



VoIP Management Metrics and Methods

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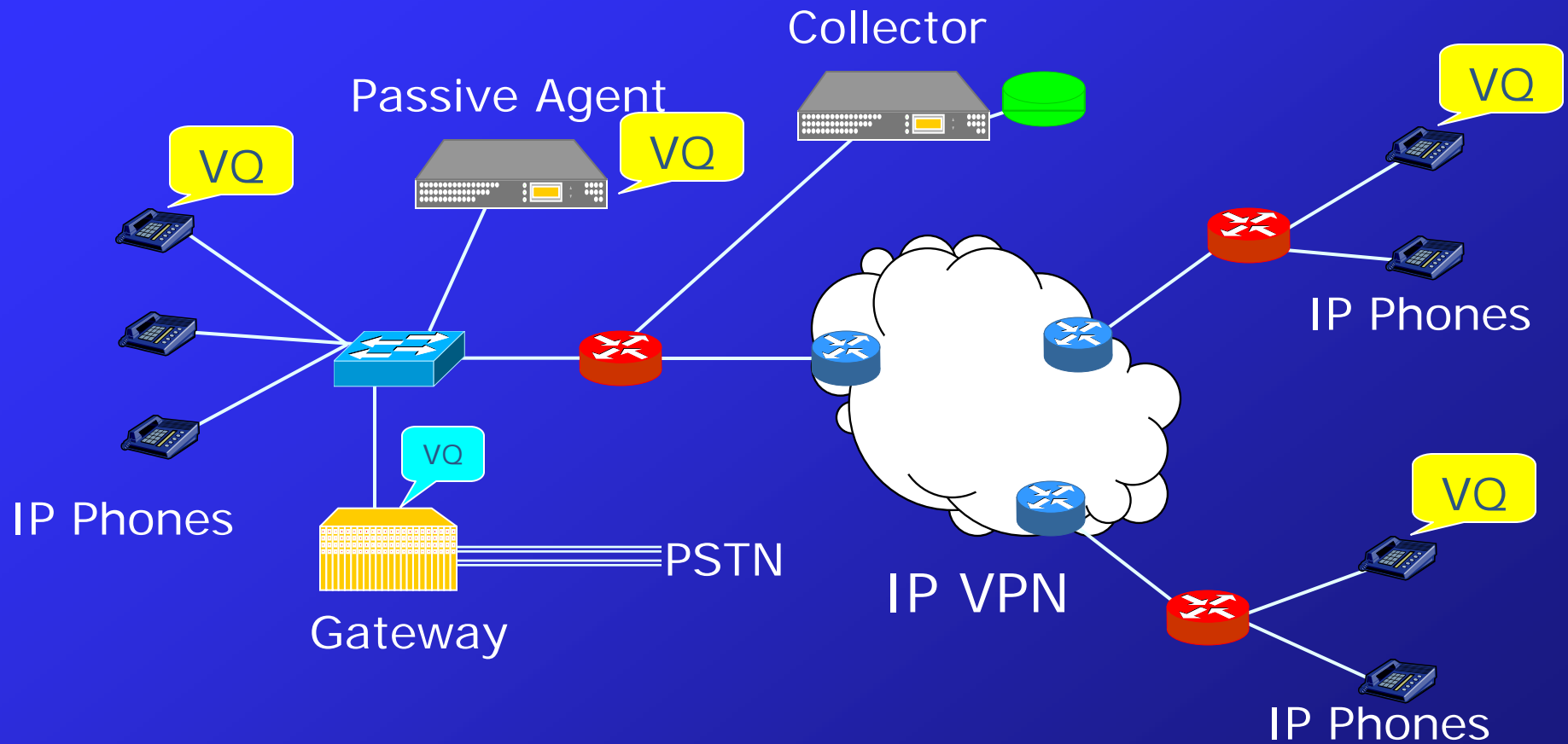
Agenda

- Key Metrics
- Obtaining the VoIP metrics
- Example
- Interpretation
- Using the Information

Metrics

- Packet statistics
 - Loss rate, discard rate
 - Burst length/ density, Gap length/ density
- Delay metrics
 - Network round trip delay
 - End system internal delay
- Signal related
 - Signal level, noise level, echo level
- QoE scores
 - R factors and MOS scores
- Configuration
 - Jitter buffer configuration

Enterprise Environment



Protocols

- RTP/UDP (RFC 3550)
- RTCP – Real Time Control Protocol (RFC 3550)
 - Sender Report – packet and delay metrics
 - Receiver Report – packet and delay metrics
 - H.323 (H.460.9)
- RTCP eXtended Report – (RFC 3611)
 - packet/delay/signal/QoE/configuration metrics
 - H.248.30
- SIP
 - Call signaling (RFC 3621)
 - RTCP Summary Report (draft RFC – “sipping”)

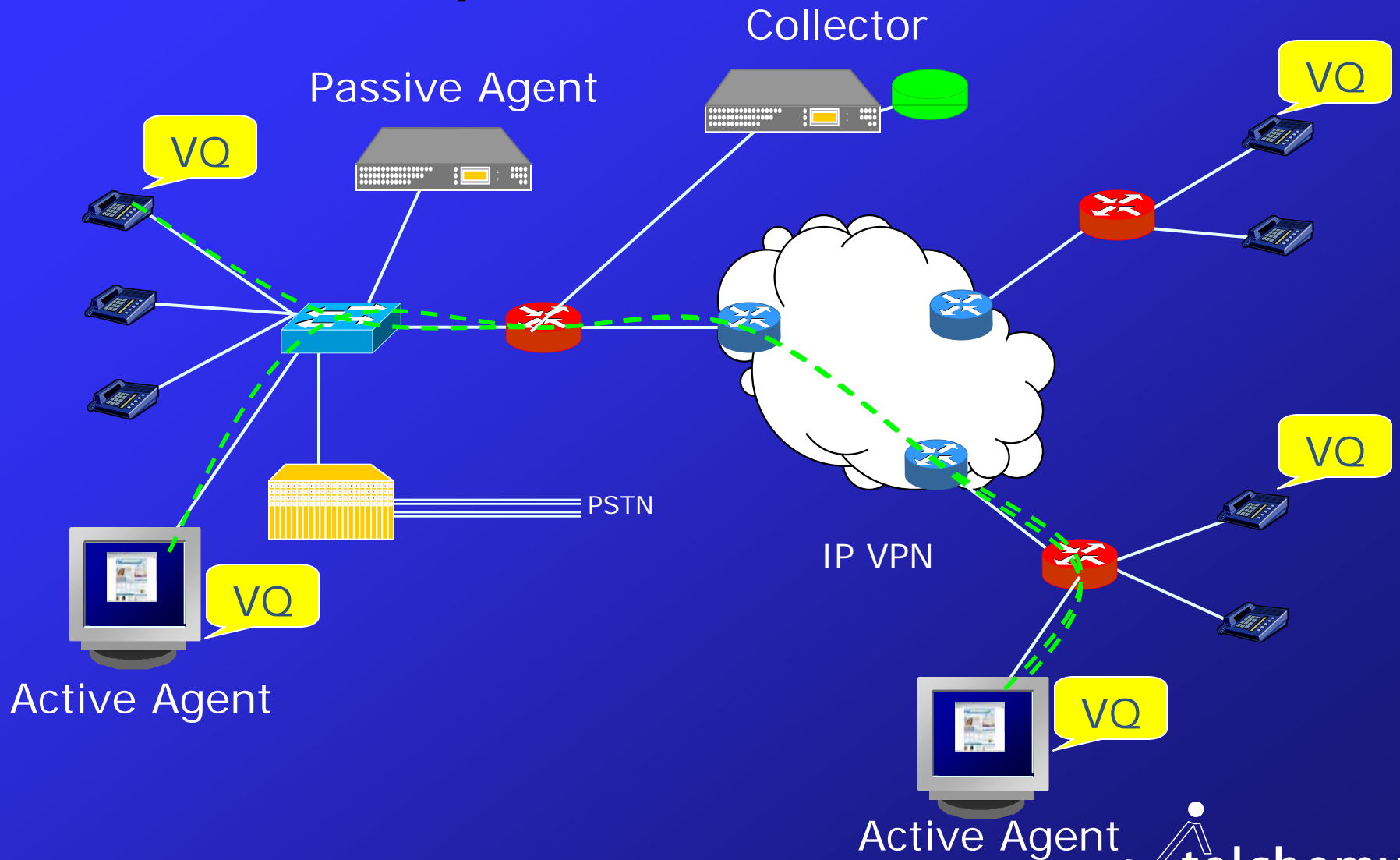
Network Monitoring

- Passive Monitoring
 - Detects calls on links
 - Reports on traffic passing through node
- Active Monitoring
 - Selectively create calls or run tests
 - Capture network signatures
- Results Collection
 - Correlate measurements
 - Identify network anomalies
 - Provide corrective actions

Network Agents

- Passive Agents
 - Connect on span port or using taps
 - Run on dedicated or shared hardware
 - Can use thresholds and alerts
 - Report to northbound systems and databases
 - Continuously detecting and measuring calls
- Active Agents
 - Conduct tests within media stream
 - Run on shared systems, network elements
 - Report to northbound systems and databases
 - Operate on instruction or predefined plans

Enterprise Environment



Sample Call Metrics

Packet Arrival Statistics	Packet Loss Rate	0.0 %
	Packet Discard Rate	0.01%
	Out of Sequence Packets	0
	Duplicate Packets	0
Mean Opinion Score (MOS)		3.86
Jitter	Mean Absolute Packet Delay Var.	3.56ms
	PPDV Jitter	3.25ms
Delay	Network Round Trip Delay	26 ms
	Average One Way Delay	73 ms
	Jitter Buffer Delay	40 ms

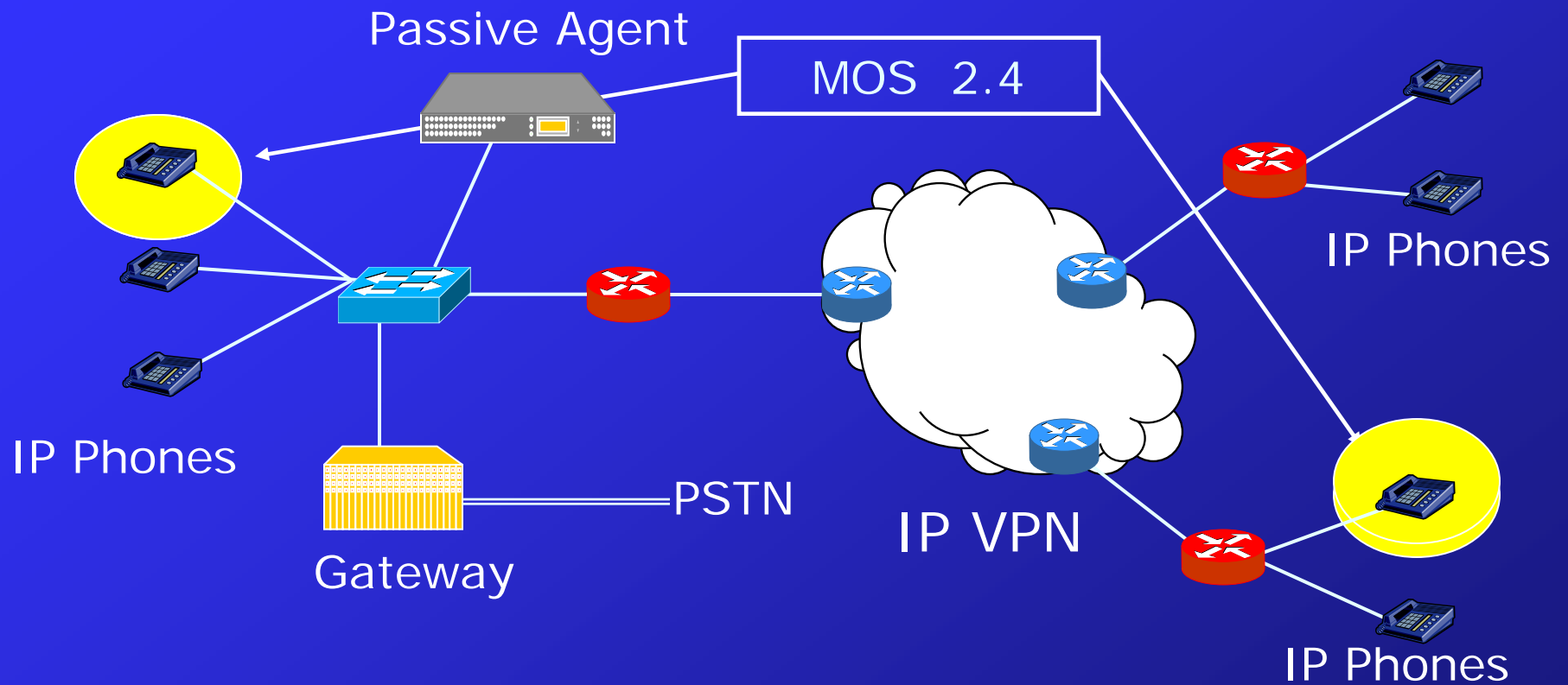
Cause and Effect

- Packet loss - poor voice quality
- Jitter - network congestion
- Delay - packet discard, poor quality
- Signal Issues - echo, line noise
- Network
 - duplex mismatch - delay
 - firewalls – no/one-way voice
 - bandwidth limitations - jitter
 - route segment analysis - isolate

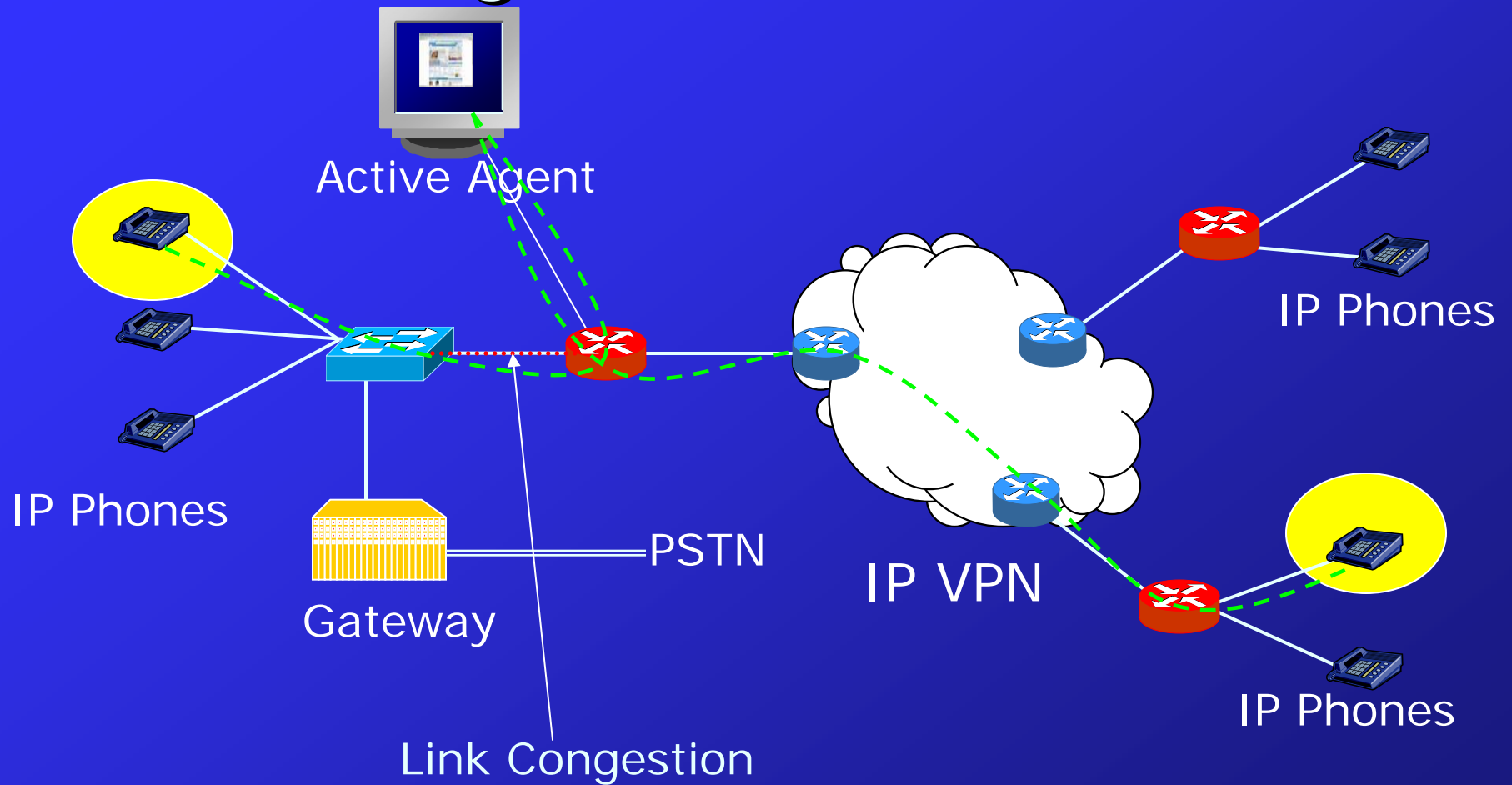
Reporting

- Results to Network Management Systems
 - Call by call
 - Batch reporting
 - Alerts and messaging based on thresholds, network events
- Collector provides persistence, analysis
 - Analysis over time, by subnet, by pairs
 - Provide data summaries, aggregate views
- Path analysis can identify segment fault
 - Partition problems
 - Identify common network elements, links
 - Provide direction for active tests

Using the Information



Using the Information



Conclusion

- Key metrics for VoIP management are well known
- Collection and reporting methods are maturing
- Key network locations yield abundant information
- Combined active and passive monitoring yields powerful results
- Observation and correlation over time yield patterns and signatures for troubleshooting
- You can do all this NOW!