IP Telephony Solution

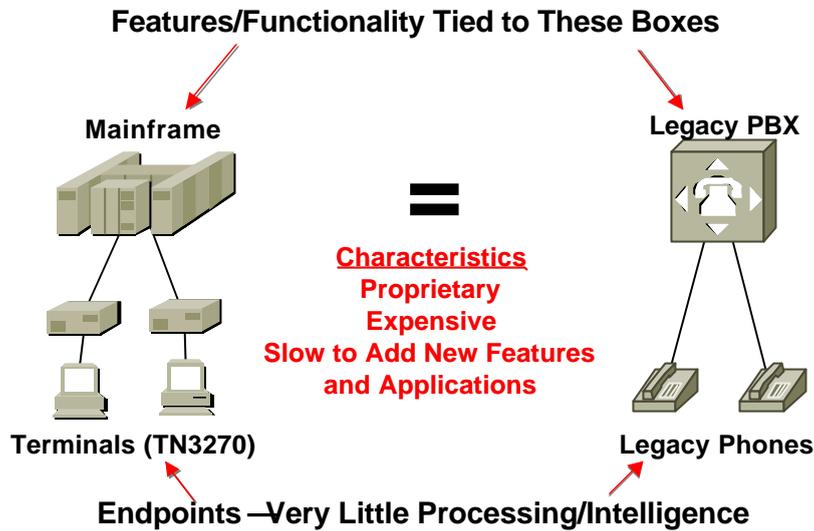**Enterprise Tech OPS Team**
Kim, Kyung-Bae
kbkim@cisco.com

Agenda

- The New World Enterprise Telephony

- Introduction of Cisco IP Telephony Solution

- Business Model with Cisco IP Telephony
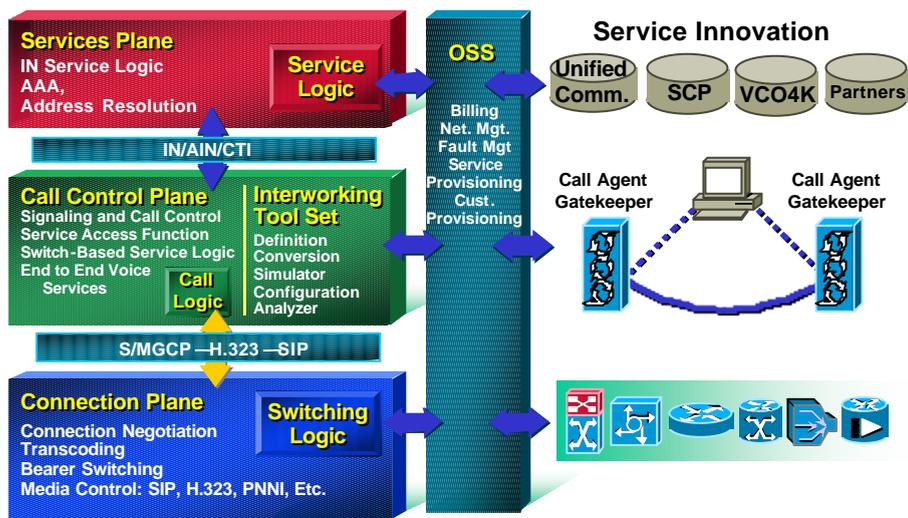
- IP Telephony Benefits (Maximizing ROI)
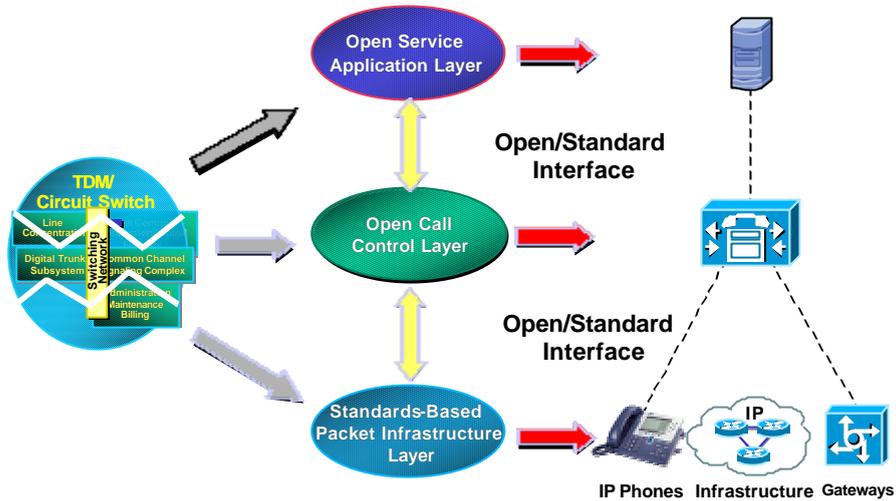
- Case Study

Old World Centralized Architecture

Features/Functionality Tied to These Boxes

Mainframe

Legacy PBX

=

Characteristics
Proprietary
Expensive
Slow to Add New Features
and Applications

Terminals (TN3270)

Legacy Phones

Endpoints — Very Little Processing/Intelligence

Open Packet Telephony Elements

Services Plane
IN Service Logic
AAA,
Address Resolution

Service Logic

OSS
Billing
Net. Mgt.
Fault Mgt
Service
Provisioning
Cust.
Provisioning

Service Innovation

Unified Comm. **SCP** **VCO4K** **Partners**

IN/AIN/CTI

Call Control Plane
Signaling and Call Control
Service Access Function
Switch-Based Service Logic
End to End Voice
Services

Call Logic

Interworking Tool Set
Definition
Conversion
Simulator
Configuration
Analyzer

Call Agent Gatekeeper

Call Agent Gatekeeper

S/MGCP — H.323 — SIP

Connection Plane
Connection Negotiation
Transcoding
Bearer Switching
Media Control: SIP, H.323, PNNI, Etc.

Switching Logic

2

The New World Enterprise Telephony Architecture

IP Telephony Building Blocks
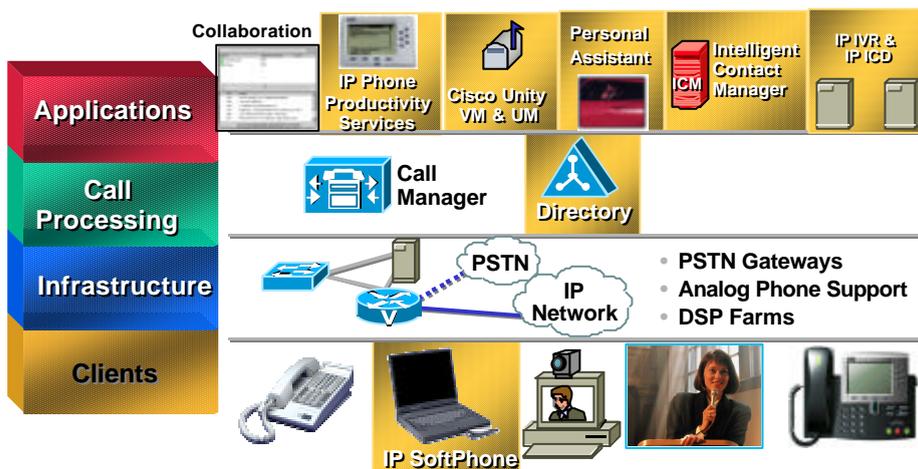
Cisco IP Telephony Solution

VoIP Solution Sets:
Toll Bypass and IP Telephony

PBX   Router/GW   IP WAN   Router/GW   PBX

Toll Bypass

IP Telephony

CallManager   Router/GW   IP WAN   Router/GW   CallManager

End-to-End IP Telephony with Application Enablement

Cisco CallManager

IP Telephony Replaces PBX Architecture

- **Call Processing** → **Cisco MCS 7800 Series Server**
- **Line Connections** / **Switching** → **Cisco ICS 7750 Communication System**
- **Switching** → **Ethernet LAN Switch**
- **Trunk Connections** → **Voice-Enabled Router or Gateway**

IP Phones/ Cisco SoftPhone Clients
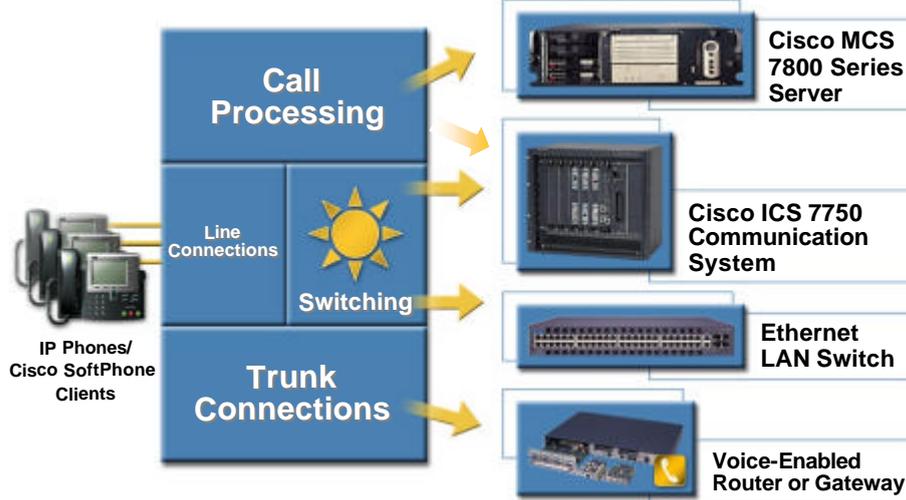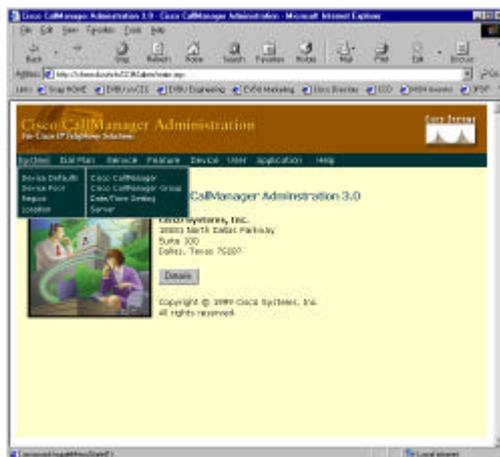
Cisco CallManager

- Standard HTML   ,
- , Protocol (Skinny, H.323, MGCP)
- Media Convergence Server platforms
  ,   CD
- Telephone , Standard Application (TAPI, JTAPI)
- 50,000 call
- MCS 2500 device
- Clustering Load Sharing Fail over – 8
- cluster 10,000 device

Cisco CallManager 3.1 Functionality

Cisco.com

- **User**
  - Answer/release
  - Forward- no answer, busy, all
  - Hold/retrieve
  - Park/pickup
  - Call pickup
  - Call status per line
  - Call waiting/retrieve
  - Calling Line/Name ID
  - Direct Inward/Outward Dial (DID/DOD)
  - Speed dial - user, system
  - Music-on-Hold
  - Access to html services
  - Message waiting indication
  - Transfer - consult/blind
  - Conferencing - ad-hoc/meet-me
  - Dial from recent/missed calls list
  - much more …

- **Admin**
  - Admin reporting tool –QoS monitoring
  - Auto bandwidth selection
  - Automatic Route Selection
  - Automatic Alternate Routing
  - Bulk device/user add tool
  - Dynamic phone firmware upgrades
  - Call Detail Records (CDR)
  - H.323, MGCP interface
  - Distributed (web) system configuration
  - Configurable date time per phone
  - Monitoring
    - SNMP, Performance Monitor, Event Viewer, syslog,
  - Diagnostics
    - Call signaling trace, Path analysis (CW2000), ISDN message translator
  - much more …

Cisco Voice Gateways

Cisco.com

Catalyst 4000

Catalyst 4224

Catalyst 6000

Cisco 7200-VXR

ICS 7750

Cisco AS5800

Cisco AS5300

Cisco MC3810

Cisco 2600

Cisco 3600

Cisco 1750

Cisco DT-24+, DE-30+

Cisco VG200

Cisco IP Phone Products

Cisco.com

7910
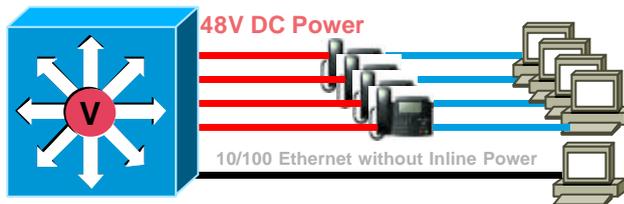
Expansion Module 7914

7940

7935

7960

SoftPhone

Catalyst Inline Power

Cisco.com

Catalyst Inline Power —Provides DC Power over Standard UTP Ethernet

Catalyst 6000
Catalyst 4000
Catalyst 3500

48V DC Power

V

10/100 Ethernet without Inline Power

Catalyst inline power Ethernet modules:

- **Catalyst 6000 10/100 modules can be field-upgraded**
- **Catalyst 6000 support RJ-45 and RJ-21**
- **Provides power over the signal pairs**
- **Catalyst power patch panel for other switches**

Catalyst Auxiliary VLAN

Cisco.com

**This Feature Provides Automatic Phone VLAN Configuration**

Phone VLAN = 200 tagged with VVID

PC VLAN = 3 untagged

IP Phone: IP Subnet B

Desktop PC: IP Subnet A

- **No end-user intervention required**
- **Extends the benefits of VLANs to IP phones**
- **Preserves existing IP address topology**
- **Uses 802.1Q technology between switch and phone**

Single Site Deployments

Cisco.com

- Single cable for phone and PC
- Inline power to phone sets
- Ease of IP addressing plus adds, moves, and changes
- Quality of Service from the desktop
- CallManager cluster for redundancy and scaling
- Support for 10,000 users per cluster
- Multiple clusters allowed via H.322

IP

PSTN

VM/UM

Call Manager
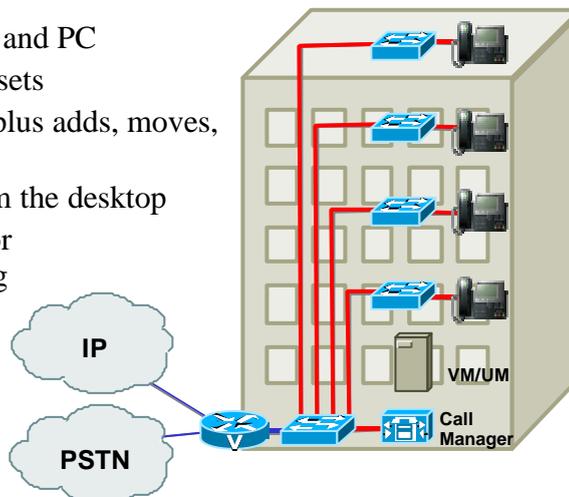
Independent Call Processing
(No WAN Networking for Voice)

Cisco.com

Site B

PSTN

Site A

Site C
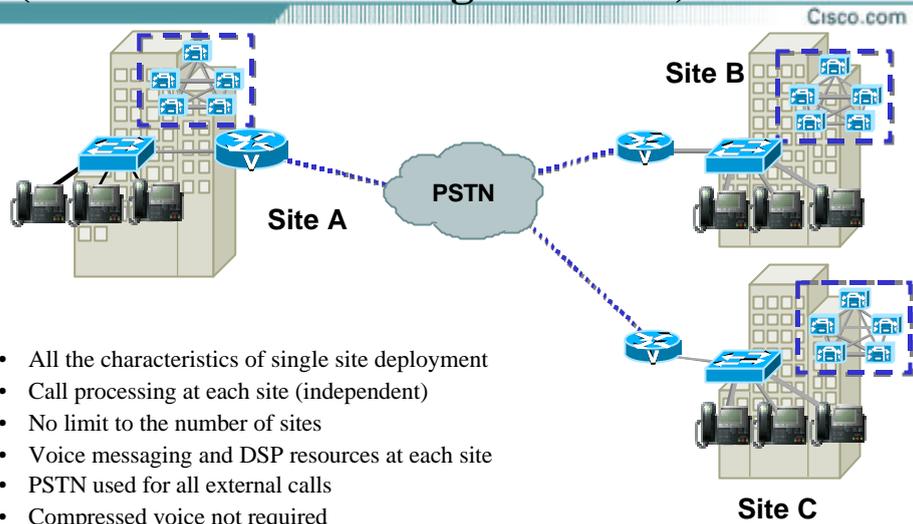
- All the characteristics of single site deployment
- Call processing at each site (independent)
- No limit to the number of sites
- Voice messaging and DSP resources at each site
- PSTN used for all external calls
- Compressed voice not required
- Uniform dial plan

Multi-Site Deployments
Distributed Call Processing

Cisco.com

VM/UM
Call
Manager

VM/UM
Call
Manager

PSTN

IP WAN

Branch B

Headquarters

VM/UM
Call
Manager
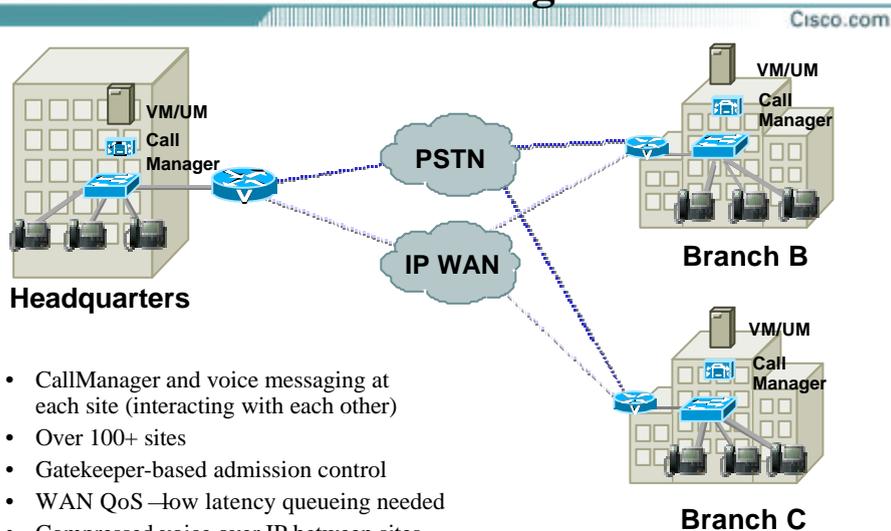
- CallManager and voice messaging at each site (interacting with each other)
- Over 100+ sites
- Gatekeeper-based admission control
- WAN QoS —low latency queueing needed
- Compressed voice over IP between sites
- Transparent use of PSTN if IP WAN unavailable

Branch C

Multi-Site Deployments
Centralized Call Processing

Cisco.com

VM/UM

PSTN

Branch B

IP WAN
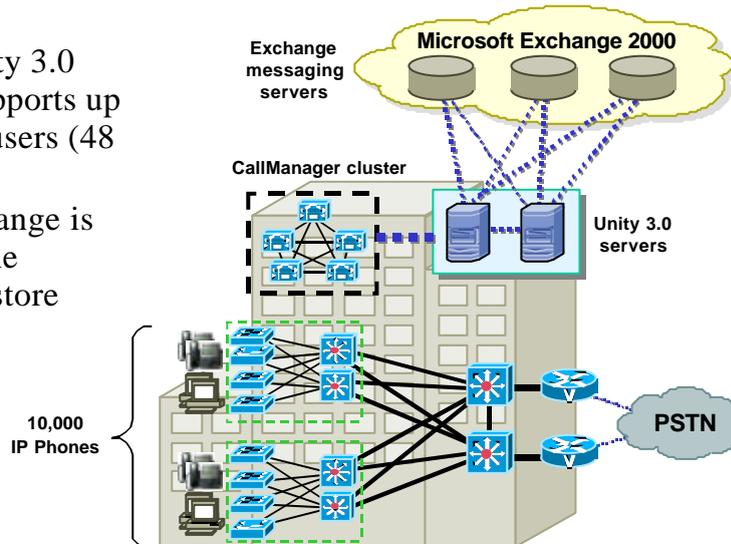
Branch C

Headquarters
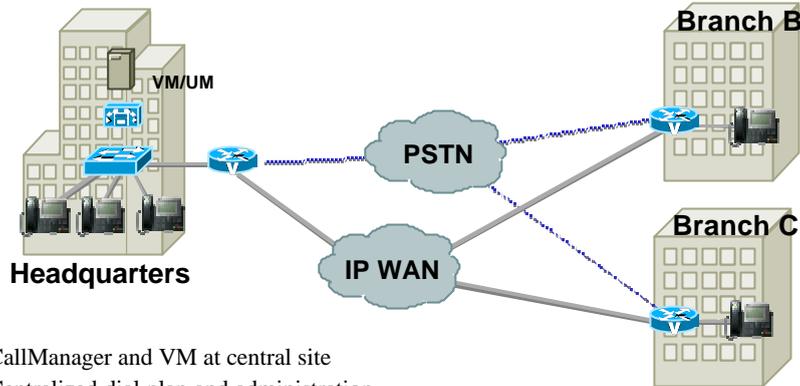
- CallManager and VM at central site
- Centralized dial plan and administration
- Supports up to 2500 users total per cluster with multiple clusters possible
- Call Admission Control implemented at central CM by limiting number of calls in or out of a site
- No service if WAN down (unless dial back-up or new IOS feature –SRST)

Applications: Voice Mail

Cisco.com

- Each Unity 3.0 server supports up to 5,000 users (48 ports)
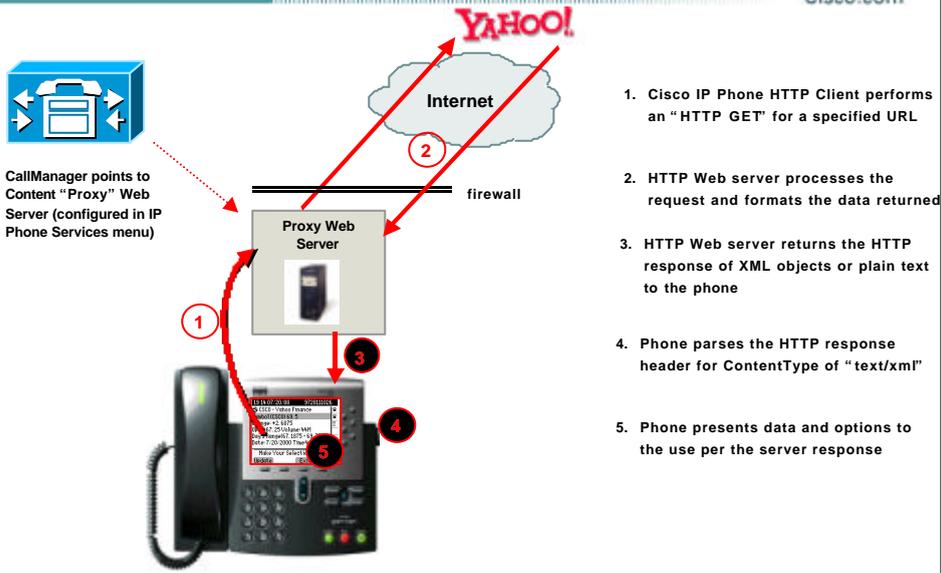- MS Exchange is used as the message store

Exchange messaging servers

Microsoft Exchange 2000

CallManager cluster

Unity 3.0 servers

10,000 IP Phones

PSTN

XML Applications

2 Developer or CallManager Administrator Copies the Web Script Files to a Web (HTTP) Server That the Cisco CallManager Will Point to for IP Phone Services

3 Cisco CallManager Administrator
Adds IP Phone Services and Makes It Available to the Users

4 User Logs Into Cisco CallManager User Preferences and Configures Which Services to Be Displayed on the Phone

Sample.asp

XML Tags

1 Web Developer
Creates the IP Phone Services Application

5 User Presses the "Services" Button on the IP Phone to Display the Selected IP Phone Services on the LCD Screen

---

IP Phone Services Example
Getting the Cisco Stock Quote

YAHOO!

Internet

CallManager points to Content "Proxy" Web Server (configured in IP Phone Services menu)

firewall

Proxy Web Server

1. Cisco IP Phone HTTP Client performs an "HTTP GET" for a specified URL

2. HTTP Web server processes the request and formats the data returned

3. HTTP Web server returns the HTTP response of XML objects or plain text to the phone

4. Phone parses the HTTP response header for ContentType of "text/xml"

5. Phone presents data and options to the use per the server response

Applications: IP-IVR, IP-ICD, PA

Cisco.com

Interactive Voice Response

- Can be co-resident with CallManager

  MCS-7835-1000
- Built-in Auto Attendant
- Can be used as part of IP-CC

  MCS-7825-800

Intelligent Call Distribution

- **Basic call queuing**
- **Agents can be distributed across the WAN**
- **For larger deployments, use IP-CC**

IP-ICD · CCM · Agents · PSTN · IP

Personal Assistant

- **Route calls according to time of day, calendar, caller ID**
- **Dispatch calls to user-defined locations (office, cellular, home)**
- **Integrates with speech recognition system**

Ring · Calendar · Personal Assistant · Voice Mail · Cell Phone · PSTN · IP · Call Manager · Ring · Home Phone · Directory · IP phone/ SoftPhone

---

Extension Mobility

Cisco.com

- Directory based phone log-in
- Application XML based
    - authenticates to directory
    - Updates CallManager with user extension
    - User's extension is pushed to phone where login occurred
    - User receives all personal settings
- Applicable for mobile office environments
- Offered with CallManager 3.1
- Substantial cost savings benefits

Directory · Call Mgr · Data Center · Web Server · DHCP Server · Bldg 2 · Bldg 1
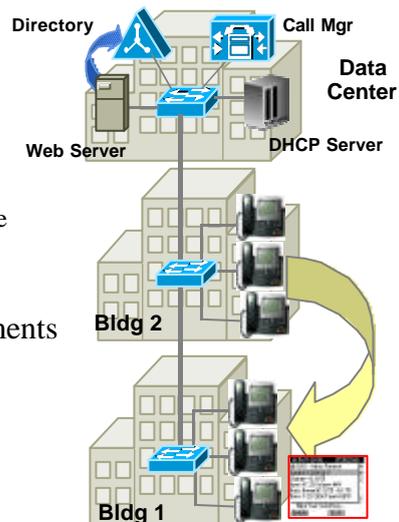
Introducing the Catalyst® 4224
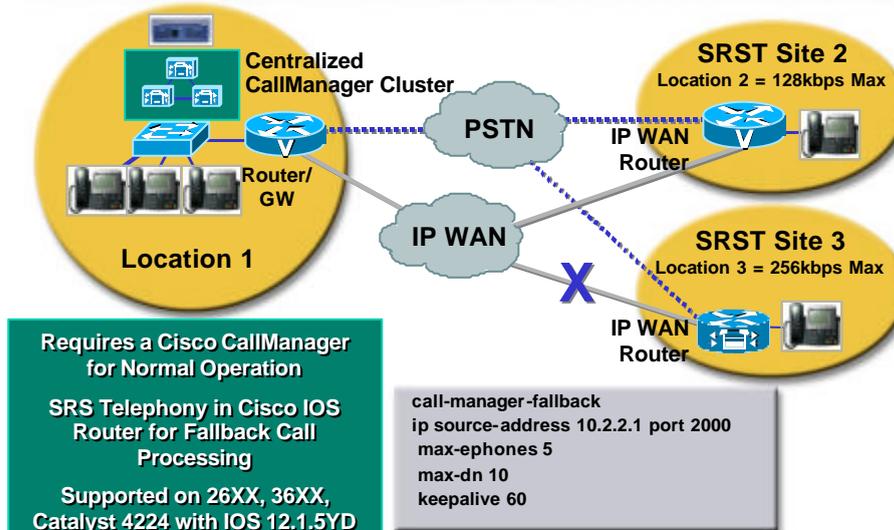
- The Catalyst 4224 is a single-box small branch office solution for offices with less than 24 users
- The Catalyst 4224 provides:
  - IP Routing, but only IP
  - PSTN and PBX voice gateway
  - Onboard FXS connectivity and DSPs
  - 24 Ports 10/100 Ethernet switch with Inline power
  - VPN and Encryption options
  - Cisco IOS Survivable Remote Site Telephony
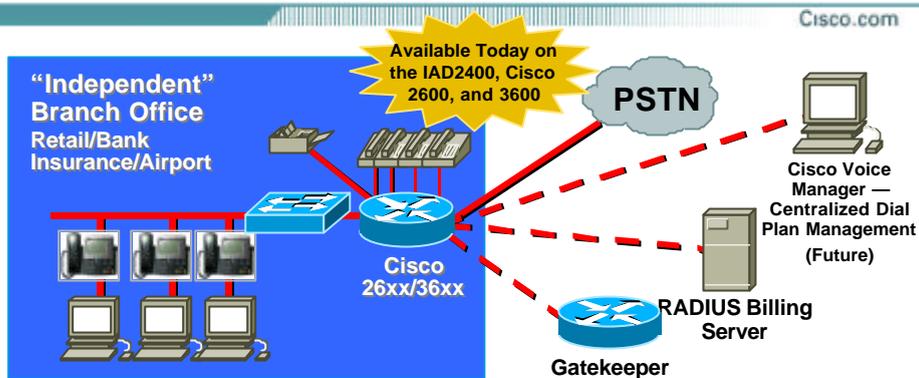 - Shares modular VIC and WIC interfaces with the Cisco 1600, 1700, 2600, 3600, and Cat 4K AGM platforms

---

Survivable Remote Site Telephony

Centralized CallManager Cluster

Location 1

Router/GW

PSTN

IP WAN

SRST Site 2
Location 2 = 128kbps Max

IP WAN Router

SRST Site 3
Location 3 = 256kbps Max

IP WAN Router

Requires a Cisco CallManager for Normal Operation

SRS Telephony in Cisco IOS Router for Fallback Call Processing

Supported on 26XX, 36XX, Catalyst 4224 with IOS 12.1.5YD

```
call-manager-fallback
ip source-address 10.2.2.1 port 2000
 max-ephones 5
 max-dn 10
 keepalive 60
```

IP Keyswitch for Branch Offices

- Perfect solution for small "independently" run offices with up to 48 phones
- Provides call processing on the local router for Cisco 7910/7940 and 7960
- Provides many features for Cisco IP Phones —Xfer, hold, FWD, shared line, multi-line appearance, POTs phones
- Leverages many voice features currently available in IOS such as DID, DOD, Caller ID, ANI, Calling Name Display, T1 CAS, Analog FXS, FXO
- It is not a scaled down CallManager; has keyswitch focused features

IP Telephony & PBX

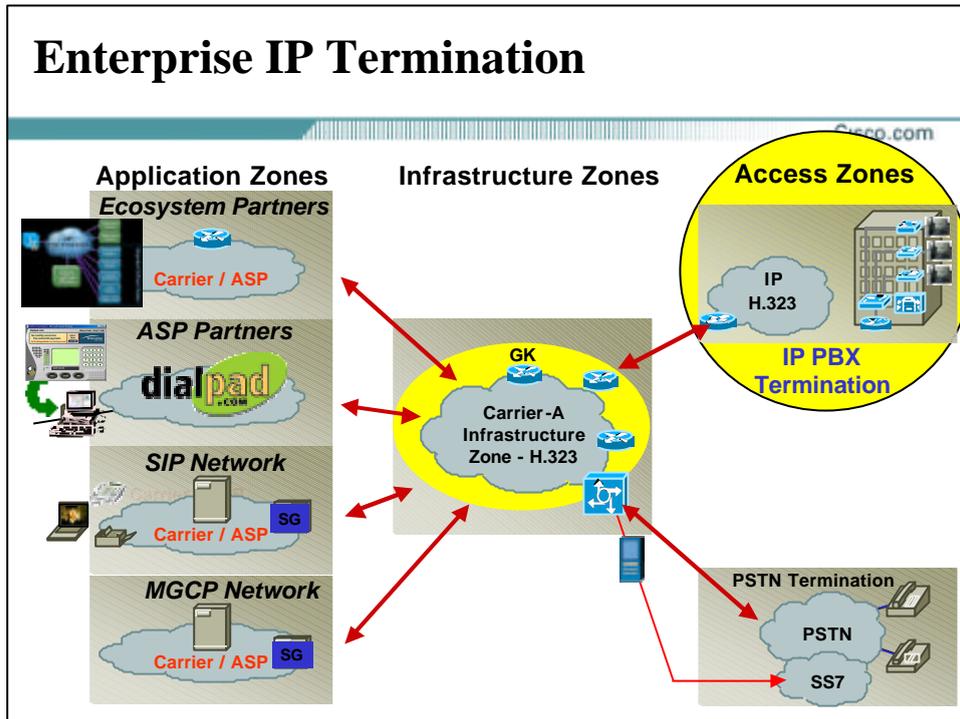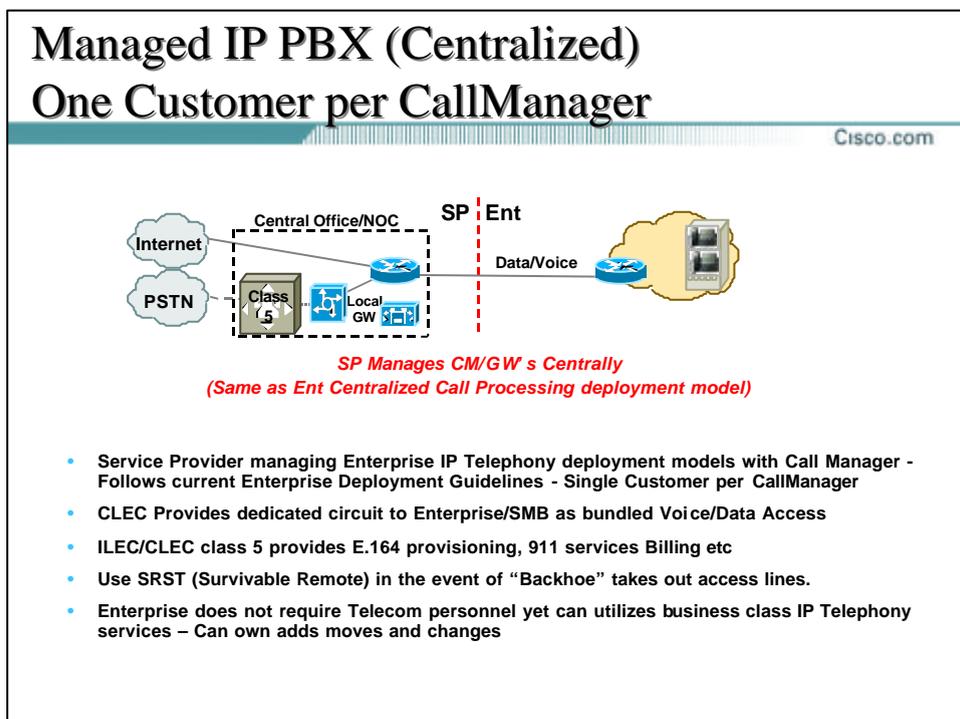| IP Telephony	PBX
Open Standard	Proprietary
Scalable (10 to 100,00 user sites possible using the same technology)	Fixed (based on capacity of PBX)
Uses Common Infrastructure	Separate Network required
Simplified, Centralized Management	System Specific
Single converged network for remote sites	Voice network AND Data Network AND Video Network for a single remote site
Open Ecosystem (interoperable with best of breed applications)	Proprietary/Limited partnerships
1-step Add, Moves and Changes	Voice support personnel involved in every Add, Move or Change
One team supporting voice, data and video	Separate support teams for separate networks (Increase management cost)
Migration options (telephony gateways, voice mail gateways, PBX-compatible)	Vendor specific
Packet based (global standards– like IP, Ethernet, Gig-Ethernet, DWDM, etc)	TDM based (local/country specific standards – like T1/E1, SONET/SDH, etc)

**Third Party IP Phone
Supporting Cisco Skinny Protocol**

Cisco.com

Cisco.com

IP Telephony Business Model

Enterprise IP Termination

Cisco.com

Application Zones   **Infrastructure Zones**   **Access Zones**

Ecosystem Partners

Carrier / ASP

ASP Partners

dialpad.com

SIP Network

Carrier / ASP   SG

MGCP Network

Carrier / ASP   SG

GK

**Carrier -A
Infrastructure
Zone - H.323**

**IP
H.323**

**IP PBX
Termination**

PSTN Termination

PSTN

SS7

Managed IP PBX (Centralized)
One Customer per CallManager

Cisco.com

Central Office/NOC   **SP | Ent**

Internet

PSTN

Class
5   Local
GW

Data/Voice

SP Manages CM/GW s Centrally
(Same as Ent Centralized Call Processing deployment model)

- Service Provider managing Enterprise IP Telephony deployment models with Call Manager - Follows current Enterprise Deployment Guidelines - Single Customer per CallManager

- CLEC Provides dedicated circuit to Enterprise/SMB as bundled Voice/Data Access

- ILEC/CLEC class 5 provides E.164 provisioning, 911 services Billing etc

- Use SRST (Survivable Remote) in the event of "Backhoe" takes out access lines.

- Enterprise does not require Telecom personnel yet can utilizes business class IP Telephony services – Can own adds moves and changes

Shared CO based Gateways
One Customer per CallManager

Central Office/NOC

SP | Ent

Internet

Data/Voice

PSTN

Class 5

Local GW

SP Manages GW's Centrally
(CO based shared PSTN Trunk Gateways)

- Service Provider managing Enterprise IP Telephony deployment models with Call Manager - Follows current Enterprise Deployment Guidelines - Single Customer per CallManager
- CLEC Provides dedicated circuit to Enterprise/SMB as bundled Voice/Data Access
- ILEC/CLEC class 5 provides E.164 provisioning, 911 services Billing etc
- Primarily targeted at CLEC looking to take away local service delivery away from an disrupt ILEC

Campus Based Multi-tenant (Single Site)

- Partitioned Dial Plan and VM/UM among Tenants
- Call Manager Cluster, VM/UM and Gateway's located on Building/Campus Premises
- Looks like PBX to the PSTN
- Follows AVVID Enterprise guidelines for a Campus network – Provisioned/Managed as an Enterprise IP PBX
- Max 100 Tenants Recommended (VM + Dial Plan Policy dependant)
- VM/UM capabilities system dependant
- Challenges – Security, Billing, Provisioning/Mgt

Tenant 1 1XXX

Tenant 2 2XXX

Tenant 3 3XXX

Tenant 4 4XXX

IP WAN

PSTN

VM/UM

CallManager Cluster
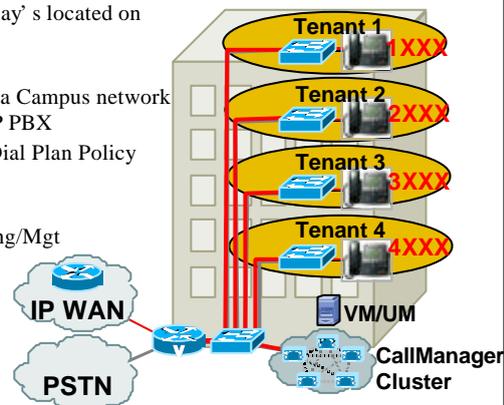
Managed Service Solution Landscape - Vision
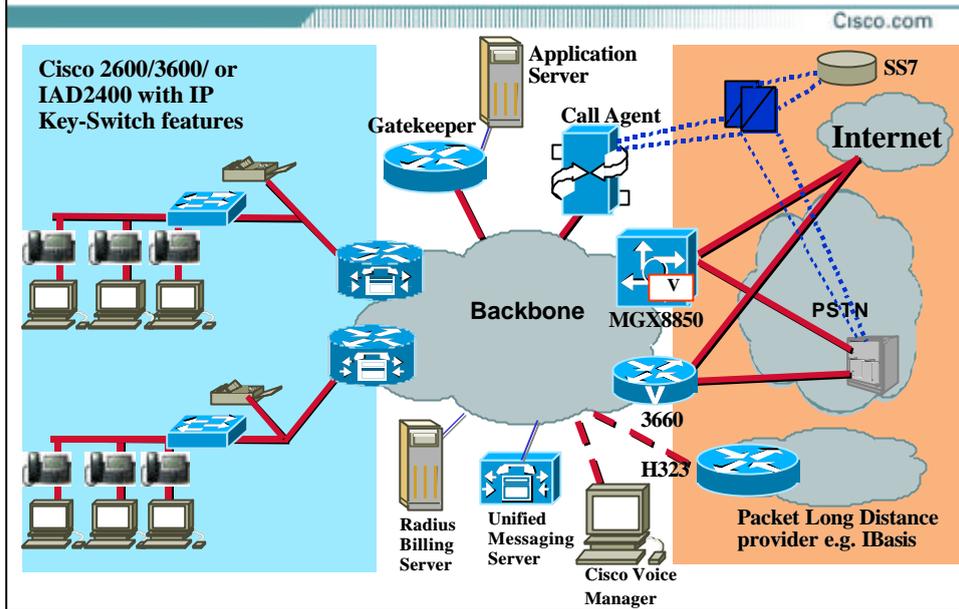
IP Telephony Benefits (Maximizing ROI)

Maximizing the Return On "Network" Investment

To maximize the return on their "network" investment a company must:

- **Lower the cost of "network" ownership**
    - Reduce overall network infrastructure costs
    - Reduce application integration costs
    - Reduce ongoing network administration costs
    - Fully leverage existing network investments
- **Enhance business communications to create strategic value**
    - Improve employee productivity
    - Increase Knowledge Sharing
    - Enhance customer care
    - Enable employee mobility

Lower Cost of "Network" Ownership

- Almost 70% of survey respondents believe they will realize substantial to moderate infrastructure savings when converging their network
- 50% expect substantial to moderate administrative cost savings
- 60% expect to achieve substantial to moderate toll-bypass savings

Anticipated Cost Savings

Legend:
- Administrative Streamlining (Red)
- Infrastructure (Cabling, Hardware) (Yellow)
- Circuit Costs (T1s, T3s) (Green)
- Toll Bypass (Magenta)
- Other (Blue)
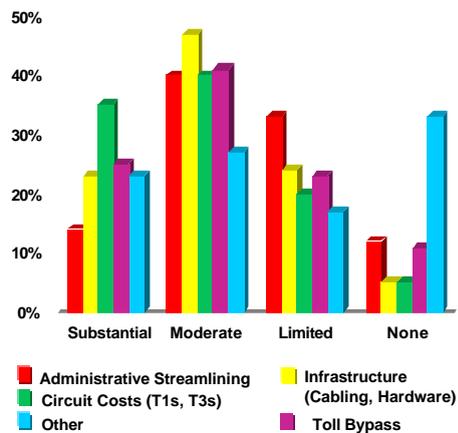
Source: The META Group Multi-Client Study 2000/01

Lower Cost of "Network" Ownership

Cisco.com

- A converged voice, video and data network reduces infrastructure costs
    - **Reduced infrastructure expense for new sites**
    - **Substantial savings in remote site networking equipment costs with centralized call processing deployment model**
    - **Reduced equipment upgrade/replacement costs versus maintaining multiple networks**
    - **Phone and PC share single Ethernet cable drop resulting in 50% reduction in # of wiring drops ($150/drop)**
- A converged voice, data and video network reduces network carrier costs
    - **Reduction in international and domestic inter-office calling charges**
    - **Reduction in the number of external communication lines**

Lower Cost of "Network" Ownership

Cisco.com

- A converged voice, data and video network reduces ongoing network administration and support costs
    - **Improved productivity of network support staff**
        - **10-40% productivity improvement post data/voice convergence**
        - **Shifts IT staffs focus from administrative to value-added**
    - **Improved productivity of consolidated voice and data help desk**
    - **No-Cost Moves, Adds, Changes (MAC's)**
        - **Performed by user, saves $75–$125 per MAC**
    - **Reduced cost of outsourced contracts for on-site support and maintenance**
    - **Reduced branch office administrative expenses via centralized call processing deployment model**
    - **Reduced ongoing network design, project management and implementation costs**

Lower Cost of "Network" Ownership

- A converged voice, data and video network lowers support costs and enhances the productivity of mobile workers
    - Extension mobility feature of Cisco CallManager enables shared workspace office environments
        - Increases the number of employees per office thereby reducing real estate and facilities costs
            - A typical 2:1 worker to workspace ratio can reduce real estate and facilities costs by 30-50%
    - Virtual at home office extension provides complete network functionality at home or in the office
        - Increases telecommuting productivity
        - Reduces telecommuting support costs
            - $1500 on average PBX versus $100 on converged network
    - Ubiquitous network access and converged applications provides the increasingly mobile worker easy access anywhere, anytime

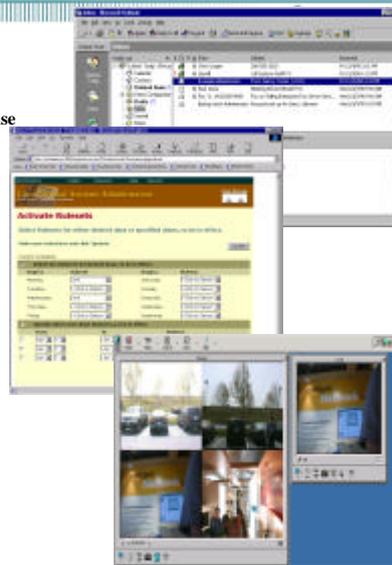# Enhanced Business Communications

- **A converged voice,video and data network provides the optimum foundation to deploy a variety of applications that can significantly improve**
    - Employee Productivity
    - Knowledge Sharing
    - Customer Care/Satisfaction
    - Employee Mobility
- **Understanding these strategic business benefits is critical to calculating the true Return on "Network" Investment**

Enhanced Business Communications

- Increase Employee Productivity
    - **Cisco Unity Unified Messaging**
        - **Time/motion studies have shown 25-40 minute increase in productivity per day***
    - **Cisco Personal Assistant**
        - **Streamlines communications via user defined call routing**
        - **Connect to people easily via speech recognition**
    - **Cisco Conference Connection Audio Conferencing**
        - **Lower-cost, less hassle alternative to subscription services**

- Enhance Knowledge Sharing
    - **Cisco IP Video Conferencing**
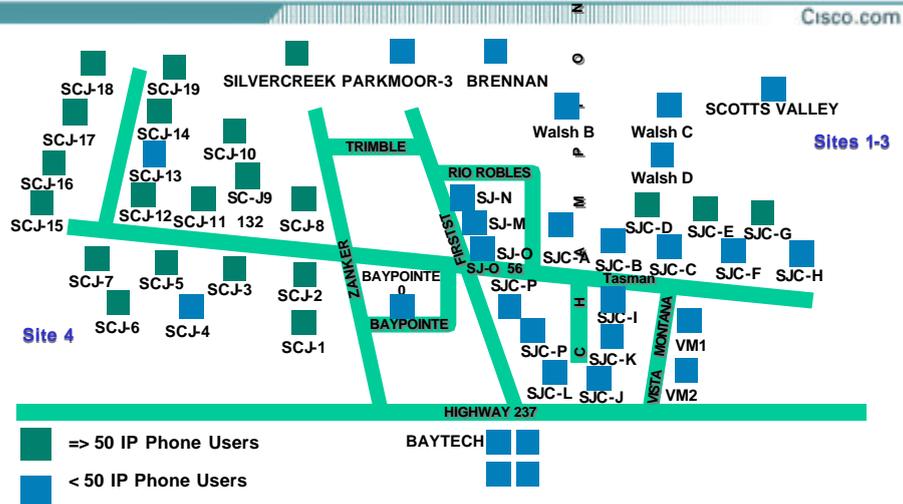   - **Cisco IP-TV enabled distance learning**

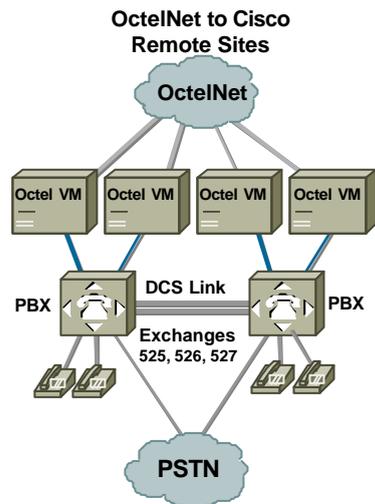*Source: Raddicati Study 1998*

Cisco.com

IP Telephony Case Study

Cisco Campus Map

SCJ-18 SCJ-19 SILVERCREEK PARKMOOR-3 BRENNAN

SCJ-17 SCJ-14 SCOTTS VALLEY

SCJ-16 SCJ-13 SCJ-10 TRIMBLE Walsh B Walsh C **Sites 1-3**

SCJ-15 SCJ-12 SCJ-11 132 SCJ-8 RIO ROBLES Walsh D

SJ-N

SJ-M

SJ-O SJC-A SJC-D SJC-E SJC-G

SCJ-7 SCJ-5 SCJ-3 SCJ-2 BAYPOINTE 0 SJ-O 56 SJC-B SJC-C SJC-F SJC-H
Tasman

Site 4 SCJ-6 SCJ-4 BAYPOINTE SJC-P SJC-I VM1

SCJ-1 SJC-P SJC-K VM2

SJC-L SJC-J

HIGHWAY 237

▇ => 50 IP Phone Users BAYTECH

▇ < 50 IP Phone Users

80+ Buildings, 20,000+ People, Growing at 150+/week
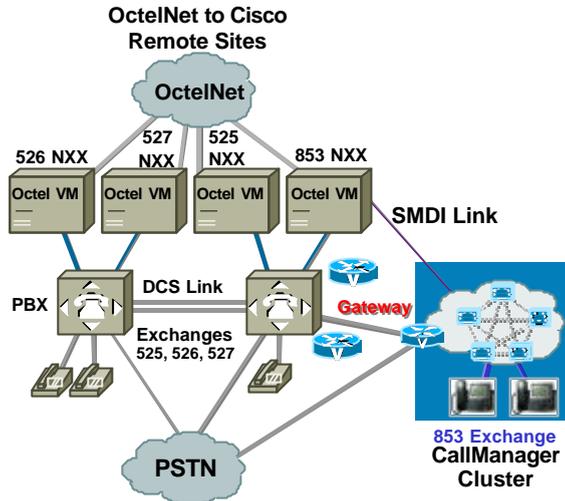

Initial San Jose Topology

- 20,000 users and growing
- Three exchanges (525, 526 and 527)
- 2 Lucent G3r PBXs
- Number portability across the PBXs
- 3 Octel 350 Voicemail systems
- Networked Voicemail to 80+ other systems
- Problems
  – Growth exceeding PBX/VM Scaling ability
  – Adding 4th exchange (853)
  – Choices —IP Telephony or add PBX/VM
  – Difficult to deploy new voice applications
  – Lease expiration approaching
  – Need a "shrink and grow" migration
  – Remote offices can "flash cut"

OctelNet to Cisco Remote Sites

OctelNet

Octel VM Octel VM Octel VM Octel VM

PBX **DCS Link** PBX

Exchanges 525, 526, 527

PSTN

Q2 2000
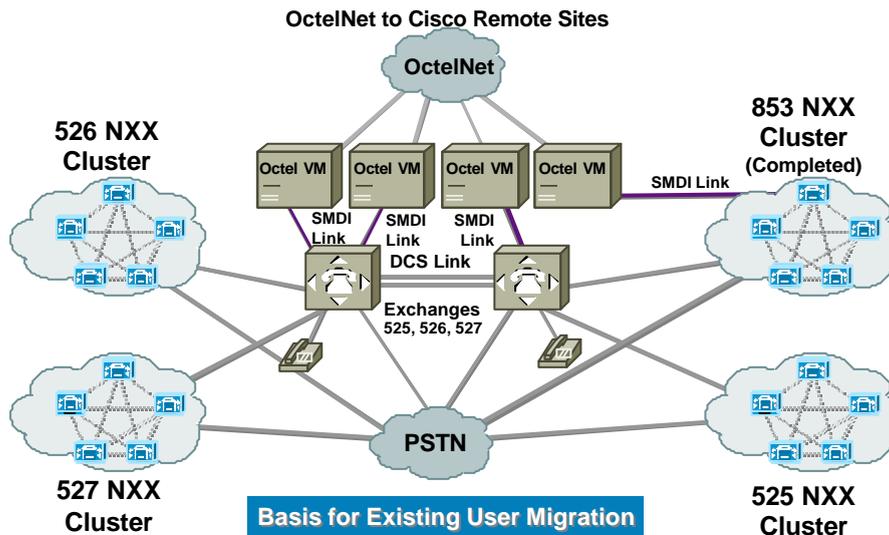
- New employees on pilot —"853"
- Total of 7,000+ users
- CallManager connected to existing VM for networking to rest of system (Proprietary VM restricted this)
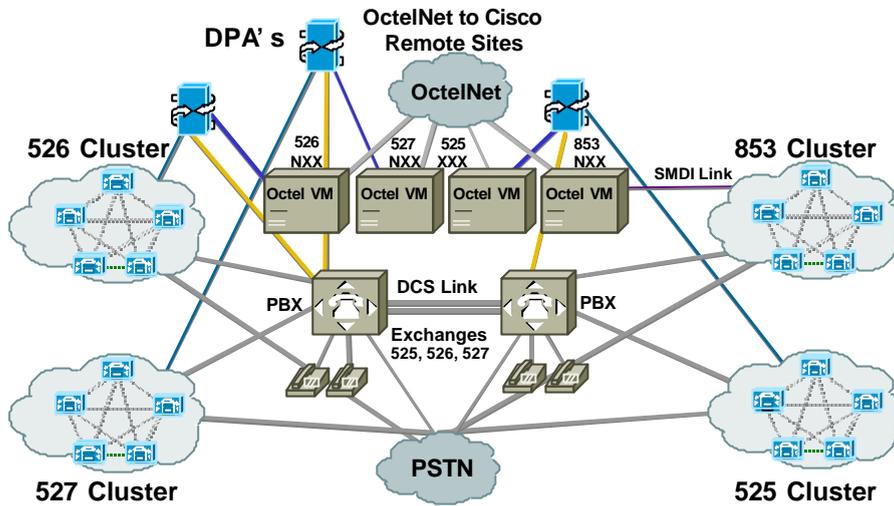- IP phones using 10.0.0.0 Network

OctelNet to Cisco Remote Sites

OctelNet

527 NXX   525 NXX

526 NXX   853 NXX

Octel VM   Octel VM   Octel VM   Octel VM

SMDI Link

PBX   DCS Link

Gateway

Exchanges 525, 526, 527

853 Exchange
CallManager Cluster

PSTN

Install CallManager Cluster for each Exchange

OctelNet to Cisco Remote Sites

OctelNet

526 NXX Cluster

853 NXX Cluster (Completed)

Octel VM   Octel VM   Octel VM   Octel VM

SMDI Link

SMDI Link   SMDI Link   SMDI Link

DCS Link

Exchanges 525, 526, 527

PSTN

527 NXX Cluster

525 NXX Cluster

Basis for Existing User Migration

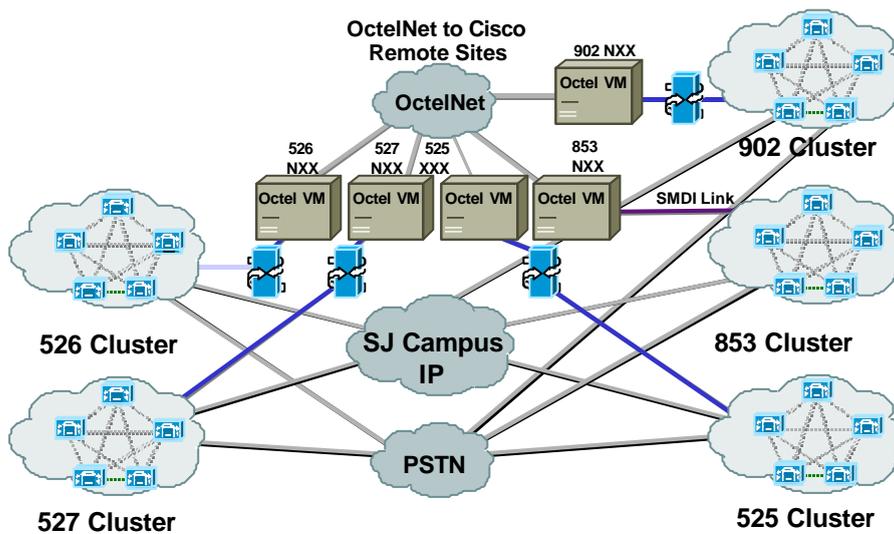# Hybrid Solution Migration Today

IP Telephony after Phone Migration

What's Next

- Finish migration of existing Lucent phones
- Continue to flash cut-over branch offices
- Trials of telecommuter IP phones
- Upgrade LAN Infrastructure for Cisco for QoS
- Unified messaging to replace Octel
- Replace call-centres with IP contact center

Initial New Zealand Landscape

- 8000 users over 200 offices
- 130 PBX's
- Four major hub sites
  - Auckland, Wellington, Hamilton, Christchurch
- 150,000 calls a day
- Growth exceeding PBX/VM scaling ability
- Needed user mobility while maintaining number
- Lease expiration approaching
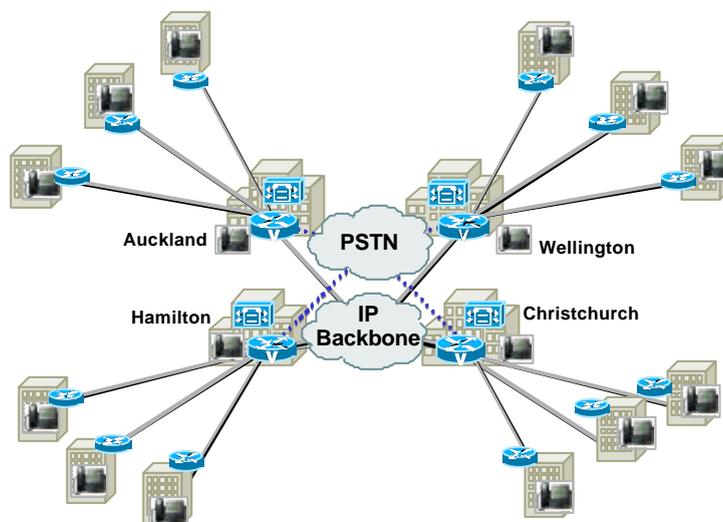
New Zealand Solution Overview

- 10 MCS-7835 CallManager servers replaced 130 PBX' s
- 20 VM servers for 8000 people
- Call processing only at four major hub sites
  - Auckland, Wellington, Hamilton, Christchurch
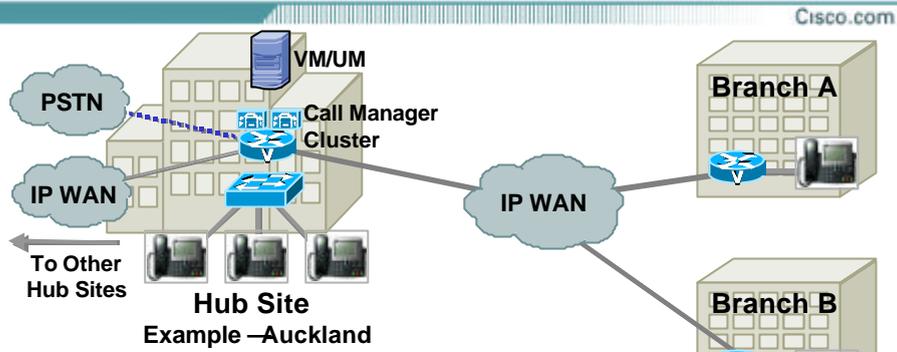- Centralized call processing and administration
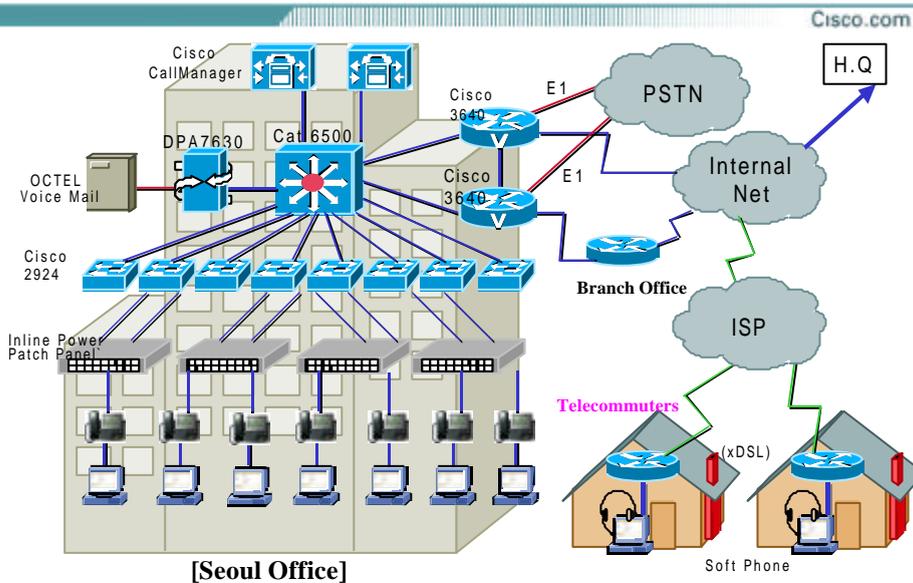

Composite Solution Diagram

Hub Site Topology

VM/UM

PSTN

Call Manager Cluster

IP WAN

Branch A

IP WAN

To Other Hub Sites

Hub Site
Example –Auckland

Branch B

- Centralized call processing at each hub site
- IP phones only at remote sites
- IP the only access for remote locations
- Centralized PSTN access

Korea Reference site (200Users)

Cisco CallManager

Cisco 3640

E1

PSTN

H Q

DPA7630

Cat 6500

Cisco 3640

E1

Internal Net

OCTEL Voice Mail

Cisco 2924

Branch Office

ISP

Inline Power Patch Panel

Telecommuters

(xDSL)

Soft Phone

[Seoul Office]