

Performance Management: Key to IP Telephony Success

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VoIP Performance Management

- Voice, Video and other Real Time Applications
- VoIP Performance Issues and Problems
- Managing through multiple domains
- Enterprise VoIP Deployment Scenarios
- Measuring VoIP Performance
- Emerging VoIP Management Framework



Voice over IP Technology



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Voice, Video and other Real Time Applications

- Voice over IP services .. deployment model
- Migration from isolated service "islands" to an integrated service
- Emerging real-time and near real-time services
- What does this mean from a performance management system perspective







Growing range of (near) real time services

- Voice
 - Traditional telephone service, interactive voice
 - Conference services
 - Push-to-talk
- Video
 - Videoconferencing
 - Push-to-see
- Messaging

– IM



Performance management implications

- Voice over IP is a key application however moving forward – need to consider wider range of real time apps
- Today's VoIP scenarios are often isolated "islands" however tomorrow it will be necessary to manage across multiple networks



VoIP Performance Issues and Problems

- Well Known Problems
 - Packet Loss -- Leads to quality degradation
 - Jitter -- Leads to packet loss (discards)
 - Delay -- Causes conversational difficulty



VoIP Performance Issues and Problems

- Well known problems
 - Packet Loss -- Leads to quality degradation
 - Jitter -- Leads to packet loss (discards)
 - Delay -- Causes conversational difficulty
- Lesser Known Problems
 - Packet loss and jitter are <u>transient</u> and can be hard to detect and diagnose
 - Echo becomes more obvious due to the delay of VoIP systems
 - Clipping, echo and gaps in speech can be caused by incorrect configuration of gateways and phones
 - Excessive delay or quality degradation can result from incorrect configuration of jitter buffers



Transient IP Problems – root cause

- Short (1-2 second) periods of high jitter or packet loss
- Typically due to short term congestion
- Can occur even if QoS enabled
 - Input queue in router overloaded
 - Processor bandwidth in router
- Major problem on lower bandwidth links
 - Teleworkers and branch offices



Transient IP Problems – effect on call quality



Effect on VoIP call quality

-Appears as burst of 20-30% packet loss/ discard lasting 1-2 seconds

-Brief degradation in call quality – robotic/ distorted sound



Transient IP problems – user reaction





Echo – the "other" common VoIP problem





- Echo is quite common on phone services, particularly with 2-4 wire transitions
- Pre-VoIP, delay was short and hence echo sounded like "sidetone"
- VoIP introduces extra delay, hence makes echo more obvious



Delay

- High levels of delay can make interactive conversation difficult
- Effects of delay are task dependant
- Delay can be caused by
 - Network (transmission) delay
 - Core IP network delay
 - Serialization delay on slow access links
 - Jitter buffers in receiving systems
 - Encoding/decoding delays



- Active Testing
 - Generate test calls, measure characteristics
 - Ideal for on-demand and pre-deployment testing
 - Does generate additional network traffic
 - Does not measure what happens to "real" calls
- Non-Intrusive Testing
 - Measure characteristics of live calls
 - Ideal for performance management and troubleshooting
 - Does not generate additional network traffic
 - Needs live calls to measure



Active testing





Non-intrusive testing



- Fast (0.01 MIPS/call)

- Distributed
- Can be embedded in phone/gateway

Voice signal based monitoring

- More expensive (100 MIPS/call)
- Requires access to analog stream



Comparison

- Active and non-intrusive methods produce
 - Call Quality scores R factor and MOS score
 - Listening and Conversational quality metrics
 - Diagnostic data
- Active tests report conditions
 - As they were at the time of the test
 - Between source and termination of test call
- Non-intrusive tests report conditions
 - That affected a live call
 - Between the source and the monitoring point



Servce Quality Monitoring with VQmon

- Widely used for both active and non-intrusive monitoring
- Extended E Model, incorporates a model of time varying call quality
- Measures distribution of lost and discarded packets, detects transient problems
- Can be integrated into IP phones/ gateways
- Core analysis function for VoIP probes
- Ultra-fast, supports cost-effective monitoring of large volumes of calls



2004... Enterprise IP Telephony Scenario



Switched 100BaseT, VLAN, GigE, etc.



2004... Hybrid IP PBX/ PSTN Gateway Scenario





2004... Teleworkers and Distributed Call Centers?





2004... Inter-Enterprise "IP Telephony"



telchem Actively managing multimedia

2005... Inter-Enterprise "IP Telephony"





2005... VoIP over WiFi



Industry focus on quality; however, still somewhat uncertain what level of quality to expect...

... but, WiFi's a "hot" technology, expect widespread deployment





Probes, analyzers and voice quality testers can't decode encrypted payloads



Secure RTP – More Secure, Less Manageable?



Probes, analyzers and voice quality testers <u>can</u> decode RTP headers and <u>can</u> make use of RTCP SR/RR/XR metrics



Where does this leave us?

- QoS controls, VLANs, prioritization can help
- Problems can still occur due to
 - Access links to teleworkers, branch offices
 - Core IP network issues and problems
 - VoWiFi is an unknown quantity
 - Interaction of VoIP with "analog" networks
- Secure protocols make problem detection/ resolution difficult
- How to solve problems that span multiple networks?
- How to solve system level problems?



VoIP Performance Management Framework





- RFC 3611 VoIP Metrics universal set of "useful" data for VoIP performance reporting
- Packet metrics
 - Loss, Discard, Burst and Gap data
- Delay metrics
 - Round trip and end system delay
- Analog metrics
 - Signal, noise and echo level
- Call quality metrics
- Configuration data



Monitoring VoIP Performance

- Next generation VoIP Probes
 - Non-intrusively monitor VoIP streams
 - Produce per-call and interval based call quality metrics
 - Detect transient IP problems and their impact on call quality
 - Collect RTCP XR reports from endpoints
 - Incorporate endpoint reported data into call quality metrics



Enterprise Application using New Framework





Summary

- Voice over IP performance management faces the challenge of growing complexity .. more real time services spanning more networks
- IP problems are transient, time varying and hard to reproduce – need real time performance monitoring
- Emerging performance management framework based on RTCP XR

