INCREASING THE EFFICIENCY OF VIRTUAL INFRASTRUCTURE WITH SYSTEMS MANAGEMENT

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ABSTRACT

Virtualization has helped organizations realize new levels of flexibility and scalability. It also achieves greater efficiency through the use of templates, or virtual machine images. Such images reduce the amount of time required to provision a virtual machine. A binary copy of a specified system is used at the time of virtual machine provisioning, replacing traditional installation. While virtual machine images provide a faster means of delivering an operating environment, they typically fail to adequately apply system updates and can lead to a loss of operational efficiency. Systems management is critical to the realization of operational efficiency through the use of virtualization.
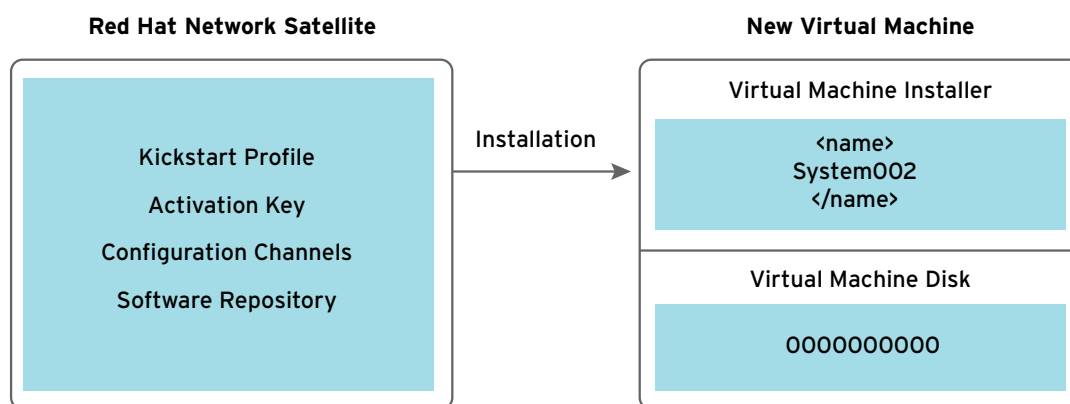
PROVISIONING

Provisioning is a set of actions performed on a system in order to prepare the system for operation. Generally these actions include instantiation of a server, whether physical or virtual, and installation of the operating system and applications. Furthermore, system-specific configurations such as network and storage settings must be changed on a per-instance basis.

PROVISIONING VIRTUAL MACHINES WITH SATELLITE

Traditionally, systems were provisioned manually. This process has since been automated by systems management software such as Red Hat® Network (RHN) Satellite. This automation has led to increased system administrator productivity and reduced the likelihood of human errors.

Figure 1 provides a diagram of a scenario in which a virtual machine is provisioned using RHN Satellite. The Anaconda installation program connects to RHN Satellite and downloads the operating system. Any necessary configuration management within the virtual machine is also deployed and managed.

FIGURE 1

Red Hat Network Satellite

New Virtual Machine

Kickstart Profile

Activation Key

Configuration Channels

Software Repository

Installation

Virtual Machine Installer

<name>
System002
</name>

Virtual Machine Disk

0000000000

While this installation provides an up-to-date virtual machine with central configuration management, the installation process takes time and is limited to the resources available to both the virtual machine and RHN Satellite Server.
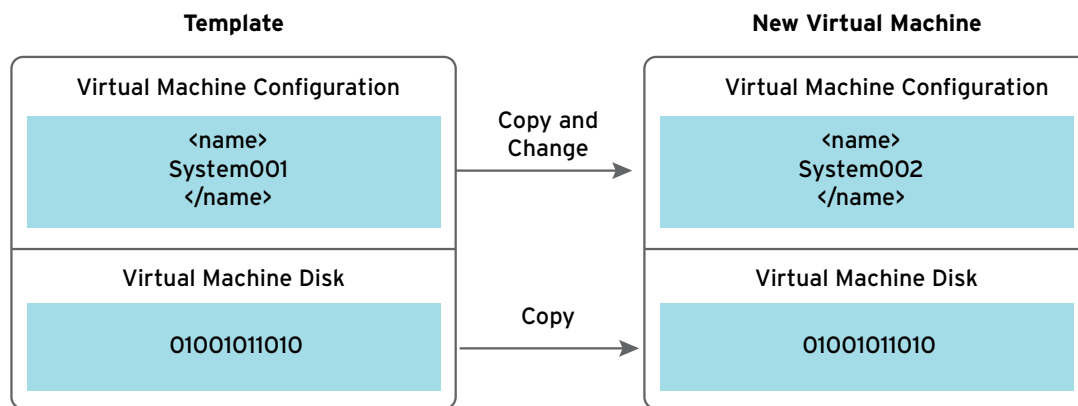
PROVISIONING VIRTUAL MACHINES WITH TEMPLATES

While binary replication of systems has always been possible, virtualization has allowed organizations to view machines as binary images and has rapidly increased the adoption of templates within information technology (IT) operations organizations. This has lead to the creation of standard virtual machine images, often referred to as "golden images", which are often used to deploy large numbers of virtual machines.

Figure 2 describes a scenario in which a virtual machine is provisioned using a virtual machine template. The virtual machine disk and virtual machine configuration are copied and the necessary configuration parameters are changed.

FIGURE 2

While this methodology is faster than provisioning virtual machines with RHN Satellite, it does not provide the latest updates to the new virtual machine. For example, if a critical patch is released after the template is created, the virtual machine based on the template would not contain the patch.

UPDATING

An update is a change applied to a system in order to provide new functionality or address a vulnerability. In the case of security updates, application of the update prevents exploitation of the vulnerability by an attacker.

UPDATING VIRTUAL MACHINES BASED ON TEMPLATES

Each time a new update is released, it must be applied to systems based on the template. The time required to update the system after initial provisioning increases as new updates are released. The number of updates needed after initially provisioning a system increases with time. Figure 3 shows the increase in updates needed by a template-based virtual machine over a 200-day period.

FIGURE 3: UPDATE DELTA
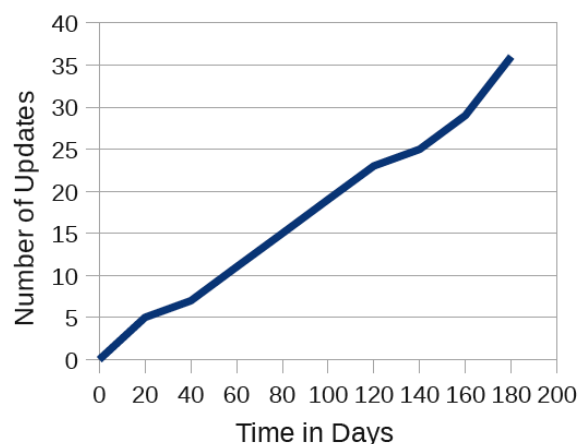
Over time, the amount of updates required by a template-based system outweighs the benefits offered by the decreased provisioning time. Figure 4 illustrates the amount of time required to provision a system using a virtual machine image and unattended installation (systems management). Over time, the amount of time saved by using a virtual machine image and an unattended installation is reduced. This occurs because of the update delta that virtual machine images present – as illustrated in Figure 3.

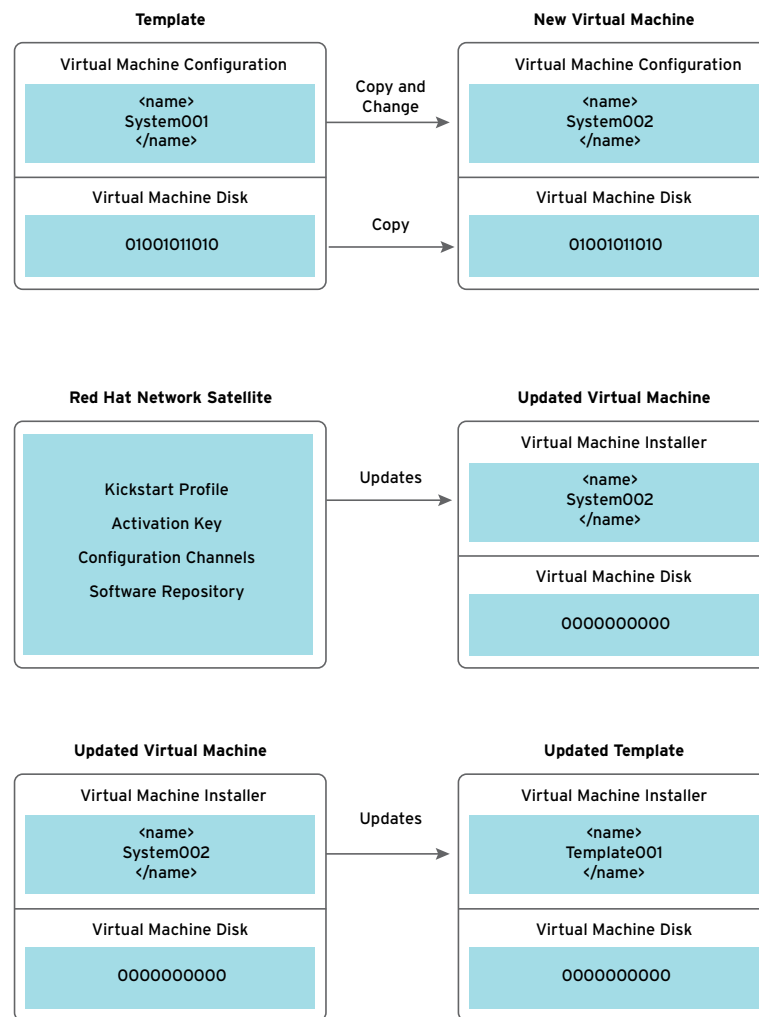**FIGURE 4: MINUTES TO PROVISION OVER TIME**
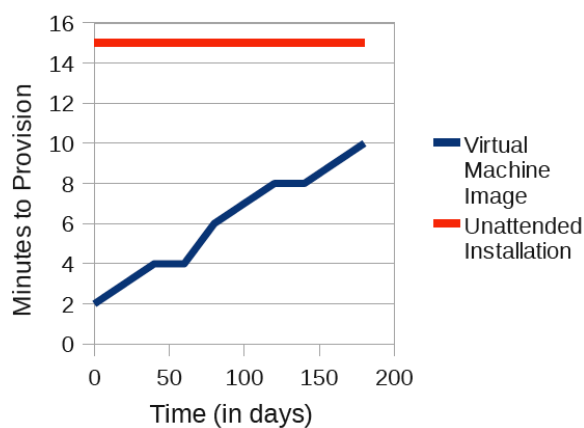
UPDATING TEMPLATES

As the number of updates to a template grow, the effort required to apply the updates outweighs the benefits of using the template in the first place. Thus, the decision may be made to update the template. This will bring the number of updates applied after provisioning from the template back to zero and start the cycle over again. Figure 5 illustrates the steps required to update a template to the latest updated software version.

FIGURE 5: NEW VIRTUAL MACHINE

Template

Virtual Machine Configuration

<name>
System001
</name>

Copy and
Change

Virtual Machine Disk

01001011010

Copy

New Virtual Machine

Virtual Machine Configuration

<name>
System002
</name>

Virtual Machine Disk

01001011010

Red Hat Network Satellite

Kickstart Profile

Activation Key

Configuration Channels

Software Repository

Updates

Updated Virtual Machine

Virtual Machine Installer

<name>
System002
</name>

Virtual Machine Disk

0000000000

Updated Virtual Machine

Virtual Machine Installer

<name>
System002
</name>

Updates

Virtual Machine Disk

0000000000

Updated Template

Virtual Machine Installer

<name>
Template001
</name>

Virtual Machine Disk

0000000000

While this process solves the problem of the update delta, it requires significant effort. As more distributions are created, complexity is multiplied.

USING RED HAT NETWORK SATELLITE TO PROVISION VIRTUAL MACHINES

By building each virtual machine from systems management, the penalty of recreating templates is avoided. While the initial provisioning time of a virtual machine may be longer than that of a template-based virtual machine, the opportunity cost is extremely low. The process is automated and does not require a system administrator's attention during installation.

USING RED HAT NETWORK SATELLITE WITH VIRTUAL MACHINE IMAGES

In some scenarios, the time saved in the provisioning process by using virtual machine images outweighs the loss of efficiency in providing updates to the virtual machines. Often, these are scenarios in which the speed-to-provision is critical–like rapid prototyping environments or dynamically scaled environments. In such scenarios, virtual machine images that contain Red Hat Enterprise Linux® can be automatically registered to RHN Satellite, providing a means of systems management that bridges the gap between speed-of-provisioning (through virtual machine images) and the ability to provide updates and systems management through RHN Satellite.

REGISTERING A TEMPLATE-BASED VIRTUAL MACHINE WITH RHN SATELLITE

The following changes can be applied to a virtual machine running Red Hat Enterprise Linux prior to the conversion into a virtual machine image. As a result, all systems based on the virtual machine image are automatically registered to RHN Satellite upon next boot.

Make a copy of the original rc.local file. The original will be restored after the modified version is executed upon starting the virtual machine.

```
cp /etc/rc.d/rc.local /etc/rc.d/rc.localpretemplate
```

Append the following line to the rc.local file–it will set the virtual machine to register with RHN Satellite. Replace satellite.domain.com with the fully qualified domain name of your organization's Satellite server. Replace ActivationKey with the activiation key that you would like the virtual machine to use.

```
echo "rhnreg_ks --force –serverUrl=https://satellite.domain.com/XMLRPC
--sslCACert=/usr/share/rhn/RHN-ORG-TRUSTED-SSL-CERT –
activationkey=ActivationKey" >> /etc/rc.d/rc.local
```

Append the following line to the rc.local file in order to ensure that the original rc.local file is put back in place after the modified file executes. This ensures the virtual machine is registered only a single time rather than each time the system is started.

```
echo "mv /etc/rc.d/rc.local.pretemplate /etc/rc.d/rc.local" >>
/etc/rc.d/rc.local
```

SUMMARY

Virtual machine images provide faster provisioning of systems in the near-term, but over time the update delta decreases those benefits. The use of systems management, such as Red Hat Network Satellite, can provide a more operationally efficient means of provisioning systems. If virtual machine images are used, systems management can compliment the methodology by providing updates for the systems in an auto-mated fashion, thus increasing operational efficiency. Furthermore, systems management allows a similar provisioning methodology to be used across both physical and virtual environments. Systems management is critical to the realization of operational efficiency through the use of virtualization.

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