



ASR 1000 Solutions Overview



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Enterprise Solution Overview Agenda

- **Quick Review of the ASR**

- **Solutions:**

- **Secure WAN**

- Secure WAN Aggregation
 - Internet Transit / Gateway
 - High Speed FW

= Aggregation Services Router Series 1000 (with QuantumFlow Processor shown)

- **Voice**

- Next Generation Voice & Multimedia Gateways

- **WAN Optimizations**

- Performance Routing (PFR) & Netflow
 - Wide Area Application Services (WAAS)

- **Enterprise Operational Efficiencies Gained with ASR 1000:**

- Application Availability & QOS
 - High Availability
 - Traffic Monitoring (ERSPAN)
 - Managed CPE / Large Branch

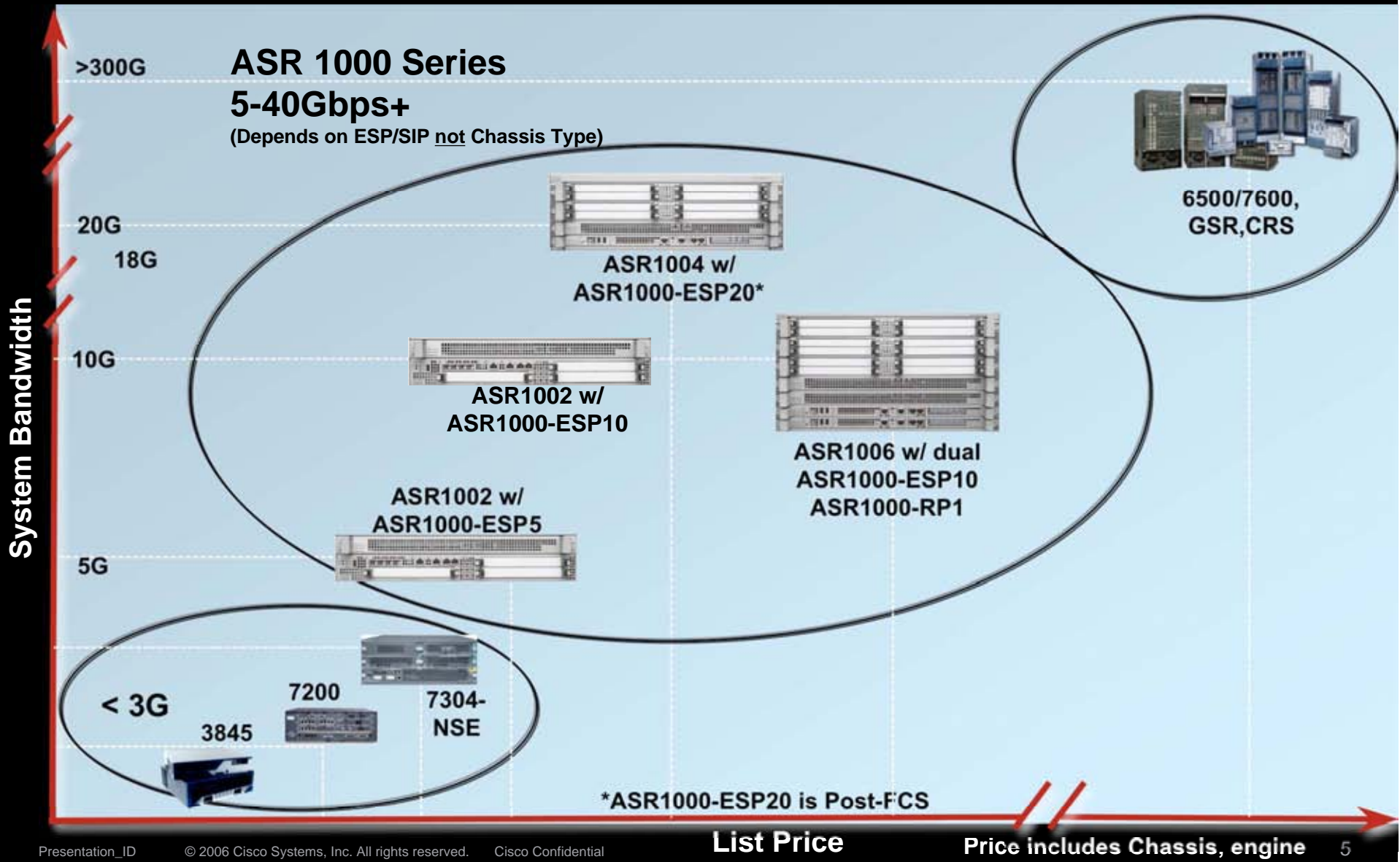
- **Solution and Technology Detailed Roadmap**

Aggregation Services Router (ASR) Series 1000 Overview

- **Next-generation of Midrange router family**
 - 2RU/4RU/6RU chassis
 - 5 / 10 / 20 / 40 Gbps forwarding
 - Supporting same feature set at different price performance points
- **ASR 1000 Differentiators**
 - Highly available carrier-class design
 - Integrated services (SBC, FPM, Security..)
 - State of the art QoS
 - Unmatched midrange scalability & performance
 - Feature velocity
- **Feature richness provides deployment flexibility**
 - Support for Service Provider & Enterprise features
 - BNG (BRAS, LAC, LNS)
 - IPSec Termination
 - Distributed PE / MSE
 - High-speed CPE



ASR 1000 – Product Positioning



ASR 1000 Series Product Family



SPA Slots

of ESP Slots
 # of RP Slots
 # of SIP Slots
 IOS Redundancy
 Built in GigE
 Height
 Bandwidth
 Performance
 Air Flow
 Power Supply (Watts)

3-slot

1
 Integrated (RP1)
 Integrated (SIP10)
 S/W
 4
 3.5" (2RU)
 5-10 Gbps
 4-8 Mpps
 Front to Back
 470

8-slot

1
 1
 2
 S/W
 n/a
 7" (4RU)
 10-40+ Gbps
 8-16+ Mpps
 Front to Back
 765

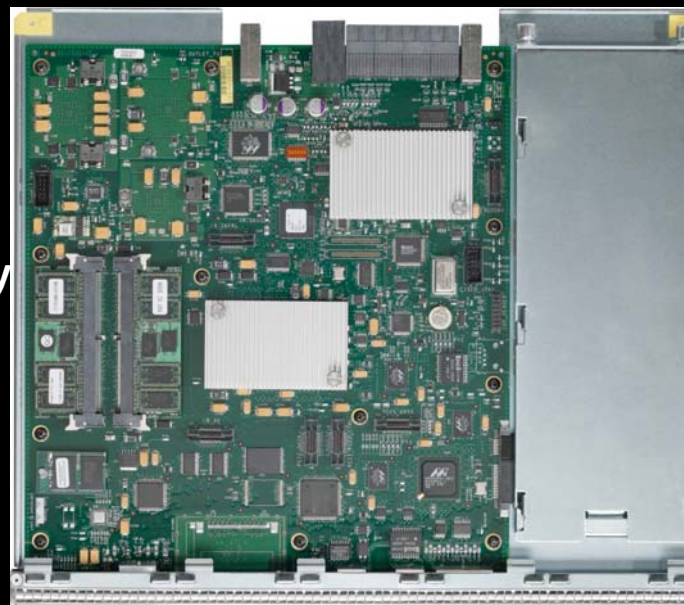
12-slot

2
 2
 3
 H/W
 n/a
 10.5" (6RU)
 10-40+ Gbps
 8-16+ Mpps
 Front to Back
 1275

Aggregated Services & Scale

Route Processor – RP1

- **Memory:**
 1. DRAM: Default: 2 GB; Max: 4 GB
 2. NVRAM: 1G of Internal Flash for code storage, boot, config, logs, etc.
- **Management Interfaces:**
 - Management ethernet management port, auxiliary port, console port
- **Storage:**
 - For core dumps, failure capture, etc; 40 GB Hard Disk Drive (rotary) initially;
 - Solid-state drive (SSD) option
 - External USB flash for IOS configs or File copying
- **Communications paths to other cards (for control and for network control packets)**
- **Stratum-3 network clock circuitry**
- **Miscellaneous control functions for card presence detection, card ID, power/reset control, alarms, redundancy, etc.**

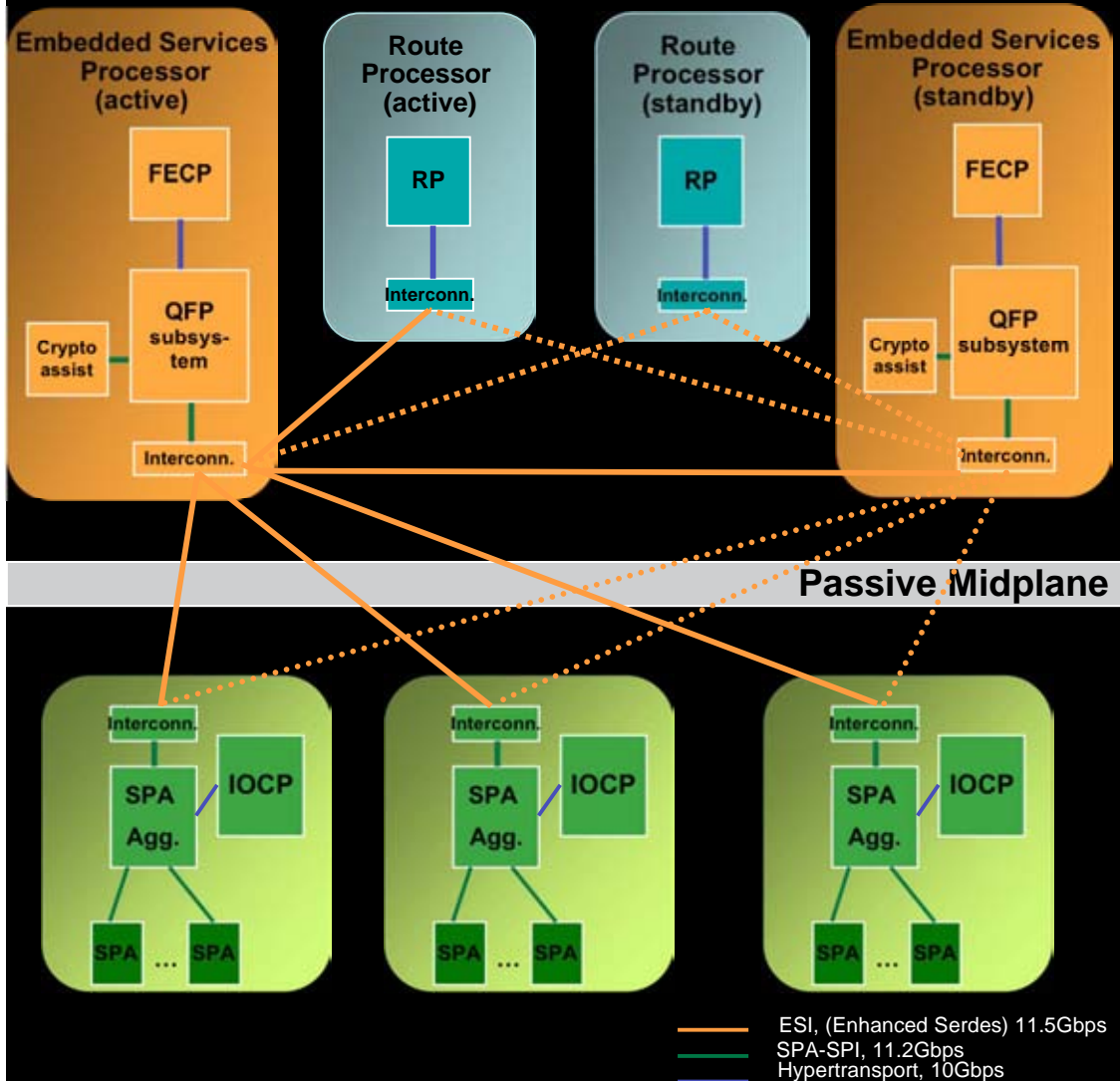


Embedded Services Processor – ESP-5G, ESP-10G

- **Centralized, programmable forwarding engine (i.e. QFP subsystem (PPE) and crypto engine) providing full-packet processing**
- **Packet buffering and queuing/scheduling (BQS)**
 - For output traffic to SPA Interface Processors/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 midplane**
 - Transports traffic into and out of QFP10
 - Input scheduler for allocating QFP10 BW among ESI's
- **FEC CPU managing QFP, crypto device, midplane links, etc**

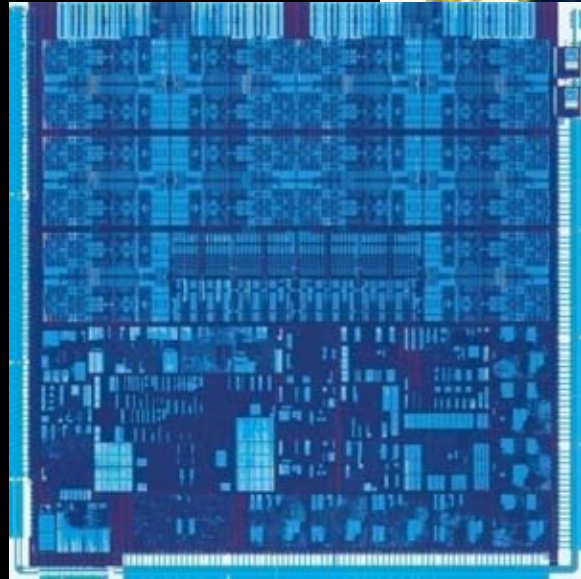


ASR 1000 Series Building Blocks

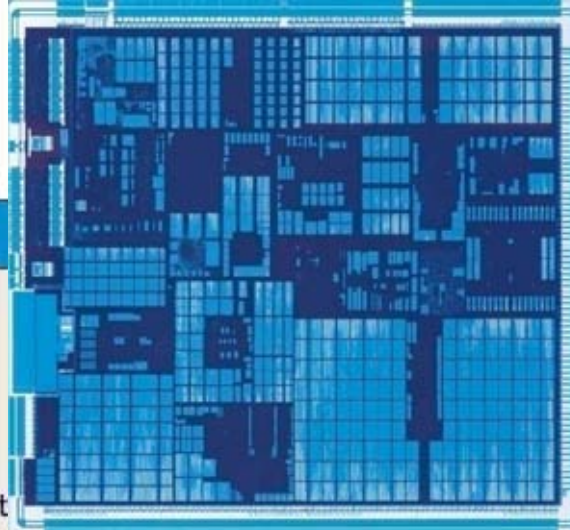


- **RP (Route Processor)**
Handles control plane traffic
Manages system
- **ESP**
Handles forwarding plane traffic
- **SPA Interface Processor**
Shared Port Adapters provide interface connectivity
- **Centralized Forwarding Architecture**
All traffic flows through the active ESP, standby is synchronized with all flow state with a dedicated 10Gbps link
- **Distributed Control Architecture**
All major system components have a powerful control processor dedicated for control and management planes (using dedicated GigE links running between all system components – not shown)

Cisco QuantumFlow Processor (QFP) Architecture, 1st generation



+



+

Quantum Flow Processor Software

Multi-Core (40) Packet Processor

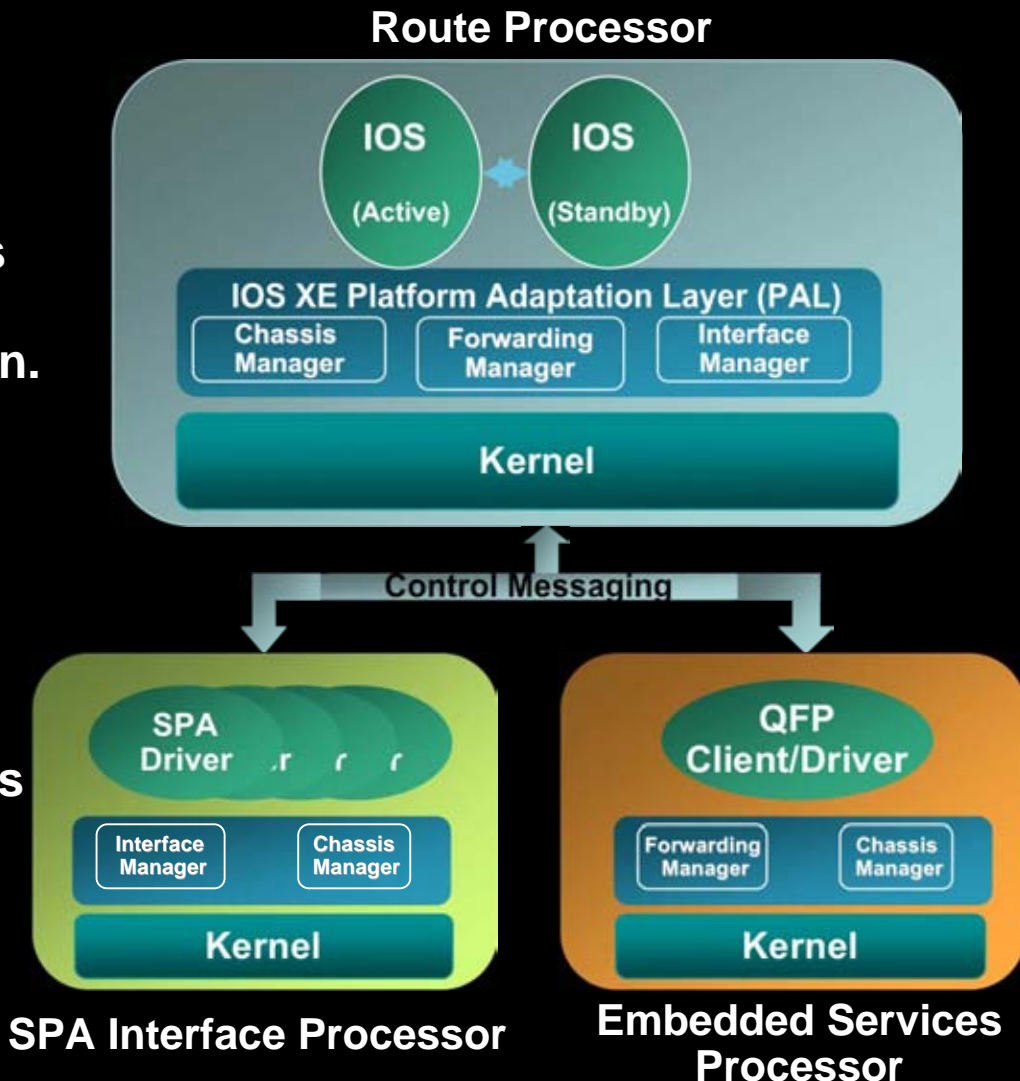
1. Scale → 100s of resources & massive feature scale
2. Performance → Designed to deliver 5-100s of Gbps
3. Feature Velocity → Software designed to deliver a common forwarding plane for all devices.
4. Multi-Generational → This is only the 1st Generation!

QFP Summary

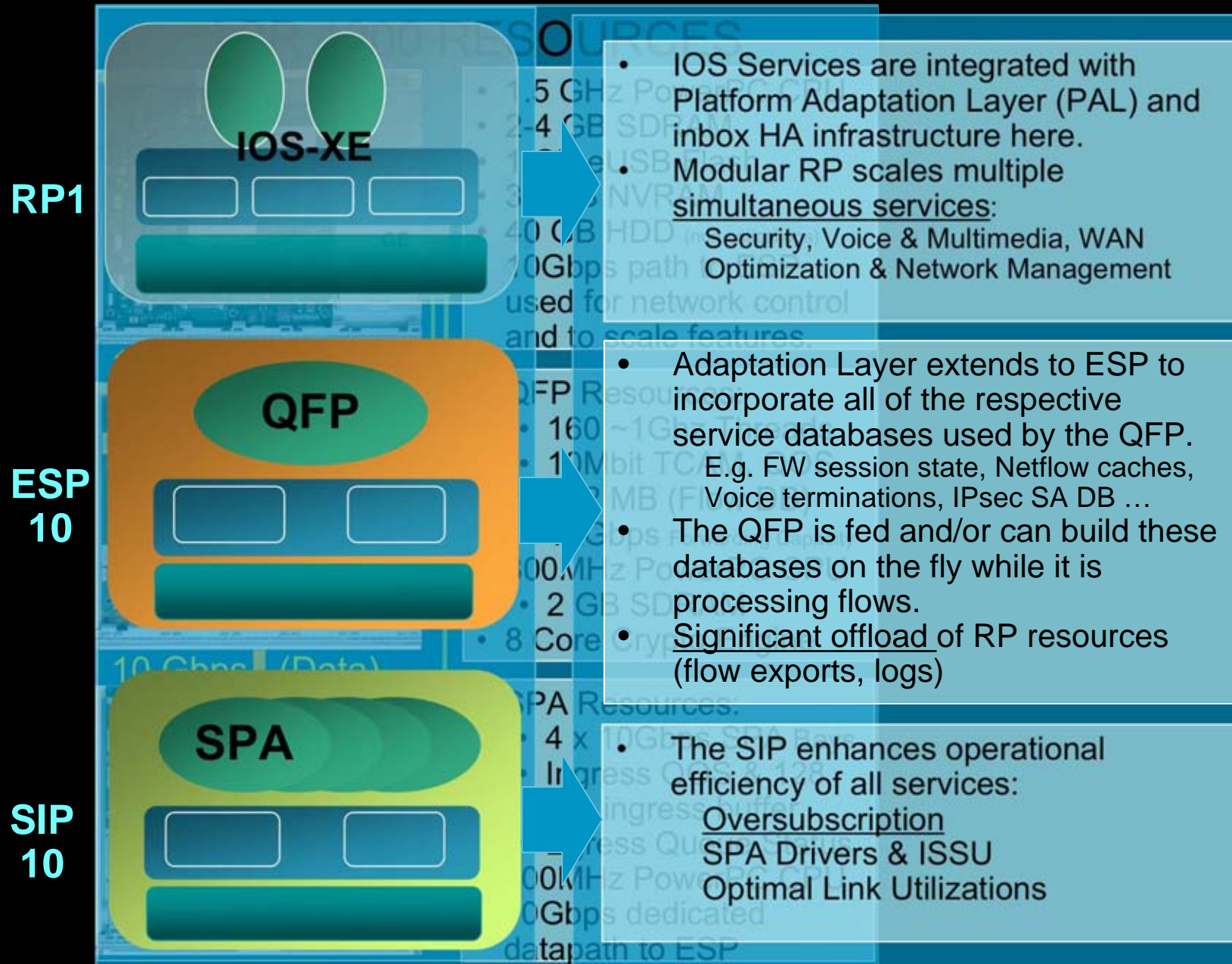
- **Packet Processing Engine (QFP-PPE)**
 - 40 Packet Processors – 4 Contexts (threads) each, total of 160 COMPLETE packets processed at the same time!
 - 1.2GHz (Tensilica ISA) processors + DRAM packet memory
 - HW assist for flow-locks, look-ups, stats, WRED, policers, range lookup, crypto, CRC
- **Buffer/queue subsystem (QFP-BQS)**
 - HW hierarchical 5 Leves
 - Fully configurable # of layers based on HQF
 - Priority propagation through the multiple layers

Software Architecture – IOS XE

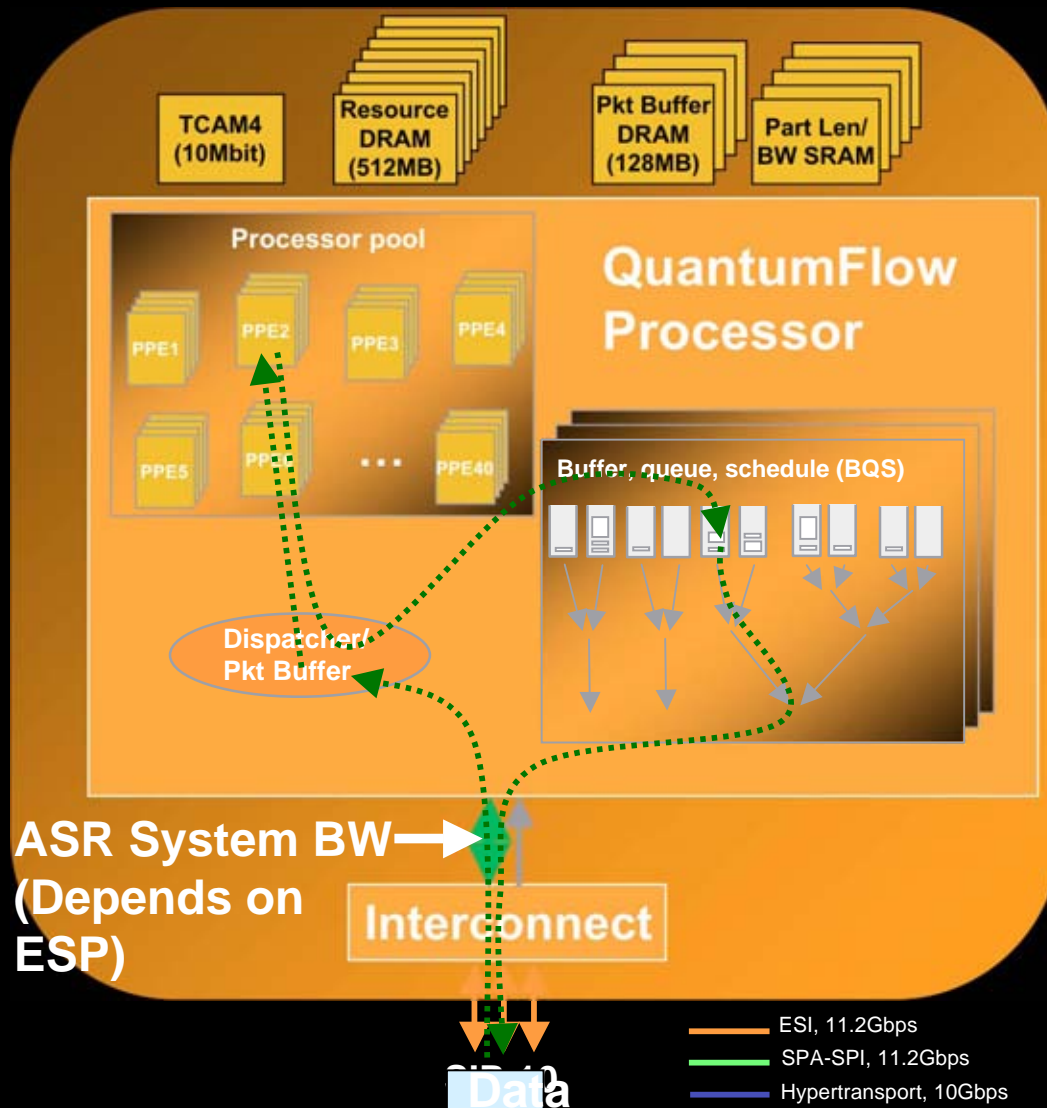
- IOS XE = IOS + IOS XE Middleware + Platform Software
- Operational Consistency - same look and feel as IOS Router
- IOS runs as its own Linux process for control plane (Routing, SNMP, CLI etc). Capable of 64bit operation.
- Linux kernel with multiple processes running in protected memory for
 - Fault containment
 - Re-startability
 - ISSU of individual SW packages
- ASR 1000 HA Innovations
 - Zero-packet-loss RP Failover
 - <50ms ESP Failover
 - “Software Redundancy”



ASR 1000 → Scalable IOS Services Delivered



Data Packet Flow: Through ESP10

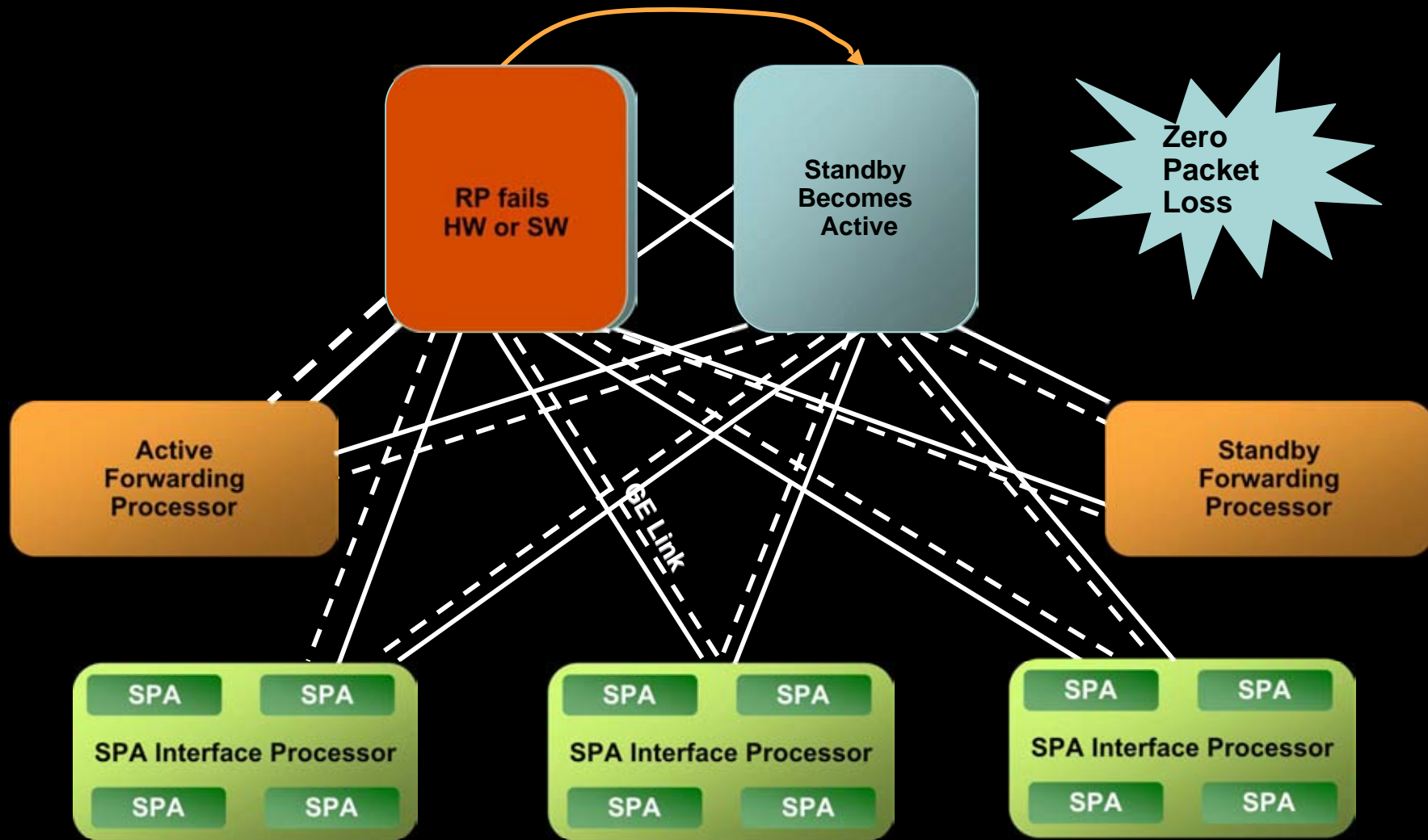


1. Packet arrives on QFP
2. Packet assigned to a PPE thread.
3. The PPE thread processes the packet in a feature chain similar to 12.2S IOS (very basic view of a v4 packet):
 - A. **Input Features applied**
 - Netflow, MQC/NBAR Classify, FW, RPF, Mark/Police, NAT, WCCP etc.
 - B. **Forwarding Decision is made**
 - Ipv4 FIB, Load Balance, MPLS, MPLSoGRE, Multicast etc.
 - C. **Output Features applied**
 - Netflow, FW, NAT, Crypto, MQC/NBAR Classify, Police/Mark etc.
 - D. **Finished**
4. Packet released from on-chip memory to Traffic Manager (**Queued**)
5. The Traffic Manager schedules which traffic to send to which SIP interface (**or RP or Crypto Chip**) based on priority and what is configured in MQC
6. **SIP can independently backpressure ESP via ESI control message to pace the packet transfer if overloaded.**

ASR 1000 HA Highlights

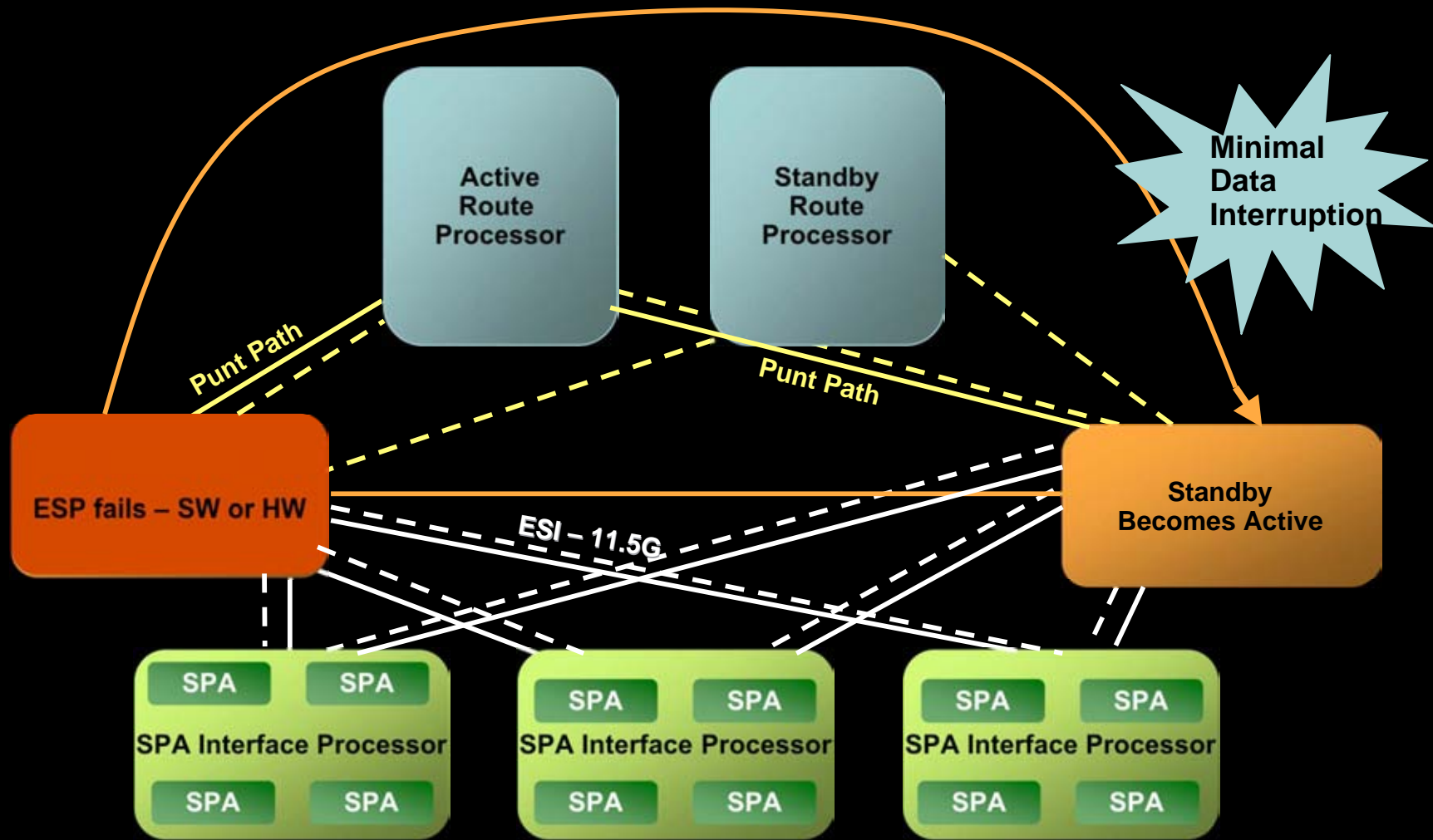
- **ASR 1000 leverages Cisco IOS HA infrastructure – NSF/SSO, ISSU**
- **1+1 redundancy option for RP and ESP**
 - Active and standby
 - No load balancing
- **RP's are separate from ESP's**
 - Switchover of ESP does not result in switchover of RP
 - Switchover of RP/IOS does not result in switchover of ESP
- **Single RP may be configured with dual IOS for SW redundancy (single RP only)**
- **No redundancy for SIP or other I/O cards**
 - SPA plugs into a single SIP
- **Protection against SPA or SIP failure is via APS or Y-cable redundancy feature (Future: requires SPA support)**

System Architecture – Distributed Control Plane



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

System Architecture – Centralized Data Plane



- All packets processed by QFP for forwarding
- Separate and Independent links for Data Plane communication (ESI 11.5G)

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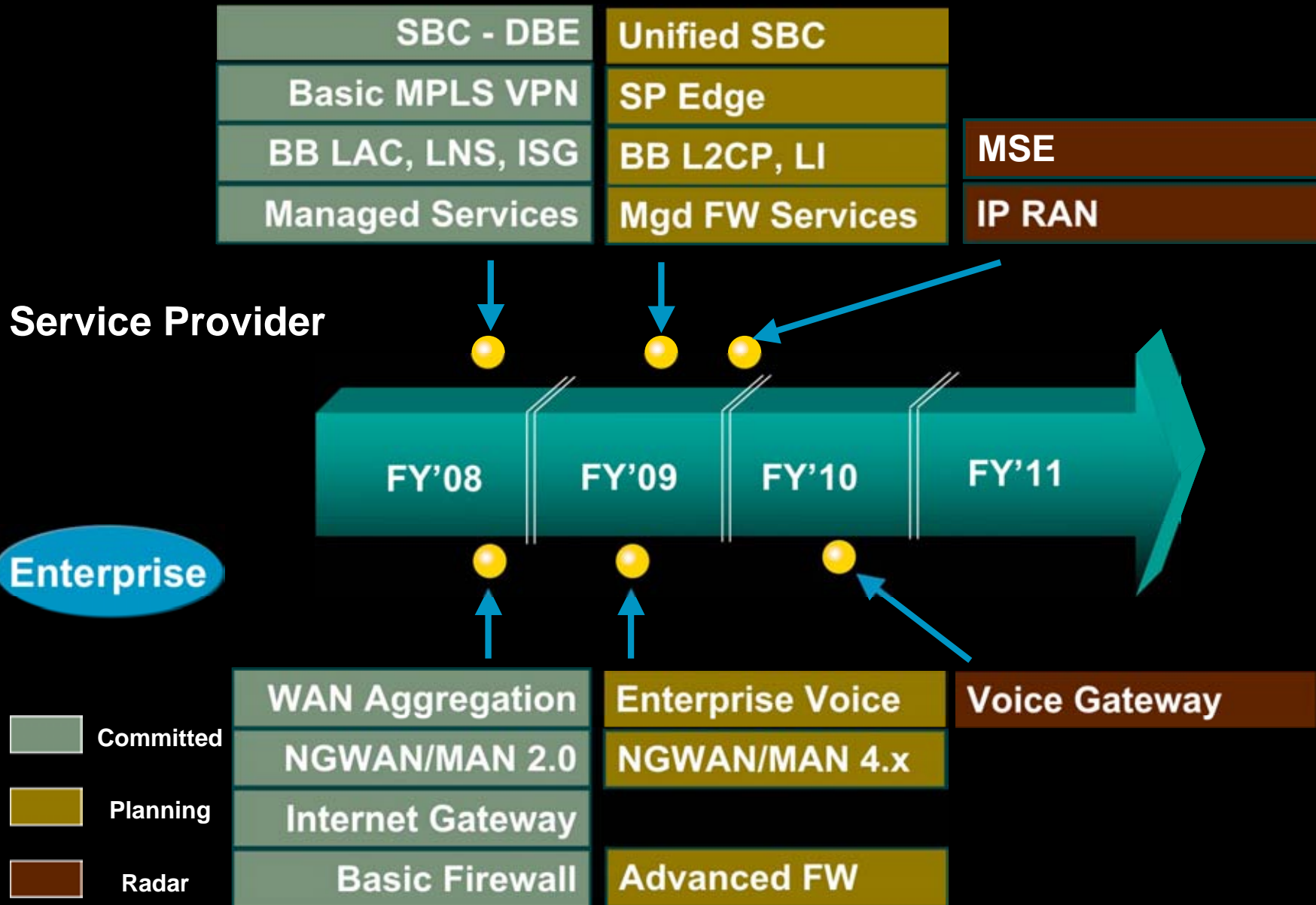
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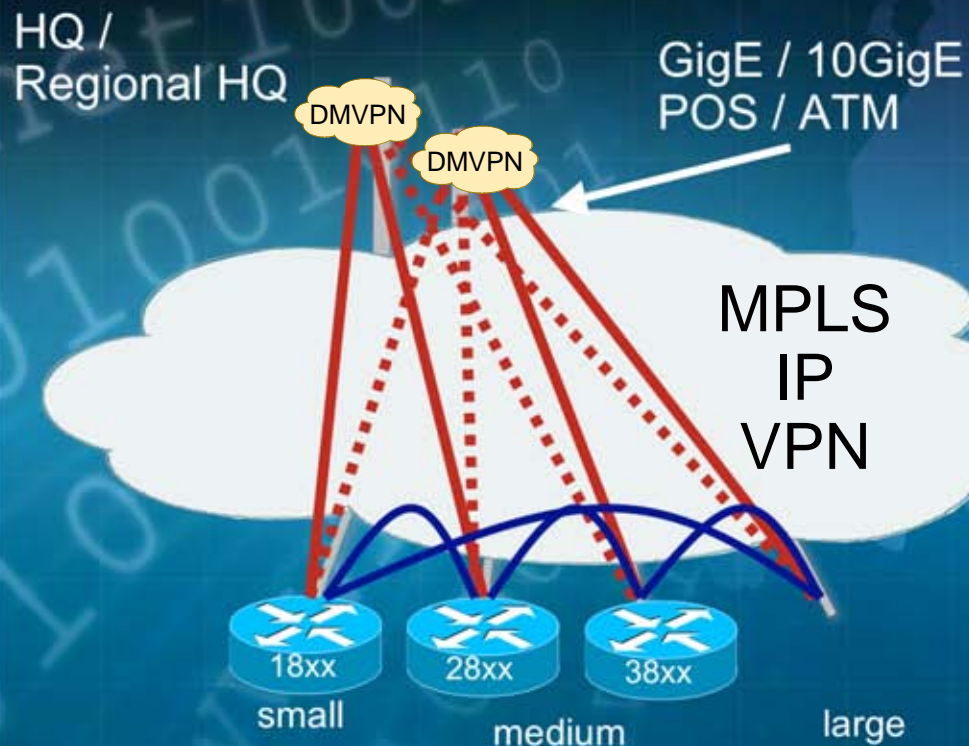
- **Solution and Technology Detailed Roadmap**

Architectural Insertion Roadmap



ASR 1000 → Multi-Service, 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...

Solution Objective

- Offer a full service IPsec VPN Aggregation Router which scales to meet new BW demands of SP IP VPNs

Solution Benefits

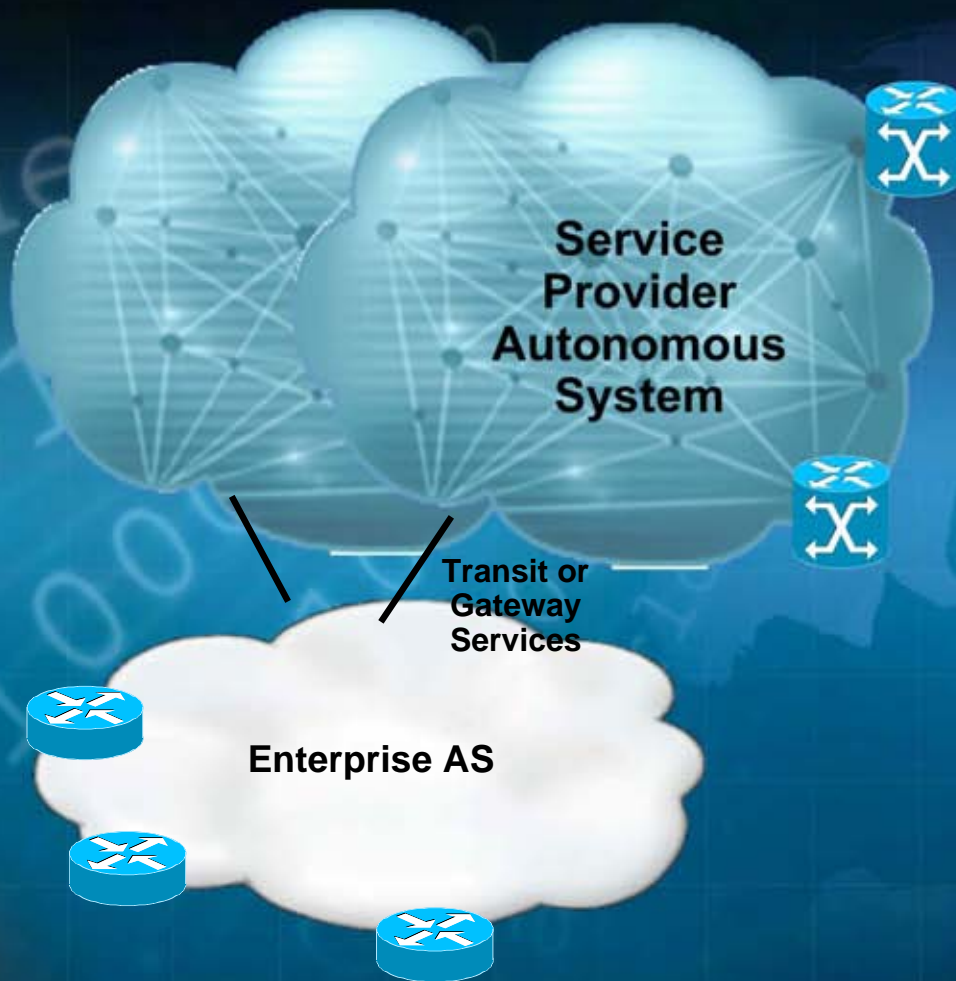
- Consolidate a stack of 7200s into 1 ASR 1000
- Investment protected by smooth transitions to more Crypto Bandwidth as requirements change
- No service blades
- Optimized for QOS & Multicast

A Cisco
First!

Keys to ASR 1000 (FCS h/w & s/w)

- 1000s of Sites / 10K IPsec tunnels (up to 50tps)
- Up to 3 Gbps crypto BW + 7 Gbps non-crypto (FCS)
- 3DES/AES/SHA-1/IKEv1
- DMVPN Phase 2

ASR 1000 → Internet Transit / Gateway



Solution Objective

- Provide Internet connectivity between Service Provider and Enterprise

Solution Benefits

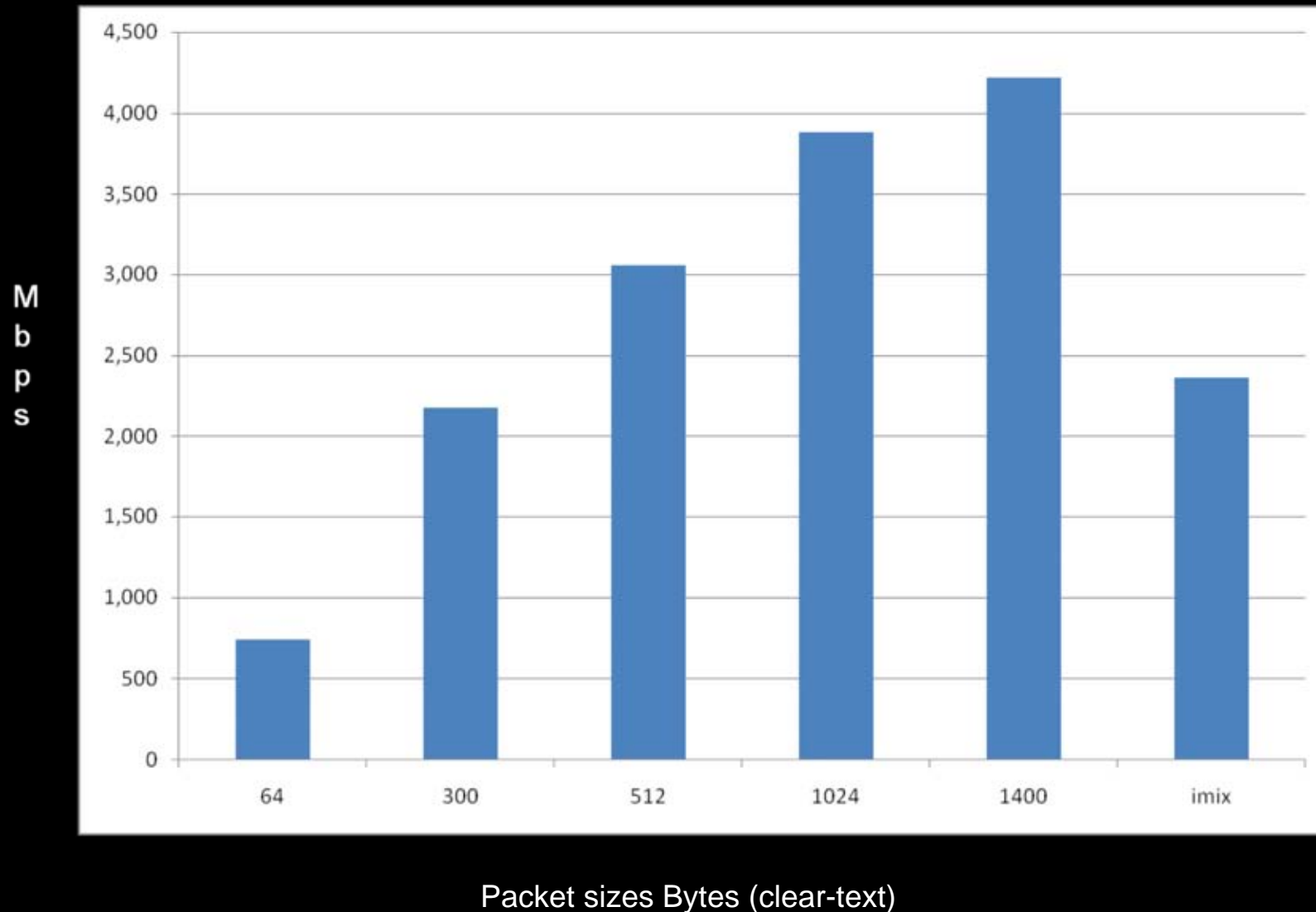
- Full internet reachability by peering with other autonomous systems
- IPv4 and IPv6 support
- Investment protection via modular design & ESP upgrades
- Low Power Requirements
- Small Form Factor
- End-to-end SLAs & Netflow stats

Keys to ASR 1000 (FCS h/w & s/w)

- Scalable performance up to 14Mpps (v4/v6 only)
- Scalability (IPv4 and IPv6 Routing Tables) up to Millions of routes.
- Up to 10GE/OC192

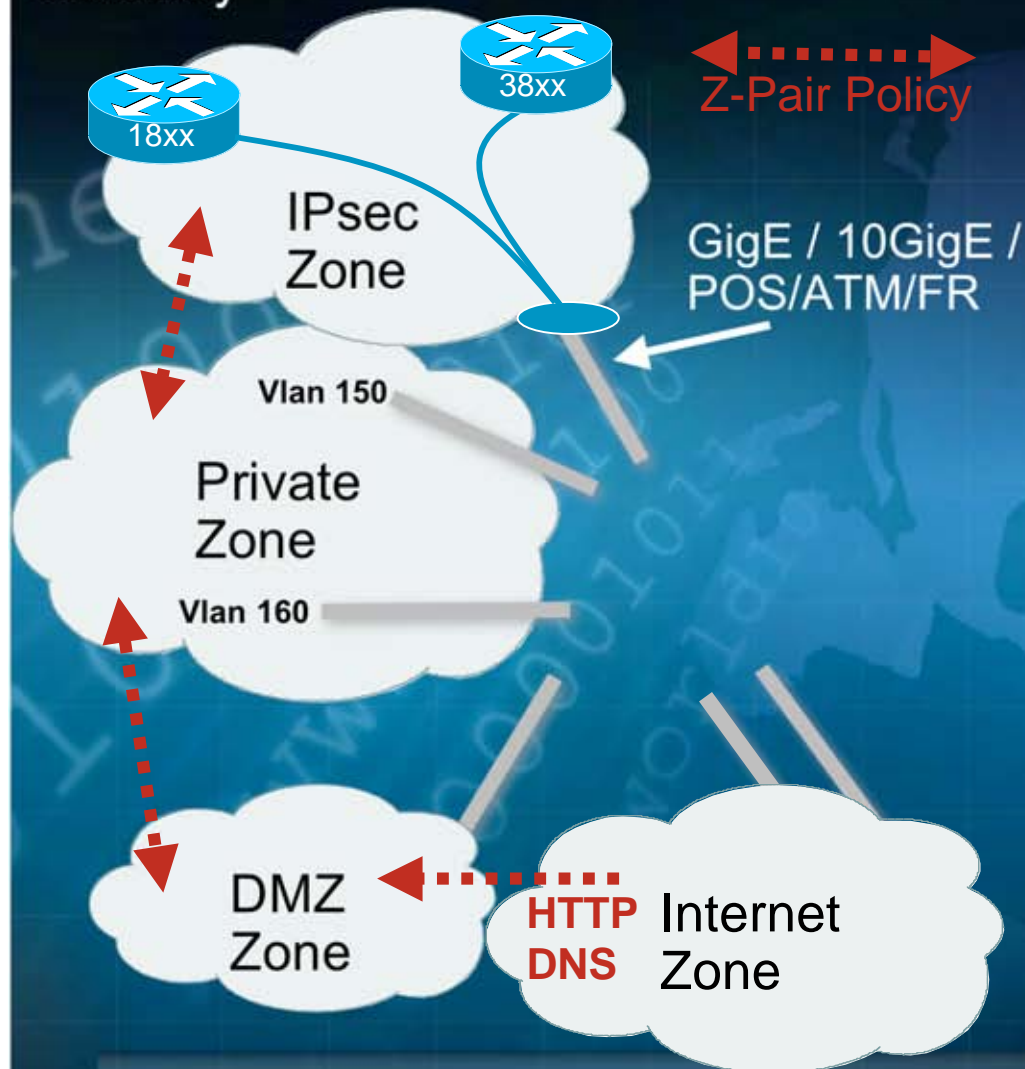
Industry-leading VPN Performance

Multi-Gigabit IPsec Throughput (ESP-10G)



ASR 1000 → Zone-Policy Firewall

WAN Aggregation Head-end or Internet Gateway



Solution Objective

- Being able to scale IOS FW in a router to multi-gigabit BW

Solution Benefits

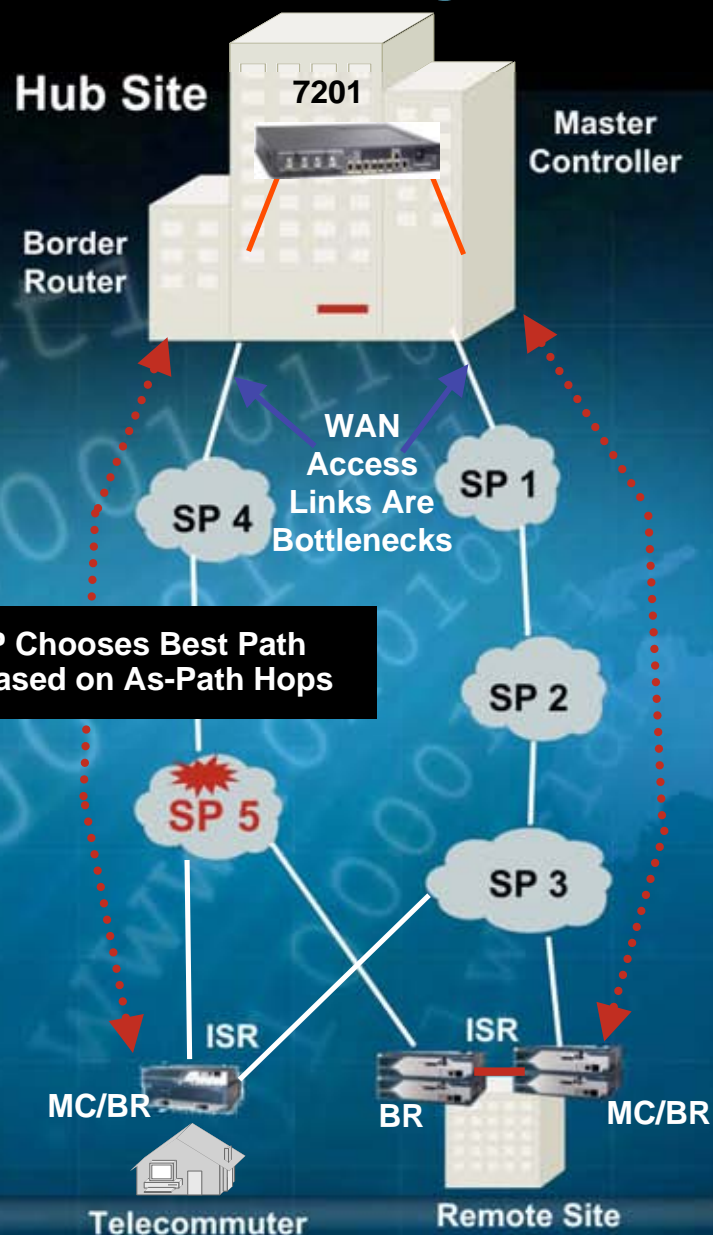
- Multi-Gigabit IOS FW in a router
- IOS Firewall supported on all interfaces in the router
- No service blades required
- IOS ZPF uses CPL for:
 - L4, L7 (HTTP, IM, P2P...), Self, URL Filter, DOS Params & more.

Keys to ASR 1000 (FCS h/w)

- ALL FW processing is done within QFP up to 5/10Gbps
- High-Speed Logging (40K/sec) via NetFlow v9
- 2 Mpps+ with all baseline services combined & FW enabled

ASR 1000 → WAN Optimization → Measuring Performance

Performance routing



Solution Objective

- Offer a full service Path Optimized treatment of all WAN traffic.

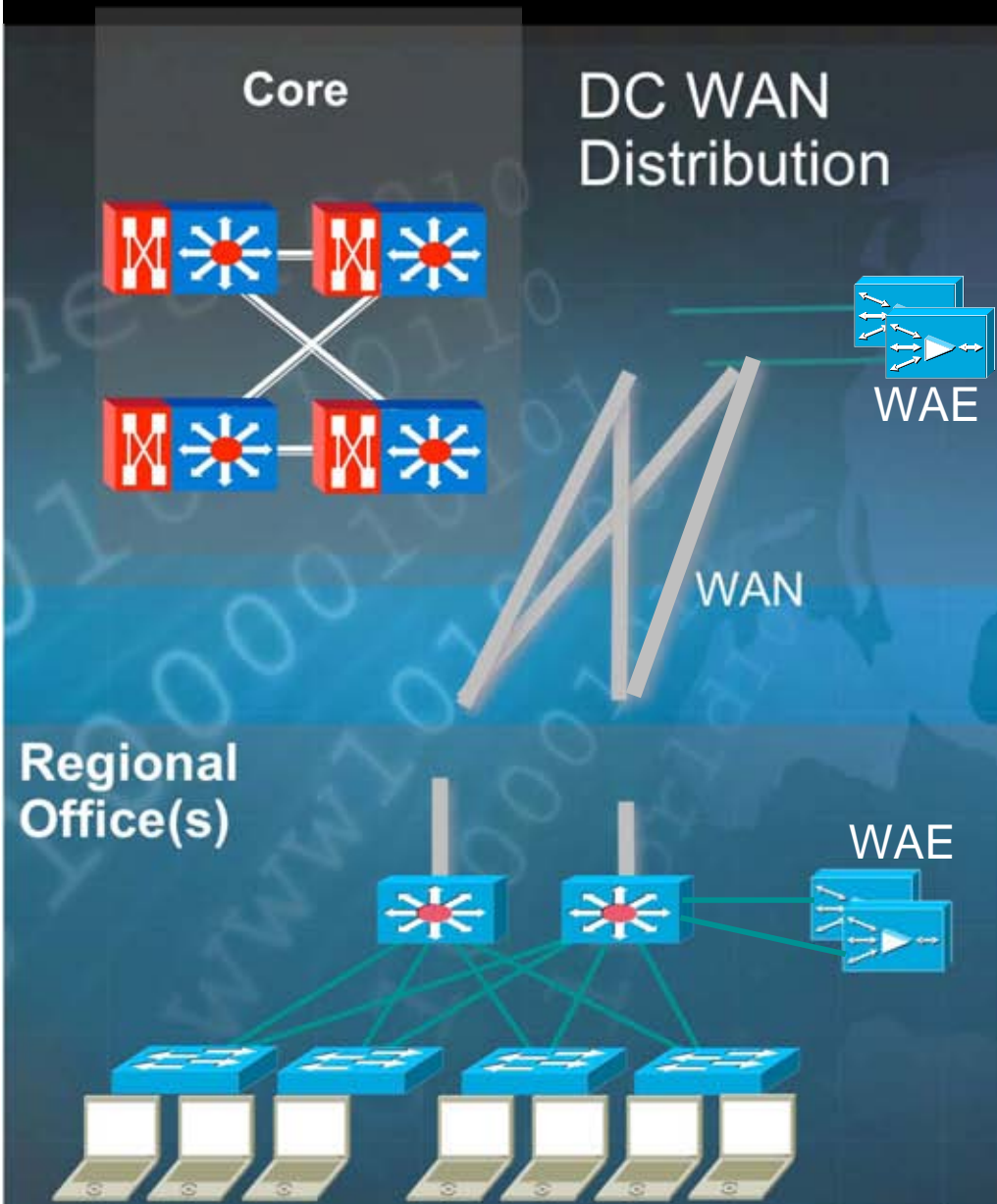
Solution Benefits

- Improve network performance
- Route around problems at first sign of (soft error) trouble
- Path Selection based upon Application requirements
- Business critical applications (ie: ERP, CRM, Oracle) & Voice over IP can enjoy dynamic optimization that is constantly being tracked.

Keys to ASR 1000 (FCS h/w, RLS3)

- Tracks TCP Header to provide DLY/Loss/Reachability metrics for applications & Throughput for prefixes
- **QFP has a huge flow cache & NBAR classification capability that can be leveraged by PFR (2M).**
- Able to optimize Private and Public WANs (IPsec) w/o Service Blades

ASR 1000 → WAN Optimization → DRE(WCCPv2) / TFO



Solution Objective

- Utilize expensive WAN more efficiently by minimizing amount of data and optimize TCP sessions transparently.

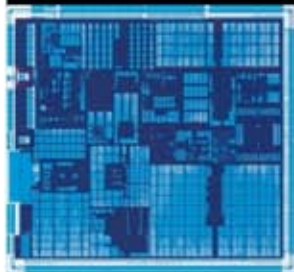
Solution Benefits

- Centralize more servers & storage
- Improve Large/Regional branch network responsiveness
- ASR 1000 can redirect traffic to Wide Area Application Engines (WAE) inline with IOS FW & QOS

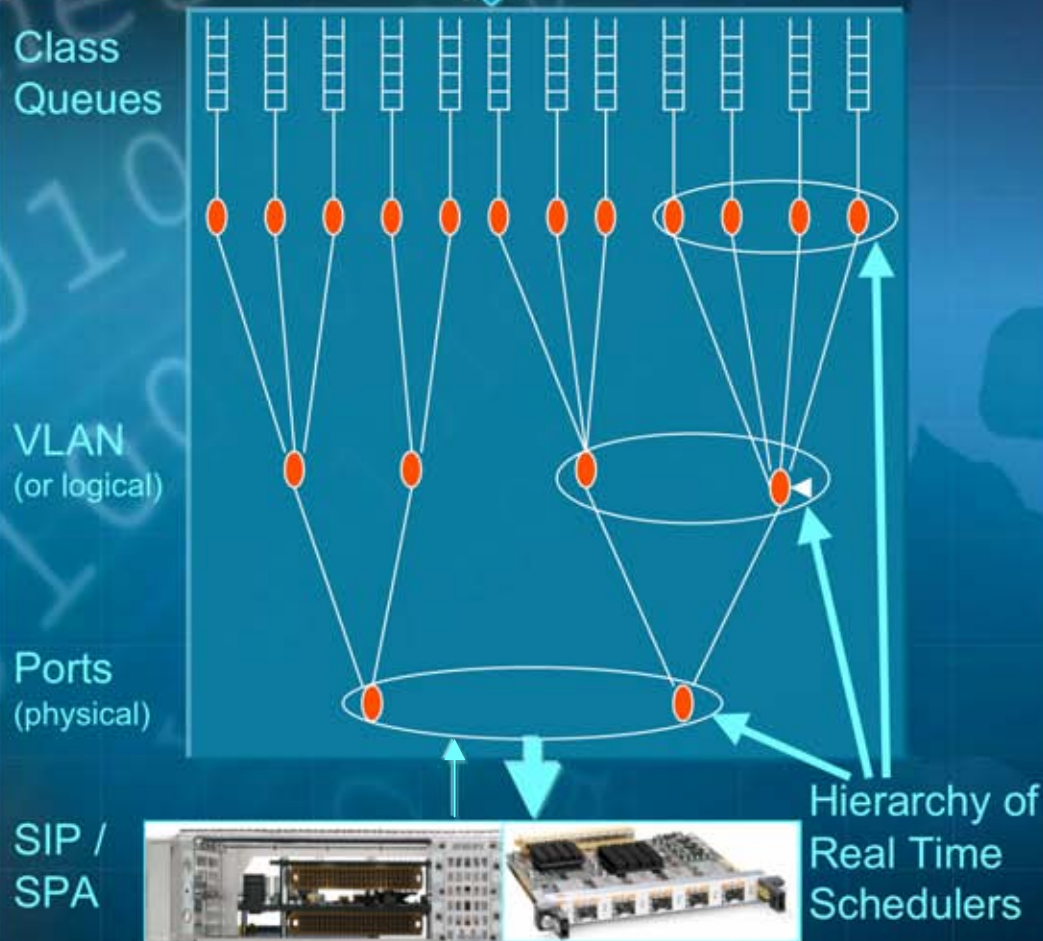
Keys to ASR 1000 (FCS h/w, RLS2)

- L2 and GRE redirection performance expected to be in 8Mpps range
- Priority will be to offer as input feature first with both Hash & Mask based Load Balancing
- Supports 256 Services

ASR 1000 → Superior Application Availability



The QFP Traffic Manager implements hierarchies of schedules in hardware.



Solution Objective

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

Solution Benefits

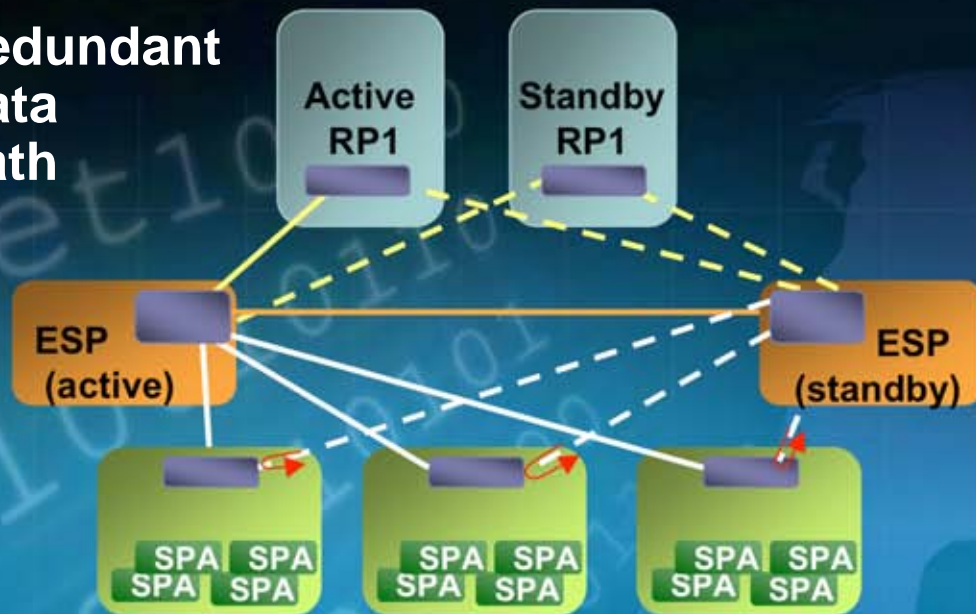
- Guarantees High Priority Applications always get forwarded up to entire system BW.
- Can clamp an arbitrary collection of Low Priority traffic to a certain BW
- Forms an integral part of all Enterprise solutions, the QFP Traffic Manager enables queue based operations without a performance hit.
- Non-queue ops (police, WRED, classifications etc.) are performed by PPE threads and are h/w accelerated

Keys to ASR 1000 (FCS h/w & s/w)

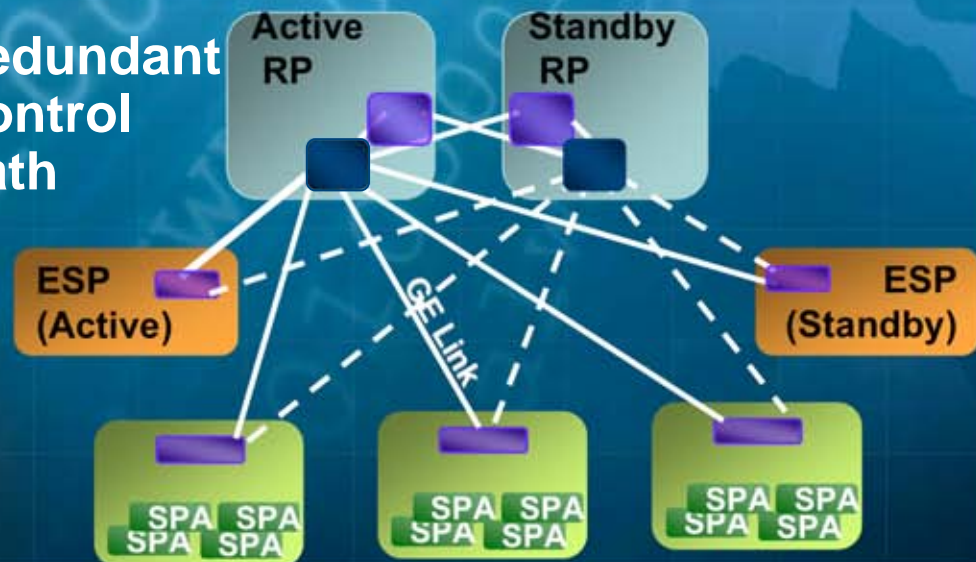
- Flexible Hierarchies
- 128K Queues
 - All queues can have a Min. BW, Max & Excess w/ Priority Propagation
 - 2 Priority queues per policy
- Low 10s of usec of latency

ASR 1000 → Superior High Availability / ISSU

Redundant Data Path



Redundant Control Path



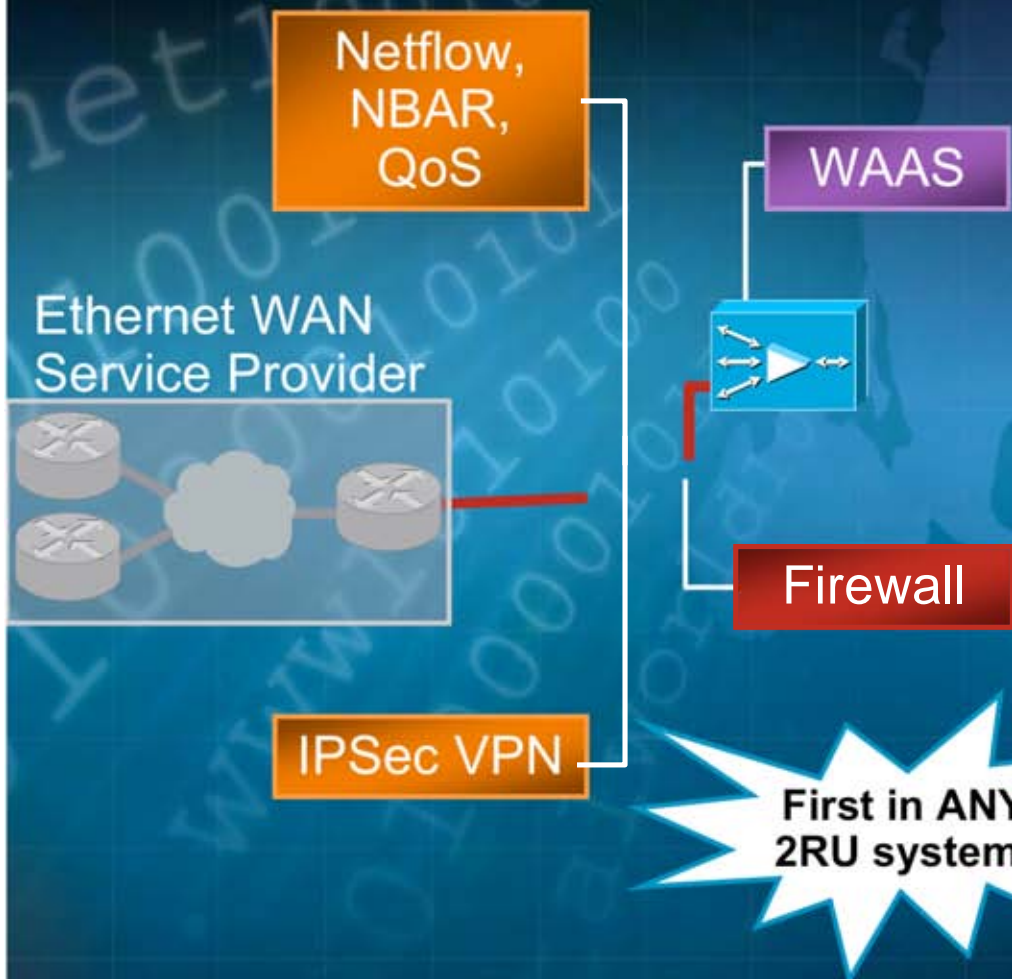
Solution Objective

- Offer a carrier class platform which continues to forward traffic during planned or un-planned events.

Solution Benefits (FCS h/w & s/w)

- Software Redundancy for 2RU/4RU
- NSF / Graceful Restart
 - BGP, OSPF (Cisco/IETF), OSPFv3, IS-IS, EIGRP, LDP
- SSO/ISSU: (generally follow each other)
 - CEF, SNMP, ARP, NAT
 - Stateful ISIS
 - MPLS, MPLS VPN, LDP, VRF-lite
 - IPv6 (NDP, uRPF)
 - FR, PPP, MLPPP, HDLC, VLAN
 - Broadband: PPPoE, AAA, DHCPv4, DHCPv6 PD
- IPsec (SSO), FW/NAT (SSO/ISSU)
- Network
 - IP event dampening
 - BGP & SPF optimizations
 - Multicast sub second convergence
 - GLBP, HSRP, VRRP
 - BFD for BGP, ISIS, OSPFv2 & static v4/v6

ASR 1000 → Next Generation Branch / Managed CPE



Solution Objective

- A branch architecture that offers unparalleled investment protection with services and scale.

Solution Benefits

- Ensures branch ability to route correctly over various types of Ethernet SLAs
- Encrypt multi-Gigabits of BW
- Optimize the WAN to route around brownouts in the SP network to further guarantee mission critical applications
- Small form factor (2RU) which also offers IOS modularity and ISSU
- Manageable even when IOS is down

Keys to ASR 1000 (FCS h/w)

- Incredible Price/Performance
- IOS redundancy w/o a hardware requirement
- 5-10 Gbps FW/NAT + 1.5-3 Gbps IPsec + WAN Optimization + Voice

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