



Cisco TelePresence VCS Cluster Creation and Maintenance

Deployment Guide

Cisco VCS X8.2
Cisco TMS 13.2 or later

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Introduction

Cisco TelePresence Video Communication Server (VCS) clusters are designed to extend the resilience and capacity of a VCS installation. VCS peers in a cluster share bandwidth usage as well as routing, zone, FindMe™ and other configuration among themselves. Endpoints can register to any of the peers in the cluster; if they lose connection to their initial peer, they can re-register to another peer in the cluster.

Call licensing is carried out on a per-cluster basis. Any call licenses that have been installed on a cluster peer are available for use by any peer within the cluster. If a cluster peer becomes unavailable, the call licenses installed on that peer will remain available to the rest of the cluster peers for two weeks from the time the cluster lost contact with the peer. This will maintain the overall license capacity of the cluster — however, note that each peer is limited by its physical capacity.

Every VCS peer in the cluster must have the same routing capabilities — if any VCS can route a call to a destination it is assumed that all VCS peers in that cluster can route a call to that destination. If the routing is different on different VCS peers, then separate VCSs / VCS clusters must be used.

This guide describes how to create and maintain VCS clusters. It provides information on:

- [Upgrading an X7.1 or later cluster to X8.2 \[p.6\]](#)
- [Setting up a new cluster of VCS peers \[p.9\]](#)
- [Adding a VCS to an existing cluster \[p.12\]](#)
- [Specifying peer-specific items \[p.17\]](#)
- [Removing a live VCS from a cluster \(permanently\) \[p.19\]](#)
- [Removing an out-of-service VCS from a cluster \(permanently\) \[p.21\]](#)
- [Disbanding a VCS cluster \[p.23\]](#)
- [Changing the primary peer of a VCS cluster \[p.25\]](#)
- [Changing the IP address of a VCS peer \[p.26\]](#)
- [Replacing a VCS peer \[p.27\]](#)

Cisco TMS is required if FindMe configuration is to be sourced from Cisco TMS and also if endpoints are to be provisioned. Cisco TMS is not needed to set up cluster, and FindMe can be configured locally on the VCS cluster if required. (If FindMe is stored locally on the VCS cluster and not sourced by Cisco TMS, there is no way at a later date to move that FindMe information to Cisco TMS.)

Enabling provisioning and creating a cluster are two separate processes. If you intend to enable provisioning on your cluster, either:

- follow the instructions in this guide to create the cluster of VCSs (without provisioning enabled), and then follow the instructions in *Cisco TMS Provisioning Extension Deployment Guide* to enable provisioning across the cluster, or
- follow the instructions in *Cisco TMS Provisioning Extension Deployment Guide* to enable provisioning on what will be the primary VCS, and then follow the instructions in this guide to create the cluster of VCSs

Note that VCS X8 and later supports only Cisco TMS Provisioning Extension mode.

For more information about TMS Agent legacy mode provisioning, or for creating, modifying, and troubleshooting clusters that will remain running on earlier software versions, see earlier versions of this deployment guide. Also, see [Upgrading earlier VCS versions to X8.2 \[p.28\]](#) for information about upgrading these clusters to X8.2.

Prerequisites

Before setting up a cluster of X8.2 VCS peers or adding an X8.2 VCS to a cluster, ensure that:

- All clusters peers are running the same version of code. The only occasion where different peers are allowed to run different versions of code is for the short period of time while a cluster is being upgraded from one version of code to another, during which time the cluster will operate in a partitioned fashion.
- A DNS SRV record is available for the cluster which contains A or AAAA records for each peer of the cluster.
- Each peer has a different LAN configuration (a different IPv4 address and a different IPv6 address, where enabled).
- Each peer in a cluster is within a 15ms hop (30ms round trip delay) of each and every other VCS in or to be added to the cluster.
- Each peer in a cluster is directly routable to each and every other VCS in or to be added to the cluster. (There must be no NAT between cluster peers – if there is a firewall ensure that the required ports are opened.)
- Each peer is using a hardware platform (appliance or virtual machine) with equivalent capabilities; for example, you can cluster peers that are running on standard appliances with peers running on 2 core Medium VMs, but you cannot cluster a peer running on a standard appliance with peers running on 8 core Large VMs.
- All peers have the same set of option keys installed:
 - The number of call license keys may be different on different peers; all other license keys must be identical on each peer.
 - The VCS must be restarted after installing some option keys in order to fully activate them.
- Cisco TMS, if used, is running version 13.2 or later (12.6 or later is permitted if you are not using Cisco TMS for provisioning or FindMe).
- Each peer has a different system name.
- H.323 mode is enabled on each peer (**Configuration > Protocols > H.323**, and for **H.323 mode** select *On*); even if all endpoints in the cluster are SIP only, H.323 signaling is used for endpoint location searching and sharing bandwidth usage information with other peers in the cluster.
- The VCS cluster has a DNS SRV record that defines all cluster peers.
- The DNS servers used by the VCS peers must support both forward and reverse DNS lookups of Cisco TMS and all VCS peer addresses; the DNS servers must also provide address lookup for any other DNS functionality required, such as:
 - NTP servers or the external manager if they configured using DNS names
 - Microsoft Lync Server FQDN lookup
 - LDAP server forward and reverse lookup (reverse lookups are frequently provided through PTR records).Note that DNS server configuration is specific to each peer.
- If Cisco TMS is to be used for replicating FindMe and/or Provisioning data, ensure that Provisioning Extension mode functionality has been enabled on Cisco TMS (see [Cisco TMS Provisioning Extension Deployment Guide](#) for details).

Upgrading an X7.1 or later cluster to X8.2

This procedure describes how to upgrade an existing X7.1 or later cluster to an X8.2 cluster.

We recommend that you upgrade VCS components while the system is inactive.

Prerequisites

If you are using Cisco TMS for device provisioning or FindMe, this procedure assumes that:

- Cisco TMS is already running version 13.2 or later software and is operational with the X7.1 or later cluster.
- The VCS cluster and Cisco TMS are configured and operating using Cisco TMS Provisioning Extension mode.

If Provisioning Extension mode is not already operational, upgrade to Provisioning Extension mode, using the steps in *Cisco TelePresence Management Suite Provisioning Extension Deployment Guide* before performing this upgrade.

For each VCS peer (including the primary), check the **Alarms** page (**Status > Alarms**) and ensure that all alarms are acted upon and cleared.

Upgrade VCS cluster peers to X8.2

Note: To avoid the risk of configuration data being lost, in addition to maintaining service continuity, it is important that you follow the upgrade instructions in the order specified here. In summary, we recommend that you:

1. Upgrade and restart the primary peer first.
2. Upgrade the other non-primary peers and then restart them one at a time.

Full instructions are provided below.

Upgrade the primary peer

For the primary peer in the cluster:

1. Log in to the primary peer as admin on the web interface.
2. Backup the VCS (**Maintenance > Backup and restore**).
You should backup your system before upgrading. If at a later date you need to downgrade to an earlier version, to restore the configuration you will need to restore a backup made against that previous release.
3. Enable maintenance mode:
 - a. Log in to the VCS as admin (SSH or serial).
 - b. At a command prompt, type `xConfiguration SystemUnit Maintenance Mode: On`
Note that from X8.1 you can enable maintenance mode via the web interface (**Maintenance > Maintenance mode**).
This will stop the primary peer processing any new calls (existing calls will be dropped only if a restart occurs; other cluster peers will continue processing calls)
4. Wait for all calls to clear and registrations to timeout on this peer.
 - If necessary, manually remove any calls on this peer that do not clear automatically (using the web browser go to **Status > Calls**, then select the check box next to the calls you want to terminate and

click **Disconnect**).

- If necessary, manually remove any registrations from this peer that do not clear automatically (using the web browser go to **Status > Registrations > By device**, then select the check box next to the devices you want to remove and click **Unregister**).

You can leave the registration for the Conference Factory – this will not be the source of calls, and even if deleted will not roll over to another peer, as other peers have their own Conference Factory registration (if enabled).

5. Upgrade and restart the primary VCS (**Maintenance > Upgrade**).

For any further details see the "Upgrading Software" section of *VCS Administrator Guide*.

Note that the web browser interface may timeout during the restart process, after the progress bar has reached the end. This may occur if VCS carries out a disk file system check – which it does approximately once every 30 restarts, or if it has not checked its disks in the last 6 months.

Upgrading of the software on the primary VCS is now complete.

Cluster-related alarms

You can ignore any cluster-related alarms that occur during the upgrade process, for example:

- "Cluster communication failure" alarm on the primary or any non-primary peers – this is expected.
- "Cluster replication error: cannot find primary or this subordinate's peer configuration file, manual synchronization of configuration is required"

Similarly you can ignore any Cisco TMS warnings and emails about cluster problems created during this upgrade. These alarms and warnings are expected and will clear when all cluster peers are upgraded and cluster data synchronization has occurred (they should clear within 10 minutes of the complete upgrade).

On the primary VCS peer:

1. Check that configuration data exists as expected:
 - If FindMe is in use, check that the expected FindMe entries still exist (**Status > Applications > TMS Provisioning Extension Services > FindMe > Accounts**).
 - Check configuration for items from the **System**, **Configuration** and **Application** menus.
2. Backup the VCS (**Maintenance > Backup and restore**).

Note: While VCS peers are running different versions of code, we recommend that configuration changes to any VCS in the cluster are limited to the changes needed to complete the upgrade. Configuration changes will not be replicated across VCS peers that are not running the same version of software as the primary VCS.

Upgrade non-primary peers

You can ignore any cluster-related alarms that occur during the upgrade process – these are expected.

For each non-primary peer in the cluster:

1. Log in to the non-primary peer as admin on the web interface.
2. Backup the VCS (**Maintenance > Backup and restore**).

You should backup your system before upgrading. If at a later date you need to downgrade to an earlier version, to restore the configuration you will need to restore a backup made against that previous release.
3. Enable maintenance mode:

- a. Log in to the VCS as admin (SSH or serial).
 - b. At a command prompt, type `xConfiguration SystemUnit Maintenance Mode: On`
Note that from X8.1 you can enable maintenance mode via the web interface (**Maintenance > Maintenance mode**).
4. Wait for all calls to clear and registrations to timeout on this peer.
 - If necessary, manually remove any calls on this peer that do not clear automatically (using the web browser go to **Status > Calls**, then select the check box next to the calls you want to terminate and click **Disconnect**).
 - If necessary, manually remove any registrations from this peer that do not clear automatically (using the web browser go to **Status > Registrations > By device**, then select the check box next to the devices you want to remove and click **Unregister**).
You can leave the registration for the Conference Factory – this will not be the source of calls, and even if deleted will not roll over to another peer, as other peers have their own Conference Factory registration (if enabled).
 5. Upgrade and restart the VCS (**Maintenance > Upgrade**).
If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the web interface before restarting the next peer.
For any further details see the "Upgrading Software" section of *VCS Administrator Guide*.
Note that the web browser interface may timeout during the restart process, after the progress bar has reached the end. This may occur if VCS carries out a disk file system check – which it does approximately once every 30 restarts, or if it has not checked its disks in the last 6 months.

Upgrading the software on this non-primary VCS peer is now complete.

Cluster-related alarms

You can ignore any cluster-related alarms that occur during the upgrade process, for example:

- "Cluster communication failure" alarm on the primary or any non-primary peers – this is expected.
- "Cluster replication error: cannot find primary or this subordinate's peer configuration file, manual synchronization of configuration is required"

Similarly you can ignore any Cisco TMS warnings and emails about cluster problems created during this upgrade. These alarms and warnings are expected and will clear when all cluster peers are upgraded and cluster data synchronization has occurred (they should clear within 10 minutes of the complete upgrade).

On this non-primary VCS peer:

1. Go to **Status > Alarms** and ensure that all alarms are acted upon and cleared.
2. Check that configuration data exists as expected:
 - If FindMe is in use, check that the expected FindMe entries still exist (**Status > Applications > TMS Provisioning Extension Services > FindMe > Accounts**).
 - Check configuration for items from the **System**, **Configuration** and **Application** menus.
3. Repeat these steps for each non-primary peer.

After all the cluster peers have been upgraded: check cluster status

On each VCS (including the primary), go to **System > Clustering** and check that the cluster database status reports as Active.

Upgrading an X7.1 or later cluster to an X8.2 cluster is now complete.

Setting up a new cluster of VCS peers

Note: This procedure requires a period of downtime for the VCS service. Ensure that these instructions are followed in a scheduled maintenance window.

If Device Provisioning is to be used with an X8.2 VCS cluster, then use of Cisco TMS is essential. Also if FindMe is to be managed by Cisco TMS, then use of Cisco TMS is essential. If neither Device Provisioning nor FindMe managed by Cisco TMS is to be used, then use of Cisco TMS is optional but recommended.

Process summary

This process initiates a cluster of a single VCS. Do not use this process if the cluster already exists.

To complete the cluster containing multiple VCSs, when this section is complete, follow the instructions in [Adding a VCS to an existing cluster \[p.12\]](#) to add the non-primary peers to the cluster.

Prerequisites

- Cisco TMS, if used, is running version 13.2 or later (12.6 or later is permitted if you are not using Cisco TMS for provisioning or FindMe).
- If Device Provisioning or FindMe are managed by Cisco TMS, this VCS and Cisco TMS must be operating in Provisioning Extension mode, and this mode proven to be operational.
- If a firewall exists between cluster peers, it must be configured to permit the traffic documented in [Appendix 3: IP ports and protocols \[p.35\]](#).
- All VCSs to be included in the cluster must be running the same version (X8.2) of VCS software.

Set up the primary peer of the cluster

This process sets up the first (primary) peer of this new cluster – additional peers are added afterwards using the [Adding a VCS to an existing cluster \[p.12\]](#) process.

Before proceeding, the VCS that will be the primary must be determined. The primary VCS will be the source of the configuration information for all VCS peers in the cluster. Non-primary VCS peers will have their configuration deleted and replaced by that from the primary.

On other VCSs:

Check that no other VCS (anywhere in the organization) has this VCS's IP address in its clustering peers list.

On this primary VCS:

1. Check that the VCS is running X8.2 software.
2. Backup the VCS (**Maintenance > Backup and restore**).
3. Using the web interface, review the configuration to ensure that the VCS has:
 - A valid Ethernet speed (**System > Ethernet**).
 - Valid IP address and IP gateway (**System > IP**).
 - The same set of option keys installed as those that will be installed on all other peers of the cluster (**Maintenance > Option keys**).Note that the number of call license keys may be different on different peers; all other license keys must be identical on each peer.

- At least one valid DNS server configured, and that if unqualified DNS names are used elsewhere (e.g. for the NTP server), that the correct **Domain name** is also configured (**Domain name** is added as a suffix to an unqualified DNS name to make it into an FQDN) (**System > DNS**).
 - A valid and working NTP server configured (**System > Time**; in the Status section, the State should be “**Synchronized**”).
 - No peers configured (**System > Clustering** – all Peer x IP address fields on this page should be blank. If not, delete any entries and click **Save**).
4. Ensure that this VCS does not list any of the VCSs that are to be peers in this new cluster in any of its neighbor zones or traversal zones (**Configuration > Zones > Zones** then check each neighbor and traversal zone).
 5. Set the **H.323 Time to live** to 60 (seconds) so that if a VCS becomes inaccessible to an endpoint, the endpoint will re-register quickly with another peer (**Configuration > Protocols > H.323**).
 6. Go to **System > DNS** and ensure that **System host name** is the DNS hostname for this VCS (typically the same as the **System name** in **System > Administration**, but excluding spaces, and unique for each VCS in the cluster). If it is not configured correctly, set it up appropriately and click **Save**.
Note: <System host name>.<DNS domain name> = FQDN of this VCS
 7. Go to **Configuration > Call routing** and set **Call signaling optimization** to *On*.
 8. Click **Save**.
 9. Enable maintenance mode:
 - a. Go to **Maintenance > Maintenance mode**.
 - b. Set **Maintenance mode** to *On*.
 - c. Click **Save** and click **OK** on the confirmation dialog.
 10. Wait for all calls to clear and registrations to timeout on this peer.
 - If necessary, manually remove any calls on this peer that do not clear automatically (using the web browser go to **Status > Calls**, then select the check box next to the calls you want to terminate and click **Disconnect**).
 - If necessary, manually remove any registrations from this peer that do not clear automatically (using the web browser go to **Status > Registrations > By device**, then select the check box next to the devices you want to remove and click **Unregister**).
You can leave the registration for the Conference Factory – this will not be the source of calls, and even if deleted will not roll over to another peer, as other peers have their own Conference Factory registration (if enabled).
 11. Go to **System > Clustering** and ensure that **Cluster name** is the routable Fully Qualified Domain Name used in SRV records that address this VCS cluster, for example **cluster1.example.com**. (See [Appendix 6: Cluster name and DNS SRV records \[p.41\]](#)).
Change the **Cluster name** if necessary.
 12. Click **Save**.
 13. On the **Clustering** page configure the fields as follows:

Configuration primary	1
Cluster pre-shared key	Enter a password (any characters)
Peer 1 IP address	Set to the IP address of this (the primary peer) VCS

Note: If the VCS has advanced networking, the **Peer IP address** MUST specify the LAN 1 interface address. Also, this interface must not have NAT enabled on it.

14. Click **Save**.
To the right of the **Peer 1 IP address** field the words “**This system**” should appear (though this may require the page to be refreshed before they appear).
15. Restart the VCS (go to **Maintenance > Restart options**, then click **Restart** and confirm **OK**).

After the restart, on the primary VCS web interface:

1. Check that configuration data exists as expected:
 - If FindMe is in use, check that the expected FindMe entries still exist (**Status > Applications > TMS Provisioning Extension Services > FindMe > Accounts**).
 - Check configuration for items from the **System, Configuration** and **Application** menus.
2. Backup the VCS (**Maintenance > Backup and restore**).

On other devices:

If you have any other VCSs neighbored (or connected via a traversal zone) to this primary VCS peer, ensure that their zone configuration for this cluster is updated to only include the address of this primary VCS.

On this primary VCS peer:

1. Log in to the web browser of this VCS.
2. Go to **Status > Alarms**.
If there is an alarm that the VCS must be restarted, go to **Maintenance > Restart options** and then click **Restart**.
3. If the VCS did not need to be restarted, ensure that maintenance mode is disabled.
 - a. Go to **Maintenance > Maintenance mode**.
 - b. Set **Maintenance mode** to *Off*.
 - c. Click **Save**.

After the primary peer configuration

Go to **Status > Alarms** and ensure that all alarms are acted upon and cleared.

The setup of the new cluster (of one VCS) is complete; add other VCSs to the cluster using [Adding a VCS to an existing cluster \[p.12\]](#).

If Microsoft Lync is to be connected to this cluster, see [Appendix 4: Impact of clustering on other VCS applications \[p.36\]](#).

Adding a VCS to an existing cluster

Follow this process if you have an existing X8.2 cluster (of one or more peers) to which you want to add another VCS peer. If you do not have an existing cluster, following the instructions in the section [Setting up a new cluster of VCS peers \[p.9\]](#).

This process will add an X8.2 VCS to the cluster and replicate the cluster primary's configuration onto that VCS. Note that:

- You can have up to 6 VCSs, including the primary VCS, in a cluster.
- Only one VCS must be added to the cluster at a time.

Prerequisites

General prerequisites:

- If Device Provisioning is enabled, or FindMe is managed by Cisco TMS the existing cluster of 1 or more peers must already be running using Provisioning Extension mode.
- All VCSs to be included in the cluster must be running the same version (X8.2) of VCS software.

Add the new peer

On the primary VCS:

Ensure that the primary VCS does not list this new VCS peer in any of its neighbor zones or traversal zones ([Configuration > Zones > Zones](#)).

Note: The primary VCS will be the source of the configuration for this new VCS peer and all other VCS peers in the cluster. When a VCS is added to the cluster, its configuration will be deleted and replaced by that from the primary.

On the VCS to be added to the cluster:

1. Check that no other VCS (anywhere in the organization) has this VCS's IP address in its clustering peers list.
2. Backup the VCS ([Maintenance > Backup and restore](#)).
3. Using the web interface, review the configuration to ensure that the VCS has:
 - A valid Ethernet speed ([System > Ethernet](#)).
 - Valid IP address and IP gateway ([System > IP](#)).
 - The same set of option keys installed as those that will be installed on all other peers of the cluster ([Maintenance > Option keys](#)).
Note that the number of call license keys may be different on different peers; all other license keys must be identical on each peer.
 - At least one valid DNS server configured, and that if unqualified DNS names are used elsewhere (e.g. for the NTP server), that the correct **Domain name** is also configured (**Domain name** is added as a suffix to an unqualified DNS name to make it into an FQDN) ([System > DNS](#)).
 - A valid and working NTP server configured ([System > Time](#); in the Status section, the State should be "Synchronized").
 - No peers configured ([System > Clustering](#) – all Peer x IP address fields on this page should be blank. If not, delete any entries and click **Save**).

If the cluster is managed by Cisco TMS, this VCS being added to the cluster must also be managed by Cisco TMS.

If Cisco TMS is used, on the VCS to be added to the cluster:

1. Ensure that the VCS can see Cisco TMS.
To do this, go to **System > External manager** and in the Status section, ensure that the **State** is **Active**. If it is not active, follow the process in [Appendix 2: Adding a VCS to Cisco TMS \[p.33\]](#).
2. Ensure that Cisco TMS can communicate with this VCS.
To do this, on Cisco TMS go to **Systems > Navigator** (and any required sub folders) then click on the name of the VCS and ensure that it says:
“✓ System has no open or acknowledged tickets”
If it does not say this, follow the process in [Appendix 2: Adding a VCS to Cisco TMS \[p.33\]](#).

On the VCS being added to the cluster:

Go to **Status > Alarms**. If there is an alarm that the VCS must be restarted, go to **Maintenance > Restart options** and then click **Restart**.

If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the web interface before restarting the next peer.

If Cisco TMS is used:

1. For the VCS to be added to the cluster, ensure that the Host Name of the VCS is set up in Cisco TMS:
 - a. Go to **Systems > Navigator** (and any required sub folders).
 - b. Select this VCS.
 - c. Select the **Connection** tab.
 - d. Set **Host Name** to be the FQDN of this non-primary peer, for example vcs3.uk.company.com.
 - e. Click **Save/Try**.
You can ignore any error messages such as “DNS config failure resolving <DNS name>: Did not find system IP address () in DNS: <Server IP>”
 - f. Ensure that Cisco TMS updates its DNS.
 - i. Select the **Settings** tab.
 - ii. Click **Force Refresh**.
2. Review FindMe accounts (if applicable).
If Cisco TMS is configured to replicate FindMe information with this VCS being added to the cluster (to check: on Cisco TMS go to **Systems > Navigator** (and any required sub folders) select this VCS, select the **Provisioning** tab and see if the FindMe services tick box is selected), then any user accounts that existed on the VCS should be deleted.
 - If FindMe replication is not enabled, no FindMe data will be stored on Cisco TMS, and so the FindMe entries do not need to be deleted.
 - If FindMe data is provisioned from Cisco TMS, delete any user accounts that currently exist. On the VCS being added to the cluster:
 - i. Go to **Users > FindMe accounts**.
 - ii. Select all of the accounts shown and click **Delete**.

On the VCS being added to the cluster:

1. Enable maintenance mode:
 - a. Go to **Maintenance > Maintenance mode**.
 - b. Set **Maintenance mode** to *On*.
 - c. Click **Save** and click **OK** on the confirmation dialog.

2. Wait for all calls to clear and registrations to timeout on this peer.
 - If necessary, manually remove any calls on this peer that do not clear automatically (using the web browser go to **Status > Calls**, then select the check box next to the calls you want to terminate and click **Disconnect**).
 - If necessary, manually remove any registrations from this peer that do not clear automatically (using the web browser go to **Status > Registrations > By device**, then select the check box next to the devices you want to remove and click **Unregister**).
You can leave the registration for the Conference Factory – this will not be the source of calls, and even if deleted will not roll over to another peer, as other peers have their own Conference Factory registration (if enabled).

On the primary VCS:

1. Go to **System > Clustering**.
One or more of the **Peer x IP address** fields should be empty.
2. In the first empty field, enter the IP address of the new VCS peer.

Note:

- Only one VCS must be added to the cluster at a time (repeat the whole process if multiple VCS peers are being added).
 - If the new VCS peer has advanced networking, the Peer IP address MUST specify the LAN 1 interface address – also this interface must not have NAT enabled on it.
-

3. Click **Save**.
Peer 1 should indicate '**This system**'. The new peer may indicate '**Unknown**' and then with a refresh should indicate '**Failed**' as the VCS is not completely added to the cluster.

Note:

- A cluster communication failure alarm will be raised on the primary and on other non-primary peers already in the cluster advising that this new VCS peer is not communicating – this will clear later.
 - Cluster configuration replication is suspended at this point until the new VCS has been completely added. Any changes made to the configuration of the cluster will not be replicated until this VCS has been completely added.
-

On every other non-primary VCS already in the cluster (not the VCS being added):

1. Go to **System > Clustering** and configure the fields as follows:

Cluster name	Identical to the Cluster name configured on the primary VCS
Cluster pre-shared key	Identical to that configured on the primary VCS
Configuration primary	Identical to that configured on the primary VCS
Peer 1 IP address ...Peer 6 IP address	Identical to those configured on the primary VCS

2. Click **Save**.

On the additional non-primary VCS being added to the cluster:

1. Log in as admin on an SSH or other CLI interface. At the VCS command prompt, type:

```
xcommand DefaultValueSet Level: 2
xcommand DefaultLinksAdd
```

Note: This command removes any LDAP authentication configuration – ensure that you have the web admin password before executing this command.

2. Go to **Users > Administrator accounts**.
3. Delete all entries except the default admin account.
4. Go to **System > DNS** and ensure that **System host name** is the DNS hostname for this VCS (typically the same as the **System name** in **System > Administration**, but excluding spaces, and unique for each VCS in the cluster). If it is not configured correctly, set it up appropriately and click **Save**.
Note: <System host name>.<DNS domain name> = FQDN of this VCS
5. Go to **System > Clustering** and configure the fields as follows:

Cluster name	Identical to the Cluster name configured on the primary VCS
Cluster pre-shared key	Identical to that configured on the primary VCS
Configuration primary	Identical to that configured on the primary VCS
Peer 1 IP address ...Peer 6 IP address	Identical to those configured on the primary VCS

6. Click **Save**.
Note that a cluster communication failure alarm will be raised on this VCS peer advising that this new VCS is not communicating – this will clear after the restart.
7. Restart the VCS (go to **Maintenance > Restart options**, then click **Restart** and confirm **OK**).
If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the web interface before restarting the next peer.
8. After the restart, wait approximately 2 minutes – this is the frequency with which configuration is copied from the primary.
9. Go to **Status > Alarms**. If there is an alarm that the VCS must be restarted, go to **Maintenance > Restart options** and then click **Restart**.
If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the web interface before restarting the next peer.
10. Check that configuration data exists as expected:
 - If FindMe is in use, check that the expected FindMe entries still exist (**Status > Applications > TMS Provisioning Extension Services > FindMe > Accounts**).
 - Check configuration for items from the **System**, **Configuration** and **Application** menus.

On other devices:

If you have any other VCSs neighbored (or connected via a traversal zone) to this cluster of VCS peers, ensure that their zone configuration for this cluster is updated to include the address of this new peer.

On each VCS peer (including the primary and this new VCS peer):

Go to **Status > Alarms**. If there is an alarm that the VCS must be restarted, go to **Maintenance > Restart options** and then click **Restart**.

If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the web interface before restarting the next peer.

Check replication status

It can take 5 or more minutes before VCS reports the successful status. If problems are seen, refresh the screen after waiting 5 minutes.

On VCS:

1. Go to **System > Clustering** and check that the cluster database status reports as Active.
2. If Cisco TMS is being used, ensure that Cisco TMS has all the correct settings for this upgraded VCS by forcing a refresh of Cisco TMS.

On Cisco TMS:

1. For every VCS in the cluster (including the primary VCS):
 - a. Select **Systems > Navigator** (and any required sub folders) and click on the name of the VCS.
 - b. Select the **Settings** tab.
 - c. Click **Force Refresh**.
2. Repeat for all VCS peers in the cluster.

Additional cluster configuration

If Conference Factory (Multiway™) is to be used, see [Appendix 4: Impact of clustering on other VCS applications \[p.36\]](#).

If the cluster has non-default trusted CA certificate and / or non default server certificate ensure that the added peer is configured with the required trusted CA certificate and an appropriate server certificate.

Adding an X8.2 VCS to a VCS X8.2 cluster is now complete.

Specifying peer-specific items

Most items of configuration are applied to all peers in a cluster. However, the following items (marked with a † on the web interface) must be specified separately on each cluster peer.

Cluster configuration (System > Clustering)

The list of **Peer IP addresses** (including the peer's own IP address) that make up the cluster has to be specified on each peer and they must be identical on each peer.

The **Cluster name** and **Cluster pre-shared key** have to be specified on each peer and must be identical for all peers.

Ethernet speed (System > Ethernet)

The **Ethernet speed** is specific to each peer. Each peer may have slightly different requirements for the connection to their Ethernet switch.

IP configuration (System > IP)

LAN configuration is specific to each peer.

- Each peer must have a different **IPv4 address** and a different **IPv6 address**.
- **IP gateway** configuration is peer-specific. Each peer can use a different gateway.
- IP routes (also known as static routes) are peer-specific. If these are used, they can be different for each peer.

Note that the IP protocol is applied to all peers, because each peer must support the same protocols.

System name (System > Administration)

The **System name** must be different for each peer in the cluster.

DNS servers and DNS host name (System > DNS)

DNS servers are specific to each peer. Each peer can use a different set of DNS servers.

The **System host name** and **Domain name** are specific to each peer.

NTP servers and time zone (System > Time)

The **NTP servers** are specific to each peer. Each peer may use one or more different NTP servers.

The **Time zone** is specific to each peer. Each peer may have a different local time.

SNMP (System > SNMP)

SNMP settings are specific to each peer. They can be different for each peer.

Logging (Maintenance > Logging)

The Event Log and Configuration Log on each peer only report activity for that particular VCS. The **Log level** and the list of **Remote syslog servers** are specific to each peer. We recommend that you set up a remote syslog server to which the logs of all peers can be sent. This allows you to have a global view of activity across all peers in the cluster.

Security certificates (Maintenance > Security certificates)

The trusted CA certificate, server certificate and certificate revocation lists (CRLs) used by the VCS must be uploaded individually per peer.

Administration access (System > Administration)

The following system administration access settings are specific to each peer:

- Serial port / console
- SSH service
- Web interface (over HTTPS)
- Redirect HTTP requests to HTTPS
- Automated protection service

Option keys (Maintenance > Option keys)

Option keys are specific to each peer. Each peer must have an identical set of option keys installed, but you must purchase these separately for each peer in the cluster. However, this does not apply to traversal call licenses, non-traversal call licenses and TURN relay licenses; these licenses can be installed on any cluster peer and are available for use by any peer in the cluster.

Active Directory Service (Configuration > Authentication > Devices > Active Directory Service)

When configuring the connection to an Active Directory Service for device authentication, the **NetBIOS machine name (override)**, and domain administrator **Username** and **Password** are specific to each peer.

Conference Factory template (Applications > Conference Factory)

The template used by the Conference Factory application to route calls to the MCU is peer-specific, as it must be unique for each peer in the cluster.

VCS front panel display mode (configurable through CLI only)

The `xConfiguration Administration LCDPanel Mode` CLI setting is specific to each peer.

Note: configuration data that is applied across all peers should not be modified on non-primary peers. At best it will result in the changes being overwritten from the primary; at worst it will cause cluster replication to fail.

Removing a live VCS from a cluster (permanently)

This process removes one VCS peer from an existing cluster. FindMe and configuration replication to this VCS will be stopped and the VCS will no longer be included in the list of peers in the cluster. Provisioning will also be disabled on the removed VCS.

- If the whole cluster is to be disbanded then use the [Disbanding a VCS cluster \[p.23\]](#) procedure instead.
- If the cluster peer to be removed is not accessible, use the procedure defined in [Removing an out-of-service VCS from a cluster \(permanently\) \[p.21\]](#).

Before starting:

1. Ensure that the VCS to be removed from the cluster is not indicated as the primary peer. If it is the primary, see [Changing the primary peer of a VCS cluster \[p.25\]](#) for instructions on how to make a different peer the primary.

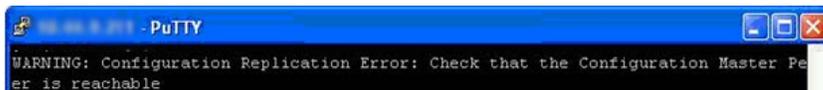
On the VCS that is being removed:

1. Log into the web interface.
2. Go to **System > Clustering**:
 - a. Change the **Cluster name** to a unique ID for this VCS (ideally to the routable Fully Qualified Domain Name used in SRV records that address this individual VCS, for example "vcse1.example.com". See [Appendix 6: Cluster name and DNS SRV records \[p.41\]](#).)
 - b. Delete the **Cluster pre-shared key**.
 - c. Delete all entries in the **Peer x IP address** fields.

3. Click **Save**.

Note that:

- All previous FindMe users will still be available on this removed VCS. Remove them manually (**Users > FindMe accounts**) if required.
- An alarm similar to that shown below may appear on the web interface and CLI of the VCS being removed. This is not a problem, the alarm will be cleared when the VCS is restarted:



4. If Microsoft Lync B2BUA was used in the cluster:
 - a. Go to **Applications > B2BUA > Microsoft Lync > Configuration**.
 - b. If **Microsoft Lync B2BUA** is *Enabled*, change it to *Disabled* and click **Save**.
5. Restart the VCS (go to **Maintenance > Restart options**, then click **Restart** and confirm **OK**).

On the primary VCS:

1. Go to **System > Clustering**.
2. Delete the IP address of the VCS that has been removed.
3. If the VCS being removed is not the last field in the list, move any other IP addresses up the list so that there are no empty fields between entries.
4. If the primary VCS peer's IP address has been moved up the list in the previous step, alter the **Configuration primary** value to match its new location.
5. Click **Save**.

On all the remaining non-primary VCS peers:

1. Go to **System > Clustering**.
2. Edit the **Peer x IP address** and **Configuration primary** fields so that they are identical to those configured on the primary VCS.
3. Click **Save**.
4. Repeat for all remaining non-primary VCS peers until they all have identical clustering configuration.

On other devices:

1. If you have any other systems neighbored (or connected via a traversal zone) to this cluster of VCS peers, ensure that their zone configuration for this cluster is updated to exclude the address of the removed peer.
2. If you have any endpoints registering to the VCS that has now been removed, change the configuration of the endpoint (or the configuration of the DNS server entry that points to the cluster peers) so that they register to one of the remaining clustered VCS peers instead.

CAUTION: The removed VCS will retain its configuration at the time it is removed from the cluster, and will continue to function as a non-clustered VCS. After it has been removed from the cluster, we recommend that it is taken out of service (e.g. perform a factory reset as documented in [Removing an out-of-service VCS from a cluster \(permanently\) \[p.21\]](#) before reconnecting the out-of-service VCS back to the network) or an alternative configuration is applied to the VCS, so that other devices no longer try to use it as a cluster peer.

Removing a live VCS from a cluster is now complete.

Removing an out-of-service VCS from a cluster (permanently)

Use the following procedure if:

- the VCS is dead and needs to be RMA'd, or
- the VCS cannot be accessed for some other reason

If the whole cluster is to be disbanded then use the procedure defined in [Disbanding a VCS cluster \[p.23\]](#).

If the cluster peer to be removed is accessible, use the procedure defined in [Removing a live VCS from a cluster \(permanently\) \[p.19\]](#) which clears up the removed VCS as well as its previous peers.

Note: This procedure does not delete clustering configuration from the removed VCS. When removed, you must not reconnect the out-of-service VCS without first deleting all of its peers and stopping FindMe and configuration replication (see [Before reconnecting the out-of-service VCS back to the network \[p.22\]](#) below).

Before starting:

Ensure that the VCS to be removed from the cluster is not indicated as the primary VCS on Cisco TMS.

If it is the primary VCS, see [Changing the primary peer of a VCS cluster \[p.25\]](#) for instructions on how to make a different peer the primary.

On the primary VCS:

1. Go to **System > Clustering**.
2. Delete the IP address of the VCS that has been removed.
3. If the VCS being removed is not the last field in the list, move any other IP addresses up the list so that there are no empty fields between entries.
4. If the primary VCS peer's IP address has been moved up the list in the previous step, alter the **Configuration primary** value to match its new location.
5. Click **Save**.

On all the remaining non-primary VCS peers:

1. Go to **System > Clustering**.
2. Edit the **Peer x IP address** and **Configuration primary** fields so that they are identical to those configured on the primary VCS.
3. Click **Save**.
4. Repeat for all remaining non-primary VCS peers until they all have identical clustering configuration.

On other devices:

1. If you have any other systems neighbored (or connected via a traversal zone) to this cluster of VCS peers, ensure that their zone configuration for this cluster is updated to exclude the address of the removed peer.
2. If you have any endpoints registering to the VCS that has now been removed, change the configuration of the endpoint (or the configuration of the DNS server entry that points to the cluster peers) so that they register to one of the remaining clustered VCS peers instead.

Removing an out-of-service VCS from a cluster is now complete.

Before reconnecting the out-of-service VCS back to the network

If the removed VCS is ever recovered, before you reconnect it you must clear out its configuration. This is most easily implemented as follows:

1. Log into the VCS as root (over serial or SSH – serial connection will show more details as the factory reset progresses).
2. Type **factory-reset**
3. Answer the prompts as follows:
 - a. Keep option keys = YES
 - b. Keep IP configuration = YES or NO - depends on whether the VCS has been replaced with another at the same IP address
 - c. Keep SSH keys = NO
 - d. Keep root and admin passwords = YES or NO ... as desired
 - e. Save log files = NO ... unless specifically requested for analysis purposes
 - f. Replace hard disk = NO
 - g. Are you sure you want to continue = YESSome messages will be displayed, then connection over serial / SSH will be lost.
It may take some 20 or more minutes before VCS is available to access again.
4. Log into the VCS as admin over SSH.
5. Type **xcommand DefaultLinksAdd**

This ensures that the configuration of the recovered VCS is returned to default and it will not interact with its ex-peers.

Disbanding a VCS cluster

This process removes all VCS peers from an existing cluster. FindMe and configuration replication will be stopped, as will provisioning, and the cluster will be deleted from Cisco TMS.

Each VCS will retain its configuration at the time the cluster was disbanded, and will function as a stand-alone VCS.

CAUTION: If any of the VCSs are left in operation after being removed from the cluster, calls between endpoints registered to different VCSs that were once part of the same cluster will not succeed. This is because after the cluster has been disbanded, the Cluster Subzone will no longer exist and there will not be any link between the two VCSs over which calls can be routed. To overcome this, you must create neighbor relationships between the VCSs so that there are links between them.

Before you start:

If any VCS is not accessible, firstly remove it using the procedure [Removing an out-of-service VCS from a cluster \(permanently\) \[p.21\]](#).

If Cisco TMS is used (in Provisioning Extension mode):

1. Select **Systems > Navigator** (and any required sub folders), then click on any VCS in the cluster.
2. Select the **Provisioning** tab.
3. Disable all 4 services (clear tick boxes).
4. Click **Save**.

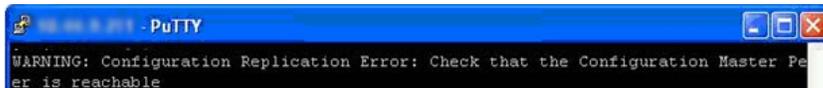
On each non-primary VCS peer:

1. Log into the web interface.
2. Go to **System > Clustering**:
 - a. Change the **Cluster name** to a unique ID for this VCS (ideally to the routable Fully Qualified Domain Name used in SRV records that address this individual VCS, for example "vcse1.example.com". See [Appendix 6: Cluster name and DNS SRV records \[p.41\]](#).)
 - b. Delete the **Cluster pre-shared key**.
 - c. Delete all entries in the **Peer x IP address** fields.

3. Click **Save**.

Note that:

- All previous FindMe users will still be available on this removed VCS. Remove them manually (**Users > FindMe accounts**) if required.
- An alarm similar to that shown below may appear on the web interface and CLI of the VCS being removed. This is not a problem, the alarm will be cleared when the VCS is restarted:



4. If Microsoft Lync B2BUA was used in the cluster:
 - a. Go to **Applications > B2BUA > Microsoft Lync > Configuration**.
 - b. If **Microsoft Lync B2BUA** is *Enabled*, change it to *Disabled* and click **Save**.
5. Restart the VCS (go to **Maintenance > Restart options**, then click **Restart** and confirm **OK**).
If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the

web interface before restarting the next peer.

6. Repeat for each non-primary VCS.

On the primary VCS:

1. Log into the web interface.
2. Go to **System > Clustering**:
 - a. Optionally, change the **Cluster name** to a unique ID for this VCS (ideally to the routable Fully Qualified Domain Name used in SRV records that address this individual VCS, for example "vcse1.example.com". (See [Appendix 6: Cluster name and DNS SRV records \[p.41\].](#)))
 - b. Delete the **Cluster pre-shared key**.
 - c. Delete all entries in the **Peer x IP address** fields.

3. Click **Save**.

Note that:

- All previous FindMe users will still be available on this removed VCS
- An alarm similar to that shown below may appear on the web interface and CLI of the VCS being removed. This is not a problem, the alarm will be cleared when the VCS is restarted:



4. Restart the VCS (go to **Maintenance > Restart options**, then click **Restart** and confirm **OK**).

On other devices:

1. If you have any other systems neighbored (or connected via a traversal zone) to this cluster of VCS peers, ensure that they have those zones removed, or modified appropriately.
2. If you have any endpoints registering to this VCS cluster, change the configuration of the endpoints (or the configuration of the DNS server entry that points to the cluster peers) so that they now register with an appropriate VCS.

Disband a cluster of VCSs is now complete.

Changing the primary peer of a VCS cluster

This procedure can be applied regardless of whether the old primary peer is accessible or not.

Note: The operations in this process should be performed successively so that the cluster is not left in a state where there are multiple VCSs which think they are cluster primary.

On the “new” primary VCS:

1. Go to **System > Clustering**.
2. From the **Configuration primary** drop-down menu select the ID number of the peer entry that says ‘This system’.
3. Click **Save**.
While performing this change of primary peer, ignore any alarms on VCS that report ‘Cluster primary mismatch’ or ‘Cluster replication error’ – they will be rectified as part of this procedure.

On all other VCS peers, starting with the “old” primary peer (if it is still accessible):

1. Go to **System > Clustering**.
2. From the **Configuration primary** drop-down menu select the ID number of the “new” primary VCS.
3. Click **Save**.

On each VCS in the cluster (including the primary):

1. Confirm that the change to the **Configuration primary** has been accepted by going to **System > Clustering** and refreshing the page.
2. If any VCSs have not accepted the change, repeat the steps above.
3. Check that the cluster database status reports as Active.

Note that any alarms raised on the VCS peers that relate to ‘Cluster primary mismatch’ and ‘Cluster replication error’ should clear automatically after approximately 2 minutes.

Cisco TMS

No changes are required; Cisco TMS will see the primary change on the VCS cluster and report this appropriately.

If the old primary is not available

If you are changing the primary because the “old” primary is not accessible, remove the “old” primary using the [Removing an out-of-service VCS from a cluster \(permanently\) \[p.21\]](#) procedure.

If the “old” primary was not accessible when changing the cluster primary peer, but later becomes available, you must bring it back into the cluster using the [Adding a VCS to an existing cluster \[p.12\]](#) procedure.

Changing the primary peer of a VCS cluster is now complete.

Changing the IP address of a VCS peer

To change the IP address of a VCS peer you must remove the VCS from the cluster, change its IP address, and then add the VCS back into the cluster.

The process is as follows:

1. Ensure that the VCS whose IP address is to be changed is not the primary VCS.
If it is the primary VCS, follow the steps in [Changing the primary peer of a VCS cluster \[p.25\]](#) to make a different peer the primary.
2. Carry out the process documented in [Removing a live VCS from a cluster \(permanently\) \[p.19\]](#).
3. Change the IP address of the VCS.
4. Carry out the process documented in [Adding a VCS to an existing cluster \[p.12\]](#).

Changing the IP address of a VCS peer is now complete.

Replacing a VCS peer

This section summarizes the procedure for replacing a cluster peer VCS with a different unit.

1. Ensure that the VCS to be replaced is not the primary VCS.
If it is the primary VCS, follow the steps in [Changing the primary peer of a VCS cluster \[p.25\]](#) to make a different peer the primary.
2. Remove the existing peer from the cluster:
 - a. If the cluster peer to be replaced is not accessible, use the procedure defined in [Removing an out-of-service VCS from a cluster \(permanently\) \[p.21\]](#).
 - b. If the cluster peer to be replaced is accessible, use the procedure defined in [Removing a live VCS from a cluster \(permanently\) \[p.19\]](#).
3. Add the replacement peer to the cluster using the procedure defined in [Adding a VCS to an existing cluster \[p.12\]](#).

Upgrading earlier VCS versions to X8.2

This section describes how to upgrade earlier VCS versions to X8.2.

Upgrading an X7.1 or X7.2 cluster in TMS Agent legacy mode to an X8.2 cluster

As from X8, TMS Agent legacy mode is no longer supported. You cannot upgrade directly from a cluster running in TMS Agent legacy mode to an X8 or later cluster.

To upgrade to X8.2 you must:

1. Upgrade your X7.1 or X7.2 cluster to Provisioning Extension mode as described in *Cisco TelePresence Management Suite Provisioning Extension Deployment Guide*.
2. Upgrade to X8.2 as described in [Upgrading an X7.1 or later cluster to X8.2 \[p.6\]](#).

Upgrading an X6.0, X6.1, X7.0, or X7.0.n cluster to an X8.2 cluster

If you are using Cisco TMS for Device Provisioning or FindMe:

- As from X8, TMS Agent legacy mode is no longer supported.
- You cannot upgrade directly from a cluster running in TMS Agent legacy mode to an X8 or later cluster.

To upgrade to X8.2 you must:

1. Upgrade the cluster to X7.2 as described in *VCS Cluster Creation and Maintenance Deployment Guide (X7.2)*.
2. If you are using Cisco TMS for Device Provisioning or FindMe, upgrade to Provisioning Extension mode as described in *Cisco TelePresence Management Suite Provisioning Extension Deployment Guide*.
3. Upgrade to X8.2 as described in [Upgrading an X7.1 or later cluster to X8.2 \[p.6\]](#).

Upgrading an X5.1, X5.1.1 or X5.2 cluster to an X8.2 cluster

An upgrade from an X5.1 / X5.1.1 / X5.2 cluster directly to an X8.2 cluster is not possible. You must upgrade in stages through previous VCS versions:

To upgrade to X8.2 you must:

1. Upgrade the cluster to X6.1 as described in *VCS Cluster Creation and Maintenance Deployment Guide (X6.1)*.
2. Upgrade the cluster to X7.2 as described in *VCS Cluster Creation and Maintenance Deployment Guide (X7.2)*.
3. If you are using Cisco TMS for Device Provisioning or FindMe, upgrade to Provisioning Extension mode as described in *Cisco TelePresence Management Suite Provisioning Extension Deployment Guide*.
4. Upgrade to X8.2 as described in [Upgrading an X7.1 or later cluster to X8.2 \[p.6\]](#).

Upgrading X1 / X2 Alternates or an X3 / X4 / X5.0 cluster to an X8.2 cluster

An upgrade from X1 / X2 alternates or an X3 / X4 / X5.0 cluster directly to an X8.2 cluster is not possible. You must upgrade in stages through previous VCS versions:

To upgrade to X8.2 you must:

1. Upgrade the cluster to X5.2 as described in *VCS Cluster Creation and Maintenance Deployment Guide (X5)*.
2. Upgrade the cluster to X6.1 as described in *VCS Cluster Creation and Maintenance Deployment Guide (X6.1)*.
3. Upgrade the cluster to X7.2 as described in *VCS Cluster Creation and Maintenance Deployment Guide (X7.2)*.
4. If you are using Cisco TMS for Device Provisioning or FindMe, upgrade to Provisioning Extension mode as described in *Cisco TelePresence Management Suite Provisioning Extension Deployment Guide*.
5. Upgrade to X8.2 as described in [Upgrading an X7.1 or later cluster to X8.2 \[p.6\]](#).

Appendix 1: Troubleshooting

VCS alarms and warnings

“Cluster name not configured: if FindMe or clustering are in use a cluster name must be defined”

Ensure that the same cluster name is configured on each VCS in the cluster.

The **Cluster name** should be the routable Fully Qualified Domain Name used in SRV records that address this VCS cluster, for example "cluster1.example.com". (See [Appendix 6: Cluster name and DNS SRV records \[p.41\]](#)).

“Cluster replication error: <details> manual synchronization of configuration is required”

This may be:

- “Cluster replication error: manual synchronization of configuration is required”
- "Cluster replication error: cannot find primary or this subordinate's peer configuration file, manual synchronization of configuration is required"
- "Cluster replication error: configuration primary ID is inconsistent, manual synchronization of configuration is required"
- "Cluster replication error: this peer's configuration conflicts with the primary's configuration, manual synchronization of configuration is required"

If a non-primary VCS reports an alarm: “Cluster replication error – <details> synchronization of configuration”

On that non-primary VCS:

1. Log in as admin on an SSH or other CLI interface.
2. At the command prompt type:

```
xcommand ForceConfigUpdate
```

This will delete the non-primary VCS configuration and then force it to update its configuration from the primary VCS.

CAUTION: Only use this command if the configuration on the primary VCS is known to be in a good state. We recommend that you take a backup before running this command.

“Cluster replication error: the NTP server is unreachable”

Configure an accessible NTP server on the VCS **System > Time** page.

“Cluster replication error: the local VCS does not appear in the list of peers”

Check and correct the list of peers for this VCS on the primary VCS, and copy to all other VCS peers (**System > Clustering**).

"Cluster replication error: automatic replication of configuration has been temporarily disabled because an upgrade is in progress"

Wait until the upgrade has completed.

"Invalid clustering configuration: H.323 mode must be turned On - clustering uses H.323 communications between peers"

Ensure that H.323 mode is on (see [Configuration > Protocols > H.323](#)).

"VCS database failure: Please contact your Cisco support representative"

The support representative will help you work through the following steps:

1. Take a system snapshot and provide it to your support representative.
2. Remove the VCS from the cluster using: [Removing a live VCS from a cluster \(permanently\) \[p.19\]](#).
3. Restore that VCS's database by restoring a backup taken on that VCS previously.
4. Add the VCS back to the cluster using [Adding a VCS to an existing cluster \[p.12\]](#).

A second method is possible if the database does not recover:

1. Take a system snapshot and provide to TAC.
2. Remove the VCS from the cluster using: [Removing a live VCS from a cluster \(permanently\) \[p.19\]](#).
3. Log in as root and run `clusterdb_destroy_and_purge_data.sh`
4. Restore that VCS's database by restoring a backup taken on that VCS previously.
5. Add the VCS back to the cluster using [Adding a VCS to an existing cluster \[p.12\]](#).

Note: `clusterdb_destroy_and_purge_data.sh` is as dangerous as it sounds – only use this command in conjunction with instructions from your support representative.

Cisco TMS warnings

Cisco TMS Cluster Diagnostics

If Cisco TMS cluster diagnostics reports a difference in configuration on VCS peers, it is comparing the output of `https://<ip address>/alternatesconfiguration.xml` for each VCS.

To manually check the differences, on a Unix / Linux system, run:

```
wget --user=admin --password=<password> --no-check-certificate https://<IP or FQDN of VCS>/alternatesconfiguration.xml
```

for each of the VCS peers, then use `diff` to check for differences.

Conference Factory template does not replicate

This is by design; the Conference Factory %% value is NOT shared between cluster peers and the Conference Factory application configuration is NOT replicated across a cluster.

See [Appendix 4: Impact of clustering on other VCS applications \[p.36\]](#).

VCS's External manager protocol keeps getting set to HTTPS

Cisco TMS can be configured to force specific management settings on connected systems. This includes ensuring that a VCS uses HTTPS for feedback. If enabled, Cisco TMS will (on a time period defined by Cisco TMS) re-configure the VCS's **System > External manager Protocol** to *HTTPS*.

If HTTPS must be used for VCS to supply feedback to Cisco TMS, see [Appendix 2: Adding a VCS to Cisco TMS \[p.33\]](#) for information about how to set up certificates.

Cisco TMS will force HTTPS on VCS if:

- **TMS Services > Enforce Management Settings on Systems = On (Administrative Tools > Configuration > Network Settings)**
and
- **Secure-Only Device Communication > Secure-Only Device Communication = On (Administrative Tools > Configuration > Network Settings)**

Set **Enforce Management Settings on Systems** to *Off* if Cisco TMS does not need to force the management settings.

Set **Secure-Only Device Communication** to *Off* if it is unnecessary for VCS to provide feedback to Cisco TMS using HTTPS (if HTTP is sufficient).

Cluster with Advanced Networking is not replicating correctly

VCS Expressways with Advanced Networking are only designed to replicate through their LAN 1 interface. Ensure that the **Peer x IP Address** entries specified in **System > Clustering** all refer to LAN 1 interfaces.

Also, this replicating interface (LAN 1) must not have NAT enabled on it.

Cluster with static NAT is not replicating correctly

When using VCS Expressways with static NAT, the cluster replication must occur on the LAN interface which is not behind the NAT device. Therefore LAN interface 1 must be the non-NAT interface and the **Peer x IP Address** entries specified in **System > Clustering** must all refer to LAN 1 interfaces. LAN interface 2 must be configured for static NAT.

Appendix 2: Adding a VCS to Cisco TMS

On the VCS:

- Go to **System > SNMP** and ensure that:
 - SNMP mode** is set to *v3 plus Cisco TMS support* or *v2c*.
 - Community name** is set to *public*.
 (If SNMP was previously disabled, an alarm may appear indicating the need for a restart. If so, restart the system via **Maintenance > Restart options**.)
 If multiple peers need restarting: restart each peer in turn, waiting for the peer to be accessible through the web interface before restarting the next peer.
- Go to **System > External manager** and ensure that:
 - Address** is set to the IP address or FQDN of Cisco TMS.
 - Path** is set to *tms/public/external/management/SystemManagementService.asmx*.
 - If the **Protocol** is *HTTPS* and **Certificate verification mode** is *On* then you must load the relevant certificates before the connection can become 'Active'. See *Implementing Secure Management* (document reference D50520) for details.
 (If the **Protocol** is *HTTP* or **Certificate verification mode** is *Off*, no certificates need to be loaded.)
- Click **Save**.

The **Status** section of the **External manager** page should show a **State** of 'Active' or 'Initialising'.¹

On Cisco TMS:

- Select **Systems > Navigator**.
- Select (or create) an appropriate folder in which to put the VCS (in the example below the folder has been called "Cluster"):



- Click **Add Systems**.
- In section **1. Specify Systems by IP addresses or DNS names**, enter the IP address or DNS name of the VCS.
- Click **Next**.
- Look for ✓ System added.
 If an error occurs, such as "Wrong Password", click on the **Edit System** link and correct the problem (enter the root password of the VCS).
- Click **Finish Adding Systems**, **Add System despite warnings** or **Add More Systems** as appropriate.

¹Cisco TMS may force the protocol to be HTTPS. The configuration for this is found in **Administrative Tools > Configuration > Network settings**. The protocol will be forced to HTTPS if, in the **TMS Services** section **Enforce Management Settings on Systems** is set to *On* and in the **Secure-Only Device Communication** section **Secure-Only Device Communication** is set to *On*.

8. If 'Could not connect to system. Details: No SNMP response' is reported, go to the **Connection** tab and type 'public' into the SNMP Get Community Name and select **Save/Try**.
9. If the VCS password is not default, set this up in the **Connection** tab or in **Settings > Edit Settings**.

If the VCS was already configured in Cisco TMS, ensure that it has the correct IP address (in Cisco TMS, go to **Systems > Navigator** (and any required sub folders), select the VCS, and from the **Connection** tab check the **IP Address** field).

On VCS:

Go to **System > External manager** and check that the **State** now shows **Active**.

Appendix 3: IP ports and protocols

It is unusual to have any sort of firewall between cluster peers, but if there is, the IP protocols and ports that must be open between each and every VCS peer in the cluster are listed below.

For cluster communications between VCS peers:

- UDP port 500 (ISAKMP) is used for PKI (Public Key Infrastructure) key exchange
- Standard SIP and H.323 signaling ports are used for calls
- UDP port 1719 is used for bandwidth updates between VCS peers
- IP protocol 51 (IPSec AH) is used for database synchronization

If you are using the VCS's built-in **Firewall rules** feature then you must ensure that it is not configured to drop or reject traffic sent to UDP ports 4369 – 4380.

For cluster communications between VCS peers and a Cisco TMS when running in Provisioning Extension mode:

- VCS ephemeral port to port 443 on Cisco TMS (secure) or
- VCS ephemeral port to port 80 on Cisco TMS

Note that ports 443 and 80 are the default values; they can be configured in the Cisco TMS IIS, and VCS if different ports are required.

IPSec communications

For IPSec between VCS cluster peers:

- AES256 is used for encryption, SHA256 (4096 bit key length) is used for authentication; peers are identified by their IP address and are authenticated using a pre-shared key
- Main mode is used during the IKE exchange
- diffie-hellman group 'modp4096' is used

Appendix 4: Impact of clustering on other VCS applications

Conference Factory (Multiway™)

When using Conference Factory (Multiway) in a cluster, note that:

- The Conference Factory application configuration is NOT replicated across a cluster.
- The Conference Factory template MUST be DIFFERENT on each of the VCS peers.

When configuring a cluster to support Multiway:

1. Set up the **same** Conference Factory alias (the alias called by the endpoint to initiate a Multiway conference) on each peer.
2. Set up a **different** Conference Factory template on each peer (so that each peer generates unique Multiway conference IDs).

For example, if the MCU service prefix for ad hoc conferences is 775 then the primary VCS may have a template of 775001%%@domain, peer 2 a template of 775002%%@domain, and peer 3 a template of 775003%%@domain. In this way, whichever VCS serves the conference ID, it cannot serve a conference ID that any other VCS could have served.

The same applies across a network. If there is more than one VCS or VCS cluster that provides Conference Factory functionality in a network, each and every VCS must provide values in a unique range, so that no two VCSs can serve the same conference ID.

See [Cisco TelePresence Multiway Deployment Guide](#) for more information.

Microsoft Lync

If Lync Server is to be configured to operate with a VCS cluster, see [Microsoft Lync and VCS Deployment Guide](#).

Appendix 5: Configuring endpoints to work with a VCS cluster

When configuring endpoints it is desirable for them to know about all the VCS peers in a cluster, so that at initial registration or later, if they lose connection to their VCS peer, they have the ability to register with and use another peer in the VCS cluster.

SIP and H.323 endpoints behave differently – the following sections show the methods that can be used, and list them in preferred order.

For additional details about DNS SRV and round-robin DNS see the URI dialing section in *VCS Administrator Guide*.

Also see [Appendix 6: Cluster name and DNS SRV records \[p.41\]](#).

H.323 endpoints

The options below are listed in preference order for providing resilience of connectivity of endpoints to a cluster of VCSs where 1 or more VCS cluster peers become inaccessible. The choice of option will depend on what functionality the endpoint you are using supports.

Option 1 – DNS SRV (preferred)

To use this option, there must be a DNS SRV record available for the DNS name of the VCS cluster that defines an equal weighting and priority for each cluster peer.

On each H.323 endpoint, configure the Gatekeeper Settings as:

- Discovery = Manual
- IP Address = DNS name of the VCS cluster

If the endpoint supports DNS SRV, on startup the endpoint issues a DNS SRV request and receives a DNS SRV record back defining an equal weighting and priority for each cluster peer.

The endpoint then tries to register with a relevant cluster peer (having taken into account the priority / weightings). If that peer is not available, the endpoint will try and register to another listed peer at the same priority, or if all peers at that priority have been tried, a peer at the next lower (higher numbered) priority.

This will be repeated until the endpoint can register with a VCS. On registering with the VCS, the VCS will respond with the H.323 “Alternate Gatekeepers” list containing the list of VCS cluster peer members.

The endpoint will continue to use the first VCS that it registered to for re-registrations and for calls. If it ever loses connection to its VCS then it will select an “Alternate Gatekeeper” from the list it was supplied with.

DNS SRV cache timeout should be set to a fairly long time (e.g. 24 hours) to minimize DNS traffic.

Option 2 – DNS Round-Robin (2nd choice)

To use this option, there must be a DNS A-record available for the DNS name of the VCS cluster that supplies a round-robin list of IP addresses.

On each H.323 endpoint configure the Gatekeeper Settings as:

- Discovery = Manual
- IP Address = DNS name of the VCS cluster

If the endpoint does not support DNS SRV, on startup the endpoint will perform a DNS A-record lookup. The DNS server will have been configured to support round-robin DNS, with each of the cluster peer members defined in the round-robin list.

The endpoint will take the address given by the DNS lookup and will then try and register with the relevant cluster peer. If that peer is not available, then the endpoint will perform another DNS lookup and will try to connect to the new VCS peer that it is given. (The DNS server will have supplied the next cluster peer's IP address.)

This will be repeated until the endpoint can register with a VCS. On registering with the VCS, the Cisco will respond with the H.323 'Alternate Gatekeepers' list containing the list of VCS cluster peer members.

The endpoint will continue to use the first VCS that it registered to for re-registrations and for calls. If it ever loses connection then it will select an "Alternate Gatekeeper" from the list it was supplied with.

DNS cache timeout should be set to a fairly short time (e.g. 1 minute or less) so that on failure to reach a VCS at startup, the endpoint is quickly pointed at a different VCS.

Option 3 – Static IP (least preferred)

Use this option if the VCS cluster does not have a DNS name.

On each H.323 endpoint configure the Gatekeeper Settings as:

- Discovery = Manual
- IP Address = IP address of a VCS peer

On startup the endpoint will try and register with the VCS at the specified IP address. If that is not available, then the endpoint will continue trying at regular intervals.

This will be repeated until the endpoint can register with the VCS. On registering with the VCS, the VCS will respond with the H.323 "Alternate Gatekeepers" list containing the list of VCS cluster peer members.

The endpoint will continue to use the first VCS that it registered to for re-registrations and for calls. If it ever loses connection then it will select an "Alternate Gatekeeper" from the list it was supplied with.

SIP endpoints

The options below are listed in preference order for providing resilience of connectivity of endpoints to a cluster of VCSs where 1 or more VCS cluster peers become inaccessible. The choice of option will depend on what functionality the endpoint you are using supports.

Option 1 – SIP Outbound (preferred)

SIP outbound allows an endpoint to be configured to register to 2 or more VCS peers simultaneously. The benefit of this is that if the connection between one peer and the endpoint gets broken, then a connection from the endpoint to the other peer remains. With the endpoint registering to both peers simultaneously, there is no break in service while the endpoint realizes that its registration has failed, before it registers to a different peer. Thus, at no time is the endpoint unreachable.

Configuration of SIP outbound is endpoint specific, but typically will be:

- Proxy 1
 - Server discovery = Manual
 - Server Address =
DNS name of cluster peer or
IP address of cluster peer

- Proxy 2
 - Server discovery = Manual
 - Server Address =
DNS name of a different cluster peer or
IP address of a different cluster peer
- Outbound = On

Option 2 – DNS SRV (2nd choice)

To use this option, there must be a DNS SRV record available for the DNS name of the VCS cluster that defines an equal weighting and priority for each cluster peer.

On each SIP endpoint configure the SIP Settings as:

- Server discovery = Manual
- Server Address = DNS name of the VCS cluster

If the endpoint supports DNS SRV, on startup the endpoint issues a DNS SRV request and receives a DNS SRV record back defining an equal weighting and priority for each cluster peer.

The endpoint then tries to register with a relevant cluster peer (having taken into account the priority / weightings). If that peer is not available, the endpoint will try and register to another listed peer at the same priority, or if all peers at that priority have been tried, a peer at the next lower priority.

This will be repeated until the endpoint can register with a VCS.

The endpoint will continue to use the first VCS that it registered to for re-registrations and for calls. If it ever loses connection to its VCS, it will use the DNS SRV entry to find a new VCS to register to, starting at the highest priority.

DNS SRV cache timeout should be set to a fairly long time (e.g. 24 hours) to minimize DNS traffic.

Option 3 – DNS Round-Robin (3rd choice)

To use this option, there must be a DNS A-record available for the DNS name of the VCS cluster that supplies a round-robin list of IP addresses.

On each SIP endpoint configure the SIP Settings as:

- Server discovery = Manual
- Server Address = DNS name of the VCS cluster

If the endpoint does not support DNS SRV, on startup the endpoint will perform a DNS A-record lookup. The DNS server will have been configured to support round-robin DNS, with each of the cluster peer members defined in the round-robin list.

The endpoint will take the address given by the DNS lookup and will then try and register with the relevant cluster peer. If that is not available, then the endpoint will perform another DNS lookup and will try to connect to the new VCS peer that it is given. (The DNS server will have supplied the next cluster peer's IP address.)

This will be repeated until the endpoint can register with a VCS.

The endpoint will continue to use the first VCS that it registered to for re-registrations and for calls. If it ever loses connection to its VCS it will perform another DNS lookup to find a new VCS to register to (the DNS server providing a VCS in the round-robin sequence).

DNS cache timeout should be set to a fairly short time (e.g. 1 minute or less) so that if a VCS is not accessible the endpoint is quickly pointed at a different VCS.

Option 4 – Static IP (least preferred)

Use this option if the VCS cluster does not have a DNS name.

On each SIP endpoint configure the SIP Settings as:

- Server discovery = Manual
- Server Address = IP address of a VCS peer

On startup the endpoint will try and register with the VCS at the specified IP address. If that is not available, then the endpoint will continue trying at regular intervals.

This will be repeated until the endpoint can register with the VCS.

The endpoint will continue to use the first VCS that it registered to for re-registrations and for calls. If it ever loses connection then it will keep on trying to register to that VCS until it is accessible again.

Appendix 6: Cluster name and DNS SRV records

Using DNS SRV to convert a domain to an IP address has a number of benefits:

- The structure of the lookup includes service type and protocol as well as the domain, so that a common domain can be used to reference multiple different services which are hosted on different machines (e.g. html, sip, h.323).
- The DNS SRV response includes priority and weighting values which allow the specification of primary, secondary, tertiary etc groups of servers, and within each priority group, the weighting defines the proportion of accesses that should use each server.
- As the DNS SRV response contains details about priorities and weights of multiple servers, the receiving device can use a single lookup to search for an in-service server (where some servers are inaccessible) without the need to repeatedly query the DNS server. (This is in contrast to using round robin DNS which does require repeated lookups into the DNS server if initial servers are found to be inaccessible.)

The generic format of a DNS SRV query is:

- `_service._protocol.<fully.qualified.domain>`

The format of DNS SRV queries for sip (RFC 3263) and h.323 used by VCS are:

- `_sips._tcp.<fully.qualified.domain>`
- `_sip._tcp.<fully.qualified.domain>`
- `_sip._udp.<fully.qualified.domain>` - not recommended for video calls, only use for audio-only calls
- `_h323ls._udp.<fully.qualified.domain>` - for UDP location (RAS) signaling, such as LRQ
- `_h323cs._tcp.<fully.qualified.domain>` - for H.323 call signaling

The format of DNS SRV queries for sip (RFC 3263) and h.323 typically used by an endpoint are:

- `_sips._tcp.<fully.qualified.domain>`
- `_sip._tcp.<fully.qualified.domain>`
- `_sip._udp.<fully.qualified.domain>` - not recommended for video calls, only use for audio-only calls
- `_h323ls._udp.<fully.qualified.domain>` - for UDP location (RAS) signaling, such as LRQ
- `_h323cs._tcp.<fully.qualified.domain>` - for H.323 call signaling
- `_h323rs._udp.<fully.qualified.domain>` - for H.323 registrations

The DNS SRV response is a set of records in the format:

- `_service._protocol.<fully.qualified.domain>. TTL Class SRV Priority Weight Port Target`
where Target is an A-record defining the destination.

Note that UDP is not a recommended transport medium for video signaling; SIP messaging for video system is too large to be reliably carried on datagram-based (rather than stream-based) transports.

Further details on DNS SRV can be found in *VCS Administrator Guide* and *RFC 2782*.

The VCS **Cluster name** (configured on the [System > Clustering](#) page) should be the `<fully.qualified.domain>` specified in the DNS SRV records that point to the VCS cluster.

Example

DNS SRV records for 2 peers of a VCS-E cluster for company.com

where:

- FQDN of VCS Expressway peer 1: vcse1.company.com
- FQDN of VCS Expressway peer 2: vcse2.company.com
- FQDN of VCS Expressway cluster: company.com

```
_sips._tcp.company.com. 86400 IN SRV 1 1 5061 vcse1.company.com.  
_sips._tcp.company.com. 86400 IN SRV 1 1 5061 vcse2.company.com.
```

```
_sip._tcp.company.com. 86400 IN SRV 1 1 5060 vcse1.company.com.  
_sip._tcp.company.com. 86400 IN SRV 1 1 5060 vcse2.company.com.
```

```
_h323ls._udp.company.com. 86400 IN SRV 1 1 1719 vcse1.company.com.  
_h323ls._udp.company.com. 86400 IN SRV 1 1 1719 vcse2.company.com.
```

```
_h323cs._tcp.company.com. 86400 IN SRV 1 1 1720 vcse1.company.com.  
_h323cs._tcp.company.com. 86400 IN SRV 1 1 1720 vcse2.company.com.
```

```
_h323rs._udp.company.com. 86400 IN SRV 1 1 1719 vcse1.company.com.  
_h323rs._udp.company.com. 86400 IN SRV 1 1 1719 vcse2.company.com.
```

Note that:

- Priorities are all the same. Only use different priorities if you have different clusters allowing failover from one primary cluster to another (secondary) cluster. In that case the primary cluster's peers should have one value and the other (secondary) cluster's peers a (larger) value.
- Weights should be the same – so that there is equal use of each peer.

Endpoints supporting SIP DNS SRV

Jabber Video versions prior to 4.0 supports:

- _sip._tls.<fully.qualified.domain>
- _sip._tcp.<fully.qualified.domain>

Jabber Video version 4.0 and later supports:

- _sips._tcp.<fully.qualified.domain>
- _sip._tcp.<fully.qualified.domain>

E20 version TE2.1 supports:

- _sips._tls.<fully.qualified.domain>
- _sip._tcp.<fully.qualified.domain>

MXP version F8.2 supports:

- _sip._tls.<fully.qualified.domain>
- _sip._tcp.<fully.qualified.domain>

T150 version L6.0 supports:

- _sip._tls.<fully.qualified.domain>
- _sip._tcp.<fully.qualified.domain>

C-Series versions prior to TC4.0 supports:

- `_sip._tls.<fully.qualified.domain>`
- `_sip._tcp.<fully.qualified.domain>`

C-Series from version TC4.0 supports:

- `_sips._tcp.<fully.qualified.domain>`
- `_sip._tcp.<fully.qualified.domain>`

Cisco TelePresence MCU supports:

- `_sips._tcp.<fully.qualified.domain>`
- `_sip._tcp.<fully.qualified.domain>`

SIP DNS SRV records required:

- `_sips._tcp.<fully.qualified.domain>` Jabber Video (4.0 and later), C-Series (TC4.0 and later), VCS, MCU
- `_sips._tls.<fully.qualified.domain>` E20 to TE2.1
- `_sip._tls.<fully.qualified.domain>` MXP to F8.2, T150 to L6.0, Jabber Video prior to 4.0, C-Series prior to TC4.0
- `_sip._tcp.<fully.qualified.domain>` All products for TCP

Checking DNS SRV settings

Checking DNS SRV settings via web interface

1. Go to **Maintenance > Tools > Network utilities > DNS lookup**.
2. Enter the SRV path in the **Host** field.
3. Click **Lookup**.

Nslookup

```
nslookup -query=SRV _sip._tcp.example.com
```

Dig

```
dig _sip._tcp.example.com SRV
```

```
; <<>> DiG 9.4.1 <<>> _sip._tcp.example.com SRV
;; global options: printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 44952
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 2, ADDITIONAL: 4

;; QUESTION SECTION:
;_sip._tcp.example.com.      IN      SRV
```

```
;; ANSWER SECTION:
_sip._tcp.example.com. 1183    IN      SRV     1 0 5060 vcse1.example.com.
_sip._tcp.example.com. 1183    IN      SRV     1 0 5060 vcse2.example.com.

;; AUTHORITY SECTION:
example.com.           87450   IN      NS      ns1.mydyndns.org.
example.com.           87450   IN      NS      ns2.mydyndns.org.

;; ADDITIONAL SECTION:
vcse1.example.com.    1536    IN      A       194.73.59.53
vcse2.example.com.    1376    IN      A       194.73.59.54
ns1.mydyndns.org.     75      IN      A       204.13.248.76
ns2.mydyndns.org.    10037   IN      A       204.13.249.76

;; Query time: 0 msec

~ #
```

Appendix 7: NAPTR records

NAPTR records are typically used to specify various methods to connect to a destination URI, for example by email, by SIP, by H.323. They can also be used to specify the priority to use for those connection types, for example to use SIP TLS in preference over using SIP TCP or SIP UDP.

NAPTR records are also used in ENUM, when converting a telephone number into a dialable URI. (For further details on ENUM see [ENUM Dialing on VCS Deployment Guide](#)).

NAPTR record format

Example: SIP access to example.com, and for enum lookups for 557120, 557121, and 557122.

\$ORIGIN example.com.

```
IN  NAPTR  10  100  "s"  "SIPS+D2T"  ""  _sips._tcp.example.com.
IN  NAPTR  12  100  "s"  "SIP+D2T"   ""  _sip._tcp.example.com.
IN  NAPTR  14  100  "s"  "SIP+D2U"   ""  _sip._udp.example.com.
```

\$ORIGIN www.example.com.

```
IN  NAPTR  10  100  "s"  "http+I2R"  ""  _http._tcp.example.com.
IN  NAPTR  10  100  "s"  "ftp+I2R"   ""  _ftp._tcp.example.com.
```

\$ORIGIN 0.2.1.7.5.5.enum.lookup.com.

```
IN  NAPTR  10  100  "u"  "E2U+sip"   "!^.*$!john.smith@tandberg.com!"  .
IN  NAPTR  12  100  "u"  "E2U+h323"  "!^.*$!john.smith@tandberg.com!"  .
IN  NAPTR  10  100  "u"  "mailto+E2U" "!^.*$!mailto:john.smith@tandberg.com!"  .
```

\$ORIGIN 1.2.1.7.5.5.enum.lookup.com.

```
IN  NAPTR  10  100  "u"  "E2U+sip"   "!^.*$!mary.jones@tandberg.com!"  .
```

\$ORIGIN 2.2.1.7.5.5.enum.lookup.com.

```
IN  NAPTR  10  100  "u"  "E2U+h323"  "!^.*$!peter.archibald@myco.com!"  .
```

IN = Internet routing

NAPTR = record type

10 = order value (use lowest order value first)

100 = preference value if multiple entries have the same order value

"u" = the result is a routable URI

"s" = the result is a DNS SRV record

"a" = the result is an 'A' or 'AAAA' record

"E2U+sip" to make SIP call

"E2U+h323" to make h.323 call

Regular expression:

! = delimiter

"" = no expression used

... usual Regex expressions can be used

Replace field; . = not used

Looking up an ENUM NAPTR record

dig 4.3.7.8.enum4.example.com. NAPTR

```

; <<>> ;; global options: printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 38428
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 1, ADDITIONAL: 2

;; QUESTION SECTION:
;4.3.7.8.enum4.example.com. IN NAPTR

;; ANSWER SECTION:
4.3.7.8.enum4.example.com. 60 IN NAPTR 10 100 "u" "E2U+sip" "!^.*$!bob@example.com!" .
4.3.7.8.enum4.example.com. 60 IN NAPTR 10 100 "u" "E2U+h323" "!^.*$!bob@example.com!" .

;; AUTHORITY SECTION:
enum4.example.com. 60 IN NS int-server1.example.com.

;; ADDITIONAL SECTION:
int-server1.example.com. 3600 IN A 10.44.9.144
int-server1.example.com. 3600 IN AAAA 3ffe:80ee:3706::9:144

;; Query time: 0 msec

```

Looking up a domain NAPTR record

Example: NAPTR record allowing endpoints to detect that they are in the public (external) network. The flag “s” is extended to “se” to indicate that it is “external”.

```
~ # dig -t NAPTR example.com
```

```

; <<>> DiG 9.4.1 <<>> -t NAPTR example.com
;; global options: printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 1895
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 6, ADDITIONAL: 4

;; QUESTION SECTION:
;example.com. IN NAPTR

;; ANSWER SECTION:
example.com. 2 IN NAPTR 50 50 "se" "SIPS+D2T" "" _sips._tcp.example.com.
example.com. 2 IN NAPTR 90 50 "se" "SIP+D2T" "" _sip._tcp.example.com.
example.com. 2 IN NAPTR 100 50 "se" "SIP+D2U" "" _sip._udp.example.com.

;; AUTHORITY SECTION:
example.com. 320069 IN NS nserver2.example.com.
example.com. 320069 IN NS nserver.euro.example.com.
example.com. 320069 IN NS nserver.example.com.
example.com. 320069 IN NS nserver3.example.com.
example.com. 320069 IN NS nserver4.example.com.
example.com. 320069 IN NS nserver.asia.example.com.

;; ADDITIONAL SECTION:
nserver.example.com. 56190 IN A 17.111.10.50
nserver2.example.com. 57247 IN A 17.111.10.59
nserver3.example.com. 57581 IN A 17.22.14.50
nserver4.example.com. 57452 IN A 17.22.14.59

;; Query time: 11 msec

```

Document revision history

The following table summarizes the changes that have been applied to this document.

Revision	Date	Description
18	June 2014	Republished for X8.2.
17	April 2014	Updated for VCS X8.1.1: <ul style="list-style-type: none"> ■ New 'Replacing a VCS peer' section ■ Updates to 'IP ports and protocols' appendix
16	December 2013	Updated for VCS X8.1, including the removal of support for TMS Agent legacy mode provisioning.
15	November 2012	Removed recommendation to use DNS name of the VCS cluster for endpoint SIP outbound configuration.
14	August 2012	Updated for VCS X7.2.
13	March 2012	Updated for VCS X7.1.
12	January 2012	Various minor revisions and clarifications applied.
11	October 2011	Updated for VCS X7.0.n.
10	September 2011	Updated Appendix 3 – IP port and protocol numbers.
9	August 2011	Updated for VCS X7.0.
8	May 2011	Updated for VCS X6.1.
7	February 2011	Clarify this document refers to VCS X6.0 only, and to Cisco TMS 12.6 or later.
6	December 2010	Updated for VCS X6.
5	October 2010	New document styles applied.
4	August 2010	Updated for VCS X5.2. Replace previous Appendix 12 (Upgrading debian packages - only required for X5.1.1) with a new Appendix 12 - NAPTR records overview.
3	May 2010	Updated for VCS X5.1.1 and Cisco TMS 12.6.
2	December 2009	Updated for VCS X5.
1	Up to December 2009	Releases for earlier versions of VCS.

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