



# Configure Intercluster Lookup Service

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## Intercluster Lookup Service Overview

The Intercluster Lookup Service (ILS) allows you to create networks of remote Cisco Unified Communications Manager clusters. When you configure ILS on multiple clusters, it updates Cisco Unified Communications Manager with the current status of remote clusters in the ILS network.

In Cisco Unified CM Administration, you can configure ILS on a pair of clusters and then join those clusters to form an ILS network. ILS allows you to join additional clusters to the network without having to configure the connections between each cluster.

An ILS network comprises the following components:

- Hub clusters
- Spoke clusters
- Global dial plan imported catalogs

## Hub Clusters

Hub clusters form the backbone of an ILS network. Hub clusters exchange ILS updates with the other hub clusters in the ILS network, and then relay that information to and from their spoke clusters.

When a new hub cluster registers to another hub cluster in an existing ILS network, ILS automatically creates a full mesh connection between the new hub cluster and all the existing hub clusters in the ILS network.

## Spoke Clusters

A spoke cluster connects to the hub cluster in an ILS network to relay ILS updates to and from the rest of the ILS network. Spoke clusters contact only their local hub cluster and never directly contact other hub clusters or other spoke clusters.

## Global Dial Plan Imported Catalogs

To provide URI dialing compatibility with third-party systems, you can manually import a third-party directory URI or +E.164 number catalog from a CSV file into any hub cluster in the ILS network. ILS maintains the imported catalog and replicates that catalog out to the other clusters in the network. You can dial one of the third-party directory URIs or +E.164 numbers catalog from any server in the ILS network.

## ILS Prerequisites

You must study your network and design an ILS topology.

For more information about the Solution Reference Network Design, see the *Cisco Unified Communications Solution Reference Network Design* guide at <http://www.cisco.com/c/en/us/support/unified-communications/unified-communications-manager-callmanager/products-implementation-design-guides-list.html>.

## ILS Configuration Task Flow

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<a href="#">Activate Intercluster Lookup Service, on page 3</a>	Activate Intercluster Lookup Service to configure cluster IDs and remote clusters.
<b>Step 2</b>	<a href="#">Configure Cluster IDs, on page 3</a>	Provide a unique identifier for each cluster in the ILS network.
<b>Step 3</b>	<a href="#">Configure Remote Clusters, on page 4</a>	Configure remote clusters in the ILS network.
<b>Step 4</b>	To activate ILS on the various clusters, complete the following tasks: <ul style="list-style-type: none"> <li>• <a href="#">Activate ILS on the Hub Cluster, on page 5</a></li> <li>• <a href="#">Activate ILS on the Spoke Cluster, on page 5</a></li> </ul>	<p>Activate ILS on the hub cluster and spoke cluster in the ILS network.</p> <p><b>Note</b> You must configure each cluster in your ILS network as either a hub cluster or a spoke cluster.</p>
<b>Step 5</b>	(Optional) Configure authentication between your cluster. Select one of the following procedures: <ul style="list-style-type: none"> <li>• <a href="#">Enable TLS Authentication Between Clusters, on page 6</a></li> <li>• <a href="#">Enable Password Authentication Between Clusters, on page 7</a></li> <li>• <a href="#">Enable TLS with Password Authentication Between Clusters, on page 7</a></li> </ul>	<p>Use TLS authentication between clusters in the ILS network.</p> <p>Use password authentication between remote clusters in the ILS network.</p> <p>Use TLS and password authentication to setup a ILS network using common Certificate Authority (CA) signed certificates without exchanging self-signed certificates between clusters.</p>

	Command or Action	Purpose
<b>Step 6</b>	<a href="#">Enable ILS Support for Global Dial Plan Replication</a>	(Optional) Enable ILS support for Global Dial Plan Replication to share dial plan information between participating ILS enabled clusters.
<b>Step 7</b>	<a href="#">Import Catalogs in ILS Network, on page 9</a>	(Optional) To provide URI dialing compatibility with third party systems, you can manually import a third party directory URI or +E.164 number catalog from a csv file into any hub cluster in the ILS network.

## Activate Intercluster Lookup Service

You must activate the Intercluster Lookup Service to configure Cluster IDs and Remote Clusters.

### Procedure

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- Step 1** From Cisco Unified Serviceability, choose **Tools > Service Activation**.
  - Step 2** From the **Server** drop-down list, choose the node on which you want to activate Cisco Intercluster Lookup Service, and then click **Go**.
  - Step 3** Check the **Cisco Intercluster Lookup Service** check box.
  - Step 4** Click **Save**.
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### What to do next

[Configure Cluster IDs, on page 3](#)

## Configure Cluster IDs

You must configure a unique cluster ID for each cluster in the ILS network. You must also ensure that you have a unique peer ID. The clusters use this unique cluster ID and peer ID when they exchange status messages.

For example, if you have an existing ILS network of four Cisco Unified Communications Manager clusters and you want to add an additional cluster, you can configure ILS on the new cluster and then register that cluster to any hub cluster in the existing ILS network. ILS automatically informs the new cluster of all clusters in the existing network.

Each cluster in an ILS network exchange and update messages, called peer info vectors, that are designed to inform remote clusters of the status of each cluster in the network. The update messages contain information about the known clusters in the network, including:

- Cluster IDs
- Peer IDs for the publisher
- Cluster descriptions and versions
- Fully Qualified Domain Name (FQDN) of the host

- IP addresses and host names for the cluster nodes that have ILS activated

Perform the following procedure to configure a unique identifier for each cluster in the network.

### Before you begin

[Activate Intercluster Lookup Service, on page 3](#)

### Procedure

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- Step 1** Log in to the Unified Communications Manager publisher node.
- Step 2** In Cisco Unified Communications Manager Administration, choose **System > Enterprise Parameters**.
- Step 3** In the **Enterprise Parameters Configuration** window **Cluster ID** field, enter a name of the cluster that you want to configure in your network.
- You can enter up to 50 characters. You can enter alphanumeric characters, period (.), and hyphen (-). The default value is StandAloneCluster.
- Step 4** Click **Save**.
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### What to do next

[Configure Remote Clusters, on page 4](#)

## Configure Remote Clusters

Perform the following steps to configure remote clusters in the ILS network.

### Before you begin

[Configure Cluster IDs, on page 3](#)

### Procedure

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- Step 1** In Cisco Unified Communications Manager Administration, choose **Advanced Features > Cluster View**.
- Step 2** In the **Find and List Remote Clusters** window, choose any previously created remote cluster.
- Step 3** From the **Remote Cluster Service Configuration** window, check the appropriate check box to configure services such as Extension Mobility Cross Cluster, TFTP, and RSVP Agent for remote clusters.
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### What to do next

Perform one of the following procedures:

- [Activate ILS on the Hub Cluster, on page 5](#)
- [Activate ILS on the Spoke Cluster, on page 5](#)

## Activate ILS on the Hub Cluster

Configure each cluster in your ILS network as either a hub cluster or a spoke cluster. Each ILS network must have at least one hub cluster. You can connect a hub cluster to other hub clusters, or you can configure a hub cluster as the only hub cluster in the network. In addition, you can connect a hub cluster to multiple spoke clusters, or you can configure the hub cluster with no spoke clusters.

Perform the following procedure to activate the ILS on the hub cluster in the ILS network.

### Before you begin

[Configure Remote Clusters, on page 4](#)

### Procedure

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- Step 1** Log in to the Cisco Unified Communications Manager publisher node.
- Step 2** Choose **Advanced Features** > **ILS Configuration**.
- Step 3** In the **ILS Configuration** window, in the **Role** drop-down list, select **Hub Cluster** and click **Save**.
- Note** To remove a specific cluster in the ILS network, in the **ILS Configuration** window, in the **Role** drop-down list, select **Standalone** and click **Save**.
- Step 4** In the **ILS Configuration Registration** pop-up window, leave the **Registration Server** text box empty and click **OK**.
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### What to do next

- [Activate ILS on the Spoke Cluster, on page 5](#)

## Activate ILS on the Spoke Cluster

A spoke cluster connects to the hub cluster in an ILS network to relay ILS updates to and from the rest of the ILS network. Follow this procedure to activate ILS on the spoke cluster.

### Before you begin

- [Configure Cluster IDs, on page 3](#)
- [Configure Remote Clusters, on page 4](#)

### Procedure

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- Step 1** Log in to the Unified Communications Manager publisher node.
- Step 2** In Cisco Unified CM Administration, choose **Advanced Features** > **ILS Configuration**.
- Step 3** From the **Role** drop-down list, select **Spoke Cluster** and click **Save**.

**Step 4** In the **ILS Configuration Registration** popup window, enter the IP address or fully qualified domain name of the publisher node for an existing hub cluster in your ILS network in the **Registration Server** text box and click **OK**.

**Step 5** Confirm that your ILS network is configured by viewing the network in the ILS Clusters and Global Dial Plan Imported Catalogs section.

When the full network appears, your ILS network is configured for cluster discovery.

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### What to do next

Perform any of these optional procedures:

- [Enable TLS with Password Authentication Between Clusters, on page 7](#)
- [Enable TLS Authentication Between Clusters, on page 6](#)
- [Enable Password Authentication Between Clusters, on page 7](#)
- [Enable ILS Support for Global Dial Plan Replication](#)

## Enable TLS Authentication Between Clusters

(Optional) Use this procedure for the TLS authentication to encrypt communications between remote clusters in the ILS network:

### Before you begin

To use Transport Layer Security (TLS) authentication between clusters, you must exchange Tomcat certificates between the publisher node of each cluster in the ILS network. From Cisco Unified Operating System Administration, use the Bulk Certificate Management feature to:

- export certificates from the publisher node to a central location, for each cluster in your network
- consolidate exported certificates from any publisher node server in your ILS network
- import certificates into the publisher node for each cluster in your network




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**Note** For more information about enabling TLS Authentication Between Clusters, see the *Administration Guide for Cisco Unified Communications Manager* at <http://www.cisco.com/c/en/us/support/unified-communications/unified-communications-manager-callmanager/products-maintenance-guides-list.html>.

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### Procedure

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- Step 1** Log in to the Unified Communications Manager publisher node.
- Step 2** In Cisco Unified CM Administration, choose **Advanced Features > ILS Configuration**.
- Step 3** In the **ILS Configuration** window, check the **Use TLS Certificates** check box under ILS Authentication.
- Step 4** Click **Save**.
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**What to do next**

Perform any of these optional procedures:

- [Enable Password Authentication Between Clusters, on page 7](#)
- [Enable ILS Support for Global Dial Plan Replication](#)

## Enable Password Authentication Between Clusters

(Optional) To use password authentication between remote clusters, you must assign a password for all communications between clusters in your ILS network.

**Procedure**

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- Step 1** Log in to the Unified Communications Manager publisher node.
- Step 2** In Cisco Unified CM Administration, choose **Advanced Features** > **ILS Configuration**.
- Step 3** In the **ILS Configuration** window, check the **Use Password** check box under ILS Authentication.
- Step 4** Enter a password in the **Use Password** text box.
- Note** You must configure all clusters in your network with the same password.
- Step 5** Re-enter the password in the **Confirm Password** text box.
- Step 6** Click **Save**.
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**What to do next**

Perform any of these optional procedures:

- [Enable TLS Authentication Between Clusters, on page 6](#)
- [Enable ILS Support for Global Dial Plan Replication](#)

## Enable TLS with Password Authentication Between Clusters

**Before you begin**

To use Transport Layer Security (TLS) and password authentication without exchanging certificates between clusters, you must upload the certificate authority root certificates to the Tomcat trust and get the Tomcat certificate signed by the certificate authority root certificate. The certificate is then imported back on the same cluster. The clusters can be connected to Intercluster Lookup Service (ILS) network once the certificates are uploaded with the same password for all the clusters.



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**Note** For more information about enabling TLS Authentication Between Clusters, see the *Administration Guide for Cisco Unified Communications Manager* at <http://www.cisco.com/c/en/us/support/unified-communications/unified-communications-manager-callmanager/products-maintenance-guides-list.html>.

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### Procedure

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- Step 1** Log in to the Cisco Unified Communications Manager publisher node.
- Step 2** In Cisco Unified CM Administration, choose **Advanced Features > ILS Configuration**.
- Step 3** In the **ILS Configuration** window, check the **Use TLS Certificates** check box under ILS Authentication..
- Step 4** In the **ILS Configuration** window, check the **Use Password** check box under ILS Authentication.
- Step 5** Enter a password in the **Use Password** text box.
- Note** You must configure all clusters in your network with the same password.
- Step 6** Re-enter the password in the **Confirm Password** text box.
- Step 7** Click **Save**.
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### What to do next

(Optional) [Enable ILS Support for Global Dial Plan Replication](#)

## Enable ILS Support for Global Dial Plan Replication

(Optional) To enable ILS support for Global Dial Plan Replication in the local cluster, follow this procedure:

### Procedure

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- Step 1** Log in to the Unified Communications Manager publisher node.
- Step 2** In Cisco Unified Communications Manager Administration, choose **Advanced Features > ILS Configuration**.
- Step 3** In the **ILS Configuration** window, check the **Exchange Global Dial Plan Replication Data with Remote Clusters** check box.
- Step 4** In the **Advertised Route String** text box, enter a route string for the local cluster.
- Step 5** Click **Save**.
- Note** When advertising URI patterns (`user@domain`), in the **SIP Profile Configuration** window, make sure that the **Dial String Interpretation** field is set to **Always treat all dial strings as URI addresses** to prevent the devices to dial URI learned patterns with only numbers in the user section as Directory Number patterns. Alternatively, you can advertise only URI patterns with text strings in the user section through ILS.
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### What to do next

[Import Catalogs in ILS Network, on page 9](#)

## Import Catalogs in ILS Network

(Optional) To provide URI dialing compatibility with third party systems, you can manually import a third party directory URI or +E.164 number catalog from a csv file into any hub cluster in the ILS network. To Import Catalogs in the ILS network, follow this procedure:

### Procedure

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- Step 1** In Cisco Unified Communications Manager Administration, choose **Call Routing > Global Dial Plan Replication > Imported Global Dial Plan Catalogs**.
  - Step 2** In the **Find and List Imported Global Dial Plan Catalogs** window, click **Add New**.
  - Step 3** Enter a Name, Description and Route String for the catalog and click **Save**.
  - Step 4** In Cisco Unified Communications Manager Administration, choose **Bulk Administration > Upload/Download Files**.
  - Step 5** Click **Choose** and select the CSV file that you want to import for the catalogs.
  - Step 6** From the **Select the Target** drop-down list, choose **Imported Directory URIs and Patterns**.
  - Step 7** From the **Select Transaction Type** drop-down list, choose **Insert Imported Directory URIs and Patterns**.
  - Step 8** Click **Save**.
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# ILS Interactions and Restrictions

## ILS Interactions

Table 1: ILS Interactions

Feature	Interaction
Cluster discovery	<p>ILS cluster discovery allows Cisco Unified Communications Manager clusters to learn dynamically about remote clusters without the need for an administrator to manually configure connections between those clusters.</p> <p>Each cluster in an ILS network exchange update messages, called peer info vectors, that are designed to inform remote clusters of the status of each cluster in the network. The update messages contain information about the known clusters in the network, including:</p> <ul style="list-style-type: none"> <li>• Cluster IDs</li> <li>• Cluster descriptions and versions</li> <li>• Fully qualified domain name of the host</li> <li>• IP addresses and hostnames for the cluster nodes that have ILS activated</li> </ul> <p>The ILS cluster discovery feature automatically populates the list of remote clusters that can be viewed in Cisco Unified CM Administration by choosing <b>Advanced Features &gt; Cluster View</b>. From this window, you can configure services such as Extension Mobility Cross Cluster, TFTP, and RSVP Agent for remote clusters.</p> <p><b>Note</b> A fully qualified domain name of the remote cluster, as seen in the Cluster View, must be DNS resolvable for ILS discovery to work.</p>
Global Dial Plan Replication	<p>When Global Dial Plan Replication is enabled across an ILS network, remote clusters in an ILS network share global dial plan data, including the following:</p> <ul style="list-style-type: none"> <li>• Directory URIs</li> <li>• Alternate numbers</li> <li>• Alternate number patterns</li> <li>• Route strings</li> <li>• PSTN failover numbers</li> </ul>
Block Inbound Calls	<p>To block Inbound calls based on calling party number in an ILS-based network, you must include the SIP route pattern's partition in the calling party's CSS. For example, if the call originates from SIP Trunk then SIP trunk inbound CSS must have SIP route pattern's partition.</p>

## ILS Restrictions

Table 2: ILS Restrictions

Restriction	Description
ILS Service	The ILS Service runs only on the Unified Communications manager publisher node.
Clusters	A hub cluster can have many spokes but, a spoke cluster can have only one hub cluster.
ILS Network	You cannot connect a third-party call control system into an ILS network.
Cluster Import	You can import a third-party catalog into a hub cluster only.
Duplicated URI	If a learned ILS cluster contains duplicated URIs from a different remote cluster and when a call is placed to that URI, it will be routed to the cluster whose URI has been learned and inserted into the database first.
Database Replication Status	Although the Global dial plan data is exchanged successfully on the ILS Network, an ILS receiving cluster will not write learned information into the database until it completes its database replication status.
Import	For imported third-party directory URIs and patterns, the CSV file format must match the exact syntax as shown in the administration window sample file otherwise, the import fails.
ILS Hub	<p>When adding an additional hub cluster into the ILS network ensure to verify the following conditions are met for the primary ILS hub node:</p> <ul style="list-style-type: none"> <li>• Cluster ID is unique across all the hub nodes in the ILS cluster.</li> <li>• Fully Qualified Domain Name (FQDN) is configured.</li> <li>• UDS and EM services are running on the all of the hub nodes in the ILS cluster</li> <li>• DNS primary and reverse resolution are working fine.</li> <li>• Import consolidated Tomcat certificates from all the hub nodes.</li> </ul> <p>Else, the "version" information will not get displayed in the <b>Find and List Remote Clusters</b> window even after rebooting the clusters or correcting the errors. The workaround is to remove the hub cluster from the ILS network, comply with the above requirements and add the hub cluster back into the ILS network.</p>
ILS Network Capacities	<p>ILS networking supports up to 10 hub clusters with 10 spoke clusters per hub, up to a 100 total cluster maximum. The design limits a maximum of 10 ILS clusters connections per hub cluster. A hub and spoke combination topology is used to avoid many TCP connections created within each cluster.</p> <p><b>Note</b> The specified number of hubs and spokes are only recommendations. Unified Communications Manager does not enforce to limit the numbers. However, to ensure optimum performance use this combination.</p>

# ILS Troubleshooting

## Local Cluster Cannot Connect to the ILS Network

To troubleshoot connection issues within the local cluster, open RTMT and run alarms and diagnostic traces on that publisher node.

If you receive an error message when trying to establish ILS between your clusters, you can try to restart the Cisco Intercluster Lookup service from Cisco Unified Serviceability Administration.

In addition, connection issues may arise if authentication is improperly configured between clusters. Check authentication in the following manner:

- If you are using TLS, make sure that all clusters in the network are using TLS and that Tomcat certificates have been exchanged for all the servers that need to communicate.



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**Note** Certificates exchanged using bulk certificate export, merge, and import can cause an untrusted ILS hub due to TLS errors.

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- If you are using TCP password authentication, make sure that all ILS clusters are using TCP password authentication and that the same TCP password is assigned across the network.

## Directory URIs Are Not Being Replicated Across the ILS Network

This error can occur for a variety of reasons. Check the following:

- Verify that all clusters in the network are configured to exchange global dial plan data. If a hub cluster is not configured to exchange global dial plan data, none of that hub's spoke clusters will be able to exchange directory URI catalogs.
- Allow enough time for end-to-end replication based on synchronization intervals (set on the ILS Configuration page) that are configured for all the clusters involved in the path. All clusters in an ILS network are a maximum of three hops from every other cluster in the network.
- Use the **utils ils showpeerinfo** CLI command to monitor replication progress by looking at the USN values for the remote clusters.
- Increase speed of replication by changing the ILS Sync Throttle Service Parameter. Note that a low setting can affect system performance.
- Verify that all clusters in the ILS network have unique cluster IDs and that none of the clusters are configured with Stand Alone Cluster as its cluster ID. You can check Cluster IDs in Cisco Unified CM Administration under **System > Enterprise Parameters**.

## Global Dial Plan Replication Is Configured, but Unified CM Still Cannot Place a Call to A Learned Directory URI or Learned Number in a Remote ILS Cluster

This condition can occur if ILS and Global Dial Plan Replication are enabled on all clusters in the network, but SIP route patterns that route to the route strings for the remote clusters have not been configured. Do the following:

- In the ILS Clusters and Global Dial Plan Imported Catalogs view in the ILS Configuration window, check the route string for the remote cluster.
- In the SIP Route Pattern configuration window, make sure that you have route patterns that map to the route strings for your remote clusters.



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**Note** When advertising URI patterns (`user@domain`), in the **SIP Profile Configuration** window, make sure that the **Dial String Interpretation** field is set to **Always treat all dial strings as URI addresses** to prevent the devices to dial URI learned patterns with only numbers in the user section as Directory Number patterns. Alternatively, you can advertise only URI patterns with text strings in the user section through ILS.

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### **ILS Global Dial Plan Replication Update is Cached Until Cisco Unified Communications Manager Database Replication is Not Corrected**

The value of **Last USN Data Received** is Current and USN Data Synchronization Status is **Up to date**. However, the Learned URIs or Learned Patterns are not viewable on local cluster.

This condition occurs when database replication is not corrected. ILS caches the updates with learned URIs or patterns from remote clusters if database replication is not viewable on local cluster across all nodes. Unified Communications Manager can place a call to these learned URIs or patterns after the database replication is corrected.

