Capacity Management for Cisco IP Telephony

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Agenda



Understanding 'capacity issues'

- Understanding Cisco IP Telephony
- Understanding Cisco IP Telephony tools
- Reporting with HP OpenView Performance Insight Report Pack...



Why the Push to IP Telephony?

- IP über alles
- Productivity Enhancements
 - Staffing some groups show 10-40 percent improvement in productivity
 - Employee mobility IPT and associated IPT-based applications provide easier MACs and employee flexibility
 - Application integration XML based display provides access to non-PC based employees





Users' Management Objective



Present Method of Operations

Enterprise IP Telephony Management...



- The introduction of IP telephony has caught some organizations off-guard
 - data networking managers historically have done little capacity planning or evaluation of how efficiently they use PSTN trunks
 - traditional telephony managers either relied on the Service Provider for performance and efficiency data or did not have question the service level



Enterprise IP Telephony Management...



Fault
Configuration
Accounting
Performance
Security

Operations

Administrative

Maintenance

Provisioning





Understanding Capacity 'Issues'

- Manage ongoing or operational-based costs
- Evaluate current design/implementation
- Plan and support future requirements

The need for usage visibility...





"We have a serious issue because we do not have any means to capture utilization on individual DSOs within a T1/E1.

We require this information for capacity planning and management of their voice infrastructure. we see this as a <u>show stopper</u> for deploying IP Telephony."



The need for managing costs...

- PRIs are expensive and represent one of the few areas that can significantly reduce operational costs
- Over the past few years, the availability of PRI usage data (particularly idle time and 'blockages') has been reduced.
- Current economic times mean we must manage capital and operations budgets...





Is what I have working?

- The introduction of IP telephony has impacted the behavior of most networks
- In addition to voice, other real-time data may be riding on the network that was designed for other traffic
- The current economy means we must more effectively manage what we have
- To do that, we must know if it is working...





How do I plan for the future...

- How will I know what I must do for the future if I do not understand the traffic and behavior of the network today...
- I need to establish a process to evaluate and document current capacity and continue to monitor it as I begin to manage the network for the future...





Capacity Planning: Defined



...to explain and define capacity situations to management and make recommendations based on 1) business plans and 2) the behavior of active and anticipated enterprise computing workloads..."

Gregory V. Caliri, Getting Started in Mainframe Capacity Planning Activities (CMG1996)



Historical Reporting

- Historical reporting is the basis of most "rules of thumb" and "history has shown us" capacity planning
 - Documents the state of examined metrics over time
 - Provides a historic database for trend and cost/benefit analysis





Historical Reporting

	Jan	Feb	Mar	Avg
CPU Utilization	45	63	57	55





Correlation Reporting

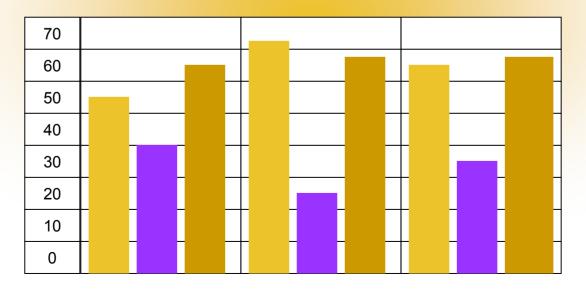
- Correlation reporting is an attempt to find a "cause and effect" or relationship that cause the effect
 - Usually compares multiple metrics that may have some relationship
 - Many times, assumed relationships have no corresponding effect
 - Apparently disassociated environments interplay with other subsystem performance





Correlation Reporting

	Jan	Feb	Mar	Avg
Rtr A Utilization	45	63	57	55
Rtr B Utilization	35	15	24	25
Rtr C Utilization	55	59	57	57





Exception Reporting 1

- Exception reporting can be used to notice and document frequency of threshold violations in a given environment
 - Usually based on time grids
 - Often use Boolean constructs
 - Most useful, long term data capture





Exception Reporting 1

	Mon	Tues	Wed	Thu	Fri	Sat	Sun
0700							
0800	2						
0900	3						
1000							
1100		1	2	2	4		
1200							
1300					13		
1400	2	3	5	4	18		
1500	1	2	4	6	15		
1600		1	4	5	13		
1700		1	4	2			
1800							

Exception Report: Router A CPU Utilization > 60%



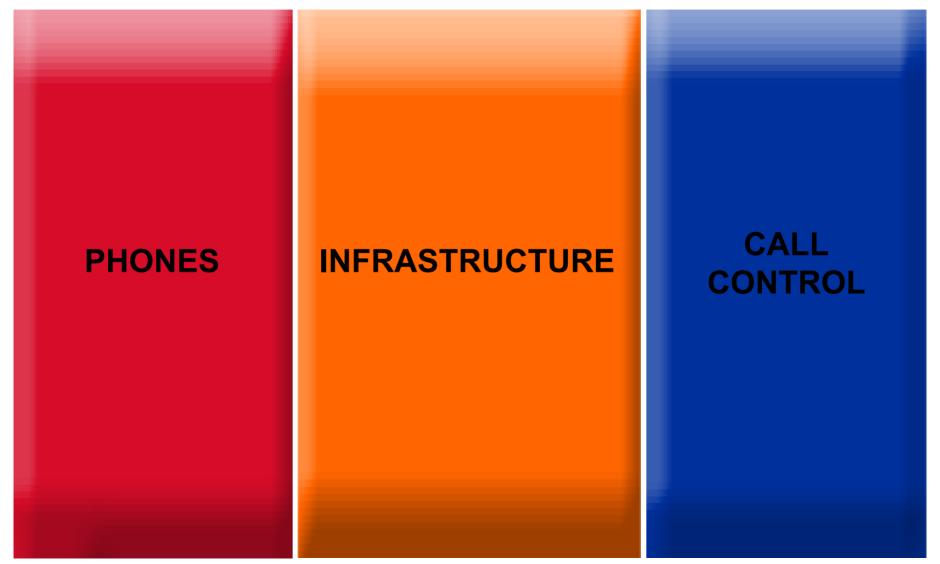
Exception Reporting 2

- Exception reporting can also be used to filter large amounts of information and present a fixed number of best and/or worst examples of a specific metric or group of metrics...
 - Best ten' utilization (can be high or low metric)
 - Worst ten' (can be high or low metric)





Telephony Infrastructure



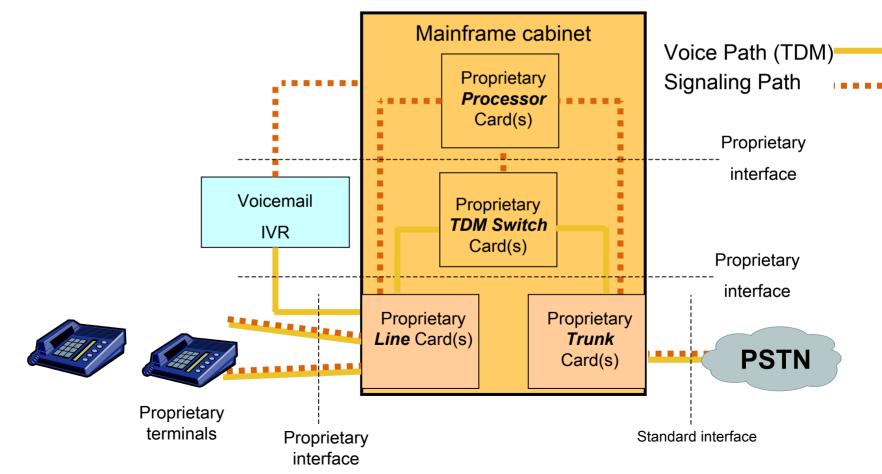
Traditional Telephony Infrastructure



PHONES

INFRASTRUCTURE

CALL CONTROL



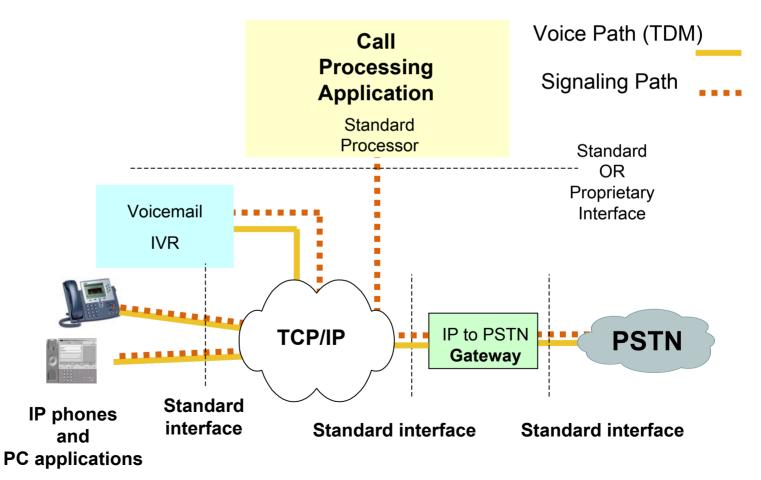


IP Telephony Infrastructure

PHONES

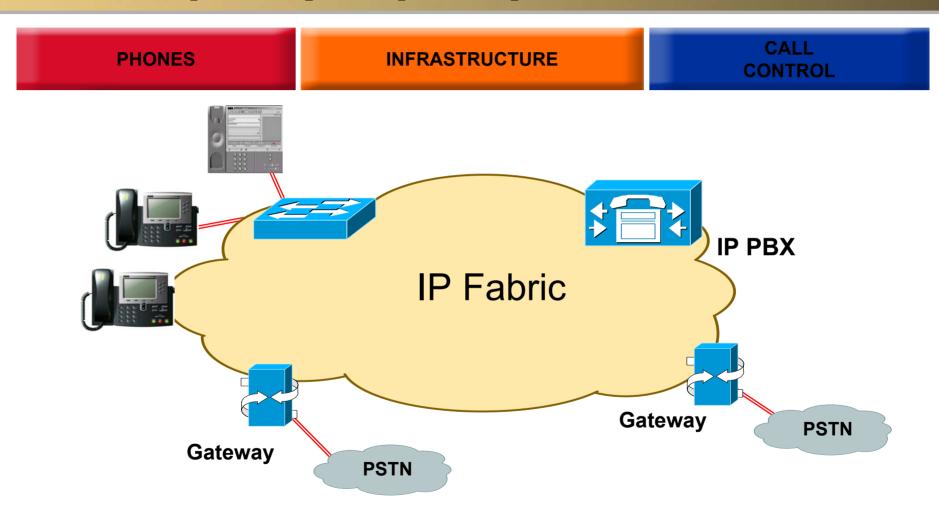
INFRASTRUCTURE

CALL CONTROL





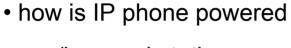
IP Telephony Capacity Issues





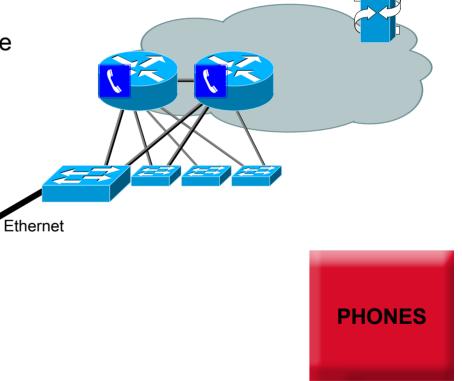
IP Telephone Installation

Implementation questions:



can/is a workstation cascaded off phone

IP addressing







IP Telephone Implementation



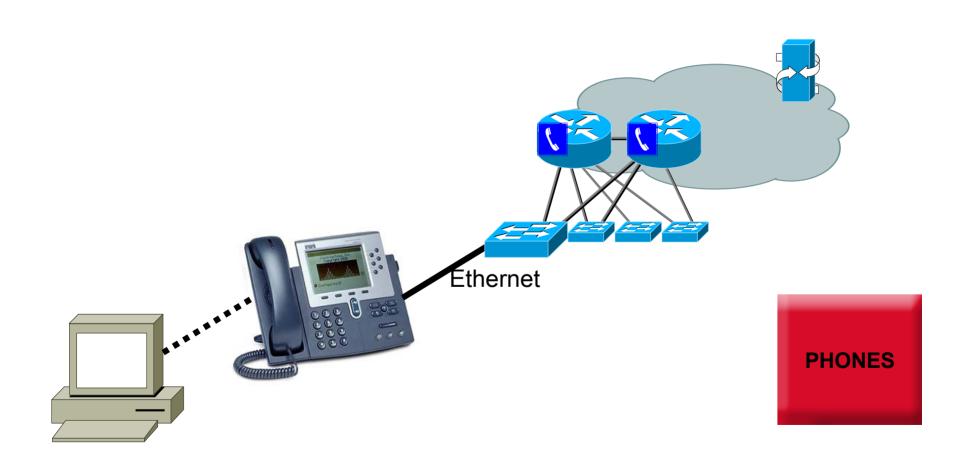
- IP Telephone Power
 - from switch (in-line power)
 - from 'power cube'
 - from patch-panel

- Integrated Switch
 - no switch port
 - Ethernet switch port to support cascaded workstation





How Is This Manageable...?





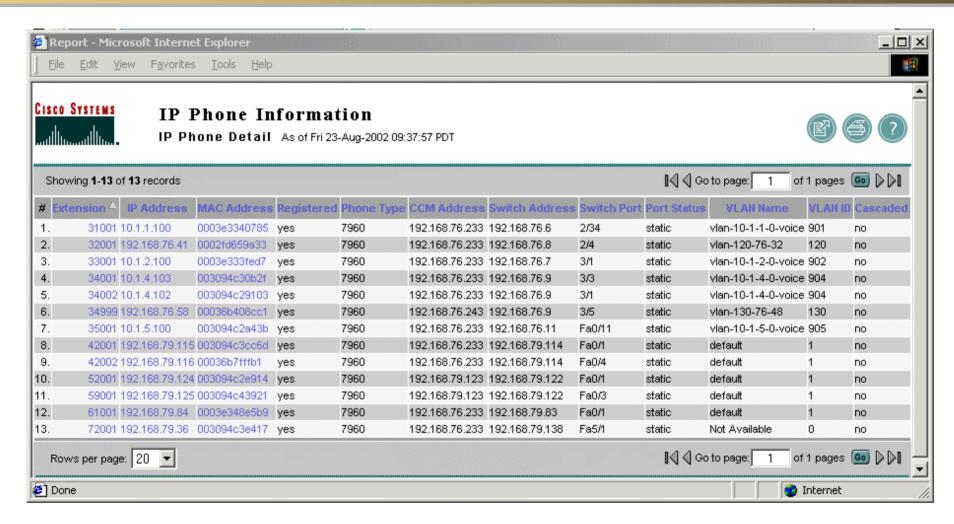
IP Phone Information Utility

- Enables useful, instant "on-demand" information about IP telephone and underlying plumbing
- Provides table of all IP phones including
 - Phone extension, MAC Address, IP Address
 - Registration Status, Phone Type
 - CCM Address, Switch Address, Switch Port
 - Port VLAN status, VLAN name & ID
 - Cascaded status





IP Phone Information Utility



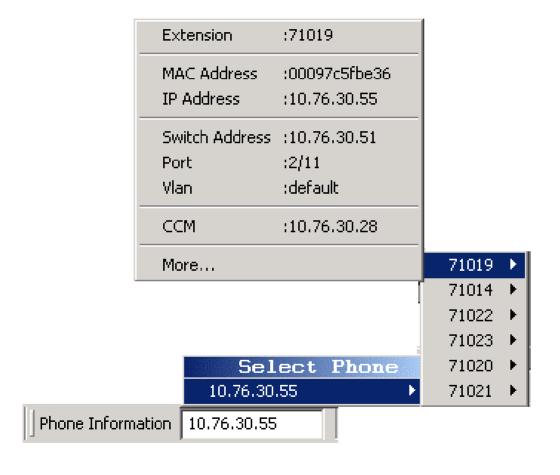


IP Phone Help Desk Utility





IP Phone Help Desk Utility





IP Phone Capacity Planning Issues



- Power requirements
 - On in-line switches
 - On other power methodologies
- IP address administration
- Performance of underlying network
- Other implementation issues
 - switch ports where they are needed
 - bandwidth issues (LAN and WAN)
 - access to PSTN





IP Telephony, Simplified







IP Telephony: Clarified...

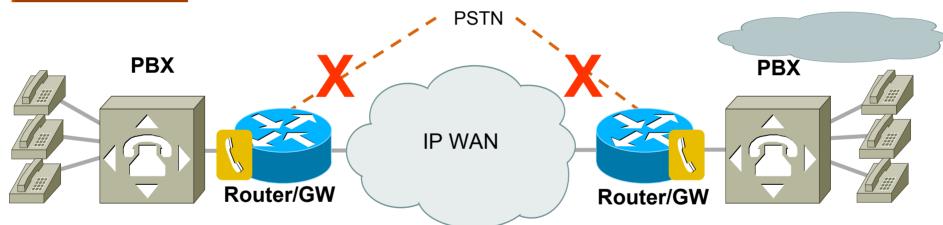




IP Telephony 'Plumbing' Toll By-Pass







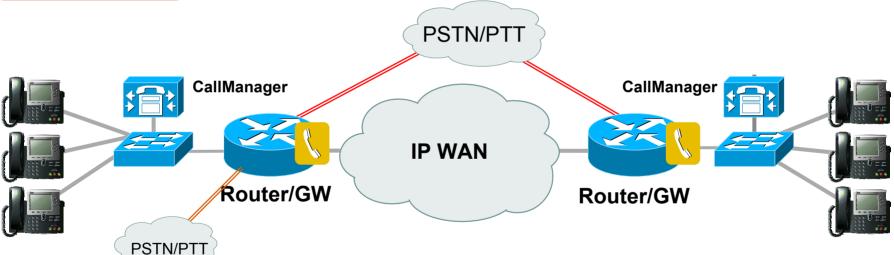
Implementation:

- intended to reduce costs
- Goal is to eliminated PSTN charges
- Often called VoIP



IP Telephony 'Plumbing'





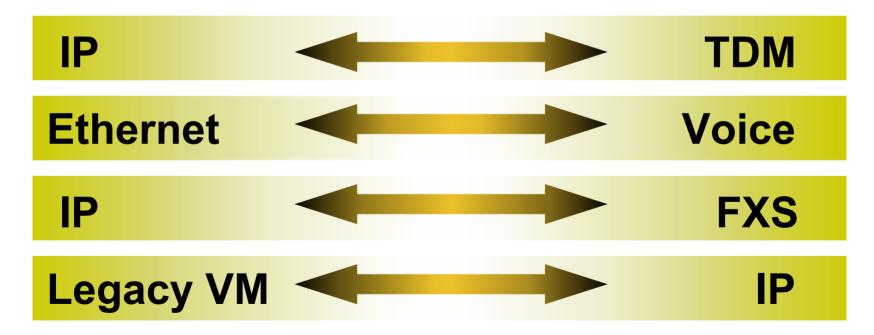
Implementation:

- Gateways serve several functions
- Several 'types' to solve specific problems



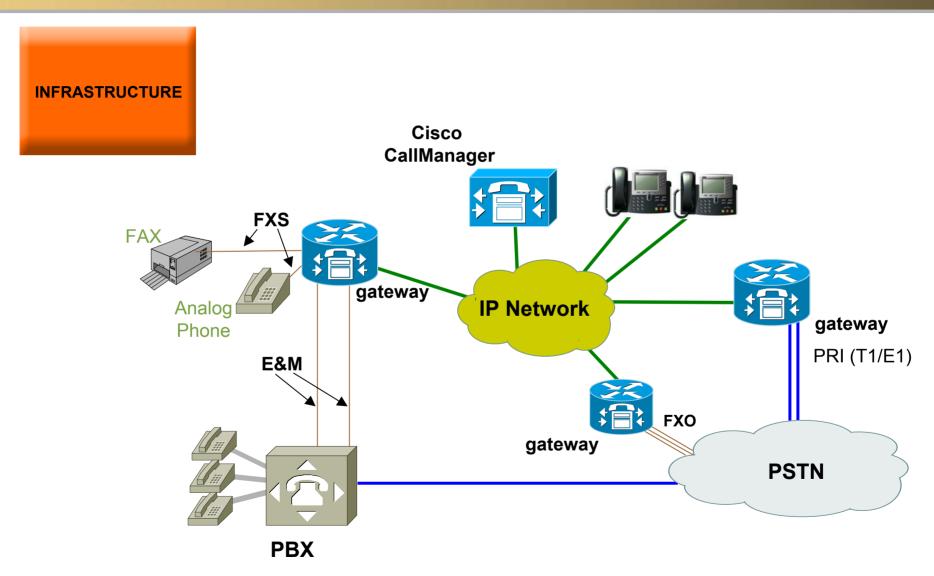
IP Telephony Gateways







IP Telephony Gateways



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Cisco IP Telephony Gateways





routers





- T1/E1 Interface-T1-CAS, PRI, E1-R2
- VIC ports -- FXS, FXO, E&M, or BRI
- Caller ID and Analog DID
- Voice Codec Support
 -G.711, G.729, G.723.1, G.726

cards

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IP Telephony Gateways



- Gateway protocol
 - SCCP (skinny Gateway)
 - H.323-based Gateways
 - MGCP-based Gateways (recommended for call survivability)
 - SIP-based Gateways
- Support for PSTN side interface(s) and signaling
 - T1-CAS, PRI, BRI, FXO, E&M, etc.
- Required voice port density
- Support for required WAN interface(s) & QoS
- Standalone versus integrated router/Gateway
 - Cost versus flexibility, functionality and manageability

IP Telephony Infrastructure Capacity Planning Issues





- VoIP environments
 - Voce traffic (calls) metrics
 - Dropped call metrics
 - QoV metrics (VoIP calls only)
- WAN/LAN infrastructure metrics
 - Data latency metrics
 - Data jitter metrics
 - Path analysis

IP Telephony Infrastructure Capacity Planning Issues





- IP telephony metrics
 - Calls over infrastructure over time
- Trunk utilization and concurrent usage
 - FXS and FXO metrics
 - Individual DS0 usage metrics
 - DS1 roll-up usage metrics
 - DS0 within DS1 concurrency metrics
 - 'top ten' and 'worst ten' summaries

IP Telephony Infrastructure Capacity Planning Issues





- Router/gateway platform utilization
 - CPU and memory utilization
 - Contention/other performance metrics
- Gateways to legacy voice mail systems
 - CPU and memory utilization
 - Port utilization
 - Port idle time vs. concurrency
 - SMDI/MWI information



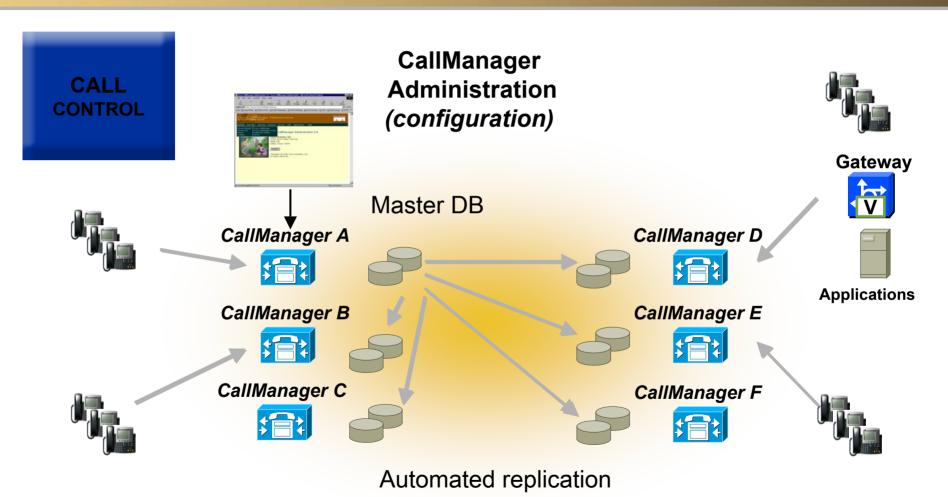
IP Telephony: Cisco CallManager



- Software application within Cisco AVVID architecture
- Provides call processing, call control, feature control, signaling to phones, gateways, media processing devices and applications
- Shared resource manager for VoIP gateways, conference bridges, etc.
- Host for call control APIs (TAPI/JTAPI), configuration API (AXL) and login services API to third-party applications and devices



IP Telephony Cisco CallManager



IP Telephony Call Control Capacity Planning Issues





- CallManager Cluster
 - Aggregate number of calls
 - Distribution of calls among CCMs in cluster
 - Cluster busy hour
 - Cluster FXO/FXS activity
 - Cluster PRI channel activity
 - Cluster CAS channel activity summary
 - Cluster 'top ten' and 'worst ten' summaries
 - Cluster "futures" trending/forecast

IP Telephony Call Control Capacity Planning Issues





- CallManager
 - CCM call activity
 - CCM busy hour
 - CCM FXO/FXS activity summary
 - CCM PRI channel activity
 - CCM CAS channel activity summary
 - CCM 'top ten' and 'worst ten' summaries
 - CCM "futures" trending/forecast

IP Telephony Call Control Capacity Planning Issues





- IP telephony application platform metrics
 - CPU utilization
 - Memory/other resource utilization
 - Trending data over time
 - Application specific metrics

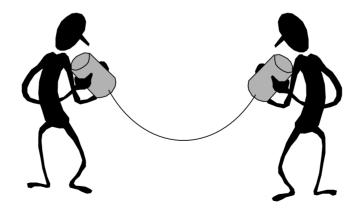


How it works...

PHONES

INFRASTRUCTURE







Telephone Initialization

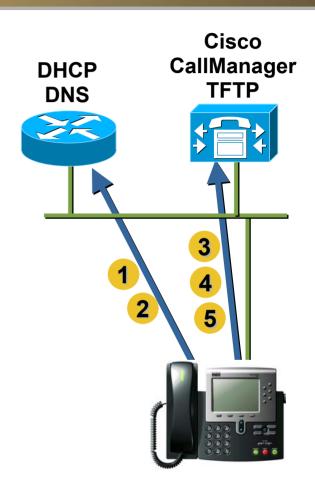
- 1 Get IP address, mask, DNS, etc.
 - 2 Get TFTP server address

Use Any One Static address
Option 150 (single IP address)
Option 66 (first IP address or DNS name)
Look up CiscoCM1.your.domain

3 Get configuration from Cisco CallManager TFTP

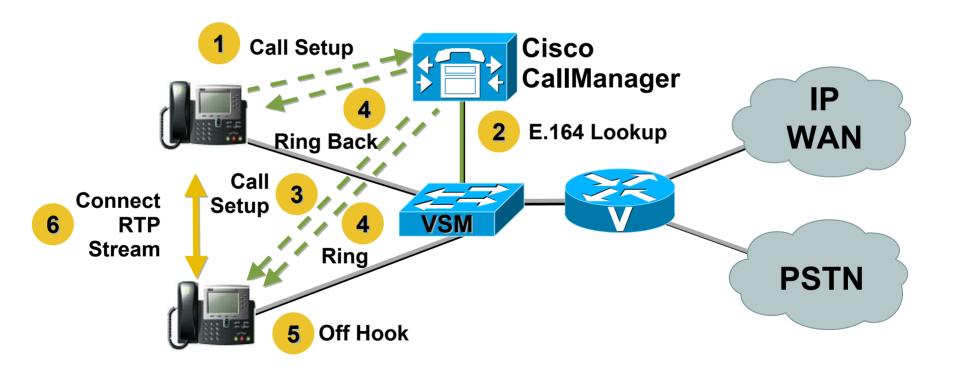
List of up to three Cisco CallManagers
Region info and keyboard template
Version of code to run

- 4 Get new code (one time only)
- 5 Register with Cisco CallManager



Basic "Phone-to-Phone" Call Processing

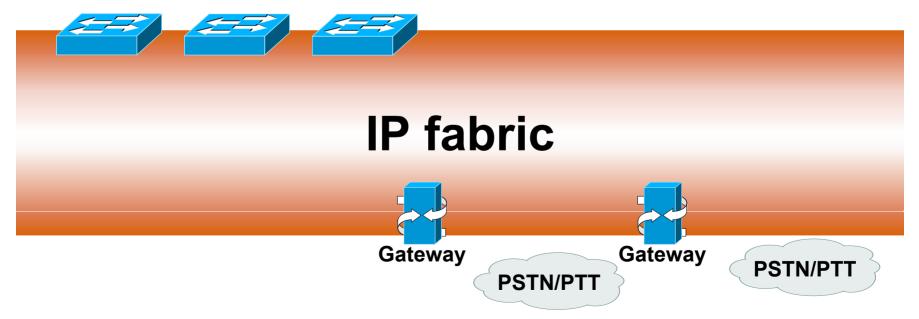




IPT Has Two 'Managed' Environments...



The first is the underlying Cisco IP network or IP fabric upon which all data and voice traffic must flow.



IPT Has Two 'Managed' Environments

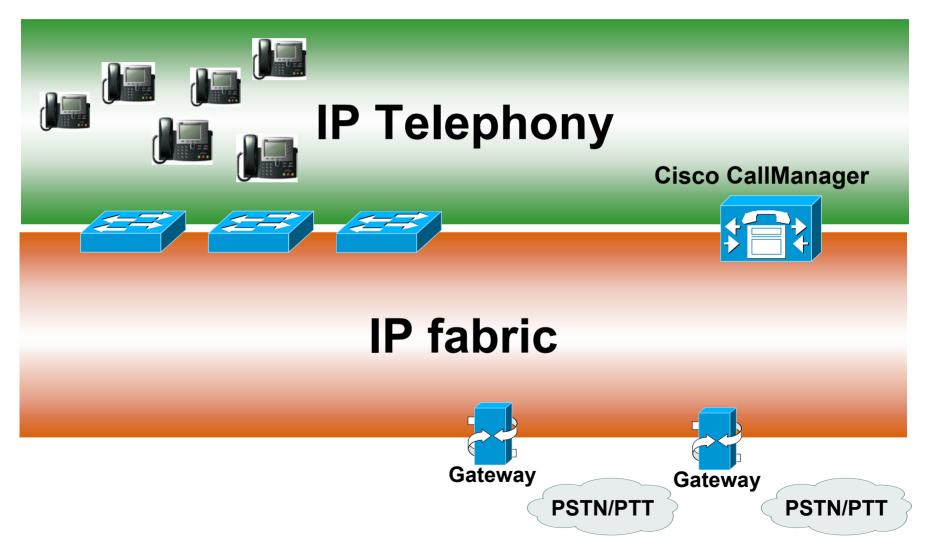


The second is the Cisco AVVID-based IP telephony components that support the IP telephony operations.



Both Environments Must Be Managed







Cisco Management Tool



Service Assurance Agent (SAA)



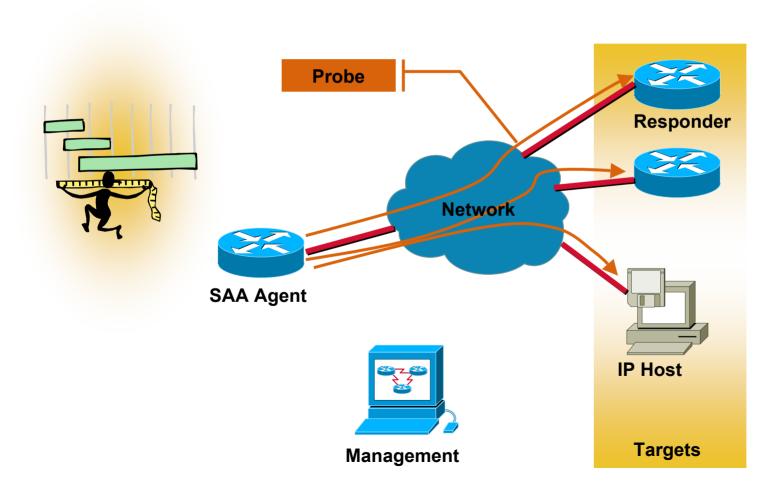
Service Assurance Agent (SAA)

- SAA is a feature of most IOS® based Cisco devices that can be instructed to define, schedule, execute, and report on network performance testing.
- SAA can continuously or periodically provide insight into key performance elements of production networks:
 - network delay, packet loss,
 - network delay variation (jitter), and 'availability'/connectivity.





Service Assurance Agent (SAA)





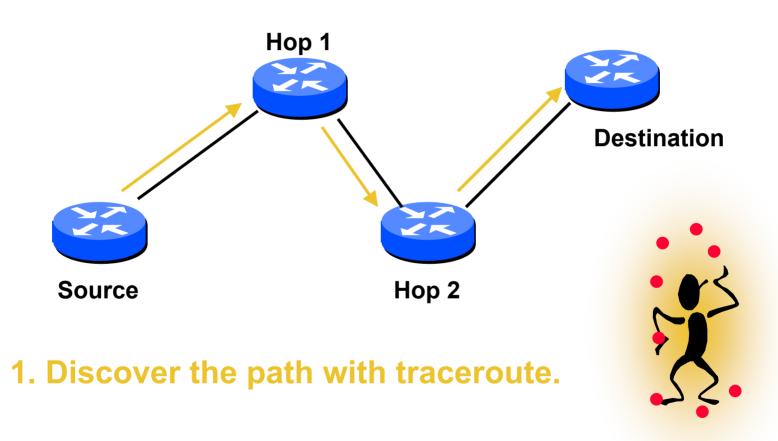
Path Jitter Operation

- Runs in two phases: route discovery and hops evaluation
- Per hop round trip time.
- Per hop packet loss.
- Per hop cumulated Jitter with noise reduction. (RFC1889)
- No SAA responder required on the destination or on the hops.



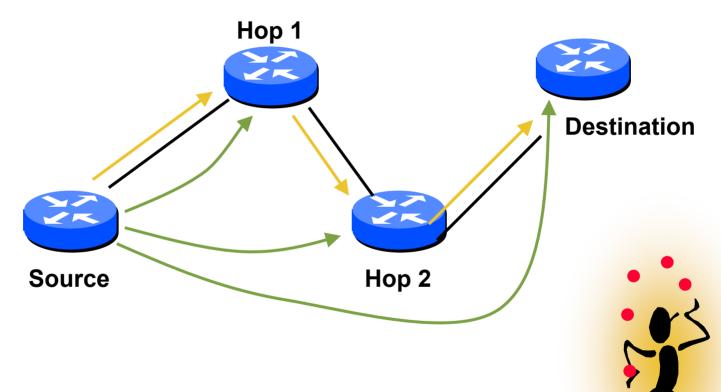


Path Jitter Operation: Two Phases





Path Jitter Operation: Two Phases



- 1. Discover the path with traceroute.
- 2. Evaluate each hop one by one for RT lost, and round-trip total Jitter.



CiscoWorks Management Tool



Performance Monitor (IPM)

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CiscoWorks IPM

- Monitoring the performance of multi-protocol networks
 - UDP, SNA, ICMP, HTTP, DNS, DLSw+
- Response time monitoring
- "Availability" monitoring
 - Device availability
 - Path/service availability
- Historical reporting
- Supported on Windows and Solaris platforms

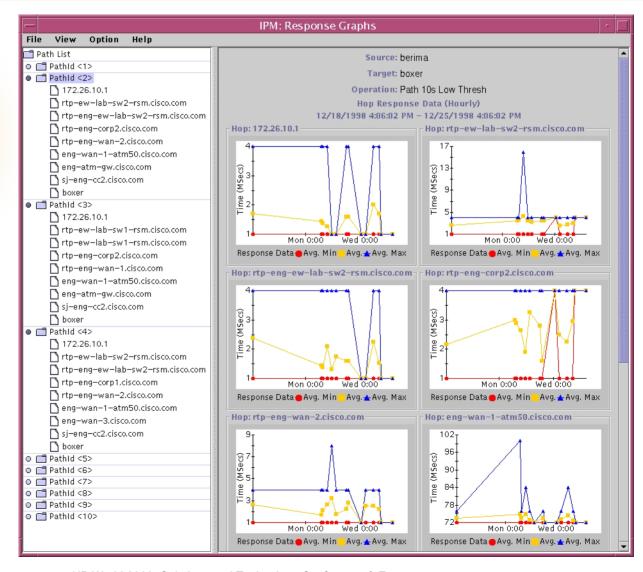


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CiscoWorks IPM



- Reporting
 - -Yearly
 - -Quarterly
 - -Monthly
 - -Weekly
 - -Daily





CiscoWorks Management Tool



Cisco Voice Manager (CVM)

CiscoWorks Voice Manager Overview



- CiscoWorks Voice Manager (CVM) is a client-server web-based voice management and data collection solution.
- The application provides capabilities to configure and provision voice ports, and to create and modify dial plans on Cisco IOS voice gateways for
 - voice over IP (VoIP),
 - voice over Frame Relay (VoFR) and
 - voice over ATM (VoATM) network deployments.

CVM Features: Dial Plan Management



- Allows user to create and manage local POTS dial plans and VoIP, VoFR, and VoATM network dial plans.
- Allows user to propagate local POTS dial plan information input on a gateway to other voice gateways in the network and can synchronize dial plan information on a router with dial plan information from other routers.
- CVM can verify dial plan information by showing all routes between two specified phone numbers.



CVM Features: Call History Retrieval



- CVM retrieves the Call History information from all the voice gateways defined within the CVM system.
- The retrieved data is passed to third-party reporting package for storing in its database.
 - -Telemate.Net
 - hp Performance Insight Report Pack
- The frequency for polling a gateway is dependant on router type and can be overridden by user.



CVM Features: Gateway Monitoring



- CVM provides a real-time display of CPU, memory usage and the number of different types of call legs that are currently active on a gateway. The refresh rate for this display is user configurable.
- CVM provides a real-time summary display of calls currently active on a gateway. The refresh rate for this display is user configurable.



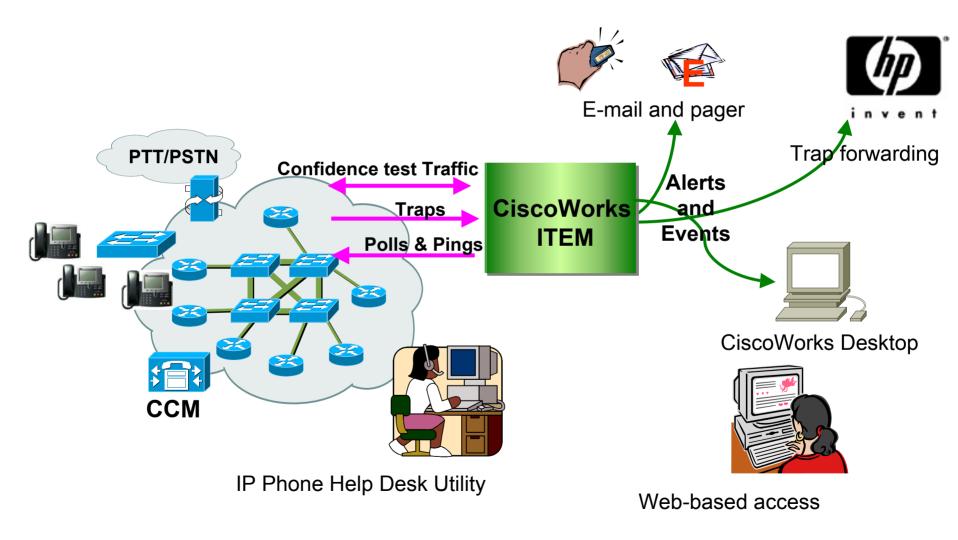


CiscoWorks Management Tool



IP Telephony Environment Monitor





Gateway Statistics Utility (GSU)



- Part of the ITEM family, GSU can be downloaded from CCO
- Collects performance and behavior statistics about Cisco CallManager (CCM) controlled IP telephony gateways and call traffic.
- Collected statistical information is exported for processing by the hp Performance Insight reporting package.



Gateway Statistics Utility (GSU)

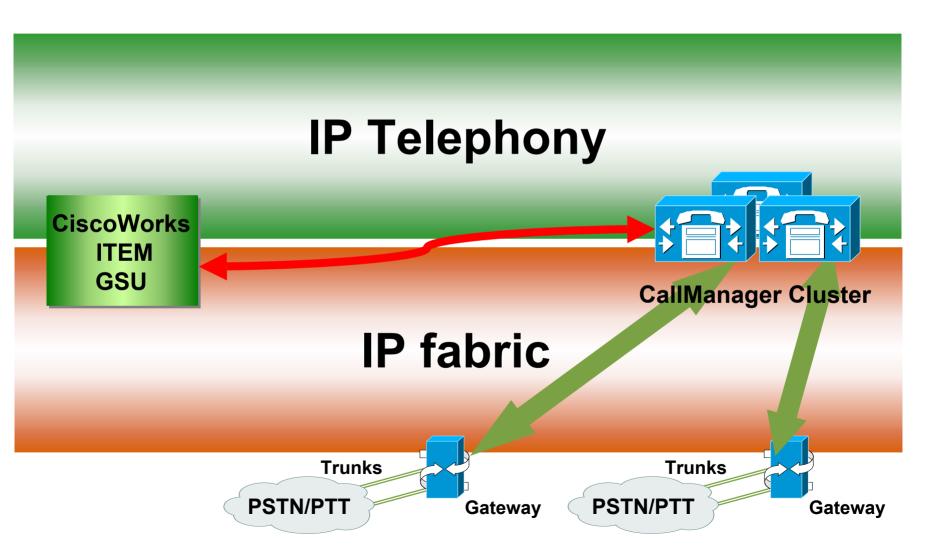


- Setting up a Cisco IP Telephony Statistics study...
 - Determine the devices and timeframe of the study
 - Define the study using the GSU study definition screens
 - Verify data is being collected
 - Prepare data files for transfer to reporting workstation



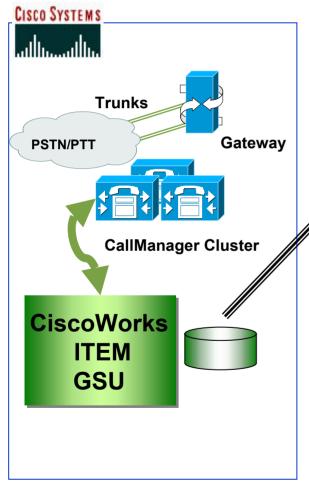
Gateway Statistics Utility (GSU)

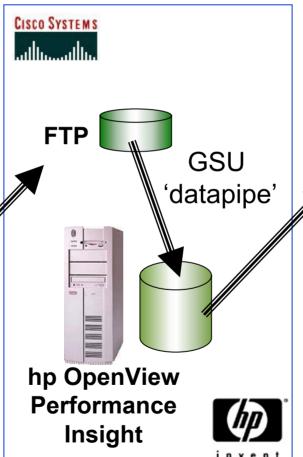


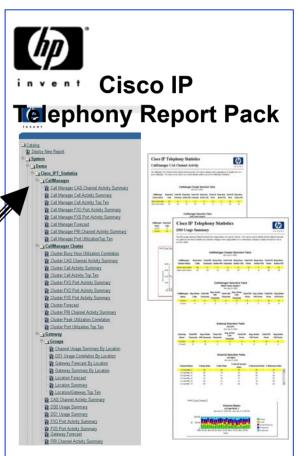


Processing IPT Performance Data...









capture

process/archive

reporting

Cisco IP Telephony Report Pack: The Reports



- Cluster Busy Hour
- Cluster CAS Channel Activity Summary
- Cluster Call Activity
- Cluster Call Activity Top Ten
- Cluster FXO Port Activity Summary

- Cluster FXS Port Activity Summary
- Cluster Forecast
- Cluster PRI Channel Activity
- Cluster Peak Utilization Correlation
- Cluster Port Utilization Top Ten

CallManager Cluster Reports

Cisco IP Telephony Report Pack: The Reports



- CallManager CAS Channel Activity Summary
- CallManager Call Activity
- CallManager Call Activity Top Ten
- CallManager FXO Port Activity Summary

- CallManager FXS Port Activity Summary
- CallManager Forecast
- CallManager PRI Channel Activity Summary
- CallManager Port UtilizationTop Ten

CallManager Reports

Cisco IP Telephony Report Pack: The Reports



- CAS Channel Activity Summary
- PRI Channel Activity Summary
- DS0 Usage Summary
- DS1 Usage Summary
- FXO Port Activity Summary
- FXS Port Activity Summary

- Gateway Summary By Location
- Gateway Forecast by Location
- Channel Usage Summary by Location
- DS1 Usage Correlation by Location
- Location/Gateway Top Ten

Gateway Level Reports



Individual DS0 Report

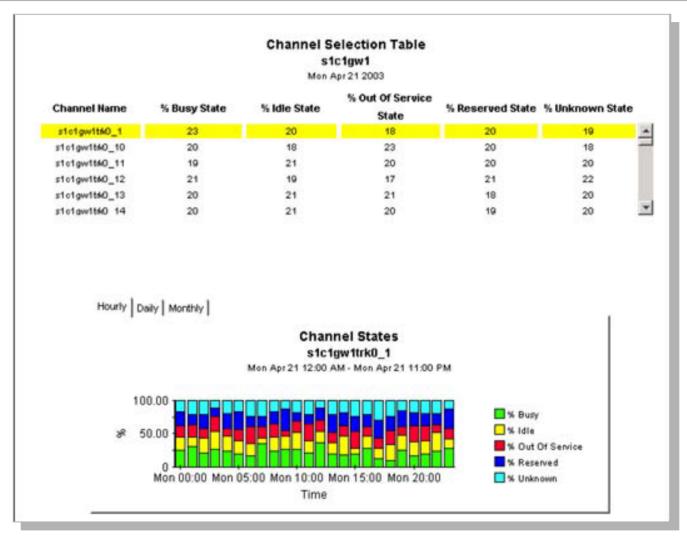
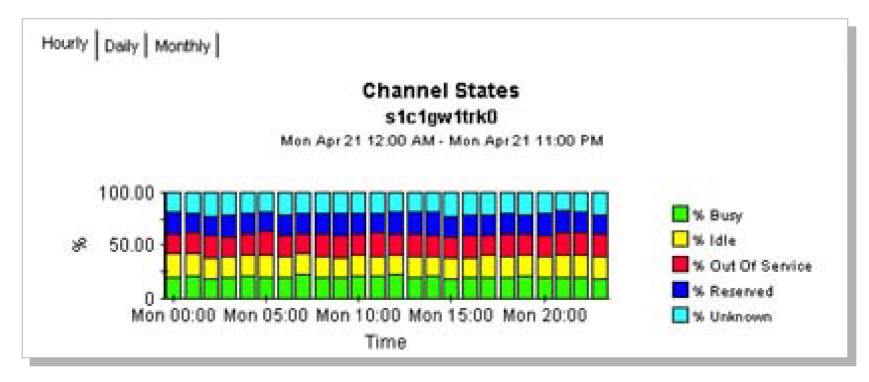


Illustration does not reflect actual data



Individual DS1 Report

DS1 Selection Table s1c1gw1 Mon Apr 21 2003					
DS1 Name	% Busy State	% Idle State	% Out Of Service State	% Reserved State	% Unknown State
s1c1gw1tM0	20	20	20	20	20
s1c1gw1tk1	20	20	20	20	20



The Future: More Data and More Reports



- Cisco has a strategic development program in place to provide more capacity management information about key elements of the networks and other elements supporting IP telephony
 - recurring updates to the CiscoWorks Gateway Statistics Utility to include IOS® based gateways
 - more information from future versions of CallManager
 - many reports are already in the works with the Cisco IP Telephony Statistics Report Pack from HP



