



# Cisco VCS Expressway and VCS Control – Basic Configuration

Deployment Guide

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Cisco VCS X8.11.4



## Preface

### Change History

**Table 1 Deployment Guide Change History**

Date	Change
January 2019	Documentation enhancements for service setup wizard section. Clarify use of LAN2 external interface in all dual NIC cases (Advanced Networking Deployments appendix).
September 2018	Updated software version from X8.11 to X8.11.1, as version X8.11 is no longer available.
July 2018	Republished for X8.11. Removed duplicate port reference information
December 2016	Republished for X8.9.
July 2016	Republished for X8.8.
November 2015	New template applied. Advanced Network Deployments appendix revised. Republished for X8.7.
July 2015	Updated for X8.6.
April 2015	Menu path changes for X8.5. Republished with X8.5.2.
December 2014	Republished for X8.5.
August 2014	Correction in firewall appendix.
June 2014	Republished for X8.2.
December 2013	Updated for X8.1.
October 2012	Revised page layout.
August 2012	Updated for X7.2.
March 2012	Updated for X7.1. Added Appendix 4 Static NAT and Dual Network Interface architectures.
September 2011	Updated for X7.0.
November 2010	Initial release.

# Contents

Preface .....	3
Change History .....	3
Introduction .....	7
Example Network Deployment .....	9
Network Elements .....	10
Process Summary .....	12
Prerequisites .....	13
Run the Service Setup Wizard .....	14
Overview .....	14
Task 1: Accessing and Navigating the Wizard .....	16
Task 2: Running the Service Setup Wizard and Applying Licenses .....	17
Examples for Running the Service Setup Wizard .....	20
VCS System Configuration .....	21
Task 3: Setting the System Name .....	21
Task 4: Configuring DNS .....	21
Task 5: Replacing the Default Server Certificate .....	23
Task 6: Configuring NTP Servers .....	24
Task 7: Configuring SIP Domains .....	25
Routing Configuration .....	26
Pre-search Transforms .....	26
Search Rules .....	26
Task 8: Configuring Transforms .....	26
Task 9: Configuring Local Zone Search Rules .....	27
Task 10: Configuring the Traversal Zone .....	30
Neighboring Between VCS Clusters .....	34
Task 11: Configuring Traversal Zone Search Rules .....	35
Task 12: Configuring the DNS Zone .....	37
Task 13: Configuring DNS Zone Search Rules .....	37
Task 14: Configuring External (Unknown) IP Address Routing .....	39
Endpoint Registration .....	41
System Checks .....	42
Zone Status .....	42
Registration Status .....	42
Call Signaling .....	42
Connectivity Test Tool .....	42
Maintenance Routine .....	44
Creating a System Backup .....	44
Optional Configuration Tasks .....	45
Task 15: Configuring Cisco TMS (Optional) .....	45
Task 16: Configuring Logging (Optional) .....	47
Task 17: Configuring Registration Restriction Policy (Optional) .....	47
Task 18: Configuring Device Authentication Policy (Optional) .....	48
Task 19: Configuring B2B Federation for Video Calls (Optional) .....	49

Task 20: Restricting Access to ISDN Gateways (Optional) .....	53
Appendix 1: Configuration Details .....	61
VCS Control Configuration Details .....	61
VCS Expressway Configuration Details .....	62
VCS Control and VCS Expressway Configuration Details .....	64
Appendix 2: DNS Records .....	65
DNS Configuration on Host Server .....	65
DNS Configuration (internal DNS server) .....	65
Appendix 3: Firewall and NAT Settings .....	67
Internal Firewall Configuration .....	67
External Firewall Configuration Requirement .....	67
Appendix 4: Advanced Networking Deployments .....	68
Planning and Prerequisites .....	68
Recommended: Dual NIC Static NAT Deployment .....	68
Background Information .....	70
Other Deployment Examples .....	75
Obtaining Documentation and Submitting a Service Request .....	80
Cisco Legal Information .....	81
Cisco Trademark .....	81



## Introduction

The Cisco TelePresence Video Communication Server (VCS) software simplifies session management and control of telepresence conferences. It provides flexible and extensible conferencing applications, enabling organizations to benefit from increased employee productivity and enhanced communication with partners and customers.

The VCS delivers exceptional scalability and resiliency, secure communications, and simplified large-scale provisioning and network administration in conjunction with Cisco TelePresence Management Suite (Cisco TMS).

The VCS interworks transparently with Cisco Unified Communications Manager (Unified CM), bringing rich telepresence services to organizations with Unified CM. It also offers interoperability with third-party unified communications, IP telephony networks, and voice-over-IP (VoIP) systems.

This document describes how to configure a VCS Expressway and a VCS Control as the cornerstones of a basic video infrastructure deployment. It takes you through the following tasks:

1. Using the Service Setup Wizard to select the services you want to use and to apply the corresponding keys (licenses).
2. Configuring system parameters and routing information.
3. Checking that the system is working as expected.
4. Configuring optional items such as Cisco TMS, system logging, and access restrictions.

### Advanced configuration

This document also provides detailed DNS, NAT, and firewall configuration information. In each case we assume that you have a working knowledge of how to configure these systems. The appendices to the document provide detailed reference information, as follows:

- VCS configuration details used in this document are listed in [Appendix 1: Configuration Details, page 61](#).
- DNS records required for the example deployment used in this document are in [Appendix 2: DNS Records, page 65](#).
- Details of required NAT and firewall configurations are in [Appendix 3: Firewall and NAT Settings, page 67](#). This document describes a small subset of the numerous NAT and firewall deployment options that are made possible by using the VCS Expressway dual network interface and NAT features.
- How to deploy your system with a static NAT and Dual Network Interface architecture is explained in [Appendix 4: Advanced Networking Deployments, page 68](#).

For descriptions of all system configuration parameters, see the [VCS Administrator Guide](#) and the VCS web application's online field help  and page help .

### Example configuration values used in this guide

For ease of reading this guide is based around an example deployment, which uses the following assumed configuration values throughout:

	VCS Control	VCS Expressway
LAN1 IPv4 address	10.0.0.2	192.0.2.2
IPv4 gateway	10.0.0.1	192.0.2.1
LAN1 subnet mask	255.255.255.0	255.255.255.0
Domain name	<i>internal-domain.net</i>	<i>example.com</i>

### Information in other deployment guides

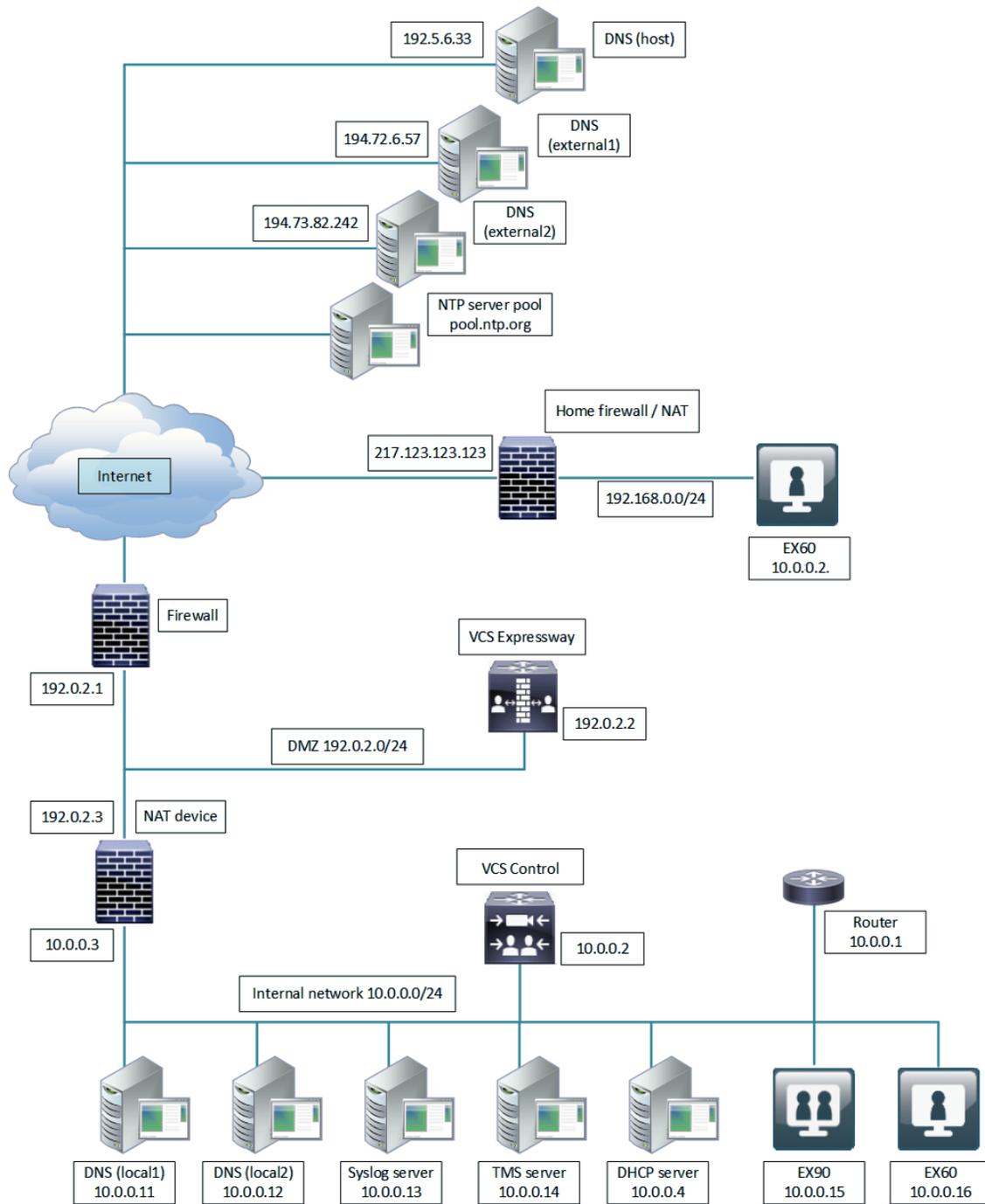
This document does not describe how to deploy a clustered system, or systems running device provisioning, device authentication, or FindMe applications. For more details about these features, see the following documents:

## Introduction

- *VCS Cluster Creation and Maintenance Deployment Guide* on the [VCS configuration guides page](#)
- *Cisco TMS Provisioning Extension Deployment Guide* on the [VCS configuration guides page](#)
- *FindMe Express Deployment Guide* on the [VCS configuration guides page](#) (to deploy FindMe with the Cisco TMSPE see the *Cisco TMS Provisioning Extension Deployment Guide* instead)
- *VCS IP Port Usage for Firewall Traversal* on the [VCS configuration guides page](#)
- *Cisco VCS Authenticating Devices* on the [VCS configuration guides page](#)

## Example Network Deployment

**Figure 1 Example Network for the Deployment Described in this Document**



This example includes internal and DMZ segments - in which VCS Control and VCS Expressway platforms are respectively deployed.

## Introduction

## Network Elements

### Internal Network Elements

The internal network elements are devices which are hosted on your local area network. Elements on the internal network have an internal network domain name. This name is not resolvable by a public DNS. For example, the VCS Control is configured with an internally resolvable name of `vcsc.internal-domain.net` (which resolves to an IP address of 10.0.0.2 by the internal DNS servers).

Element	Role
VCS Control	SIP Registrar & Proxy and H.323 Gatekeeper for devices which are located on the internal network.
EX90 and EX60	Example endpoints hosted on the internal network which register to the VCS Control.
DNS (local 1 & local 2)	DNS servers used by the VCS Control to perform DNS lookups (resolve network names on the internal network).
DHCP Server	Provides host, IP gateway, DNS server, and NTP server addresses to endpoints located on the internal network.
Router	Acts as the gateway for all internal network devices to route towards the DMZ (to the NAT device internal address).
Cisco TMS Server	Management and scheduling server. See <a href="#">Task 15: Configuring Cisco TMS (Optional), page 45</a> .
Syslog Server	Logging server for Syslog messages. See <a href="#">Task 16: Configuring Logging (Optional), page 47</a> .

### DMZ Network Element

#### VCS Expressway

The VCS Expressway is a SIP Registrar & Proxy and H.323 Gatekeeper for devices which are located outside the internal network (for example, home users and mobile workers registering across the internet and 3<sup>rd</sup> party businesses making calls to, or receiving calls from this network).

The VCS Expressway is configured with a traversal server zone to receive communications from the VCS Control in order to allow inbound and outbound calls to traverse the NAT device.

The VCS Expressway has a public network domain name. For example, the VCS Expressway is configured with an externally resolvable name of `vcse.example.com` (which resolves to an IP address of 192.0.2.2 by the external / public DNS servers).

### External Network Elements

Element	Role
EX60	An example remote endpoint, which is registering to the VCS Expressway via the internet.
DNS (Host)	The DNS owned by the service provider which hosts the external domain <code>example.com</code> .
DNS (external 1 & external 2)	The DNS used by the VCS Expressway to perform DNS lookups.
NTP server pool	An NTP server pool which provides the clock source used to synchronize both internal and external devices.

## Introduction

### NAT Devices and Firewalls

The example deployment includes:

- NAT (PAT) device performing port address translation functions for network traffic routed from the internal network to addresses in the DMZ (and beyond – towards remote destinations on the internet).
- Firewall device on the public-facing side of the DMZ. This device allows all outbound connections and inbound connections on specific ports. See [Appendix 3: Firewall and NAT Settings, page 67](#).
- Home firewall NAT (PAT) device which performs port address and firewall functions for network traffic originating from the EX60 device.
- See [Appendix 4: Advanced Networking Deployments, page 68](#) for information about how to deploy your system with a static NAT and Dual Network Interface architecture.

### SIP and H.323 Domain

The example deployment is configured to route SIP (and H.323) signaling messages for calls made to URIs which use the domain example.com. The DNS SRV configurations are described in [Appendix 2: DNS Records, page 65](#).

- DNS SRV records are configured in the public (external) and local (internal) network DNS server to enable routing of signaling request messages to the relevant infrastructure elements (for example, before an external endpoint registers, it will query the external DNS servers to determine the IP address of the VCS Expressway).
- The internal SIP domain (example.com) is the same as the public DNS name. This enables both registered and non-registered devices in the public internet to call endpoints registered to the VCS Control.

## Process Summary

### Before You Begin

- [Prerequisites, page 13](#)

### Run the Service Setup Wizard

- [Task 1: Accessing and Navigating the Wizard, page 16](#)
- [Task 2: Running the Service Setup Wizard and Applying Licenses, page 17](#)
- [Examples for Running the Service Setup Wizard, page 20](#)

### VCS system configuration tasks

- [Task 3: Setting the System Name, page 21](#)
- [Task 4: Configuring DNS, page 21](#)
- [Task 5: Replacing the Default Server Certificate, page 23](#)
- [Task 6: Configuring NTP Servers, page 24](#)
- [Task 7: Configuring SIP Domains, page 25](#)

### Routing configuration tasks

- [Task 8: Configuring Transforms, page 26](#)
- [Task 9: Configuring Local Zone Search Rules, page 27](#)
- [Task 10: Configuring the Traversal Zone, page 30](#)
- [Task 11: Configuring Traversal Zone Search Rules, page 35](#)
- [Task 12: Configuring the DNS Zone, page 37](#)
- [Task 13: Configuring DNS Zone Search Rules, page 37](#)
- [Task 14: Configuring External \(Unknown\) IP Address Routing, page 39](#)

### Optional configuration tasks

- [Task 15: Configuring Cisco TMS \(Optional\), page 45](#)
- [Task 16: Configuring Logging \(Optional\), page 47](#)
- [Task 17: Configuring Registration Restriction Policy \(Optional\), page 47](#)
- [Task 18: Configuring Device Authentication Policy \(Optional\), page 48](#)
- [Task 20: Restricting Access to ISDN Gateways \(Optional\), page 53](#)

## Prerequisites

# Prerequisites

Before you begin any of the tasks in this guide, make sure that the following prerequisites are complete.

### General prerequisites

- We recommend that you use the VCS web user interface to do the system configuration. This guide assumes that you are using a web browser running on a PC. The PC needs an Ethernet connection to a LAN which can route HTTP(S) traffic to the VCS.
- Review the relevant release notes on the [VCS release notes page](#).
- Have the *VCS Administrator Guide* on the [VCS maintenance and operation guides page](#) available for reference before you start.

### IP address and password prerequisites

This guide also assumes that you have already configured a static IP address and changed the default passwords, as described in the appropriate installation guide:

*Cisco Video Communication Server CE1100 Appliance Installation Guide* on the [VCS installation guides page](#).

**Note:** VCS requires a static IP address. It doesn't use DHCP/SLAAC to get an IP address.

Do not use a shared address for the VCS Expressway and the VCS Control, as the firewall cannot distinguish between them. If you use static NAT for IP addressing on the VCS Expressway, make sure that any NAT operation on the VCS Control does not resolve to the same traffic IP address. We do not support shared NAT addresses between VCS Expressway and VCS Control.

### DNS, NAT/firewall, and DHCP prerequisites

The following non-VCS system configuration needs to be in place before you start:

- Internal and external DNS records. See [Appendix 2: DNS Records, page 65](#).
- NAT & firewall configuration. See [Appendix 3: Firewall and NAT Settings, page 67](#).
- DHCP server configuration (not described in this document).

## Run the Service Setup Wizard

# Run the Service Setup Wizard

## Overview

The Service Setup Wizard makes it easier to configure and license the VCS system for its chosen purpose in your environment. It also simplifies the user interface. The wizard starts when you first launch the web user interface. In the wizard, you select the system series (Expressway series or VCS series) and system type (VCS Control or VCS Expressway). Based on the series and type, you select the services and apply appropriate option keys for licenses.

You can also use the wizard to review and edit the VCS basic network settings (typically already configured during initial installation). When you restart, the user interface is tailored to match your service selections and you only see menus and pages for the services you chose.

Some examples of popular services include the following:

- Mobile and Remote Access including Meeting Server Web Proxy
- Jabber Guest Services
- Microsoft gateway service - this service is only for when you want this system to adapt between Microsoft SIP and standards-based SIP variants. If a different system (such as Cisco Meeting Server) is doing that adaptation in your deployment, you don't need this service.
- Registrar
- Collaboration Meeting Rooms (CMR) Cloud
- Business to business calls

## Services That Can Be Hosted Together

Some services are incompatible and cannot be selected together. The following table provides a matrix of compatible services. The matrix specifies which services you can use together on the same system or cluster.

## Run the Service Setup Wizard

**Table 2 Services That Can Be Hosted Together**

	Cisco Webex Hybrid Services (Connectors)	Mobile and Remote Access	Jabber Guest Services	Microsoft gateway service	Registrar	CMR Cloud	Business to Business calling (incl. Hybrid Call Service)
Cisco Webex Hybrid Services (Connectors)	Y	N	N	N	N	Y	Y
Mobile and Remote Access and/or (from X8.9) Meeting Server Web Proxy	N	Y	N	N	Y	Y	Y*
Jabber Guest Services	N	N	Y	N	Y	Y	Y
Microsoft gateway service	N	N	N	Y	N	N	N
Registrar	N	Y	Y	N	Y	Y	Y
CMR Cloud	Y	Y	Y	N	Y	Y	Y
Business to Business calling (includes Cisco Webex Hybrid Call Service)	Y	Y*	Y	N	Y	Y	Y

**Key to Table**

Y: Yes, these services can be hosted on the same system or cluster

N: No, these services may not be hosted on the same system or cluster

**Rules**

- Hybrid Services connectors may co-reside with the VCS Control of a traversal pair used for Call Service, subject to user number limitations.
  - \* If your Hybrid Call Service (or B2B) traversal pair is also used for MRA, then the Hybrid Services connectors must be on a separate VCS Control. This is because we do not support the connectors being hosted on the VCS Control that is used for MRA.
- Microsoft gateway service requires a dedicated VCS Control or Expressway-C (called "Gateway VCS" or "Gateway Expressway" in the help and documentation)
- Jabber Guest cannot work with MRA (technical limitation)
- MRA is currently not supported in IPv6 only mode. If you want IPv6 B2B calling to co-reside with IPv4 MRA on the same VCS traversal pair, the VCS Expressway and VCS Control must both be in dual stack mode.

**What If I Don't Want to Use the Wizard?**

A skip option exists if you don't want to use the wizard. If you change your mind later, you can go back and run it at any time (**Status > Overview** page; click **Run service setup**).

If you opt to skip the wizard, you need to deal with the VCS licensing setup requirements manually before you start the configuration tasks in this guide. Also, the user interface isn't customized to reflect your specific service selections.

## Run the Service Setup Wizard

## Task 1: Accessing and Navigating the Wizard

There are multiple ways to access the wizard:

- From X8.8, you'll automatically see the Service Setup Wizard when you first log in to the VCS user interface. You don't need to launch it.
- If you previously logged in or have upgraded, you'll see the **Status > Overview** page as usual. Click **Run service setup** to launch the wizard.
- If you've already run the wizard you can rerun it at any time. From the **Status > Overview** page, click **Return to service setup**.

To navigate the wizard:

- Click **Skip Service Setup Wizard** if you want to back out of the wizard completely, or **Back** to return to the previous page.
- Click **Continue** to save and move to the next wizard page.

**Note:** On CE1200 appliances, when you click **Continue** on a page, the settings that are configured on the page are not saved on the appliance. The settings are saved only after you click **Finish** on the **Confirm core configuration** page.

**Figure 2 Service Setup Wizard Example - Selection Page**

Welcome to Cisco Collaboration services [? Help](#) [Logout](#)

**Select Series**

Expressway series  ⓘ

VCS series

**Select Type**

Expressway-C  ⓘ

Expressway-E

**Select Services**

After you select services, you get a simplified menu that is relevant to your selection. ⓘ

Cisco Webex Hybrid Services

Mobile and Remote Access including Meeting Server Web Proxy

Jabber Guest services

Microsoft gateway service

Registrar

Collaboration Meeting Rooms (CMR) Cloud

Business to business calls

If you proceed without selecting services, you will get the full menu.

Proceed without selecting services

## Task 2: Running the Service Setup Wizard and Applying Licenses

### 65 option key limit

If you try to add more than 65 option keys (licenses), they appear as normal on the **Option keys** page. However, only the first 65 keys take effect. Additional keys from 66 onwards appear to be added, but actually the VCS does not process them. CDETS [CSCvf78728](#) refers.

## Process

1. Choose *VCS series*.
2. Choose *VCS Control* or *VCS Expressway*. We recommend that you select VCS Control first and run the wizard for it. Then run the wizard on the VCS Expressway.

The list of services changes to match what's available on your chosen Series and Type.

3. Select Services. Check the boxes next to the services you want to use on this system. For the compatible services that you can use together on the same system or cluster, see [Services That Can Be Hosted Together, page 14](#).

If you want to keep all the menu options, or if you want to use the wizard for applying licenses but don't want to choose services yet, check *Proceed without selecting services*.

- Click **Continue** to move to the **Option keys** page of the wizard. This page helps you to identify and acquire the appropriate licenses for your chosen selections. Worked examples are provided in [Examples for Running the Service Setup Wizard, page 20](#).

The [Licensing help](#) section at the top of the page explains how to use your Product Authorization Key (PAK) in Cisco's Product License Registration Portal. The [License status](#) section at the bottom of the page lists the actual licenses that you need and their status (loaded / not loaded).

The exact entries vary by deployment - this example is for the Cisco Expressway-C Registrar service:

**Figure 3 Service Setup Wizard Example - Option Keys Page**

**Option keys**

Licenses are still required for the services you selected. You may need to paste more text from your email, or return to the ordering portal

**Licensing help**

Serial number

How to get licenses

You need this system's serial number to order keys. Go to the [Product License Registration Portal](#), and load your PAK (Product Authorization Key). Inside your PAK you have one or more Product Identifiers (PIDs) that are named like the examples shown in the License status section further down this page. Select the PIDs that you need from the ones in the PAK, by looking at the examples shown in the Required section of the License status below. When you've selected PIDs, click Assign to device and enter the serial number from this page. When you click Finish, you'll get an email with the keys you need. Paste all the email text into this page so the system can read the keys for you. If you generate more than one email from the licensing portal, you can add new paste areas.

**Apply keys**

Paste the text from your release key email here

Paste the text from your option keys email here

New paste area

**Add keys**

**License status**

Based on the services you have selected:

Required	License PID example	Status
Description	LC-SW-EXP-K9	Loaded
Release key	LC-EXP-SERIES	Needed
Expressway Series		
Optional	License PID example	Status
Description	LC-EXP-RMS	Not loaded
Rich Media Sessions	LC-EXP-AN	Not loaded
Advanced Networking	LC-EXP-GW	Not loaded
H323-SP Interworking Gateway	LC-EXP-ROOM	Not loaded
Room Systems	LC-EXP-DSK	Loaded
Desktop Systems		

- On the **Option Keys** page, click the [Product License Registration Portal](#) link to go to the licensing portal. (For this step you need to work away from the wizard to obtain the necessary licenses, and you need the serial number of the system.) In the licensing portal, enter the necessary details for the required licenses. Detailed information about using the licensing portal is in the online help or the [VCS Administrator Guide](#). An ordering guide for our products is available on the Cisco [Collaboration Ordering Guides page](#).
- Wait for system-generated emails from the licensing portal with the release key and option keys for your selected services.
- Back in the wizard, paste the text from the release key email into the first text area. The system reads the release key out of the pasted text and displays it next to the text area.
- Paste the text from the option keys email into the second text area. The system reads the option keys out of the pasted text and displays them next to the text area.
- Add new text areas if you have more email text to paste in, such as your room or desktop system registration license keys.

**10. Click Add Keys.**

The **License status** table groups the keys that are possible on this system, and indicates whether they are loaded or not loaded. The keys are grouped as follows:

- **Required:** If any keys in this section are not yet loaded, you see status **Required** and will not be able to continue through the wizard.
- **Optional:** Shows keys that may or may not be useful, but are not strictly required for the services you chose.
- **Unrelated:** These keys won't harm the system if they are loaded, but will not provide any benefit for the services you chose.
- **Incompatible:** These keys cannot work with the selected services. You must remove them or choose different services before you can continue.

**11. Click Continue.**

**12.** Review the network configuration and modify the settings if necessary. Save any changes before you continue the wizard.

**13. Click Finish.**

**14.** Restart the system when prompted.

**Result:** When you log in, the user interface is tailored to match your service selections. You only see menus and pages for the services you chose.

## What to do next

The wizard is complete for the VCS Control element. Now you need to run it on the VCS Expressway. For typical deployments with the VCS Expressway the services you are most likely to select with the wizard include *Mobile and remote access* and *Business to business calls*. When the VCS Expressway is done, go to the next section in this guide, "VCS System Configuration."

## Examples for Running the Service Setup Wizard

### Example for VCS Registrar

1. Click *VCS series*.
2. Click *VCS Control*.
3. Check *Registrar*.
4. Check any other compatible services that you have bought for this system. For this example, let's assume *Business to business calls*. (The matrix of compatible services is in the online help and the [VCS Administrator Guide](#).)
5. Click **Continue**.  
The wizard takes you to the licensing and options page.
6. [If required] Paste the release key into the first text area.
7. Paste the VCS series key into the second text area (eg. 116341E00-1-~~AAAAAAA~~).
8. Click **Continue**.
9. Review the networking configuration and click **Continue**.
10. Restart the system when prompted.

This completes the service setup and licensing for the VCS Control part of your desired outcome. However, since we chose *Business to business calls*, we would have to run the wizard again to set up and license the VCS Expressway, because the business to business calling deployment requires firewall traversal.

## VCS System Configuration

### Task 3: Setting the System Name

The **System name** defines the name of the VCS. It appears in various places in the web interface and is also used by Cisco TMS. We recommend using a name that lets you easily and uniquely identify the VCS.

To configure the **System name**:

1. Go to **System > Administration**.
2. Configure the **System name** as follows:

	VCS Control	VCS Expressway
<b>System name</b>	Enter <code>vcsc</code>	Enter <code>vcse</code>

3. Click **Save**.

**Figure 4 VCS Control**

The screenshot shows the 'System administration' page for VCS Control. The breadcrumb trail indicates 'You are here: System > Administration'. The 'System name' field is highlighted in blue and contains the text 'VCSc'. An information icon is visible to the right of the input field.

**Figure 5 VCS Expressway**

The screenshot shows the 'System administration' page for VCS Expressway. The breadcrumb trail indicates 'You are here: System > Administration'. The 'System name' field is highlighted in blue and contains the text 'VCSe'. An information icon is visible to the right of the input field.

### Task 4: Configuring DNS

#### System Host Name

The **System host name** defines the DNS hostname that this system is known by. Note that this is not the fully-qualified domain name, just the host label portion.

Note that **<System host name>.<Domain name>** = FQDN of this VCS.

To configure the **System host name**:

1. Go to **System > DNS**.
2. Configure the **System host name** as follows:

	VCS Control	VCS Expressway
<b>System host name</b>	Enter <code>vcsc</code>	Enter <code>vcse</code>

3. Click **Save**.

## Domain Name

The **Domain name** is the name to append to an unqualified host name before querying the DNS server.

To configure the **Domain name**:

1. Go to **System > DNS**.
2. Configure the **Domain name** as follows:

	VCS Control	VCS Expressway
<b>Domain name</b>	Enter <code>internal-domain.net</code>	Enter <code>example.com</code>

3. Click **Save**.

The fully qualified domain name for the VCS Control is now `vcsc.internal-domain.net`

The fully qualified domain name for the VCS Expressway is now `vcse.example.com`

## DNS Servers

The DNS server addresses specify the IP addresses of up to five domain name servers to be used for resolving domain names. In either of the following cases you must specify at least one default DNS server for address resolution:

- To use fully qualified domain names instead of IP addresses when specifying external addresses. For example, for LDAP and NTP servers, neighbor zones and peers.
- To use features such as URI dialing or ENUM dialing.

The VCS queries one server at a time. If that server is unavailable the VCS tries another server from the list.

In the example deployment two DNS servers are configured for each VCS, which provides a level of DNS server redundancy. The VCS Control is configured with DNS servers which are located on the internal network. The VCS Expressway is configured with DNS servers which are publicly routable.

To configure the **Default DNS server** addresses:

1. Go to **System > DNS**.
2. Configure the DNS server **Address** fields as follows:

	VCS Control	VCS Expressway
<b>Address 1</b>	Enter <code>10.0.0.11</code>	Enter <code>194.72.6.57</code>
<b>Address 2</b>	Enter <code>10.0.0.12</code>	Enter <code>194.73.82.242</code>

3. Click **Save**.

## VCS System Configuration

VCS Control has a fully qualified domain name of `vcsc.internal-domain.net`

### DNS

#### DNS settings

Local host name	<input type="text" value="vcsc"/>	
Domain name	<input type="text" value="internal-domain.net"/>	
DNS requests port range	<input type="text" value="Use the ephemeral port range"/>	

#### Default DNS servers

Address 1	<input type="text" value="10.0.0.11"/>	
Address 2	<input type="text" value="10.0.0.12"/>	
Address 3	<input type="text"/>	
Address 4	<input type="text"/>	
Address 5	<input type="text"/>	

VCS Expressway has a fully qualified domain name of `vcse.example.com`

### DNS

#### DNS settings

Local host name	<input type="text" value="vcse"/>	
Domain name	<input type="text" value="example.com"/>	
DNS requests port range	<input type="text" value="Use the ephemeral port range"/>	

#### Default DNS servers

Address 1	<input type="text" value="194.72.6.57"/>	
Address 2	<input type="text" value="194.73.82.242"/>	
Address 3	<input type="text"/>	
Address 4	<input type="text"/>	
Address 5	<input type="text"/>	

## Task 5: Replacing the Default Server Certificate

For extra security, you may want to have the VCS communicate with other systems (such as LDAP servers, neighbor VCSs, or clients such as SIP endpoints and web browsers) using TLS encryption.

For this to work successfully in a connection between a client and server:

- The server must have a certificate installed that verifies its identity. The certificate must be signed by a Certificate Authority (CA).
- The client must trust the CA that signed the certificate used by the server.

## VCS System Configuration

The VCS lets you install a certificate that can represent the VCS as either a client or a server in connections using TLS. The VCS can also authenticate client connections (typically from a web browser) over HTTPS. You can also upload certificate revocation lists (CRLs) for the CAs used to verify LDAP server and HTTPS client certificates.

The VCS can generate server certificate signing requests (CSRs). This removes the need to use an external mechanism to generate certificate requests.

For secure communications (HTTPS and SIP/TLS), we recommend that you replace the VCS default certificate with a certificate generated by a trusted certificate authority.

**Table 3 VCS Role in Different Connection Types**

In connections...	The VCS acts as...
To an endpoint.	TLS server.
To an LDAP server.	Client.
Between two VCS systems.	Either VCS may be the client. The other VCS is the TLS server.
Over HTTPS.	Web browser is the client. VCS is the server.

TLS can be difficult to configure. For example, when using it with an LDAP server we recommend verifying that the system works correctly over TCP, before you attempt to secure the connection with TLS. We also recommend using a third-party LDAP browser to verify that your LDAP server is correctly configured for TLS.

**Note:** Be careful not to allow your CA certificates or CRLs to expire. This may cause certificates signed by those CAs to be rejected.

To load the trusted CA list, go to **Maintenance > Security > Trusted CA certificate**.

To generate a CSR and/or upload the VCS's server certificate, go to **Maintenance > Security > Server certificate**.

For full information, see *VCS Certificate Creation and Use Deployment Guide* on the [VCS configuration guides page](#).

## Task 6: Configuring NTP Servers

The **NTP server** address fields set the IP addresses or Fully Qualified Domain Names (FQDNs) of the NTP servers to be used to synchronize system time. The **Time zone** sets the local time zone of the VCS.

**Note:** You can synchronize the VCS Control and VCS Expressway with different NTP servers, if the result is that the VCS traversal pair are synchronized.

To configure the NTP server address and time zone:

1. Go to **System > Time**.
2. Configure the fields as follows, on both VCS Control and VCS Expressway:

	VCS Control	VCS Expressway
<b>NTP server 1</b>	Enter <code>pool.ntp.org</code>	Enter <code>pool.ntp.org</code>
<b>Time zone</b>	<i>GMT</i> in this example	<i>GMT</i> in this example

3. Click **Save**.

VCS System Configuration

**Time** You are here: [System](#) > [Time](#)

**NTP servers**

NTP server 1	Address	<input type="text" value="pool.ntp.org"/>	Authentication	Disabled
NTP server 2	Address	<input type="text"/>	Authentication	Disabled
NTP server 3	Address	<input type="text"/>	Authentication	Disabled
NTP server 4	Address	<input type="text"/>	Authentication	Disabled
NTP server 5	Address	<input type="text"/>	Authentication	Disabled

**Time zone**

Time zone

### Task 7: Configuring SIP Domains

The VCS acts as a SIP Registrar for configured SIP domains, accepting registration requests for any SIP endpoints attempting to register with an alias that includes these domains.

- Registration restriction (Allow or Deny) rules can be configured to limit acceptable registrations. See [Task 17: Configuring Registration Restriction Policy \(Optional\)](#), page 47.
- If authentication is enabled, only devices that can properly authenticate themselves will be allowed to register.

To configure a SIP domain:

- Go to **Configuration > Domains**.
- Click **New**.
- Enter the domain name into the **Name** field (on both VCS Control and VCS Expressway):

	VCS Control	VCS Expressway
<b>Name</b>	Enter example.com	Enter example.com

- Click **Create domain**.
- The **Domains** page displays all configured SIP domain names.

**Domains** You are here: [Configuration](#) > [Domains](#) > [New](#)

**Configuration**

Domain name

On VCS Expressway, if you are not using device authentication, leave **Traversal zone for delegated credential checking** set to *Do not delegate*. If you are using device authentication, see [Task 18: Configuring Device Authentication Policy \(Optional\)](#), page 48.

### What To Do Next

The VCS system configuration is now complete. Go to the next section, "*Routing Configuration*."

## Routing Configuration

### Pre-search Transforms

Pre-search transform configuration allows the destination alias (called address) in an incoming search request to be modified. The VCS applies the transformation before any searches take place, either locally or to external zones.

The pre-search transform configuration described in this document is used to standardize destination aliases originating from both H.323 and SIP devices. This means that the same call searches work for calls from both H.323 and SIP endpoints.

For example, if the called address is an H.323 E.164 alias "01234", the VCS automatically appends the configured domain name (in this case example.com) to the called address (that is, 01234@example.com making it into a URI), before attempting to set up the call.

- Use pre-search transforms with care, because they apply to *all* signaling messages. If they match, they will affect the routing of Unified Communications messages, provisioning and presence requests as well as call requests.
- Transformations can also be carried out in search rules. Consider whether it's best to use a pre-search transform or a search rule to modify the called address to be looked up.

### Search Rules

Search rules define how the VCS routes calls (to destination zones) in specific call scenarios. When a search rule is matched, the destination alias can be modified according to the conditions defined in the search rule.

The search rules described in this document are used to ensure that endpoints can dial H.323 devices that have registered E.164 numbers or H.323 IDs without a domain portion. The search rules first search for received destination aliases without the domain portion of the URI, and then search with the full URI.

The search rules described here are used to enable the following routing combinations:

Calling party	Called party
Registered devices (VCS Control or VCS Expressway)	Registered devices (VCS Control or VCS Expressway)
Registered devices (VCS Control or VCS Expressway)	External domains and un-registered devices (via VCS Expressway using DNS zone)
Registered devices (VCS Control or VCS Expressway)	Public external IP addresses (via VCS Expressway)
External domains and un-registered devices	Registered devices (VCS Control or VCS Expressway)

The routing configuration in this document searches for destination aliases that have valid SIP URIs. That is, using a valid SIP domain, such as id@domain.

You can configure routing which enables calls to unregistered devices on an internal network (routing to the addresses of IP of the devices) by configuring a search rule with a mode of *Any IP address* with target Local Zone. However this is not recommended (and not described in this document). The best practice is to register all devices and route using destination aliases.

## Task 8: Configuring Transforms

The pre-search transform configuration described in this document is used to standardize destination aliases originating from both H.323 and SIP devices.

## Routing Configuration

The following transform modifies the destination alias of all call attempts made to destination aliases which do not contain an '@'. The old destination alias has @example.com appended to it, thus standardizing all called destination aliases into a SIP URI format.

To configure the transform:

1. Go to **Configuration > Dial plan > Transforms**.
2. Click **New**.
3. Configure the transform fields as follows:

	VCS Control	VCS Expressway
<b>Priority</b>	Enter 1	Same as VCS Control
<b>Description</b>	Enter Transform destination aliases to URI format	
<b>Pattern type</b>	Regex	
<b>Pattern string</b>	Enter ([^@]*)	
<b>Pattern behavior</b>	Replace	
<b>Replace string</b>	Enter \1@example.com	
<b>State</b>	Enabled	

4. Click **Create transform**.

**Create transform** You are here: [Configuration](#) > [Dial plan](#) > [Transforms](#) > Create transform

**Configuration**

Priority	<input type="text" value="1"/>	
Description	<input type="text" value="Transform destination aliases to URI format"/>	
Pattern type	Regex	
Pattern string	<input type="text" value="*([^\@]*)"/>	
Pattern behavior	Replace	
Replace string	<input type="text" value="\1@example.com"/>	
State	Enabled	

## Task 9: Configuring Local Zone Search Rules

To configure the search rules to route calls to the Local Zone (to locally registered endpoint aliases):

1. Go to **Configuration > Dial plan > Search rules**.
2. First disable the supplied default search rule (**LocalZoneMatch**), as follows:
  - a. Select the check box next to **LocalZoneMatch**.
  - b. Click **Disable**.
  - c. Click **OK**.

## Routing Configuration

3. Click **New**.
4. Configure the search rule fields as follows:

	VCS Control	VCS Expressway
<b>Rule name</b>	Enter <code>Local zone - no domain</code>	Same as VCS Control
<b>Description</b>	Enter <code>Search local zone for H.323 devices (strip domain)</code>	
<b>Priority</b>	Enter <code>48</code>	
<b>Protocol</b>	<i>Any</i>	
<b>Source</b>	<i>Any</i>	
<b>Request must be authenticated</b>	<i>No</i>	
<b>Mode</b>	<i>Alias pattern match</i>	
<b>Pattern type</b>	<i>Regex</i>	
<b>Pattern string</b>	Enter <code>(.+@example\.com.*</code>	
<b>Pattern behavior</b>	<i>Replace</i>	
<b>Replace string</b>	Enter <code>\1</code>	
<b>On successful match</b>	<i>Continue</i>	
<b>Target</b>	<i>LocalZone</i>	
<b>State</b>	<i>Enabled</i>	

Routing Configuration

5. Click **Create search rule**.

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name	* Local zone – no domain <span style="float: right;">i</span>
Description	Search local zone for H.323 devices (strip domain) <span style="float: right;">i</span>
Priority	* 48 <span style="float: right;">i</span>
Protocol	Any <span style="float: right;">i</span>
Source	Any <span style="float: right;">i</span>
Request must be authenticated	No <span style="float: right;">i</span>
Mode	Alias pattern match <span style="float: right;">i</span>
Pattern type	Regex <span style="float: right;">i</span>
Pattern string	* (.+@example.com.* <span style="float: right;">i</span>
Pattern behavior	Replace <span style="float: right;">i</span>
Replace string	\1 <span style="float: right;">i</span>
On successful match	Continue <span style="float: right;">i</span>
Target	* LocalZone <span style="float: right;">i</span>
State	Enabled <span style="float: right;">i</span>

6. Click **New**.

## 7. Configure the search rule fields as follows:

	VCS Control	VCS Expressway
<b>Rule name</b>	Enter <code>Local zone - full URI</code>	Same as VCS Control
<b>Description</b>	Enter <code>Search local zone for SIP and H.323 devices with a domain</code>	
<b>Priority</b>	Enter <code>50</code>	
<b>Protocol</b>	<i>Any</i>	
<b>Source</b>	<i>Any</i>	
<b>Request must be authenticated</b>	<i>No</i>	
<b>Mode</b>	<i>Alias pattern match</i>	
<b>Pattern type</b>	<i>Regex</i>	
<b>Pattern string</b>	Enter <code>(.+@example.com.*</code>	
<b>Pattern behavior</b>	<i>Leave</i>	
<b>On successful match</b>	<i>Continue</i>	
<b>Target</b>	<i>LocalZone</i>	
<b>State</b>	<i>Enabled</i>	

8. Click **Create search rule**.

## Task 10: Configuring the Traversal Zone

The traversal zone configuration defines a connection between the VCS Control and VCS Expressway platforms. A traversal zone connection allows firewall traversal for signaling and media between the two platforms. VCS Control is configured with a traversal client zone. VCS Expressway is configured with a traversal server zone.

### Which type of traversal zone?

- If your deployment is for business to business calling, use a traversal zone.
- If your deployment is for mobile and remote access, use a Unified Communications traversal zone (see next section).

### Chained firewall traversal

#### Traversal zones for Unified Communications

If you need Unified Communications features like mobile and remote access or Jabber Guest, a secure traversal zone connection must exist between VCS Control and VCS Expressway:

- The VCS Control and VCS Expressway must be configured with a zone of type *Unified Communications traversal*. This automatically configures an appropriate traversal zone (a traversal client zone when selected on VCS Control or a traversal server zone when selected on VCS Expressway) that uses SIP TLS with **TLS verify mode** set to *On*, and **Media encryption mode** set to *Force encrypted*.
- Both VCSs must trust each other's server certificate. As each VCS acts both as a client and as a server you must ensure that each VCS's certificate is valid both as a client and as a server.
- If an H.323 or a non-encrypted connection is also required, a separate pair of traversal zones must be configured.

**To configure the traversal zone:**

1. Go to **Configuration > Zones > Zones**.
2. Click **New**.
3. Configure the fields as follows. Leave all other fields with default values:

	VCS Control	VCS Expressway
<b>Name</b>	Enter TraversalZone	Enter TraversalZone
<b>Type</b>	<i>Traversal client</i>	<i>Traversal server</i>
<b>Username</b>	Enter exampleauth	Enter exampleauth
<b>Password</b>	Enter ex4mpl3.c0m	Not applicable
<b>H.323 Mode</b>	<i>On</i>	<i>On</i>
<b>H.323 Protocol</b>	<i>Assent</i>	<i>Assent</i>
<b>H.323 Port</b>	Enter 6001	Enter 6001
<b>H.323 H.460.19 demultiplexing mode</b>	Not applicable	<i>Off</i>
<b>SIP Mode</b>	<i>On</i>	<i>On</i>
<b>SIP Port</b>	Enter 7001	Enter 7001
<b>SIP Transport</b>	<i>TLS</i>	<i>TLS</i>
<b>SIP TLS verify mode</b>	<i>Off</i>	<i>Off</i>
<b>SIP Accept proxied registrations</b>	<i>Allow</i>	<i>Allow</i>
<b>Location Peer 1 address</b>	Enter 192.0.2.2	Not applicable

4. Click **Create zone**.

## Routing Configuration

Figure 6 VCS Control

**Create zone** You are here: [Configuration](#) > [Zones](#) > [Zones](#) > Create zone

---

**Configuration**

Name  ⓘ

Type  ⓘ

Hop count  ⓘ

---

**Connection credentials**

Username  ⓘ

Password  ⓘ

---

**H.323**

Mode  ⓘ

Protocol  ⓘ

Port  ⓘ

---

**SIP**

Mode  ⓘ

Port  ⓘ

Transport  ⓘ

TLS verify mode  ⓘ

Accept proxied registrations  ⓘ

Media encryption mode  ⓘ

ICE support  ⓘ

Poison mode  ⓘ

---

**Authentication**

Authentication policy  ⓘ

---

**Client settings**

Retry interval  ⓘ

---

**Location**

Peer 1 address  ⓘ

## Routing Configuration

Figure 7 VCS Expressway

**Create zone** You are here: [Configuration](#) > [Zones](#) > [Zones](#) > [Create zone](#)

**Configuration**

Name  ⓘ

Type  ⓘ

Hop count  ⓘ

**Connection credentials**

Username  ⓘ

Password Ensure matching credentials are configured in the [local database](#) or the H.350 directory.

**H.323**

Mode  ⓘ

Protocol  ⓘ

Port  ⓘ

H.460.19 demultiplexing mode  ⓘ

**SIP**

Mode  ⓘ

Port  ⓘ

Transport  ⓘ

TLS verify mode  ⓘ

Accept proxied registrations  ⓘ

Media encryption mode  ⓘ

ICE support  ⓘ

Poison mode  ⓘ

**Authentication**

Authentication policy  ⓘ

**Configuring authentication credentials in VCS Expressway**

To configure the authentication credentials in the **Local authentication database** (configured in the VCS Expressway only), do the following:

1. Go to **Configuration > Authentication > Devices > Local database**.
2. Click **New**.

## Routing Configuration

3. Configure the fields as follows:

	VCS Control	VCS Expressway
<b>Name</b>	Not applicable	Enter <code>exampleauth</code>
<b>Password</b>	Not applicable	Enter <code>ex4mp13.c0m</code>

4. Click **Create credential**.

**Local authentication database** You are here: [Configuration](#) > [Authentication](#) > [Devices](#) > [Local database](#)

**Configuration**

Name  ⓘ

Password  ⓘ

## Neighboring Between VCS Clusters

You can neighbor your local VCS (or VCS cluster) to a remote VCS cluster; this remote cluster could be a neighbor, traversal client, or traversal server to your local VCS. In this case, when a call is received on your local VCS and is passed via the relevant zone to the remote cluster, it will be routed to whichever peer in that neighboring cluster has the lowest resource usage. That peer will then forward the call as appropriate to one of its:

- locally registered endpoints (if the endpoint is registered to that peer)
- peers (if the endpoint is registered to another peer in that cluster)
- external zones (if the endpoint has been located elsewhere)

For Expressway: Lowest resource usage is determined by comparing the number of available media sessions (maximum - current use) on the peers, and choosing the peer with the highest number. Peers that are in maintenance mode are not considered.

For VCS: Lowest resource usage is determined by comparing the number of available traversal calls (maximum - current use) on the peers, and choosing the peer with the highest number. Peers that are in maintenance mode are not considered.

When configuring a connection to a remote cluster, you create a single zone and configure it with details of all the peers in the cluster. Adding this information to the zone ensures that the call is passed to that cluster regardless of the status of the individual peers.

You also need to enter the address of all peers in the remote cluster when the connection is via a **neighbor** or **traversal client** zone. You do not do this for **traversal server** zones, as these connections are not configured by specifying the remote system's address.

**Note:** Systems that are configured as peers must **not** also be configured as neighbors to each other, and vice versa.

### Neighboring your clusters

To neighbor your local VCS (or VCS cluster) to a remote VCS cluster, you create a single zone to represent the cluster and configure it with the details of all the peers in that cluster:

1. On your local VCS (or, if the local VCS is a cluster, on the primary peer), create a zone of the appropriate type. This zone will represent the connection to the cluster.
2. In the **Location** section, enter the IP address or FQDN of each peer in the remote cluster in the **Peer 1 to Peer 6** address fields.

Note that:

## Routing Configuration

- Ideally you should use FQDNs in these fields. Each FQDN must be different and must resolve to a single IP address for each peer. With IP addresses, you may not be able to use TLS verification, because many CAs will not supply certificates to authenticate an IP address.
- The order in which the peers in the remote VCS cluster are listed here does not matter.
- Whenever you add an extra VCS to a cluster (to increase capacity or improve redundancy, for example) you will need to modify any VCSs which neighbor to that cluster to let them know about the new cluster peer.

## Task 11: Configuring Traversal Zone Search Rules

To create the search rules to route calls via the traversal zone.

1. Go to **Configuration > Dial plan > Search rules**.
2. Click **New**.
3. Configure the fields as follows:

	VCS Control	VCS Expressway
<b>Rule name</b>	"Traversal zone search rule" for example	"Traversal zone search rule" for example
<b>Description</b>	"Search traversal zone - VCSe" for example	"Search traversal zone - VCSc" for example
<b>Priority</b>	100	100
<b>Protocol</b>	<i>Any</i>	<i>Any</i>
<b>Source</b>	<i>Any</i>	<i>Any</i>
<b>Request must be authenticated</b>	<i>No</i>	<i>No</i>
<b>Mode</b>	<i>Any alias</i>	<i>Any alias*</i>
<b>On successful match</b>	<i>Continue</i>	<i>Continue</i>
<b>Target</b>	<i>Traversal zone</i>	<i>Traversal zone</i>
<b>State</b>	<i>Enabled</i>	<i>Enabled</i>

\* This example routes any alias across the traversal zone towards the VCS Control. You can be more selective by adding search rules or configuring call policy.

4. Click **Create search rule**.

## Routing Configuration

Figure 8 Traversal Zone Search Rule on VCS Control

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name	* Traversal zone search rule <span style="float: right;">i</span>
Description	Search traversal zone - VCSe <span style="float: right;">i</span>
Priority	* 100 <span style="float: right;">i</span>
Protocol	Any <span style="float: right;">i</span>
Source	Any <span style="float: right;">i</span>
Request must be authenticated	No <span style="float: right;">i</span>
Mode	Any alias <span style="float: right;">i</span>
On successful match	Continue <span style="float: right;">i</span>
Target	* TraversalZone <span style="float: right;">i</span>
State	Enabled <span style="float: right;">i</span>

Figure 9 Traversal Zone Search Rule on VCS Expressway

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name	* Traversal zone search rule <span style="float: right;">i</span>
Description	Search traversal zone - VCSc <span style="float: right;">i</span>
Priority	* 100 <span style="float: right;">i</span>
Protocol	Any <span style="float: right;">i</span>
Source	Any <span style="float: right;">i</span>
Request must be authenticated	No <span style="float: right;">i</span>
Mode	Any alias <span style="float: right;">i</span>
On successful match	Continue <span style="float: right;">i</span>
Target	* TraversalZone <span style="float: right;">i</span>
State	Enabled <span style="float: right;">i</span>

## Task 12: Configuring the DNS Zone

The DNS zone is used to search for externally hosted systems (such as for business to business calling). Destination aliases are searched for by a name using a DNS lookup.

To configure the DNS zone:

1. Sign in to the VCS Expressway.
2. Go to **Configuration > Zones > Zones**.
3. Click **New**.
4. Configure the fields as follows (leave all other fields with default values):

Field name	Value
<b>Name</b>	Enter <code>DNSZone</code> for example
<b>Type</b>	<i>DNS</i>
<b>H.323 Mode</b>	<i>On</i>
<b>SIP Mode</b>	<i>On</i>
<b>Fallback transport protocol</b>	<i>TCP</i>
<b>Include address record</b>	<i>Off</i>

5. Click **Create zone**.

## Task 13: Configuring DNS Zone Search Rules

The DNS search rule defines when the DNS zone should be searched.

A specific regular expression is configured which will prevent searches being made using the DNS zone (i.e. on the public internet) for destination addresses (URIs) using any SIP domains which are configured on the local network (local domains).

To create the search rules to route via DNS:

1. Sign in to the VCS Expressway.
2. Go to **Configuration > Dial plan > Search rules**.
3. Click **New**.

## Routing Configuration

## 4. Configure the fields as follows:

Field name	Value
<b>Rule name</b>	Enter DNS zone search rule for example
<b>Description</b>	Enter Search DNS zone (external calling) for example
<b>Priority</b>	150
<b>Protocol</b>	Any
<b>Source</b>	All zones
<b>Request must be authenticated</b>	No
<b>Mode</b>	Alias pattern match
<b>Pattern type</b>	Regex
<b>Pattern string</b>	(?!.*@%localdomains%.*\$).*
<b>Pattern behavior</b>	Leave
<b>On successful match</b>	Continue
<b>Target</b>	DNSZone
<b>State</b>	Enabled

5. Click **Create search rule**.

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name \*  i

Description  i

Priority \*  i

Protocol  i

Source  i

Request must be authenticated  i

Mode  i

Pattern type  i

Pattern string \*  i

Pattern behavior  i

On successful match  i

Target \*  i

State  i

Note that the regular expression used to prevent local domains being searched via the DNS zone can be broken down into the following components:

## Routing Configuration

(.\*) = match all pattern strings

(?!.\*@example\.com.\*\$).\* = do not match any pattern strings ending in @example.com

In the deployment example, calls destined for @cisco.com would be searched via the DNS zone, whereas calls destined for @example.com would not.

## Task 14: Configuring External (Unknown) IP Address Routing

The following configuration defines how a VCS routes calls (and other requests) to external IP addresses. An external IP address is an IP address which is not 'known' to the VCS and therefore assumed to be a publicly routable address.

Known IP addresses are addresses defined in a subzone (using a subzone membership subnet rule) or the IP address of an H.323 registered device.

- All requests destined for external IP addresses, originating at the VCS Control are routed to the VCS Expressway using a search rule.
- The VCS Expressway then attempts to open a connection directly to the IP address.

To configure how the VCS handles calls to unknown IP addresses:

1. Go to **Configuration > Dial plan > Configuration**.
2. Configure the fields as follows:

	VCS Control	VCS Expressway
<b>Calls to unknown IP addresses</b>	<i>Indirect</i>	<i>Direct</i>

### VCS Control

**Dial plan configuration** You are here: [Configuration](#) > [Dial plan](#) > Configuration

**Configuration**

Calls to unknown IP addresses:  ⓘ

Fallback alias:  ⓘ

### VCS Expressway

**Dial plan configuration** You are here: [Configuration](#) > [Dial plan](#) > Configuration

**Configuration**

Calls to unknown IP addresses:  ⓘ

Fallback alias:  ⓘ

3. Click **Save**.

To create the search rules to route calls to IP addresses to the VCS Expressway:

1. Go to **Configuration > Dial plan > Search rules**.
2. Click **New**.

## Routing Configuration

## 3. Configure the fields as follows:

	VCS Control	VCS Expressway
<b>Rule name</b>	Enter External IP address search rule	Not applicable
<b>Description</b>	Enter Route external IP address	Not applicable
<b>Priority</b>	Enter 100	Not applicable
<b>Protocol</b>	Any	Not applicable
<b>Source</b>	Any	Not applicable
<b>Request must be authenticated</b>	No	Not applicable
<b>Mode</b>	Any IP address	Not applicable
<b>On successful match</b>	Continue	Not applicable
<b>Target</b>	TraversalZone	Not applicable
<b>State</b>	Enabled	Not applicable

4. Click **Create search rule**.

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name	<input type="text" value="External IP address search rule"/>	
Description	<input type="text" value="Route external IP address"/>	
Priority	<input type="text" value="100"/>	
Protocol	<input type="text" value="Any"/>	
Source	<input type="text" value="Any"/>	
Request must be authenticated	<input type="text" value="No"/>	
Mode	<input type="text" value="Any IP address"/>	
On successful match	<input type="text" value="Continue"/>	
Target	<input type="text" value="TraversalZone"/>	
State	<input type="text" value="Enabled"/>	

## Endpoint Registration

The example network configuration diagram shows three endpoints.

Endpoint	IP address	Network
EX90	10.0.0.15	Internal network
EX60	10.0.0.16	Internal network
EX60	192.168.0.2	Home user network

After system configuration, endpoint registration should be possible using these endpoint configuration details:

EX90 (uses SIP protocol)	
SIP URI	user.one.ex90@example.com
SIP Proxy1	vcsc.internal-domain.net
EX60 (uses H.323 and SIP protocol)	
H.323 ID	user.two.mxp@example.com
H.323 E.164	7654321
Gatekeeper IP Address	vcsc.internal-domain.net
SIP URI	user.two.mxp@example.com
SIP Proxy1	vcsc.internal-domain.net
EX60 at home (uses H.323 and SIP protocol)	
H.323 ID	user.three.mxp@example.com
H.323 E.164	1234567
Gatekeeper IP Address	vcse.example.com
SIP URI	user.three.mxp@example.com
SIP Proxy1	vcse.example.com

## What To Do Next

The VCS routing configuration is now complete. Go to the next section, "*System Checks*."

## System Checks

### Zone Status

Go to **Status > Zones** on both VCS Control and VCS Expressway to check that the traversal zone is **Active**. You can also check the zone status in **Configuration > Zones > Zones**.

If the traversal zone is not active, do the following:

- Review the traversal zone configuration.
- Check that the relevant ports are enabled for outbound routing on the NAT and firewall devices located between the VCS Control and VCS Expressway. See [Appendix 3: Firewall and NAT Settings, page 67](#).
- Check that the username and password credentials are configured correctly (and match) on VCS Control and VCS Expressway traversal zones and in the authentication database on the VCS Expressway.

### Registration Status

Check that all endpoints which are expected to be registered are actually registered to the relevant VCS. And that they are registering the expected aliases. All successfully registered endpoints are listed on **Status > Registrations > By device**.

If the expected endpoints are not registered, review the following items:

- The endpoint's registration configuration. Is it configured to register with the VCS Expressway if located on the external network / internet, and to register with the VCS Control if located on the internal network?
- The SIP domains ([Task 7: Configuring SIP Domains, page 25](#)).
- Any registration restriction configuration applied to the VCS (optional, [Task 17: Configuring Registration Restriction Policy \(Optional\), page 47](#)).

In some cases, home endpoints may fail to register when using SRV records. This can happen if the endpoint uses the home router for its DNS server, and the router's DNS server software doesn't support SRV records lookup. (Also applies to the DNS server being used by a PC when Jabber Video is running on it.) If registration failure occurs, do either of the following:

- Change the DNS server on the endpoint to use a publicly available DNS server which can resolve SRV record lookups. For example, Google - 8.8.8.8
- Change the SIP/H.323 server address on the endpoint to use the FQDN of a node in the VCS cluster and not the cluster SRV record. So that the device performs an AAAA or A record lookup.

### Call Signaling

If calls do not complete, despite the endpoints being successfully registered to a VCS:

- Review the VCS Control search rule configuration.
- Review the VCS Expressway search rule configuration.
- Check the search history page for search attempts and failures (**Status > Search history**).
- Check the Event Log for call connection failure reasons (**Status > Logs > Event Log**).

### Connectivity Test Tool

The SRV connectivity tester is a network utility that tests whether the VCS can connect to particular services on a given domain. You can use this tool to proactively test your connectivity while configuring VCS-based solutions such as Cisco Webex Hybrid Call Service or business-to-business video calling. You specify the DNS Service Record Domain and the Service Record Protocols you want to query for that domain. The VCS does a DNS SRV query for

## System Checks

each specified protocol, and then attempts TCP connections to the hosts returned by the DNS. If you specify TLS, the VCS only attempts a TLS connection after the TCP succeeds. The VCS connectivity test page shows the DNS response and the connection attempts. For any connection failures, the reason is provided along with advice to help with resolving specific issues. To troubleshoot connectivity, you can download the TCP data from your test in *.pcap* format. You can selectively download a dump of the DNS query, or a specific connection attempt, or you can get a single *.pcap* file showing the whole test.

## What To Do Next

When you've completed the system checks and are satisfied that the system is working as expected, [create a system backup](#) and then go on to "*Optional Configuration Tasks*".

## Maintenance Routine

### Creating a System Backup

#### Before You Begin

- From X8.11, backup files are always encrypted. In particular because they include the bootstrap key, and authentication data and other sensitive information.
- Backups can only be restored to a system that is running the **same version of software from which the backup was made**.
- You can create a backup on one VCS and restore it to a different VCS. For example if the original system has failed. Before the restore, you must install the same option keys on the new system that were present on the old one.

If you try to restore a backup made on a different VCS, you receive a warning message, but you will be allowed to continue.

(If you use FIPS140-2 cryptographic mode) You can't restore a backup made on a non-FIPS system, onto a system that's running in FIPS mode. You can restore a backup from a FIPS-enabled system onto a non-FIPS system.

- Do not use backups to copy data between VCSs. If you do so, system-specific information will be duplicated (like IP addresses).
- Because backup files contain sensitive information, you should not send them to Cisco in relation to technical support cases. Use snapshot and diagnostic files instead.

#### Passwords

- From X8.11, all backups must be password protected.
- If you restore to a previous backup, and the administrator account password has changed since the backup was done, you must also provide the old account password when you first log in after the restore.
- Active Directory credentials are **not** included in system backup files. If you use NTLM device authentication, you must provide the Active Directory password to rejoin the Active Directory domain after any restore.
- For backup and restore purposes, emergency account passwords are handled the same as standard administrator account passwords.

#### Process

To create a backup of VCS system data:

1. Go to **Maintenance > Backup and restore**.
2. Enter an **Encryption password** to encrypt the backup file.  
**Caution: The password will be required in future if you ever want to restore the backup file.**
3. Click **Create system backup file**.
4. Wait for the backup file to be created. This may take several minutes. Do not navigate away from this page while the file is being prepared.
5. When the backup is ready, you are prompted to save it. The default filename uses format: **<software version>\_<hardware serial number>\_<date>\_<time>\_backup.tar.gz.enc**. Or if you use Internet Explorer, the default extension is **.tar.gz.gz**. (These different filename extensions have no operational impact, and you can create and restore backups using any supported browser.)
6. Save the backup file to a secure location.

## Optional Configuration Tasks

### Task 15: Configuring Cisco TMS (Optional)

The following configuration enables the VCS system to be integrated to a Cisco TelePresence Management Suite (Cisco TMS).

Points to note:

- Further configuration tasks are also required on Cisco TMS to fully integrate the VCS with the TMS server. For details, see *Cisco TMS Administrator Guide* on the [TMS Maintain and Operate Guides page](#).
- Enabling SNMP speeds up the VCS - TMS integration process, but is not essential.
- VCS Expressway integration with TMS requires additional firewall / NAT configuration. VCS Expressway needs to access port 80/443 on Cisco TMS from outside the firewall. See [Appendix 3: Firewall and NAT Settings, page 67](#).

To enable and configure SNMP:

- Go to **System > SNMP**.
- Configure the SNMP fields as follows:

	VCS Control	VCS Expressway
<b>SNMP mode</b>	<i>v3 plus TMS support</i>	Same as VCS Control
<b>Community name</b>	Check that it is <code>public</code>	
<b>System contact</b>	Enter <code>IT administrator</code>	
<b>Location</b>	Enter <code>example.com head office</code>	
<b>Username</b>	Enter <code>vcs</code>	
<b>Authentication mode</b>	<i>On</i>	
<b>Type</b>	<i>SHA</i>	
<b>Password</b>	Enter <code>ex4mp13.c0m</code>	
<b>Privacy mode</b>	<i>On</i>	
<b>Type</b>	<i>AES</i>	
<b>Password</b>	Enter <code>ex4mp13.c0m</code>	

- Click **Save**.

## Optional Configuration Tasks

**SNMP** You are here: [System](#) > [SNMP](#)

**Configuration**

SNMP mode: v3 plus TMS support ⓘ

Community name: public ⓘ

System contact: IT administrator ⓘ

Location: example.com head office ⓘ

Username: VCS ⓘ

**Authentication**

Authentication mode: On ⓘ

Type: SHA ⓘ

Password: ..... ⓘ

**Privacy**

Privacy mode: On ⓘ

Type: AES ⓘ

Password: ..... ⓘ

To configure the necessary external manager (Cisco TMS) parameters:

1. Go to **System > External manager**.
2. Configure the fields as follows:

	VCS Control	VCS Expressway
<b>Address</b>	Enter 10.0.0.14	Same as VCS Control
<b>Path</b>	Enter tms/public/external/management/ SystemManagementService.asmx	
<b>Protocol</b>	Select <i>HTTP</i> or <i>HTTPS</i>	
<b>Certificate verification mode</b>	Select <i>On</i> or <i>Off</i>  The certificate is only verified if the value is <i>On</i> and the protocol is set to <i>HTTPS</i> . If you switch this on then Cisco TMS and VCS must have appropriate certificates.	

3. Click **Save**.

## Optional Configuration Tasks

**External manager** You are here: [System](#) > External manager

**Configuration**

Address:  ⓘ

Path:  ⓘ

Protocol: HTTP ⓘ

Certificate verification mode: On ⓘ

## Task 16: Configuring Logging (Optional)

The following configuration enables event logs to be sent to an external logging server using the SYSLOG protocol.

- The **Local event log verbosity** setting controls the granularity of event logging. 1 is the least verbose, 4 the most.
- We recommend a minimum level of 2. This provides both system and basic signaling message logging.

The VCS Expressway needs further firewall / NAT configuration for external logging. See [Appendix 3: Firewall and NAT Settings](#), page 67 for details.

To configure a logging server:

1. Go to **Maintenance > Logging**.
2. Configure the fields as follows:

	VCS Control	VCS Expressway
<b>Local event log verbosity</b>	2	2
<b>Remote syslog server 1: Address</b>	Enter 10.0.0.13	Enter 10.0.0.13
<b>Remote syslog server 1: Message Format</b>	<i>IETF syslog format</i>	<i>IETF syslog format</i>

3. Click **Save**.

## Task 17: Configuring Registration Restriction Policy (Optional)

You can limit the aliases that endpoints can register, using either an Allow list or a Deny list. This is an example of how to configure Allow list registration restrictions:

1. Go to **Configuration > Registration > Allow List**.
2. Click **New**.

## Optional Configuration Tasks

3. Create an allow pattern by configuring the following fields. This example limits registrations to endpoints which register with an identity that contains "@example.com".

	VCS Control	VCS Expressway
<b>Description</b>	Enter Only allow registrations containing "@example.com"	Same as VCS Control
<b>Pattern type</b>	Regex	
<b>Pattern string</b>	Enter .*@example\.com	

4. Click **Add Allow List pattern**.

**Create allow pattern** You are here: [Configuration](#) > [Registration](#) > [Allow List](#) > Create allow pattern

**Configuration**

Description  ⓘ

Pattern type  ⓘ

Pattern string  ⓘ

To activate the registration restriction:

1. Go to **Configuration > Registration > Configuration**.
2. Configure the **Restriction policy** as follows:

	VCS Control	VCS Expressway
<b>Restriction policy</b>	Allow List	Allow List

3. Click **Save**.

**Registration configuration** You are here: [Configuration](#) > [Registration](#) > Configuration

**Configuration**

Restriction policy  ⓘ

## Task 18: Configuring Device Authentication Policy (Optional)

Authentication policy is applied by the VCS at the zone and subzone levels. It controls how the VCS challenges incoming messages (for provisioning, registration, presence, phone books, and calls) from that zone or subzone and whether those messages are rejected, treated as authenticated, or treated as unauthenticated within the VCS.

Each zone and subzone can set its **Authentication policy** to *Check credentials*, *Do not check credentials*, or *Treat as authenticated*.

- Registration authentication is controlled by the Default Subzone configuration (or the relevant alternative subzone).
- Initial provisioning subscription request authentication is controlled by the Default Zone configuration.
- Call, presence, and phone book request authentication is controlled by the Default Subzone (or relevant alternative subzone) if the endpoint is registered, or by the Default Zone if the endpoint is not registered.

## Optional Configuration Tasks

By default, zones and subzones are configured as *Do not check credentials*.

### Using Delegated Credential Checking

If you have enabled device authentication in your network (by using an **Authentication policy** of *Check credentials*) and you have remote workers (outside the enterprise) with SIP devices, you should consider enabling delegated credential checking. In summary, this would require you to:

- Set up a secure traversal zone between the VCS Expressway and the VCS Control.
- Enable the VCS Expressway and the VCS Control's SIP settings, traversal zones and required SIP domains for delegated credential checking.
- Configure the VCS Control with the relevant authentication mechanisms.

This means that remote workers can now register to the VCS Expressway (assuming it has its **SIP registration proxy mode** set to *Off*) and be authenticated securely via the VCS Control against an authentication mechanism inside the enterprise.

See [Device Authentication on VCS Deployment Guide](#) for full information on configuring device authentication and delegated credential checking.

## Task 19: Configuring B2B Federation for Video Calls (Optional)

### Description

This section applies if you want to federate voice, video, and content calls with another standards-based organization. Federation in this context means to connect users in two or more organizations, using collaboration technologies. In this B2B deployment, it enables users in your organization to call users in a different, known organization. (The target domain and the edge technology of the other organization are known.)

We illustrate an example deployment, the signaling connections, and some sample dial plan rules. The diagrams show Unified CM as the primary standards-based call control agent on-premises, but VCS could alternatively be the registrar and call control agent. (And the deployment could apply to any third-party, standards-based solution.) For example purposes, this section uses *stdsdomain1.com* to indicate the external organization, and assumes VCS Expressway is at the edge of that domain.

### Supported Systems

- On premises SIP collaboration environments.
- Call control can be Cisco Unified Communications Manager-centric, or VCS or third party-centric.
- Cisco collaboration clients in other organizations

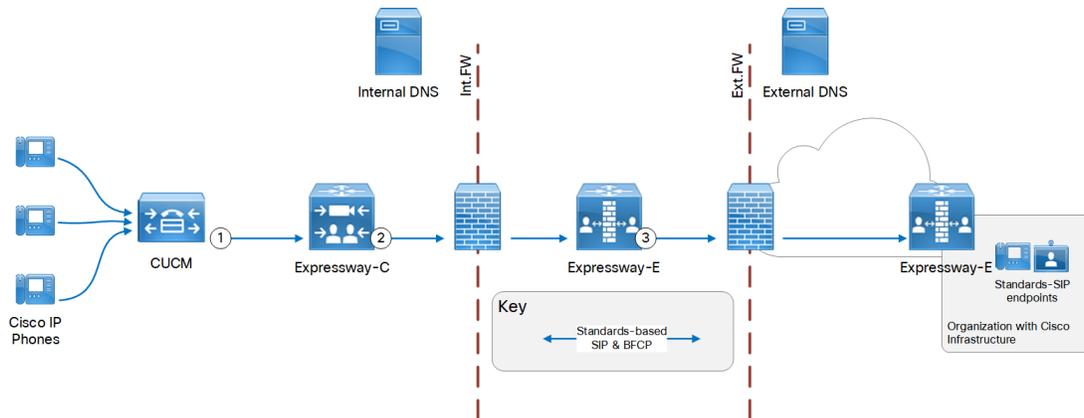
### Prerequisites

- VCS X8.9 or later.
- (If used - optional) Cisco Unified Communications Manager 10.x or later.
- DNS. An internal DNS configured with forward and reverse lookups for VCS Expressway, VCS Control.
- External DNS. An external DNS configured with forward lookup for the VCS Expressway cluster FQDN.
- NTP. All servers must be internally synchronized to the same time source.
- Basic configuration. We assume that the VCS traversal pair is installed, and basic configuration is done. Including certificate creation and install, and traversal server and client zones. Clustering is optionally supported.

Optional Configuration Tasks

## Signaling and Dial Plan

**Figure 10 Outbound Call Signaling**



**Table 4 Sample Outbound Dial Plan Rules**

Arrow #	Rule Hosted On	From	Pattern and Logic	To
1	SIP registrar (this example assumes a Cisco Unified Communications Manager)  This entry does not apply if VCS is the registrar. In that case, call routing from endpoints registered to VCS Control (local zone) is covered from source zone "CUCM" in the next entry.	Locally-registered endpoints	SIP route pattern *@stdsdomain1.com  If the registrar is an Expressway or VCS, then <b>On successful match Stop</b> .	Trunk/neighbor zone to VCS Control
2	VCS Control	Source zone "CUCM"	Match alias pattern . *@stdsdomain1\ .com  <b>On successful match Stop</b>	Traversal client zone
3	VCS Expressway	Traversal server zone	Match alias pattern . *@stdsdomain1\ .com  <b>On successful match Stop</b>	DNS zone

Optional Configuration Tasks

Figure 11 Inbound Call Signaling

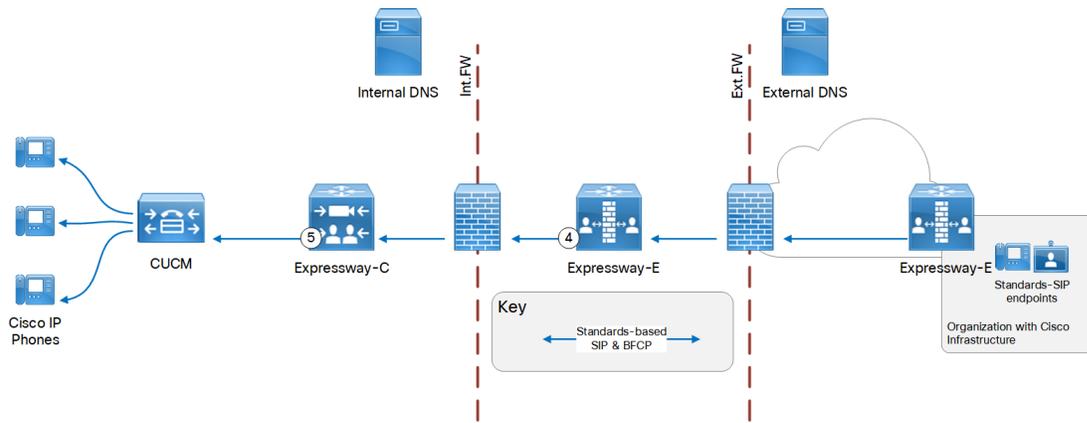


Table 5 Sample Dial Plan Rules for Inbound Call Flow

Arrow #	Rule Hosted	From	Pattern and Logic	To
4	VCS Expressway	Default zone	Standards-based SIP variant, and alias pattern <code>.*@ciscoexample\.com</code> <b>On successful match Stop</b>	Traversal server zone
5	VCS Control	Traversal client zone	Standards-based SIP variant, and alias pattern <code>.*@ciscoexample\.com</code> <b>On successful match Stop</b>	Zone to standards-based SIP registrar If Expressway is the registrar, this rule should instead target the Local Zone.

Using Collaboration Solutions Analyzer

Collaboration Solutions Analyzer is created by Cisco Technical Assistance Center (TAC) to help with deployment validation (and log file analysis). You can use the *Business to Business Call Tester* component to validate and test calls.

**Note:** You need a customer or partner account to use Collaboration Solutions Analyzer. Details about using it are provided in the VCS release notes.

Configuration Overview

**Note: Coexistence with Mobile and Remote Access**

If you have B2B federation to Unified CM as well as Mobile and Remote Access (MRA), you must configure the SIP trunk profile to listen on a different port. Unified CM listens on (TCP/TLS) 5060/5061 for line-side communications from MRA endpoints. The trunk you use for B2B traffic must listen on a different TCP or TLS port—if available, we recommend using 5560 for TCP or 5561 for TLS.

## Optional Configuration Tasks

## Required Elements

The following elements are needed:

- VCS Control and VCS Expressway, with traversal zones between them.  
Use UC traversal zones if you have MRA on this pair.
- Neighbor zone to the registrar, unless all endpoints register to VCS Control.
- Neighbor zone to Cisco Meeting Server(s) if the deployment uses Meeting Server spaces.

VCS Expressway TURN server is not required for this deployment, and Meeting Server is optional.

## Process Summary

1. VCS Expressway: Create a DNS zone on VCS Expressway. (**Configuration > Zones > Zones** with type = *DNS*)
2. (Not required if VCS Control is the registrar) VCS Control: Create a neighbor zone from VCS Control to the on-premises SIP registrar. (**Configuration > Zones > Zones** with type = *Neighbor*)
3. (Not required if VCS Control is the registrar) SIP registrar: Trunk/neighbor from the on-premises SIP registrar to VCS Control.  
If the registrar is Unified CM, see *Cisco Expressway SIP Trunk to Unified CM Deployment Guide* on the [Expressway configuration guides page](#).
4. Create domain-based search rules and a dial plan.

## Dial Plan Description

1. (Not required if VCS Control is the registrar) CUCM / SIP registrar: Route calls addressed to the federated domain to the VCS Control.  
CUCM example: create a route pattern for the `*@stdsdomain1.com` domain.
2. VCS Control: Route any calls from the local zone if VCS Control is the registrar, or from any zone if you have some endpoints registered on Cisco Unified Communications Manager and others on VCS Control, for pattern `.*@stdsdomain1.com`. To the traversal client zone.
3. VCS Expressway: Route any calls from the traversal server zone, for pattern `.*@stdsdomain1.com`. To the DNS zone.
4. VCS Expressway: Route any calls from the default zone, for pattern `.*@example.com`. To the traversal server zone.
5. VCS Control: Route any calls from the traversal client zone, for pattern `.*@example.com`. To the registrar neighbor zone.

## External DNS Records

The external DNS needs to be configured with the records required for your deployment. This table contains some example records that may apply:

**Table 6 DNS Configuration Summary**

Purpose	Record type	Example entry	Port	Resolves to target
Resolve VCS Expressway cluster FQDN to peer IP addresses	A/AAAA	<code>expe.example.com</code>		Public IP address of one VCS Expressway cluster peer.  Create one record for each peer in the VCS Expressway cluster (Up to 6 records).

## Optional Configuration Tasks

**Table 6 DNS Configuration Summary (continued)**

Purpose	Record type	Example entry	Port	Resolves to target
Discover destination for calls to third party standards-based infrastructure domain  (Outside of your control, but needs to be there for federation to succeed)	SRV	<code>_sip._tcp. ciscob2bexample.com .of_sips._tcp. ciscob2bexample.com .</code>	5060 or 5061	Public address of standards-based edge server / cluster
Discover user destination for calls from standards-based business to business federation, SIP TCP	SRV	<code>_sip._tcp. example.com.</code>	5060	FQDN of VCS Expressway cluster, eg. <code>expe.example.com</code>
Discover user destination for calls from standards-based business to business federation, SIP TLS	SRV	<code>_sips._tcp. example.com.</code>	5061	FQDN of VCS Expressway cluster, eg. <code>expe.example.com</code>

## Internal DNS Records

If you can split your DNS to give different results internally, then we recommend that you create different records for the following purposes. These records must be resolvable by VCS Control.

**Table 7 DNS Configuration Summary**

Purpose	Record type	Example entry	Port	Resolves to
For VCS Control to resolve the Federation Routing IM/P FQDN of the IM and Presence Service cluster	A	<code>IMP1- public.ciscoexample.com</code>		IP address of the IM and Presence Service publisher

## Task 20: Restricting Access to ISDN Gateways (Optional)

We recommend that you restrict unauthorized access to any ISDN gateway resources (also known as toll-fraud prevention). Some methods to achieve this are described here.

In these examples, an ISDN gateway is registered to the VCS Control with a prefix of 9. And / or it has a neighbor zone specified that routes calls starting with a 9.

## VCS Expressway

Two search rules are created on the VCS Expressway:

- Both rules have a pattern string that matches calls directed at the ISDN gateway. (In this example calls prefixed with a 9.)
- The first rule has a **Source** of *All zones*. This allows calls from registered endpoints and neighbor zones to pass through to the traversal zone.
- The second rule is similar to the first rule but has a **Source** of *All*. So it includes nonregistered endpoints (which are excluded from the previous rule). They can be stopped by defining the **Replace string** as "do-not-route-this-call."
- Both rules stop any further search rules from being looked at (**On successful match** = *Stop*).

To create the search rules:

## Optional Configuration Tasks

1. Go to **Configuration > Dial plan > Search rules**.
2. Click **New**.

## Optional Configuration Tasks

## 3. Configure the fields as follows:

	VCS Expressway
<b>Rule name</b>	Enter <code>Allow ISDN call</code> for example
<b>Description</b>	Enter <code>Allow ISDN calls for registered devices and neighbors</code>
<b>Priority</b>	Enter 40 (these rules must be the highest priority in the search rule configuration)
<b>Protocol</b>	<i>Any</i>
<b>Source</b>	<i>All zones</i>
<b>Request must be authenticated</b>	<i>No</i>
<b>Mode</b>	<i>Alias pattern match</i>
<b>Pattern type</b>	<i>Regex</i>
<b>Pattern string</b>	Enter <code>(9\d+) (@example.com)</code>
<b>Pattern behavior</b>	<i>Replace</i>
<b>Replace string</b>	Enter <code>\1</code>
<b>On successful match</b>	<i>Stop</i>
<b>Target</b>	<i>TraversalZone</i>
<b>State</b>	<i>Enabled</i>

Optional Configuration Tasks

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name	* Allow ISDN call	
Description		
Priority	* 40	
Protocol	Any	
Source	AllZones	
Request must be authenticated	No	
Mode	Alias pattern match	
Pattern type	Regex	
Pattern string	* (9\d+)(@example.com)	
Pattern behavior	Replace	
Replace string	\1	
On successful match	Stop	
Target	* TraversalZone	
State	Enabled	

4. Click **Create search rule**.
5. Click **New**.

## Optional Configuration Tasks

## 6. Configure the fields as follows:

	VCS Expressway
<b>Rule name</b>	Enter <code>Block ISDN call</code> for example
<b>Description</b>	Enter <code>Blocks everything (including nonregistered endpoints)</code>
<b>Priority</b>	Enter <code>41</code>
<b>Protocol</b>	<i>Any</i>
<b>Source</b>	<i>Any</i>
<b>Request must be authenticated</b>	<i>No</i>
<b>Mode</b>	<i>Alias pattern match</i>
<b>Pattern type</b>	<i>Regex</i>
<b>Pattern string</b>	Enter <code>(9\d+) (.*) (@example.com)</code>
<b>Pattern behavior</b>	<i>Replace</i>
<b>Replace string</b>	Enter <code>do-not-route-this-call</code> for example
<b>On successful match</b>	<i>Stop</i>
<b>Target</b>	<i>TraversalZone</i>
<b>State</b>	<i>Enabled</i>

## Optional Configuration Tasks

**Create search rule** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#) > Create search rule

**Configuration**

Rule name \*  ⓘ

Description  ⓘ

Priority \*  ⓘ

Protocol  ⓘ

Source  ⓘ

Request must be authenticated  ⓘ

Mode  ⓘ

Pattern type  ⓘ

Pattern string \*  ⓘ

Pattern behavior  ⓘ

Replace string  ⓘ

On successful match  ⓘ

Target \*  ⓘ

State  ⓘ

7. Click **Create search rule**.

**Search rules** You are here: [Configuration](#) > [Dial plan](#) > [Search rules](#)

Priority	State	Rule name	Protocol	Source	Authentication required	Mode	Pattern type	Pattern string	Pattern behavior	On match	Target	Actions
<input type="checkbox"/> 40	✓ Enabled	<a href="#">Allow ISDN call</a>	Any	AllZones	No	Alias pattern match	Regex	(9 d+)(.*)(@example.com)	Replace	Stop	<a href="#">TraversalZone</a>	<a href="#">View/Edit</a>
<input type="checkbox"/> 41	✓ Enabled	<a href="#">Block ISDN call</a>	Any	Any	No	Alias pattern match	Regex	(9 d+)(.*)(@example.com)	Replace	Stop	<a href="#">TraversalZone</a>	<a href="#">View/Edit</a>
<input type="checkbox"/> 50	✓ Enabled	<a href="#">LocalZoneMatch</a>	Any	Any	No	Any alias				Continue	<a href="#">LocalZone</a>	<a href="#">View/Edit</a>

## VCS Control

This example describes how to configure the VCS Control to stop calls that come in through the gateway, from being able to route calls back out of the gateway.

To do this, you load some specially constructed CPL onto the VCS Control and configure its **Call policy mode** to use *Local CPL*.

## Creating a CPL File

The CPL file can be created in a text editor.

Here are two example sets of CPL. In these examples:

- “GatewayZone” is the neighbor zone to the ISDN gateway.
- “GatewaySubZone” is the subzone to the ISDN gateway (required if the gateway registers the 9 prefix to the VCS).
- Calls coming into the ISDN gateway and hitting a FindMe do not ring devices that use the gateway. So for example, calls forwarded to a mobile phone are disallowed.

This example CPL excludes any checking of whether the calling party is authenticated:

```
<?xml version="1.0" encoding="UTF-8" ?>
<cpl xmlns="urn:ietf:params:xml:ns:cpl"
xmlns:taa="http://www.tandberg.net/cpl-extensions"
```

## Optional Configuration Tasks

```

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:ietf:params:xml:ns:cpl cpl.xsd">
<taa:routed>
  <taa:rule-switch>
    <!--Check that gateway is not hairpinning call - Neighbor zone -->
    <taa:rule originating-zone="GatewayZone" destination="9.*">
      <!-- Calls coming from the gateway may not send calls back out of this gateway -->
      <!-- Reject call with a status code of 403 (Forbidden) -->
      <reject status="403" reason="ISDN hairpin call denied"/>
    </taa:rule>
    <!-- Check that gateway is not hairpinning call - Subzone for registered gateway -->
    <taa:rule originating-zone="GatewaySubZone" destination="9.*">
      <!-- Calls coming from the gateway may not send calls back out of this gateway -->
      <!-- Reject call with a status code of 403 (Forbidden) -->
      <reject status="403" reason="ISDN hairpin call denied"/>
    </taa:rule>
    <taa:rule origin="*" destination="*">
      <!-- All other calls allowed -->
      <proxy/>
    </taa:rule>
  </taa:rule-switch>
</taa:routed>
</cpl>

```

This example CPL also ensures that the calling party is authenticated:

```

<?xml version="1.0" encoding="UTF-8" ?>
<cpl xmlns="urn:ietf:params:xml:ns:cpl"
xmlns:taa="http://www.tandberg.net/cpl-extensions"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:ietf:params:xml:ns:cpl cpl.xsd">
<taa:routed>
  <taa:rule-switch>
    <!-- Check that calling party is authenticated -->
    <taa:rule authenticated-origin="" destination="9.*">
      <!-- Reject call with a status code of 403 (Forbidden) -->
      <reject status="403" reason="ISDN call denied as unauthenticated caller"/>
    </taa:rule>
    <!-- Check that gateway is not hairpinning call - Neighbor zone -->
    <taa:rule originating-zone="GatewayZone" destination="9.*">
      <!-- Calls coming from the gateway may not hairpin and send calls back out -->
      <!-- Reject call with a status code of 403 (Forbidden) -->
      <reject status="403" reason="ISDN hairpin call denied"/>
    </taa:rule>
    <!-- Check that gateway is not hairpinning call - Subzone for registered gateway -->
    <taa:rule originating-zone="GatewaySubZone" destination="9.*">
      <!-- Calls coming from the gateway may not hairpin and send calls back out -->
      <!-- Reject call with a status code of 403 (Forbidden) -->
      <reject status="403" reason="ISDN hairpin call denied"/>
    </taa:rule>
    <taa:rule origin="*" destination="*">
      <!-- All other calls allowed -->
      <proxy/>
    </taa:rule>
  </taa:rule-switch>
</taa:routed>
</cpl>

```

## Loading the CPL onto VCS Control

To configure the VCS Control to use the CPL:

## Optional Configuration Tasks

1. Go to **Configuration > Call Policy > Configuration**.
2. Click **Browse....** Select the CPL file you created in the previous step from your file system.
3. Click **Upload file**.
  - If the file upload succeeds, you see a "File upload successful" message.
  - If you receive an "XML invalid" message, correct the problems with the CPL file and upload it again.
4. Select a **Call policy mode** of *Local CPL*.
5. Click **Save**.

**Call Policy configuration** You are here: [Configuration](#) > [Call Policy](#) > Configuration

**Configuration**

Call Policy mode  ⓘ

**Save**

**Policy files**

Call policy file	CPL File	<input type="button" value="Show Call Policy file"/> ⓘ
CPL XSD file	XSD File	<input type="button" value="Show CPL XSD file"/> ⓘ
CPL extensions xsd file	XSD File	<input type="button" value="Show CPL extensions XSD file"/> ⓘ
Select the new Call Policy file	<input type="text"/>	<input type="button" value="Browse..."/> ⓘ

**Upload file**

## Appendix 1: Configuration Details

This appendix summarizes the configuration required for the VCS Control and VCS Expressway, in three sections:

- Configuration for VCS Control only
- Configuration for VCS Expressway only
- Configuration for both VCS Control and VCS Expressway

### VCS Control Configuration Details

Configuration item	Value	VCS page
System configuration		
System name	VCS	System > Administration
LAN1 IPv4 address	10.0.0.2	System > Network interfaces > IP
IPv4 gateway	10.0.0.1	System > Network interfaces > IP
LAN1 subnet mask	255.255.255.0	System > Network interfaces > IP
DNS server address 1	10.0.0.11	System > DNS
DNS server address 2	10.0.0.12	System > DNS
DNS Domain name	internal-domain.net	System > DNS
DNS System host name	vcsc	System > DNS
NTP server 1	pool.ntp.org	System > Time
Time zone	GMT	System > Time
Protocol configuration		
SIP domain name	example.com	Configuration > Domains
Traversal zone		
Zone Name	TraversalZone	Configuration > Zones > Zones
Zone Type	Traversal client	Configuration > Zones > Zones
Protocol SIP port	7001	Configuration > Zones > Zones
Protocol H.323 port	6001	Configuration > Zones > Zones
Location Peer 1 address	192.0.2.2	Configuration > Zones > Zones
Authentication username	exampleauth	Configuration > Zones > Zones
Authentication password	ex4mpl3.c0m	Configuration > Authentication > Devices > Local database
Traversal search rule		
Rule name	Traversal zone search rule	Configuration > Dial plan > Search rules
Description	Search traversal zone (VCS Control)	Configuration > Dial plan > Search rules

## Appendix 1: Configuration Details

Configuration item	Value	VCS page
Priority	100	Configuration > Dial plan > Search rules
Source	Any	Configuration > Dial plan > Search rules
Mode	Any alias	Configuration > Dial plan > Search rules
On successful match	Continue	Configuration > Dial plan > Search rules
Target	TraversalZone	Configuration > Dial plan > Search rules
Direct IP search rule		
Rule name	External IP address search rule	Configuration > Dial plan > Search rules
Description	Route external IP address	Configuration > Dial plan > Search rules
Priority	100	Configuration > Dial plan > Search rules
Source	Any	Configuration > Dial plan > Search rules
Mode	Any IP address	Configuration > Dial plan > Search rules
On successful match	Continue	Configuration > Dial plan > Search rules
Target	TraversalZone	Configuration > Dial plan > Search rules
IP call routing		
Calls to unknown IP addresses	Indirect	Configuration > Dial plan > Configuration

## VCS Expressway Configuration Details

Configuration item	Value	VCS page
System configuration		
System name	VCSe	System > Administration
LAN1 IPv4 address	192.0.2.2	System > Network interfaces > IP
IPv4 gateway	192.0.2.1	System > Network interfaces > IP
LAN1 subnet mask	255.255.255.0	System > Network interfaces > IP
DNS server address 1	194.72.6.57	System > DNS
DNS server address 2	194.73.82.242	System > DNS
DNS Domain name	example.com	System > DNS
DNS System host name	vcse	System > DNS
NTP server 1	pool.ntp.org	System > Time
Time zone	GMT	System > Time
Protocol configuration		
SIP domain name	example.com	Configuration > Domains
Traversal zone		

## Appendix 1: Configuration Details

Configuration item	Value	VCS page
Zone Name	TraversalZone	Configuration > Zones > Zones
Zone Type	Traversal server	Configuration > Zones > Zones
Client authentication username	exampleauth	Configuration > Zones > Zones
Protocol SIP port	7001	Configuration > Zones > Zones
Protocol H.323 port	6001	Configuration > Zones > Zones
Name	exampleauth	Configuration > Authentication > Devices > Local database
Password	ex4mpl3.c0m	Configuration > Authentication > Devices > Local database
Traversal zone search rule		
Rule name	Traversal zone search rule	Configuration > Dial plan > Search rules
Description	Search traversal zone (VCS Expressway)	Configuration > Dial plan > Search rules
Priority	100	Configuration > Dial plan > Search rules
Source	Any	Configuration > Dial plan > Search rules
Mode	Any alias	Configuration > Dial plan > Search rules
On successful match	Continue	Configuration > Dial plan > Search rules
Target	TraversalZone	Configuration > Dial plan > Search rules
DNS zone		
Zone Name	DNSZone	Configuration > Zones
Zone Type	DNS	Configuration > Zones > Zones
DNS zone search rule		
Rule name	DNS zone search rule	Configuration > Dial plan > Search rules
Zone name	Search DNS zone (external DNS)	Configuration > Dial plan > Search rules
Priority	150	Configuration > Dial plan > Search rules
Source	All zones	Configuration > Dial plan > Search rules
Mode	Alias pattern match	Configuration > Dial plan > Search rules
Pattern type	Regex	Configuration > Dial plan > Search rules
Pattern string	(?!.*@example\.com.*\$).*	Configuration > Dial plan > Search rules
On successful match	Continue	Configuration > Dial plan > Search rules
Target	DNSZone	Configuration > Dial plan > Search rules
IP call routing		
Calls to unknown IP addresses	Direct	Configuration > Dial plan > Configuration

## Appendix 1: Configuration Details

## VCS Control and VCS Expressway Configuration Details

Configuration item	Value	VCS page
Transform		
Pattern string	([^\@]*)	Configuration > Dial plan > Transforms
Pattern type	Regex	Configuration > Dial plan > Transforms
Pattern behavior	Replace	Configuration > Dial plan > Transforms
Replace string	\1@example.com	Configuration > Dial plan > Transforms
Local search rule 1		
Rule name	Local zone - no domain	Configuration > Dial plan > Search rules
Priority	48	Configuration > Dial plan > Search rules
Source	Any	Configuration > Dial plan > Search rules
Mode	Alias pattern match	Configuration > Dial plan > Search rules
Pattern type	Regex	Configuration > Dial plan > Search rules
Pattern string	(.+)@example\.com.*	Configuration > Dial plan > Search rules
Pattern behavior	Replace	Configuration > Dial plan > Search rules
Replace string	\1	Configuration > Dial plan > Search rules
On successful match	Continue	Configuration > Dial plan > Search rules
Target	LocalZone	Configuration > Dial plan > Search rules
Local search rule 2		
Rule name	Local zone - full URI	Configuration > Dial plan > Search rules
Priority	50	Configuration > Dial plan > Search rules
Source	Any	Configuration > Dial plan > Search rules
Mode	Alias pattern match	Configuration > Dial plan > Search rules
Pattern type	Regex	Configuration > Dial plan > Search rules
Pattern string	(.+)@example\.com.*	Configuration > Dial plan > Search rules
Pattern behavior	Leave	Configuration > Dial plan > Search rules
On successful match	Continue	Configuration > Dial plan > Search rules
Target	LocalZone	Configuration > Dial plan > Search rules

## Appendix 2: DNS Records

### DNS Configuration on Host Server

The following records are required in the external DNS which hosts the externally routable domain (*example.com*). This allows:

- External endpoints registration messages to be routed to the VCS Expressway.
- Calls from non-registered endpoints (or other infrastructure devices) to be routed to the VCS Expressway.

#### Host DNS A Record

Host	Host IP address
vcse.example.com	192.0.2.2

#### DNS SRV Records

Name	Service	Protocol	Priority	Weight	Port	Target host
example.com.	h323cs	tcp	10	10	1720	vcse.example.com.
example.com.	h323ls	udp	10	10	1719	vcse.example.com.
example.com.	h323rs	udp	10	10	1719	vcse.example.com.
example.com.	sip	tcp	10	10	5060	vcse.example.com.
example.com.	sip	udp *	10	10	5060	vcse.example.com.
example.com.	sips	tcp	10	10	5061	vcse.example.com.
example.com.	turn	udp	10	10	3478 **	vcse.example.com.

\* SIP UDP is disabled on VCS by default.

\*\* On Large VCS deployments you should configure multiple records for the range 3478 - 3483.

For example, the DNS records would be:

```
_h323cs._tcp.example.com. 86400 IN SRV 10 10 1720 vcse.example.com.
_h323ls._udp.example.com. 86400 IN SRV 10 10 1719 vcse.example.com.
_h323rs._udp.example.com. 86400 IN SRV 10 10 1719 vcse.example.com.
_sip._tcp.example.com.    86400 IN SRV 10 10 5060 vcse.example.com.
_sip._udp.example.com.    86400 IN SRV 10 10 5060 vcse.example.com.
_sips._tcp.example.com.   86400 IN SRV 10 10 5061 vcse.example.com.
_turn._udp.example.com.   86400 IN SRV 10 10 3478 vcse.example.com.
vcse.example.com.        86400 IN A 192.0.2.2
```

If you have a cluster of VCS Expressways, you must set up DNS A and SRV records for each peer/host in the cluster. See [VCS Cluster Creation and Maintenance Deployment Guide](#) for more information.

#### DNS Configuration (internal DNS server)

The following records are required in the local DNS which hosts the internally routable domain: internal-domain.net to allow internal messages to be routed to the VCS Control.

## Appendix 2: DNS Records

## Local DNS A Record

Host	Host IP address
vcsc.internal-domain.net	10.0.0.2

## Local DNS SRV Records

Name	Service	Protocol	Priority	Weight	Port	Target host
internal-domain.net.	h323cs	tcp	10	10	1720	vcsc.internal-domain.net.
internal-domain.net.	h323ls	udp	10	10	1719	vcsc.internal-domain.net.
internal-domain.net.	h323rs	udp	10	10	1719	vcsc.internal-domain.net.
internal-domain.net.	sip	tcp	10	10	5060	vcsc.internal-domain.net.
internal-domain.net.	sip	udp *	10	10	5060	vcsc.internal-domain.net.
internal-domain.net.	sips	tcp	10	10	5061	vcsc.internal-domain.net.

\* SIP UDP is disabled on VCS by default.

For example, the DNS records would be:

```
_h323cs._tcp.internal-domain.net. 86400 IN SRV 10 10 1720 vcsc.internal-domain.net.
_h323ls._udp.internal-domain.net. 86400 IN SRV 10 10 1719 vcsc.internal-domain.net.
_h323rs._udp.internal-domain.net. 86400 IN SRV 10 10 1719 vcsc.internal-domain.net.
_sip._tcp.internal-domain.net.    86400 IN SRV 10 10 5060 vcsc.internal-domain.net.
_sip._udp.internal-domain.net.    86400 IN SRV 10 10 5060 vcsc.internal-domain.net.
_sips._tcp.internal-domain.net.   86400 IN SRV 10 10 5061 vcsc.internal-domain.net.
vcsc.internal-domain.net.        86400 IN A 10.0.0.2
```

If you have a cluster of VCS Controls, you must set up DNS A and SRV records for each peer/host in the cluster. See *VCS Cluster Creation and Maintenance Deployment Guide* for more information.

## Appendix 3: Firewall and NAT Settings

Port reference information is now maintained in a separate document.

See the *Cisco Expressway IP Port Usage Configuration Guide*, for your version, on the [Cisco Expressway Series configuration guides page](#).

### Internal Firewall Configuration

Ensure that any SIP or H.323 'fixup' ALG or awareness functionality is disabled on the NAT firewall - if enabled this will adversely interfere with the VCS functionality.

As VCS Control to VCS Expressway communications are always initiated from the VCS Control to the VCS Expressway (VCS Expressway sending messages by responding to VCS Control's messages) no ports need to be opened from DMZ to Internal for call handling.

However, if the VCS Expressway needs to communicate with local services, such as a Syslog server, some firewall configuration may be required.

Traffic destined for logging or management server addresses (using specific destination ports) must be routed to the internal network.

### External Firewall Configuration Requirement

Ensure that any SIP or H.323 "fixup" ALG or awareness functionality is disabled on the NAT firewall - if enabled this will adversely interfere with the VCS functionality.

If you want to restrict communications from the DMZ to the wider Internet, see the connection maps and port reference tables in the *Cisco Expressway IP Port Usage Guide* to make sure you allow legitimate traffic.

## Appendix 4: Advanced Networking Deployments

### Planning and Prerequisites

#### Advanced Networking option key

The **Advanced Networking** option key is required on any VCS Expressway that needs static NAT or two LAN interfaces.

This option is available for both the VCS Expressway and VCS Control, but only the VCS Expressway supports static NAT.

#### Use the LAN2 external interface

In a dual NIC deployment (recommended), configure the **External LAN interface** setting on the IP configuration page to be *LAN2*.

**Note:** This setting determines where the VCS Expressway TURN server allocates TURN relays.

#### SIP and H.323 Application Layer Gateways (ALGs)

Disable SIP and H.323 ALGs (SIP / H.323 awareness) on routers and firewalls carrying network traffic to or from the VCS Expressway. We do not support this functionality on firewalls when deploying a VCS Expressway behind a NAT. The VCS must perform the static network address translation on its own interface (see [What About Routers/Firewalls with SIP/H.323 ALG?](#), page 74).

#### Do not overlap subnets

The recommended deployment of the VCS Expressway configures both LAN interfaces. The LAN1 and LAN2 interfaces **must** be located in non-overlapping subnets, to ensure that traffic is sent through the correct interface.

#### Requirements for clustered systems

The following additional requirements apply to clustered systems:

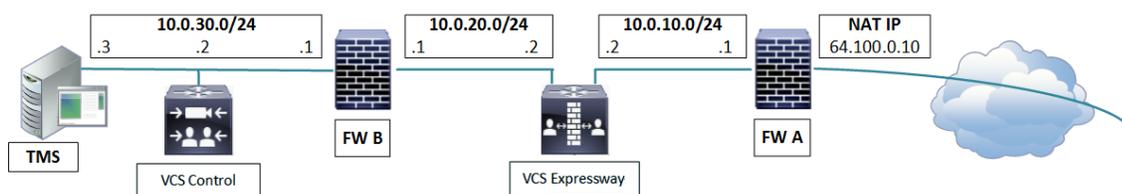
- When the peers have **Advanced Networking** enabled, use the LAN1 interface address of each peer to create the cluster.
- The LAN interface used for clustering must not have static NAT mode enabled. If static NAT is required, enable it on the LAN2 interface.

### Recommended: Dual NIC Static NAT Deployment

The following example illustrates the recommended deployment. It shows the typical DMZ configuration where the internal and external firewalls cannot route directly to each other, and dual-NIC devices such as VCS Expressway are required to validate and forward the traffic between the isolated subnets.

The VCS Expressway has both NICs enabled, and static NAT enabled on its outward-facing LAN interface. The VCS Control inside the network is a traversal client of the VCS Expressway in the DMZ.

**Figure 12 Dual Network Interfaces Deployment**



## Appendix 4: Advanced Networking Deployments

This deployment consists of:

- DMZ subnet 1 - 10.0.10.0/24, containing:
  - the internal interface of Firewall A - 10.0.10.1
  - the LAN2 interface of the VCS Expressway - 10.0.10.2
- DMZ subnet 2 - 10.0.20.0/24, containing:
  - the external interface of Firewall B - 10.0.20.1
  - the LAN1 interface of the VCS Expressway - 10.0.20.2
- LAN subnet - 10.0.30.0/24, containing:
  - the internal interface of Firewall B - 10.0.30.1
  - the LAN1 interface of the VCS Control - 10.0.30.2
  - the network interface of the Cisco TMS server - 10.0.30.3
- Firewall A is the outward-facing firewall; it is configured with a NAT IP (public IP) of 64.100.0.10 which is statically NATed to 10.0.10.2 (the LAN2 interface address of the VCS Expressway)
- Firewall B is the internally-facing firewall
- VCS Expressway LAN1 has static NAT mode disabled
- VCS Expressway LAN2 has static NAT mode enabled with Static NAT address 64.100.0.10
- VCS Control has a traversal client zone pointing to 10.0.20.2 (LAN1 of the VCS Expressway)
- Cisco TMS has VCS Expressway added with IP address 10.0.20.2

With the above deployment, there is no regular routing between the 10.0.20.0/24 and 10.0.10.0/24 subnets. The VCS Expressway bridges these subnets and acts as a proxy for SIP/H.323 signaling and RTP/RTCP media.

## Static Routes Towards the Internal Network

With a deployment like [Figure 12 Dual Network Interfaces Deployment, page 68](#), you would typically configure the private address of the external firewall (10.0.10.1 in the diagram) as the default gateway of the VCS Expressway. Traffic that has no more specific route is sent out from either VCS Expressway interface to 10.0.10.1.

- **If the internal firewall (B) is doing NAT** for traffic from the internal network (subnet 10.0.30.0 in diagram) to LAN1 of the VCS Expressway (such as traversal client traffic from VCS Control), that traffic is recognized as being from the same subnet (10.0.20.0 in diagram) as it reaches LAN1 of the VCS Expressway. The VCS Expressway can therefore reply to this traffic through its LAN1 interface.

MRA limitation: Due to VCS Expressway security mechanisms, Mobile & Remote Access (MRA) is not compatible with this scenario. If there is source NAT on the packets from VCS Control then edge login requests will fail (destination NAT is unaffected).

- **If the internal firewall (B) is not doing NAT** for traffic from the internal network (subnet 10.0.30.0 in diagram) to LAN1 of the VCS Expressway (such as traversal client traffic from VCS Control), that traffic still has the originating IP address (for example, 10.0.30.2 for traffic from VCS Control in the diagram). You must create a static route towards that source from LAN1 on the VCS Expressway, or the return traffic will go to the default gateway (10.0.10.1). You can do this on the web UI (**System > Network interfaces > Static routes**) or using `xCommand RouteAdd` at the CLI.

If the VCS Expressway needs to communicate with other devices behind the internal firewall (for example, to reach network services such as NTP, DNS, LDAP/AD and syslog servers) you also need to add static routes from VCS Expressway LAN1 to those devices/subnets.

In this particular example, we want to tell the VCS Expressway that it can reach the 10.0.30.0/24 subnet behind the 10.0.20.1 firewall (router), which is reachable via the LAN1 interface. This is accomplished using the following `xCommand RouteAdd` syntax (the `Interface` parameter could also be set to `Auto` as the gateway address - 10.0.20.1 - is only reachable via LAN1):

```
xCommand RouteAdd Address: 10.0.30.0 PrefixLength: 24 Gateway: 10.0.20.1 Interface: LAN1
```

Figure 13 The Web UI for Creating a Static Route

**Static routes** You are here: [System](#) > [Network interfaces](#) > [Static routes](#)

**Create a static route**

IP address \* 10.0.30.0 *i*

Prefix length \* 24 *i*

Address range 10.0.30.0 - 10.0.30.255

Gateway \* 10.0.20.1 *i*

Interface LAN 1 *i*

**Create route**

The `xCommand RouteAdd` command and the equivalent web UI, are detailed in the VCS help and the *VCS Administrator Guide*.

## Background Information

### The Challenge of NAT for SIP and H.323 Applications

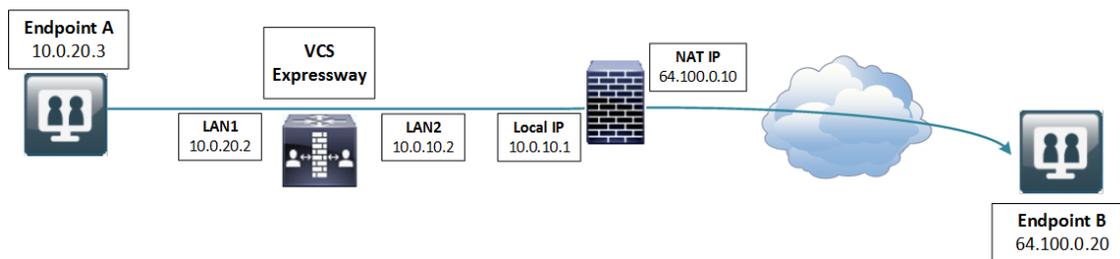
When deploying a VCS Expressway for business to business communications, or for supporting home workers and travelling workers, it is usually desirable to deploy the VCS Expressway in a NATed DMZ rather than having the VCS Expressway configured with a publicly routable IP address.

Network Address Translation (NAT) poses a challenge with SIP and H.323 applications, as with these protocols, IP addresses and port numbers are not only used in OSI layer 3 and 4 packet headers, but are also referenced within the packet payload data of H.323 and SIP messages themselves.

This usually breaks SIP/H.323 call signaling and RTP media packet flows, since NAT routers/firewalls will normally translate the IP addresses and port numbers of the headers, but leave the IP address and port references within the SIP and H.323 message payloads unchanged.

To provide an example of this, assume you have a VCS Expressway deployed behind a NAT router and two endpoints. The VCS Expressway has static NAT disabled on LAN2, but the NAT router is configured with a static 1:1 NAT, NATing the public address 64.100.0.10 to the VCS Expressway LAN2 IP address 10.0.10.2:

Figure 14 Example Deployment with Static NAT on Firewall



- NAT router with local IP address 10.0.10.1 and NAT IP address 64.100.0.10, statically NATed to 10.0.10.2
- VCS Expressway LAN1 (internally-facing interface) with IP address 10.0.20.2

## Appendix 4: Advanced Networking Deployments

- VCS Expressway LAN2 (externally-facing interface) with IP address 10.0.10.2 (and with static NAT disabled)
- VCS Expressway default gateway set to 10.0.10.1 (inside address of NAT firewall, reachable via LAN2)
- Endpoint A with IP address 10.0.20.3, registered to VCS Expressway
- Endpoint B with IP address 64.100.0.20, located on the Internet, not registered to the VCS Expressway

Assume that endpoint A places a SIP call towards endpoint B. The call will arrive at the VCS Expressway, which will proxy the SIP INVITE towards endpoint B. The VCS Expressway to Endpoint B will then be a traversal call, which means that the VCS Expressway will take both signaling and media, and the packet carrying the SIP INVITE message will have the following contents as it arrives at the NAT router (the actual INVITE contents have been simplified for ease of reading):

**SIP INVITE Arriving at NAT Router**

```

Packet header:
Source IP: 10.0.10.2
Destination IP: 64.100.0.20
SIP payload:
INVITE sip: 64.100.0.20 SIP/2.0
Via: SIP/2.0/TLS 10.0.10.2:5061
Via: SIP/2.0/TLS 10.0.20.3:55938
Call-ID: 20ec9fd084eb3dd2@127.0.0.1
CSeq: 100 INVITE
Contact: <sip:EndpointA@10.0.20.3:55938;transport=tls>
From: "Endpoint A" <sip:EndpointA@cisco.com>;tag=9a42af
To: <sip: 64.100.0.20>
Max-Forwards: 70
Content-Type: application/sdp
Content-Length: 2825

v=0
o=tandberg 1 2 IN IP4 10.0.10.2
s=-
c=IN IP4 10.0.10.2
b=AS:2048
...
...
...

```

In the example above, the SDP (session description protocol) within the SIP payload contains a reference to the VCS Expressway IP address, marked in yellow: `c=IN IP4 10.0.10.2`.

Upon receiving the SIP INVITE packet, the NAT router will rewrite the layer 3 source IP address header (marked in green: `10.0.10.2`) and replace 10.0.10.2 (VCS Expressway LAN2 IP address) with its own public NAT address (`64.100.0.10`) and route the packet out to the Internet, so that the SIP INVITE message will have the following contents as it arrives at endpoint B:

**SIP INVITE Arriving at Endpoint B**

```

Packet header:
Source IP: 64.100.0.10
Destination IP: 64.100.0.20
SIP payload:
INVITE sip:64.100.0.20 SIP/2.0
Via: SIP/2.0/TLS 10.0.10.2:5061
Via: SIP/2.0/TLS 10.0.20.3:55938
Call-ID: 20ec9fd084eb3dd2@127.0.0.1
CSeq: 100 INVITE
Contact: <sip:EndpointA@10.0.20.3:55938;transport=tls>
From: "Endpoint A" <sip:EndpointA@cisco.com>;tag=9a42af

```

## Appendix 4: Advanced Networking Deployments

```
To: <sip:64.100.0.20>
Max-Forwards: 70
Content-Type: application/sdp
Content-Length: 2825
```

```
v=0
s=-
c=IN IP4 10.0.10.2
```

```
b=AS:2048
...
...
...
```

As can be seen from the example above, endpoint B will see that the SIP INVITE was received from IP 64.100.0.10 (NAT router), so the endpoint will know where to send its reply messages for the INVITE itself.

The c-line within the SDP of the SIP INVITE is however still set to `c=IN IP4 10.0.10.2`, which means that endpoint B will attempt to send RTP media to the IP address 10.0.10.2, an address which is not routable on the Internet.

The result in this scenario will therefore be that endpoint A will never receive media sent by endpoint B (while endpoint B will normally receive media from endpoint A, since endpoint B is assigned with a publicly routable IP address).

Similar behavior will be seen in H.323 calls, since H.323 uses the same principles as SIP in terms of embedding IP address and port references within the message payload.

## How Does VCS Expressway Address This Challenge?

To ensure that call signaling and media connectivity remains functional in scenarios where the VCS Expressway is deployed behind a NAT (as in the example above), the VCS Expressway will have to modify the parts of SIP and H.323 messages which contain references to its actual LAN2 network interface IP address (10.0.10.2) and replace these with the public NAT address of the NAT router (64.100.0.10).

This can be achieved by enabling **Static NAT mode** on selected network interfaces on the VCS Expressway. The Static NAT mode feature on the VCS Expressway is made available with the **Advanced Networking** option key.

This option key allows the use of two network interfaces (LAN1 and LAN2), and on a VCS Expressway it allows Static NAT mode to be enabled on one or both of these interfaces. You do not have to use both interfaces, but we recommend that you do. If you choose to use a single interface, and enable static NAT on that interface, read [Why We Advise Against Using These Types of Deployment, page 77](#).

When static NAT has been enabled on an interface, the VCS will apply static NAT for all outbound SIP and H.323 traffic for this interface, which means that H.323 and SIP devices have to communicate with this interface using the static NAT address rather than the local interface address.

When the **Advanced Networking** key is installed on the VCS Expressway, the **IP** configuration page (**System > Network interfaces > IP**) has additional options, allowing the user to decide whether to **Use dual network interfaces**, to nominate which interface is the **External LAN interface**, to enable **Static NAT mode** on selected interfaces and configure an **IPv4 static NAT address** for each interface.

## Appendix 4: Advanced Networking Deployments

Figure 15 VCS Expressway Configuration for the Example Deployment

**IP** You are here: [System](#) > [IP](#)

**Configuration**

IP protocol: IPv4 ⓘ

Use dual network interfaces: Yes ⓘ

External LAN interface: LAN2 ⓘ

IPv4 gateway: 10.0.10.1 ⓘ

IPv6 gateway: ⓘ

---

**LAN 1**

IPv4 address: 10.0.20.2 ⓘ

IPv4 subnet mask: 255.255.255.0 ⓘ

IPv4 subnet range: 10.0.20.0 - 10.0.20.255

IPv4 static NAT mode: Off ⓘ

IPv6 address: ⓘ

---

**LAN 2**

IPv4 address: 10.0.10.2 ⓘ

IPv4 subnet mask: 255.255.255.0 ⓘ

IPv4 subnet range: 10.0.10.0 - 10.0.10.255

IPv4 static NAT mode: On ⓘ

IPv4 static NAT address: 64.100.0.10 ⓘ

IPv6 address: ⓘ

- Dual interfaces are selected and the external LAN interface is set to LAN2
- Configuration > IPv4 gateway is set to 10.0.10.1, the local IP address of the NAT router
- LAN1 > IPv4 address is set to 10.0.20.2
- LAN1 > IPv4 static NAT mode is set to *Off*
- LAN2 > IPv4 address is set to 10.0.10.2
- LAN2 > IPv4 static NAT mode is set to *On*
- LAN2 > IPv4 static NAT address is set to 64.100.0.10, the public NAT address of the NAT router

When enabling **IPv4 static NAT mode** on an interface (LAN2 in our example), the VCS Expressway will modify the payload of H.323 and SIP messages sent out via this interface, so that references to the LAN2 interface address (10.0.10.2) are replaced with the IPv4 static NAT address configured for this interface (64.100.0.10). This means that when looking at the payload of SIP and H.323 messages sent out via this interface, it will appear as if the LAN2 interface has a public IP address (64.100.0.10).

It is important to note that the VCS Expressway will not modify the layer 3 source address of outgoing H.323 and SIP packets sent out of this interface, as this will be done by the NAT router.

With this configuration in place, the SIP INVITE shown in Figure 4 will now look as follows as it arrives at endpoint B:

#### SIP INVITE Arriving at Endpoint B - Static NAT Mode Enabled

**Packet header:**

## Appendix 4: Advanced Networking Deployments

```

Source IP: 64.100.0.10
Destination IP: 64.100.0.20
SIP payload:
INVITE sip: 64.100.0.20 SIP/2.0
Via: SIP/2.0/TLS 10.0.10.2:5061
Via: SIP/2.0/TLS 10.0.20.3:55938
Call-ID: 20ec9fd084eb3dd2@127.0.0.1
CSeq: 100 INVITE
Contact: <sip:EndpointA@10.0.20.3:55938;transport=tls>
From: "Endpoint A" <sip:EndpointA@cisco.com>;tag=9a42af
To: <sip: 64.100.0.20>
Max-Forwards: 70
Content-Type: application/sdp
Content-Length: 2825

v=0
s=-
c=IN IP4 64.100.0.10

b=AS:2048
...
...
...

```

With static NAT enabled on LAN2 of the VCS Expressway, the c-line of the SIP INVITE has now been rewritten to `c=IN IP4 64.100.0.10`, and this means that when endpoint B sends outbound RTP media to endpoint A, this will be sent to IP address 64.100.0.10, the public NAT address of the NAT router, which is 1:1 NATed to the LAN2 IP address of the VCS Expressway, 10.0.10.2. As RTP media from endpoint B arrives at the NAT router with a destination IP address of 64.100.0.10, the NAT router will forward these packets to the VCS Expressway at 10.0.10.2 and two-way media is achieved.

## What About Routers/Firewalls with SIP/H.323 ALG?

Some routers and firewalls have SIP and H.323 ALG capabilities. ALG is also referred to as Fixup, Inspection, Application Awareness, Stateful Packet Inspection, Deep Packet Inspection and so forth. This means that the router/firewall is able to identify SIP and H.323 traffic as it passes through and inspect, and in some cases modify, the payload of the SIP and H.323 messages. The purpose of modifying the payload is to help the H.323 or SIP application from which the message originated to traverse NAT, i.e. to perform a similar process to what the VCS Expressway does.

The challenge with router/firewall-based SIP and H.323 ALGs is that these were originally intended to aid relatively basic H.323 and SIP applications to traverse NAT, and these applications had, for the most part, very basic functionality and often only supported audio.

Over the years, many H.323 and SIP implementations have become more complex, supporting multiple video streams and application sharing (H.239, BFCP), encryption/security features (H.235, DES/AES), firewall traversal (Assent, H.460) and other extensions of the SIP and H.323 standards.

For a router/firewall to properly perform ALG functions for SIP and H.323 traffic, it is therefore of utmost importance that the router/firewall understands and properly interprets the full content of the payload it is inspecting. Since H.323 and SIP are standards/recommendations which are in constant development, it is not likely that the router/firewall will meet these requirements, resulting in unexpected behavior when using H.323 and SIP applications in combination with such routers/firewalls.

There are also scenarios where the router/firewall normally will not be able to inspect the traffic at all, for example when using SIP over TLS, where the communication is end-to-end secure and encrypted as it passes through the router/firewall.

As per the Prerequisites section of this appendix, you should disable SIP and H.323 ALGs on routers/firewalls carrying network traffic to or from a VCS Expressway. We do not support this functionality, as, when enabled, it is frequently found to negatively affect the built-in firewall/NAT traversal functionality of the VCS Expressway itself.

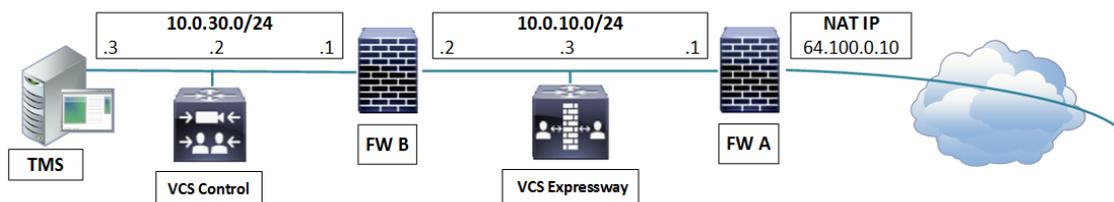
## Other Deployment Examples

**Note:** Using the VCS Expressway as shown in these examples could have a serious impact on your network bandwidth, and may contravene your security policy. We strongly recommend that you use the [Recommended: Dual NIC Static NAT Deployment, page 68](#). Read [Why We Advise Against Using These Types of Deployment, page 77](#).

### Single Subnet DMZ Using Single VCS Expressway LAN Interface and Static NAT

In this case, FW A can route traffic to FW B (and vice versa). VCS Expressway allows video traffic to be passed through FW B without pinholing FW B from outside to inside. VCS Expressway also handles firewall traversal on its public side.

**Figure 16 Single Subnet DMZ - Single LAN Interface and Static NAT**



This deployment consists of the following elements:

- Single subnet DMZ (10.0.10.0/24) with the following interfaces:
  - Internal interface of firewall A - 10.0.10.1
  - External interface of firewall B - 10.0.10.2
  - LAN1 interface of VCS Expressway - 10.0.10.3
- LAN subnet (10.0.30.0/24) with the following interfaces:
  - Internal interface of firewall B - 10.0.30.1
  - LAN1 interface of VCS Control - 10.0.30.2
  - Network interface of Cisco TMS - 10.0.30.3

A static 1:1 NAT has been configured on firewall A, NATing the public address 64.100.0.10 to the LAN1 address of the VCS Expressway. **Static NAT mode** is enabled for LAN1 on the VCS Expressway, with a static NAT address of 64.100.0.10.

---

#### Note:

You must enter the FQDN of the VCS Expressway, as it is seen from outside the network, as the peer address on the VCS Control's secure traversal zone. The reason for this is that in static NAT mode, the VCS Expressway requests that incoming signaling and media traffic should be sent to its external FQDN, rather than its private name.

**This also means that the external firewall must allow traffic from the VCS Control to the VCS Expressway's external FQDN. This is known as NAT reflection, and may not be supported by all types of firewalls.**

---

So, in this example, firewall A must allow NAT reflection of traffic coming from the VCS Control that is destined for the external address, that is 64.100.0.10, of the VCS Expressway. The traversal zone on the VCS Control must have 64.100.0.10 as the peer address.

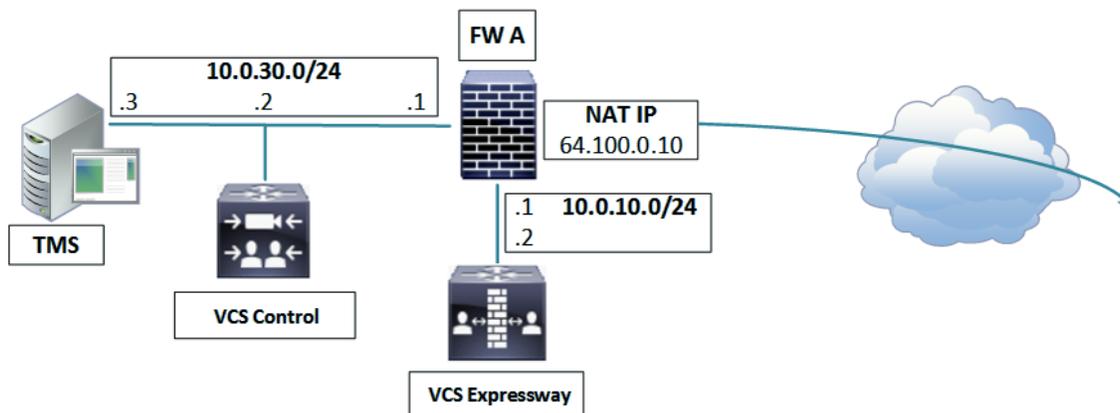
The VCS Expressway should be configured with a default gateway of 10.0.10.1. Whether or not static routes are needed in this scenario depends on the capabilities and settings of FW A and FW B. VCS Control to VCS Expressway

## Appendix 4: Advanced Networking Deployments

communications will be to the 64.100.0.10 address of the VCS Expressway. The return traffic from the VCS Expressway to VCS Control might have to go through the default gateway. If a static route is added to the VCS Expressway so that reply traffic goes from the VCS Expressway and directly through FW B to the 10.0.30.0/24 subnet, asymmetric routing occurs. Which may or may not work, depending on the firewall capabilities.

The VCS Expressway can be added to Cisco TMS using its internal IP address (10.0.10.3). This is because static NAT mode settings on the VCS Expressway do not affect Cisco TMS management communications. You could add the VCS Expressway's external interface to TMS instead (64.100.0.10 in the diagram) if FW A allows it.

## 3-port Firewall DMZ Using Single VCS Expressway LAN Interface



In this deployment, a 3-port firewall is used to create the following:

- DMZ subnet (10.0.10.0/24) with the following interfaces:
  - DMZ interface of firewall A - 10.0.10.1
  - LAN1 interface of VCS Expressway - 10.0.10.2
- LAN subnet (10.0.30.0/24) with the following interfaces:
  - LAN interface of firewall A - 10.0.30.1
  - LAN1 interface of VCS Control - 10.0.30.2
  - Network interface of Cisco TMS - 10.0.30.3

A static 1:1 NAT has been configured on firewall A, NATing the public address 64.100.0.10 to the LAN1 address of the VCS Expressway. Static NAT mode is enabled for LAN1 on the VCS Expressway, with a static NAT address of 64.100.0.10.

The VCS Expressway should be configured with a default gateway of 10.0.10.1. Since this gateway must be used for all traffic leaving the VCS Expressway, no static routes are needed in this type of deployment.

---

**Note:** The traversal client zone on the VCS Control needs to be configured with a peer address which matches the static NAT address of the VCS Expressway, in this case 64.100.0.10, for the same reasons as described in [Single Subnet DMZ Using Single VCS Expressway LAN Interface and Static NAT, page 75](#).

**This means that firewall A must allow traffic from the VCS Control with a destination address of 64.100.0.10. This is also known as NAT reflection, and it should be noted that this is not supported by all types of firewalls.**

---

The VCS Expressway can be added to Cisco TMS with the IP address 10.0.10.2 (or with IP address 64.100.0.10 if FW A allows this), since Cisco TMS management communications are not affected by static NAT mode settings on the VCS Expressway.

## Why We Advise Against Using These Types of Deployment

For deployments that use only one NIC on the VCS Expressway, but also require static NAT for the public address, the media must "hairpin" or reflect on the external firewall whenever media is handled by the VCS Expressway's back to back user agent (B2BUA).

For all calls coming in on a Unified Communications Traversal Server zone, or another zone where SIP **Media encryption mode** is not *Auto*, the VCS Expressway's B2BUA could be engaged to decrypt or encrypt the media packets. In these deployments, the B2BUA sees the public IP address of the VCS Expressway instead of its private IP address, so the media stream must go through the network address translator to get to the private IP address.

- Not all firewalls will allow this reflection, and it is considered by some to be a security risk.
- Each call where the B2BUA is engaged will consume three times as much bandwidth as it would using the recommended dual NIC deployment. This could adversely affect call quality.

**Figure 17 Media Path in Dual NIC Static NAT Example (Recommended)**

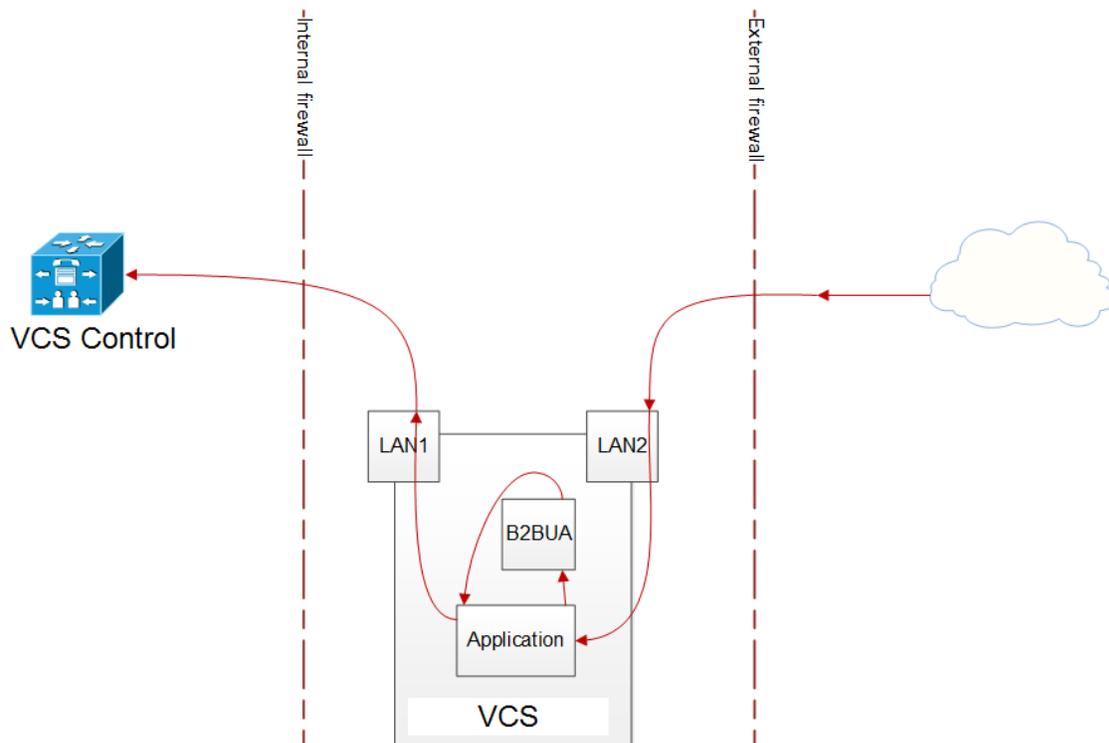


Figure 18 Media Path in Single NIC Static NAT Example

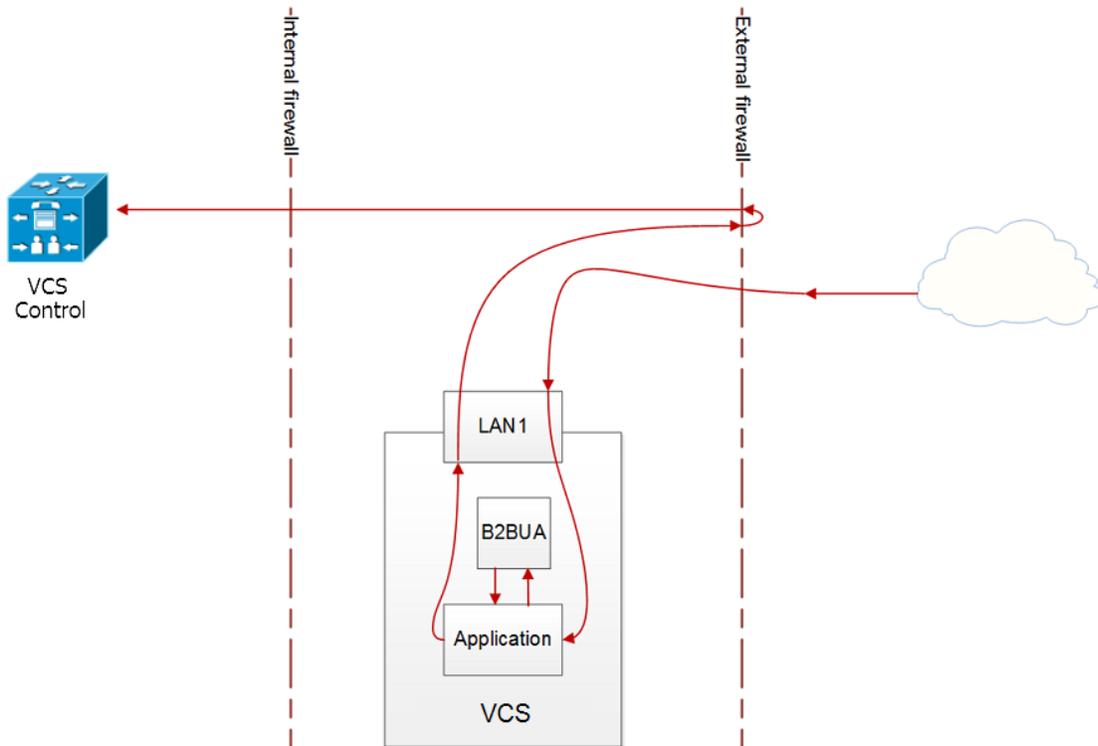
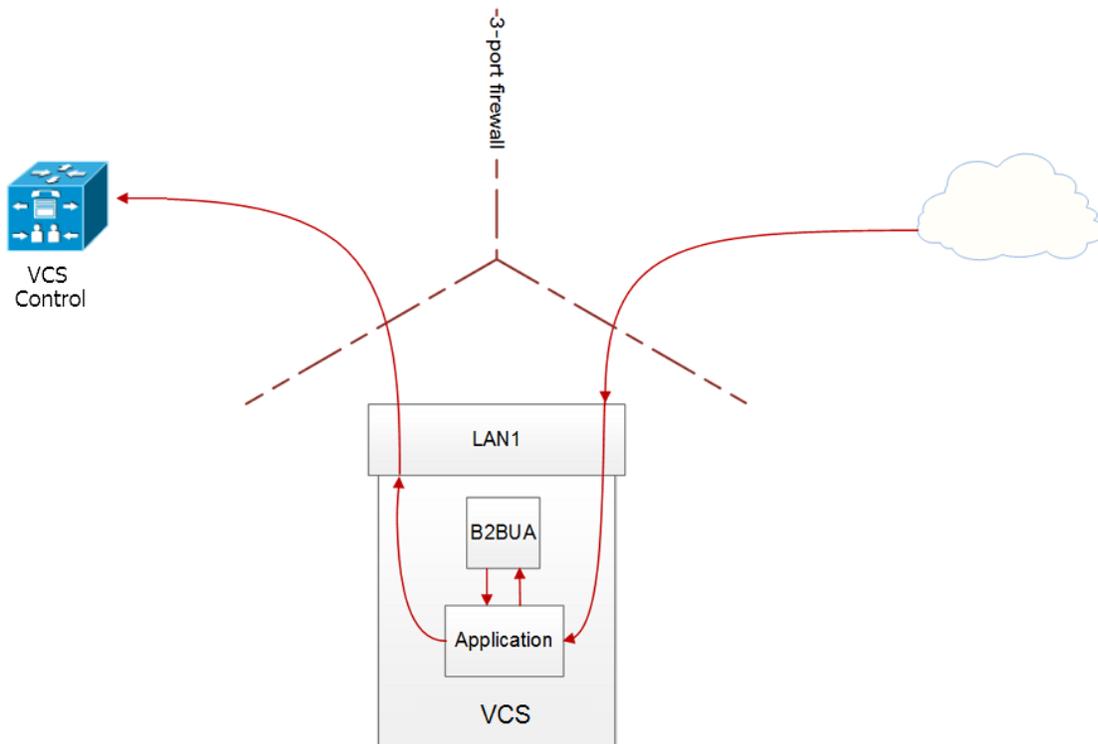


Figure 19 Media Path in 3-port Firewall Static NAT Example



#### Appendix 4: Advanced Networking Deployments

The 3-port Firewall Static NAT diagram, above, shows the traffic flow in the case where a Cisco ASA 8.4 and later series, has been configured to allow traffic to flow from LAN1 through the 3-port firewall.

Other vendors' firewalls may not have a similar configuration option.

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