



## Red Hat Satellite 6.9

### Installing Capsule Server

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Installing Red Hat Satellite Capsule Server

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## Abstract

This guide describes how to install Red Hat Satellite Capsule Server, perform initial configuration, and configure external services.

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# CHAPTER 1. PREPARING YOUR ENVIRONMENT FOR INSTALLATION

## 1.1. SYSTEM REQUIREMENTS

The following requirements apply to the networked base operating system:

- x86\_64 architecture
- The latest version of Red Hat Enterprise Linux 7 Server
- 4-core 2.0 GHz CPU at a minimum
- A minimum of 12 GB RAM is required for Capsule Server to function. In addition, a minimum of 4 GB RAM of swap space is also recommended. Capsule running with less RAM than the minimum value might not operate correctly.
- A unique host name, which can contain lower-case letters, numbers, dots (.) and hyphens (-)
- A current Red Hat Satellite subscription
- Administrative user (root) access
- A system umask of 0022
- Full forward and reverse DNS resolution using a fully-qualified domain name

Before you install Capsule Server, ensure that your environment meets the requirements for installation.

Capsule Server must be installed on a freshly provisioned system that serves no other function except to run Capsule Server. The freshly provisioned system must not have the following users provided by external identity providers to avoid conflicts with the local users that Capsule Server creates:

- postgres
- mongod
- apache
- qpidd
- qdrouterd
- squid
- foreman-proxy
- puppet
- puppetserver

For more information on scaling your Capsule Servers, see [Capsule Server Scalability Considerations](#).

### Certified hypervisors

Capsule Server is fully supported on both physical systems and virtual machines that run on hypervisors that are supported to run Red Hat Enterprise Linux. For more information about certified hypervisors, see [Which hypervisors are certified to run Red Hat Enterprise Linux?](#) .

## SELinux Mode

SELinux must be enabled, either in enforcing or permissive mode. Installation with disabled SELinux is not supported. **FIPS Mode** You can install Capsule Server on a Red Hat Enterprise Linux system that is operating in FIPS mode. For more information, see [Enabling FIPS Mode](#) in the *Red Hat Enterprise Linux Security Guide*.

## 1.2. STORAGE REQUIREMENTS

The following table details storage requirements for specific directories. These values are based on expected use case scenarios and can vary according to individual environments.

The runtime size was measured with Red Hat Enterprise Linux 6, 7, and 8 repositories synchronized.

**Table 1.1. Storage Requirements for Capsule Server Installation**

Directory	Installation Size	Runtime Size
/var/cache/pulp/	1 MB	32 GB (Minimum)
/var/lib/pulp/	1 MB	300 GB
/var/lib/mongodb/	3.5 GB	50 GB
/var/spool/squid/	0 GB	10 GB
/opt	500 MB	Not Applicable

## 1.3. STORAGE GUIDELINES

Consider the following guidelines when installing Capsule Server to increase efficiency.

- If you mount the **/tmp** directory as a separate file system, you must use the **exec** mount option in the **/etc/fstab** file. If **/tmp** is already mounted with the **noexec** option, you must change the option to **exec** and re-mount the file system. This is a requirement for the **puppetserver** service to work.
- Because most Capsule Server data is stored in the **/var** directory, mounting **/var** on LVM storage can help the system to scale.
- Using the same volume for the **/var/cache/pulp/** and **/var/lib/pulp/** directories can decrease the time required to move content from **/var/cache/pulp/** to **/var/lib/pulp/** after synchronizing.
- The **/var/lib/qpidd/** directory uses slightly more than 2 MB per Content Host managed by the **goferd** service. For example, 10 000 Content Hosts require 20 GB of disk space in **/var/lib/qpidd/**.
- Use high-bandwidth, low-latency storage for the **/var/lib/pulp/** and **/var/lib/mongodb/** directories. As Red Hat Satellite has many operations that are I/O intensive, using high latency,



low-bandwidth storage causes performance degradation. Ensure your installation has a speed in the range 60 - 80 Megabytes per second. You can use the **fiio** tool to get this data. See the Red Hat Knowledgebase solution [Impact of Disk Speed on Satellite Operations](#) for more information on using the **fiio** tool.

## File System Guidelines

- Use the XFS file system for Red Hat Satellite 6 because it does not have the inode limitations that **ext4** does. Because Capsule Server uses a lot of symbolic links it is likely that your system might run out of inodes if using **ext4** and the default number of inodes.
- Do not use NFS with MongoDB because MongoDB does not use conventional I/O to access data files and performance problems occur when both the data files and the journal files are hosted on NFS. If required to use NFS, mount the volume with the following options in the **/etc/fstab** file: **bg**, **nolock**, and **noatime**.
- Do not use NFS for Pulp data storage. Using NFS for Pulp has a negative performance impact on content synchronization.
- Do not use the GFS2 file system as the input-output latency is too high.

## Log File Storage

Log files are written to **/var/log/messages/**, **/var/log/httpd/**, and **/var/lib/foreman-proxy/openscap/content/**. You can manage the size of these files using **logrotate**. For more information, see [Log Rotation](#) in the *Red Hat Enterprise Linux 7 System Administrator's Guide*.

The exact amount of storage you require for log messages depends on your installation and setup.

## SELinux Considerations for NFS Mount

When the **/var/lib/pulp** directory is mounted using an NFS share, SELinux blocks the synchronization process. To avoid this, specify the SELinux context of the **/var/lib/pulp** directory in the file system table by adding the following lines to **/etc/fstab**:

```
nfs.example.com:/nfsshare /var/lib/pulp/content nfs
context="system_u:object_r:httpd_sys_rw_content_t:s0" 1 2
```

If NFS share is already mounted, remount it using the above configuration and enter the following command:

```
# chcon -R system_u:object_r:httpd_sys_rw_content_t:s0 /var/lib/pulp
```

## Duplicated Packages

Packages that are duplicated in different repositories are only stored once on the disk. Additional repositories containing duplicate packages require less additional storage. The bulk of storage resides in the **/var/lib/mongodb/** and **/var/lib/pulp/** directories. These end points are not manually configurable. Ensure that storage is available on the **/var** file system to prevent storage problems.

## Temporary Storage

The **/var/cache/pulp/** directory is used to temporarily store content while it is being synchronized. After a full synchronization task is completed, the content is moved to the **/var/lib/pulp/** directory.

For content in RPM format, each RPM file is moved to the `/var/lib/pulp` directory after it is synchronized. A maximum of 5 RPM files are stored in the `/var/cache/pulp/` directory at any time. Up to 8 RPM content synchronization tasks can run simultaneously by default, with each using up to 1 GB of metadata.

## Software Collections

Software collections are installed in the `/opt/rh/` and `/opt/foreman/` directories.

Write and execute permissions by the root user are required for installation to the `/opt` directory.

## Symbolic links

You cannot use symbolic links for `/var/lib/pulp/` and `/var/lib/mongodb/`.

## Synchronized RHEL ISO

If you plan to synchronize RHEL content ISOs to Satellite, note that all minor versions of Red Hat Enterprise Linux also synchronize. You must plan to have adequate storage on your Satellite to manage this.

# 1.4. SUPPORTED OPERATING SYSTEMS

You can install the operating system from a disc, local ISO image, kickstart, or any other method that Red Hat supports. Red Hat Capsule Server is supported only on the latest versions of Red Hat Enterprise Linux 7 Server that is available at the time when Capsule Server 6.9 is installed. Previous versions of Red Hat Enterprise Linux including EUS or z-stream are not supported.

Red Hat Capsule Server requires a Red Hat Enterprise Linux installation with the **@Base** package group with no other package-set modifications, and without third-party configurations or software not directly necessary for the direct operation of the server. This restriction includes hardening and other non-Red Hat security software. If you require such software in your infrastructure, install and verify a complete working Capsule Server first, then create a backup of the system before adding any non-Red Hat software.

Install Capsule Server on a freshly provisioned system.

Do not register Capsule Server to the Red Hat Content Delivery Network (CDN).

Red Hat does not support using the system for anything other than running Capsule Server.

# 1.5. PORTS AND FIREWALLS REQUIREMENTS

For the components of Satellite architecture to communicate, ensure that the required network ports are open and free on the base operating system. You must also ensure that the required network ports are open on any network-based firewalls.

The installation of a Capsule Server fails if the ports between Satellite Server and Capsule Server are not open before installation starts.

Use this information to configure any network-based firewalls. Note that some cloud solutions must be specifically configured to allow communications between machines because they isolate machines similarly to network-based firewalls. If you use an application-based firewall, ensure that the application-based firewall permits all applications that are listed in the tables and known to your firewall. If possible, disable the application checking and allow open port communication based on the protocol.

## Integrated Capsule

Satellite Server has an integrated Capsule and any host that is directly connected to Satellite Server is a Client of Satellite in the context of this section. This includes the base operating system on which Capsule Server is running.

## Clients of Capsule

Hosts which are clients of Capsules, other than Satellite's integrated Capsule, do not need access to Satellite Server. For more information on Satellite Topology, see [Capsule Networking](#) in *Planning for Red Hat Satellite 6*.

Required ports can change based on your configuration.

A matrix table of ports is available in the Red Hat Knowledgebase solution [Red Hat Satellite List of Network Ports](#).

The following tables indicate the destination port and the direction of network traffic:

**Table 1.2. Ports for Capsule to Satellite Communication**

Port	Protocol	Service	Required For
5646	TCP	amqp	Capsule's Qpid dispatch router to Qpid dispatch router in Satellite

**Table 1.3. Ports for Client to Capsule Communication**

Port	Protocol	Service	Required for
80	TCP	HTTP	Anaconda, yum, and for obtaining Katello certificate updates
443	TCP	HTTPS	Anaconda, yum, Telemetry Services, and Puppet
5647	TCP	AMQP	Katello agent to communicate with Capsule's Qpid dispatch router
8000	TCP	HTTPS	Anaconda to download kickstart templates to hosts, and for downloading iPXE firmware
8140	TCP	HTTPS	Puppet agent to Puppet master connections
8443	TCP	HTTPS	Subscription Management Services and Telemetry Services
9090	TCP	HTTPS	Sending SCAP reports to the Capsule and for the discovery image during provisioning

Port	Protocol	Service	Required for
53	TCP and UDP	DNS	Client DNS queries to a Capsule's DNS service (Optional)
67	UDP	DHCP	Client to Capsule broadcasts, DHCP broadcasts for Client provisioning from a Capsule (Optional)
69	UDP	TFTP	Clients downloading PXE boot image files from a Capsule for provisioning (Optional)
5000	TCP	HTTPS	Connection to Katello for the Docker registry (Optional)

Table 1.4. Ports for Capsule to Client Communication

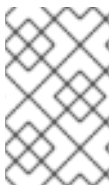
Port	Protocol	Service	Required For
7	TCP and UDP	ICMP	DHCP Capsule to Client network, ICMP ECHO to verify IP address is free (Optional)
68	UDP	DHCP	Capsule to Client broadcasts, DHCP broadcasts for Client provisioning from a Capsule (Optional)
8443	TCP	HTTP	Capsule to Client "reboot" command to a discovered host during provisioning (Optional)

Any managed host that is directly connected to Satellite Server is a client in this context because it is a client of the integrated Capsule. This includes the base operating system on which a Capsule Server is running.

Table 1.5. Optional Network Ports

Port	Protocol	Service	Required For
22	TCP	SSH	Satellite and Capsule originated communications, for Remote Execution (Rex) and Ansible.

Port	Protocol	Service	Required For
7911	TCP	DHCP	<ul style="list-style-type: none"> <li>● Capsule originated commands for orchestration of DHCP records (local or external).</li> <li>● If DHCP is provided by an external service, you must open the port on the external server.</li> </ul>



## NOTE

A DHCP Capsule sends an ICMP ECHO to confirm an IP address is free, **no response** of any kind is expected. ICMP can be dropped by a networked-based firewall, but **any** response prevents the allocation of IP addresses.

## 1.6. ENABLING CONNECTIONS FROM CAPSULE SERVER TO SATELLITE SERVER

On Satellite Server, you must enable the incoming connection from Capsule Server to Satellite Server and make this rule persistent across reboots.

### Prerequisites

- Ensure that the firewall rules on Satellite Server are configured to enable connections for client to Satellite communication, because Capsule Server is a client of Satellite Server. For more information, see [Enabling Connections from a Client to Satellite Server](#) in *Installing Satellite Server from a Connected Network*.

### Procedure

1. On Satellite Server, enter the following command to open the port for Capsule to Satellite communication:

```
# firewall-cmd --add-port="5646/tcp"
```

2. Make the changes persistent:

```
# firewall-cmd --runtime-to-permanent
```

## 1.7. ENABLING CONNECTIONS FROM SATELLITE SERVER AND CLIENTS TO A CAPSULE SERVER

On the base operating system on which you want to install Capsule, you must enable incoming connections from Satellite Server and clients to Capsule Server and make these rules persistent across reboots.

### Procedure

1. On the base operating system on which you want to install Capsule, enter the following command to open the ports for Satellite Server and clients communication to Capsule Server:

```
# firewall-cmd --add-port="53/udp" --add-port="53/tcp" \  
--add-port="67/udp" --add-port="69/udp" \  
--add-port="80/tcp" --add-port="443/tcp" \  
--add-port="5000/tcp" --add-port="5647/tcp" \  
--add-port="8000/tcp" --add-port="8140/tcp" \  
--add-port="8443/tcp" --add-port="9090/tcp"
```

2. Make the changes persistent:

```
# firewall-cmd --runtime-to-permanent
```

## 1.8. VERIFYING FIREWALL SETTINGS

Use this procedure to verify your changes to the firewall settings.

### Procedure

To verify the firewall settings, complete the following step:

1. Enter the following command:

```
# firewall-cmd --list-all
```

For more information, see [Getting Started with firewalld](#) in the *Red Hat Enterprise Linux 7 Security Guide*.

## CHAPTER 2. INSTALLING CAPSULE SERVER

Before you install Capsule Server, you must ensure that your environment meets the requirements for installation. For more information, see [Section 1.1, “System Requirements”](#).

### 2.1. REGISTERING TO SATELLITE SERVER

Use this procedure to register the base operating system on which you want to install Capsule Server to Satellite Server.

#### Prerequisites

Before registering it to Satellite Server, ensure that the base operating system on which you want to install Capsule meets the following conditions:

#### Subscription Manifest Prerequisites

- On Satellite Server, a manifest must be installed and it must contain the appropriate repositories for the organization you want Capsule to belong to.
- The manifest must contain repositories for the base operating system on which you want to install Capsule, as well as any clients that you want to connect to Capsule.
- The repositories must be synchronized.

For more information on manifests and repositories, see [Managing Subscriptions](#) in the *Red Hat Satellite Content Management Guide*.

#### Proxy and Network Prerequisites

- The Satellite Server base operating system must be able to resolve the host name of the Capsule base operating system and vice versa.
- The base operating system on which you want to install Capsule Server must not be configured to use a proxy to connect to the Red Hat CDN.
- You must configure the host and network-based firewalls accordingly. For more information, see [Section 1.5, “Ports and Firewalls Requirements”](#).
- You must have a Satellite Server user name and password. For more information, see [Configuring External Authentication](#) in *Administering Red Hat Satellite*.

#### Procedure

To register your system to Satellite Server, complete the following steps:

1. Download the **katello-ca-consumer-latest.noarch.rpm** package on the base operating system on which you want to install Capsule. The consumer RPM configures the host to download content from the content source that is specified in Satellite.

```
# curl --insecure --output katello-ca-consumer-latest.noarch.rpm  
https://satellite.example.com/pub/katello-ca-consumer-latest.noarch.rpm
```

2. Install the **katello-ca-consumer-latest.noarch.rpm** package:

```
# yum localinstall katello-ca-consumer-latest.noarch.rpm
```

- 3. Register the Capsule base operating system with the environments that you want Capsule to belong to. Use an activation key to simplify specifying the environments. For more information about activation keys, see [Managing Activation Keys](#) in the *Content Management Guide*.

```
# subscription-manager register --org=organization_name --
activationkey=example_activation_key
```

## 2.2. ATTACHING THE SATELLITE INFRASTRUCTURE SUBSCRIPTION

After you have registered Capsule Server, you must identify your subscription Pool ID and attach an available subscription. The Red Hat Satellite Infrastructure subscription provides access to the Red Hat Satellite, Red Hat Enterprise Linux, and Red Hat Software Collections (RHSC) content. This is the only subscription required.

Red Hat Satellite Infrastructure is included with all subscriptions that include Smart Management. For more information, see the Red Hat Knowledgebase solution [Satellite Infrastructure Subscriptions MCT3718 MCT3719](#).

Subscriptions are classified as available if they are not already attached to a system. If you are unable to find an available Satellite subscription, see the Red Hat Knowledgebase solution [How do I figure out which subscriptions have been consumed by clients registered under Red Hat Subscription Manager?](#) to run a script to see if your subscription is being consumed by another system.

### Procedure

1. Identify the Pool ID of the Satellite Infrastructure subscription:

```
# subscription-manager list --all --available --matches 'Red Hat Satellite Infrastructure
Subscription'
```

The command displays output similar to the following:

```
Subscription Name:  Red Hat Satellite Infrastructure Subscription
Provides:           Red Hat Satellite
                   Red Hat Software Collections (for RHEL Server)
                   Red Hat CodeReady Linux Builder for x86_64
                   Red Hat Ansible Engine
                   Red Hat Enterprise Linux Load Balancer (for RHEL Server)
                   Red Hat
                   Red Hat Software Collections (for RHEL Server)
                   Red Hat Enterprise Linux Server
                   Red Hat Satellite Capsule
                   Red Hat Enterprise Linux for x86_64
                   Red Hat Enterprise Linux High Availability for x86_64
                   Red Hat Satellite
                   Red Hat Satellite 5 Managed DB
                   Red Hat Satellite 6
                   Red Hat Discovery
SKU:                MCT3719
Contract:           11878983
Pool ID:            8a85f99968b92c3701694ee998cf03b8
Provides Management: No
Available:          1
```



```
Suggested:      1
Service Level:  Premium
Service Type:   L1-L3
Subscription Type: Standard
Ends:          03/04/2020
System Type:    Physical
```

2. Make a note of the subscription Pool ID. Your subscription Pool ID is different from the example provided.
3. Attach the Satellite Infrastructure subscription to the base operating system that your Capsule Server is running on:

```
# subscription-manager attach --pool=pool_id
```

The command displays output similar to the following:

```
Successfully attached a subscription for: Red Hat Satellite Infrastructure Subscription
```

4. Optional: Verify that the Satellite Infrastructure subscription is attached:

```
# subscription-manager list --consumed
```

## 2.3. CONFIGURING REPOSITORIES

Use this procedure to enable the repositories that are required to install Capsule Server.

### Procedure

To configure the required repositories, complete the following steps:

1. Disable all repositories:

```
# subscription-manager repos --disable "*" 
```

2. Enable the following repositories:

```
# subscription-manager repos --enable=rhel-7-server-rpms \
--enable=rhel-7-server-satellite-capsule-6.9-rpms \
--enable=rhel-7-server-satellite-maintenance-6-rpms \
--enable=rhel-7-server-satellite-tools-6.9-rpms \
--enable=rhel-server-rhsc-7-rpms \
--enable=rhel-7-server-ansible-2.9-rpms
```



### NOTE

If you are installing Capsule Server as a virtual machine hosted on Red Hat Virtualization, you must also enable the **Red Hat Common** repository, and install Red Hat Virtualization guest agents and drivers. For more information, see [Installing the Guest Agents and Drivers on Red Hat Enterprise Linux](#) in the *Virtual Machine Management Guide*.

3. Clear any metadata:

```
# yum clean all
```

- Optional: Verify that the required repositories are enabled:

```
# yum repolist enabled
```

## 2.4. INSTALLING CAPSULE SERVER PACKAGES

Before installing the Capsule Server packages, you must update all packages that are installed on the base operating system.

### Procedure

To install Capsule Server, complete the following steps:

- Update all packages:

```
# yum update
```

- Install the **satellite-capsule** package:

```
# yum install satellite-capsule
```

## 2.5. SYNCHRONIZING THE SYSTEM CLOCK WITH CHRONYD

To minimize the effects of time drift, you must synchronize the system clock on the base operating system on which you want to install Capsule Server with Network Time Protocol (NTP) servers. If the base operating system clock is configured incorrectly, certificate verification might fail.

For more information about the **chrony** suite, see [Configuring NTP Using the chrony Suite](#) in the *Red Hat Enterprise Linux 7 System Administrator's Guide*.

### Procedure

- Install the **chrony** package:

```
# yum install chrony
```

- Start and enable the **chronyd** service:

```
# systemctl start chronyd  
# systemctl enable chronyd
```

## 2.6. CONFIGURING CAPSULE SERVER WITH SSL CERTIFICATES

Red Hat Satellite uses SSL certificates to enable encrypted communications between Satellite Server, external Capsule Servers, and all hosts. Depending on the requirements of your organization, you must configure your Capsule Server with a default or custom certificate.

- If you use a default SSL certificate, you must also configure each external Capsule Server with a distinct default SSL certificate. For more information, see [Section 2.7.1, "Configuring Capsule Server with a Default SSL Certificate"](#).

- If you use a custom SSL certificate, you must also configure each external Capsule Server with a distinct custom SSL certificate. For more information, see [Section 2.7.2, "Configuring Capsule Server with a Custom SSL Certificate"](#).

## 2.7. ASSIGNING THE CORRECT ORGANIZATION AND LOCATION TO CAPSULE SERVER IN THE SATELLITE WEB UI

After installing the Capsule Server packages, if there is more than one organization or location, you must assign the correct organization and location to Capsule to make Capsule visible in the Satellite web UI.

### Procedure

1. Log into the Satellite web UI.
2. From the **Organization** list in the upper-left of the screen, select **Any Organization**.
3. From the **Location** list in the upper-left of the screen, select **Any Location**.
4. Navigate to **Hosts > All Hosts** and select the Capsule Server.
5. From the **Select Actions** list, select **Assign Organization**.
6. From the **Organization** list, select the organization where you want to assign this Capsule.
7. Click **Fix Organization on Mismatch**.
8. Click **Submit**.
9. Select the Capsule Server. From the **Select Actions** list, select **Assign Location**.
10. From the **Location** list, select the location where you want to assign this Capsule.
11. Click **Fix Location on Mismatch**.
12. Click **Submit**.
13. Navigate to **Administer > Organizations** and click the organization to which you have assigned Capsule.
14. Click the **Capsules** tab and ensure that the Capsule Server is listed under the **Selected items** list, then click **Submit**.
15. Navigate to **Administer > Locations** and click the location to which you have assigned Capsule.
16. Click the **Capsules** tab and ensure that the Capsule Server is listed under the **Selected items** list, then click **Submit**.

### Conclusion

Optionally, you can now verify if the Capsule Server is correctly listed in the Satellite web UI.

1. Select the organization from the **Organization** list.
2. Select the location from the **Location** list.
3. Navigate to **Hosts > All Hosts**.

4. Navigate to **Infrastructure > Capsules**.

### 2.7.1. Configuring Capsule Server with a Default SSL Certificate

Use this section to configure Capsule Server with an SSL certificate that is signed by the Satellite Server default Certificate Authority (CA).

#### Prerequisites

Before configuring Capsule Server with a default server certificate, ensure that your Capsule Server meets the following conditions:

- Capsule Server is registered to Satellite Server. For more information, see [Section 2.1, "Registering to Satellite Server"](#).
- The Capsule Server packages are installed. For more information, see [Section 2.4, "Installing Capsule Server Packages"](#).

#### Procedure

To configure Capsule Server with a default server certificate, complete the following steps:

1. On Satellite Server, to store all the source certificate files for your Capsule Server, create a directory that is accessible only to the **root** user, for example **/root/capsule\_cert**:

```
# mkdir /root/capsule_cert
```

2. On Satellite Server, generate the **/root/capsule\_cert/capsule\_certs.tar** certificate archive for your Capsule Server:

```
# capsule-certs-generate \
--foreman-proxy-fqdn capsule.example.com \
--certs-tar /root/capsule_cert/capsule_certs.tar
```

Retain a copy of the **satellite-installer** command that the **capsule-certs-generate** command returns for deploying the certificate to your Capsule Server.

#### Example output of capsule-certs-generate

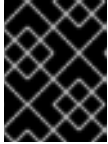
```
output omitted
satellite-installer \
--scenario capsule \
--certs-tar-file          "/root/capsule_certs.tar"
--foreman-proxy-content-parent-fqdn "satellite.example.com"
--foreman-proxy-register-in-foreman "true"
--foreman-proxy-foreman-base-url    "https://satellite.example.com"
--foreman-proxy-trusted-hosts       "satellite.example.com"
--foreman-proxy-trusted-hosts       "capsule.example.com"
--foreman-proxy-oauth-consumer-key  "s97QxvUAgFNAQZNGg4F9zLq2biDsxM7f"
--foreman-proxy-oauth-consumer-secret "6bpzAdMpRAfYaVZtaepYetomgBVQ6ehY"
--puppet-server-foreman-url          "https://satellite.example.com"
```

3. On Satellite Server, copy the certificate archive file to your Capsule Server:

```
# scp /root/capsule_cert/capsule.example.com-certs.tar \
root@capsule.example.com:/root/capsule.example.com-certs.tar
```

4. On Capsule Server, to deploy the certificate, enter the **satellite-installer** command that the **capsule-certs-generate** command returns.

When network connections or ports to Satellite are not yet open, you can set the **--foreman-proxy-register-in-foreman** option to **false** to prevent Capsule from attempting to connect to Satellite and reporting errors. Run the installer again with this option set to **true** when the network and firewalls are correctly configured.



### IMPORTANT

Do not delete the certificate archive file after you deploy the certificate. It is required, for example, when upgrading Capsule Server.

## 2.7.2. Configuring Capsule Server with a Custom SSL Certificate

If you configure Satellite Server to use a custom SSL certificate, you must also configure each of your external Capsule Servers with a distinct custom SSL certificate.

To configure your Capsule Server with a custom certificate, complete the following procedures on each Capsule Server:

1. [Section 2.7.2.1, "Creating a Custom SSL Certificate for Capsule Server"](#)
2. [Section 2.7.2.2, "Deploying a Custom SSL Certificate to Capsule Server"](#)
3. [Section 2.7.2.3, "Deploying a Custom SSL Certificate to Hosts"](#)

### 2.7.2.1. Creating a Custom SSL Certificate for Capsule Server

On Satellite Server, create a custom certificate for your Capsule Server. If you already have a custom SSL certificate for Capsule Server, skip this procedure.

When you configure Capsule Server with custom certificates, note the following considerations:

- You must use the Privacy-Enhanced Mail (PEM) encoding for the SSL certificates.
- You cannot use the same certificate for both Satellite Server and Capsule Server.
- The same Certificate Authority must sign certificates for Satellite Server and Capsule Server.

#### Procedure

To create a custom SSL certificate, complete the following steps:

1. To store all the source certificate files, create a directory that is accessible only to the **root** user.

```
# mkdir /root/capsule_cert
```

2. Create a private key with which to sign the Certificate Signing Request (CSR). Note that the private key must be unencrypted. If you use a password-protected private key, remove the private key password.

If you already have a private key for this Capsule Server, skip this step.

```
# openssl genrsa -out /root/capsule_cert/capsule_cert_key.pem 4096
```

3. Create the `/root/capsule_cert/openssl.cnf` configuration file for the Certificate Signing Request (CSR) and include the following content:

```
[ req ]
req_extensions = v3_req
distinguished_name = req_distinguished_name
x509_extensions = usr_cert
prompt = no

[ req_distinguished_name ] 1
C = Country Name (2 letter code)
ST = State or Province Name (full name)
L = Locality Name (eg, city)
O = Organization Name (eg, company)
OU = The division of your organization handling the certificate
CN = capsule.example.com 2

[ v3_req ]
basicConstraints = CA:FALSE
keyUsage = digitalSignature, nonRepudiation, keyEncipherment, dataEncipherment
extendedKeyUsage = serverAuth, clientAuth, codeSigning, emailProtection
subjectAltName = @alt_names

[ usr_cert ]
basicConstraints=CA:FALSE
nsCertType = client, server, email
keyUsage = nonRepudiation, digitalSignature, keyEncipherment
extendedKeyUsage = serverAuth, clientAuth, codeSigning, emailProtection
nsComment = "OpenSSL Generated Certificate"
subjectKeyIdentifier=hash
authorityKeyIdentifier=keyid,issuer

[ alt_names ]
DNS.1 = capsule.example.com 3
```

- 1** In the `[ req_distinguished_name ]` section, enter information about your organization.
- 2** Set the certificate's Common Name **CN** to match the fully qualified domain name (FQDN) of your Capsule Server or a wildcard value `*`. To confirm a FQDN, on that Capsule Server, enter the `hostname -f` command. This is required to ensure that the `katello-certs-check` command validates the certificate correctly. If you set a wildcard value, you must add the `-t capsule` option when you use the `katello-certs-check` command.
- 3** Set the Subject Alternative Name (SAN) **DNS.1** to match the fully qualified domain name (FQDN) of your server.

4. Generate the Certificate Signing Request (CSR):

```
# openssl req -new \
-key /root/capsule_cert/capsule_cert_key.pem \ 1
-config /root/capsule_cert/openssl.cnf \ 2
-out /root/capsule_cert/capsule_cert_csr.pem 3
```

- - 1 Path to the private key.
  - 2 Path to the configuration file.
  - 3 Path to the CSR to generate.
5. Send the certificate signing request to the Certificate Authority. The same Certificate Authority must sign certificates for Satellite Server and Capsule Server. When you submit the request, specify the lifespan of the certificate. The method for sending the certificate request varies, so consult the Certificate Authority for the preferred method. In response to the request, you can expect to receive a Certificate Authority bundle and a signed certificate, in separate files.

### 2.7.2.2. Deploying a Custom SSL Certificate to Capsule Server

Use this procedure to configure your Capsule Server with a custom SSL certificate signed by a Certificate Authority. The **satellite-installer** command, which the **capsule-certs-generate** command returns, is unique to each Capsule Server. Do not use the same command on more than one Capsule Server.

#### Prerequisites

Before configuring Capsule Server with a custom server certificate, ensure that your Satellite and Capsules meet the following conditions:

- Satellite Server is configured with a custom certificate. For more information, see [Configuring Satellite Server with a Custom SSL Certificate](#) in *Installing Satellite Server from a Connected Network*.
- Capsule Server is registered to Satellite Server. For more information, see [Section 2.1, "Registering to Satellite Server"](#).
- The Capsule Server packages are installed. For more information, see [Section 2.4, "Installing Capsule Server Packages"](#)

#### Procedure

To configure your Capsule Server with a custom SSL certificate, complete the following steps:

1. On Satellite Server, validate the custom SSL certificate input files:

```
# katello-certs-check \
-c /root/capsule_cert/capsule_cert.pem \ 1
-k /root/capsule_cert/capsule_cert_key.pem \ 2
-b /root/capsule_cert/ca_cert_bundle.pem 3
```

- 1 Path to the Capsule Server certificate file that is signed by a Certificate Authority.
- 2 Path to the private key that was used to sign the Capsule Server certificate.
- 3 Path to the Certificate Authority bundle.

If you set a wildcard value `*` for the certificate's Common Name **CN =** in the `/root/capsule_cert/openssl.cnf` configuration file, you must add the **-t capsule** option to the **katello-certs-check** command.

If the command is successful, it returns two **capsule-certs-generate** commands, one of which you must use to generate the certificate archive file for your Capsule Server.

### Example output of **katello-certs-check**

Validation succeeded.

To use them inside a NEW `$CAPSULE`, run this command:

```
capsule-certs-generate --foreman-proxy-fqdn "$CAPSULE" \
  --certs-tar "~/capsule-certs.tar" \
  --server-cert "/root/capsule_cert/capsule_cert.pem" \
  --server-key "/root/capsule_cert/capsule_cert_key.pem" \
  --server-ca-cert "/root/capsule_cert/ca_cert_bundle.pem" \
```

To use them inside an EXISTING `$CAPSULE`, run this command INSTEAD:

```
capsule-certs-generate --foreman-proxy-fqdn "$CAPSULE" \
  --certs-tar "~/capsule-certs.tar" \
  --server-cert "/root/capsule_cert/capsule_cert.pem" \
  --server-key "/root/capsule_cert/capsule_cert_key.pem" \
  --server-ca-cert "/root/capsule_cert/ca_cert_bundle.pem" \
  --certs-update-server
```

- On Satellite Server, from the output of the **katello-certs-check** command, depending on your requirements, enter the **capsule-certs-generate** command that generates a certificate for a new or existing Capsule.  
In this command, change **\$CAPSULE** to the FQDN of your Capsule Server.
- Retain a copy of the **satellite-installer** command that the **capsule-certs-generate** command returns for deploying the certificate to your Capsule Server.

### Example output of **capsule-certs-generate**

```
output omitted
satellite-installer \
--scenario capsule \
--certs-tar-file           "/root/capsule_certs.tar" \
--foreman-proxy-content-parent-fqdn "satellite.example.com" \
--foreman-proxy-register-in-foreman "true" \
--foreman-proxy-foreman-base-url    "https://satellite.example.com" \
--foreman-proxy-trusted-hosts      "satellite.example.com" \
--foreman-proxy-trusted-hosts      "capsule.example.com" \
--foreman-proxy-oauth-consumer-key  "s97QxvUAgFNAQZNGg4F9zLq2biDsXM7" \
--foreman-proxy-oauth-consumer-secret "6bpzAdMpRAfYaVZtaepYetomgBVQ6ehY" \
--puppet-server-foreman-url         "https://satellite.example.com"
```

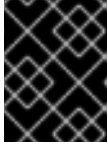
- On Satellite Server, copy the certificate archive file to your Capsule Server:

```
# scp /root/capsule_cert/capsule.example.com-certs.tar \
root@capsule.example.com:/root/capsule.example.com-certs.tar
```



5. On Capsule Server, to deploy the certificate, enter the **satellite-installer** command that the **capsule-certs-generate** command returns.

When network connections or ports to Satellite are not yet open, you can set the **--foreman-proxy-register-in-foreman** option to **false** to prevent Capsule from attempting to connect to Satellite and reporting errors. Run the installer again with this option set to **true** when the network and firewalls are correctly configured.



### IMPORTANT

Do not delete the certificate archive file after you deploy the certificate. It is required, for example, when upgrading Capsule Server.

### 2.7.2.3. Deploying a Custom SSL Certificate to Hosts

After you configure Capsule Server to use a custom SSL certificate, you must also install the **katello-ca-consumer** package on every host that is registered to this Capsule Server.

#### Procedure

- On each host, install the **katello-ca-consumer** package:

```
# yum localinstall \
http://capsule.example.com/pub/katello-ca-consumer-latest.noarch.rpm
```

## CHAPTER 3. PERFORMING ADDITIONAL CONFIGURATION ON CAPSULE SERVER

Use this chapter to configure additional settings on your Capsule Server.

### 3.1. INSTALLING THE KATELLO AGENT

You can install the Katello agent to remotely update Satellite clients.



#### NOTE

The Katello agent is deprecated and will be removed in a future Satellite version. Migrate your processes to use the remote execution feature to update clients remotely. For more information, see [Host Management Without Goferd and Katello Agent](#) in the *Managing Hosts Guide*.

The **katello-agent** package depends on the **goferd** package that provides the **goferd** service. This service must be enabled so that Satellite Server or Capsule Server can provide information about errata that are applicable for content hosts.

#### Prerequisites

Before installing the Katello agent, ensure the following conditions are met:

- You have enabled the Satellite Tools 6.9 repository on Satellite Server. For more information, see [Enabling the Satellite Tools 6.9 Repository](#) in *Installing Satellite Server from a Connected Network*.
- You have synchronized the Satellite Tools 6.9 repository on Satellite Server. For more information, see [Synchronizing the Satellite Tools 6.9 Repository](#) in *Installing Satellite Server from a Connected Network*.
- You have enabled the Satellite Tools 6.9 repository on the client.

#### Procedure

To install the Katello agent, complete the following steps:

1. Install the **katello-agent** package:

```
# yum install katello-agent
```

2. Start the **goferd** service :

```
# systemctl start goferd
```

### 3.2. ENABLING OPENS CAP ON EXTERNAL CAPSULES

On Satellite Server and the integrated Capsule of your Satellite Server, OpenSCAP is enabled by default.

To use the OpenSCAP plug-in and content on an external Capsule, you must enable OpenSCAP on each Capsule.

## Procedure

- To enable OpenSCAP, enter the following command:

```
# satellite-installer --scenario capsule \
--enable-foreman-proxy-plugin-openscap
```

## 3.3. ADDING LIFE CYCLE ENVIRONMENTS TO CAPSULE SERVERS

If your Capsule Server has the content functionality enabled, you must add an environment so that Capsule can synchronize content from Satellite Server and provide content to host systems.

Do not assign the *Library* lifecycle environment to your Capsule Server because it triggers an automated Capsule sync every time the CDN updates a repository. This might consume multiple system resources on Capsules, network bandwidth between Satellite and Capsules, and available disk space on Capsules.

You can use Hammer CLI on Satellite Server or the Satellite web UI.

## Procedure

To add a life cycle environment to Capsule Server, complete the following steps:

- In the Satellite web UI, navigate to **Infrastructure** > **Capsules**, and select the Capsule that you want to add a life cycle to.
- Click **Edit** and click the **Life Cycle Environments** tab.
- From the left menu, select the life cycle environments that you want to add to Capsule and click **Submit**.
- To synchronize the content on the Capsule, click the **Overview** tab and click **Synchronize**.
- Select either **Optimized Sync** or **Complete Sync**.  
For definitions of each synchronization type, see [Recovering a Repository](#) in the *Content Management Guide*.

## For CLI Users

- To display a list of all Capsule Servers, on Satellite Server, enter the following command:

```
# hammer capsule list
```

Note the Capsule ID of the Capsule that you want to add a life cycle to.

- Using the ID, verify the details of your Capsule:

```
# hammer capsule info --id capsule_id
```

- To view the life cycle environments available for your Capsule Server, enter the following command and note the ID and the organization name:

```
# hammer capsule content available-lifecycle-environments --id capsule_id
```

- Add the life cycle environment to your Capsule Server:

```
# hammer capsule content add-lifecycle-environment \
--id capsule_id --organization "My_Organization" \
--lifecycle-environment-id lifecycle-environment_id
```

Repeat for each life cycle environment you want to add to Capsule Server.

#### 5. Synchronize the content from Satellite to Capsule.

- To synchronize all content from your Satellite Server environment to Capsule Server, enter the following command:

```
# hammer capsule content synchronize --id capsule_id
```

- To synchronize a specific life cycle environment from your Satellite Server to Capsule Server, enter the following command:

```
# hammer capsule content synchronize --id external_capsule_id \
--lifecycle-environment-id lifecycle-environment_id
```

## 3.4. ENABLING POWER MANAGEMENT ON MANAGED HOSTS

To perform power management tasks on managed hosts using the intelligent platform management interface (IPMI) or a similar protocol, you must enable the baseboard management controller (BMC) module on Capsule Server.

### Prerequisites

- All managed hosts must have a network interface of BMC type. Capsule Server uses this NIC to pass the appropriate credentials to the host. For more information, see [Adding a Baseboard Management Controller \(BMC\) Interface](#) in *Managing Hosts*.

### Procedure

- To enable BMC, enter the following command:

```
# satellite-installer --scenario capsule \
--foreman-proxy-bmc "true" \
--foreman-proxy-bmc-default-provider "freeipmi"
```

## 3.5. CONFIGURING DNS, DHCP, AND TFTP ON CAPSULE SERVER

To configure the DNS, DHCP, and TFTP services on Capsule Server, use the **satellite-installer** command with the options appropriate for your environment. To view a complete list of configurable options, enter the **satellite-installer --scenario satellite --help** command.

Any changes to the settings require entering the **satellite-installer** command again. You can enter the command multiple times and each time it updates all configuration files with the changed values.

To use external DNS, DHCP, and TFTP services instead, see [Chapter 4, Configuring Capsule Server with External Services](#).

### Adding Multihomed DHCP details

If you want to use Multihomed DHCP, you must update the network interface file.

1. In the `/etc/systemd/system/dhcpd.service.d/interfaces.conf` file, edit the following line to add Multihomed DHCP:

```
[Service]
ExecStart=/usr/sbin/dhcpd -f -cf /etc/dhcp/dhcpd.conf -user dhcpd -group dhcpd --no-pid eth0
eth1 eth2
```

If this file does not exist already, create it.

2. Enter the following command to perform a daemon reload:

```
# systemctl --system daemon-reload
```

3. Enter the following command to restart the `dhcpd` service:

```
# systemctl restart dhcpd.service
```

### Prerequisites

- You must have the correct network name (**dns-interface**) for the DNS server.
- You must have the correct interface name (**dhcp-interface**) for the DHCP server.
- Contact your network administrator to ensure that you have the correct settings.

### Procedure

- Enter the **satellite-installer** command with the options appropriate for your environment. The following example shows configuring full provisioning services:

```
# satellite-installer --scenario capsule \
--foreman-proxy-dns true \
--foreman-proxy-dns-managed true \
--foreman-proxy-dns-interface eth0 \
--foreman-proxy-dns-zone example.com \
--foreman-proxy-dns-reverse 2.0.192.in-addr.arpa \
--foreman-proxy-dhcp true \
--foreman-proxy-dhcp-managed true \
--foreman-proxy-dhcp-interface eth0 \
--foreman-proxy-dhcp-range "192.0.2.100 192.0.2.150" \
--foreman-proxy-dhcp-gateway 192.0.2.1 \
--foreman-proxy-dhcp-nameservers 192.0.2.2 \
--foreman-proxy-tftp true \
--foreman-proxy-tftp-managed true \
--foreman-proxy-tftp-servername 192.0.2.3
```

For more information about configuring DHCP, DNS, and TFTP services, see the [Configuring Network Services](#) section in the *Provisioning Guide*.

## 3.6. RESTRICTING ACCESS TO MONGOD

To reduce the risk of data loss, configure only the **apache** and **root** users to have access to the MongoDB database daemon, **mongod**.

To restrict access to **mongod** on your Capsule Server, you must update your firewall configuration.

## Procedure

1. Update the firewall configuration by entering the following command:

```
# firewall-cmd --direct --add-rule ipv4 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 27017 -m owner --uid-owner apache -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv6 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 27017 -m owner --uid-owner apache -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv4 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 27017 -m owner --uid-owner root -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv6 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 27017 -m owner --uid-owner root -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv4 filter OUTPUT 1 -o lo -p \
tcp -m tcp --dport 27017 -j DROP \
&& firewall-cmd --direct --add-rule ipv6 filter OUTPUT 1 -o lo -p \
tcp -m tcp --dport 27017 -j DROP \
&& firewall-cmd --direct --add-rule ipv4 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 28017 -m owner --uid-owner apache -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv6 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 28017 -m owner --uid-owner apache -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv4 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 28017 -m owner --uid-owner root -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv6 filter OUTPUT 0 -o lo -p \
tcp -m tcp --dport 28017 -m owner --uid-owner root -j ACCEPT \
&& firewall-cmd --direct --add-rule ipv4 filter OUTPUT 1 -o lo -p \
tcp -m tcp --dport 28017 -j DROP \
&& firewall-cmd --direct --add-rule ipv6 filter OUTPUT 1 -o lo -p \
tcp -m tcp --dport 28017 -j DROP
```

2. Make the changes persistent:

```
# firewall-cmd --runtime-to-permanent
```

## CHAPTER 4. CONFIGURING CAPSULE SERVER WITH EXTERNAL SERVICES

If you do not want to configure the DNS, DHCP, and TFTP services on Capsule Server, use this section to configure your Capsule Server to work with external DNS, DHCP and TFTP services.

### 4.1. CONFIGURING CAPSULE SERVER WITH EXTERNAL DNS

You can configure Capsule Server with external DNS. Capsule Server uses the **nsupdate** utility to update DNS records on the remote server.

To make any changes persistent, you must enter the **satellite-installer** command with the options appropriate for your environment.

#### Prerequisites

- You must have a configured external DNS server.

#### Procedure

1. Install the **bind-utils** package:

```
# yum install bind bind-utils
```

2. Copy the **/etc/rndc.key** file from the external DNS server to Capsule Server:

```
# scp root@dns.example.com:/etc/rndc.key /etc/rndc.key
```

3. Configure the ownership, permissions, and SELinux context:

```
# restorecon -v /etc/rndc.key
# chown -v root:named /etc/rndc.key
# chmod -v 640 /etc/rndc.key
```

4. To test the **nsupdate** utility, add a host remotely:

```
# echo -e "server DNS_IP_Address\n \
update add aaa.virtual.lan 3600 IN A Host_IP_Address\n \
send\n" | nsupdate -k /etc/rndc.key
# nslookup aaa.virtual.lan DNS_IP_Address
# echo -e "server DNS_IP_Address\n \
update delete aaa.virtual.lan 3600 IN A Host_IP_Address\n \
send\n" | nsupdate -k /etc/rndc.key
```

5. Assign the **foreman-proxy** user to the **named** group manually. Normally, **satellite-installer** ensures that the **foreman-proxy** user belongs to the **named** UNIX group, however, in this scenario Satellite does not manage users and groups, therefore you need to assign the **foreman-proxy** user to the **named** group manually.

```
# usermod -a -G named foreman-proxy
```

- Enter the **satellite-installer** command to make the following persistent changes to the **/etc/foreman-proxy/settings.d/dns.yml** file:

```
# satellite-installer --foreman-proxy-dns=true \
--foreman-proxy-dns-managed=false \
--foreman-proxy-dns-provider=nsupdate \
--foreman-proxy-dns-server="DNS_IP_Address" \
--foreman-proxy-keyfile=/etc/rndc.key \
--foreman-proxy-dns-ttl=86400
```

- Restart the foreman-proxy service:

```
# systemctl restart foreman-proxy
```

- Log in to the Satellite Server web UI.
- Navigate to **Infrastructure > Capsules**, locate the Capsule Server, and from the list in the **Actions** column, select **Refresh**.
- Associate the DNS service with the appropriate subnets and domain.

## 4.2. CONFIGURING CAPSULE SERVER WITH EXTERNAL DHCP

To configure Capsule Server with external DHCP, you must complete the following procedures:

- [Section 4.2.1, "Configuring an External DHCP Server to Use with Capsule Server"](#)
- [Section 4.2.2, "Configuring Capsule Server with an External DHCP Server"](#)

### 4.2.1. Configuring an External DHCP Server to Use with Capsule Server

To configure an external DHCP server to use with Capsule Server, on a Red Hat Enterprise Linux server, you must install the ISC DHCP Service and Berkeley Internet Name Domain (BIND) packages. You must also share the DHCP configuration and lease files with Capsule Server. The example in this procedure uses the distributed Network File System (NFS) protocol to share the DHCP configuration and lease files.



#### NOTE

If you use dnsmasq as an external DHCP server, enable the **dhcp-no-override** setting. This is required because Satellite creates configuration files on the TFTP server under the **grub2/** subdirectory. If the **dhcp-no-override** setting is disabled, clients fetch the bootloader and its configuration from the root directory, which might cause an error.

#### Procedure

- On a Red Hat Enterprise Linux Server server, install the ISC DHCP Service and Berkeley Internet Name Domain (BIND) packages:

```
# yum install dhcp bind
```

- Generate a security token:

```
# dnssec-keygen -a HMAC-MD5 -b 512 -n HOST omapi_key
```



- 

As a result, a key pair that consists of two files is created in the current directory.

3. Copy the secret hash from the key:

```
# cat Komapi_key.+*.private |grep ^Key|cut -d ' ' -f2
```

4. Edit the **dhcpd** configuration file for all of the subnets and add the key. The following is an example:

```
# cat /etc/dhcp/dhcpd.conf
default-lease-time 604800;
max-lease-time 2592000;
log-facility local7;

subnet 192.168.38.0 netmask 255.255.255.0 {
  range 192.168.38.10 192.168.38.100;
  option routers 192.168.38.1;
  option subnet-mask 255.255.255.0;
  option domain-search "virtual.lan";
  option domain-name "virtual.lan";
  option domain-name-servers 8.8.8.8;
}

omapi-port 7911;
key omapi_key {
  algorithm HMAC-MD5;
  secret "jNSE5YI3H1A8Oj/tkV4...A2ZOHb6zv315CkNAY7DMYYCj48Umw==";
};
omapi-key omapi_key;
```

Note that the **option routers** value is the Satellite or Capsule IP address that you want to use with an external DHCP service.

5. Delete the two key files from the directory that they were created in.
6. On Satellite Server, define each subnet. Do not set DHCP Capsule for the defined Subnet yet. To prevent conflicts, set up the lease and reservation ranges separately. For example, if the lease range is 192.168.38.10 to 192.168.38.100, in the Satellite web UI define the reservation range as 192.168.38.101 to 192.168.38.250.
7. Configure the firewall for external access to the DHCP server:

```
# firewall-cmd --add-service dhcp \
&& firewall-cmd --runtime-to-permanent
```

8. On Satellite Server, determine the UID and GID of the **foreman** user:

```
# id -u foreman
993
# id -g foreman
990
```

9. On the DHCP server, create the **foreman** user and group with the same IDs as determined in a previous step:

```
# groupadd -g 990 foreman
# useradd -u 993 -g 990 -s /sbin/nologin foreman
```

10. To ensure that the configuration files are accessible, restore the read and execute flags:

```
# chmod o+rx /etc/dhcp/
# chmod o+r /etc/dhcp/dhcpd.conf
# chattr +i /etc/dhcp/ /etc/dhcp/dhcpd.conf
```

11. Start the DHCP service:

```
# systemctl start dhcpd
```

12. Export the DHCP configuration and lease files using NFS:

```
# yum install nfs-utils
# systemctl enable rpcbind nfs-server
# systemctl start rpcbind nfs-server nfs-lock nfs-idmapd
```

13. Create directories for the DHCP configuration and lease files that you want to export using NFS:

```
# mkdir -p /exports/var/lib/dhcpd /exports/etc/dhcp
```

14. To create mount points for the created directories, add the following line to the **/etc/fstab** file:

```
/var/lib/dhcpd /exports/var/lib/dhcpd none bind,auto 0 0
/etc/dhcp /exports/etc/dhcp none bind,auto 0 0
```

15. Mount the file systems in **/etc/fstab**:

```
# mount -a
```

16. Ensure the following lines are present in **/etc/exports**:

```
/exports 192.168.38.1(rw,async,no_root_squash,fsid=0,no_subtree_check)
/exports/etc/dhcp 192.168.38.1(ro,async,no_root_squash,no_subtree_check,nohide)
/exports/var/lib/dhcpd 192.168.38.1(ro,async,no_root_squash,no_subtree_check,nohide)
```

Note that the IP address that you enter is the Satellite or Capsule IP address that you want to use with an external DHCP service.

17. Reload the NFS server:

```
# exportfs -rva
```

18. Configure the firewall for the DHCP omapi port 7911:

```
# firewall-cmd --add-port="7911/tcp" \
&& firewall-cmd --runtime-to-permanent
```

19. Optional: Configure the firewall for external access to NFS. Clients are configured using NFSv3.

```
# firewall-cmd --zone public --add-service mountd \
&& firewall-cmd --zone public --add-service rpc-bind \
&& firewall-cmd --zone public --add-service nfs \
&& firewall-cmd --runtime-to-permanent
```

## 4.2.2. Configuring Capsule Server with an External DHCP Server

You can configure Capsule Server with an external DHCP server.

### Prerequisite

- Ensure that you have configured an external DHCP server and that you have shared the DHCP configuration and lease files with Capsule Server. For more information, see [Section 4.2.1, “Configuring an External DHCP Server to Use with Capsule Server”](#).

### Procedure

1. Install the **nfs-utils** utility:

```
# yum install nfs-utils
```

2. Create the DHCP directories for NFS:

```
# mkdir -p /mnt/nfs/etc/dhcp /mnt/nfs/var/lib/dhcpd
```

3. Change the file owner:

```
# chown -R foreman-proxy /mnt/nfs
```

4. Verify communication with the NFS server and the Remote Procedure Call (RPC) communication paths:

```
# showmount -e DHCP_Server_FQDN
# rpcinfo -p DHCP_Server_FQDN
```

5. Add the following lines to the **/etc/fstab** file:

```
DHCP_Server_FQDN:/exports/etc/dhcp /mnt/nfs/etc/dhcp nfs
ro,vers=3,auto,nosharecache,context="system_u:object_r:dhcp_etc_t:s0" 0 0

DHCP_Server_FQDN:/exports/var/lib/dhcpd /mnt/nfs/var/lib/dhcpd nfs
ro,vers=3,auto,nosharecache,context="system_u:object_r:dhcpd_state_t:s0" 0 0
```

6. Mount the file systems on **/etc/fstab**:

```
# mount -a
```

7. To verify that the **foreman-proxy** user can access the files that are shared over the network, display the DHCP configuration and lease files:

```
# su foreman-proxy -s /bin/bash
bash-4.2$ cat /mnt/nfs/etc/dhcp/dhcpd.conf
bash-4.2$ cat /mnt/nfs/var/lib/dhcpd/dhcpd.leases
bash-4.2$ exit
```

- Enter the **satellite-installer** command to make the following persistent changes to the **/etc/foreman-proxy/settings.d/dhcp.yml** file:

```
# satellite-installer --foreman-proxy-dhcp=true \
--foreman-proxy-dhcp-provider=remote_isc \
--foreman-proxy-plugin-dhcp-remote-isc-dhcp-config /mnt/nfs/etc/dhcp/dhcpd.conf \
--foreman-proxy-plugin-dhcp-remote-isc-dhcp-leases /mnt/nfs/var/lib/dhcpd/dhcpd.leases \
--foreman-proxy-plugin-dhcp-remote-isc-key-name=omapi_key \
--foreman-proxy-plugin-dhcp-remote-isc-key-
secret=jNSE5YI3H1A8Oj/tkV4...A2ZOHb6zv315CkNAY7DMYYCj48Umw== \
--foreman-proxy-plugin-dhcp-remote-isc-omapi-port=7911 \
--enable-foreman-proxy-plugin-dhcp-remote-isc \
--foreman-proxy-dhcp-server=DHCP_Server_FQDN
```

- Restart the **foreman-proxy** service:

```
# systemctl restart foreman-proxy
```

- Log in to the Satellite Server web UI.
- Navigate to **Infrastructure > Capsules**, locate the Capsule Server, and from the list in the **Actions** column, select **Refresh**.
- Associate the DHCP service with the appropriate subnets and domain.

## 4.3. CONFIGURING CAPSULE SERVER WITH EXTERNAL TFTP

You can configure Capsule Server with external TFTP services.

### Procedure

- Create the TFTP directory for NFS:

```
# mkdir -p /mnt/nfs/var/lib/tftpboot
```

- In the **/etc/fstab** file, add the following line:

```
TFTP_Server_IP_Address:/exports/var/lib/tftpboot /mnt/nfs/var/lib/tftpboot nfs
rw,vers=3,auto,nosharecache,context="system_u:object_r:tftpd_dir_rw_t:s0" 0 0
```

- Mount the file systems in **/etc/fstab**:

```
# mount -a
```

- Enter the **satellite-installer** command to make the following persistent changes to the **/etc/foreman-proxy/settings.d/tftp.yml** file:

```
# satellite-installer --foreman-proxy-tftp=true \
--foreman-proxy-tftp-root /mnt/nfs/var/lib/tftpboot
```

- If the TFTP service is running on a different server than the DHCP service, update the **tftp\_servername** setting with the FQDN or IP address of the server that the TFTP service is running on:

```
# satellite-installer --foreman-proxy-tftp-servername=TFTP_Server_FQDN
```

- Log in to the Satellite Server web UI.
- Navigate to **Infrastructure > Capsules**, locate the Capsule Server, and from the list in the **Actions** column, select **Refresh**.
- Associate the TFTP service with the appropriate subnets and domain.

## 4.4. CONFIGURING CAPSULE SERVER WITH EXTERNAL IDM DNS

When Satellite Server adds a DNS record for a host, it first determines which Capsule is providing DNS for that domain. It then communicates with the Capsule that is configured to provide DNS service for your deployment and adds the record. The hosts are not involved in this process. Therefore, you must install and configure the IdM client on the Satellite or Capsule that is currently configured to provide a DNS service for the domain you want to manage using the IdM server.

Capsule Server can be configured to use a Red Hat Identity Management (IdM) server to provide DNS service. For more information about Red Hat Identity Management, see the [Linux Domain Identity, Authentication, and Policy Guide](#).

To configure Capsule Server to use a Red Hat Identity Management (IdM) server to provide DNS service, use one of the following procedures:

- [Section 4.4.1, "Configuring Dynamic DNS Update with GSS-TSIG Authentication"](#)
- [Section 4.4.2, "Configuring Dynamic DNS Update with TSIG Authentication"](#)

To revert to internal DNS service, use the following procedure:

- [Section 4.4.3, "Reverting to Internal DNS Service"](#)



### NOTE

You are not required to use Capsule Server to manage DNS. When you are using the realm enrollment feature of Satellite, where provisioned hosts are enrolled automatically to IdM, the **ipa-client-install** script creates DNS records for the client. Configuring Capsule Server with external IdM DNS and realm enrollment are mutually exclusive. For more information about configuring realm enrollment, see [External Authentication for Provisioned Hosts](#) in *Administering Red Hat Satellite*.

### 4.4.1. Configuring Dynamic DNS Update with GSS-TSIG Authentication

You can configure the IdM server to use the generic security service algorithm for secret key transaction (GSS-TSIG) technology defined in [RFC3645](#). To configure the IdM server to use the GSS-TSIG technology, you must install the IdM client on the Capsule Server base operating system.

#### Prerequisites

## Prerequisites

- You must ensure the IdM server is deployed and the host-based firewall is configured correctly. For more information, see [Port Requirements](#) in the *Linux Domain Identity, Authentication, and Policy Guide*.
- You must contact the IdM server administrator to ensure that you obtain an account on the IdM server with permissions to create zones on the IdM server.
- You must confirm whether Satellite Server or Capsule Server is configured to provide DNS service for your deployment.
- You must configure DNS, DHCP and TFTP services on the base operating system of either the Satellite or Capsule that is managing the DNS service for your deployment.
- You must create a backup of the answer file. You can use the backup to restore the answer file to its original state if it becomes corrupted. For more information, see [Configuring Satellite Server](#).

## Procedure

To configure dynamic DNS update with GSS-TSIG authentication, complete the following steps:

### Creating a Kerberos Principal on the IdM Server

1. Obtain a Kerberos ticket for the account obtained from the IdM administrator:

```
# kinit idm_user
```

2. Create a new Kerberos principal for Capsule Server to use to authenticate on the IdM server.

```
# ipa service-add capsule.example.com
```

### Installing and Configuring the IdM Client

1. On the base operating system of either the Satellite or Capsule that is managing the DNS service for your deployment, install the **ipa-client** package:

```
# satellite-maintain packages install ipa-client
```

2. Configure the IdM client by running the installation script and following the on-screen prompts:

```
# ipa-client-install
```

3. Obtain a Kerberos ticket:

```
# kinit admin
```

4. Remove any preexisting **keytab**:

```
# rm /etc/foreman-proxy/dns.keytab
```

5. Obtain the **keytab** for this system:

```
# ipa-getkeytab -p capsule/satellite.example.com@EXAMPLE.COM \
-s idm1.example.com -k /etc/foreman-proxy/dns.keytab
```



## NOTE

When adding a keytab to a standby system with the same host name as the original system in service, add the **r** option to prevent generating new credentials and rendering the credentials on the original system invalid.

- For the **dns.keytab** file, set the group and owner to **foreman-proxy**:

```
# chown foreman-proxy:foreman-proxy /etc/foreman-proxy/dns.keytab
```

- Optional: To verify that the **keytab** file is valid, enter the following command:

```
# kinit -kt /etc/foreman-proxy/dns.keytab \
capsule/satellite.example.com@EXAMPLE.COM
```

## Configuring DNS Zones in the IdM web UI

- Create and configure the zone that you want to manage:
  - Navigate to **Network Services > DNS > DNS Zones**.
  - Select **Add** and enter the zone name. For example, **example.com**.
  - Click **Add and Edit**
  - Click the **Settings** tab and in the **BIND update policy** box, add the following to the semi-colon separated list:

```
grant capsule/047satellite.example.com@EXAMPLE.COM wildcard * ANY;
```

- Set **Dynamic update** to **True**.
  - Enable **Allow PTR sync**.
  - Click **Save** to save the changes.
- Create and configure the reverse zone:
    - Navigate to **Network Services > DNS > DNS Zones**.
    - Click **Add**.
    - Select **Reverse zone IP network** and add the network address in CIDR format to enable reverse lookups.
    - Click **Add and Edit**
    - Click the **Settings** tab and in the **BIND update policy** box, add the following to the semi-colon separated list:

```
grant capsule\047satellite.example.com@EXAMPLE.COM wildcard * ANY;
```

- f. Set **Dynamic update** to **True**.
- g. Click **Save** to save the changes.

### Configuring the Satellite or Capsule Server that Manages the DNS Service for the Domain

1. Use the **satellite-installer** command to configure the Satellite or Capsule that manages the DNS Service for the domain:

- On Satellite, enter the following command:

```
satellite-installer --scenario satellite \
--foreman-proxy-dns=true \
--foreman-proxy-dns-managed=true \
--foreman-proxy-dns-provider=nsupdate_gss \
--foreman-proxy-dns-server="idm1.example.com" \
--foreman-proxy-dns-tsig-principal="capsule/satellite.example.com@EXAMPLE.COM" \
--foreman-proxy-dns-tsig-keytab=/etc/foreman-proxy/dns.keytab \
--foreman-proxy-dns-reverse="55.168.192.in-addr.arpa" \
--foreman-proxy-dns-zone=example.com \
--foreman-proxy-dns-ttl=86400
```

- On Capsule, enter the following command:

```
satellite-installer --scenario capsule \
--foreman-proxy-dns=true \
--foreman-proxy-dns-managed=true \
--foreman-proxy-dns-provider=nsupdate_gss \
--foreman-proxy-dns-server="idm1.example.com" \
--foreman-proxy-dns-tsig-principal="capsule/satellite.example.com@EXAMPLE.COM" \
--foreman-proxy-dns-tsig-keytab=/etc/foreman-proxy/dns.keytab \
--foreman-proxy-dns-reverse="55.168.192.in-addr.arpa" \
--foreman-proxy-dns-zone=example.com \
--foreman-proxy-dns-ttl=86400
```

2. Restart the Satellite or Capsule's Proxy Service.

```
# systemctl restart foreman-proxy
```

After you run the **satellite-installer** command to make any changes to your Capsule configuration, you must update the configuration of each affected Capsule in the Satellite web UI.

### Updating the Configuration in the Satellite web UI

1. Navigate to **Infrastructure** > **Capsules**, locate the Capsule Server, and from the list in the **Actions** column, select **Refresh**.
2. Configure the domain:
  - a. Navigate to **Infrastructure** > **Domains** and select the domain name.
  - b. In the **Domain** tab, ensure **DNS Capsule** is set to the Capsule where the subnet is connected.
3. Configure the subnet:



- a. Navigate to **Infrastructure** > **Subnets** and select the subnet name.
- b. In the **Subnet** tab, set **IPAM** to **None**.
- c. In the **Domains** tab, select the domain that you want to manage using the IdM server.
- d. In the **Capsules** tab, ensure **Reverse DNS Capsule** is set to the Capsule where the subnet is connected.
- e. Click **Submit** to save the changes.

#### 4.4.2. Configuring Dynamic DNS Update with TSIG Authentication

You can configure an IdM server to use the secret key transaction authentication for DNS (TSIG) technology that uses the **rndc.key** key file for authentication. The TSIG protocol is defined in [RFC2845](#).

##### Prerequisites

- You must ensure the IdM server is deployed and the host-based firewall is configured correctly. For more information, see [Port Requirements](#) in the *Linux Domain Identity, Authentication, and Policy Guide*.
- You must obtain **root** user access on the IdM server.
- You must confirm whether Satellite Server or Capsule Server is configured to provide DNS service for your deployment.
- You must configure DNS, DHCP and TFTP services on the base operating system of either the Satellite or Capsule that is managing the DNS service for your deployment.
- You must create a backup of the answer file. You can use the backup to restore the answer file to its original state if it becomes corrupted. For more information, see [Configuring Satellite Server](#).

##### Procedure

To configure dynamic DNS update with TSIG authentication, complete the following steps:

##### Enabling External Updates to the DNS Zone in the IdM Server

1. On the IdM Server, add the following to the top of the **/etc/named.conf** file:

```
include "/etc/rndc.key"; controls { inet IdM_Server_IP_Address port 953 allow {
Satellite_IP_Address; } keys { "rndc-key"; }; };
```

2. Reload the **named** service to make the changes take effect:

```
# systemctl reload named
```

3. In the IdM web UI, navigate to **Network Services** > **DNS** > **DNS Zones** and click the name of the zone. In the **Settings** tab, apply the following changes:

- a. Add the following in the **BIND update policy** box:

```
grant "rndc-key" zonesub ANY;
```

- b. Set **Dynamic update** to **True**.
  - c. Click **Update** to save the changes.
4. Copy the **/etc/rndc.key** file from the IdM server to the base operating system of your Satellite Server. Enter the following command:

```
# scp /etc/rndc.key root@satellite.example.com:/etc/rndc.key
```

5. To set the correct ownership, permissions, and SELinux context for the **rndc.key** file, enter the following command:

```
# restorecon -v /etc/rndc.key
# chown -v root:named /etc/rndc.key
# chmod -v 640 /etc/rndc.key
```

6. Assign the **foreman-proxy** user to the **named** group manually. Normally, **satellite-installer** ensures that the **foreman-proxy** user belongs to the **named** UNIX group, however, in this scenario Satellite does not manage users and groups, therefore you need to assign the **foreman-proxy** user to the **named** group manually.

```
# usermod -a -G named foreman-proxy
```

7. On Satellite Server, enter the following **satellite-installer** command to configure Satellite to use the external DNS server:

```
# satellite-installer --scenario satellite \
--foreman-proxy-dns=true \
--foreman-proxy-dns-managed=false \
--foreman-proxy-dns-provider=nsupdate \
--foreman-proxy-dns-server="IdM_Server_IP_Address" \
--foreman-proxy-keyfile=/etc/rndc.key \
--foreman-proxy-dns-ttl=86400
```

## Testing External Updates to the DNS Zone in the IdM Server

1. Install the **bind-utils** utility:

```
# yum install bind-utils
```

2. Ensure that the key in the **/etc/rndc.key** file on Satellite Server is the same key file that is used on the IdM server:

```
key "rndc-key" {
    algorithm hmac-md5;
    secret "secret-key==";
};
```

3. On Satellite Server, create a test DNS entry for a host. For example, host **test.example.com** with an A record of **192.168.25.20** on the IdM server at **192.168.25.1**.

```
# echo -e "server 192.168.25.1\n \
update add test.example.com 3600 IN A 192.168.25.20\n \
send\n" | nsupdate -k /etc/rndc.key
```

4. On Satellite Server, test the DNS entry:

```
# nslookup test.example.com 192.168.25.1
Server: 192.168.25.1
Address: 192.168.25.1#53

Name: test.example.com
Address: 192.168.25.20
```

5. To view the entry in the IdM web UI, navigate to **Network Services > DNS > DNS Zones**. Click the name of the zone and search for the host by name.
6. If resolved successfully, remove the test DNS entry:

```
# echo -e "server 192.168.25.1\n \
update delete test.example.com 3600 IN A 192.168.25.20\n \
send\n" | nsupdate -k /etc/rndc.key
```

7. Confirm that the DNS entry was removed:

```
# nslookup test.example.com 192.168.25.1
```

The above **nslookup** command fails and returns the **SERVFAIL** error message if the record was successfully deleted.

### 4.4.3. Reverting to Internal DNS Service

You can revert to using Satellite Server and Capsule Server as your DNS providers. You can use a backup of the answer file that was created before configuring external DNS, or you can create a backup of the answer file. For more information about answer files, see [Configuring Satellite Server](#).

#### Procedure

On the Satellite or Capsule Server that you want to configure to manage DNS service for the domain, complete the following steps:

#### Configuring Satellite or Capsule as a DNS Server

- If you have created a backup of the answer file before configuring external DNS, restore the answer file and then enter the **satellite-installer** command:

```
# satellite-installer
```

- If you do not have a suitable backup of the answer file, create a backup of the answer file now. To configure Satellite or Capsule as DNS server without using an answer file, enter the following **satellite-installer** command on Satellite and each affected Capsule:

```
# satellite-installer \
--foreman-proxy-dns=true \
--foreman-proxy-dns-managed=true \
```

```
--foreman-proxy-dns-provider=nsupdate \  
--foreman-proxy-dns-server="127.0.0.1" \  
--foreman-proxy-dns-tsig-principal="foremanproxy/satellite.example.com@EXAMPLE.COM" \  
--foreman-proxy-dns-tsig-keytab=/etc/foreman-proxy/dns.keytab
```

For more information, see [Configuring DNS, DHCP, and TFTP on Capsule Server](#).

After you run the **satellite-installer** command to make any changes to your Capsule configuration, you must update the configuration of each affected Capsule in the Satellite web UI.

### Updating the Configuration in the Satellite web UI

1. Navigate to **Infrastructure** > **Capsules**.
2. For each Capsule that you want to update, from the **Actions** list, select **Refresh**.
3. Configure the domain:
  - a. Navigate to **Infrastructure** > **Domains** and click the domain name that you want to configure.
  - b. In the **Domain** tab, set **DNS Capsule** to the Capsule where the subnet is connected.
4. Configure the subnet:
  - a. Navigate to **Infrastructure** > **Subnets** and select the subnet name.
  - b. In the **Subnet** tab, set **IPAM** to **DHCP** or **Internal DB**.
  - c. In the **Domains** tab, select the domain that you want to manage using Satellite or Capsule.
  - d. In the **Capsules** tab, set **Reverse DNS Capsule** to the Capsule where the subnet is connected.
  - e. Click **Submit** to save the changes.

## APPENDIX A. CAPSULE SERVER SCALABILITY CONSIDERATIONS

The maximum number of Capsule Servers that the Satellite Server can support has no fixed limit. The tested limit is 17 Capsule Servers with 2 vCPUs on a Satellite Server with Red Hat Enterprise Linux 7. However, scalability is highly variable, especially when managing Puppet clients.

Capsule Server scalability when managing Puppet clients depends on the number of CPUs, the run-interval distribution, and the number of Puppet managed resources. The Capsule Server has a limitation of 100 concurrent Puppet agents running at any single point in time. Running more than 100 concurrent Puppet agents results in a 503 HTTP error.

For example, assuming that Puppet agent runs are evenly distributed with less than 100 concurrent Puppet agents running at any single point during a run-interval, a Capsule Server with 4 CPUs has a maximum of 1250-1600 Puppet clients with a moderate workload of 10 Puppet classes assigned to each Puppet client. Depending on the number of Puppet clients required, the Satellite installation can scale out the number of Capsule Servers to support them.

If you want to scale your Capsule Server when managing Puppet clients, the following assumptions are made:

- There are no external Puppet clients reporting directly to the Satellite 6 integrated Capsule.
- All other Puppet clients report directly to an external Capsule.
- There is an evenly distributed run-interval of all Puppet agents.



### NOTE

Deviating from the even distribution increases the risk of filling the passenger request queue. The limit of 100 concurrent requests applies.

The following table describes the scalability limits using the recommended 4 CPUs.

**Table A.1. Puppet Scalability Using 4 CPUs**

Puppet Managed Resources per Host	Run-Interval Distribution
1	3000-2500
10	2400-2000
20	1700-1400

The following table describes the scalability limits using the minimum 2 CPUs.

**Table A.2. Puppet Scalability Using 2 CPUs**

Puppet Managed Resources per Host	Run-Interval Distribution
1	1700-1450

Puppet Managed Resources per Host	Run-Interval Distribution
10	1500-1250
20	850-700