
#            Automate Method
#
$evm.log("info", "scalewebsrv Automate Method Started")
@method = 'buildrequest'
@log_prefix = "[#{@method}]"
@debug = true
#
#            Method Code Goes here
#

def build_request(solution_hash)

output = ''

prov = $evm.root["service_template_provision_task"]

#Set some things
  # Get the current logged in user
  user = $evm.root['user']
  #$evm.log("info","#{@method} - Inspecting User object:<#{user.inspect}>")
if @debug

  if user.nil?
    userid = 'admin'
    user_mail = 'bthurber@redhat.com'
```

```
    # Should get rid of these 2 below in the dialog
    #user_first = 'Admin'
    #user_last = 'Administrator'
  else
    userid = user.userid
    user_mail = user.email

    # If currently logged in user email is nil assign a default email
address
    user_mail ||= 'bthurber@redhat.com'
    user_first = "Brett"
    user_last = "Thurber"
  end

$evm.log("info","Output of Root Object")
$evm.root.attributes.sort.each { |k, v| $evm.log("info", "\t#{k}: #{v}")}

scalewebsrv = true

if scalewebsrv == true
    $evm.log("info","scalewebsrv is a go")
    # arg0 = version
    args = ['1.1']
    # arg1 = templateFields
    args << "name=#{solution_hash[:template_name]}|request_type=template"
    # arg2 = vmFields
    args << "number_of_cpus=#{solution_hash[:vcpu]}|
vm_memory=#{solution_hash[:vm_memory]}|number_of_vms=#{solution_hash[:vms]}|
vlan=#{solution_hash[:vlan]}|catalog_id=#{solution_hash[:catalog_id]}|
vm_prefix=#{solution_hash[:vm_prefix]}|
provision_type=#{solution_hash[:provision_type]}|
pxe_server_id=#{solution_hash[:pxe_server_id]}|
pxe_image_id=#{solution_hash[:pxe_image_id]}|
customization_template_id=#{solution_hash[:customization_template_id]}"
    # arg3 = requester
    args << nil
    # arg4 = tags
    args << "Environment: CloudForms"
    # arg5 = additionalValues
    args << "user_name=#{userid}|owner_email=#{user_mail}|
user_first=#{user_first}|user_last=#{user_last}"
    # arg6 = emsCustomAttributes
    args << solution_hash.collect { |k, v| "#{k}=#{v}" }.join('|')
    # arg7 = miqCustomAttributes
    args << nil
    $evm.log("info", "Inline Method: <#{@log_prefix}> - Building
provisioning request with the following arguments: <#{args.inspect}>")
    # exit MIQ_ABORT
    $evm.execute('create_provision_request', *args)
else
     $evm.log("info","scalewebsrv is foo bar, not scaling")
end

end
```

```
def parse_piped_string(text_input, options={})
  return {} unless text_input.kind_of?(String)
  result = {}
  text_input.split('|').each do |value|

    next if value.blank?
    idx = value.index('=')
    next if idx.nil?
    key = !options[:modify_key_name] ? value[0, idx].strip : value[0,
idx].strip.to_sym
    result[key] = value[idx+1..-1].strip
  end
  return result
end

## Get variables
solution_id = $evm.root['dialog_solution_id'].to_i
$evm.root['solution_id'] = solution_id
$evm.log("info", "Inline Method: <#{@log_prefix}> - Solution_ID :
#{solution_id}") if @debug


  solution_hash= {
      :template_name => "websrv",
      :vcpu => "1",
      :vm_memory => "2048",
      :vms => "1",
      :owner_first_name => "brett",
      :owner_last_name => "thurber",
      :owner_email => "bthurber@redhat.com",
      :vm_prefix => "websrv",
      :vlan => "rhevm",
      :provision_type => "pxe",
      :pxe_server_id => "2",
      :pxe_image_id => "2",
      #:cust_temp => "websrv",
      :customization_template_id => "7",
      "PrimaryFirstname" => "Brett",
      "PrimaryLastName" => "Thurber",
      "PrimaryEmail" => "bthuber@redhat.com"
  }
  $evm.log("info", "Building request") if @debug

  build_request(solution_hash)

$evm.log("info", "<Inline Method: <#{@log_prefix}> - EVM Service Task
Finished")  if @debug

#
#
#
$evm.log("info", "scalewebsrv Automate Method Ended")
exit MIQ_OK
```

Note: Custom automation methods are not supported by Red Hat Global Support Services[13].

Appendix F: Troubleshooting

Log files for a CloudForms Management Engine appliance are located under:

*/var/www/miq/vmdb/log/**

File	Purpose
evm.log	Main CFME log file. Very verbose and all events are written to this file.
automate.log	Automate events are logged to this file.
audit.log	Security related events are logged to this file.
miqconsole.log	CFME appliance events are logged to this file. Ex. power off or on.
miq_ntpdate.log	Time synchronization events are logged to this file.
policy.log	Policy related events are logged to this file.
prince.log	Events related to report conversions are logged to this file.
production.log	Rails and application events are logged to this file.
rhevm.log	RHEV related events are logged in this file.
top_output.log	Periodic top output is logged to this file.
vim.log	VMware related events are logged in this file.
vmdb_restart.log	Events related to restarting the VMDB database are logged in this file.
vmstat_output.log	Periodic virtual memory statistics are logged to this file.

Table F-1: CFME Log Files

Alternately, log file output can be accessed via the CloudForms Management Engine Console[25]. If more than one CFME appliance exists, a collection of log files across multiple CFME appliances within the same Zone can be collected to a centralized location. Refer to the *CloudForms 2.0, Management Engine 5.1 Settings and Operations Guide*[26] for configuration specifics.

25 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/sect-Server_and_Audit_Logs.html

26 https://access.redhat.com/site/documentation/en-US/CloudForms/2.0/html/Management_Engine_5.1_Settings_and_Operations_Guide/

Appendix G: Configuration Files

All configuration files can be downloaded from the Red Hat customer portal[27] . A listing of the files and a brief description are provided below.

Files	Description
automate_method.rb	Ruby snippet used for custom CFME automation.
devel.ks	Kickstart files used for the development server deployment.
iptables	iptables configuration information for systems used.
post_devel.sh	Post deployment script used for development systems.
post_websrv.sh	Post deployment script used for web server systems.
websrv.ks	Kickstart file used for the web server deployment.
web.spec	RPM spec file used for custom RPM creation.

Table G-1: Configuration Files

27 https://access.redhat.com/site/node/411683/40/1