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# CU9

## Anatomy of a CT Server

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# Introductions



## ■ Michael Bayer

- President, Computer Telephony Solutions
  - Company dedicated to CTI Plug and Play
- Author, "CTI Solutions and Systems"
- Member CTE Expos Advisory Board
- [mbayer@CTExpert.com](mailto:mbayer@CTExpert.com)
- [www.CTExpert.com](http://www.CTExpert.com)

# Agenda



- 1. Evolution of Computer Telephony
- 2. What makes CT compelling?
- 3. CT Server Architecture
- 4. CT Server Specifications
- 5. Putting It All Together
- Q&A

# What this session is NOT about



- Product reviews and recommendations
- Unified messaging or other specific product categories in depth
- Detailed implementation practices and tips



# Evolution of Computer Telephony

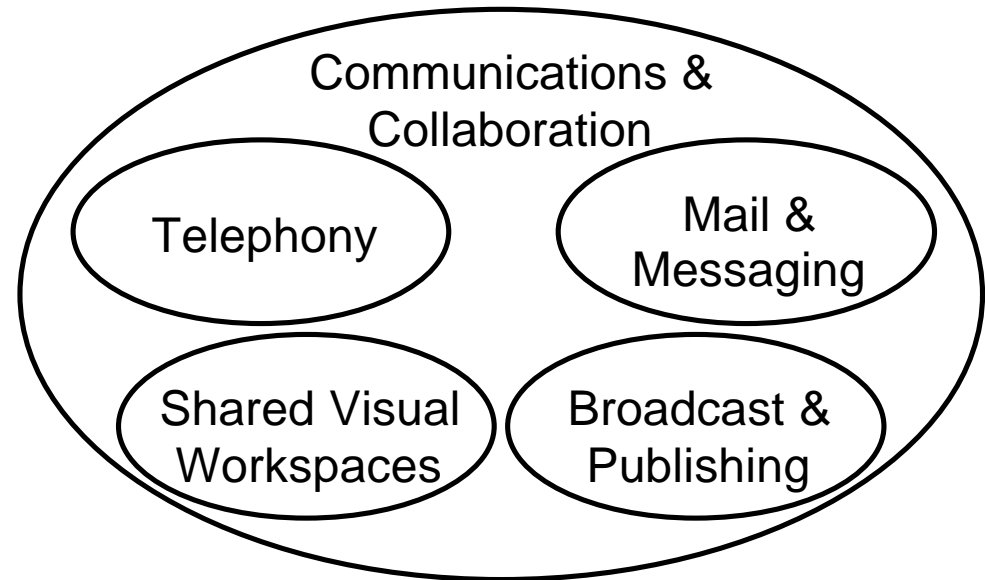


# Context: Working Definitions

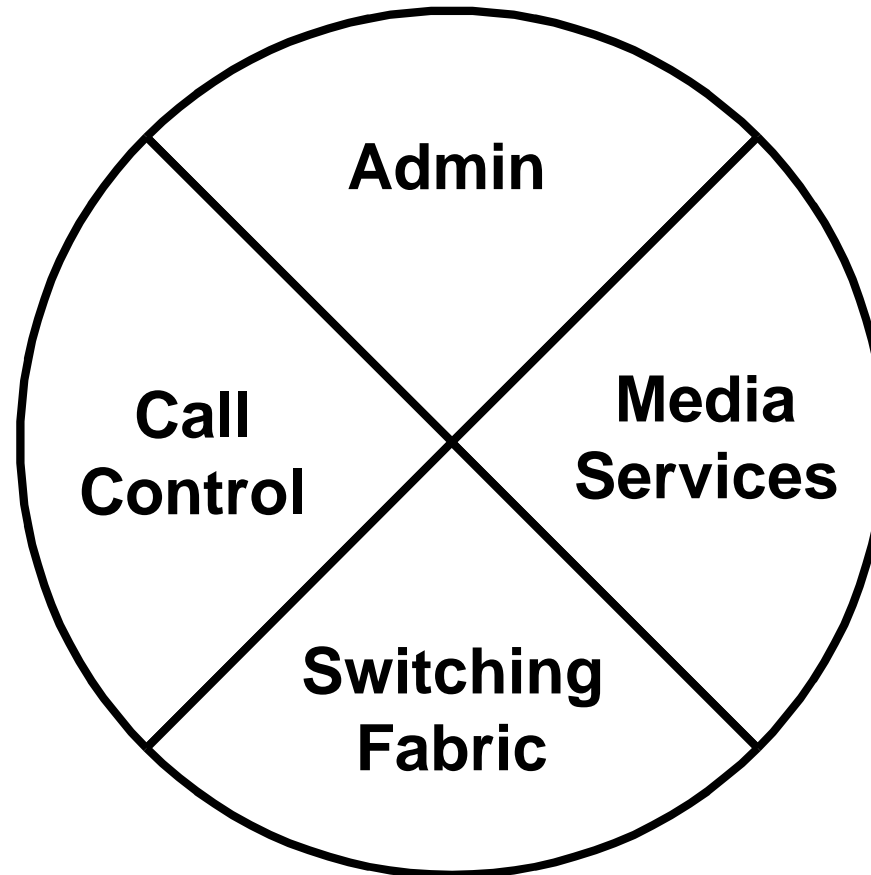


## ■ Communications & Collaboration

- Telephony
- Shared Visual Workspaces
- Mail & Messaging
- Broadcast & Publishing



# Telephone System Technologies







# CTI Defined



## ■ Call Control

- Monitoring and directing calls in a telephone system

## ■ Telephone Control

- Monitoring and controlling features of a telephone set

## ■ Media Binding

- Relating other communications / telephony functionality to calls in a telephone system

# CT Media Access / Services



- Tone Detection and Generation
- Recording and Playback
- Text-to-Speech
- Speech Recognition
- Modulated Data (Modem / Fax)
- Digital Data (Compressed Video, etc.)
- Call Binding

# Switching Fabric



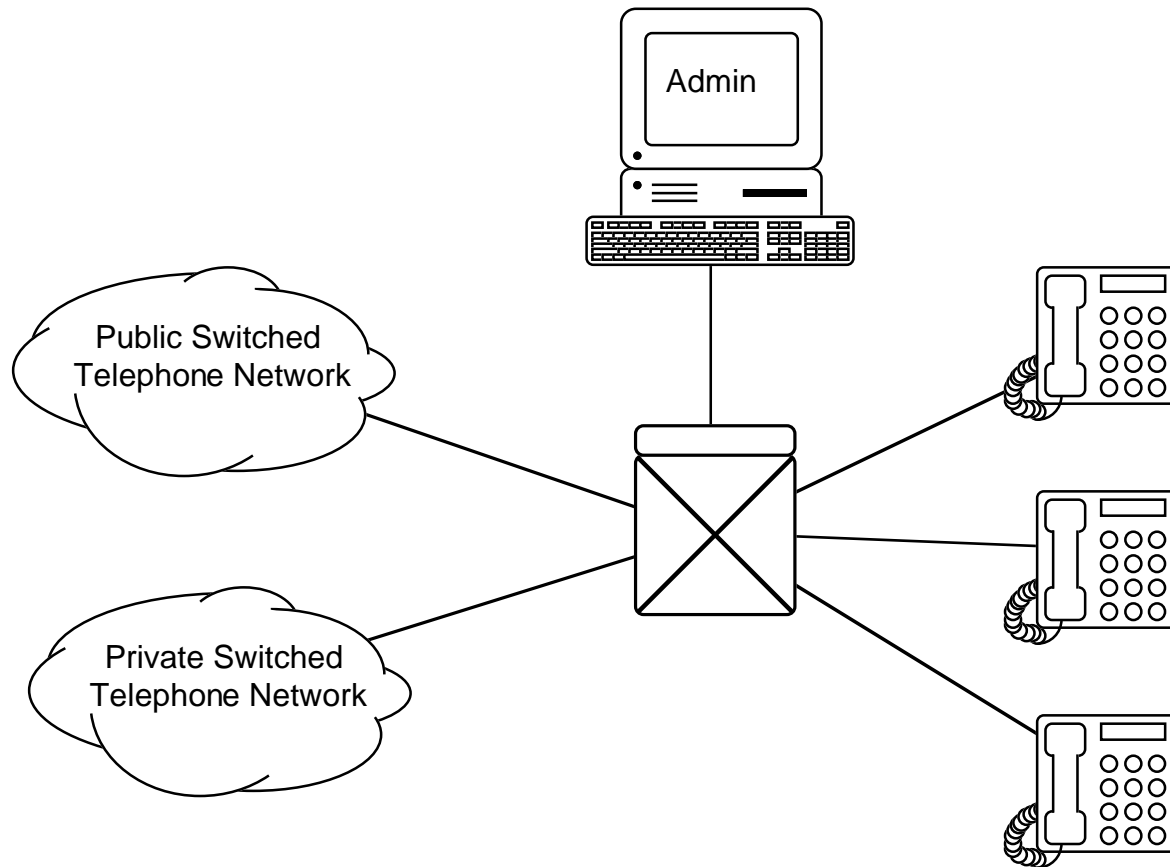
- Establishes media stream channels between endpoints and conveys signaling information
- Traditional Switching Fabric
  - TDM bus backplanes connecting line cards
  - Analog (POTS) and digital (T-1, ISDN, proprietary) telephony circuits
- IP Telephony Switching Fabric
  - Packetized voice over conventional IP networking infrastructure
  - Typically based on off-the-shelf computer technology

# Admin

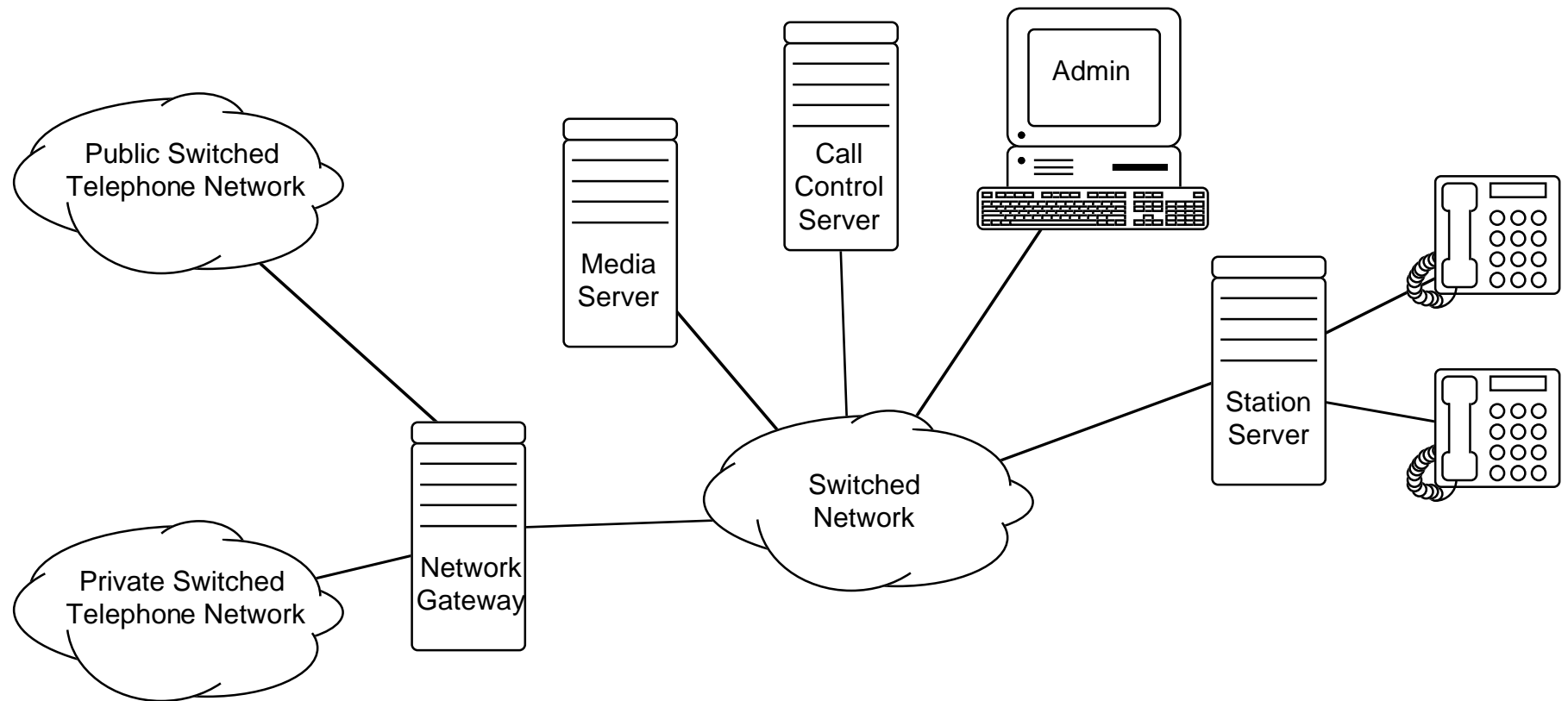


- System configuration
  - System customization
  - Moves / Adds / Changes
- Fault monitoring
- Accounting
- Performance management
- Security

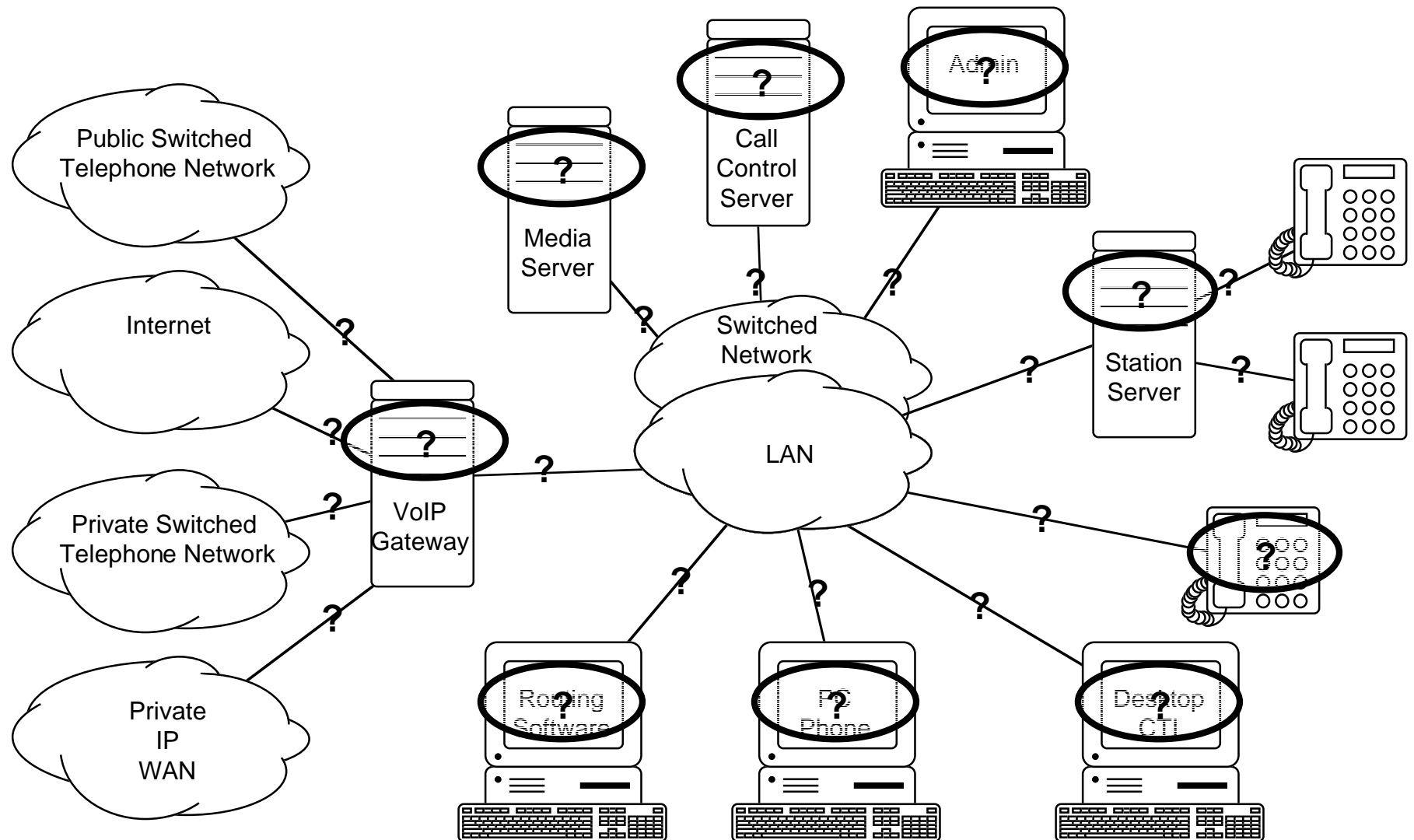
# Telephone System Implementation



# Distributed PBX Architecture



# Telephone System Implementation



# What is a CT Server?



## ■ Platform for computer telephony modules:

- Call Control / CTI
- Media Services
- Administrative Services
- Switching Fabric

## ■ Centralized vs. Distributed

- All modules may be installed on a single server
- System may consist of many single-purpose CT servers

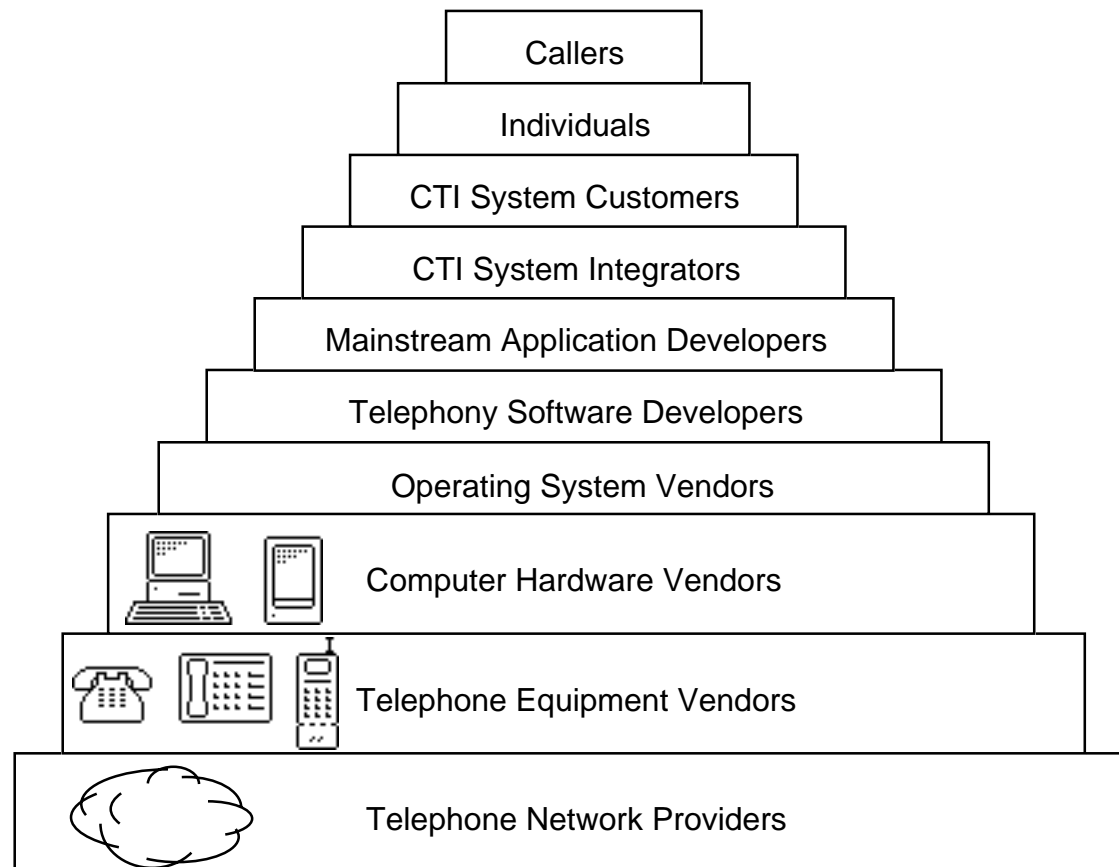


# The Promise of CTI/CT Technology

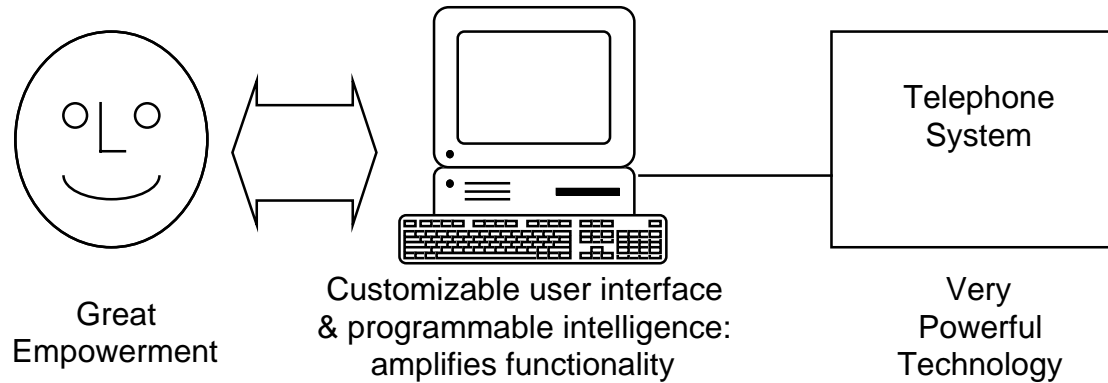
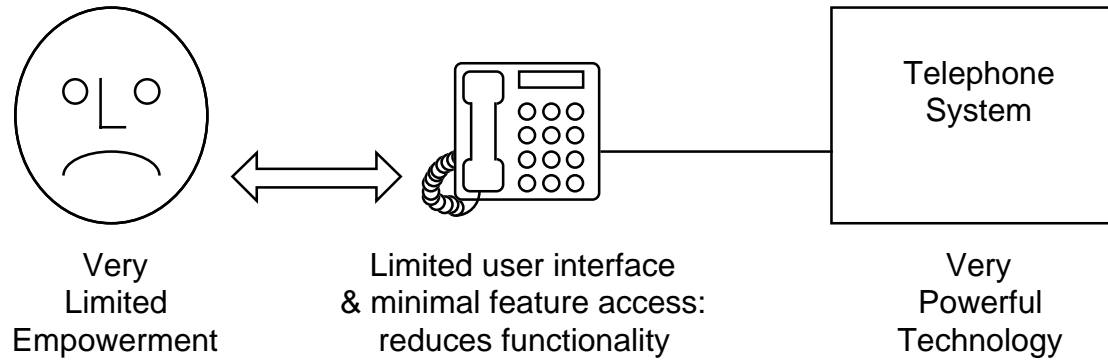


**Telephone systems**  
that are  
**tailored**  
to the  
**specific needs and preferences**  
of **users**

# CT Value Chain



# CT: Before & After



# User Requirements



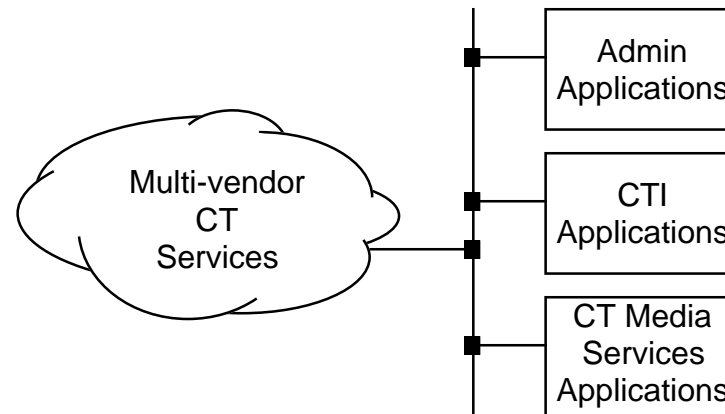
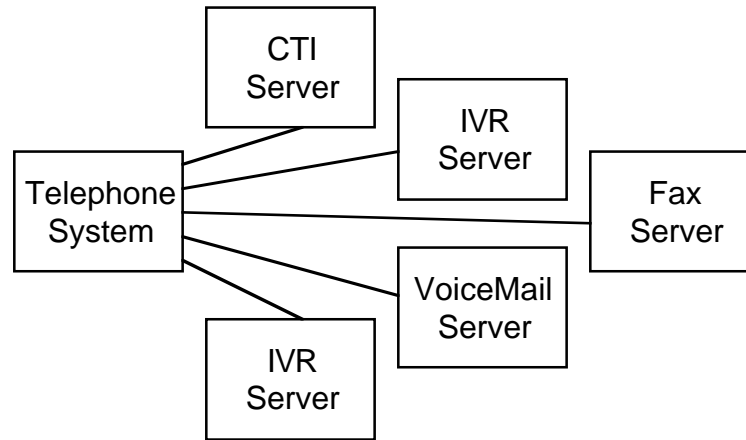
- Take full advantage of user-identified telephony features
- Integration with mainstream applications
- No functional limitations to prevent personalization
- Add-on as needed

# Customer Requirements



- No limits to addition of functionality
- Easy to scale
- No barriers to multi-vendor systems
- No barriers to multi-platform support
- System-centric (rather than vendor-centric) administration

# Customer Requirements

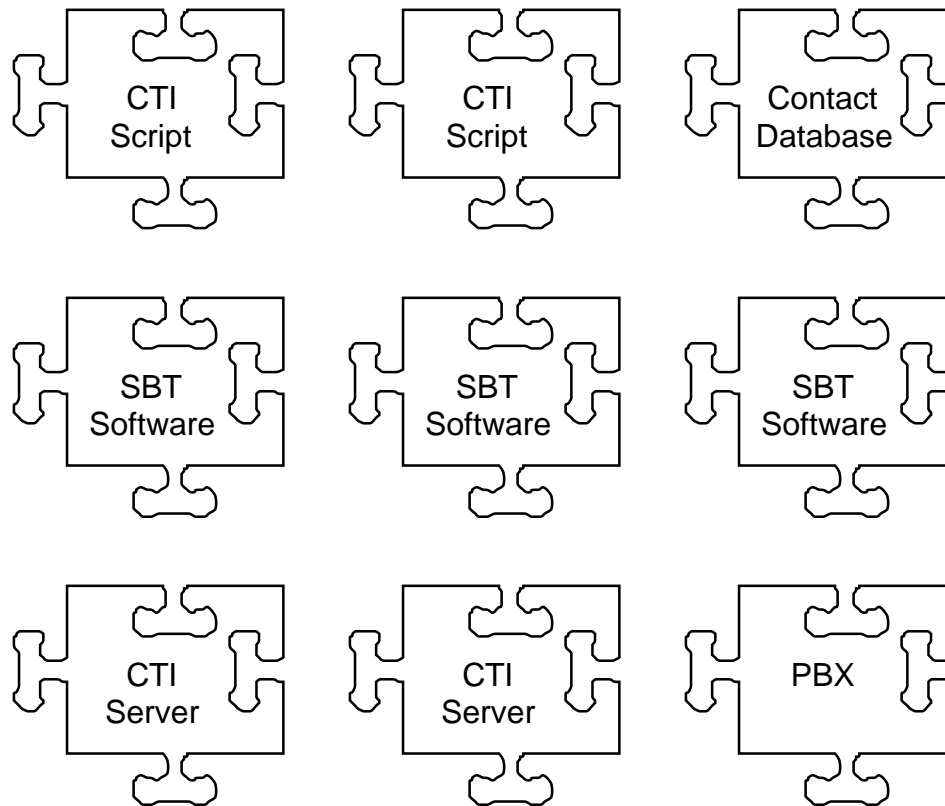


# Integrator's Point of View



- Maximize opportunity for value-add through customized solutions
- Ability to source solution components from a diversity of vendors

# Integrator's Point of View

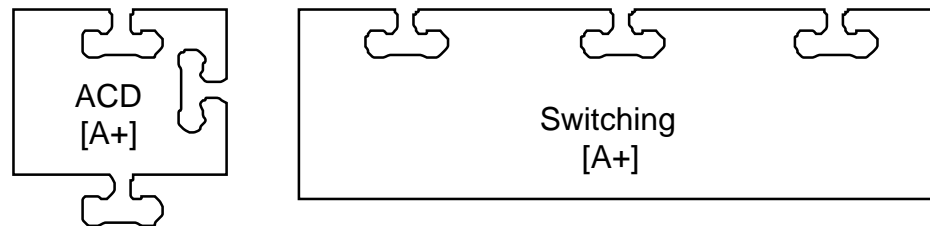
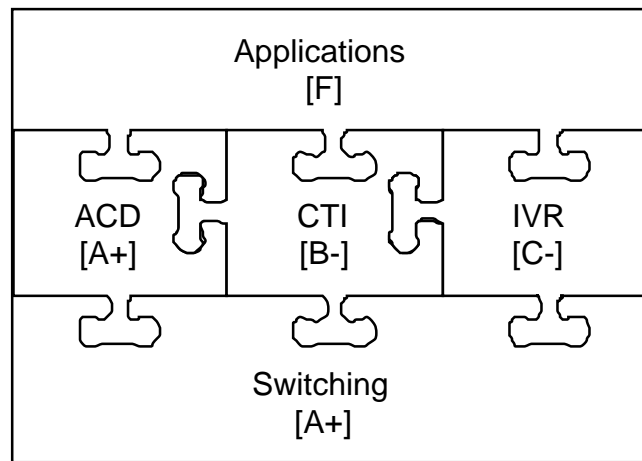


# Vendor's Point of View



- Expose underutilized features and capabilities to differentiate products
- Maximize the opportunities to sell best-of-breed components rather than monolithic systems
- Not dependent on a particular platform or OS/tool vendor

# Vendor's Point of View





# Computer Telephony Solutions



## ■ May utilize just one technology:

- CTI Solutions
- Media Services Solutions
- VoIP Solutions

## ■ May incorporate multiple technologies to create custom solutions or new categories:

- Unified Messaging
- Call Center
- Personal Agents

## ■ CTI offers the most opportunities

- Potential for added value, diversity of applications

# How...



- ...do you take advantage of the opportunity?
- ...do you cope?

# Focus on Modularity and Prioritize Interoperability



- Standards and other interoperability specifications allow for modular systems
- Modularity is a measure of maturity



# CT Server Architecture



# CT Frameworks



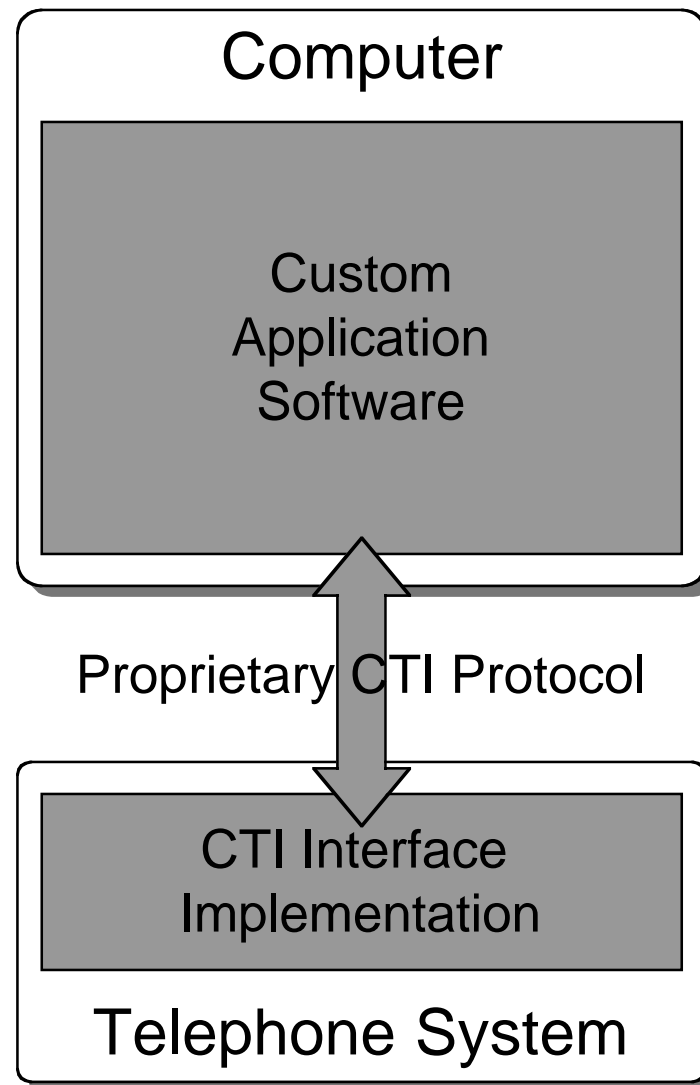
- Everyone has to talk the same language before they can discuss interoperability

# Example: Three Phases of CTI

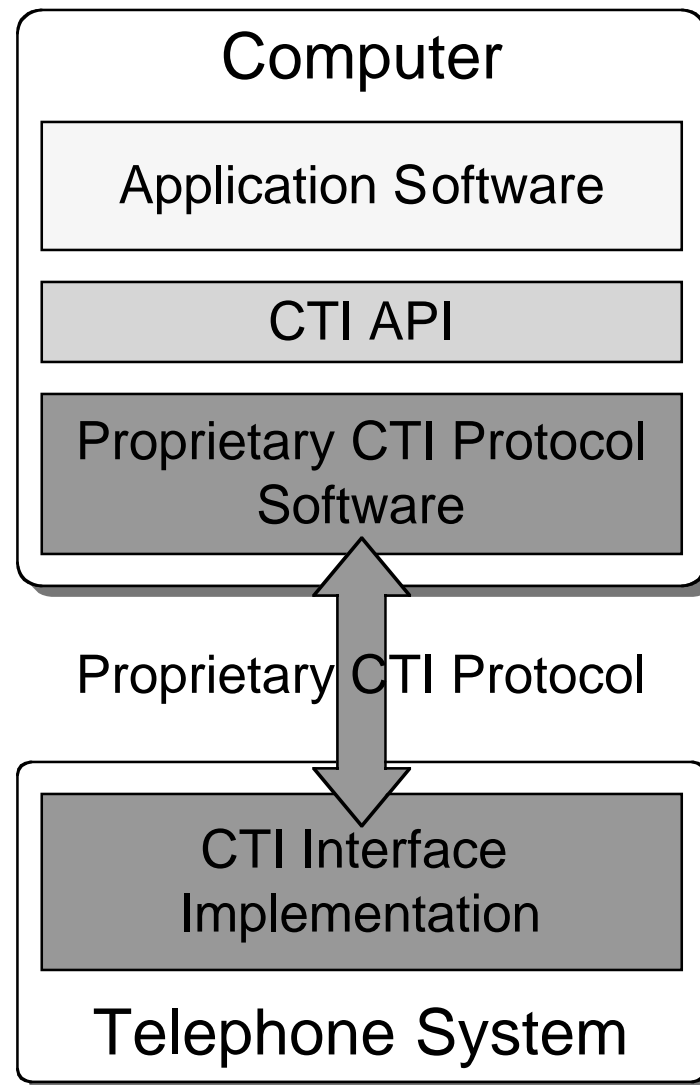


- First Phase of CTI: Custom Systems
- Second Phase of CTI: APIs
- Third Phase of CTI: CTI Protocols

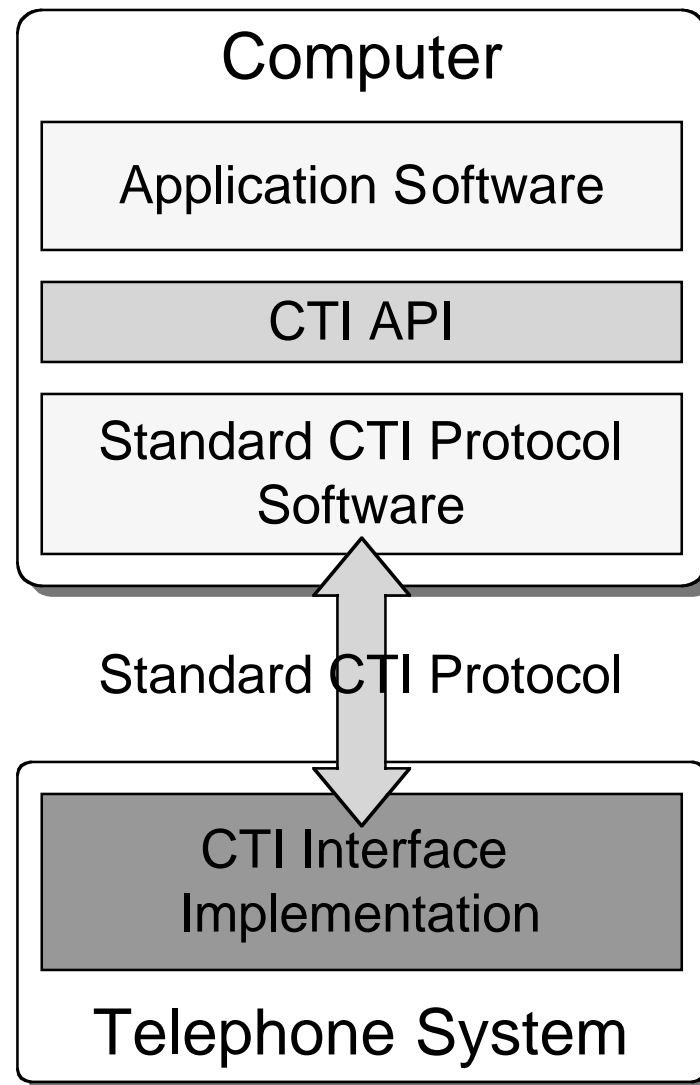
# First Phase of CTI: Custom Systems



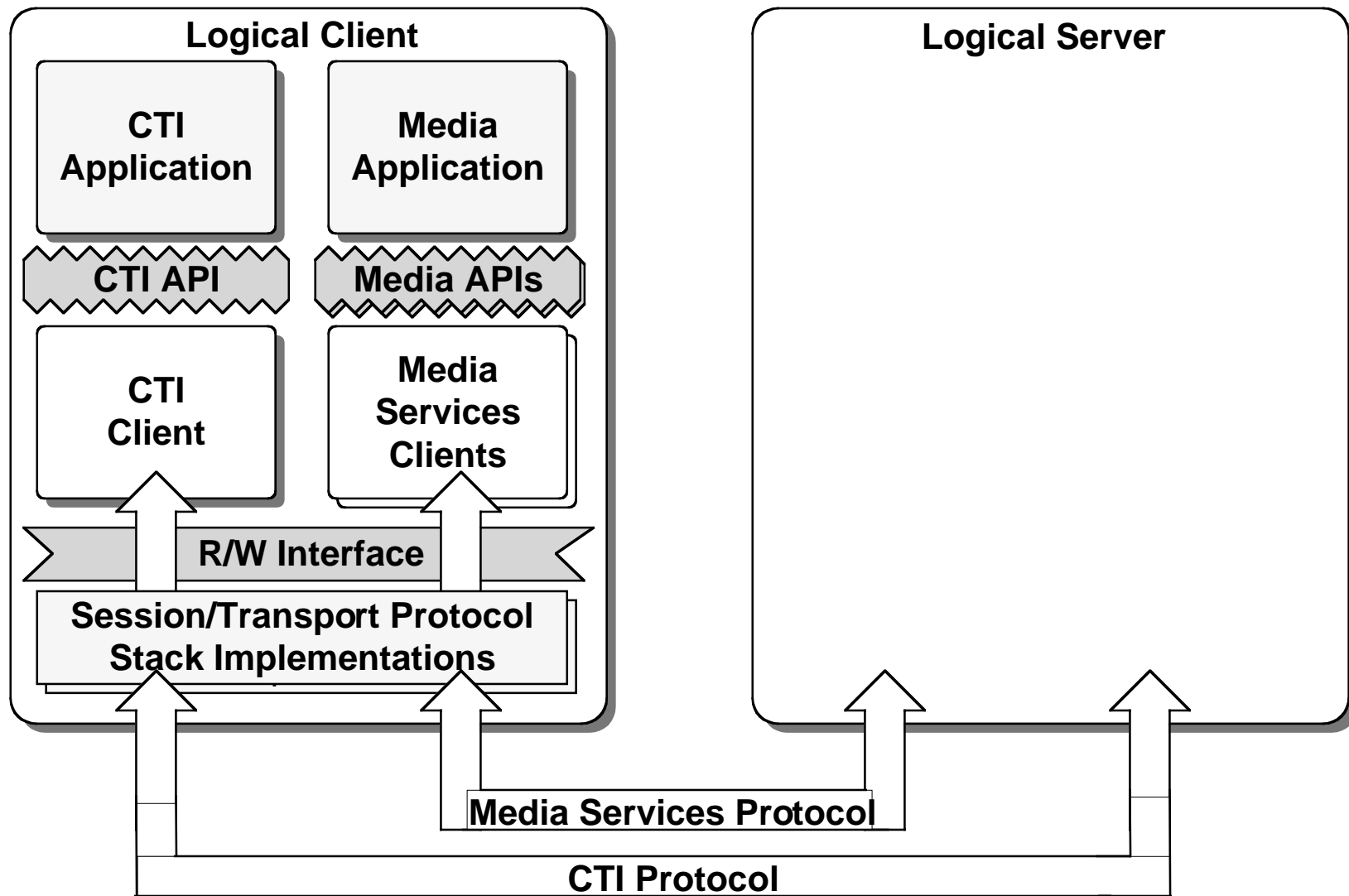
# Second Phase of CTI: APIs



# Third Phase of CTI: CTI Protocols



# Logical Client and Server



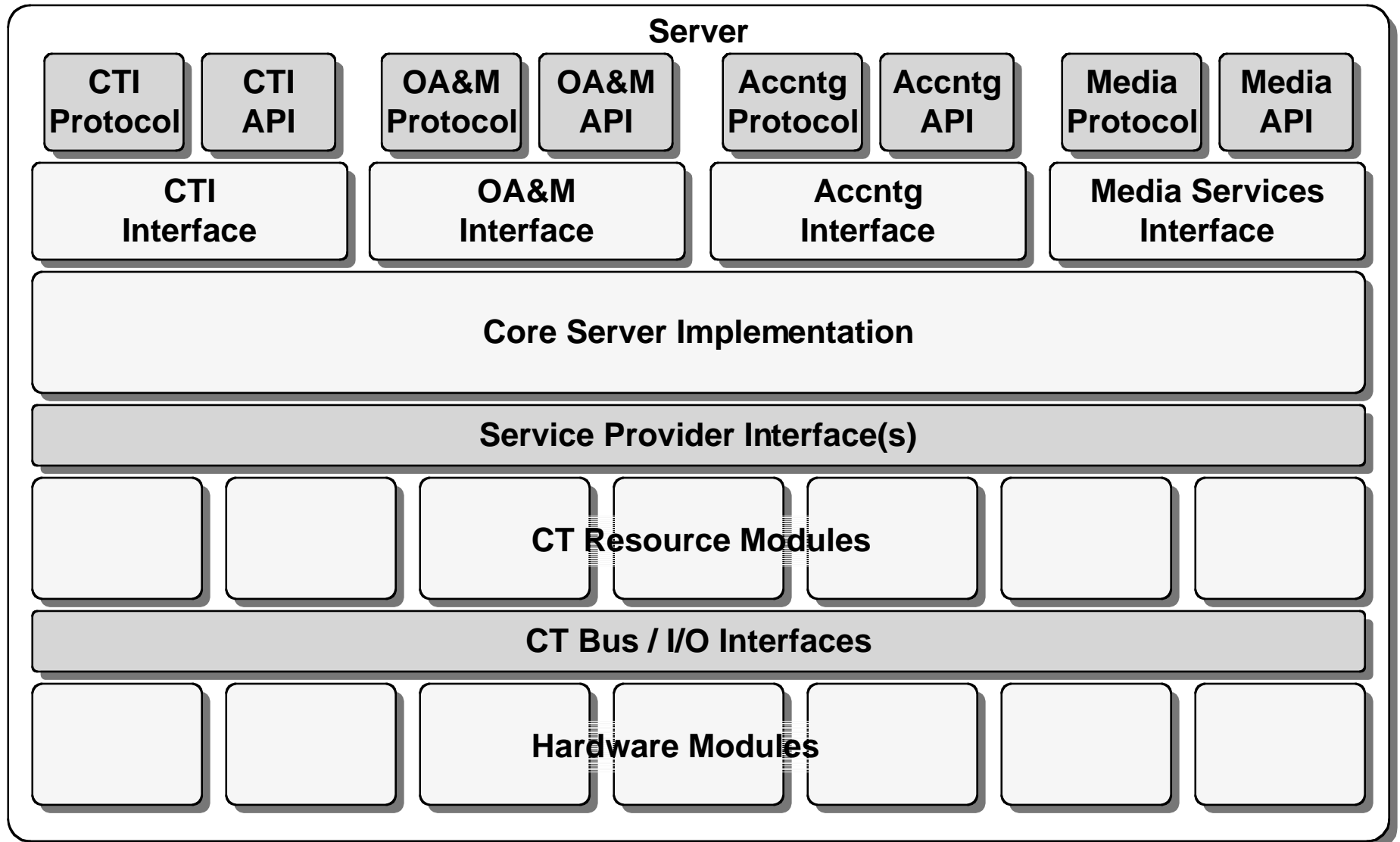


# Generic CT Server



- All components are modular
- Server can be scaled and enhanced as required
- Server can interoperate with other servers and clients
- Server supports local applications

# Generic CT Server

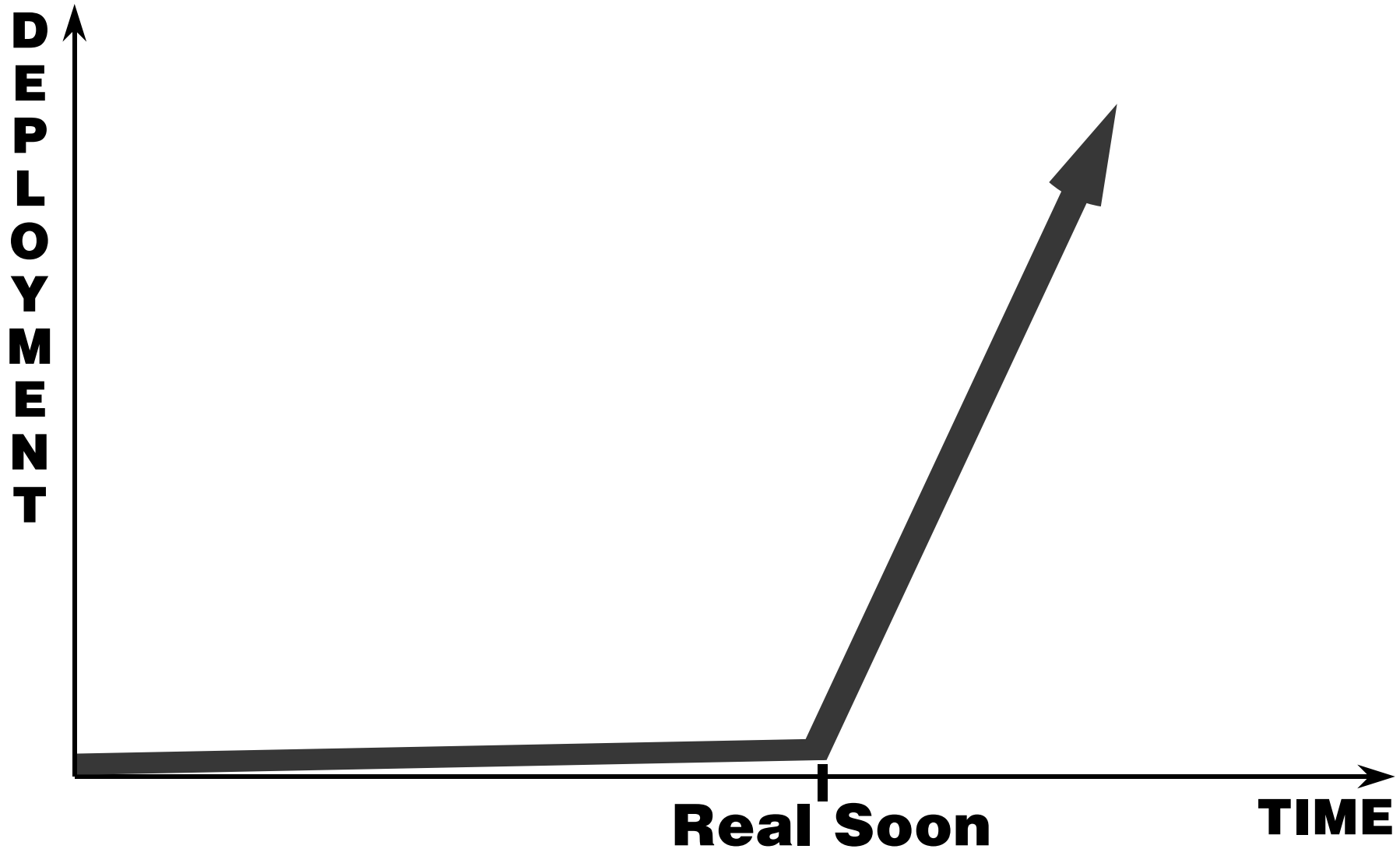




# CT Server Specifications



# Any day CT will take off...



# Specifications and Standards



## ■ Standards Bodies

- ITU
- ECMA

## ■ Individual Vendors

- Microsoft
- Lucent/Novell
- Sun

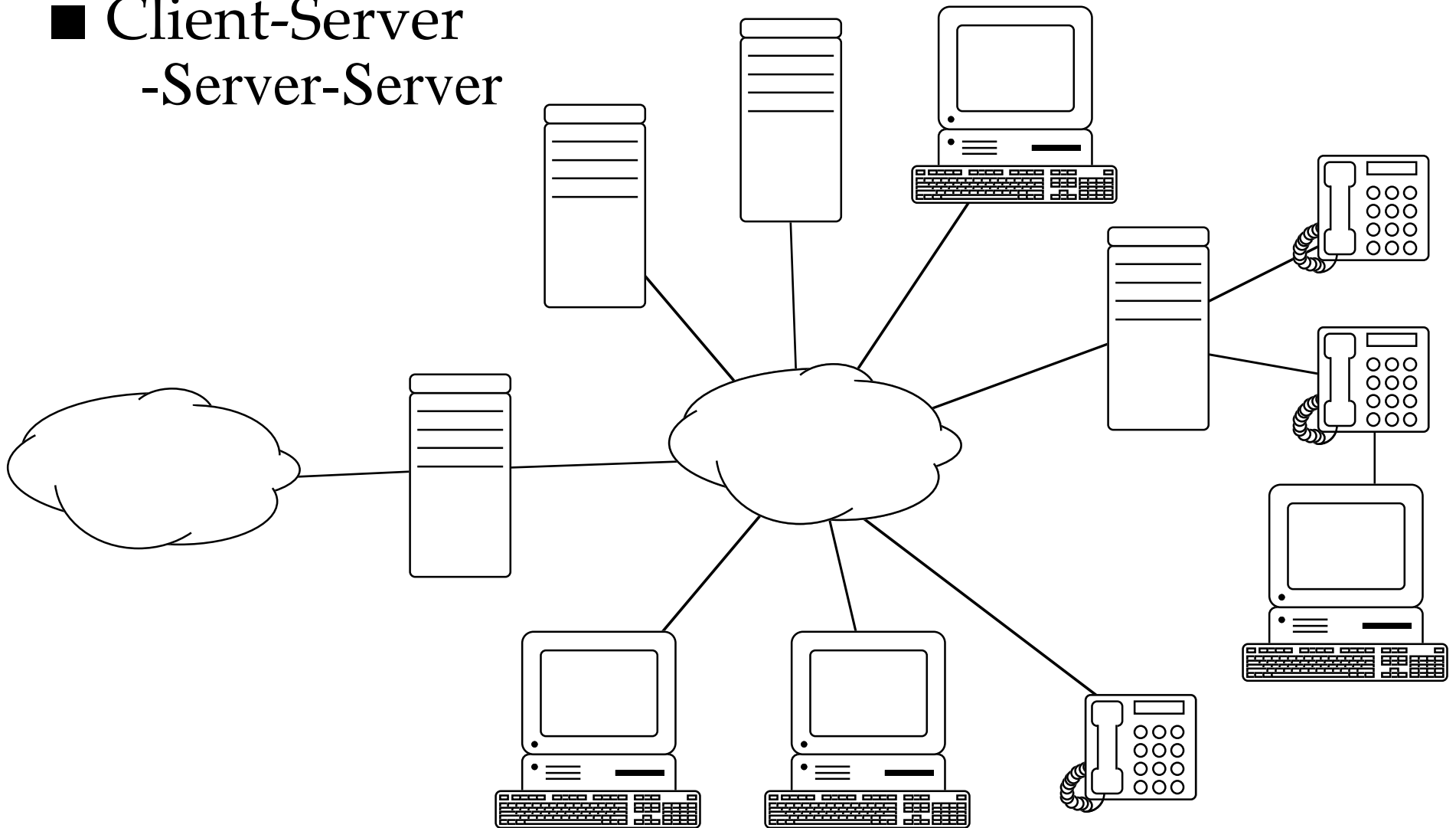
## ■ Industry Organizations

- IETF
- ECTF

# Modular CT Solutions



## ■ Client-Server -Server-Server

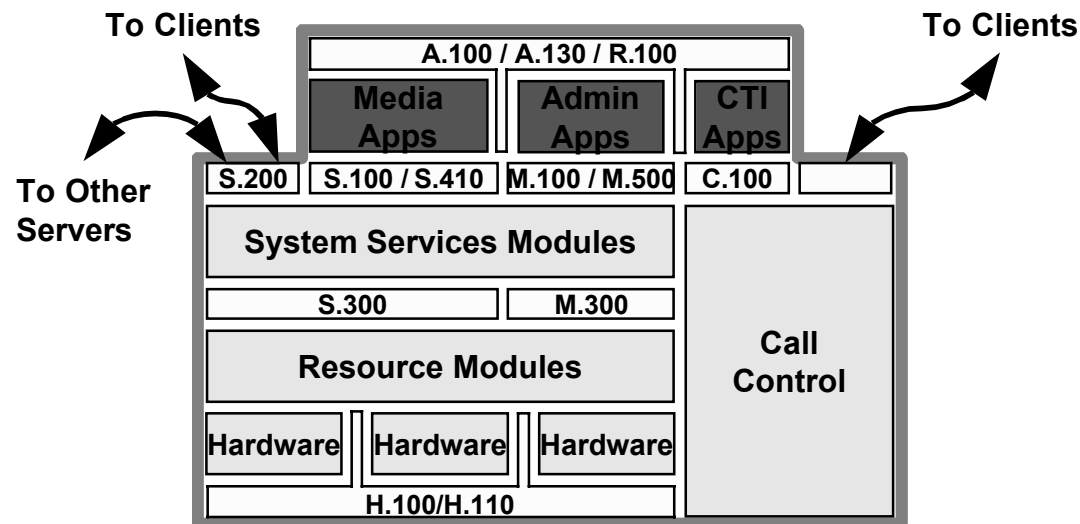


# ECTF Framework



## ■ Architecture Framework

- Architecture for CT services
- ECTF view of CT systems evolution
- Framework for developing interoperability agreements
- Drives ECTF technical working groups



# ECTF Framework and Specifications



## ■ Application Interoperability

- A.001, A.100, A.130

## ■ Call Control

- C.001, C.100

## ■ Hardware

- H.100, H.110

## ■ Administration

- M.001, M.100, M.500

## ■ Media Services

- S.100, S.200, S.300, S.410



# Vendor Specific Extensions



- CTI interfaces generally support “escape mechanisms” that allow access to proprietary features that cannot be accessed through a standard abstraction.
- Use of these escape mechanisms requires that a given computer have specific knowledge of a particular telephone system's vendor specific extensions.

# Call Control Specifications



## ■ Universal Call Control Model

- ECTF C.001 / Versit CTIE / ECMA CSTA

## ■ Protocols

- Versit / CSTA

## ■ Interfaces

- TSAPI
- Java Telephony
- Windows Telephony

# Call Control Specifications



## ■ Universal Call Control Model

- ECTF C.001 / Versit CTIE / ECMA CSTA

## ■ Protocols

- Versit / CSTA

## ■ Interfaces

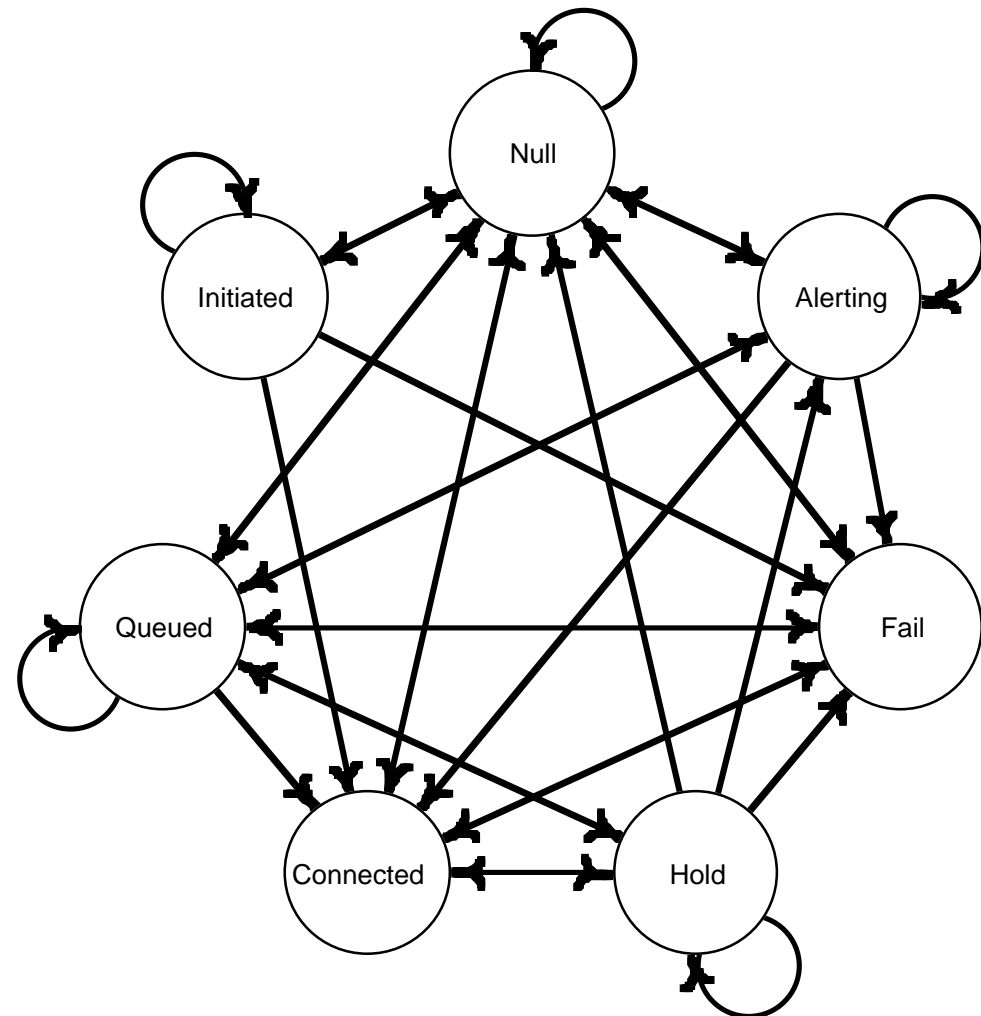
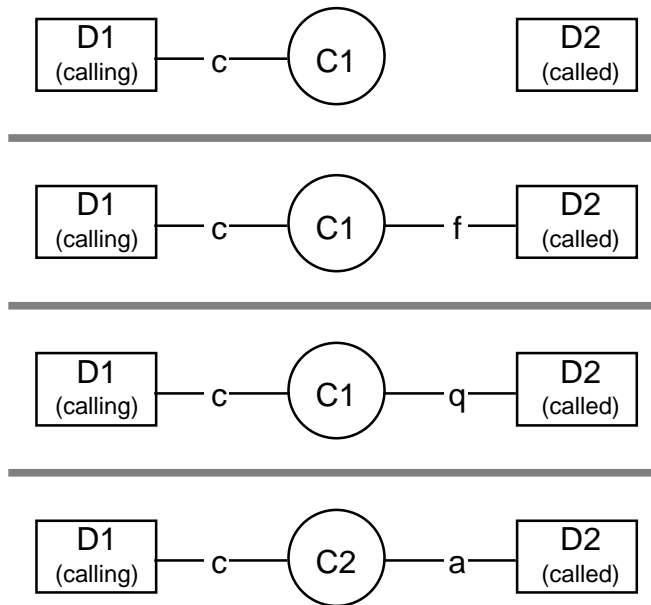
- TSAPI
- Java Telephony
- Windows Telephony



# ECTF C.001 / Versit / CSTA



## ■ Connection State Model



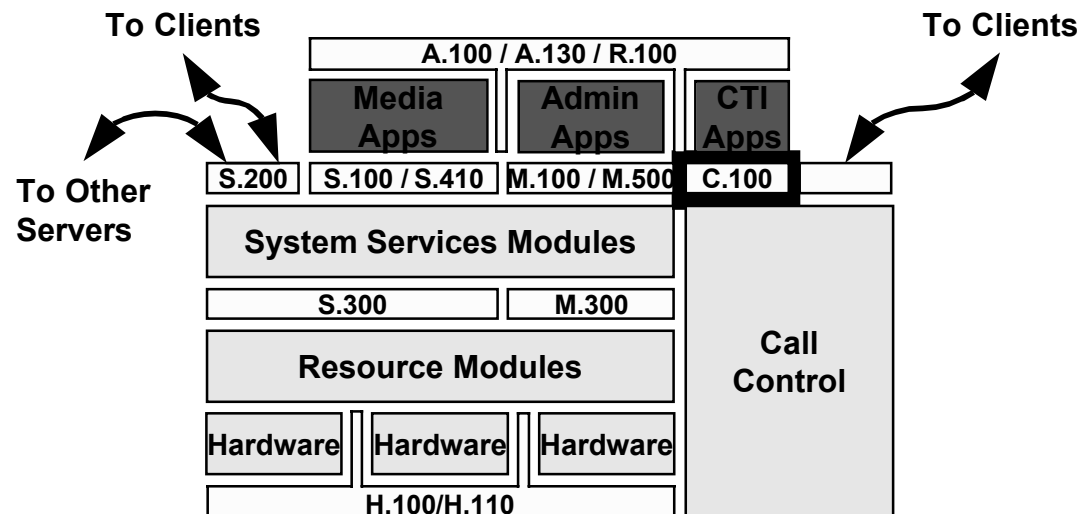


# ECTF Framework



## ■ C.100 Call Control API

- Allow portability of applications between platforms and call control implementations.

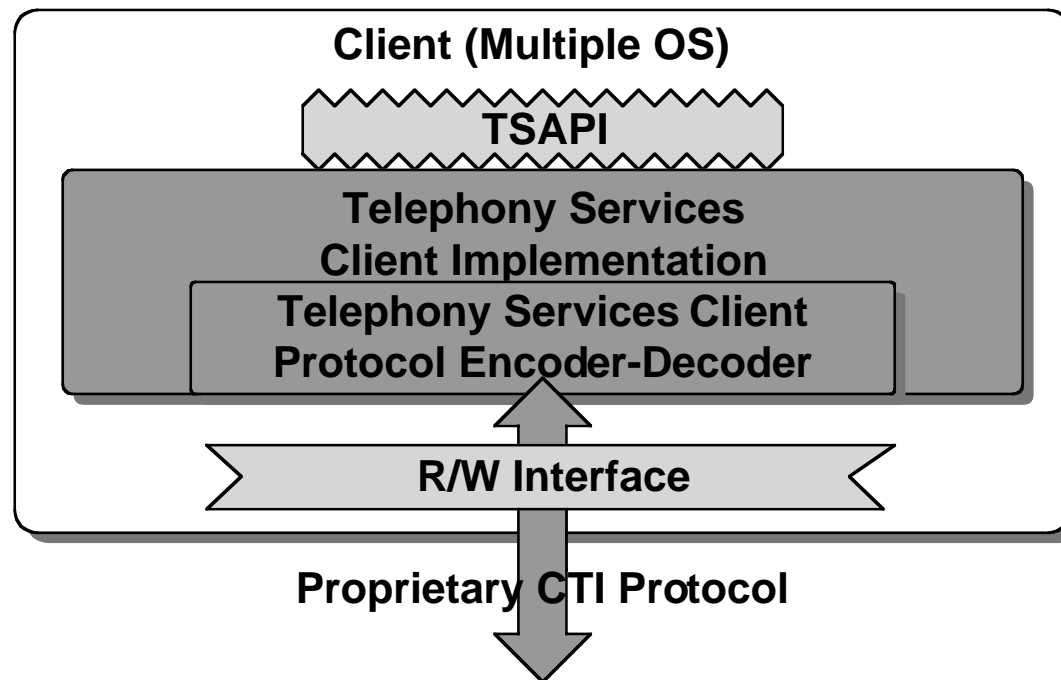




# TSAPI (MacOS, Unix, Windows, etc.)



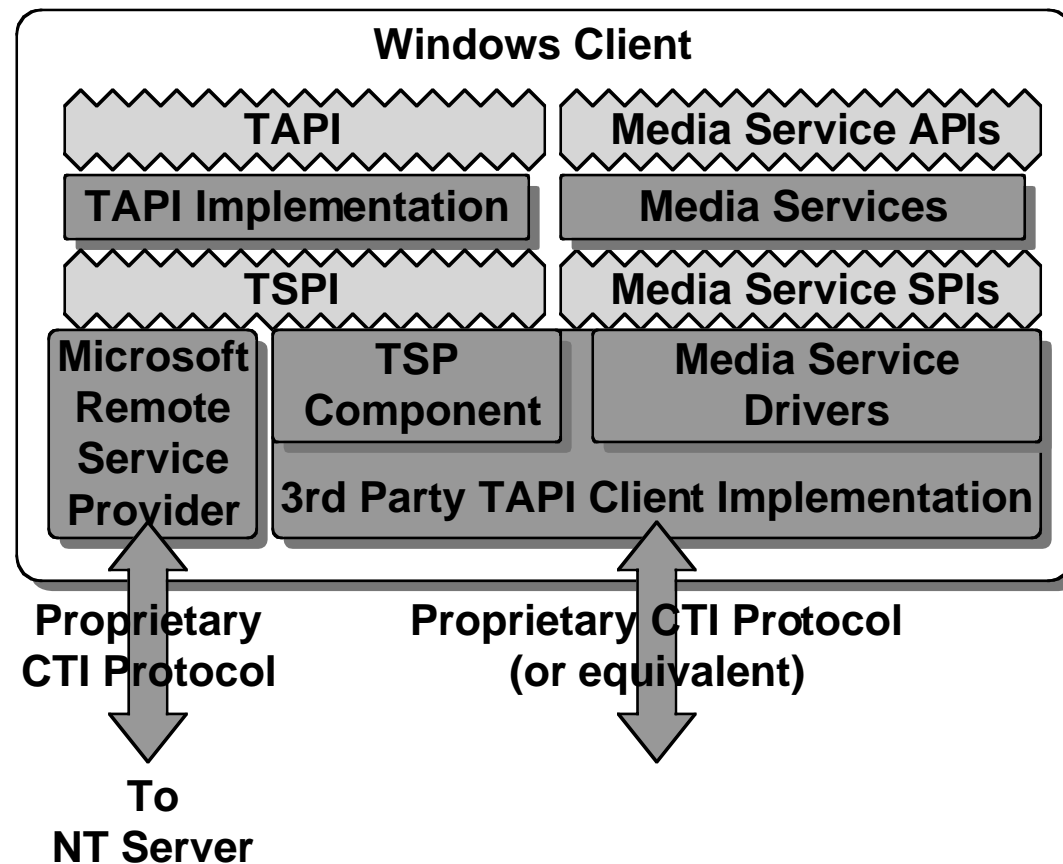
## ■ Shipping versions:



# TAPI 2.1 (Windows 9x/NT)



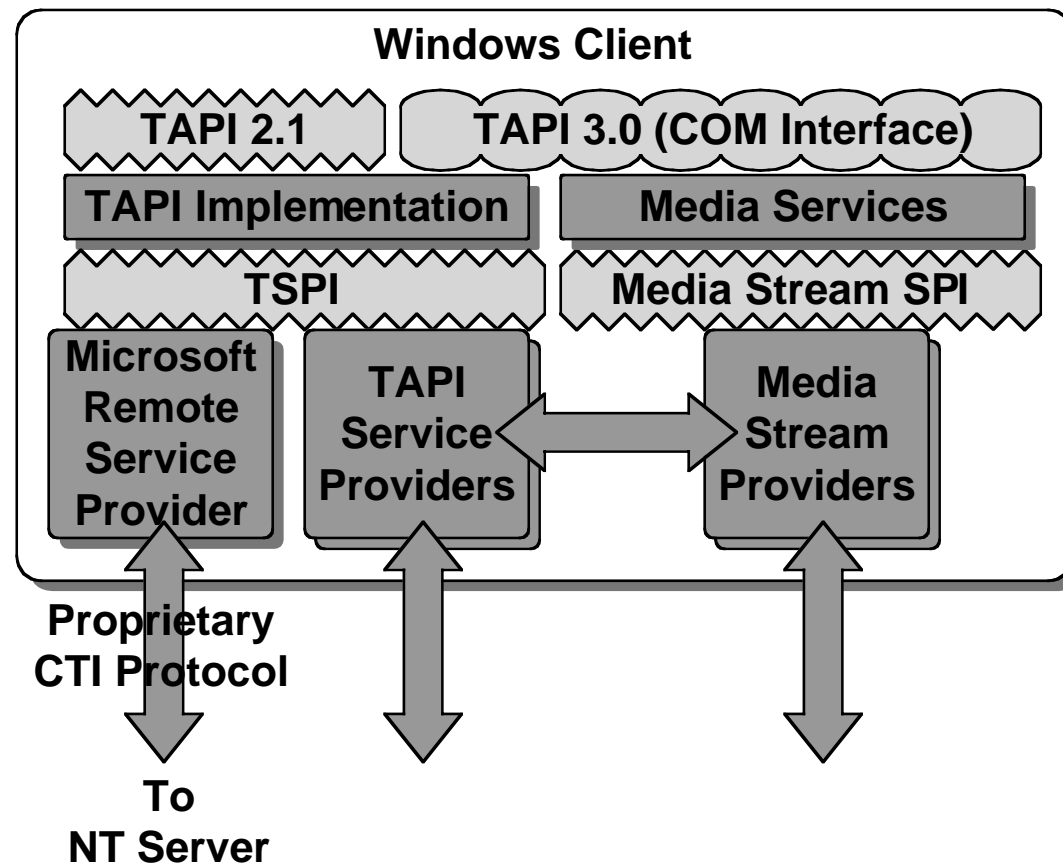
## ■ Windows Telephony



# TAPI 3.0 (Windows 98 / 2000)



## ■ Architecture



# For More Information



- C.001 specifications and Versit CTIE:

<http://www.ectf.org>

- Lucent TSAPI information at:

<http://www.lucent.com/enterprise/who/docs/product11.html>

- Novell TSAPI information at:

<http://www.novell.com/catalog/qr/sne24310.html>

- JTAPI information at:

<http://java.sun.com/products/jtapi/index.html>

- TAPI information at:

<http://www.microsoft.com/communications/telephony.htm>

# Media Services Specifications



## ■ Framework

- ECTF S.100

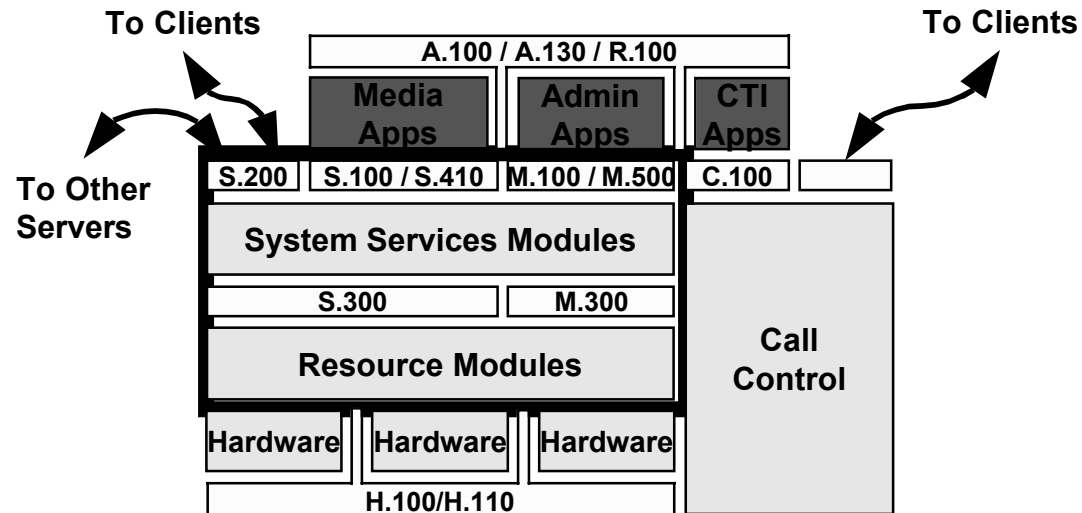
## ■ Protocols

- ECTF S.200

## ■ APIs/SPIs

- ECTF S.100
- ECTF S.300
- JTAPI Media (ECTF S.410)
- Windows Telephony

# ECTF Media Services Framework



# S.100 Concepts



## ■ Client-Server

- Application Interface Adapter (AIA)

## ■ Resources

## ■ Groups

## ■ Containers and Data Objects

## ■ Extensible name space

## ■ System Call Router (SCR)

## ■ Runtime Control (RTC)



# Containers and Data Objects



- OS-independent file system abstraction
- Supports location-independent operation
- Containers are equivalent to directories
- Data Objects are equivalent to files

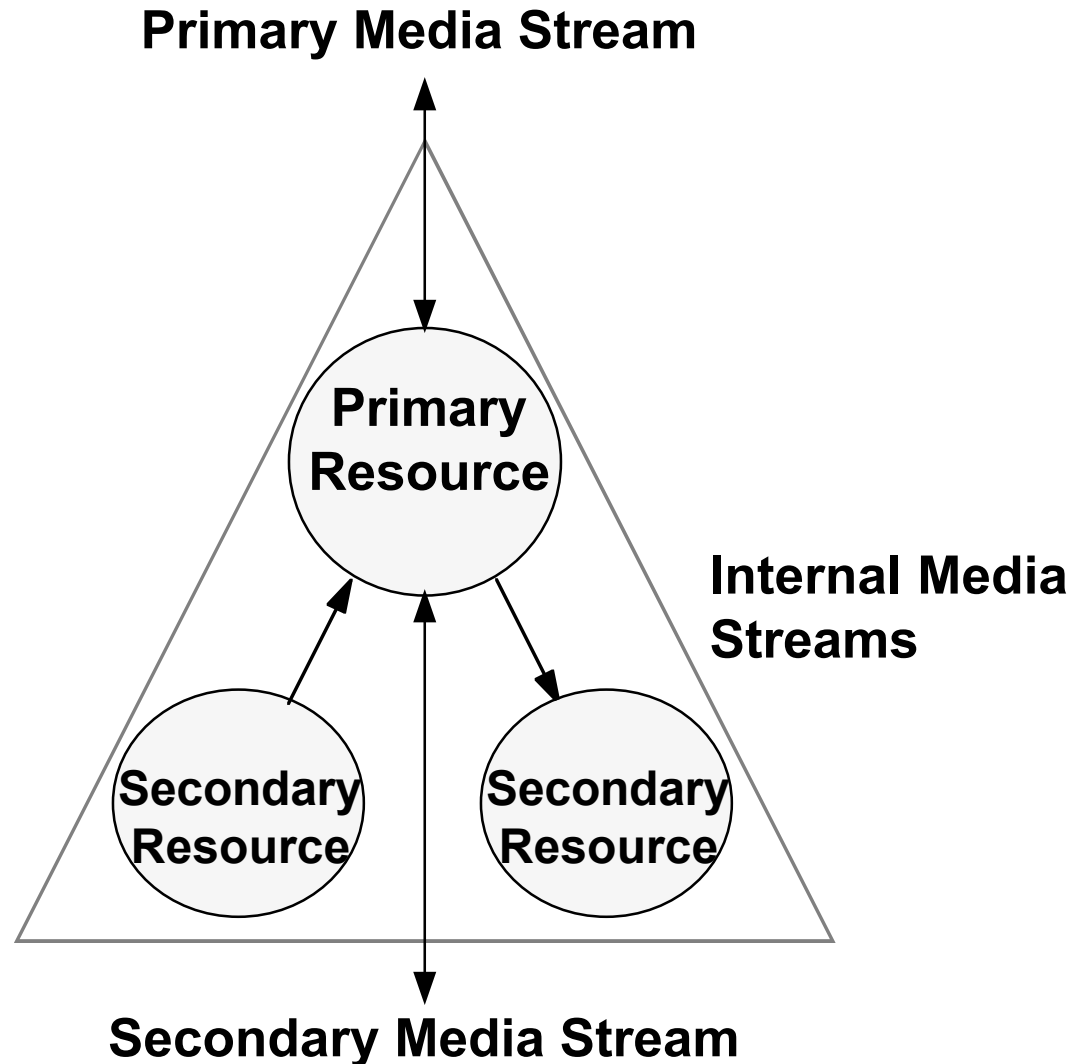
# S.100 Resources



- CCR (Call Channel Resource)
- SPR (Switch Port Resource)
- Player
- Recorder
- Signal Detector
- Signal Generator
- ASR
- TTS (Type of Player Resource)
- Fax



# Group Model

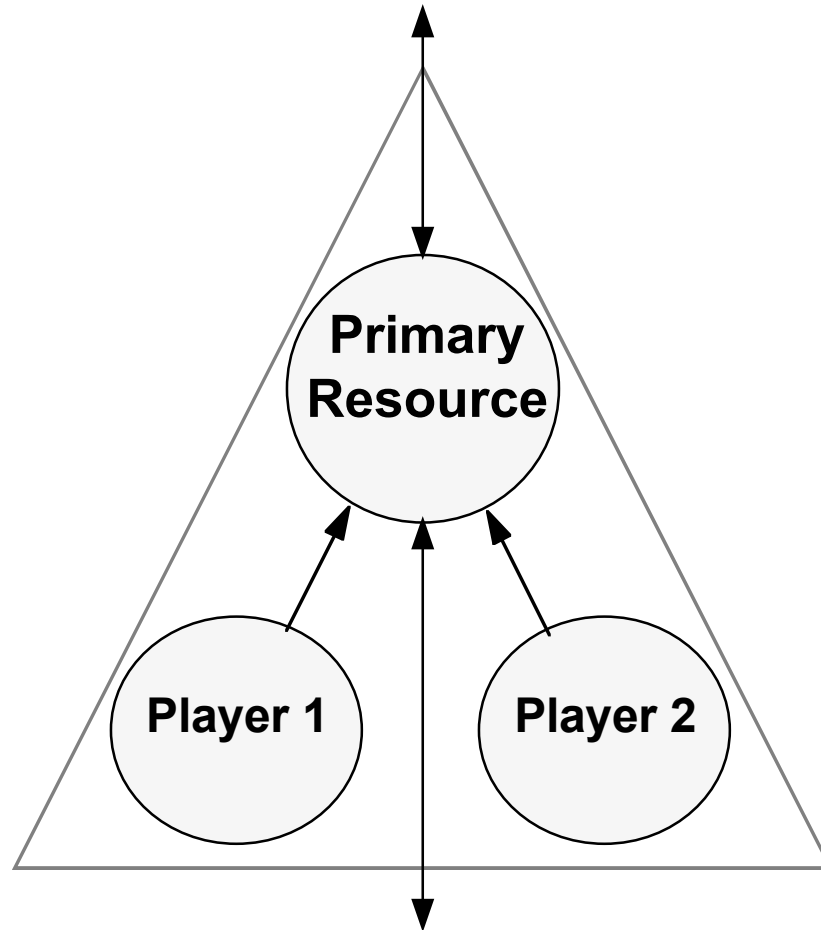


# Group Configuration

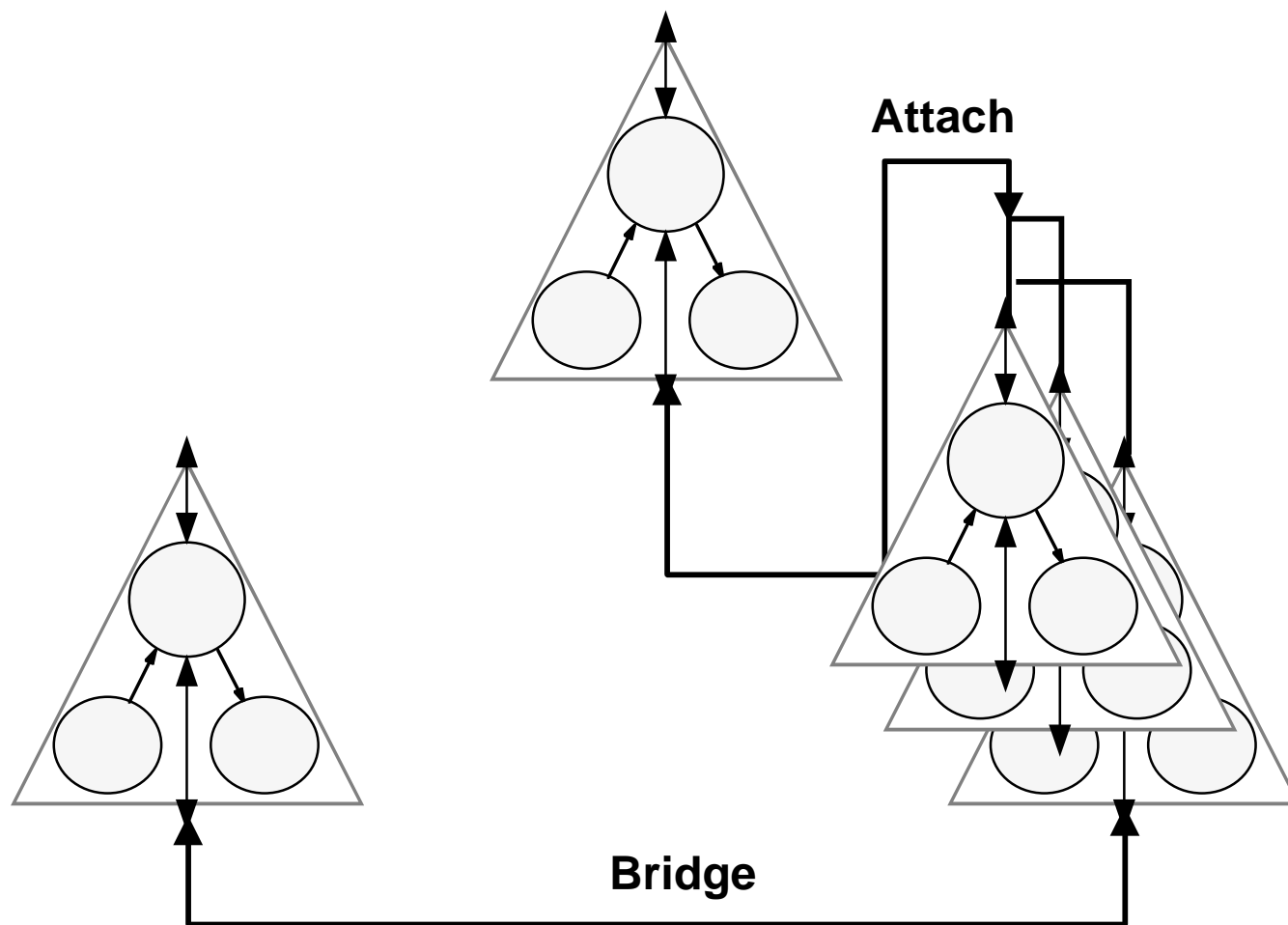


- Resources allocated from shared pools
  - dedicated until released
- Statically configurable via Application Profile
- Dynamically configurable via application request
- Reconfiguration allows for resource sharing

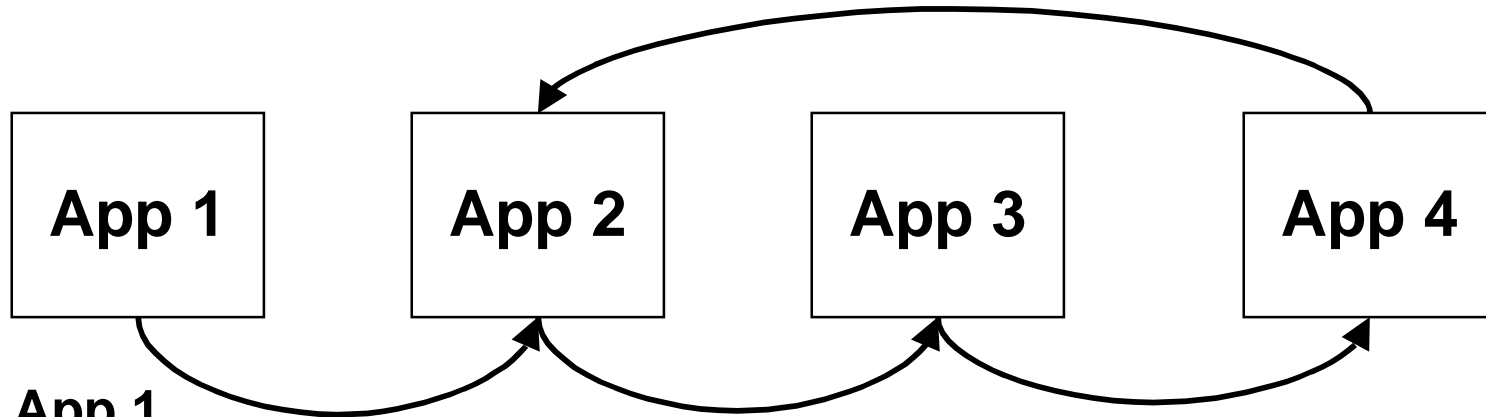
# Intra-group Switching



# Inter-group Switching



# Group Handoff



**1) App 1  
hands off to  
App 2 with  
catch tags.**

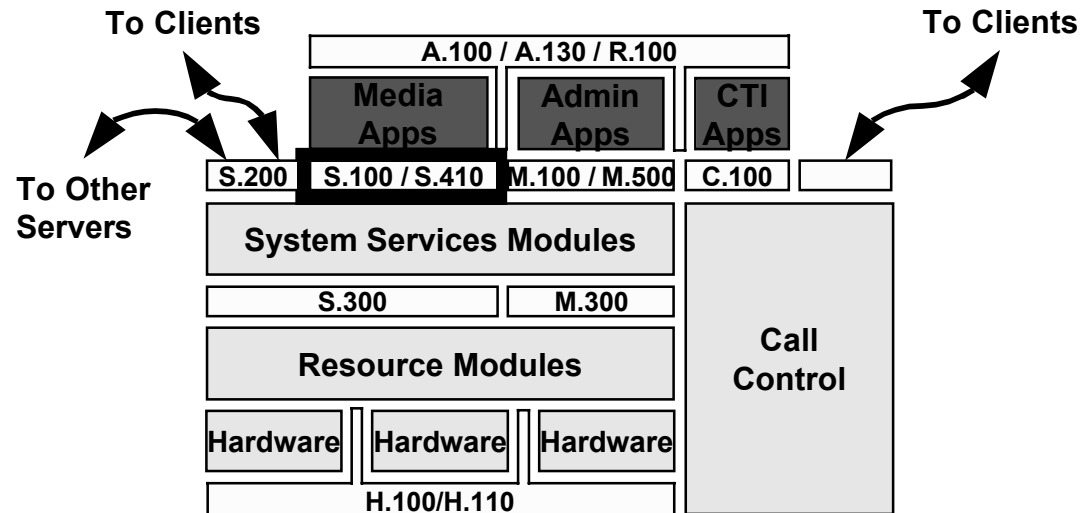
**2) App 2  
hands off to  
App 3 with  
catch tags.**

**3) App 3  
hands off to  
App 4 indicating  
Remove from  
Ownership stack.**

**4) App 4 does  
normal return  
App 2 is next  
on owner  
stack.**



# ECTF Media Services APIs



# ECTF S.100 Media Services API



- ECTF Media Services “C” API and Framework
- Operating system independent
- Extensible support for new media services
- Multiple applications share location-independent resources and calls
- Location-independent support for modular media resources





# For More Information



- S.100 R2 and S.200 specifications and the ECTF product directory can be found at:

<http://www.ectf.org>

- JTAPI information at:

<http://java.sun.com/products/jtapi/index.html>

- TAPI information at:

<http://www.microsoft.com/communications/telephony.htm>

# Administrative Services Specifications



- System configuration
  - System customization
  - Moves / Adds / Changes
- Fault monitoring
- Accounting
- Performance management
- Security







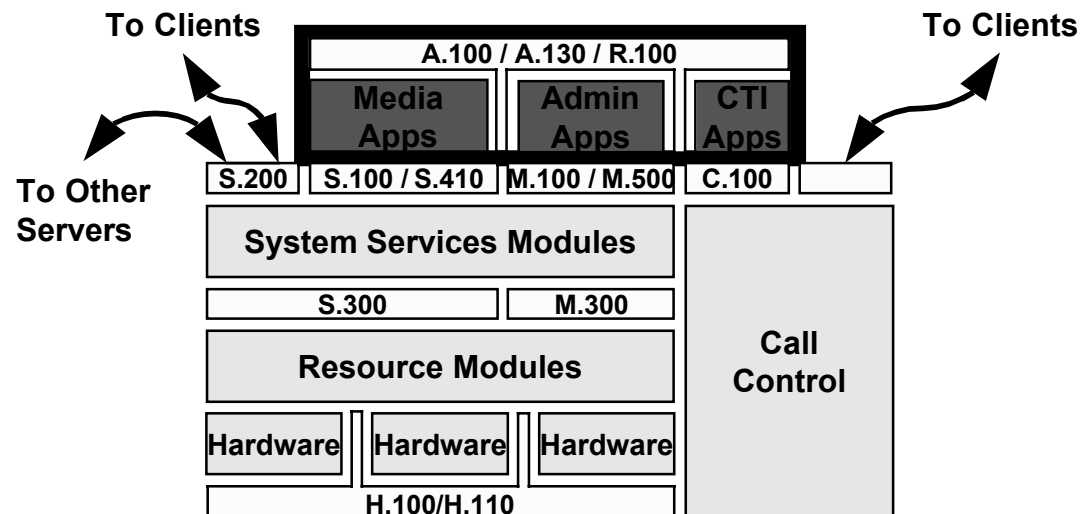


# ECTF Framework



## ■ A.001 Application Interoperability

- Framework for multiple applications to share calls and exchange call-related information
- Roadmap for technical working groups



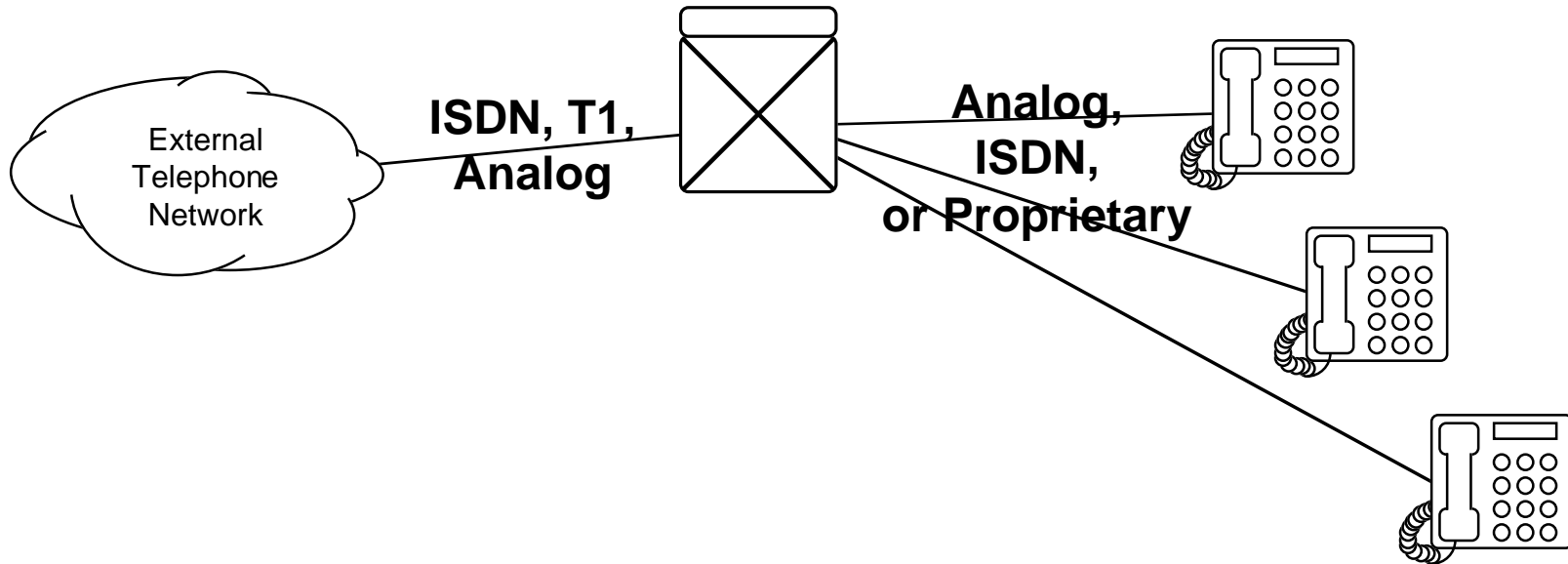




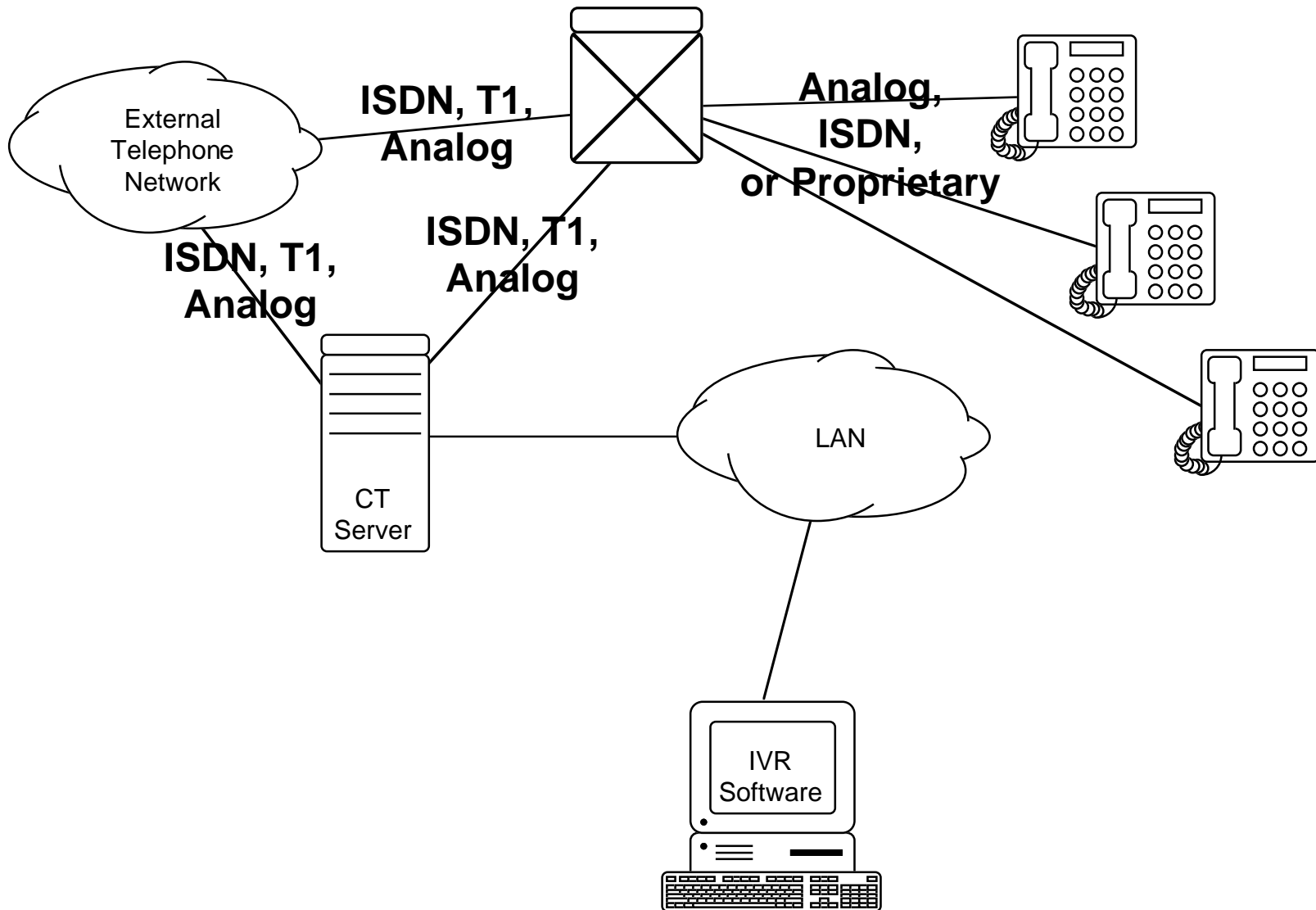
# Putting It All Together



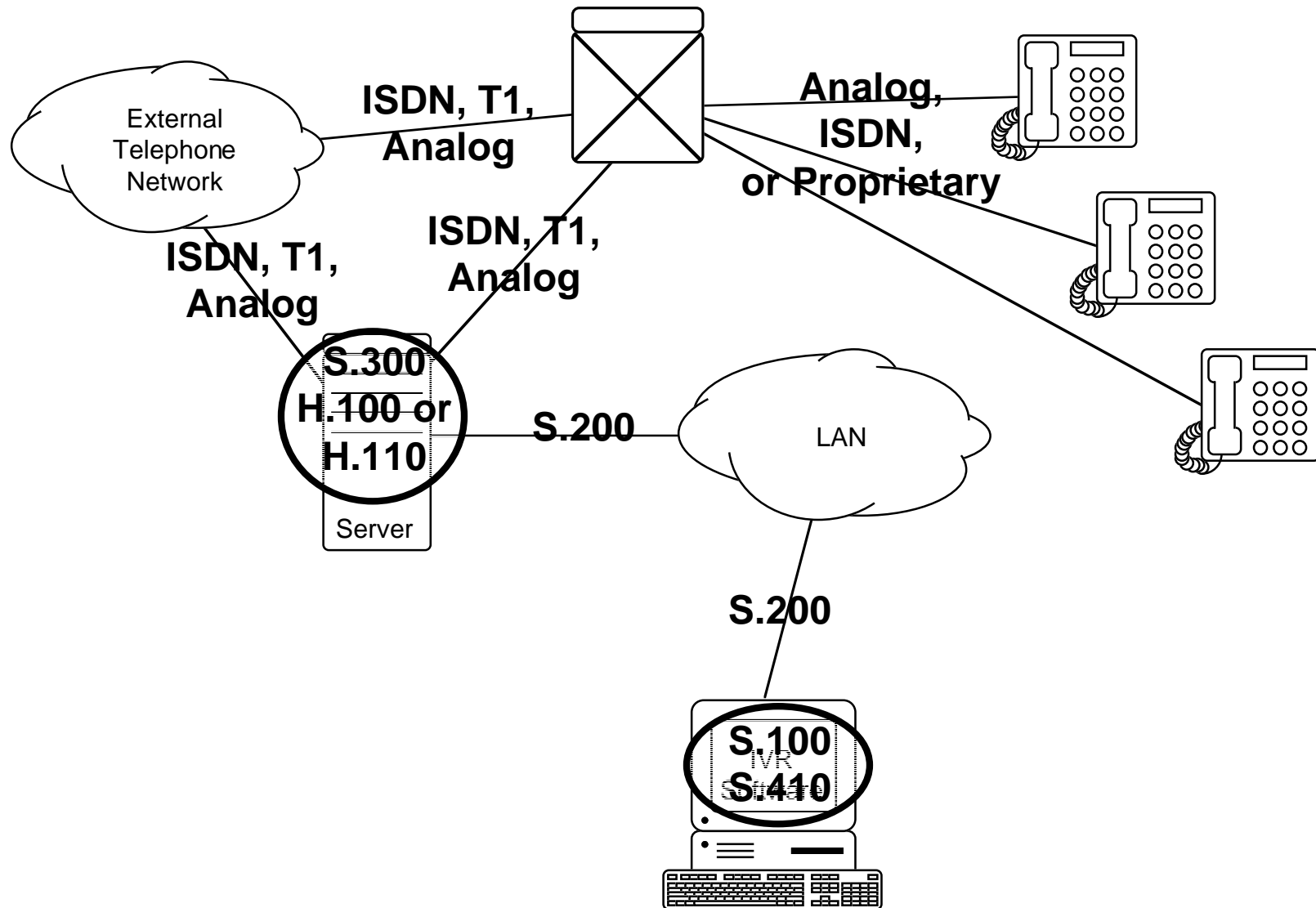
# CT Servers in Legacy Configurations



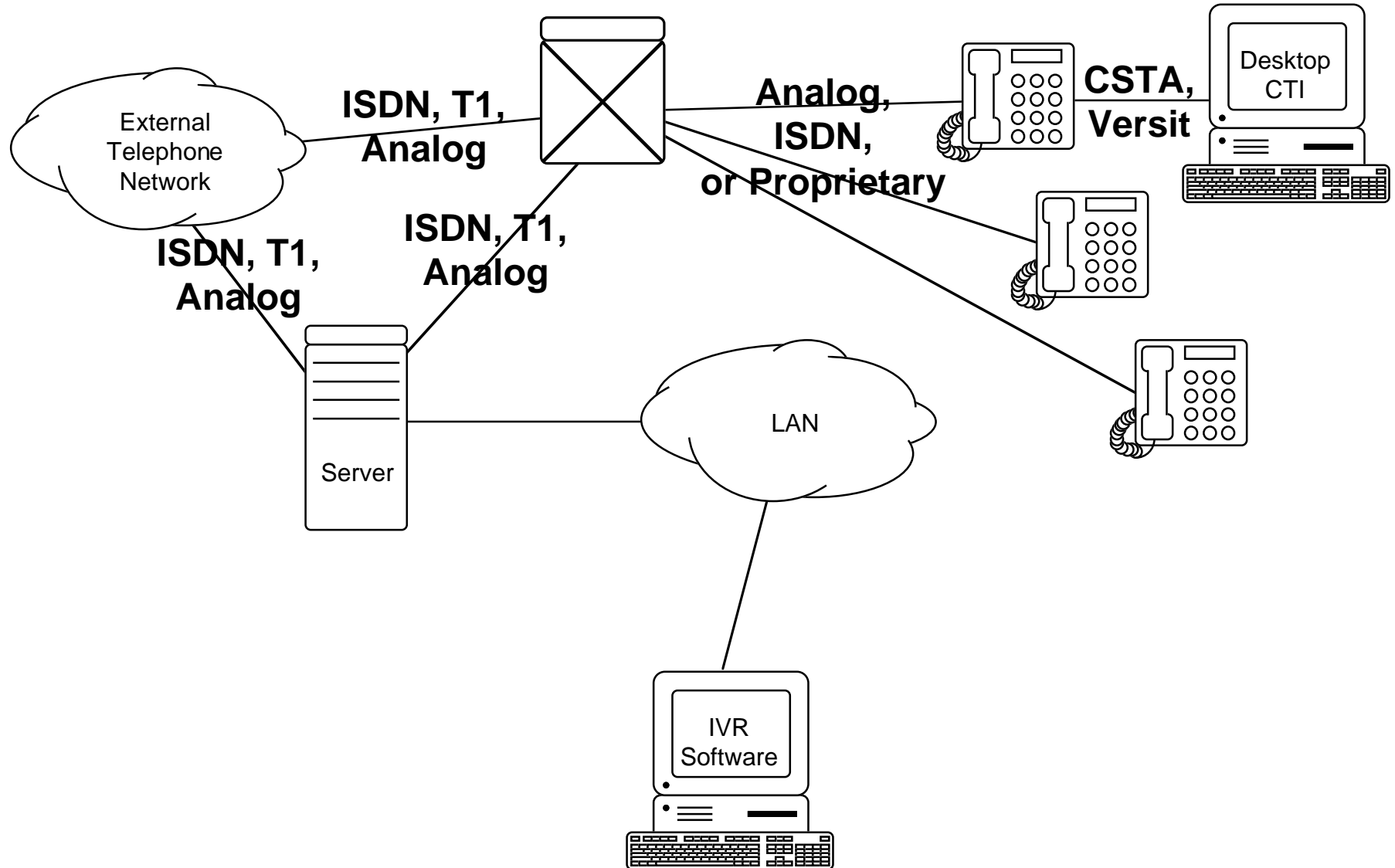
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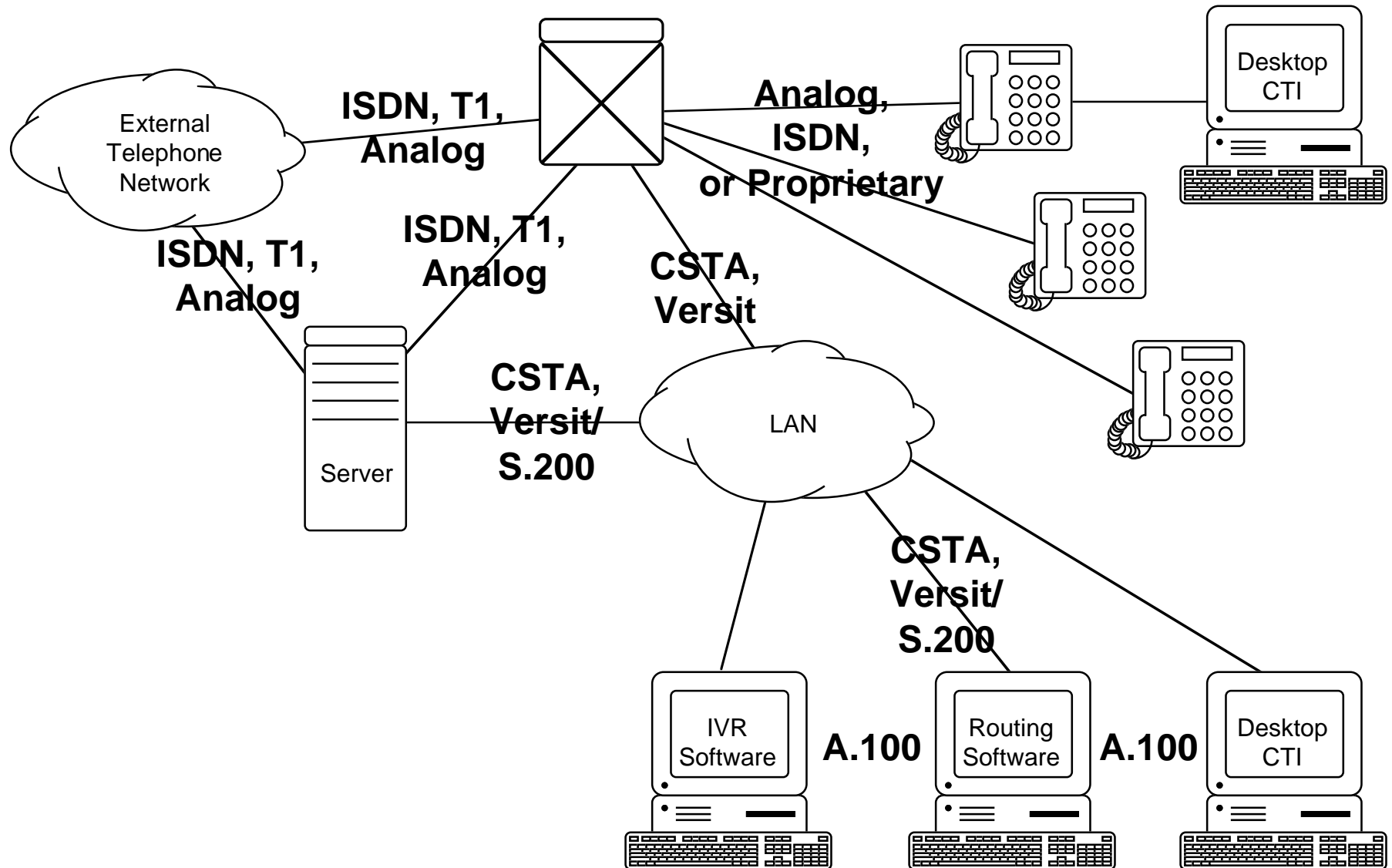


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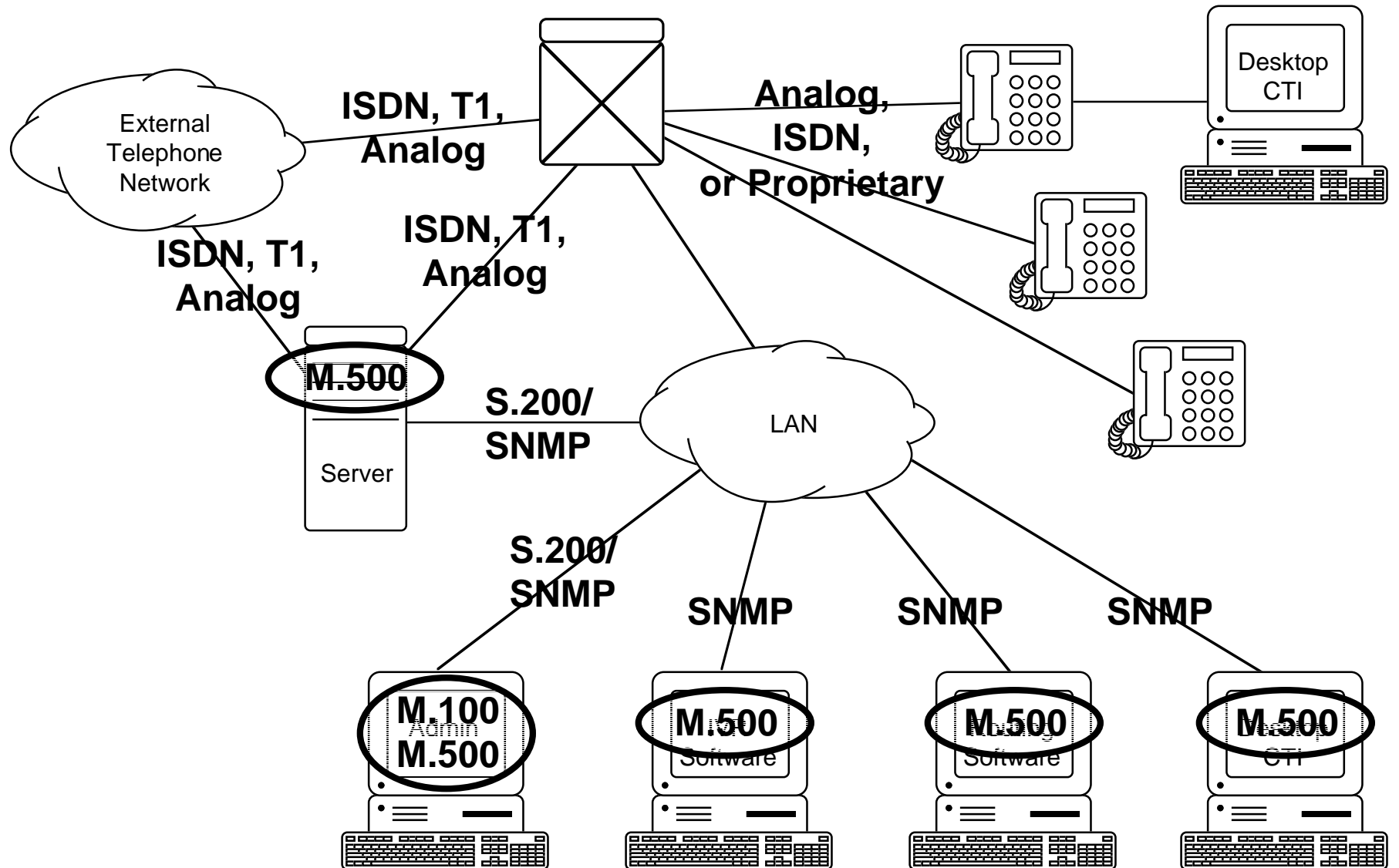




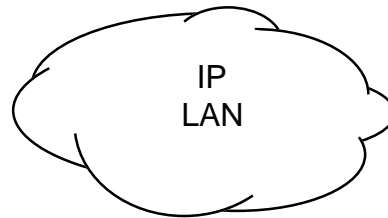
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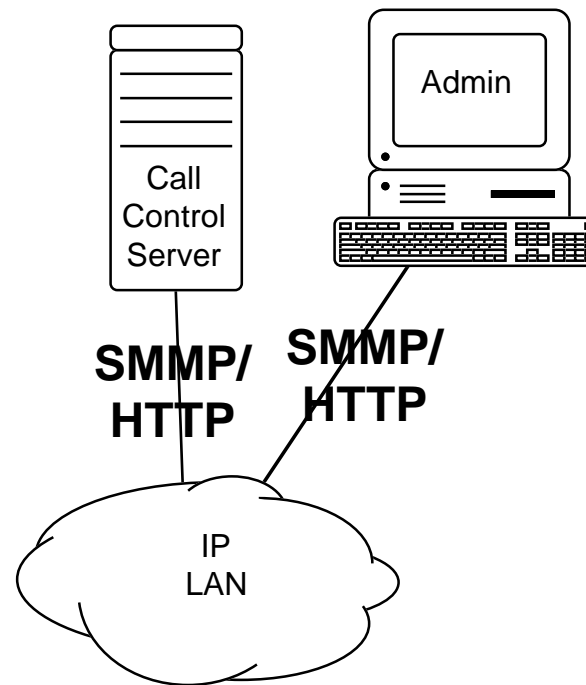
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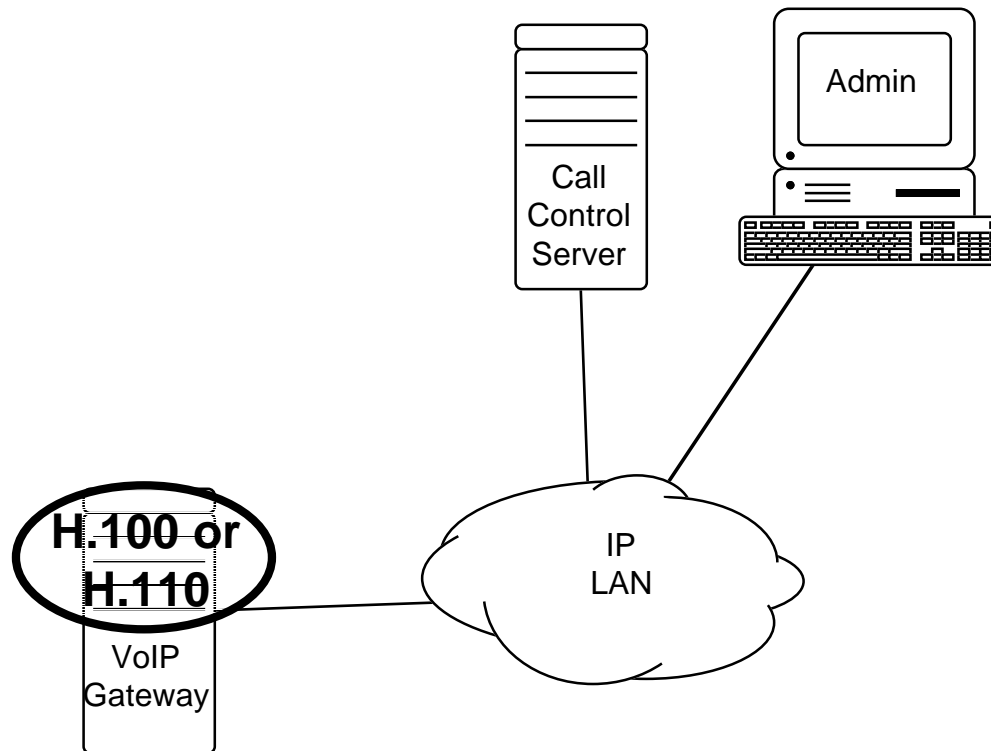
# New Generation Telephone System



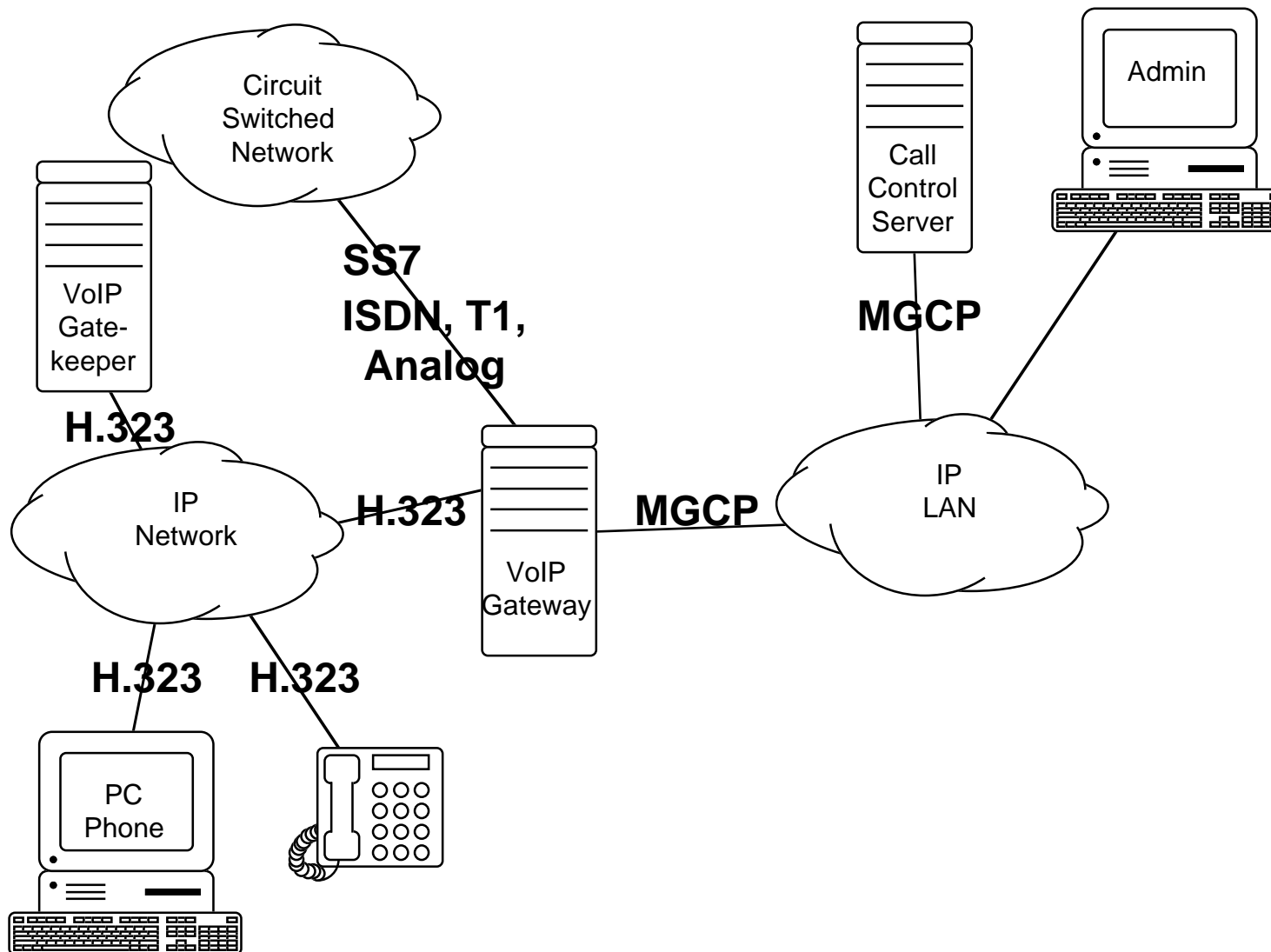
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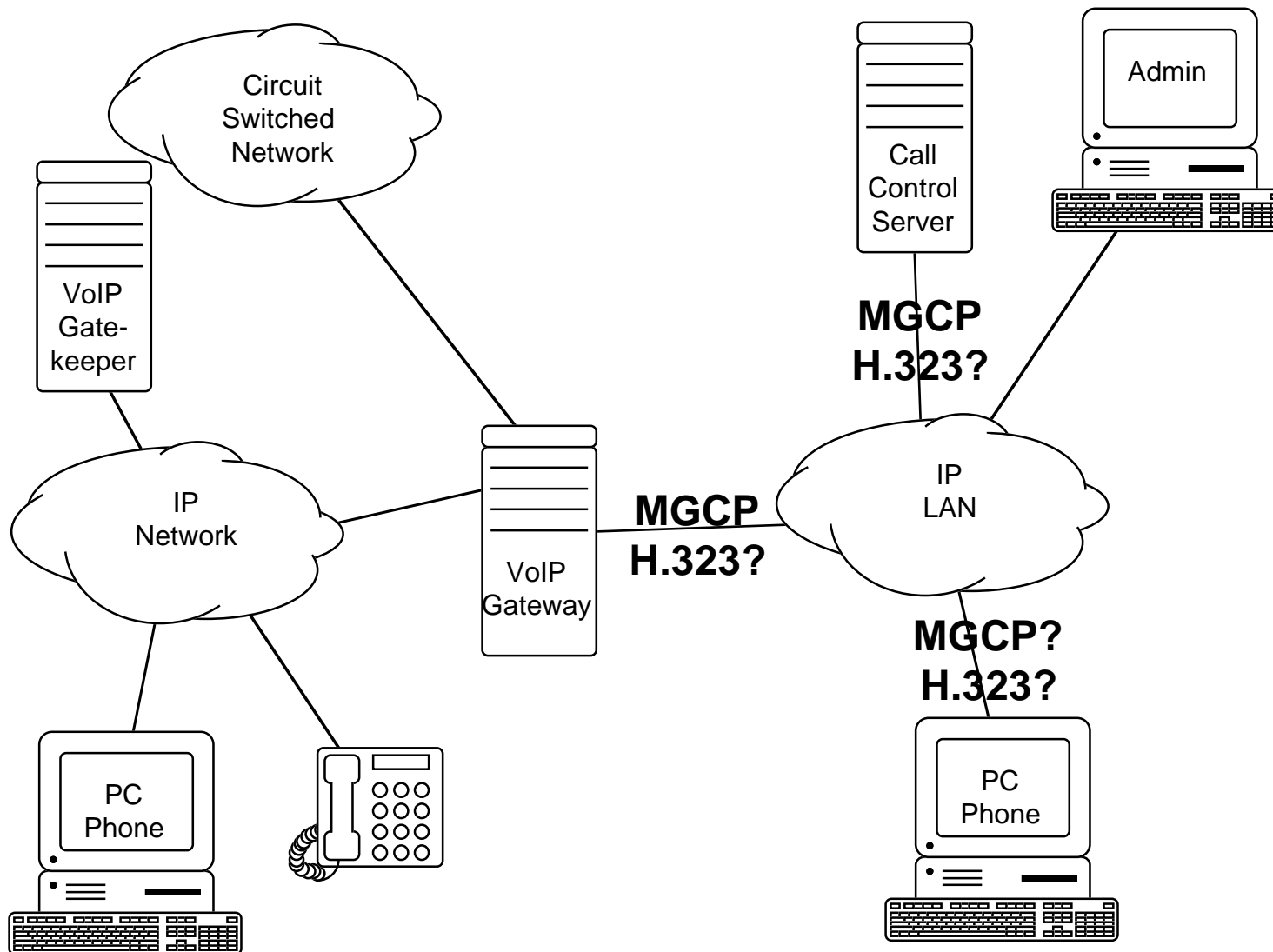
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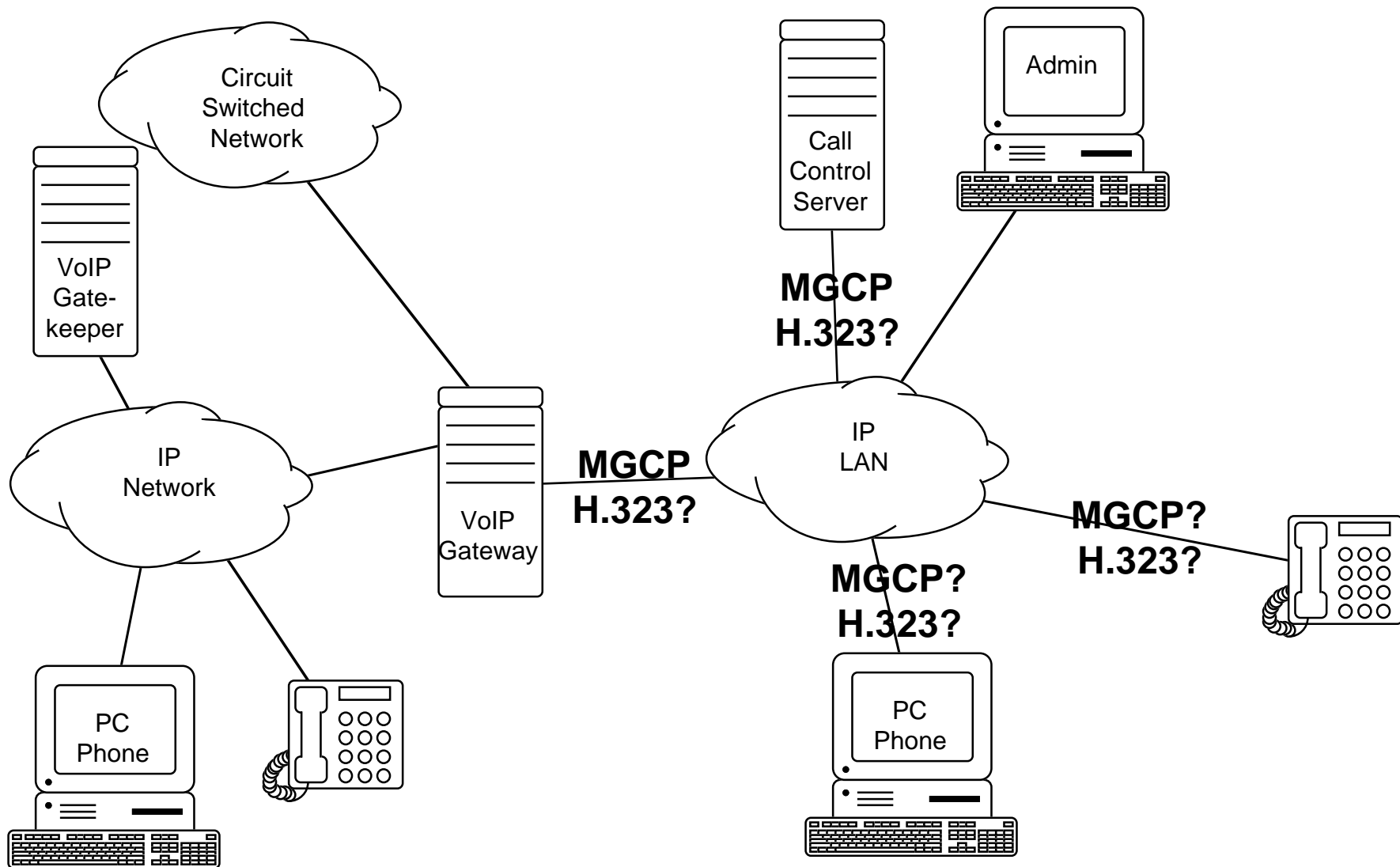
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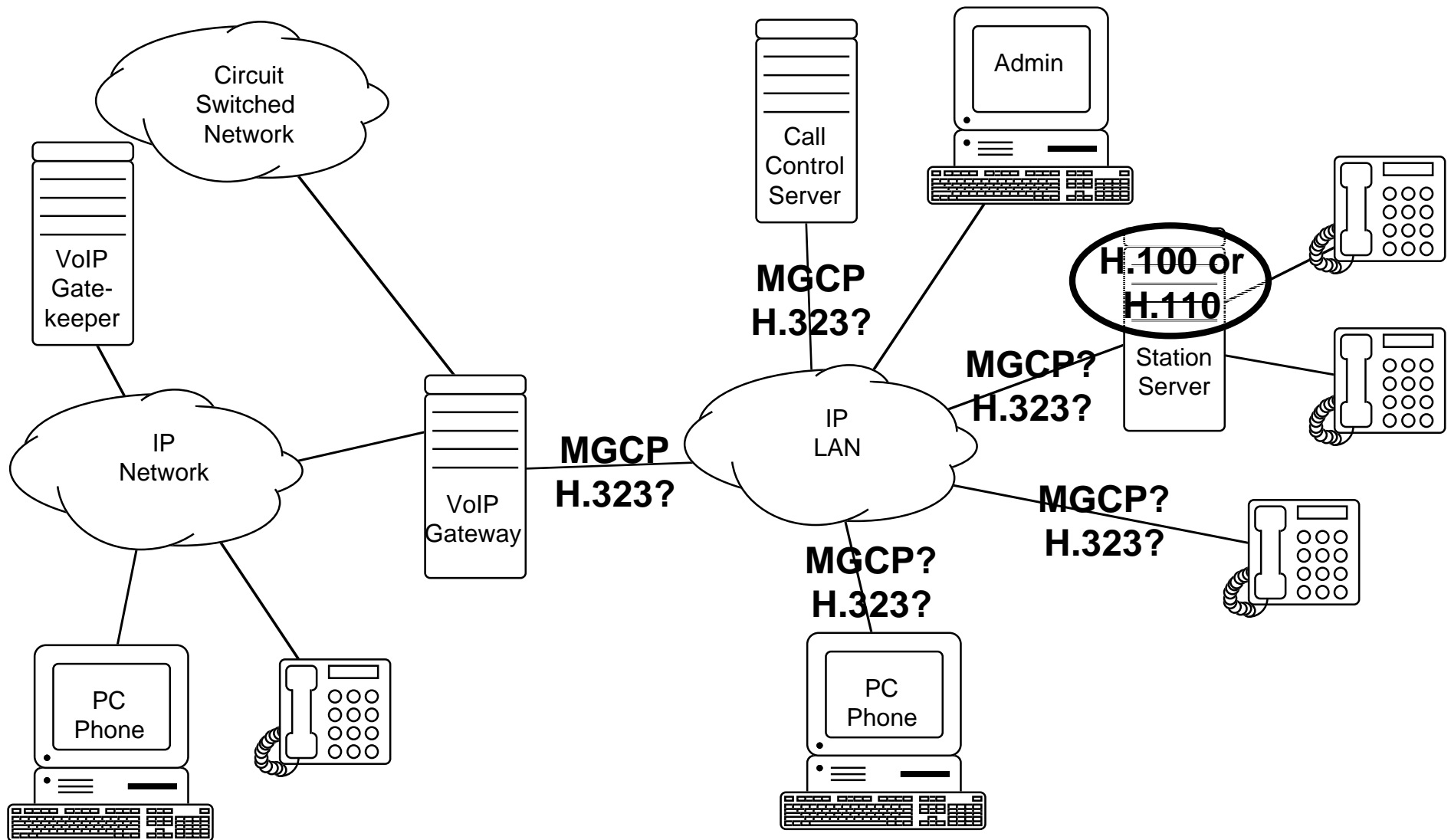
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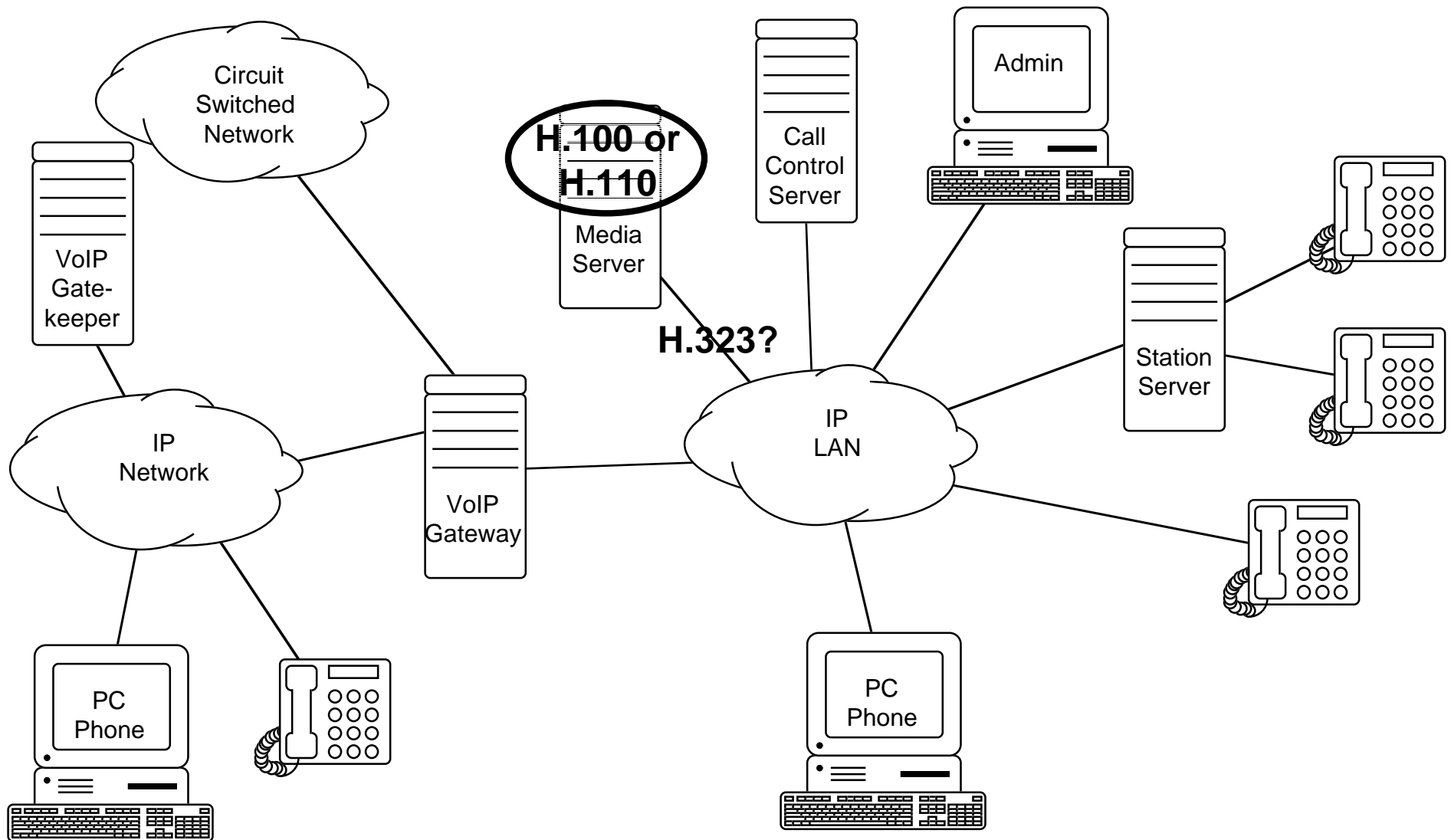
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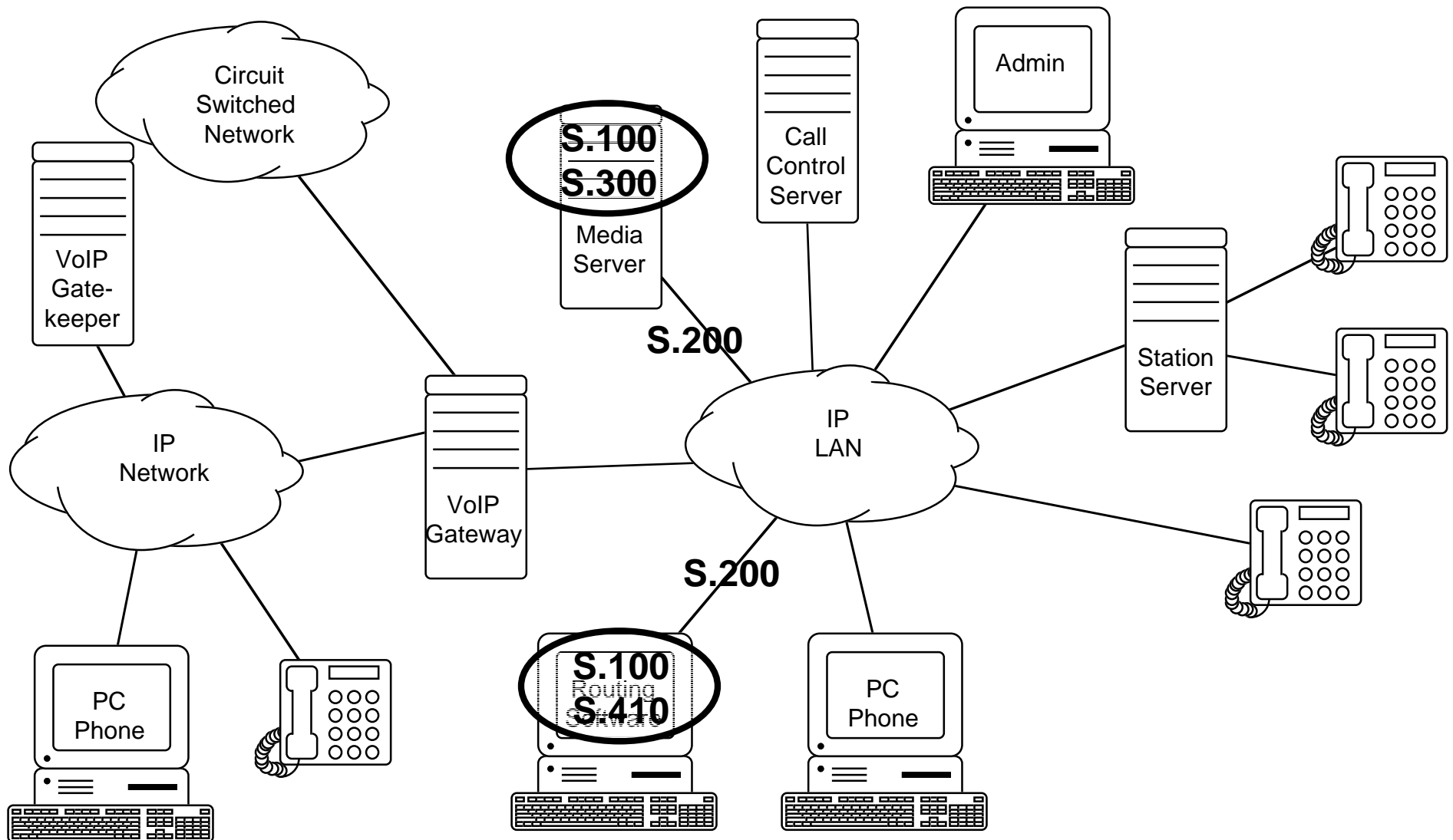
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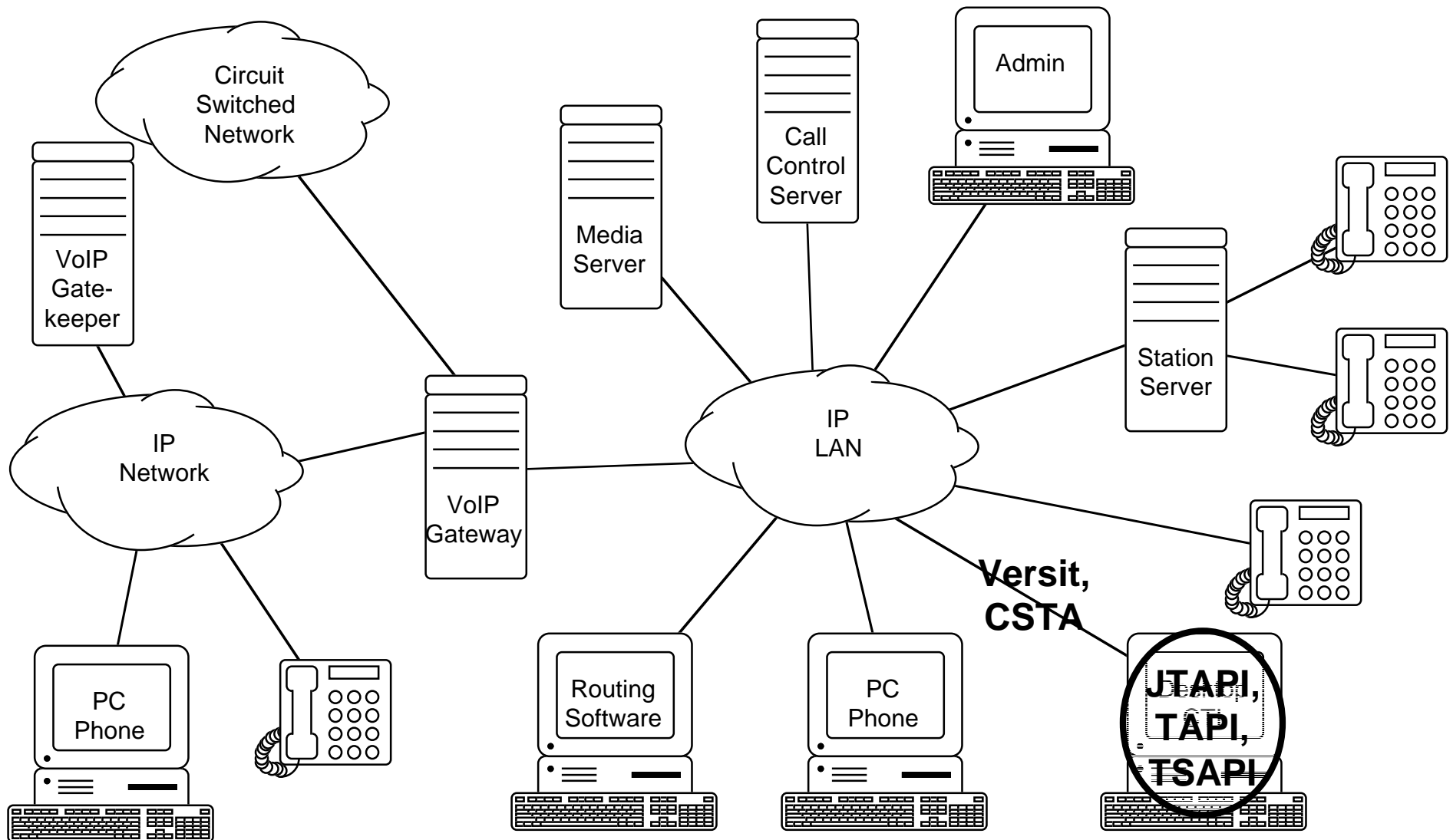
# New Generation Telephone System



# New Generation Telephone System



# New Generation Telephone System



# CT Server Product Maturity Checklist



- Framework
- Published APIs
- Published Protocols
- Reference Implementations
- Plug & Play Products

# Conclusions



## ■ Call Control

- Universal framework has emerged
- Newest generation of APIs are / will be functionally rich
- CTI Plug & Play dependent upon adoption / completion of Versit / CSTA Phase III protocols

# Conclusions



## ■ Media Services

- ECTF framework is the focus
- Availability is a function of vendor adoption

# Conclusions



## ■ Admin

- M.100, M.300, M.500 are a solid suite for management and fault monitoring
- HTML/HTTP is a good bet for configuration interfaces
- Interfaces/protocols are still required for accounting (e.g., CDR)
- Watch for standard directory schemas for call control configuration (MAC, CoS, etc.)

# Conclusions



## ■ Switching

- TDM backplanes are here to stay in one form or another
- H.100 and H.110 are the way to go for PCI and cPCI
- Support for both traditional and packet-based telephony networks



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## Q&A

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