Cisco AutoQoS: A New Paradigm for Automating the Delivery of Network Quality of Service

Michael Lin

Product Manager – QoS

A New Paradigm for Automating the Delivery of Network Quality of Service

- **Simpler, Cheaper, & Faster QoS Deployments**
  - **Reduces operator errors**
  - **Up to 3 times cheaper & faster**
- **Cisco AutoQoS initial focus: *QoS for Voice over IP***
  - **IP Telephony is here!**
  - **IP Telephony requires QoS**
  - **QoS deployment can be challenging**
  - **Cisco AutoQoS makes VoIP deployments simpler, cheaper, and faster**
- **Cisco AutoQoS retains 100% customer control over configuration**

Agenda

- Quality of Service – Why should you care?
- Introducing Cisco AutoQoS
- Cisco AutoQoS Phase 1 - The Details
- Summary

It Begins and Ends with Applications

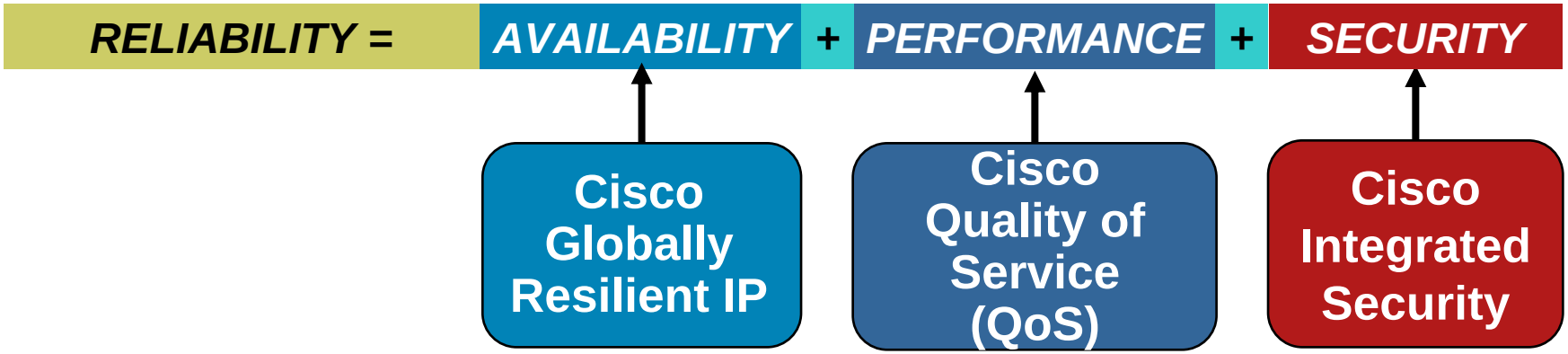
Reliability Goal: Eliminate Network Failure Points

Application	Cost of Downtime per Minute
ERP	$13,000
Supply chain mgmt	$11,000
E-commerce	$10,000
Internet banking	$7,000
Customer service center	$3,700
Electronic funds transfer	$3,500
Messaging	$1,000

Survey of 250 Fortune 1000 companies

Source: Forrester Research Inc

How Do We Make the Network Reliable?
(CxO & Network Manager Perspective)



What is QoS?
Basic Perspectives

The User Perspective

- The network capability to provide the desired application performance
- It's all about the applications and their users
- Voice, Video, and Data!

The Network Manager Perspective

- Bandwidth, delay, jitter, and packet loss are *policy variables* to achieve the desired application performance

What is QoS?
Business Relevance

- Cisco QoS empowers the network manager to set *Proactive Policies* in delivering the desired application performance

- **Increased User Satisfaction**
- **Increased Productivity**

Why Not Just "Add Bandwidth" For Performance?

- **Adding bandwidth is NOT free!**

A Real Example: Hotelier with 2000 locations in the U.S.

Going from 128Kbps to 256Kbps for application performance =

$256 extra per site/month =

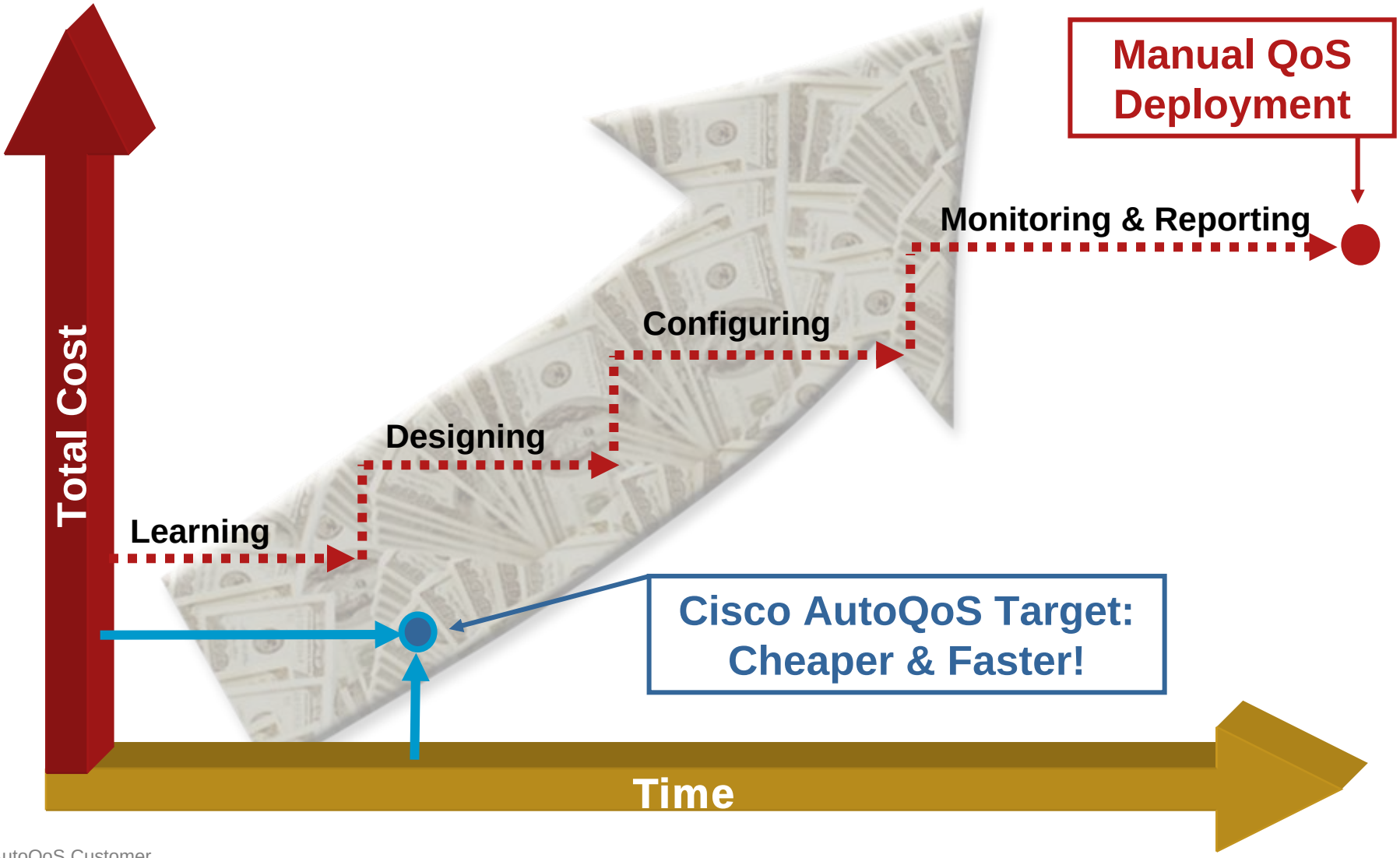
$512K/month for 2000 sites =

$6.1M/year in additional cost!

QoS provided required network performance for the hotel reservation application, saving the customer recurring OPEX!

- **All bandwidth is not created equally**
  - **Dependent on location, SLA, and Service**
- **Need to prioritize bandwidth utilization on the network**
  - **There are speed mismatches, leading to congestion (transient or persistent), in every network**
  - **Insurance policy for business critical applications**

The QoS Challenge:
Reduce the Cost & Time to Deploy QoS



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What does Cisco AutoQoS Do For Customers?

Uses intelligence to automate

- **Automation makes it simpler to**

  Get a quick start on QoS deployment

  Deploy QoS in the most common business scenarios

  Reduce operator and configuration errors

  Gain visibility into network & application performance

- **Simpler implies fast and cheaper**

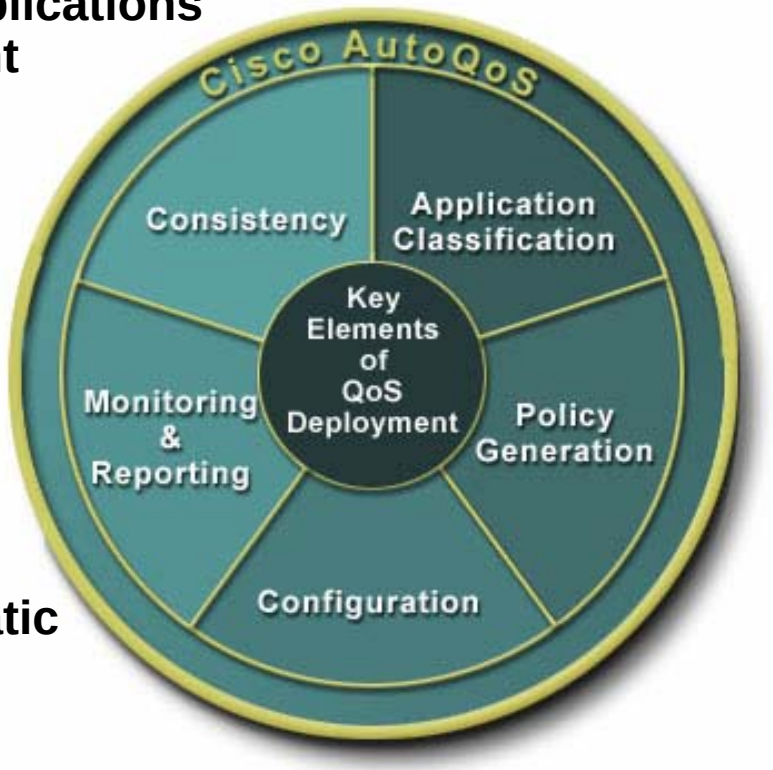
  Example Scenario: I need to add VoIP to my network

  - **Where do I begin for QoS on the network?**
  - **What should I monitor and report on?**

  Cisco AutoQoS drastically reduces learning, designing and configuration

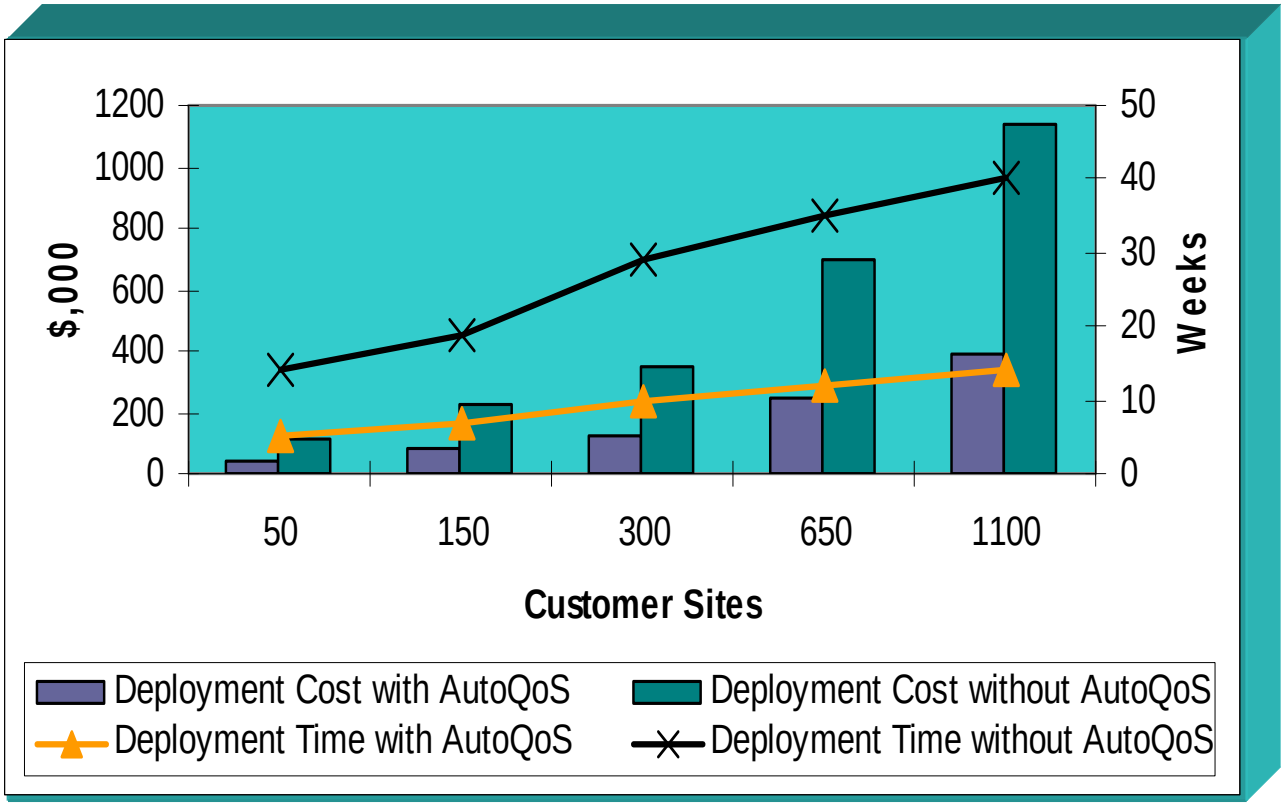
Cisco AutoQoS – *Automating the Key Elements of QoS Deployment*

1. **Application Classification**
   - **Example: automatically discovering applications and providing appropriate QoS treatment**
2. **Policy Generation**
   - **Example: auto-generation of initial and ongoing QoS policies**
3. **Configuration**
   - **Example: providing high level business knobs, and multi-device / domain automation for QoS**
4. **Monitoring & Reporting**
   - **Example: generating intelligent, automatic alerts and summary reports**
5. **Consistency**
   - **Example: enabling automatic, seamless interoperability among all QoS features and parameters across a network topology – LAN, MAN, and WAN**



The Proof is in the Savings with Cisco AutoQoS!

Up to 3 Times Cheaper & Faster QoS Deployments!



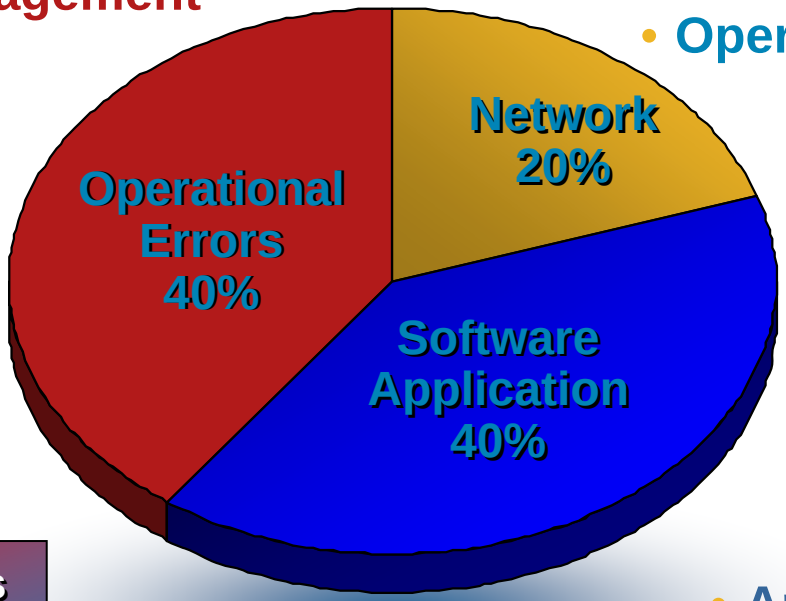
Faster QoS deployments allow customers to realize VoIP opportunities more quickly!

Not to Forget….

Human Error is the Most Significant Contributor to Downtime

- Platform Problems
- The network
- Operating system or hardware

- Change management
- Process consistency

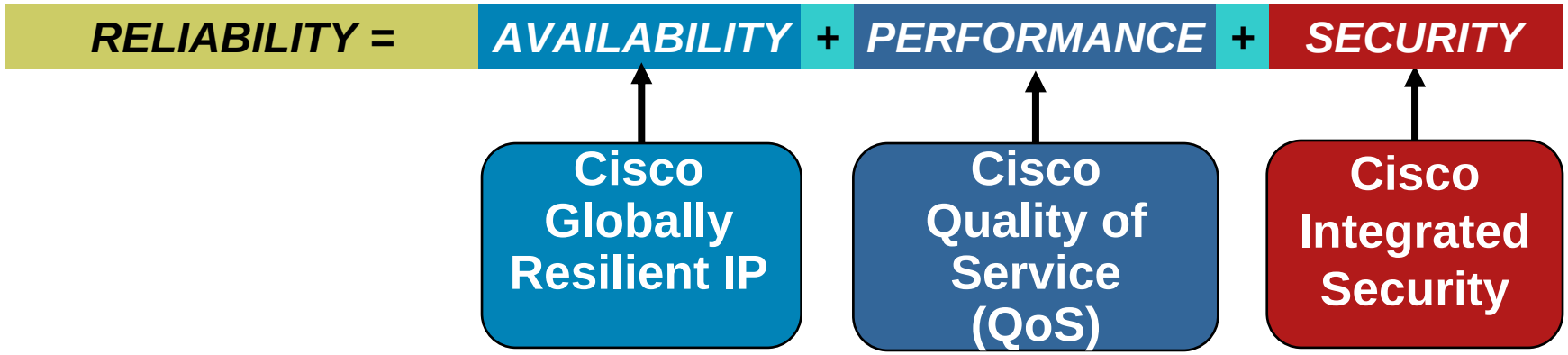


AutoQoS reduces potential for operator error

- Application bugs (ie: DNS)
- Misconfiguration

Source: Gartner Group, CNET News.com Jan 26, 2001

QoS Automation Reduces Operator Error!



Fewer knobs, and Fewer low-level knobs to tune!

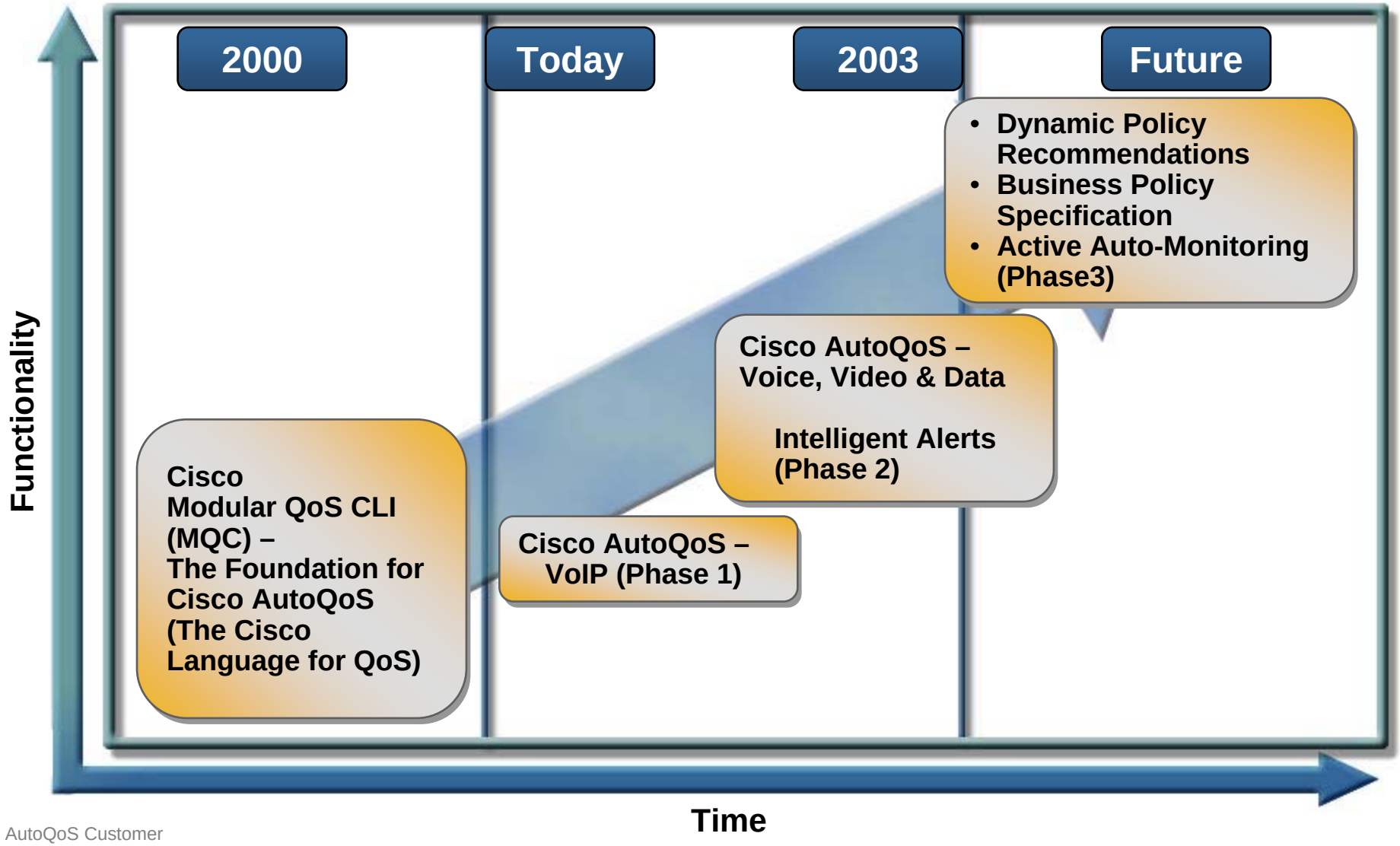
Simpler, Cheaper, and Faster

Cisco AutoQoS – *The Vision*

Evolve the network to an intelligent entity that tunes itself for QoS

- **Provide high-level business knobs**
- **Customer retains ultimate control**

The Future of Cisco AutoQoS



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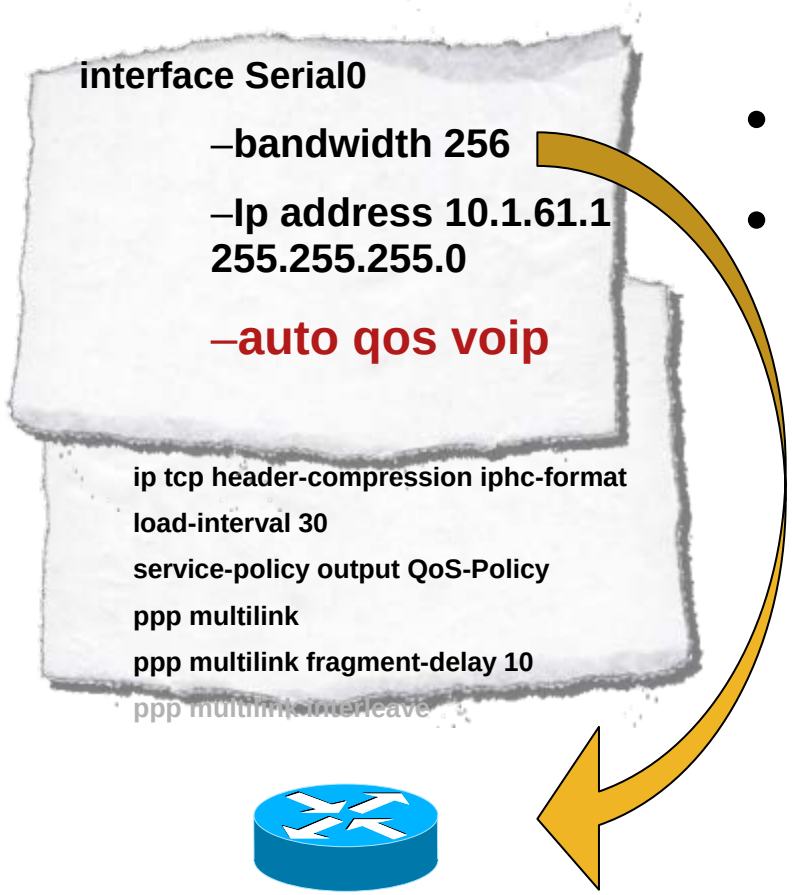
Cisco AutoQoS Phase1 –
'Automatic QoS for VoIP Traffic' (AutoQoS – VoIP)

Configures Each Switch or Router



- **LAN & WAN - Routers & Switches**
- **One single command enables Cisco QoS for VoIP on a given port/interface/PVC!**

Cisco AutoQoS – VoIP Feature Availability

Platform	Software	Availability
Cisco Catalyst 2950 and 3550 Switches	Cisco IOS Software Release 12.1(12c)EA1	Today!
Cisco Catalyst 6500 Series Switches	Cisco Catalyst OS 7.5.1	Today!
Cisco 2600, 2600-XM, 3600, 3700, 7200 Series Routers	Cisco IOS Software Release 12.2(15)T	Q2 CY'03
Cisco Catalyst 4500 Series Switches	Cisco IOS Software Release 12.1(19)E	Q3 CY'03

Using Cisco AutoQoS – VoIP & CiscoWorks QPM

Configures Each Switch or Router

interface Serial0

–bandwidth 256

–Ip address 10.1.61.1 255.255.255.0

–auto qos voip

ip tcp header-compression iphc-format

load-interval 30

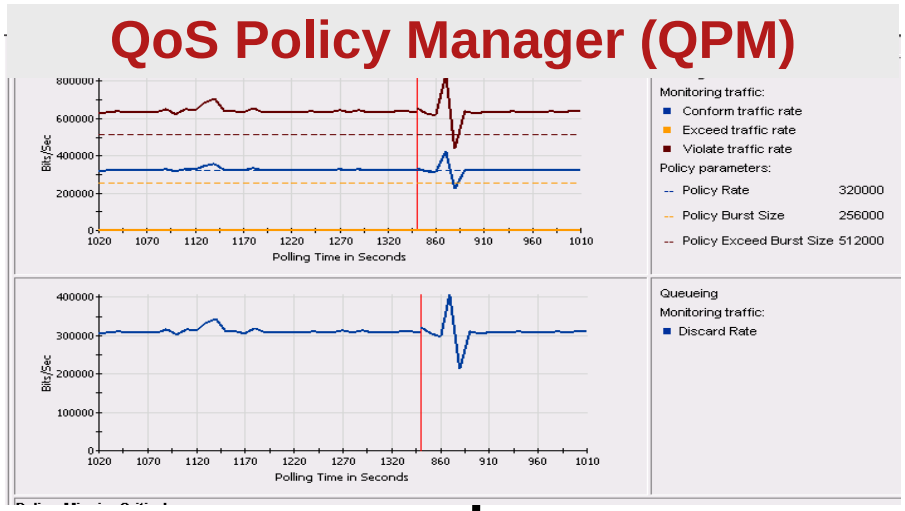
service-policy output QoS-Policy

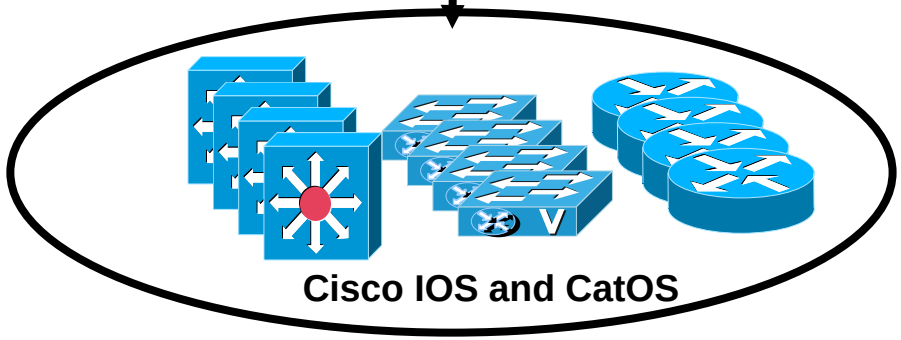
ppp multilink

ppp multilink fragment-delay 10

ppp multilink interleave

Centralized, web-based tool to manage network-wide QoS for multiple devices





Agile QoS Deployment for VoIP Using Cisco AutoQoS-VoIP and CiscoWorks QPM

- **Application Classification**
  - Cisco AutoQoS identifies VoIP bearer and control traffic
- **Policy Generation**
  - Cisco AutoQoS evaluates the network environment and generates initial policy on a given Port, Interface, or PVC
- **Configuration**
  - Cisco AutoQoS provides a single command to enable QoS on each interface/PVC
  - QPM provides centralized network-wide configuration, management and monitoring
- **Monitoring & Reporting**
  - Traps issued on VoIP packet drops
  - QPM uses data received from network devices to generate QoS reports
- **Consistency**
  - Cisco AutoQoS is fully inter-operable between LAN & WAN devices

Cisco AutoQoS Benefits Router Platforms

Cisco 2600, 2600-XM, 3600, 3700, and 7200 Series Routers

- User can meet the voice QoS requirements without extensive knowledge about:
  - Underlying technologies (ie: PPP, FR, ATM)
  - Service policies
  - Link efficiency mechanisms
- AutoQoS lends itself to tuning of all generated parameters & configurations

Automation with Cisco AutoQoS Router Platforms

- Supported on serial (PPP & HDLC), ATM PVCs, FR DLCIs and FR/ATM links
  - Only on point-to-point sub-interfaces for FR and low speed ATM PVCs
  - Policies are specific to underlying transport layer protocol
- Automatically identifies H.323, MGCP, and Skinny Signaling Protocols
- Command Line Interface

`auto qos voip [trust]` – Untrusted Mode by default

`auto qos voip [fr-atm]` – Enabled on FR DLCI for FR/ATM Interworking

Automation with Cisco AutoQoS Router Platforms (Cont)

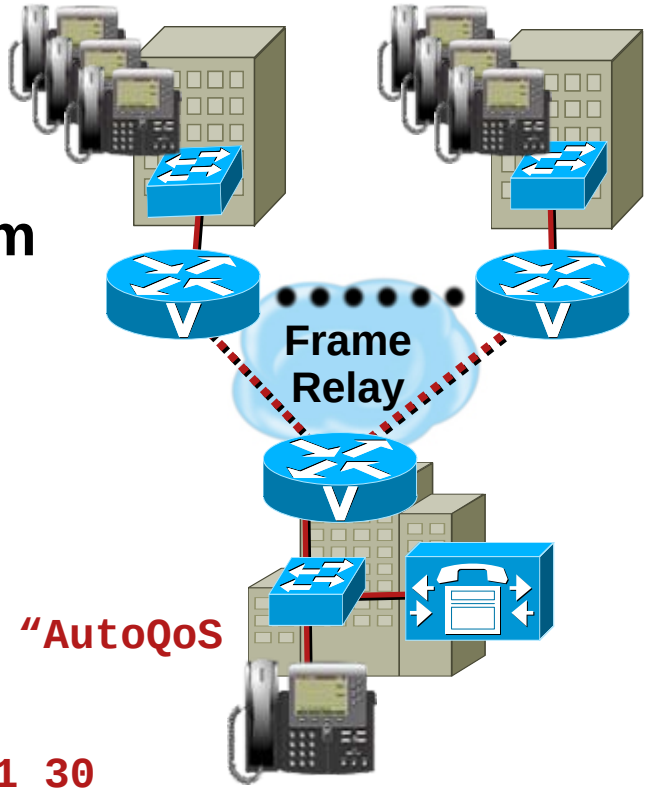
- **Classification**
  - **Trust: relies on DSCP markings from wwitches (DSCP EF & AF31)**
  - **Un trust: nBAR RTP Payload Type Classification & Access Lists**
- **Provisioning**
  - **LLQ protects voice bearer and voice signaling traffic**
  - **WFQ shares bandwidth fairly in the Best Effort Data class**
- **Policy Generation**
  - **Enables high- (>768Kbps) and low- (<=768Kbps) speed QoS**
- **Monitoring**
  - **SNMP monitoring events are reported if the SNMP server is enabled**
  - **Thresholds activated in RMON alarm table to monitor LLQ drops**

Automation with Cisco AutoQoS Router Platforms (Cont)

With AutoQoS

Monitoring Drops in LLQ

- Thresholds are activated in RMON alarm table to monitor drops in Voice Class
- Default drop threshold is 1bps




```
Rmon event 33333 log trap AutoQoS description “AutoQoS
SNMP traps for Voice Drops” owner AutoQoS

Rmon alarm 33350 cbQoSCMDDropBitRate.2881.2991 30
Absolute rising-threshold 1 33333 falling-threshold 0
Owner AutoQoS
```

RMON event configured generated by AutoQoS

Functionality & Benefits – WAN

Functionality	Benefits
Auto-determination of Wide-Area Network (WAN) Settings	**Automatic determination of WAN settings for fragmentation and interleaving, compression, encapsulation, and Frame Relay-ATM interworking.** Eliminates the need to understand QoS theory and design practices in common deployment scenarios.
Initial Policy Generation	**Initial Policy Generation provides users an advanced starting point for VoIP deployments.** This reduces the time needed to establish an initial feasible QoS policy solution that includes providing QoS to VoIP bearer traffic, signaling traffic, and best-effort data.
Traps & Reporting	**Syslog & SNMP traps provide visibility into the Classes of Service deployed,** and notification of abnormal events such as VoIP packet drops.
Intelligent Classification of Network Traffic	**Using Cisco Network Based Application Recognition (nBAR) for deep and stateful packet inspection, this feature can identify VoIP bearer and control traffic.** Simplifies QoS configurations by reducing – and in some cases eliminating – the need for Access Control Lists (ACLs).

Cisco AutoQoS Benefits Switch Platforms

Cisco Catalyst 6500, 4500, 3550, and 2950EI Switches

- **User can meet the voice QoS requirements without extensive knowledge about:**
  - **Trust boundary**
  - **CoS to DSCP mappings**
  - **Weighted Round Robin (WRR) & Priority Queue (PQ) scheduling parameters**
- **Generated parameters and configurations are user tunable**

Automation with Cisco AutoQoS Switch Platforms

- **Single command at the interface level configures interface and global QoS**
  - **Support for Cisco IP Phone & Cisco Soft Phone**
    - **Support for Cisco Soft Phone currently exists only on the Cat6500**
  - **Trust Boundary is disabled when IP Phone is moved / relocated**
  - **Buffer Allocation & Egress Queuing dependent on interface type (GE/FE)**
- **Supported on Static, dynamic-access, voice VLAN access, and trunk ports**
- **CDP must be enabled for AutoQoS to function properly**
- **Cisco Catalyst 2950 EI supports WRR, Strict Priority Scheduling, and Strict Priority Queuing**

Automation with Cisco AutoQoS Switch Platforms (Cont.)

Command Line Interface

- **Cisco Catalyst 6500 Switch**

  Single Command: `set port macro <mod/port> [ciscosoftphone | ciscoipphone]`

  `Global: set qos autoqos`

  `Interface: set port qos autoqos <mod/port> voip [ciscosoftphone | ciscoipphone]`

  `Trust Boundary: Set port qos autoqos <mod/port> trust [cos|dscp]`

- **Cisco Catalyst 3550 and 2950EI Switches**

  `auto qos voip trust` – QoS Labels in ingress packets are trusted

  `auto qos voip Cisco-phone` – Extends trust boundary if IP Phone detected

- **Cisco Catalyst 4500 Switch**

  Similar to Cat 3550/2950

Functionality & Benefits – LAN

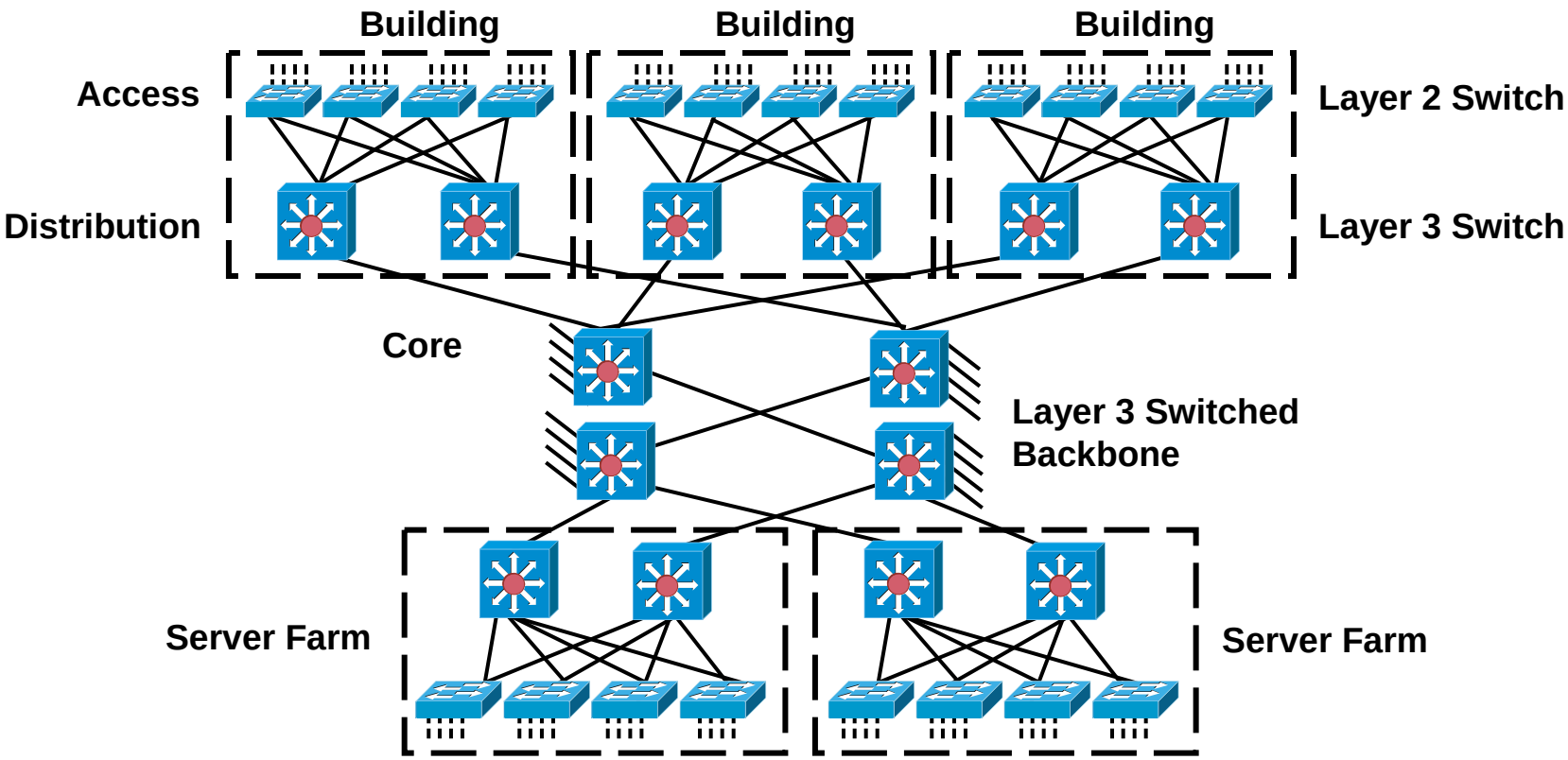
Functionality	Benefits
Simplified Configuration	In one command, Cisco AutoQoS configures the port to prioritize voice traffic without affecting other network traffic. Includes the flexibility to tune Cisco AutoQoS settings for unique network requirements.
Automated and Secure	**Automatically detects Cisco IP Phones and enables Cisco AutoQoS settings (Catalyst 2950 & 3550).** Prevents malicious activity by disabling QoS settings when a Cisco IP phone is relocated/moved.
Optimal VoIP Performance	**Leverages decades of networking experience, extensive lab performance testing, and input from a broad base of customer AVVID installations to** determine the optimal QoS configuration for typical VoIP deployments. Uses all advanced QoS capabilities of the Cisco Catalyst switches.
End-to-End Interoperability	**Designed to work in harmony with the Cisco AutoQoS settings on all other Cisco switches and routers,** ensuring consistent end-to-end quality of service.

Cisco *AutoQoS - VoIP* Framework
DiffServ Functions Automated

Fine tuning of AutoQoS generated parameters by user, if desired

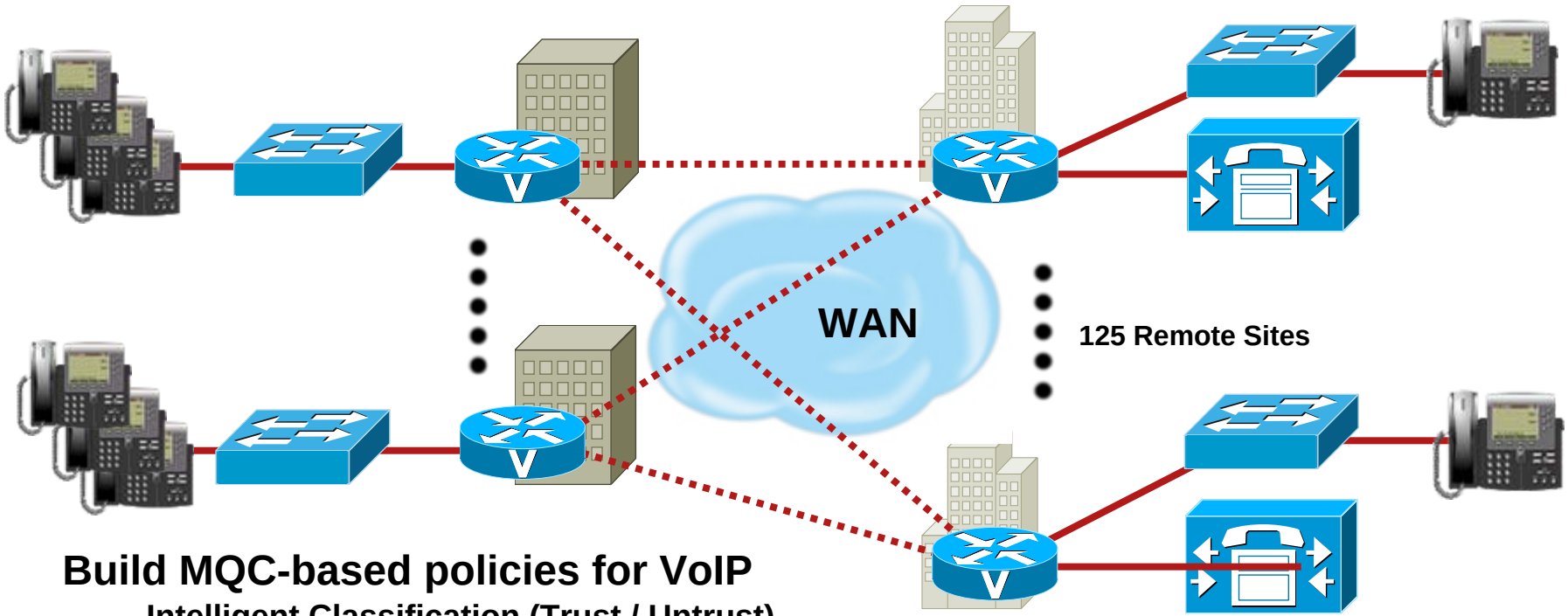
DiffServ Function	Cisco IOS / CatOS QoS Feature	Behavior
Classification	NBAR DSCP, Port	Classification of VoIP based on packet attributes or port trust
Marking	Class-based marking	Set L3 / L2 attributes to categorize packets into a class
Congestion Management	Percentage-based LLQ, WRR	Provide EF treatment to voice & BE treatment to data
Shaping	Class-based shaping or FRTS	Shape to CIR to prevent burst & smooth Traffic to Configured Rate
Link Efficiency Mechanism	Header compression	Reduce the VoIP bandwidth requirement
Link Efficiency Mechanism	Link Fragmentation & Interleaving	Reduce jitter experienced by voice packets

Automation with Cisco AutoQoS – VoIP Intelligence in the LAN



- Enable trust boundary (phone, access, uplink/downlink)
- Enable Priority Queuing where required
- Modify queue admission criteria where required
- Configure CoS to DSCP and IP Prec to DSCP maps where required

Automation with Cisco AutoQoS – VoIP Intelligence in the WAN



Build MQC-based policies for VoIP

- Intelligent Classification (Trust / Untrust)
- High- and low-speed QoS policies

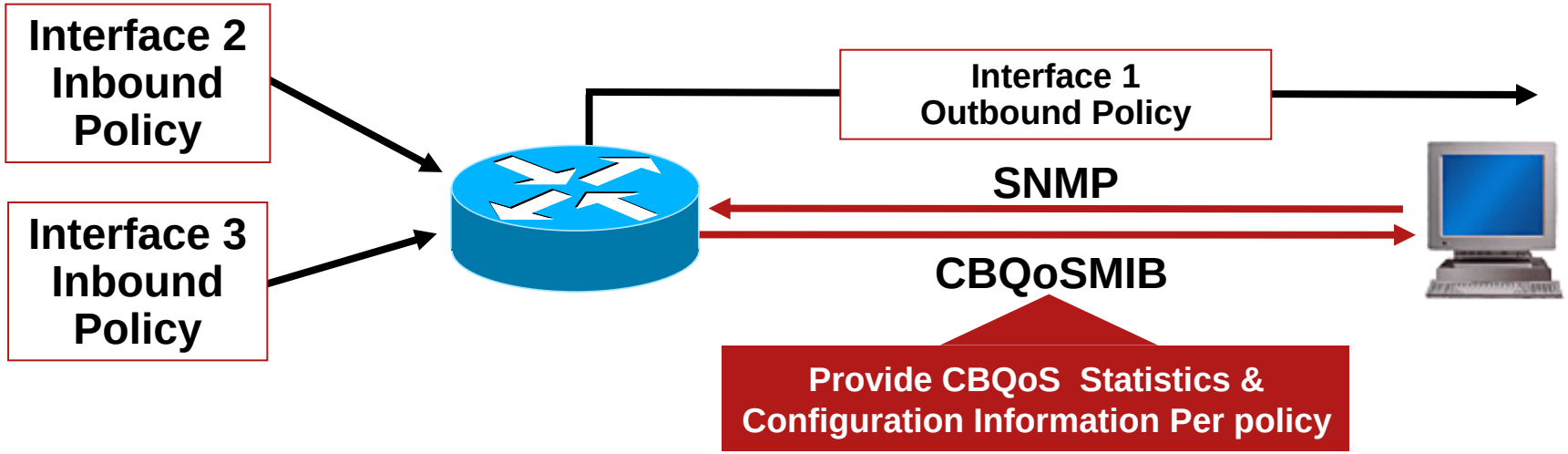
Automatically enable QoS features specific to transport (FR, ATM, PPP, FR-to-ATM)

- Enable Traffic Shaping where required
- Enable LFI (FRF.12, MLP) where required
- Enable CRTP

Monitoring and SNMP Alerts

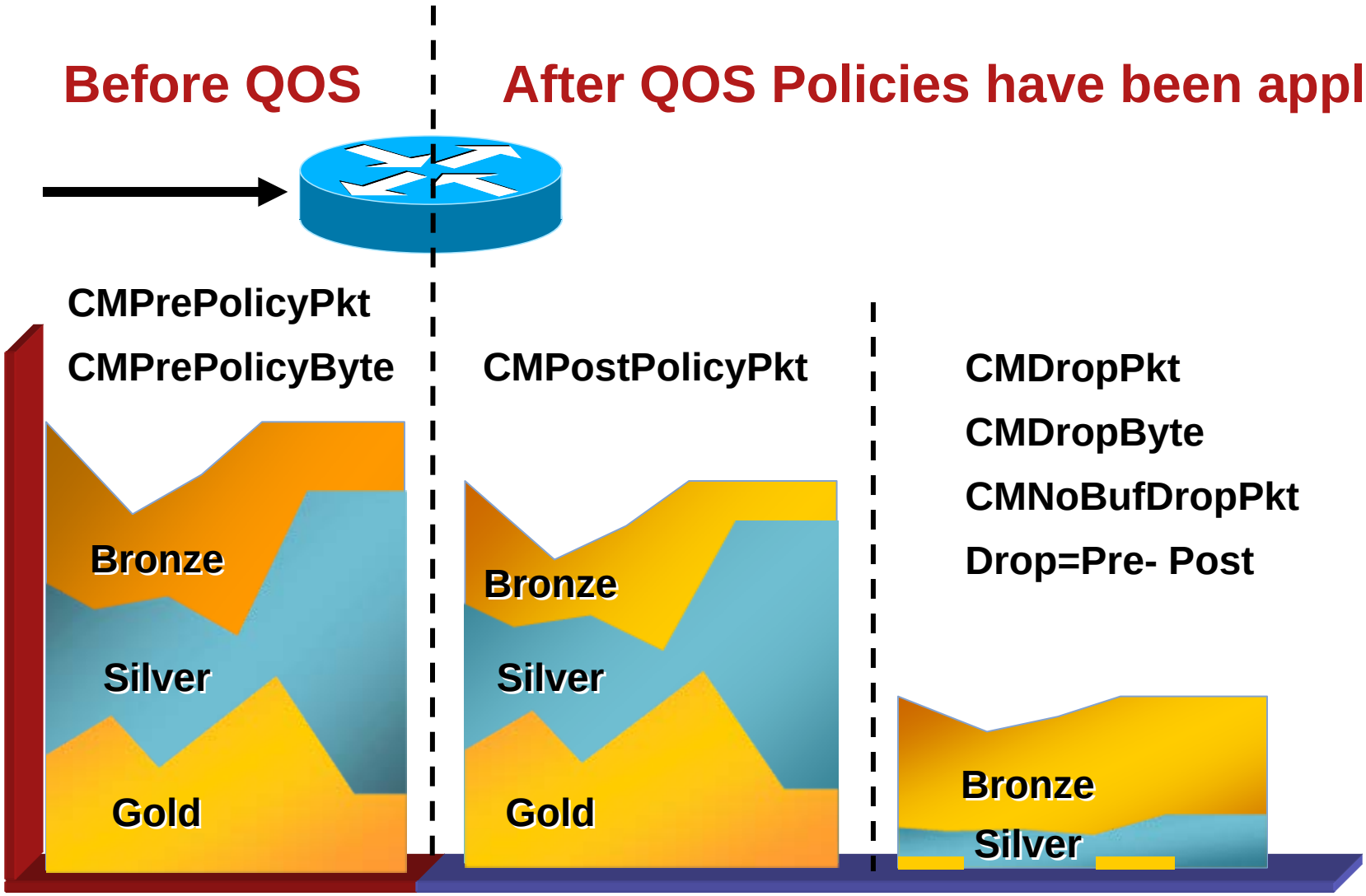
QoS Deployment for VoIP – Class-Based QoS MIB (CBQoSMIB)

- Provides read access to configuration and statistical information for MQC based QoS Policies
- Provides MQC configuration information and application statistics
- Provides CBQoS statistics on a per-policy/per-interface or PVC basis
- Monitor pre- and post-policy bit rates on a device

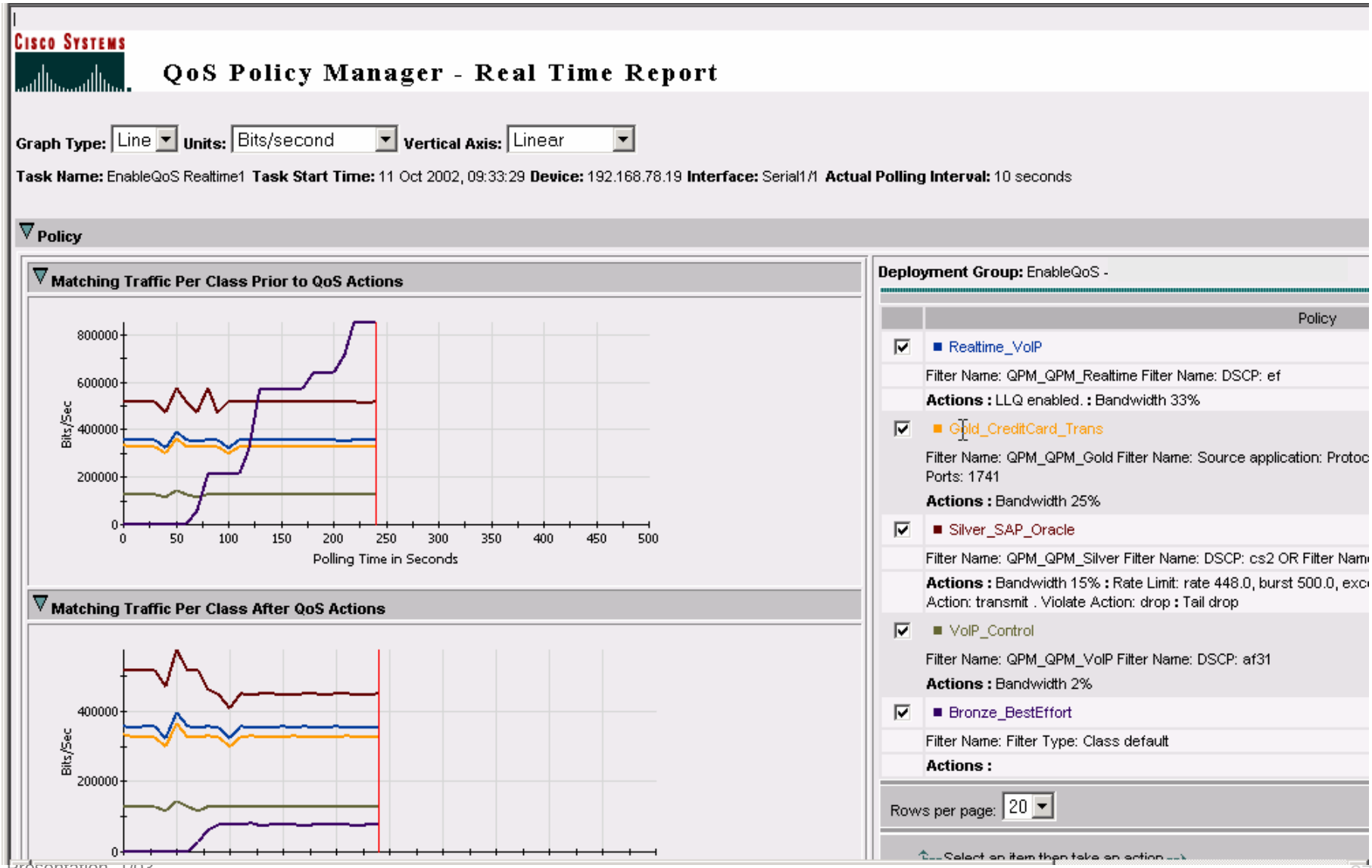


ftp://ftp.cisco.com/pub/mibs/v2/CISCO-CLASS-BASED-QOS-MIB.my

QoS Deployment for VoIP - Monitoring and Reporting with CBQoSMIB & QPM 3.0



QoS Deployment for VoIP – An example using QPM 3.0



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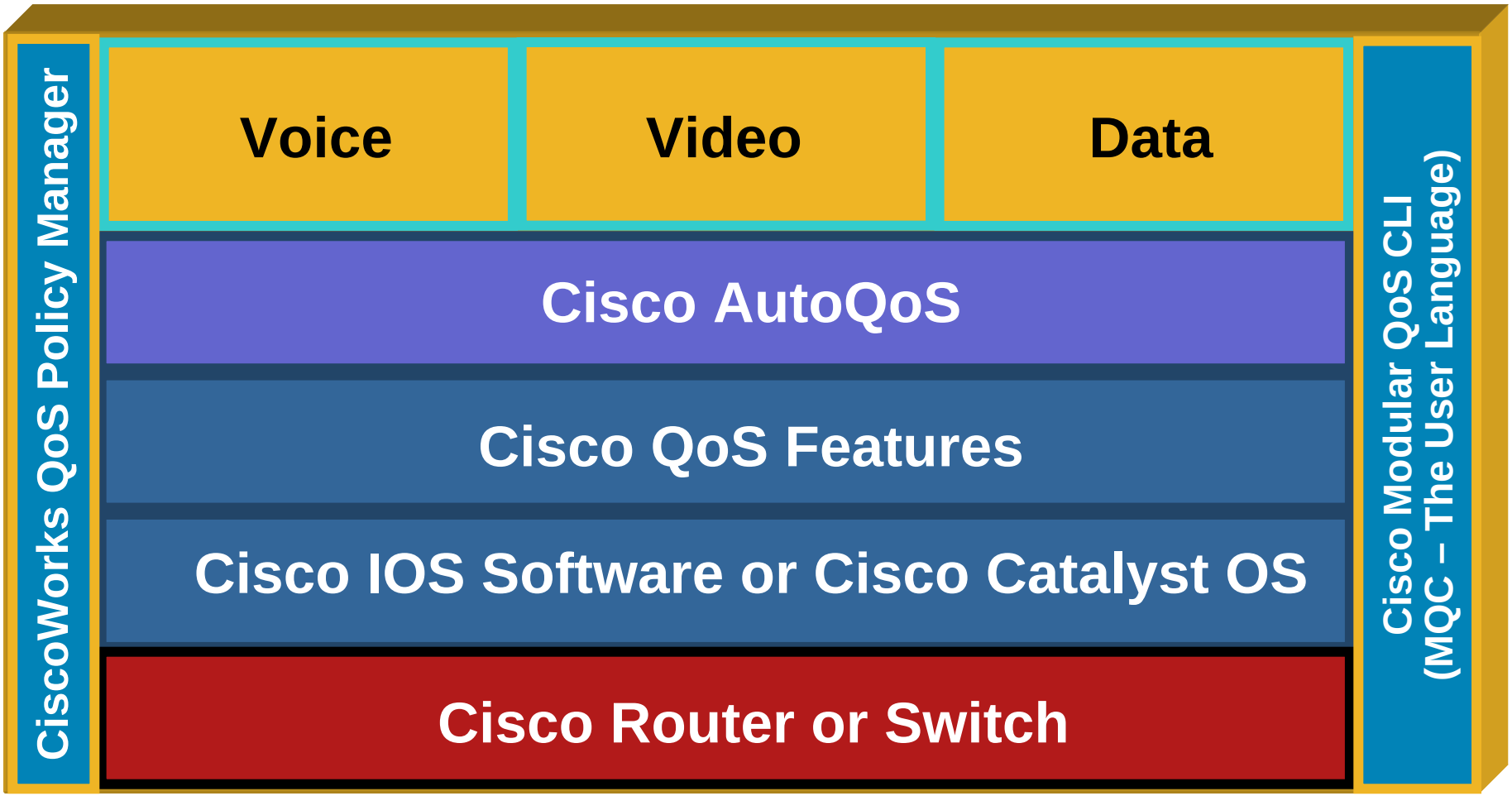
Understanding the Complete Cisco QoS Picture

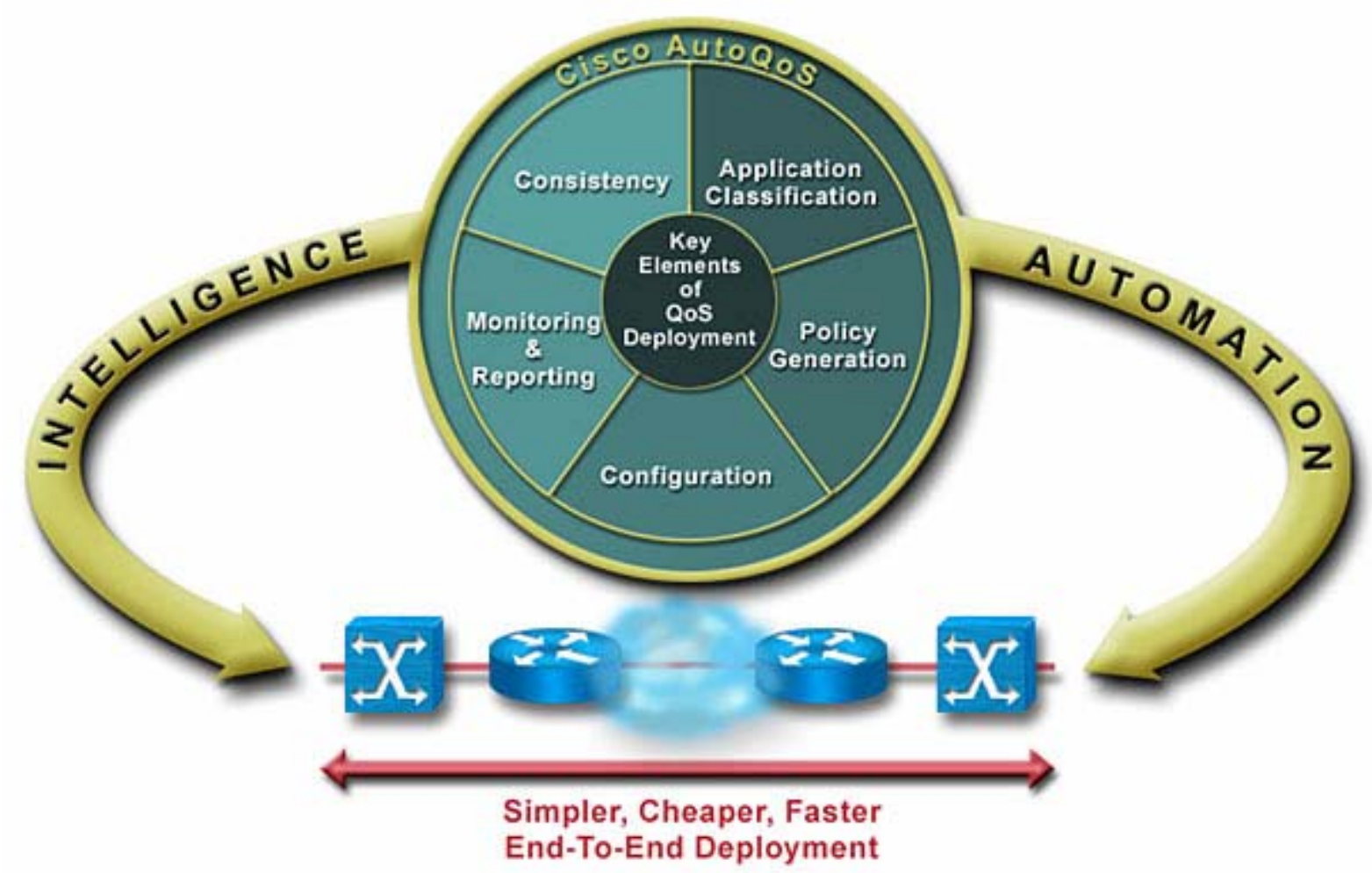


The Cisco Advantage –*Most Comprehensive QoS Functionality Available*

- ✓ First to ship Advanced Differentiated Services Toolkit in 2000
- ✓ Comprehensive QoS language framework via MQC
- ✓ First to ship Intelligent Application Level classification (Cisco Network Based Application Recognition - NBAR)
- ✓ Complete QoS monitoring & reporting support with Cisco Works QPM 3.0
- ✓ Broadest platform support (switch & router space) for QoS
- ✓ Full interoperability across the LAN & WAN DiffServ nodes
- ✓ Only vendor to ship a Complete End-to-End Differentiated Services solution

First to ship QoS Automation

A New Paradigm for QoS
Simpler, Cheaper, Faster QoS Deployments



References

- **Cisco QoS Home Page**
  - http://www.cisco.com/go/qos
- **Cisco QPM 3.0**
  - http://www.cisco.com/en/US/products/sw/cscowork/ps2064

Total Cisco QoS Picture
Comprehensive Functionality for Cost Savings

QoS Element	Cisco AutoQoS / QoS Toolkit	Generic Router Vendors	Generic Switch Vendors	Appliance Vendors
Policy Generation (Comprehensive Toolkit)				
Consistency (Common User Language)				
Application Classification				
Easy Configuration				
Monitoring & Reporting				
Total Cost of Solution	$	$$	$$$	$$

Outdated **Lagging Behind** **Leading Edge**