





## > BUSINESS MADE **SIMPLE**

### Proactive Voice Quality Management

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# Convergence Management Challenges



- > Cost-effectively delivering toll quality voice services on an IP infrastructure
- > Proactively assuring application, service, and network performance for converged networks
- > Seamlessly linking infrastructure and IP Telephony QoE management



**The number 2 deployment impediment for 2003 / 2004 was "systems for managing and trouble-shooting VoIP quality"**

"2003 VoIP State of the Market Report", Distributed Networking Associates

"2004 VoIP State of the Market Report", Distributed Networking Associates

**"Successful IP Telephony deployments depend on... proactive, real-time monitoring of voice quality"**

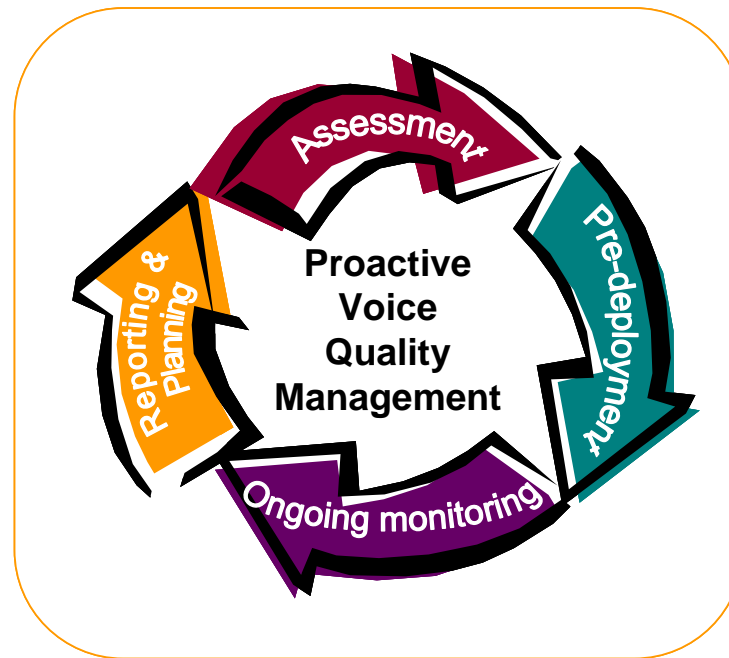
"The Importance of Integrated VoIP, Network and QoS Management", Yankee, October 2003

# Proactive Voice Quality Management Business Process Lifecycle Model



## Assessments

Voice and network  
quality reporting for  
SLA management  
and planning



Network QoS configuration  
and roll-out

Monitoring of end-user voice quality and overall system health

*VoIP Business Processes  
OPTIMIZED by PVQM*

# QoS Versus QoE



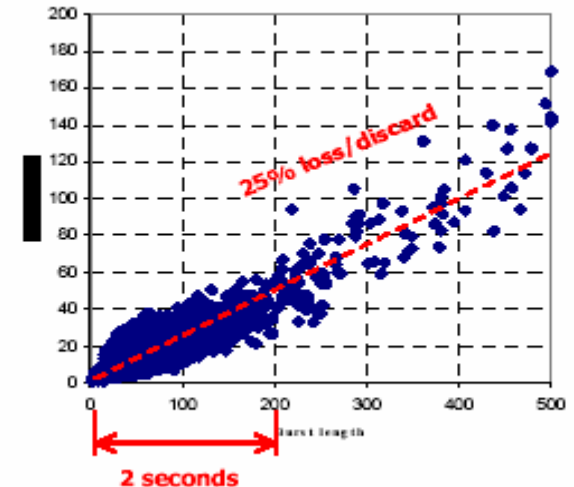
- > **Quality of Experience (QoE)** is a subjective assessment of the quality of a service as perceived by the user.
- > **Quality of Service (QoS)** is an optimization tool designed to deliver a certain Quality of Experience (QoE) by ensuring that network elements apply consistent treatment to traffic flows as they traverse the network.



# Why Traditional Management Approaches Don't Work for IP Telephony



- > Can't provide end-to-end information from a user perspective
  - Traditional approaches to managing IP networks capture the wrong metrics: throughput is not relevant for real-time traffic and jitter vs. discard rates
- > Doesn't see transient problems
  - Current metrics (such as RTCP) are too coarse: per call statistics and average packet loss rates are not detailed enough to capture the transitory nature of the impairments
  - Can't combine per-call average metrics



**Traditional Approaches Do Not Work for Real-Time Traffic  
Do not accommodate transient effects and end user perspective**



# Standards Based Solutions

- > E-Model (ITU G.107):
  - Transmission planning tool for estimating user satisfaction
  - Objective measurement
  - E-model output: R value
    - Under 60 is not acceptable
    - Over 94.5 is unattainable in VOIP
- > RTCP XR (RFC 3611)
  - Quality of Experience metrics which make sense for VoIP
    - Focus on end-user
    - Detect and report on transient problems
    - Correlate quality back to the underlying network infrastructure
- > Toll Quality is 80 and above
  - G.711 best score is ~94
  - G.729 best score is ~82 !

R-Value	User Satisfaction	MOS
100	Very Satisfied	5.0
94		4.4
90	Satisfied	4.3
80		4.0
70	Some Users Dissatisfied	3.6
60	Many Users Dissatisfied	3.1
50	Nearly All Users Dissatisfied	2.6
0	Not Recommended	1.0

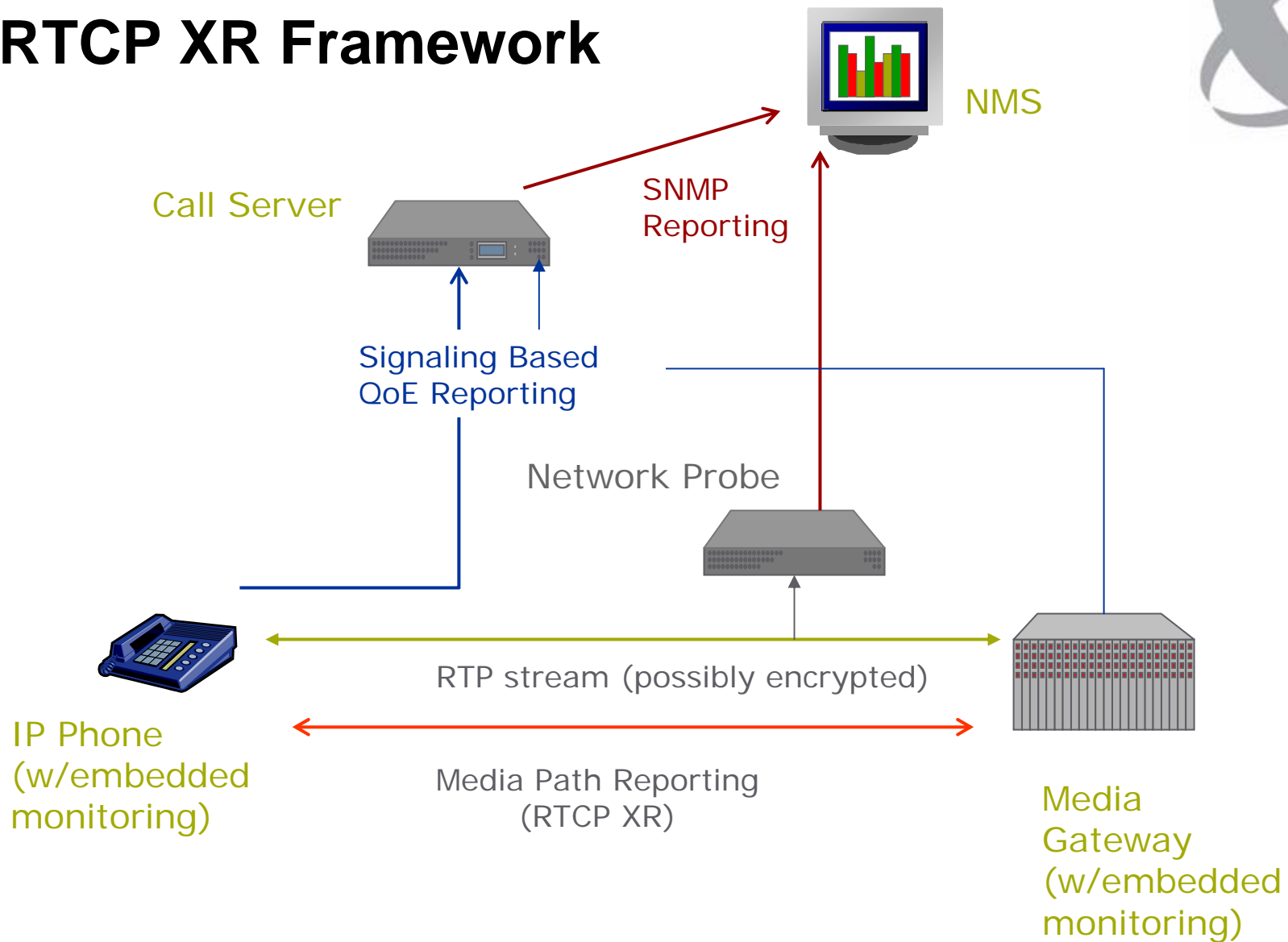
**Average network quality scores over the duration of a call do not reflect end users perception of call quality**

# Basic design philosophy behind RTCP XR



- >Embed measurement in the endpoints
- >Correlate data in real time - send less data that is more meaningful
- >Measure distribution of lost and discarded packets
- >Leverage the DSP to measure analog parameters
- >Provide support for understanding system level problems such as echo
- >Use protocols that exist and are firewall friendly

# RTCP XR Framework





# Types of QoE monitoring

## > Active monitoring

- Inject simulation flows, estimate performance
- Great for “assessment and troubleshooting
- No real session statistics
- Requires management of additional processes

## > Passive monitoring with probes

- Monitor real session flows
- Need to be strategically placed
- Doesn't measure real user experience or performance of endpoint
- Fails with encryption

## > Passive monitoring in endpoints (phones, clients, gateways)

- Phones monitor every session
- Report statistics at end of every call and upon threshold violation
- Able to measure user experience and performance of endpoint

# Proactive Monitoring

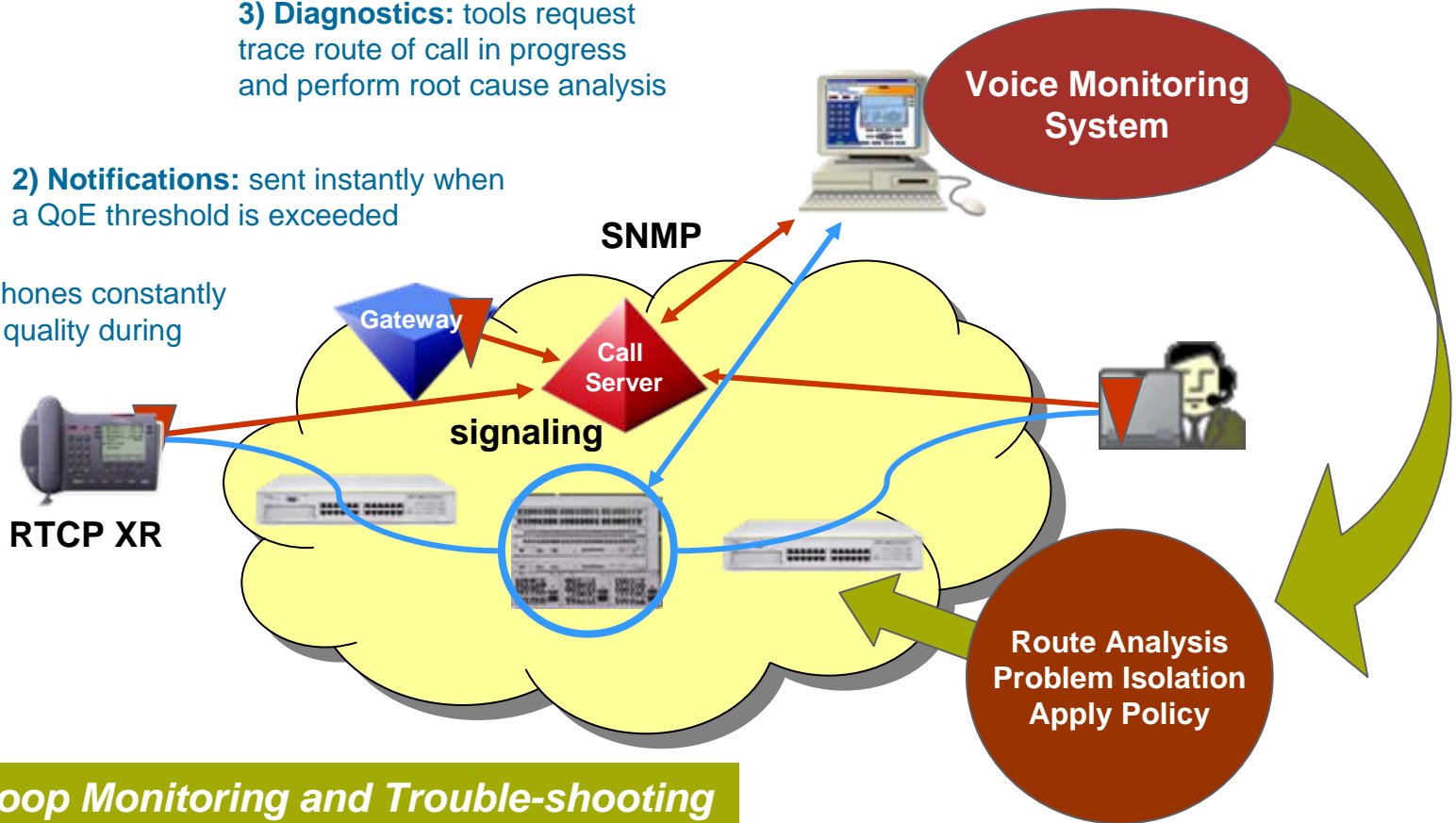
## Functional Architecture

4) **Correction:** Network Management tools reconfigure devices and/or apply routing policies

3) **Diagnostics:** tools request trace route of call in progress and perform root cause analysis

2) **Notifications:** sent instantly when a QoE threshold is exceeded

1) **Monitor:** Phones constantly monitor voice quality during each call



**Closed-loop Monitoring and Trouble-shooting for actual Voice Quality in Real-time**

# Tools: QoE Event - RTCP-XR info



## > QoE monitoring

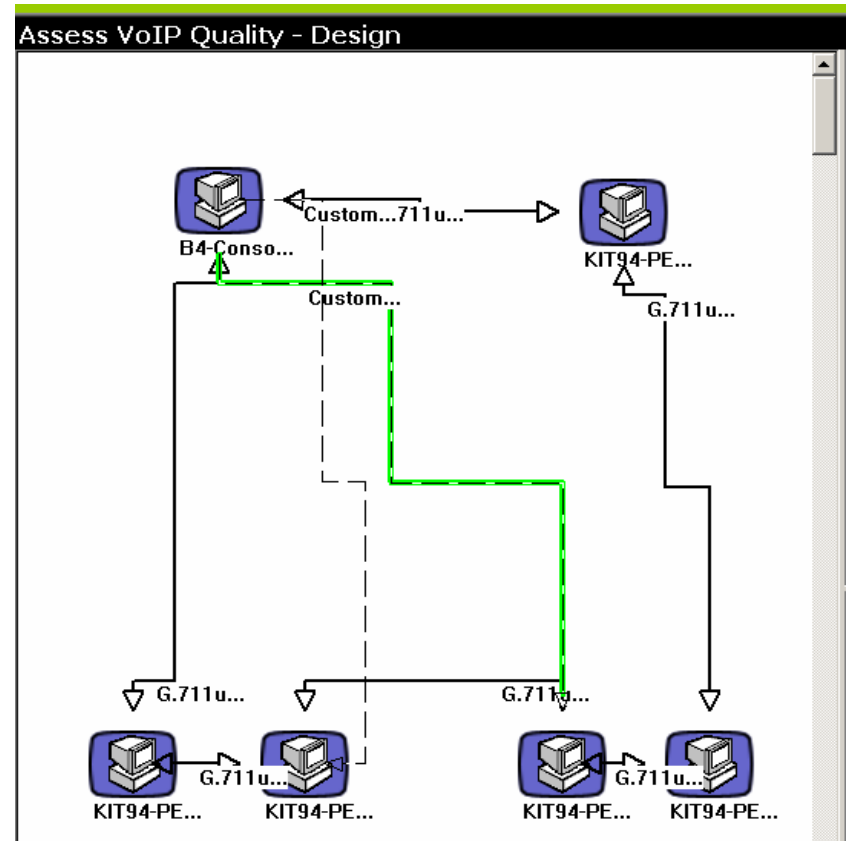
- R-factor
- Codec info
- Packet Loss
- Jitter buffer loss
- Other stats

```
Event Properties: 52
Event Message Comments
R-factor: 64.42
Near TN: 0x604b
Source IP address: 10.2.1.1
Source port: 5000
Destination IP address: 10.1.1.1
Destination port: 5200
TCID: -1
Codec type: G.711 Mu
Network loss rate: 27.8%
Average discard rate: 7.6%
Burst loss density: 35.4%
Burst length: 790 ms
Gap loss density: 0.0%
Average length of gap: 0 ms
End system delay: 2048 ms
Local round trip time average: 0 ms
<DIAGNOSE>
<ListenRfactor>64.42</ListenRfactor>
<NearTN>0x604b</NearTN>
```

# Tools: Assessors

## Assess VoIP Quality Before Deployment

- > Network Inventory (SNMP Discovery)
- > Assess Utilization (after Inventory)
- > Model Bandwidth (after Utilization)
- > Assess VoIP Quality (independent)
  - Scheduled mode
  - Run Once mode
- > Analyze and Chart Results (after Assess VoIP Quality)



# Tools: FPM

## *Integrated Infrastructure Management including IP Telephony*



- > Discovery
  - IP Telephony and Data network devices
- > Visualization
  - Physical (Converged) Topology Map
  - Logical VoIP (Service) System View
  - Fault Propagation
  - VoIP Troubleshooting View
- > Fault Aggregator
  - SNMP fault management for IP Telephony Systems
- > Real time Performance Metrics
- > Inventory Management

The screenshot displays the InfoCenter software interface with several windows open:

- InfoCenter** (Main Window): Shows a tree view on the left with categories like Alarms, Baselines, Resources, and VLANs. The main area displays a network topology map with nodes and connections.
- Subnet 10.128.100.0 (Temporary)**: Shows a detailed network topology map for a specific subnet.
- Alarms**: A table displaying alarm information.
- Alarms Warning**: A table displaying warning information.
- IP Management**: A window showing IP address management details.
- IP Management**: A window showing IP address management details.

Label	Type	Subnet	Config	System Link	App Info	is Provisioned
10.128.100.1	Probe	10.128.100.1	10.128.100.1	10.128.100.1	10.128.100.1	10.128.100.1
10.128.100.2	Probe	10.128.100.2	10.128.100.2	10.128.100.2	10.128.100.2	10.128.100.2
10.128.100.3	Probe	10.128.100.3	10.128.100.3	10.128.100.3	10.128.100.3	10.128.100.3
10.128.100.4	Probe	10.128.100.4	10.128.100.4	10.128.100.4	10.128.100.4	10.128.100.4

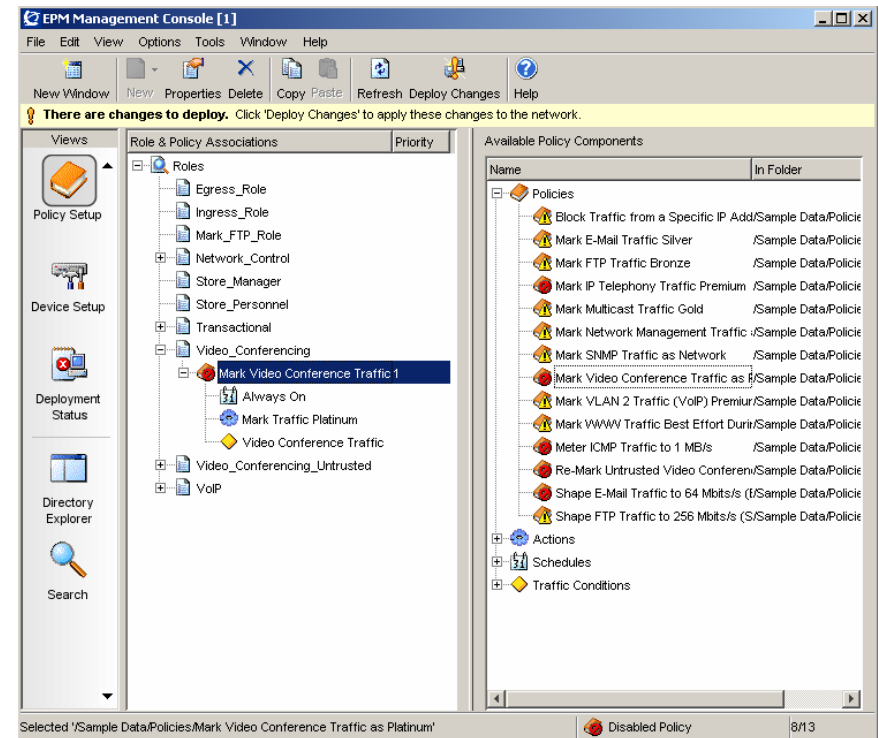
**Display and Manage Converged Network Devices**

# Tools: Policy Management

## *Integrated QoS and Security Provisioning*



- > One-click QoS provisioning for Voice, Video and Data over IP
  - Provides system-wide configuration and administration of QoS, reducing complexity and operational costs
  - Enables effective delivery of real time applications such as IP Telephony, video over IP and business critical applications using application templates
- > Network admission control to protect against denial of service attacks
  - Protects network resources against external attacks
  - Minimizes lost profits & maximizes productivity



**Apply System-Wide QoS policies on Converged Infrastructure to ensure End User QOE**

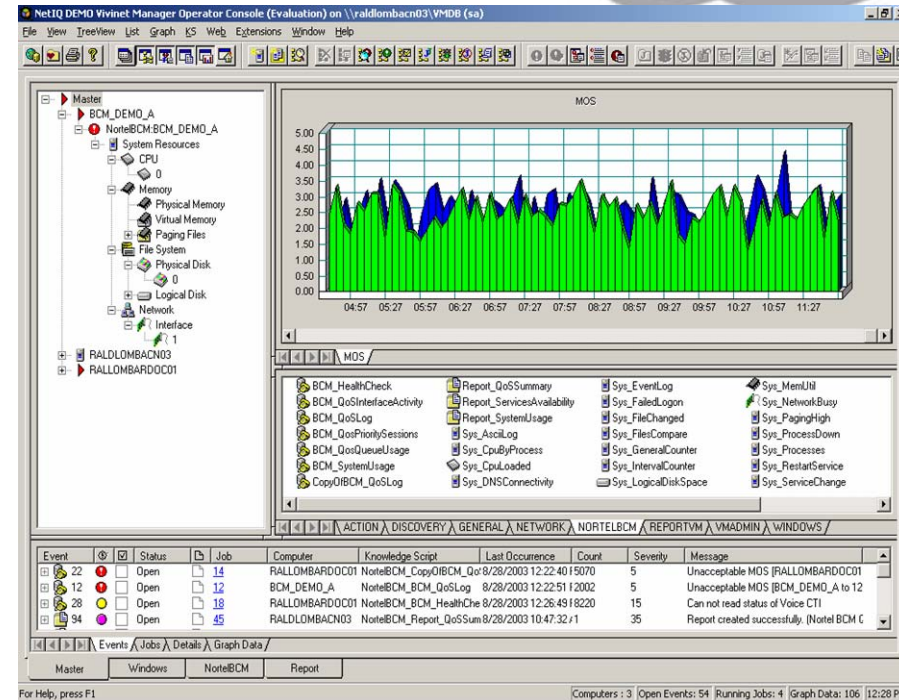
# Tools: Application Management

## > Capabilities

- Performance management of:
  - IP Telephony system components,
  - and voice quality
- Easy-to-use web-based console
- Automates operations and monitoring policies
- Reporting of call quality, usage trends, overall performance and capacity planning

## > Benefits

- Simplifies voice and video management
- Maximizes performance and uptime
- Lowers support costs
- Rapidly identify critical problems



**Historical Reporting of Service Level trends over time  
pinpoint issues before they become problems**

# Tools: Diagnostics

- > Real-time Call Quality Diagnosis
- > Automatically invoked by QoE trap *for a call in progress*
  - Traces the path of the call
  - Collects diagnostic information from routers, switches and links in the path
  - Discovers, analyzes and prioritizes problems
  - Performs root cause analysis

The screenshot displays the NetIQ Vivinet Diagnostics interface. The top window shows a 'Report' for 'NortelPhone2PhoneTrapSample1.dgy'. It includes a table of performance metrics and a 'Diagnosis' section with a cause: 'LAN Congestion: LAN Link overutilization between interfaces 10.42.13.1, E11-enet and 10.42.13.254, Ethernet0/0, (I'. Below this, a 'Path Trace' window shows a network diagram with nodes and links, indicating the path of the call through various network devices.

Performance Metric	Rating	Measured Value	Good Threshold Value	Marginal Threshold Value
MOS	⊘	2.16	4.03	3.60
F-value	⊘	42.00	90.45	69.19
Delay	⊙	61 ms	150 ms	400 ms
Jitter Buffer Loss	⚠	4.520%	0.100%	90.000%
Lost Data	⊘	11.055%	0.100%	0.200%

**Diagnosis**  
Cause: LAN Congestion: LAN Link overutilization between interfaces 10.42.13.1, E11-enet and 10.42.13.254, Ethernet0/0, (I

**Path Trace**  
Outgoing: 10.41.2.7 to 10.42.14.100  
Incoming: 10.42.14.100 to 10.41.2.7

Network diagram showing nodes: 10.41.2.7, 10.41.1.22, 10.41.1.17, ralisb03.raldev.n.etiq.dev, ralisb13.raldev.n.etiq.dev, ralisb12.raldev.n.etiq.dev, ralisb04.raldev.n.etiq.dev, ralisb01.raldev.n.etiq.dev, 10.42.14.100.

Displays routers, switches, and links between the two phones or endpoints









**Trouble-shooting across Multi-vendor Network Infrastructure For ACTIVE calls**



# Tools: Diagnostics (cont'd)

## >Problem cause analytics

- Automatically gathers relevant data (eg. Trace route)
- Provides root cause analysis
- Quickly identifies VoIP quality issues
- Discovers, analyzes and prioritizes problems
- Reduces skills needed for troubleshooting

Cause : WAN Link Framing: Low speed WAN link interface doesn't have fragmentation configured:		
	 10.41.2.7	Burst Density: burst density exceeded the 1.000% threshold as reported by R-value trap. 16.848% burst density was measured between the Target Devices. Time detected: 4/11/2005 at 2:01:19 PM.
	 10.41.2.7	Lost data: packet loss exceeded the 0.200% threshold. Packet loss at a rate of 11.055% was reported by R-value trap. Time detected: 4/11/2005 at 2:01:19 PM.
	 10.41.2.7	Jitter buffer loss: loss due to jitter buffer overruns or underruns exceeded the 0.100% threshold as reported by R-value trap. 4.520% loss was measured between the Target Devices. Time detected: 4/11/2005 at 2:01:19 PM.
	 Outgoing:	Configuration: problem detected on an interface. 10.42.30.2, Serial0/0, does not have WAN link fragmentation and interleaving configured for VoIP Traffic. Time detected: 4/11/2005 at 2:02:05 PM.



# Summary

- >Start with the end user Quality of Experience
- >Industry Standards based
- >Automate path level diagnostics for actual calls
- >Real-time management of calls in progress
- >Life-cycle models cover all phases of VoIP Deployment
- >Enable all deployment options:
  - End-user manages their own network
  - Channel Partner offers managed service

