



Packet Telephony Protocols and Architectures

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Agenda

- **The Protocols**
- **Network and Protocols in Fixed Network**
- **Moving Into Wireless Mobile**

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H.323

- H.323 is a suite of multimedia conferencing protocol, which includes voice, video, and data conferencing, for use over packet-switched networks
- ITU-T SG16. v1 approved in 1996, v2 in January 1998, v3 in September 1999, v4 in November 2000, v5 targeted 2002.
- ASN.1 coded. Highly scalable, Versatile and Robust Protocol Suite Since v2.

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H.323 is an “Umbrella” Specification

Media

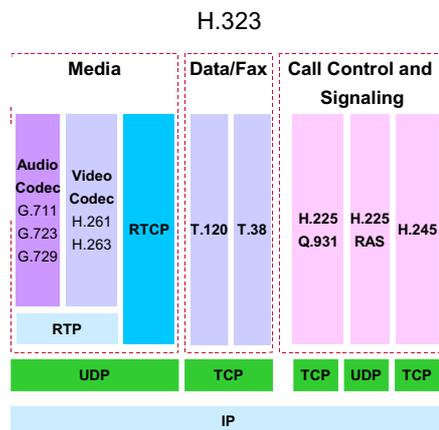
H.261 and H.263 – Video codecs.
G.711, G.723, G.729 – Audio codecs.
RTP/RTCP – Media.

Data/Fax

T.120 – Data conferencing.
T.38 – Fax.

Call Control and Signaling

- H.245 - Capabilities advertisement, media channel establishment, and conference control.
- H.225
- Q.931 - call signaling and call setup.
- RAS - registration and other admission control with a gatekeeper.



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Elements of an H.323 System

- Terminals
- Multipoint Control Units (MCUs)
- Gateways
- Gatekeeper
- Border Elements

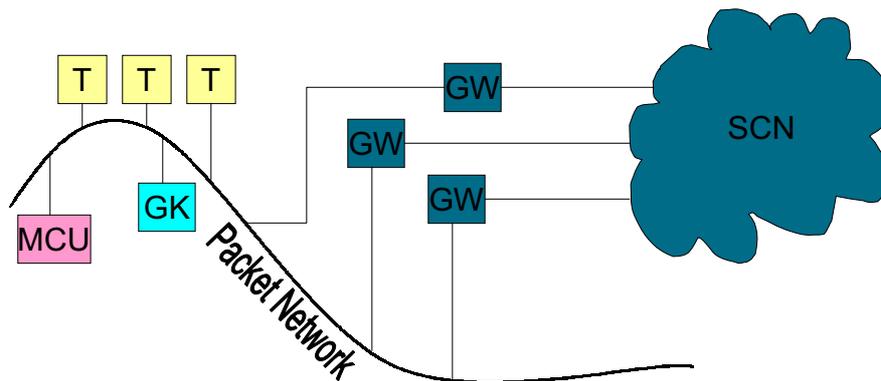
Referred to as
as
“endpoints”



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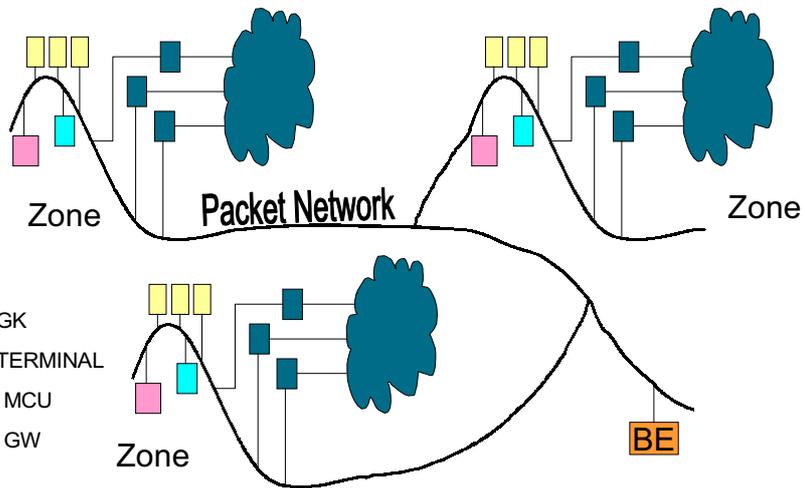
The Zone



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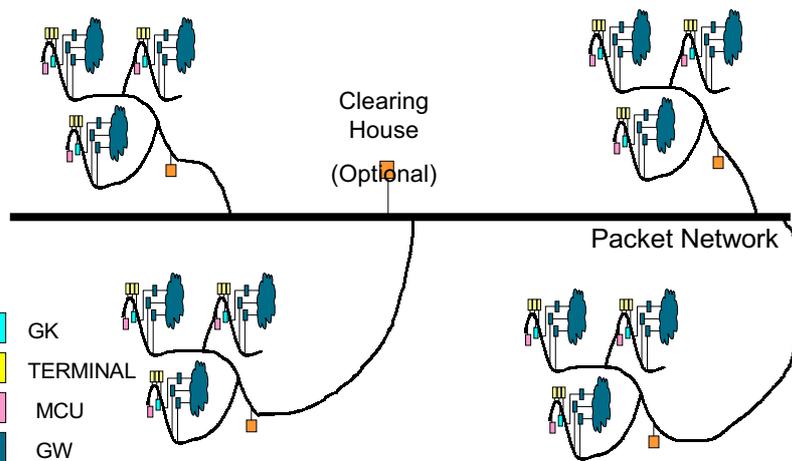
A Single Administrative Domain



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Multiple Administrative Domains



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Past To Present

- Recognizing the fact that H.323 was much more than a LAN protocol, the name was changed in H.323 Version 2 (1998)
- Enhancements were made, including:
 - Security
 - Performance
 - Supplementary Services
 - Scalability



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Past to Present

- H.323 version 3 introduced a few modest improvements, mostly geared for better PSTN integration and scalability
- New annexes were introduced:
 - Annex E/H.323 – UDP signaling
 - Annex F/H.323 – Simple endpoint type
 - Annex G/H.225.0 – Communication between administrative domains

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H.323 Version 4

- **H.323 version 4 was approved November 17, 2000 and brings a number of enhancements to H.323. Areas of focus include:**

Robustness and Flexibility

Services

“Must Have” Features

Generic Extensibility Framework



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Robustness and Flexibility

- **Gateway Decomposition with H.248**
- **Additive Registrations**
- **Alternate Gatekeepers***
- **Endpoint Capacity Reporting**

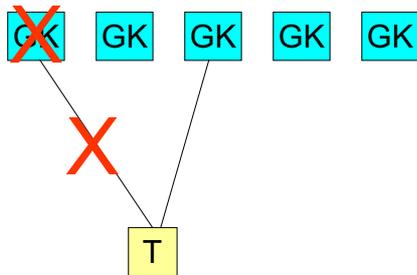
*Alternate gatekeepers were first introduced in H.323v2, but not documented. H.323 version 4 fully defines the procedure.



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Alternate Gatekeepers

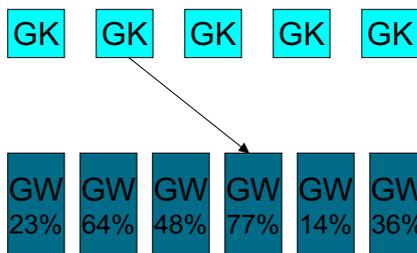


- By using Alternate Gatekeepers, endpoints are able to continue functioning in the face of one or more failures
- *Never Lose a Call!*

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Endpoint Capacity Reporting



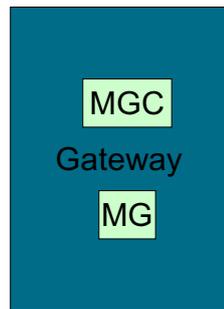
The GK selects the GW with the most capacity. *Note that H.323 endpoints report capacity in absolute terms, not in percentages.*

- By utilize endpoint capacity reporting, Gatekeepers may select an endpoint that is best capable of handling the call
- This is extremely useful for large scale deployments of Gateways and is also useful in call center applications
- *Never Lose a Call!*

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The Composite Gateway

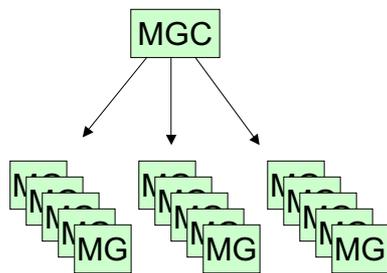


- Traditional Gateways were designed in such a way that both media and call control were handled by the same box
- The two components are referred to as the Media Gateway Controller (MGC) and Media Gateway (MG)

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The Decomposed Gateway

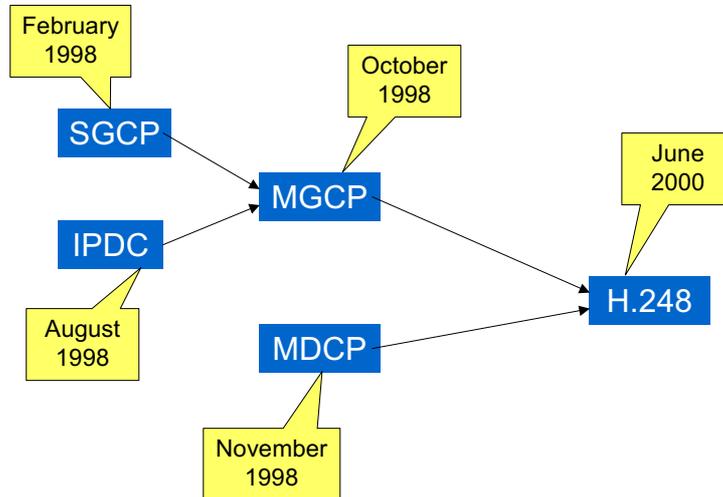


- The decomposed Gateway separates the MGC function and the MG function
- Multiple MGs may exist to allow the Gateway to scale to support much more capacity than a composite Gateway
- Communication between the MGC and MGs is done through H.248

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H.248 and MGCP



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H.248 and MGCP (cont.)

- **SGCP was the first protocol to address Media Gateway Control, but IPDC followed very soon**
- **In October 1998, SGCP and IPDC were merged to create MGCP**
- **Lucent (among others) did not like the design philosophy behind MGCP and proposed MDCP**
 - **MGCP had an “endpoint” model**
 - **MDCP had an “edgepoint” model**
- **The ITU and IETF worked jointly to create H.248,**

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H.248 and MGCP (cont.)

- One context (multiple terminations)
- Context associating terminations
- Service in change
- Add/subtract/move
- TermID has local part only
- Possible to specify parameters for diff codecs
- Protocol encoding in text or binary (ASN.1)
- One end-point model (multiple connections)
- Endpoint associating connections
- RSIP
- CRCX/DLCX/MDCX
- Endpoint—Domain/ local part
- Impossible to specify different parameters for diff codecs
- Protocol encoding in text

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SIP

- SIP (Session Initiation Protocol) is a text based, flexible, yet simple tool for establishing interactive connections across the Internet.
- RFC 2543, March 1999 and other docs by SIP WG
- It can be extended in numerous ways. New methods, headers and body types and new parameters for existing headers can be defined.

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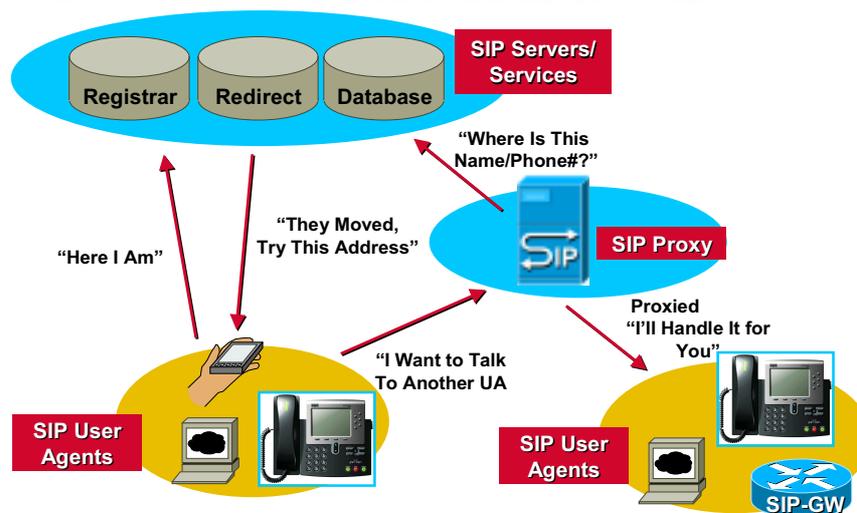
SIP Basics

- SIP is a peer-to-peer protocol where end-devices (User Agents—UAs) initiate sessions
- SIP defines the signaling mechanism for multimedia calls and conferences
- SIP uses several existing IETF protocols to provide message formatting (HTTP 1.1), media negotiation (Session Description Protocol—SDP), media (RTP), name resolution and mobility (DHCP and DNS), and application encoding (MIME)
- SIP is ASCII text-based for easy implementation and debugging

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SIP Servers/Services (Cont.)



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SIP Methods

- Consists of requests and responses
- Requests (unless mentioned, each has a response)
 - REGISTER** (UA registers with registration server)
 - INVITE** (request from a UA to initiate a call)
 - ACK** (confirms receipt of a final response to INVITE)
 - BYE** (sent by either side to end a call)
 - CANCEL** (sent to end a call not yet connected)
 - OPTIONS** (sent to query capabilities)
- Proposed new methods—SUBSCRIBE, NOTIFY, INFO, REFER, MESSAGE
- Gateways support INVITE, ACK, BYE and CANCEL; GWs and phones will respond to OPTIONS but will not send them; Gateways do not support REGISTER; Phones do support REGISTER
- Messages contain SIP headers and body; body might be SDP or an attachment or some other application

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SIP Applications

- Easily enables applications (Internet model)
 - Text-based
 - Web-enabled
 - Application-independent
- Uses a distributed architecture that overlays on existing data networks and allows new services to be added anywhere in the network
- Availability of commercial products is growing rapidly, and interoperability has been very strong
- Carriers and ASPs are beginning to announce availability of SIP services

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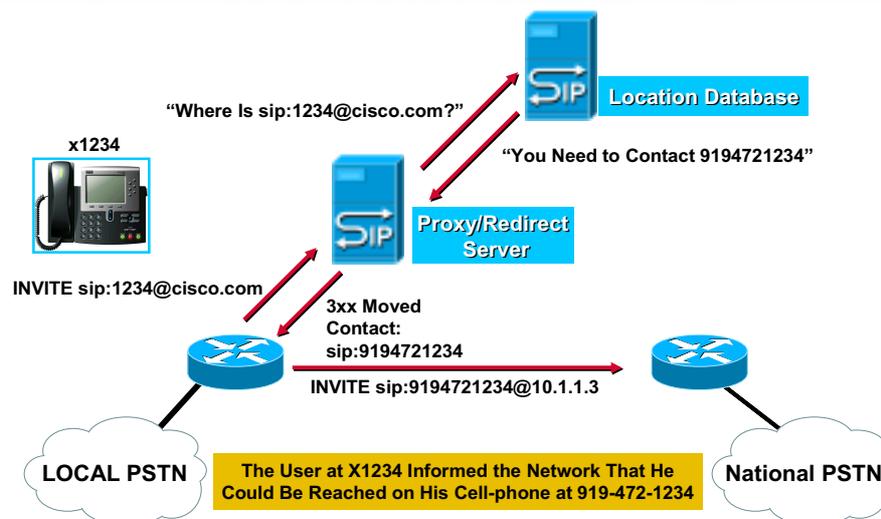
SIP Topologies/Applications

- IP centrex and IP-PBX
- PC to phone and/or PC to PC (ASP)
- Integration with existing applications like Instant Messaging
- 3rd-party call-control applications
- Find-me/follow-me, roaming, single-number-reach
- Internet call-waiting
- Presence
- Voice VPNs, managed voice/data networks
- Many other possibilities...

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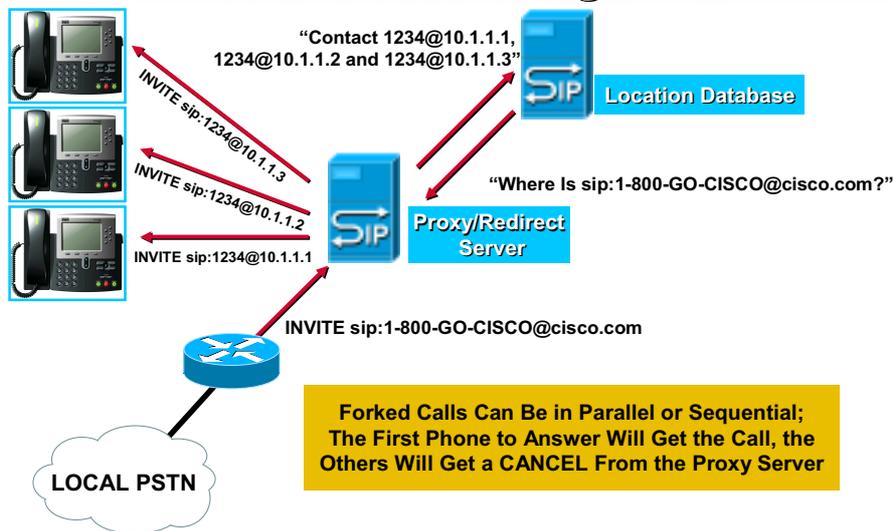
SIP Topologies/Applications— Call Redirection



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SIP Topologies/Applications— Call Forking



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SIP (Cont.)

- SIP model is quite analogous to H.323
- Intelligence is spread over the network
- Model similar to GK routed model (proxy servers, app servers and UAs)
- Semi-intelligent model (proxy servers, ASPs, UAs)

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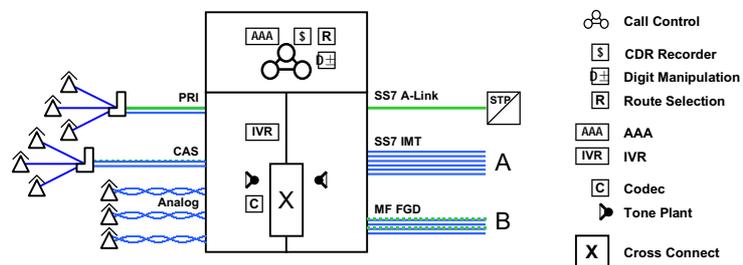
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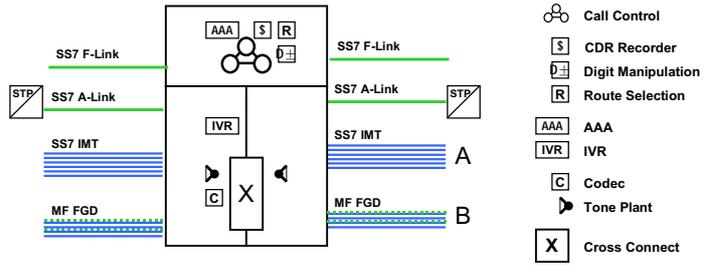
Basic Class 5 Switch



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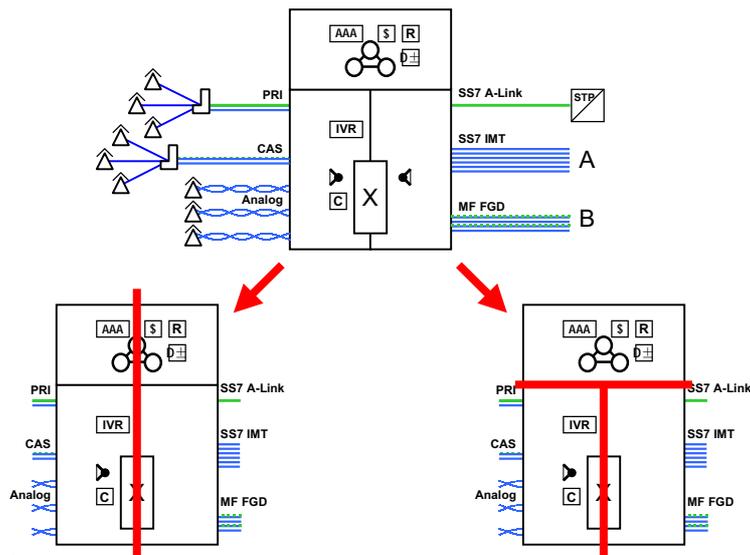
Basic Class 4/3 Switch



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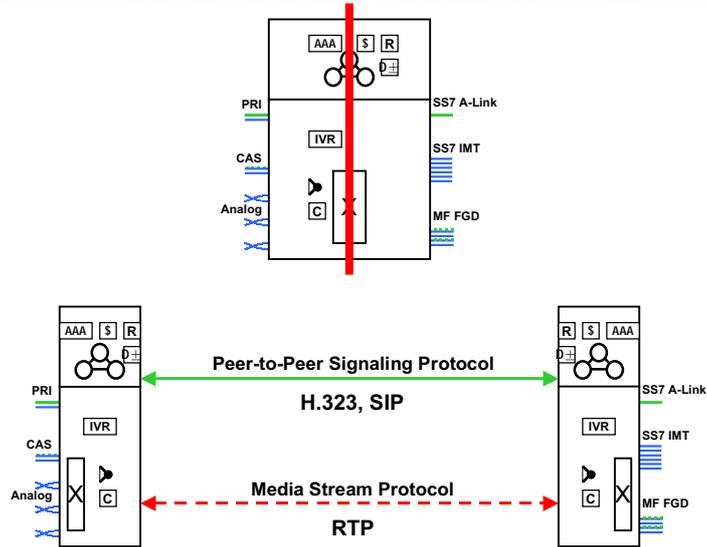
“Distribution Models” of a Basic Switch



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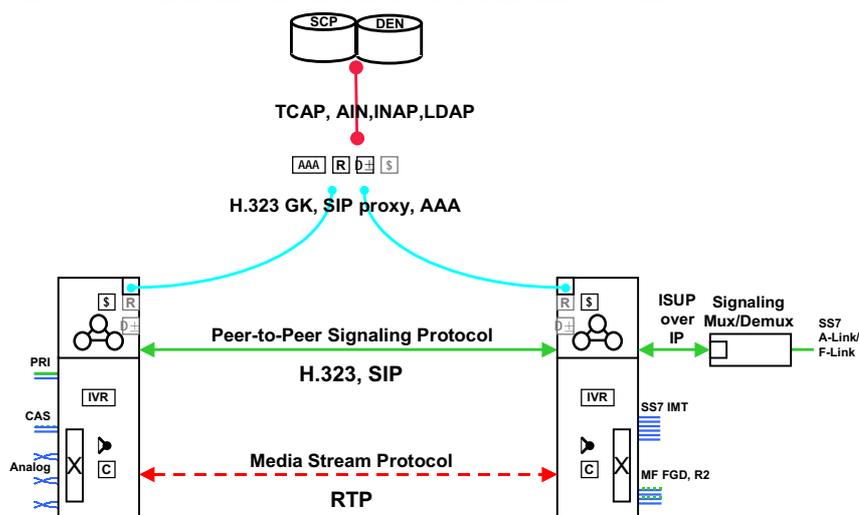
Peer-to-Peer Distribution



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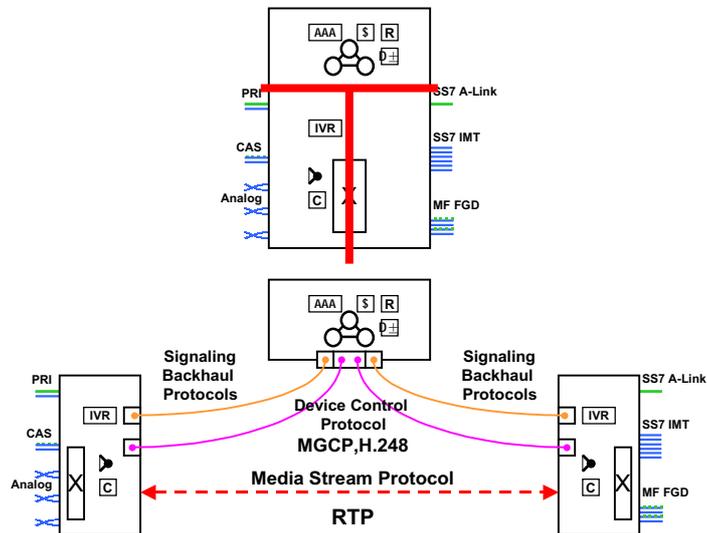
"Scalable" Peer-to-Peer



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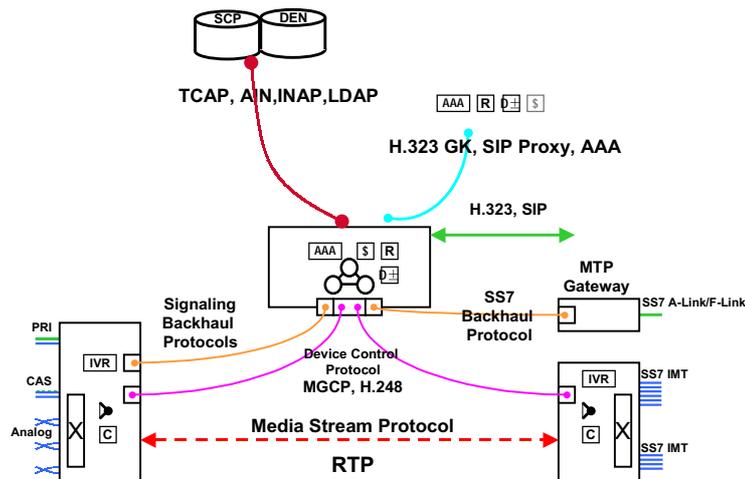
Master-Slave Distribution



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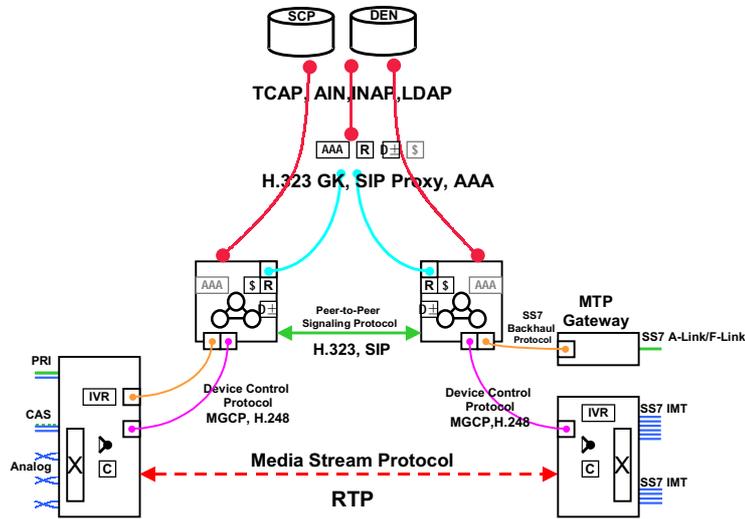
Basic Device Control (Realigned SS7)



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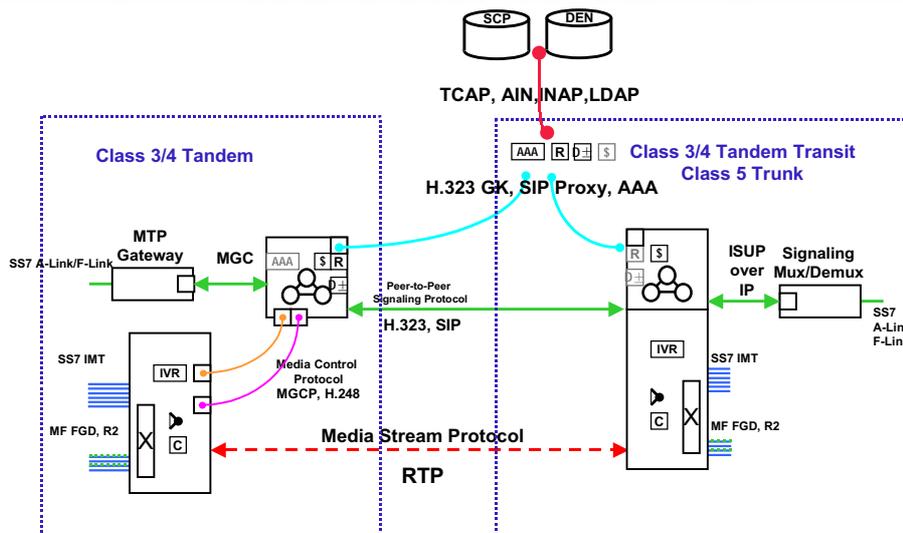
"Scalable" Device Control



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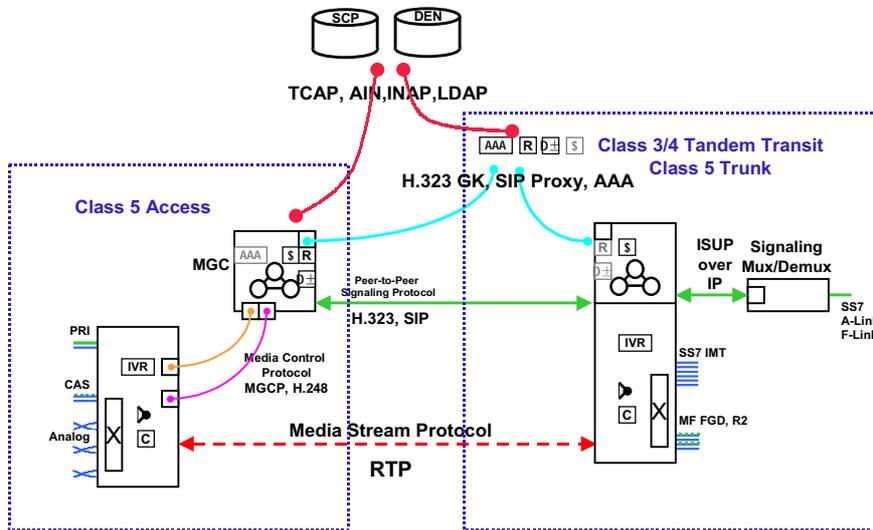
"Convergence" of Both Models



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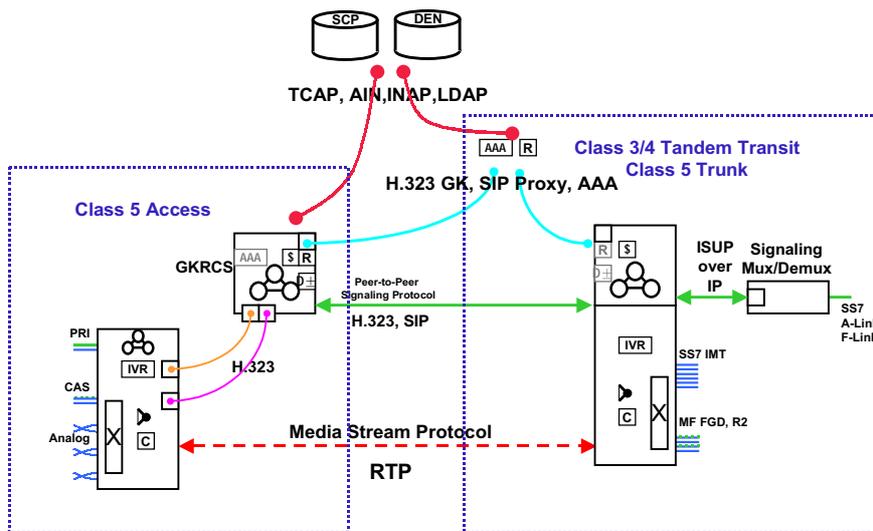
“Convergence” of Both Models (Cont'd)



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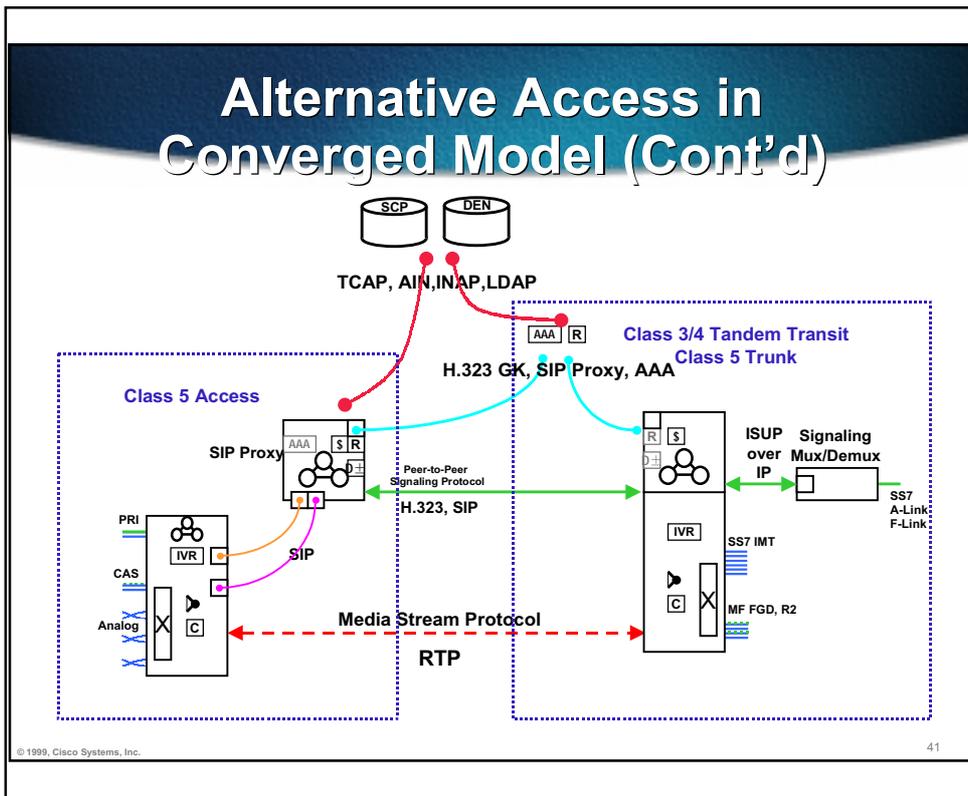
Alternative Access in Converged Model (Cont'd)



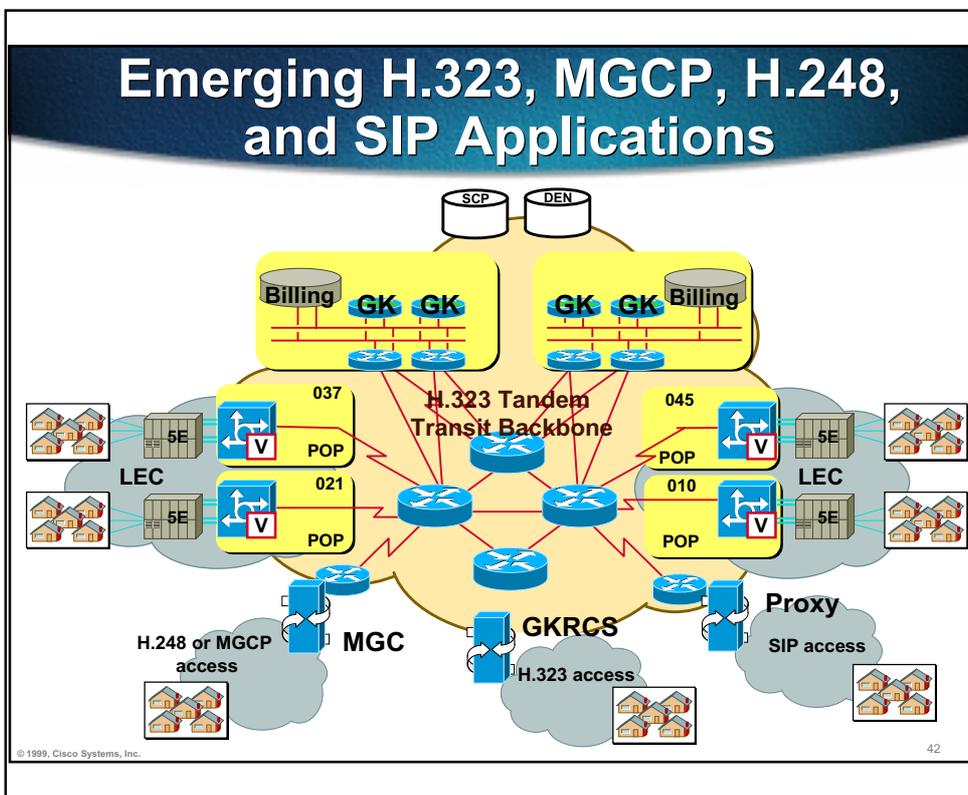
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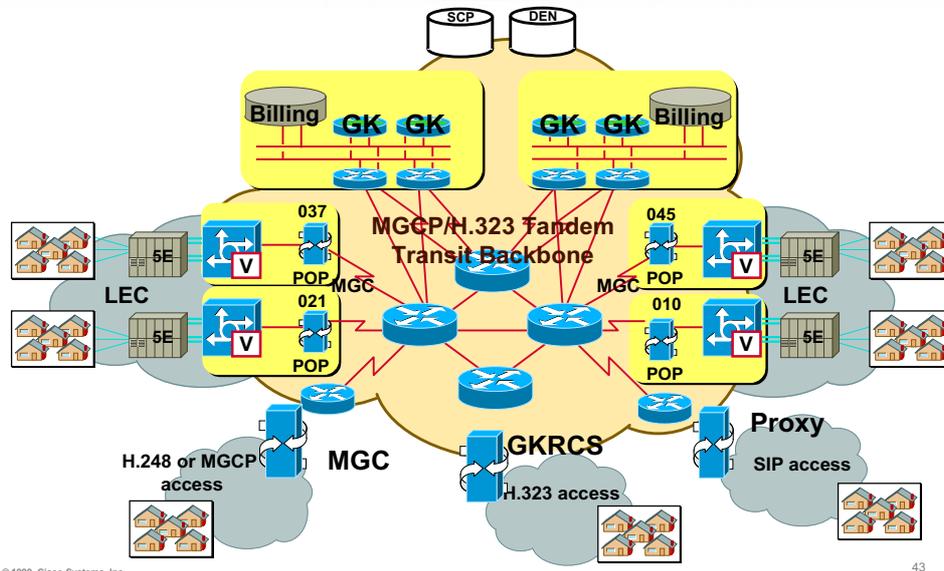
Alternative Access in Converged Model (Cont'd)



Emerging H.323, MGCP, H.248, and SIP Applications



Emerging H.323, MGCP, H.248, and SIP Applications (Cont'd)



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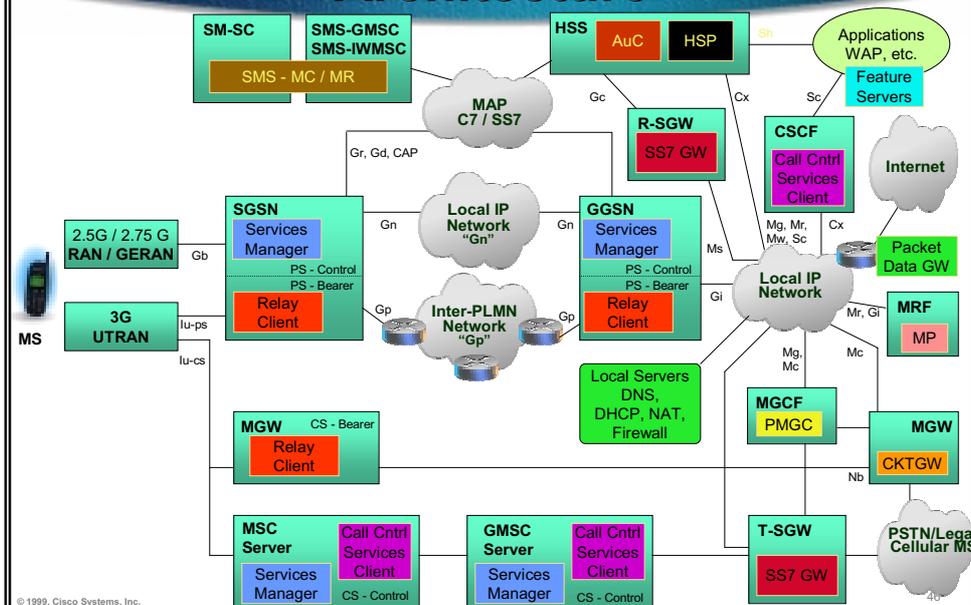
Protocol Evolutions

- The VoIP architecture and protocols for Fixed Network is already well understood.
- Telephony will be a key application in 3G Mobile Wireless Network, yet the protocols and architecture issues are not resolved yet.
- A set of new and different requirements on the protocols in 3G Mobile Wireless.
- Different parts of the network and different implementation of the Network Elements will shape the evolution of the protocols.

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3G Mobile Reference Architecture



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