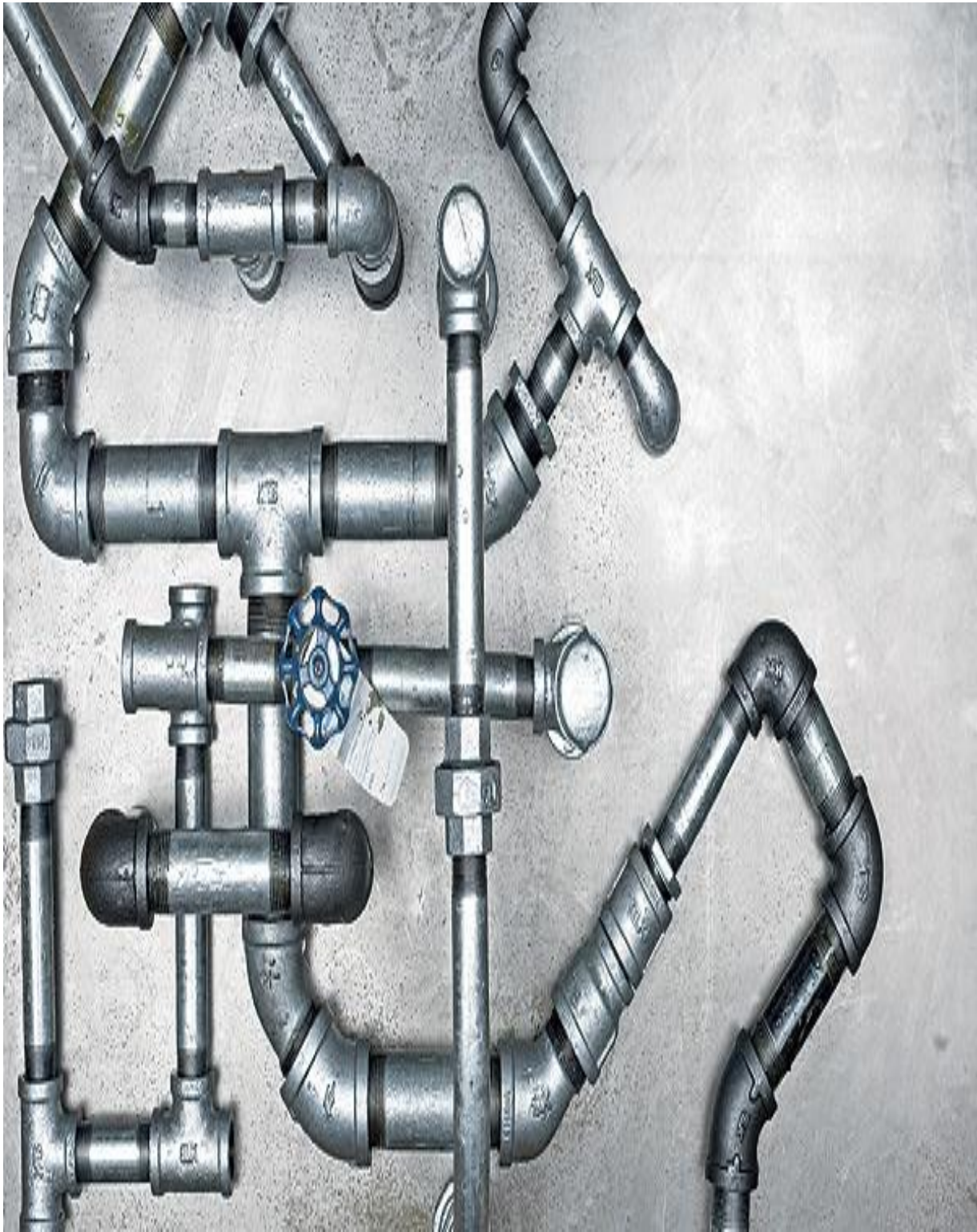# Troubleshooting Nexus 7000

BRKRST-3066

Session Goal

- To provide you with an understanding of the Cisco Nexus™ 7000 built-in troubleshooting tools and troubleshooting technique of NX-OS operating system

- Increase familiarity with Cisco Nexus™ 7000 logging and information capture

- Ensure you get the right information at the right time

Agenda

- **Introduce** NXOS software architecture and logging capability

- **Define** built-in troubleshooting tools that will assist with problem analysis and resolution

- **Demonstrate** troubleshooting tools used when investigating common network functions

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NXOS Architecture Introduction
Traditional IOS Versus NX-OS – Software Modularity

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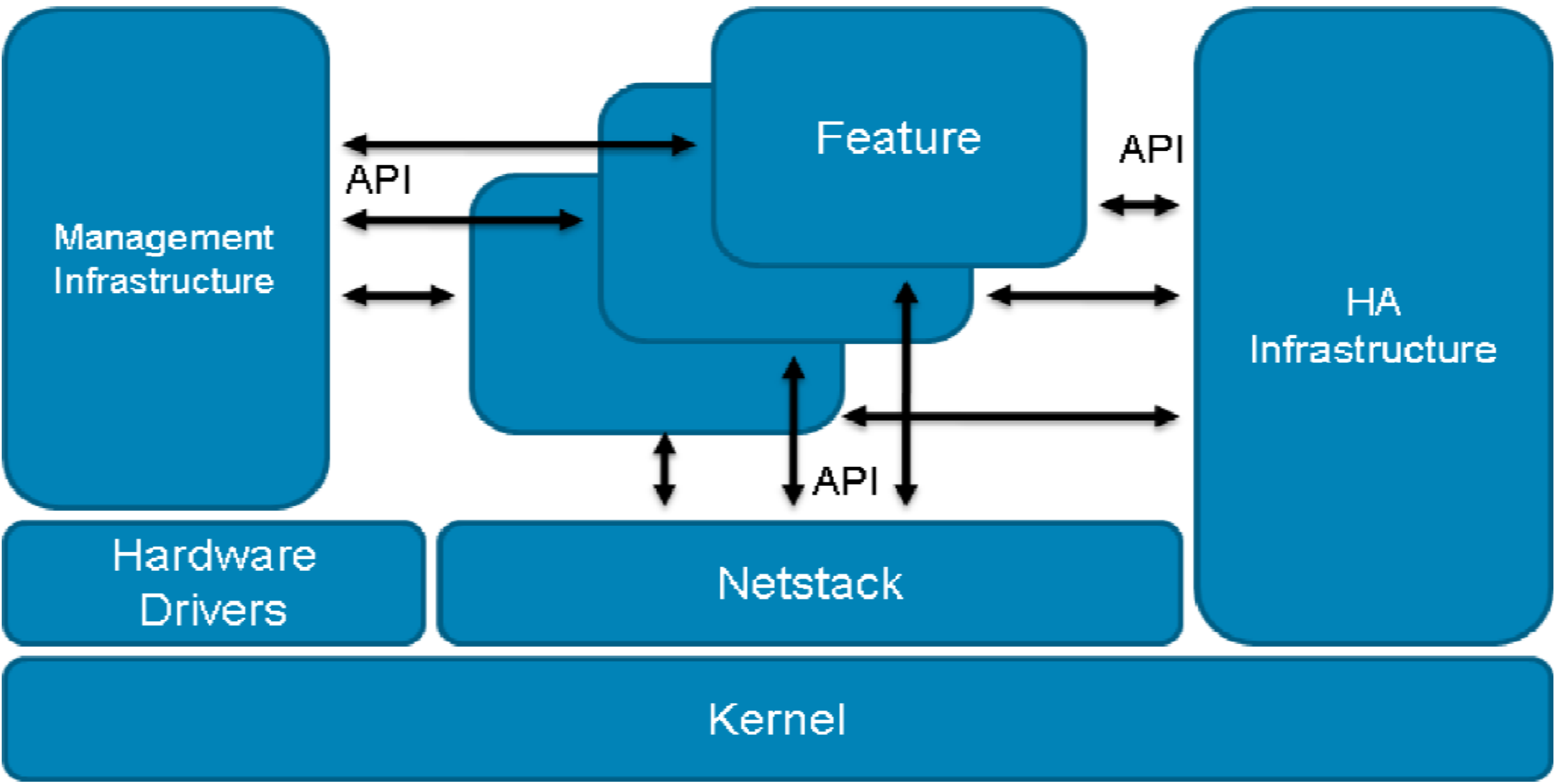
NXOS Architecture Introduction
IOS vs NX-OS – Show Tech

- Logging output greatly increased; assists stateful information capture

- More data requires more effective filtering

- Capture feature related information for later analysis

```
Cat6K#show tech | redirect bootflash:6k.tech
Cat6K#dir bootflash:
Directory of bootflash:/
    9  -rwx      1194813   Feb 10 2012 06:42:30 +00:00  6k.tech


N7K1# show tech >> bootflash:giant.tech
Show tech brief will take  4-6 minutes to complete. Please Wait ...


N7K1# dir bootflash:
120077767       Feb 10 16:18:40 2012  giant.tech
```

1.2MB file to review

120MB file to review

Agenda

- NXOS Architecture Introduction
- Built-in Troubleshooting Tools
- Troubleshooting Nexus 7000
  - CPU
  - Control-Plane – CoPP
  - Hardware
  - vPC
  - Unicast Layer 2 and Layer 3 Forwarding and ARP
  - Multicast Layer 2 and Layer 3 Forwarding
  - QoS

Troubleshooting Tools
CLI Capture and Filter – eigrp, start-time, last

- Powerful CLI based on Linux Kernel

- Built-in CLI filter techniques increases speed and relevance

- grep, egrep, include, last, wc, start-time

- Use the filtering options in real-time to increase your effectiveness

```
N7K1-VPC# show logging logfile start-time 2012 Jan 11 16:00:00
2012 Jan 23 16:00:08 Campus_N7K1-VPC %ETHPORT-5-IF_DOWN_NONE: Interface port-channel40 is down (None)


N7K1-VPC# show logging logfile | egrep "MAC|VLAN|ETHPM"
2012 Jan 23 11:42:49 Campus_N7K1-VPC %ETHPORT-3-IF_ERROR_VLANS_SUSPENDED: VLANs 1,5-
   9,11,100,200,203,1002-1005,1111 on Interface port-channel10 are being suspended.


N7K1-VPC# show ip route | egrep "local$"
    *via 1.1.1.1, Lo0, [0/0], 04:30:29, local
```

Troubleshooting Tools
Debugging Log and Filter – debug logfile, debug-filter

- Debugging per feature logged to bootflash

- Set a filter file and log to a new file

```
N7K1-VPC# debug-filter ip ospf interface vlan 64
N7K1-VPC# debug logfile offending_traffic
N7K1-VPC# debug ip ospf packets
N7K1-VPC# undebug all
```

```
N7K1-VPC# show debug logfile offending_traffic

2012 Mar 26 23:33:25.992586 ospf: 6467 [3981] (default) rcvd: prty:7 ver:2 t:HELLO len:44 rid:0.0.0.0
    area:0.0.0.0 crc:0xfdd2 aut:0 aukid:0 from 192.253.64.254/Vlan64
2012 Mar 26 23:33:25.992780 ospf: 6467 [3981] Invalid src address 192.253.64.254, should not be seen
    on Vlan64
2012 Mar 26 23:33:25.992966 ospf: 6467 [3981] Invalid src address 192.253.64.254, should not be seen
    on Vlan64
```

Troubleshooting Tools

Logging and Feature History – show logging logfile, show <feature> internal

- Syslogs and feature event history per Virtual Device Context (VDC)

- Feature interaction tracked through 'event-history'

- Use syslogs with feature logging to compare feature behaviour

```
N7K1-VPC# show logging logfile
2012 Jan 23 17:20:12 Campus_N7K1-VPC %ETHPORT-3-IF_ERROR_VLANS_SUSPENDED: VLANs 50 on Interface port-
    channel20 are being suspended. (Reason: Vlan is not allowed on Peer-link)


N7K1-VPC# show system internal ethpm event-history interface port-channel 20
29) FSM:<port-channel20> Transition at 500252 usecs after Mon Jan 23 17:20:12 2012
    Previous state: [ETH_PORT_FSM_ST_TRUNK_UP]
    Triggered event: [ETH_PORT_FSM_EV_LOGICAL_CHG]
    Next state: [ETH_PORT_FSM_ST_WAIT_LOGICAL_CHANGE_TRUNK]
```

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Troubleshooting Tools

Logging and Feature History – Show Tech Collection

```
Campus_N7K1-VPC# show tech | grep "'show "
'show license usage vdc-all LAN_ENTERPRISE_SERVICES_PKG'
'show license usage vdc-all LAN_ADVANCED_SERVICES_PKG'
'show license usage vdc-all SCALABLE_SERVICES_PKG'
'show license usage vdc-all TRANSPORT_SERVICES_PKG'
'show license usage vdc-all ENHANCED_LAYER2_PKG'
'show system internal license event-history'
'show system internal license mem-stats'
'show system internal license mem-stats detail'
'show system redundancy ha status'
'show system redundancy status'
'show system internal eltm errors'


N7K1-VPC# show tech-support stp
N7K1-VPC# show tech-support vtp
N7K1-VPC# show tech-support pixm
N7K1-VPC# show tech-support forwarding l2 unicast
```

Troubleshooting Tools
Data Plan Traffic Capture - SPAN

- Data Plane SPAN in hardware

- VACL, Local SPAN, ERSPAN

- ACL Log to flash

```
N7K1-VPC(config)# monitor session 1 type ?
  acl-capture          Create an acl-capture session
  erspan-destination   Create an erspan destination session
  erspan-source        Create an erspan source session
  local                Create a local session

N7K1-VPC(config)# monitor session 1 type local
N7K1-VPC(config-monitor)# source interface e2/1
N7K1-VPC(config-monitor)# destination interface e2/2
N7K1-VPC(config-monitor)# no shut
```

Troubleshooting Tools

Onboard Logging & Diagnostic Monitoring – show logging enabled, show diagnostic

- Persistent, per module logging

- Review event history for failure detection

- Always check diagnostics before troubleshooting!

```
N7K1# show logging onboard module 2 exception-log
----------------------------
    Module:  2
----------------------------


Exception Log Record :  Wed Nov 16 09:36:28 2011 (608385 us)



N7K1# show diagnostic events
1) Event:E_DEBUG, length:115, at 475956 usecs after Mon Jan 23 16:17:07 2012
    [104] Event_INFO: TestName->ASICRegisterCheck TestingType->health monitoring module->5 Result->pass
  Reason->Success
```

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Troubleshooting Tools
CPU Traffic Capture - Ethanalyzer

- Ethanalyzer built in Wireshark capture utility

- Filter capture based on granular 'tcpdump' syntax

- Display capture natively from NXOS console using Wireshark filters

```
N7K1# ethanalyzer local interface inband capture-filter 'arp' limit-captured-frames
   100 write bootflash:arp.pcap
Capturing on inband
100
Program exited with status 0.


N7K1# ethanalyzer local read bootflash:arp.pcap limit-captured-frames 100
2012-01-26 10:13:18.697098 00:00:00:00:01:23 -> ff:ff:ff:ff:ff:ff ARP Gratuitous ARP for 0.0.0.0 (Request)
2012-01-26 10:13:18.697182 00:00:00:00:01:23 -> ff:ff:ff:ff:ff:ff ARP Gratuitous ARP for 0.0.0.0 (Request)
2012-01-26 10:13:18.697430 00:00:00:00:01:23 -> ff:ff:ff:ff:ff:ff ARP Gratuitous ARP for 0.0.0.0 (Request)
2012-01-26 10:13:18.697680 00:00:00:00:01:23 -> ff:ff:ff:ff:ff:ff ARP Gratuitous ARP for 0.0.0.0 (Request)
```

Agenda

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  - Multicast Layer 2 and Layer 3 Forwarding
  - QoS

Troubleshooting CPU
Identify Process and Timeline – show system resources, show proc cpu

- N7K Sup1 DualCore CPU with robust preemptive scheduling

- High CPU process is not always an issue

- Per VDC output; identify the process using CPU resources

```
N7K1# show system resources
Load average:    1 minute: 0.40    5 minutes: 0.36    15 minutes: 0.28
Processes   :    1091 total, 1 running
CPU states  :    0.5% user,    4.0% kernel,    95.5% idle
Memory usage:    8260888K total,    3164848K used,    5096040K free


N7K1# show proc cpu sort | grep -v 0.0
PID     Runtime(ms)   Invoked    uSecs   1Sec     Process
-----   -----------   --------   -----   ------   -----------
 3530        259509    119851    2165     1.9%    platform


Please note that only processes from the requested vdc are shown above
```

Troubleshooting CPU

Identify Process and Timeline – show process cpu history

```
N7K1# show proc cpu history

<snip>
                                         1
        5555554435555544354657844550
        4665464764202299562613607 20
100                                 *
 90                                 *
 80                         *       *
 70                         **      *
 60   ***      *        *  ****  * *
 50  ******  *****  *  *******  ***
 40 **************************
 30 ****************************
 20 ****************************
 10 ###########################
    0....5....1....1....2....2....3....3....4....4....5....5....6....6....7.
             0    5    0    5    0    5    0    5    0    5    0    5    0
            CPU% per hour (last 72 hours)
         * = maximum CPU%    # = average CPU%
```

- History shows combined utilisation across VDC
- Compare problem timeline with CPU spikes and average
- Identify the start of utilisation issues
- Snapshot to bootflash file for historical trending

Boot up 26 hours earlier

Troubleshooting CPU

Module CPU Health Check – show system resources

- CPU per module; manages module processes, no network traffic

```
module-1# show system resources
Load average:    1 minute: 0.24    5 minutes: 0.40    15 minutes: 0.34
Processes   :    69 total, 2 running
CPU states  :    3.0% user,    0.0% kernel,    97.0% idle
Memory usage:    1035776K total,     443632K used,     592144K free


module-1# show system internal processes cpu
top - 14:06:36 up 21 days, 15:34,  1 user,  load average: 0.27, 0.42, 0.34
Tasks:  71 total,   3 running,  68 sleeping,   0 stopped,   0 zombie
Cpu(s):  9.8%us,  7.1%sy,  2.6%ni, 78.8%id,  0.0%wa,  0.1%hi,  1.6%si,  0.0%st
Mem:   1035776k total,   443784k used,   591992k free,       0k buffers
Swap:        0k total,        0k used,        0k free,    93352k cached

  PID USER       PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 1935 root       25   5 39304 8352 3628 R 81.1  0.8   3240:42 stats_client
 1921 root       -2   0 37296 9476 4116 S 15.8  0.9   1534:01 naxos
 1917 root       -2   0 35656 6600 4524 S  2.0  0.6 377:50.48 eureka
```

Troubleshooting CPU
Receiving Traffic Sent to CPU – show proc cpu sort

```
N7K1# show proc cpu | ex 0.0

PID      Runtime(ms)    Invoked     uSecs    1Sec      Process
-----    -----------    --------    -----    ------    -----------
 3904            204          74     2764     0.9%     netstack
 3939         477316      717760      665     0.9%     R2D2_usd


CPU util  :   12.0% user,    4.0% kernel,    84.0% idle
Please note that only processes from the requested vdc are shown above


N7K1# switchto vdc VPC


N7K1-VPC# show proc cpu sort | ex 0.0
PID      Runtime(ms)    Invoked     uSecs    1Sec      Process
-----    -----------    --------    -----    ------    -----------
 5861            360         126     2861    11.3%     netstack
 5840            162          38     4273     4.7%     arp


CPU util  :    5.0% user,   21.5% kernel,    73.5% idle
Please note that only processes from the requested vdc are shown above
```

Per VDC instance of netstack; each process utilization separate from other

Netstack and ARP are running higher than usual; we have traffic hitting CPU

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Troubleshooting CoPP
Control Plane Policing – Protect CPU from your network
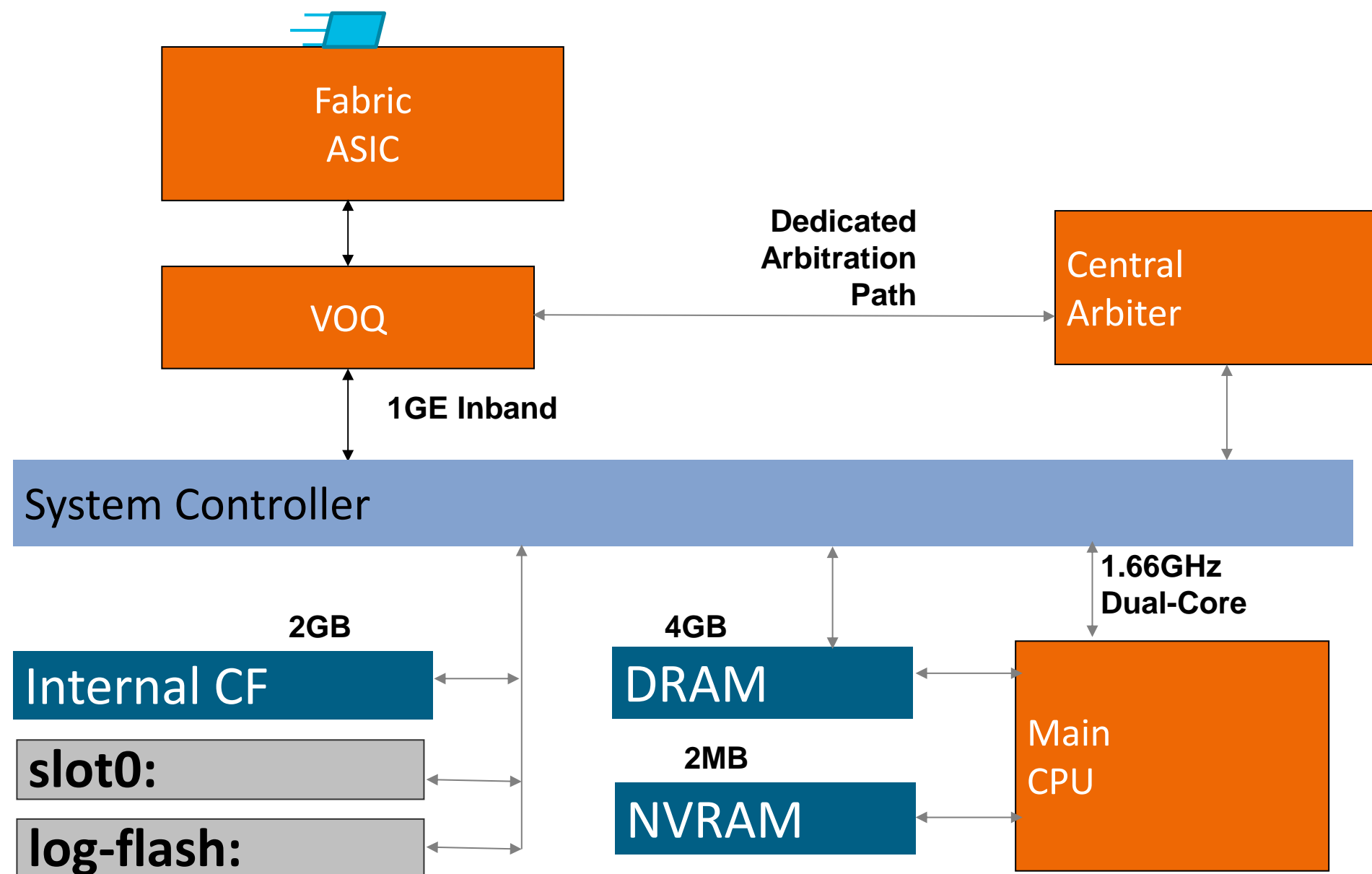
Troubleshooting CoPP

Control Plane Policing – Protect CPU from your network

- Protect CPU from network traffic
    - arp, nd (ipv6)
    - DHCP traffic
    - Glean traffic (no arp or nd)

- Two stage policing

    - Rate-limit in hardware per-module before sending to CPU

    - Policy based policing traffic that have passed rate-limiters

- May require **tweaking** to match your network conditions

Troubleshooting CoPP
Control Plane Policing – show policy-map interface control-plane

```
N7K1# show policy-map int control
Control Plane
  service-policy  input: copp-system-policy

class-map copp-system-class-critical (match-any)
    match access-group name copp-system-acl-bgp


  class-map copp-system-class-exception (match-any)
    match exception ip option
    match exception ip icmp unreachable
    match exception ipv6 option
    match exception ipv6 icmp unreachable
    set cos 1
    police cir 360 kbps, bc 250 ms
    module 2 :
      conformed 0 bytes; action: transmit
      violated 0 bytes; action: drop
    module 3 :
      conformed 0 bytes; action: transmit
      violated 0 bytes; action: drop
    module 10 :
      conformed 273344 bytes; action: transmit
      violated 0 bytes; action: drop
```

Granular class based matching; IP and MAC ACL in one class

Exception traffic; CPU issues no longer created by ICMP exception generation

Implemented per-module; check for violated traffic

Troubleshooting CoPP

Control Plane Policing – show policy-map interface control-plane

- Filter output to confirm affected classes

- Check class-map definitions if violated traffic does not match your expectation

```
N7K1# show policy-map int control | egrep "class-map|violated"
    class-map copp-system-class-critical (match-any)
        violated 0 bytes; action: drop
        violated 0 bytes; action: drop
        violated 0 bytes; action: drop
    class-map copp-system-class-management (match-any)
        violated 0 bytes; action: drop
        violated 0 bytes; action: drop
        violated 0 bytes; action: drop
    class-map class-default (match-any)
        violated 0 bytes; action: drop
        violated 0 bytes; action: drop
        violated 274930048 bytes; action: drop
```

Routing protocols class; no drops

TFTP; SNMP; FTP protocols

Low rate policer on default class; 100Kbps default dropped traffic

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Troubleshooting CoPP

Control Plane Policing – show hardware rate-limit

- ■ Per module rate-limiter in addition to control-plane policy

```
N7K1# show hardware rate-limiter
Units for Config: packets per second
Rate Limiter Class                     Parameters
--------------------------------------------------------------
layer-3 control                        Config    : 10000
                                       Allowed   : 0
                                       Dropped   : 0
                                       Total     : 0
<snip>


copy                                   Config    : 30000
                                       Allowed   : 3934270
                                       Dropped   : 829800
                                       Total     : 4764070



receive                                Config    : 30000
                                       Allowed   : 6875754
                                       Dropped   : 0
                                       Total     : 6875754
```

Review layer-3 control if control-plane instablility

Copy to sup used for Exceptions; limited before CoPP

Traffic destined to Sup

- ■ Hardware Rate-Limiter performed by forwarding engine hardware
- ■ Global system wide hardware feature
- ■ Limit based on packet definitions

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Troubleshooting CoPP

Review Traffic Sent to CPU – show hardware internal inband cpu-mac stats

```
N7K-1# show hardware internal cpu-mac inband stats

RMON counters                              Rx                    Tx
total packets                         779905245            1421785114
good packets                          779905245            1421650279
total octets (hi)                             0                     0
total octets (low)                  172302724342          192974265660
Error counters
----------------------------------+--
Rx no buffers ................... 1203243
Throttle statistics
Throttle interval .......... 2 * 100ms
Packet rate limit .......... 32000 pps
Tick counter ............... 12414130
Rx packet rate (current/max) 4993 / 20296 pps
Tx packet rate (current/max) 60 / 3474 pps
MAC counters                    MAC0 (R2D2)           MAC1 (CPU)
                             Rx          Tx        Rx          Tx
XOFF packets auto-generated            5447
XOFF packets                      7590855    6731953
XON packets                  0                   18561642
```

Total number of frames received and sent by CPU

Traffic tail dropped; after CoPP and RL

CPU bound traffic current pps /maximum pps reached

Troubleshooting CoPP

Review Traffic Sent to CPU – ethanalyzer local interface

- Start by capturing all traffic; define filters based on first capture

- Capture to text file or .pcap

- Local review or export to wireshark

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Troubleshooting CoPP
Review Traffic Sent to CPU – ethanalyzer local interface

```
N7K1# ethanalyzer local int inband limit-captured-frame 100 write
bootflash:cpu.pcap

Capturing on inband
100
Program exited with status 0.

N7K1# ethanalyzer local int inband decode-internal limit-captured-frames 100 >
cpu.txt
```

Creates pcap file which can later be analysed by GUI wireshark

Provides information from internal system headers, not allowed with 'write' keyword

Filter syntax: http://www.wireshark.org/docs/wsug_html_chunked/ChCapCaptureFilterSection.html

Troubleshooting CoPP
Review Traffic Sent to CPU – ethanalyzer local read

```
N7K1# ethanalyzer local read bootflash:cpu.pcap

2012-01-26 10:02:20.387538 172.16.60.123 -> 172.16.50.1  UDP Source port: 63  Destination port: 63
2012-01-26 10:02:20.387691 172.16.60.123 -> 172.16.50.1  UDP Source port: 63  Destination port: 63
2012-01-26 10:02:20.388066 172.16.60.123 -> 172.16.50.1  UDP Source port: 63  Destination port: 63
2012-01-26 10:02:20.388566 172.16.60.123 -> 172.16.50.1  UDP Source port: 63  Destination port: 63
2012-01-26 10:02:20.388940 172.16.60.123 -> 172.16.50.1  UDP Source port: 63  Destination port: 63
```

Local analysis completed from CLI prompt

Troubleshooting CoPP

Review Traffic Sent to CPU – ethanalyzer local read

```
N7K1# ethanalyzer local read bootflash:cpu.pcap detail

Frame 1 (92 bytes on wire, 60 bytes captured)
    Arrival Time: Jan 26, 2012 10:02:20.387538000
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 92 bytes
    Capture Length: 60 bytes
    [Frame is marked: False]
    [Protocols in frame: eth:ip:udp:data]
Ethernet II, Src: 00:24:97:36:81:3f (00:24:97:36:81:3f), Dst: 04:c5:a4:e9:ac:44
(04:c5:a4:e9:ac:44)
    Destination: 04:c5:a4:e9:ac:44 (04:c5:a4:e9:ac:44)
        Address: 04:c5:a4:e9:ac:44 (04:c5:a4:e9:ac:44)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
```

Wireshark output; display filters help to find relevant packets

Use filter in next capture to increase the relevance

Troubleshooting CoPP
Ethanalyzer Examples

```
Capture ICMP traffic from specific source to destination
ethanalyzer local inter inband capture-filter 'icmp && src host 192.168.0.2 && dst host 192.168.0.1'

Capture ALL traffic from specific source to destination using IP
ethanalyzer local inter inband capture-filter 'src host 192.168.0.2 && dst host 192.168.0.1'

Capture ALL traffic from specific source to destination using MAC
ethanalyzer local inter inband capture-filter 'ether src 00:1b:0d:ef:5a:c0 && ether dst
00:11:92:fa:b2:c0'

Capture ARP traffic destined to an interface or SVI having IP 192.168.88.3
ethanalyzer local inter inband capture-filter 'arp && src host 192.168.88.3'

Capture ALL SNMP traffic
ethanalyzer local inter inband capture-filter 'udp port 161 || tcp port 161' limit-captured-frames 1000

Capture ALL HSRP v1 Control Packets
ethanalyzer local interface inband capture-filter "dst net 224.0.0.2 and udp dst port 1985"
```

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Troubleshooting Hardware

Module – show module, reload module <x>

```
N7K1# show module
Mod   Ports  Module-Type                              Model                Status
---   -----  ------------------------------------     --------------       ----------
2     32     10 Gbps Ethernet XL Module               N7K-M132XP-12L       ok
3     48     1000 Mbps Optical Ethernet Module        N7K-M148GS-11        testing
5     0      Supervisor module-1X                     N7K-SUP1             active *
6     0      Supervisor module-1X                     N7K-SUP1             ha-standby
10    48     10/100/1000 Mbps Ethernet Module         N7K-M148GT-11        ok


<snip>
Mod   Online Diag Status
---   ------------------
2     Pass
3     Untested
5     Pass
6     Pass
10    Pass


N7K1# reload module 3
This command will reload module 3. Proceed[y/n]?  [n] y
reloading module 3 ...
```

Module booting during troubleshooting

Reload from CLI denies module access to power shelf; only reseat will resolve physical issue

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Troubleshooting Hardware
Online Diagnostics Review – show diagnostic result, show diagnostic event

```
N7K1# show diagnostic result mod 3 | grep -v ^$
Current bootup diagnostic level: complete
Module 3: 1000 Mbps Optical Ethernet Module
        Test results: (. = Pass, F = Fail, I = Incomplete,
        U = Untested, A = Abort, E = Error disabled)
        1) ASICRegisterCheck------------> .
        2) PrimaryBootROM---------------> .
        3) SecondaryBootROM-------------> .
        4) EOBCPortLoopback-------------> .
        5) OBFL-------------------------> .
        6) PortLoopback:
        Port    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16
        -----------------------------------------------------

                .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
        Port   17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
        -----------------------------------------------------

                .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
        Port   33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
        -----------------------------------------------------

                .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
N7K1# show diagnostic events error
1) Event:E_DEBUG, length:217, at 362751 usecs after Wed Jan 25 03:26:21 2012
    [103] Event_ERROR: TestName->SpineControlBus TestingType->health monitoring module->5 Result->fail
    Reason-> XBar
```

Eliminates empty lines

Per port diagnostic test.
Initiated from module CPU.
F could be transient or
survive a module reset

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Troubleshooting Hardware

Fabric – show module, show hardware capacity

```
N7K1# show module xbar
Xbar Ports   Module-Type                            Model                  Status
---  -----   -------------------------------------- ---------------------- ----------
1    0       Fabric Module 1                        N7K-C7010-FAB-1        ok
2    0       Fabric Module 1                        N7K-C7010-FAB-1        ok
3    0       Fabric Module 1                        N7K-C7010-FAB-1        ok


N7K1# show hardware capacity fabric-utilization
-------------------------------------------------------------------------
Fabric Planes:
A -- Unicast fabric interface
B -- Multicast/Multidestination fabric interface
-----------------------PEAK FABRIC UTILIZATION-------------------------
I/O  |-----FABRIC----|      Ingress           |       Egress
Slot |Mod Inst  Plane| Util           Time    | Util            Time
-------------------------------------------------------------------------
2     1    1     A     0%      01-23@16:41:46     0%     01-23@16:41:46
2     1    1     B     0%      01-23@16:41:46     0%     01-23@16:41:46


N7K1(config)# poweroff xbar 1
```

Xbar utilization max, check previous history for trending info

Power off xbar before trying hardware swap

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Troubleshooting Hardware

Fabric – show module, show hardware capacity

```
Campus_N7K1-VPC# sh int e2/2
Ethernet2/2 is up
admin state is up, Dedicated Interface
  Belongs to Po10
  Hardware: 10000 Ethernet, address: c89c.1d82.07f9 (bia c89c.1d82.07f9)
  Description: 40G Trunk btwn 7ks
  MTU 1500 bytes, BW 10000000 Kbit, DLY 10 usec
  Last link flapped 4d11h
  Last clearing of "show interface" counters never
  1 interface resets
  30 seconds input rate 11192 bits/sec, 14 packets/sec
  30 seconds output rate 11096 bits/sec, 14 packets/sec
  Load-Interval #2: 5 minute (300 seconds)
    input rate 10.89 Kbps, 19 pps; output rate 10.74 Kbps, 19 pps
  RX
    698 unicast packets  7616146 multicast packets  28542 broadcast packets
    7645386 input packets  553579374 bytes
    0 jumbo packets  0 storm suppression packets
    0 runts  0 giants  0 CRC  0 no buffer
    0 input error  0 short frame  0 overrun   0 underrun  0 ignored
    0 watchdog  0 bad etype drop  0 bad proto drop  0 if down drop
    0 input with dribble  0 input discard
    0 Rx pause
```
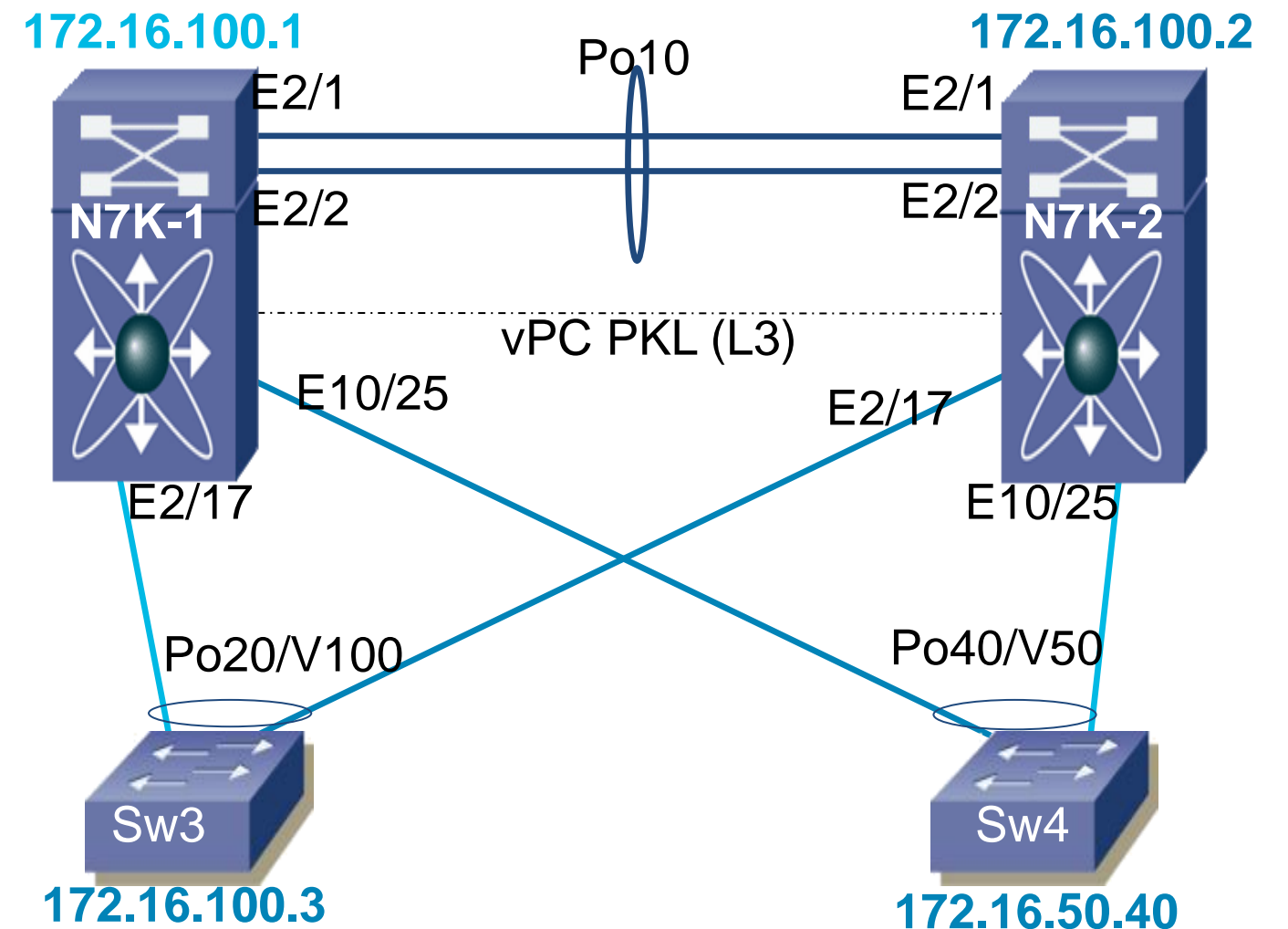
Agenda

- NXOS Architecture Introduction
- Built-in Troubleshooting Tools
- Troubleshooting Nexus 7000
  - CPU
  - Control-Plane – CoPP
  - Hardware
  - vPC
  - Unicast Layer 2 and Layer 3 Forwarding and ARP
  - Multicast Layer 2 and Layer 3 Forwarding
  - QoS

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Troubleshooting vPC
Distributed Layer 2 Forwarding

- Designed as an alternative to STP

- Appear as one L2 device to the network

- Peers must maintain consistent network view

- Recovery mechanisms protect forwarding

172.16.100.1

Po10

172.16.100.2

E2/1   E2/1

N7K-1   E2/2   E2/2   N7K-2

vPC PKL (L3)

E10/25   E2/17

E2/17   E10/25

Po20/V100   Po40/V50

Sw3   Sw4

172.16.100.3   172.16.50.40

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Troubleshooting vPC
Global Consistency Check – show vpc brief

```
N7K1-VPC# show vpc brief
vPC domain id                          : 1
Peer status                            : peer adjacency formed ok
vPC keep-alive status                  : peer is alive
Configuration consistency status       : success
Per-vlan consistency status            : success
Type-2 consistency status              : failed
Type-2 inconsistency reason            : SVI type-2 configuration incompatible
vPC role                               : secondary
Number of vPCs configured              : 2
Peer Gateway                           : Enabled
<snip>
vPC Peer-link status
---------------------------------------------------------------------

id   Port    Status Active vlans
--   ----    ------ --------------------------------------------------
1    Po10    up     1,5-9,11,100,200,203,1111

vPC status
---------------------------------------------------------------------
id   Port    Status Consistency Reason              Active vlans
--   ----    ------ ----------- ------              -----------
20   Po20    up     success     success             1,5-9,11,203
40   Po40    up     success     success             1,5-9,11,100,200,203,1111
```

Secondary role, vPCs shut if peer-link is down

Peer gateway enabled; routing for peer

Type-2 consistency check failed, but vlans still passing on vPC and peer-link

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Troubleshooting vPC

Global Consistency Check – show vpc consistency parameters global

```
N7K1-VPC# show vpc consistency-parameters global
Type 1 : vPC will be suspended in case of mismatch
Name                         Type   Local Value              Peer Value
-------------                ----   ---------------------    ---------------------
STP Mode                     1      Rapid-PVST               Rapid-PVST
STP Disabled                 1      None                     None
<snip>
STP Port Type, Edge          1      Normal, Disabled,        Normal, Disabled,
BPDUFilter, Edge BPDUGuard          Disabled                 Disabled
STP MST Simulate PVST        1      Enabled                  Enabled
VTP domain                   2      TEST                     -
VTP version                  2      1                        -
VTP mode                     2      Server                   -
VTP password                 2                               -
VTP pruning status           2      Disabled                 -
Interface-vlan admin up      2      5-6,100                  5-6,100,200
Interface-vlan routing       2      1,5-6,100                1,5-6,100,200
capability
Allowed VLANs                -      1,5-9,11,100,200,203,1   1-3,5-12,16,20-23,32,1
                                    002-1005,1111            00,156,200-201,203,220
                                                             -222,230,508,555,921,9
                                                             93-994,1000,1111,1221,
                                                             1999,2211-2213,2233-22
                                                             34,2901

Local suspended VLANs        -      1002-1005                -
```

VTP enabled locally, disabled on remote

SVI 200 not configured locally

Mismatched allowed VLANs

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Troubleshooting vPC

MAC Address Synchronised – show mac address-table

- MAC addresses synchronized via CFS

- First Hop Redundancy Protocol addresses forwarded by both peers

- Peer-gateway allows routing for peer SVI MAC

```
N7K1-VPC# show mac add vlan 100
    * - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
       age - seconds since last seen,+ - primary entry using vPC Peer-Link
   VLAN      MAC Address       Type       age     Secure NTFY Ports/SWID.SSID.LID
---------+-----------------+--------+---------+------+----+-------------------
G 100      0000.0c07.ac01    static      -        F     F   vPC Peer-Link(R)
G 100      04c5.a4e9.aac4    static      -        F     F   vPC Peer-Link(R)
G 100      04c5.a4e9.ac44    static      -        F     F   sup-eth1(R)
* 100      0021.d87c.2740    dynamic    0         F     F   Po20


N7K1-VPC# show run vpc | egrep "peer-gateway"
   peer-gateway
```

Peer MAC address with G-bit set, route traffic destined to peer

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Troubleshooting vPC
Loop Avoidance – Peer Gateway
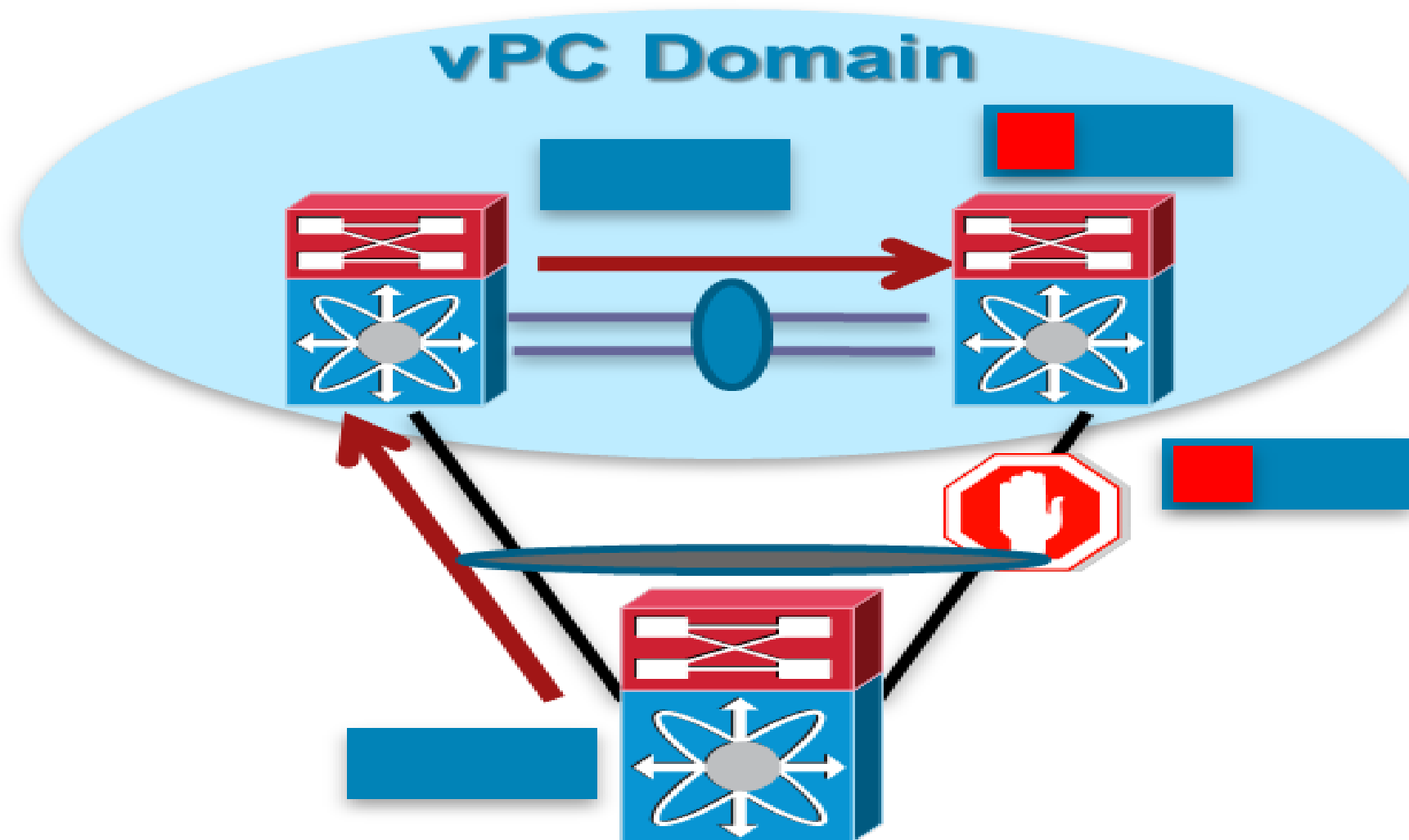
Troubleshooting vPC

Data Collection – show tech vpc, show tech stp, show tech pixm

```
N7K1-VPC# show tech-support vpc | grep "`show "
`show version`
`show module`
`show vpc brief`
`show vpc role`
`show running-config vpc`
`show system internal vpcm event-history global`
`show system internal vpcm event-history errors`
`show system internal vpcm event-history msgs`
`show system internal vpcm event-history interactions`
`show system internal vpcm mem-stats detail`
`show system internal vpcm info all`
`show system internal vpcm info global`
`show cfs internal ethernet-peer database`
`show spanning-tree`

N7K1-VPC# show tech-support stp
N7K1-VPC# show tech-support vtp
N7K1-VPC# show tech-support pixm
N7K1-VPC# show tech-support forwarding l2 unicast
```
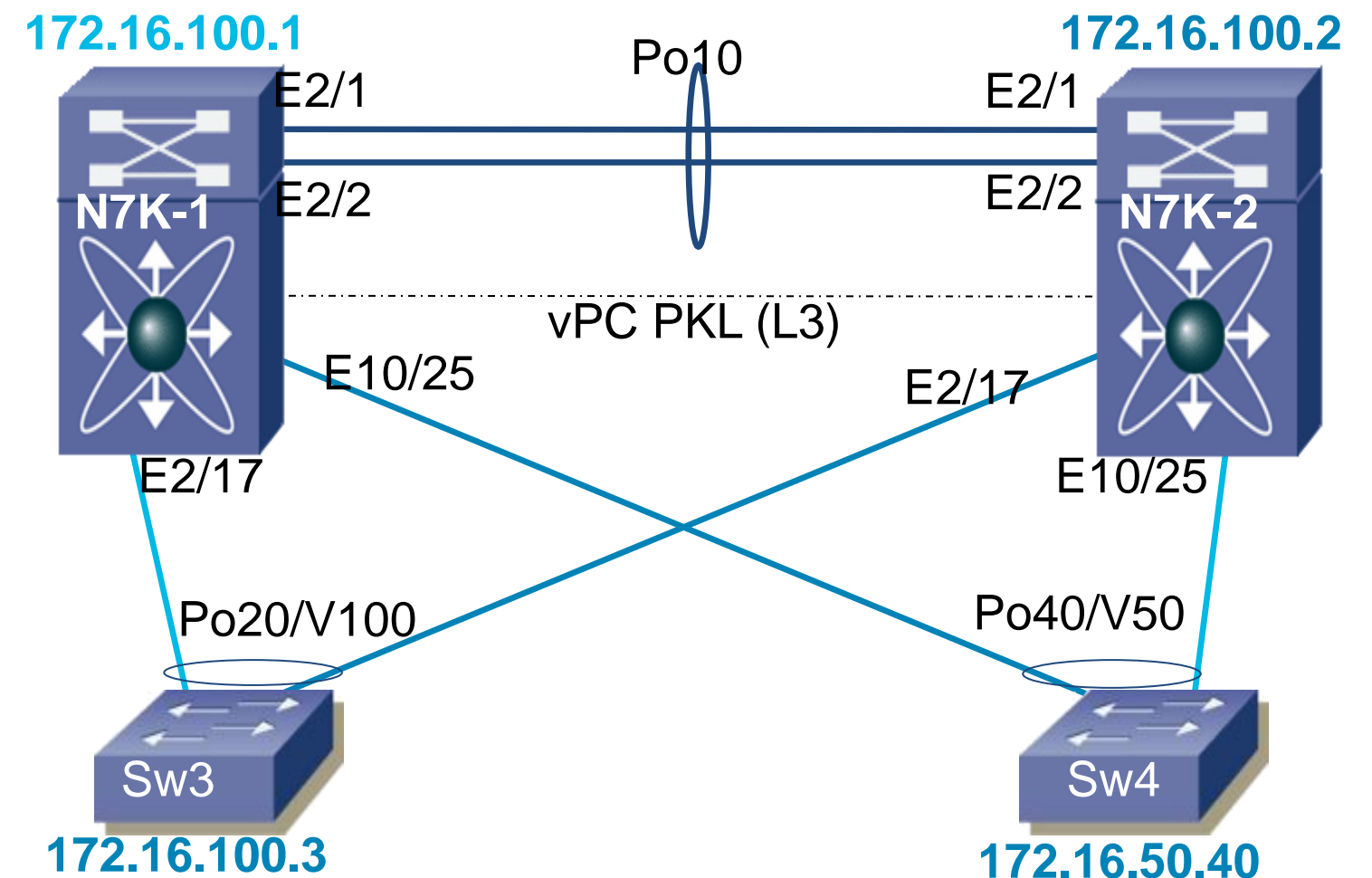
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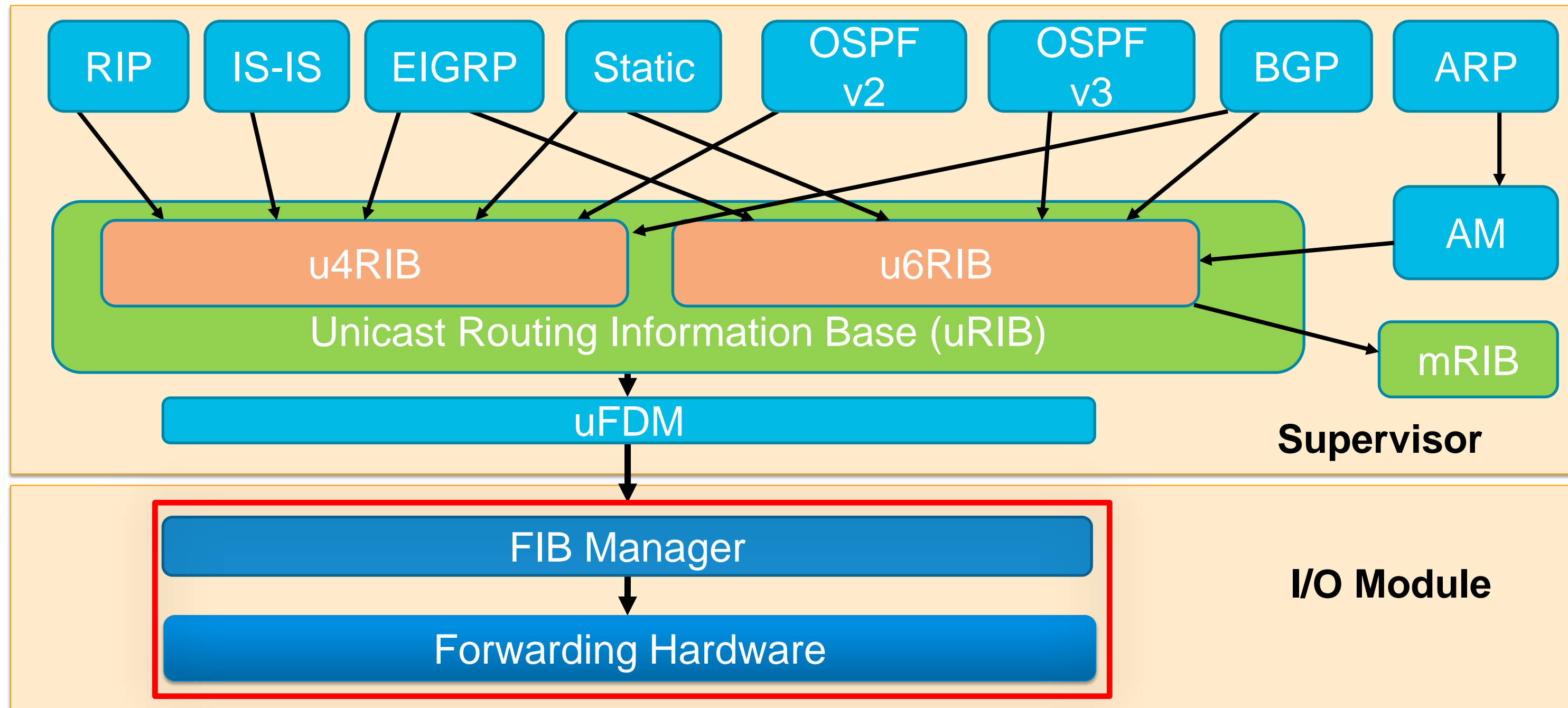 - QoS

Troubleshooting Unicast Forwarding

Forwarding L2 and L3 in Hardware

- L2 learning in hardware by forwarding engine per module

- L3 entries learned by CPU and pushed to hardware engine

- Verify software entries against topology diagrams

- Verify hardware entries against software entries

Troubleshooting Unicast Forwarding

Forwarding L2 and L3 in Hardware

RIP | IS-IS | EIGRP | Static | OSPF v2 | OSPF v3 | BGP | ARP

AM

Unicast Routing Information Base (uRIB)

u4RIB | u6RIB

mRIB

uFDM

Supervisor

FIB Manager

I/O Module

Forwarding Hardware

Troubleshooting Unicast Forwarding

Software Tables – show ip route, show ip adjacency, show mac address-table

```
N7K1-VPC# show ip route 172.16.50.40
IP Route Table for VRF "default"
'*' denotes best ucast next-hop


172.16.50.40/32, ubest/mbest: 1/0, attached
    *via 172.16.50.40, Vlan50, [250/0], 00:02:09, am
```

```
N7K1-VPC# show ip adjacency 172.16.50.40
Flags: # - Adjacencies Throttled for Glean
IP Adjacency Table for VRF default
Total number of entries: 1
Address          MAC Address     Pref Source      Interface
172.16.50.40     0024.9736.813f  50   arp         Vlan50
```

```
Campus_N7K1-VPC# show mac address-table address 0024.9736.813f
Legend:
        * - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
        age - seconds since last seen,+ - primary entry using vPC Peer-Link
   VLAN      MAC Address       Type        age     Secure NTFY Ports/SWID.SSID.LID
---------+-----------------+--------+---------+------+----+------------------
* 50         0024.9736.813f    dynamic    150          F    F  Po40
```

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Troubleshooting Unicast Forwarding

L2 Hardware Entries – show hardware mac-add, show system internal pixm

```
N7K1-VPC# show hardware mac add 2 vlan 50
FE | Valid| PI|  BD  |      MAC       |  Index| Stat| SW  | Modi| Age| Tmr| GM| Sec| TR| NT| RM| RMA| Cap| Fld|Always
   |      |   |      |                |       | ic  |     | fied|Byte| Sel|   | ure| AP| FY|   |    |TURE|    | Learn
--+-----+---+-----+---------------+------+----+----+----+----+---+---+----+--+---+--+---+---+---+---
 0    1    0    59   0024.9736.813f  0x00a48   0   0x003   0    9    1   0   0   0   0   0   0    0    0    0
 0    1    0    59   0000.0000.0123  0x00a48   0   0x003   0   156   1   0   0   0   0   0   0    0    0    0
 0    1    1    59   0000.0c07.ac01  0x00400   1   0x000   0   156   1   1   0   0   0   0   0    0    0    0
 0    1    1    59   04c5.a4e9.ac44  0x00400   1   0x000   0   130   1   1   0   0   0   0   0    0    0    0
 0    1    0    59   4180.0000.0127  0x07ff1   1   0x001   0   170   0   0   0   0   0   0   0    1    0    0
 0    1    0    59   4180.0000.0128  0x07ff1   1   0x001   0    29   0   0   0   0   0   0   0    1    0    0
```

```
N7K1-VPC# show vlan internal bd-info vlan-to-bd 50
VDC Id   Vlan Id   BD Id
------   -------   -------

4          50        59
```

Allocated bridge-domain matches in hardware table

DMAC sent to LTL index for PO40

```
N7K1-VPC# show system internal pixm info ltl 0xa48
PC_TYPE      PORT      LTL      RES_ID        LTL_FLAG       CB_FLAG        MEMB_CNT
-----------------------------------------------------------------------------
Normal      Po40   0x0a48    0x16000027    0x00000000     0x00000002     1
```

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Troubleshooting Unicast Forwarding

L3 Hardware Entries – show ip fib route <dest>, show system internal forward

```
N7K1-VPC# show ip fib route 172.16.50.40 module 2
IPv4 routes for table default/base
-----------------+-----------------+--------------------+----------------
Prefix           | Next-hop        | Interface          | Labels
-----------------+-----------------+--------------------+----------------
172.16.50.40/32    172.16.50.40          Vlan50
```

```
N7K1-VPC# show system internal forwarding ip route 172.16.50.40 module 2
----+--------------------+---------+---------+------+-----------
Dev | Prefix             | PfxIndex | AdjIndex | LIFB | LIF
----+--------------------+---------+---------+------+-----------
 1     172.16.50.40/32       0x2033    0x43015     0    0x3b

Campus_N7K1-VPC# show system internal forwarding adjacency mod 2 entry 0x43015 det
Device: 1   Index: 0x43015   DMAC: 0024.9736.813f  SMAC: 00c5.a4e9.ac44
            LIF: 0x3b (Vlan50) DI: 0x0     ccc: 4    L2_FWD: NO   RDT: NO
            packets: 0    bytes: 0     zone enforce: 0
```

Troubleshooting Unicast Forwarding
Scale and Utilsation – show ip route summary, show hardware internal

```
N7K1-VPC# show ip route summary
IP Route Table for VRF "default"
Total number of routes: 45
Total number of paths:  47
Best paths per protocol:        Backup paths per protocol:
  am               : 4              None
  local            : 9
<snip>
Number of routes per mask-length:
  /8 : 1        /24: 6        /30: 1        /32: 37
```

```
N7K1-VPC# show hardware internal forwarding table utilization module 2
Note: Utilization may not reach the maximum.
Module 2 usage:
Route Type              Used        %Used        Free        %Free        Total
                        (Log/Phys)               (Log/Phys)               (Log/Phys)
-------------------------------------------------------------------------------
IPv4 Unicast:           67/67        0
L2VPN Peer:             0/0          0
MPLS:                   0/0          0  -------------------------------------
                                           904967/904967    99   905120/905120
                                        -------------------------------------
```

Troubleshooting Unicast Forwarding

Data Collection – show tech forwarding, show tech netstack, show tech arp

```
N7K1-VPC# show tech-support forwarding L3 unicast | grep "`show "
`show forwarding route summary vrf all`
`show forwarding route max-display-count 100000 vrf all`
`show forwarding vrf all adjacency`
`show forwarding ipv6 route summary vrf all`
`show forwarding ipv6 route max-display-count 100000 vrf all`
`show forwarding vrf all ipv6 adjacency`
`show forwarding trace`
`show forwarding internal errors`
`show forwarding internal error counts`
`show forwarding internal unicast counts vdc all`
`show forwarding internal message counts`

N7K1-VPC# show tech-support netstack | grep "`show " | wc -l
212

N7K1-VPC# show tech-support arp | grep "`show "
`show running-config arp`
`show ip arp internal event-history cli`
`show ip arp vrf all`
`show ip arp static vrf all`
`show ip arp summary vrf all`
`show ip arp tunnel-statistics`
```

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Agenda

- NXOS Architecture Introduction
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  - QoS

Troubleshooting Multicast Forwarding

Distributing Streams in Hardware

- Software learning and hardware entries mirror IPv4 distribution model

- Conservation of L2 replication based on L3 address

- Egress replication forwarding conserves hardware resources

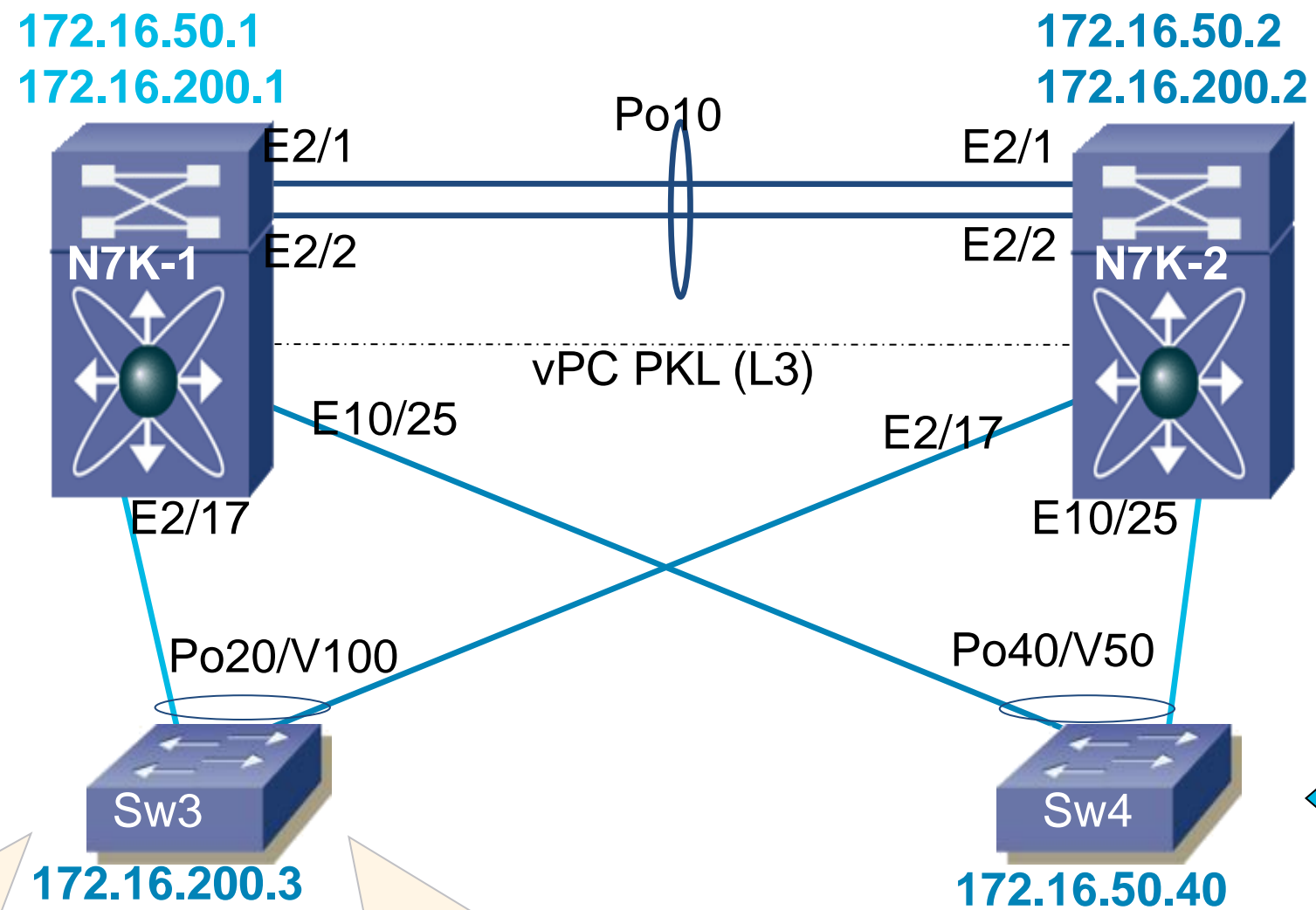- Single copy sent across fabric conserves bandwidth
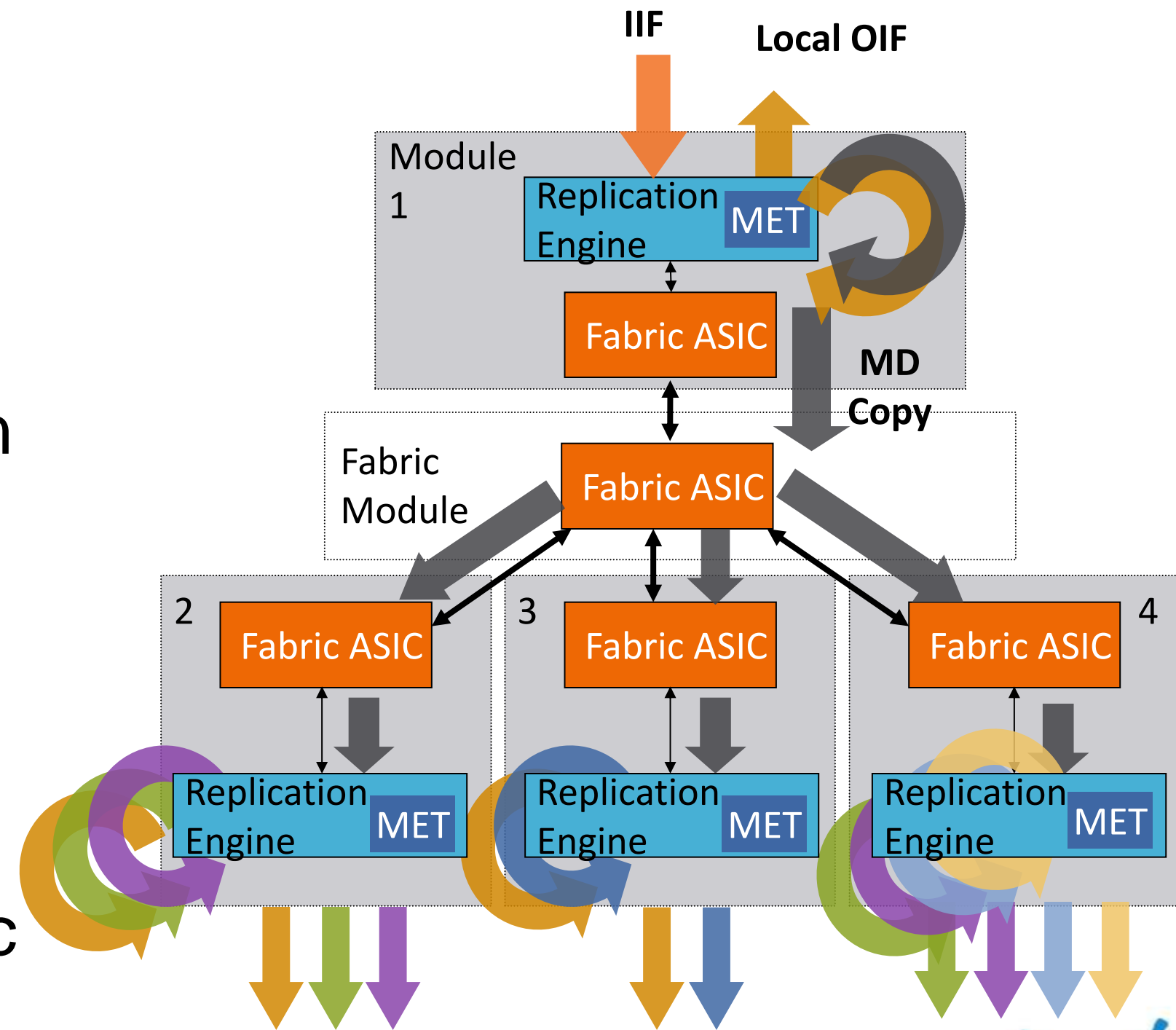
Troubleshooting Multicast Forwarding
Layer 3

- Forwarding information propagates from Supervisor to LC.

- Below process modules are in involved.

  - **MRIB**

  - **MFDM PI**

  - **MFDM PD**

  - **MFIB**

  - **Hardware** (FIB TCAM, FIB DRAM, Adjacency Table)

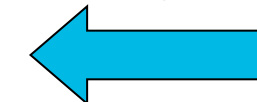# Troubleshooting Multicast Forwarding
Example Topology

172.16.50.1
172.16.200.1

172.16.50.2
172.16.200.2

Po10

E2/1   E2/1

N7K-1   E2/2   E2/2   N7K-2

vPC PKL (L3)

E10/25   E2/17

E2/17   E10/25

Po20/V100   Po40/V50

L2 Stream from VLAN200

Sw3   Sw4

172.16.200.3   **172.16.50.40**

L3 Stream from VLAN50

L2 Stream:
igmp join-group 239.0.0.200

L3 Stream:
igmp join-group 239.0.0.70

Troubleshooting Multicast Forwarding

L2 Software Entries– show ip igmp snooping

- Querier must be present; typically points towards mrouter

```
Campus_N7K1-VPC# show ip igmp snooping group 239.0.0.200 vlan 200
Type: S - Static, D - Dynamic, R - Router port, F - Fabricpath core port

Vlan    Group Address         Ver   Type   Port list
200     239.0.0.200           v2    D      Po20


Campus_N7K1-VPC# show ip igmp snooping mrouter vlan 200
Type: S - Static, D - Dynamic, V - vPC Peer Link
      I - Internal, F - Fabricpath core port
      U - User Configured
Vlan    Router-port      Type         Uptime          Expires
200     Po20             D            6d03h           00:04:59
200     Vlan200          ID           6d03h           00:04:20


Campus_N7K1-VPC# show ip igmp snooping querier vlan 200
Vlan    IP Address         Version    Expires      Port
200     172.16.200.1       v2         00:03:33     Vlan200 (internal)
```

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Troubleshooting Multicast Forwarding

L2 MFDM Software Entries– show forwarding distribution multicast

```
Campus_N7K1-VPC# show forwarding distribution ip igmp snooping vlan 200 group
239.0.0.200
Vlan: 200, Group: 239.0.0.200, Source: 0.0.0.0
  Outgoing Interface List Index: 5
  Reference Count: 3
  Platform Index: 0x7fed
  Vpc peer link exclude flag set
  Number of Outgoing Interfaces: 2
    port-channel10
    port-channel20
```

```
Campus_N7K1-VPC# show forwarding distribution multicast outgoing-interface-list L2 5
  Outgoing Interface List Index: 5
  Reference Count: 3
  Platform Index: 0x7fed
  Vpc peer link exclude flag set
  Number of Outgoing Interfaces: 2
    port-channel10
    port-channel20
```

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Troubleshooting Multicast Forwarding

L2 Hardware Entries– show system internal ip igmp snooping

```
Campus_N7K1-VPC# show system internal ip igmp snooping vlan 200 group 239.0.0.200
module 2
VDC: 4
Vlan    Group           Source          Epoch   RID   DTL      hwptr
200    239.0.0.200                      1       5     0x7fed   0x1e60f


Campus_N7K1-VPC# show system internal ip igmp snooping vlan 200 group 239.0.0.200
module 10
VDC: 4
Vlan    Group           Source          Epoch   RID   DTL      hwptr
200    239.0.0.200                      1       12    0x7fed   0x1e60f
```

```
Campus_N7K1-VPC# show system internal pixm info ltl 0x7fed
MCAST LTLs allocated for VDC:4
================================================
LTL     IFIDX       LTL_FLAG CB_FLAG MI[0]
0x7fed 0x0000000c 0x00      0x0002  0x002
-------------------
IFIDX           LTL
------------------------------------
Po20            0x0a42
Po10            0x0a40
```

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Troubleshooting Multicast Forwarding

L3 Software Entries – show ip pim, show ip mroute

```
Campus_N7K1-VPC# show ip mroute
IP Multicast Routing Table for VRF "default"

(*, 239.0.0.70/32), uptime: 5d21h, pim ip
  Incoming interface: loopback0, RPF nbr: 1.1.1.1
  Outgoing interface list: (count: 1)
    Vlan200, uptime: 5d21h, pim

(172.16.50.123/32, 239.0.0.70/32), uptime: 5d21h, ip pim mrib
  Incoming interface: Vlan50, RPF nbr: 172.16.50.123, internal
  Outgoing interface list: (count: 1)
    Vlan200, uptime: 5d21h, pim
```

```
Campus_N7K1-VPC# show ip pim interface brief
PIM Interface Status for VRF "default"
Interface            IP Address        PIM DR Address    Neighbor  Border
                                                         Count     Interface

Vlan200              172.16.200.1      172.16.200.1      2         no
Vlan50               172.16.50.1       172.16.50.1       2         no
loopback0            1.1.1.1           1.1.1.1           0         no
```

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Troubleshooting Multicast Forwarding

L3 Hardware Entries – show forwarding multicast route

```
Campus_N7K1-VPC# show forwarding multicast route group 239.0.0.70 source
172.16.50.123
slot  2
=========
   (172.16.50.123/32, 239.0.0.70/32), RPF Interface: Vlan50, flags:
     Received Packets: 0 Bytes: 0
     Number of Outgoing Interfaces: 1
     Outgoing Interface List Index: 4
       Vlan200 Outgoing Packets:1100739 Bytes:870975864
slot 10
=========
   (172.16.50.123/32, 239.0.0.70/32), RPF Interface: Vlan50, flags:
     Received Packets: 422488 Bytes: 334427892
     Number of Outgoing Interfaces: 1
     Outgoing Interface List Index: 4
       Vlan200 Outgoing Packets:370782 Bytes:293426795
```

```
Campus_N7K1-VPC# show forwarding multicast outgoing-interface-list 4
slot  2
Outgoing Interface List Index: 4
   Reference Count: 4
     Vlan200
```

Troubleshooting Multicast Forwarding
Data Collection – show tech ip pim, show tech forwarding

```
N7K1-VPC# show tech-support ip pim | grep "`show "
`show running-config pim`
`show ip pim group-range vrf all`
`show ip pim interface vrf all`
`show ip pim neighbor vrf all`
`show ip pim route vrf all`
[snip]

N7K1-VPC# show tech-support forwarding l3 multicast | grep "`show "
`show forwarding multicast outgoing-interface-list`
`show forwarding ip multicast route summary vrf all `
`show system internal forwarding ip multicast route summary`
`show forwarding ipv6 multicast route summary vrf all`
`show system internal forwarding adjacency multicast`
[snip]

N7K1-VPC# show tech-support ip multicast | grep "`show "
`show tech-support ip igmp`
`show running-config igmp`
`show ip igmp route vrf all`
[snip]
`show tech-support ip msdp`
```

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Troubleshooting QoS
Utilising Hardware Resources Effectively

- Nexus 7000 QoS is on by default and cannot be disabled

- System defined classification consistent across all VDCs

- Trust on all ports, marking can be modified with policy

- Similar queuing to prior platforms; added VoQ Fabric and MQC implementation

Troubleshooting QoS

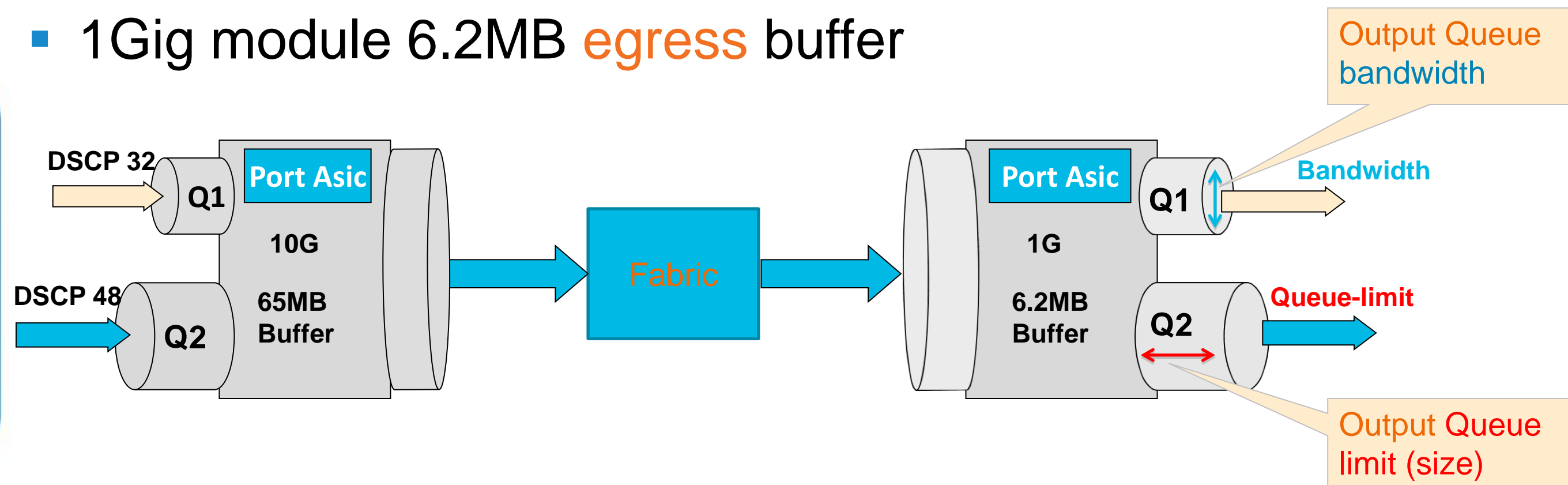## Types of Qos with Nexus 7K

- Queuing

  - Applied on and processed by Port ASIC

- QOS

  - Applied on forwarding engine ASIC

  - Processed during lookup by forwarding engine ASIC

- Network

  - Applied system wide, has significance within N7000 system

  - Used to influence the way traffic is handled within the system.

Troubleshooting QoS

How Drops Occur – Big Pipe to little pipe

- 10 Gig Module 65MB ingress buffer

- 1Gig module 6.2MB egress buffer

DSCP 32 → Q1 | Port Asic | 10G | 65MB Buffer | Q2 ← DSCP 48

Fabric →

Port Asic | 1G | 6.2MB Buffer | Q1 → Bandwidth | Q2 →

Output Queue bandwidth

Queue-limit

Output Queue limit (size)

- Hardware drops due to buffer oversubscription

- Must ask: how much traffic is appropriate for **this** network?

Troubleshooting QoS

- Queuing class-map names are static, based on port-type and queue

- Configurable only in default VDC
  - Changes apply to ALL ports of specified type in ALL VDCs
  - Changes are traffic disruptive for ports of specified type

Troubleshooting QoS
System wide Class-map configuration

N7K1(Config)#class-map type queuing match-any ?

1G Egress Port Type

1p3q4t-out-pq1
1p3q4t-out-q-default
1p3q4t-out-q2
1p3q4t-out-q3

1G Ingress Port Type

2q4t-in-q-default
2q4t-in-q1

10G Ingress Port Type

8q2t-in-q-default
8q2t-in-q1
8q2t-in-q2
8q2t-in-q3
8q2t-in-q4
8q2t-in-q5
8q2t-in-q6
8q2t-in-q7

10G Egress Port Type

1p7q4t-out-pq1
1p7q4t-out-q-default
1p7q4t-out-q2
1p7q4t-out-q3
1p7q4t-out-q4
1p7q4t-out-q5
1p7q4t-out-q6
1p7q4t-out-q7

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Troubleshooting QoS

Classification and Queuing – show policy-mpa interface

```
N7K1-VPC# show policy-map int e2/17
  Service-policy (queuing) output:   default-out-policy
    SNMP Policy Index:  301990010

    Class-map (queuing):   out-pq1 (match-any)
      priority level 1
      queue-limit percent 16
      queue dropped pkts : 0

    Class-map (queuing):   out-q2 (match-any)
      queue-limit percent 1
      queue dropped pkts : 0

    Class-map (queuing):   out-q3 (match-any)
      queue-limit percent 1
      queue dropped pkts : 0

    Class-map (queuing):   out-q-default (match-any)
      queue-limit percent 82
      bandwidth remaining percent 25
      queue dropped pkts : 0
```

Priority queueing on by default

Output drops will increment if queue limit exceeded

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Troubleshooting QoS

Classification and Queuing – show queuing interface

```
N7K1-VPC# show queuing int e2/17
  Interface Ethernet2/17 TX Queuing strategy: Weighted Round-Robin
  Port QoS is enabled
    Queuing Mode in TX direction: mode-cos
    Transmit queues [type = 1p7q4t]
    Queue Id                        Scheduling    Num of thresholds
      1p7q4t-out-q-default          WRR                04
      1p7q4t-out-q2                 WRR                04
      1p7q4t-out-q3                 WRR                04
      1p7q4t-out-q4                 WRR                04
      1p7q4t-out-q5                 WRR                04
      1p7q4t-out-q6                 WRR                04
      1p7q4t-out-q7                 WRR                04
      1p7q4t-out-pq1                Priority           04


    WRR configuration read from HW
      WRR bandwidth ratios:   25[1p7q4t-out-q-default] 15[1p7q4t-out-q2] 11[1p7q4t-out-q3] 11[1p7q4t-
out-q4] 11[1p7q4t-out-q5] 11[1p7q4t-out-q6] 11[1p7q4t-out-q7]
    queue-limit ratios configuration read from HW
      queue-limit ratios:      78[1p7q4t-out-q-default] 1[1p7q4t-out-q2] 1[1p7q4t-out-q3] *1[1p7q4t-out-
q4] *1[1p7q4t-out-q5] *1[1p7q4t-out-q6] *1[1p7q4t-out-q7] 16[1p7q4t-out-pq1]
    * means unused queue with mandatory minimum queue-limit
```

> **Scheduling and queue-limit read from hardware should match your configuration**

Troubleshooting QoS

Hardware Drop – show hardware internal statistics

```
N7K1-VPC# show hardware internal error mod 2
|------------------------------------------------------------------|
| Device:R2D2                     Role:MAC              Mod: 2     |
| Last cleared @ Mon Jan 23 11:42:12 2012                         |
|------------------------------------------------------------------|
Instance:5
ID    Name                                    Value           Ports
--    ----                                    -----           -----
37920 r2d2_tx_taildrop_drop_ctr_q2           0000000000000030  17,19,21,23 -
37936 r2d2_tx_taildrop_drop_ctr_q3           0000000000010650  17,19,21,23 -


|------------------------------------------------------------------|
| Device:Naxos                    Role:MAC SECURITY     Mod: 2     |
| Last cleared @ Mon Jan 23 11:42:12 2012                         |
|------------------------------------------------------------------|
Instance:10
ID    Name                                    Value           Ports
--    ----                                    -----           -----
8194 mac_egress_taildrop_ctr                  0000000000010680  21 -
8195 mac_egress_taildrop_ctr                  0000000000010680  23 -
```

Tail drop only typically applicable

Per port output read from hardware device "Naxos"

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Summary

- NXOS offers a huge increase in available information over traditional data centre platforms

- Familiarising yourself with the tools available gives you the best chance to understand your own network

- Start capturing the right information at the right time

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References

- Nexus 7000 Troubleshooting Guide

  http://docwiki.cisco.com/wiki/Cisco_Nexus_7000_Series_NX-OS_Troubleshooting_Guide

- NXOS YouTube Intro

  http://www.youtube.com/user/nxs7000

- NXOS vs IOS Comparison Guide

  http://docwiki.cisco.com/wiki/Cisco_Nexus_7000_NX-OS/IOS_Comparison_Tech_Notes

- Ethanalyzer Capture Filters

  http://www.wireshark.org/docs/wsug_html_chunked/ChCapCaptureFilterSection.html

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