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ASR 1006-X and ASR1009-X Overview and Architecture

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Session ID : BRKARC-2013

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Agenda

- Introduction
- ASR1000 Portfolio Introduction
- Platform Overview
- Software Overview
- Basic Troubleshooting
- Solution Overviews
- Key Takeaways
- Q & A

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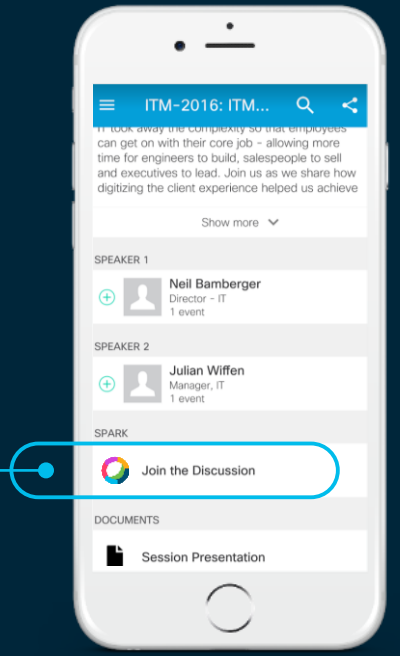

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Introduction

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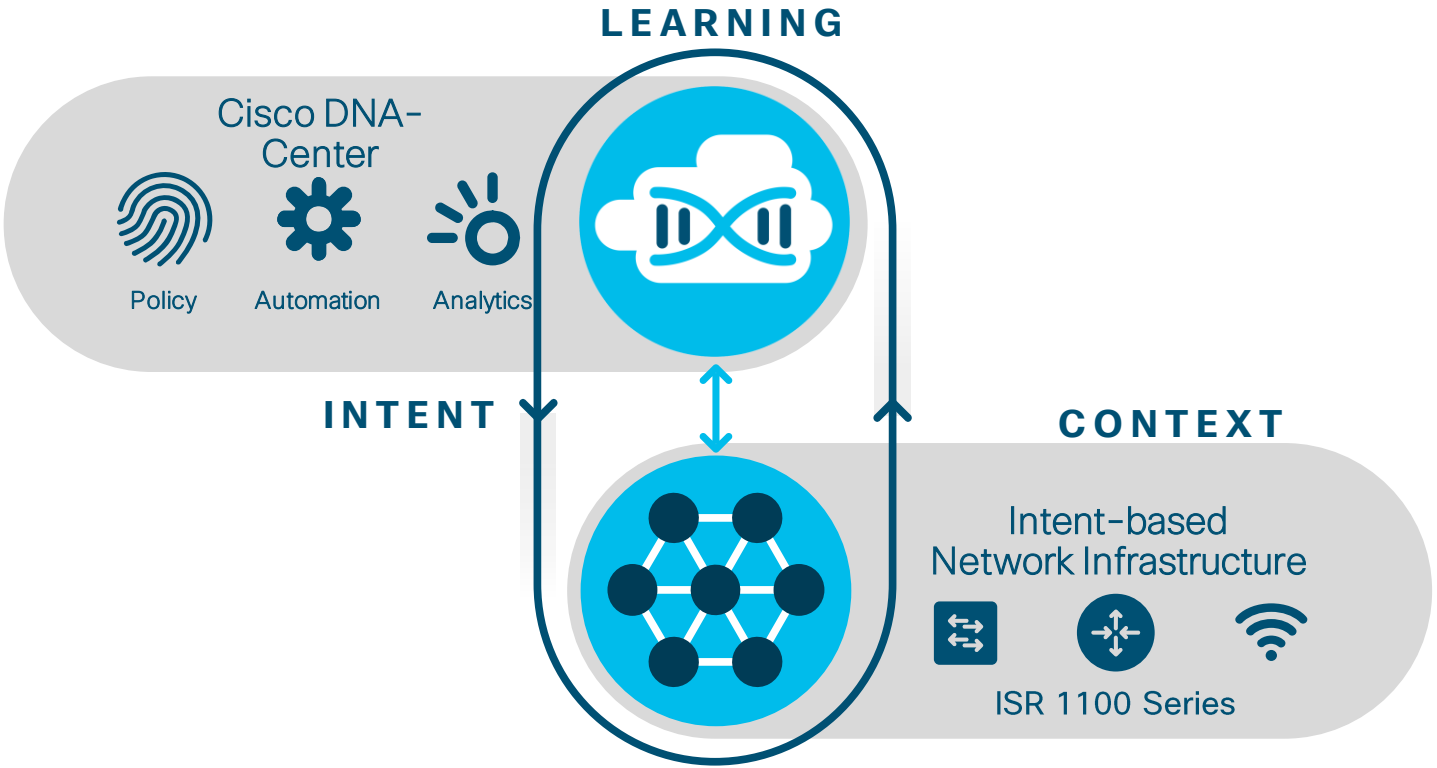
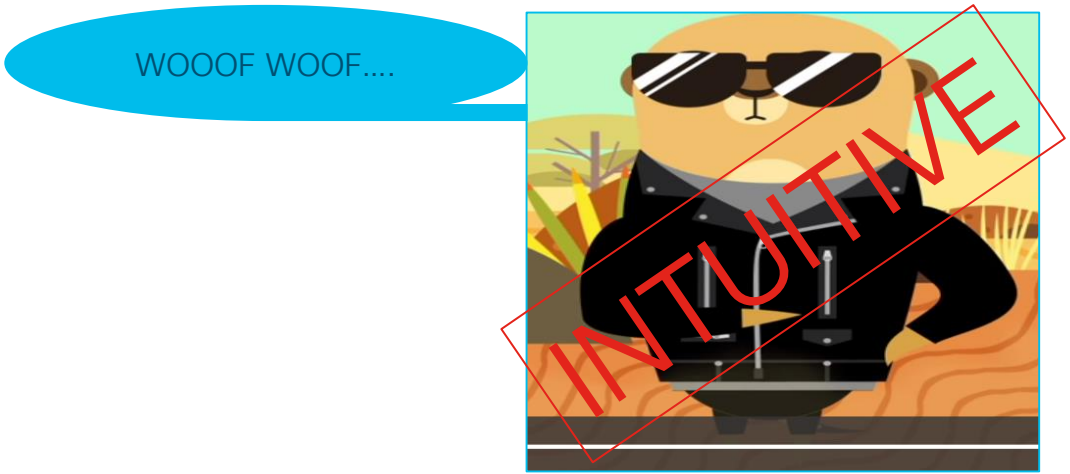
The Network. Intuitive

Powered by Intent. Informed by Context.

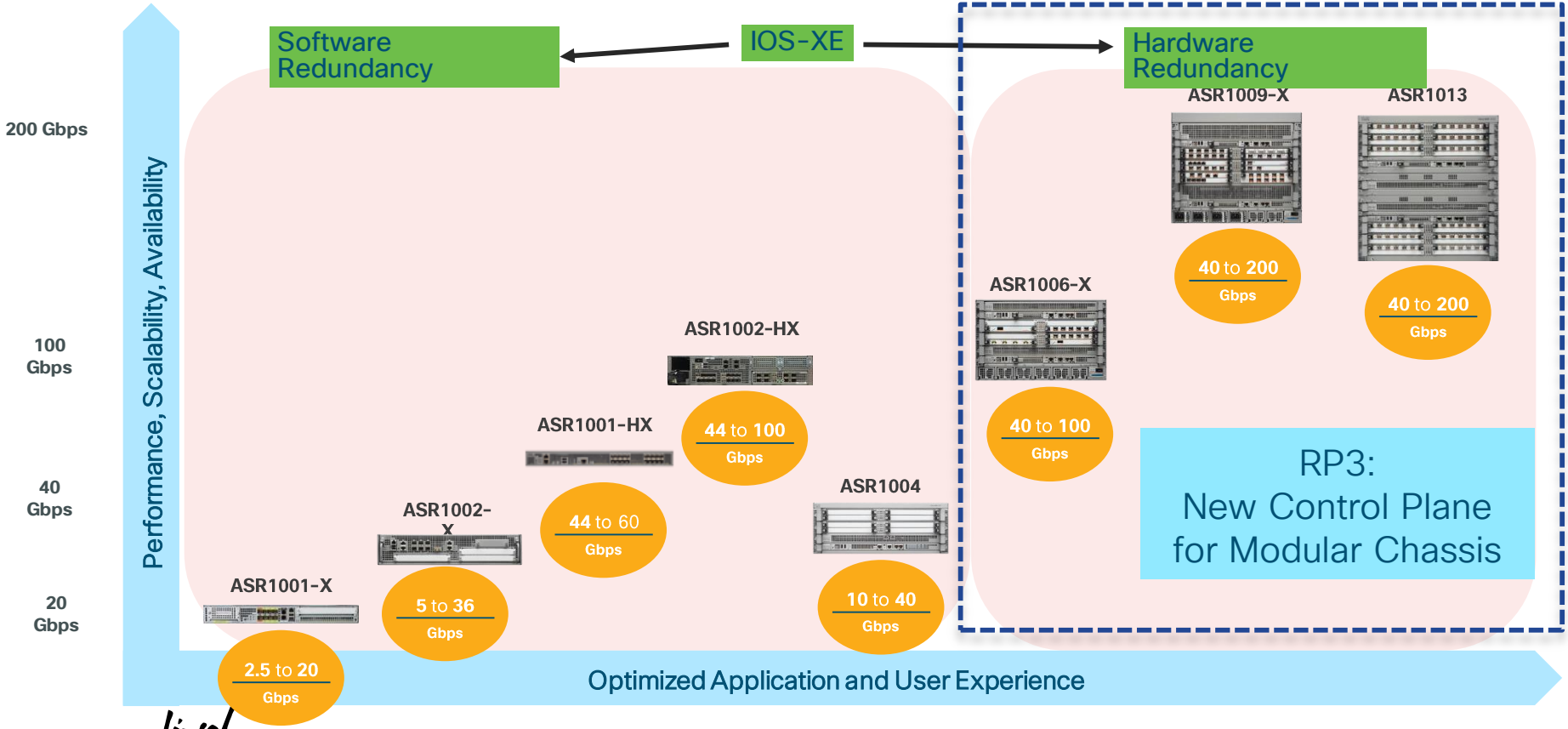


The System. Intuitive



- ✓ Takes a walk and comes back once REALIZES mistake.
- ✓ Sniffs the shoulder bag only, does not REPEAT the whole task.
- ✓ Corrects mistake in REAL TIME.
- ✓ Does not need a PUSH, self controlled.

Cisco ASR1000 Series Routers



Hardware Overview

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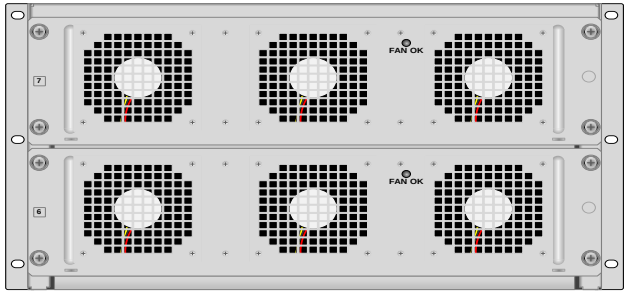
Chassis ASR1006-X

FAN Modules



Two SIP Slot

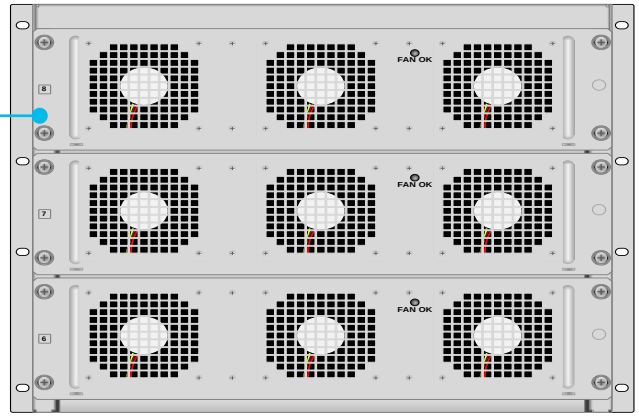
Redundant FP

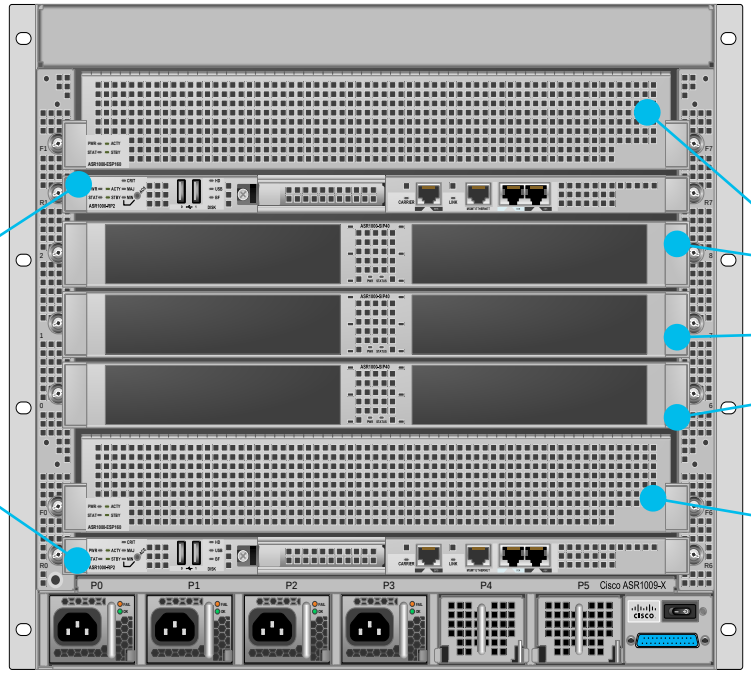
Redundant RP (RP2 or RP3)

Six Power supply

ASR1009-X

FAN Modules





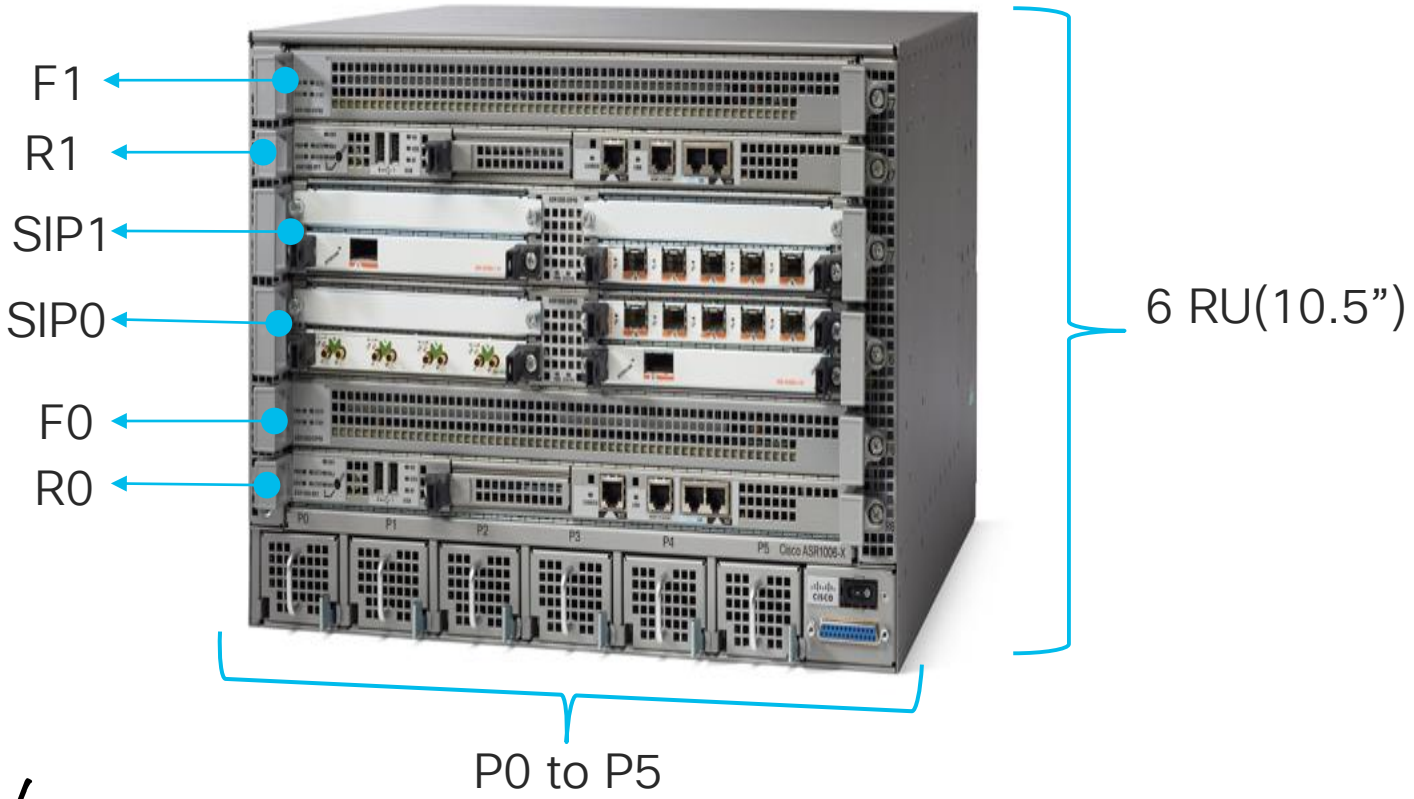
Three SIP Slots

Redundant RP
(RP2 or RP3)

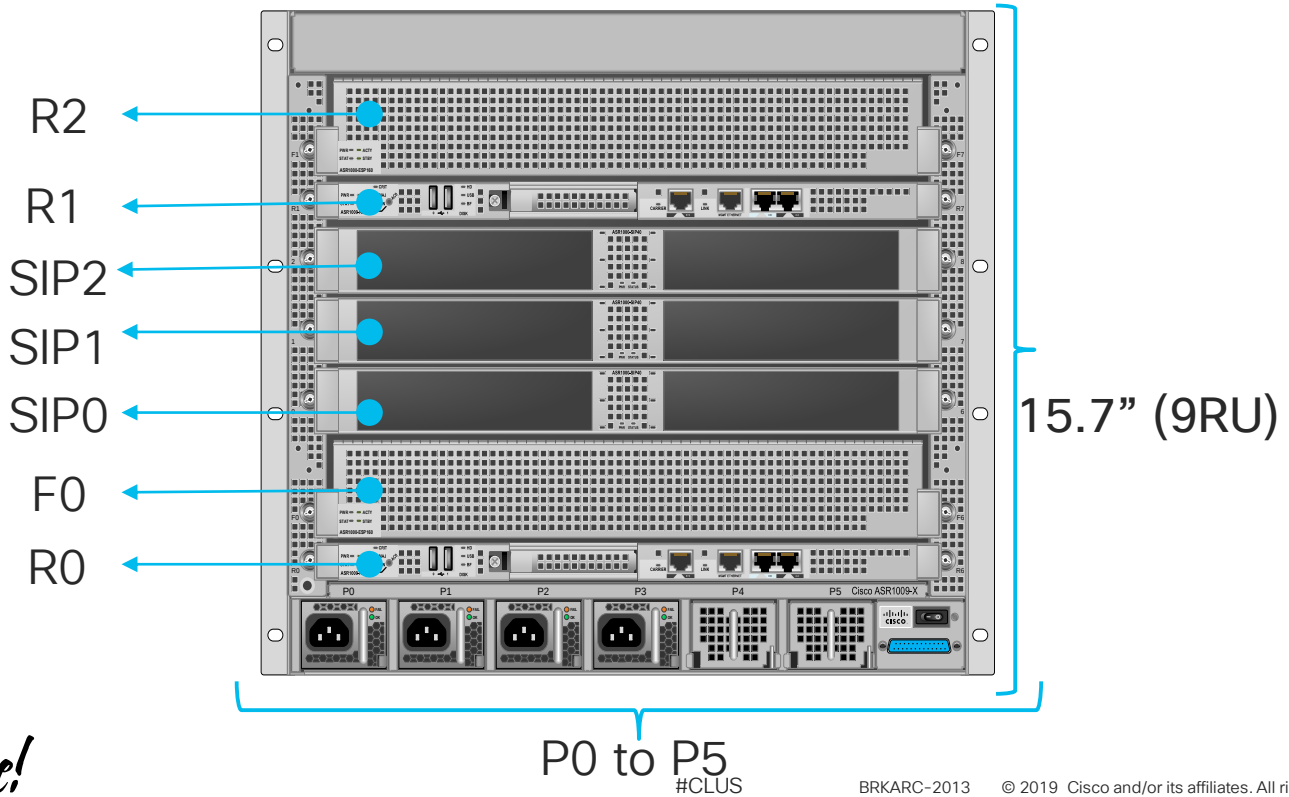
Redundant FP

Six Power Supplies

Chassis ASR1006-X - Numbering Convention



ASR1009-X – Numbering Convention



ASR 1006/9-X Power Supply

- AC or DC power supply modules

1) Fault tolerance - Detects short circuits and component failures within the PS, if a failure is found, the unit is shut down

2) High efficiency - More than 85% efficient to reduce power waste even at low loads

3) Load sharing

4) Redundancy (N+1)

5) Hot-swappable

- Both chassis default config is 2xPS (non-redundant model).
- ASR1009-X may need 3xPS (non-redundant model) in some high power consumption configs.
- Each chassis can accommodate up to 6 power supplies, providing both chassis-level and facility level power fault tolerance.

ASR 1006/9-X Power Supply

```
Router# show platform power
Chassis type: ASR1009-X
Slot      Type                State                 Allocation (W)
--------- ------------------- --------------------- ---------
0         ASR1000-SIP40       ok                    64
0/0       SPA-5X1GE-V2        inserted              18.10
1         ASR1000-SIP40       ok                    64
1/0       SPA-8X1GE-V2        inserted              20
1/3       SPA-4XOC3-POS       inserted              14
2         ASR1000-SIP40       ok                    64
R0        ASR1000-RP2         ok, active            105
F0        ASR1000-ESP80       ok, standby           310
F1        ASR1000-ESP80       ok, active            350
P6        ASR1000X-FAN        ok                    125
P7        ASR1000X-FAN        ok                    125
P8        ASR1000X-FAN        ok                    125
Slot      Type                State                 Capacity (W) Load (W)
--------- ------------------- --------------------- ------------ -----------
P0        ASR1000X-AC-1100W   ok                    1100         228
P1        ASR1000X-AC-1100W   ok                    1100         216
P3        ASR1000X-AC-1100W   ok                    1100         204
Total load: 648 W, total capacity: 3300 W. Load / Capacity is 19%
Power capacity:      3300 W
Redundant allocation: 0 W
PS/Fan allocation:    375 W
FRU allocation:      1009 W
-----------------------------------------
Excessive Power in Reserve:   1916 W
Excessive / (Capacity - Redundant) is 58%
Power Redundancy Mode: none
Power Allocation Status: Sufficient
```

```
Router# show platform power
Chassis type: ASR1006-X
Slot      Type                State                 Allocation (W)
--------- ------------------- --------------------- ---------
1         ASR1000-SIP40       ok                    64
R0        ASR1000-RP2         ok, active            105
F0        ASR1000-ESP80       ok, active            350
P6        ASR1000X-FAN        ok                    125
P7        ASR1000X-FAN        ok                    125
Slot      Type                State                 Capacity (W) Load (W)
--------- ------------------- --------------------- ------------ -----------
P0        ASR1000X-AC-1100W   ok                    1100         132
P1        ASR1000X-AC-1100W   ok                    1100         144
P2        ASR1000X-AC-1100W   ok                    1100         144
Total load: 420 W, total capacity: 3300 W. Load/Capacity is 12%
Power capacity:      3300 W
Redundant allocation: 1100 W
PS/Fan allocation:    250 W
FRU allocation:      519 W
-----------------------------------------
Excessive Power in Reserve:   1431 W
Excessive / (Capacity - Redundant) is 65%
Power Redundancy Mode: nplus1
Power Allocation Status: Sufficient
```

Router(config)# platform power redundancy-mode nplus1

Customer Case study

Issue noticed : ASR 1009-X unexpected shutdown for few mins and came up fine. No crash logs or core dump generated.

Solution: TAC looked into the available data and found this

Buy additional PSU

```
Router# show platform power
Chassis type: ASR1009-X


Slot    Type              State              Allocation(W)
--------- ------------------ -------------------- -------------
0       ASR1000-SIP40      ok                 64
0/0     SPA-1XOC12-POS     inserted             12.75
1       ASR1000-2T+20X1GE  ok                   75
1/0     BUILT-IN-2T+20X1GE inserted             72.31
2       ASR1000-6TGE       ok                 75
2/0     BUILT-IN-6TGE      inserted             69.42
R0      ASR1000-RP2        ok, active           105
F0      ASR1000-ESP100     ok, active           350
P6      ASR1000X-FAN       ok                 125
P7      ASR1000X-FAN       ok                 125
P8      ASR1000X-FAN       ok                 125

Slot    Type              State              Capacity (W) Load (W)
--------- ------------------ -------------------- ----------- --------
----
P2      ASR1000X-AC-1100W  ok                   1100        300
P3      ASR1000X-AC-1100W  ok                   1100        276

Total load: 576 W, total capacity: 2200 W. Load / Capacity is 26%
Power capacity:      2200 W
Redundant allocation: 0 W
Fan allocation:      375 W
FRU allocation:      823 W
---------------------------------------
Excess Power in Reserve:   1002 W
Excess / (Capacity - Redundant) is 45%
Power Redundancy Mode: none
Power Allocation Status: Sufficient
```

Before the Control Plane.....

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Trustworthy Systems of Untrustworthy World!!

Attack 1 :

In the year 2011-12, a **malware** was identified which was seen installing a modified version of IOS file on the host system**(2800 and 3800 routers)** and targeted **the DH key exchange in IPsec**. With this new modified image, attacker were able to decrypt IPsec tunnel data easily.

Solution : Signed Binary and Trust anchor

Attack 2:

Another incident was noticed in the year 2013 on **7600 devices** where attacker has gained access to the device with the help of **compromised admin credentials and modified in-memory(DRAM) code** to send particular packet to attacker defined destinations, also to gain access to the network with some NAT rules written to help attacker. Since this was in-memory, this attack would not survive reload of the device.

Solution : Strong password policy

Attack 3:

The very recent was the SYNful Knock which was noticed in the year 2015. This has **changed the image sitting in flash** and installed it on the router. since this malware used TCP for command and control communication hence named SYN(from TCP)ful attack.

Solution : Having singed image from trusted source can prevent this.

Control Plane

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ASR1000 Route Processors

	RP2	RP3
CPU	Intel Dual-core Wolfdale 2.66GHz	Intel Quad-core Broadwell 2.2GHz
Memory	8, 16GB	8, 16, 32, 64GB
Built-in Boot flash	2GB	8GB
Storage	80GB HDD, External USB	100 – 400 GB SSD, External USB
Chassis Support	ASR1004 ASR1006 ASR1006-X ASR1009-X ASR1013	ASR1006-X ASR1009-X ASR1013

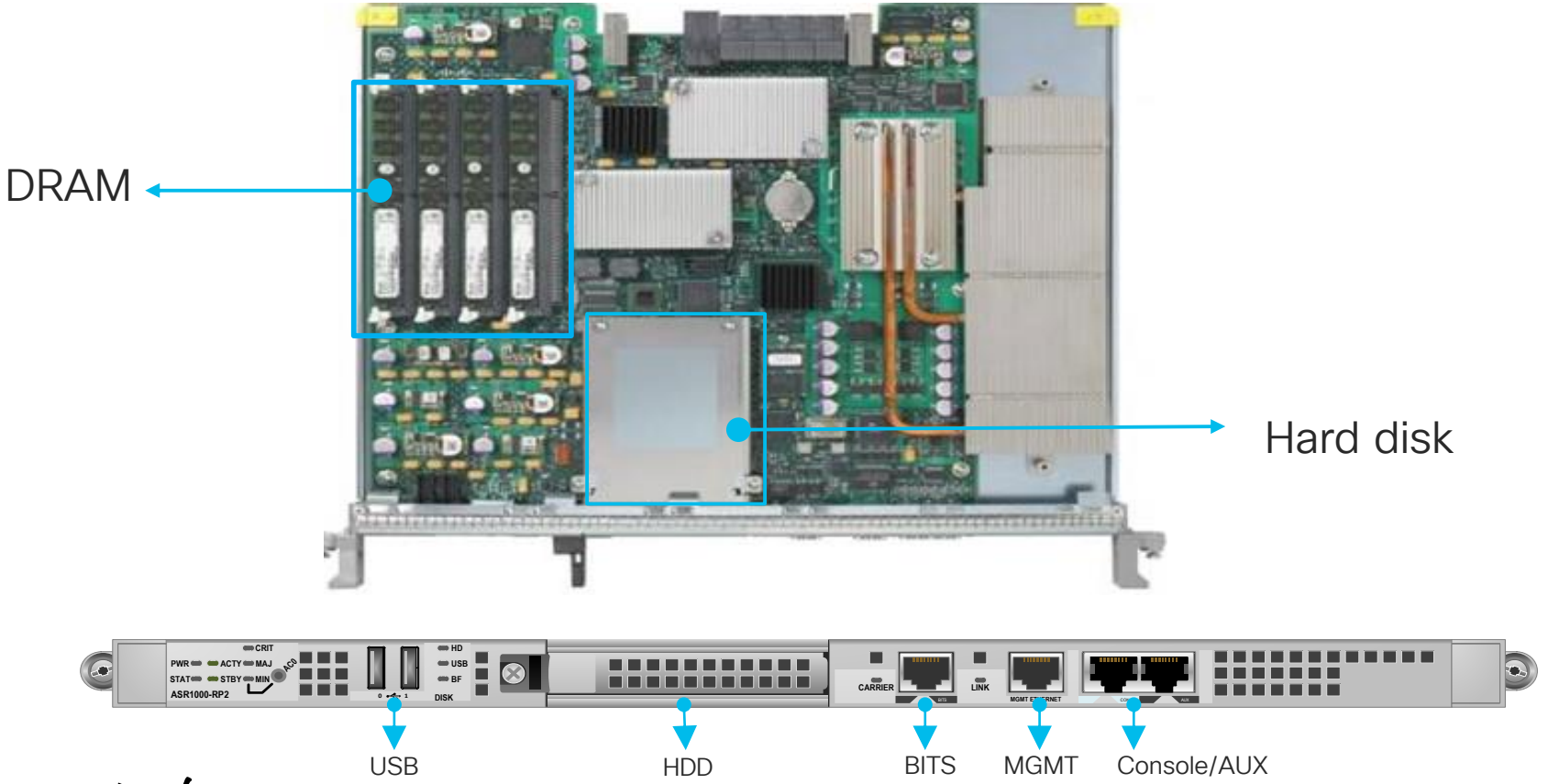
ASR 1006-X Supported Hardware Summary

RP (Control Plane)	RP2 and RP3
ESP (Data Plane)	ESP 40 , ESP 100
SIP/MIP (I/O)	ASR1000-2T+20X1GE,ASR1000-6TGE, ASR1000-MIP100, and ASR1000-SIP40
SIP	Upto 8 SPA slots are supported with SIP40 line cards
EPA	Up to 4 EPA slots are supported with MIP100 line card

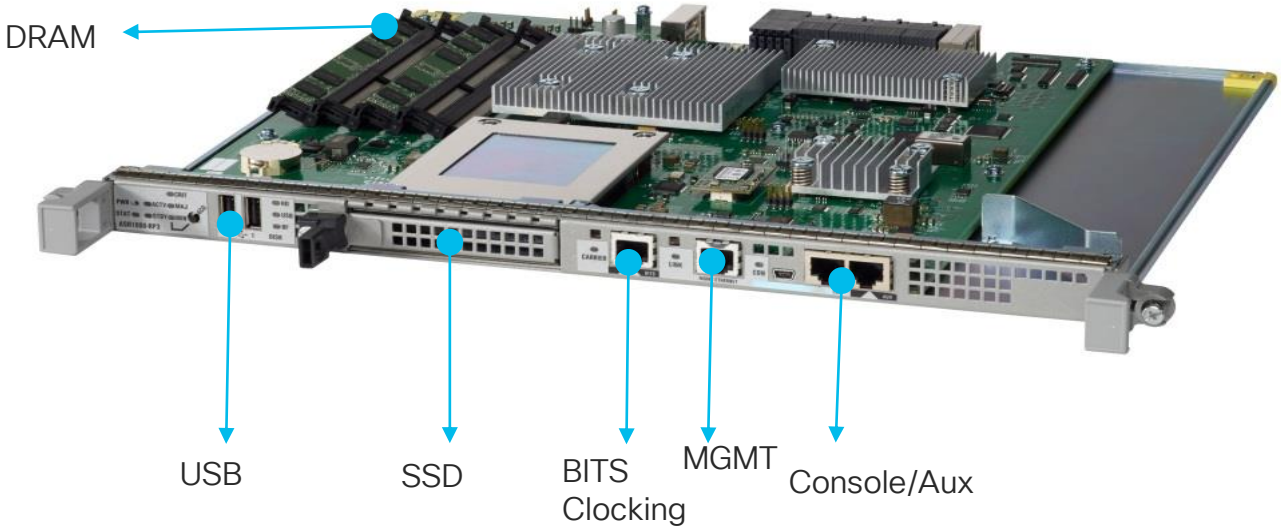
ASR 1009-X Supported Hardware Summary

RP (Control Plane)	RP2 and RP3
ESP (Data Plane)	ESP40, ESP100, ESP200
SIP/MIP (I/O Plane)	SR1000-2T+20X1GE, ASR1000-6TGE,ASR1000-MIP100, and ASR1000-SIP40
SIP	Up to 12 SPA Slots are supported with SIP40 line cards
MIP	Up to 6 EPA slots are supported with MIP100 line card

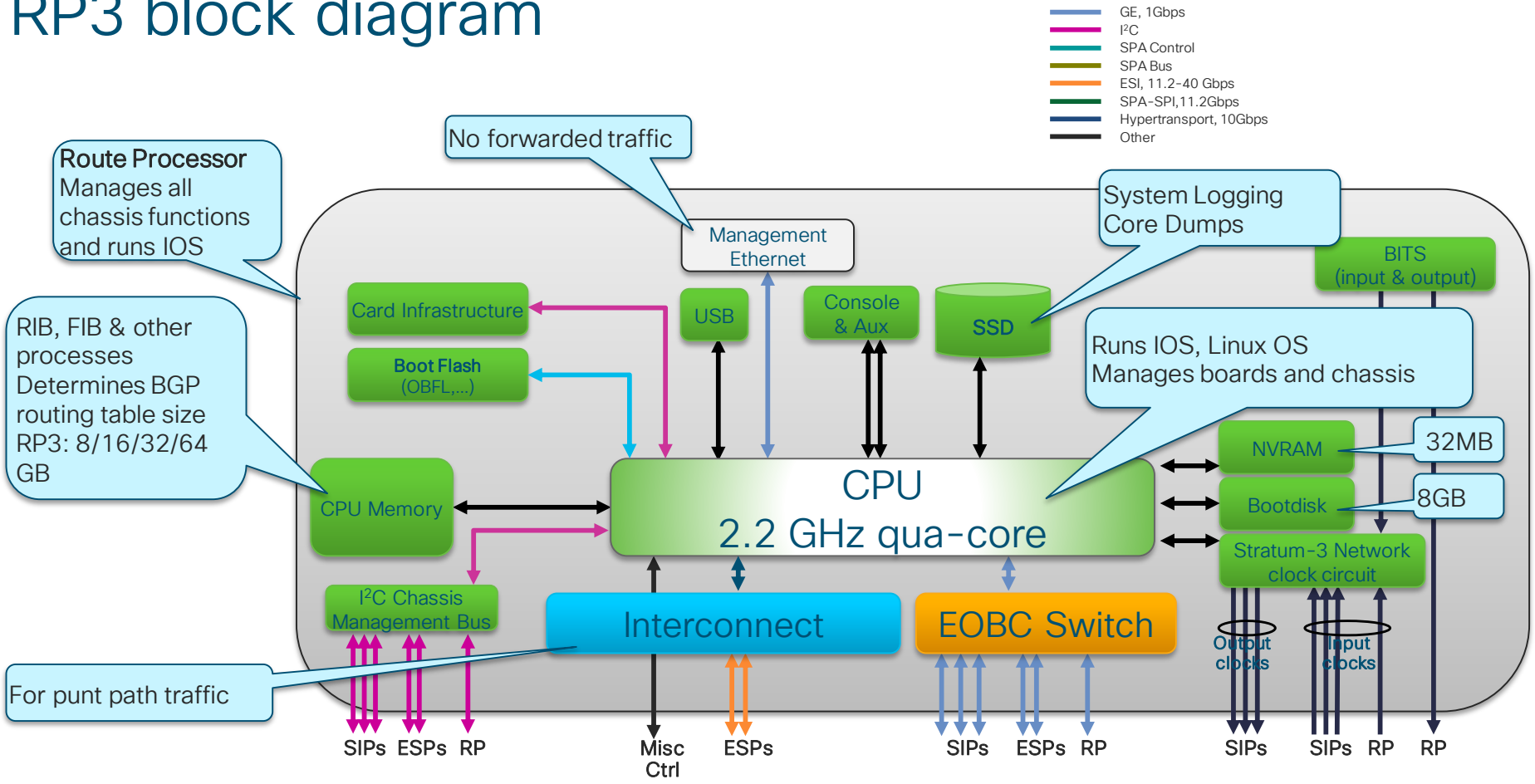
ASR1000 RP-2



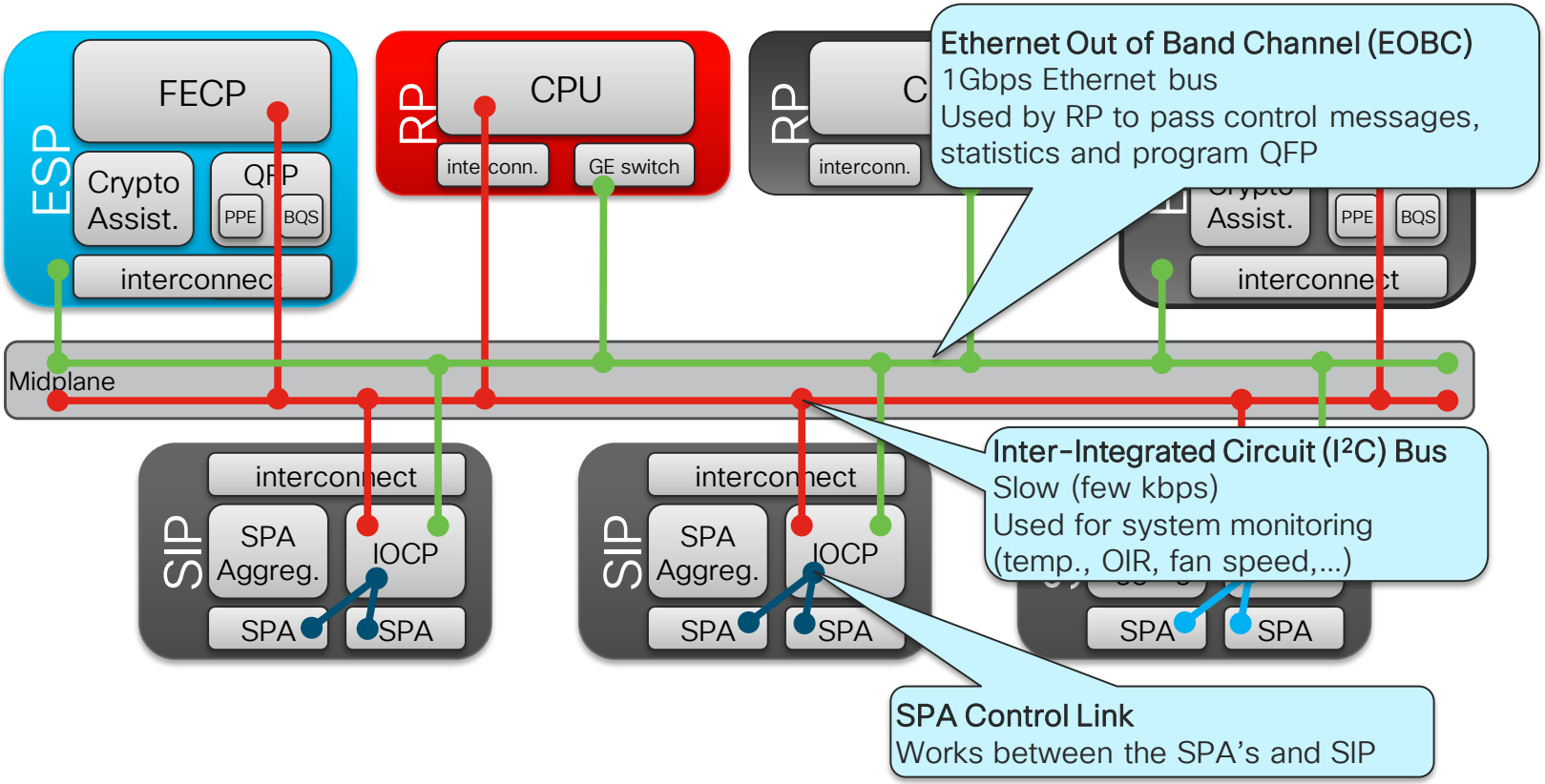
ASR1000 RP-3



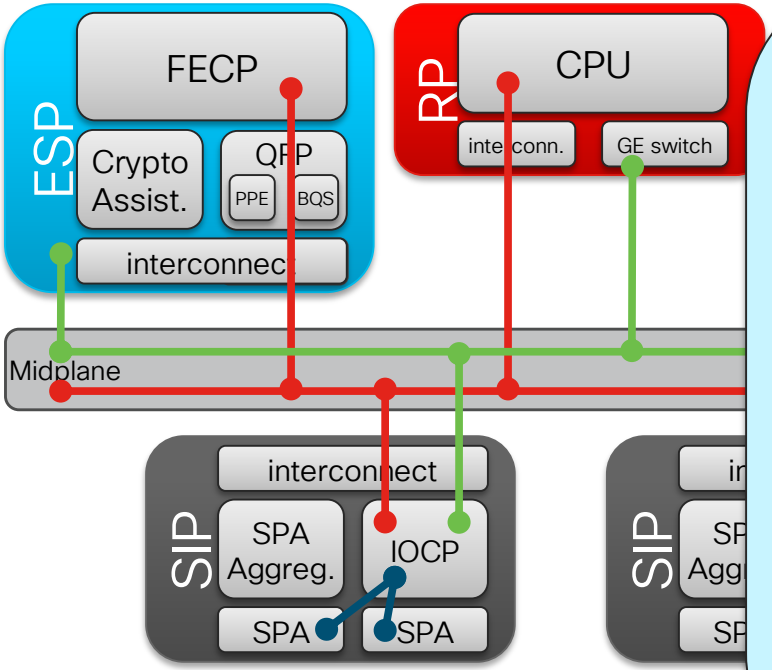
RP3 block diagram



ASR1000 control plane architecture



ASR1000 control plane architecture



Ethernet out-of-band channel (EOBC)

- indication if cards are installed and ready loading images, stats collection
- messages to program QFP

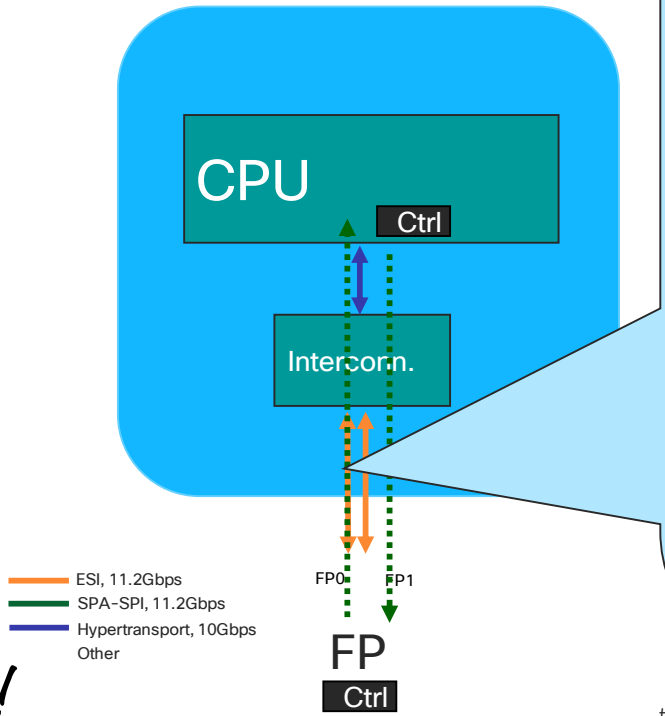
Inter-Integrated Circuit (I²C)

- monitor health of hardware components
- control resets
- communicate active/standby
- real time presence and ready indicators
- control the other RP (reset, power-down,etc.)
- report power-supply status
- EEPROM access

SPA control links

- detect SPA OIR
- reset SPAs (via I²C)
- power-control SPAs (via I²C)
- read EEPROMs

Control Packet Flow: Through RP



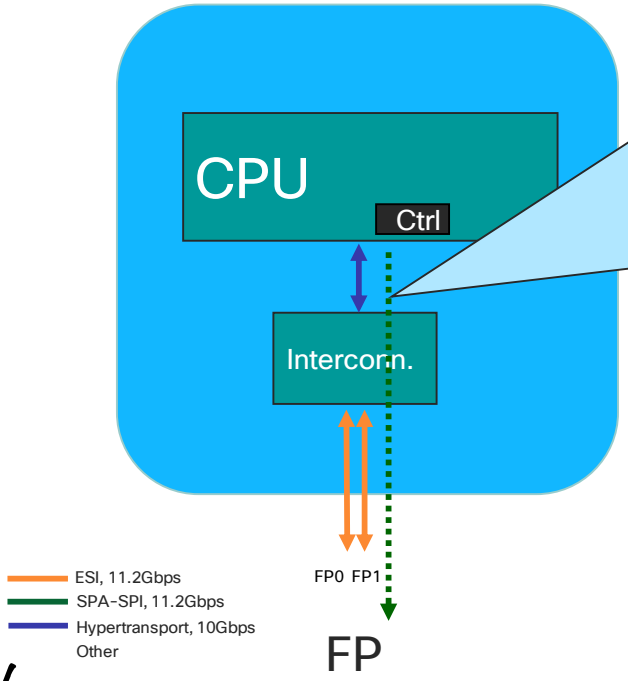

```
!!!! PUNT PACKETS, RP PLATFORM SW VIEW !!!!

ASR1000#show platform software
infrastructure punt

LSMPI interface internal stats:
enabled=0, disabled=0, throttled=0, unthrottled=0, state is
ready
Input Buffers = 262689
Output Buffers = 36383
…….
…….
Bad total length 0
Bad packet length 0
Bad network offset 0
Not punt header 0
Unknown link type 0
No swidb 0
Bad ESS feature header  0
No ESS feature 0
Punt For Us type unknown 0
Punt cause out of range 0
ASR1000-RP Punt packet causes:
      252430 L2 control/legacy packets
           6 ARP packets
       10252 FOR_US packets
Packet histogram(500 bytes/bin), avg size in 92, out 305:
 Pak-Size       In-Count         Out-Count
      0+:         262688            22438
    500+:              0              312
```

Control Packet Flow: Through RP

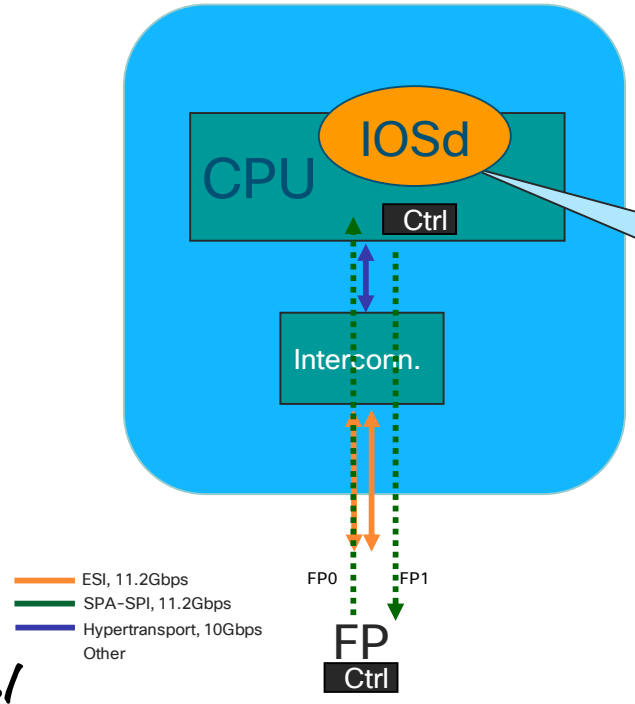
- Packet is received from FP
- Interconnect on FP receives




```
!!!! INJECT PACKETS, RP PLATFORM SW VIEW !!!!

ASR1000#show platform software
infrastructure inject
Statistics for L3 injected packets:
 30665 total inject pak, 0 failed
 0 sent, 0 prerouted
 0 non-CEF capable, 0 non-unicast
 7628 IP, 0 IPv6
 0 MPLS, 0 Non-IP Tunnel
 0 UDLR tunnel, 0 P2MP replicated mcast
 0 Non-IP Fastswitched over Tunnel, 23037 legacy pak path
 0 Other packet
 0 IP fragmented
 7628 normal, 0 nexthop
 0 adjacency, 0 feature
 0 undefined
 0 pak find no adj, 0 no adj-id
 0 sballoc, 7628 sb local
per feature packet inject statistics
 0 Feature multicast
 0 Feature Edge Switching Service
 0 Feature Session Border Controller
 0 Feature interrupt level
 0 Feature use outbound interface
 0 Feature interrupt level with OCE
```

Control Packet Flow: Through RP



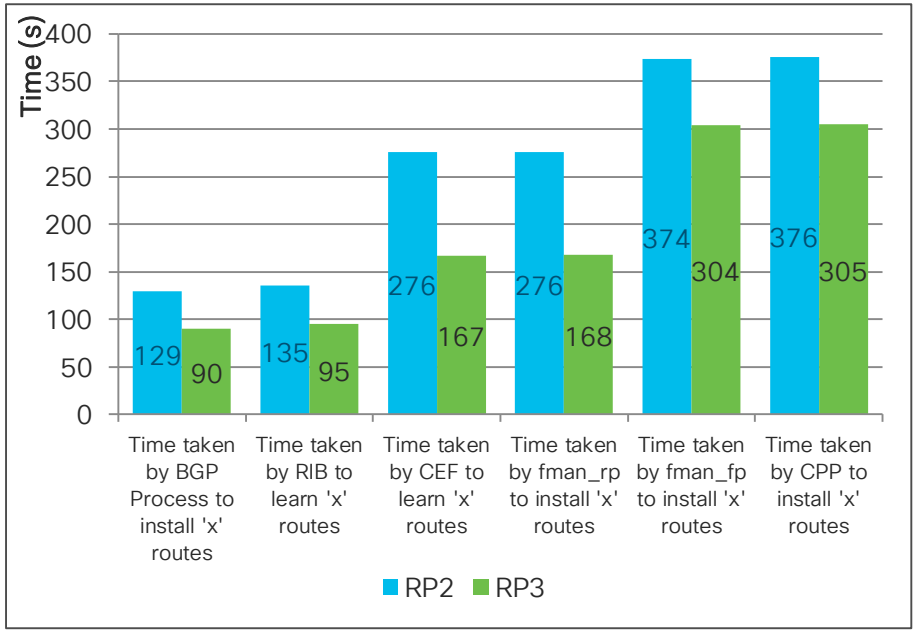
- Packet is received from FP
- Interconnect on FP receives packet data from FP's over ESI's at up to 11.5Gbps each and writes it to packet memory
- The CPU on the RP processes the packet
- Control plane packets generated by the RP are produced by the CPU

```
!!!! PUNT PACKETS, IOS  VIEW !!!!
Mgmt Ethernet traffic also hits it, coming directly
into RP.

ASR1000#show ip traffic  | b
ARP
ARP statistics:
  Rcvd: 251583 requests, 278 replies, 0 reverse, 0
other
  Sent: 25 requests, 862 replies (0 proxy), 0
reverse
  Drop due to input queue full: 0
```

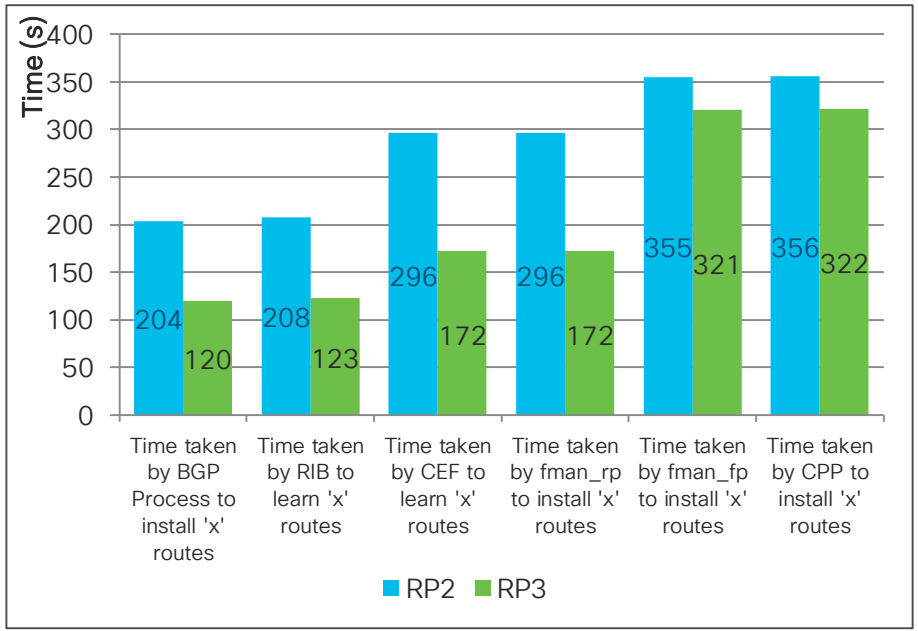
RP2 vs RP3 Performance

BGPv4 Performance (4M routes)



~20-30% better BGPv4 Performance

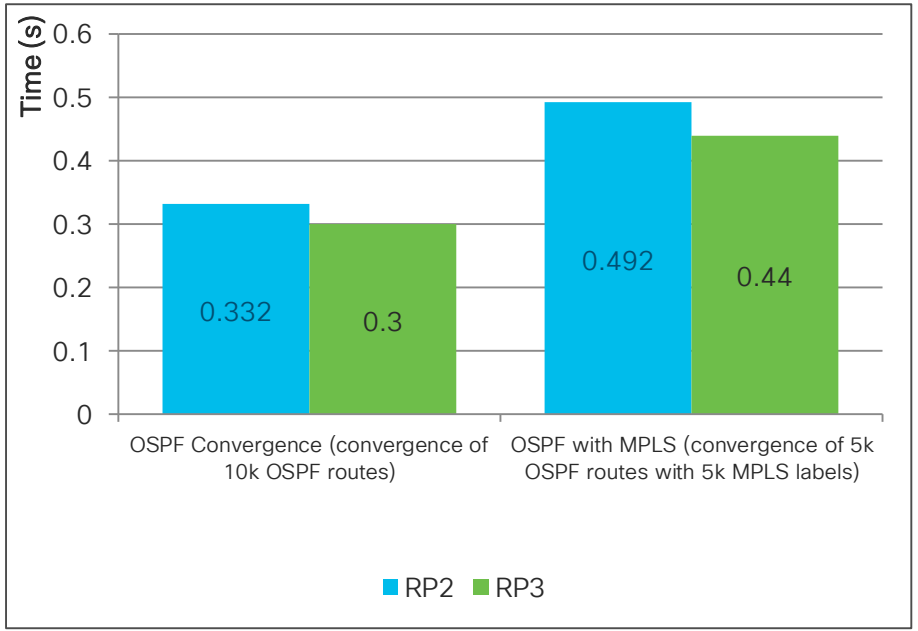
BGPv6 Performance (4M routes)



~40% better BGPv6 Performance

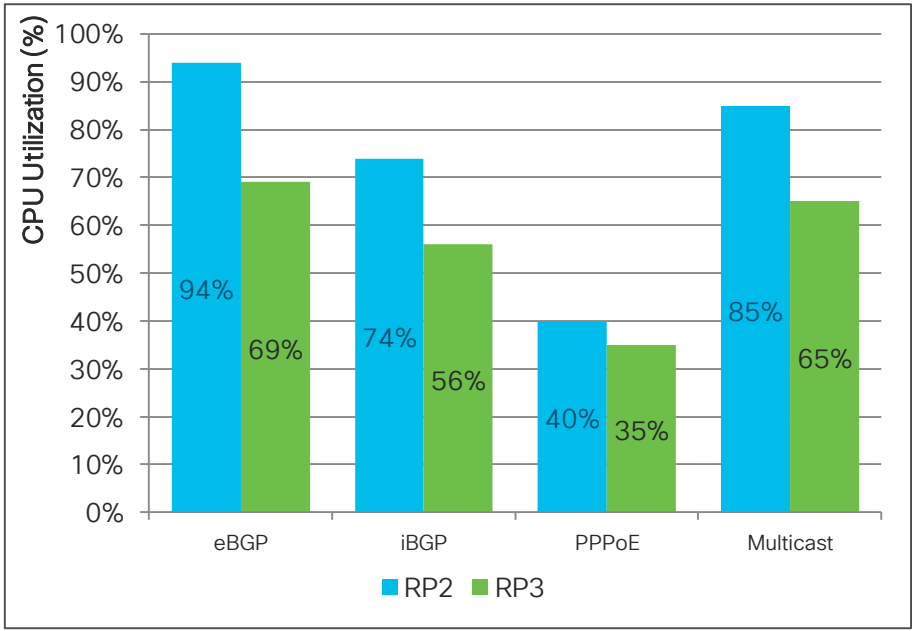
RP2 vs RP3 Performance

Route Convergence Time



~10% faster OSPF convergence

CPU Utilization (%)



Less CPU utilization on RP3

Data Plane Hardware

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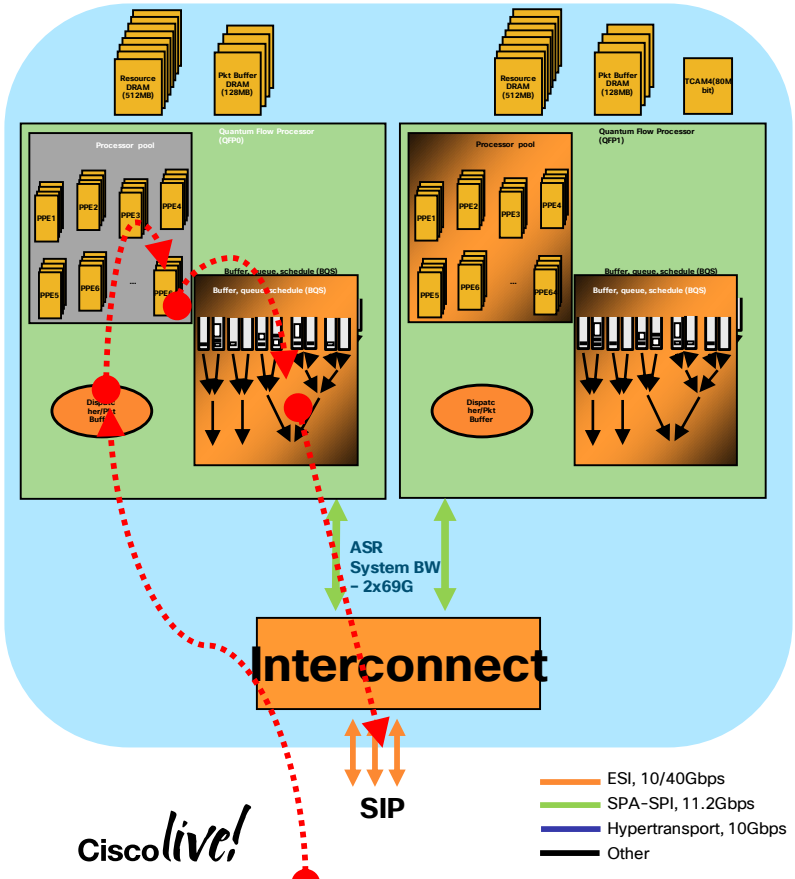
Data Plane –Hardware

ASR1000-ESP100	ASR1000-ESP200
	
Total Bandwidth: 100G	Total Bandwidth: 200G
Crypto Bandwidth (1400 bytes)– 29G Crypto Bandwidth (IMIX) – 16G (AES Encryption Type)	Crypto Bandwidth (1400 bytes)– 75-78G Crypto Bandwidth (IMIX) – 59G (AES Encryption Type)
QFP Resource Memory: 4G TCAM: 80Mb Packet Buffer: 1GB	QFP Resource Memory: 8G TCAM: 2x80Mb Packet Buffer: 2GB
Control CPU: 1.73GHz dual-core CPU Control CPU memory: 16GB	Control CPU: 1.73GHz dual-core CPU Control CPU memory: 32GB
4,000,000 IPv4 or 4,000,000 IPv6 routes Multicast: 100,000 routes and 44,000 groups	4,000,000 IPv4 or 4,000,000 IPv6 routes Multicast: 100,000 routes and 44,000 groups
Chassis support: ASR1006 and ASR1013, ASR1006-X, ASR1009-X	Chassis support: ASR1013, ASR1006-X,ASR1009-X

Data Packet Flow: Through ESP100



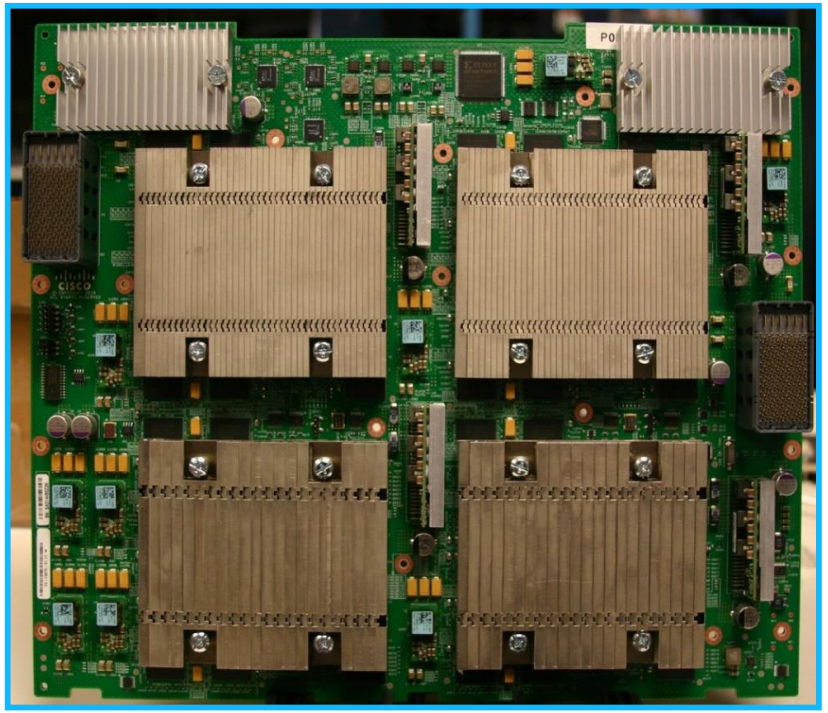
1. Packet arrives on QFP
2. Interconnect ASIC send the packet to one of the QFPs in round-robin fashion
3. Packet assigned to a PPE thread.
4. The PPE thread processes the packet in a feature chain

Ingress Feature : NetFlow, MQC/NBAR Classify, FW, RPF, Mark/Police, NAT, WCCP etc.
Forwarding Decision: Ipv4 FIB, Load Balance, MPLS, MPLSoGRE, Multicast etc.
Output Features : NetFlow, FW, NAT, Crypto, MQC/NBAR Classify, Police/Mark etc

1. Packet released from on-chip memory to Traffic Manager (Queued). Depends on the location of egress interface, the packet may need to be forwarded to BQS in another QFP for dequeues.
2. 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
3. SIP can independently backpressure ESP via ESI control message to pace the packet transfer if overloaded

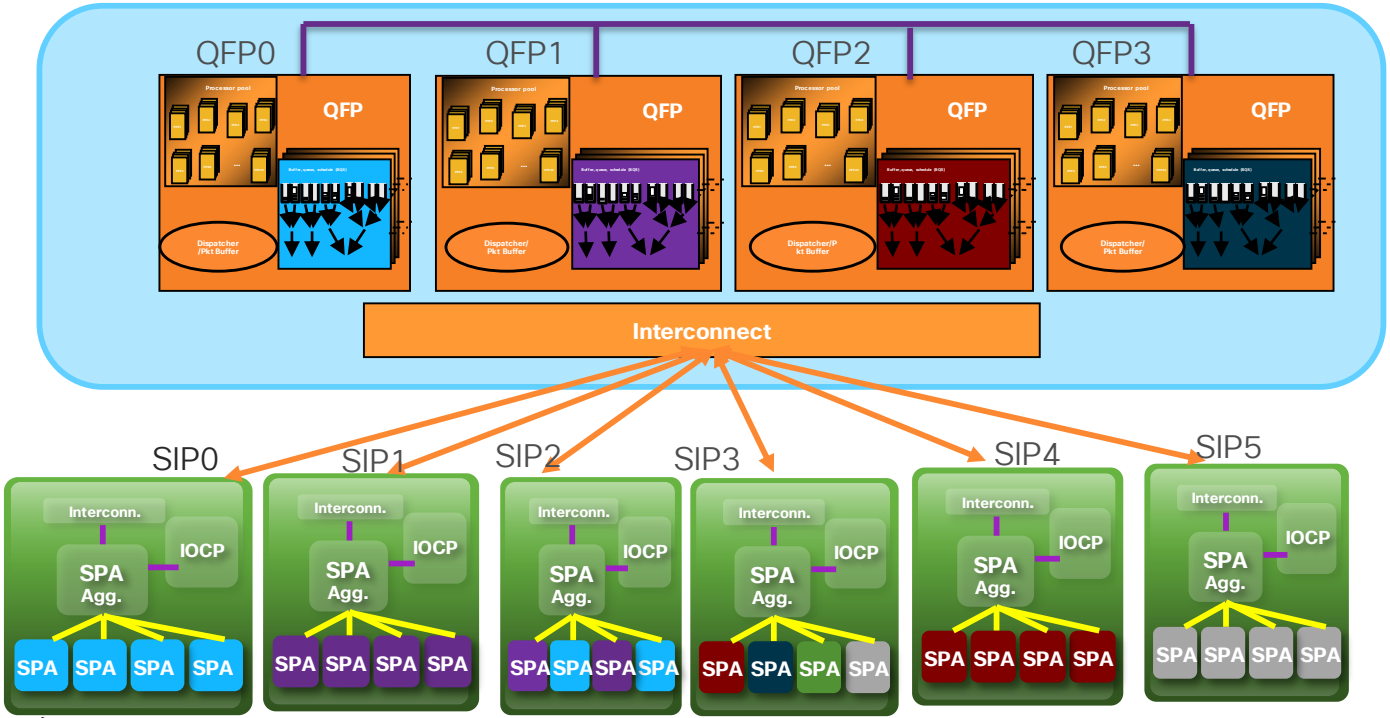
ASR1000-ESP200

- Centralized, programmable forwarding engine (i.e. QFP subsystem (PPE) and crypto engine) providing full-packet processing
- Packet buffering and queuing/scheduling (BQS)
- Increases BW to provide 200G throughput up to 78Gbps crypto BW
- Interconnect providing data path links (ESI) to/from other cards over midplane
- Support up to two 23 GbpsESI links to each SIP slot (1 x 11G or 2 x 23G)
- FECP CPU (1.73GHz dual core CPU with 32GB memory) managing QFP, crypto device, midplane links, etc



ESP 200 Block Diagram

- Interconnect sprays packets to PPEs on all four QFPs in a round-robin fashion.
- Interconnect also maintains packet ordering on egress side.
- Unlike ASR9k(Single stage forwarding) Packet arriving on SIP0 and leaving on SIP3.



Input Output(SIP/SPA) Hardware

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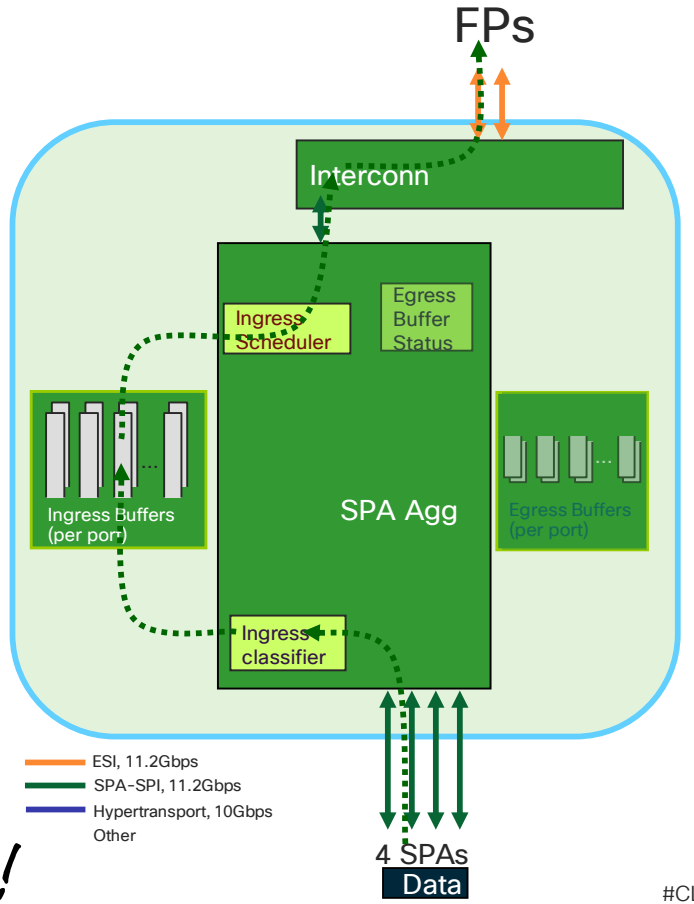
SIP40

	ASR1000-SIP40
	
Bandwidth	40G
Ingress Buffering	128MB
Egress Buffering	8MB
ESI Frequency	6.25GHz or 3.125GHz
Bandwidth per ESI Link	23Gbps
ESI Links used	1 or 2
Total Bandwidth	23Gbps/46Gbps

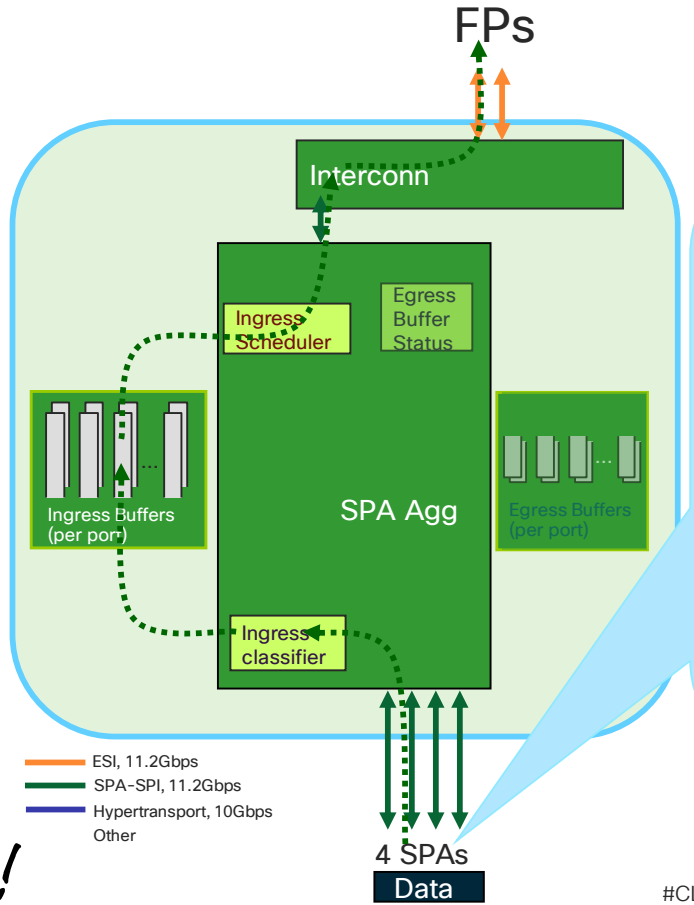
*SIP 10 is not supported on asr1006-x and asr1009-x

Data Packet Flow: From SPA through CC



1. SPA receives packet data from its network interfaces and transfers the packet to the CC
2. SPA Aggregation classifies the packet into H/L priority
3. CC writes packet data to external 128MB memory.
4. Ingress buffer memory is carved into 64 queues. The queues are arranged by SPA-SPI channel and optionally H/L.Channels on "channelized" SPA's share the same queue.
5. CC selects among ingress queues for next pkt to send to FP over ESI. It prepares the packet for internal transmission
6. The interconnect transmits packet data of selected packet over ESI to active FP at up to 11.5Gbps.
7. Active FP can backpressure CC via ESI ctl message to slow pkt transfer over ESI if overloaded (provides separate backpressure for Hi vs. Low priority pkt data).

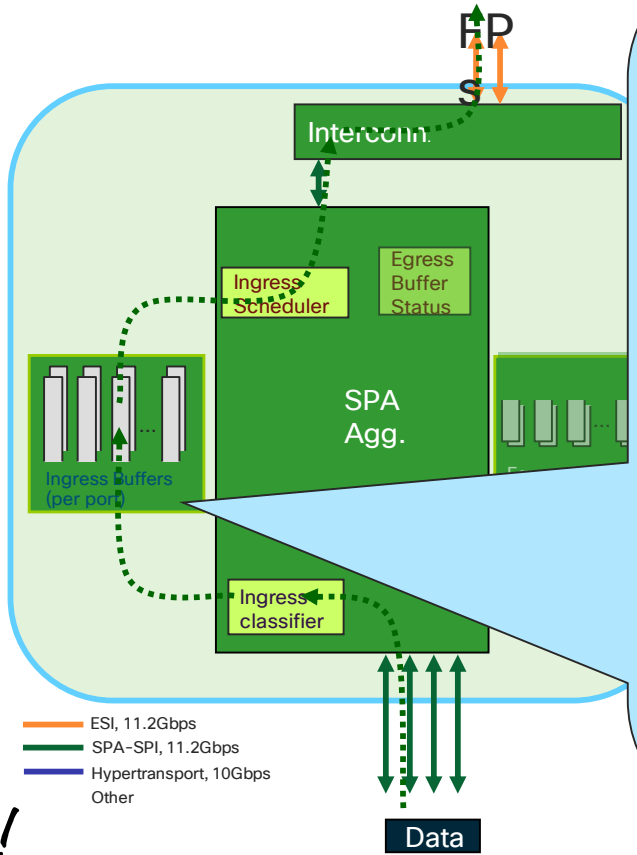
Data Packet Flow: From SPA through CC



1. SPA receives packet data from its network interfaces and transfers the packet to the CC
2. SPA Aggregation classifies the packet into H/L priority

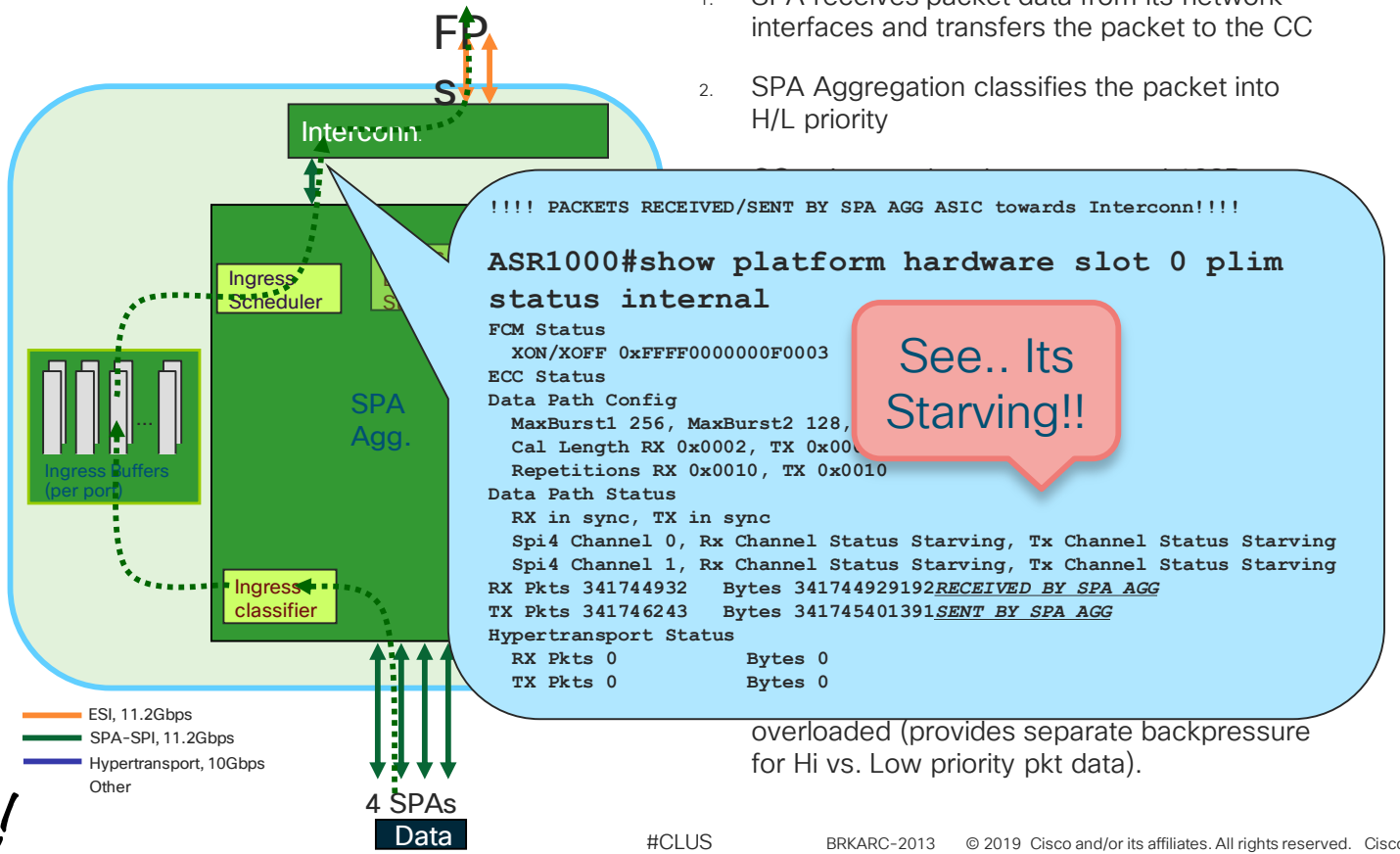
```
!!!! PACKETS RECEIVED/SENT BY SPA !!!!

ASR1000#ipc-console 0 3

Entering CONSOLE for slot 0
Type "^C^C^C" to end this session

Router>

Router#show hw-module subslot 3 counters |
iport|frames
port:0
good_frames_received: 324435304
bad_frames_received: 0
broadcast_frames_received: 1
multicast_frames_received: 0
good_frames_sent: 324435908
broadcast_frames_sent: 0
multicast_frames_sent: 0
   spi4_rx_frames: 0
   spi4_tx_frames: 0

Router#show hw-module subslot 3 drops-all
```

Data Packet Flow: From SPA through CC




```
!!!! PLATFORM QoS on SIP  !!!!

ASR1000#show platform hardware
interface g0/2/0 plimqos input map

Interface GigabitEthernet0/2/0
    Low Latency Queue (High Priority):
        IP PREC, 6, 7
        IPv6 TC, 46
        MPLS EXP, 6, 7

ASR1000#show platform hardware port
0/2/0 plim buffer settings

Interface 0/2/0
RX Low
    Buffer Size 2064384 Bytes
    Drop Threshold 1020864 Bytes
    Fill Status Curr/Max 0 Bytes / 0 Bytes
TX Low
    Interim FIFO Size 48 Cache line
    Drop Threshold 35136 Bytes
    Fill Status Curr/Max 0 Bytes / 3072 Bytes
RX High
    Buffer Size 2064384 Bytes
    Drop Threshold 402624 Bytes
    Fill Status Curr/Max 0 Bytes / 0 Bytes
  TX High
    Interim FIFO Size 48 Cache line
    Drop Threshold 35136 Bytes
    Fill Status Curr/Max 0 Bytes / 5120 Bytes
```

Data Packet Flow: From SPA through CC

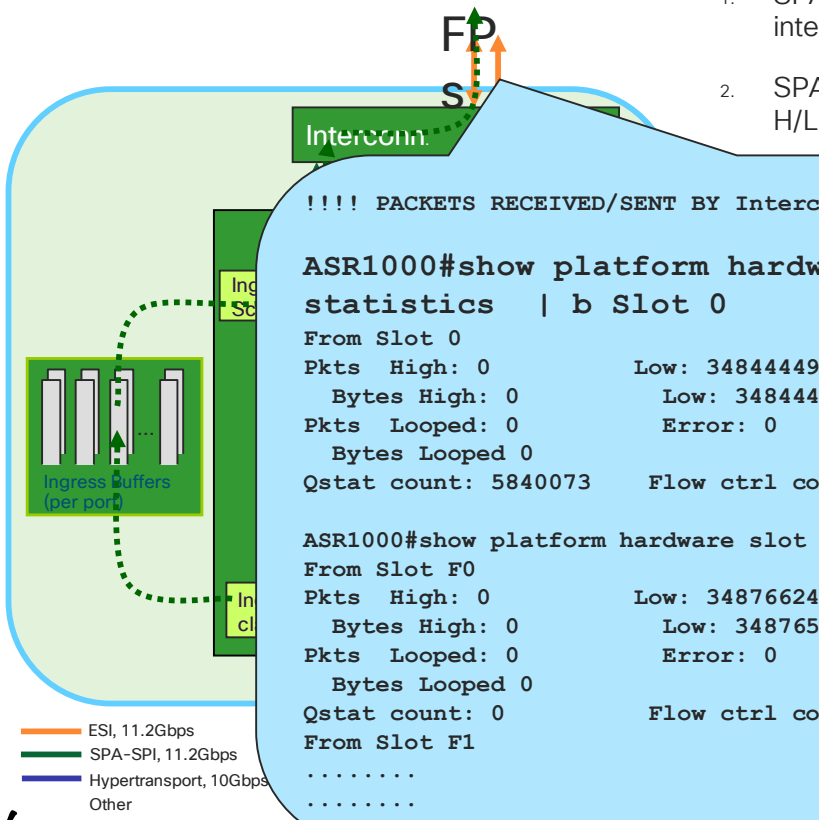


1. SPA receives packet data from its network interfaces and transfers the packet to the CC
2. SPA Aggregation classifies the packet into H/L priority

overloaded (provides separate backpressure for Hi vs. Low priority pkt data).

Data Packet Flow: From SPA through CC

1. SPA receives packet data from its network interfaces and transfers the packet to the CC
2. SPA Aggregation classifies the packet into H/L priority




```
!!!! PACKETS RECEIVED/SENT BY Interconn ASIC towards ESP on ESI Link!!!!

ASR1000#show platform hardware slot f0 serdes
statistics  | b Slot 0
From Slot 0
Pkts  High: 0          Low: 348444499  Bad: 0          Dropped: 0
  Bytes High: 0          Low: 348444496192 Bad: 0          Dropped: 0
Pkts  Looped: 0          Error: 0
  Bytes Looped 0
Qstat count: 5840073    Flow ctrl count: 128046

ASR1000#show platform hardware slot 0 serdes statistics
From Slot F0
Pkts  High: 0          Low: 348766249  Bad: 0          Dropped: 0
  Bytes High: 0          Low: 348765390969 Bad: 0          Dropped: 0
Pkts  Looped: 0          Error: 0
  Bytes Looped 0
Qstat count: 0          Flow ctrl count: 128050
From Slot F1
.........
.........
```

MIP(modular interface processors) Overview

ASR1000-MIP1000 delivers:

- 100 Gb/sec forwarding per line card
- Support for new Ethernet Port Adapter (EPA) modular interfaces
- Up to 100 Gb/sec interface speeds
- Complete forwarding feature parity with existing ASR1000 Ethernet hardware
- Support of 100GE connectivity

Future support for:

- High density 10 Gb/sec EPAs
- High density 1 Gb/sec EPAs

- Initial software release IOS XE 3.16.1 and all future XE3.16 software rebuilds
- Supported in initial release of XE3.17 and all subsequent builds
- Compatible with ESP-100 and ESP-200
- Supported in ASR1006-X, ASR1009-X and ASR1013 chassis
- Not supported with ESP-40 or lower ESPs
- Not supported in ASR1004 or ASR1006 chassis

MIP Highlights

MAC-SEC on 40gig EPA

- Oversubscription capability.
- Modular architecture
- Each host can support up to two EPA (Ethernet port adapter)
- Supports up to 200 Gbps aggregate ingress BW with 2 EPAs

- ✓ L3 Classification : IP Prec 6,7
- ✓ L3 Classification : IPv6 TC values EF
- ✓ L3 Classification : MPLS EXP 6,7
- ✓ Dot1Q COS : 6,7
- ✓ QinQ Vlan COS: Outer tag 6,7

Data Packet flow MIP verification..

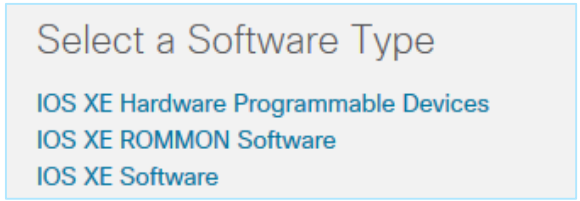
```
Router#show platform hardware slot 0 serdes statistics internal
Warning: Clear option may not clear all the counters

L2 Co-Processor-1 Link
  Local TX in sync, Local RX in sync
  From L2 Co-Processor      Packets:      1167  Bytes:     278559
  To L2 Co-Processor        Packets:      3230  Bytes:    1240897

Network-Processor-0 Link:
  Local TX in sync, Local RX in sync
  From Network-Processor    Packets:      1615  Bytes:     629556
  To Network-Processor      Packets:      1615  Bytes:     629556

Network-Processor-1 Link
  Local TX in sync, Local RX in sync
  From Network-Processor    Packets:      1615  Bytes:     630721
  To Network-Processor      Packets:      1615  Bytes:     630721

Network-Processor-2 Link
  Local TX in sync, Local RX in sync
  From Network-Processor    Packets:       278  Bytes:      64301
  To Network-Processor      Packets:       278  Bytes:      64301

Network-Processor-3 Link
  Local TX in sync, Local RX in sync
  From Network-Processor    Packets:       277  Bytes:      66865
  To Network-Processor      Packets:       277  Bytes:      66865
```

```
Router# show platform hardware port 0/1/0 eman statistics
RX Counters
  MAC Filter drop:0  Unknown Vlan Drop:0
  High Priority
    Pass Pkt:0          Bytes:0
    Drop Pkt:0          Bytes:0
  Low Priority
    Pass Pkt:0          Bytes:0
    Drop Pkt:0          Bytes:0
TX Counters
  High Priority
    Pass Pkt:0          Bytes:0
    Drop Pkt:0          Bytes:0
  Low Priority
    Pass Pkt:0          Bytes:0
    Drop Pkt:0          Bytes:0
```

```
Router#show platform hardware slot 0 serdes statistics
From Slot F1-Link A
  Pkts  High: 0         Low: 3230       Bad: 0          Dropped: 0
  Bytes High: 0         Low: 1240897    Bad: 0          Dropped: 0
  Pkts  Looped: 0         Error: 0
  Bytes Looped 0
  Qstat count: 0        Flow ctrl count: 0
To Slot F1-Link A
  Pkts  High: 0         Low: 0
```

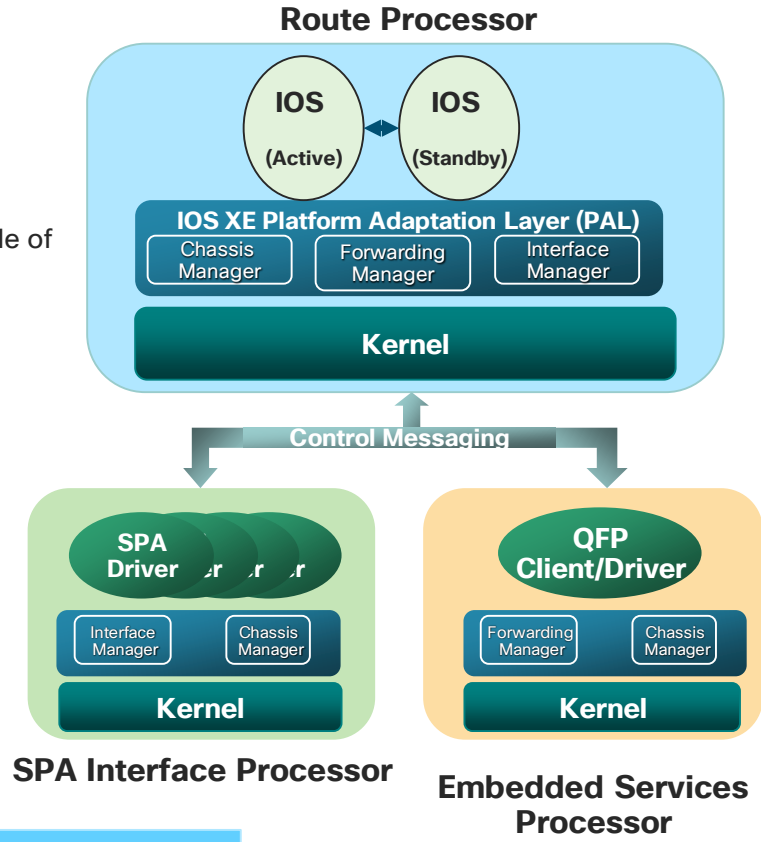
Software Architecture – IOS XE

- 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"

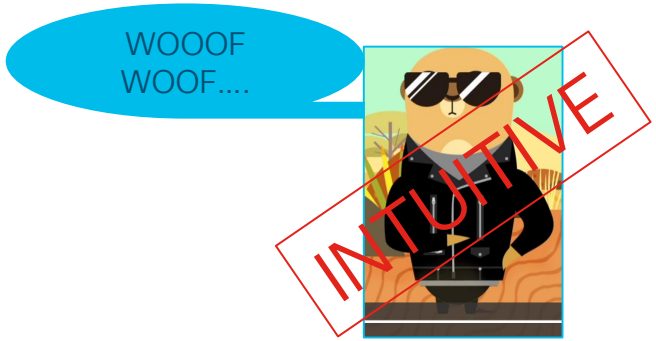


Download RP3 Images

Denali : 16.3.x
Everest : 16.4.x, 16.5.x,16.6.x
Fuji : 16.7.x,16.8.x



What is special about 16.x



Products supported by Cisco IOS XE

Enterprise switches	Wireless Controllers	Aggregation/edge routers	Branch routers
Catalyst 9600 Series	Catalyst 9800 Series	ASR 1013	4451 ISR
Catalyst 9500 Series		ASR 1009-X	4431 ISR
Catalyst 9400 Series		ASR 1006-X	4351 ISR
Catalyst 9300 Series		ASR 1006	4331 ISR
Catalyst 9200 Series		ASR 1004	4321 ISR
Catalyst 3850		ASR 1002-HX	4221 ISR
Catalyst 3650		ASR 1001-HX	1000 ISR
		ASR 1002-X	
		ASR 1001-X	
		ASR 900	
		NCS 4200	

Virtual Routing ISRv	Converged Broadband Routers	Access points
ISRv	CBR Series	Catalyst 9100 Series
CSR1000v		

ASR 1000 Series Route Processor (RP3)

Release Gibraltar-16.10.1a **ED**

My Notifications

Related Links and Documentation

Release Notes for ASR1000-RP3

⚠ Release Gibraltar 16.10.1a supports Smart License as the only Licensing mode Refer ***Smart Licensing Guide for Access and Edge Routers*** for more details. A Smart Account is mandatory Use Device Led Conversion (DLC) to convert traditional licenses to Smart (DLC for CSR1000v will come in 16.11.1)

Downloads Home / Cisco Interfaces and Modules / Route Processors and Route Switch Processors / ASR 1000 Ser

Select a Software Type

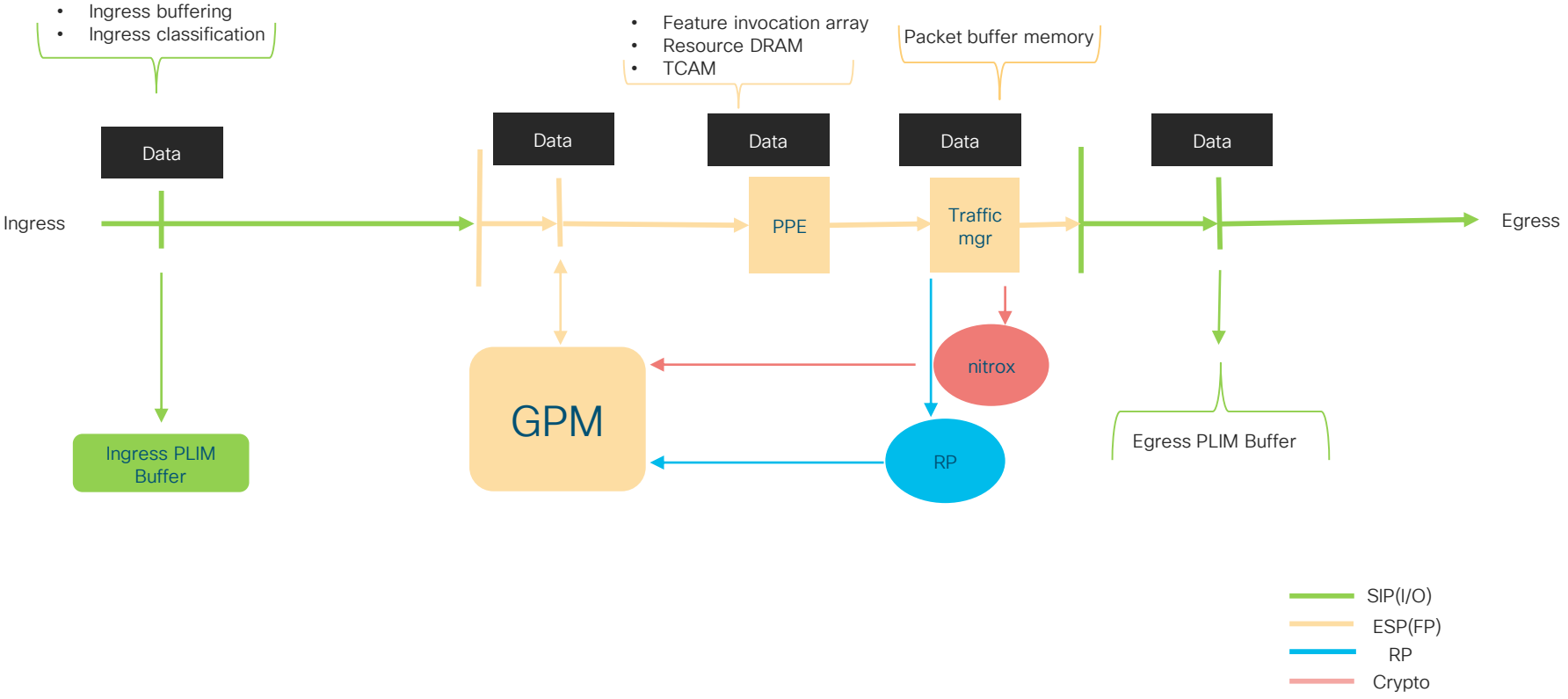
IOS XE Hardware Programmable Devices
IOS XE ROMMON Software
IOS XE Software
IOS XE Software Maintenance Upgrades (SMU)
NBAR2 Protocol Packs

Basic Troubleshooting and case studies

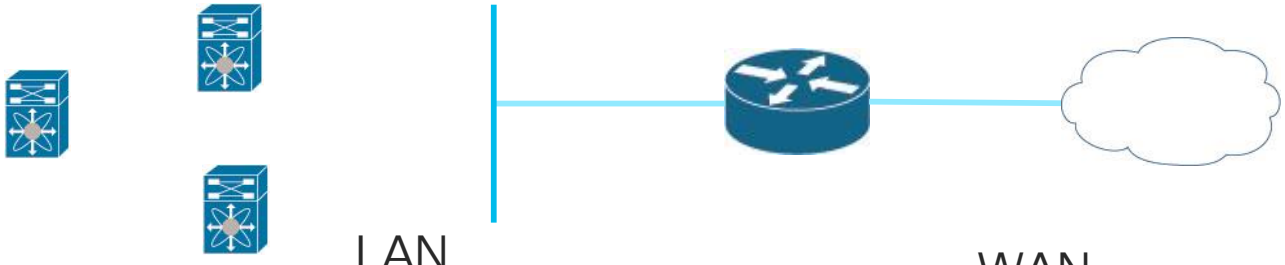
You make networking **possible**

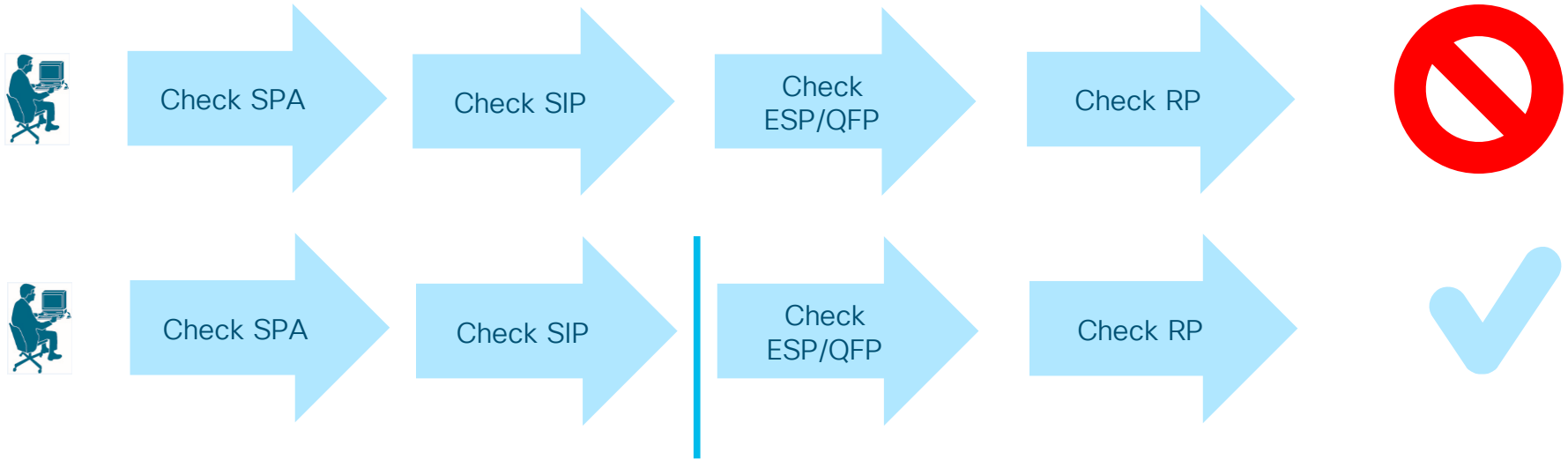
Cisco live!

Packet flow overall understanding...



Case 1 : No ARP on WAN interface





No ARP on WAN interface

```
ASR1006-X#show platform hardware qfp active statistics drop
------------------------------------------------------------------------
------
Global Drop Stats                  Packets              Octets
------------------------------------------------------------------------
------
PuntPerCausePolicerDrops           13                   1260
```

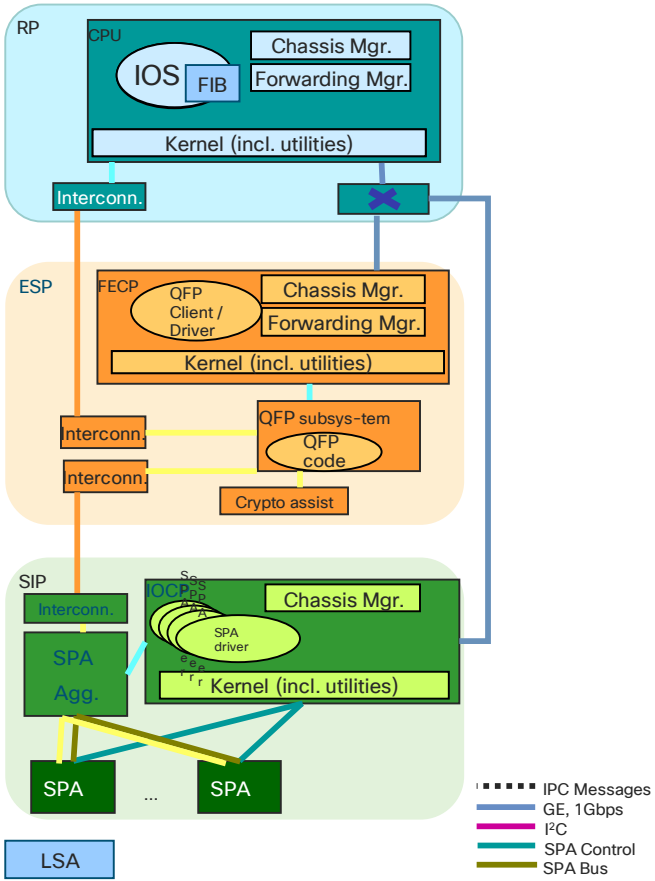
```
ASR1006-X#show platform hardware qfp active infrastructure punt  statistics type ?
  global-drop     Show aggregate drop statistics
  inject-drop     Show aggregate inject drop statistics
  per-cause       Show aggregate per cause punt statistics
  punt-drop       Show aggregate punt drop statistics
  punt-intf-drop  Show aggregate punt-intf drop statistics
```

```
R1#monitor capture CAPTURE access-list CONTROL control-plane both
R1#moni capture CAPTURE start

R1#sh moni capture CAPTURE buff brief
 ----------------------------------------------------------------------------
 #   size   timestamp     source      destination      dscp    protocol
 ----------------------------------------------------------------------------
   0  114    0.000000    10.10.10.1       ->  10.10.10.2       0  BE   ICMP
   1  118    0.003006    10.10.10.2       ->  10.10.10.1       0  BE   ICMP
   2  114    0.003006    10.10.10.1       ->  10.10.10.2       0  BE   ICMP
   3  114    0.003997    10.10.10.1       ->  10.10.10.2       0  BE   ICMP
   4  118    0.005004    10.10.10.2       ->  10.10.10.1       0  BE   ICMP
   5  118    0.006011    10.10.10.2       ->  10.10.10.1       0  BE   ICMP
```

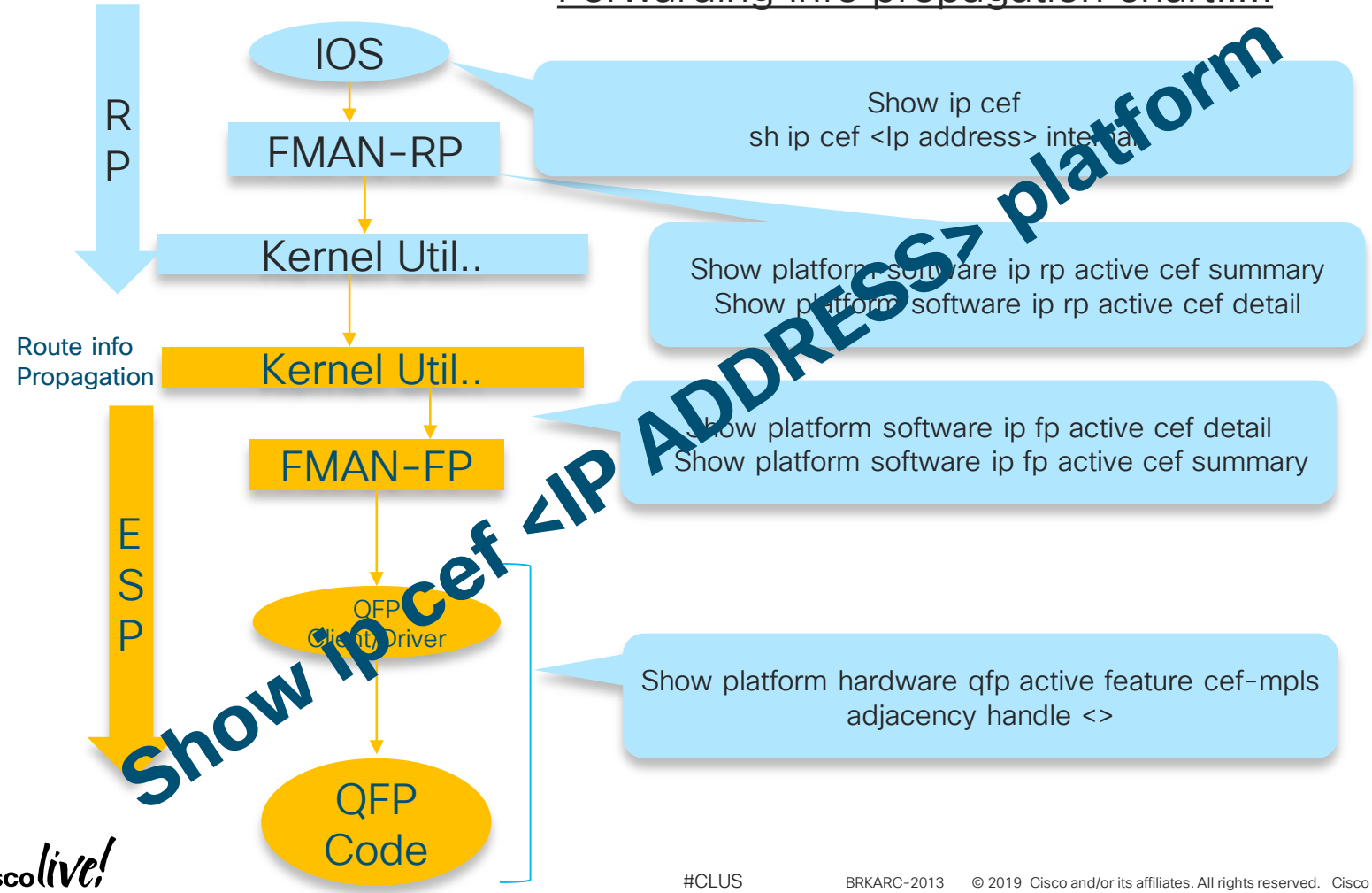
```
ASR1006-X#show platform hardware qfp active infrastructure punt  statistics type punt-drop
Punt Drop Statistics
  Number of punt causes = 128
  Drop Counter ID  0     Drop Counter Name PUNT_NOT_ENABLED_BY_DATA_PLANE
  Counter ID  Punt Cause Name                          Packets
  ------------------------------------------------------------------------
<SNIP>
  007         ARP request or response                  13
  008         Reverse ARP request or repsonse          0
```

Case 2 : CEF troubleshooting

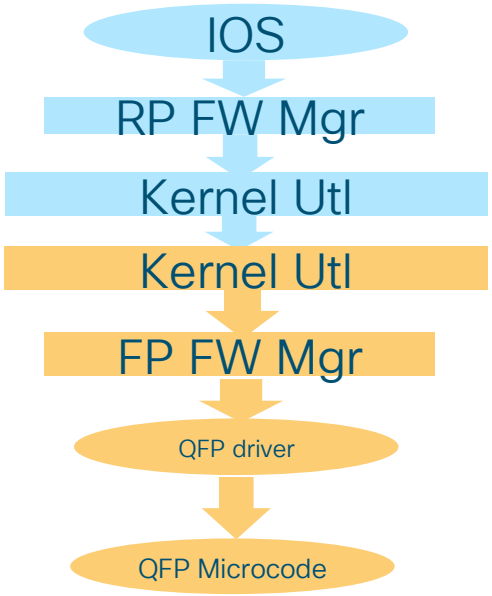
- By example of OSPF LSA
- OSPF LSA arrives on the SPA and is forwarded to the SIP
- SIP performs ingress H/L classification and sends packet to ESP
- QFP receives OSPF LSA and sends to a PPE for processing
- PPE executes features and realizes this is an OSPF LSA
- PPE marks internal header to forward packet to the RP
- PPE releases OSPF LSA to BQS
- BQS Scheduler sends packet to RP
- RP receives packet over ESI link and sends to IOS
- IOS Processes OSPF LSA and performs SPF
- IOS updates RIB/FIB and sends to FM_{RP}
- FM_{RP} keeps copy of FIB and sends also down to FM_{ESP}
- FM_{ESP} keeps a copy of the FIB and programs QFP



Forwarding info propagation chart.....



CEF Troubleshooting

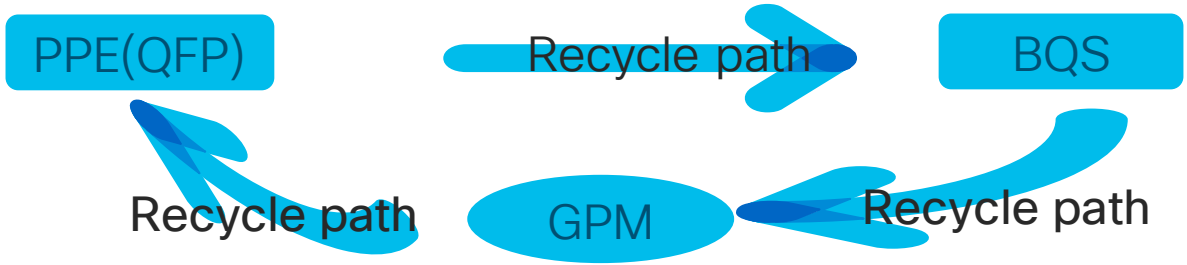



```
ASR1006-X#show ip cef 2.2.2.2 platform detail
2.2.2.2/32
Active RP FM Forwarding Table
Forwarding Table

2.2.2.2/32 -> OBJ_ADJACENCY (24), urpf: 31
Prefix Flags: unknown
OM handle: 0x3a004fdfc8

Active FP FM Forwarding Table
Forwarding Table

2.2.2.2/32 -> OBJ_ADJACENCY (24), urpf: 31
Prefix Flags: unknown
aom id: 238, HW handle: 0x56351f68e878 (created)

Active QFP Forwarding Table=== Gtrie Node ===

Gtrie Node Type: Tree Node
HW Content: : 0bec000d 00000004 80008000 80008000
Gtrie Tree Node Type:: Search Trie Node
=== Gtrie Search Node ===
  TN type 0, TN scan use 1, TN stride 6
  TN inode exists 1, TN skip 0
  TN zero perf real len: 0
  TN par bl offset: 0
  TN par bl len: 0
TBM Tree Array
  TA NNodes 4, TA INode Exists 1, TN TNRefs 0x000056351f697338
TBM Tree Node Bitmap
Search Node Bitmap: 80 00 80 00 80 00 80 00
=== Gtrie Node ===
```

Case 3 : Punt Path, Recycle Path and Punt keepalive

Punt path : Sending packet from QFP to RP Or From QFP to RP

Recycle path : BQS sends packet back to GPM for further processing



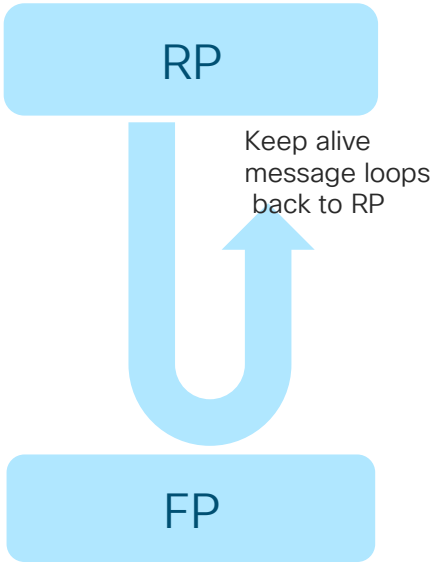
Case 3 : Punt Path, Recycle Path and Punt keepalive

Punt KeepAlive : Health monitor mechanism for punt/inject path

Keep Alive interval : 2 seconds
Warning : 10 seconds
Fatal Count : 15 seconds

ASR1006-X#show platform software infrastructure punt-keepalive

```
----- punt inject keepalive settings -----
punt keepalive fatal (warn count)      = 15
punt keepalive interval (sec)          = 2
punt keepalive warning count (miss)    = 10
Disable XE kernel core                 = No

----- punt inject keepalive status -----
Last punt keepalive proc sched           = 0.752 sec ago
Last punt keepalive sent                 = 0.752 sec ago
punt keepalive rx count                  = 737211
punt keepalive tx count                  = 737211
punt keepalive miss count                = 0
punt keepalive last keepalive received   = yes

----- punt inject keepalive errors -----
punt keepalive failed to send no buffers  = 0
punt keepalive tx fail count              = 0
```



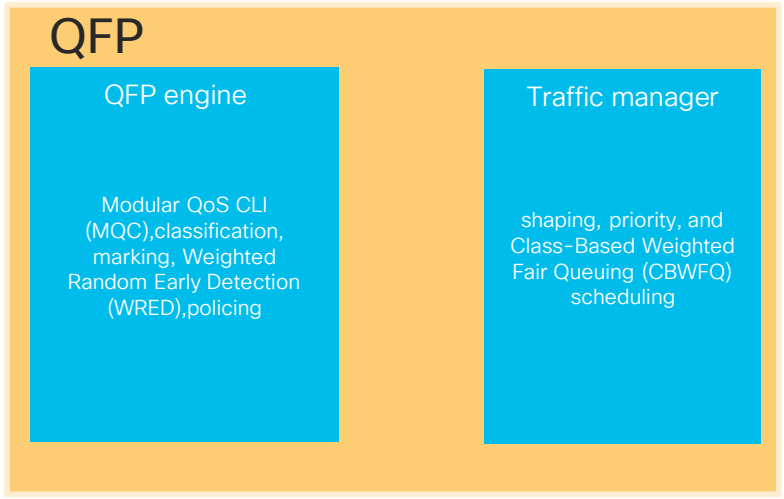
Punt Keepalive

%IOSXE-2-PLATFORM: F0: cpp_cp: QFP:00 Thread:052 TS:00000035918521858882 %HAL_PKTMEM-2-OUT_OF_RESOURCES

%ASR1000_INFRA-4-NO_PUNT_KEEPALIVE: Keepalive not received for 280 seconds
%ASR1000_INFRA-4-NO_PUNT_KEEPALIVE: Keepalive not received for 300 seconds
%ASR1000_INFRA-2-FATAL_NO_PUNT_KEEPALIVE: Keepalive not received for 300 seconds resetting

ASR1006-X(config)#no platform punt-keepalive
ASR1006-X#test platform software punt-keepalive ignore-fault
*Jun 14 21:09:55.685: IOSXE-PUNT_KEEPALIVE:Disable keepalive fault failover

Case 4 : BQS memory exhaustion



ASR1006-X#show platform hardware qfp active statistics drop

Global Drop Stats	Packets	Octets
BqsOor	13	1260

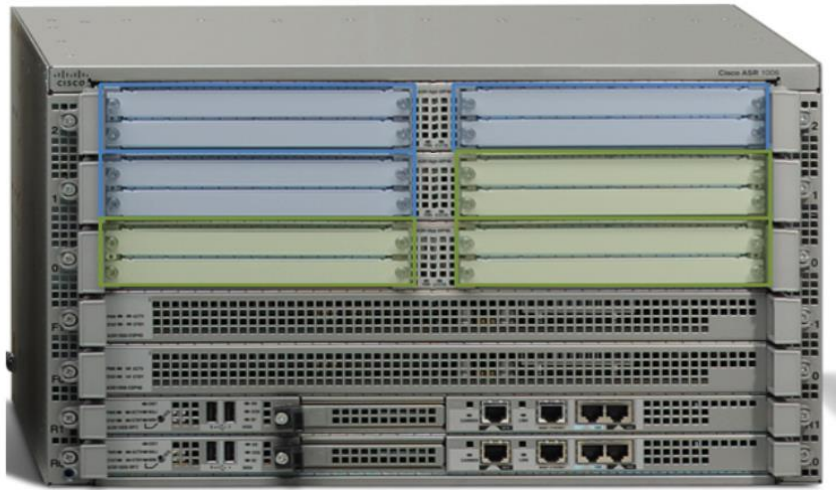
ASR1006-X#show platform hardware qfp active statistics drop all | i Bqs

BqsOor	0	0
BqsOorPakPri	0	0
BqsOorPri	0	0
BqsOorVital	0	0

SPA distribution....

ASR1006 chassis with ESP-100:

- SPA slots in green serviced by QFP 0
- SPA slots in blue serviced by QFP 1



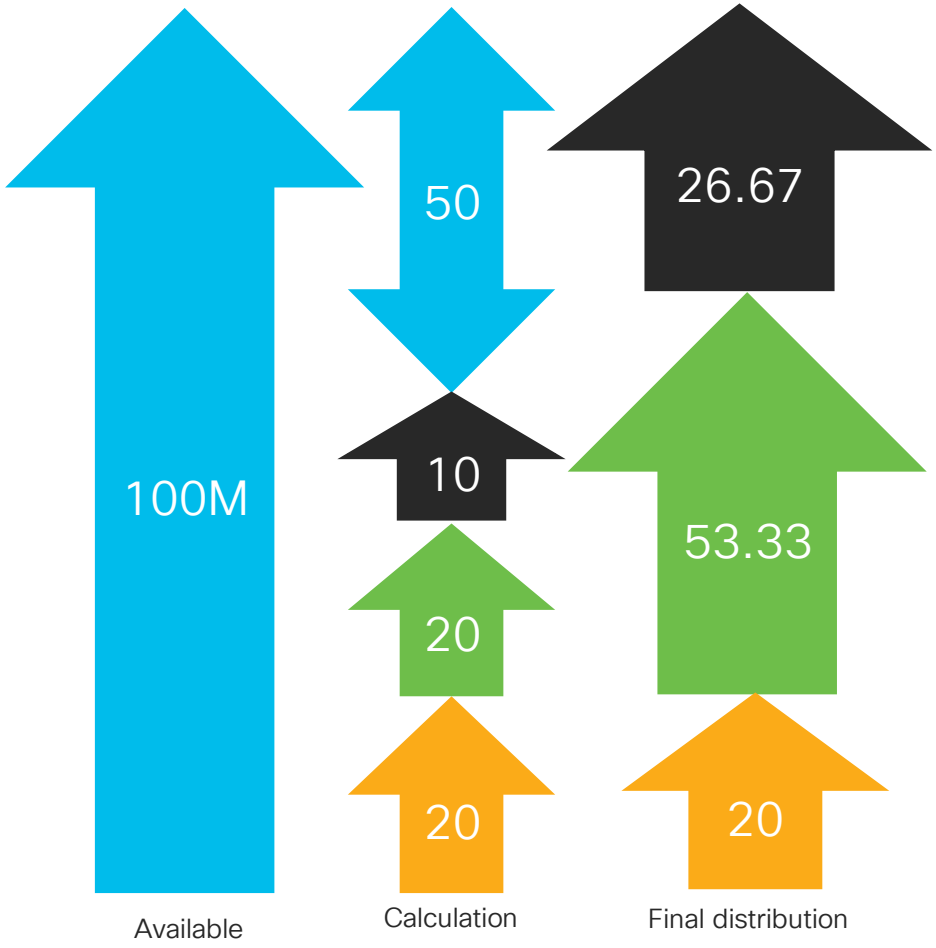
QOS IOS vs IOS-XE

```
policy-map TEST
 class priority
  priority per 20
  police cir 20M
class generic
  bandwidth per 20
class class-default
bandwidth per 10
```

```
policy-map Parent
 class class-default
 shape-average 100M
Service-policy TEST
```

Excess bandwidth calculation :

IOS = (20/(20+10))*50 = 33.33 = 20+33.33= 53.33
= (10/(10+20))*50 = 16.67 = 10 + 16.67= 26.67

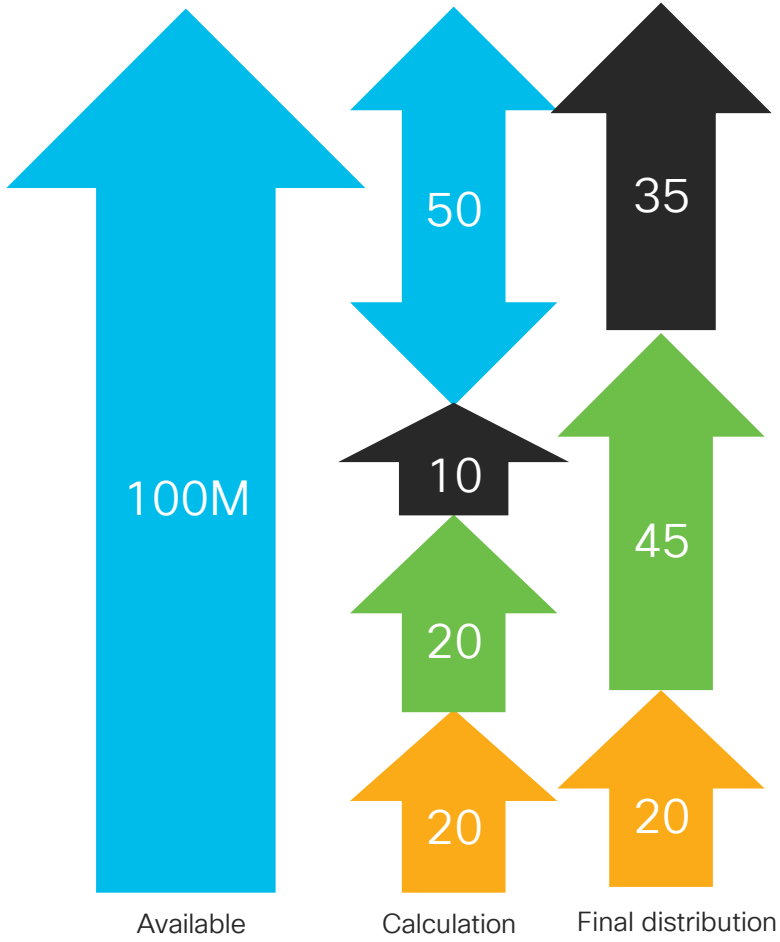


QOS IOS vs IOS-XE

```
policy-map TEST
 class priority
  priority per 20
  police cir 20M
class generic
  bandwidth per 20
class class-default
bandwidth per 10
```

```
policy-map Parent
 class class-default
 shape-average 100M
Service-policy TEST
```

Excess bandwidth calculation :
IOS XE = Excess/2 = 50/2=25



BQS Memory exhaustion...

ASR1006-X #show platform hardware qfp active bqs 0 packet-buffer utilization

```
Packet buffer memory utilization details:
  Yoda: 0
    Total:     512.00 MB
    Used :      66.50 KB
    Free :     511.94 MB

    Utilization:    0 %

    Threshold Values:
      Vital            :    511.95 MB, Status: False
      Packet Priority  :     507.12 MB, Status: False
      Priority         :    487.59 MB, Status: False
      Non-Priority     :     438.76 MB, Status: False
  Yoda: 1
    Total:     512.00 MB
    Used :      66.50 KB
    Free :     511.94 MB

    Utilization:    0 %

    Threshold Values:
      Vital            :    511.95 MB, Status: False
      Packet Priority  :     507.12 MB, Status: False
      Priority         :    487.59 MB, Status: False
      Non-Priority     :     438.76 MB, Status: False
```

Queue limit value should be tuned to ensure resource is shared fairly by all interfaces (or more accurately small number of interface should not starve the complete pool) . Default priority scheme is in place to protect high priority traffic in times of congestion

- Non-priority : Normal data
- Priority : User defined priority
- Vital : PAK_Priority(Never drop)

Bug Search > CSCuw94653

ISR4431 : Excessive pause frames cause Platform wide DOS / traffic drop

CSCuw94653

Description

Symptom:
The device stops forwarding all traffic and may not even be able to ping its interface or loopback.

Huge amount of pause frames are seen on connected interfaces, causing excessive buffering on the router.

GigabitEthernet0/0/0 is up, line protocol is up
Hardware is ISR4431-X-4x1GE, address is f4cf.e235.4790 (bia f4cf.e235.4790)
Internet address is 10.0.4.124/29
MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,

Full Duplex, 1000Mbps, link type is auto, media type is RJ45
output flow-control is on, input flow-control is on

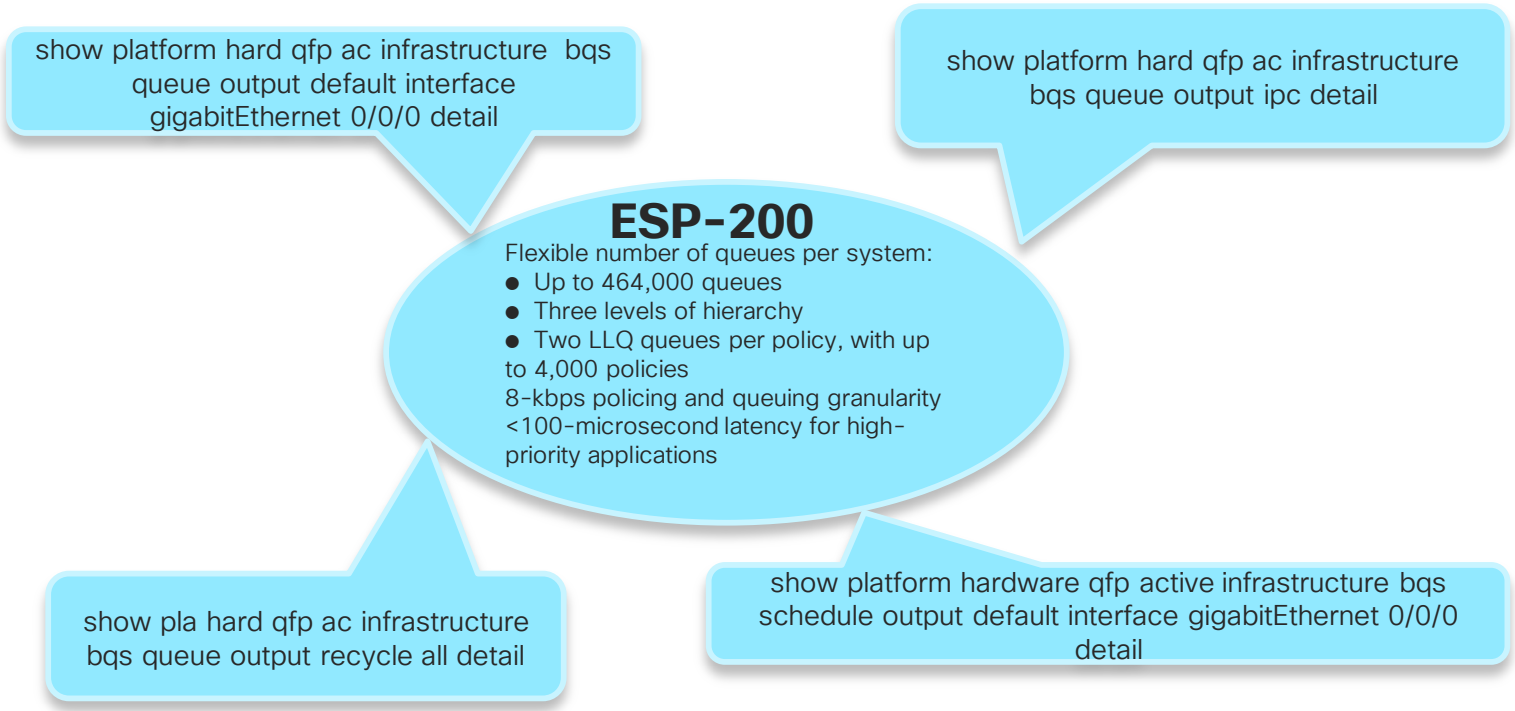
Last input 1d16h, output 00:00:17, output hang never
Last clearing of "show interface" counters 1d16h
Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 241

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 4324916 pause input <--

This essentially leads to a platform wide denial-of-service, tracebacks like the following may be reported :

000115: Oct 7 06:46:19.536: %IOSXE-2-PLATFORM:cpp_cp: QFP:0.0 Thread:001 TS:00000281225700909388
%HAL_PKTMEM-2-OUT_OF_RESOURCES: -Traceback=1#22156066818a733db8ce8063e63cb448 1033bee4
1033c340 1002d3b0 10a99ca8 10938b74 109392a0 10000308
000116: Oct 7 06:47:19.547: %IOSXE-2-PLATFORM:cpp_cp: QFP:0.0 Thread:001 TS:00000281285712326148
%HAL_PKTMEM-2-OUT_OF_RESOURCES: -Traceback=1#22156066818a733db8ce8063e63cb448 1033bee4
1033c340 103550dc 10a99ca8 10938b74 109392a0 10000308

Packet Story (BQS) Details....



Keep them handy mainly when QOS is NOT configured on router!!

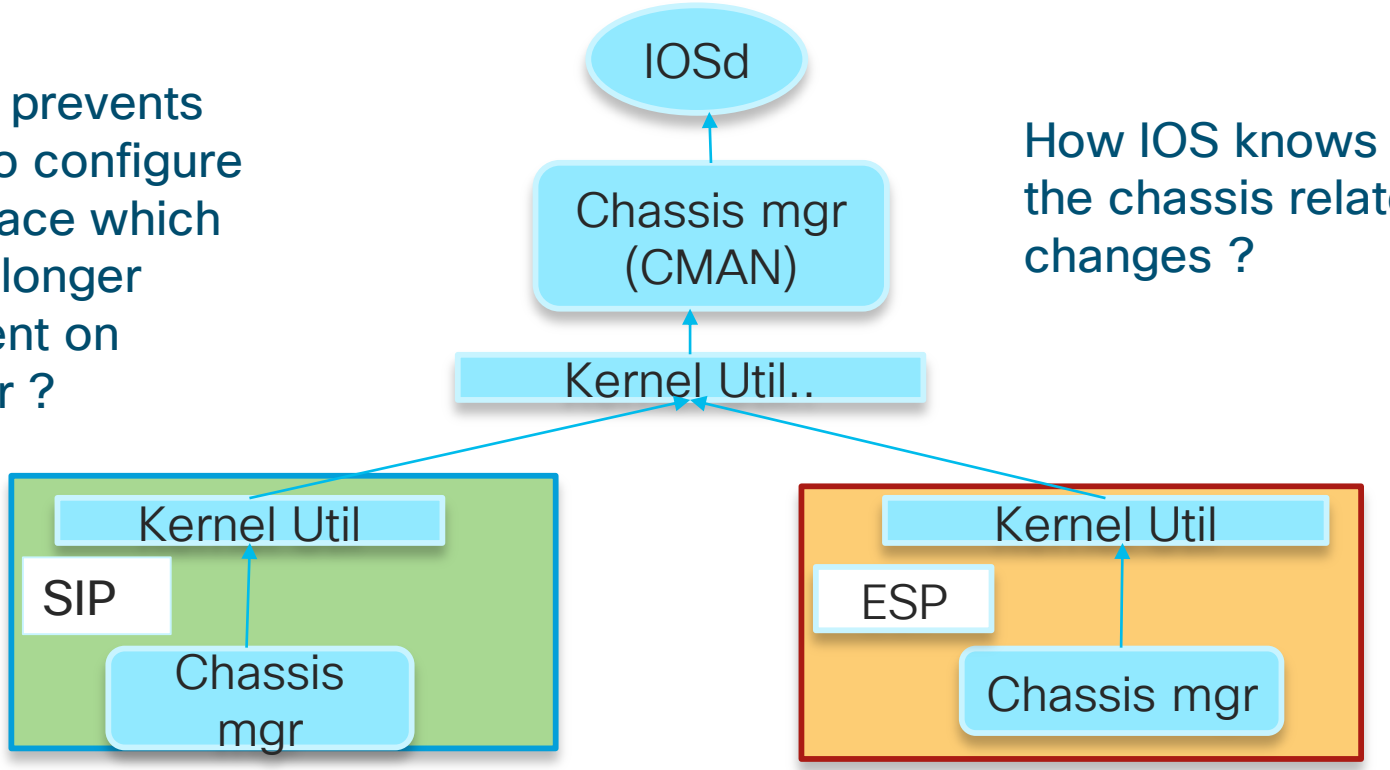
Packet Story (BQS) Details....cont..

Handy when QOS is Configured...

Case 5 : Chassis manager

Chassis mgr info propagation chart.....

What prevents you to configure interface which is no longer present on router ?



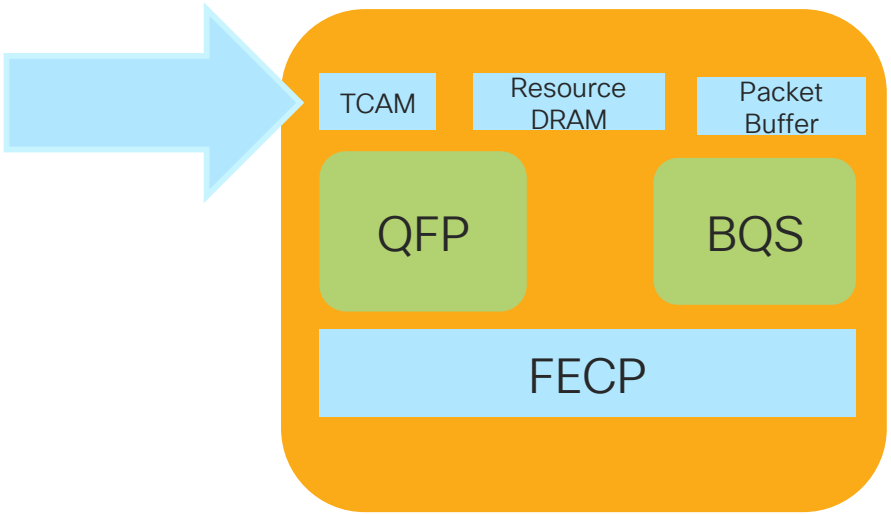
How IOS knows about the chassis related changes ?

Why it is good to know this ?

Case 6 : TCAM Exhaustion

ASR1006-X #show platform hardware qfp active tcam resource-manager usage

```
QFP TCAM Usage Information

80 Bit Region Information
--------------------------
Name                          : Leaf Region #0
Number of cells per entry     : 1
Current 80 bit entries used   : 0
Current used cell entries     : 0
Current free cell entries     : 0

160 Bit Region Information
--------------------------
Name                          : Leaf Region #1
Number of cells per entry     : 2
Current 160 bits entries used : 6
Current used cell entries     : 12
Current free cell entries     : 4084

320 Bit Region Information
--------------------------
Name                          : Leaf Region #2
Number of cells per entry     : 4
Current 320 bits entries used : 0
Current used cell entries     : 0
Current free cell entries     : 0


Total TCAM Cell Usage Information
---------------------------------
Name                          : TCAM #0 on CPP #0
Total number of regions       : 3
Total tcam used cell entries  : 12
Total tcam free cell entries  : 1048564
Threshold status              : below critical limit
```



“Deny-Jump” TCAM Issue …

- ✓ There is no deny statements in TCAM, for every deny statement encountered the search pointer JUMPS to the next class to find a permit statement. This phenomenon is called deny-jump.

- Operation:
  - ✓ For deny statements in ACL TCAM recursively creates list of permutations with the other classes to classify the traffic.
  - ✓ For this recursion TCAM uses POD (Platform-independent ordered dependent merge) algorithm

- Problem :
  - ✓ For each deny statement the algorithm builds a list of entries which are derived with the product of deny and the subsequent permit statements from other classes. This increases the number of TCAM entry exponentially which leads to TCAM exhaustion

Policy-map abc

Match Class A

Set prec 1

Match class B

Set prec 2

Match class C

Set prec 3

Class-map match-any A

match a1 (permit)

match not a2 (deny)

match a3 (permit)

class-map match-any B

match b1 (permit)

match b2 (permit)

class-map match-any C

match c1 (permit)

match not c2 (deny)

match c3 (permit)

The final list will become

Match a1

Match a2&b1

Match a2&b2

Match a2&c1

Match a2&c3

Match a3

Match b1

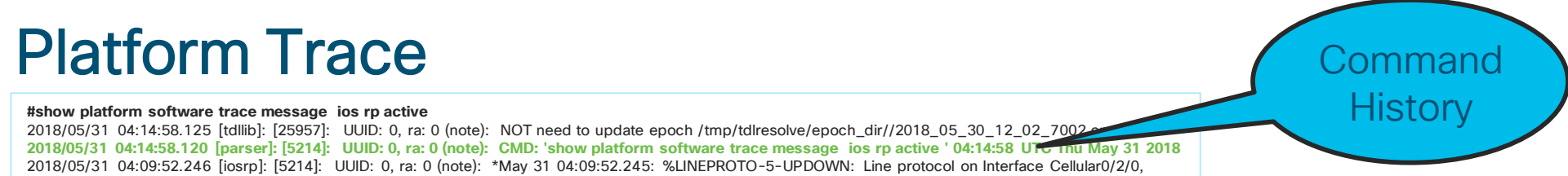
Match b2

Match c1

Match c3

The deny a2 causes four extra entries, while c2 contributes none.

Platform Trace



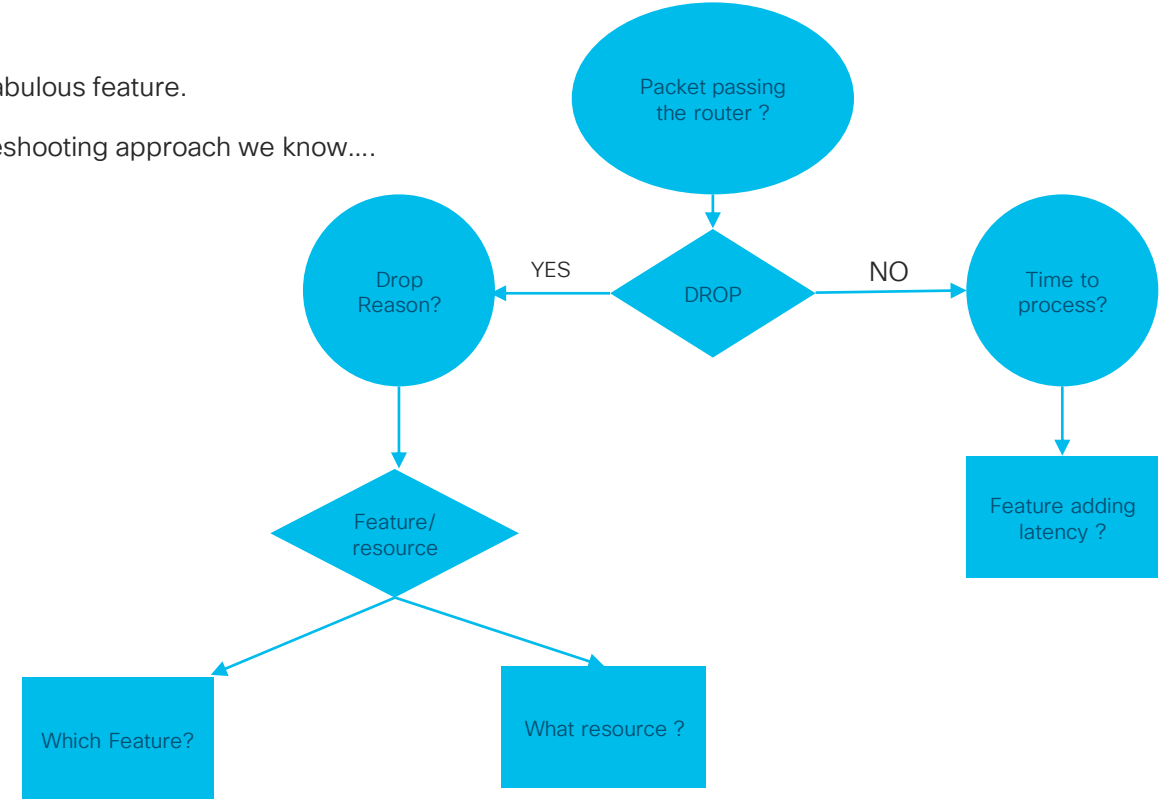

```
#show platform software trace message  ios rp active
2018/05/31  04:14:58.125 [tdllib]: [25957]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.e
2018/05/31  04:14:58.120 [parser]: [5214]:  UUID: 0, ra: 0 (note):  CMD: 'show platform software trace message  ios rp active ' 04:14:58 UTC Thu May 31 2018
2018/05/31  04:09:52.246 [iosrp]: [5214]:  UUID: 0, ra: 0 (note):  *May 31 04:09:52.245: %LINEPROTO-5-UPDOWN: Line protocol on Interface Cellular0/2/0,
changed state to up
2018/05/31  03:59:31.964 [tdllib]: [25957]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.epoch
2018/05/31  03:59:31.964 [tdllib]: [25957]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.epoch
2018/05/31  03:59:31.959 [parser]: [5214]:  UUID: 0, ra: 0 (note):  CMD: 'show platform software trace message  ios rp active ' 03:59:31 UTC Thu May 31 2018
2018/05/31  03:59:08.528 [tdllib]: [25957]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.epoch
2018/05/31  03:59:08.528 [tdllib]: [25957]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.epoch
2018/05/31  03:59:08.523 [parser]: [5214]:  UUID: 0, ra: 0 (note):  CMD: 'show platform software trace message  ios rp active ' 03:59:08 UTC Thu May 31 2018
```

```
#show platform software trace message  chassis-manager r0
2018/05/31  03:56:32.264 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  Could not read sensor Temp: Wifi, Input/output error
2018/05/31  03:56:32.264 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  SNSR READ: failed to read Temp: Wifi Sensor
2018/05/31  03:56:32.264 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  MAX31730  read: failed to read at 0x0
2018/05/31  03:56:12.266 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  Could not read sensor Temp: Wifi, Input/output error
2018/05/31  03:56:12.266 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  SNSR READ: failed to read Temp: Wifi Sensor
2018/05/31  03:56:12.266 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  MAX31730  read: failed to read at 0x0
2018/05/31  03:55:52.262 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  Could not read sensor Temp: Wifi, Input/output error
2018/05/31  03:55:52.262 [envlib]: [18459]:  UUID: 0, ra: 0 (ERR):  SNSR READ: failed to read Temp: Wifi Sensor
```

```
#show platform software trace message forwarding-manager fp active
2018/05/31  04:22:36.771 [btrace]: [3232]:  UUID: 0, ra: 0 (note):  Successfully registered module [97] [tdl_ui_shr]
2018/05/31  04:22:36.769 [btrace]: [3232]:  UUID: 0, ra: 0 (note):  Successfully registered module [98] [uiutil]
2018/05/31  04:22:36.759 [btrace]: [3232]:  UUID: 0, ra: 0 (note):  Successfully registered module [99] [tdl_cdlcore]
2018/05/31  04:22:36.757 [tdllib]: [3232]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.epoch
2018/05/31  04:22:36.757 [tdllib]: [3232]:  UUID: 0, ra: 0 (note):  NOT need to update epoch /tmp/tdlresolve/epoch_dir//2018_05_30_12_02_7002.epoch
2018/05/31  04:22:08.867 [tdl_qos_stats]: [3232]:  UUID: 0, ra: 0 (ERR):  Message qos_wred_stats_msg  failed to marshal: Message too long
2018/05/31  04:21:08.866 [tdl_qos_stats]: [3232]:  UUID: 0, ra: 0 (ERR):  Message qos_wred_stats_msg  failed to marshal: Message too long
2018/05/31  04:20:08.867 [tdl_qos_stats]: [3232]:  UUID: 0, ra: 0 (ERR):  Message qos_wred_stats_msg  failed to marshal: Message too long
2018/05/31  04:19:08.867 [tdl_qos_stats]: [3232]:  UUID: 0, ra: 0 (ERR):  Message qos_wred_stats_msg  failed to marshal: Message too long
2018/05/31  04:18:08.867 [tdl_qos_stats]: [3232]:  UUID: 0, ra: 0 (ERR):  Message qos_wred_stats_msg  failed to marshal: Message too long
2018/05/31  04:17:08.867 [tdl_qos_stats]: [3232]:  UUID: 0, ra: 0 (ERR):  Message qos_wred_stats_msg  failed to marshal: Message too long
```

Packet-Trace

- Discussion on ASR1k is incomplete without this fabulous feature.
- Packet trace provides alternative to all the troubleshooting approach we know….
- Packet capture tool + Debugger
- FIA steals the show




```
Feature: NAT
Direction    : IN to OUT
Action       : Translate Source
Old Address : 172.16.10.2  00028
New Address : 192.168.10.1 00002
Feature: FIA_TRACE
Entry        : 0x8031c248 - IPV4_NAT_OUTPUT_FIA
```

```
    Feature: IPSec
    Result     : IPSEC_RESULT_SA
    Action     : ENCRYPT
    SA Handle  : 6
    Peer Addr  : 192.168.20.1
    Local Addr: 192.168.10.1
    Feature: FIA_TRACE
    Entry      : 0x8043caec - IPV4_OUTPUT_IPSEC_CLASSIFY
    Lapsed time: 9528 ns
    Feature: FIA_TRACE
```

Sample packet trace config

debug platform condition interface Gig 0/0/1 ingress
debug platform condition start
debug platform packet-trace packet 1024 fia-trace
debug platform packet-trace copy packet input size 2048
debug platform packet-trace enable

Verification commands :
Show platform packet-trace summary
Show platform packet-trace statistics
Show platform packet-trace packet <packet-number>
Show platform condition
clear platform packet-trace statistics

```
BGL16.I.21-ASR1001-8#show platform pack packet 0
Packet: 0           CBUG ID: 4310
Summary
  Input     : GigabitEthernet0/0/0
  Output    : internal0/0/rp:0
  State     : PUNT 055 (For-us control)
  Timestamp : 4834321400169
Path Trace
  Feature: IPV4
    Source      : 10.10.10.1
    Destination : 224.0.0.10
    Protocol    : 88 (EIGRP)
  Feature: FIA_TRACE
    Entry     : 0x8059d400 - DEBUG_COND_INPUT_PKT
    Timestamp : 4834321404552
  Feature: FIA_TRACE
    Entry     : 0x82011d80 - IPV4_INPUT_DST_LOOKUP_CONSUME
    Timestamp : 4834321405802
  Feature: FIA_TRACE
    Entry     : 0x82000170 - IPV4_INPUT_FOR_US_MARTIAN
    Timestamp : 4834321407039
  Feature: FIA_TRACE
    Entry     : 0x80358770 - IPV4_OUTPUT_LOOKUP_PROCESS
    Timestamp : 4834321419699
  Feature: FIA_TRACE
    Entry     : 0x80358080 - IPV4_INPUT_IPOPTIONS_PROCESS
    Timestamp : 4834321424379
  Feature: FIA_TRACE
    Entry     : 0x8054072c - IPV6_INPUT_GOTO_OUTPUT_FEATURE
    Timestamp : 4834321425156
  Feature: FIA_TRACE
    Entry     : 0x8056fe1c - IPV4_INTERNAL_ARL_SANITY
    Timestamp : 4834321427109
  Feature: FIA_TRACE
    Entry     : 0x8032aee0 - IPV4_MC_INPUT_VFR_REFRAG
    Timestamp : 4834321428342
  Feature: FIA_TRACE
    Entry     : 0x801db7c4 - IPV4_OUTPUT_DROP_POLICY
    Timestamp : 4834321429076
  Feature: FIA_TRACE
    Entry     : 0x8059a7b4 - PACTRAC_OUTPUT_STATS
    Timestamp : 4834321431479
  Feature: FIA_TRACE
    Entry     : 0x80599d70 - INTERNAL_TRANSMIT_PKT
    Timestamp : 4834321432886
Packet Copy In
  01005e00 000a18e7 28cbca01 080045c0 003c021e 00000158 c2770a0a 0a01e000
  000a0205 ebd10000 00000000 00000000 00000000 00010001 000c0100 01000000
  000f0004 00080e00 0200
```

State of Packet :

PUNT : Sent to RP for further processing
DROP : Packet dropped by FP
CONS : Packet Consumed e.g. Self ping.
FWD: Packet forwarded to egress interface

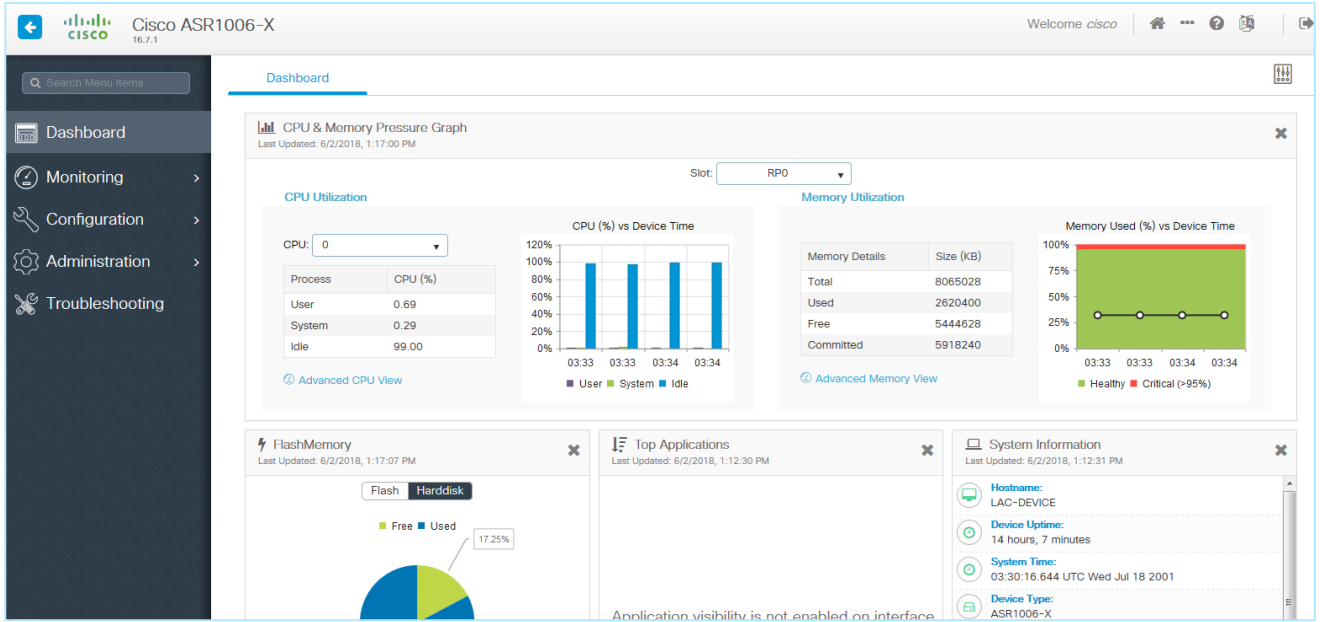
FIA Trace: The datapath features are implemented as a chain of features that are executed (mostly) one after the other. The chain is called the feature invocation array (FIA).

Checking the FIA for an interface

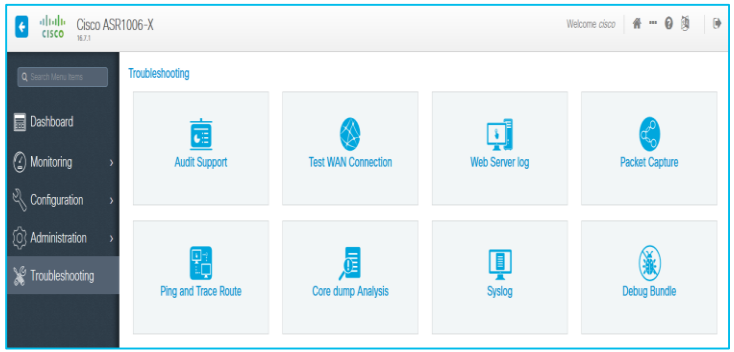
#show platform hardware qfp active interface if-name <interface name>

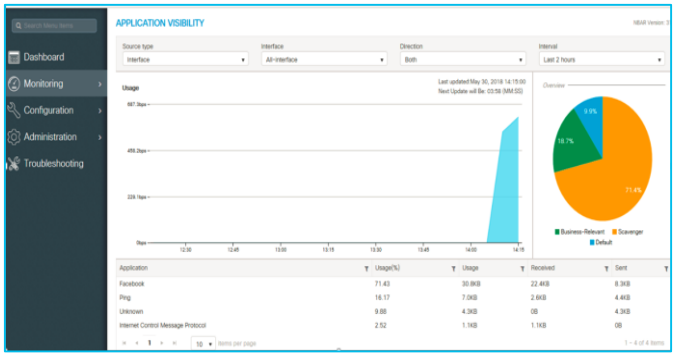
WebUI introduction

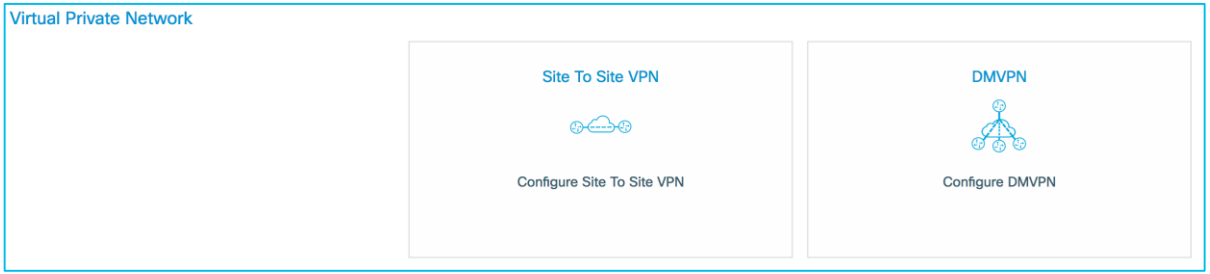
```
transport-map type persistent webui <NAME>
 server
!
ip http server
ip http authentication local
!
transport type persistent webui input <NAME>
!
```



WebUI Introduction







ASR1006/9-X Solutions

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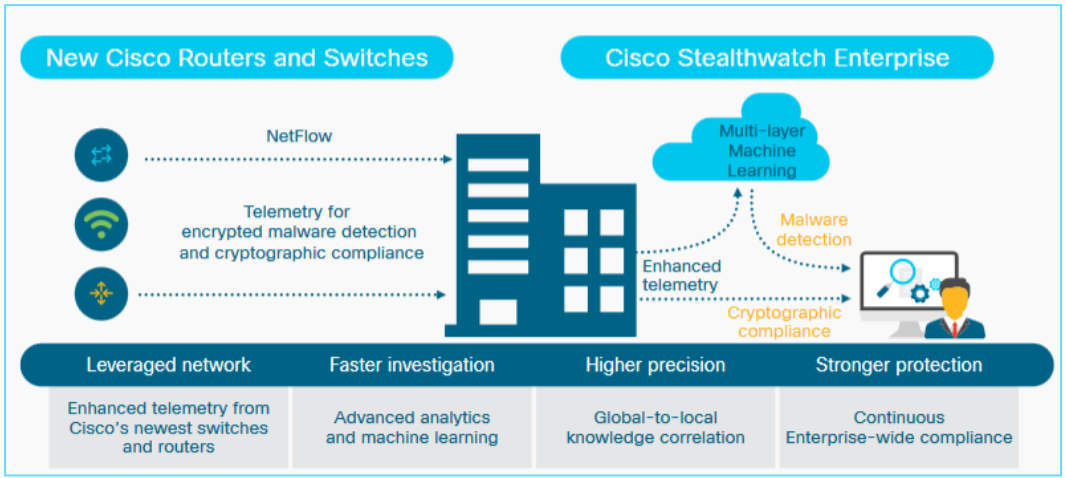
Cisco live!

ETA (Encrypted traffic Analysis)



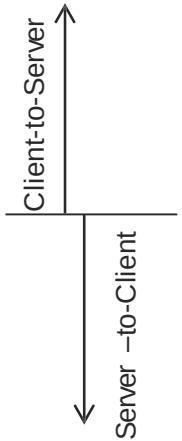

```
Device(config)# et-analytics
Device(config-et-analytics)# ip flow-record destination 192.168.10.1
2055
Device(config-et-analytics)# exit
Device(config)# interface gigabitethernet 0/0/1
Device(config-if)# et-analytics enable
Device(config-if)# end
```

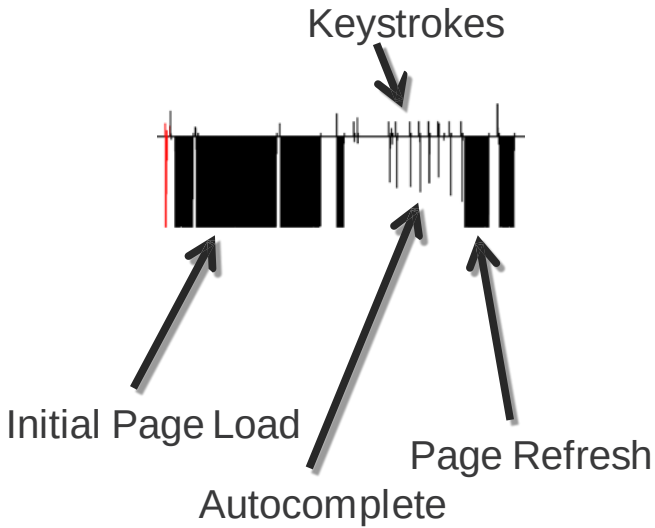
```
Device#show pla hardware qfp active feature et-analytics datapath stats
export
ET-Analytics 192.168.10.1:2055 Stats:
  Export statistics:
    Total records exported    : 388
    Total packets exported    : 243
    Total bytes exported      : 237992
    Total dropped records     : 0
    Total dropped packets     : 0
    Total dropped bytes       : 0
    Total IDP records exported :
        initiator->responder : 83
        responder->initiator : 81
    Total SPLT records exported:
        initiator->responder : 83
        responder->initiator : 81
    Total SALT records exported:
        initiator->responder : 0
        responder->initiator : 0
    Total BD records exported  :
        initiator->responder : 0
        responder->initiator : 0
    Total TLS records exported :
        initiator->responder : 0
        responder->initiator : 0
```

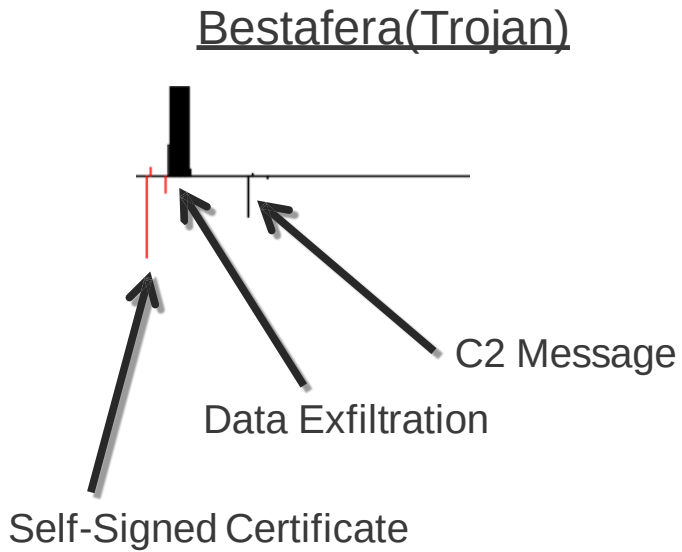
Encrypted Traffic Analytics (ETA)

What Traffic Looks Like to ETA – Google Search Example

99.99 % ACCURACY

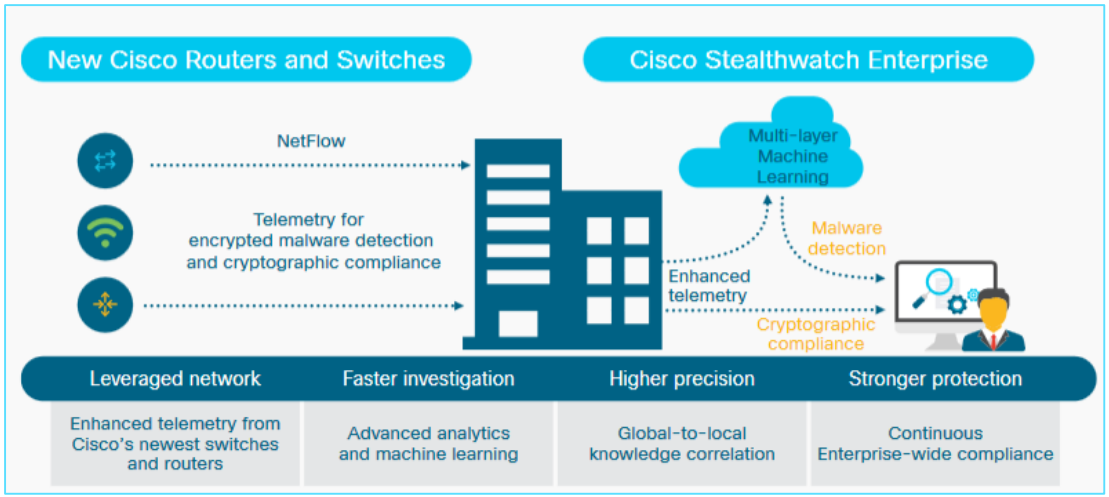


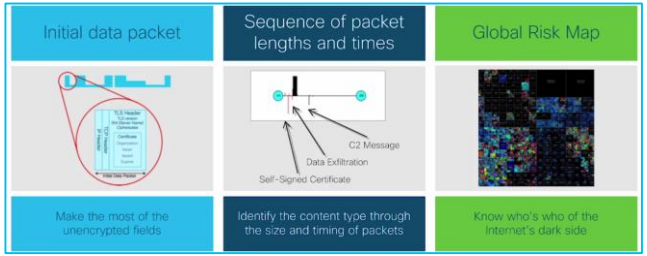




Attempts to collect a user's online banking data and sends out information to a Control server – known for keylogging and data exfiltration

Encrypted traffic Analysis(ETA)



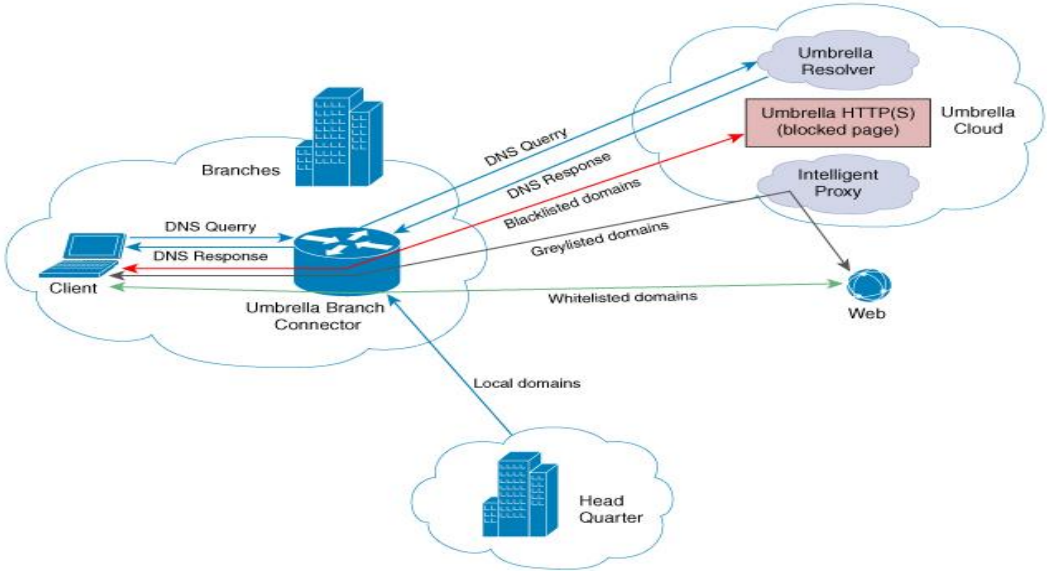



```
Device(config)# et-analytics
Device(config-et-analytics)# ip flow-record destination
192.168.10.1 2055
Device(config-et-analytics)# exit
Device(config)# interface gigabitethernet 0/0/1
Device(config-if)# et-analytics enable
Device(config-if)# end
```

```
Device#show pla hardware qfp active feature et-analytics
datapath stats export
ET-Analytics 192.168.10.1:2055 Stats:
   Export statistics:
     Total records exported     : 388
     Total packets exported     : 243
     Total bytes exported       : 237992
     Total dropped records      : 0
     Total dropped packets      : 0
     Total dropped bytes        : 0
     Total IDP records exported :
          initiator->responder  : 83
          responder->initiator  : 81
     Total SPLT records exported:
          initiator->responder  : 83
          responder->initiator  : 81
     Total SALT records exported:
          initiator->responder  : 0
          responder->initiator  : 0
     Total BD records exported  :
          initiator->responder  : 0
          responder->initiator  : 0
     Total TLS records exported :
          initiator->responder  : 0
          responder->initiator  : 0
```

Network as a security sensor

Umbrella Branch



Few well known Applications for DNS tunneling:

- Iodine
- Dns2tcp
- DnsCat
- VPNoverDNS

Few Well known Attacks

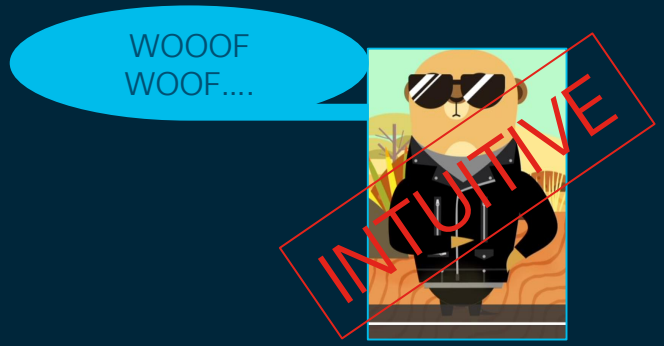
- Morto
- Feederbot
- FrameworkPOS
- BernhardPOS

- EDNS(Extended DNS) records added to the DNS query.
- Query is sent to the Cisco umbrella cloud.
- Query can be categorized in three ways.
  1. Whitelist
  2. Black list
  3. Grey list

CSCvm96663

https://learn-umbrella.cisco.com/solution-briefs/dns-tunneling

Key Takeaways



- Performance performance performance....
- Easy to manage.
- Future proof device with the current market needs
- Easy and elaborate Troubleshooting steps

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Agenda Review

- Introduction
- ASR1000 Portfolio Introduction
- Platform Overview
- Software Overview
- Basic Troubleshooting
- Solution Overviews
- Key Takeaways
- Q & A

You make networking **possible**

References:

Datasheet

Trustworthy Systems

Umbrella

SYNful knock

Trust Anchor

BRKCRS-2901

BRKARC-2031

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Roadmap: Machine Learning and Artificial Intelligence	CCP-1201	Tues 3:30 – 5:00
Roadmap: Wireless and Mobility	CCP-1202	Thurs 10:30 – 12:00

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