Introduction

This document describes how partitions and calling search spaces (CSSes) work and how they can be used in order to apply call routing restrictions by class of user and/or geographical location. This document also addresses configuration and basic troubleshooting.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Cisco CallManager configuration
- Route Pattern configuration
- IP phones configuration

Components Used

The information in this document is based on the Cisco CallManager Server 11.0.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Background Information

Partitions can be seen as a collection of route patterns. Directory numbers, route patterns, and
translation patterns can all belong to specific partitions.

CSSes are an ordered list of route partitions and they determine which partitions calling devices must search when they attempt to complete a call. In order to reach a certain destination, the called party’s partition must belong to the calling party’s CSS.

When you attempt to make a call, Cisco CallManager looks into the CSS of the calling party and checks if the called party belongs to a partition within the CSS. If it does, the call is placed or the translation pattern is executed. If not, the call is rejected or the translation pattern is ignored.

You can again assign different CSSes to IP phones, directory numbers, call forward all (CFA)/call forward no answer (CFNA)/call forward busy (CFB) destinations, gateways, and translation patterns.

Partitions and CSSes facilitate call routing since they divide the route plan into logical subsets based on organization, location, and/or call type.

The best way to understand how partitions and CSSes work is through an example. The next section provides two examples: route by class of user and route by geographic location.

Examples

Route by Class of User

This example illustrates how a company can restrict call routing for a certain group of users. In this organization there are three types of users:

- Lab environment
- Employees
- Management

From within the lab environment, only internal calls can be made.

Normal employees are not allowed to dial international numbers. Management can call any number. Three partitions are created in order to route by class of user:

- Internal = Red partition
- No-International = Blue partition
- International = Green partition

These three partitions are used to categorize the possible call destinations. All IP phones (directory numbers) are placed in the Internal (red) partition.

These two route patterns are configured on the gateway:

- All calls except international numbers.
- International numbers.

Route pattern 1 is assigned to partition No-International (blue).

Route pattern 2 is assigned to partition International (green).

Based on these mentioned restrictions, these three CSSes are configured and assigned to the appropriate devices:
- CSS 1 contains partition(s): Internal (red)
- CSS 2 contains partition(s): Internal (red) and No-International (blue)
- CSS 3 contains partition(s): Internal (red), No-International (blue), and International (green)

- IP phones in the lab environment are assigned to CSS 1.
- IP phones from Employees are assigned to CSS 2.
- IP phones from Management are assigned to CSS 3.

In the figure, there are three IP phones and one gateway with two route patterns.

Gateway
Route Pattern for Non-International Calls Blue
Route Pattern for International Calls Green
Gateway Calling Search Space looks in Partitions : Red

Lab IP phone with DN = 1000
1000 belongs to Partition Red
1000 Calling Search Space looks in Partitions : Red

Employee IP phone with DN = 2000
2000 belongs to Partition Red
Calling Search Space looks in Partitions : Red, Blue

Manager IP phone with DN = 3000
3000 belongs to Partition Red
Calling Search Space looks in Partitions : Red, Blue, Green
Example 1: Lab Phone Calls

- Internal Number
  Called Party = Red partition

Calling Party Search Space 1 contains = Red partition

Call routed = Yes (Red partition is included in the CSS)

- External Non-International number
  Called Party = Blue partition

Calling Party Search Space contains = Red partition

Call routed = No (Blue partition is not included in the CSS)

- External International Number
  Called Party = Green partition

Calling Party Search Space contains = Red partition

Call routed = No (Green partition is not included in the CSS)

Example 2: Employee Calls

- Internal Number
  Called Party = Red partition

Calling Party Search Space contains = Red and Blue partition

Call routed = Yes (Red partition is included in the CSS)

- External Non-International Number
  Called Party = Blue partition

Calling Party Search Space contains = Red and Blue partition

Call routed = Yes (Blue partition is included in the CSS)

- External International Number
  Called Party = Green partition

Calling Party Search Space contains = Red and Blue partition

Call routed = No (Green partition is not included in the CSS)

Example 3: Manager Calls

- Internal Number
  Called Party = Red partition
Calling Party Search Space contains = Red and Blue partition

Call routed = Yes (Red partition is included in the CSS)

- External Non-International Number
Called Party = Blue partition

Calling Party Search Space contains = Red, Blue, and Green partition

Call routed = Yes (Blue partition is included in the CSS)

- External International Number
Called Party = Green partition

Calling Party Search Space contains = Red, Blue, and Green partition

Call routed = Yes (Green partition is included in the CSS)

**Route by Geographical Location**

It is also possible to restrict call routing based on different types of users and location. Consider a company where the employees are located in two different locations:

- Location 1 with area code 1 and gateway 1.
- Location 2 with area code 2 and gateway 2.

And where the employees are divided into two different user classes:

- Employees
- Managers

These restrictions are applied:

- Employees and managers can call internally.
- Employees and managers can call locally within area 1 and 2. When you dial a number with area code 1, the call needs to be routed through gateway 1 in location 1. When you dial a number with area code 2, the call needs to be routed through gateway 2 in location 2.
- Managers can dial to all possible destinations.
- Calls can be routed via gateway 1 or 2.

Based on these restrictions, these partitions are configured:

- Internal = Red partition
- Location 1 users = Blue partition
- Location 2 users = Orange partition
- Managers = Green partition

All IP phones are put into the Internal partition (red).

There are two gateways located in two different locations, for which these three route patterns are configured:

- Where area code 1 exists, send call to gateway 1.
This belongs to location 2 users (orange).

Calls from location 2 that dial to location 1 need to be routed via this route pattern through gateway 1.

- Where area code 2 exists, send call to gateway 2.

This belongs to location 1 users (blue).

Calls from location 1 that dial to location 2 need to be routed via this route pattern through gateway 2.

- All calls send the call to route list with gateways 1 and 2.

This belongs to the managers.

Calls from location 1 or 2 that dial outside can be routed either via gateway 1 or gateway 2.

**Note:**

These CSSes are used:

- CSS 1 contains partition(s): Internal (red)
- CSS 2 contains partition(s): Internal (red), location 1 users (blue), and location 2 users (orange)
- CSS 3 contains partition(s): Internal (red), location 1 users (blue), location 2 users (orange), and managers (green)
Gateway 1

- Route pattern where area code 1 exists belongs to partition Blue.
- Route pattern for all calls belongs to partition Green.
- Gateway CSS looks in partition Red.

Gateway 2

- Route pattern where area code 2 exists belongs to partition Orange.
- Route pattern for all calls belongs to partition Green.
- Gateway CSS looks in partition Red.

Manager IP Phone in Location 1

- 1000 belongs to partition Red.
- CSS looks in partitions Red, Blue, Orange and Green.

Employee IP Phone in Location 1

- 2000 belongs to partition Red.
- CSS looks in partitions Red, Blue, and Orange.

Manager IP Phone in Location 2

- 3000 belongs to partition Red.
- CSS looks in partitions Red, Blue, Orange, and Green.

Employee IP Phone in Location 2

- 4000 belongs to partition Red.
- CSS looks in partitions Red, Blue, and Orange.

Example 1: Employee in Location 1 Calls

- Internal Number
  Called Party = Red partition

  Calling Party Search Space contains = Red, Blue, and Orange partitions

  Call routed = Yes

  - External Number in area 1
    Called Party matches the route pattern where area code 1 exists = Blue partition

    Calling Party Search Space contains = Red, Blue, and Orange partitions

    Call routed = Yes, via gateway 1

  - External Number in area 2
    Called Party matches the route pattern where area code 2 exists = Orange partition

    Calling Party Search Space contains = Red, Blue, and Orange partitions

    Call routed = Yes, via gateway 2
Example 1: External Number outside area 1 and 2
Called Party matches the route pattern for all calls = Green partition
Calling Party Search Space contains = Red, Blue, and Orange partitions
Call routed = No

Example 2: Employee in Location 2 Calls

- Internal Number
  Called Party = Red partition
Calling Party Search Space contains = Red, Blue, and Orange
Call routed = Yes

- External Number in area 2
  Called Party matches the route pattern where area code 2 exists = Orange partition
Calling Party Search Space contains = Red, Blue, and Orange partitions
Call routed = Yes, via gateway 2

- External Number in area 1
  Called Party matches the route pattern where area code 1 exists = Blue partition
Calling Party Search Space contains = Red, Blue, and Orange partitions
Call routed = Yes, via gateway 1

Example 3: Manager in Location 1 Calls

- Internal Number
  Called Party = Red partition
Calling Party Search Space contains = Red, Blue, Orange, and Green partitions
Call routed = Yes

- External Number in area 1
  Called Party matches the route pattern where area code 1 exists = Blue partition
Calling Party Search Space contains = Red, Blue, Orange, and Green partitions
Call routed = Yes, via gateway 1

- External Number in area 2
  Called Party matches the route pattern where area code 2 exists = Orange partition

Calling Party Search Space contains = Red, Blue, Orange, and Green partitions

Call routed = Yes, via gateway 2

- External Number outside area 1 and 2
  Called Party matches the route pattern for all calls = Green partition

Calling Party Search Space contains = Red, Blue, Orange, and Green partitions

Call routed = Yes, either via gateway 1 or 2

Note: Remember that the device and the line could have a CSS if it is an IP phone. As such, the line CSS takes precedence over the device CSS.

Note: Any device that makes a call can explicitly reach any dial plan entry that is left in the <None> partition. In order to avoid unexpected results, Cisco recommends that you do not leave dial plan entries in the <None> partition.

### Partition Name Limitations

The maximum length of the combined CSS clause (device and pattern) comprises 1024 characters that includes separator characters between partition names (for example, "partition 1:partition 2:partition 3"). Because the CSS clause uses partition names, the maximum number of partitions in a CSS varies dependent upon the length of the partition names. Also, because the CSS clause combines the CSS of the device and the CSS of the route pattern, the maximum character limit for an individual CSS specifies 512 (half of the combined CSS clause limit of 1024 characters).

When you create partitions and CSSes, keep the names of partitions short relative to the number of partitions that you plan to include in a CSS.

Note: If you rename a partition, the partition immediately ceases to function and functions properly only after the CallManager is restarted. Alternatively, if you cannot immediately restart CallManager, you can create a new partition and then delete the old partition. This procedure does not require a CallManager restart.

### CSS Partition Limitations

<table>
<thead>
<tr>
<th>Partition Name Length</th>
<th>Maximum Number of Partitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 characters</td>
<td>170</td>
</tr>
<tr>
<td>3 characters</td>
<td>128</td>
</tr>
<tr>
<td>4 characters</td>
<td>102</td>
</tr>
<tr>
<td>5 characters</td>
<td>86</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>10 characters</td>
<td>46</td>
</tr>
</tbody>
</table>
Configure

Use these two procedures in order to configure partitions and CSSes in Cisco CallManager 11.x:

- Define the Partitions
- Define the CSS

Define the Partitions

Complete these steps in order to define the partitions in Cisco CallManager 11.0

1. Choose Call Routing > Class of control > Partition from the main Cisco CallManager Administration page and click Add New in the opening window.

2. Configure partition(s) names and click Save (you can insert multiple partitions in a single operation).
3. Repeat steps 1 and 2 in order to define all required partitions.

**Define the CSS**

Complete these steps in order to define the partitions in Cisco CallManager 11.0

1. Choose **Call Routing > Class of control > Class of Control** from the main Cisco CallManager Administration page and click **Add New** in the opening window.

![Call Routing Configuration](image)

2. Enter a name for your CSS, and assign the desired partition to the CSS from the Available Partitions list. Choose each partition you want to add, and click the small arrows in order to move it to the Selected Partitions list.
3. Click **Save** in order to save your configuration.
4. Assign the appropriate partition to the device(s), route pattern(s), or translation pattern(s) you use. This example shows how to assign these parameters to the lines on an IP phone. Click the line number that you want to change.

<table>
<thead>
<tr>
<th>Status</th>
<th>Status: Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Association</strong></td>
<td>Phone Type: Cisco IP Communicator</td>
</tr>
<tr>
<td>1 Line 1</td>
<td>Device Protocol: SIP</td>
</tr>
<tr>
<td>2 Line 2</td>
<td>Real-time Device Status</td>
</tr>
<tr>
<td>3 Add a new SD</td>
<td>Registration: Registered with Cisco Unified Communications Manager 10.106.112.124</td>
</tr>
<tr>
<td>4 Add a new B2B SD</td>
<td>IPv4 Address: 10.106.112.227</td>
</tr>
<tr>
<td>5 Add a new SD</td>
<td>Active Load ID: CIPC-0-0-0-0</td>
</tr>
<tr>
<td>6 Add a new B2B Directed Call Park</td>
<td>Download Status: Unknown</td>
</tr>
<tr>
<td>7 Do Not Disturb</td>
<td><strong>Device Information</strong></td>
</tr>
<tr>
<td>8 Add Intercom 1</td>
<td>Device is Active</td>
</tr>
<tr>
<td>9 Call Park</td>
<td>Device is trusted</td>
</tr>
<tr>
<td>10 Call Pickup</td>
<td>Device Name: 1212121212</td>
</tr>
<tr>
<td>11 Callback</td>
<td>Description: Auto 1064</td>
</tr>
<tr>
<td>12 Conference List</td>
<td>Device Pool: Default</td>
</tr>
<tr>
<td>13 Conference</td>
<td>Common Device Configuration: &lt; None &gt;</td>
</tr>
<tr>
<td>14 End Call</td>
<td>Phone Button Template: Universal Device Template Button Layout</td>
</tr>
<tr>
<td>15 Forward All</td>
<td>Softkey Template: &lt; None &gt;</td>
</tr>
<tr>
<td></td>
<td>Common Phone Profile: Standard Common Phone Profile</td>
</tr>
<tr>
<td></td>
<td>Calling Search Space: &lt; None &gt;</td>
</tr>
</tbody>
</table>

5. In this Window, choose the appropriate partition from the **Route Partition** drop-down list, and then click **Save**. If you get a security warning, click **Save** again. Next, click **Apply Config**.

6. In order to configure a route pattern, open the Route Pattern configuration, and choose the appropriate partition from the **Route Partition** drop-down list.

7. Click **Save**.

8. Assign the appropriate CSS to the IP phone. Open the IP phone configuration. From the
Calling Search Space drop-down list, choose the appropriate CSS, and click **Update**.

## Symptoms

This is a list of possible symptoms if you are not able to make the call due to misconfigurations in partitions or CSSes:

- The reorder tone is heard before or after the complete number is dialed.
- The Meet-me Conference fails with a reorder tone.
- The "Your call cannot be completed as dialed" message is played by the Annunciator.
- Outgoing calls to PSTN or PBX network through a Cisco IOS® gateway never complete.

## Verify

You can find the association between the Directory Numbers (DNs) and CSSes in the SQL database **NumPlan**. Run the appropriate SQL Query in order to access the table that contains the DNs and the CSS identifier. In order to know the name of the CSS, you need to go to the **CallingSearchSpace** table and locate the identifier.

This is an example for the **Numplan** and **CallingSearchSpace** databases where extension number **3001** uses the CSS named **CSS_E**:

### Table name: NumPlan

- column name: DNO or Pattern value: 3001!--- *3001 is the directory number.*

- column name: fkCallingSearchSpace_SharedLineAppear value:

  {7AD3D293-A28E-4568-857F-E259A58DDA87}

### Table name: CallingSearchSpace

- column name: pkid!--- *This value is the CSS identifier:*

  value: {7AD3D293-A28E-4568-857F-E259A58DDA87}

- column name: Name value: **CSS_E**!--- *CSS_E is the name of the CSS.*

## Troubleshoot

Basically, a call routing problem occurs when the call does not get to where you expect it to be. The user picks up the phone, starts to dial, and gets a reorder tone even before the dialing is completed, or the user might finish dialing and then get the reorder tone.

It might be beneficial to learn the CCM trace. Usually the best way to find a device in the CCM trace is to search for the DN configured on the device. If the calling device is a gateway (the call comes in on a gateway) and the gateway does not receive calling party number information, you can search for the device name of the gateway in the trace. You can use CallManager.
Serviceability in order to search for the device and view the related traces.

When you look into the Cisco CallManager traces, this line displays when a phone attempts to make a call:

Digit analysis: match(fqcn="2001", cn="2001", pss=":Internal:No-International", dd="")

- "cn" stands for the calling number. In this case it is 2001.
- "pss" stands for partition search space, and has the information about the partition contained in the css assigned to the phone.
- "dd" stands for the destination. It displays all the digits dialed so far.

In this example, Cisco CallManager looks into the Internal (red) and No-International (blue) partitions for matching route patterns, translation patterns, or directory numbers.

Whenever a digit is dialed and as long as Cisco CallManager finds matching patterns within these partitions, these lines in the traces display:

Digit analysis: match(fqcn="2001", cn="2001", pss=":Internal:No-International", dd="0")
Digit analysis: potentialMatches=PotentialMatchesExist

If Cisco CallManager finds a matching pattern which is not part of these partitions, these lines display:

Digit analysis: match(fqcn="2001", cn="2001", pss=":Internal:No-International", dd="00")
Digit analysis: potentialMatches=NoPotentialMatchesExistStationD: 06b3b5a8 StartTone
tone=37(ReorderTone)

The user then hears a reorder (fast busy) tone.

**Note:** "Your call cannot be completed as dialed. Please consult your directory and call again or ask your operator."

When the complete number is dialed and matches any partition within the CSS, you see these lines:

Digit analysis: match(fqcn="2001", cn="2001", pss=":Internal:No-International", dd="027045429#")
results PretransformCallingPartyNumber=2001 CallingPartyNumber=2001 DialingPartition=No-International DialingPattern=0[1-9][#] DialingRoutePatternRegularExpression=(0[1-9][#]) DialingWhere=PatternType=Enterprise PotentialMatches=NoPotentialMatchesExist DialingSdlProcessId=(1,32,1) PretransformDigitString=027045429# PretransformTagsList=SUBSCRIBER PretransformPositionalMatchList=027045429# CollectedDigits=027045429#
TagsList=SUBSCRIBER PositionalMatchList=027045429#
DisplayName=RouteBlockFlag=RouteThisPattern InterceptPartition=InterceptPattern=InterceptWhere=InterceptSdlProcessId=(0,0,0) InterceptSsType=0 InterceptSsKey=0

The destination 027045429 is part of the No-International partition.