



#### NCAR IP Telephony



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## Voice over Internet Protocol (VoIP) Internet Protocol Telephony (IPT)



### Outline for today's presentation

#### **IPT** basics

- Standards, QoS, phone power options, VLAN design, addressing, etc.
- **NCAR** Overview
  - Acronym definitions
  - Network overview
- **Current NCAR deployment** 
  - PBX environment we left
  - Current and planned IPT offerings
- **Future NCAR IPT directions** 
  - Potential services and enhancements



### VoIP—What is it?

Voice packets transported using IP
 Traditional networking infrastructure carries voice traffic

 Standards based (e.g., H.323, G.711, G.729, RTP, UDP, IP, RSVP)



### Buzz words

- "Multiservice networking" and "Convergence" (data, voice, and video on one infrastructure)
- The business case is to reduce costs by integrating telephony services into the data network (avoids the dual-network approach)

 Future goals include "Unified Messaging" and seamless integration of currently disparate networking resources (e.g., video)



### VoIP Advantages

- One physical layer one infrastructure (single wiring closet)
  - Simpler and less expensive to install and maintain
- Enhances the "office of the future"
  - Mobility and integration of voice mail, electronic mail, FAX, and video technologies
- Single network management system
- Simplifies moves, adds, and changes for phones
- Choice of phone power
- Flexible IP address assignment
- Increased system redundancy



### **Pre-deployment** considerations

- Layer1 must be solid (e.g., your data network should already be "up to par").
- QoS capabilities present? (i.e., from phone to all end points--start with the high level service definitions then work through several levels of detail down to the individual device setting level (e.g., switch port settings, potential router configurations, etc.)).
- Considerations for the new merged network (e.g., now voice and data; adequate bandwidth on LAN and WAN links?).



### Quality of Service (QoS) issues

 Have to deal with packet loss, jitter, and delay



### QoS issues, continued

- At the edge of the network:
  - Additional bandwidth
  - cRTP
  - Queuing (WFQ, CQ, PQ, CB-WFQ)
  - Packet classification (IP Precedence, policy routing, RSVP, IP RTP Priority)
  - Shaping traffic flows and policing (GTS, FRTS, CAR)
  - Fragmentation (MCML PPP, FRF.12, MTU, IP MTU)
  - Jitter control on end routers



### VoIP review





### Phone basics







### Data port on phone

- 10/100 data port included on phone, keeps port count down
- Changed physical infrastructure requirements
- Two VLANs—1 for data; 1 for voice



### Powering the phones

3 ways to deliver 48V to the phone:
"Inline power" (over the same cable used for Ethernet connection)
Powered patch panel inserted between existing switch and end devices
AC power adapter to wall socket
"Phone discovery" feature



### VoIP – a typical migration





### VoIP vs. traditional PBX

What are some of the differences?
 – System redundancy

- System administration
- Phone features



## System redundancy

Function	Traditional	IPT
Power	Multiple power supplies on one power source	Multiple power supplies on multiple power sources
Telephony	Redundant telephony processors, Part of same system and hardware components	Multiple servers in a cluster On-line backup Completely separate systems
Modularity	One system All or none	Individual Components Failures only compromise partial system Multiple core paths



## System administration

Function	Traditional	IPT
Moves	Extension defined on port, scheduled w/NETS	Extension defined on phone, user moves to new office
Adds	Define port in office, send phone, plug into new telephone system port	Preconfigured phone sent to user, plug into active network port, share with computer
Additional buttons	Change phone	Add on Modules
Faceplates	Printed (current?)	Displays, always current
Additional phone functionality	New phone required	Software upgrades, Download to phones
User Customization	Limited Phone interface only	Expanded capabilities Web interface



## System administration

Function	Traditional	IPT
System Expandability	Major software upgrade, hard coded port definition Forklift replacement	License upgrade Hardware individually upgradeable
System Software	Proprietary	Standards based Multiple vendor products
Password Security	Multiple lower level logins Shared service level login	Common Domain/account TACACS
Administrative Interface	Modem w/specialized keyboard mapping	Browser based
Backups	Backup to internal system hard drive Weekly automated tape backup, monthly tape rotation	Mirrored system hard drives, hot swappable Backups across network or locally



Telephony Feature	Traditional	VoIP
Hold	Standard	Standard
Volume (handset & ring)	Standard	Standard
Transfer	Standard	Standard
Last Number Redial	Standard	Standard
System Forwarding When ring no answer(RNA) or busy, where your calls go	Separate targets for RNA internal RNA external Busy internal Busy external	Separate targets for RNA Busy
Station Speed Dial User defined	10 numbers	Determined by number of defined buttons on phone, configured via web page



Telephony Feature	Traditional	VoIP
System Speed Dial System list of numbers System administrator defines	Multiple lists	N/A
Ad hoc Conferencing User calls conferencees	Up to 7 other parties	Currently 4 parties, Expandable by adding more resources
Meet Me Conferencing Conferencees call in	N/A	Currently 10 parties, Expandable by adding more resources
System Directory	N/A	LDAP or similar directory linkable through XML parsing application
Personal Directory	N/A	User application
Ring sounds	8 pitches	25 types currently; expandable



Telephony Feature	Traditional	VoIP
Internal/External call differentiation	Single ring/Double ring	Single ring/Double ring
Bridged calls Ability to conference using extension that appears on more than one phone	Allowed w/alert tone	N/A
Call Back (Camp)	Allows user to receive ringback after another user is done with a call (busy) or places a new call after idle (lunch break)	Allows user to receive ringback after another user is done with a call (busy) or places a new call after idle (lunch break)
Speakerphone	All but basic model (RP120)	All models
Targeted PickUp	Allows the user to PickUp any dialed ringing extension within the same system	Allows the user to PickUp a ringing extension that is part of a different defined group



Telephony Feature	Traditional	VoIP
Group Pickup	Allows user to Pickup a ringing phone within their defined group	Allows user to Pickup a ringing phone within their defined group
Park	The user can Park a call on any extension within the same system	The user can Park a call in a system queue (Ext. displayed on phone) which can be retrieved from any extension within the same CM
Intercom	2 digit speaker call within a defined group	Available with customized setup
e911 services	By site	By office



## Voice Mail (VM) and Unified Messaging (UM)



## Unified Messaging (UM) – what is it?

- "Converged" email, voice, and fax messaging
  - email, voice and fax messages accessed from PC or telephone
- Text-to-speech module can read email over the phone
- Fax server allows centralized fax management
  - view, print, or forward via email client
- Browser-based personal administration
  - allows users to make their own customizations



### UM benefits:

Centralized communications control
Browser-based administration
Decentralized user-enabled tasks
Scalable, redundant, fault-tolerant system tools



### **DYA:** Define Your Acronyms

NCAR can be a very "acronym soup" kind of place! ③ **UCAR=University Corporation for Atmospheric Research NCAR=National Center for Atmospheric** Research **SCD=Scientific Computing Division NETS=Network Engineering and Telecommunications Section FRGP=Front Range GigaPop** 



### PBX system we left

- 5 Siemens PBX systems with over 2500 active ports (phones, trunks)
- Siemens 9751 v6.4
  - Components and software are proprietary
- Redundant telephony processors at ML and FL only
- Using "Classic" ROLM phones from previous systems, some purchased w/original system in 1984



### Current system life

- Current PBXs scheduled replacement for FY'04, '05, '06, and '07
  - Next generation traditional?
  - VoIP solution?
  - Telephony vendor's platforms are hybrid VoIP/traditional systems



### **PBX-based** voice messaging

ROLM PhoneMail v6.3 – PC/DOS-based systems - 386/33mhz processors 1200 subscribers Backups only save database tables, no messages/greetings ML and FL purchased 1991, due for replacement this year



### Initial IPT at NCAR

 Our oversight groups

 NCAB: Network Coordination and Advisory Board
 ITC: Information Technology Council



### Initial IPT at NCAR

- Emphasized:
  - standards-based technology
  - infrastructure convergence
  - cost reduction
  - additional/enhanced redundancy/resiliency options







#### 99 boxes of phones in the warehouse...99 boxes of phones...





#### Plus switch upgrade gear....





### Current state of deployment

- 3 Cisco Call Managers (CCMs)
- 1 Unity voicemail server
- Misc. IPT servers (e.g., for services, billing, etc.)
- ~1,800 IP phones deployed
- ~1,400 users





### **IPT** application servers

- Cisco Emergency Responder (CER)
- Cisco Integrated Contact Distribution (ICD) / CRS / IPCC
  - "help desk" or "call center" software
- Call Authorization and Tracking Tool
   Dimension Data code authorization / billing
- ophone services server
- Telemate billing software



### End state of deployment

- 4 Cisco Call Managers (CCMs)
  - 1 cluster (1 publisher; 3 subscribers)
- 1 Cisco Unity voicemail server
- Misc. IPT servers (e.g., for services, billing, etc.)
- ~1,900 IP phones deployed
- ~1,500 users on new IPT systems





#### "Lessons Learned" (or what we might have done differently)

- Moving the PBX connectivity sooner (close to the 50% conversion mark).
- Start planning moves with vendors earlier (and allow more time for slips)
- Beware of the "extended NOC!"
- Inclusive cost models (licensing for all components, including ongoing maintenance costs).
- Work disaster recovery plans in early.
- Carefully consider your deployment options (forklift or phased?).
- Do not forget legacy application support issues (e.g., analog).



### General recommendations

- Make your test bed(s) as realistic as possible.
- What is your existing level of system administration support? Ensure you will have adequate staff to deal with the system administration load that will be introduced by the IPT system you select.
- Do not forget security considerations: implement all recommended best practices of your vendors (e.g., IPT provider; OS provider; network equipment provider, etc.). Test and then implement ACLs on your network as early and thoroughly as possible.
- Remember that "change is hard" for some users!



### What we like now

 Modularity and adaptability of the system (e.g., very easy to change configuration).

- Very flexible dial-plan (allows for rapid, easy changes if required)
- Physical separation of components (e.g., multiple call managers).



### What users like now

- Same number at multiple locations.
- UCAR directory on phone.
- Web page access for phone control (e.g., speed dials, services, etc.).
- Everyone gets a display and speaker phone.
- "Little things" (e.g., big message waiting light, date and time on phone, etc.).



### Futures?

#### "SoftPhone" support?

- lots of access and support issues with "telepresence"
- Additional "services" and directory functions from phones?
  - e.g., division-specific apps?
- Intra-FRGP member VoIP?
- Intra-Internet2 member VoIP?



# NCAR phone and voicemail systems user web page:

- <u>http://www.scd.ucar.edu/nets/projects/voip/documentati</u> on/users/voip-user-info.htm
- Our project page:
  - <u>http://www.scd.ucar.edu/nets/projects/voip/</u>
- Misc. UCAR/NCAR URLs:
  - <u>http://www.ucar.edu/ucar/about.html</u>
  - http://www.ucar.edu/ucar/org/index.html
  - <u>http://www.ucar.edu/ucar/governance.html</u>
  - <u>http://www.ucar.edu/ucar/index.html</u>
  - <u>http://www.ncar.ucar.edu/ncar/index.html</u>
  - <u>http://www.scd.ucar.edu/nets/intro/staff/jcustard/ucansp</u> <u>eakucarspeak.htm</u>





#### • Questions?

