

TOMORROW starts here.



Cisco *live!*

Designing Dial Plans for Enterprise Unified Communications

BRKUCC-2008

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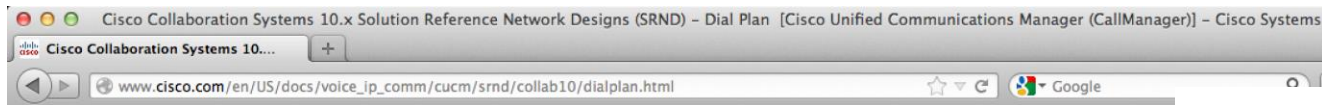
BRKUCC-2008 Abstract

This session explains the various fundamental dial plan elements of Cisco Unified Communications Manager with a focus on Enterprise dial plan design. Attendees learn how closest match routing works, how partitions and calling search spaces function, and the various constructs available to route calls. Other concepts such as class of service, URI dialing in single cluster environments and translation patterns are also covered.

For attendees that are familiar with Unified CM, but new to Dial Plan components and design, this session should provide a comprehensive understanding of the elements involved in deploying an enterprise dial plan and is a prerequisite for session “BRKUCC3000 - Advanced Dial Plan Design for Unified Communications Networks”

Meet Your Friend: the UC SRND

Source: http://www.cisco.com/en/US/docs/voice_ip_comm/cucm/srnd/collab10/dialplan.html



Cisco Collaboration Systems 10.x Solution Reference Network Designs (SRND)

Dial Plan

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Navigation: Do Do Do Fe



Agenda

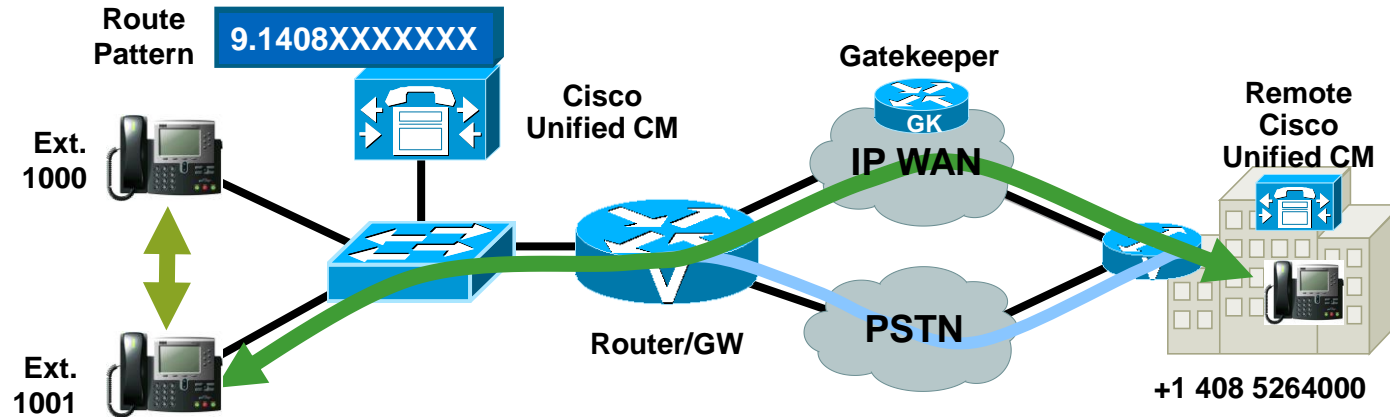
- Call Routing Basics
- Calling Search Spaces and Partitions
- Translation Patterns and External Routes
- Number Transformations
- Building Class of Service
- Alpha URI Routing
- Release 10.0 Enhancements

Agenda

- Call Routing Basics
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Dial Plan

The “IP Routing” of IP Telephony

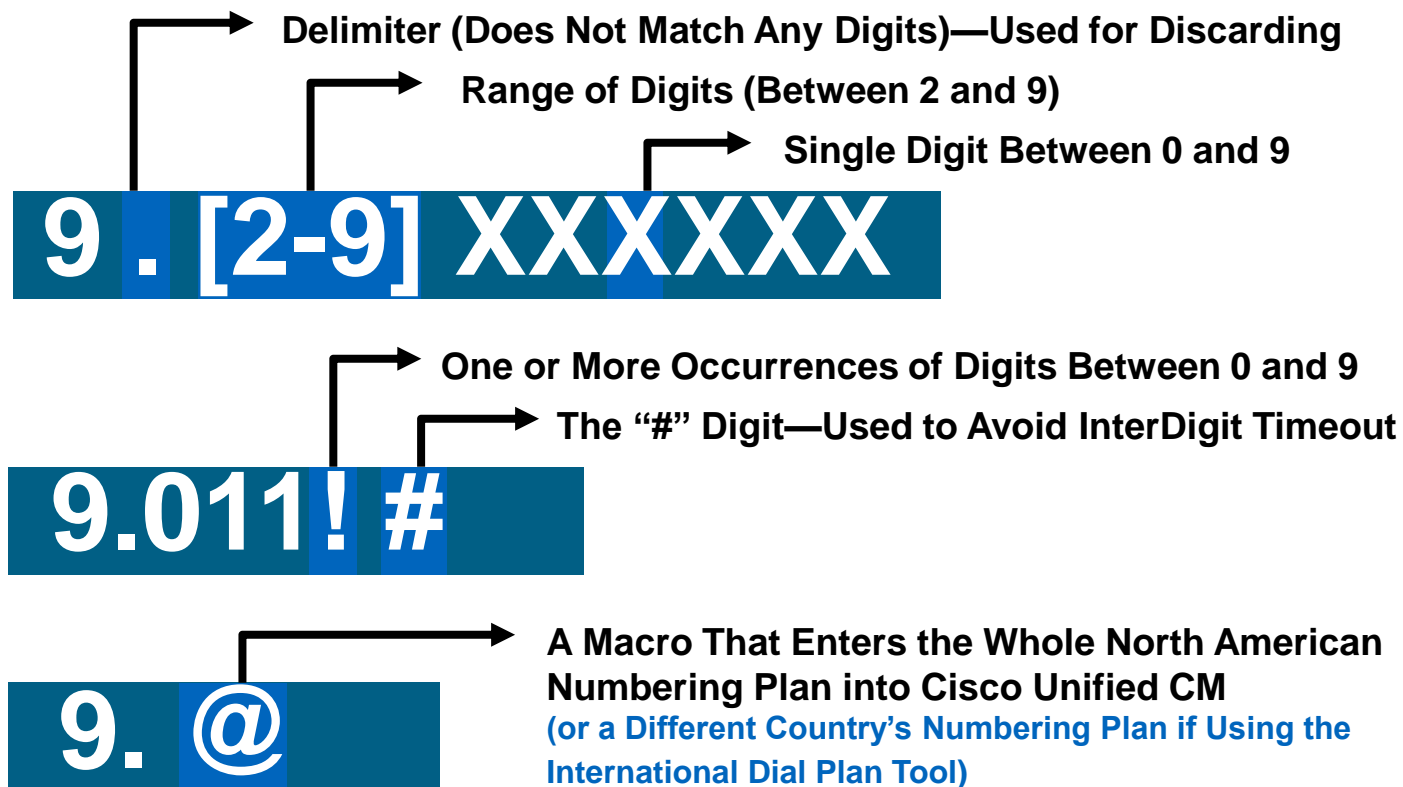


Cisco Unified CM Routes Two Basic Call Types:

- **On-Cluster Calls:** Destination Directory Number (DN) is registered with Cisco Unified CM. DNs are considered “internal” routes.
- **Off-Cluster Calls:** Destination Number is *not* registered with Cisco Unified CM. Route Patterns are configured to allow for “external” routes.
- **Alternate routes:** Allow On-Cluster and Off-Cluster calls to attempt alternate paths to destination (e.g. IP WAN not available, go through PSTN)

Cisco Unified CM Call Routing Logic

Commonly Used Wildcards



Cisco Unified CM Call Routing Logic

Patterns



For Your
Reference

Pattern	Description
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, *, #	Match Exactly One Keypad Button
X	Any Single Digit in the Range 0–9
\+	“+” as used in +E.164 numbers to indicate international format
[xy*z]	Exactly One of Any of the Keypad Buttons in the Brackets
[x-y]	Exactly One of Any Digit Between x and y Inclusively
[^x-y]	Any Digit That Is Not Between x and y Inclusively
!	One or More Digits in the Range 0–9
wildcard?	Zero or More Occurrences of the Previous Wildcard
wildcard+	One or More Occurrences of the Previous Wildcard
@	Numbering Plan Macro—More Later
<blank>	Immediately Route Call with No Digits

E.164 Geographic Numbers

Background

CC 1-3 digits	NSN max 15-n digits (n=number of CC digits)	
	NDC Defined by nat. numbering plan	SN Defined by nat. numbering plan
max 15 digits		

- ITU Recommendation E.164 describes the “Numbering Plan of the International telephone service”
 - CC: Country Code
 - NSN: National significant number
 - NDC: National destination code
 - SN: Subscriber number
 - NDC+SN = NSN: National significant number
- National numbering plan left to national authorities
 - documented at <http://www.itu.int/oth/T0202.aspx?lang=en&parent=T0202>
 - US: fixed length, NSN 10 digits
 - DE: variable length, NSN 4-13 digits

+E.164 Notation and “Numbers”

- ITU Recommendation E.123 describes the “Notation for national and international telephone numbers, e-mail addresses and Web addresses”
 - “+” signifies the international prefix
 - Example: +14085551234
- Numbers in global directories should be in +E.164 format
 - global form including country code
 - leading “+”
 - no trunk access codes included: +44 (0) 208 1234 1243 is NOT a valid +E.164 number!
 - universal use
- Benefits of +E.164 “Numbers” in dial plans
 - unique by definition
 - no overlap with any other dialing habit (“+”)

+ Sign Support

What It Is: Concept

- +E.164 support includes the use of + to wildcard international access codes AND to avoid overlap between globalised numbers and other ranges (e.g.: calls to India (+91XXXXXXXXXX) and NANP toll calls (912125551234))
- Supporting the + sign allows UCM-based systems to route calls based on an universal non-site (country) specific format
- + can be used in all dialable patterns
 - DN
 - Route Pattern
 - Translation pattern
 - ...
- Most phones support +-dialing: 7925/21 from day one, newer phones starting with phone firmware 9.1.1

+ Sign Support

Caveats

- 1st generation phones (like 7940/60 do not support + dialing from phone directories)
- Unity Connection 9.0 supports +E.164 subscribers
 - +E.164 alternate extensions, MWIs supported with 8.x
- Emergency responder 10.0 supports +E.164
- Contact Centre Enterprise and Express
 - support for +E.164 CTI route points and CTI ports (UCCX 8.5(1)SU3 added support)
 - no support for +E.164 agent extensions

Types of Patterns

Static Patterns

- Directory Number
 - extend call to registered device (phone, voicemail port etc.)
- Route Pattern
 - modify calling and called party and start routing to an external route
- Translation Pattern
 - modify calling and called party and continue to route using a different calling search space
- Hunt Pilot Number
 - distribute call to defined hunt logic

Types of Patterns

Dynamic Patterns

- Meet-Me conferences
- Call Park
- Call Pickup
- Conference

Cisco Unified CM Call Routing Logic

Matching Patterns

1111

Matches 1111

***1*1**

Matches *1*1

12XX

Matches Numbers Between 1200 and 1299

13[25-8]6

Matches 1326, 1356, 1366, 1376, 1386

13[^3-9]6

Matches 1306, 1316, 1326, 13*6, 13#6

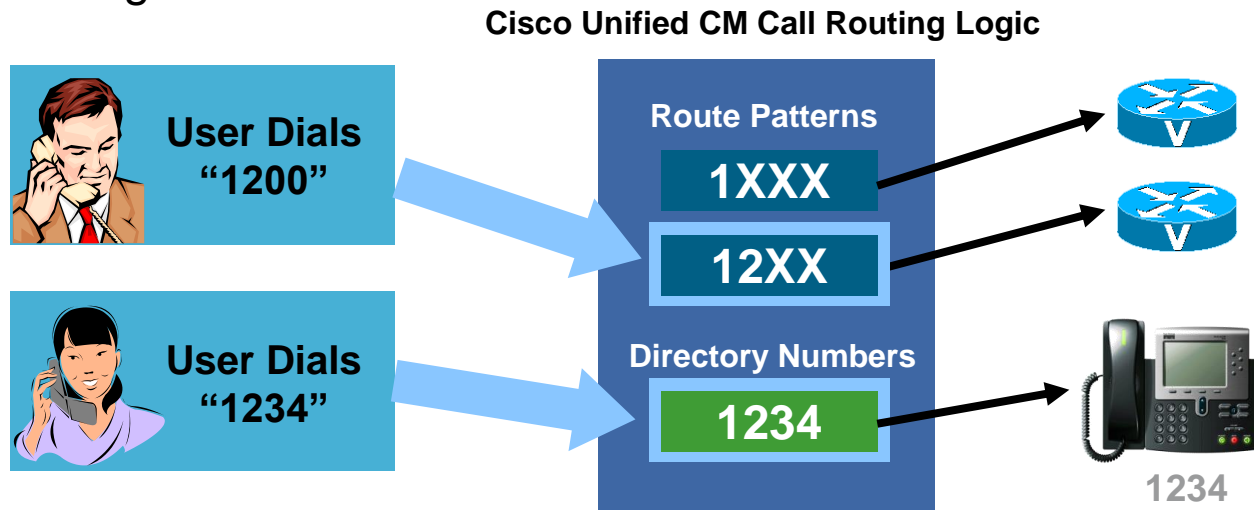
13!#

**Matches Any Number That Begins with 13, Is
Followed by One or More Digits, and Ends with #;
135# and 13579# Are Example Matches**

Cisco Unified CM Call Routing Logic

Basic Principle

- Cisco Unified CM matches the most specific pattern (longest-match logic)
- For call routing, an IP phone directory number acts as a 'route pattern' that matches a single number



Cisco Unified CM Call Routing Logic

Example (1)

User's Dial String:

Cisco Unified CM Actions:

Configured Route Patterns

1111	
1211	
1[23]XX	
131	
1[0-4]XX	
13!	

Cisco Unified CM Call Routing Logic

Example (2)

User's Dial String:

<Off Hook>

Cisco Unified CM Actions:

- Provide Dial Tone
- Wait

Configured Route Patterns

1111	Might Match
1211	Might Match
1[23]XX	Might Match
131	Might Match
1[0-4]XX	Might Match
13!	Might Match

```
Digit analysis: match(fqcn="9195555644", cn="15644",  
    pss="PA:Line1:Cisco:Local:Long Distance:International", dd="")  
Digit analysis: potentialMatches=PotentialMatchesExist
```

Cisco Unified CM Call Routing Logic

Example (3)

User's Dial String:

1

Cisco Unified CM Actions:

- Break Dial Tone
- Wait

Configured Route Patterns

1111	Might Match
1211	Might Match
1[23]XX	Might Match
131	Might Match
1[0-4]XX	Might Match
13!	Might Match

```
Digit analysis: match(fqcn="9195555644", cn="15644",  
    pss="PA:Line1:Cisco:Local:Long Distance:International", dd="1")  
Digit analysis: potentialMatches=PotentialMatchesExist
```


Cisco Unified CM Call Routing Logic

Example (4)

User's Dial String:

13

Cisco Unified CM Actions:

- Wait

Configured Route Patterns

1111	Doesn't Match
1211	Doesn't Match
1[23]XX	Might Match
131	Might Match
1[0-4]XX	Might Match
13!	Might Match

```
Digit analysis: match(fqcn="9195555644", cn="15644",  
    pss="PA:Line1:Cisco:Local:Long Distance:International", dd="13")  
Digit analysis: potentialMatches=PotentialMatchesExist
```

Cisco Unified CM Call Routing Logic

Example (5)

User's Dial String:

131

Cisco Unified CM Actions:

- Keep Waiting—More Digits Might Cause a **Different** Pattern to Match

Configured Route Patterns

1111	Doesn't Match
1211	Doesn't Match
1[23]XX	Might Match
131	Match!
1[0-4]XX	Might Match
13!	Match! and Might Match

```
Digit analysis: match(fqcn="9195555644", cn="15644",  
    pss="PA:Line1:Cisco:Local:Long Distance:International", dd="131")  
Digit analysis: potentialMatches=PotentialMatchesExist
```

Cisco Unified CM Call Routing Logic

Example (6)

User's Dial String:

1311

Cisco Unified CM Actions:

- Keep Waiting—More Digits Might Cause a **Different** Pattern to Match

Configured Route Patterns

1111	Doesn't Match
1211	Doesn't Match
1[23]XX	Match!
131	Doesn't Match
1[0-4]XX	Match!
13!	Match! and Might Match

```
Digit analysis: match(fqcn="9195555644", cn="15644",  
    pss="PA:Line1:Cisco:Local:Long Distance:International", dd="1311")  
Digit analysis: potentialMatches=PotentialMatchesExist
```

Cisco Unified CM Call Routing Logic

Example (7)

User's Dial String:

1311<timeout>

Cisco Unified CM Actions:

- Extend Call to the **Best Match**

Configured Route Patterns

1111	Doesn't Match
1211	Doesn't Match
1[23]XX	Match!
131	Doesn't Match
1[0-4]XX	Match!
13!	Match!

Can You Tell Which Route Pattern Is the Best Match in This Case?

Hint: We Are Being Crafty to Make Sure You Remember Forever ☺

Cisco Unified CM Call Routing Logic

Example (8)

Configured Route Patterns

User's Dial String:
1311<Timeout>

Matches 200 Digit Strings

Matches 500 Digit Strings

Matches ∞ Digit Strings,
but for the purposes of Closest Match Routing in this case, this matches 100 Digit Strings because you only consider the number of Potential Strings **Given the Number of Digits Dialed**

1111	Doesn't Match
1211	Doesn't Match
1[23]XX	Match!
131	Doesn't Match
1[0-4]XX	Match!
13!	Match!

Cisco Unified CM Call Routing Logic

Pattern Urgency

- Route Patterns, Translation Patterns and directory numbers (new in release 10.0) can be marked “urgent”
- Default
 - Translation Pattern: urgent
 - Route Pattern and DN: non-urgent
- Urgent patterns force immediate routing as soon as the pattern matches (even if there are still other (longer) potential matches)
- Important to avoid inter-digit timeouts
- Best match still applies

Agenda

- Call Routing Basics
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Partitions and Calling Search Spaces

Analogy (1 of 4)

Rita Wants to Call Dave

**To Do So, She Needs to
Know Dave's Number**



Rita

Miami Yellow Pages

Dave	305 555 5000
-------------	---------------------

**Dave Lists His
Number in a Directory**

Dave
305 555 5000



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Partitions and Calling Search Spaces

Analogy (2 of 4)

To Look up Numbers,
Rita Looks Through the
Directories She Owns

Rita's List of Directories

Dallas White Pages

Outlook Address Book

Little Black Book



Rita

If She Doesn't Have
the Right Directory...

... She Can't Place the Call

Miami Yellow Pages

Dave	305 555 5000
------	--------------



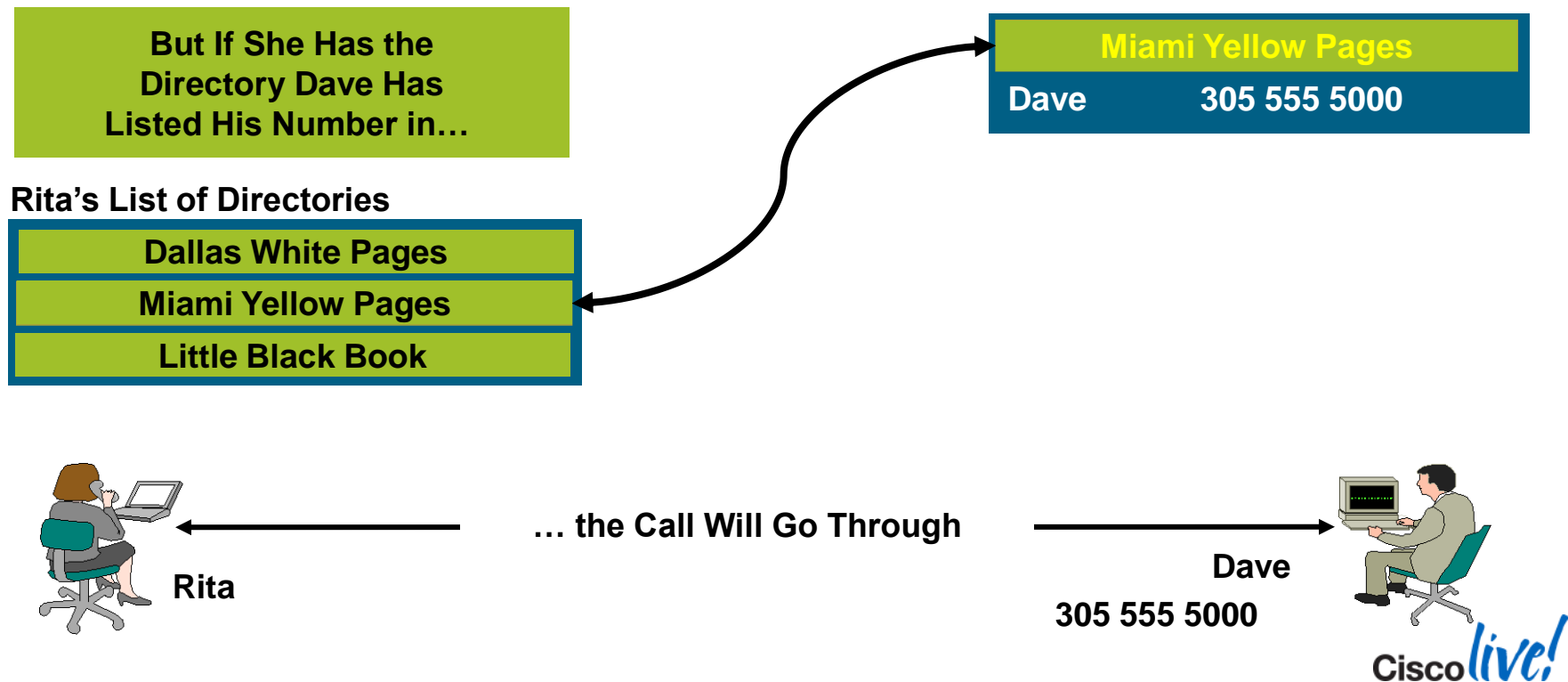
Dave

305 555 5000

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Partitions and Calling Search Spaces

Analogy (3 of 4)



Partitions and Calling Search Spaces

Analogy (4 of 4)

The Directory in Which Dave's Number Is Listed Is
His Number's **Partition**

Miami Yellow Pages

Dave 305 555 5000

Rita's List of Directories

Dallas White Pages

Miami Yellow Pages

Little Black Book

The List of Directories in Which
Rita Looks up Numbers Is Her
Calling Search Space



Rita

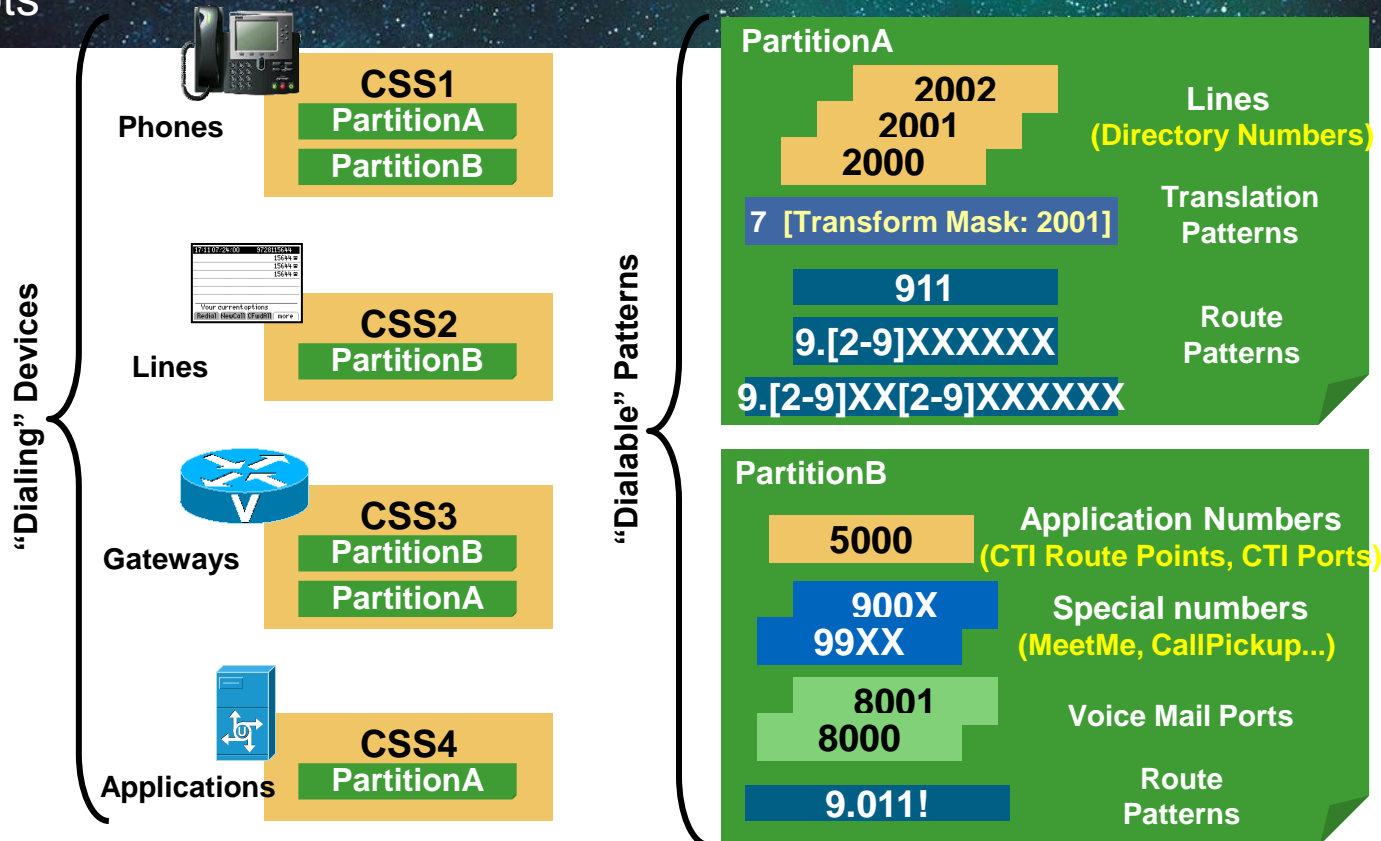
Dave
305 555 5000



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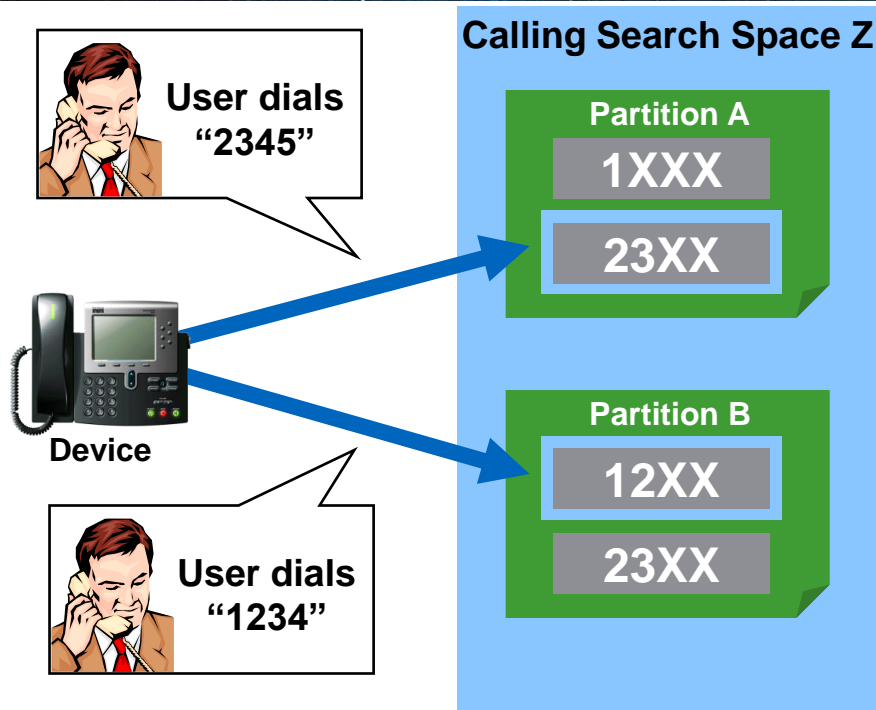
Partitions and Calling Search Spaces

Concepts



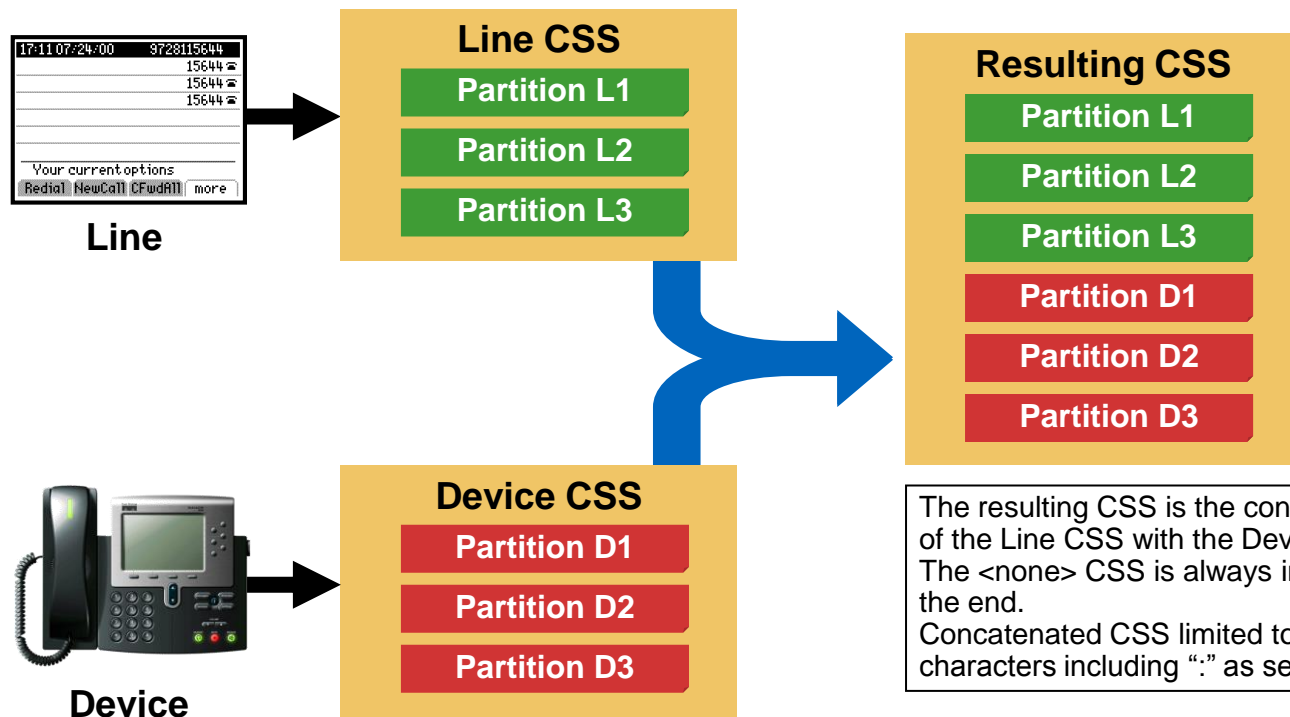
Partitions and Calling Search Spaces

Impact of the Partition Order in a CSS



- Most specific patterns are chosen irrespective of partition order
- Partition order is only used as a tie-breaker in case of equal matches

Phone Line/Device CSS Interaction



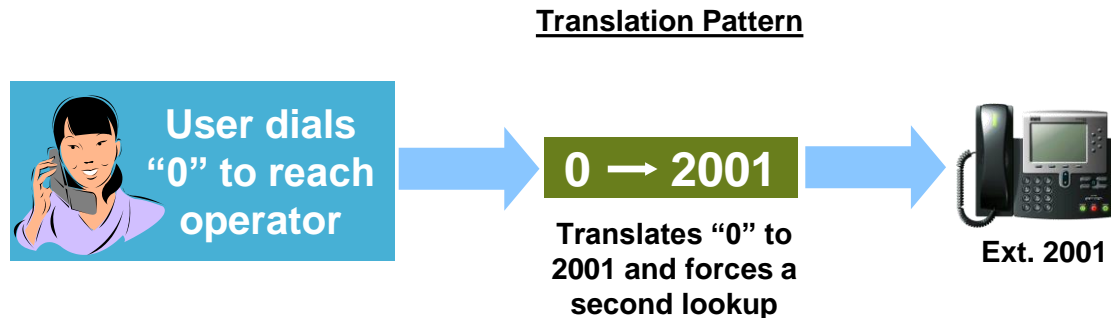
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Translation Patterns

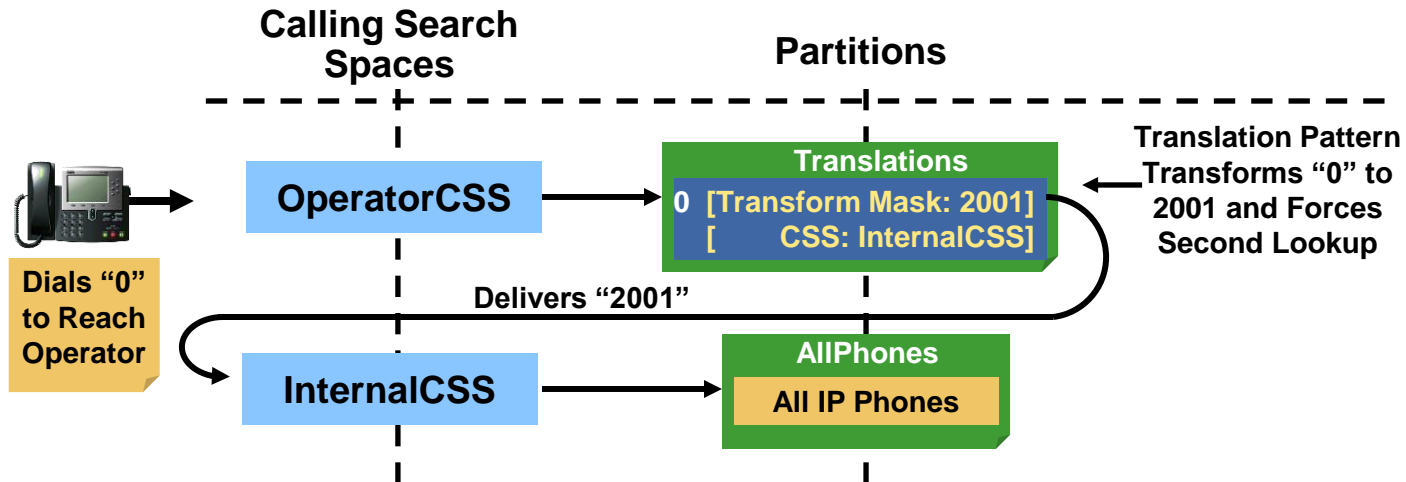
The Basics

- Match on dialed digits
- can also block a call
- Perform calling and/or called party digit manipulation
- Force second lookup in Cisco Unified CM, using a (possibly different) calling search space defined in the translation pattern



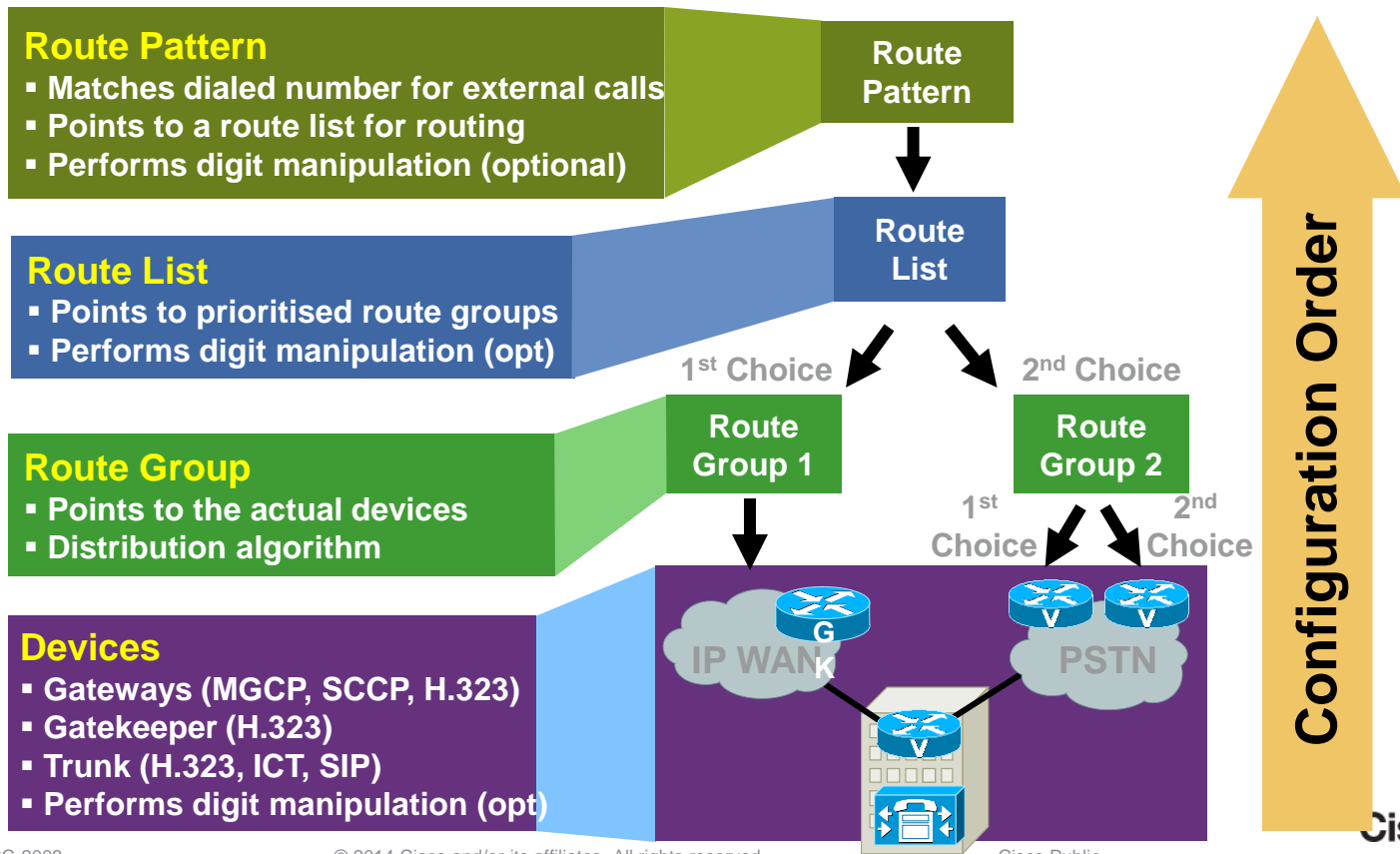
Translation Patterns

Call Flow



- Allows digit manipulation of called and calling party number
- Forces second lookup in Cisco Unified CM, using a (possibly different) calling search space

External Routes Construct



Route Pattern

- Matches on dialed digits
- can point directly to device or to Route List (recommended)
- Calling, Called & Connected Party Transformations
- Called Party Transformations reflected on calling phone's display
- Overlap Sending to support variable length numbering plans

Route Pattern Configuration

Save Delete Copy Add New

Status

Add successful

Pattern Definition

Route Pattern* 9011.1

Route Partition US_pstn_part

Description

Numbering Plan -- Not Selected --

Route Filter < None >

MLPP Precedence* Default

Resource Priority Namespace Network Domain < None >

Route Class* Default

Gateway/Route List* SFO_PSTN (Edit)

Route Option

☒ Route this pattern

☐ Block this pattern No Error

Call Classification* OffNet

☐ Allow Device Override ☒ Provide Outside Dial Tone ☐ Allow Overlap Sending ☐ Urgent Priority

☐ Require Forced Authorization Code

Authorization Level* 0

☐ Require Client Matter Code

Route List

- Prioritised list of possible paths (Route Groups)
- Digit manipulations per Route Group
- Digit manipulations on Route List level override digit manipulations on Route Pattern level
- Called Party Transformations on Route List Level are not reflected on calling phone's display
- Use Calling Party's External Phone Number Mask
 - Default: inherit setting from Route Pattern
 - On: Force to use
 - Off: Force not to use

Route List Configuration

Save Delete Copy Reset Apply Config Add New

Status

Add **Route List Detail Configuration**

Save

Route List

Registrat
IP Address
Device Name *

Status

Status: Ready

Route List Member Information

Route Group SFO_PSTN

Calling Party Transformations

Use Calling Party's External Phone Number Mask* Default

Calling Party Transform Mask

Prefix Digits (Outgoing Calls)

Calling Party Number Type* Cisco CallManager

Calling Party Numbering Plan* Cisco CallManager

Called Party Transformations

Discard Digits NANP:PreDot

Calling Party Transform Mask

Prefix Digits (Outgoing Calls)

Calling Party Number Type* Cisco CallManager

Calling Party Numbering Plan* Cisco CallManager

Route List

Selected

Removed

Route Group

- Collection of specific devices
- Distribution of calls according to selected Distribution Algorithm
 - circular
 - top down

The screenshot displays the 'Route Group Configuration' page. At the top, there are buttons for 'Save', 'Delete', and 'Add New'. Below this is a 'Status' section showing 'Status: Ready'. The 'Route Group Information' section contains a 'Route Group Name' field with the value 'SFO_PSTN' and a 'Distribution Algorithm' dropdown set to 'Circular'. The 'Route Group Member Information' section includes a 'Find Devices to Add to Route Group' area with a 'Device Name contains' search box and a 'Find' button. Below the search box is a list of 'Available Devices' containing 'ICT_cucm2', 'SFO_PSTN_GW', and 'SFO_PSTN_OVERFLOW'. A 'Port(s)' dropdown is set to 'All', and an 'Add to Route Group' button is present. The 'Current Route Group Members' section shows a list of 'Selected Devices (ordered by priority)' with 'SFO_PSTN_GW (All Ports)' and 'SFO_PSTN_OVERFLOW (All Ports)'. A 'Reverse Order of Selected Devices' button is located at the bottom right of the list.

Local Route Group

What It Is: Concept

- Allow the site-specificity of call routing to be established by the calling device's location (as derived from device pool)
- Different endpoints in different sites would be associated with different local route groups: they can all call the same patterns, and the calls will be routed **differently, based on the caller's currently associated local route group**
- In practical terms, route patterns (i.e., patterns to off-cluster destinations) are no longer site-specific and can be used for callers of different sites

Local Route Group

What It Is: Screen Shot

- Device pool is site-specific
- Local route group is associated with device pool
- Local route group is thus associated with all devices using a given device pool: e.g., phones, gateways

Device Pool Configuration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://192.168.2.205:8443/ccmadmin/devicePoolEdit.do?key=93a9d36e-b22c-6869-

Customize Links Windows Marketplace

Google Search

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

System Call Routing Media Resources Voice Mail Device Application User Management Bulk

Device Pool Configuration

Save Delete Copy Reset Add New

Status
Ready

Device Pool Information
Device Pool: sfo_device_pool (1 members**)

Device Pool Settings
Device Pool Name* sfo_device_pool
Cisco Unified Communications Manager Group* sfo_ucm_group
Calling Search Space for Auto-registration US_9011_911_dev_css
Reverted Call Focus Priority Default
Local Route Group sfo_local_route_group

Roaming Sensitive Settings
Date/Time Group* sfo_date_time
Region* sfo_region

Local Route Group

What It Is: Screen Shot

- Route lists can refer to local route groups as well as regular route group
- Allows for simple local failover
- In this example, calls go to the centralised US GW (in site HQ), and fallback to the local route group

The screenshot shows the 'Route List Configuration' window. At the top, there are icons for Save, Delete, Copy, Reset, and Add New. The 'Status' section shows 'Status: Ready'. The 'Route List Information' section includes fields for Name (US_LD_route_list), Description, and Cisco Unified Communications Manager Group (Default). A checkbox 'Enable this Route List' is checked. The 'Route List Member Information' section shows 'Selected Groups' with 'HQ_route_group' and 'Standard Local Route Group'. An 'Add Route Group' button is next to the list. The 'Route List Details' section shows a list of route groups: 'HQ_route_group' and 'Standard Local Route Group'.

Route List Configuration

Save Delete Copy Reset Add New

Status

Status: Ready

Route List Information

Name* US_LD_route_list

Description

Cisco Unified Communications Manager Group* Default

☒ Enable this Route List (change effective on Save; no reset required)

Route List Member Information

Selected Groups** HQ_route_group
Standard Local Route Group

Removed Groups***

Add Route Group

Route List Details

HQ_route_group

Standard Local Route Group

Agenda

- Call Routing Basics
- Calling Search Spaces and Partitions
- Translation Patterns and External Routes
- **Number Transformations**
- Building Class of Service
- Alpha URI Routing
- Release 10.0 Enhancements

Number Transformations

- Calling and Called Numbers can be modified
- Two Levels:
 - Call Routing – Transformations on Route Patterns and Translation Patterns
 - Device Level – Transformations on Route Lists and on devices (phones, trunks, gateways)

Number Transformations

Route Pattern

- Matches dialed number for external calls
- Points to a route list for routing
- Performs digit manipulation (optional)

Route
Pattern

Route List

- Points to prioritised route groups
- Performs digit manipulation (opt)

Route
List

Route Group

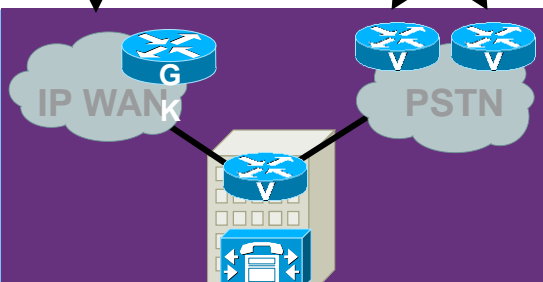
- Points to the actual devices
- Distribution algorithm

Route
Group 1

Route
Group 2

Devices

- Gateways (MGCP, SCCP, H.323)
- Gatekeeper (H.323)
- Trunk (H.323, ICT, SIP)
- Performs digit manipulation (opt)



Routing Level



DeviceLevel



Number Transformations

Routing vs. Device Level

- Only Called Party transformations on route pattern are reflected on calling phone's display
 - Update can be inhibited by setting “Always Display Original Dialed Number” to “True”; this will inhibit ANY updates of the called number on calling phone
- Caveat: numbers sent in Q.SIG APDUs don't pick up transformations on device level
 - Possible impact on services like MWI, Path Replacement, ...
 - Make sure to have a uniform numbering plan in place end to end when planning to use Q.SIG to interconnect

Number Transformations

- Two Concepts:
 - Implicit – as part of routing process
 - Translation Pattern
 - Route Pattern
 - Route Lists
 - Explicit – Transformation after routing decision
 - Incoming Calling/Called Party Settings on gateways, trunks (or device pools)
 - Calling/Called Party Transformation CSS on gateways, trunks (or device pools)
 - Calling Party Transformation CSS on phones (or device pools)

Number Transformations

Calling Party Transformation Pattern

- Similar to translation pattern, but matches on calling (not CALLED) party number
- Only allow calling party transformations
- Addressed by partitions and CSSes (like regular patterns)
- No impact on call routing decision

The screenshot shows the 'Calling Party Transformation Pattern Configuration' page in the CUCM administration interface. The page has a top bar with 'Save', 'Delete', 'Copy', and 'Add New' buttons. Below this is a 'Status' section showing 'Status: Ready'. The main configuration area is divided into two sections: 'Pattern Definition' and 'Calling Party Transformations'. In the 'Pattern Definition' section, the 'Pattern*' field contains '\+496196.7XX', the 'Partition' is set to 'CL_CnPN_normalize', and the 'Urgent Priority' checkbox is checked. In the 'Calling Party Transformations' section, the 'Use Calling Party's External Phone Number Mask' checkbox is unchecked, 'Discard Digit Instructions' is set to 'PreDot', and the 'Calling Party Transformation Mask' is empty. The 'Prefix Digits' field is also empty. The 'Calling Line ID Presentation*' is set to 'Default', 'Calling Party Number Type*' is set to 'Cisco CallManager', and 'Calling Party Numbering Plan*' is set to 'Cisco CallManager'.

Calling Party Transformation Pattern Configuration

Save Delete Copy Add New

Status
Status: Ready

Pattern Definition

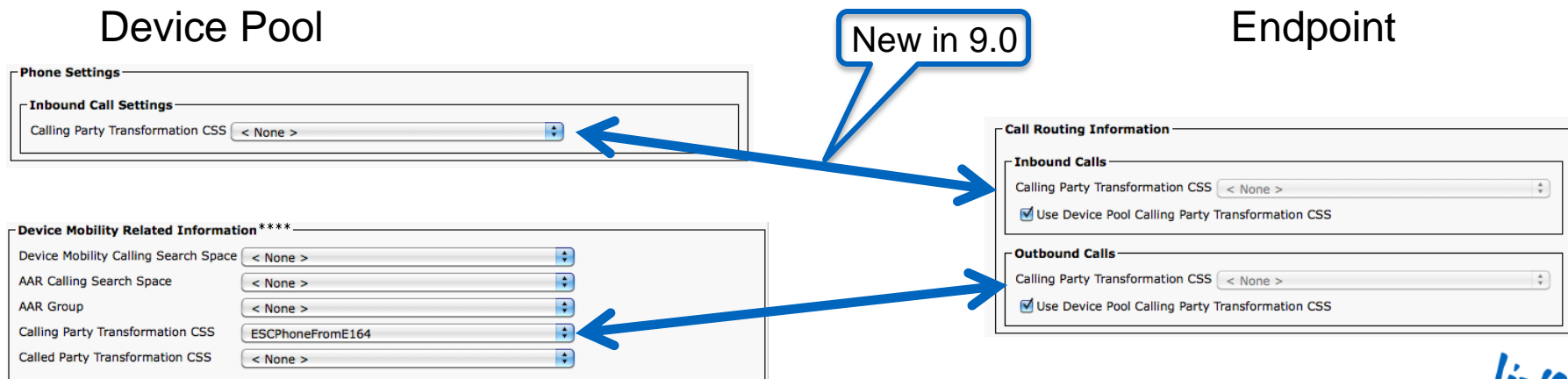
Pattern* \+496196.7XX
Partition CL_CnPN_normalize
Description
Numbering Plan < None >
Route Filter < None >
☒ Urgent Priority

Calling Party Transformations

☐ Use Calling Party's External Phone Number Mask
Discard Digit Instructions PreDot
Calling Party Transformation Mask
Prefix Digits
Calling Line ID Presentation* Default
Calling Party Number Type* Cisco CallManager
Calling Party Numbering Plan* Cisco CallManager

Number Transformations on Endpoints

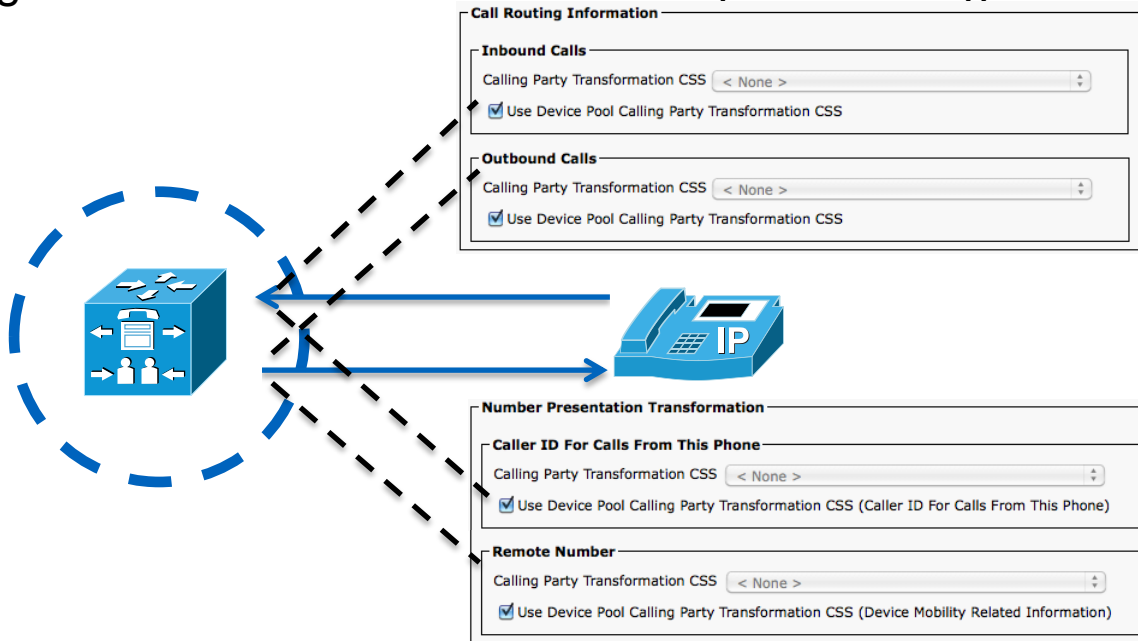
- Phones have Inbound and Outbound Calls Calling Party Transformation CSS
 - Inbound: calls originating from endpoint; typically used to map from DN to +E.164
 - Outbound: calls terminating on endpoint; typically used to map from globalised calling party to display format
- Can also be configured on device pool “Use Device Pool ...”



Endpoint Calling Party Transformations

Naming conventions

- Naming of transformation CSSes on endpoints changed with version 9.1



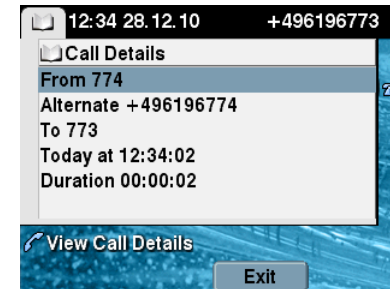
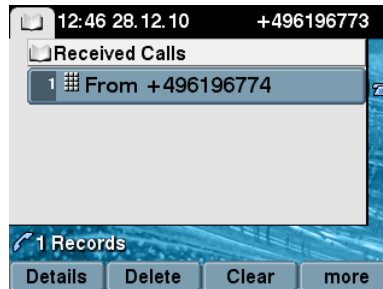
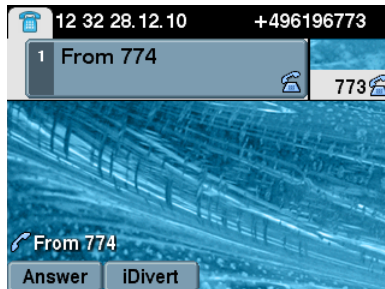
Phone Directories

- Calling Party Numbers are transformed using phone's (or device pool's) outbound calling party transformation CSS
- But: pre-transformation number is stored in missed calls directory and used for callback*
- Concept: Pre-transformation calling party numbers should be „globalised“
→ globalise on ingress, localise on egress
- Globalised numbers (pre-transformation) have to be routable! (supported dialing habit)

Outbound Calls

Calling Party Transformation CSS

☐ Use Device Pool Calling Party Transformation CSS



*7940/60 store post transformation number in missed/received calls directory

Localise on Egress (on phone)

- Calling Party Number transformation CSS on device pool and device
- Localise down to:
 - national dialing habit
 - local dialing habit (if in same area code)
 - extension (if intra-site)
- Transformed number is displayed in alerting plane
- Caution:
 - Callback from missed/received calls directory goes to pre-transformation number

Globalise on Ingress (not phones)

- Service Parameter:
 - prefixes per type for H.323, MGCP and SIP (unknown only)
 - not recommended
- Device Pool
 - prefixes or CSSes per number type
- Gateway/Trunk
 - prefixes or CSSes per number type (only “unknown” on SIP trunks)

Incoming Calling Party Settings

If the administrator sets the prefix to Default this indicates call processing will use prefix at the next level setting (DevicePool/Service Parameter). Otherwise, the value configured is used as the prefix if there is no prefix assigned.

[Clear Prefix Settings](#) [Default Prefix Settings](#)

Number Type	Prefix	Strip Digits	Calling Search Space
National Number	<input type="text" value="+49"/>	<input type="text"/>	<input style="width: 100px;" type="text" value=" < None > "/>
International Number	<input type="text" value="+"/>	<input type="text"/>	<input style="width: 100px;" type="text" value=" < None > "/>
Unknown Number	<input type="text" value="Default"/>	<input type="text"/>	<input style="width: 100px;" type="text" value=" < None > "/>
Subscriber Number	<input type="text" value="+4961"/>	<input type="text"/>	<input style="width: 100px;" type="text" value=" < None > "/>

Localise on Egress (not phones)

- required format for calling party numbers typically defined by the provider
- use Calling Party Transformation CSS for outbound calls
- Caveat: device level transformations have no effect on Q.SIG APDUs

Call Routing Information - Outbound Calls

Called Party Transformation CSS < None >

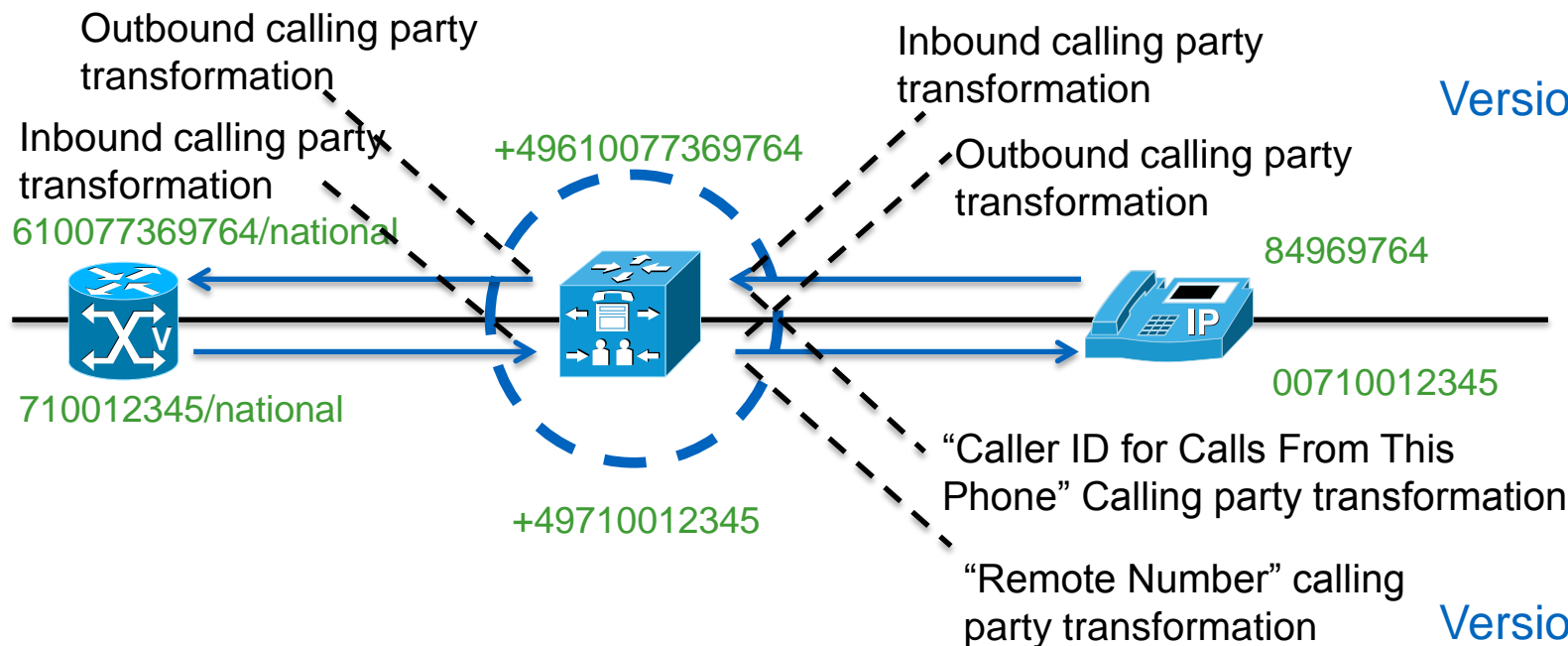
☒ Use Device Pool Called Party Transformation CSS

Calling Party Transformation CSS < None >

☒ Use Device Pool Calling Party Transformation CSS

End-to-End Calling Party Transformations

Inbound / Outbound calls



Version 9.0

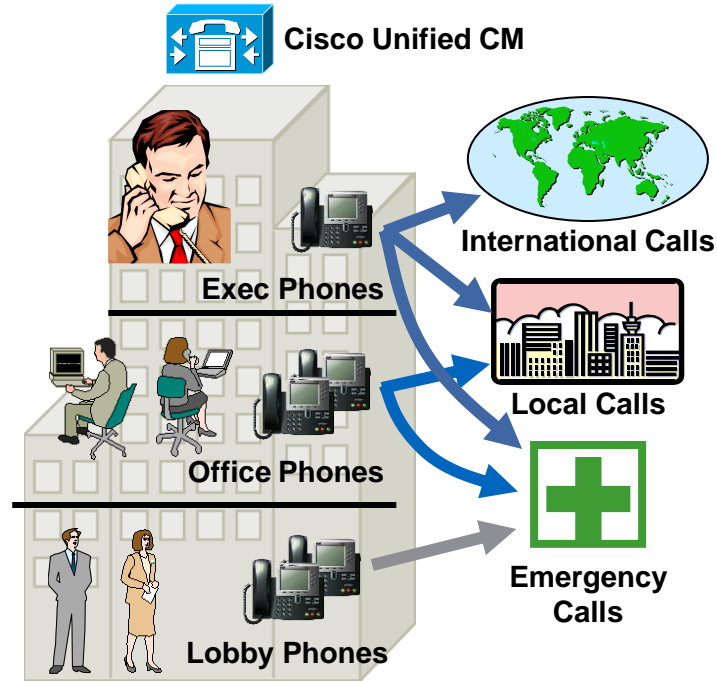
Version 9.1
Cisco *live!*

Agenda

- Call Routing Basics
- Calling Search Spaces and Partitions
- Translation Patterns and External Routes
- Number Transformations
- Building Class of Service
- Alpha URI Routing
- Release 10.0 Enhancements

Building Classes of Service

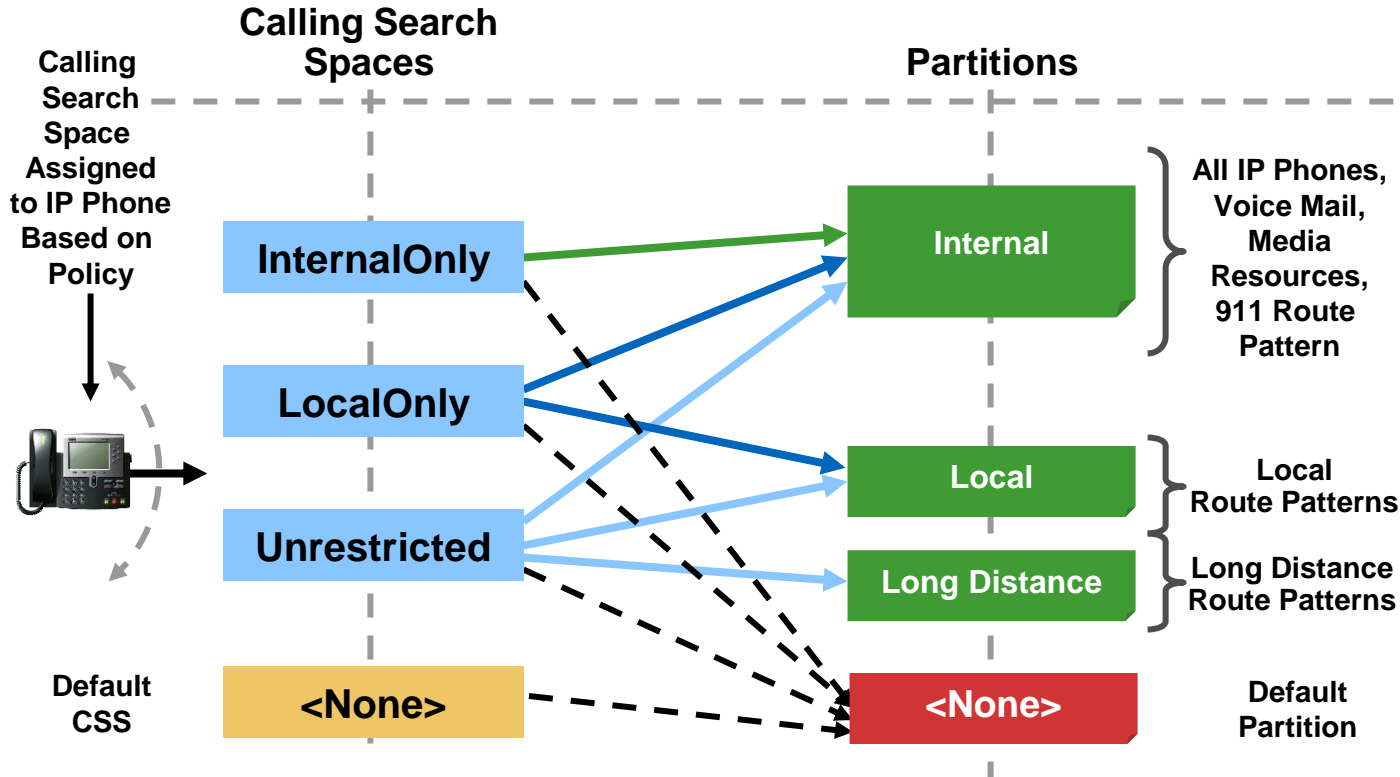
Routing by User Class



**Create “Dial-Plan Policy Groups”
to Define Calling Restrictions**

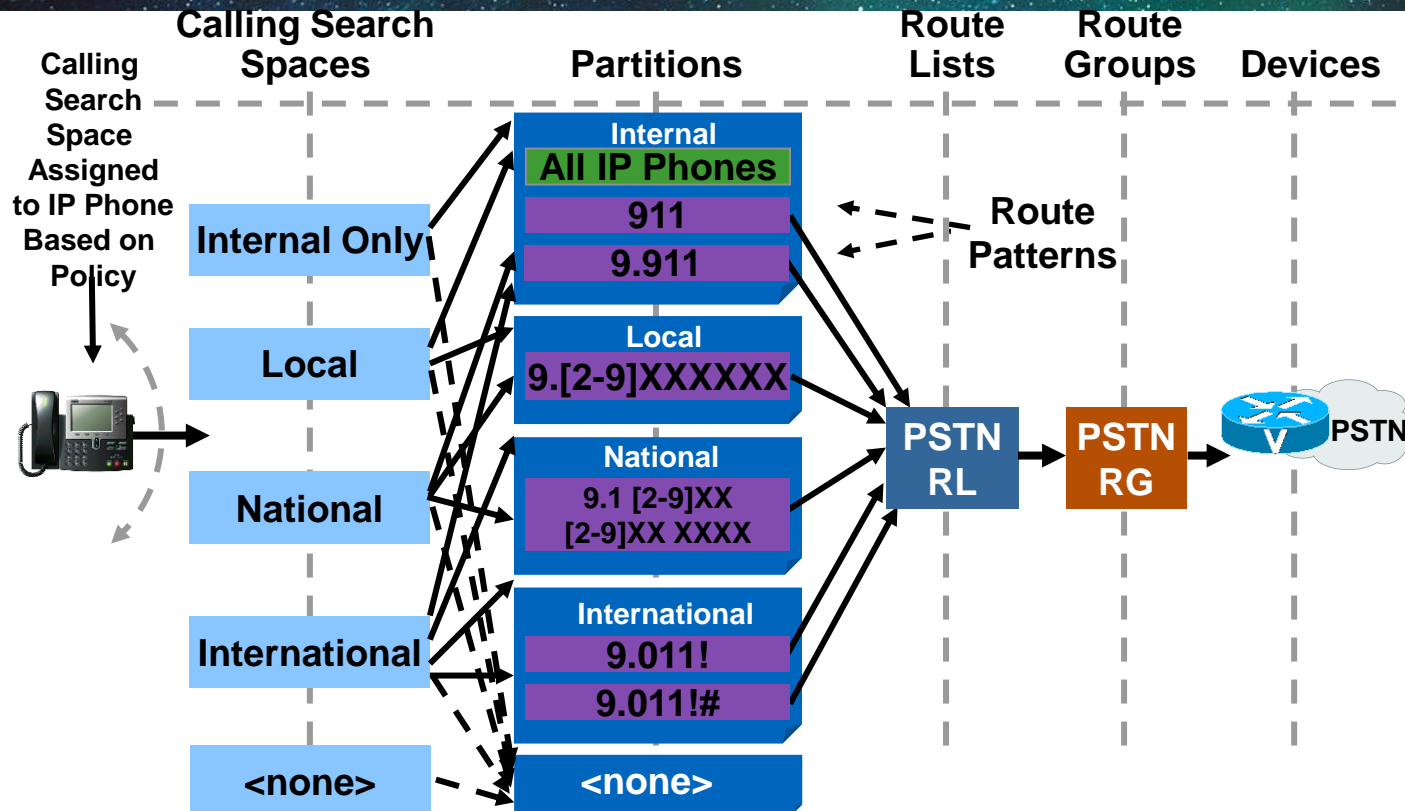
Building Classes of Service

Typical Example of User Classes



Building Classes of Service

Single Site Deployment Example: Composite Dial-Plan View



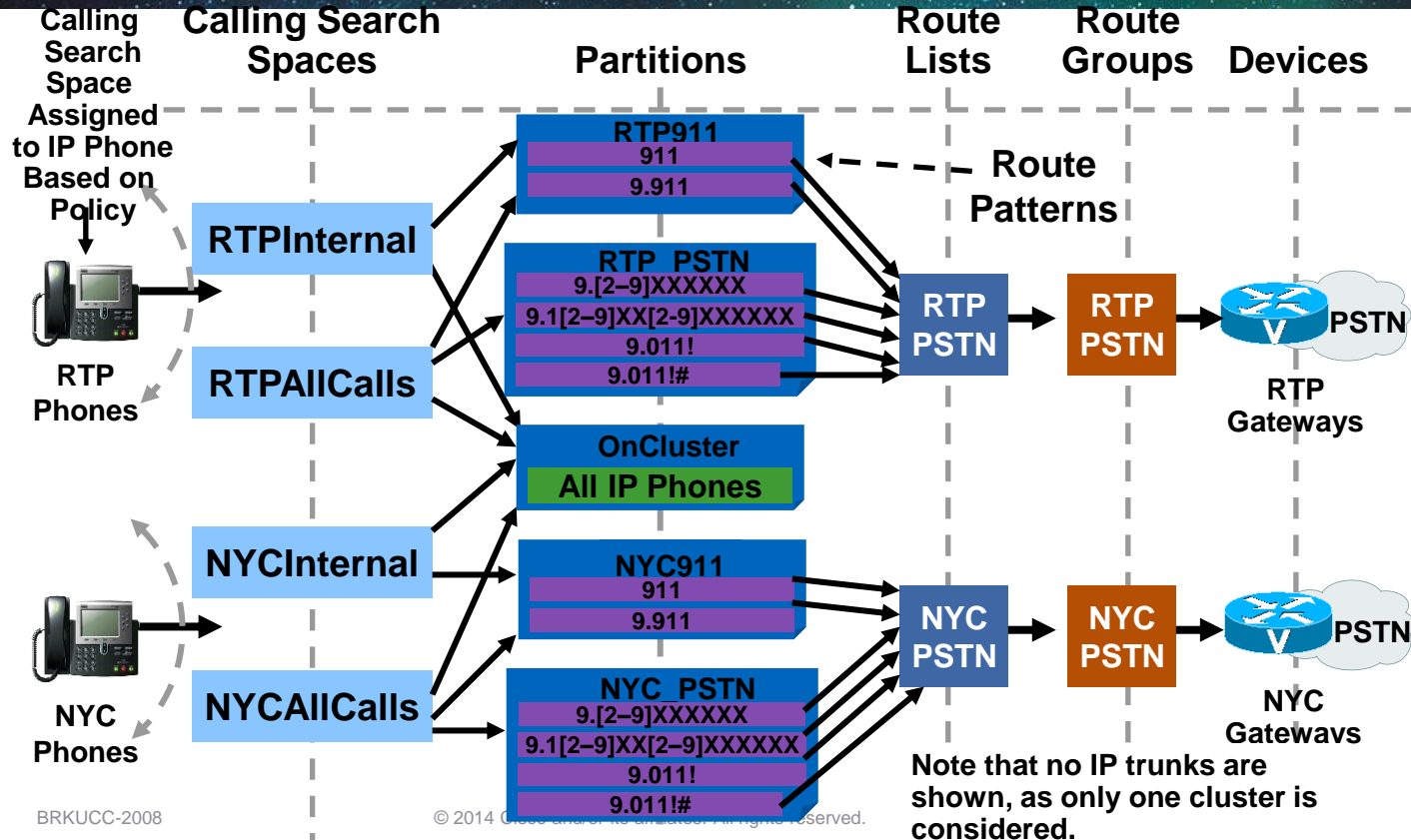
Building Classes of Service

Deployment Options

1. Single CSS Approach

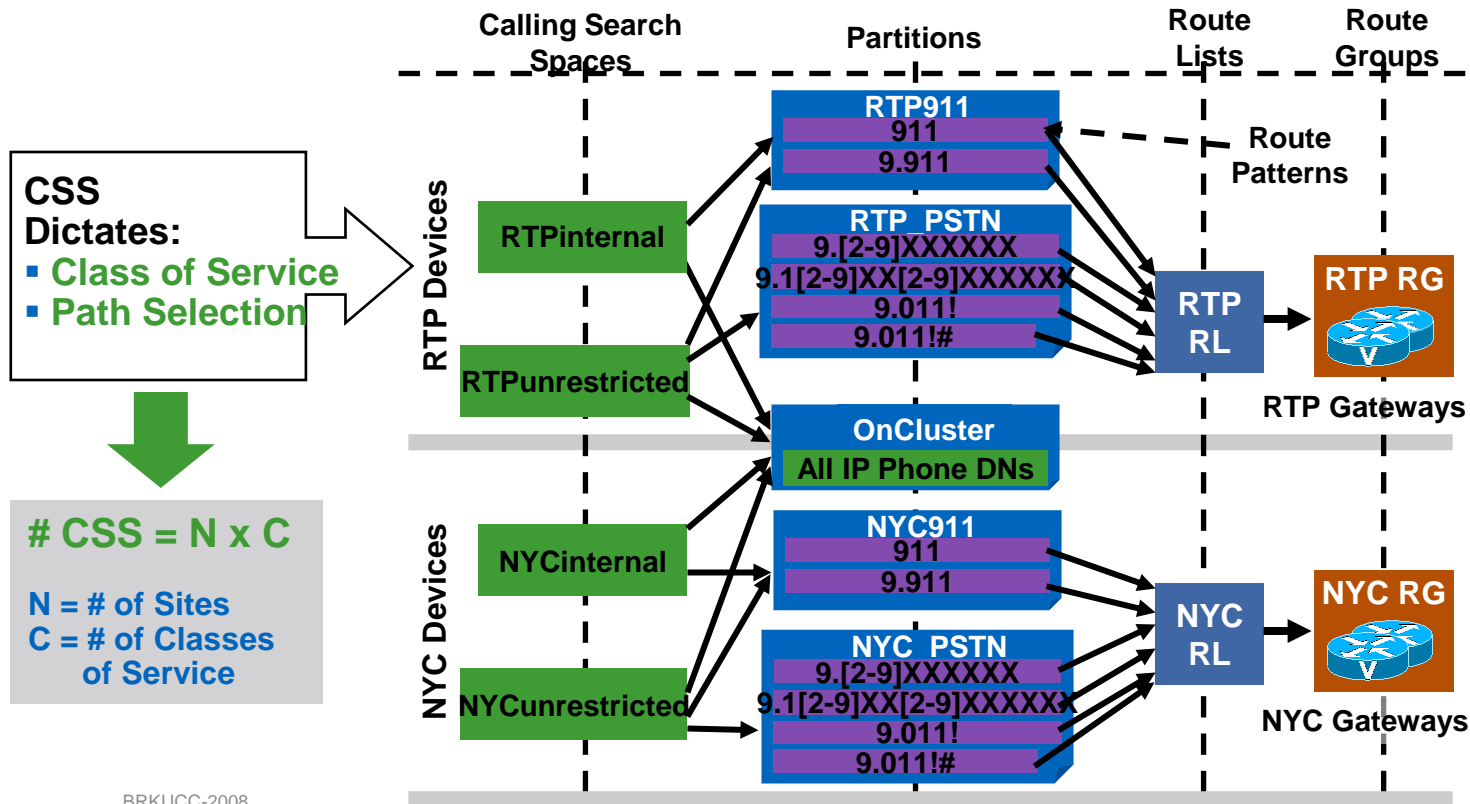
Building Classes of Service

Single Site Deployment Example: Composite Dial-Plan View



Building Classes of Service

Single CSS Approach for Centralised Deployments



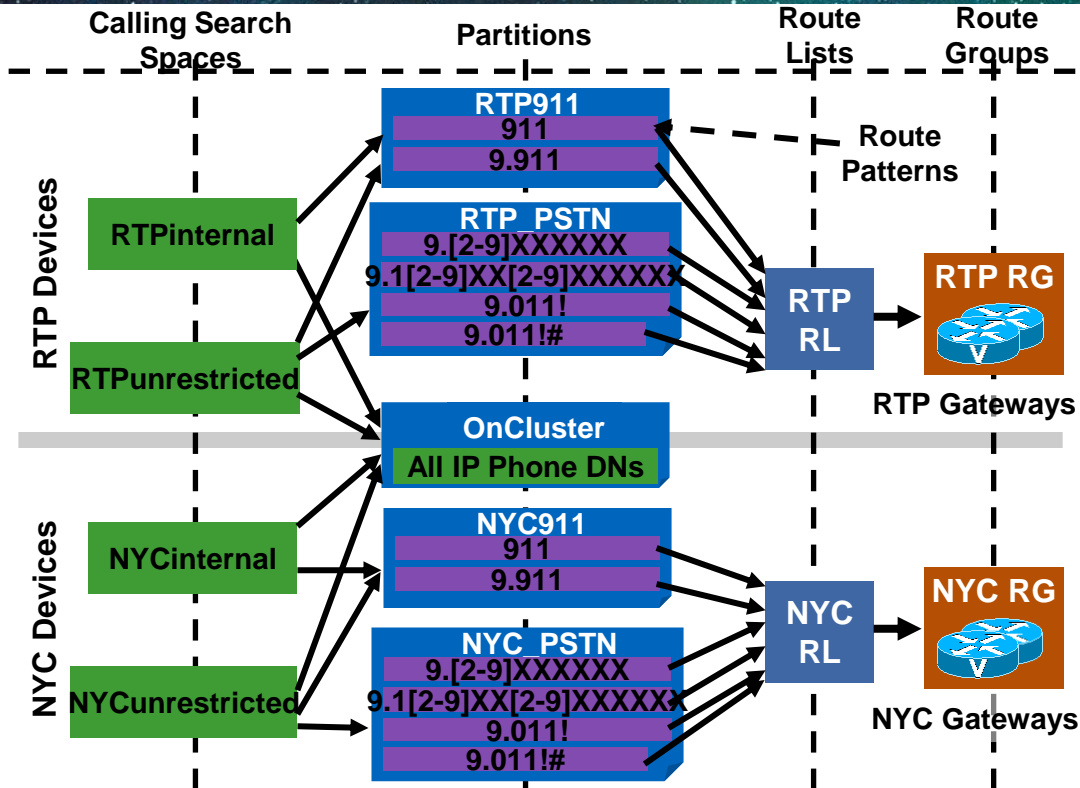
Building Classes of Service

Deployment Options

1. Single CSS Approach
2. Single CSS Approach with Local Route Group

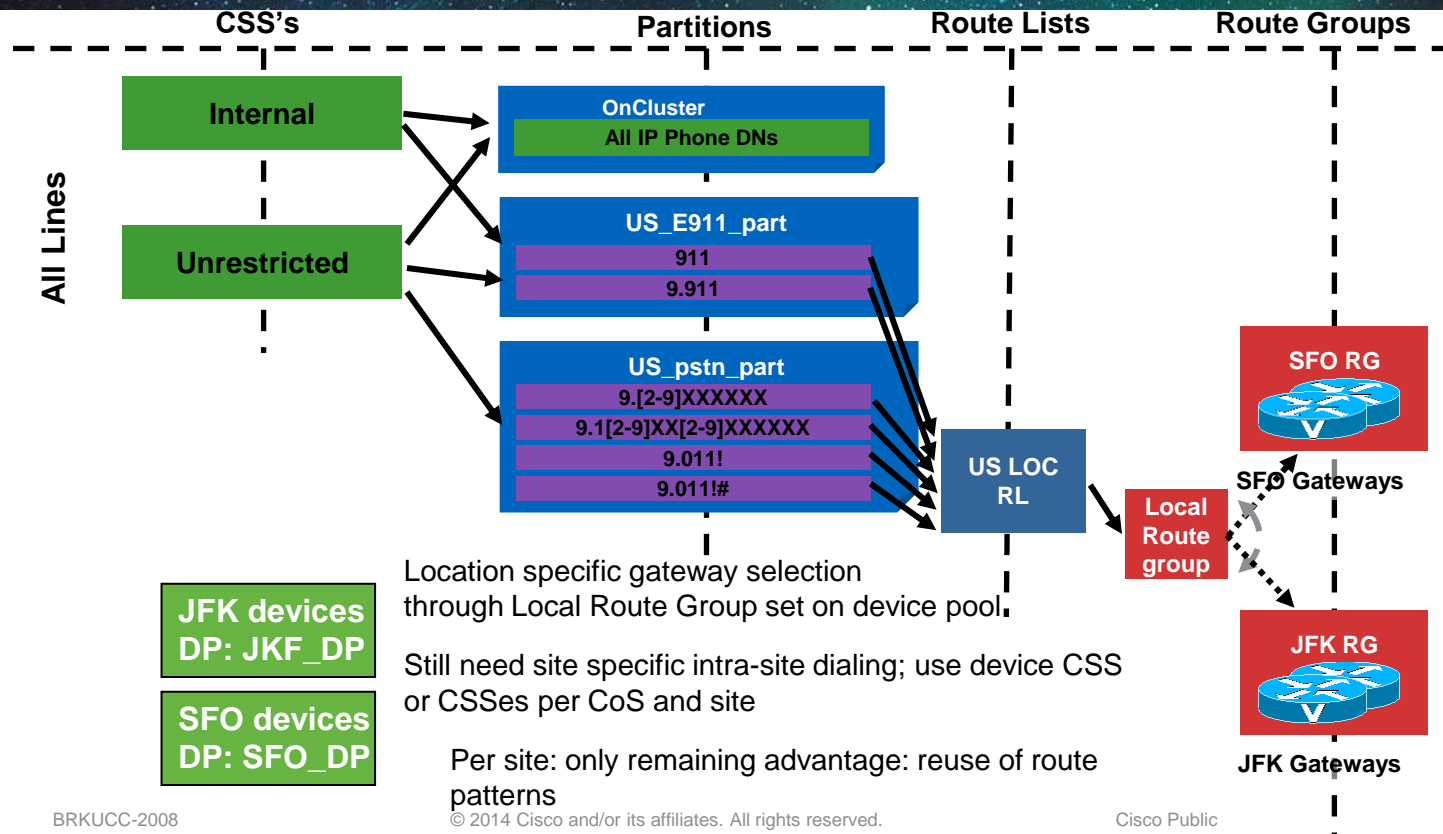
Single CSS Approach with Local Route Group

With LRG we can get from this ...



Single CSS Approach with Local Route Group

.. to this by removing site specific route patterns



Single CSS Approach with Local Route Group

LRG benefits

- LRG offloads the site specific path selection from the route pattern
- No requirement for site specific route patterns

Agenda

- Call Routing Basics
- Calling Search Spaces and Partitions
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SIP URI

What is it?

- SIP URIs identify communications resources
- general form: `sip:user:password@host:port;uri-parameters?headers`
- user is optional, but Cisco UCM does not support URIs w/o user
- uri-parameters and headers are optional
- password not recommended
- host: fqdn, ipv4 or ipv6; Cisco UCM does not support ipv6
- user is case sensitive, host is case insensitive (per RFC 3261)*:
 - Jkrohn@cisco.com != jkrohn@cisco.com
- 7 bit ASCII only
- example: sip:jkrohn@cisco.com:5060

LHS/user RHS host port

*In Cisco UCM 9.1 this behaviour is configurable

URI Routing/Dialing

- Why
 - Native dialing method in SIP based video equipment
 - Extend support for SIP video endpoints registered with Cisco UCM
 - Unambiguous dialing from directories
 - better integration with other call controls where URI dialing is the native dialing habit (e.g. VCS)
 - Enables easier B2B video call routing
- Limitations
 - URIs can not be used for PSTN calls (as long as there's no mapping to E.164)
 - Limited endpoint support (+E.164/numbers might still be the native format)

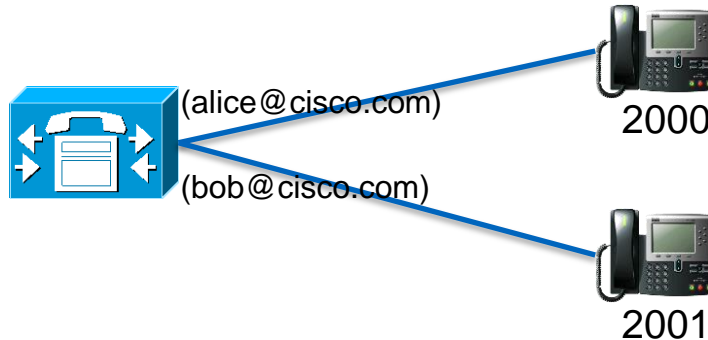
Endpoint Support

- Only a subset of endpoints support URI dialing
 - 99xx, 8961 phones (except transfer, conferencing, forwarding)
 - Video Endpoints
- Directory lookups on Cisco UCM currently will always return numbers; dialing from corporate directories will always dial numbers
- All endpoints can be called via an alpha URI (, because URI is mapped to a DN)

URI Dialing

The Concept

- In Cisco UCM all endpoints will still have a DN
- Alpha URI can be associated with DN on any device (not only SIP)
- Phones always register via the DN (do not necessarily even know that there is an associated alpha URI)



URIs and Directory Numbers

- Up to 5 URIs can be configured per DN
- Enduser's directory URIs are assigned to directory numbers based on enduser's primary extension; partition "Directory URI" (cannot be changed/deleted)
- other URIs can be in any partition; no need to have them in the same partition as the DN

Directory Number Configuration

Save Delete Copy Reset Apply Config Add New

Status
Status: Ready

Directory Number Information

Directory Number* \+4961007739764

Route Partition DN

Description

Directory URIs

Primary	URI	Partition	Advertise Globally via ILS	Edit/Remove
<input checked="" type="checkbox"/>	jkrohn@home.org	Directory URI	<input checked="" type="checkbox"/>	Edit End User
<input type="checkbox"/>		< None >	<input checked="" type="checkbox"/>	<input type="button" value="Add Row"/>

End User Configuration

Save Delete Add New

Status
Status: Ready

User Information

User Status Active LDAP Synchronized User

User ID* jkrohn

PIN

Confirm PIN

Last name* Krohn

Middle name

First name Johannes

Directory URI jkrohn@home.org

Telephone Number +4961007739764

Mail ID jkrohn@home.org

Manager User ID

Directory Number Associations

Primary Extension \+4961007739764 in DN

URIs and DNs

Primary URI

- One URI associated with DN is marked the primary URI
- Auto-generated URI based on user's primary extension will always be the primary URI

Directory URIs

Primary	URI	Partition	Advertise Globally via ILS	Edit/Remove
<input checked="" type="checkbox"/>	jkrohn@home.org	Directory URI	<input checked="" type="checkbox"/>	Edit End User
	<input type="text" value="jkrohn@9971.fra.home.org"/>	<input type="text" value="DN"/>	<input checked="" type="checkbox"/>	<input type="button" value="Remove"/>

- If no auto-generated URI exists one of the other URIs can be marked “primary”
- Primary URI will be used as URI identity for calls from/to this line

Directory URIs

Primary	URI	Partition	Advertise Globally via ILS	Remove
<input type="radio"/>	<input type="text" value="jkrohn@9971.fra.home.org"/>	<input type="text" value="DN"/>	<input checked="" type="checkbox"/>	<input type="button" value="Remove"/>
<input checked="" type="radio"/>	<input type="text" value="jkrohn@home.org"/>	<input type="text" value="DN"/>	<input checked="" type="checkbox"/>	<input type="button" value="Remove"/>

Alpha URI vs. Number

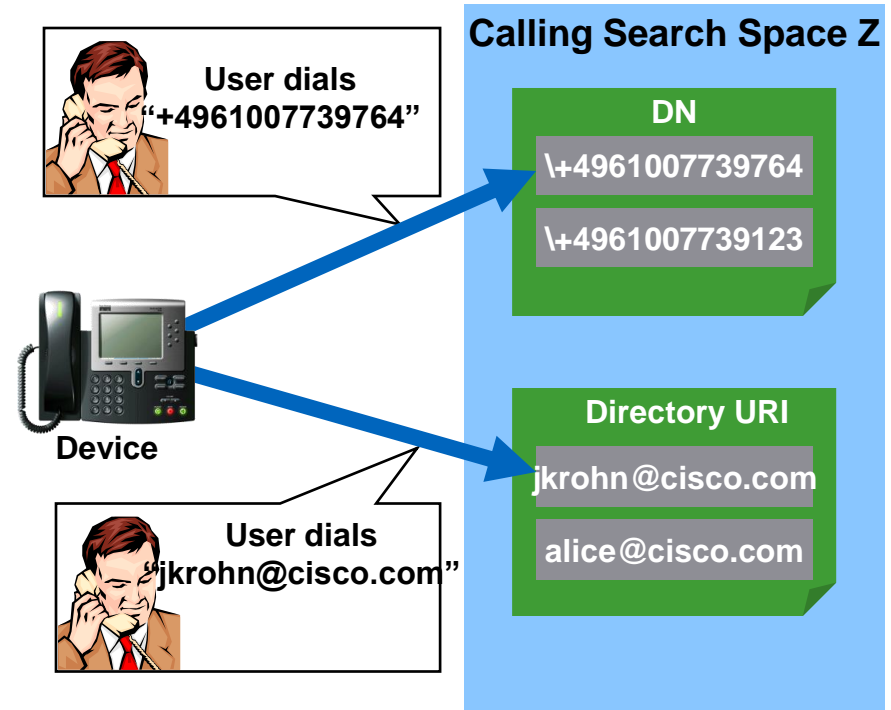
How to Differentiate Between a Number and an Alpha URI

- Dialed “numbers” can contain: +, 0-9, *, A-D
- SIP Profile now has “Dial String Interpretation” setting
- relevant for calls from endpoints and trunks
- Default: 0-9, * and + (Recommended)
- Recommendation: use un-ambiguous alpha URIs
- “user=phone” tag in request URI forces treatment as numeric URI

The screenshot displays the 'SIP Profile Configuration' window. At the top, there are tabs for 'Save', 'Delete', 'Copy', 'Reset', 'Apply Config', and 'Add New'. Below this is a 'Status' section indicating 'Status: Ready' and a note that all SIP devices using this profile must be restarted for changes to take effect. The main section is 'SIP Profile Information', which includes fields for Name, Description, Default MTP Telephony Event Payload Type, Early Offer for G.Clear Calls, SDP Session-level Bandwidth Modifier for Early Offer and Re-invites, User-Agent and Server header information, and Accept Audio Codec Preferences in Received Offer. The 'Dial String Interpretation' section is expanded, showing three radio button options: 'Redirect by Application', 'Disable Early Media on 180', and 'Outgoing T.38 INVITE include audio mline'. The 'Phone number consists of characters 0-9, *, #, and +' option is selected and highlighted with a blue border. A tooltip is visible over this option, stating: 'Always treat all dial strings as URI addresses', 'Phone number consists of characters 0-9, A-D, *, #, and + (others treated as URI addresses)', and 'Phone number consists of characters 0-9, *, #, and + (others treated as URI addresses)'.

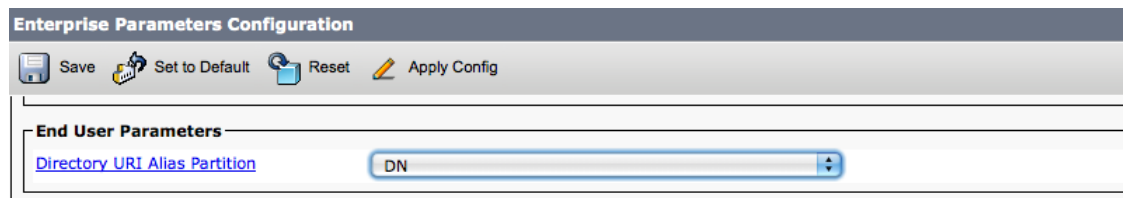
Calling URIs

- URIs can be called if the URIs' partition is member of calling CSS
- CSSs can contain DN and URI partitions
- partitions can contain DNs and URIs
- CSS/partition logic for URIs is identical to DN logic



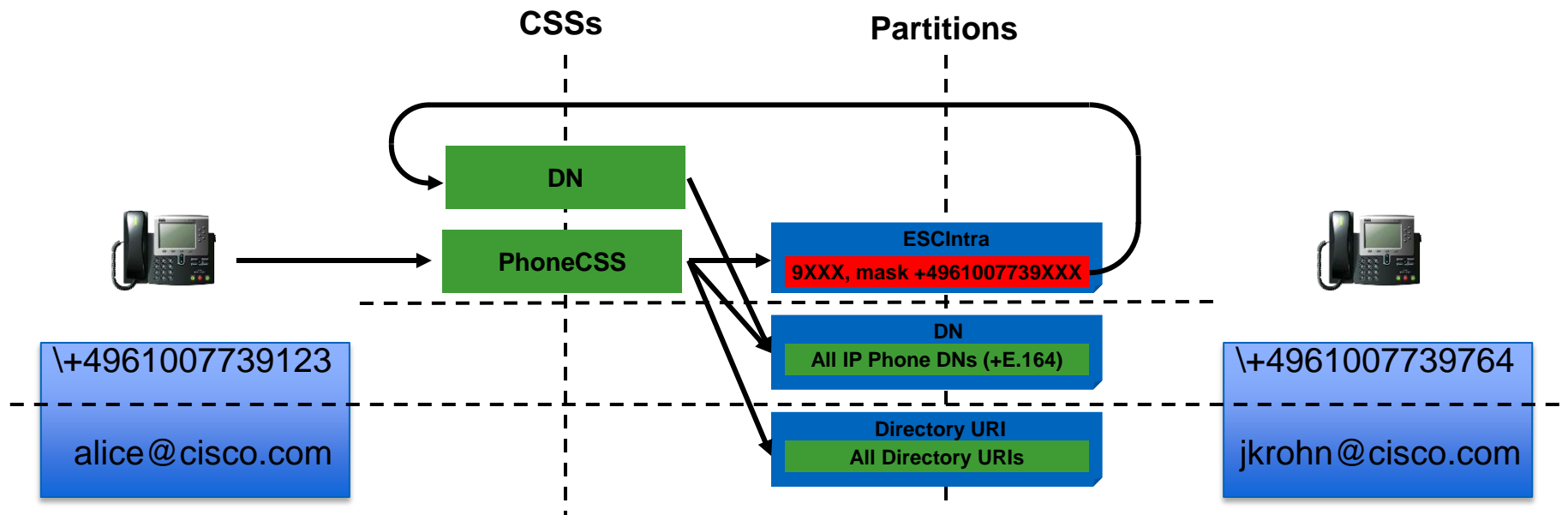
Directory URI Partition Alias

- Autogenerated directory URIs are in partition “Directory URI”
- “Directory URI” partition is predefined and can not be changed/deleted
- to be reachable this partition needs to be member of calling identity’s CSS
- An already existing partition can be defined as alias for “Directory URI” partition
 - URIs in Directory URI partition can be reached by all CSSes which have the alias partition
- Good candidate: already existing DN partition



The screenshot shows the 'Enterprise Parameters Configuration' window. At the top, there is a toolbar with icons for 'Save', 'Set to Default', 'Reset', and 'Apply Config'. Below this, the 'End User Parameters' section is visible. Under the 'End User Parameters' header, there is a label 'Directory URI Alias Partition' followed by a dropdown menu. The dropdown menu is currently open, showing the option 'DN'.

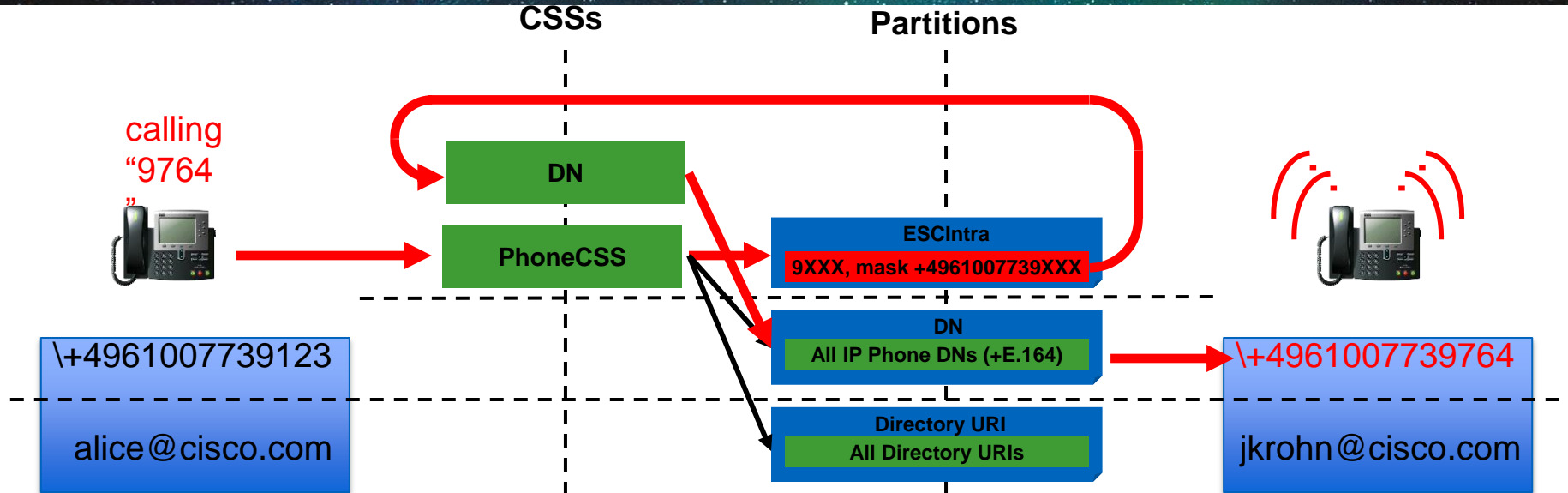
Independent Call Routing



- Typical dial plan e.g. has translation patterns to transform intra-site dialing to DN format
- This translation pattern might also have calling party transformations

Independent Call Routing

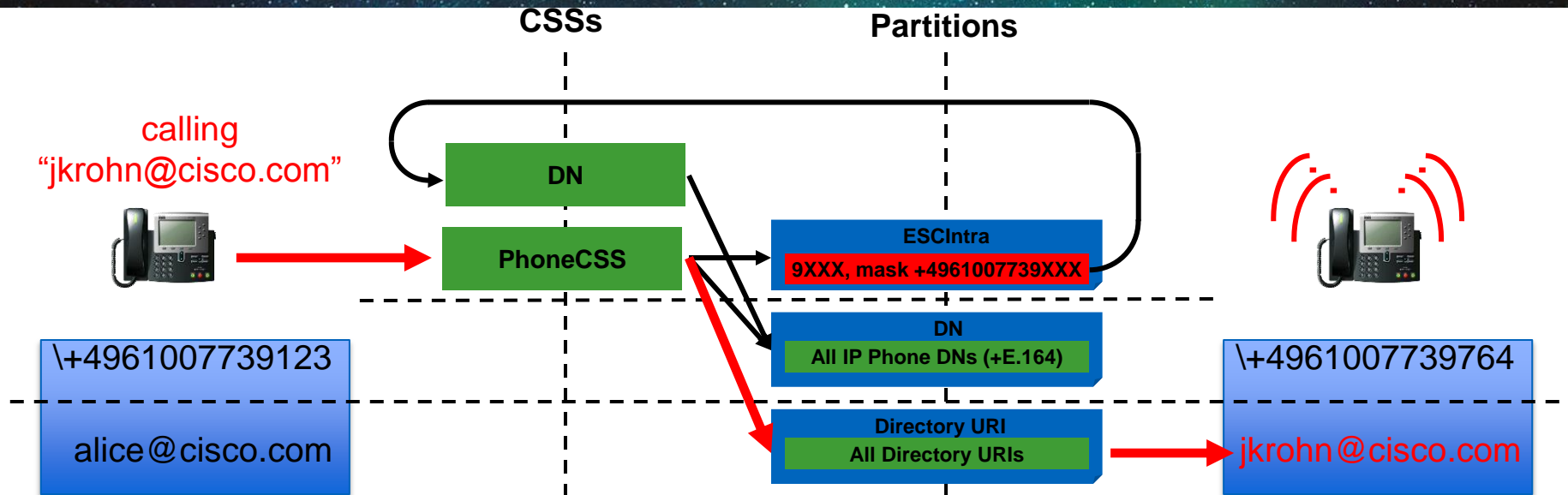
Dialing a Number



- Intra-site dialing is a two-step process (normalise and route)
- Normalisation translation pattern might impose calling party transformations (in addition to called party transformations)

Independent Call Routing

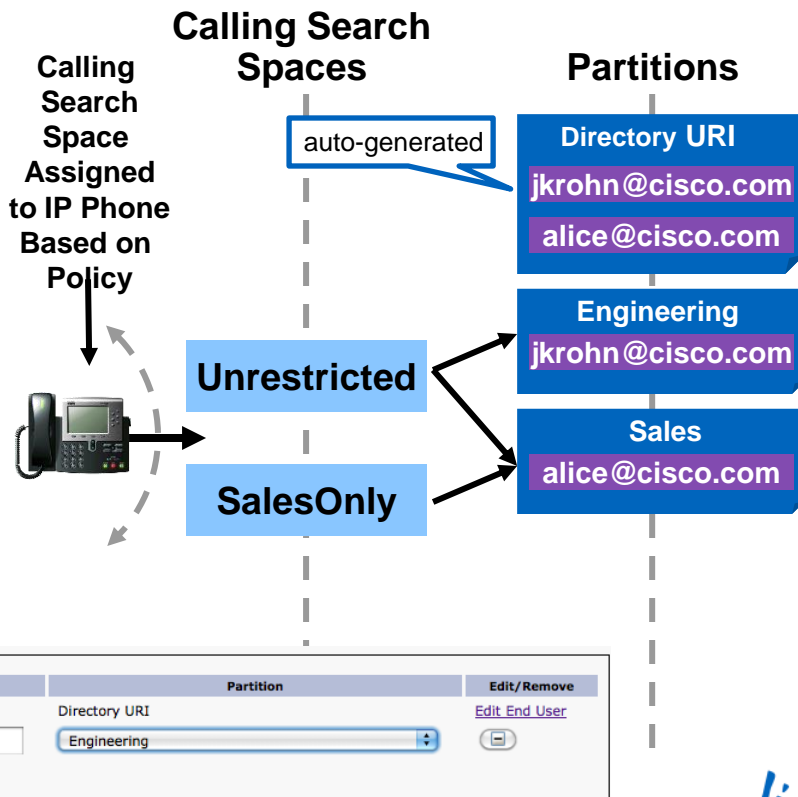
Dialing an Alpha URI



- Calling a URI takes a different path
- URI routing does not have the concept of translation patterns; no equivalence to block patterns
- Only option for calling party transformation is the outbound calls calling party transformation CSS on calling endpoint or calling endpoint's device pool

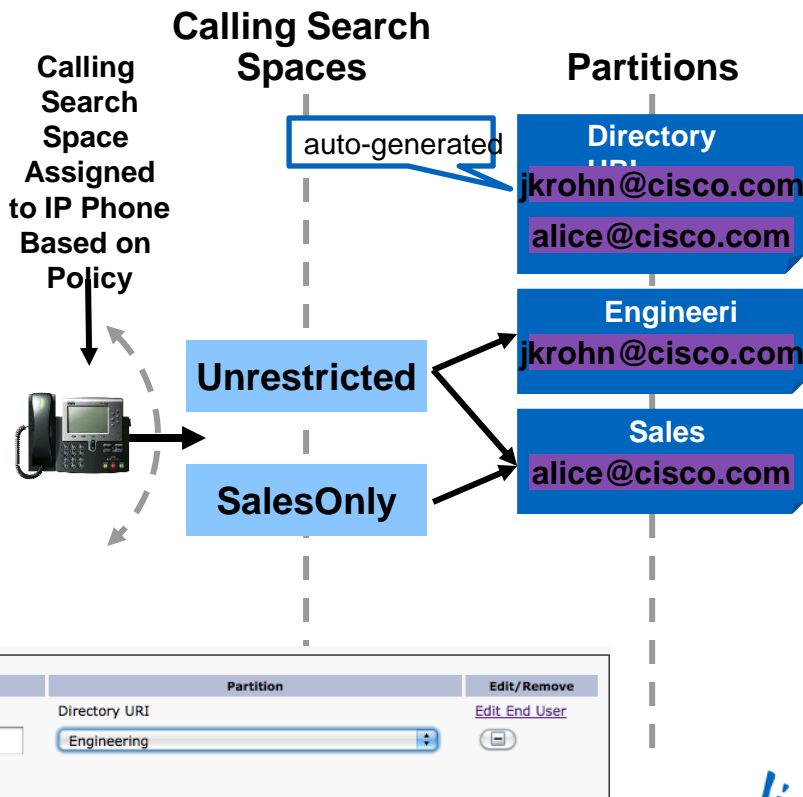
Building CoS for URIs

- Default “Directory URI” partition will have ALL auto-generated user based URIs
- No way to differentiate different user groups based on auto-generated user based URIs
- If different user groups are required you need to explicitly provision the URIs in user group specific partitions and create appropriate CSSes



Building CoS for URIs

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Agenda

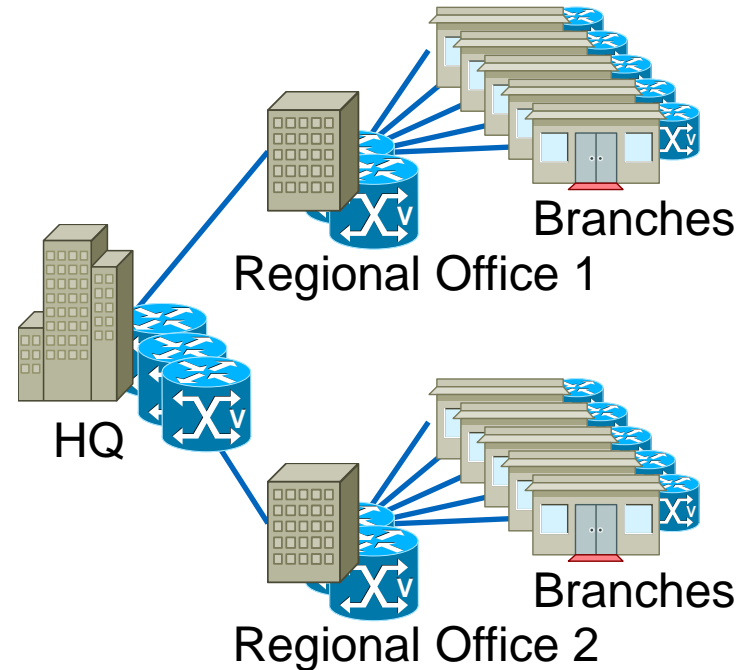
- Call Routing Basics
- Calling Search Spaces and Partitions
- Translation Patterns and External Routes
- Number Transformations
- Building Class of Service
- Alpha URI Routing
- Release 10.0 Enhancements

Local Route Group (LRG)

- LRG introduced with Unified CM 7.0
- Concept: move the site specific egress gateway selection policy from the route pattern to the calling devices' device pool
- “Standard Local Route Group” used as placeholder in route list definition
 - Dynamically replaced with route group configured on calling device's device pool when routing the call
- Allows for site un-specific route patterns → route pattern count reduction
- Restriction pre 10.0: we only have single LRG
- What if we want to use LRG based egress GW selection, but e.g. need to differentiate between emergency calls and 'regular' PSTN calls?

Example Multiple LRG Use-case

- Centralised HQ PSTN resources in the HQ used for all HQ calls and international calls (also from regional offices)
- Redundant PSTN resources in regional offices used for 911 from regional office, national calls from regional office and PSTN calls from branches. Overflow of regional office national calls from regional office to HQ (branches never use HQ resources)
- Branches have small GWs for emergency (911) calls and as overflow for regular calls
- ... but we still only want to have three route patterns:
 - 911 → emergencyRL
 - \+1XXXXXXXXXX, urgent → USNationalRL
 - \+! → InternationalRL



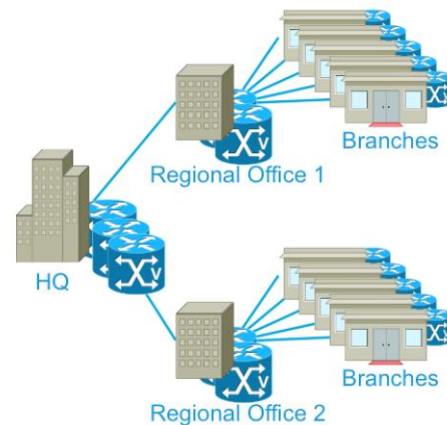
Bonus question: why does this need to be urgent?
T302 due to overlap w/ \+!

Example Multiple LRG Use-case

Device Pools
per location

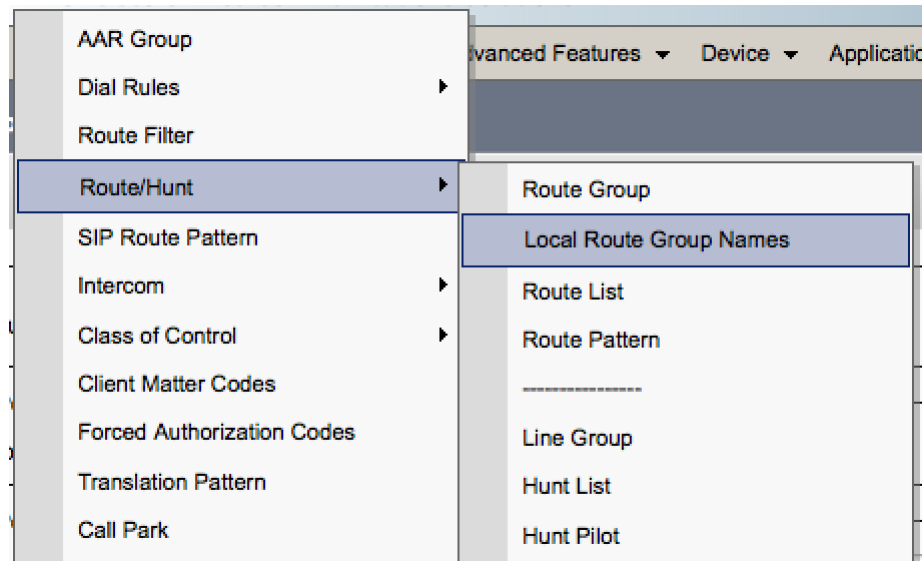
LRGs (placeholders) used in route list configuration

	911	National Primary	National Secondary	International Primary	International Secondary
HQ	HQ	HQ	-	HQ	-
Regional Office 1	Regional Office 1	Regional Office 1	HQ	HQ	Regional Office 1
Regional Office 2	Regional Office 2	Regional Office 2	HQ	HQ	Regional Office 2
Branch x of Regional Office 1	Branch x	Regional Office 1	Branch x	Regional Office 1	Branch x
Branch x of Regional Office 2	Branch x	Regional Office 2	Branch x	Regional Office 2	Branch x



Actual PSTN Resources (route groups)


LRG Name Definition










LRG Name Definition

- “Standard Local Route” Group automatically migrated
- Deleting a name removes the name from device pools (with all existing mappings!)

Local Route Group Names

 Save

Status
 Update successful

Name *	Description	
Standard Local Route Group	System Local Route Group - This entry cannot be deleted	
911	Emergency Calls	
National Primary	Primary LRG for national calls	
National Secondary	Secondary LRG for national calls	
International Primary	Primary LRG for international calls	
International Secondary	Secondary LRG for international calls	

Add Row

Save

Define LRGs on Device Pool Page

- All LRG names show up on the device pool page
- Route group selected per device pool and LRG name
- LRGs set to <none> will be skipped by the route list/group selection algorithm (as if they were referencing an empty route group)
- Setting for “Standard Local Route Group” migrated during upgrade

Device Pool Information
Device Pool: Regional Office 1 Phones (0 members**)

Device Pool Settings
Device Pool Name* Regional Office 1 Phones
Cisco Unified Communications Manager Group* Default
Calling Search Space for Auto-registration < None >
Adjunct CSS < None >
Reverted Call Focus Priority Default
Intercompany Media Services Enrolled Group < None >

Local Route Group Settings
Standard Local Route Group < None >
911 Regional Office 1
National Primary Regional Office 1
National Secondary HQ
International Primary HQ
International Secondary Regional Office 1

Multiple LRG Benefits

- Allows for more complex egress GW selection policies in LRG based dial plans
- Reduces the number of route lists
- ... which directly implies reduction of route pattern count
- LRG selection policy still always based on calling device's device pool
- For roaming users (EM, device mobility, ...) LRG selection will be based on visited site:
 - EM: physical phone's device pool
 - Device Mobility: roaming device pool
- If egress GW selection needs to be tied to calling users "home" location then site specific route patterns with route lists using fixed (non-LRG) route groups are the only solution

Alternate Numbers for DNs (part of GDPR)

- Click “Add ...” to add Alternate number
- Enterprise and +E.164 Alternate number defined using mask
- If mask is empty then DN is taken as configured
- Alternate Numbers can(!) be added to local route partition
- Alternate Numbers can(!) be advertised via ILS

Enterprise Alternate Number

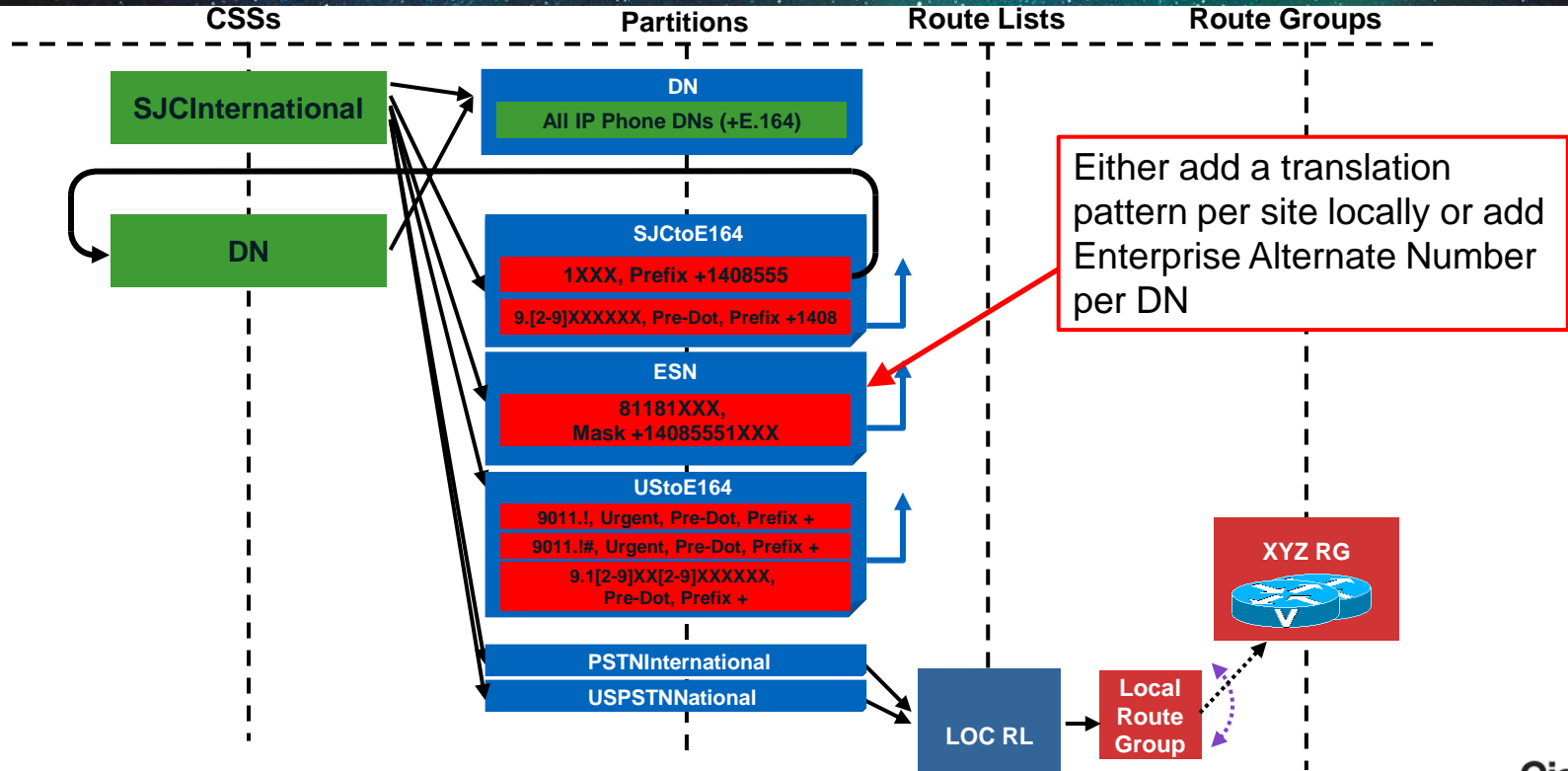
+E.164 Alternate Number

Enterprise Alternate Number
Number Mask
Alternate Number
☒ Add to Local Route Partition
Route Partition
☒ Advertise Globally via ILS

+E.164 Alternate Number
Number Mask
Alternate Number
☐ Add to Local Route Partition
Route Partition
☒ Advertise Globally via ILS

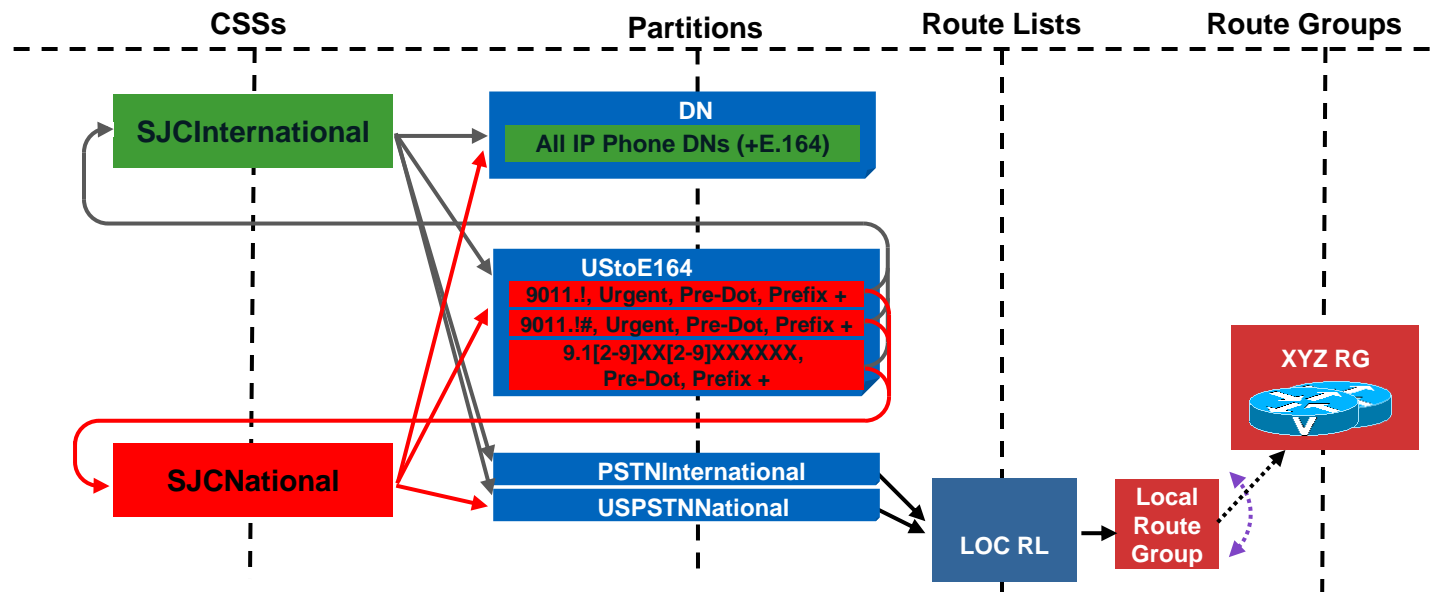
To Add or Not to Add to Local Partition

Dialing Enterprise Alternate Numbers



TP CSS Inheritance

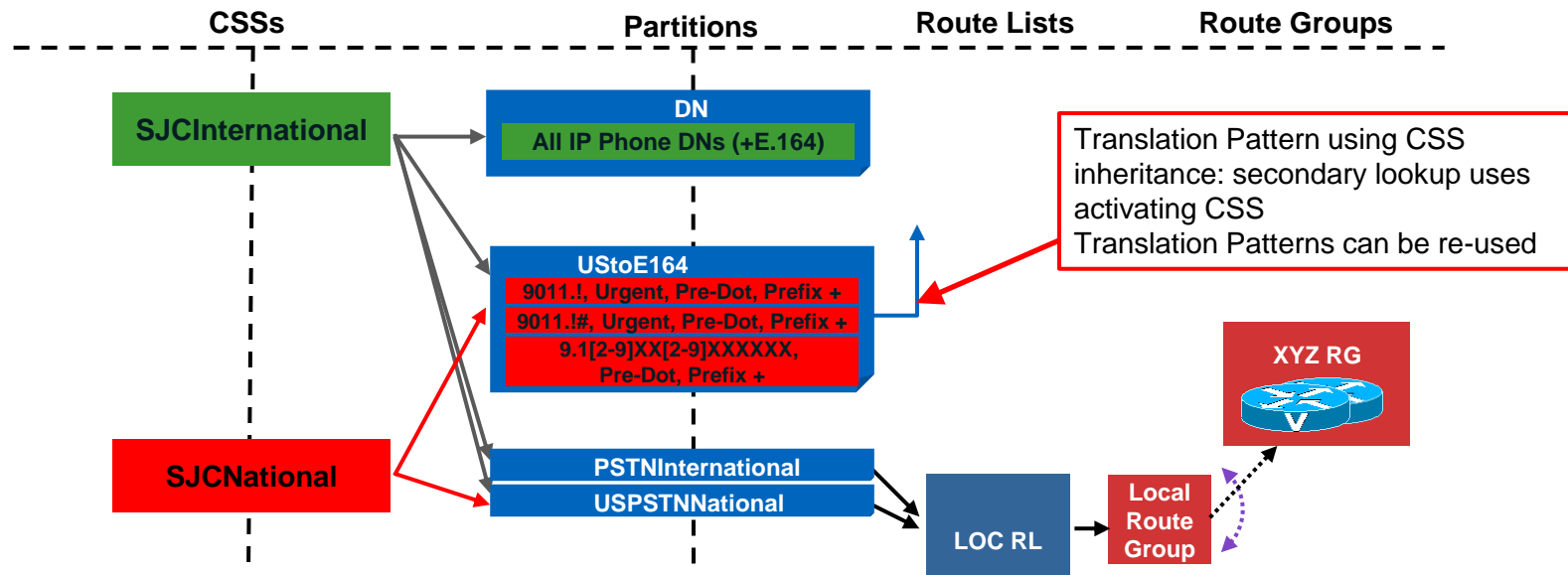
“split personality” Translation Patterns



- Normalisation translation patterns use the activating CSS for secondary lookup
- A secondary lookup CSS following the activating CSS allows for re-use of normalisation

TP CSS Inheritance

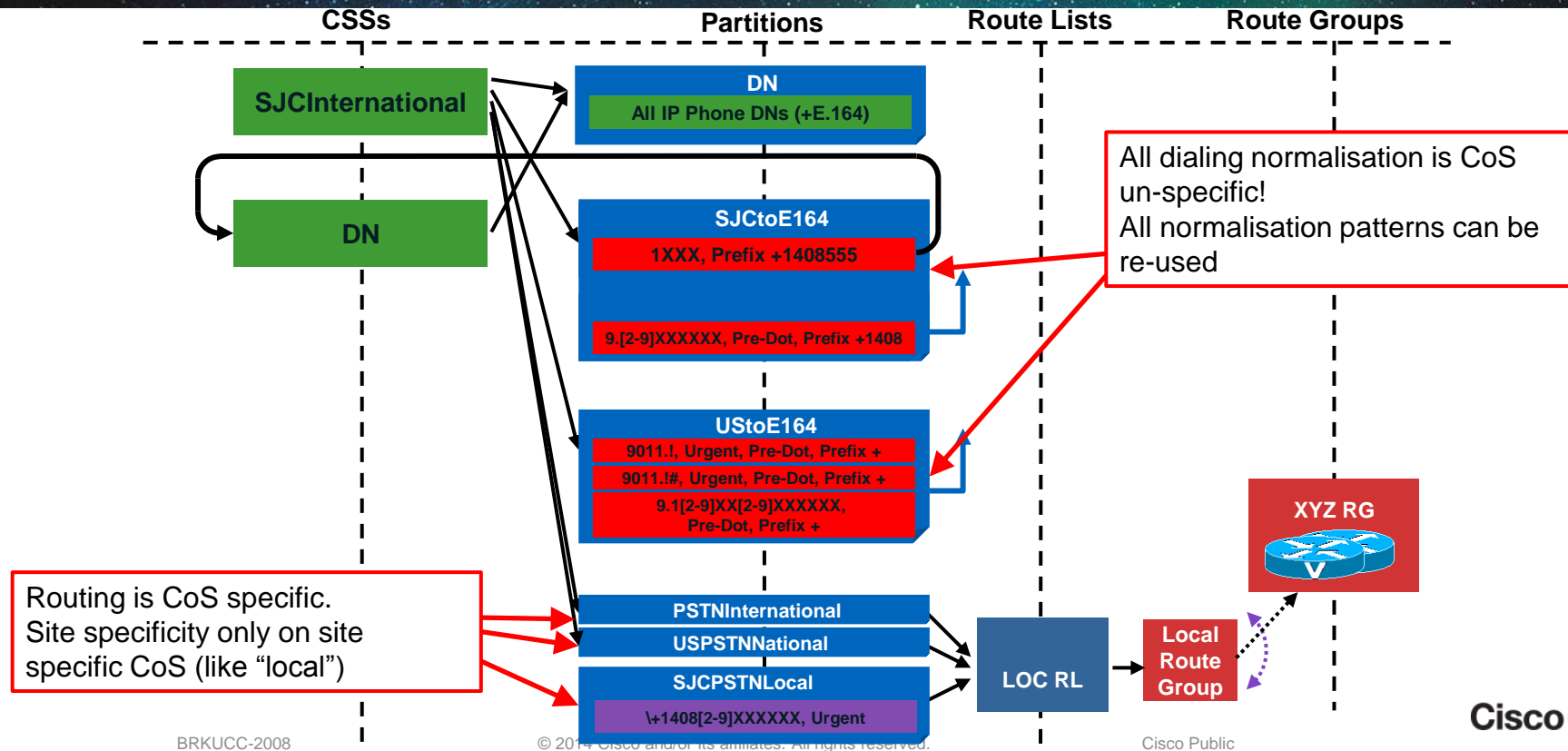
New in release 10.0



- “CSS Inheritance” forces digit analysis to go back to the activating CSS after performing the calling/called party transformations defined on the translation pattern
- Ideal use case: dialing normalisation

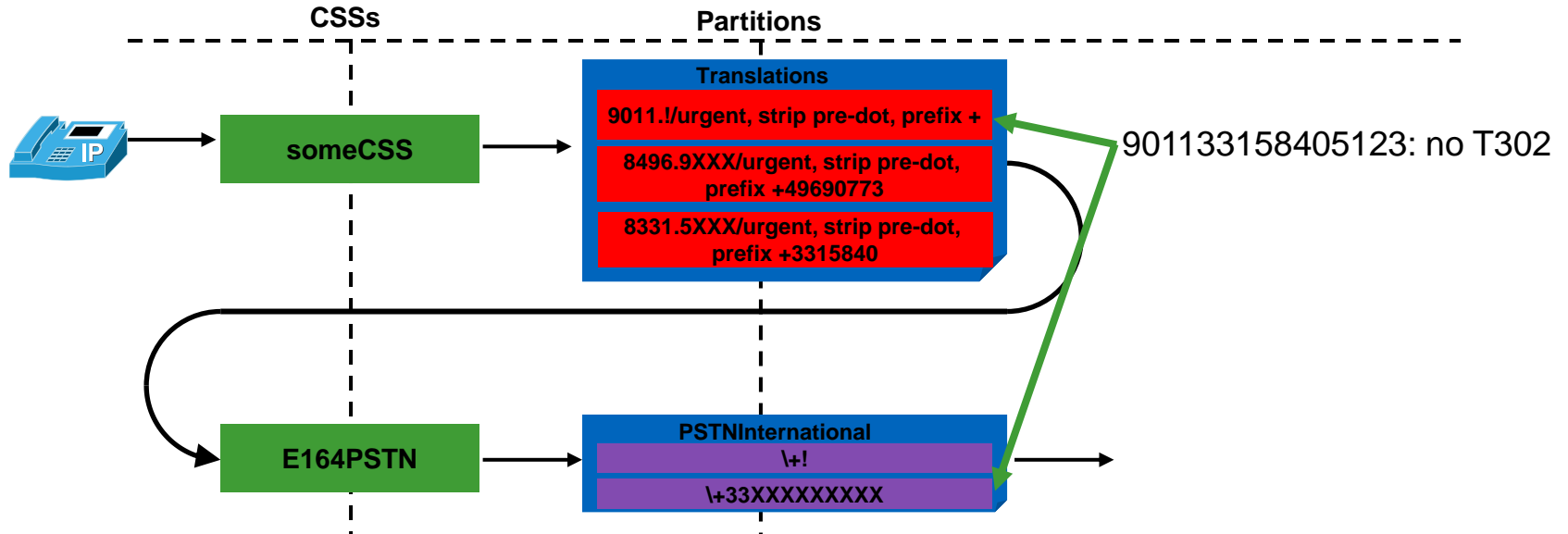
Reference +E.164 Dial Plan (10.x)

With CSS inheritance



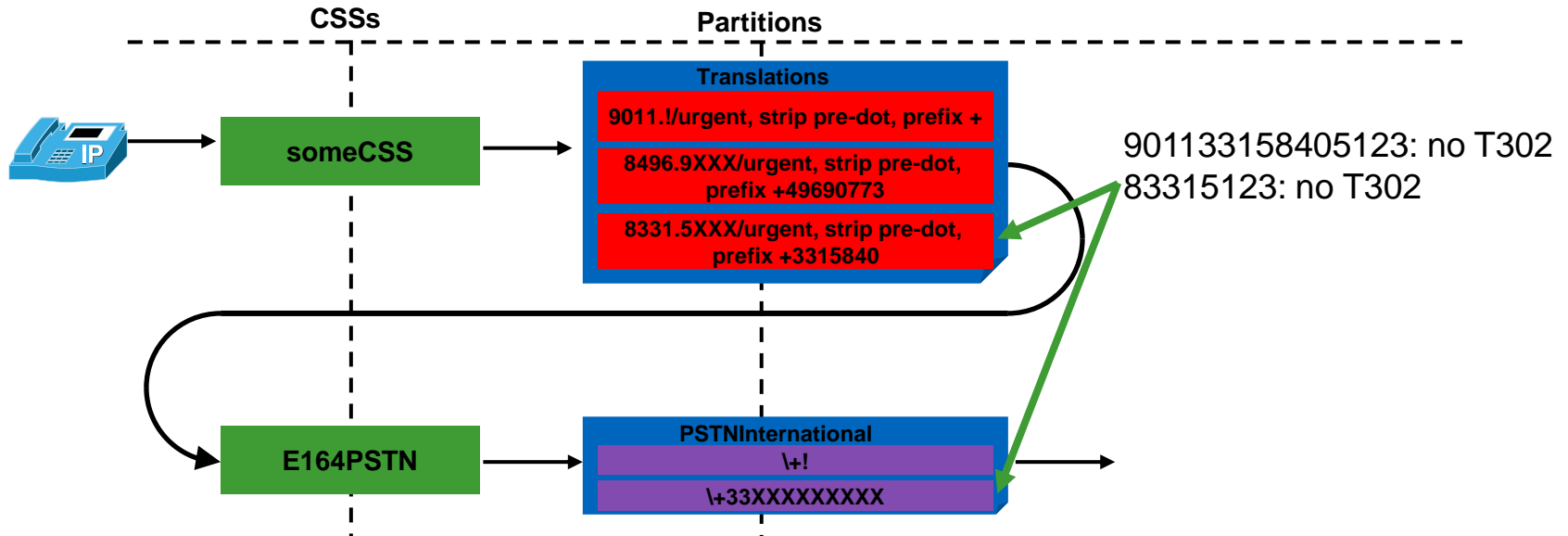
Translation Pattern and T302 Interaction

Fixed length pattern after variable length translation: no T302



Translation Pattern and T302 Interaction

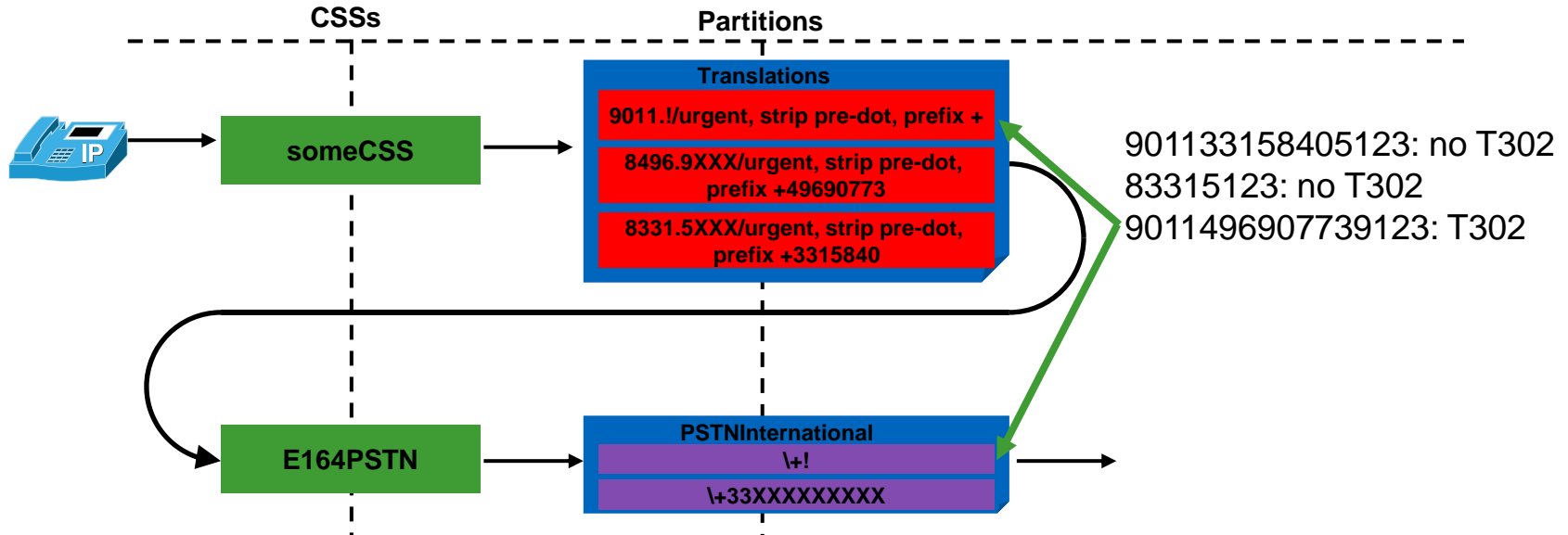
Fixed length pattern after fixed length translation: no T302



- Fixed length pattern after variable length translation: no T302

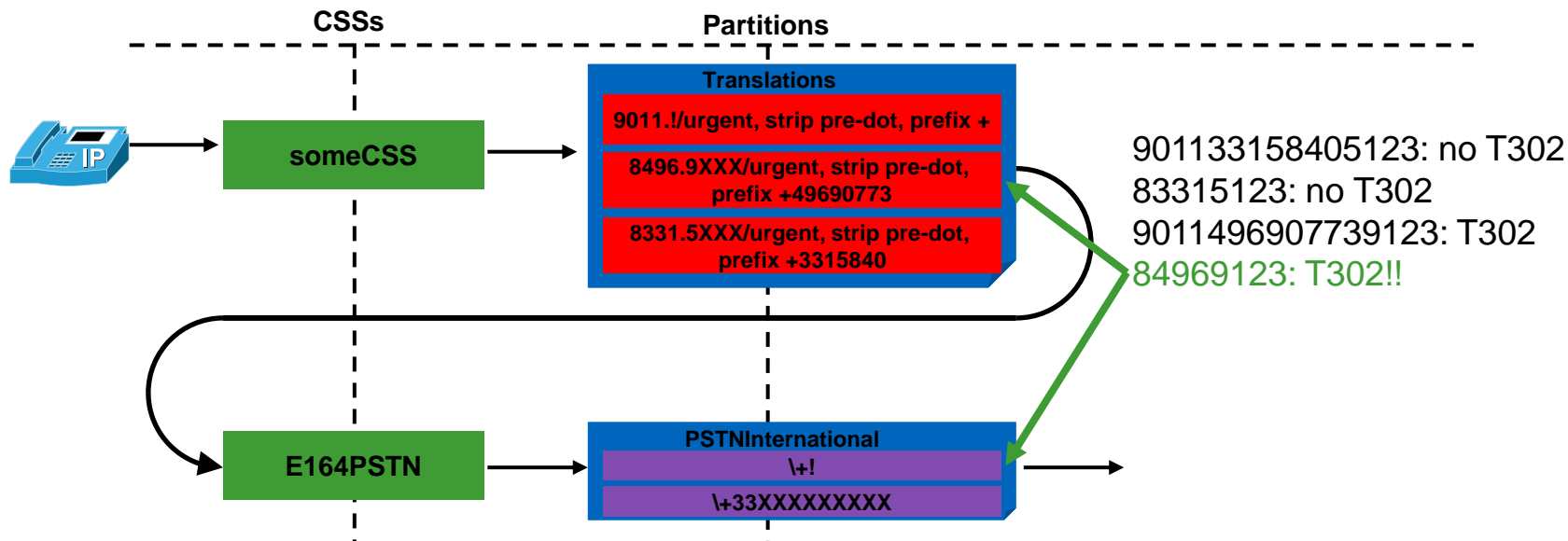
Translation Pattern and T302 Interaction

Variable length pattern after variable length translation: T302



- Fixed length pattern after variable length translation: no T302

Translation Pattern and T302 Interaction



- Fixed length pattern after variable length translation: no T302
- Variable length pattern after fixed length translation hits T302!

Configuration of IDT Policy for Secondary Lookup

- “Do Not Wait For Interdigit Timeout On Subsequent Hops” option added on Translation Pattern configuration page;
- Default: off, wait for IDT on subsequent hops
- Best practice: set for all fixed length translation patterns

Pattern Definition

Translation Pattern	1XXX
Partition	NYCIntra
Description	NYC Intra-Site
Numbering Plan	< None >
Route Filter	< None >
MLPP Precedence*	Default
Resource Priority Namespace Network Domain	< None >
Route Class*	Default
Calling Search Space	DN
<input type="checkbox"/> Use Originator's Calling Search Space	
External Call Control Profile	< None >
Route Option	<input checked="" type="radio"/> Route this pattern <input type="radio"/> Block this pattern No Error
<input type="checkbox"/> Provide Outside Dial Tone	
<input type="checkbox"/> Urgent Priority	
<input checked="" type="checkbox"/> Do Not Wait For Interdigit Timeout On Subsequent Hops	

Transformation Consistency on Trunks

What's addressed in 10.0

- Communications Manager 10.0 adds:
 - Incoming called party transforms for SIP trunks and MGCP gateways
 - Connected party transforms for H.323 trunks/GWs and MGCP GWs

Protocol	Incoming Called Party Transforms	Connected Party Transforms
SIP trunks	Added in 10.0	Available in 9.X
H.323 trunks/GWs	Available in 9.X	Added in 10.0
MGCP GW	Added in 10.0	Added in 10.0*

*for variants supporting Connected Party IE

Enterprise Dial Plan Fundamentals

General Recommendations

- Think Long Term!
- Short, Standard naming conventions
- Keep it simple



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