IOS XR Troubleshooting

T-SP5/L4

Jakub Horn – Cisco, Network Consulting Engineer
Prosíme, ptejte se nás

- Twitter  www.twitter.com/CiscoCZ
- Talk2cisco  www.talk2cisco.cz/dotazy
- SMS  721 994 600
Program

1. 10 Troubleshooting Best Practices
2. Case Study #1 – GSR
3. Case Study #2 – ASR 9000
4. Case Study #3 – CRS
#1 Log Everything

- Log your console/telnet session
  - Later reference
  - Mistakes (how many times have you done something on some other router/interface?)
  - Documentation

- Make your terminal logging by default
#2 Know Device Architecture

- Hardware&Software
- Where is happening what? Which LC? Which Process?
- Everyone has simplified model
- Level of understanding is always limited
- Ingress Interface – Device – Egress Interface
- Device = Ingress LC-Fabric-Egress LC
- Ingress LC = Ingress Interface controller-Ingress Forwarding ASIC-Ingress Queuing ASIC-Fabric ASIC-Fabric Interface
- Ingress Forwarding ASIC = Ingress interface-CPUs- many external devices interfaces (TCAMs, Lookup memories, packet memory…) egress interface
#3 What have changed?

- Any misbehavior has cause
  - Packet
  - Time
  - Config
  ...

- What happened all around?
- Knowledge of your network
- Where the packets are supposed to go and why
- Be aware of all default settings
#4 Have OOB!

- CRS is OOB hungry
- But it is always worth to have connected all
  CON
  AUX
  MgmtEth
#5 Use cisco-support Task Group

- Cisco-support means for internal usage
  - Not documented (not supported)
  - Frequently changed
  - Internal can be confusing

- Have always at least one account with such task-group ready
#6 Exec Timestamps

- `RP/0/RP1/CPU0:R1#terminal exec prompt timestamp`
- `RP/0/RP1/CPU0:R1#sh media`
- `Tue Apr 24 15:42:50.152 METDST`

Media Information for 0/RP1/CPU0.

<table>
<thead>
<tr>
<th>Mountpoint</th>
<th>Image</th>
<th>Current FsType</th>
<th>Part FsType</th>
<th>Size</th>
<th>State</th>
<th>DrvrPid</th>
<th>Mirror</th>
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</thead>
<tbody>
<tr>
<td>/disk0:</td>
<td>FAT16</td>
<td>FAT32</td>
<td></td>
<td>2.0G</td>
<td>Mounted</td>
<td></td>
<td></td>
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<tr>
<td>/disk0a:</td>
<td>FAT16</td>
<td>(?)</td>
<td></td>
<td>Not Present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/disk1:</td>
<td>FAT16</td>
<td>FAT16</td>
<td></td>
<td>0.9G</td>
<td>Mounted</td>
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<td></td>
</tr>
<tr>
<td>/disk1a:</td>
<td>FAT16</td>
<td>(?)</td>
<td></td>
<td>Not Present</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>/harddisk:</td>
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<td>FAT32</td>
<td></td>
<td>74.5G</td>
<td>Mounted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/harddiska:</td>
<td>QNX4</td>
<td>(?)</td>
<td></td>
<td>Not Present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/harddiskb:</td>
<td>FAT32</td>
<td>(?)</td>
<td></td>
<td>Not Present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/lcdisk0:</td>
<td>FAT32</td>
<td>(?)</td>
<td></td>
<td>Not Present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/lcdisk0a:</td>
<td>FAT32</td>
<td>(?)</td>
<td></td>
<td>Not Present</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- `RP/0/RP1/CPU0:R1#`

Time Synchronization across whole network!
#7 Long Logging Buffer

- Logging buffered 1000000
- XR uses syslog very extensively
#8 Use Traces

- Debugs are CPU intensive
- XR has concept of traces, typically under cisco-support
- Traces are exhaustive, but often hard to read
- Intended mainly for DE usage
- Sometimes it might be very useful
#9 Use sh controller ……

- Strictly related to device architecture
- Shows many aspects of reality behind curtain
#10 Use Utilities

- Unix like to find/filter/show/count......
  - `cut` Cut out selected fields of each line of a file
  - `egrep` Extended regular expression grep
  - `fgrep` Fixed string expression grep
  - `head` Show set of lines/characters from the top of a file
  - `less` Fixed string pattern matching
  - `more` Paging Utility More
  - `script` Launch a script for post processing
  - `sort` Sort, merge, or sequence-check text files
  - `tail` Copy the last part of files
  - `uniq` Report or filter out repeated lines in a file
  - `wc` Counting lines/words/characters of a file
  - `xargs` Construct argument list(s) and invoke a program

```bash
RP/0/RP1/CPU0:R1#sh route ipv4 | utility egrep ^L |
util wc -l
  23
RP/0/RP1/CPU0:R1#sh memory heap 225 | incl 0x00 | utility sort key 4
0x00000028 0x00000030 0x00000001 0x4c1c1d28
0x00000080 0x00000088 0x00000001 0x4c22bae4
0x0000001b 0x00000028 0x00000001 0x4c2347dc
0x00000008 0x00000010 0x00000001 0x4c238140
```
RP/0/RP1/CPU0:R1#sh tech-support routing?

bdf  Output show commands for BFD debugging
bgp  Output show commands for BGP debugging
isis Show IS-IS-related diagnostics for BGP debugging
ospf OSPF show tech-support output
ospfv3 Output show commands for OSPFv3 debugging
rpl  RPL show tech-support output

If yo do not know command try
Sh tech xxx
Troubleshooting

Case study #1

GSR
Problem description

- RP/0/5/CPU0: Apr 20 12:48:15.809 : isis[265]: %ROUTING-ISIS-5-ADJCHANGE : Adjacency to CRS4-405 (TenGigE0/2/0/0) (L2) Down, Neighbor forgot us

- RP/0/5/CPU0: Apr 20 12:48:16.816 : isis[265]: %ROUTING-ISIS-5-ADJCHANGE : Adjacency to CRS4-405 (TenGigE0/2/0/0) (L2) Up, Restarted
Troubleshooting

- RP/0/5/CPU0:Q-411#sh run int ten 0/2/0/0
- Fri Apr 20 12:53:14.537 UTC
- interface TenGigE0/2/0/0
- cdp
- service-policy **input backbone-in**
- service-policy **output backbone-out**
- ipv4 address 10.0.2.10 255.255.255.0
- load-interval 30 RP/0/5/CPU0:Q-411#sh run router isis 1 interface ten 0/2/0/0
- Fri Apr 20 12:55:17.427 UTC
- router isis 1
- interface TenGigE0/2/0/0
- hello-interval 1
- address-family ipv4 unicast
Troubleshooting

RP/0/5/CPU0:Q-411#sh policy-map int ten 0/2/0/0 output
Fri Apr 20 12:57:31.491 UTC
TenGigE0/2/0/0 output: backbone-out

Class routing
Classification statistics (packets/bytes) (rate - kbps)
Matched : 302/23779 0
Transmitted : 302/23779 0
Total Dropped : 0/0 0

Queueing statistics
Queue ID : 0
High watermark (Unknown) : 0
Inst-queue-len (packets) : 0
Avg-queue-len (packets) : 0
Taildropped(packets/bytes) : 0/0

Class real-time
Classification statistics (packets/bytes) (rate - kbps)
Matched : 1794506680/229696855040 2162640
Transmitted : 1794506680/229696855040 2162640
Total Dropped : 0/0 0

Policing statistics (packets/bytes) (rate - kbps)
Policed(conform) : 1794506680/229696855040 2162640
Policed(exceed) : 0/0 0
Policed(violate) : 0/0 0
Policed and dropped : 0/0

Queueing statistics
Queue ID : 5
High watermark (Unknown) : 0
Inst-queue-len (packets) : 10
Avg-queue-len (packets) : 0
Taildropped(packets/bytes) : 0/0

Class TV
Classification statistics (packets/bytes) (rate - kbps)
Matched : 126656658/127489862144 1200354
Transmitted : 126656658/127489862144 1200354
Total Dropped : 0/0 0

Queueing statistics
Queue ID : 1
High watermark (Unknown) : 0
Inst-queue-len (packets) : 40714
Avg-queue-len (packets) : 40686
Taildropped(packets/bytes) : 0/0
### Troubleshooting

- **Class data**
  - **Classification statistics** (packets/bytes) (rate - kbps)
    - Matched : 945093836/63213600776
    - Transmitted : 899529682/607592560456
    - Total Dropped : 45564154/24543447320

- **Queueing statistics**
  - Queue ID : 2
    - High watermark (Unknown) : 0
    - Inst-queue-len (packets) : 16367
    - Avg-queue-len (packets) : 16322
    - Taildropped (packets/bytes) : 0/0
    - RED random drops (packets/bytes) : 0/0
    - RED maxthreshold drops (packets/bytes) : 45564154/24543447320

- **WRED profile for Label 1**
  - DEFAULT: N/A
    - RED Transmitted (packets/bytes) : 0/0
    - RED random drops (packets/bytes) : 0/0
    - RED maxthreshold drops (packets/bytes) : 45564154/24543447320

- **Class vod**
  - **Classification statistics** (packets/bytes) (rate - kbps)
    - Matched : 149162836/149162836000
    - Transmitted : 149162836/149162836000
    - Total Dropped : 0/0

- **Queueing statistics**
  - Queue ID : 3
    - High watermark (Unknown) : 0
    - Inst-queue-len (packets) : 0
    - Avg-queue-len (packets) : 0
    - Taildropped (packets/bytes) : 0/0

- **Class class-default**
  - **Classification statistics** (packets/bytes) (rate - kbps)
    - Matched : 176672300/88336150000
    - Transmitted : 176636380/88324094932
    - Total Dropped : 35920/12055068

- **Queueing statistics**
  - Queue ID : 4
    - High watermark (Unknown) : 0
    - Inst-queue-len (packets) : 0
    - Avg-queue-len (packets) : 0
    - Taildropped (packets/bytes) : 35920/12055068
Troubleshooting

Engine 5 Common Engine Card (CEC)

- SPI4.2 Bridge ASIC
- IQ L3 ASIC
- PSE RxBuff ASIC
- Sockeye CPU I/f
- EQ TxBuff ASIC
- PSE L3 ASIC
- R7KC
- Fabric I/F ASIC
  - TFIA
  - Reass/PLIM SRAM
- FFIA
- Fabric

Daughter

Main
Troubleshooting

- Internal Packet market with PAK_PRIORITY
- =not subject to policers, not subject to wred
- but if buffers are missing.....

- Class qos-backbone-rt-egress
- Classification statistics
  - Matched : 2162640
  - Transmitted : 2162640
  - Total Dropped : 0/0
- Policing statistics
  - Policed(conform) : 2162640
  - Policed(exceed) : 0/0
  - Policed(violate) : 0/0
  - Policed and dropped : 0/0
- Queueing statistics
  - Queue ID : 5
  - High watermark (Unknown) : 0
  - Inst-queue-len (packets) : 10
  - Avg-queue-len (packets) : 0
  - Taildropped(packets/bytes) : 0/0

(packet/bytes) (rate - kbps)
1794506680/229696855040
1794506680/229696855040
0/0
1794506680/229696855040
0/0
0
0
0/0
Troubleshooting

- RP/0/5/CPU0:Q-411#sh controllers egressq queue 5 5 location 0/2/cpu0
- Fri Apr 20 13:38:17.864 UTC

- Qnum: 5  Port: 0
- Enabled: yes            Eligible to send: Yes
- Red index: 1

- Queue limit: 16384       Drr quantum: 0
- Minbw(kbps): 10000000    Min burst(bytes): 2147483647
- Maxbw(kbps): 10000000    Max burst(bytes): 2147483647
Troubleshooting

- sh controllers egressq qmstats 0 lo 0/2/cpu0
- Fri Apr 20 14:08:11.933 UTC
- 272197359 no mem drop, 6022014 soft drop, 0 bump count
- 0 rawq (High Priority) drops
- 0 rawq (Medium Priority) drops
- 0 rawq (Low Priority) drops
- OQ red drops cos 0: pkts: 801073 bytes: 258646788
- OQ force drops cos 0: pkts: 36803362958 bytes: 18390588787886
- OQ red drops cos 1: pkts: 145810586 bytes: 72190325866
- OQ force drops cos 1: pkts: 5752439083 bytes: 2511947412354
- OQ red drops cos 2: pkts: 0 bytes: 0
- OQ force drops cos 2: pkts: 0 bytes: 0
- OQ red drops cos 3: pkts: 0 bytes: 0
- OQ force drops cos 3: pkts: 0 bytes: 0
- OQ red drops cos 4: pkts: 0 bytes: 0
- OQ force drops cos 4: pkts: 0 bytes: 0
- OQ red drops cos 5: pkts: 0 bytes: 0
- OQ force drops cos 5: pkts: 0 bytes: 0
- OQ red drops cos 6: pkts: 0 bytes: 0
- OQ force drops cos 6: pkts: 0 bytes: 0
- OQ red drops cos 7: pkts: 0 bytes: 0
- OQ force drops cos 7: pkts: 0 bytes: 0
Troubleshooting

- RP/0/5/CPU0:Q-411#sh controllers egressq carve location 0/2/cpu0
- Fri Apr 20 14:26:23.621 UTC
- SDRAM size: 268435456 bytes, address: 39000000, carve base: 39094000
- 267829248 bytes carve size,

Carve information
- 4 SDRAM bank(s), 32768 bytes SDRAM pagesize,
- max buffer data size 9296 bytes, min buffer data size 80 bytes
- 262141/262141 buffers specified/carved
- 263857072/263857072 bytes sum buffer sizes specified/carved

<table>
<thead>
<tr>
<th>Qnum</th>
<th>Head</th>
<th>Tail</th>
<th>#Qelem</th>
<th>LenThresh</th>
</tr>
</thead>
<tbody>
<tr>
<td>117847/117847 (buffers specified/carved), 44.95%, 80 byte data size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2862</td>
<td>2861</td>
<td>117847</td>
<td>262143</td>
</tr>
<tr>
<td>75946/75946 (buffers specified/carved), 28.97%, 608 byte data size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>177320</td>
<td>148764</td>
<td>68634</td>
<td>262143</td>
</tr>
<tr>
<td>49757/49757 (buffers specified/carved), 18.98%, 1568 byte data size</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>214539</td>
<td>194672</td>
<td>4</td>
<td>262143</td>
</tr>
<tr>
<td>10475/10475 (buffers specified/carved), 3.99%, 4544 byte data size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>245475</td>
<td>245474</td>
<td>10475</td>
<td>262143</td>
</tr>
<tr>
<td>7856/7856 (buffers specified/carved), 2.99%, 9296 byte data size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>256547</td>
<td>256546</td>
<td>7856</td>
<td>262143</td>
</tr>
<tr>
<td>130/130 (buffers specified/carved), 0.4%, 128 byte data size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>131</td>
<td>260</td>
<td>130</td>
<td>262143</td>
</tr>
<tr>
<td>130/130 (buffers specified/carved), 0.4%, 9248 byte data size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>21</td>
<td>20</td>
<td>130</td>
<td>262143</td>
</tr>
</tbody>
</table>
Solution

policy-map qos-backbone-ENG5-10GE-out

class qos-backbone-routing-egress
  bandwidth percent 5
!
class qos-backbone-rt-egress
  police rate percent 25
  conform-action transmit
  exceed-action drop
!
priority
!
class qos-backbone-iptv-egress
  bandwidth percent 5
  queue-limit 100 ms
!
class qos-backbone-data-egress
  bandwidth percent 39
  random-detect 50 ms 100 ms
  set mpls experimental topmost 3
!
class qos-backbone-vod-egress
  bandwidth percent 20
  queue-limit 30 ms
!
class class-default
  bandwidth percent 5
!
end-policy-map
!
Solution

policy-map qos-backbone-ENG5-10GE-out
   class qos-backbone-routing-egress
      bandwidth percent 5
   !
   class qos-backbone-rt-egress
      police rate percent 25
      conform-action transmit
      exceed-action drop
   !
   priority
   !
   class qos-backbone-iptv-egress
      bandwidth percent 5
      queue-limit 20 ms
   !
   class qos-backbone-data-egress
      bandwidth percent 39
      random-detect 5 ms 10 ms
      set mpls experimental topmost 3
   !
   class qos-backbone-vod-egress
      bandwidth percent 20
      queue-limit 10 ms
   !
   class class-default
      bandwidth percent 5
   !
   end-policy-map
RP/0/5/CPU0:Q-411#sh controllers egressq carve location 0/2/cpu0
Fri Apr 20 14:39:35.976 UTC
SDRAM size: 268435456 bytes, address: 39000000, carve base: 39094000
267829248 bytes carve size,
Carve information
4 SDRAM bank(s), 32768 bytes SDRAM pagesize,
max buffer data size 9296 bytes, min buffer data size 80 bytes
262141/262141 buffers specified/carved
263857072/263857072 bytes sum buffer sizes specified/carved

<table>
<thead>
<tr>
<th>Qnum</th>
<th>Head</th>
<th>Tail</th>
<th>#Qelem LenThresh</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3258</td>
<td>3257</td>
<td>117847 262143</td>
</tr>
<tr>
<td>2</td>
<td>188086</td>
<td>165007</td>
<td>70569 262143</td>
</tr>
<tr>
<td>3</td>
<td>227870</td>
<td>233136</td>
<td>38747 262143</td>
</tr>
<tr>
<td>4</td>
<td>245475</td>
<td>245474</td>
<td>10475 262143</td>
</tr>
<tr>
<td>5</td>
<td>256700</td>
<td>256699</td>
<td>7856 262143</td>
</tr>
<tr>
<td>17</td>
<td>131</td>
<td>260</td>
<td>130 262143</td>
</tr>
<tr>
<td>17</td>
<td>109</td>
<td>108</td>
<td>130 262143</td>
</tr>
</tbody>
</table>

RP/0/5/CPU0:Q-411#
Troubleshooting

Case study #2

ASR 9000
Problem description

- Slow Performance on 9k for L2 VPN
Configuration

interface HundredGigE0/0/0/0
  transceiver permit pid all
  !
interface HundredGigE0/0/0/0.9 l2transport
  encapsulation dot1q 9
  rewrite ingress tag pop 1 symmetric
  !
interface HundredGigE0/0/0/1.11 l2transport
  encapsulation dot1q 11
  rewrite ingress tag pop 1 symmetric
  !
L2vpn
bridge group BRID
  bridge-domain TEST
  interface HundredGigE0/0/0/0.9
  !
  interface HundredGigE0/0/0/1.11
  !
ASR 9k 100 GE LC Architecture
Troubleshooting

RP/0/RSP0/CPU0:R2#  sh int hundredGigE 0/0/0/0
Mon Apr 16 13:11:15.159 UTC
HundredGigE0/0/0/0 is up, line protocol is up
  Interface state transitions: 11
  Hardware is HundredGigE, address is 4055.391f.8aec (bia 4055.391f.8aec)
  Internet address is Unknown
  MTU 1514 bytes, BW 100000000 Kbit (Max: 100000000 Kbit)
    reliability 254/255, txload 1/255, rxload 254/255
  Encapsulation ARPA,
  Full-duplex, 100000Mb/s, link type is force-up
  output flow control is off, input flow control is off
  loopback not set,
  ARP type ARPA, ARP timeout 04:00:00
  Last input 00:00:00, output 00:00:00
  Last clearing of "show interface" counters 3d15h
  5 minute input rate 93385511000 bits/sec, 11148190 packets/sec
  5 minute output rate 723855000 bits/sec, 90482 packets/sec
    348601178252 packets input, 110443062246080 bytes, 0 total input drops
    0 drops for unrecognized upper-level protocol
    Received 6418 broadcast packets, 0 multicast packets
      0 runts, 0 giants, 0 throttles, 0 parity
    177 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    3531556218 packets output, 1697634704186 bytes, 328 total output drops
  Output 8217 broadcast packets, 0 multicast packets
  0 output errors, 328 underruns, 0 applique, 0 resets
  0 output buffer failures, 0 output buffers swapped out
  4 carrier transitions
Troubleshooting

RP/0/RSP0/CPU0:R2#sh controllers hundredGigE 0/0/0/0
Mon Apr 16 13:11:57.632 UTC
Operational data for interface HundredGigE0/0/0/0:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On

Phy:
  Media type: Initializing, true state or type not yet known
  Optics:
    Vendor: Reflex
    Part number: CF-X12-C11801-02
    Serial number: X000B551

MAC address information:
  Operational address: 4055.391f.8aec
  Burnt-in address: 4055.391f.8aec
  No unicast addresses in filter
  No multicast addresses in filter

Autonegotiation disabled.

Operational values:
  Speed: 100Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  MTU: 1526
  MRU: 1526
  Inter-packet gap: standard (12)
Troubleshooting

RP/0/RSP0/CPU0:R2#clear controller np counters all location 0/0/cpu0
Mon Apr 16 13:13:22.093 UTC
controllers or files successfully cleared
RP/0/RSP0/CPU0:R2#sh controllers np counters all 0 0/cpu0
Mon Apr 16 13:13:47.762 UTC
Node: 0/0/CPU0:

Show global stats counters for NP0, revision v2
Read 15 non-zero NP counters:

<table>
<thead>
<tr>
<th>Offset</th>
<th>Counter</th>
<th>FrameValue</th>
<th>Rate (pps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>MDF TX LC CPU</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>MDF TX FABRIC</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>PARSE FAB RECEIVE CNT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
<td>PARSE TM LOOP RECEIVE_CNT</td>
<td>126</td>
<td>5</td>
</tr>
<tr>
<td>165</td>
<td>PRS HEALTH MON</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>174</td>
<td>INTR FRAME TYPE 7</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>205</td>
<td>PARSE_RSP TNJ DTAGS_CNT</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>329</td>
<td>PARSE_MAC_NOTIFY_KCVD</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>344</td>
<td>DBG RSV EP L RSV_ING PUNT</td>
<td>130</td>
<td>5</td>
</tr>
<tr>
<td>498</td>
<td>RSV_REFRESH_FROM_NOTIFY_CNT</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>832</td>
<td>PUNT_DIAGS_RSP_ACT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>834</td>
<td>PUNT_DIAGS_RSP_STBY</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Show global stats counters for NP1, revision v2

Read 15 non-zero NP counters:

<table>
<thead>
<tr>
<th>Offset</th>
<th>Counter</th>
<th>FrameValue</th>
<th>Rate (pps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>MDF TX LC CPU</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>MDF TX FABRIC</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>PARSE FAB RECEIVE CNT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
<td>PARSE TM LOOP RECEIVE_CNT</td>
<td>126</td>
<td>5</td>
</tr>
<tr>
<td>165</td>
<td>PRS HEALTH MON</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>174</td>
<td>INTR FRAME TYPE 7</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>205</td>
<td>PARSE_RSP TNJ DTAGS_CNT</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
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</tr>
<tr>
<td>344</td>
<td>DBG RSV EP L RSV_ING PUNT</td>
<td>1</td>
<td>0</td>
</tr>
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<td>832</td>
<td>PUNT_DIAGS_RSP_ACT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>834</td>
<td>PUNT_DIAGS_RSP_STBY</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Show global stats counters for NP2, revision v2

Read 15 non-zero NP counters:

<table>
<thead>
<tr>
<th>Offset</th>
<th>Counter</th>
<th>FrameValue</th>
<th>Rate (pps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>MDF TX LC CPU</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>MDF TX FABRIC</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>PARSE FAB RECEIVE CNT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
<td>PARSE TM LOOP RECEIVE_CNT</td>
<td>126</td>
<td>5</td>
</tr>
<tr>
<td>165</td>
<td>PRS HEALTH MON</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>174</td>
<td>INTR FRAME TYPE 7</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>205</td>
<td>PARSE_RSP TNJ DTAGS_CNT</td>
<td>2</td>
<td>0</td>
</tr>
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<td>329</td>
<td>PARSE_MAC_NOTIFY_KCVD</td>
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<td>5</td>
</tr>
<tr>
<td>344</td>
<td>DBG RSV EP L RSV_ING PUNT</td>
<td>1</td>
<td>0</td>
</tr>
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<td>PUNT_DIAGS_RSP_ACT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>834</td>
<td>PUNT_DIAGS_RSP_STBY</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Show global stats counters for NP3, revision v2

Read 14 non-zero NP counters:

<table>
<thead>
<tr>
<th>Offset</th>
<th>Counter</th>
<th>FrameValue</th>
<th>Rate (pps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>MDF TX LC CPU</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>MDF TX FABRIC</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>PARSE FAB RECEIVE CNT</td>
<td>128</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
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<td>1</td>
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<tr>
<td>205</td>
<td>PARSE_RSP TNJ DTAGS_CNT</td>
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</tr>
<tr>
<td>834</td>
<td>PUNT_DIAGS_RSP_STBY</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

RP/0/RSP0/CPU0:R2#sh controllers np counters all lo 0/0/cpu0 incl DROP
Mon Apr 16 13:14:07.448 UTC
493 RSV_VPLS_MAC_NOTIFY_LOCAL.Drop_CNT
1
Troubleshooting

RP/0/RSP0/CPU0:R2#sh controllers fabric fia drops ingress location 0/0/cpu0
Mon Apr 16 13:14:50.067 UTC

********** FIA-0 **********
Category: in_drop-0

From Spauli Drop-0
  accept tbl-0 0
  ctl len-0 0
  short pkt-0 0
  min pkt len-0 0
From Spauli Drop-1
  accept tbl-1 0
  ctl len-1 0
  short pkt-1 0
  max pkt len-1 0
  min pkt len-1 0
  Tail drp 0
  Vqi drp 0
Header parsing drp 0
pw to ni drp 0
ni from pw drp 0
sp0 crc err 0
sp0 bad align 0
sp0 bad code 0
sp0 align fail 0
sp0 prot err 0
sp1 crc err 0
sp1 bad align 0
sp1 bad code 0
sp1 align fail 0
sp1 prot err 0

********** FIA-2 **********
Category: in_drop-2

From Spauli Drop-0
  accept tbl-0 0
  ctl len-0 0
  short pkt-0 0
  max pkt len-0 0
  min pkt len-0 0
From Spauli Drop-1
  accept tbl-1 0
  ctl len-1 0
  short pkt-1 0
  max pkt len-1 0
  min pkt len-1 0
  Tail drp 0
  Vqi drp 0
Header parsing drp 0
pw to ni drp 0
ni from pw drp 0
sp0 crc err 0
sp0 bad align 0
sp0 bad code 0
sp0 align fail 0
sp0 prot err 0
sp1 crc err 0
sp1 bad align 0
sp1 bad code 0
sp1 align fail 0
sp1 prot err 0

********** FIA-1 **********
Category: in_drop-1

From Spauli Drop-0
  accept tbl-0 0
  ctl len-0 0
  short pkt-0 0
  max pkt len-0 0
  min pkt len-0 0
From Spauli Drop-1
  accept tbl-1 0
  ctl len-1 0
  short pkt-1 0
  max pkt len-1 0
  min pkt len-1 0
  Tail drp 0
  Vqi drp 0
Header parsing drp 0
pw to ni drp 0
ni from pw drp 0
sp0 crc err 0
sp0 bad align 0
sp0 bad code 0
sp0 align fail 0
sp0 prot err 0
sp1 crc err 0
sp1 bad align 0
sp1 bad code 0
sp1 align fail 0
sp1 prot err 0

********** FIA-3 **********
Category: in_drop-3

From Spauli Drop-0
  accept tbl-0 0
  ctl len-0 0
  short pkt-0 0
  max pkt len-0 0
  min pkt len-0 0
From Spauli Drop-1
  accept tbl-1 0
  ctl len-1 0
  short pkt-1 0
  max pkt len-1 0
  min pkt len-1 0
  Tail drp 0
  Vqi drp 0
Header parsing drp 0
pw to ni drp 0
ni from pw drp 0
sp0 crc err 0
sp0 bad align 0
sp0 bad code 0
sp0 align fail 0
sp0 prot err 0
sp1 crc err 0
sp1 bad align 0
sp1 bad code 0
sp1 align fail 0
sp1 prot err 0

---

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9k Fabric Architecture

1: Fabric Request

2: Arbitration

3: Fabric Grant

4: load-balanced transmission across fabric links

5: credit return

Ingress LC

Egress LC

RSP0

Crossbar Fabric ASIC

Arbiter

RSP1

Crossbar Fabric ASIC

Arbiter

FIA

FIA

Cisco Expo

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Loadbalancing Concept

Most important- ORDER
   L2- ?
   L3- ?
So load balancing must be flow based
Hash function is used based on keys
Keys must be chosen to identify flow (keep order in flow!!)
So for L2 VPN ........

MAC addresses are used!!
Is it really necessary?
Solution

RP/0/RSP0/CPU0:R2(config)#l2vpn
RP/0/RSP0/CPU0:R2(config-l2vpn)#load-balancing flow
  src-dst-ip  Use source and destination IP addresses for hashing
  src-dst-mac Use source and destination MAC addresses for hashing
RP/0/RSP0/CPU0:R2(config-l2vpn)#load-balancing flow src-dst-ip
Solution
Troubleshooting

Case study #3

CRS
Problem description

- RP/0/RP1/CPU0:Jan 23 14:16:20.446 : ospf[307]: %ROUTING-OSPF-5-ADJCHG : Process 66, Nbr 10.10.66.227 on GigabitEthernet0/0/0/9.4000 in area 0 from EXSTART to DOWN, Neighbor Down: too many DBD retransmissions

- RP/0/RP1/CPU0:Jan 23 14:20:00.985 : ospf[307]: %ROUTING-OSPF-5-ADJCHG : Process 66, Nbr 10.10.66.155 on GigabitEthernet0/1/0/8 in area 0 from FULL to DOWN, Neighbor Down: dead timer expired

- We are not receiving packets!
OSPF Config

- router ospf 66
- router-id 1.1.1.1
- bfd minimum-interval 250
- bfd multiplier 3
- mpls ldp sync
- nsf cisco
- timers throttle lsa all 0 20 5000
- timers throttle spf 50 50 5000
- timers lsa min-arrival 15
- timers pacing flood 15
- auto-cost reference-bandwidth 10000
- area 0
- interface Loopback1
  
  !
- interface GigabitEthernet0/0/0/0
- bfd fast-detect
- cost 4
- network point-to-point
CPU

• CPU utilization?

• LC – low
• RP – peak during outage
OSPF Config

- RP/0/RP1/CPU0:R1#sh ospf ?
- WORD OSPF process name
- bad-checksum Bad ospf checksum packets queue
- border-routers Border and Boundary Router Information
- cmd Generic command support
- database Database summary
- flood-list Link state flood list
- interface Interface information
- maxage-list Maxage List
- message-queue Hello, TE and router message queue data
- mpls MPLS related information
- neighbor Neighbor list
- our-address our address Database
- request-list Link state request list
- retransmission-list Link state retransmission list
- routes OSPF routes table
- standby Retrieve operational information from standby process
- statistics OSPF statistics information
- summary OSPF summary information
- summary-prefix Summary-prefix redistribution Information
- timers OSPF timers information
- trace OSPF trace information
- virtual-links Virtual link information
- vrf Show one or more non-default OSPF VRFs in process
- |
- Output Modifiers
OSPF Message Queues

- RP/0/RP1/CPU0:R1#sh ospf message-queue
- OSPF 66
  - Hello Input Queue:
    - Current queue length: 0
    - Event scheduled: 0
    - Total queuing failures: 4849627
    - Maximum length: 5001
    - Total pkts processed: 83784720
    - Limit: 5000

- Router Message Queue
  - Current instance queue length: 0
  - Current redistribution queue length: 0
  - Current ex spf queue length: 0
  - Current sum spf queue length: 0
  - Current intra spf queue length: 0
  - Event scheduled: 0
  - Maximum length: 72
  - Total low queuing failures: 0
  - Total medium queuing failures: 0
  - Total high queuing failures: 0
  - Total instance events: 18750623
  - Processing quantum: 300
  - Low queuing limit: 8000
  - Medium queuing limit: 9000
  - High queuing limit: 9500

- Rate-limited LSA processing quantum: 150
  - Current rate-limited LSA queue length: 0
  - Rate-limited LSA queue peak len: 0
  - Rate-limited LSAs processed: 0
  - Flush LSA processing quantum: 150
  - Current flush LSA queue length: 0
  - Flush LSA queue peak len: 0
  - Rate-limited flush LSAs processed: 0
  - Summary originations processed: 307
  - Summary origination queue length: 0
  - Summary origination peak queue length: 1
  - SPF-LSA-limit processing quantum: 150
  - Managed timers processing quantum: 25
  - TE msg processing quantum: 60
  - Instance message count: 0
  - Instance pulse send count: 18750623
  - Instance pulse received count: 18750623
  - Global pulse count: 0
  - Instance Pulse errors: 0

- TE Message Queue
  - Current queue length: 0
  - Total queuing failures: 0
  - Maximum length: 0

- Number of Dlink errors: 0
OSPF threads

Router Thread
Config, Adj mgmt, LSA origination, flooding, SPF, timers

TE Thread
Conn mgmt, TE msg rx, TE control msgs tx

NSR Thread
All NSR-control and data comms with peer OSPF process

Checkpoin thread
Checkpoint mirroring

EDM Thread
EDM bagging, SNMP trap tx

Timer wheel thread
LSA re-orig throttle tmrs

Hello Thread
Pkt rx processing, Hello keepalive tx

RIB Thread
RIB route batch tx

OSPF show client
snmpd
te_control
Peer OSPF process on paired RP

raw_ip
ipv4_rib
ip_arm
rsi_agent
imattr

OSPF show client

Inter-thread pulses
Intra-node IPC
OSPF-owned thread
Library-started thread

process

Library-started thread

process
What is LPTS

- PSE
  - FIB
  - TCAM Pre-IFIB
  - Policer
  - drop

- LC CPU netio
  - FIB
  - SW Pre-IFIB
  - local stack

- To RPs
  - deliver or reassemble
  - punt
  - local
LPTS check

- RP/0/RP1/CPU0:R1#sh lpts pifib hardware police

```bash
Node 0/0/CPU0:
-------------------------------------------------------------
Burst = 100ms for all flow types
-------------------------------------------------------------
FlowType | Policer | Type  | Cur. Rate | Def. Rate | Accepted | Dropped
---------|---------|-------|-----------|-----------|----------|----------
unconfigured-default | 100 | Static | 500 | 500 | 0 | 0
Fragment | 106 | Static | 1000 | 1000 | 20561 | 0
OSPF-mc-known | 107 | Static | 20000 | 20000 | 128546417 | 18122631
OSPF-mc-default | 111 | Static | 5000 | 5000 | 130 | 0
OSPF-uc-known | 161 | Static | 5000 | 5000 | 9480 | 0
OSPF-uc-default | 162 | Static | 1000 | 1000 | 12 | 0
ISIS-known | 108 | Static | 20000 | 20000 | 0 | 0
ISIS-default | 112 | Static | 5000 | 5000 | 0 | 0
BGP-known | 113 | Static | 25000 | 25000 | 0 | 0
BGP-cfg-peer | 114 | Static | 10000 | 10000 | 0 | 0
BGP-default | 115 | Static | 10000 | 10000 | 0 | 0
PIM-mcast | 116 | Static | 23000 | 23000 | 0 | 0
PIM-ucast | 117 | Static | 10000 | 10000 | 0 | 0
IGMP | 118 | Static | 3500 | 3500 | 0 | 0
ICMP-local | 119 | Static | 2500 | 2500 | 6264181 | 0
ICMP-app | 120 | Static | 2500 | 2500 | 0 | 0
na | 164 | Static | 2500 | 2500 | 0 | 0
ICMP-default | 121 | Static | 2500 | 2500 | 70074364 | 0
```
**Which Interface?**

- RP/0/RP1/CPU0:R1#sh ospf statistics interface
- ........SNIP.......
- Interface GigabitEthernet0/0/0/9.4000 Process ID 66 Area 0

**OSPF packet and LSA statistics**

- **RX(hello) RX(router) TX LSA RX LSA TX**
- **Hello** 4224314 - 2686072 - -
- **DB Des** 737 737 998 76 23466
- **LS Req** 12 12 21 51 0
- **LS Upd** 339172 339172 1125651 340062 1213095
- **LS Ack** 706461 706461 13097 882434 13144
- **TOTAL** 5270696 1046382 3825839 1222623 1249705

**OSPF Header Errors**

- **Version** 0 LLS 0
- **Type** 0 Auth RX 0
- **Length** 0 Auth TX 0
- **Checksum** 0

**OSPF LSA Errors**

- **Type** 0 Checksum 0
- **Length** 0 Data 0

**OSPF Errors**

- **Bad Source** 0 Area Mismatch 0
- **No Virtual Link** 0 **Self Originated** 7324048
- **No Sham Link** 0 Duplicate ID 0
- **Nbr ignored** 0 Graceful Shutdown 0
- **Unknown nbr** 0 Passive intf 0
- **No DR/BDR** 0 Disabled intf 0
- **Enqueue** 0 Unspecified RX 0
- **Socket** 0 Unspecified TX 0

- ........SNIP.......

---

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Solution!

• Remove loop!

• Workaround?
Otázky a odpovědi

- Twitter  www.twitter.com/CiscoCZ
- Talk2Cisco  www.talk2cisco.cz/dotazy
- SMS  721 994 600

- Zveme Vás na **Ptali jste se**… v sále **LEO**
  1.den 17:45 – 18:30
  2.den 16:30 – 17:00 asi už nestihnete
Prosíme, ohodnoťte tuto přednášku.