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# Advanced Dial Plan Design for Unified Communications

BRKUCC-3000



# Abstract

This advanced session provides detailed dial-plan design guidelines for each of the Cisco IP telephony deployment models based on Cisco Unified Communications Manager, with recommended best practices to help ensure successful, scalable deployments.

This session covers the various dial-plan tools available in Cisco Unified Communications Manager, such as route patterns, translation patterns for digit manipulation, calling party transformations for localisation and globalisation of calling party information, dial-plan interaction with PSTN gateways and Services Advertisement Framework's Call Control Discovery.

This session also covers how to best use these tools to deal with real-world deployments. The main focus of the session is on system design, with some implementation aspects. This session is aimed at network planners and designers and telephony analysts and assumes a working knowledge of the Dial Plan functionality in Cisco Unified Communications Manager.

# Meet Your Friend: The UC SRND

Cisco Unified Communications System 8.x SRND ...ations Manager (CallManager)] - Cisco Systems

http://www.cisco.com/en/US/docs/voice\_ip\_comm/ Reader Google

Cisco Unified Communications System 8.x SRND

**CISCO**

## Dial Plan

- [-] Cisco Unified Communications System 8.x SRND
  - [-] Preface
  - [-] Introduction
  - [+] Unified Communications Networking
  - [-] Unified Communications Call Routing
    - [-] Overview of Cisco Unified Communications Call Routing
    - [-] Call Processing
    - [-] **Dial Plan**
    - [-] Emergency Services
    - [-] Call Admission Control
    - [-] IP Video Telephony
    - [-] Gateways
    - [-] Cisco Unified CM Trunks
  - [+] Unified Communications Call Control
  - [+] Unified Communications Applications and Services
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Source: [http://www.cisco.com/en/US/docs/voice\\_ip\\_comm/cucm/srnd/8x/dialplan.html](http://www.cisco.com/en/US/docs/voice_ip_comm/cucm/srnd/8x/dialplan.html)



# Agenda

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- Introduction
- Call Routing Recap
- Developing a Global Dial Plan – Call Routing
- Developing a Global Dial Plan – Number Presentation
- SAF/CCD



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- **Introduction**
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# Remember

- Best and most important tools for dial plan design:
  - Pencil
  - Paper
  - Whiteboard
- Dial plans are not a new concept
- IP did not really change the fundamentals of dial plan design
- Dial Plan recommendations are not a monolith
  - Take what you need
- Keep it simple!

# What Is a Dial Plan About?

- From entered number to connected party
- Different domains of numbers
  - Input: Dialing habits
  - Core routing
  - Output: Connected party, display of alerting, calling, connected number, numbers in placed/missed calls
- Calling and called party numbers
  - Different format of numbers
  - Number get transformed in the process of call routing
- Classes of service
  - What device is allowed to reach which destinations



# Dialing

- Different types of dialed number (destinations)
  - National
  - International
  - National on-net – National calls to known sites on-net
  - International on-net – International calls to known sites on-net
  - Abbreviated on-net – Private numbering plan
  - Intra-Site – “Office next door”
- Who/what is dialing (is the source of the number)
  - Users using the keypad – Typically want short numbers
  - Applications, CTI – Number length irrelevant
  - Directories – Number format in the directory?



# Dialing Habits

- For every type of number we need to define the format to be used for these numbers
- Country specific habits might exist
- Enterprise dial plans at least need to define how to get an outside line to dial externally
  - “0” in most European countries
  - “9” in the US and UK
- Do we need to support abbreviated on-net dialing?
- Do we need to support (+)E.164 dialing?
  - Applications
  - Directories

# Example Dialing Habits in Europe

- “0” (or “9”) to get an outside line
- Any number starting with 1-9 is generally internal  
But please stay clear of “112”
- National numbers need a “0” in front of the area code:
  - 0 – Outside line
  - 0 – Escape for area code
  - 69 – Area code of Frankfurt
  - Dial 0-0-6-9-... From inside the enterprise to Frankfurt
- international numbers are typically prefixed by “00”:
  - 0 – Outside line
  - 00 – Escape for country code
  - 39 – Country code of Italy
  - Dial 0-0-0-3-9-... From inside the enterprise to Italy

# Enterprise Specific Dialing Habits

- Typically dialing habits for local, national, international calls are given
- Need to agree on how to dial:
  - Private numbers (on-net)
  - Intra-Site
  - Services (meet-me, call park, pick-up ...); non-DIDs
- Do we also need to support “+”-dialing?

# Overlaps

- Dialing habits need to avoid overlaps to avoid interdigit timeout (T302, default: 15s)
- No overlap between:
  - Outside access code & intra-site (UK: No 9xxx DN)
  - PVN access code & intra-site (Cisco: No 8xxx DN)
  - PVN access code & outside access code (PVN: No 0 or 9)
- PVN and outside access code reduce the numbering space available for intra-site dialing
- **Overlaps have to be avoided in the planning phase**
- **If overlapping dialing habits are defined this can not be resolved later**

# Private Numbering Plan

- Pro

- Possibly shorter inter-site on-net dialing

- Fixed length instead of possibly variable length inter-site on-net dialing

- Can be re-used for VM subscriber IDs

- Con

- National dialing to known sites can be forced on-net; no NEED for private numbering

- Private numbers are only useable inside the enterprise

- Will people actually use them?

- Steering digit for private numbering reduces the set of available numbers

- Planning and maintenance effort

- Is it worth it?

# Guidelines for Private Numbering Plan

- Typical format:
  - <access code> - any digit or “\*”
  - <site id> - Might be a hierarchical scheme including regional attributes
  - <extension> - Intra-site on-net extension
- Example: 8-496-1234
  - 8 – Access code
  - 496 – Site id (site 6 in Germany)
  - 1234 – Local extension
- Make sure to reserve space (what if we get more than 9 sites in Germany)
- Make it extensible (think “Shannon coding”)
- Changing an established private numbering is VERY hard

# External Numbering Plan Requirements

- Providers dictate format for Calling/Called Party Numbers on trunks
- Technology:
  - ISDN: Concept of Type (national, international, subscriber) and Number
  - SIP: Only Number; typically +E.164
- PBX interconnect (Q.SIG)
  - End-to-end support for numbering used on existing PBX systems
  - Uniform across all systems?

# What to Use as DNs?

- Options:

- Intra-site extension: Requires per-site partitions

- Example: 9764

- Unique abbreviated on-net extension

- Example: 8 496 9764

- +E.164: Unique; “+” to avoid overlaps

- Example: \+49 6100 773 9764

- E.164: Unique; how to avoid overlap?

- Example: 49 6100 773 9764

- National number (10-digit US)

- What if you need to expand to global plan?

- Number transformations in UCM allow to map between numbering schemes



## +E.164 DNs and Non-DIDs

- Non-DIDs need to be assigned using “unallocated” spaces
- International:
  - Unallocated: <http://www.itu.int/pub/T-SP-E.164D>
  - +0: Free by definition, possibly create hierarchical numbering scheme starting with +0
- National:
  - Unallocated ranges in national numbering plans: <http://www.itu.int/oth/T0202.aspx?parent=T0202>
- Completely different space: e.g. numbers starting with “\*”



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- **Call Routing Recap**
- Developing a Global Dial Plan – Call Routing
- Developing a Global Dial Plan – Number Presentation
- SAF/CCD

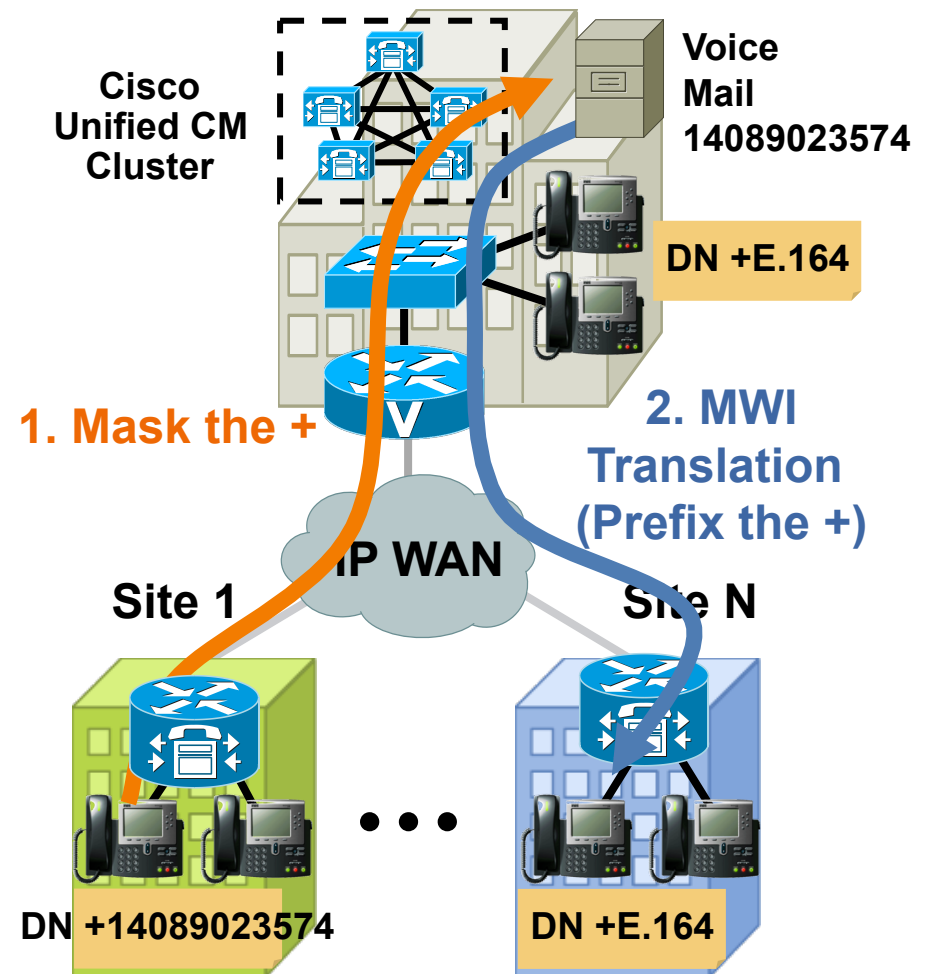
# + Sign Support

## What It Is: Concept

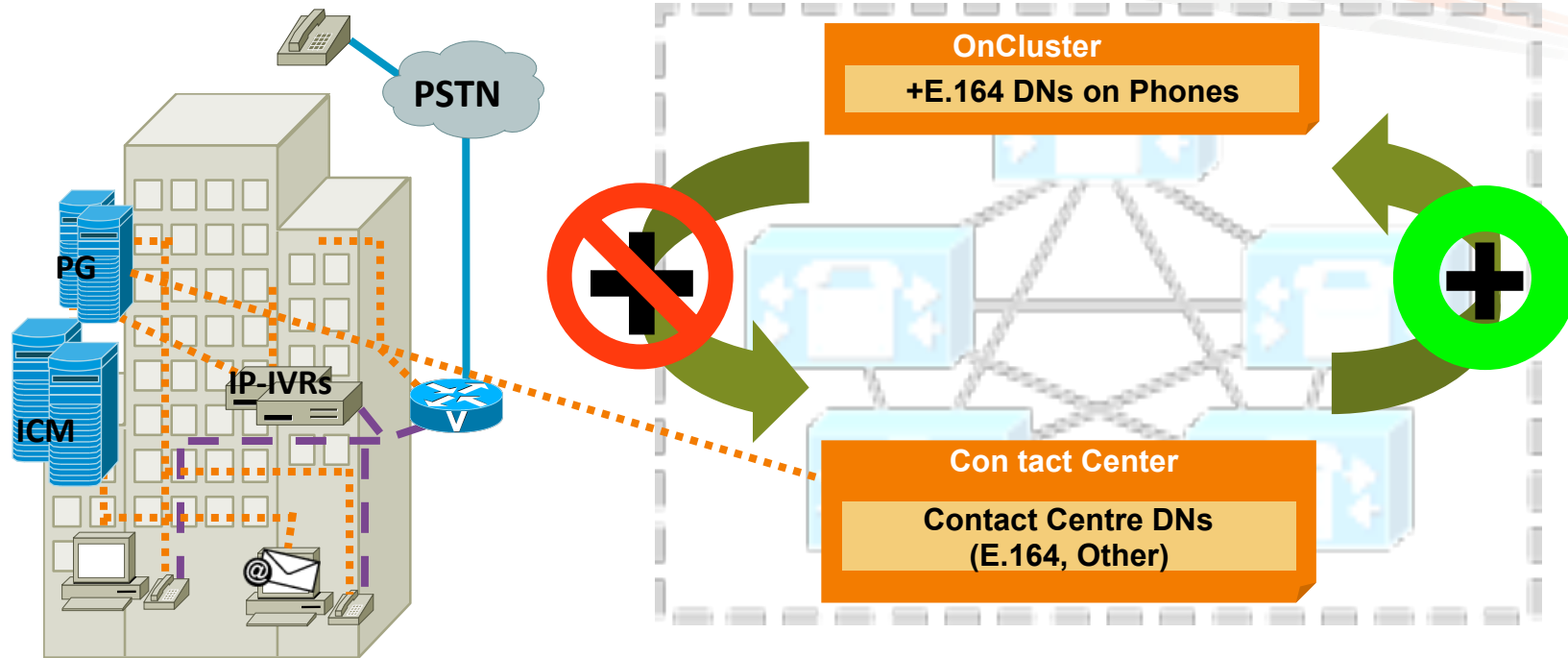
- ITU Recommendation E.164 describes the “Numbering Plan of the International telephone service”
  - CC + NDC + SN: Maximum of 15 digits
  - CC : Country code, 1 – 3 digits
  - NDC: National destination code
  - SN: Subscriber number
- ITU Recommendation E.123 describes the “Notation for national and 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!
- +E.164 support includes the use of + to **wildcard** international access codes AND to avoid overlap between globalized 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
- Most phones support +-dialing: 7925/21 from day one, newer phones starting with phone firmware 9.1.1

## +E.164 DNs and Voicemail

- When the DNs are +E.164, and the voice mail system does not support + (yet)
- Voice mail boxes need a unique DN
- Need to **mask off the +** in the DNs when accessing VM
- Message Waiting Indicator (MWI) messages from VM system need to be **prefixed with +** to match appropriate DN/partition
- Unity Connection 8.0 does support +E.164 alternate extensions



# +E.164 DNs and Contact Center



- IP Voice
- TDM Voice
- ⋯ Call Control and CTI Data

For CTI-Based Apps Not Yet Able to Control +Based DNs, Use Different Partitions to Separate the +DNs from the Non + DNs. Use Translation Patterns to Control Calls Between the These Groups of Phones. Add + to the Calling and Called Parties When Calling from a CC Phone to a +DN, and Remove the + When Calling \*to\* a CC Phone.



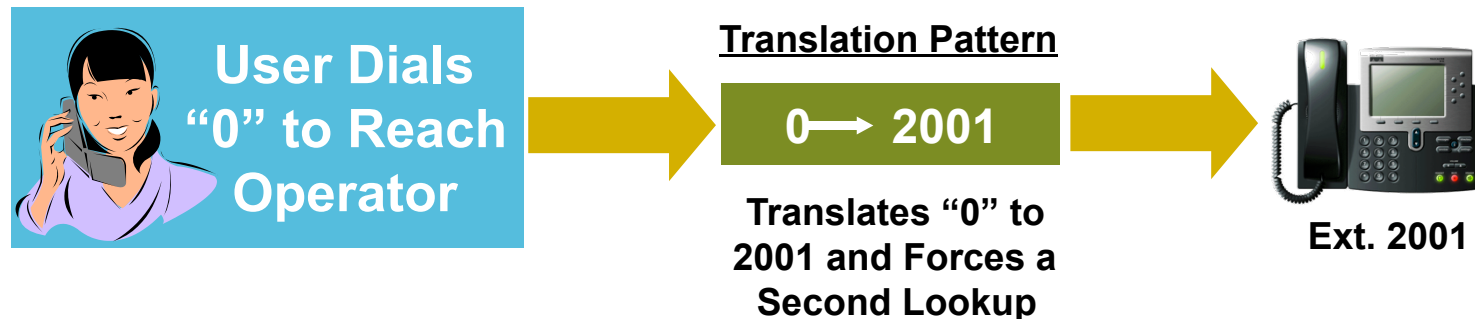
# Types of Callable Patterns

- **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

# Translation Patterns

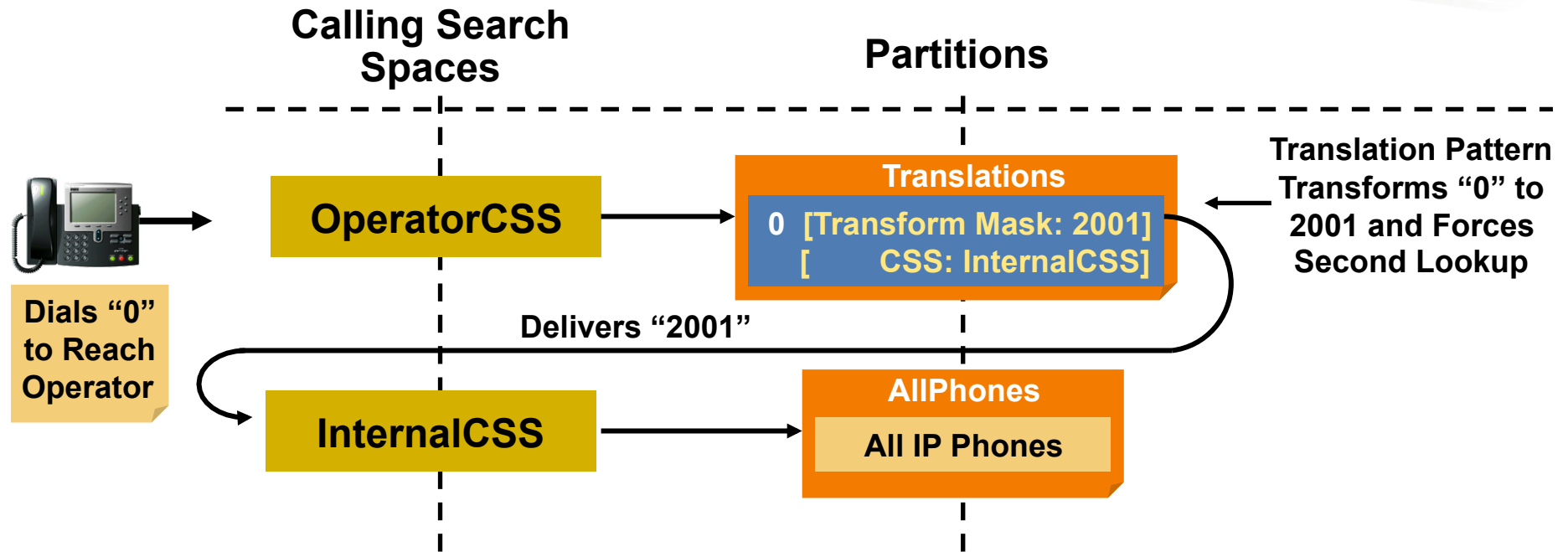
## The Basics

- Match on dialed digits
- Perform calling and/or called party digit manipulation
- Force second lookup in Cisco Unified CM, using a (possibly different) calling search space



# Translation Patterns

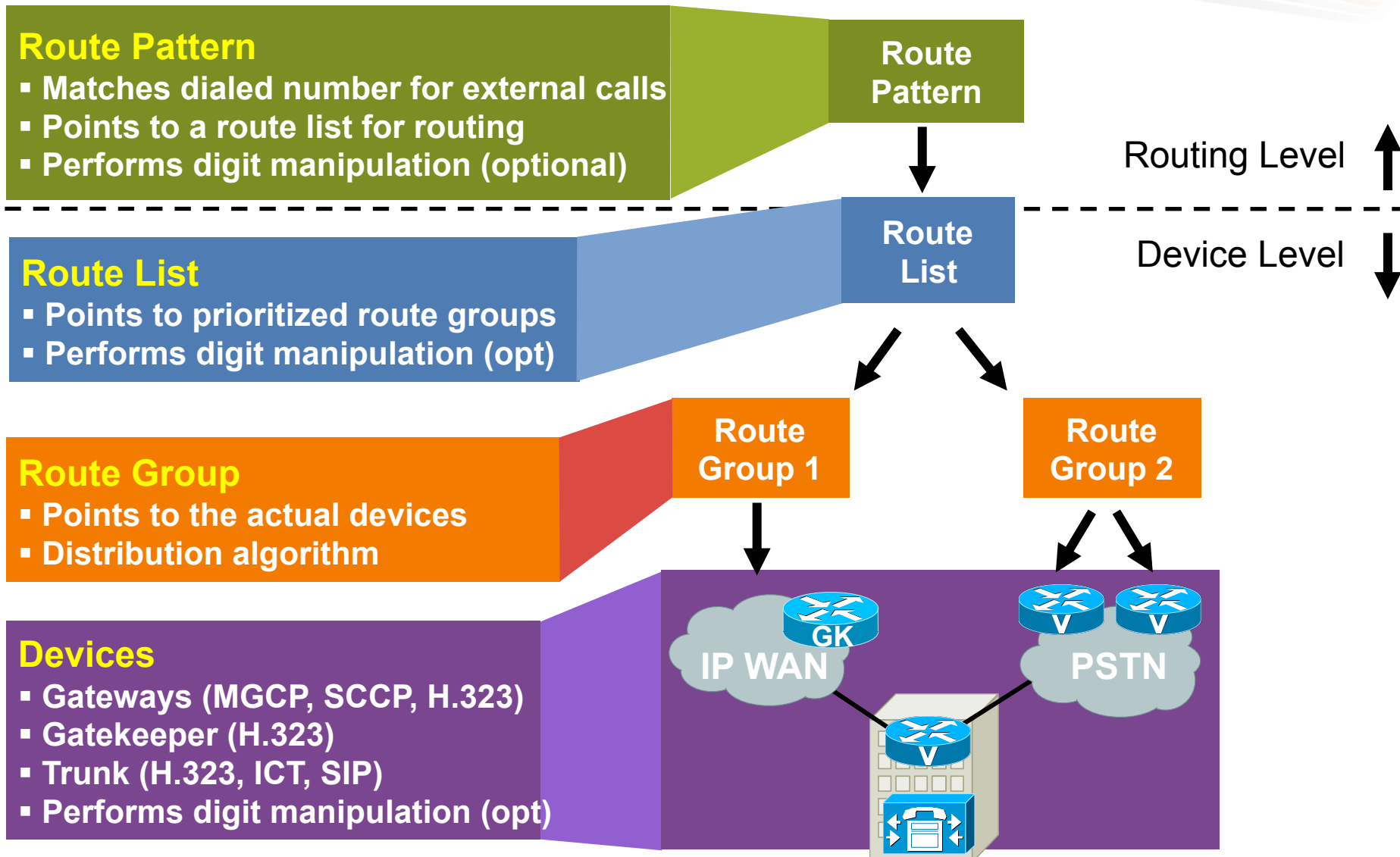
## Call Flow



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



# Number Transformations



# Number Transformations

## Routing vs. Device Level

- Only Called Party transformations on routing level are reflected on calling phone's display
- Caveat: Numbers sent in Q.SIG APDUs don't pick up changes done at the device level
  - 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)

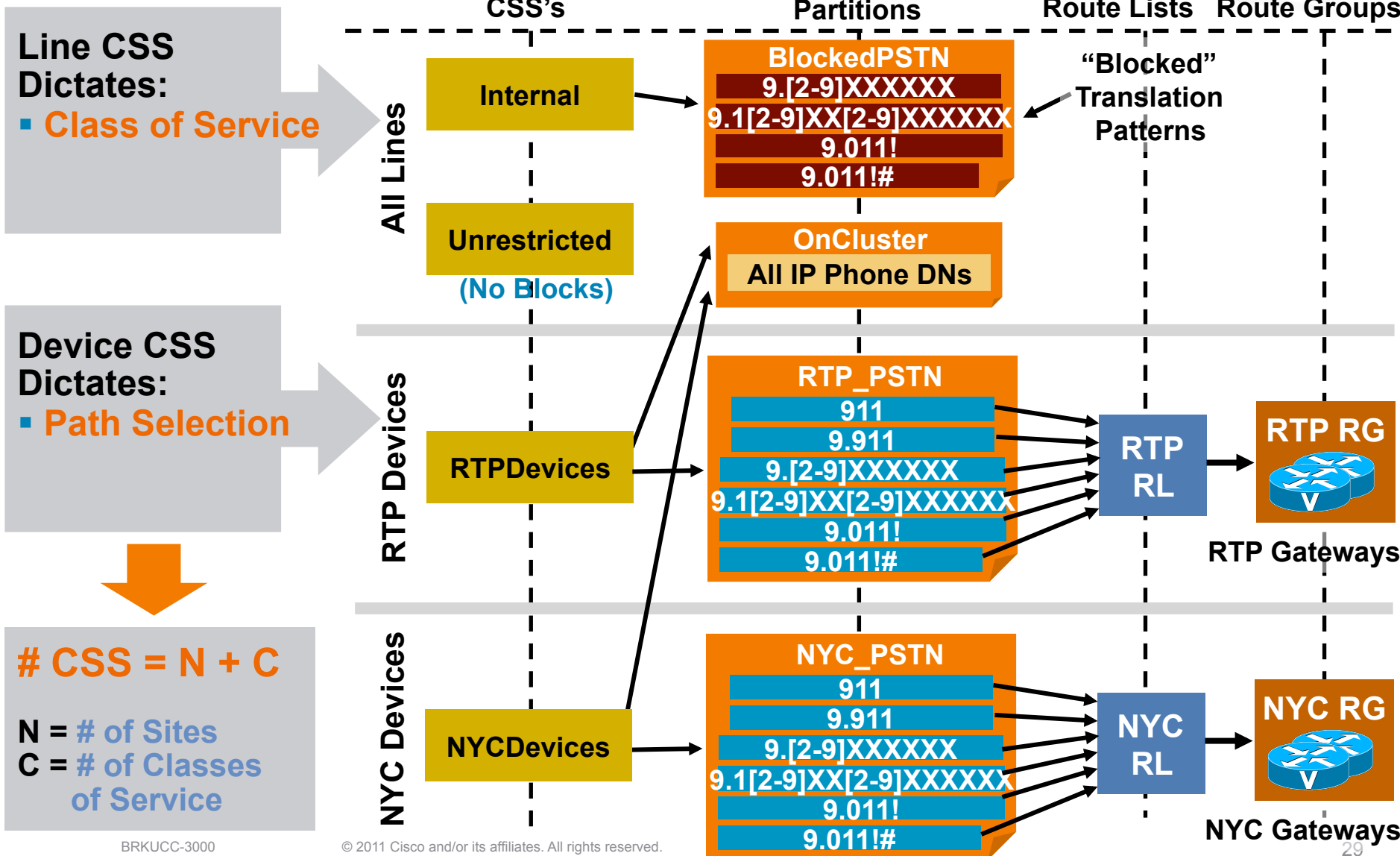
- Calling Party Transformation CSS on phones (or device pools)

# Local Route Group

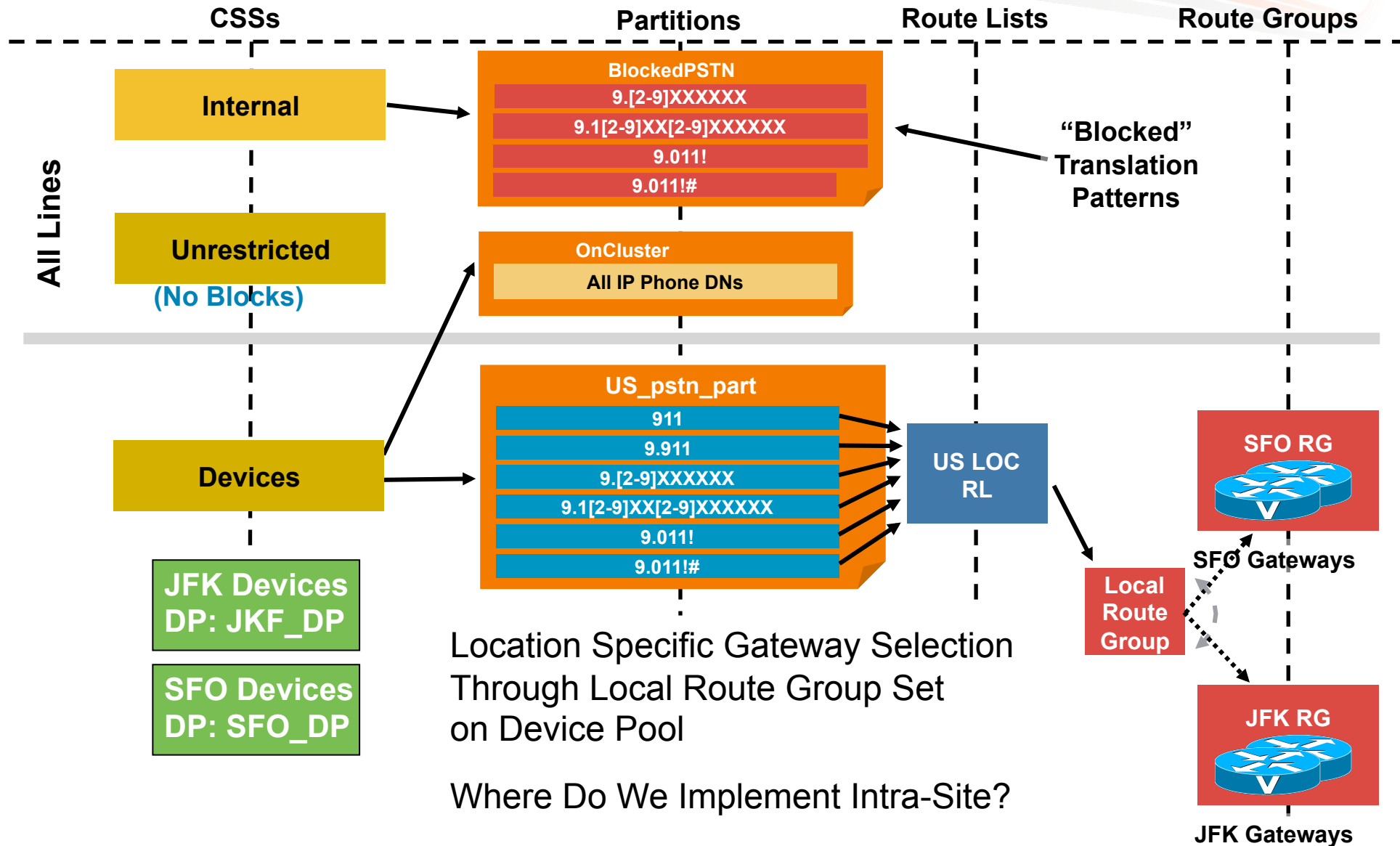
## What It Is: Concept

- 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 set of Route Patterns, yet 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**) can serve **all** phones in the cluster, and the PATH SELECTION will be determined by the phones' configuration.

# Line/Device CSS Approach for Centralized Deployments



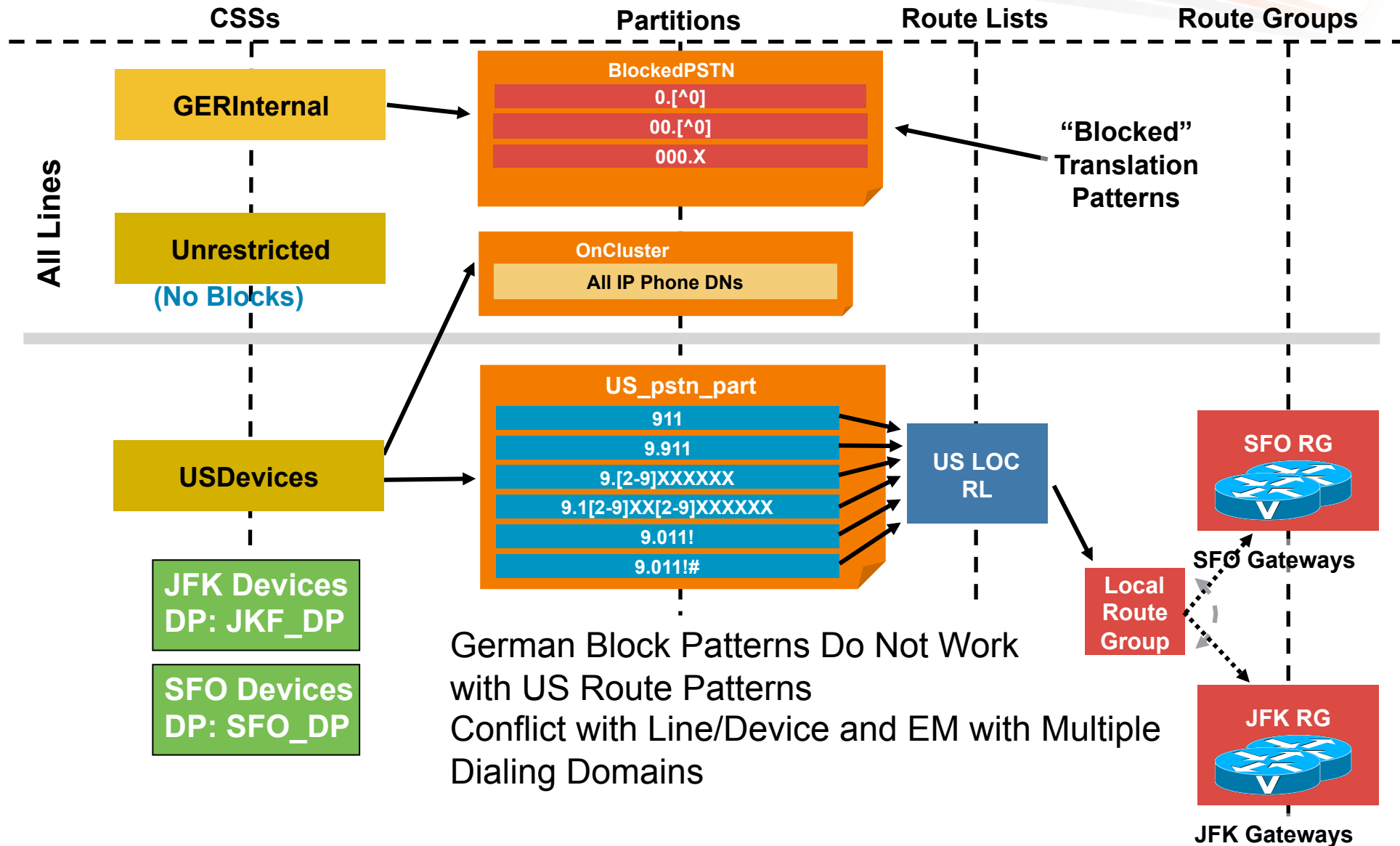
# Line/Device with Local Route Group



# Intra-Site and Extension Mobility

- Required: Site-specific translation pattern to get from 4-digit to full DN
- Option 1: Translation addressed by device CSS
  - Site specific device CSS
  - EM users get intra-site dialing of visited site
- Option 2: Translation addressed by line CSS
  - CSS per site and CoS
  - Breaks line/device approach
- Extension mobility overrides some advantages of line/device approach

# EM and Line/Device





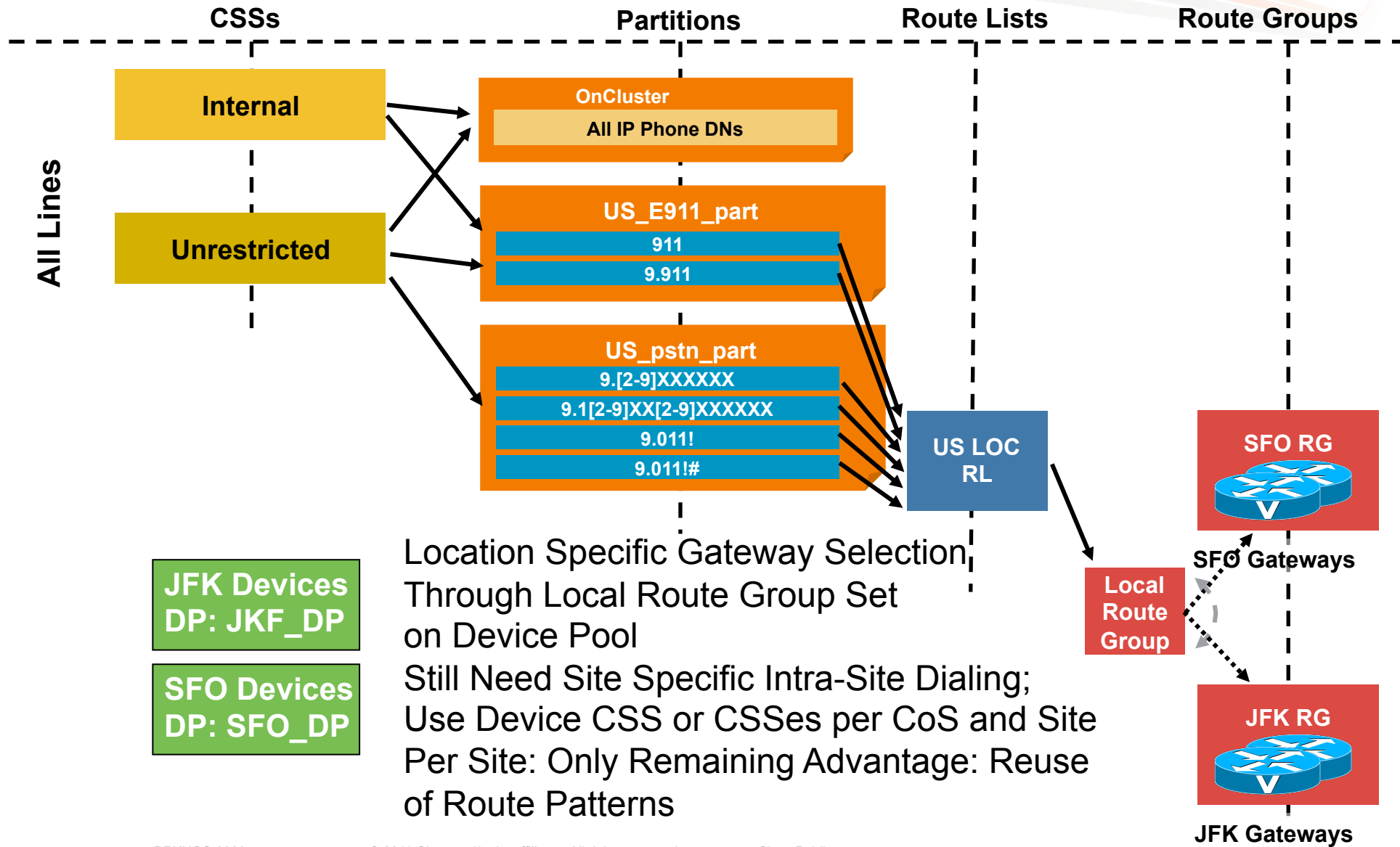
# Line/Device and CoS for + Dialing

## Block Pattern for + Dialing

- To create CoS “national” we need to allow only a single country code and block all others
- Example: Allow +49 only
  - block \+[<sup>4</sup>], urgent
    - blocks +1, +2, +3, +5, +6, +7, +8, +9; allows +4
  - block \+4[<sup>9</sup>], urgent
    - blocks +40, +41, +41, +42, +43, +44, +45, +46, +47, +48; allows +49
- One block pattern per country code digit
  - Easiest case: US, block +[<sup>1</sup>]
- CoS “local” requires even more block patterns: one per digit of each allowed area code
  - Problematic if a larger number of area codes is considered to be “local”
- CoS “local” requires site specific block patterns; somewhat breaks the line/device approach

# Local Route Group

## Two Sites, Traditional Approach



# Line/Device Approach Revisited

## Is LRG an Alternative?

- LRG offloads the site specific path selection from the route pattern
- No requirement for site specific route patterns
- Possible alternative:
  - Only use line CSS
  - Line CSS has both
    - Route patterns using LRG
    - Block patterns (if needed)
  - Complex blocking for +-dialing can be avoided by using selective route patterns (e.g. \+49 instead of \+ for CoS national)
  - Possibly use device CSS for site-specific routing (Caveat EM)
- Limitation/Caveat:
  - Only one LRG per device pool
  - If you need site specific route lists (primary/secondary route group), this approach does not work

# LRG and Number Transformations

- Using LRG moves normalisation of calling and called party numbers to device level
  - Local context and numbering requirements of route group members unknown at the routing level
- OTOH Q.SIG only picks up number transformations at the routing level
- → LRG can only be used with Q.SIG trunks when the calling and called numbering format of the PBX systems is implemented end-to-end in UCM
  - Transformation of calling and called numbers into the PBX numbering plan to be implemented using Translation and Route patterns



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# Requirements

- **Dialing Habits**

- 4-digit intra-site

- + dialing for dialing from directories

- US sites

- 9 + 7-digit for local calls

- 91 + 10-digit for national calls

- 9011 for international calls

- German sites

- 0 for local calls

- 00 for national calls

- 000 for international calls

- **Number presentation on phones in shortest possible format**



# Requirements

- Routing

  - Forced on-net

  - Local gateways in every site

  - TEHO for international calls

- Classes of Service

  - Internal: Allowed to call all on-net destinations

  - National: Only national off-net destinations

  - International: No restrictions

- Sites

  - ESC: +4961007739XXX

  - STU: +49710023911XXX

  - SJC: +14085551XXX

  - DFW: +19725551XXX



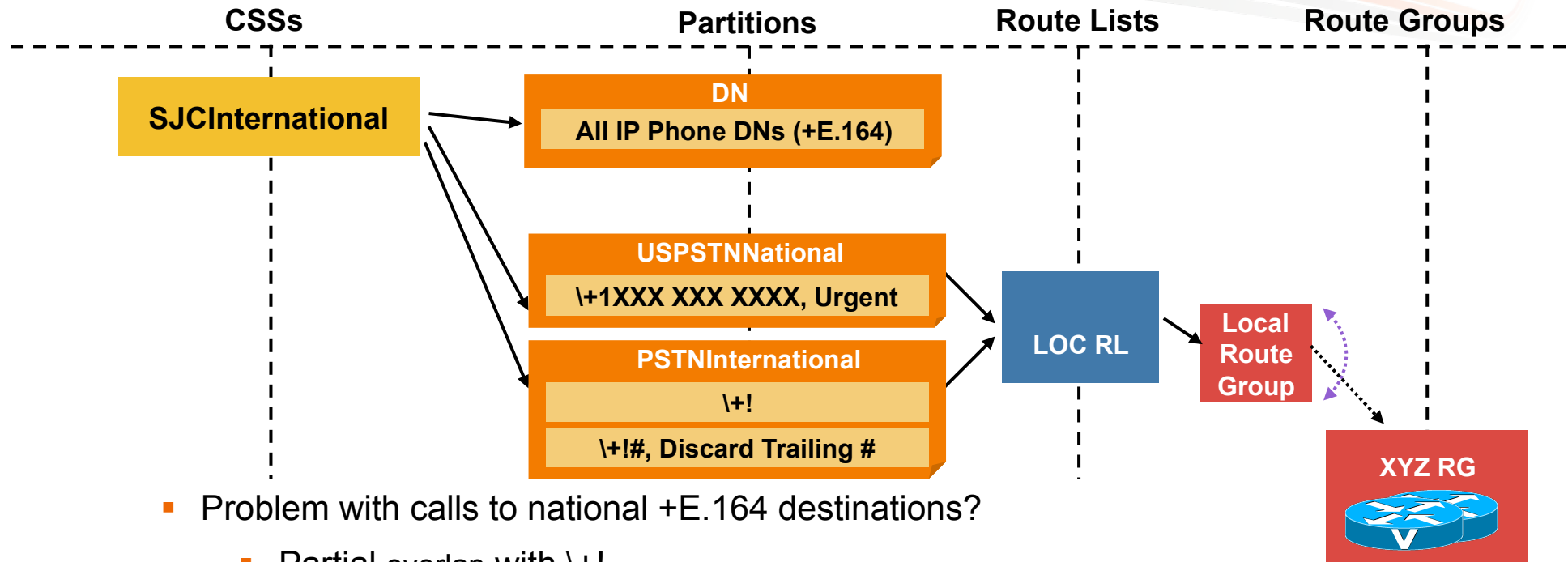
# DN Format

- Single partition for all DNs
- Requires unique DNs
- We don't have an abbreviated on-net numbering plan
  - ... and don't want to create one from scratch
- +E.164 or E.164?
  
- Let's start with +E.164 DNs
- Will it work with just line CSS and LRG?



# CoS International

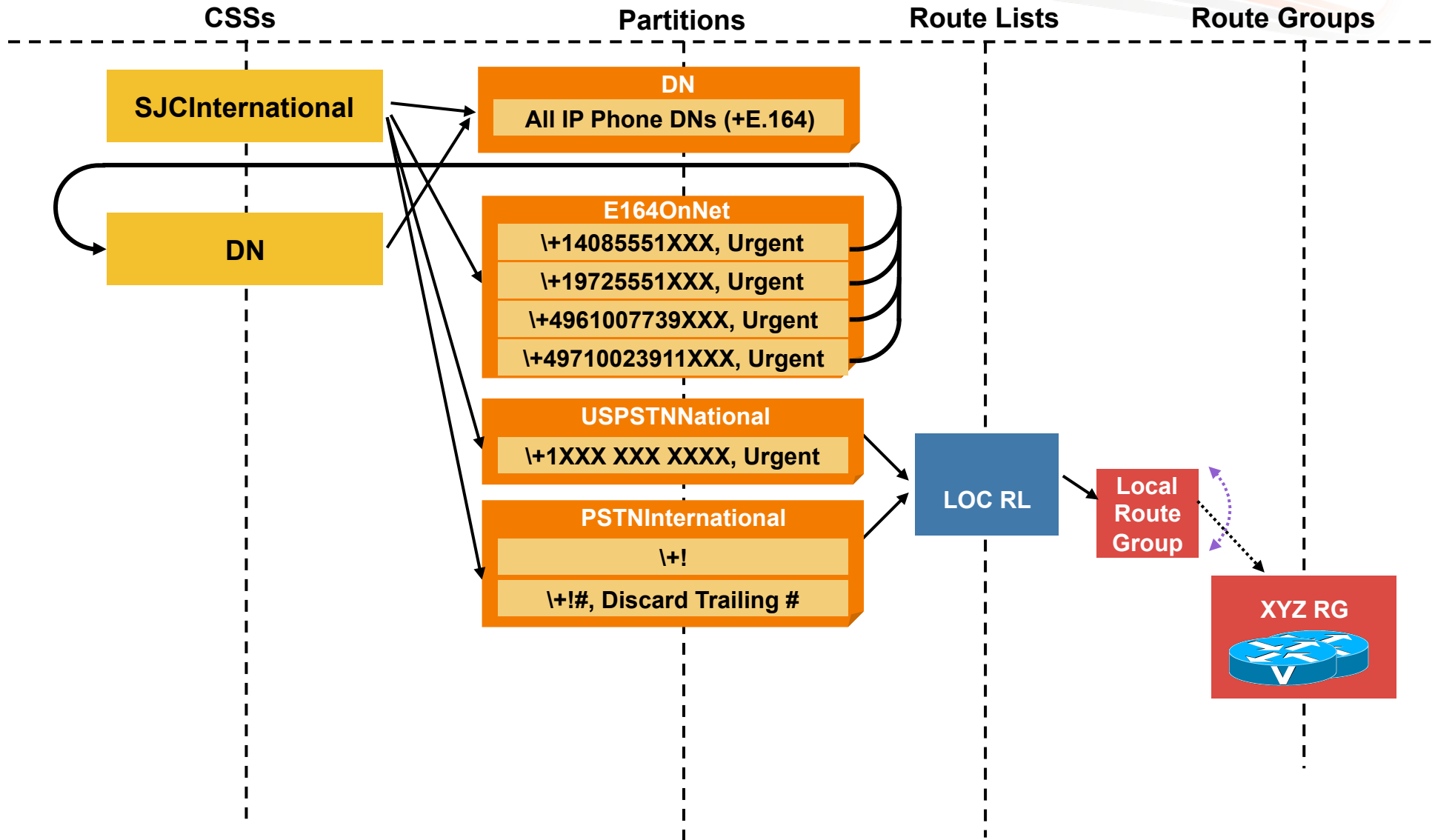
## +E.164 Destinations



- Problem with calls to national +E.164 destinations?
  - Partial overlap with \+!
  - Solution: Make \+1XXX XXX XXXX urgent
- Other problems?
  - DNs are non-urgent patterns
  - \+! has partial overlap with all DNs
  - Solution: We need urgent patterns for all on-net destinations to avoid overlap with \+!

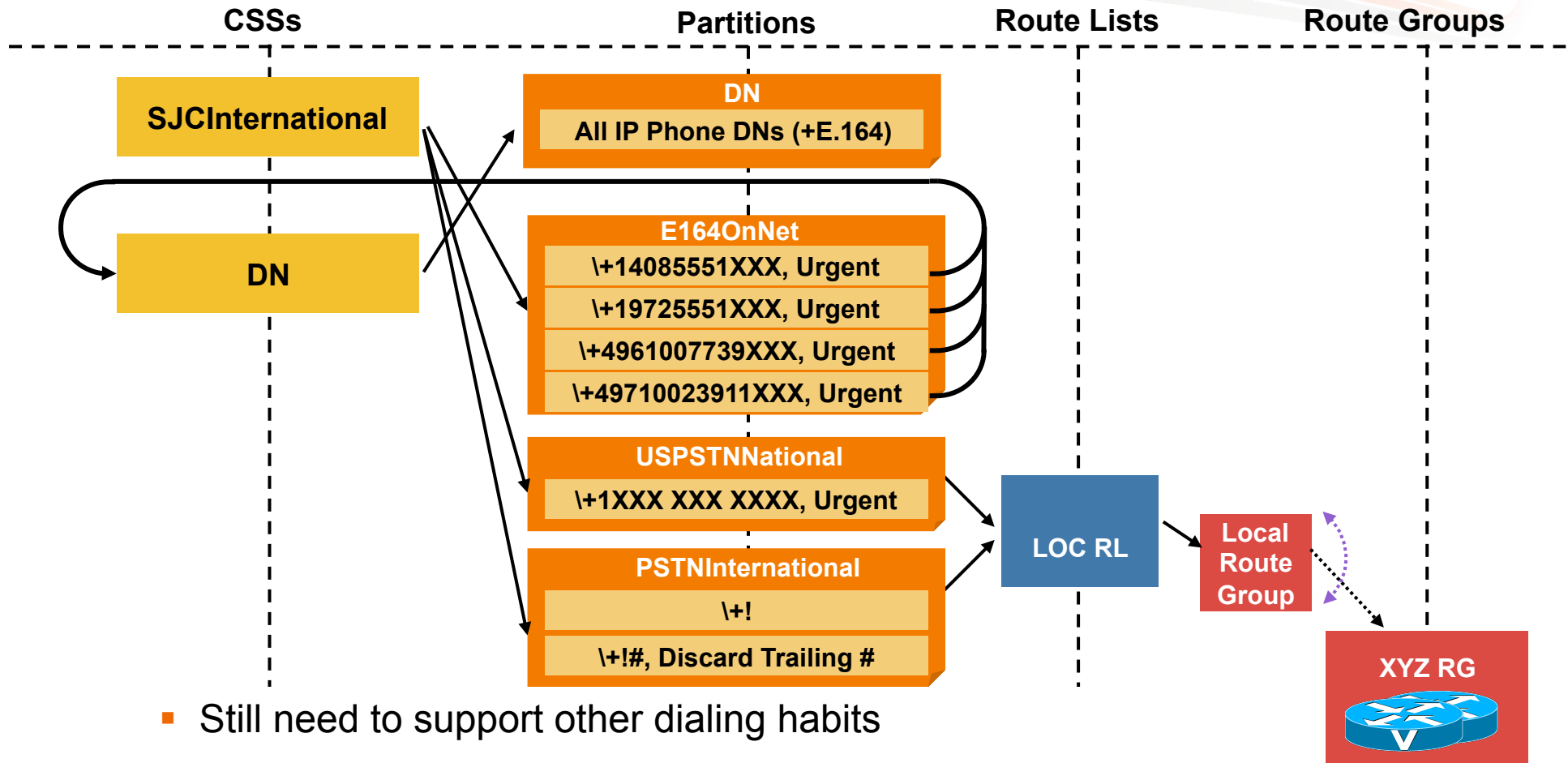
# CoS International

## +E.164 Destinations Avoiding Partial Overlap



# CoS International

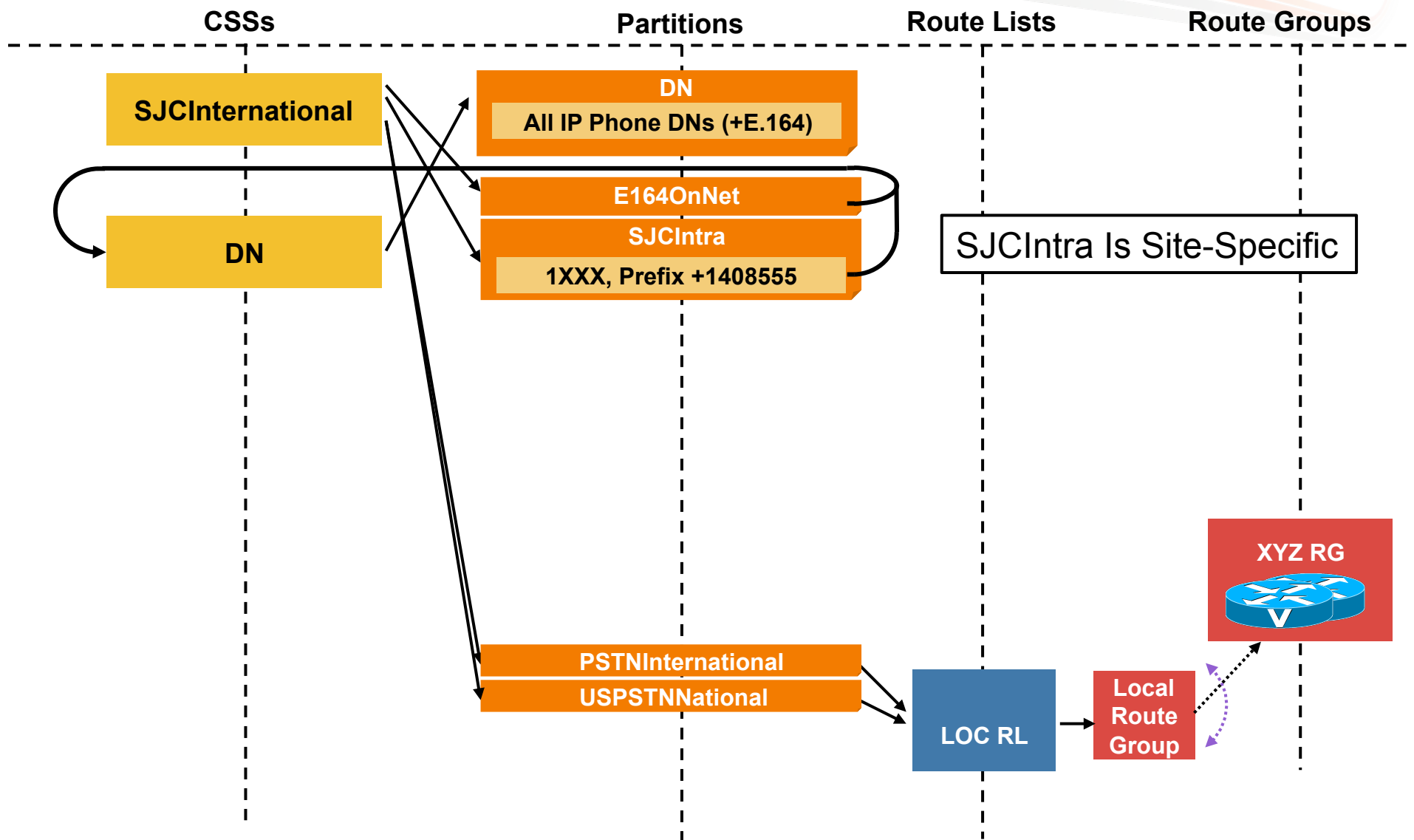
## +E.164 Destinations Avoiding Partial Overlap



- Still need to support other dialing habits
  - 4-digit intra-site
  - US PSTN dialing

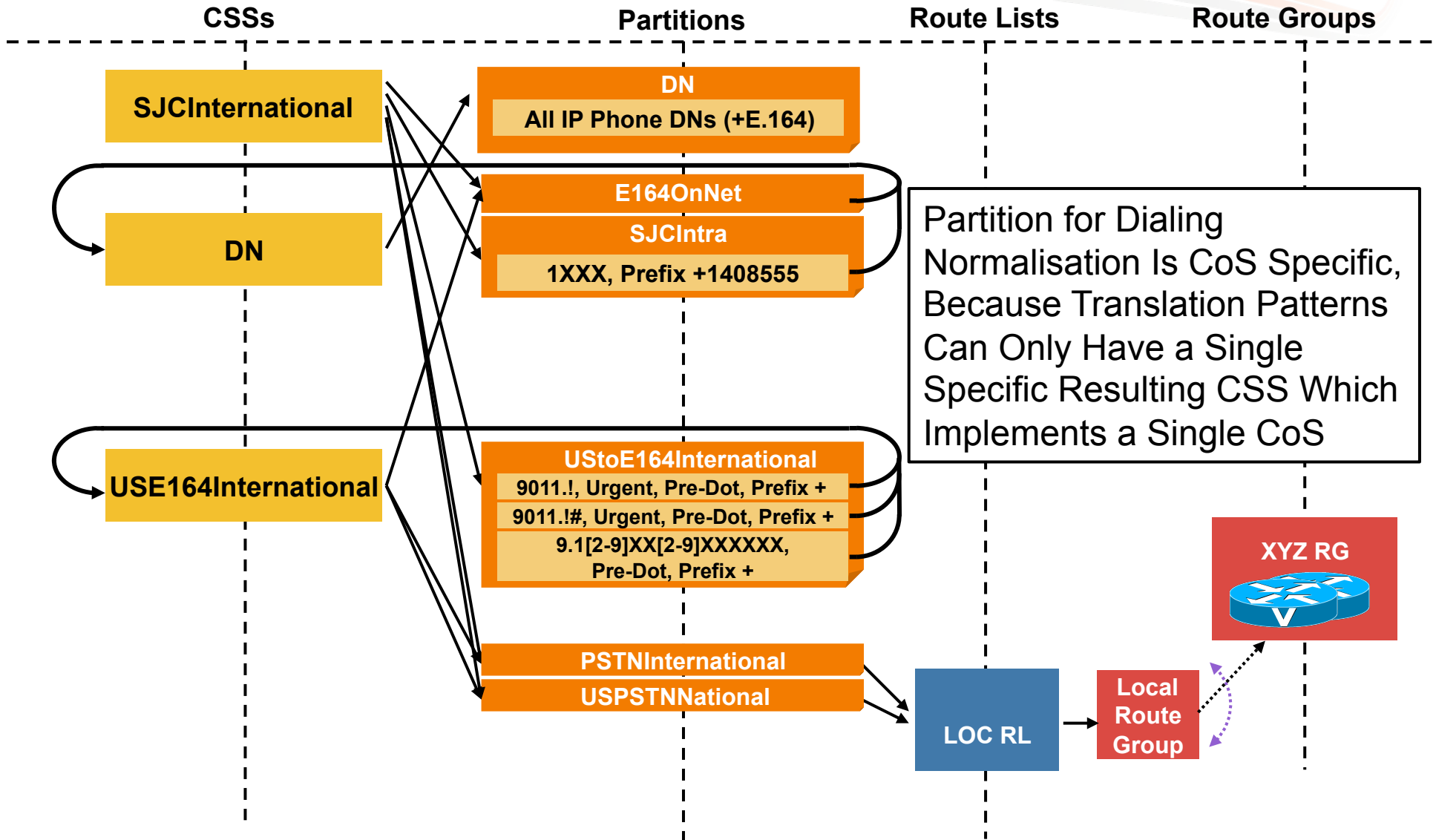
# CoS International

## Adding 4-Digit Intra-Site



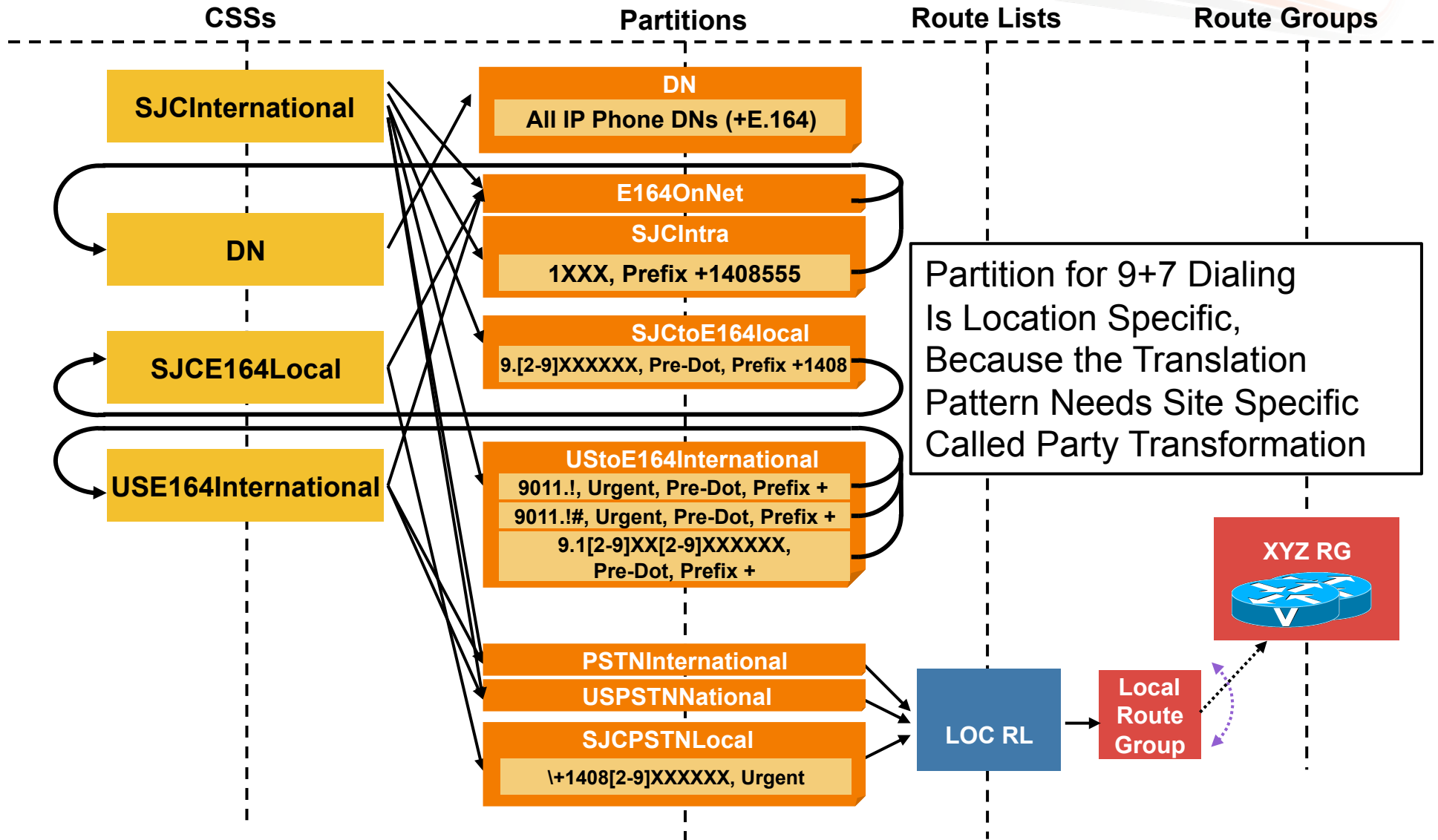
# CoS International

## Adding International Dialing



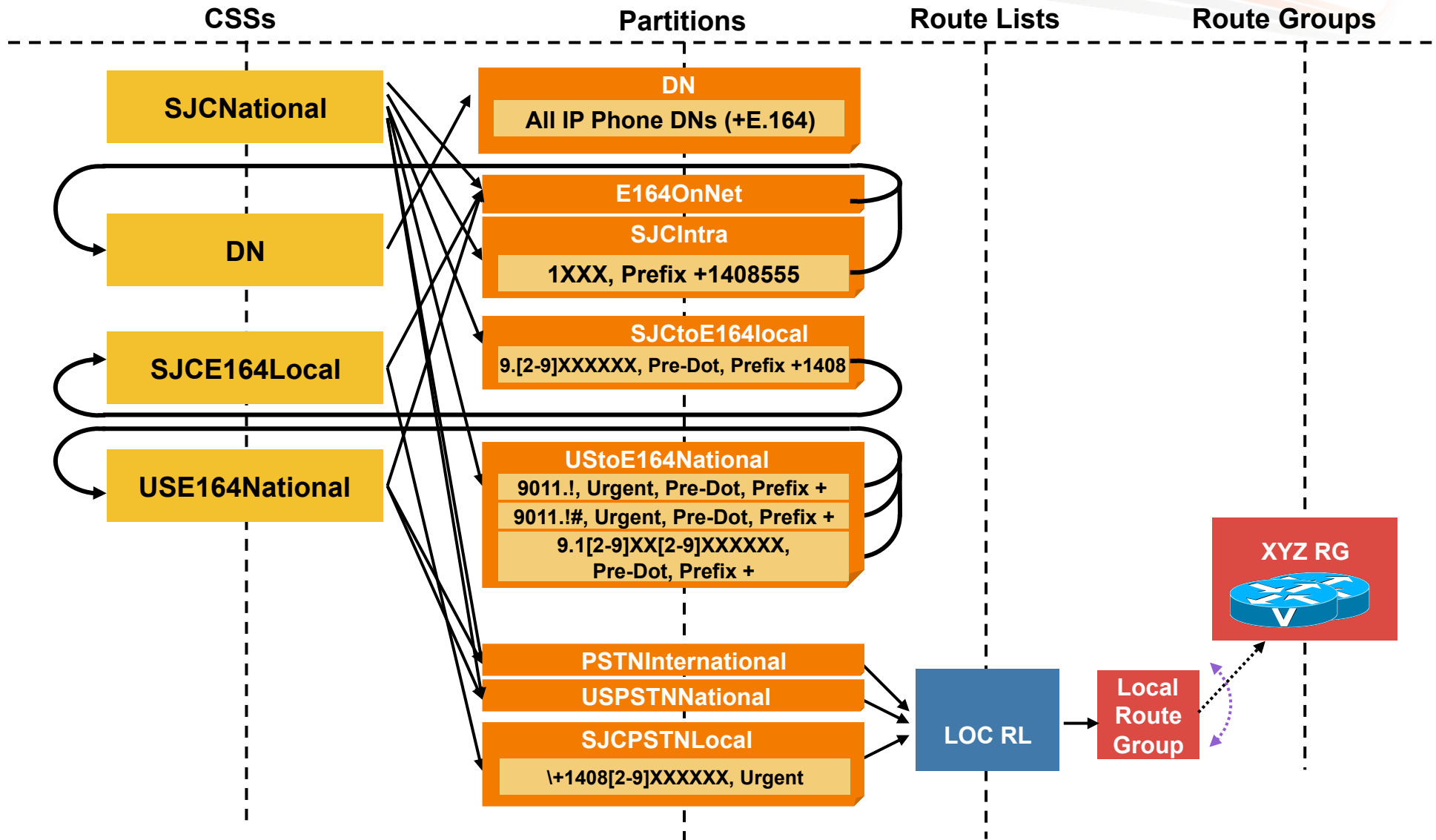
# CoS International

## Adding 9+7 (Local) Dialing; Full Picture

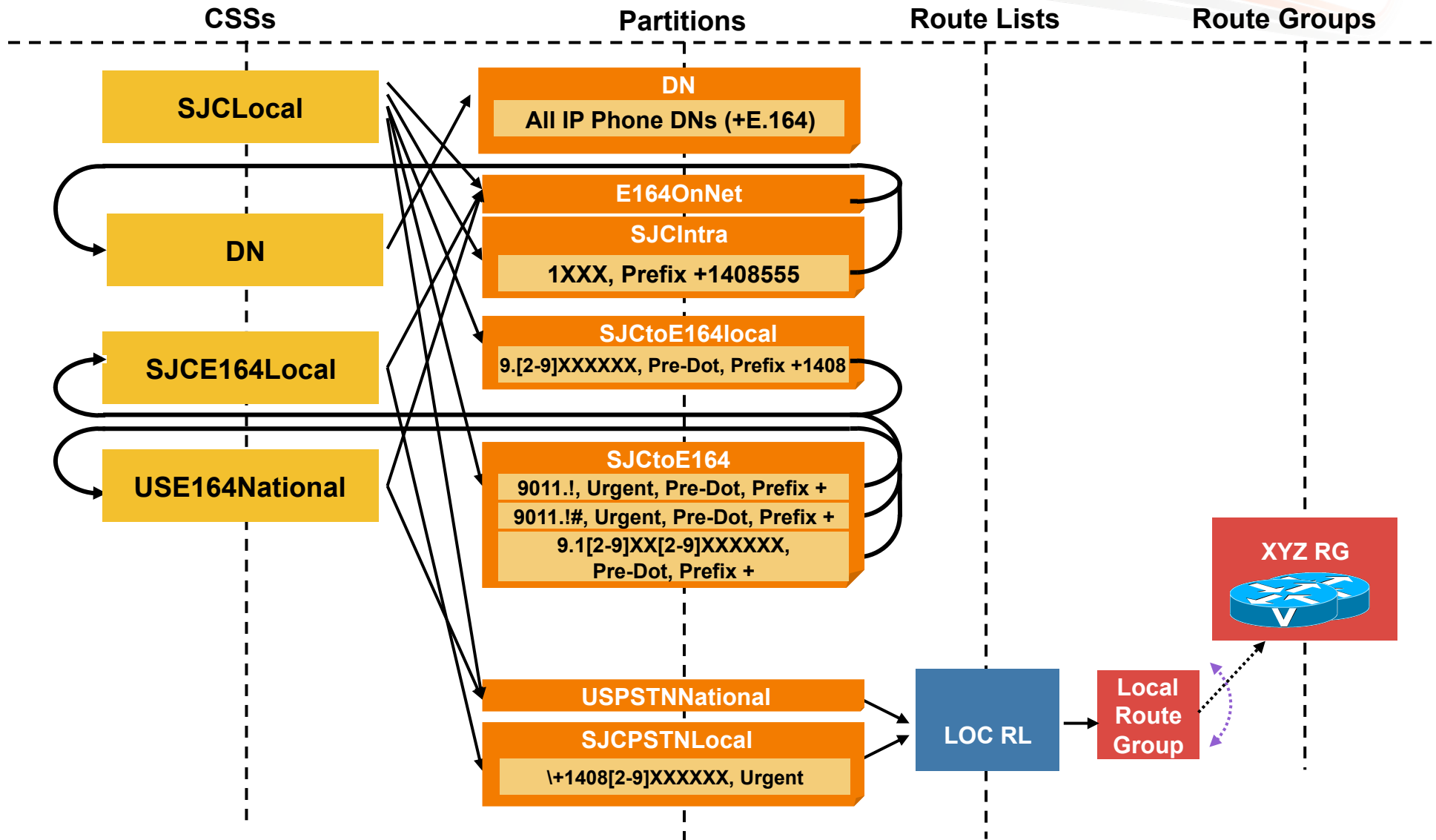


# CoS National

## Full Picture



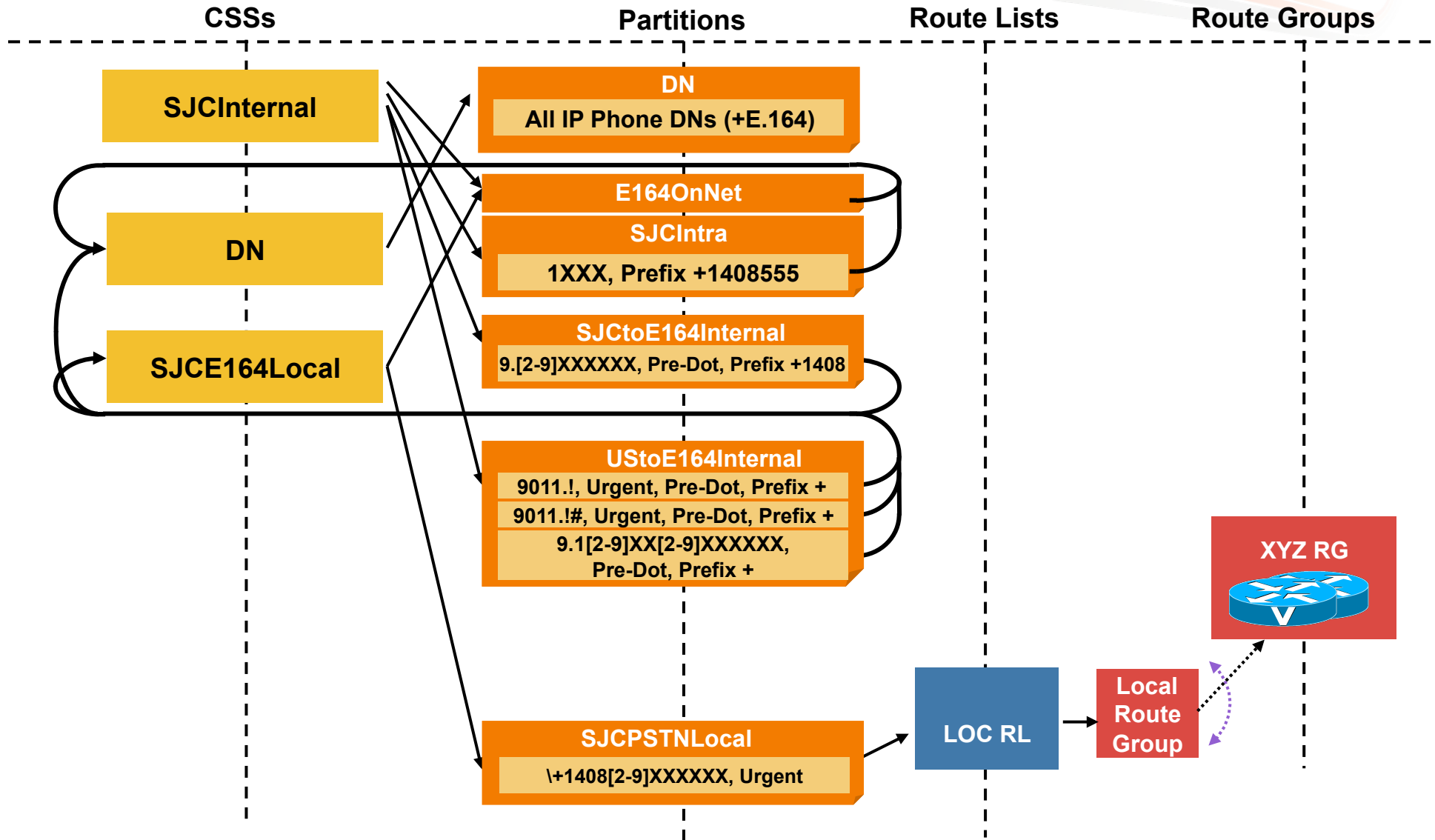
# CoS Local





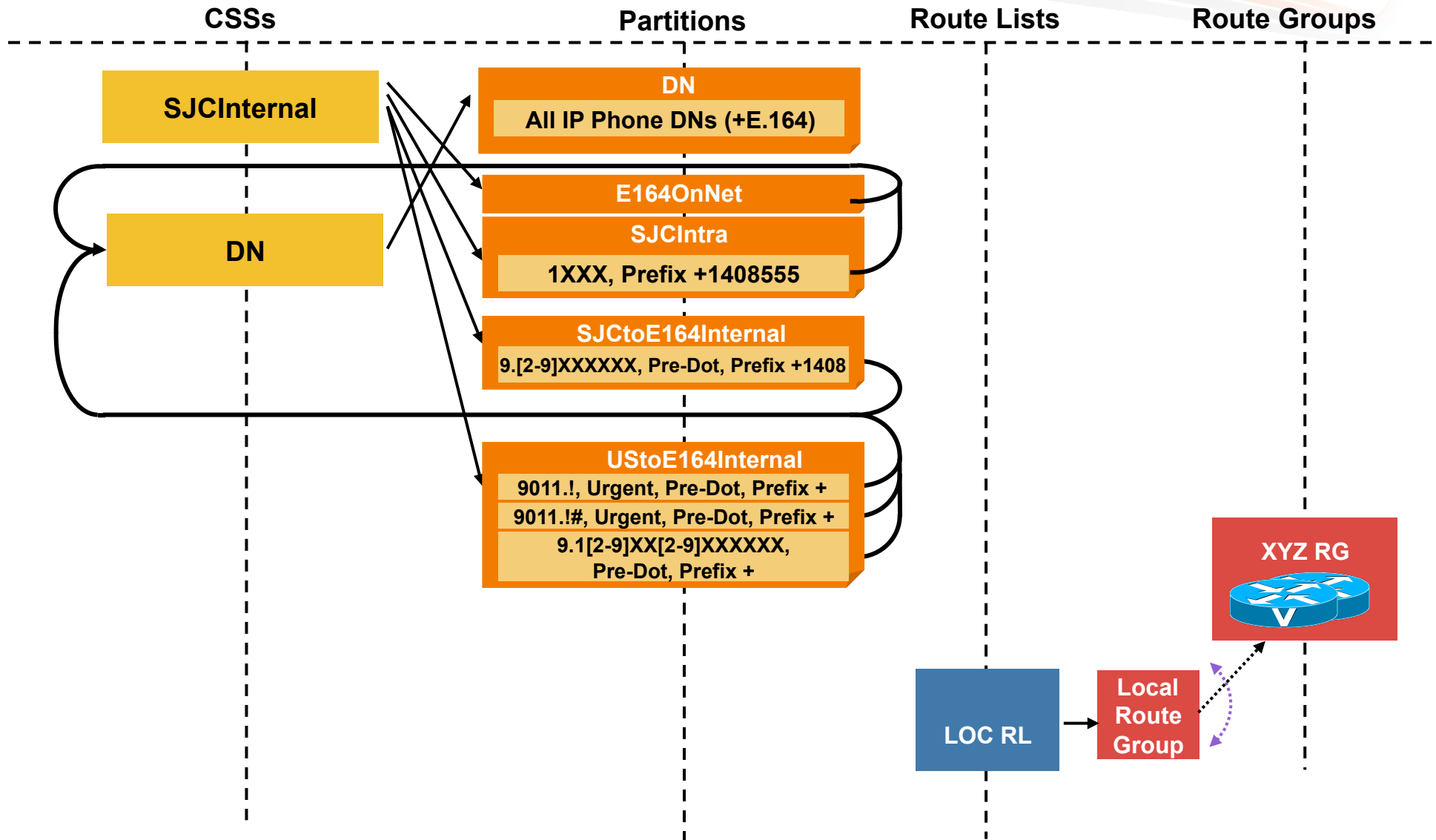


# CoS Internal



# CoS Internal

## Full Picture





# Remember

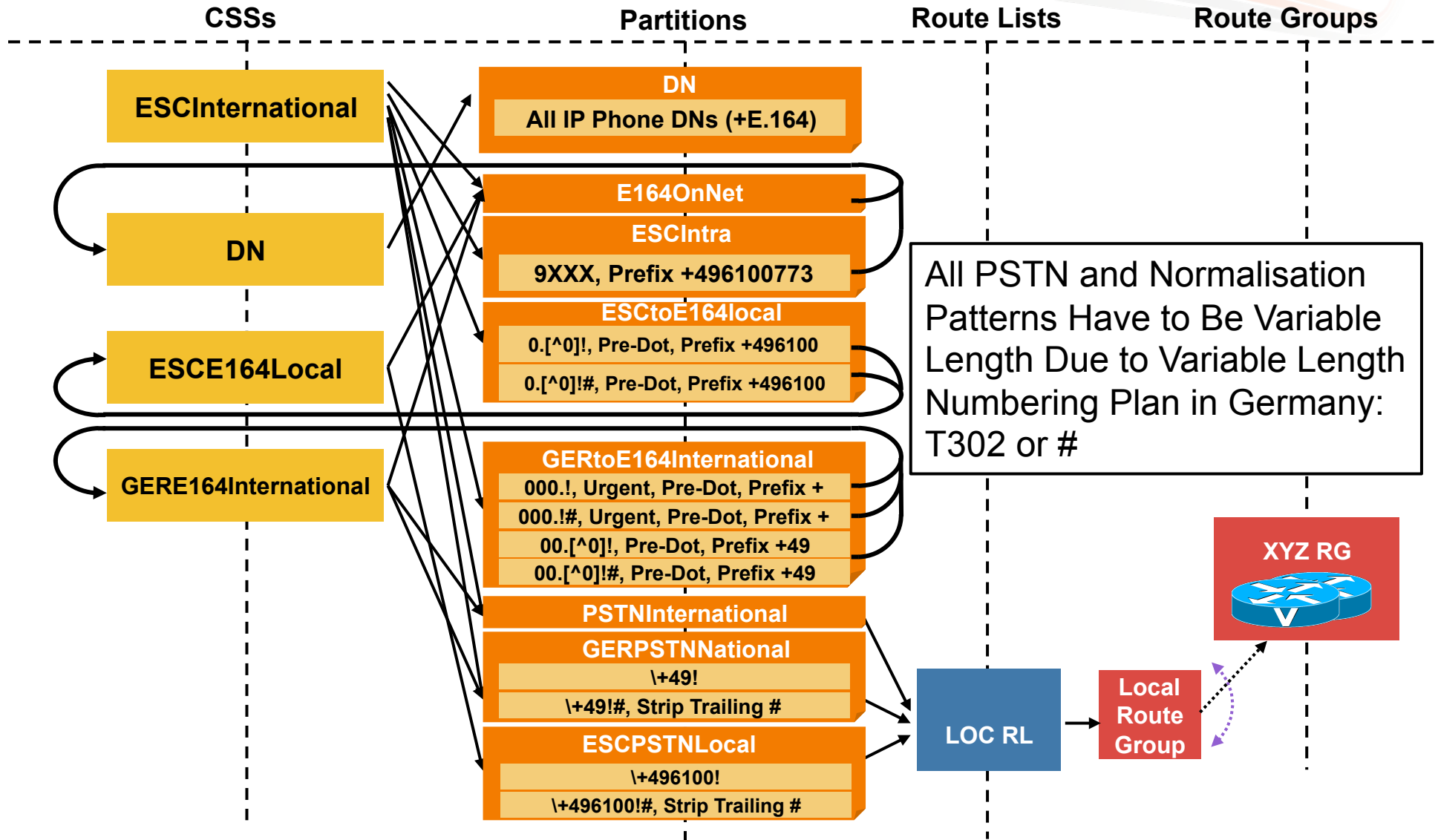
- Translation patterns used to normalise dialing to +E.164
  - Because TPs' resulting CSS implements new CoS (does not inherit the initial CoS), we need normalisation per CoS
- Non urgent DNs: Need to create urgent translation patterns to avoid T302 based on overlap between DNs and variable length PSTN route patterns

## Other Dialing Domains (Germany)

- Dialing normalisation needs to be adapted to national dialing habits
- Need to create:
  - GERtoE164International
  - GERtoE164National
  - GERPSTNNational
- Site specific dialing normalisation and local dialing normalisation also need to reflect national dialing habits

# CoS International (Germany)

## Full Picture



# Inbound Routing on Gateways

- Internal DNs are +E.164
- Format of received called party number is provider and technology depending
- Route after globalising to +E.164 on ingress
- Options
  - Incoming Called Party Settings: Prefixes and CSSes per number type (not on MGCP gateways and SIP trunks)
  - Inbound calls CSS; Translation Patterns to get to +E.164

# Inbound Routing on Gateways

## Incoming Called Party Settings

- H.323 Gateway, H.323 trunk
- Prefix or transformation CSS per type
  - Transformation CSS not used for call routing only for number transformations!
- Example: PSTN gateway in site ESC

**Incoming Called 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 unless the field is empty in which case there is no prefix assigned.

Number Type	Prefix	Strip Digits	Calling Search Space	Use Device Pool CSS
National Number	+49	0	< None >	<input checked="" type="checkbox"/>
International Number	+	0	< None >	<input checked="" type="checkbox"/>
Unknown Number	Default	0	< None >	<input checked="" type="checkbox"/>
Subscriber Number	+496100	0	< None >	<input checked="" type="checkbox"/>





# Emergency Calls

- Emergency Calls need to be enabled for ALL classes of service
- Emergency Calls need to be routed through an egress gateway local to the caller
- Different Emergency Numbers:
  - US: 911
  - Europe: 112
  - Other...
- Options:
  - Put emergency pattern in device CSS
  - Add emergency partition to all CoS CSSes

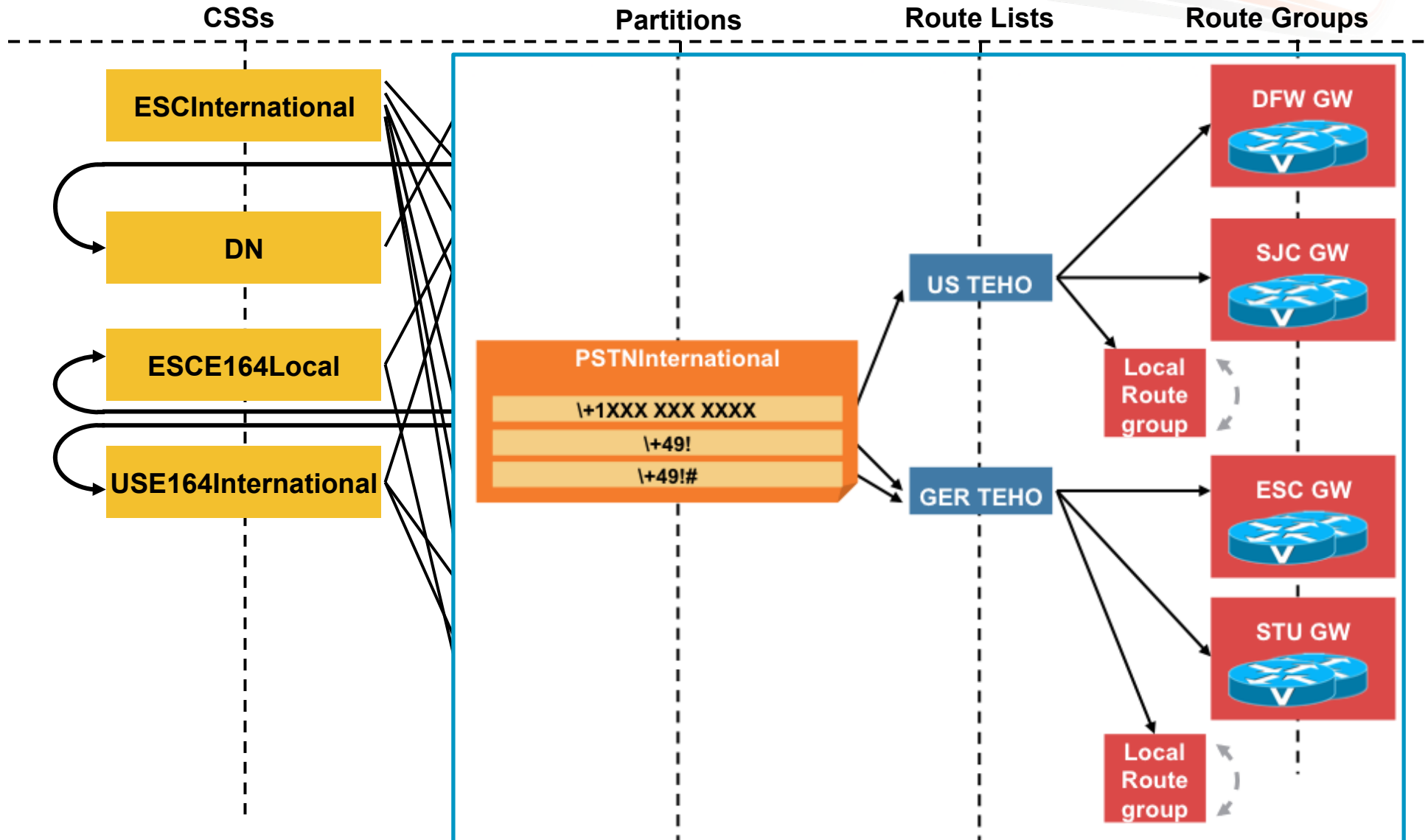


# Tail-End-Hop-Off

- Business case for national TEHO difficult
- Caller ID preservation?
  - CLIP No Screening
- National restrictions for international TEHO?
- TEHO implemented through specific route pattern overlays

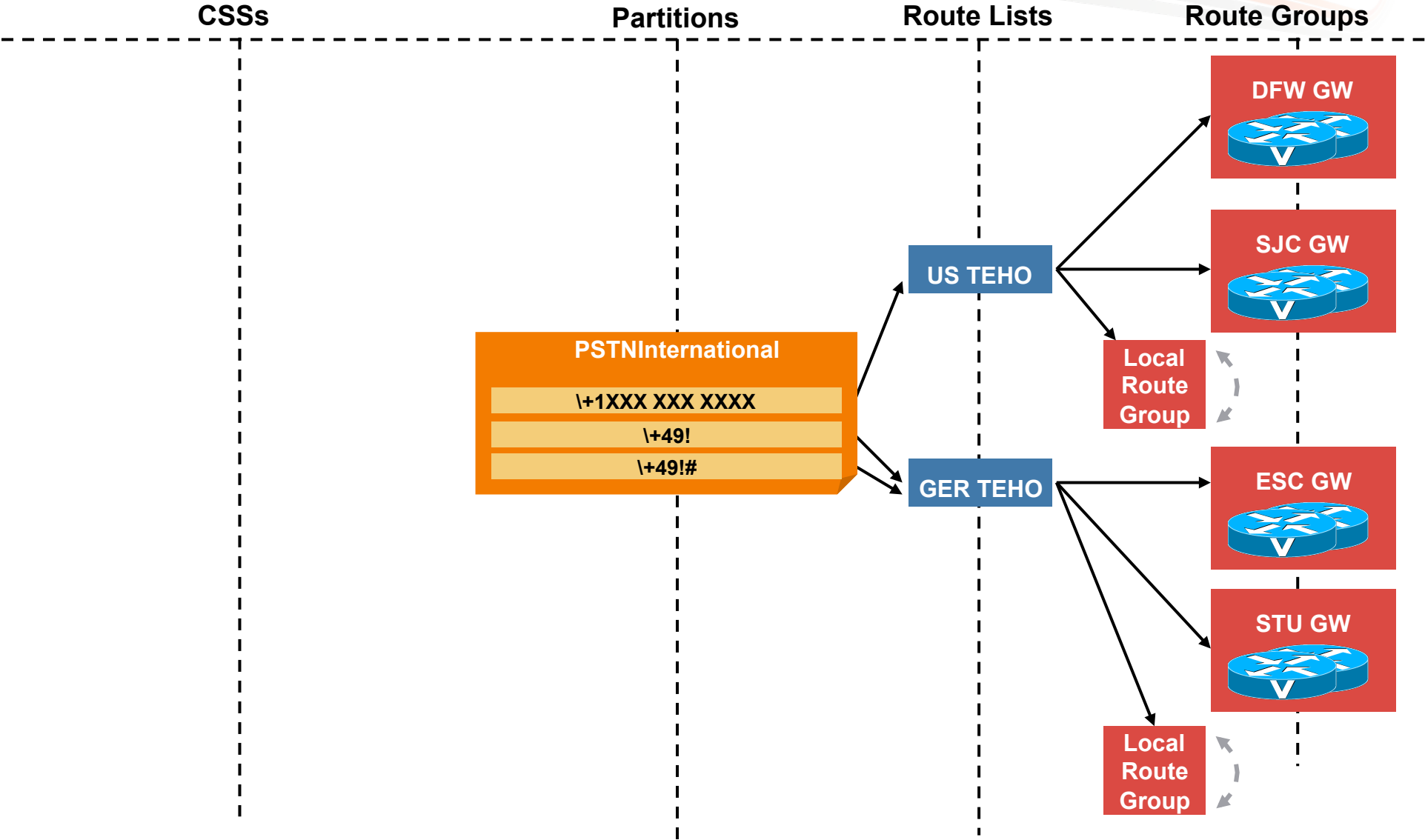
# International TEHO

## Full Picture



# International TEHO

## Full Picture





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- **Developing a Global Dial Plan – Number Presentation**
- SAF/CCD

# Calling/Called Number Transformations

## What It Is: Concept

- Calls presented to a phone or a gateway typically require the calling and the called party numbers be adapted to the local preferences/requirements of:
  - The user receiving the call
  - The gateway through which the call is routed
  - The network to which the call is routed
- Calls received from an external network (e.g., the PSTN) typically present calls in a localised flavor. We can now adapt the received call based on:
  - The numbering plan presented by the network for a specific call
  - The called/calling number delivered into the UC system by the gatewayCombining the two elements above, we can globalise the number upon entry

# Globalise on Ingress

- Goal is to get to +E.164
- 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); Example: Gateway for ESC

## 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 and 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 type="text" value=" &lt; None &gt;"/>
International Number	<input "="" type="text" value="+"/>	<input type="text"/>	<input type="text" value=" &lt; None &gt;"/>
Unknown Number	<input type="text" value="Default"/>	<input type="text"/>	<input type="text" value=" &lt; None &gt;"/>
Subscriber Number	<input type="text" value="+4961"/>	<input type="text"/>	<input type="text" value=" &lt; None &gt;"/>

# Localise on Phones

- Transform Calling Party Number to shortest possible format
- Example for SJC phones (+1 408 555 1XXX):

Calls from	Display as
+1 408 555 1XXX	1XXX
+1 XXX XXX XXXX	91 XXX XXX XXXX or XXX XXX XXXX
+XX...	9011XX... or +XX...

Is This a Problem?

- Callback from missed calls directory goes to pre-transformation number! (globalised number)
- Displayed number does not need to be dialable



# Number Transformations

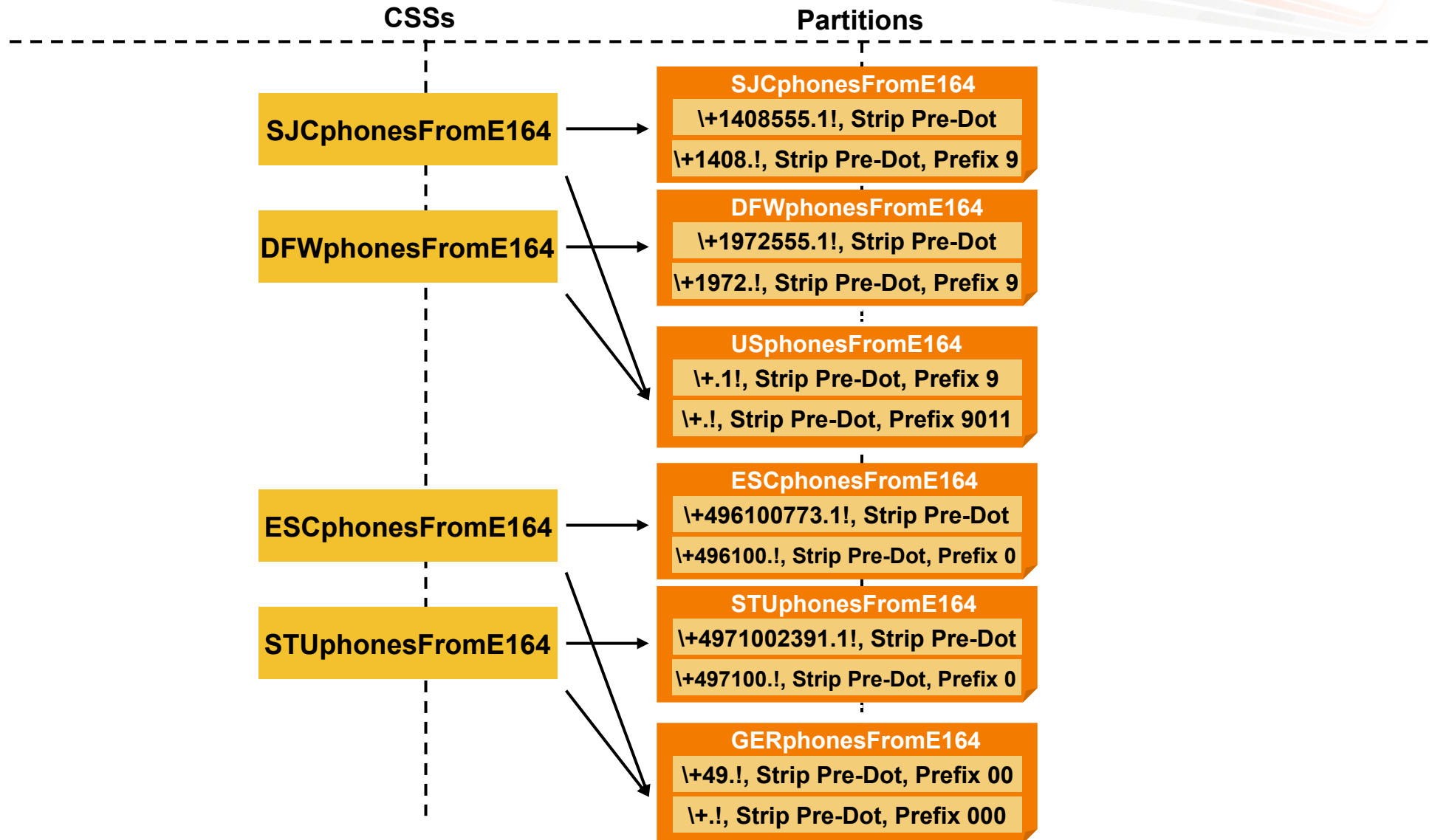
## Calling Party Transformation Pattern

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

The screenshot shows the 'Calling Party Transformation Pattern Configuration' window. At the top, there are icons for Save, Delete, Copy, and Add New. Below this is a 'Status' section with an information icon and the text 'Status: Ready'. The 'Pattern Definition' section contains several fields: 'Pattern\*' with the value '\+1408555.1!', 'Partition' with 'SJCphoneFromE164', 'Description' (empty), 'Numbering Plan' with '< None >', and 'Route Filter' with '< None >'. There is also a checked checkbox for 'Urgent Priority'. The 'Calling Party Transformations' section includes a checkbox for 'Use Calling Party's External Phone Number Mask' (unchecked), 'Discard Digit Instructions' with 'PreDot', 'Calling Party Transformation Mask' (empty), 'Prefix Digits' (empty), 'Calling Line ID Presentation\*' with 'Default', 'Calling Party Number Type\*' with 'Cisco CallManager', and 'Calling Party Numbering Plan\*' with 'Cisco CallManager'.

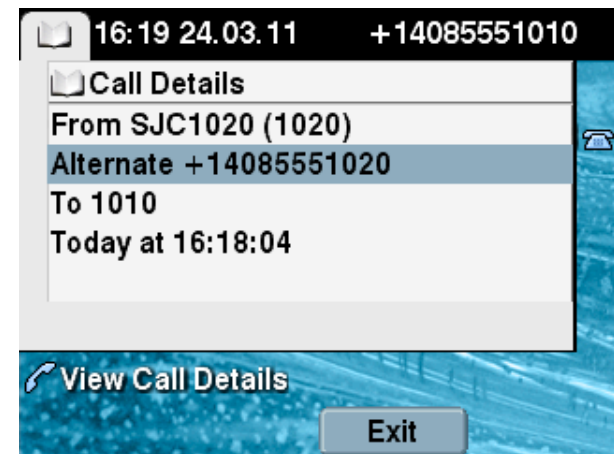
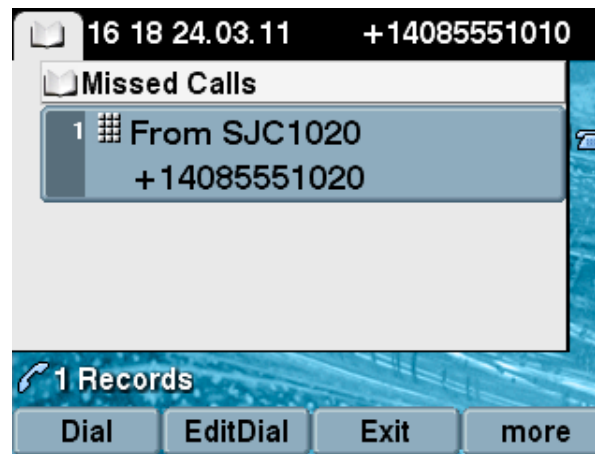
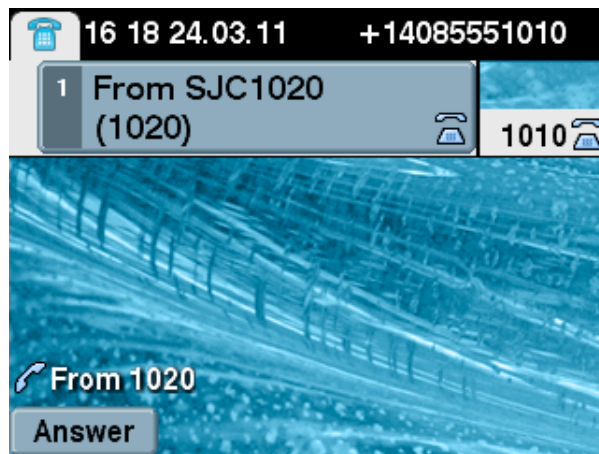
# Calling Party Normalisation

## From +E.164 to Shortest Presentation



# Phone Directories

- Calling Party Numbers are transformed using phone's (or device pool's) calling party transformation CSS
- Pre-Transformation number is stored in phone directory and is used for callback
- Normalised (post-transformation) number does not necessarily need to be a dialable number
- Pre-Transformation number needs to be dialable



# Egress Called Party Normalisation

## Gateways / Trunks




- Required format for called party numbers typically defined by the provider
- Use Called Party Transformation CSS for outbound calls
- Caveat: Device level transformations have no effect on Q.SIG APDUs
- Example: PSTN gateway in Germany

Calls to	Send as
+49XXX...	XXX..., ISDN, National
+XXX...	XXX..., ISDN, International


# Egress Called Party Normalisation

## Example: German PSTN Gateway

**Called Party Transformation Pattern Configuration**

Save  Delete  Copy  Add New

**Status**

 Status: Ready

**Pattern Definition**

Pattern\*

Partition

Description

Numbering Plan

Route Filter

Urgent Priority

**Called Party Transformations**

Discard Digits




Called Party Transformation Mask

Prefix Digits


Called Party Number Type\*

Called Party Numbering Plan\*

**Called Party Transformation Pattern Configuration**

Save  Delete  Copy  Add New

**Status**

 Status: Ready

**Pattern Definition**

Pattern\*

Partition

Description

Numbering Plan

Route Filter

Urgent Priority

**Called Party Transformations**

Discard Digits

Called Party Transformation Mask

Prefix Digits

Called Party Number Type\*

Called Party Numbering Plan\*

# Egress Calling Party Normalisation

## Gateways / Trunks

- Like called party normalisation, but use CALLING party transformation patterns and CSS!
- When using the device pool calling party CSS make sure that device pool is not shared by phones and gateways (typically require different transformations)
- Optional:
  - Filter non-DIDs and send dummy instead
  - Implement screening, if number does not match the number range assigned to the trunk by the provider



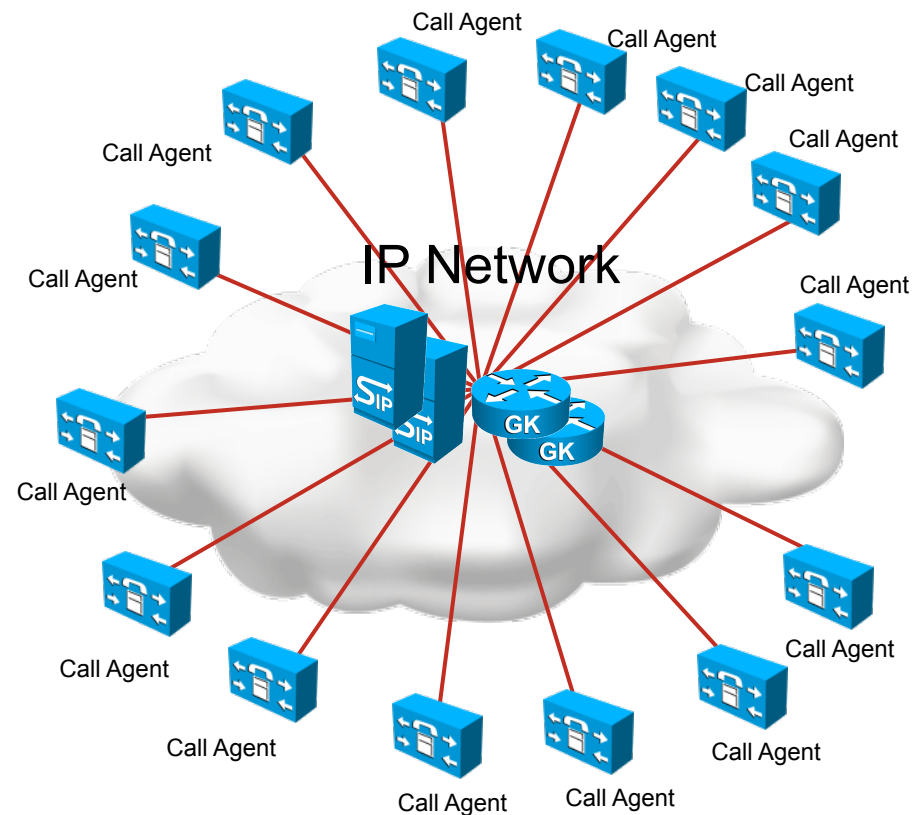
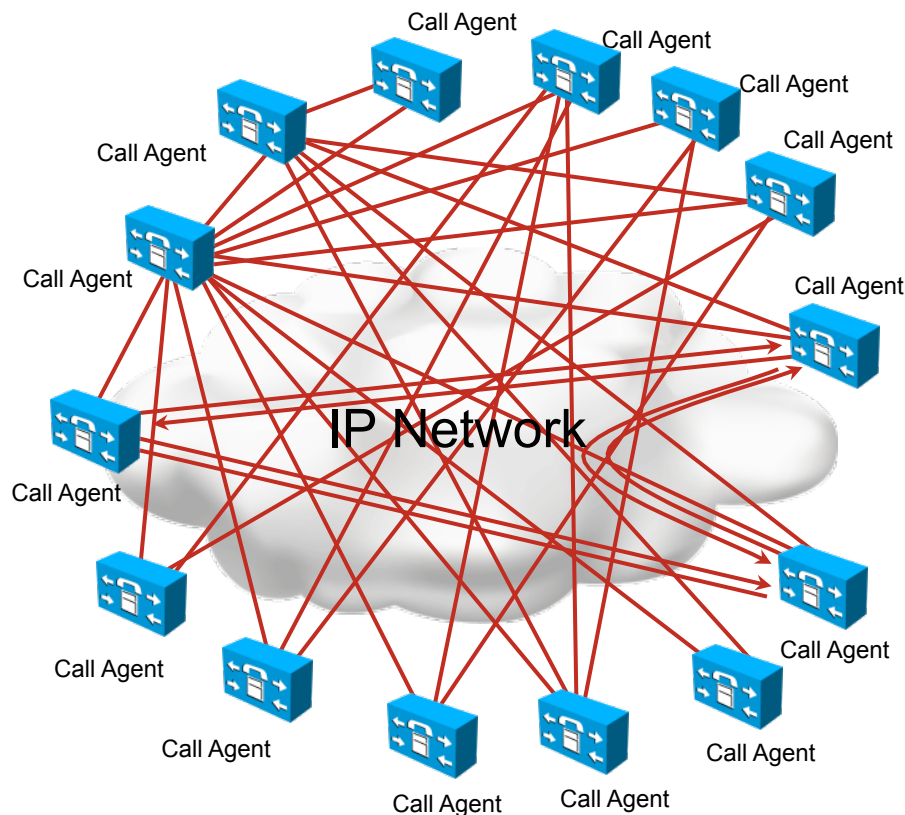
# Agenda

---

- Introduction
- Call Routing Recap
- Developing a Global Dial Plan – Call Routing
- Developing a Global Dial Plan – Number Presentation
- **SAF/CCD**

# Dial Plans in Large Networks

- Dial plans in large networks are difficult to implement and maintain
- Centralized call routing intelligence improves scalability but still does not scale well in very large networks





# Dial Plan Scalability Issues in Large Networks

- Call routing information between separate call routing domains has to be manually configured:
  - Full-mesh configuration
    - Extremely complex, only suitable for small networks
  - Hub-and-spoke configuration when using centralized call routing entities (SIP network services or H.323 gatekeepers)
    - Scales better than full-mesh topologies
    - Requires redundant deployment of central services
- Changes have to be manually configured
- PSTN backup has to be implemented independently at each call routing domain
- No dynamic exchange of call routing information, no automatic PSTN backup

# Scalable Dial Plan Solution for Large Networks

- **Solutions for dynamic exchange** of routing information exist

## Dynamic IP routing protocols

- Routers have local networks attached

- Routers advertise local networks to other routers

- All routers learn all available networks and how to get there

- **Same concept** can be used for **call routing** information

- Call routing domains advertise telephone numbers or number ranges

- Internal numbers and IP address for VoIP

- External numbers for PSTN backup

- **Call Control Discovery** (CCD) has been introduced with Cisco Unified Communications version 8

- Call agents can advertise and learn call routing information using

- Cisco Unified Communications Manager

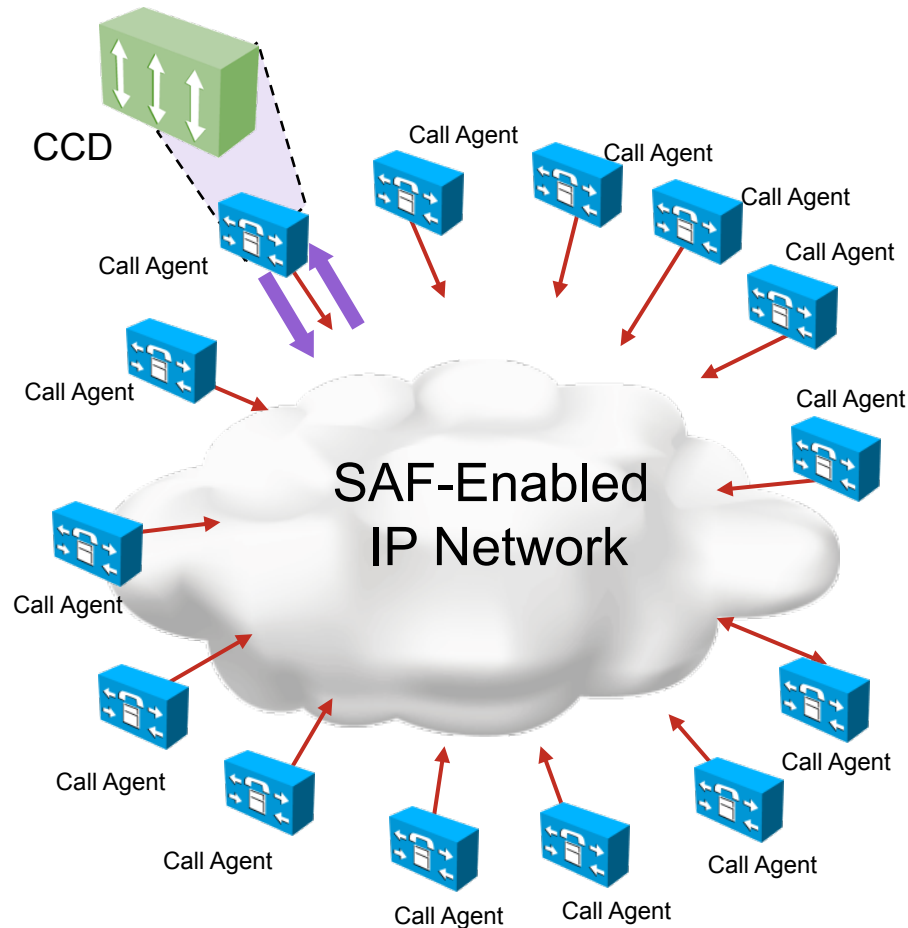
- Cisco Unified Communications Manager Express

- Cisco Unified SRST

- Cisco Unified Border Element

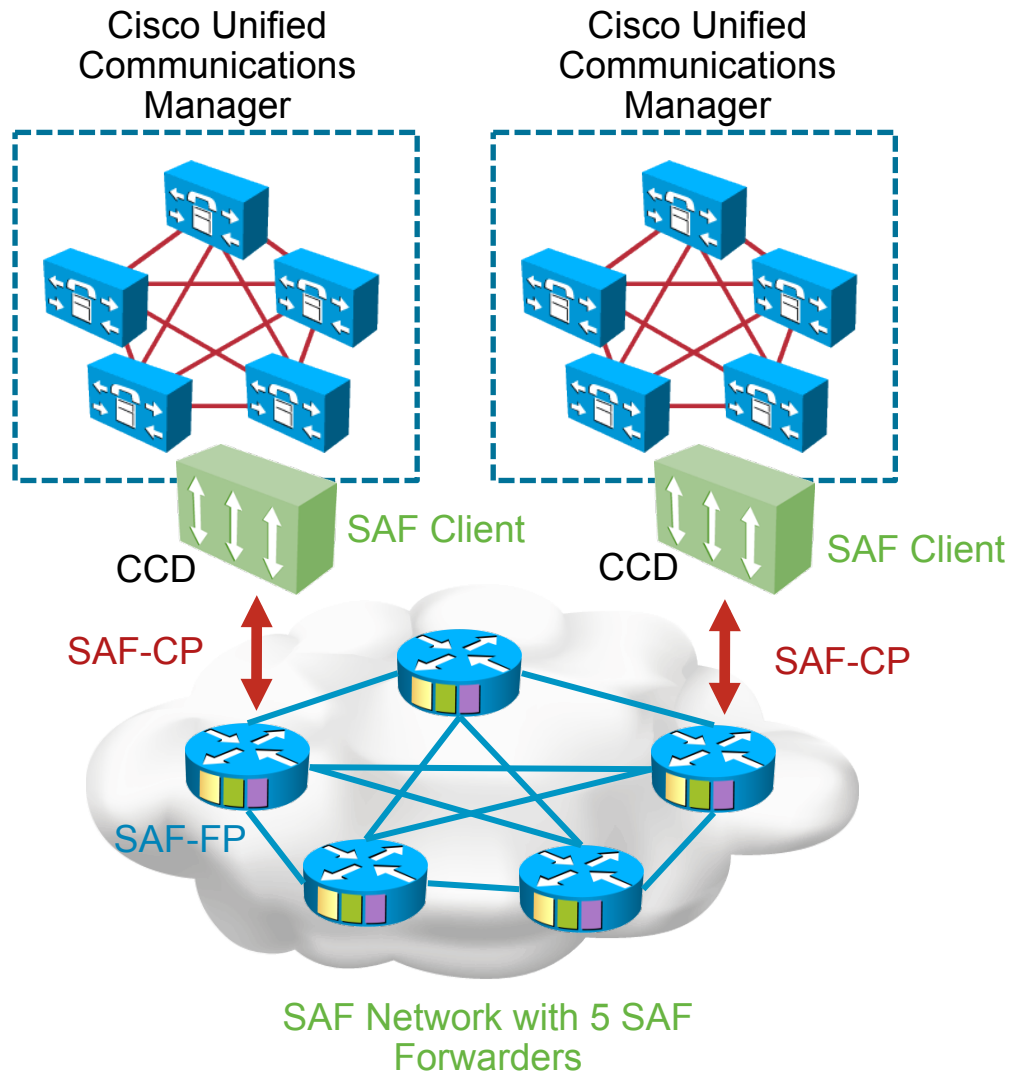
- Cisco IOS Gateway

# Call Control Discovery Overview



- CCD-enabled call agents advertise to and learn from “the network”
- SAF is used to distribute information within the network
- Service Advertisement Framework (SAF) forwarders interact with CCD-enabled call agents (SAF clients):
  - SAF forwarder learns information from SAF client
  - SAF forwarders distribute information among each other
  - SAF forwarder advertises all learned information to SAF client

# SAF Components



- SAF supports any service to be advertised
- CCD is the first Cisco application using SAF to advertise services (call routing)

## SAF Network Components

### SAF Forwarders

Exchange service information among each other  
Use the SAF forwarding protocol (**SAF-FP**)

### SAF Clients

Advertise services to and learn services from SAF forwarders

Use SAF client protocol (**SAF-CP**) to interact with SAF forwarders

In case of CCD, SAF client is a call agent

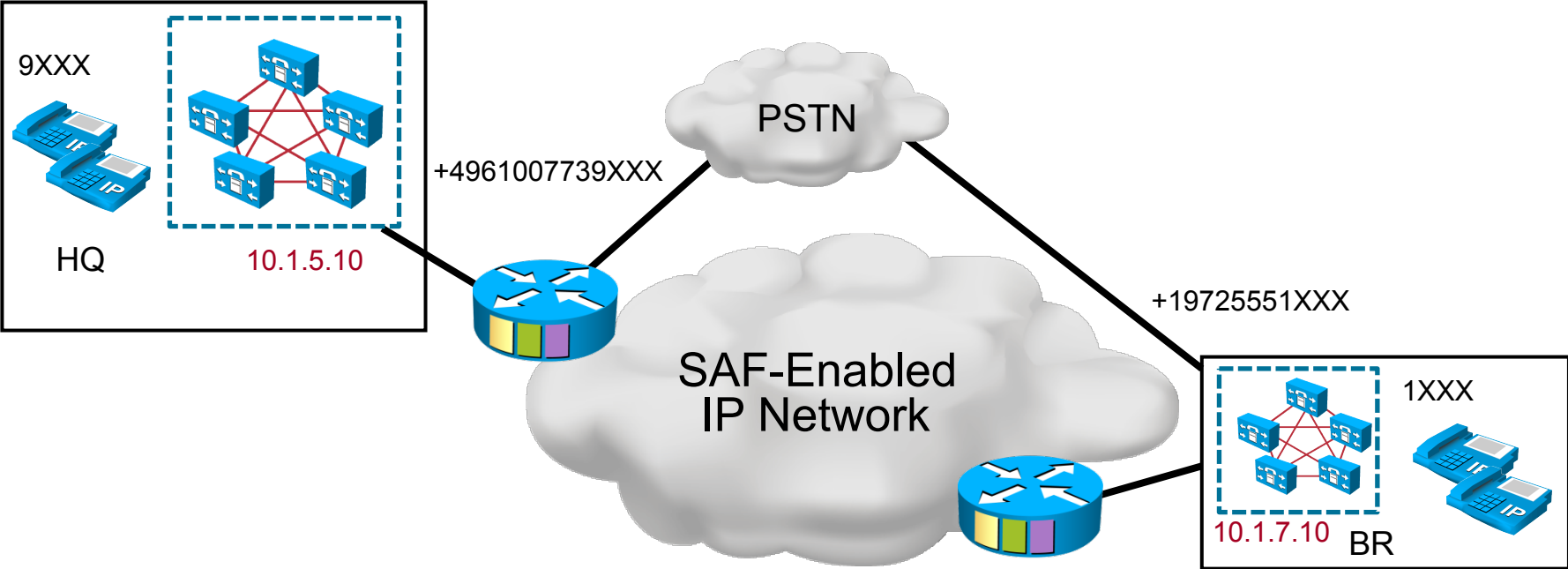
# CCD—Base Configuration

HQ Learned Routes

DN Pattern	“ToDID” Rule	IP Address	Protocol

BR Learned Routes

DN Pattern	“ToDID” Rule	IP Address	Protocol



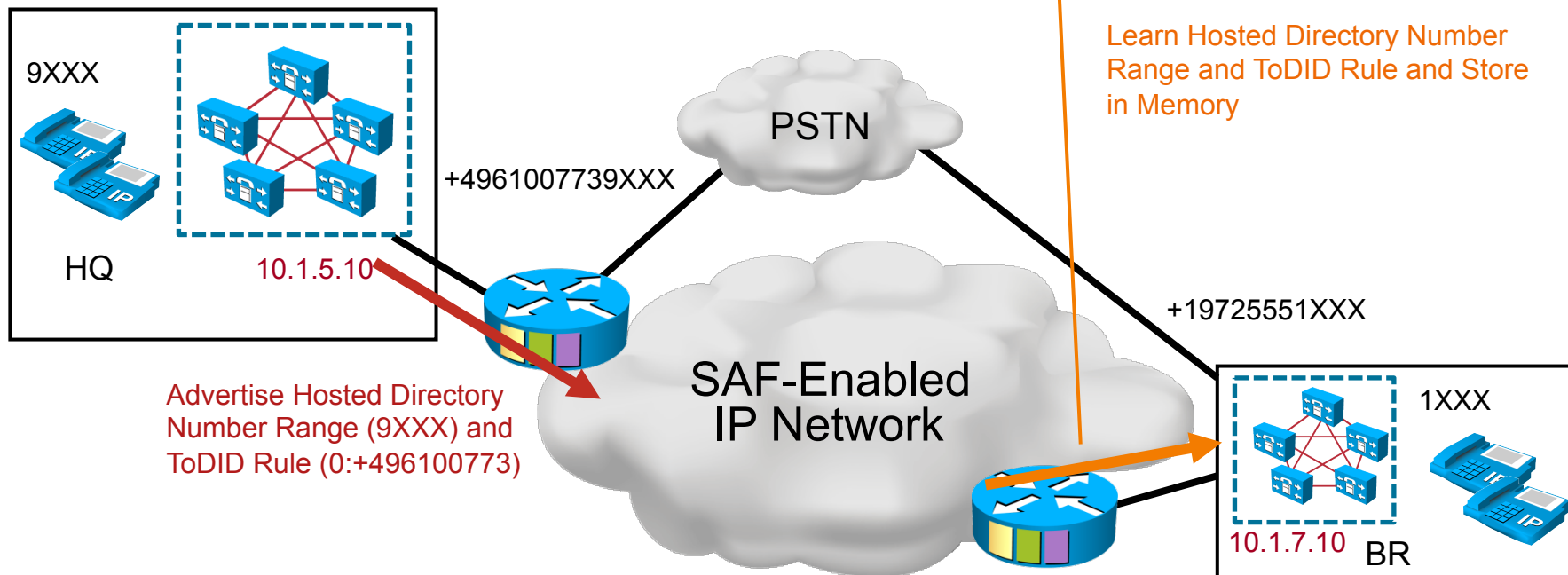
# CCD—Propagation of HQ Routes

HQ Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol

BR Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
9XXX	0:+496100773	10.1.5.10	SIP



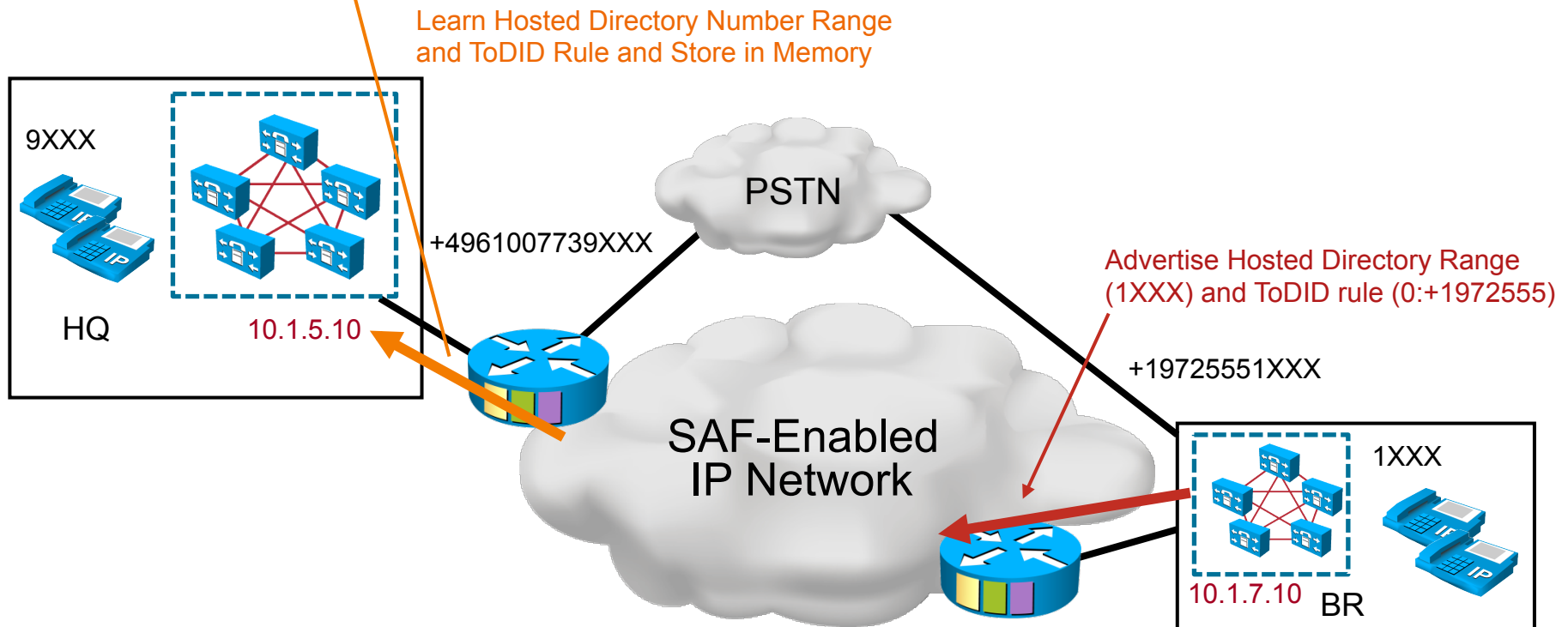
# CCD—Propagation of BR Routes

HQ Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
1XXX	0:+1972555	10.1.7.10	SIP

BR Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
9XXX	0:+496100773	10.1.5.10	SIP



# CCD—Call from HQ to BR

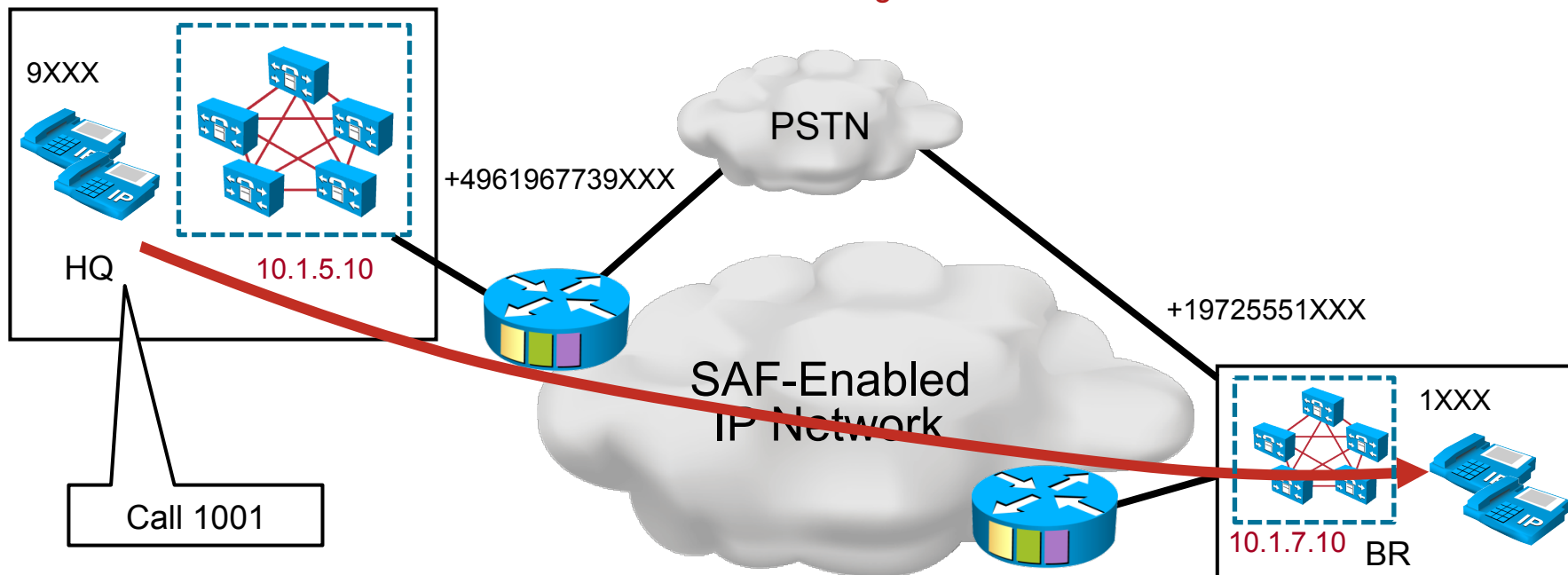
HQ Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
1XXX	0:+1972555	10.1.7.10	SIP

BR Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
9XXX	0:+496100773	10.1.5.10	SIP

Call Placed to 1001 Using SIP Trunk to 10.1.7.10





# CCD—Link Failure at BR

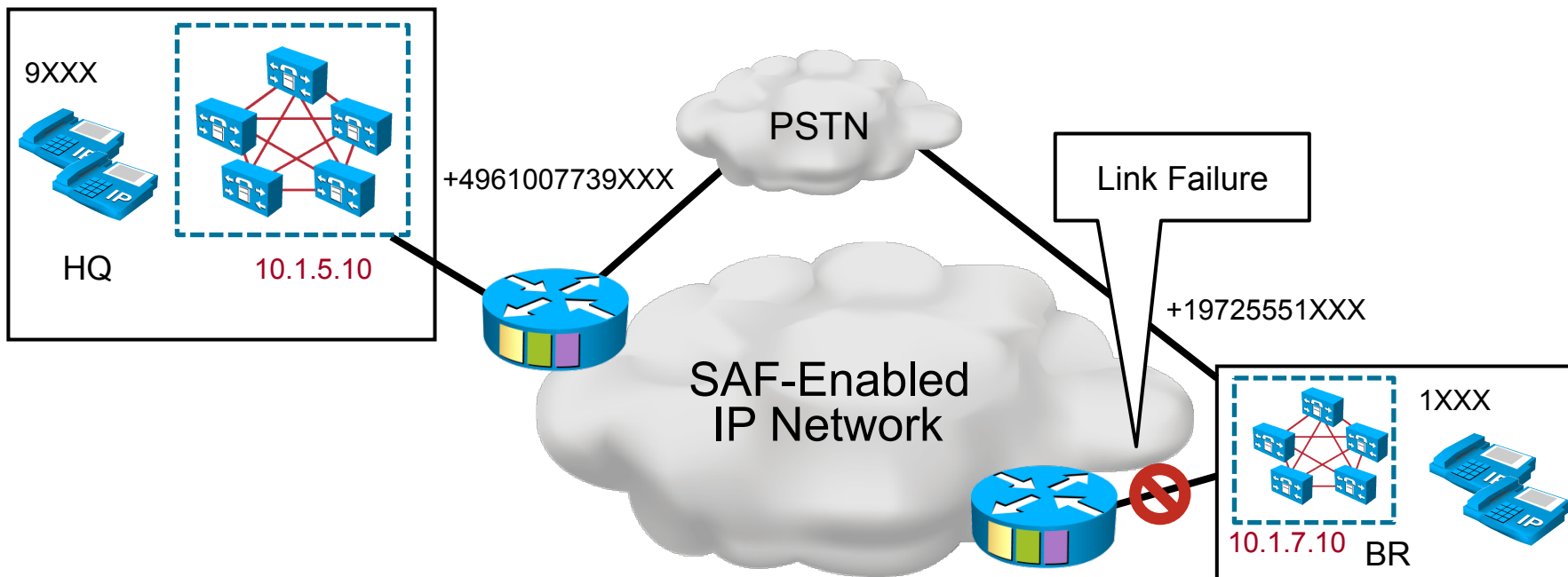
HQ Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
1XXX	0:+1972555	10.1.7.10	SIP

Marked Unreachable

BR Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
9XXX	0:+496100773	10.1.5.10	SIP



# CCD—Call from HQ to BR During Link Failure

HQ Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
1XXX	0:+1972555	10.1.7.10	SIP

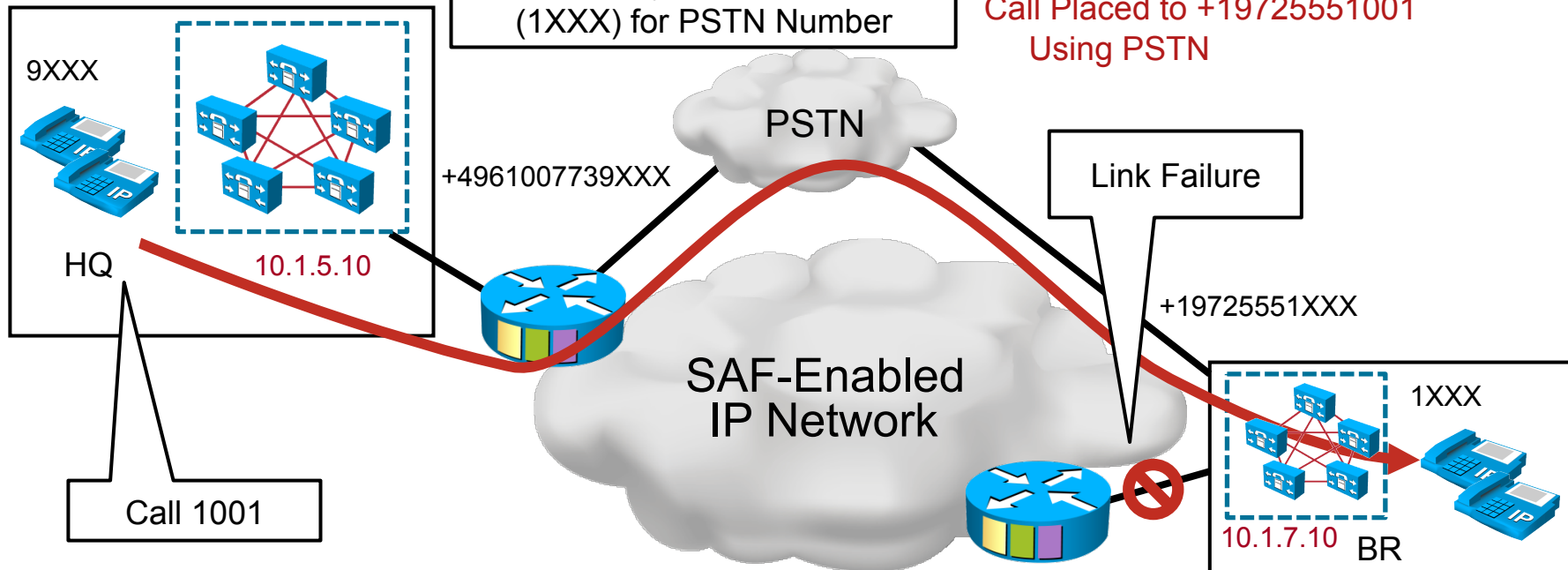
Marked Unreachable

BR Learned Routes

DN Pattern	"ToDID" Rule	IP Address	Protocol
9XXX	0:+496100773	10.1.5.10	SIP

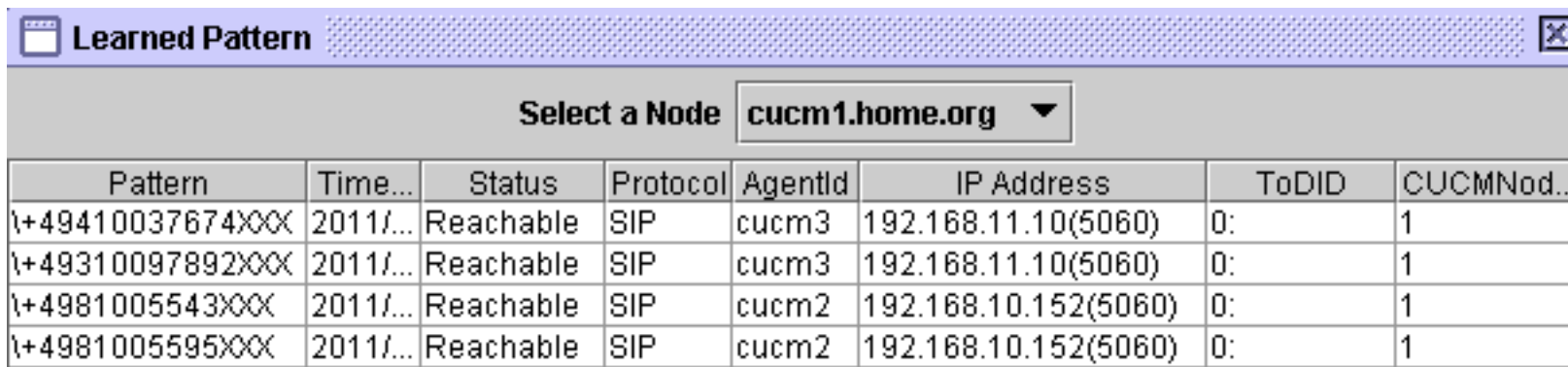
Strip 0 Digits, Prefix +1972555 to Directory Number Pattern (1XXX) for PSTN Number

Call Placed to +19725551001 Using PSTN



# Monitoring learned Patterns

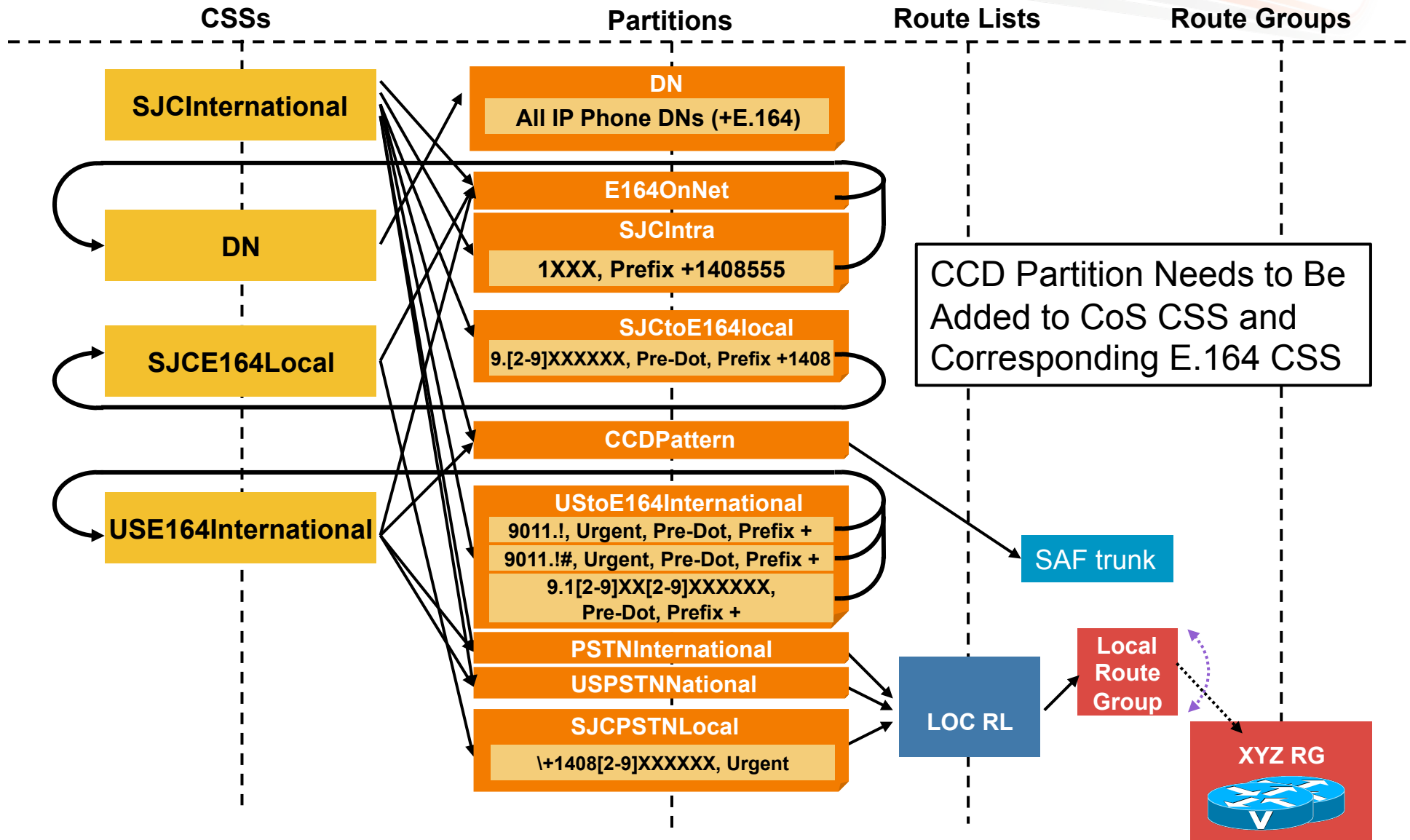
- CCD learned patterns are added to UCM digit analysis dynamically
  - Not displayed in route plan report
  - Invisible in UCM administration
- Use RTMT do view learned patterns
- Learned patterns are display without “Learned Pattern Prefix” configured in CCD requesting



Pattern	Time...	Status	Protocol	AgentId	IP Address	ToDID	CUCMNod...
\+49410037674\XXX	2011/...	Reachable	SIP	cucm3	192.168.11.10(5060)	0:	1
\+49310097892\XXX	2011/...	Reachable	SIP	cucm3	192.168.11.10(5060)	0:	1
\+4981005543\XXX	2011/...	Reachable	SIP	cucm2	192.168.10.152(5060)	0:	1
\+4981005595\XXX	2011/...	Reachable	SIP	cucm2	192.168.10.152(5060)	0:	1

# CoS International

## Integrating CCD Partition



# CCD and Static Routing Integration Considerations

- All routes **learned by CCD** are put into the **same partition**
- If partition is **listed first** in CSS it has **priority for equally-qualified matches**
  - Allows **learned routes** to take **precedence** over statically configured backup routes
  - Make sure that backup routes in later partitions are not more specific than learned hosted DNSs
- Routes in **later partition(s)** are **only considered** after learned entry is **completely deleted**
  - Learned **IP path** is tried until *CCD Learned Pattern IP Reachable Duration* (default **60 seconds**) expiration
    - If IP path does not work during this time, the **call fails**
  - ToDID is used as **backup** after expiration of *CCD Learned Pattern IP Reachable Duration* until expiration of *CCD PSTN Failover Duration*
    - If no ToDID configured, **call fails** during this time
  - Only after expiration of *CCD PSTN Failover Duration* (default **48 hours**) learned pattern is completely removed
    - Static backup** patterns are now considered

# CCD Overlap with PSTN Routes

- Specific DN ranges learned via CCD overlap with variable length PSTN patterns:
  - \+! – PSTNInternational
  - \+49! – GERPSTNNational
- T302 when dialing CCD destinations that overlap with variable length PSTN route patterns
- Hitting “#” forces call to PSTN (no match on CCD patterns)
- \+1XXXXXXXXXX, urgent in USPSTNNational will avoid T302 with US patterns learned through CCD
  - Keep in mind that urgent patterns only terminates digit collection, but still the best pattern is selected
- Abbreviated on-net patterns (like 8XXXYYYY) will not overlap with any variable length pattern



# Remember

- Best and most important tools for dial plan design:
  - Pencil
  - Paper
  - Whiteboard
- Dial plans are not a new concept
- IP did not really change the fundamentals of dial plan design
- Dial Plan recommendations are not a monolith
  - Take what you need
- Keep it simple!

# Complete Your Online Session Evaluation

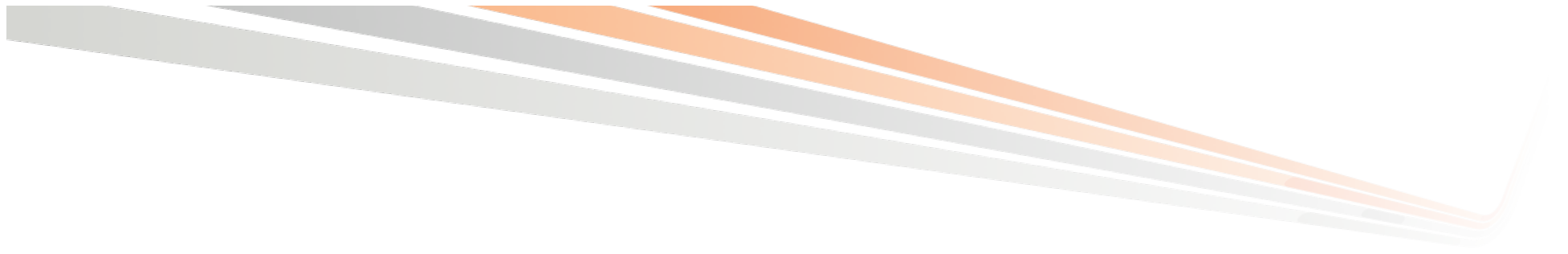
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- Complete your session evaluation online now (open a browser through our wireless network to access our portal) or visit one of the Internet stations throughout the Convention Center.
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