DESIGNING AND DEPLOYING IP VIDEO TELEPHONY NETWORKS

Session VVT-2100

Networkers Solution Forum Argentina

Presenter:

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Recuerde siempre:

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- Apagar su teléfono móvil/pager, o usar el modo “silencioso”.

- Completar la evaluación de esta sesión y entregarla a los asistentes de sala.

- Ser puntual para asistir a todas las actividades de entrenamiento, almuerzos y eventos sociales para un desarrollo óptimo de la agenda.

- Completar la evaluación general incluida en su mochila y entregarla el miércoles 8 de Junio en los mostradores de registración. Al entregarla recibirá un regalo recordatorio del evento.

Questions This Presentation Will Address

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- **What is video telephony?**
- **What do I do with my existing H.323 equipment?**
- **How does CM4.1 control video endpoints?**
- **How do I design my network for QoS with video telephony?**
- **How does the addition of video effect my existing IP telephony deployment?**

Goals of This Session

- Understand how voice and video have been unified with Cisco CallManager 4.x
- Understand the integration of SCCP and H.323 devices - terminals, mcu's, gateways
- Understand the design options and capabilities for video telephony
- Learn how to configure Cisco CallManager and H.323 video gatekeepers, MCUs and gateways to be able to route calls back and forth to each other

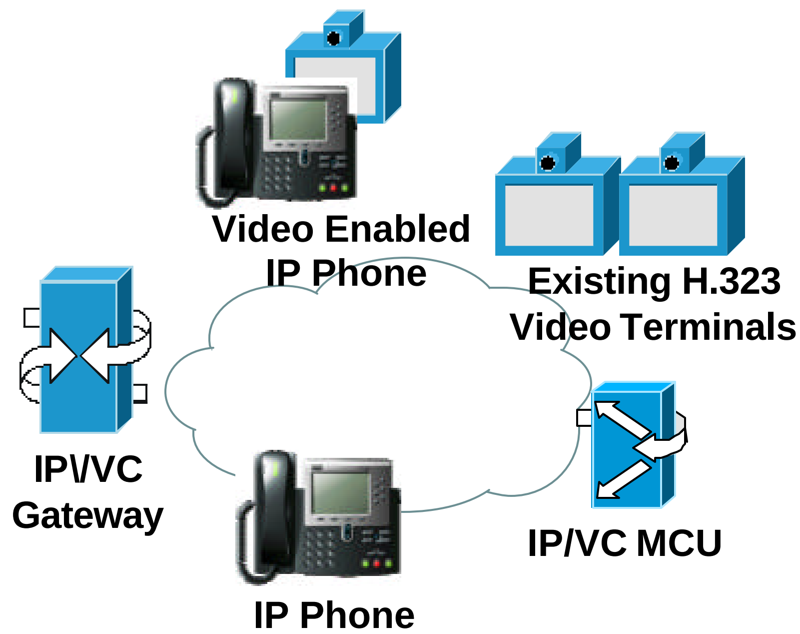
Agenda

- Video Telephony Fundamentals
- Endpoint, MCU and Gateway Integration
- Centralized Design and Deployment
- Distributed Design and Deployment
- Configuration

Introduction
Video Is a Phone Call

User friendly

- Unified voice and video dial plans
  - CDR, QoS, CAC, AAR
- Single number for voice and video
- Video calls dialed like voice calls
- Video calls have same services as voice calls
  - Basic call, mute, hold, park, transfer, conference
  - Forward, XML services
- Single point of management and administration—Proven scalability



Preserves customer investments

- Calls can be made to H.323 or SCCP video/audio terminals

Introduction
Video Telephony Solution Components

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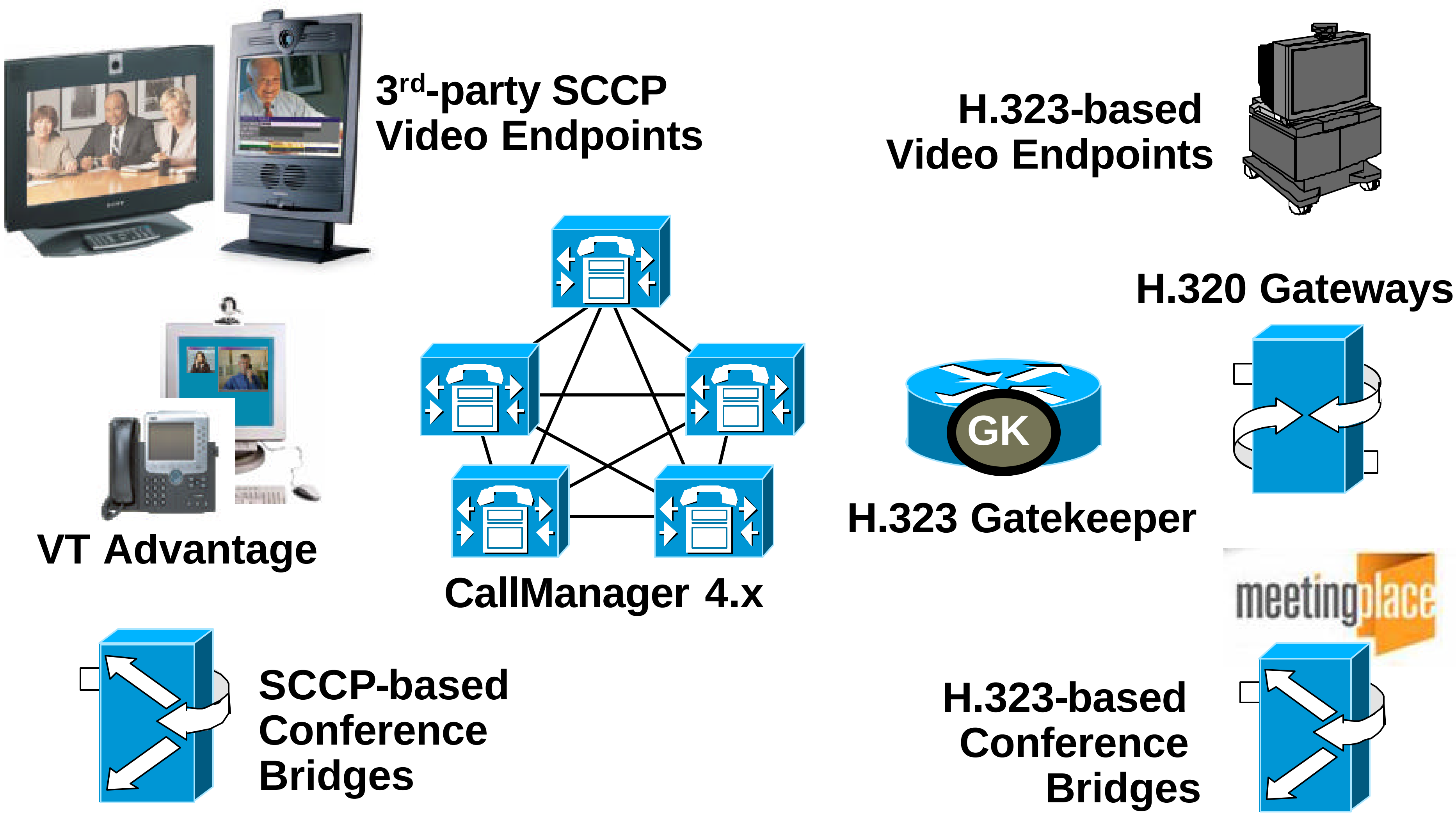

How Does It Work? Video Call Manager Example

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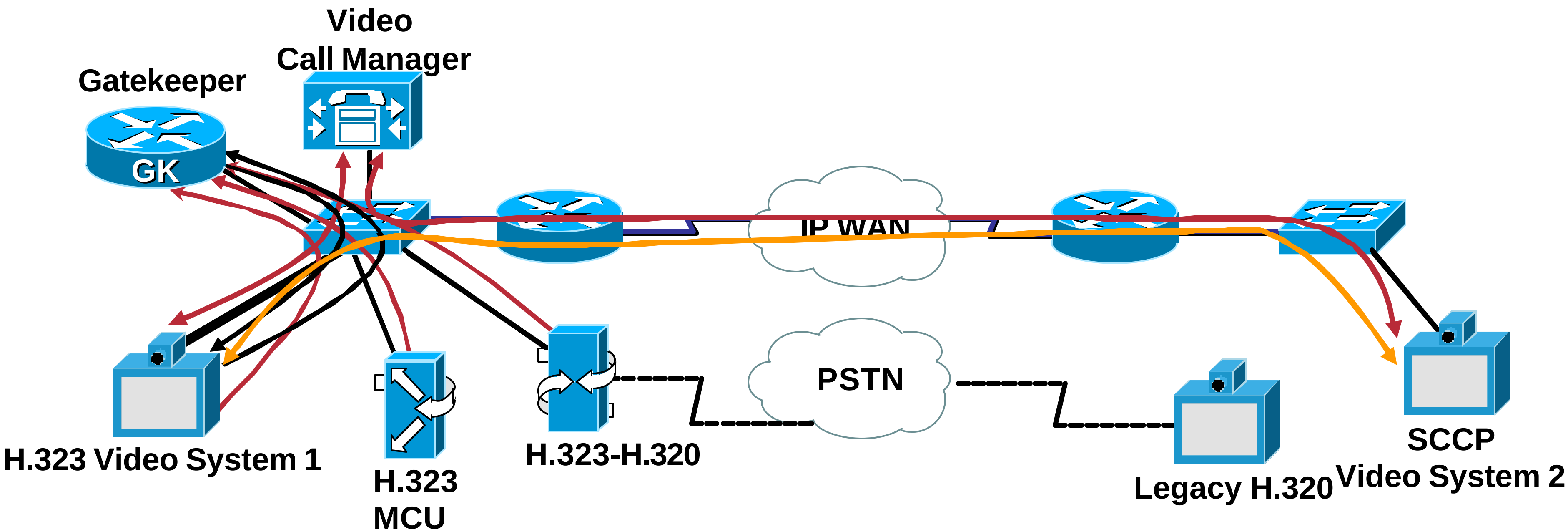

- All H.323 video devices register with gatekeeper (IP Address, E.164, H323-ID)
- Video System 1 dials video system 2 (using E.164), gatekeeper forwards call request to VCM based on "default-technology" registration
- Video system 1 sends call setup to VCM and VCM resolves address
- Video system 1 connects (video and audio) directly to video system 2; H.245 Control traffic is routed through VCM

Introduction
Cisco CallManager 4.1(3) Video Features

- **Cisco Callmanager 4.0 Video Enhancements**
  - H.323 and SCCP Protocol Stacks modified to support video capabilities
    - Added support for H.261, H.263+, Wideband Video, G.728, G.722, and FECC
  - New Cisco VT Advantage + IP Phone endpoint solution
  - SCCP protocol stack added to Cisco IP/VC 3511 and 3540 MCUs
  - Support for H.323 utilizing IP/VC 3511 and 3540 MCU's
  - Video Dial Plan Management/Call Routing (Partitions, CAC, Calling Search Spaces, Route Patterns, Translation Patterns, Shared Line Appearances, Hunt Groups, Auto-Alternate Routing, Call Forwarding, etc.)
  - Video statistics enabled
- **What did Cisco Callmanager 4.1 Enhance over Call Manager 4.0?**
  - SCCP H.264 support
  - Mid-Call Video for CVTA
  - Video Display Mode for IPVC 4.0
  - Video conference Participant Information for IPVC 4.0
  - Dynamic H.323 Addressing (E.164 addressing for GK controlled endpoints)

Introduction
Deployment Models Supported

- **Basically, any deployment model supported for voice is now also applicable for video, including:**
  - **Single-Site Deployments**
  - **Centralized Call Processing**
  - **Distributed Call Processing**
  - **V³PN / Telecommuter environments**
  - **Integration with existing H.323 and H.320 videoconferencing endpoints, MCUs, gateways and gatekeepers**
  - **Utilizing CM4.1 and IP/VC 4.0**

Agenda

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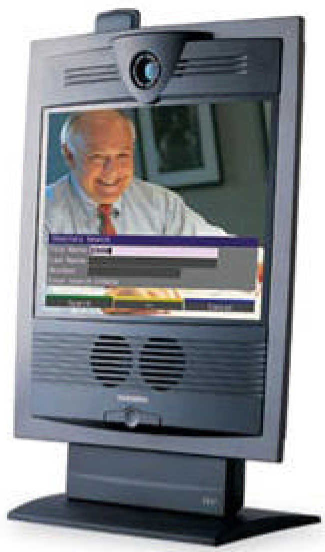
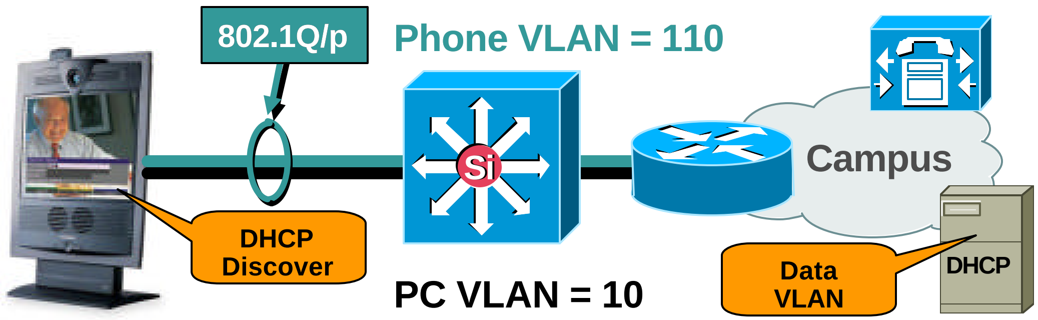
SCCP Endpoints
Tandberg Devices SCCP Release 1.X



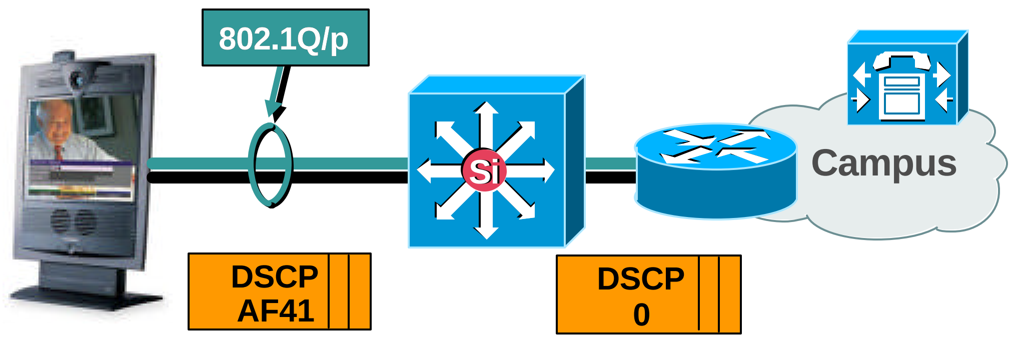
- DHCP Option 150 Support
- No CDP support
- Downloads Config via TFTP (e.g. SEPXXXXXXXXXXXX.cnf.xml)
  - Software versions are not downloaded via TFTP (Tandberg SCCP Upgrade Tool available from Tandberg)
  - Software release key obtained from Tandberg
- CallManager QED Device Patch Installer (available from Tandberg) required
- Functions just like a SCCP IP Phone
  - SoftKeys, Settings, Messages, Directories (Received/Placed/Missed/Corporate), XML Services*
- H.261, H.263+, G.711 and Far-End Camera Control
- T-1000 and T-550 models only (additional models will be supported in the future)

* Many XML services not yet supported, such as Extension Mobility for instance

SCCP Endpoints
No CDP or 802.1Q/p Support in Third-Party Devices



- **Device will come up in the PC VLAN**
  - **Option 150 must be enabled in the PC VLAN DHCP scope or else alternate TFTP must be used**



- **Devices mark DSCP correctly, but 802.1p COS will be empty**
  - **If switch is set to trust COS, DSCP will be rewritten to 0**
  - **Must set switch port to trust DSCP instead, or use an ACL**

SCCP Endpoints
Cisco VT Advantage

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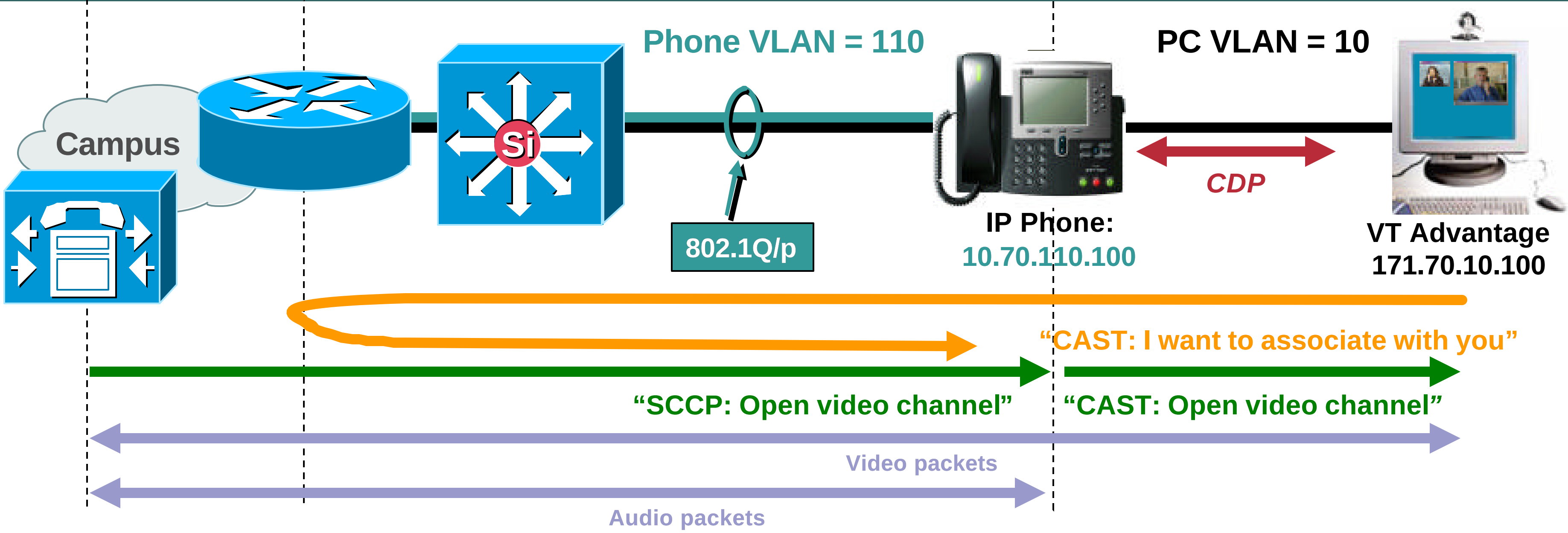
- Supported on 7940/7960 firmware version 6.0(4) and 7970 firmware version 6.0(2)
- Video-Capabilities Enabled/Disabled per-phone in CallManager Administration
- VT Advantage automatically "associates" with IP Phone. All dialing and supplementary services done through phone
- CDP installed on PC Ethernet NIC. Must be physically connected to PC port on back of IP Phone (e.g. no wireless, no associating from a different network jack)
- Cisco USB Camera required (e.g. No 3rd-party cameras)
- H.263, WideBand Video Codec, G.729, G.711 and Wideband Audio Codec

SCCP Endpoints
How VT Advantage Works



1. Phone and PC exchange CDP. Phone begins listening for CAST messages on TCP port 4224 from IP address of CDP neighbor
2. PC initiates CAST messages to phone over TCP/IP. CAST packets are routed up to layer-3 boundary between VLANs. Firewalls and/or ACLs must permit TCP port 4224
3. Phone acts as SCCP proxy between VT Advantage and CallManager. CallManager tells phone to open video channels per call. Phone proxies those messages to PC via CAST protocol
4. Phone sends/receives audio. PC sends/receives video. Audio and video marked DSCP AF41. Switch port must be set to trust DSCP (or use an ACL) instead of trust COS or else VT Advantage packets will be rewritten to DSCP 0

SCCP Endpoints
Cisco VT Advantage

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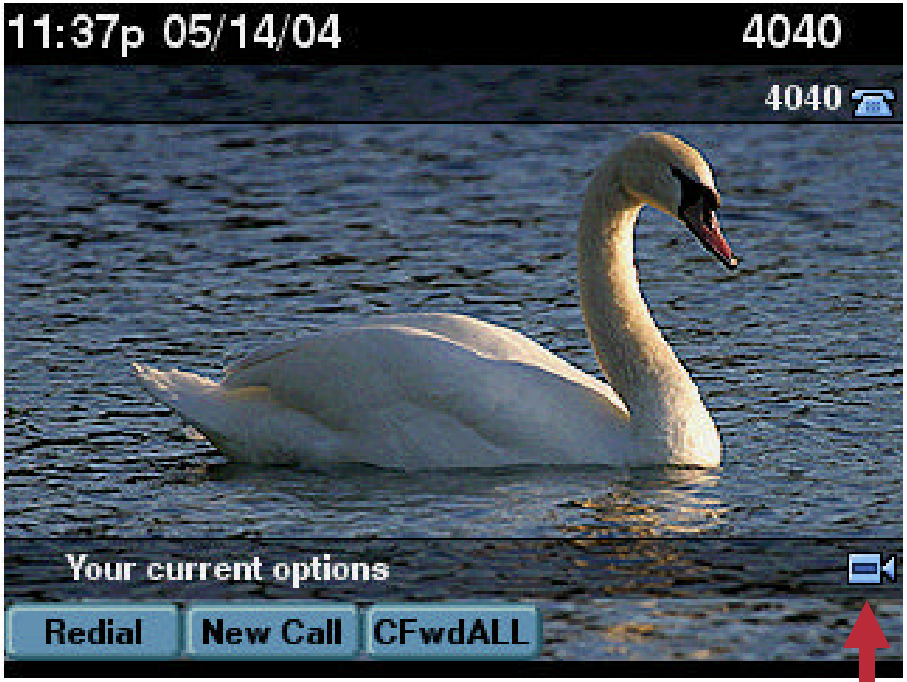

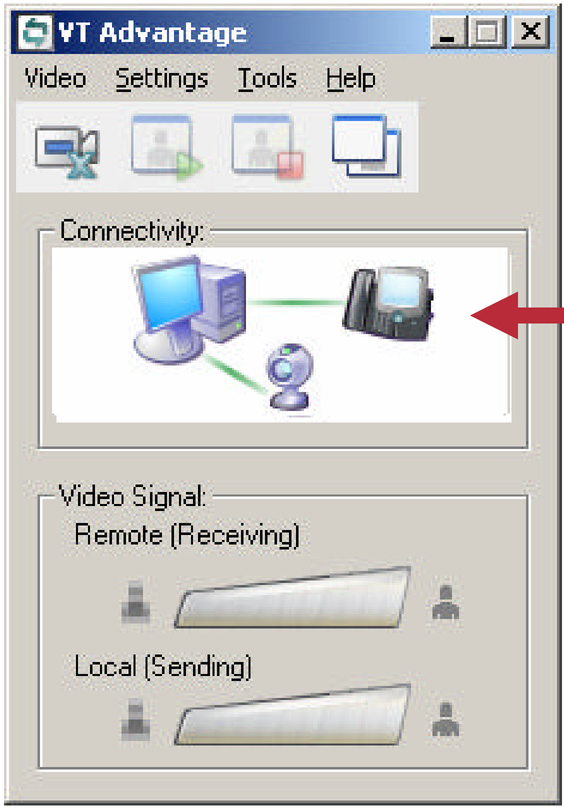

- Camera icon on phone indicates that Video Capabilities are enabled
- VT Advantage user interface indicates status of association

SCCP Endpoints
Cisco VT Advantage

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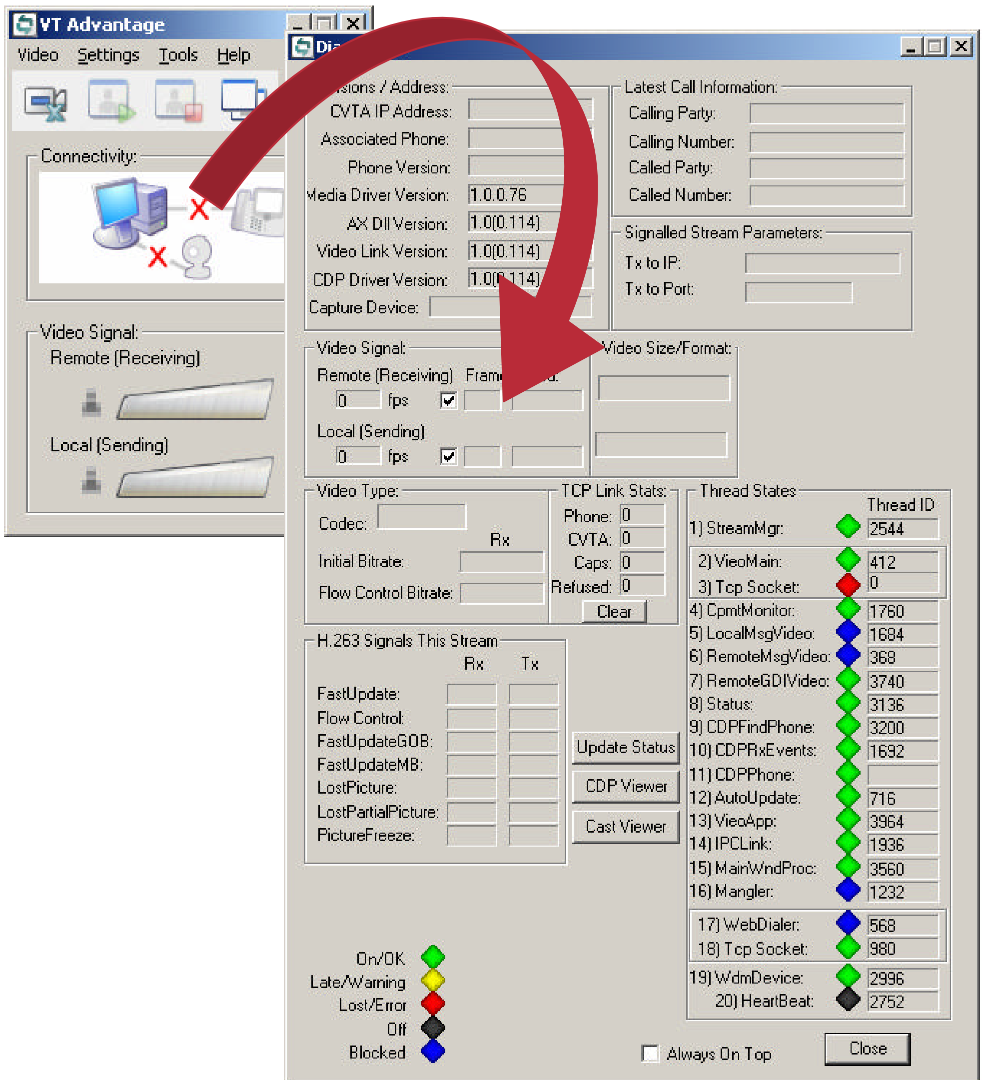

- **Double-right-click on VT Advantage user interface to view Diagnostics screen**

  Shows you detailed status of association, call status, CDP, and CAST protocol trace

H.323 Endpoints
Tandberg Devices H.323 Release E3.X

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- **Release E3.X supports CallManager in two ways:**

  Implemented Empty Capabilities Set support so that it can be placed on Hold, Transferred, Conferenced, etc.

  Does not require a Gatekeeper. Can point straight to CallManager

- **Supports Cisco IOS Gatekeeper Clustering (e.g. Alternate Gatekeeper)**

- **Configured in CallManager as an H.323 Client**

  H.323 Clients are only allowed to make one call, so if built-in MCU functionality is required, configure it in CallManager as an H.323 Gateway instead

  Uses port 1720

- **H.261, H.263+, G.728, G.711, G.722 and Far-End Camera Control**

H.323 Endpoints
Polycom, Sony et all

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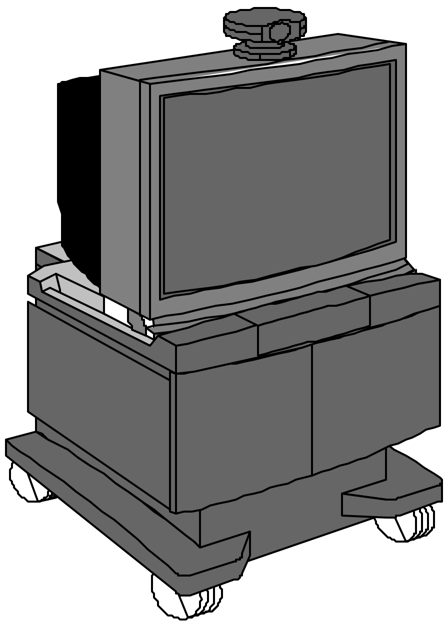


- **Pretty much any endpoint on the market will work, with certain caveats:**
  - **Endpoint must support Empty Capabilities Set (ECS) in order to be placed on hold, transferred, conferenced or parked**
  - **CallManager does NOT support some of the latest endpoint-specific non-standard or recently ratified features such as PictureTel iPower, Dual-Video, Encryption, etc.**
  - **DTMF *may* NOT work because many H.323 devices pass DTMF in-band. CallManager uses out-of-band H.245 alpha-numeric DTMF**
  - **H.261, H.263+, G.728, G.711, G.722 and Far-End Camera Control**
- **Working closely with Polycom, Tandberg and Sony to resolve the above caveats**
- **Endpoints can register to Gatekeeper or point directly to CallManager as a Gateway**

H.323 Endpoint Integration

- **2 Methods:**
  1. **Endpoint defined in CallManager, no GK requirement**

     Not widely available
  2. **Endpoint registers to gatekeeper, 2 options for dial plan and call routing:**

     Use default tech-prefix routing

     —or—

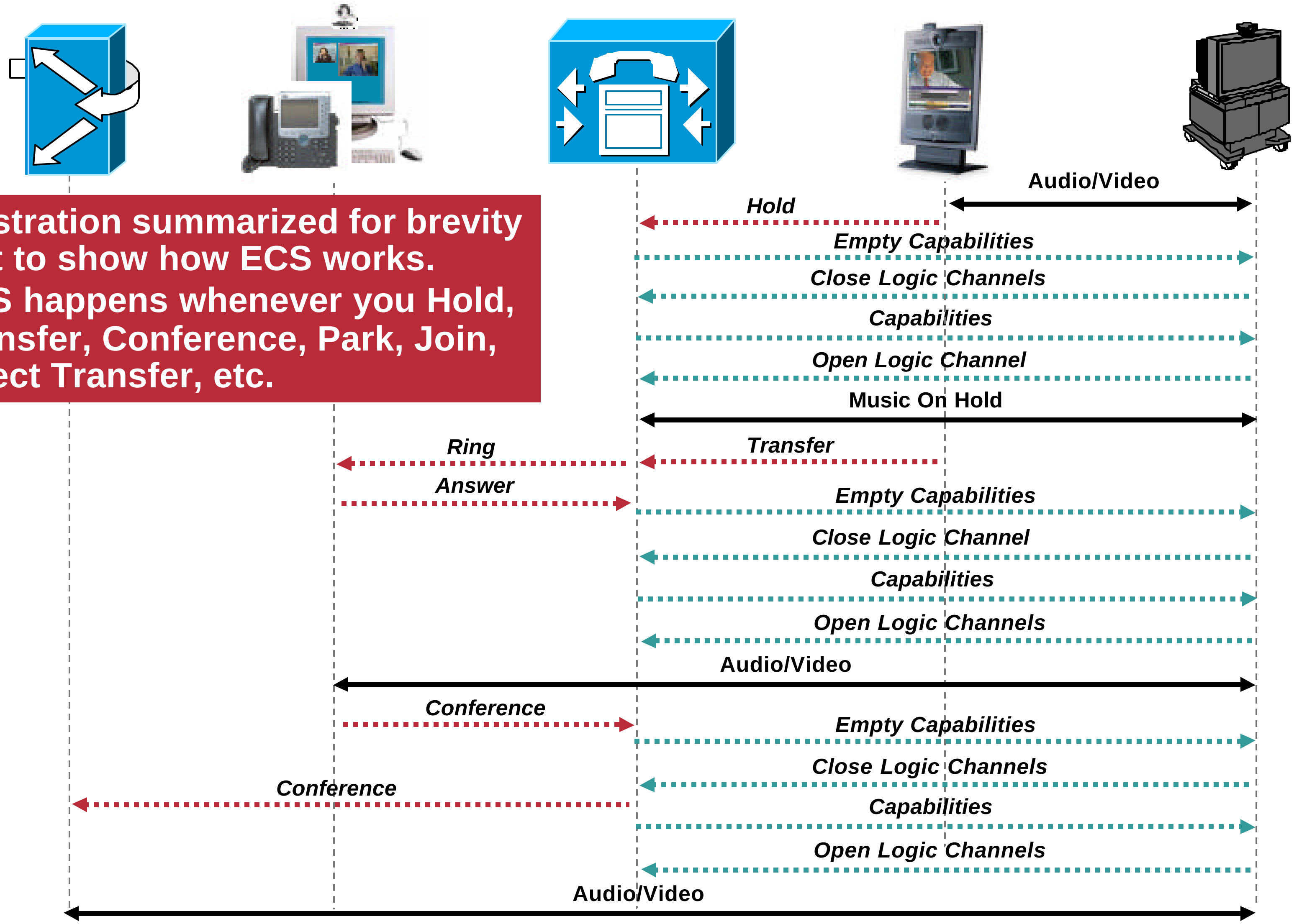
     Use Route-Patterns on CM

     CM functions in H.245 routed mode, GK is direct mode

     (more on this shortly)

H.323 Endpoints
Empty Capabilities Set

- Illustration summarized for brevity just to show how ECS works.
- ECS happens whenever you Hold, Transfer, Conference, Park, Join, Direct Transfer, etc.



H.323 Endpoints
Empty Capabilities Set

Note: Not a comprehensive list, just some that we've specifically tested against

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	Empty Caps Supported
All Tandberg Endpoint Models	Yes
Tandberg MCU/Gateway	No
Cisco IP/VC 3511/3540 MCUs	Yes
Cisco IP/VC 3510 MCUs	No
Cisco IP/VC 3526/3540 Gateways	Planned
Cisco IP/VC 3520/3525/3530 Gateways	No
Polycom VSX 3000/7000 →	Planned
Polycom ViewStation128 FX	No
Polycom ViaVideo, ViaVideo II	No, Planned
Polycom iPower Series (a.k.a. PictureTel)	No
Polycom MGC MCUs/GWs (a.k.a. Accord)	Planned
Sony PCS Endpoints	Planned
Microsoft NetMeeting	No
VCON ViGO	Yes

- Workaround for devices that don't support ECS to prevent them from being placed on Hold, Transferred, etc.

1. Checkmark the "MTP Required" option for that device
2. Assign it a Media Resource Group List that does NOT have any MTPs available in any of its MRGs
3. Set the "Fail Call if MTP Allocation Fails" service parameter to FALSE

- Result = Softkeys will be disabled when you call that device

H.323-Based Endpoints with Older ECS Implementations

- **No empty capability set support means that hold, park, transfer, conference, divert, or any other feature that breaks and reestablishes the media will not work**
- **Early implementations of empty capability set were overly restrictive; these implementations allow all of the above features to work except the call will be limited to whatever bandwidth the caller used to set the call up**
- **In some call scenarios after the feature is invoked the video may not be available or the bandwidth will be lower than it should be**

H.323-Based Endpoints with More Recent ECS Implementations

- More recent implementations of Empty Capability Set provide full support for these features
- To test an H.323 video endpoint to see which class it falls into do the following:
  - Have an audio only SCCP phone call the endpoint (it is important that the audio phone initiates the call); hit transfer; call a SCCP video endpoint; hit transfer
  - If the transfer fails (wait for 20 seconds to make sure the call will stay up) then the H.323 endpoint does not support empty capability set
  - If the transfer succeeds but is audio only the endpoint supports the earlier style of implementation of empty capability set
  - If the transfer succeeds and has video then the endpoint has the more recent style of implementation
- Make sure regions, locations and gatekeepers are not restricting the call
- Workaround for devices that don't support ECS to prevent them from being placed on Hold, Transferred, etc. :
  1. Checkmark the "MTP Required" option for that device
  2. Assign it a Media Resource Group List that does NOT have any MTPs available in any of its MRGs
  3. Set the "Fail Call if MTP Allocation Fails" service parameter to FALSE

Gatekeeper Integration

Decision Points for Gatekeeper Implementations:

- Utilizing Via-Zones?
- Redundancy

    HSRP or Alt-GK?

- Scalability

    Load-sharing, directory gatekeepers?

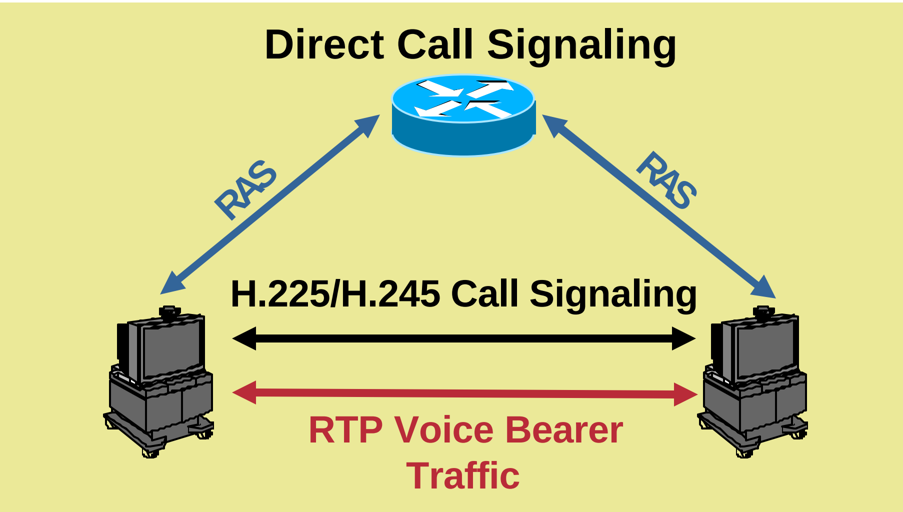
- Policy

    Dial plan restrictions between zones, device types

    Is there any way that GK would resolve dialed digits without sending the call setup info to CM?

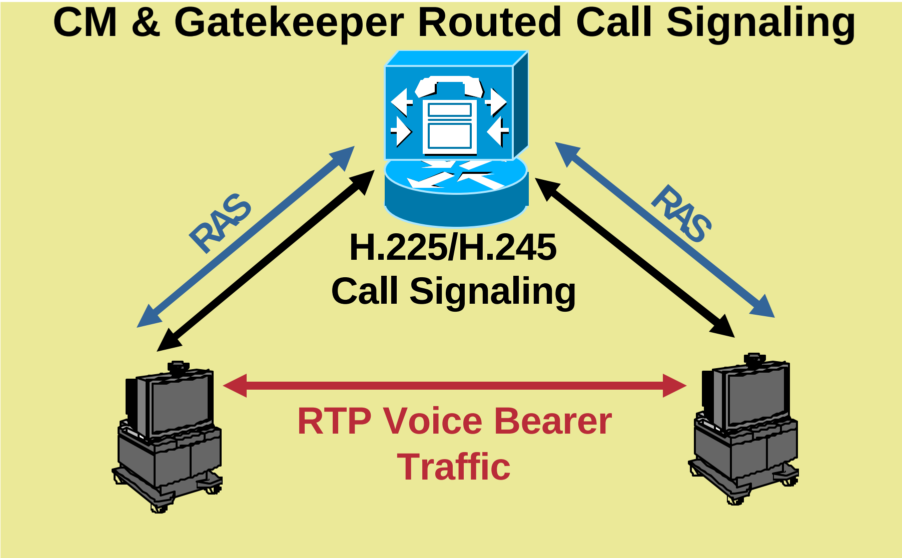
    These decisions may lead to implementations of GK that require multiple sets of gatekeepers

Direct and Gatekeeper Call Routed Signaling Models



- RAS signaling between H.323 device and G/K
- H.225 and H.245 signaling between gateways

- RAS signaling between H.323 device and G/K
- When deploying CM and IOS GK, CM functions as a routed mode call processing platform
- CM thus must support capabilities exchange parameters, such as codec, defined in call setup



Gatekeeper Redundancy
HSRP

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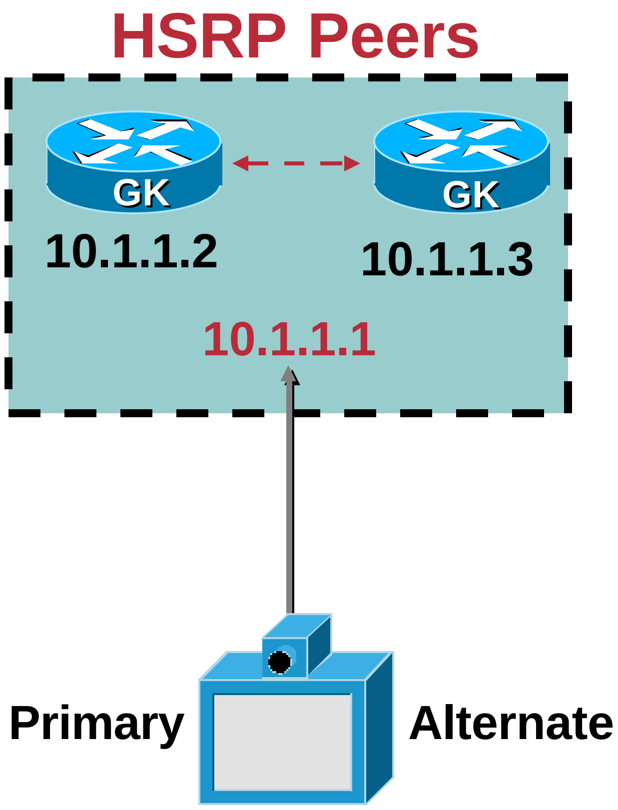
Gatekeeper HSRP Characteristics

- Endpoints point to the HSRP virtual address
- Appears as one virtual Gatekeeper
- HSRP standby is “asleep” until primary fails*
- Up to 3,000 endpoints per Gatekeeper
- HSRP peers must be in the same IP subnet



Note: HSRP Standby Does Not Keep Active State

Gatekeeper Redundancy
Gatekeeper Clustering

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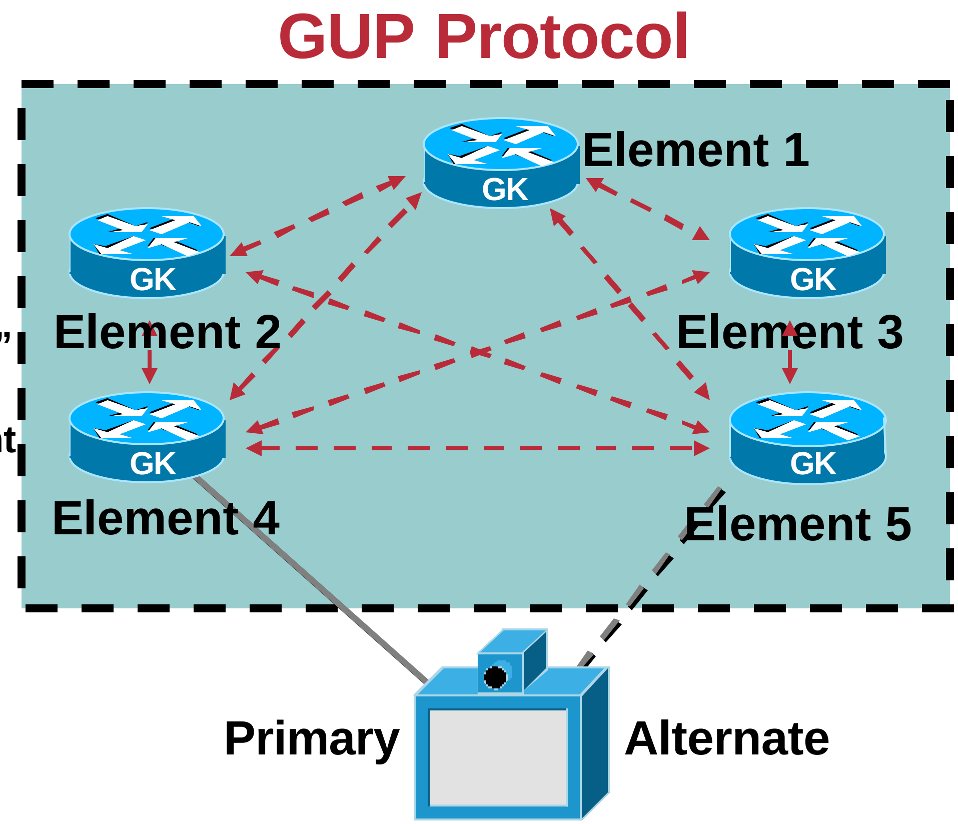
Gatekeeper Cluster Characteristics

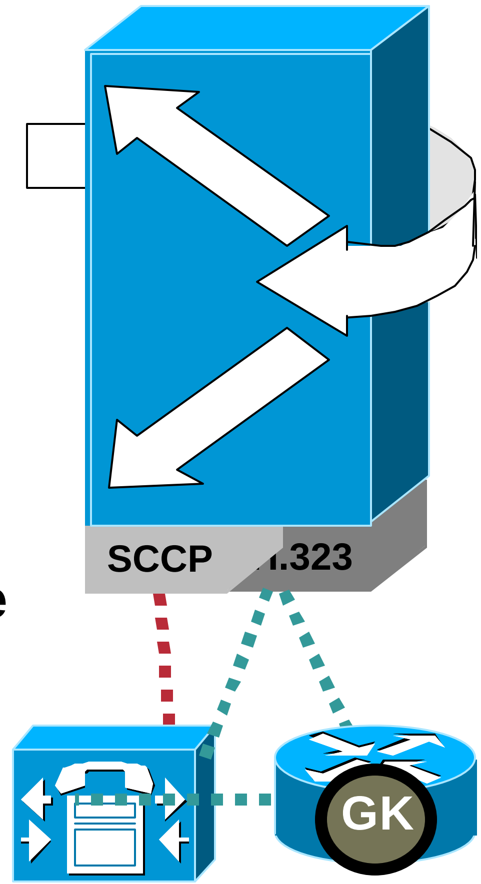
- Endpoints point to their primary gatekeeper, notified of the alternates during registration*
- Up to 3,000 endpoints per gatekeeper
- Maximum of 7,500 endpoints in a cluster
- Maximum of five gatekeeper "Elements" in a cluster
- Gatekeeper elements may be in different subnets
- Load balancing supported
  - Memory and CPU utilization
  - Number of active calls
  - Registered endpoints



Note: Not All H.323 Video Endpoints Support alt-GK at this Time

MCU Integration

- **SCCP - Ad-Hoc & Meet-Me video:**
    - **Define the MCU in CM for Ad-hoc conferencing**
    - **Add meet-me numbers for Meet-me Conferencing**
- **H.323 - Scheduled video:**
    - **Relies on defining services on the MCU to define types of conferences**
    - **Define a route-pattern and assign it to the H.225 trunk**
- **In all cases, assign the resources/DN's within the dial plan to the appropriate partitions, locations, etc.**
- **Consider using the <NULL> location for services such as the MCUs and gateways that are common for all users and are centralized**



How Does the MCU Work with IP Video Telephony using SCCP?

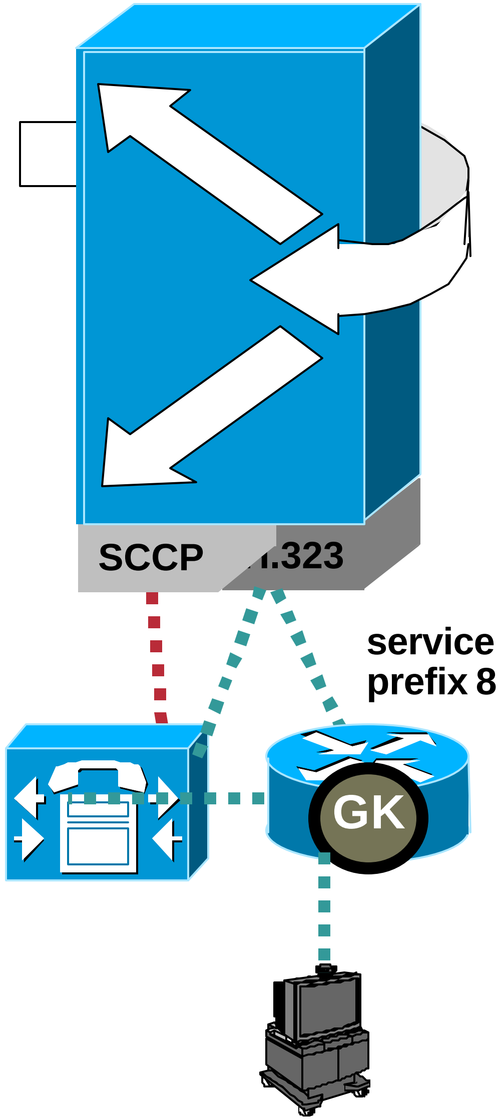
- New IP/VC software with SCCP provides MCU resource for Cisco CallManager 4.x
- Conferencing resources provides IP telephony-like functionality for videoconferencing
- Allows customers to create point-point calls then seamlessly expand into videoconference format
- These MCU resources are defined directly in CM, require additional dial plan configurations and meet-me number definitions
- Same telephony button setup experience:

  CONFR—push, dial tone, add participants, repeat

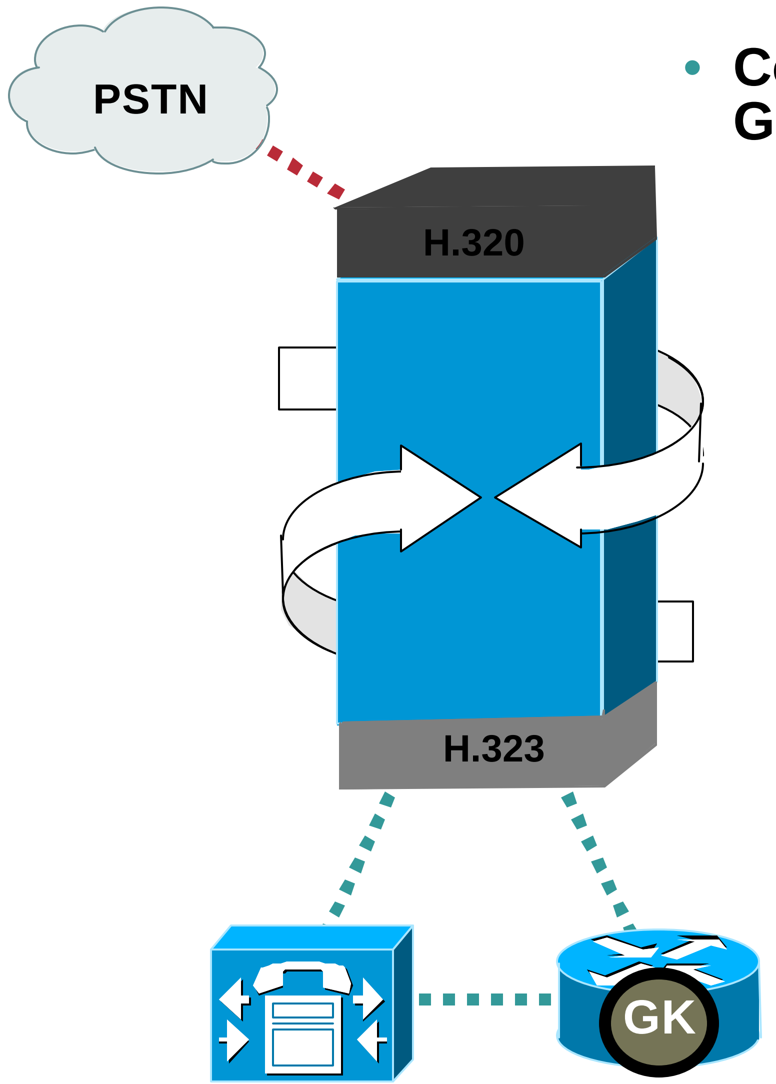
  MeetMe—push, enter number, create or join conference

How does the MCU Work with IP Video Telephony Using H.323?

- **MCUs register to GK as a terminal type gateway**
- **Service prefixes configured on the MCU may or may not be part of the registration message**
- **If they are, there exists a possibility of H.323 endpoints being able to dial directly to the MCU service**
  - **To avoid this, there are several considerations:**
    - **Do not allow for services to be registered**
    - **Register MCUs to one set of GKs, endpoints to another**
    - **Use translation patterns to mask the MCU service numbers from the dialed numbers the user is given**
    - **Use dial-out only services on the MCU**
    - **Use Via-Zones to force dial plan resolution to CallManager**



H.320 Gateways
Cisco IP/VC 35xx Release 2.0



- **Configured in CallManager as an H.323 Gateway or reached via an H.225 Trunk**
  - Can be added to a Route Group/Route List(s)
  - Gateways listen on TCP port 1820 by default. CallManager uses port 1720 by default. You can change either side
  - Direct Inward Dial (DID) and IVR modes supported
  - Gateway must register with Gatekeeper for inbound calls
    - Alternate Gatekeeper supported
    - Alternate Endpoints not supported
    - Empty Capabilities Set not supported
    - RAI/RAC supported for outbound calls if CallManager uses H.225 Trunk to Gatekeeper to reach the Gateway

Gateway Integration

SCCP gateways - voice only

H.323 gateways for video -

- **Typically use 8# for service prefix (9# for audio only gateways)**

- **2 options for implementation:**
  - **Define in CM**
    - **Allows for use of CSS, hunt groups, etc.—full mgmt by CM**
    - **-or-**
  - **Define route patterns and use GK to register gwys**
    - **Allows for use of RAI/RAC messaging for gwy congestion, but limited to providing CM mgmt to the trunk only (CSS, etc.)**
    - **-or-**
  - **Both**
    - **Implementation needs to be carefully designed such that a gateway with inadequate number of B channels available will not be used in hunt group**

What about SIP?

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- CM4.1 supports SIP as a trunk protocol only - not as a line side protocol
- To incorporate SIP, use a SIP trunk from CM to the SIP call control platform
- Call Routing between platforms is across the trunk, utilizing the call control platform dial plans
- Supports Voice only - not video. Placing a video call results in an audio only call if ‘Retry as Audio’ enabled, else call is denied

For future releases of CM that support SIP line side protocols, an existing CM video telephony deployment will simply add SIP as a protocol, and support call routing between varying devices as it does for SCCP and H.323 today

Agenda

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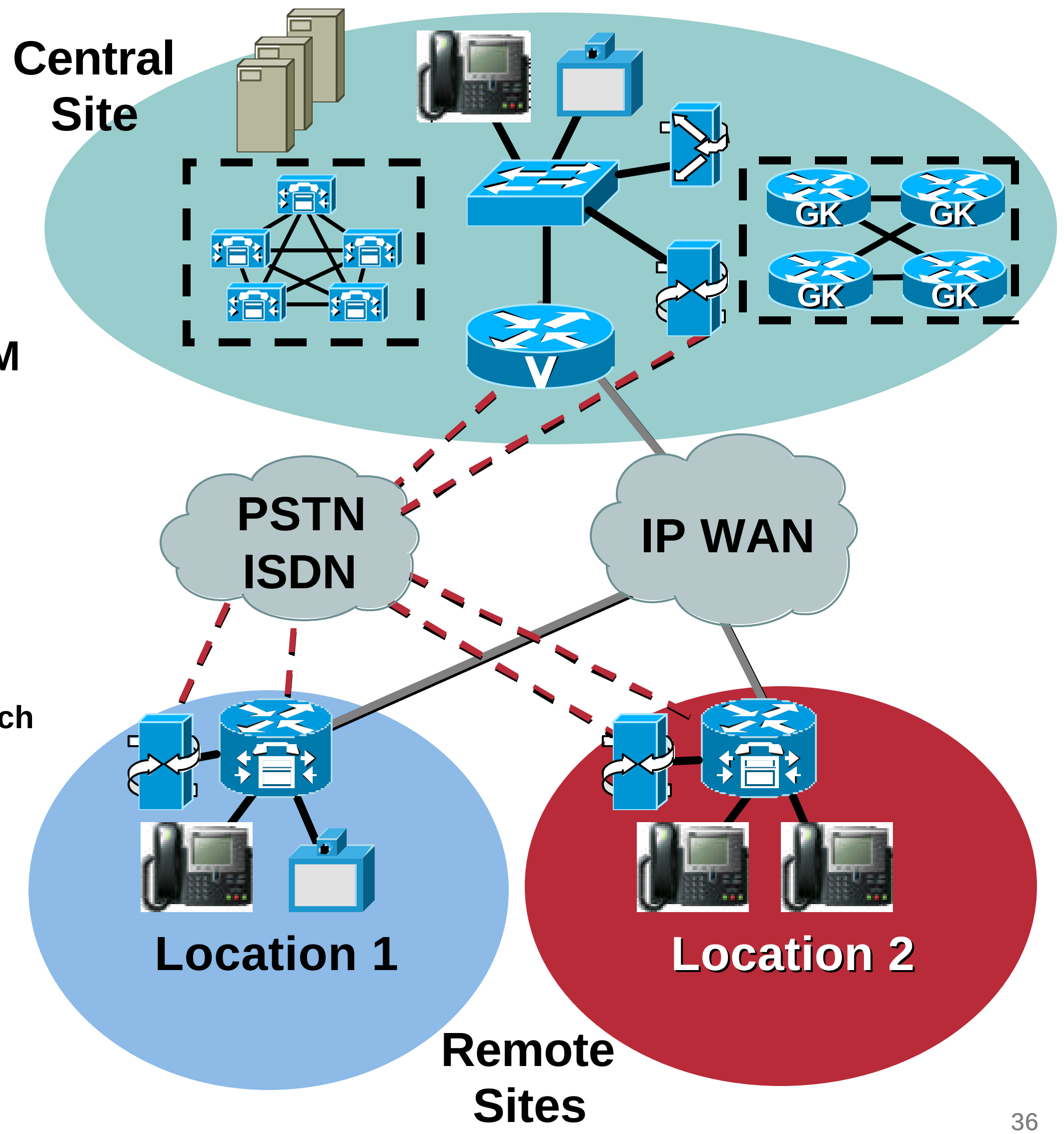
Centralized Call Processing AND Centralized Gatekeeper for H.323 Legacy and SCCP Video

- Cisco CallManager and GK located at single site, endpoints distributed
- H.323 endpoints register to GK or CM
- SCCP endpoints register to CM
- CM locations and region CAC
- Centralized or distributed gateways?
    - DID or IVR?
- Dial plan design
    - Call routing, partitions, calling search spaces



Fundamentals - Dial Plan and QoS

- **SCCP Resources - endpoints, MCU's**
- **H.323 Endpoints**
- **QoS for video via ACLs**
- **External Devices**

  H.323 MCU's - scheduled conferencing

  H.323 Gateways - PSTN/ISDN access, AAR

SCCP Dial Plan

CM utilizes the same logic for class of service, call routing, etc., for video as it does for audio

- Shared Line Appearances

  SCCP devices can share lines with full features

  H.323 devices can share lines, but loss of features such as hold, etc, which require specific interface features not found on H.323 devices

- Call Forwarding

  Across regions can be difficult, depending on H.245 and H.225 caps exchanges

  H.323 devices must be on but not answered, or CF fails

- Hunt Groups

  SCCP and H.323 devices can be in a hunt group

  If H323 device is in hunt, but is OFF, hunt terminates - use ‘broadcast’ to avoid this condition

SCCP Media Resources
Distributed Conferencing Resources

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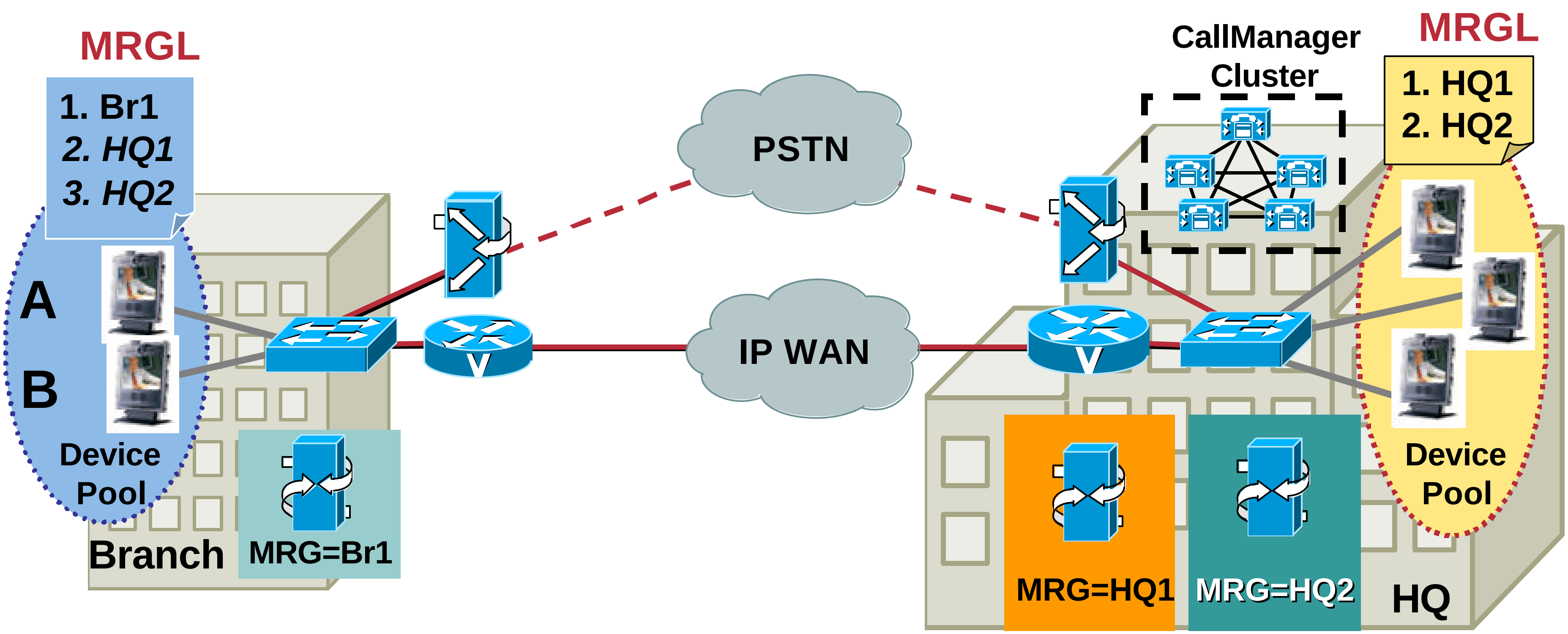


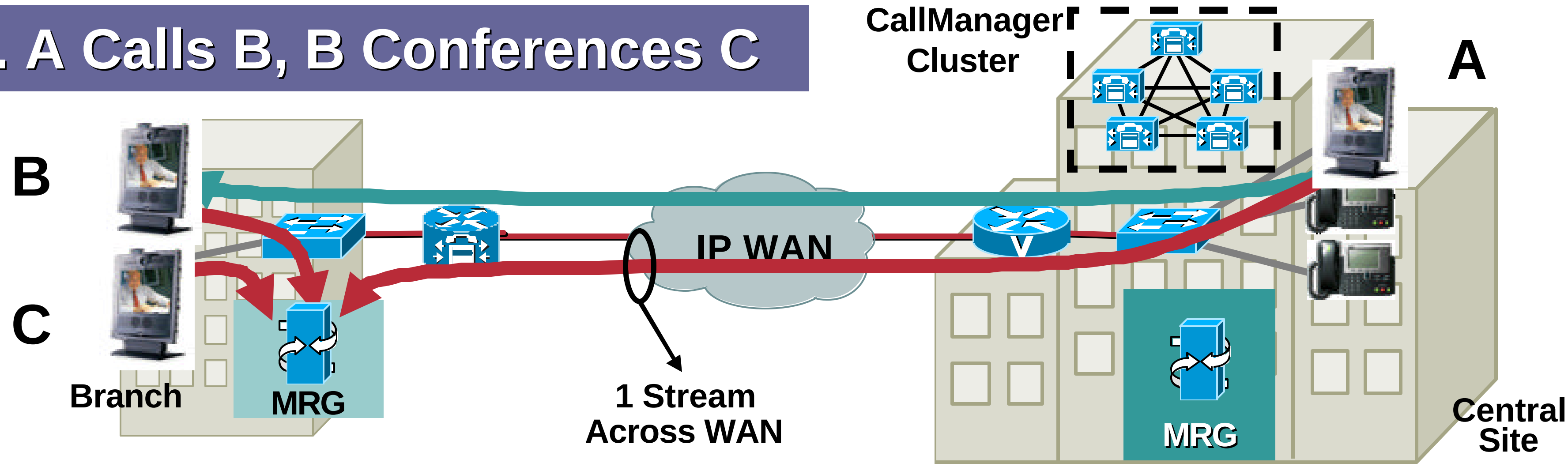
- Conference between A, B —no video across WAN
- MCU, Gateway resources at branch
- Transcoding/Transrating resources are 'owned' and managed by the MCU
- No conferencing during WAN failures

MRG = Media Resource Group
MRGL = Media Resource Group List

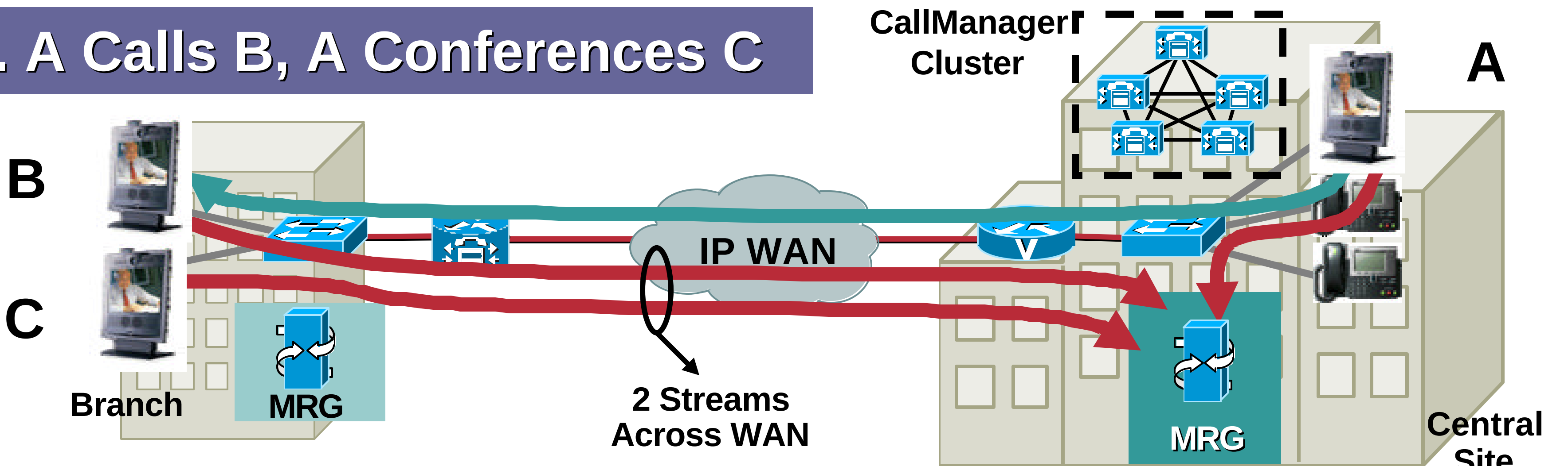
SCCP Media Resources "Conference Initiator" Concept

Overprovision WAN to Allow for This…

1. A Calls B, B Conferences C



2. A Calls B, A Conferences C

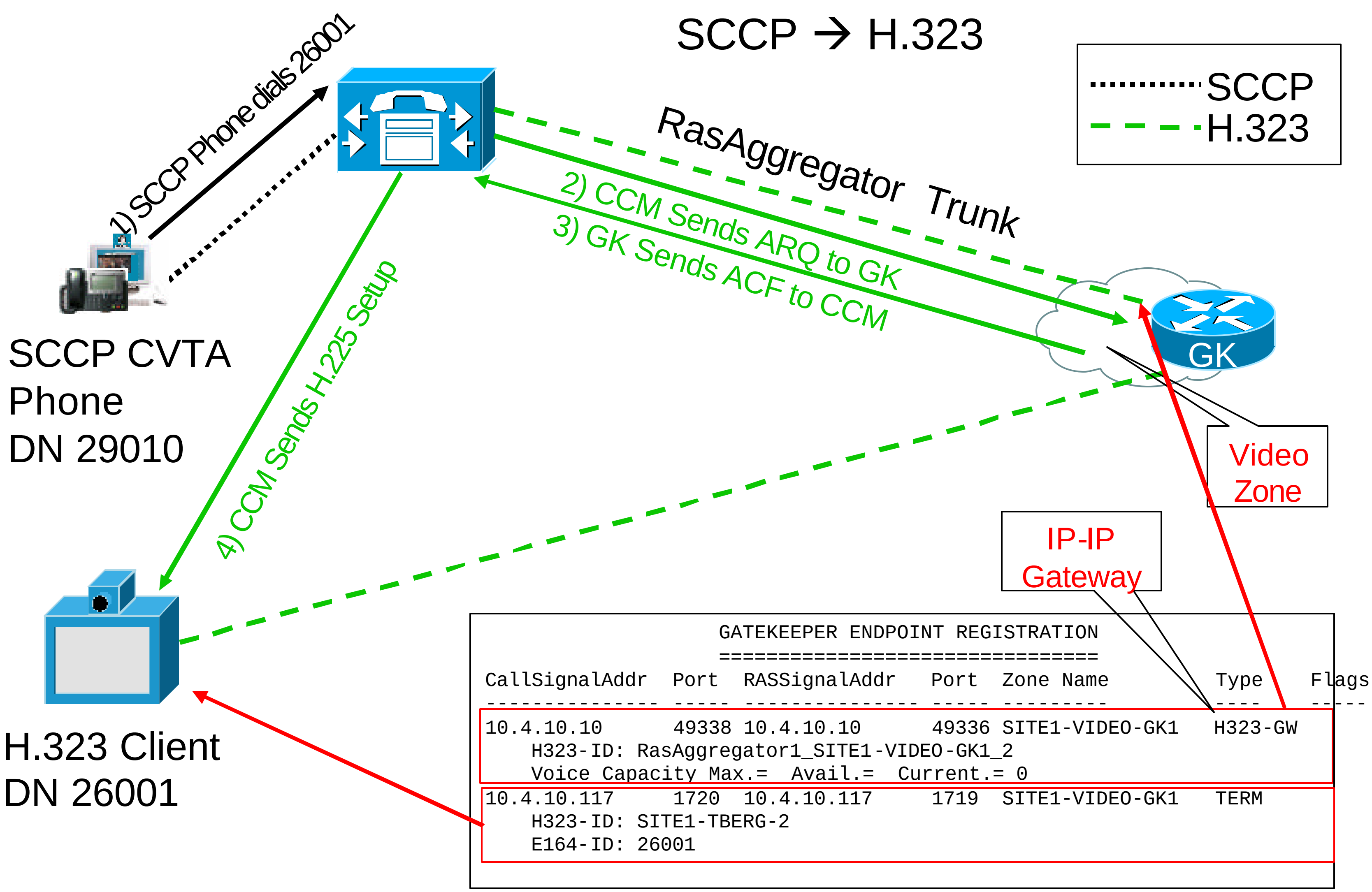


Deploying GK for H.323 Endpoints

- **In CM4.0, H.323 endpoints are identified by IP address**
  - **H.323 trunk can not support DNS or E.164 currently for endpoint definitions**
- **In CM 4.1, the IOS GK utilizes the RAS aggregator trunk to define the GK, and endpoints are defined by E.164 address**
- **With CM 4.1 registered as IP-IP gateway and via-zone configuration on GK, all dial plan resolution is forced to CM**

Dynamic H.323 Addressing

Call Routing SCCP → H.323

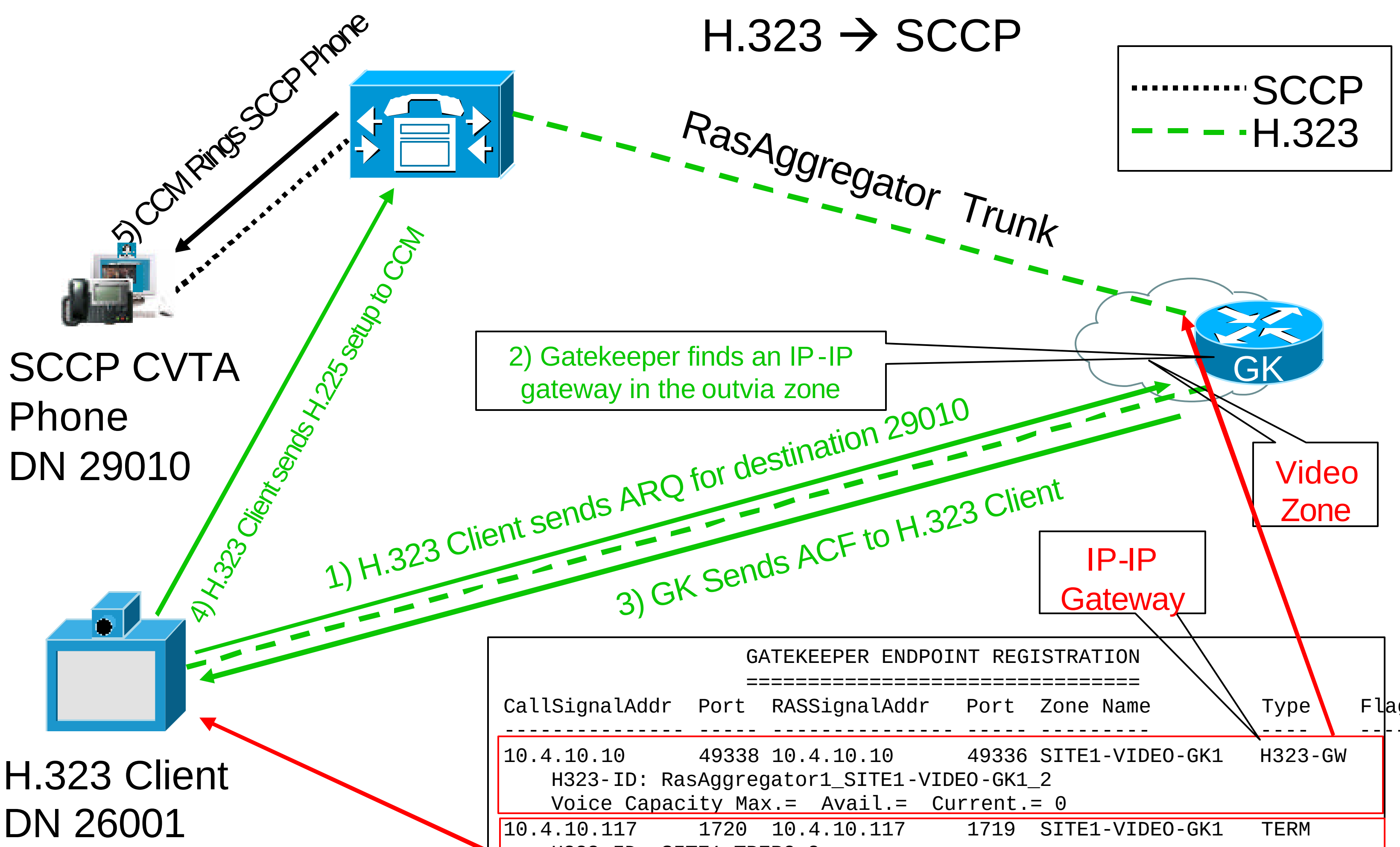



```
                    GATEKEEPER ENDPOINT REGISTRATION
                    ================================
CallSignalAddr  Port  RASSignalAddr   Port  Zone Name         Type     Flags
--------------- ----- --------------- ----- ---------         ----     -----
10.4.10.10      49338 10.4.10.10      49336 SITE1-VIDEO-GK1   H323-GW
    H323-ID: RasAggregator1_SITE1-VIDEO-GK1_2
    Voice Capacity Max.=  Avail.=  Current.= 0
10.4.10.117     1720  10.4.10.117     1719  SITE1-VIDEO-GK1   TERM
    H323-ID: SITE1-TBERG-2
    E164-ID: 26001
```

Dynamic H.323 Addressing

Call Routing H.323 → SCCP

Cisco.com




```
                    GATEKEEPER ENDPOINT REGISTRATION
                    ================================
CallSignalAddr  Port  RASSignalAddr   Port  Zone Name         Type    Flags
--------------- ----- --------------- ----- ---------         ----    -----
10.4.10.10      49338 10.4.10.10      49336 SITE1-VIDEO-GK1   H323-GW
    H323-ID: RasAggregator1_SITE1-VIDEO-GK1_2
    Voice Capacity Max.=  Avail.=  Current.= 0
10.4.10.117     1720  10.4.10.117     1719  SITE1-VIDEO-GK1   TERM
    H323-ID: SITE1-TBERG-2
    E164-ID: 26001
```

GK Deployment Options

- Design GK deployment for redundancy, scalability, and call routing via CM
- CM and IP/VC support Alt-GK, while some endpoints do not, requiring the use of HSRP
- To ensure that endpoints can not dial directly to MCU or Gateway resources, but need to route to CM, requires a separate GK deployment OR the use of via-zones
  - Simply putting MCU and gateways into a separate zone will not block call routing between endpoints and the conferences or gateways
  - Inbound gateway calls would be forced to CM
- One design option utilizes one set of gatekeepers for endpoints utilizing HSRP, and another set of GKs for MCUs and gateways utilizing Alt-GK
  - CM has two trunks—one to each GK
- The use of Via-Zones resolves multiple issues, including mobility and call routing

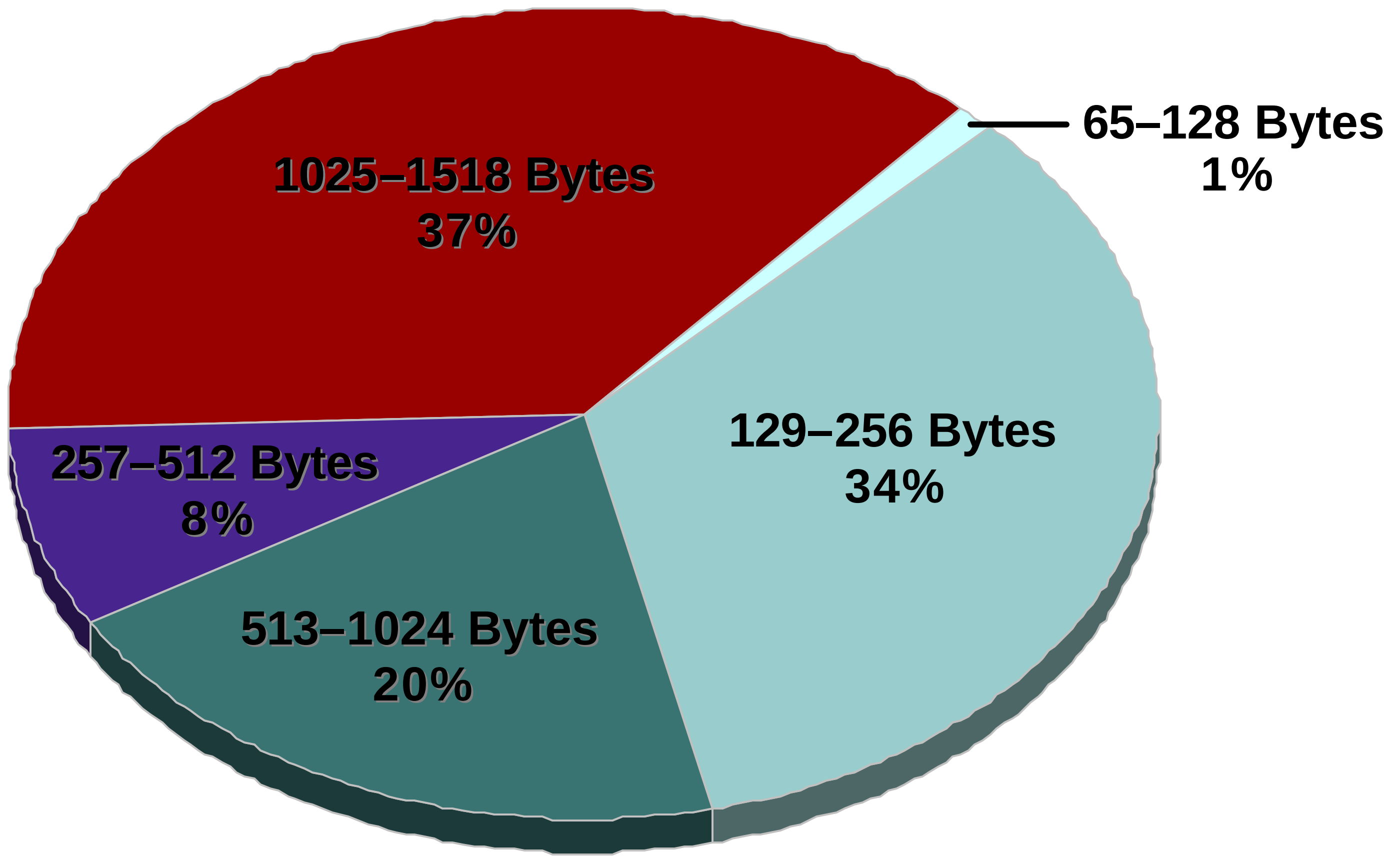
Video QoS & CAC

To deploy QoS for video, utilize Low-Latency Queueing configurations where video is placed in a separate PQ, or in a CBWFQ, and the audio channel of a video call is placed in the same class as the video channel

Use CM Regions and Locations for inter-cluster CAC:

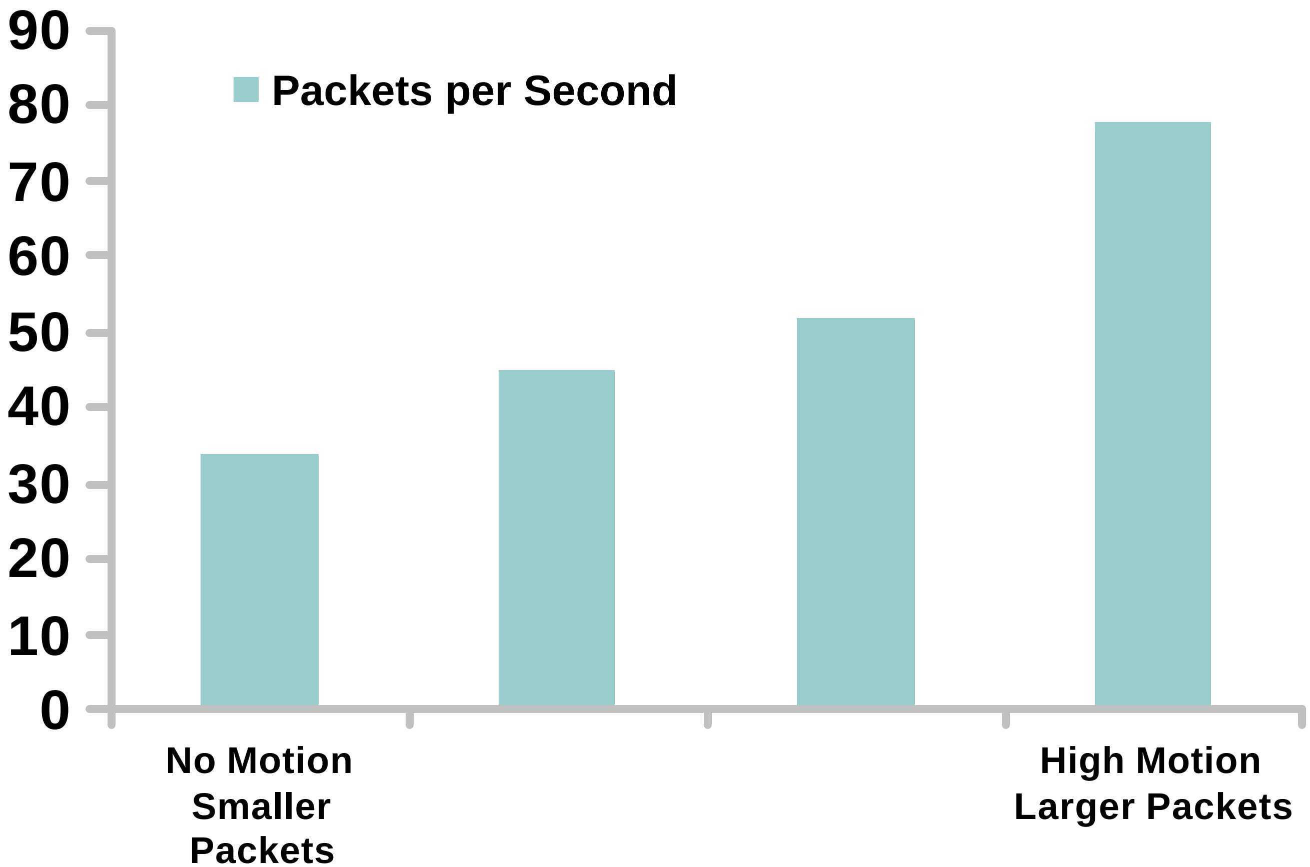
- Audio is represented as bit-rate + overhead (i.e. 24k for G.729, 80k for G.711)
- Video is represented as bit-rate only (i.e. 384k for a 384k call) and includes the audio portion

Video Conferencing Traffic Packet Size Breakdown (CIF)



384kbps Video call = 320kbps video, 64kbps audio
With overhead (approx 20%) equates to 420kbps

Video Characteristics 384kbps Video Call



Due to the nature of the encoding algorithm, video bearer traffic is bursty

Recommended QoS Traffic Classifications

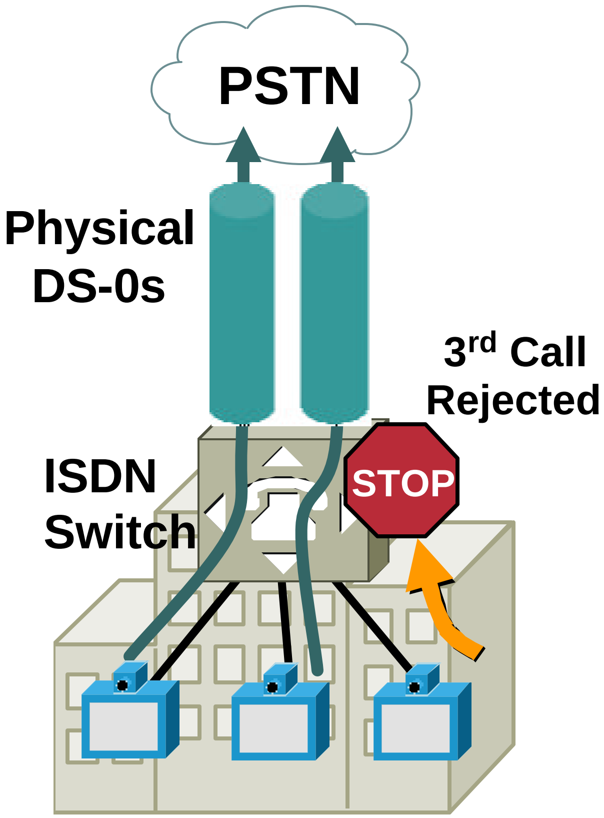
Cisco.com

L2 CoS	L3 Classification IP Prec.	PHB	DSCP	Application
7	7	-	56-63	Reserved
6	6	-	48-55	Reserved
5	5	EF	46	Voice Media
4	4	AF41	34	Videoconferencing*
3	3	CS3	24	Voice Signaling**
2	2	AF2y	18,20,22	High Priority Data
1	1	AF1y	10,14,16	Medium Priority Data
0	0	BE	0	Best Effort Data

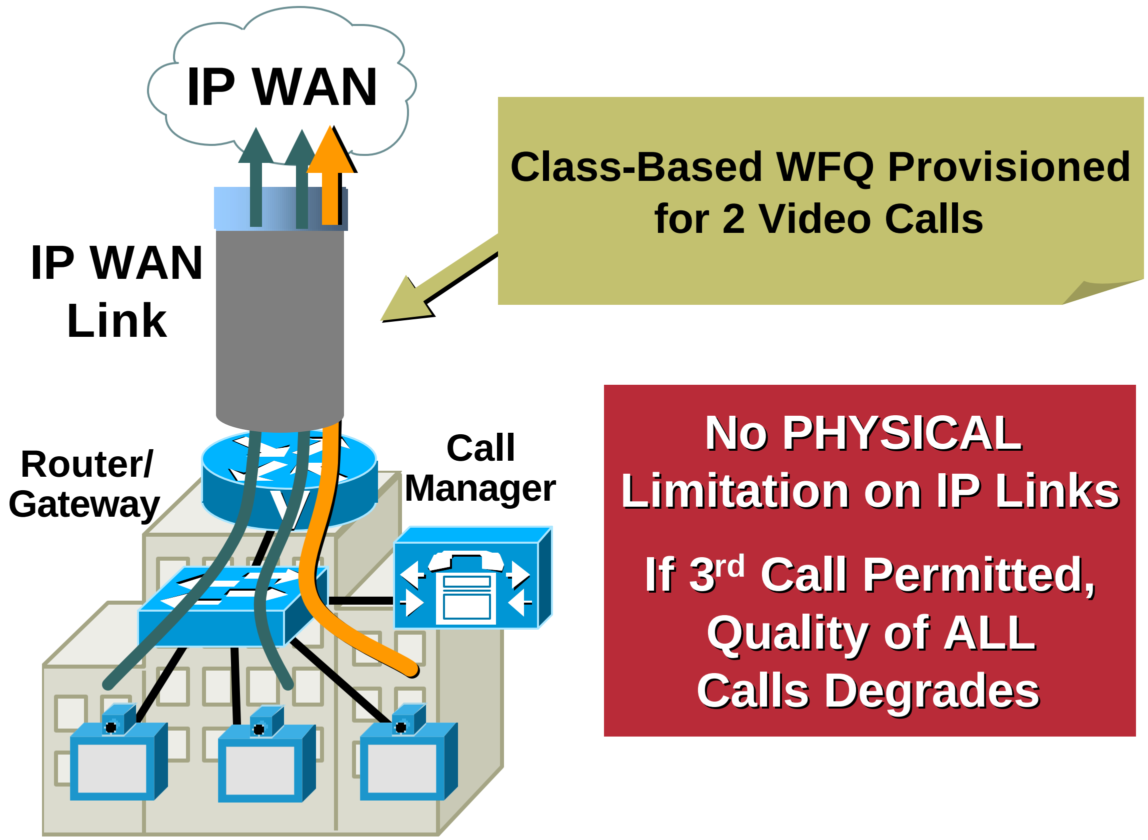
*Including Audio and Signaling for H.323
** Including Signaling for SCCP Video

Call Admission Control

Circuit-Switched Networks



Packet-Switched Networks



No PHYSICAL Limitation on IP Links

If 3rd Call Permitted, Quality of ALL Calls Degrades

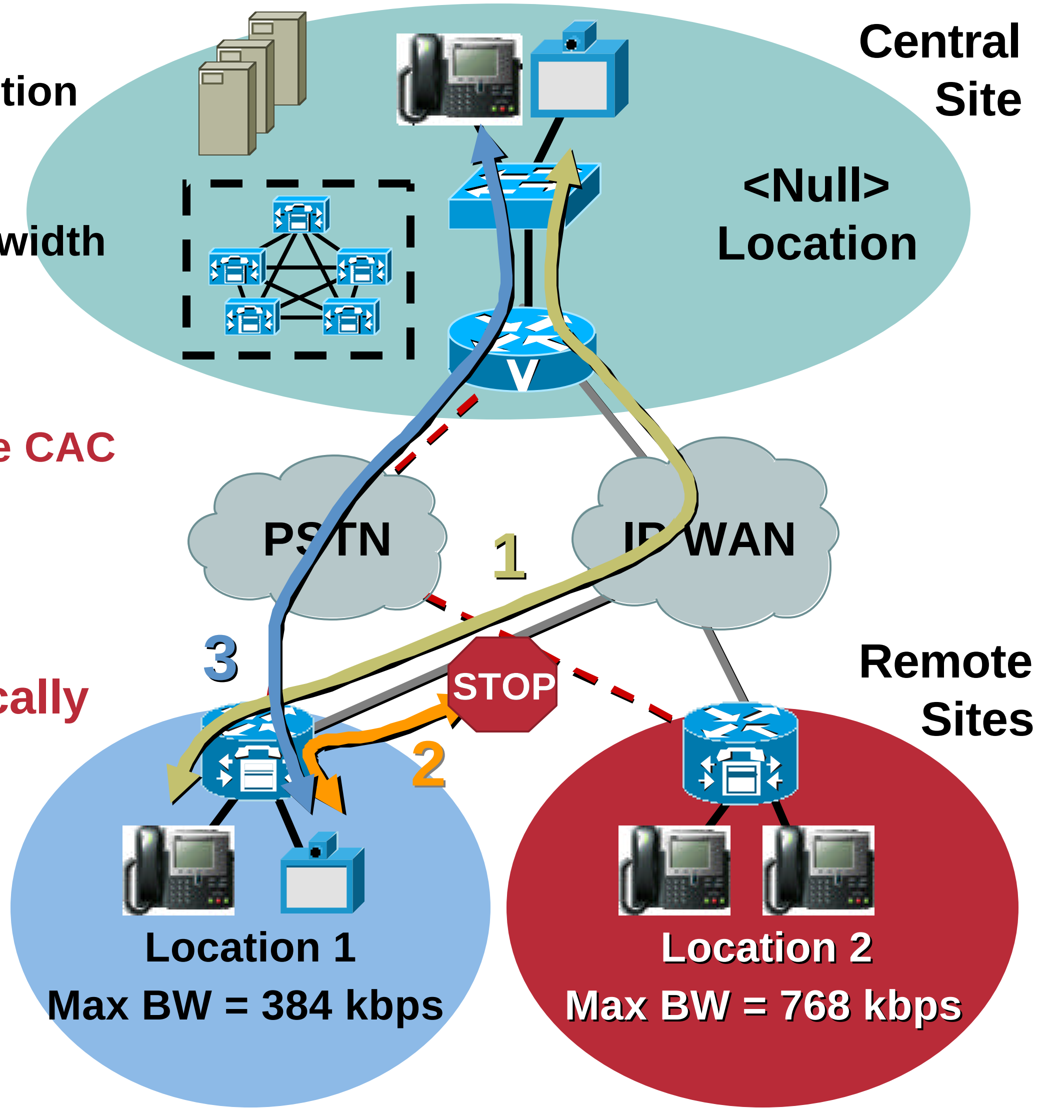
Call Adm. Control Limits # of Calls Between Sites

Cisco CallManager CAC Within a Cluster

- Prevent WAN link over-subscription by limiting voice and video bandwidth
- Use regions to set per call bandwidth limit
- Assign aggregate bandwidth limit per location
- Not like H.323—how do I provide CAC for call transfer, etc.?????

- When resources are insufficient, call is automatically prefixed to auto-alternate route via gateway/PSTN—Works for voice and video* calls

  *When IP/VC GW Is Present; Without Video Gwy, Reroute as Audio Only



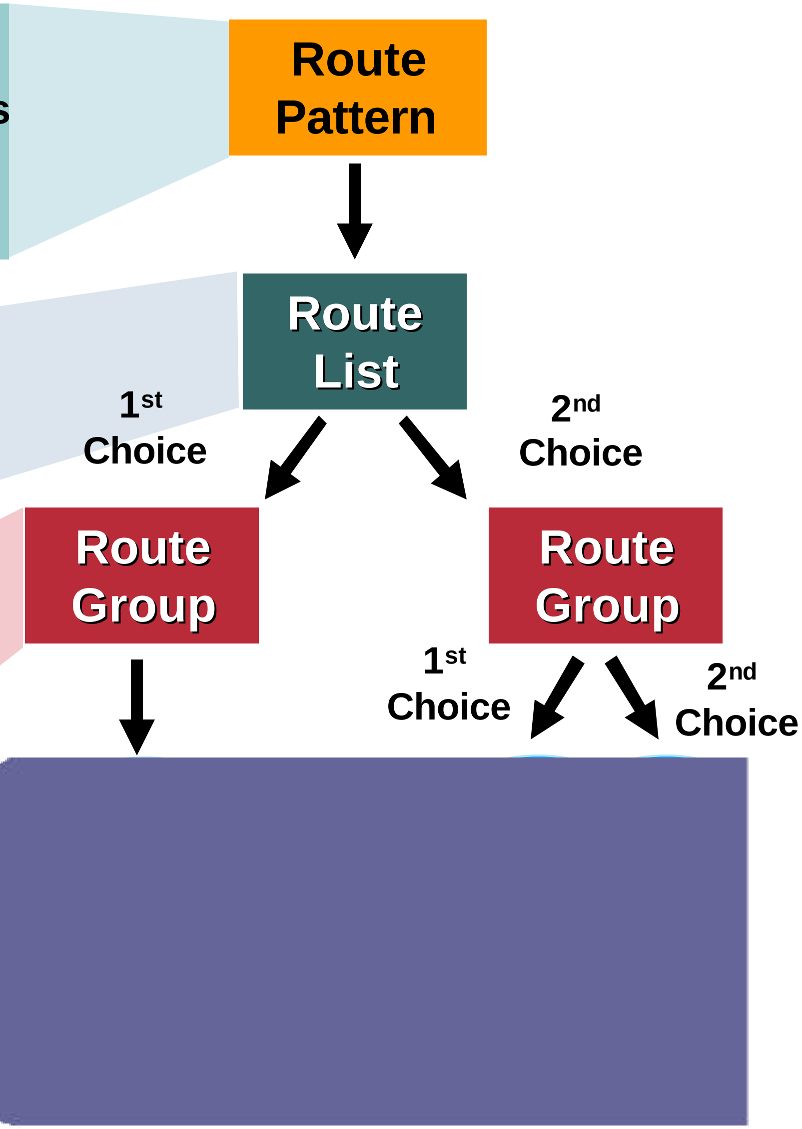
Dial Plan
External Route Elements in CallManager

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

Route List
- Chooses path for call routing
- Points to prioritized route groups

Route Group
- Performs digit manipulation
- Points to the actual devices

Devices
- Gateways (H.323, MGCP)
- Gatekeeper
- Intercluster trunk (remote CM)



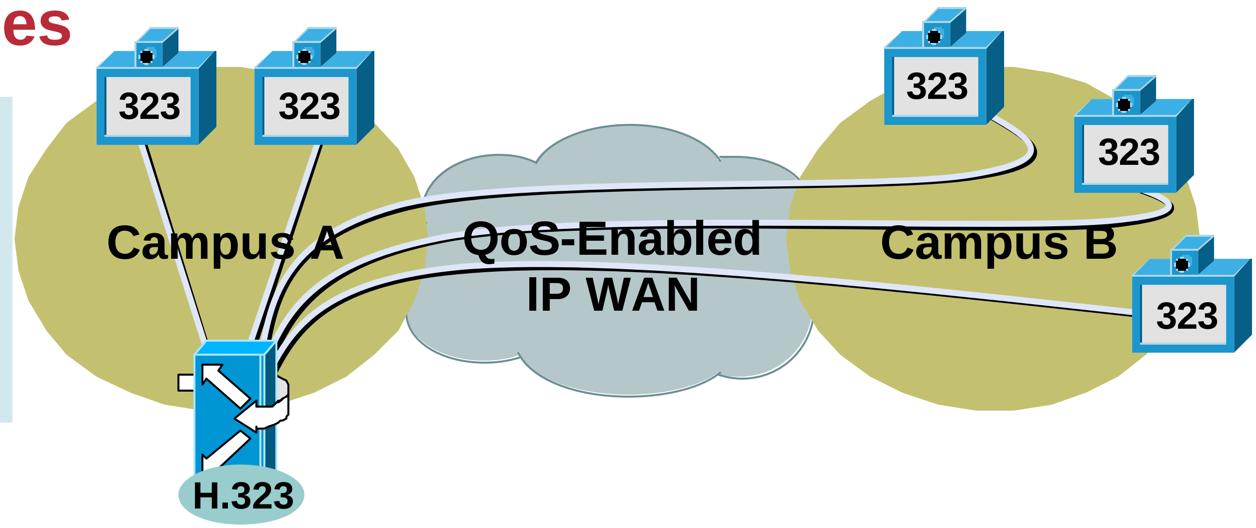
Dial Plan Design

- **Deploying gateways**
  - H.323 gateways for video, registered to gatekeeper
- **For inbound calls, DID or IVR? Distributed or centralized?**
- **Gatekeepers requires H.225 trunk, route pattern for outbound calls**
- **Assign voice and video gateways to separate partitions and use a common prefix (i.e., 9) or use separate prefixes (9 for voice, 8 for video)**
- **Digit stripping for inbound calls**
- **Deploying AAR**
  - How do the dialed digits get altered to allow for PSTN/ISDN access?
  - H.323
    - H.245 routed mode—No use of CanMapAlias required!

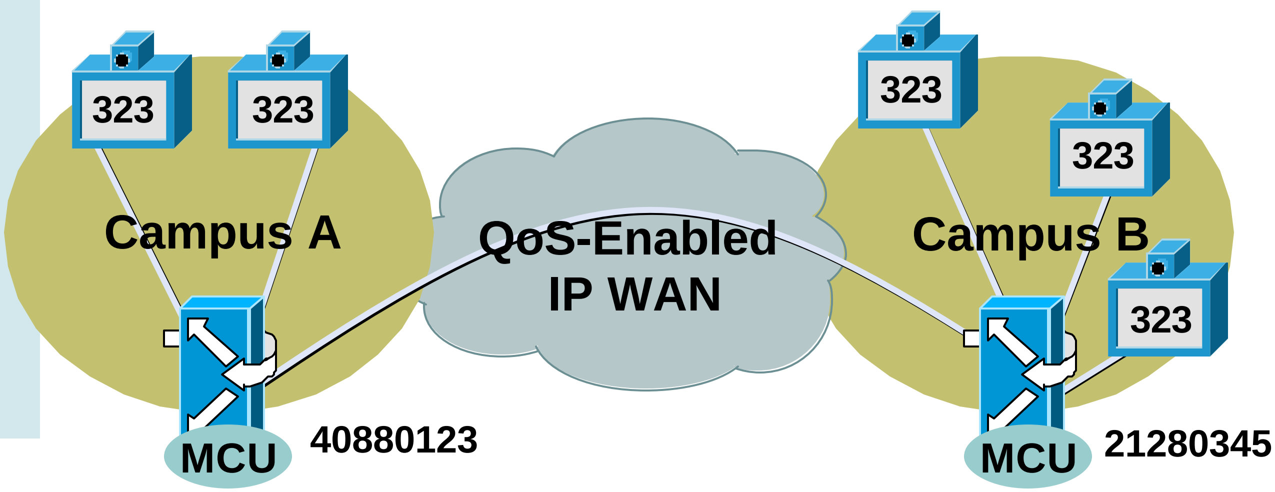
H.323 MCU Resources

Bandwidth Issues

- Low-speed WAN Links
- Remote sites are limited to the amount of bandwidth provisioned for videoconferencing



- Distribute MCUs to large sites
- Video terminals use their local MCU
- Single site multipoint calls stay local
- WAN bandwidth is limited to one call at the conference bandwidth



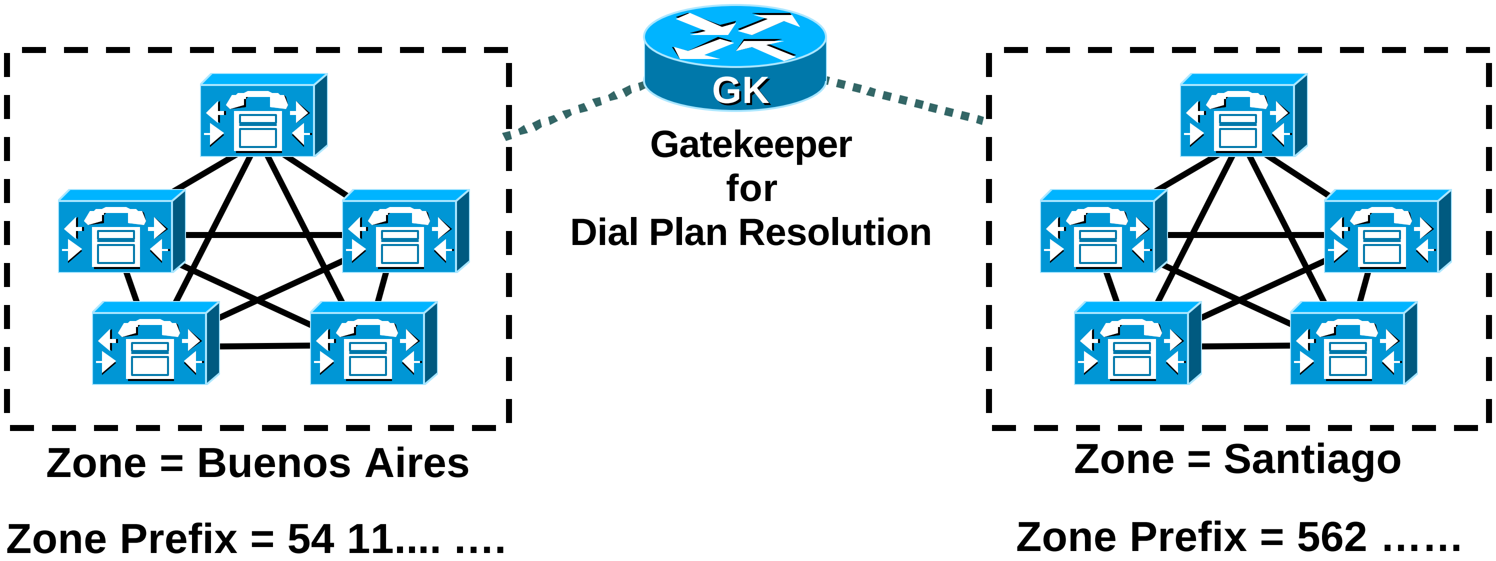
Agenda

Cisco.com

- Video Telephony Fundamentals
- Endpoint, MCU and Gateway Integration
- Centralized Design and Deployment
- Distributed Design and Deployment
- Configuration

Intercluster Trunk Call Routing Using GK

Cisco.com



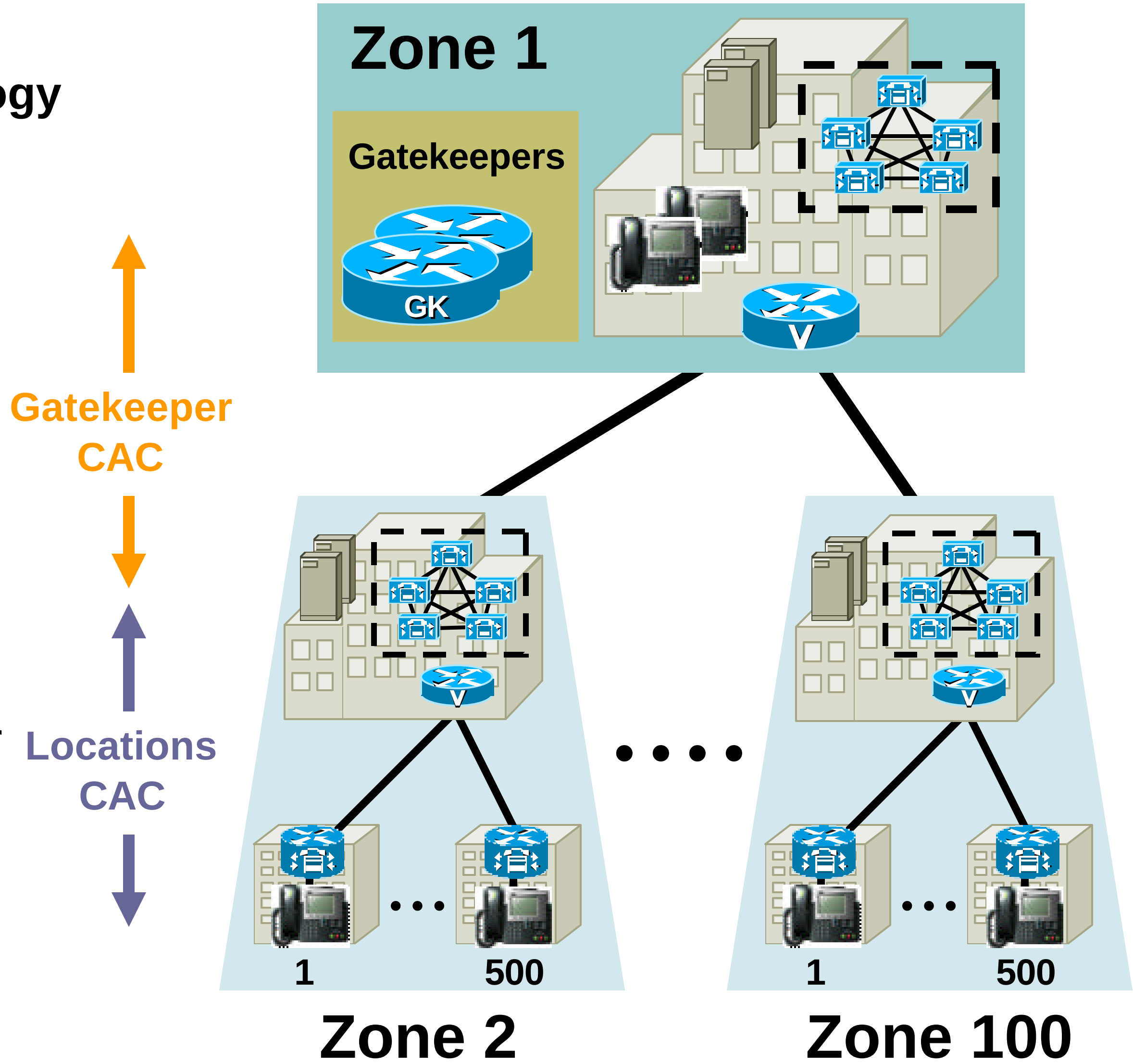
- Cisco CallManager registers with gatekeeper and has H.323 “Trunk” configured as a route to/from the gatekeeper
- Up to 100 local zones per gatekeeper, one Cisco CallManager cluster per zone
- Gatekeeper is configured with prefix for call routing between multiple CallManager clusters
- Configure GK with zone prefixes to match dial plan of each cluster, utilizing simple, consolidated dial plan

Cisco CallManager CAC Between Clusters

- Gatekeeper provides Call Admission Control (CAC) between Cisco CallManager clusters
- Cisco CallManager registers with gatekeeper and has H.323 “Trunk” configured as a route to/from the gatekeeper
- Up to 100 local zones per gatekeeper, one Cisco CallManager cluster per zone
- If gatekeeper rejects call request, Cisco CallManager can auto-alternate route via route lists/route groups
- Utilizes Alt-Gk for resiliency

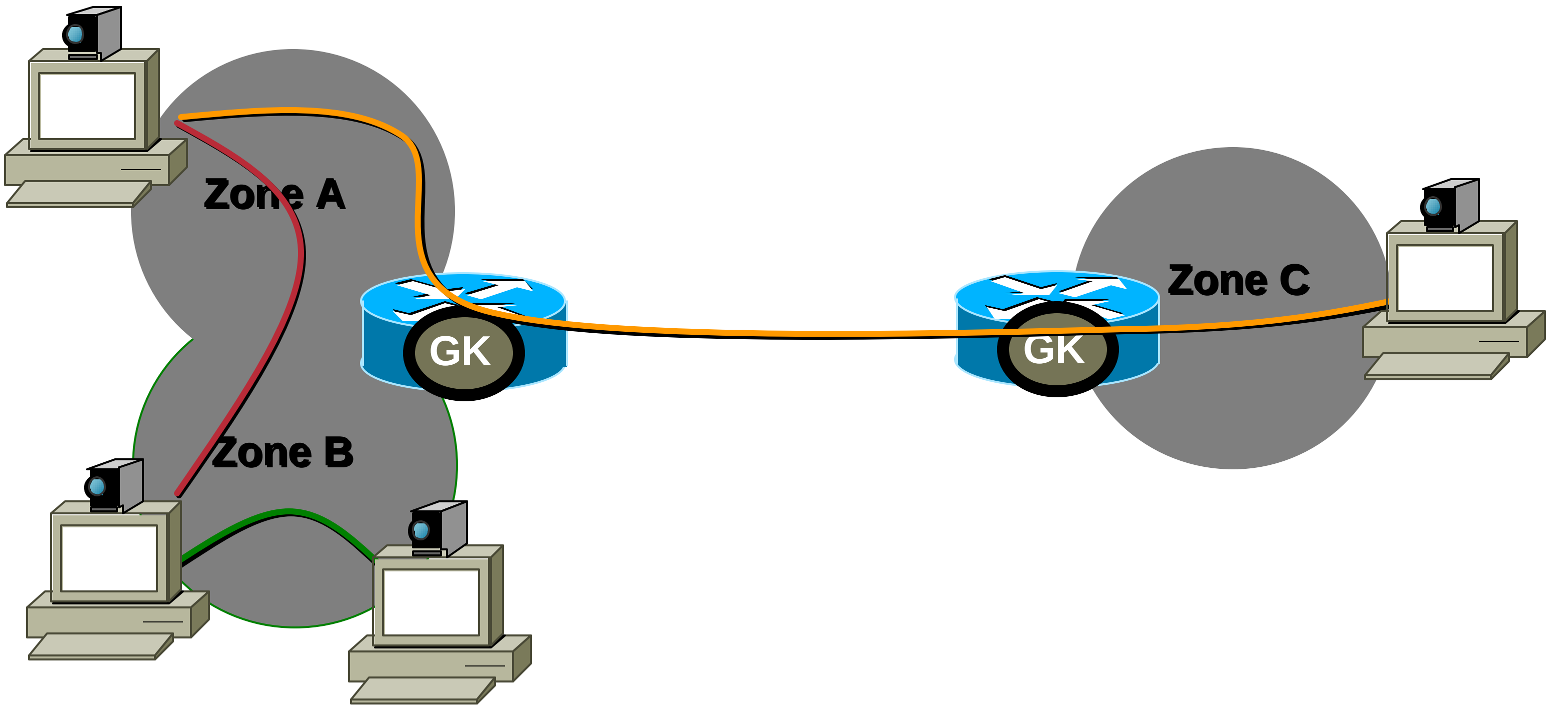
Combined (Two-Tier) CAC Within and Between Clusters

- **Hub-and-spoke topology**
- **Gatekeeper CAC used between regional sites**
  - **1 CallManager cluster per zone**
  - **100 local zones per Gatekeeper**
- **Locations CAC used for branch sites**
  - **500 locations per cluster**



Call Admission Control

Gatekeeper Bandwidth Commands Explained



1. Interzone = Bandwidth of all calls for a local zone to/from all other zones
2. Remote = Aggregate bandwidth of all local zone(s) to/from any remote zones
3. Total = Bandwidth of all calls within an individual zone
4. Session = Bandwidth allowed on a per call basis

Call Admission Control
What Values to Use

Cisco.com

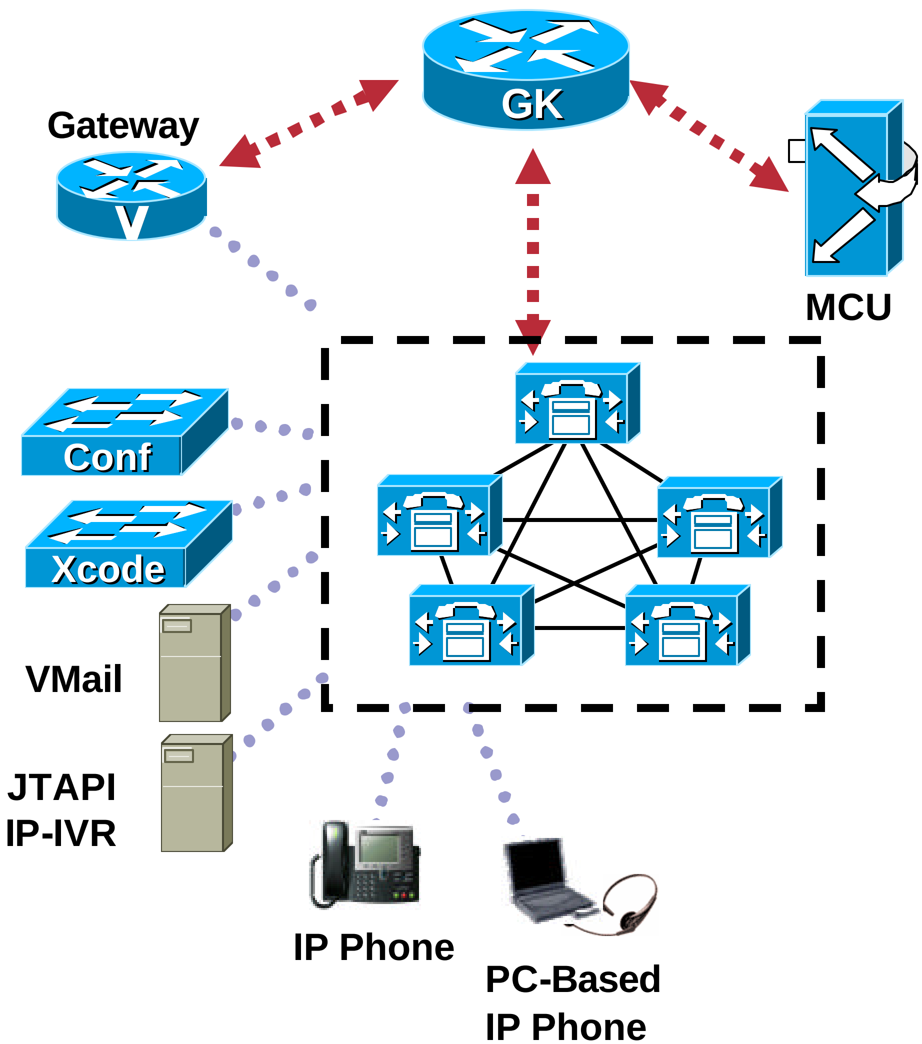
	CallManager Region	CallManager Location	H.323 Gatekeeper	LLQ Class
Audio-Only Calls Configuration	Audio Codec Only	Audio Bit-Rate + Layer-3 Overhead	2X the Bit-Rate[1]	Bit-Rate + all Layer2 and 3 overhead
Video Calls Configuration	Audio Codec + Video Call Bandwidth	Video Call Bandwidth	2X the Bit-Rate	Bit-Rate + 20% overhead
Example G.711 Call	G.711	80kbps	128kbps[1]	80kbps
Example 384kbps Video Call	G.711 audio codec and 384kbps video bandwidth	384kbps	768kbps	460kbps

[1] This behavior changed in CallManager 3.2(2)c and IOS release 12.2(2)XA. Prior to that, CallManager asked for bit-rate + layer-3 overhead, and IOS Gateways asked for 64kbps no matter what type of call it was

Agenda

- Video Telephony Fundamentals
- Endpoint, MCU and Gateway Integration
- Centralized Design and Deployment
- Distributed Design and Deployment
- Configuration

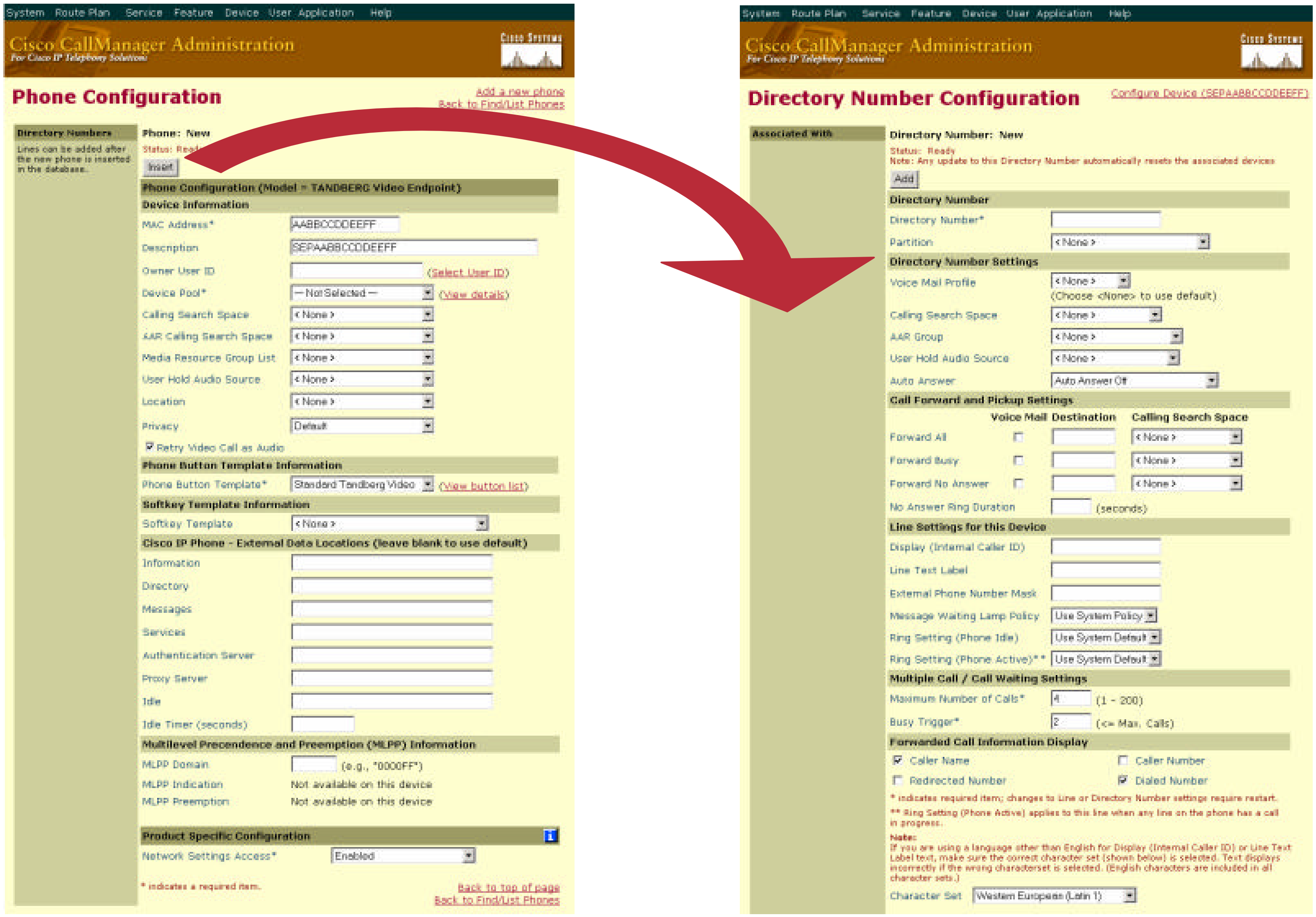
Configuring Cisco CallManager, Cisco IOS GK



- Configure regions, locations
- Configure Gatekeeper device in CCM
  - Choose “H.225” or use auto-discovery
- Configure H.225 trunk
- Configure endpoints
- Configure SCCP MCUs, MRGLs
- Configure Meet-Me numbers
- Configure Gateways that register to CM
- Configure route list/AAR
- Define route patterns, CSS, etc.

SCCP Endpoints

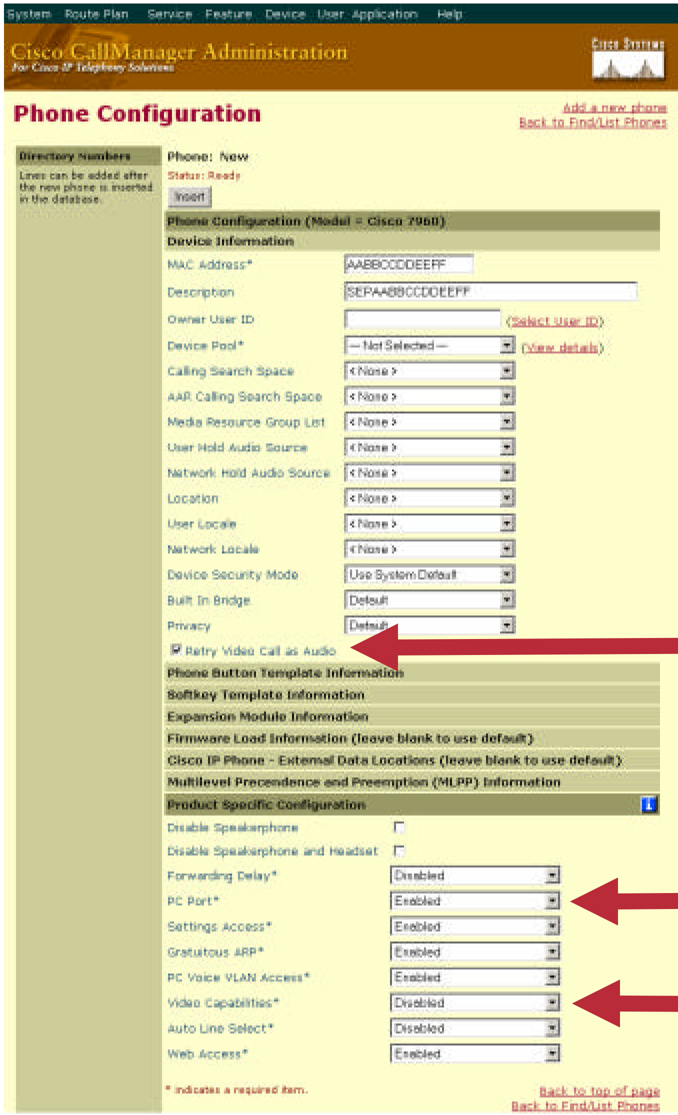
Configuring the SCCP Tandberg in CallManager



SCCP Endpoints

Configuring a VT Advantage Client in CallManager

Cisco.com



<u>Relevant Video Configuration Options:</u>

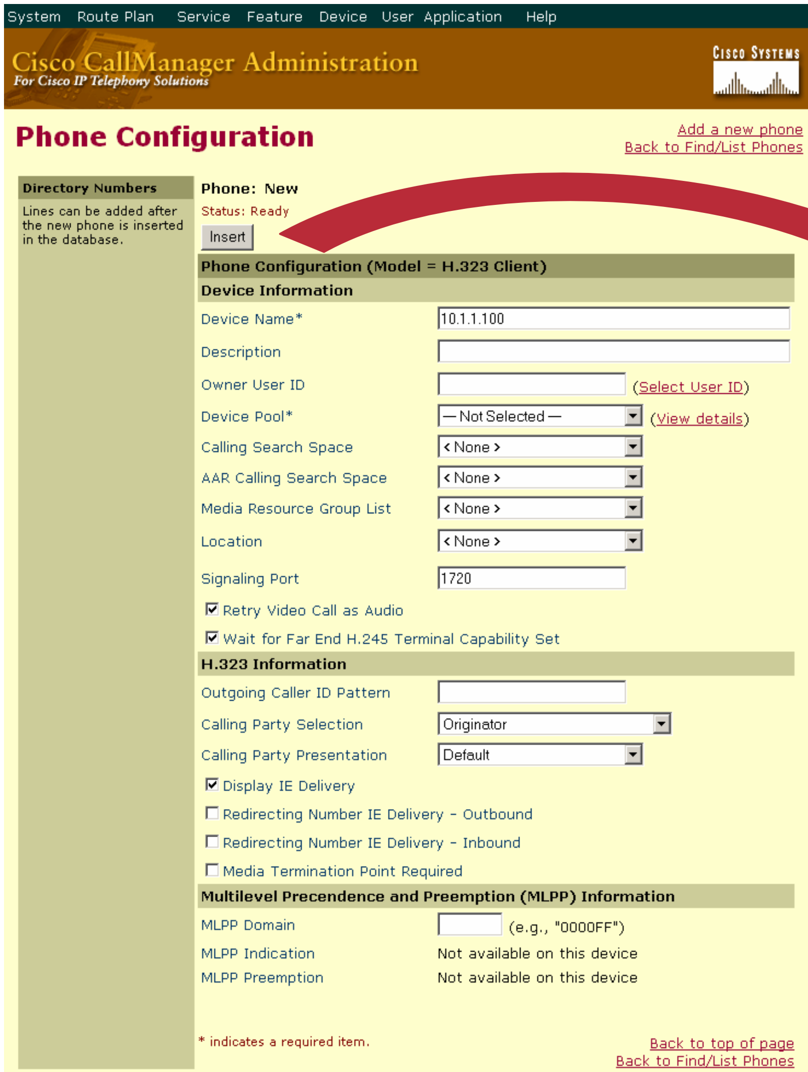
Retry Video Call as Audio
- **Checked by default**
  - ***Beware of bug between 4.0(1) and 4.0(1)sr1***
- **Uncheck it to allow for AAR**

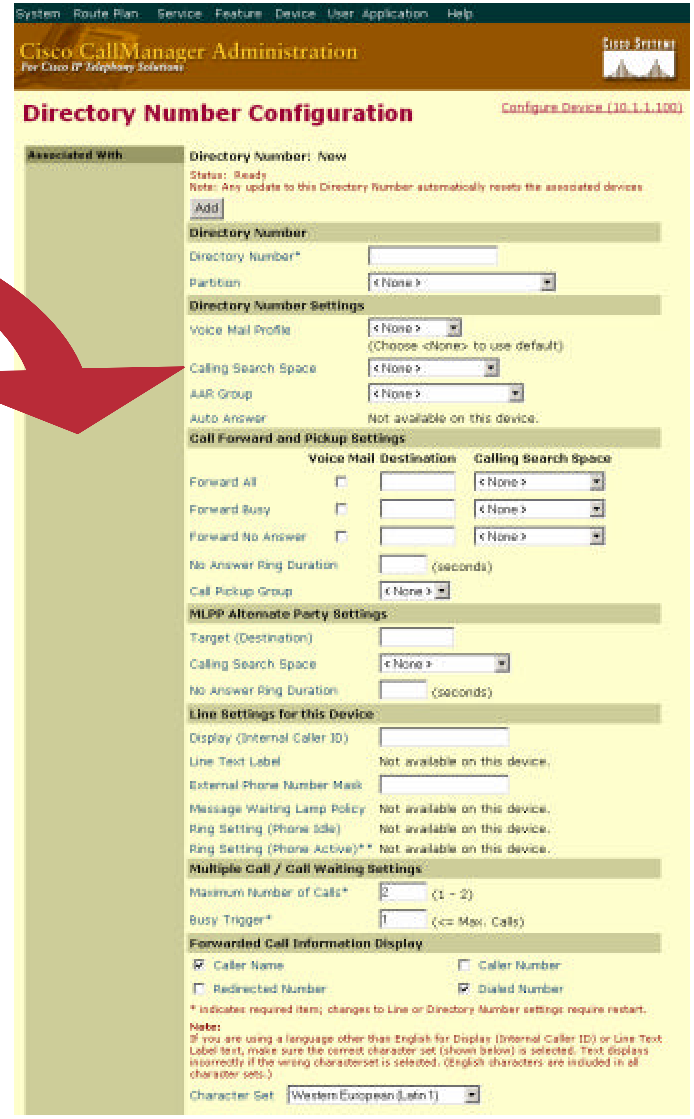
PC Port
- **Enabled by default**
- **Must be enabled for VT Advantage to connect to IP Phone**

Video Capabilities
- **Disabled by default**
- **Enable to allow VT Advantage to associate with IP Phone**

H.323 Endpoints

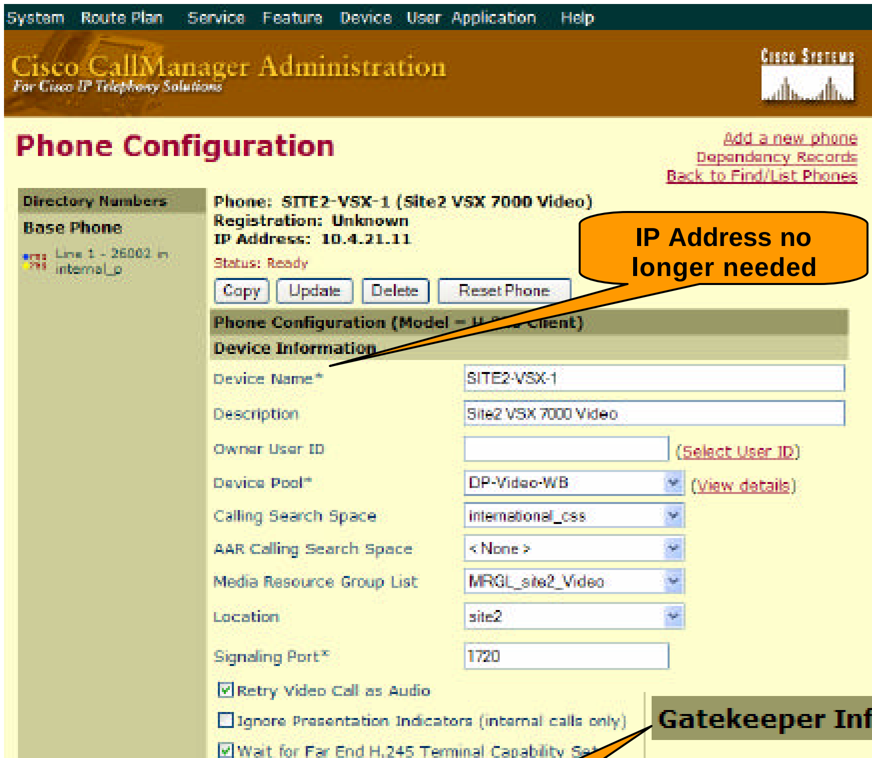
Configuring H.323 Clients in CallManager 4.0



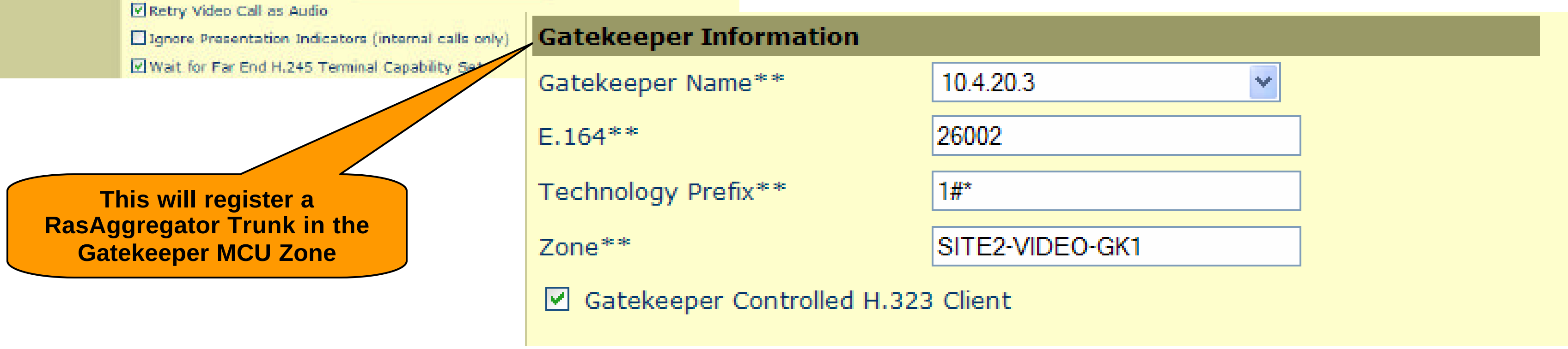


H.323 Endpoints

Configuring H.323 Clients in CallManager 4.1



- Supports Dynamic DHCP Addressing
- Must have a Gatekeeper configured in CCM
- E.164 has to match endpoint configuration
  - CCM 4.1(2) must also match the CCM DN
    - See CSCef71775
- Video endpoints dedicated Gatekeeper Zone
- Must Group Endpoints with the following
  - Device Pool
  - Gatekeeper
  - Technology Prefix
  - Zone



Dynamic H.323 Addressing
Caveats

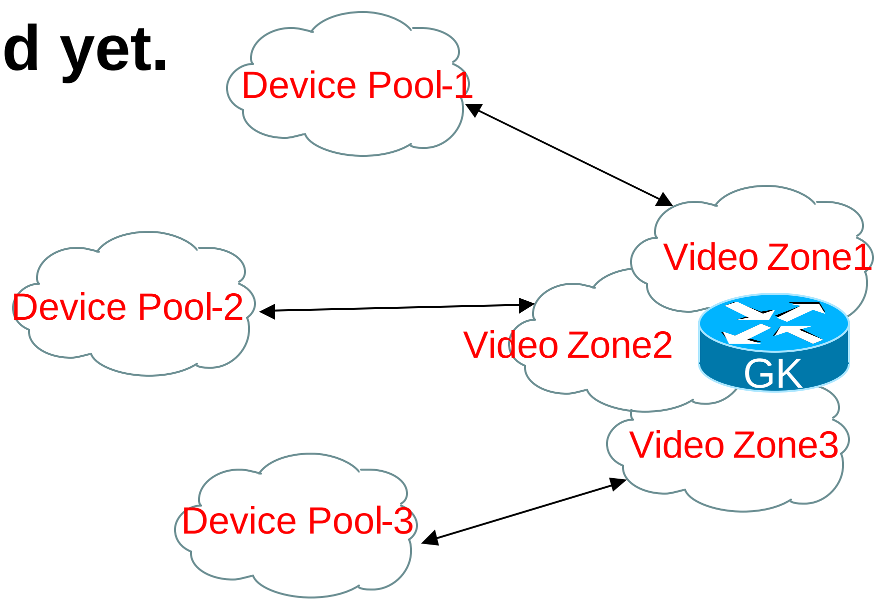
Cisco.com

- **Must Group all GK Controlled H.323 Clients in the same Device Pool with the same Gatekeeper Zone**
- **In order to load balance these endpoints within the CCM cluster more Gatekeeper zones need to be created.**
- **NOT tested or documented yet.**


Gatekeeper Information

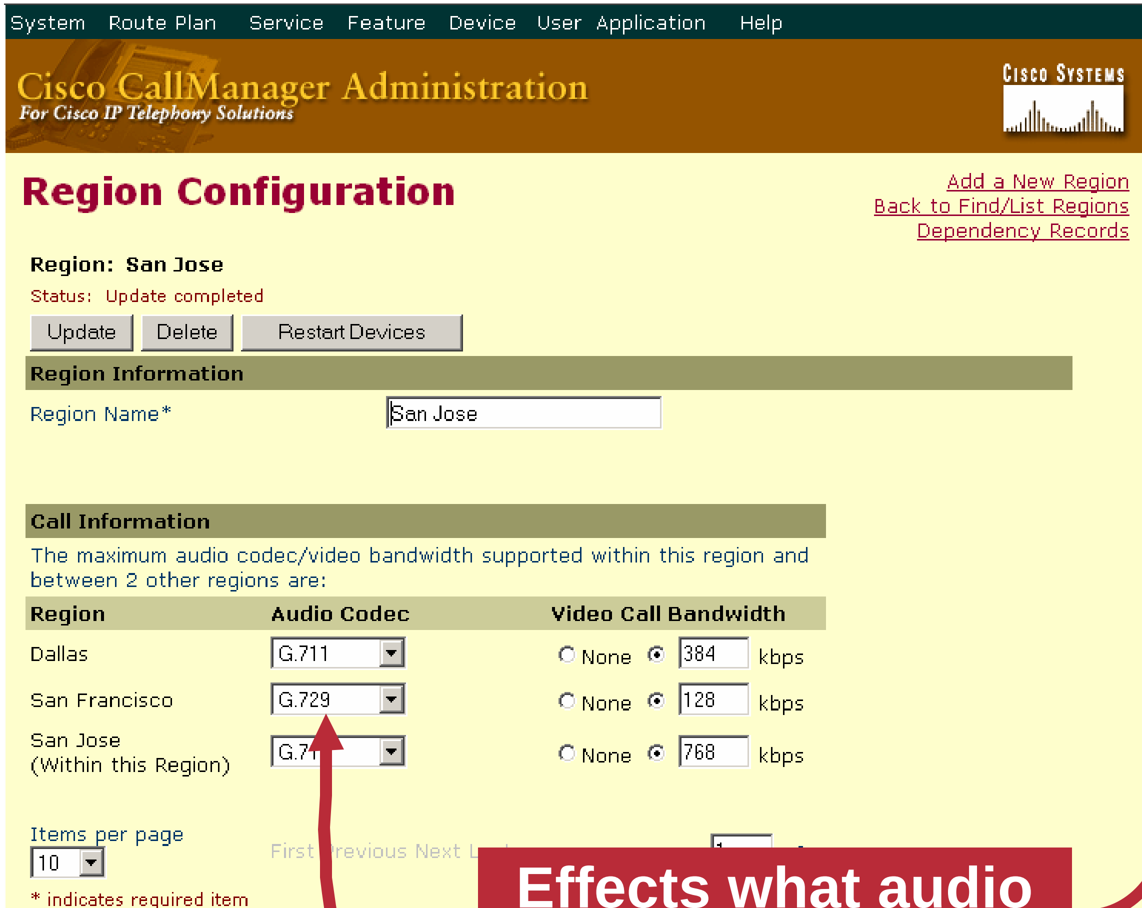
Gatekeeper Name**	10.4.20.3
E.164**	26001
Technology Prefix**	1#
Zone**	SITE2-VIDEO-GK1

☑ Gatekeeper Controlled H.323 Client



Call Admission Control
CallManager Regions

Cisco.com



Effects what audio codec is used for video calls as well!

- **Audio is represented by codec while video is represented by speed. Both really mean the same thing: the maximum bit-rate allowed**
- **Video bandwidth includes audio (i.e. 320kbps + 64kbps)**
- **Audio codec also applies to video calls**

!!!VERY IMPORTANT!!!

Video endpoints typically only support G.728, G.711 and G.722

Audio endpoints typically only support G.729 and G.711

Call Admission Control

CallManager Locations

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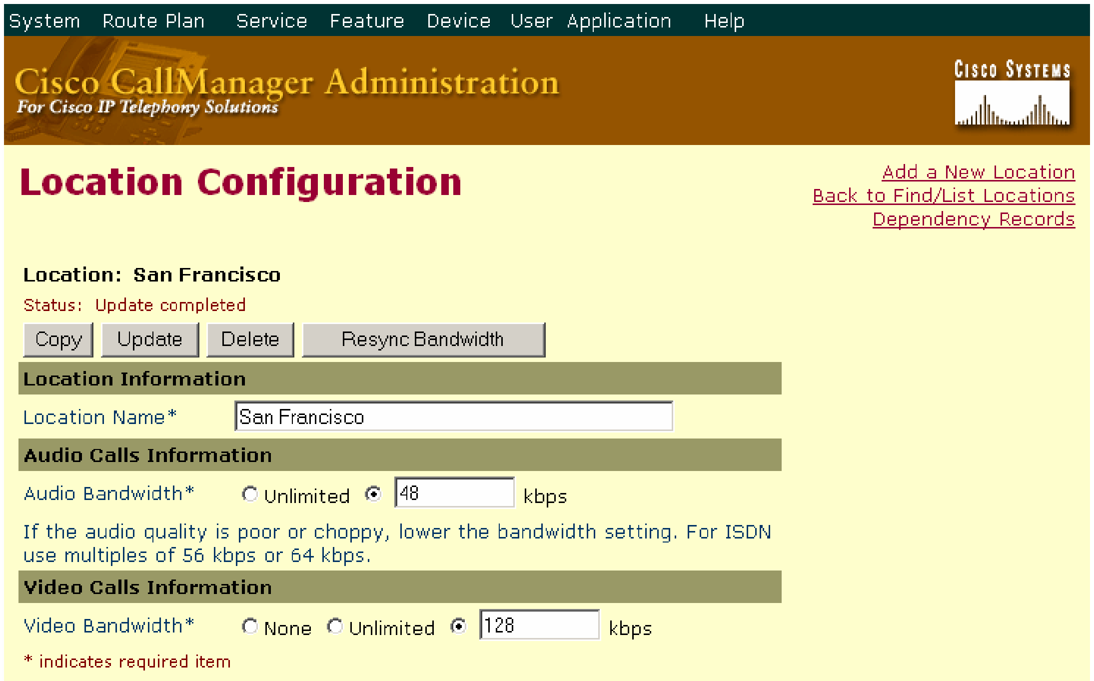


- Audio is represented as bit-rate + overhead (i.e. 24k for G.729, 80k for G.711)
- Video is represented as bit-rate only (i.e. 384k for a 384k call) and includes the audio portion

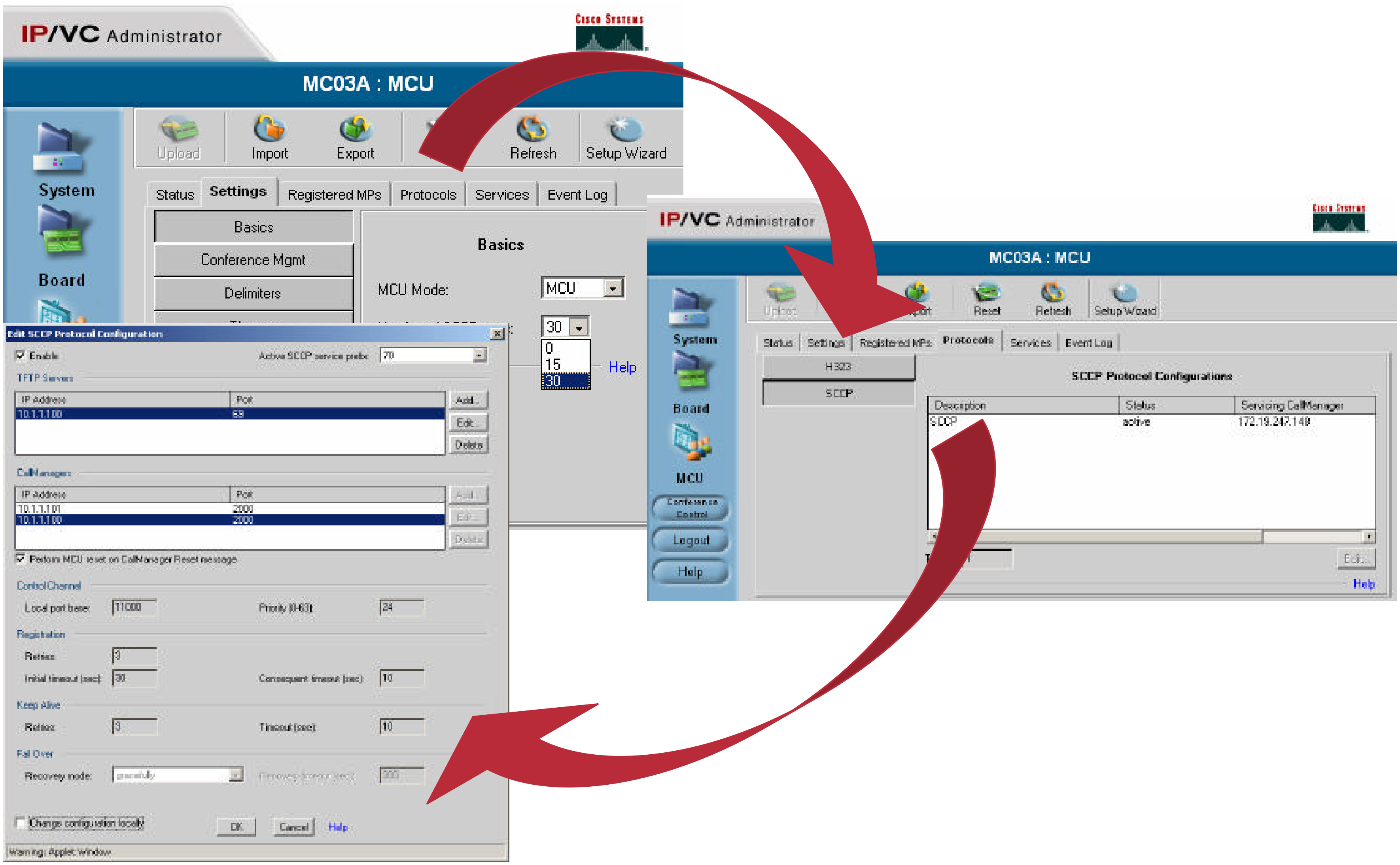
  !!!VERY IMPORTANT!!!

  The audio bandwidth setting does not pertain to the audio channel of a video call

- Kept separate for a very good reason: voice should have its own dedicated bucket, separate from video, rather than having them fight over one big bucket

  Matches the way it works at Layer-2 in Low-Latency Queueing configurations where video is placed in a separate PQ, or in a CBWFQ, and the audio channel of a video call is placed in the same class as the video channel

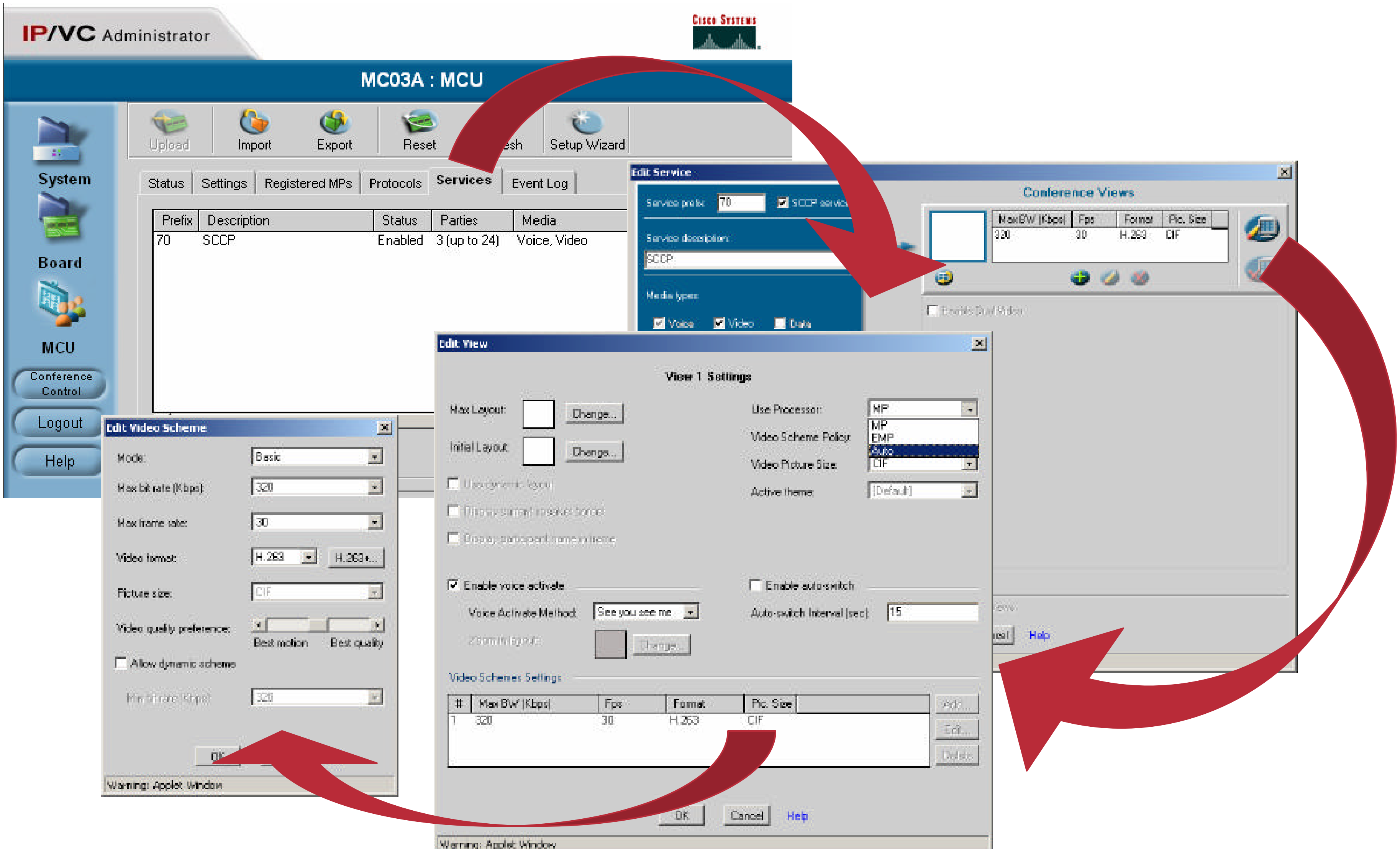
SCCP Conference Bridges
Configuring the Conference Bridge SCCP Protocol



SCCP Conference Bridges

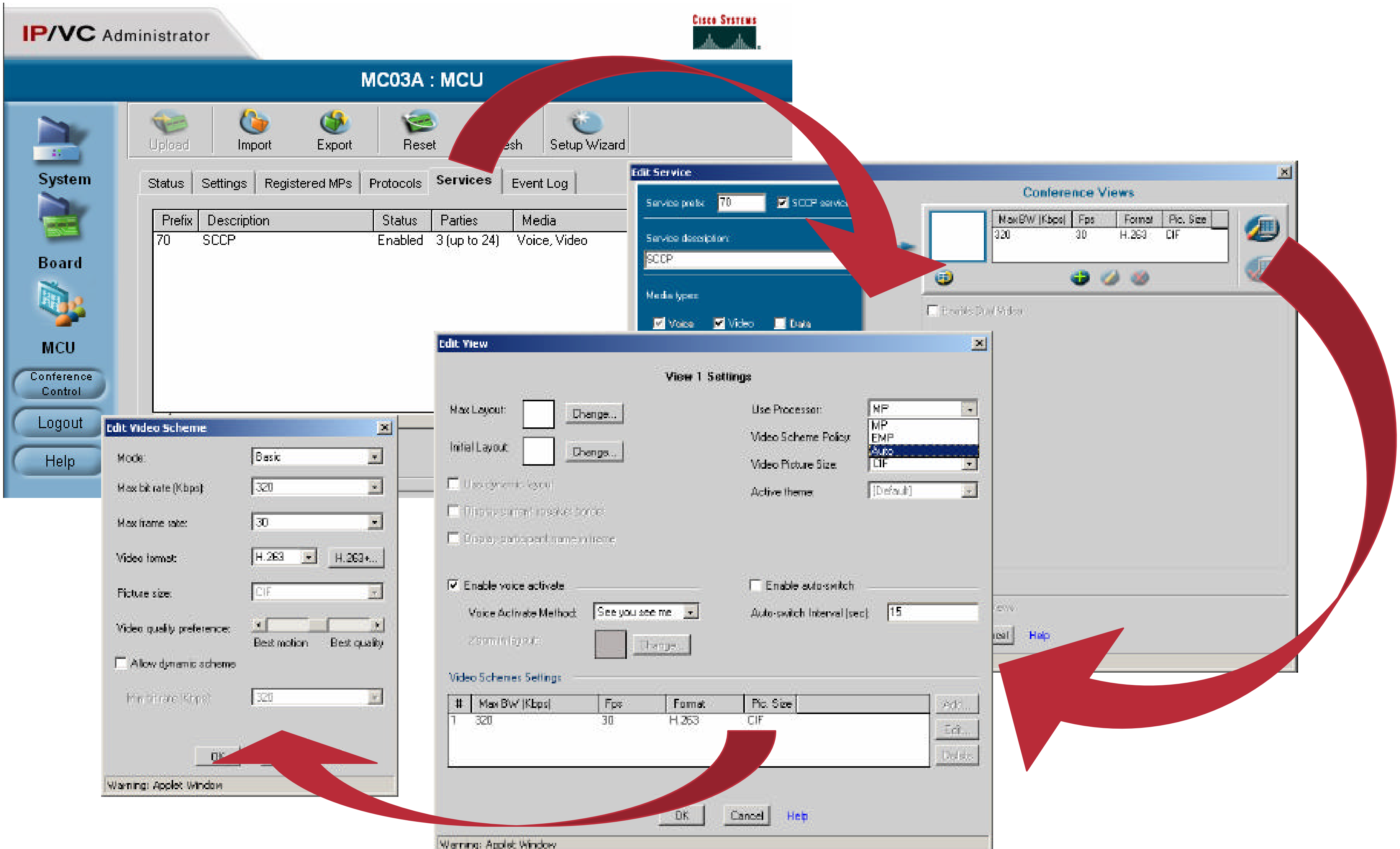
Configuring the Conference Bridge SCCP Service

Cisco.com



SCCP Conference Bridges

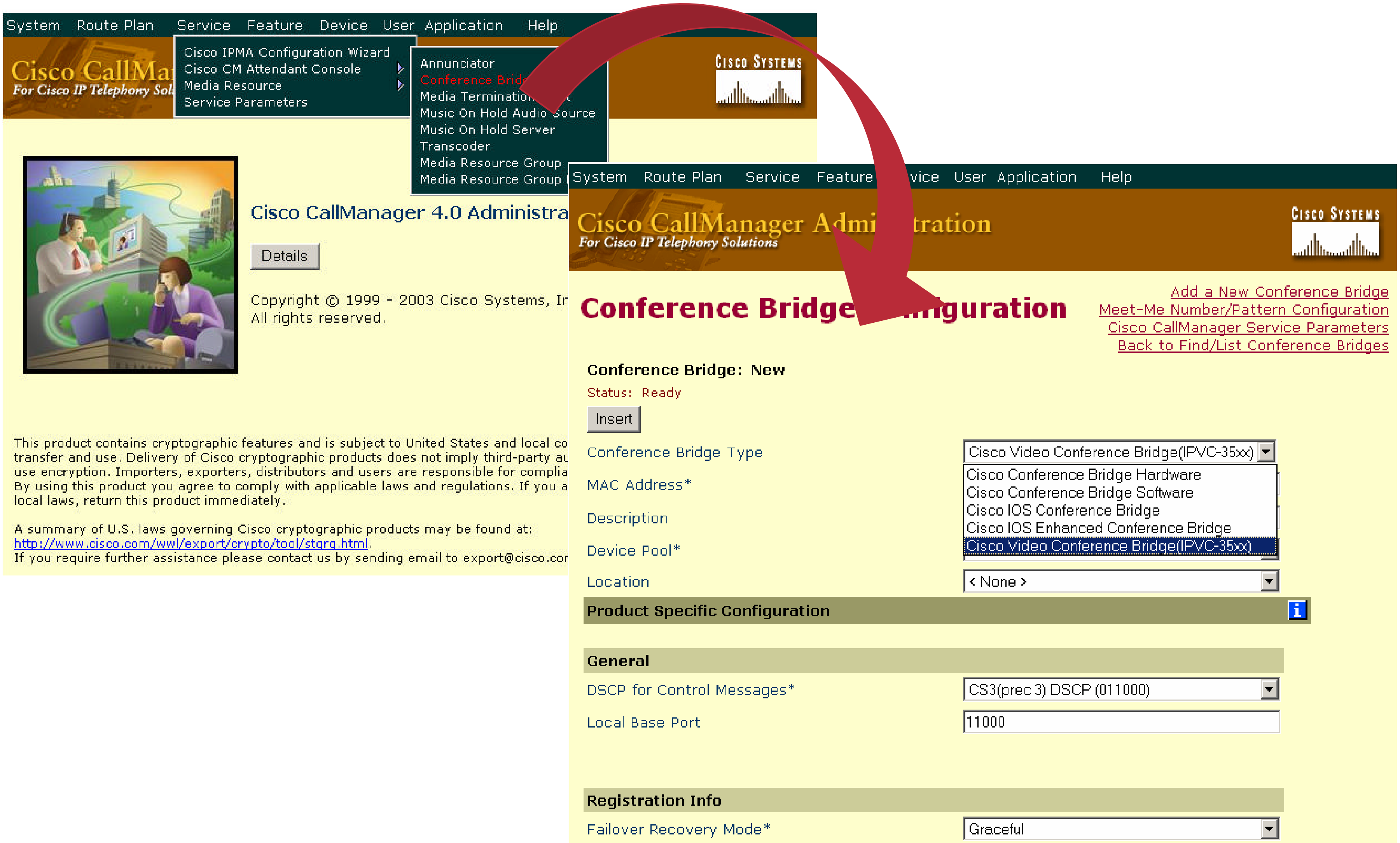
Configuring the Conference Bridge SCCP Service for Continuous Presence



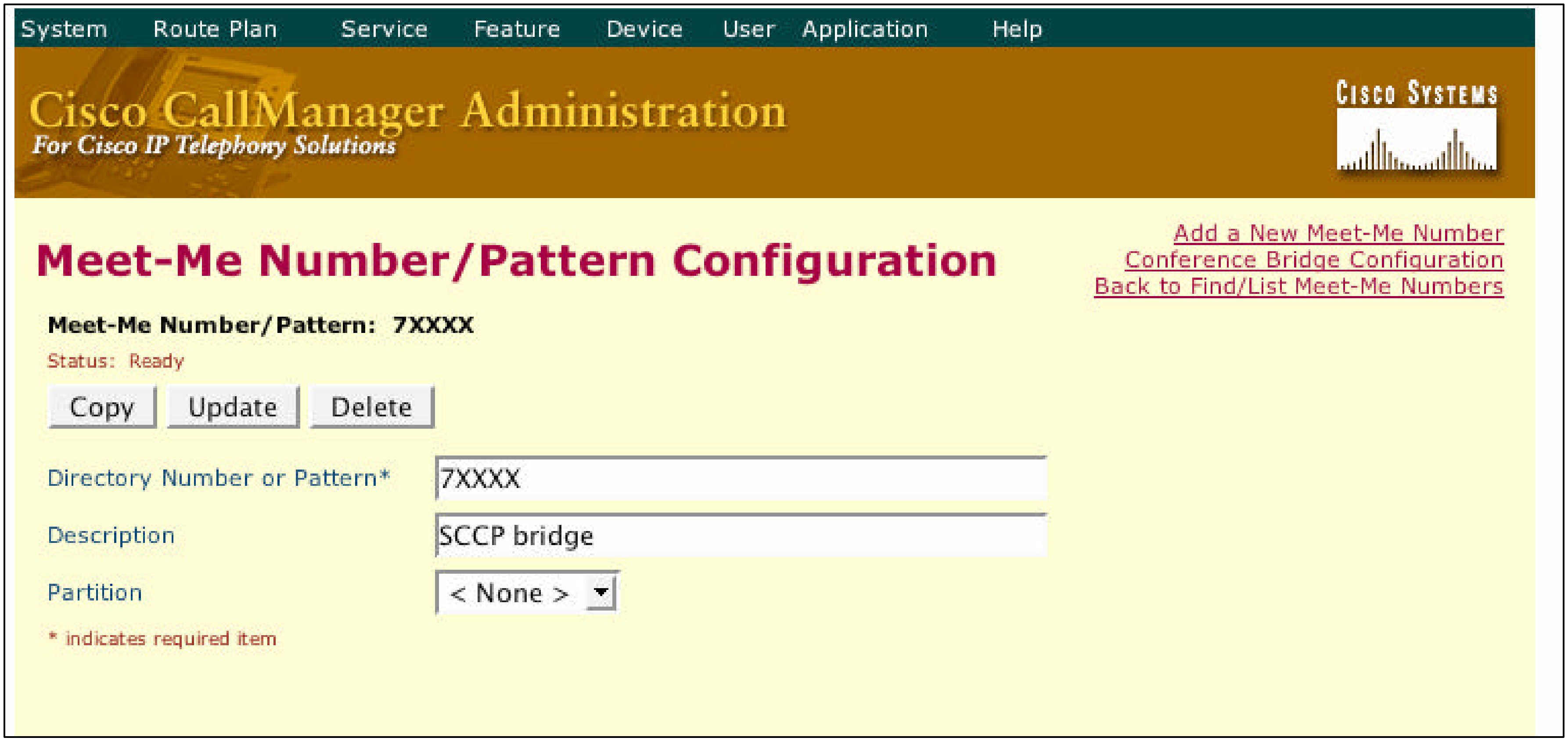
SCCP Conference Bridges

Configuring the Conference Bridge in CallManager

Cisco.com



Configuring Meet-Me Numbers



Configuring Cisco IOS Gatekeeper

Cisco.com

- Gatekeeper release 12.2(4)T or higher required
- Configure different local zones for CallManager and videoconferencing devices
  - Enables scalable dial plans, differentiation in zone bandwidth controls (CAC mechanisms), granular proxy usage definitions and endpoint management
  - Video endpoints can't specify the zone name they want to register with, so use "zone subnet" commands to force video endpoints into the proper zone
- Be careful to turn proxy usage off for calls
  - Default proxy usage configuration is:

```
PROXY USAGE CONFIGURATION :
  Inbound Calls from all other zones :
    to terminals in local zone : use proxy
    to gateways in local zone  : do not use proxy
    to mcu's in local zone  : do not use proxy
  Outbound Calls to all other zones :
    from terminals in local zone : use proxy
    from gateways in local zone  : do not use proxy
    from mcu's in local zone  : do not use proxy
```

- Configure "hopoff" commands for all MCU technology prefixes and optionally use the "default-technology" command for the CallManager technology prefix; this must only be done if using multiple local zones on a single gatekeeper

Configuring Cisco IOS Gatekeeper - CM4.1

Cisco.com

- **CM 4.1 will register to IOS GK as an IP-IP gateway, allowing a simplified gatekeeper configuration as well as H.323 endpoint mobility**

```
gatekeeper
zone local endpoints-mcus-and-gateways domain.com invia callmanager outvia callmanager enable-intrazone
zone local callmanager domain.com
zone prefix video-endpoints <XXXX> //E.164 zone prefix of the endpoint zone
gw-type-prefix 1# default-technology
endpoint ttl 60
no shutdown
```

Gatekeeper Clustering Configuration Example

Cisco.com

12.2(15)T1 Enterprise MCM

```
gatekeeper
 zone local CHC_Video customer.com 10.1.2.1
 zone local SJC_Video2 customer.com

 zone cluster local CHCVideo_Cluster CHC_Video
  element CHC_Video2 10.1.3.1 1719
  element CHC_Video3  10.1.1.1 1719
!
 zone cluster local SJCVideo_Cluster SJC_Video2
  element SJC_Video 10.1.1.1 1719
  element SJC_Video3 10.1.3.1 1719
!
  zone prefix SJC_Video2 40852…..
  zone prefix CHC_Video 72067…..

  load-balance cpu 80 memory 80
```

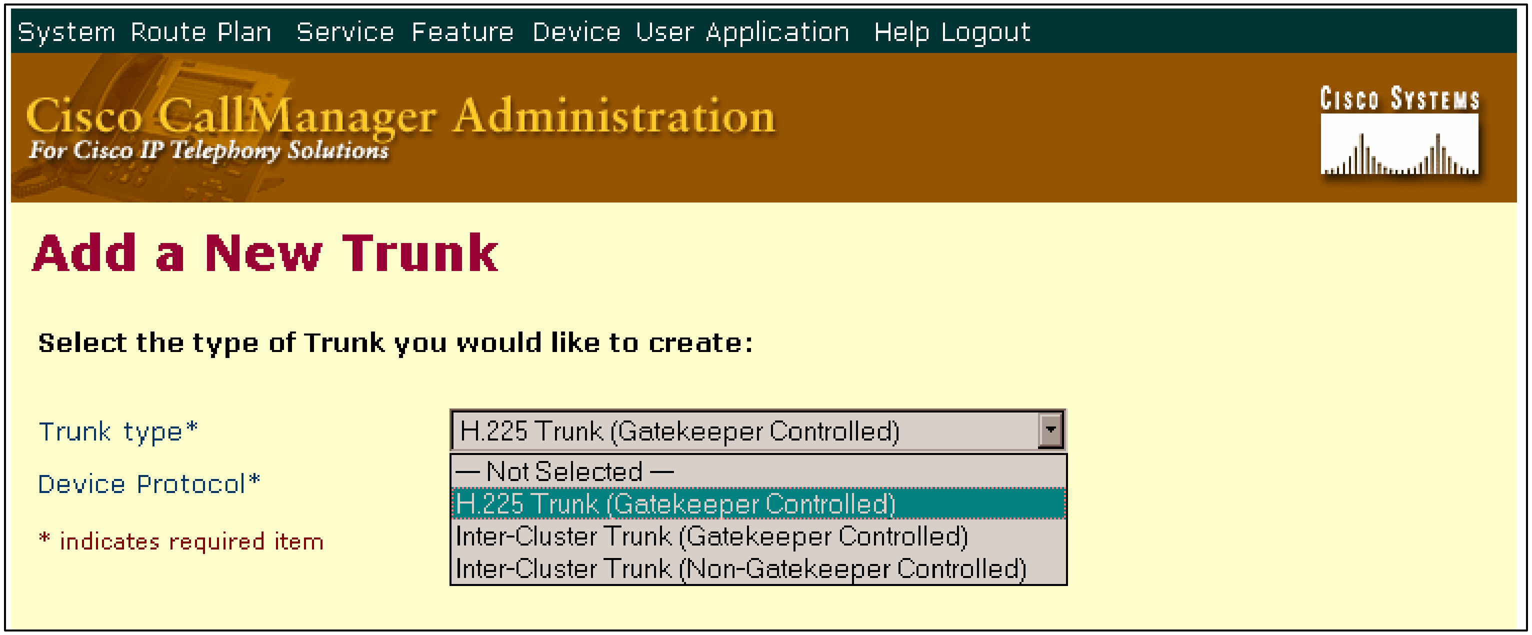
Cluster Configured for Each Zone Supported in the Cluster; Elements Listed in Order Used for Backup

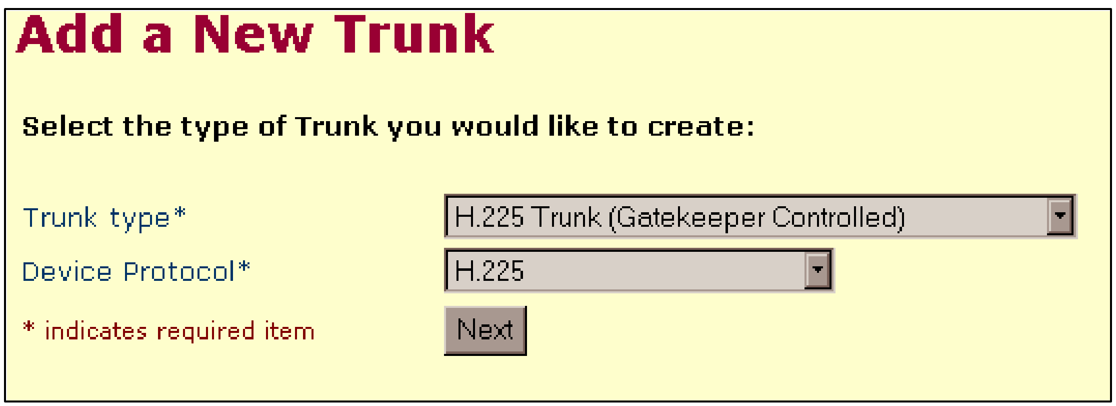
Load-Balance Thresholds Set to 80% for CPU and Memory

Cisco CallManager Gatekeeper Configuration

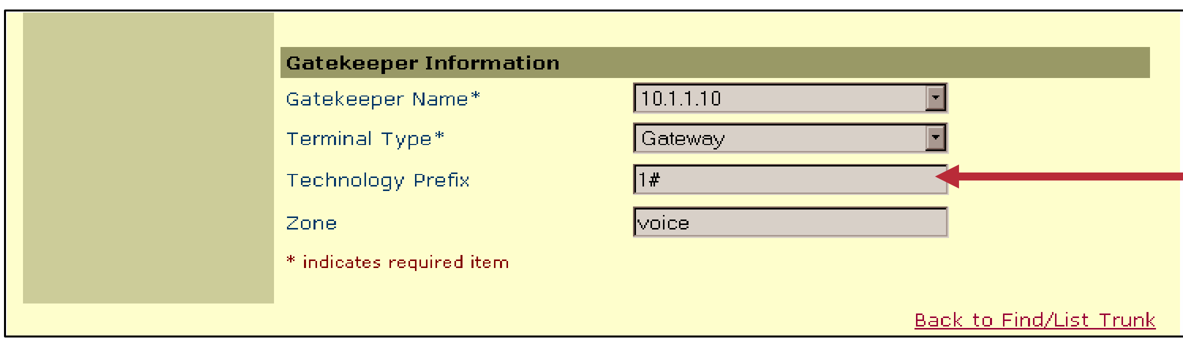
Cisco.com

Cisco CallManager H.225 Trunk Setup





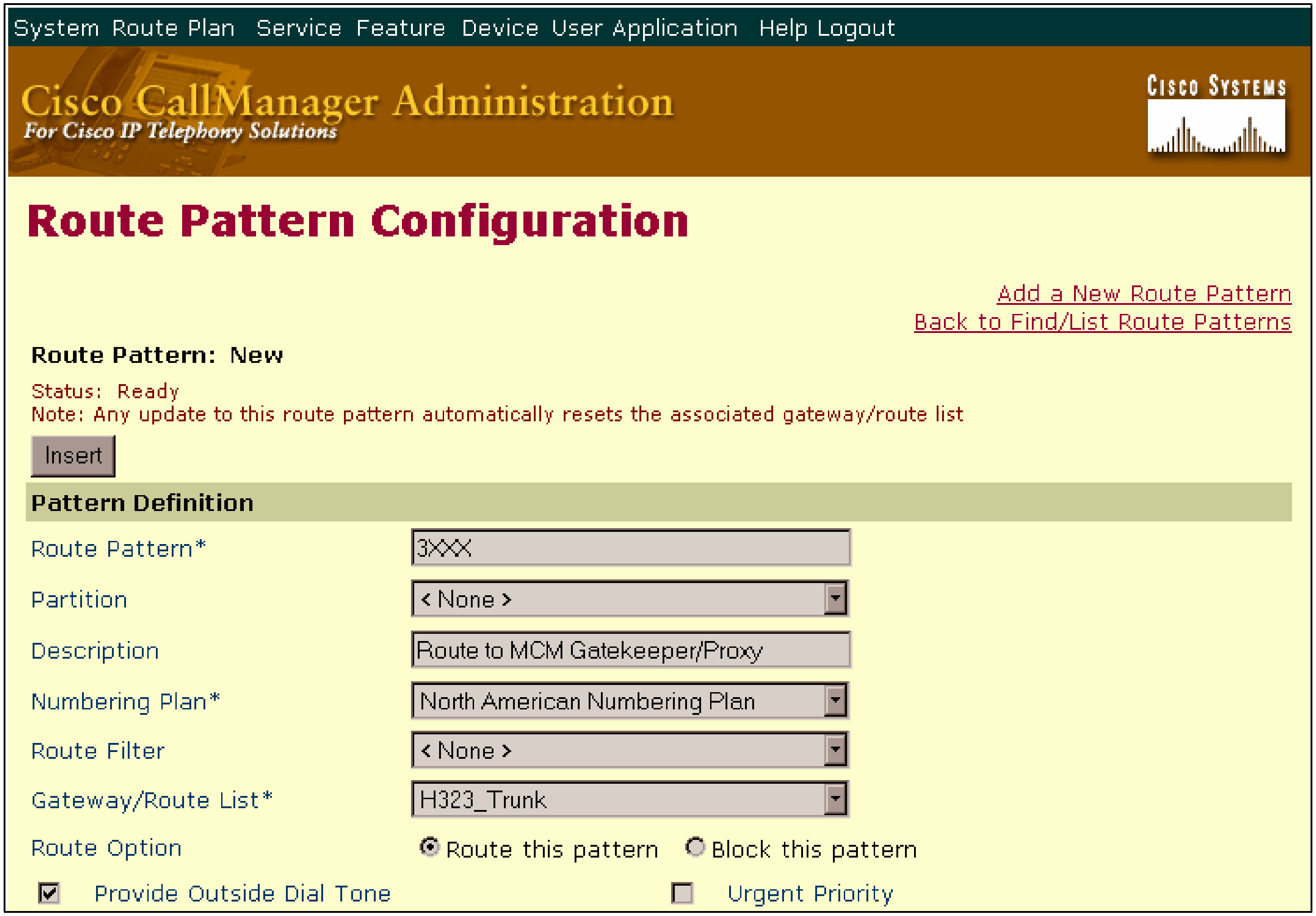
Cisco CallManager H.225 Trunk Setup (Cont.)



This Defines the Default Tech-Prefix in GK

Adding Route to GK in Cisco CallManager

Cisco.com

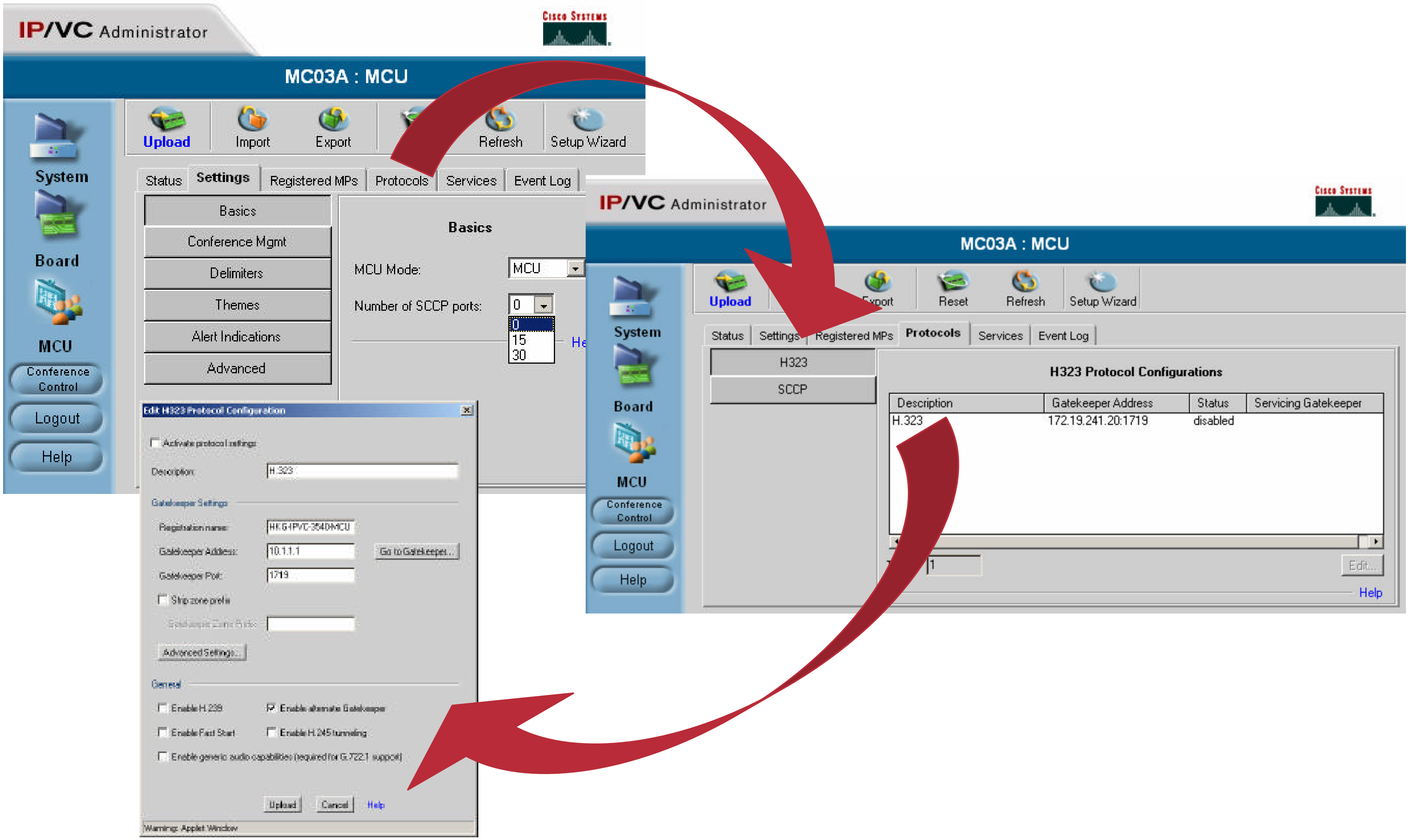


Configuring IP/VC MCUs

- MCU registers its service prefixes with the gatekeeper
- You can configure services to support audio-only, or configure them to support a variety of speeds of both voice+video, and it will allow audio-only participants to join as well
- IP/VC 35xx MCUs only support G.711 (except for 3540 with optional daughtercard and 3511 models)
- Support for SCCP in 3.2 plus
- Continuous Presence is supported for H.323 conferences, using either SCCP or H.323 endpoints
- EMP module may be required for some formats or endpoints

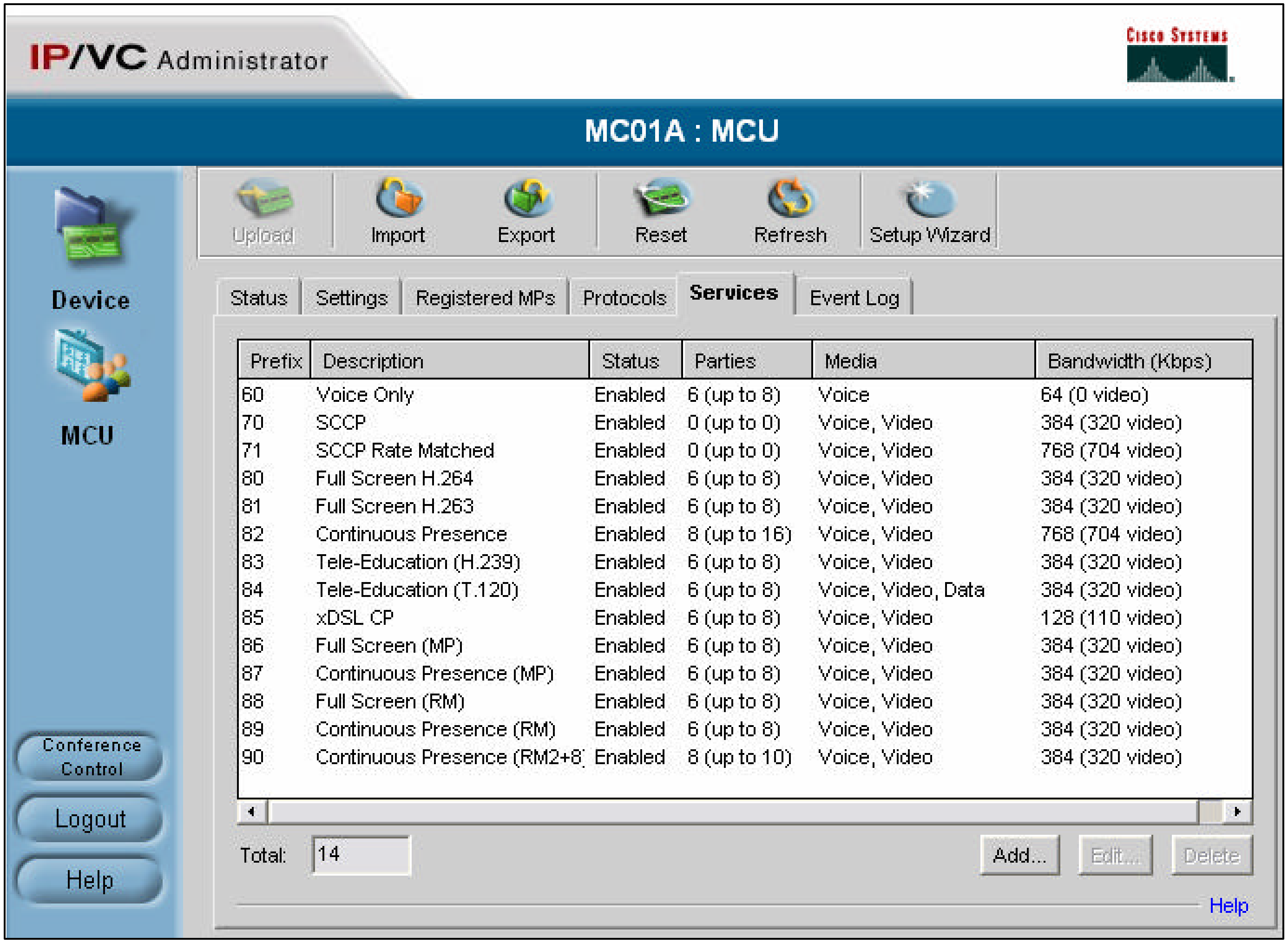
H.323 Conference Bridges

Configuring the Conference Bridge H.323 Protocol



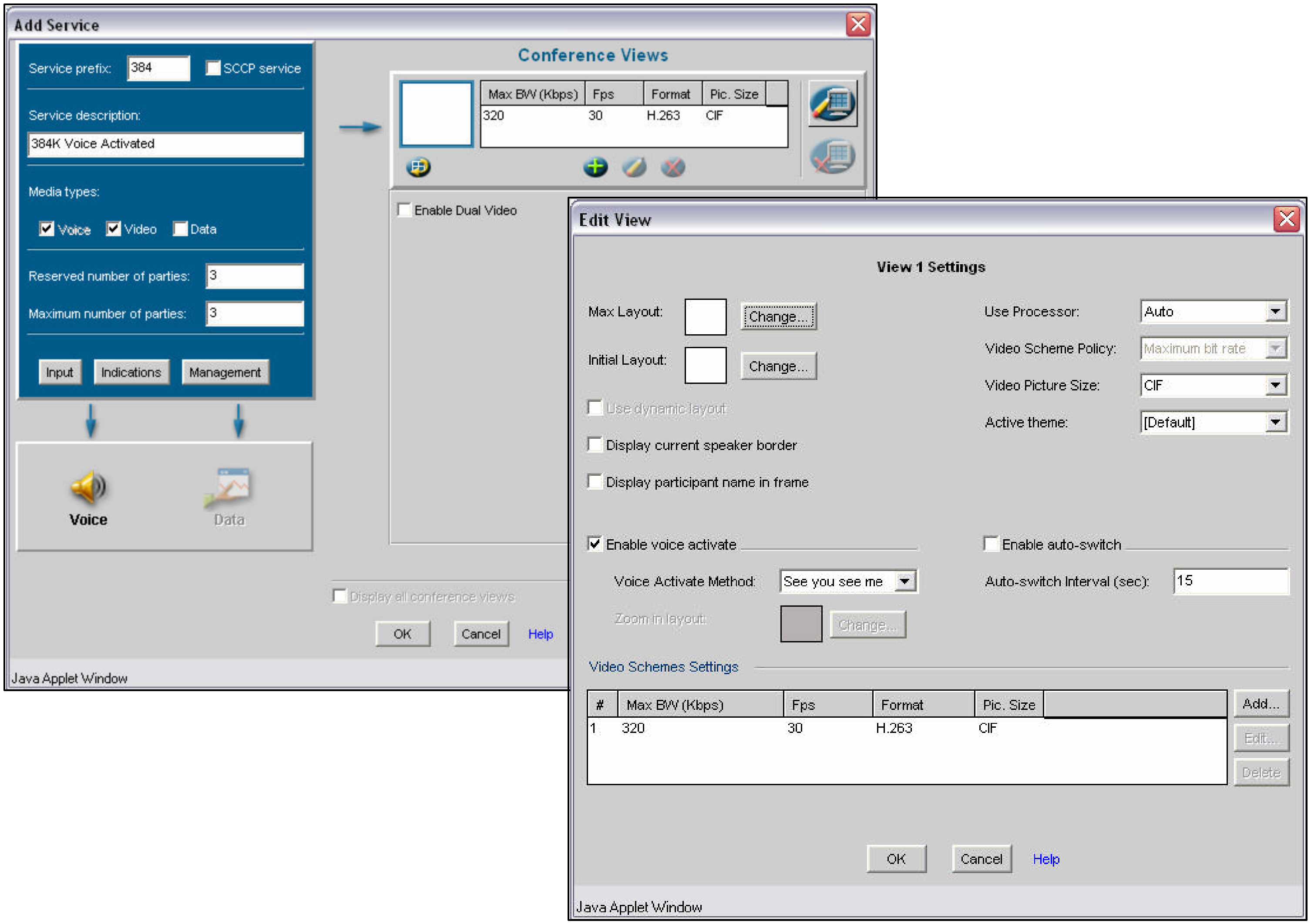
MCU Service Table

Cisco.com



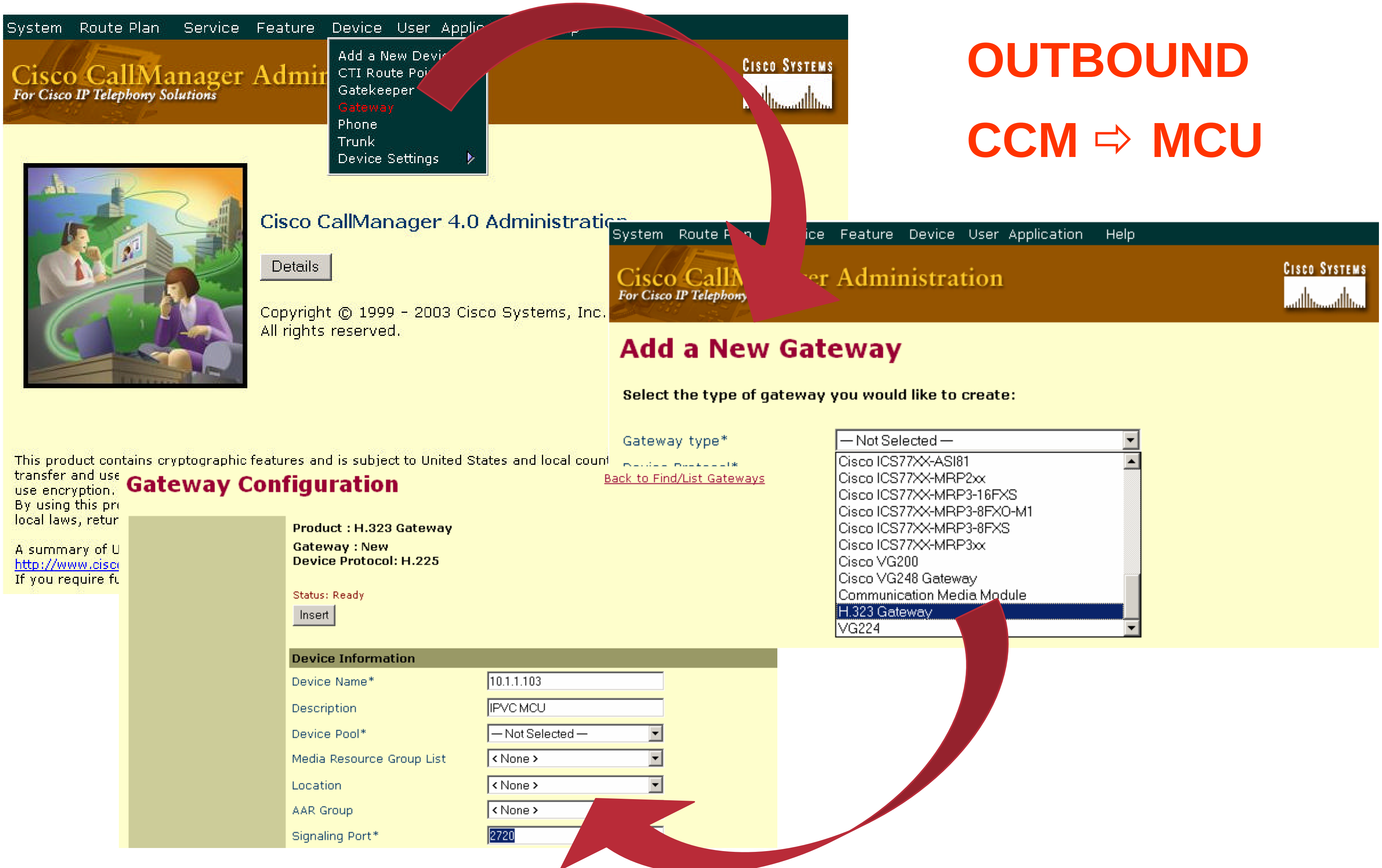
Prefix	Description	Status	Parties	Media	Bandwidth (Kbps)
60	Voice Only	Enabled	6 (up to 8)	Voice	64 (0 video)
70	SCCP	Enabled	0 (up to 0)	Voice, Video	384 (320 video)
71	SCCP Rate Matched	Enabled	0 (up to 0)	Voice, Video	768 (704 video)
80	Full Screen H.264	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
81	Full Screen H.263	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
82	Continuous Presence	Enabled	8 (up to 16)	Voice, Video	768 (704 video)
83	Tele-Education (H.239)	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
84	Tele-Education (T.120)	Enabled	6 (up to 8)	Voice, Video, Data	384 (320 video)
85	xDSL CP	Enabled	6 (up to 8)	Voice, Video	128 (110 video)
86	Full Screen (MP)	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
87	Continuous Presence (MP)	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
88	Full Screen (RM)	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
89	Continuous Presence (RM)	Enabled	6 (up to 8)	Voice, Video	384 (320 video)
90	Continuous Presence (RM2+8)	Enabled	8 (up to 10)	Voice, Video	384 (320 video)

MCU H.323 Service Configuration



H.323 Conference Bridges

Configuring the Conference Bridge in CallManager 1 of 2



OUTBOUND

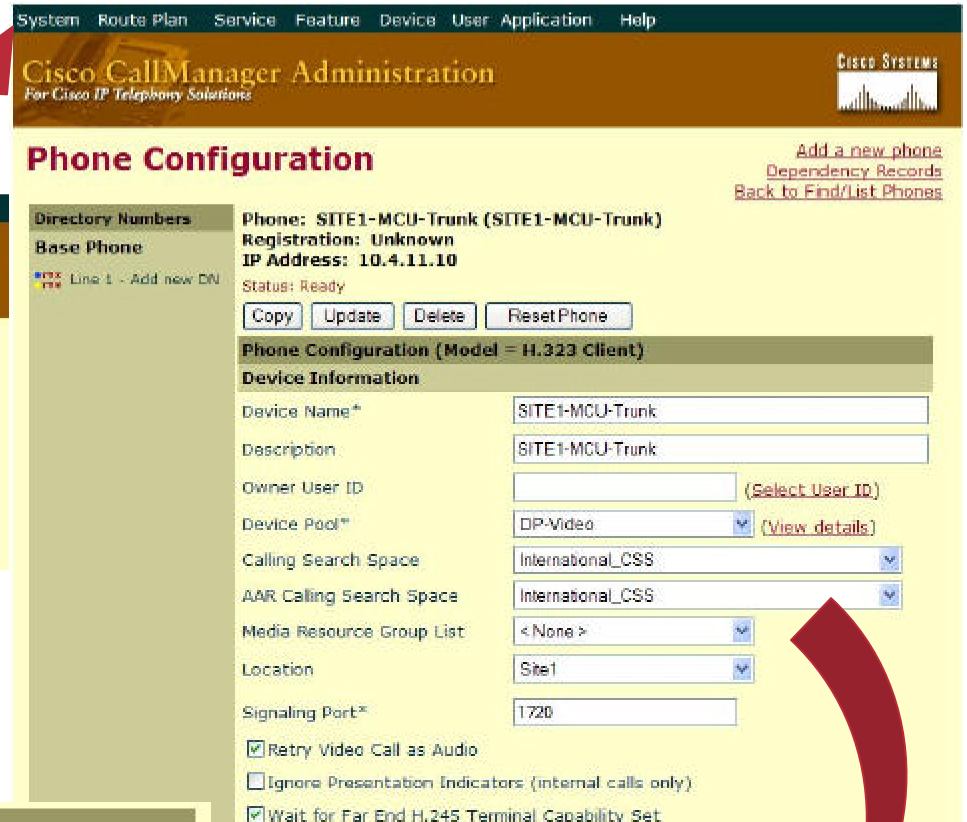
CCM ⇨ MCU

H.323 Conference Bridges

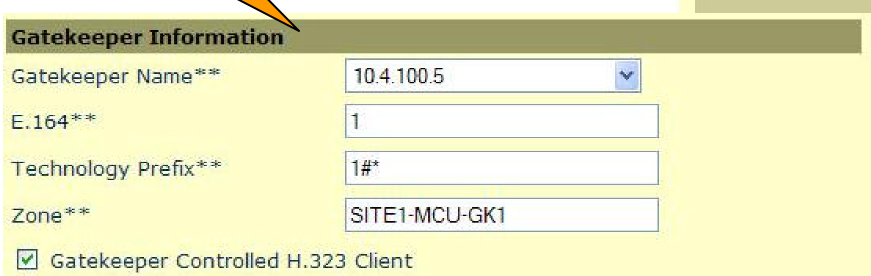
Configuring the Conference Bridge in CallManager

INBOUND

MCU ⇨ CCM



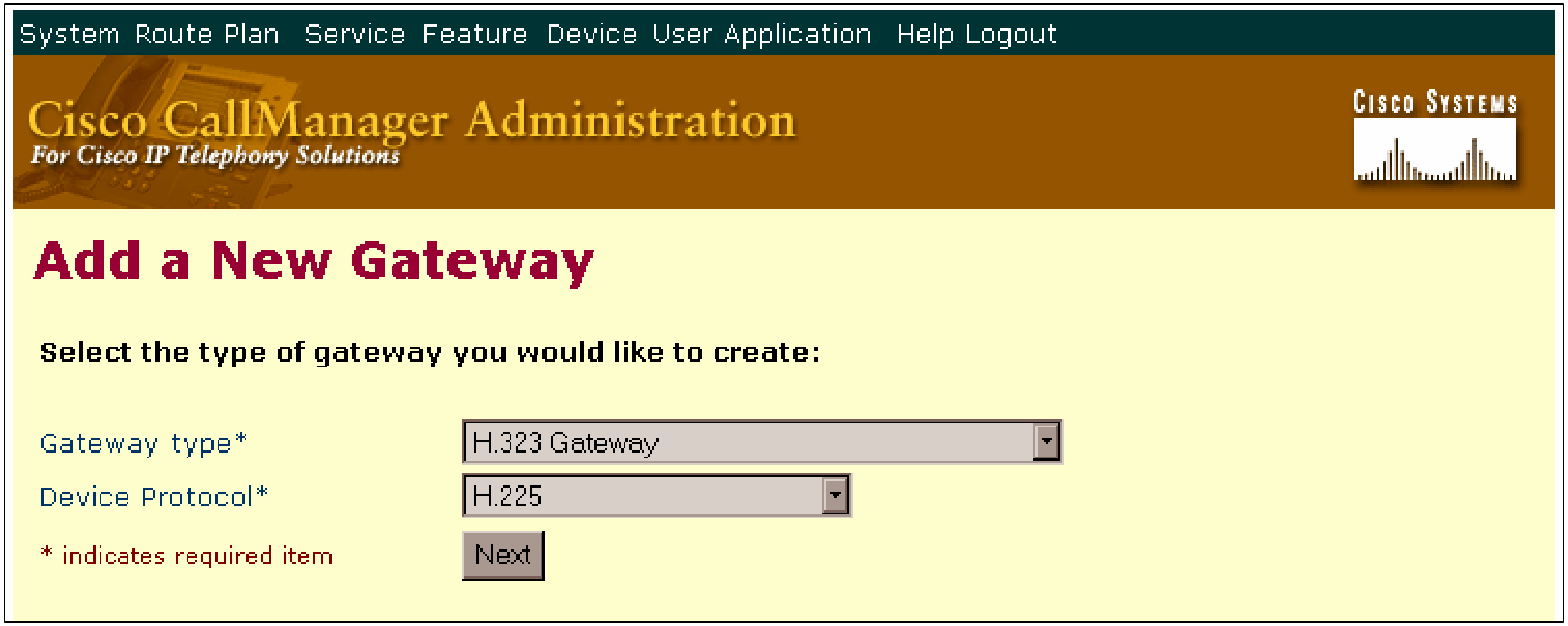
This will register a RasAggregator Trunk in the Gatekeeper MCU Zone



Configuring Gateways

- **Depends on the type and use of the gateway**
  - MGCP/PSTN gateways register with Cisco CallManager
  - H.323/PSTN gateways can point directly to Cisco CallManager or register with the gatekeeper (depends on the deployment scenario/application: VoIP or IP telephony…)
  - H.323/H.320 gateways (i.e. IP/VC gateways) register with the gatekeeper (they do not know how to point directly to Cisco CallManager)
- **Any-to-any connectivity**
  - IP phone to PSTN calls use MGCP/PSTN gateway, or H.323/PSTN gateway
  - PSTN to IP phone same as above but in opposite direction
  - H.323 video to PSTN/H.320, or PSTN/H.320 to H.323 use IP/VC gateway

Cisco CallManager H.323 Gateway Setup



Cisco CallManager H.323 Gateway Setup (Cont.)

Cisco.com

Summary

Cisco.com

- **Cisco CallManager 4.x has unified and simplified voice and video deployments**
- **There is a clear migration strategy from traditional video deployments to a Cisco CallManager unified voice/video approach**
- **QoS is critical to successful voice AND video deployments**

Complete Your Online Session Evaluation!

Por favor, complete el formulario de evaluación.

Muchas gracias.

Session ID: VVT–2100

**“DESIGNING AND DEPLOYING
IP VIDEO TELEPHONY NETWORKS”**