Cisco Expo 2008

A New Era of Wan Edge Solutions

Introducing Cisco ASR 1000 Series Aggregation Services Routers

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Product Marketing - Midrange Routing Business Unit

Cisco: History of Innovation Getting Ahead of Market Trends

	Then	Now
1984	Cisco founded by two people, developing the first mainstream IP router	Employees exceed 63,000
1986	Ships first router	More than 60 million routers shipped
1995	Cisco introduces 7200 series optimized WAN aggregation router	Shipped in excess of 350,000 units
2001	Cisco introduces 7600 series, establishing Carrier Ethernet	More than 50,000 shipped, $1B annual run rate
2004	CRS-1 introduced for core, declared overkill by some with predictions of no more than 50 ever needed	More than 1000 shipped in less than three years
2005	Integrated services router introduced for CPE	More than 2,000,000 shipped in first two years
2008	→	Cisco Aggregation Services Router Series Introduced for Edge

Introducing…

Industry's Most Powerful, Compact Aggregation Routers

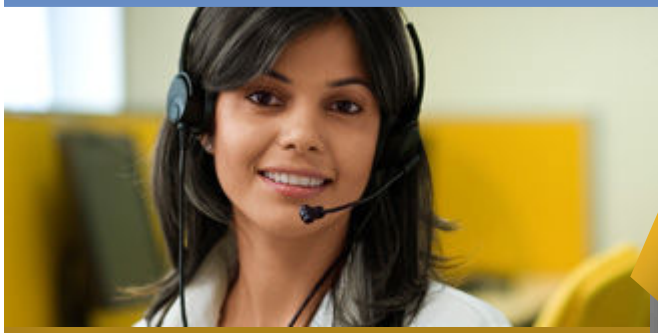
Cisco ASR 1000 Series

Transforming and Extending the Network Edge

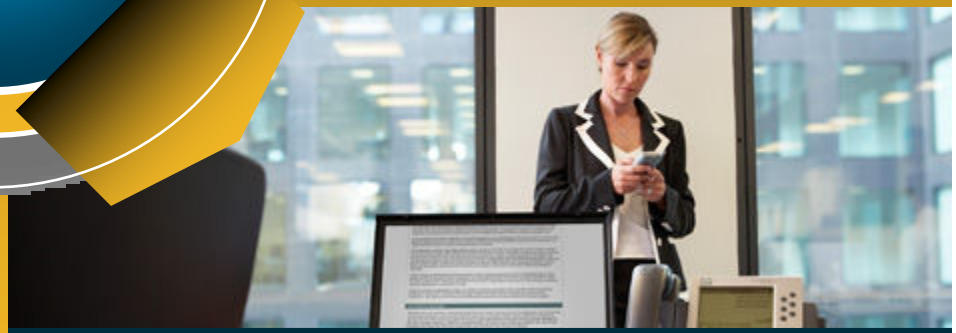
New Enterprise WAN Requirements
Services Without Compromise…or Complexity!

High-Performance Services

Integrated Security



Redefined WAN

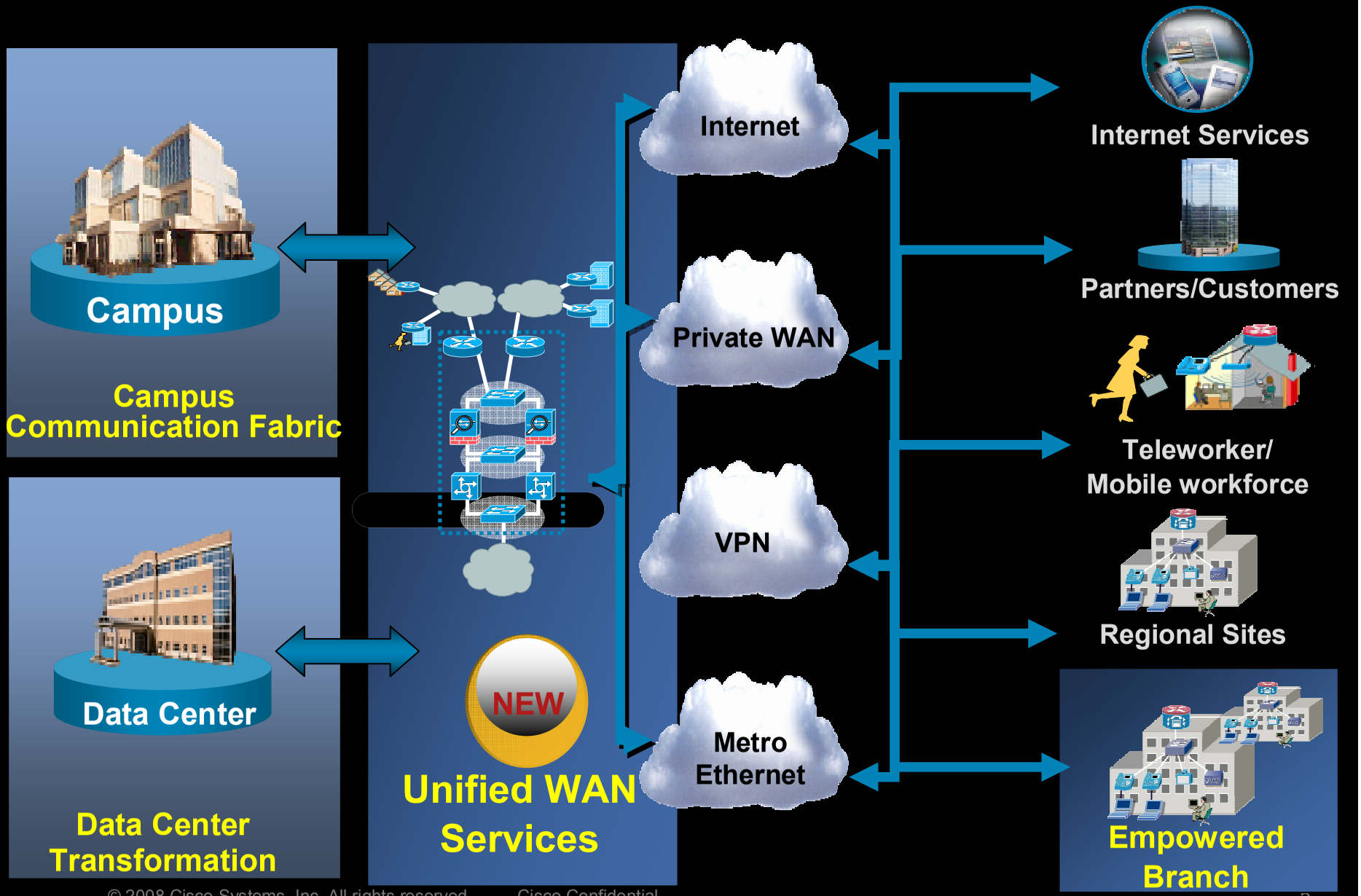


Non-Stop Communications

Application Intelligence

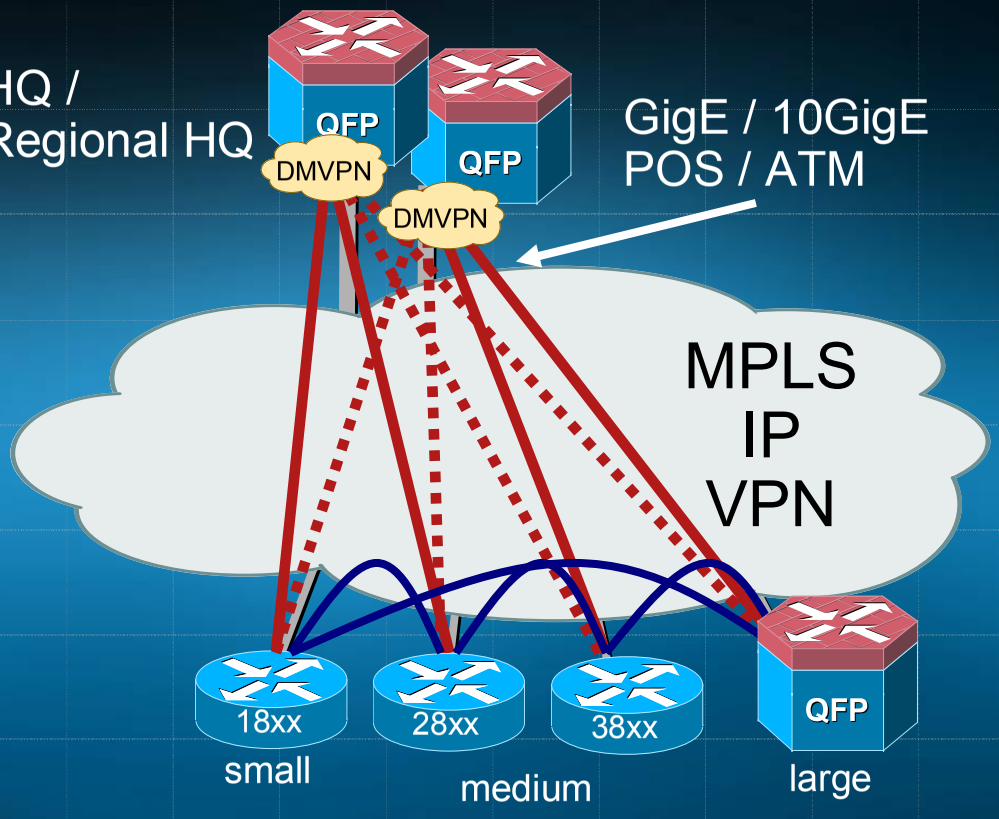
Operational Efficiency

ASR1000: Enterprise Places in the Network



ASR 1000 → Unified WAN Services, Scalable & Secure

Managed FR / ATM (higher BW)
Going to → Managed L2VPN / L3VPN



Branch Offices
Full T1's w/ satellite, DSL etc. backup
Going to multiples of Ethernet/DSL/Wireless…

Objective

- Offer FULL SERVICE IPsec VPN Aggregation Router which scales to growing BW demands of SP IP VPNs

Benefits

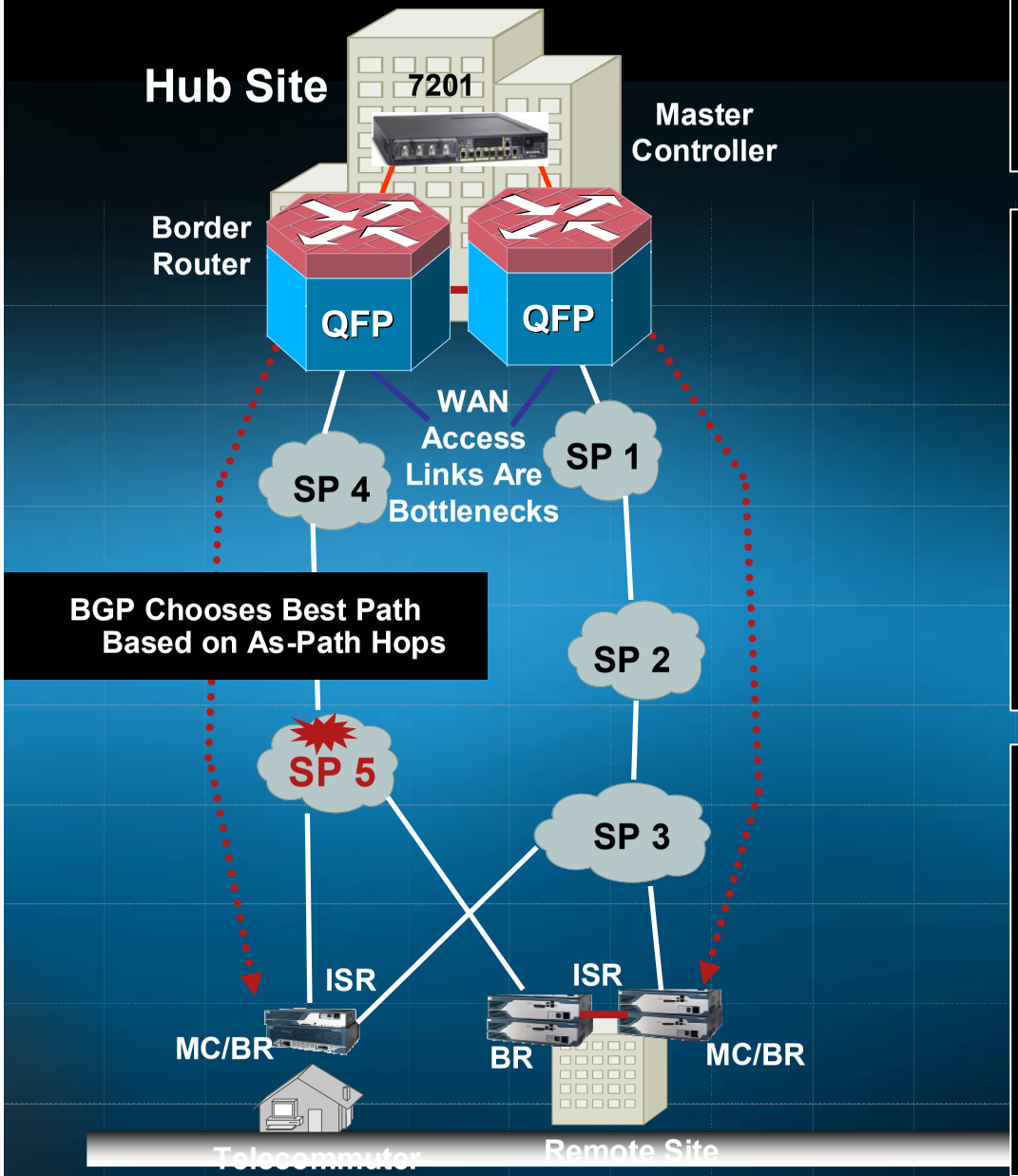
- Consolidate a stack of 7200s into 1 ASR 1000
- Easy transition to increasing crypto performance
- No service blades required
- Optimized for QOS & Multicast

A Cisco First!

ASR 1000 delivers…

- 1000s of Sites / 10K IPsec tunnels Up to 3 Gbps crypto + 7 Gpbs non-crypto
- 3DES/AES/SHA-1/IKEv1
- DMVPN Phase 2 support

ASR 1000 → WAN Optimization



Objective

- Optimized treatment of all WAN traffic

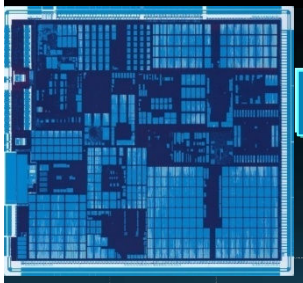
Benefits

- Improve network performance
- Route around problems at first sign of issue
- Path Selection based upon Application requirements
- Business critical applications & Voice over IP enjoy dynamic optimization - constantly tracked

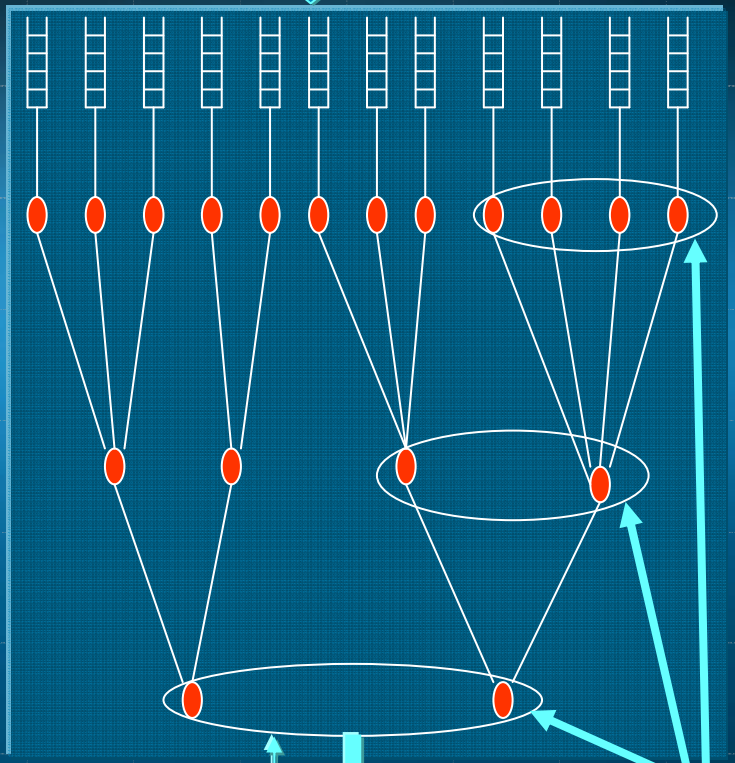
ASR 1000 delivers…

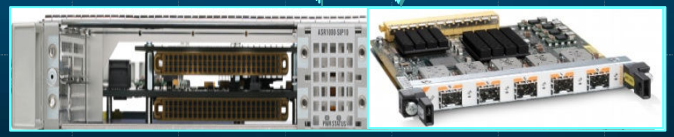
- Optimization for Private and Public WANs w/o Service Blades
- Better throughput for certain prefixes
- High flow scalability & NBAR classification capability that can be leveraged by PFR

ASR 1000 → Superior Application Availability



The QFP Traffic Manager implements hierarchies of schedules in hardware.





Objective

- Guarantee delivery of High Priority Applications regardless of which features are enabled

Benefits

- Guarantees High Priority Applications to be forwarded up to entire system BW.
- Clamps an arbitrary collection of Low Priority traffic to a certain BW
- High throughput for Quality of Service features
- Enables queue based operations without a performance hit

ASR 1000 delivers…

- Flexible Hierarchies
- 128K Queues
  - 2 Priority queues per policy
- Low 10s of usec of latency

Service Provider Trends
Increasing BW needs!

Video

Integral to nearly every major service experience

Web 2.0 Collaboration

Increasing dependency of services and applications

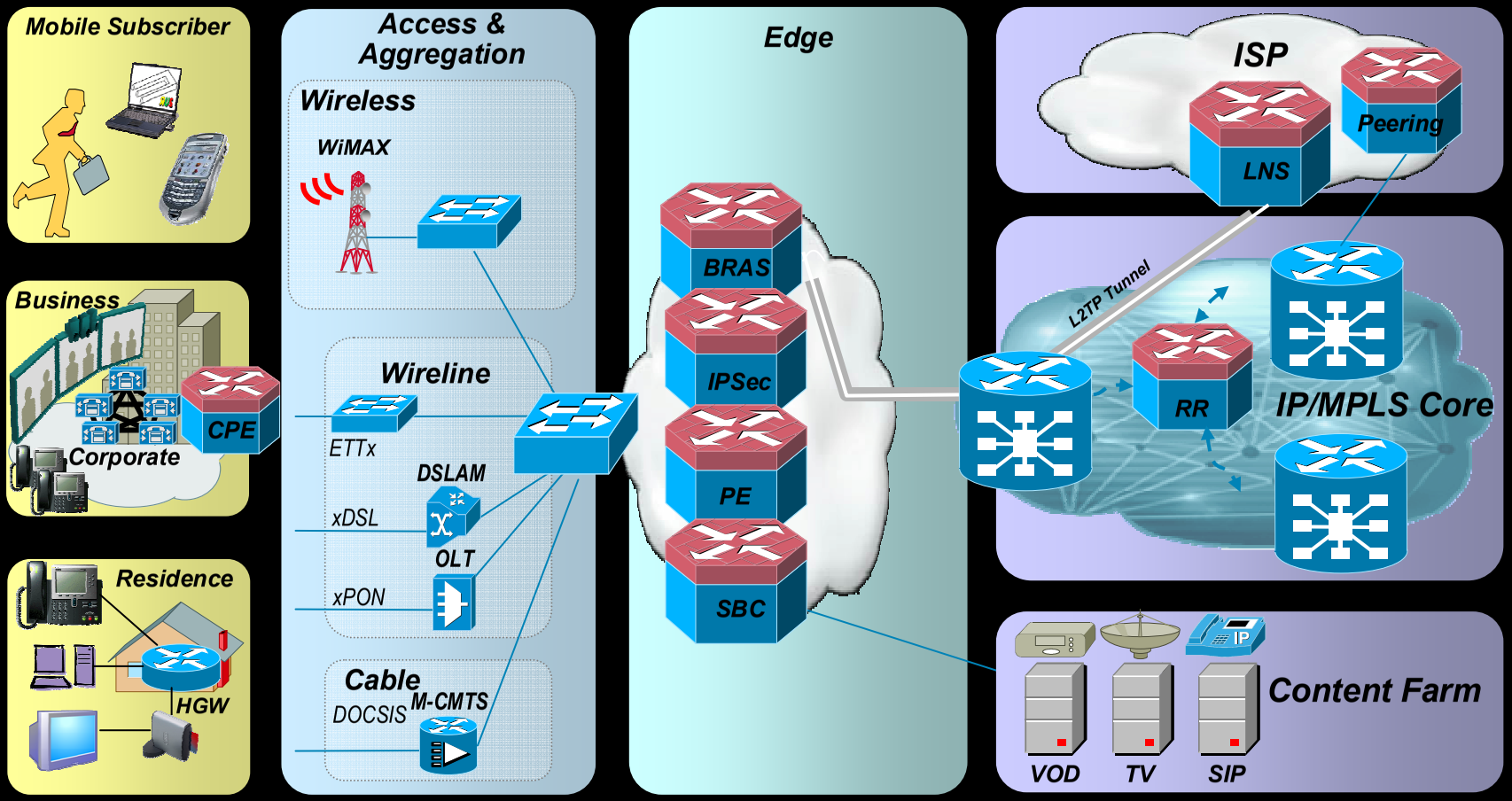
Emerging Services

Network Intelligence needed to seize market opportunities

Cost Efficiencies

CapEx and OpEx not growing as fast as change on networks, power not unlimited

ASR 1000 in Service Provider IP Next Generation Network

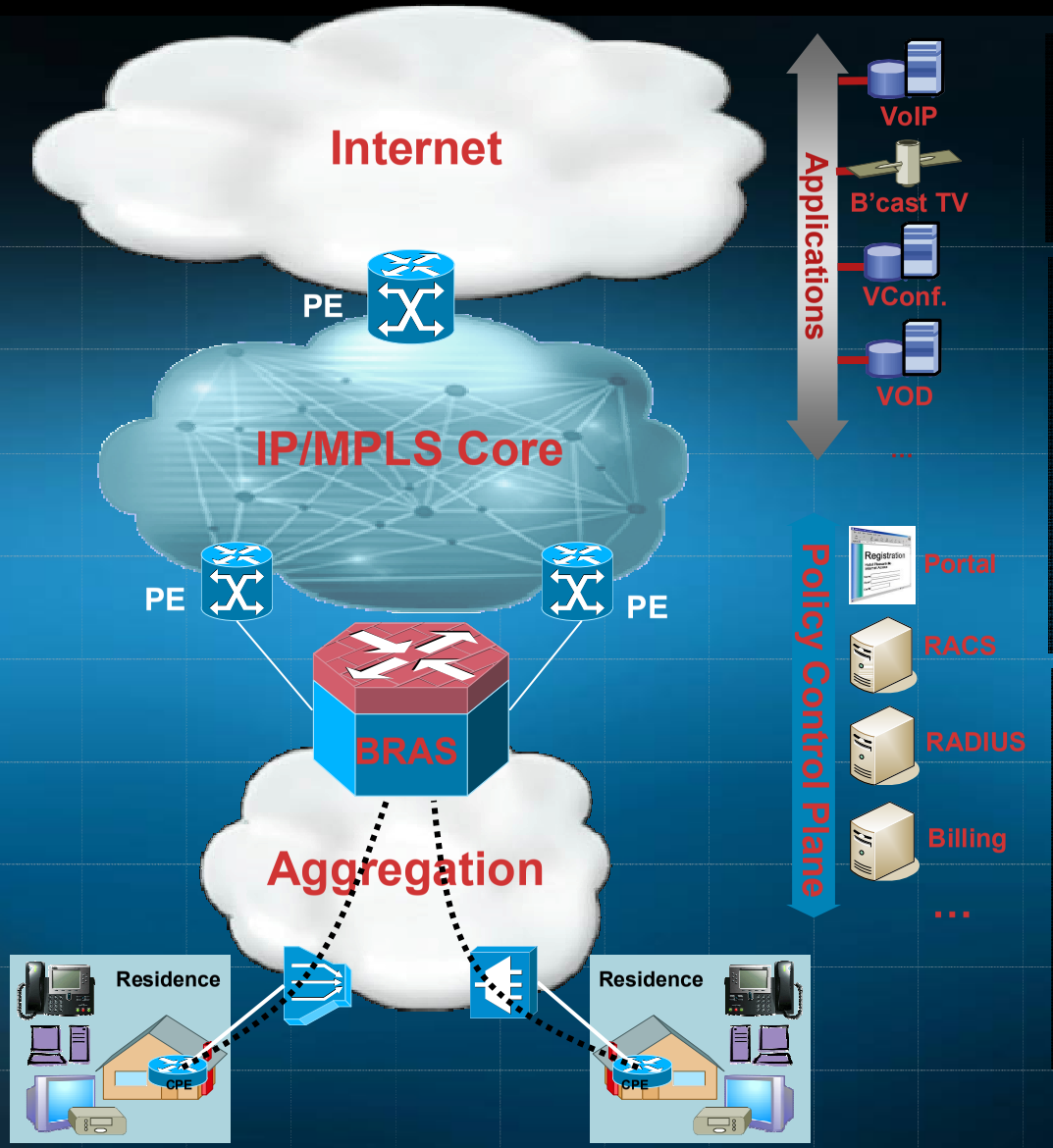


- High Speed CPE

- BRAS-PPP0E
- LAC, PTA, ISG
- IPSec Aggregator
- VoIP SBC
- PE (L3VPN PE)

- LNS
- Route Reflector
- Internet Peering

ASR 1000 → Distributed BRAS for PTA



Objective

- Offer high-speed Internet access focused on residential customers

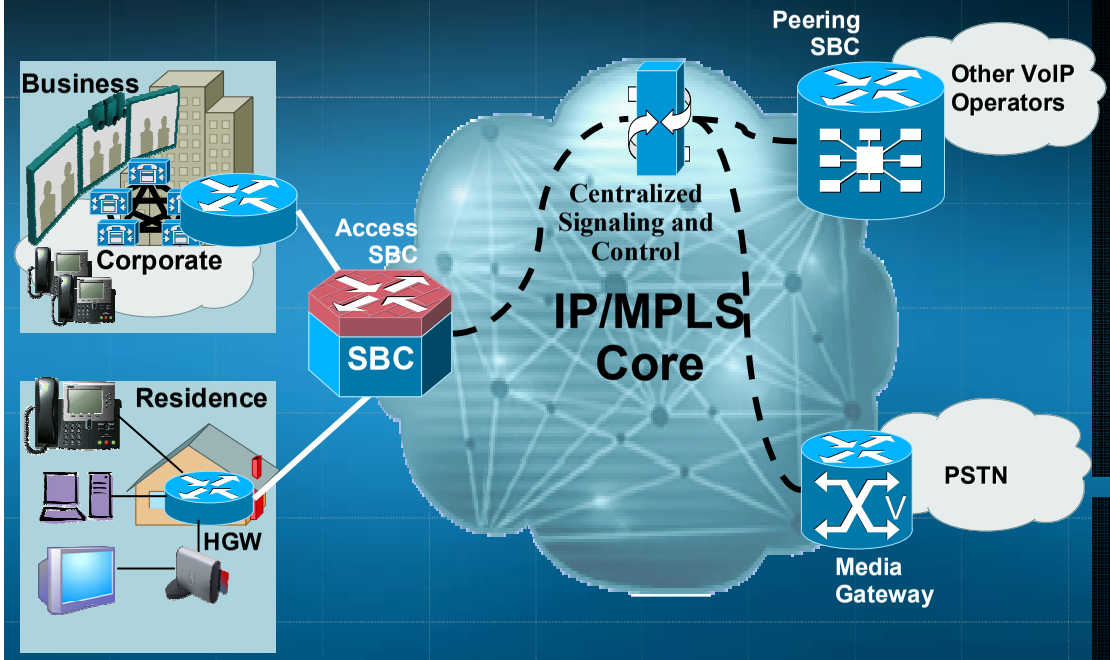
Benefits

- Various access speeds
- Different QoS levels
- End-to-end SLAs & reporting
- Optional: DSL fastpath
- Upsell service: voice, video, remote access into VPN

ASR 1000 delivers…

- Scalability up to 32K subscribers with QoS
- Broadband high availability (HA)
- Carrier-class modular chassis
- Integrated features for future value-added services

ASR 1000 → Session Border Controller



Objective

- To enable end-to-end feature rich and secure IP communications

Benefits

- SP solution (C-BGF) to support services such as IP PBX-to-SP peering, Telepresence and the fast-growing residential IP telephony.
- Eliminate need for overlay networks and standalone appliances
- Distributed SBC for scalable design w/ centralized signaling & control

ASR 1000 delivers…

- Integrated SBC solution w/o extra service blades
- Scalable solution, up to 32K sessions
- High Availability (SSO, ISSU)
- Consistent w/ other high end Cisco SBCs for features and interop
- Extensible through modular design

Cisco ASR 1000 Series
The Anatomy of Innovation

High Performance Services
- Instant-on services
- Future-ready provisioning
- Wire-speed secure services
- Reduced IT OpEx and CapEx

Integrated Security
- Instant-on highly available security services
- Tight integration of routing & security services
- Standards based, certified security services
- Auditable security services

NonStop Communications
- Rapid failover without service disruption
- In-service maintenance
- Reusable hardware
- Industry first - Dual-image software availability

Operational Excellence
- Reduced real-estate, power requirement
- Service and device consolidation
- Software redundancy, ISSU for hitless upgrades

Application Intelligence
- Ensures mission-critical application performance
- Full-circle optimization: Monitor, classify, control
- Meets compliance requirements

Cisco Routing Portfolio

Performance and Services Scalability

ISR Series

7200 Series

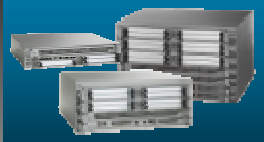
New

ASR 1000 Series

ASR 1000 with ESP-5G

New

ASR 1000 Series



ASR 1000 with ESP-10G

Catalyst 6500 Series

Cisco 7600 Series

Branch

Head Office / WAN Aggregation

ASR 1000 Series Routers

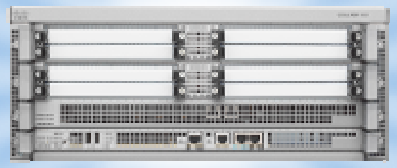
Industry's Most Powerful, Compact Aggregation Routers

ASR 1002

5–10 Gbps

- 3 SPA Slots
- Modular Embedded Services Processor (ESP)
- Software Redundancy

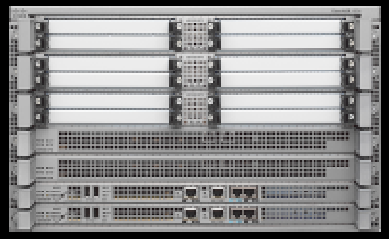
ASR 1004



10-20+ Gbps

- 8 SPA Slots
- Modular ESP & RP
- Software Redundancy

ASR 1006

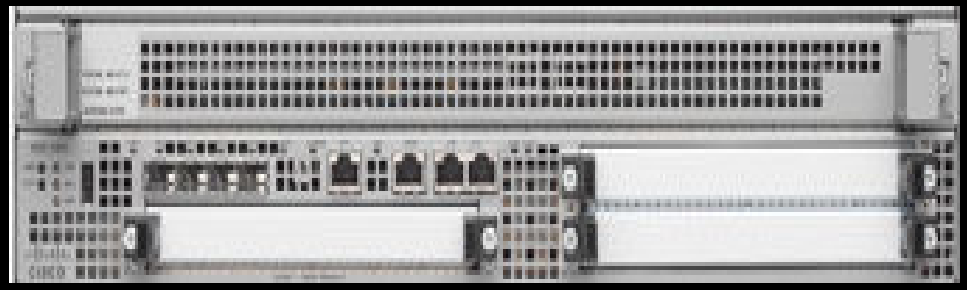


10-20+ Gbps

- 12 SPA Slots
- Modular ESP & RP
- Hardware Redundancy

Transforming and Extending the Network Edge

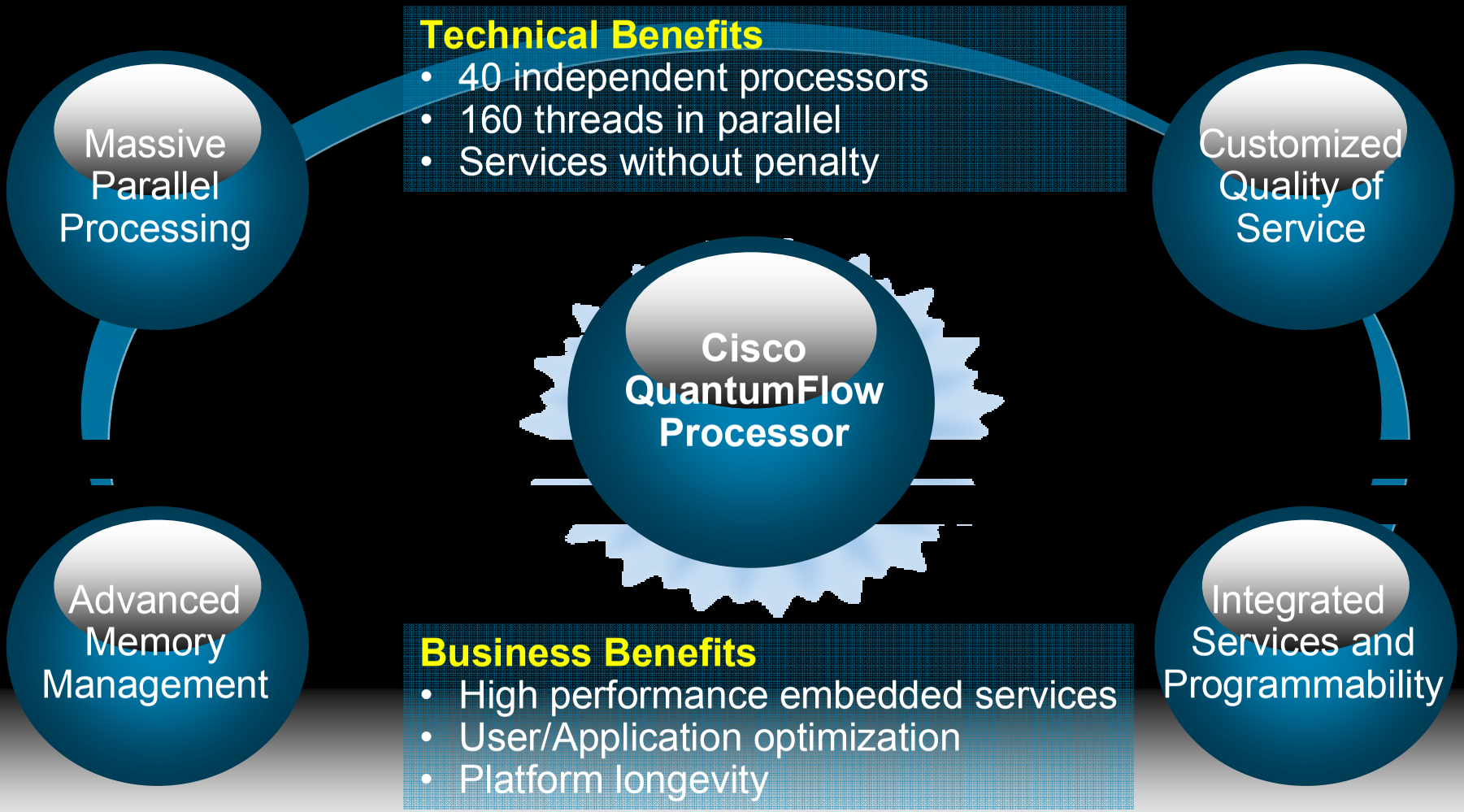
Cisco ASR1002 Router



- Integrated RP1 and SIP
- Exact same hardware features as RP1 with following exception
  - 4GB DRAM by default
  - 8 GB eUSB for mass storage + NVRAM (2X32MB NVRAM)
- Support of modular ESP-5G and ESP-10G
- Built-in 4XGE ports – feature/performance parity to GE SPA

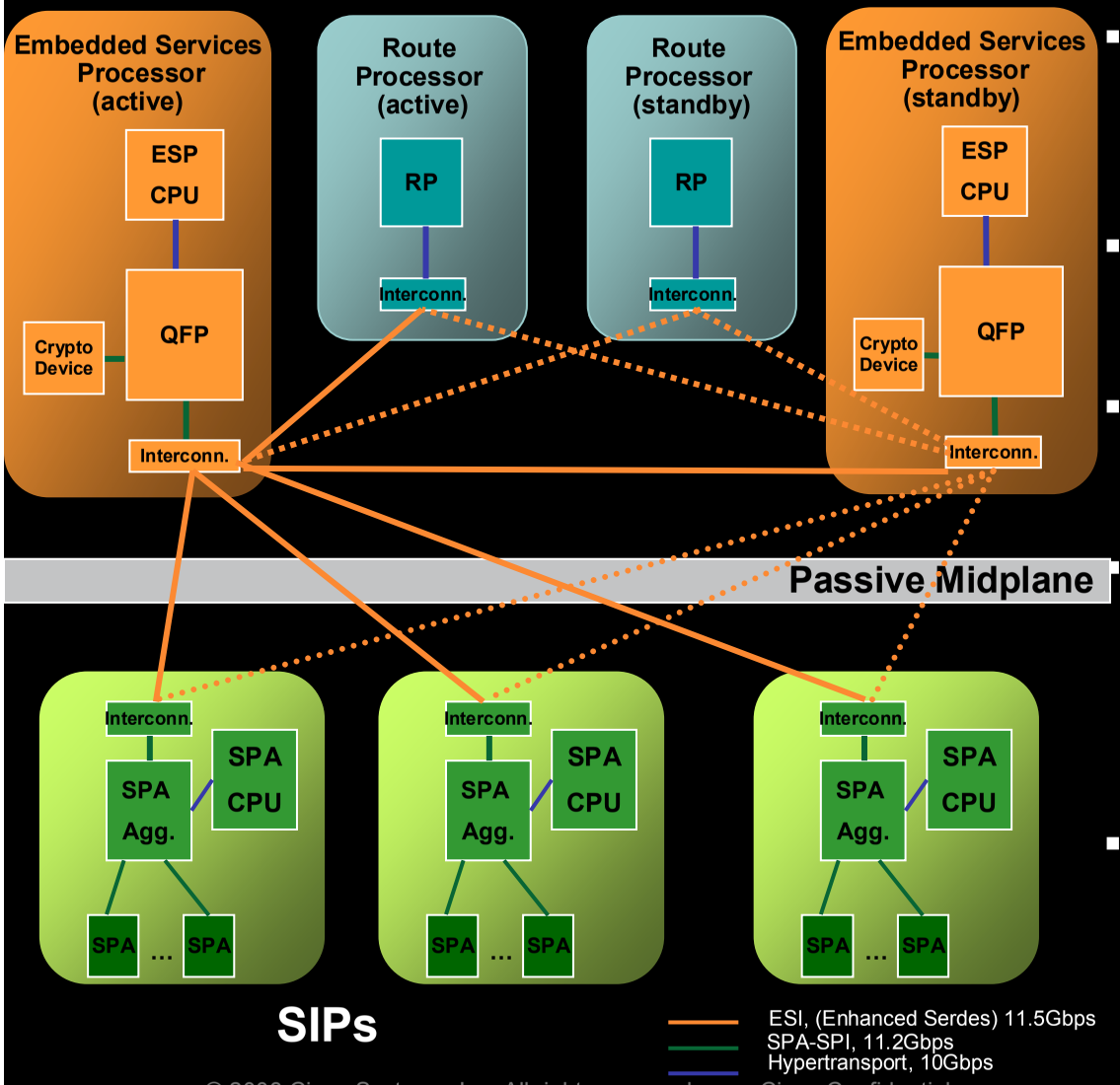
Cisco ASR 1000 Series

Powered by Cisco QuantumFlow Processor



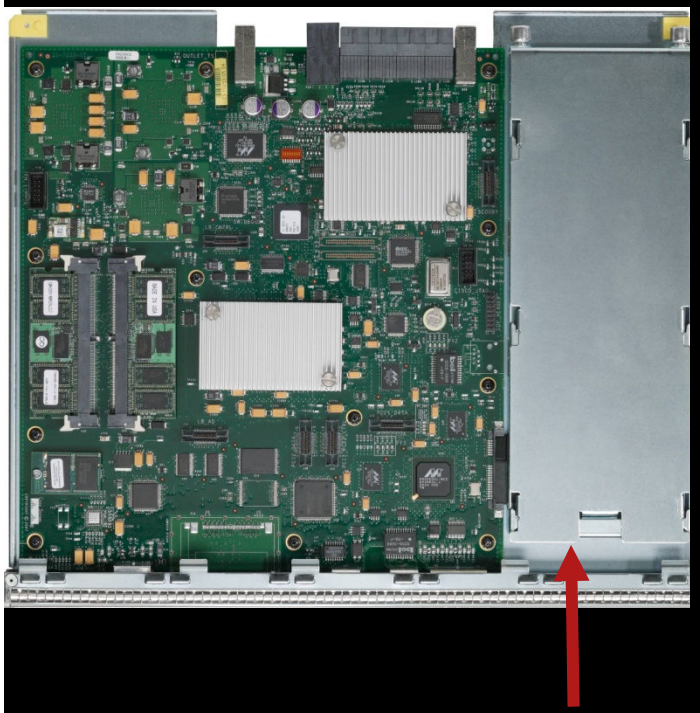
World's Most Advanced Piece of Networking Silicon

ASR 1000 Series Building Blocks



- **RP (Route Processor)**
  - Handles control plane traffic
  - Manages system
- **ESP (Embedded Services Processor)**
  - Handles forwarding plane traffic
- **SIP (SPA Interface Processor)**
  - SPAs provide interface connectivity
- **Centralized Forwarding Architecture**
  - Processes all traffic
  - Standby is synchronized with all flow state with dedicated 10Gbps link
- **Distributed Control Architecture**
  - All major system components have a powerful control processor dedicated for control and management planes

ASR 1000 Route Processor
RP1



40 GB HDD

General Purpose CPU 1.5GHz

Memory

- DRAM: Default: 2 GB; Max: 4 GB
- 1GB of Internal Flash
  - For code storage, boot, config, logs, etc.
  - 2X32 MB of NVRAM are partitioned

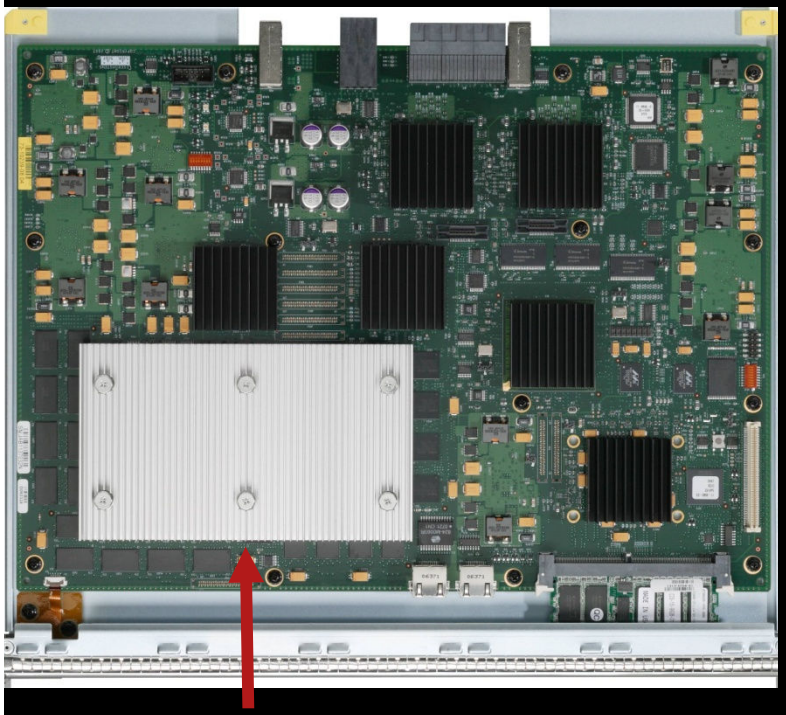
Management Interfaces

- Ethernet management port, auxiliary port, console port

Storage

- Default: 40 GB Hard Disk Drive
  - 2X32 MB NVRAM are partitioned
- Option: 32 GB Solid State Drive (Post – FCS)
- For core dumps, failure capture, etc
- External USB flash for IOS configurations or File copying

ASR 1000 Embedded Services Processor
ESP-5G, ESP-10G



QFP Engine and
QFP Traffic Manager

Cisco QFP engine

- Centralized forwarding engine
- Programmable providing full-packet processing

Cisco QFP Traffic Manager

- Packet buffering and queuing/scheduling
- For output traffic to carrier cards/SPA's
- For special features such as input shaping, reassembly, replication, punt to RP, etc.

Interconnect providing data path links (ESI) to/from other cards over mid-plane

- Transports traffic into and out of QFP
- Input scheduler for allocating BW among links

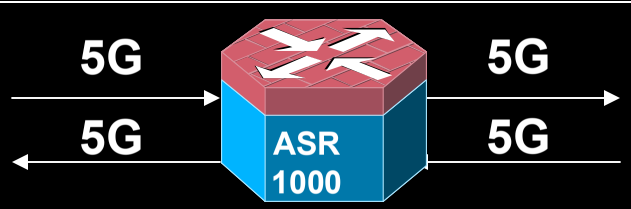
ESP CPU managing QFP, crypto engine, mid-plane links, etc

ASR 1000 ESP Generations

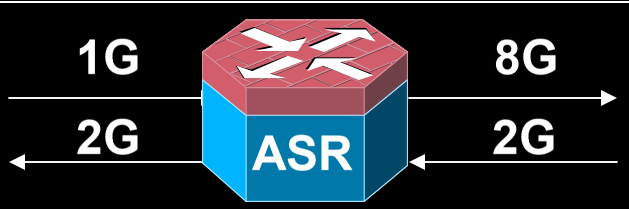
	ESP-5G	ESP-10G	ESP-20G
Bandwidth	5Gbps	10Gbps	20Gbps
Based on	QFP	QFP	QFP
# of Processors	20	40	40
Clock Rate	900 Mhz	900 Mhz	1.2 Ghz
Crypto Engine BW	~1Gbps	3Gbps	8Gbps
QFP Memory	256MB	512MB	1GB
Packet Buffer	64MB	128MB	256MB
TCAM	10Mb	10Mb	40Mb

ASR 1000 System Bandwidth

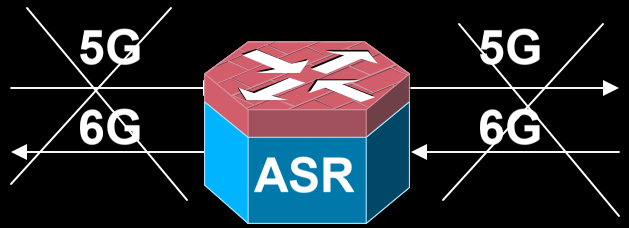
- ESP bandwidth denotes the total 'output' bandwidth of the system, regardless of the direction
- High priority traffic (as long as it is not over-subscribed - Example: <=10G for ESP-10G) will not be affected by this bandwidth limit
- ESP-10G Examples:



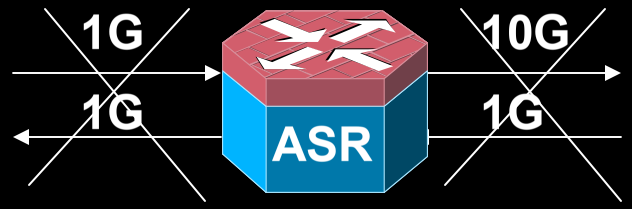
5G Unicast in each direction
Total Output bandwidth 5+5=10



1G Multicast with 8X replication in one direction
2G unicast in the other direction
Total Output bandwidth 8+2=10G



5G Unicast in one direction & 6G Unicast in the other direction
Total output bandwidth (5+6=11) exceeds 10G; Only 10G will go through



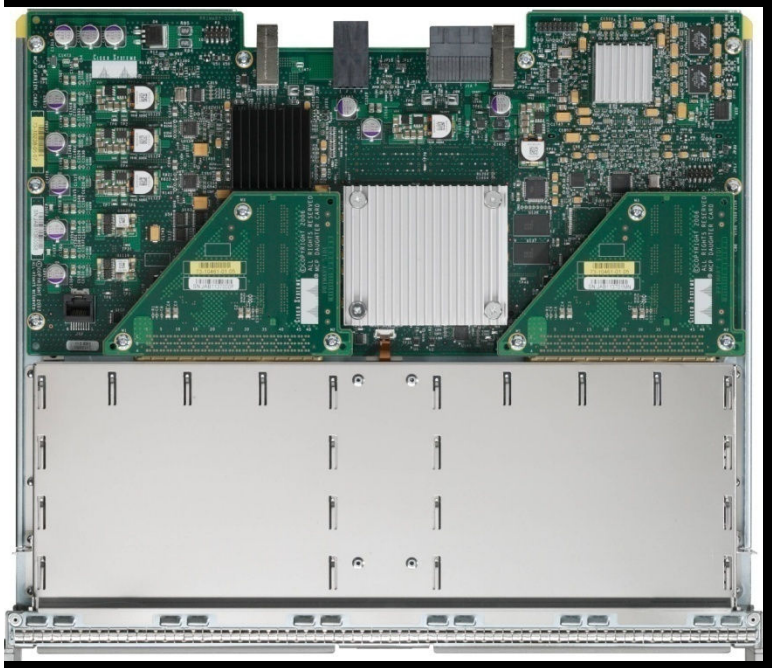
1G Multicast with 10X replication in one direction
1G Unicast in the other direction
Total bandwidth (10+1=11) exceeds 10G; only 10G will go through

ASR 1000 Ingress Oversubscription

ESP Version	Max SPAs per SIP	Max BW / SPA (Gbps)	Max BW / SIP (Gbps)	SIP Oversubscription Ratio (worst case)	ASR1006 Oversubscription Ratio (worst case)
ESP10 (with SIP10)	4	10	10	4:1	12:1
ESP20 (with SIP40)	4	10	20	2:1	6:1

The ASR 1000 Series is designed for oversubscription

ASR 1000 SPA Interface Processor
SIP-10G



- **Physical termination of SPA**
- **Supports up to 4 SPAs**
  - 4 half-height
  - 2 full-height
  - 2 full-height+1 half-height
  - Full OIR support
- **Offers Ingress QoS**
  - Ingress packet classification – high/low
  - Ingress over-subscription buffering (low priority) until ESP can service them
- **Captures stats on dropped packets**
- **Distributes Network Clock to SPA's**
- **Manages Midplane links, SPA OIR, SPA drivers (via IOCP CPU)**

ASR1000 SPA + SFP Support TODAY

1GE SFP & WDM
SFP-GE-L
SFP-GE-S
SFP-GE-T
SFP-GE-Z
CWDM-SFP-1470
CWDM-SFP-1490
CWDM-SFP-1510
CWDM-SFP-1530
CWDM-SFP-1550
CWDM-SFP-1570
CWDM-SFP-1590
CWDM-SFP-1610

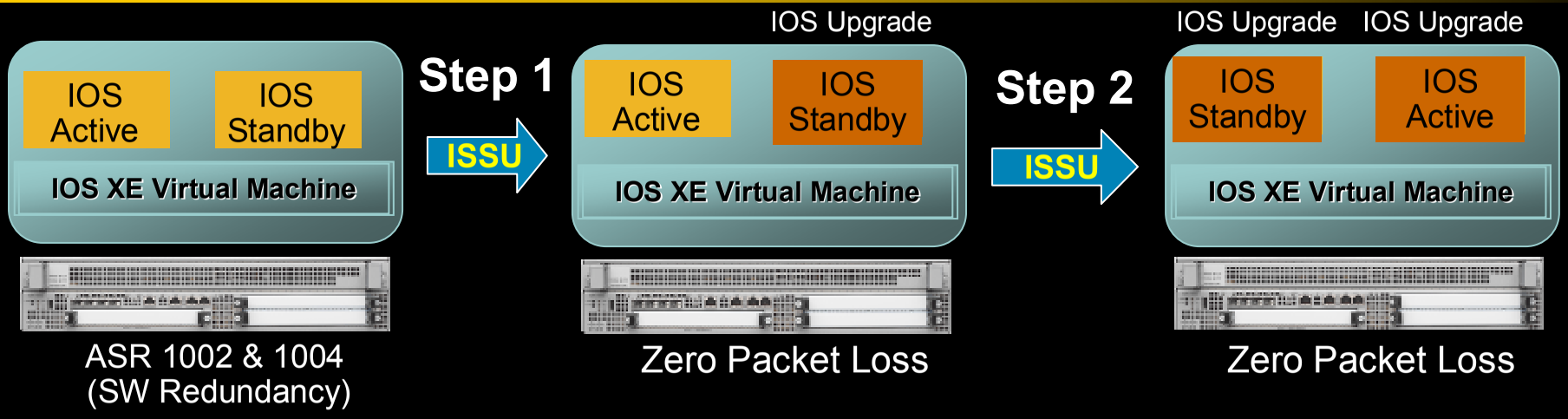
10GE XFP
XFP-10GER-OC192SR (10GE mode)
XFP-10GLR-OC192IR (10GE mode)
XFP-10GZR-OC192LR (10GE mode)

POS SFP
SFP-OC3-SR
SFP-OC3-MM
SFP-OC3-LR2
SFP-OC3-LR1
SFP-OC3-IR1
SFP-OC12-SR
SFP-OC12-MM
SFP-OC12-LR2
SFP-OC12-LR1
SFP-OC12-IR1

Ethernet SPA
SPA-1X10GE-L-V2
SPA-2X1GE-V2
SPA-5X1GE-V2
SPA-8X1GE-V2
SPA-10X1GE-V2
SPA-4X1FE-TX-V2
SPA-8X1FE-TX-V2
POS SPA
SPA-1XOC12-POS
SPA-2XOC3-POS
SPA-4XOC3-POS
Serial + Channelized SPA
SPA-2XT3/E3
SPA-2XCT3/DS0
SPA-4XCT3/DS0
SPA-4XT3/E3
SPA-8XCHT1/E1

IOS XE – An ASR 1000 Innovation

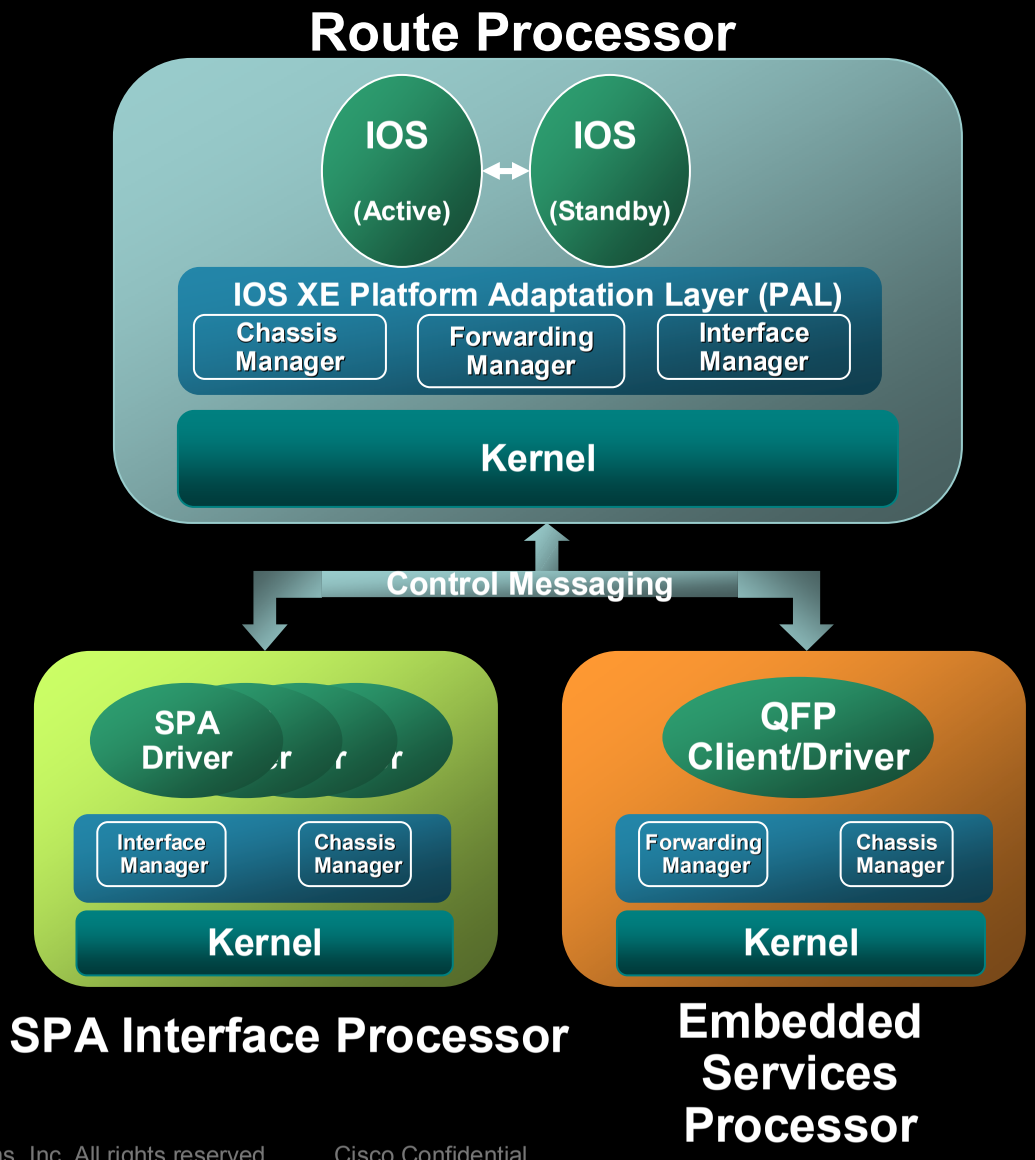
Software Virtualization



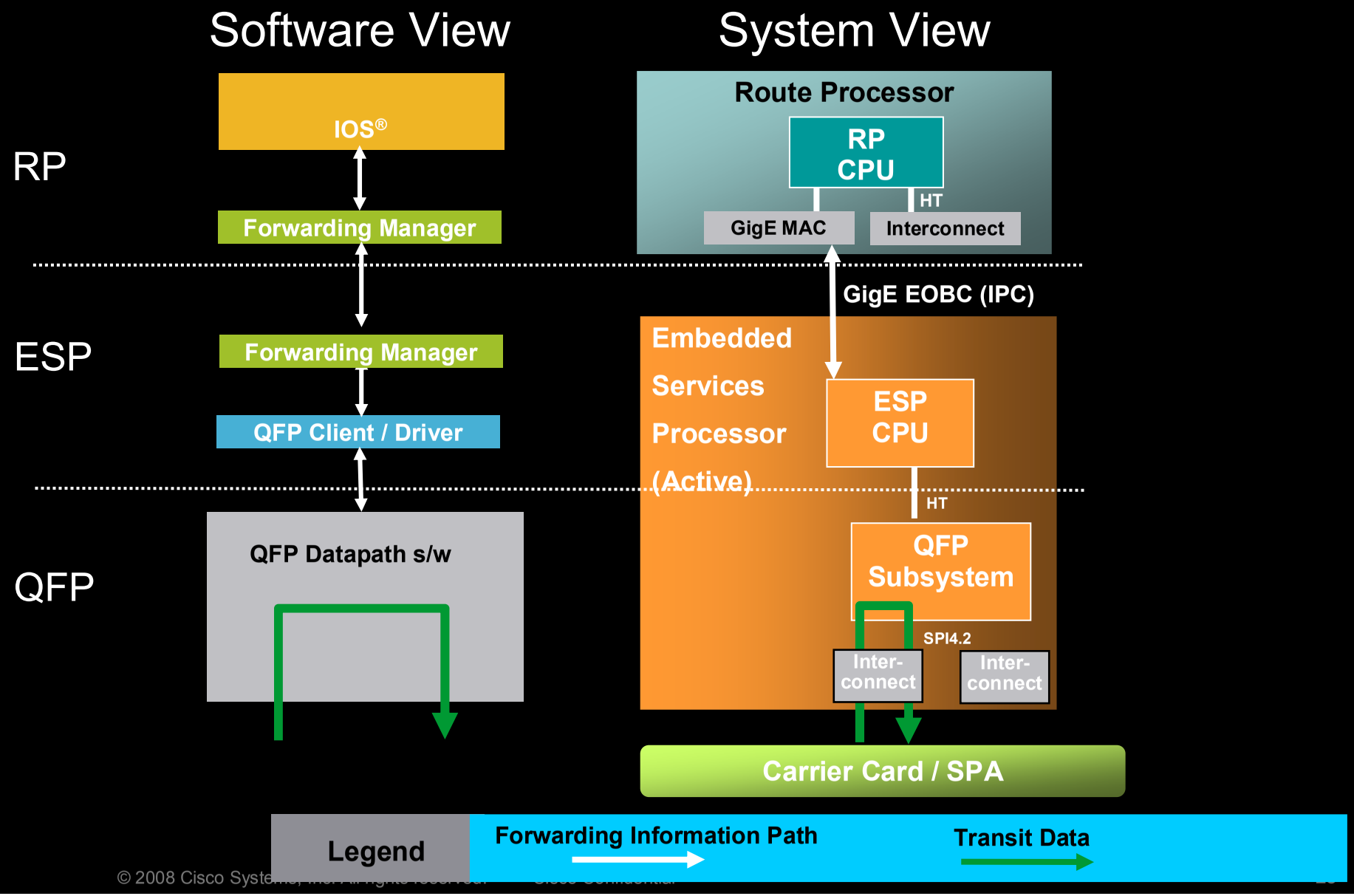
Industry first, delivering hitless upgrades without costly hardware redundancy

Feature	Benefit
Combines rich edge feature set of IOS	Broad services: Enterprise & SP, hosted or managed
Common look and feel to IOS	Decreases OpEx, increases training ROI

ASR 1000 Software Architecture – IOS XE



Software/System Stack on ASR1000/QFP



IOS XE Software SUB PACKAGES

- Each ASR 1000 functional element supports different software sub-packages
- 7 different software sub-packages in total
- Sub-packages are designed to maximize 'In Service Software Upgrade' capability
- All 7 sub-packages are integrated and available as one consolidated package for download from CCO

- RP
  1. **RPBase:** RP OS
  2. **RPControl:** Control Plane processes that interface between IOS and the rest of the platform
  3. **RPIOS**
  4. **RPAccess:** Software required for Router access; 2 versions are available. One that contains open SSH & SSL and one without (RPAccess and RPAccess-K9)
- SIP
  5. **SIPBase:** SIP OS + Control processes
  6. **SIPSPA:** SPA drivers and FPD (SPA FPGA image)
- ESP
  7. **ESPBase:** ESP OS + Control processes + CPP client/driver/ucode

+ ROM Monitor: One ROM Monitor image containing ROMMON for RP, ESP, SIP (released when needed)

IOS XE SOFTWARE CONSOLIDATED PACKAGES

FOUR different Cisco IOS XE consolidated packages

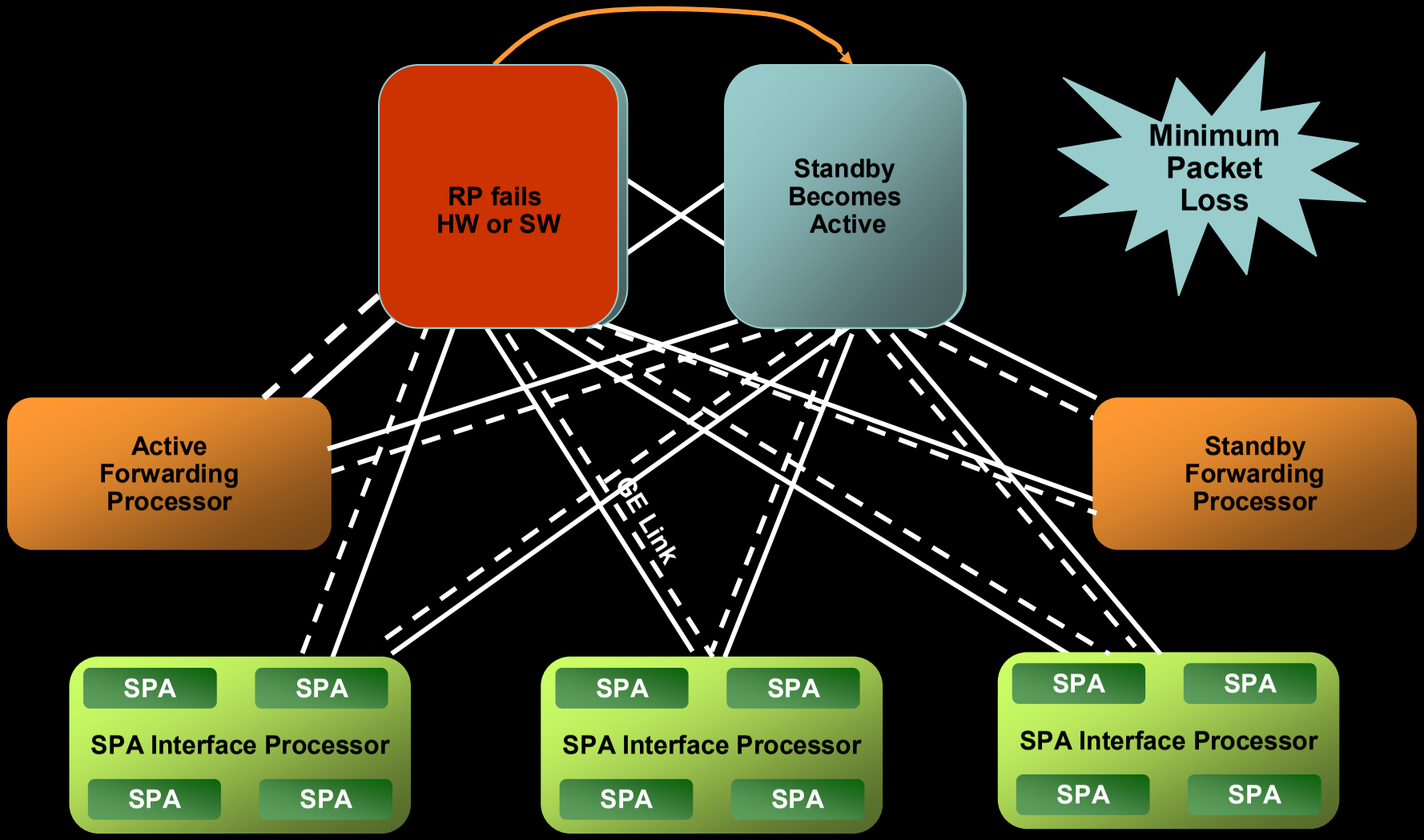
1. **Cisco ASR1000 Series RP1 ADV ENTERPRISE SERVICES**
   All features including legacy protocols (no SNA Switching)
2. **Cisco ASR1000 Series RP1 ADVANCED IP SERVICES**
   Excludes all Legacy Protocols
3. **Cisco ASR1000 Series RP1 IP BASE**
   Includes basic IP features with SSH support
4. **Cisco ASR1000 Series RP1 IP BASE W/O CRYPTO**
   Includes basic IP features

- **ADV ENT and ADV IP both include SBC and LI**

ASR 1000 HA Highlights

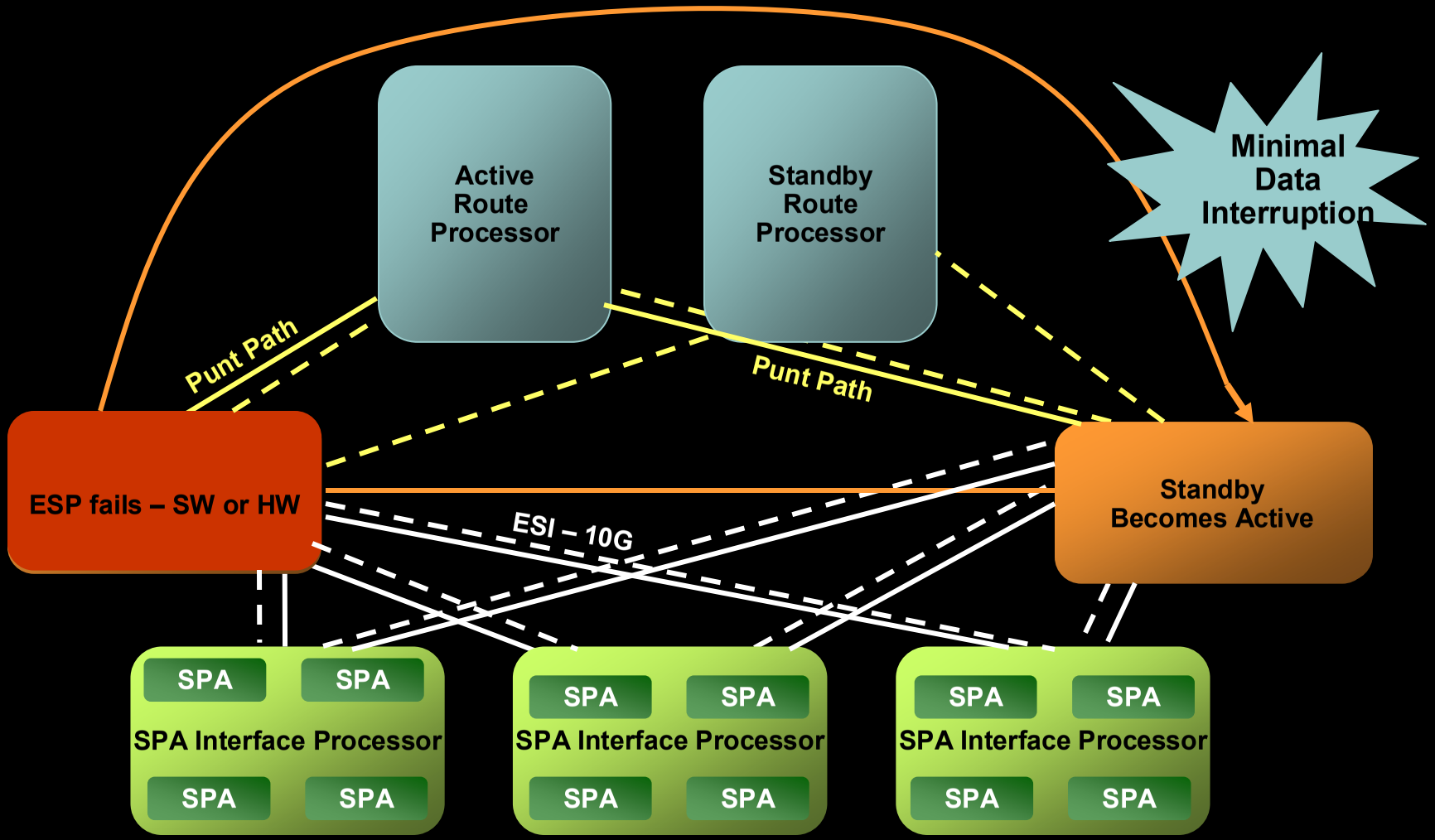
- ASR 1000 leverages Cisco IOS HA infrastructure
  - NSF/SSO, ISSU
- 1+1 redundancy option for RP and ESP
  - Active and standby
- Software Redundancy with single RP

HW Redundancy with dual RP on ASR1006



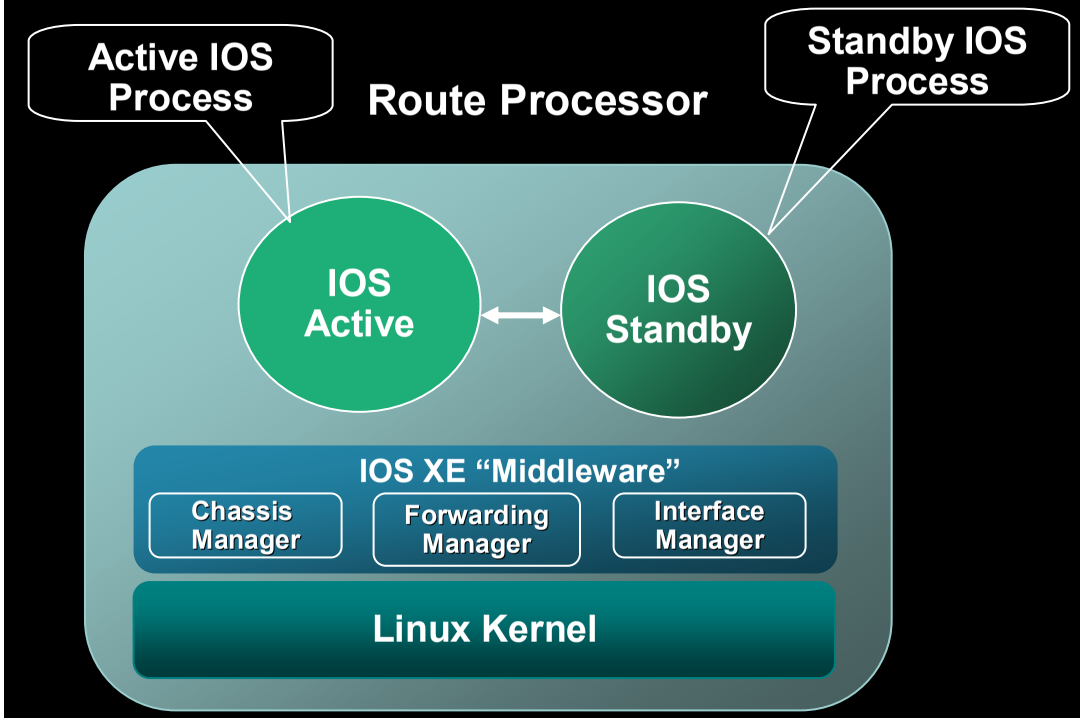
Separate and independent internal communication link for control plane (GE)

HW Redundancy with dual ESP on ASR1006



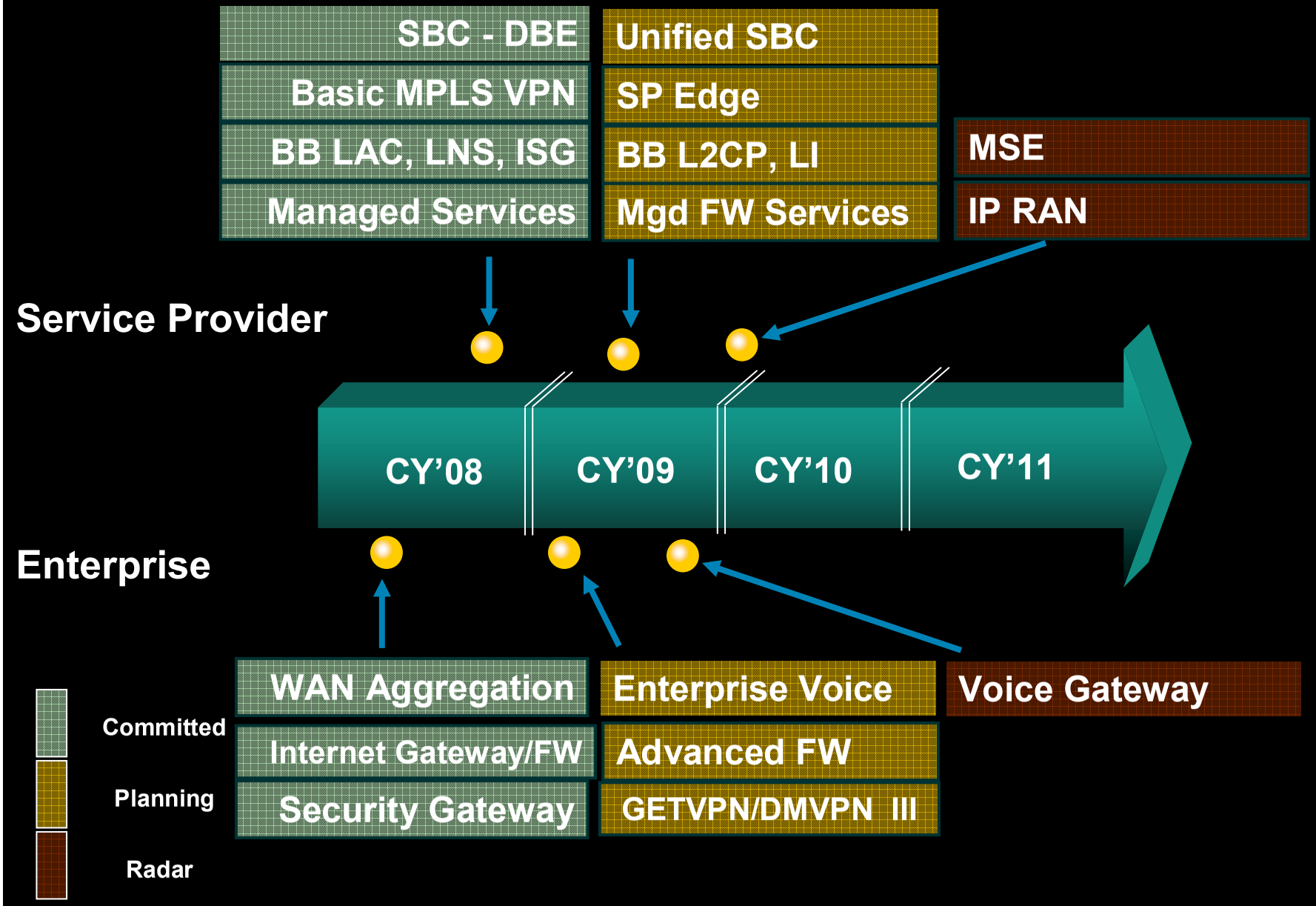
- All packets processed by QFP for forwarding
- Separate and Independent links for Data Plane communication

SW Redundancy on ASR1002/1004



- Stand-by IOS sub package in the single RP systems (ASR1004/ASR1002)
- Two IOS sub packages in a single RP function similarly to the IOS sub packages on separate RPs
- Supports all NSF/SSO features as supported by dual RP system (ASR1006)
- Requires 4 GB DRAM on RP

ASR 1000 Series Solution Roadmap



What Customers Are Saying…

"The ASR 1000 is uniquely positioned to blend a very positive TCO with flexibility and innovation to support not only our current requirements, but **those that we are just beginning to envision**. Scalability, security and reliability are three areas where we look to the ASR 1000 as a ground-breaking platform."

John Burns, Vice President, Network Architecture and Planning

"We operate IT systems for our customers that are critical for their core business processes. So non-stop operations is an extremely important issue for us. We are witnessing an increased demand on **highly secure, scalable, and reliable IT infrastructure services**. The Cisco ASR 1000 Series helps us meet those demands. For example, the 'in service software update' feature offers great improvements towards non-stop operations ."

Bardo Werum, VP Cross-Industries and Operation, Lufthansa Systems

"For Texas Instruments, the Cisco ASR 1000 Series gives us the assurance we need to manage and secure vastly greater traffic flow at our network edge, while enabling us to focus on what we do best - **accelerating the pace of innovation** and serving our customers."

Brian Bonner, CIO, Texas Instruments

Summary

Cisco transforms and extends the Enterprise WAN & SP Edge

Cisco ASR 1000 Series Routers deliver instant-on, secure, and reliable services

Cisco ASR 1000 Series simplifies operation and delivers increased return on investment

NOW AVAILABLE

ASR 1000 Series Routers
Services .. without compromise or complexity