

NCS5500: Life of a Packet(Transit, Punt/Inject, Ping Path)

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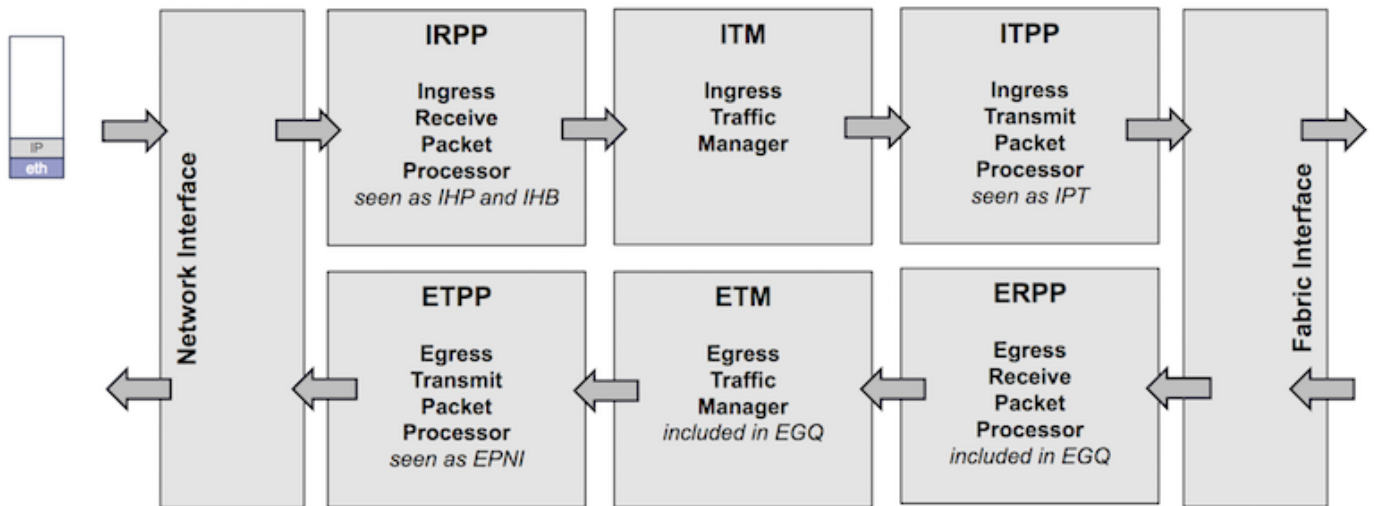
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Introduction

This document describes the path taken by ICMP echo request/Echo Reply packets inside NCS55xx(Fretta) box.

Life of a Packet in Forwarding ASIC



IRPP

A packet is received on an interface and passed to IRPP where the first 128 bytes will be extracted and processed. As a result, the internal system header is prepended.

ITM

The packet gets stored in DRAM/OCB

ITPP

If needed rewrite the system header(multicast replication, Port mirroring, etc)

Packets are split into cells and loadbalanced to Fabric

ERPP

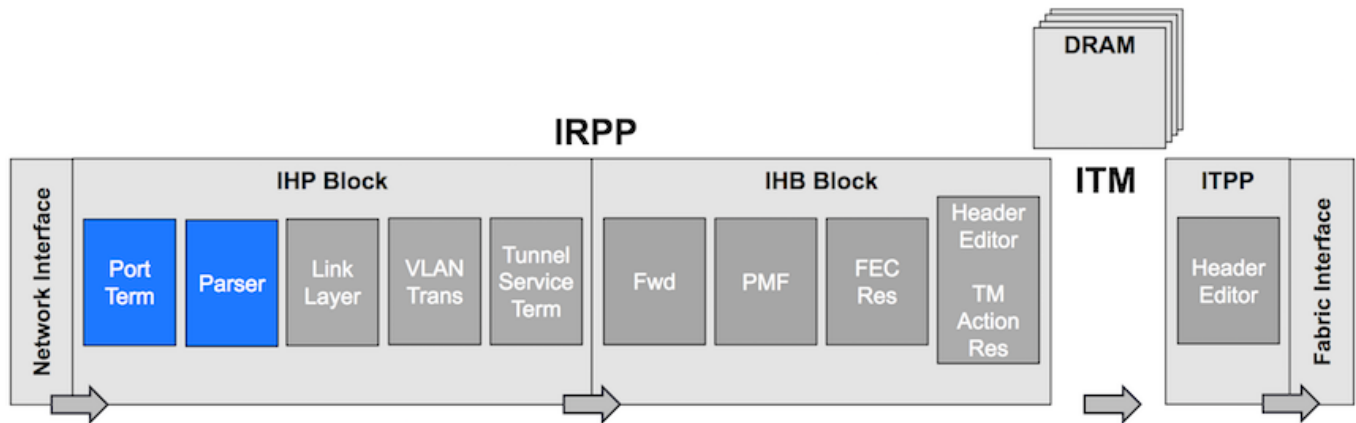
Cells are received and reassembled. The first 128 bytes are extracted and apply all link-layer filters, Egress ACL, Egress Replication(Multicast)

ETPP/ETM

The Entire packet is stored in a buffer until the packet out is scheduled. System headers are removed.

Pipeline Forwarding ASIC

IRPP (Port Term, Parser)

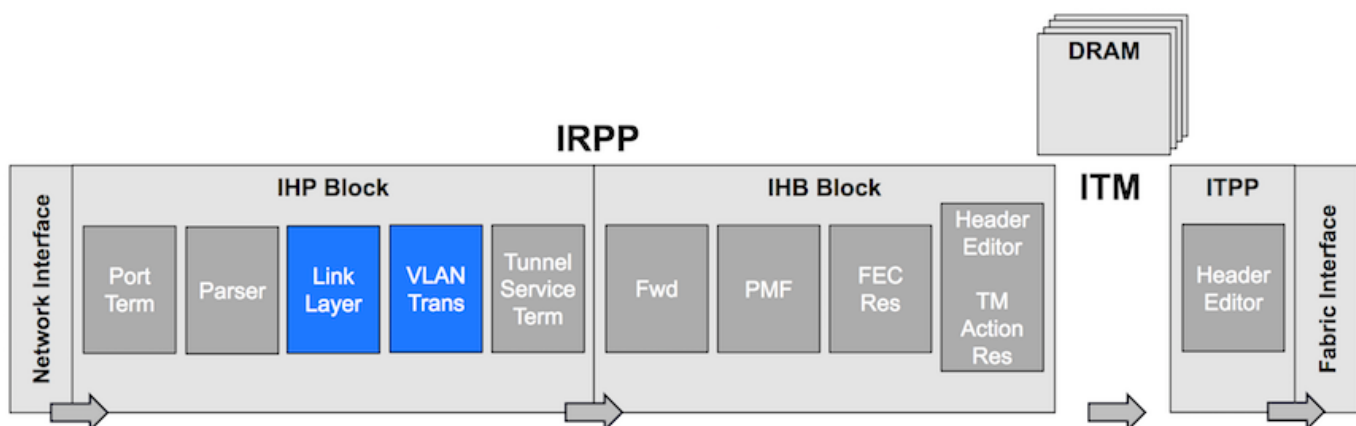


Port Termination: Packets received from Network interface/CPU/Recirculation

- Determine source port and mark packet with it.
- Decide the initial program to use in Parser.
- Identify where the network header starts.

Parser: Extract Ethertype, MAC Addresses, Determine offset for next stages in the pipeline.

IRPP(Link Layer, VLAN Trans)



Link Layer: Filtering on L2 and source address authentication.

VLAN Translation: We map the logical interface of the packet.

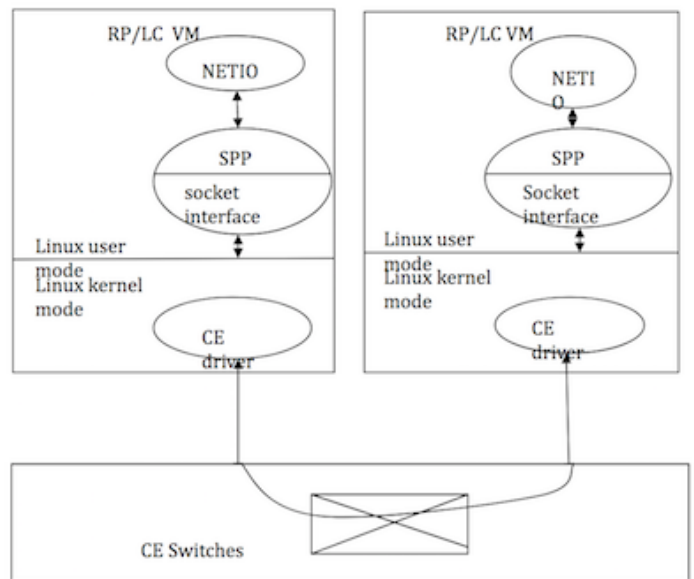
Punt Path

- Only a few LPTS TCAM entries are available on the NPU due to a lack of TCAM resources.
- Major LPTS lookup is done in SW LPTS Pre-IFIB on LC Netio
- LPTS punt packet from NPU to RP directly via PMF TCAM lookup: OSPF, OSPFv3 mcast, ISIS packets are punted to active and Standby RP directly
- LPTS punt packet from NPU to local CPU via PMF TCAM lookup: Any protocol that uses TCP, UDP; ICMP, ND
- L2 protocol packets are punted to LC via BRCM CPU trap: ARP, RARP, CDP, LACP, LLDP, Ether-link OAM, MACSec
- Exception packets are punted to LC via BRCM CPU trap. TTL0, TTL1, MTU Exceed, Option packets

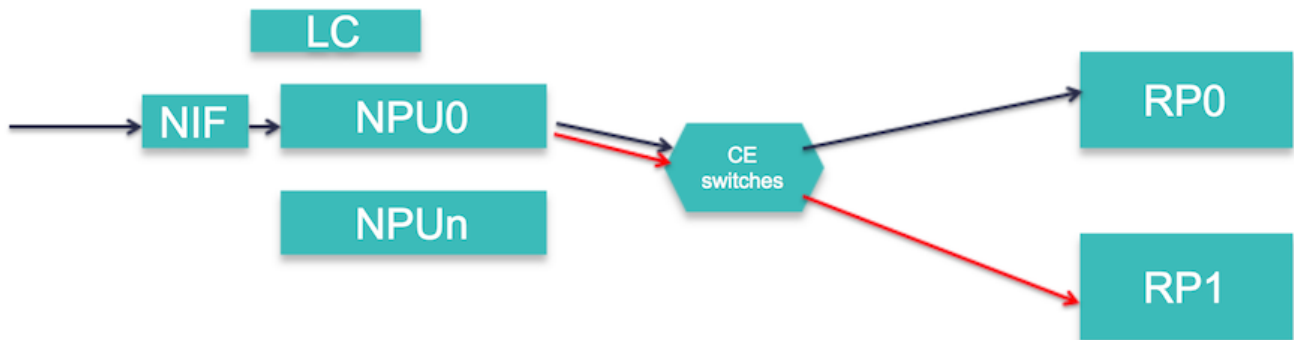
Punt Path between two CPU nodes

NetIO → SPP → CE switches → SPP → NETIO

CE switches: SC, FC, LC switches

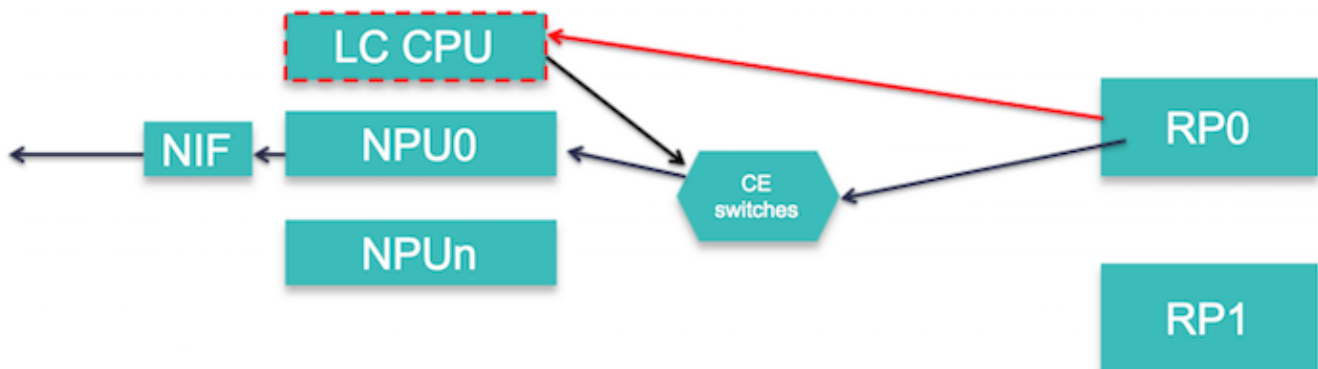


Punt Path from NPU to RP CPU



RX Forus packets are replicated on NPU. One is sent to Active RP and another to Stby RP

Inject from RP CPU to NPU or LC CPU

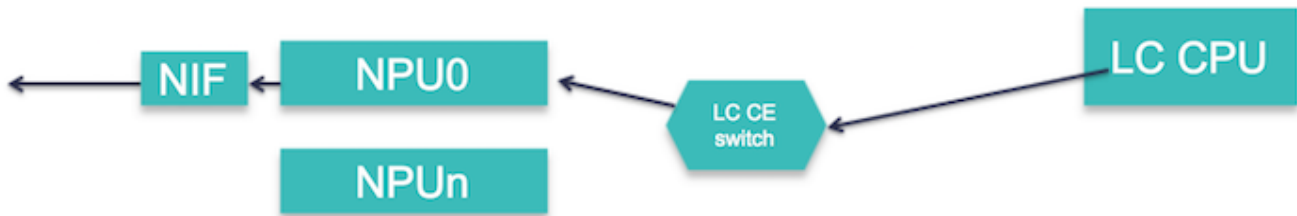


L3 packets are injected directly to NPU if prefix adjacency is complete or it is a pre-route packet

L3 packets are injected to LC CPU in case:

- The Prefix adjacency is GLEAN.
- MPLS pre-route packet
- Packet size exceeds MTU.

Inject Path from LC CPU to NPU



These packets are Injected from LC CPU to NPU:

- ARP, ND, ICMP Echo Reply, Fragmented Packets
- CDP, LACP, LLDP, Ether-link OAM packets

CLI for Punt/Inject Debugging

```
Show SPP node counters location <>
```

```
show netio chain <interface> location <>
```

```
show netio drop location <>
```

```
show ipv4/ipv6 traffic location <>
```

```
show fwd statistics location <>
```

```
show lpts pifib entry brief statistics location <>
```

```
show controllers fia diagshell <npu> "diag counters g cdsp" location <>
```

```
show interface <> location <>
```

Remote Ping

Packet Path: Echo Request

```
Local Node[ICMP(RP) -> IP I/O(RP) -> NetIO/Forwarder(RP) -> SPP(RP) -> NPU] -> wire ->
Remote[NPU -> LPTS(HW) -> SPP(LC) -> NetIO/Forwarder(LC) -> LPTS(SW)(LC) -> IP I/O (LC) -> ICMP
(LC)]
```

Packet Path: Echo Reply

```
Remote Node[IPv4/ICMP (LC) -> FWD/NetIO (LC) -> SPP (LC) -> NPU] -> wire -> Local Node[LPTS(HW)
-> SPP(LC) -> NetIO/Forwarder(LC) -> NetIO(RP) -> IP I/O (RP) -> ICMP (RP)]
```

Local Ping

Packet Path: Echo Request

```
RP(ICMP/IPv4 IO -> netio -> SPP -> CE) -> LC(SPP -> netio -> ICMP/ipv4 IO)
```

Packet Path: Echo Reply

```
LC(IPv4 IO/ICMP -> Netio -> SPP -> CE) -> RP(SPP -> net -> ipv4 io/ICMP)
```

Useful debugs:

```
debug icmp ipv4 location 0/0/CPU0
```

```
debug ipv4 packet location 0/0/CPU0
```

```
debug ipv4 ping events location 0/0/CPU0
```

Topology

```
Fretta_1(GigabitEthernet0/0/0/16 ) <---->(GigabitEthernet0/0/0/16 ) Fretta_2
```

```
RP/0/RP0/CPU0:fretta_1# ping 1.1.16.2 count 10000
```

Commands to check Remote Ping

Echo Request: Local RP: TX

```
Path: ICMP(RP) -> IP I/O(RP) -> NetIO/Forwarder(RP) -> SPP(RP) -> NPU
```

1. IP I/O: Check if Echo Request is generated:

```
show ipv4 traffic brief
```

```
ICMP statistics:
```

```
  Sent: 0 admin unreachable, 0 network unreachable
        0 host unreachable, 0 protocol unreachable
        0 port unreachable, 0 fragment unreachable
        0 time to live exceeded, 0 reassembly ttl exceeded
  10000 echo request, 0 echo reply
        0 mask request, 0 mask reply
        0 parameter error, 0 redirects
        10000 total
```

2. NetIO

```
RP/0/RP0/CPU0:fretta_1#show netio clients location 0/rp0/CPU0
```

```

Counters                Errors/Total
-----
Output                0/10019
Input                   0/11804
Puntback                0/0
Jump                    0/0
Driver Output           0/10002

```

```

Mutex Bypass Counters  Total
-----
Egress handled         0
Egress chainwalked    10006
Egress dropped         0
Ingress handled       10000
Ingress chainwalked   0
Ingress dropped        0

```

```

ClientID                Drop/Total          Drop/Total          Cur/High/Max        Cur/High/Max
-----
ipv6_icmp               0/0                 0/0                 0/0/1000            0/0/1000
icmp                  0/10000           0/0                 0/1/1000            0/0/1000

```

If ping is failing then check if it is getting dropped in Netio:

```

RP/0/RP0/CPU0:fretta_1#show netio drops location 0/rp0/CPU0
Thu Apr 20 20:28:09.577 UTC

```

Drops for interfaces on node 0/RP0/CPU0

No drops

3. SPP

```

RP/0/RP0/CPU0:fretta_1#show spp node-counters
Thu Apr 20 20:29:05.785 UTC
0/0/CPU0:

```

```

fretta/classify
  forwarded to spp clients:          10006
  forwarded NPU packet to NetIO:     10006
  dropped in classify node:           24
  Fwded to CoPP sampler:              1
    PUNT ARP:                         1
    PUNT IFIB:                         10006
  IFIB RAWIP4_FM:                    10000
  IFIB RAWIP6_FM:                     6

```

```

-----
client/inject
  pkts injected into spp:             10002
  NetIO->NPU injected into spp:        2
  NetIO->CPU injected into spp:        10000
    NetIO->NPU PROTO ARP:              2
    NetIO->CPU PKT LPTS:                10000

```

```

-----
socket/rx
  ether raw pkts:                     10031

```

socket/tx

```

                ce pkts:                10002
-----
client/punt
    punted to client:                10007
-----

0/RP0/CPU0:
socket/rx
    ether raw pkts:                10002
    mgmt interface pkts:            3204
-----
socket/tx
    ce pkts:                        10000
    mgmt interface pkts:            5
-----
fretta/classify
    forwarded to spp clients:        13204
    forwarded CPU packet to NetIO:   10000
    forwarded Mgmt packet to NetIO:  3204
    dropped in classify node:         2
-----
client/inject
    pkts injected into spp:          10005
    NetIO->NPU injected into spp:    10000
    MGMT_IF injected into spp:       5
    NetIO->NPU PROTO IPV4_PREROUTE:  10000
-----
client/punt
    punted to client:                13204
-----

```

4. Check if Echo Request is sent out to wire:

```

RP/0/RP0/CPU0:fretta_1#show controllers gigabitEthernet 0/0/0/16 stats | be Egress
Thu Apr 20 21:17:28.176 UTC

```

Egress:

```

Output total bytes          = 1140270
Output good bytes           = 1140270

Output total packets        = 10004
Output 802.1Q frames        = 0
Output pause frames         = 0
Output pkts 64 bytes        = 1
Output pkts 65-127 bytes    = 10003
Output pkts 128-255 bytes   = 0
Output pkts 256-511 bytes   = 0
Output pkts 512-1023 bytes  = 0
Output pkts 1024-1518 bytes = 0
Output pkts 1519-Max bytes  = 0

Output good pkts            = 10004
Output unicast pkts         = 10000
Output multicast pkts       = 3
Output broadcast pkts       = 1

Output drop underrun        = 0
Output drop abort           = 0
Output drop other           = 0

Output error other          = 0

```

Echo Request: Remote LC: RX

Path: NPU -> LPTS(HW) -> SPP(LC) -> NetIO/Forwarder(LC) -> LPTS(SW)(LC) -> IP I/O (LC) -> ICMP (LC)

1. Check if the packet is received from wire:

```
RP/0/RP0/CPU0:fretta_2#show controllers gigabitEthernet 0/0/0/16 stats
Thu Apr 20 20:44:22.115 UTC
Statistics for interface GigabitEthernet0/0/0/16 (cached values):
```

```
Ingress:
  Input total bytes          = 1140270
  Input good bytes           = 1140270

  Input total packets        = 10004
  Input 802.1Q frames         = 0
  Input pause frames         = 0
  Input pkts 64 bytes        = 1
  Input pkts 65-127 bytes    = 10003
```

2. Check LPTS counter.

```
RP/0/RP0/CPU0:fretta_2#show lpts pifib hardware entry brief location 0/0/CPU0 | i ICMP
Thu Apr 20 20:45:54.687 UTC
```

| DestIP | SrcIP | vrf | L4 | LPort/Type | RPort | npu | Flowtype |
|----------|-----------------------|-----|----|------------|-------|-----|-------------------|
| DestNode | PuntPrio Accept Drop | | | | | | |
| 0.0.0.0 | 0.0.0.0 | 0 | 1 | ECHO | 0 | 0 | ICMP-local |
| Local LC | MEDIUM 10000 0 | | | | | | |

3. SPP

```
RP/0/RP0/CPU0:fretta_2#show spp node-counters location 0/0/CPU0
```

```
fretta/classify
  forwarded to spp clients:          10006
  forwarded NPU packet to NetIO:     10006
  dropped in classify node:           22
  Fwded to CoPP sampler:              2
    PUNT ARP:                          2
    PUNT IFIB:                          10006
  IFIB IPv4_STACK:                   10000
  IFIB RAWIP6_FM:                     6
-----
client/inject
  pkts injected into spp:             10002
  NetIO->NPU injected into spp:       10002
    NetIO->NPU PROTO ARP:               2
    NetIO->NPU PROTO IPV4:              10000
-----
socket/rx
  ether raw pkts:                     10030
-----
socket/tx
  ce pkts:                            10002
-----
client/punt
  punted to client:                   10008
-----
```

4. Netio

show netio chains gigabitEthernet 0/0/0/16 location 0/0/cpu0

<12> (ipv4) Stats IN: 10000 pkts, 1140000 bytes; OUT: 10000 pkts, 1140000 bytes

| Protocol | SAFI | Pkts In | Bytes In | Pkts Out | Bytes Out |
|-------------|----------------|--------------|----------|----------|-----------|
| ipv4 | Unicast | 10000 | 1140000 | 10000 | 1000000 |
| ipv4 | Multicast | 0 | 0 | 0 | 0 |
| ipv4 | Broadcast | 0 | 0 | 0 | 0 |
| ipv6 | Unicast | 0 | 0 | 0 | 0 |
| ipv6 | Multicast | 0 | 0 | 0 | 0 |

RP/0/RP0/CPU0:fretta_2#show netio clients location 0/0/CPU0

Thu Apr 20 20:52:26.802 UTC

| Counters | Errors/Total |
|---------------|--------------|
| Output | 0/10002 |
| Input | 0/10008 |
| Puntback | 0/0 |
| Jump | 0/0 |
| Driver Output | 0/10002 |

| XIPC queues | Dropped/Queued | Cur/High/Max |
|-------------|----------------|--------------|
| OutputL | 0/10000 | 0/1/6000 |
| OutputH | 0/2 | 0/1/3000 |
| Puntback | 0/0 | 0/0/6000 |

| ClientID | Input Drop/Total | Punt Drop/Total | XIPC InputQ Cur/High/Max | XIPC PuntQ Cur/High/Max |
|---------------------|------------------|-----------------|--------------------------|-------------------------|
| ipv6_icmp | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| icmp | 0/10000 | 0/0 | 0/1/1000 | 0/0/1000 |
| clns | L 0/0 | 0/0 | L 0/0/1000 | 0/0/0 |
| | H 0/0 | | H 0/0/1000 | |
| ipv6_io | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| ipv6_nd | 0/0 | 0/0 | 0/0/1500 | 0/0/1000 |
| l2snoop | 0/0 | 0/0 | 0/0/1000 | 0/0/0 |
| ether_sock | 0/0 | 0/0 | | |
| tp_oam | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| icmpv6_unreach_jump | 0/0 | 0/0 | 0/0 | 0/0 |
| arp | 0/2 | 0/0 | 0/1/1000 | 0/0/1000 |
| mpls_io | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| ipv4 | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| ipv6 | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |

Key:

L = queue for lower priority packets

H = queue for higher priority packets

5. FWD stats

RP/0/RP0/CPU0:fretta_2#show fwd statistics all location 0/0/cpu0

Thu Apr 20 20:51:50.347 UTC

RECEIVE STATISTICS SUMMARY:

rx_pkts: 10008

punt_pkts: 10008

ingress_total_drops: 0

TRANSMIT STATISTICS SUMMARY:

inject_pkts: 10002

tx_pkts: 10002

egress_total_drops: 0

RP/0/RP0/CPU0:fretta_2#

6. IP IOS

show ipv4 traffic brief location 0/0/CPU0

Rcvd: 0 admin unreachable, 0 network unreachable
0 host unreachable, 0 protocol unreachable
0 port unreachable, 0 fragment unreachable
0 time to live exceeded, 0 reassembly ttl exceeded
10000 echo request, 0 echo reply
0 mask request, 0 mask reply
0 redirect, 0 parameter error
0 source quench, 0 timestamp, 0 timestamp reply
0 router advertisement, 0 router solicitation
10000 total, 0 checksum errors, 0 unknown

Echo Reply: Remote Node(LC): TX

Path: IPv4/ICMP (LC) -> FWD/NetIO (LC) -> SPP (LC) -> NPU

1. IP IO

RP/0/RP0/CPU0:fretta_2#show ipv4 traffic brief location 0/0/CPU0

ICMP statistics:

Sent: 0 admin unreachable, 0 network unreachable
0 host unreachable, 0 protocol unreachable
0 port unreachable, 0 fragment unreachable
0 time to live exceeded, 0 reassembly ttl exceeded
0 echo request, **10000 echo reply**
0 mask request, 0 mask reply
0 parameter error, 0 redirects
10000 total

2. Netio

show netio chains gigabitEthernet 0/0/0/16 location 0/0/cpu0

<12> (ipv4) **Stats IN: 10000 pkts, 1140000 bytes; OUT: 10000 pkts, 1140000 bytes**

| Protocol | SAFI | Pkts In | Bytes In | Pkts Out | Bytes Out |
|----------|-----------|---------|----------|--------------|-----------|
| ipv4 | Unicast | 10000 | 1140000 | 10000 | 1000000 |
| ipv4 | Multicast | 0 | 0 | 0 | 0 |
| ipv4 | Broadcast | 0 | 0 | 0 | 0 |
| ipv6 | Unicast | 0 | 0 | 0 | 0 |
| ipv6 | Multicast | 0 | 0 | 0 | 0 |

RP/0/RP0/CPU0:fretta_2#show netio clients location 0/0/CPU0

Thu Apr 20 20:52:26.802 UTC

Counters

Errors/Total

```

-----
Output                0/10002
Input                    0/10008
Puntback                 0/0
Jump                     0/0
Driver Output           0/10002

XIPC queues              Dropped/Queued    Cur/High/Max
-----
OutputL                  0/10000            0/1/6000
OutputH                  0/2                0/1/3000
Puntback                 0/0                0/0/6000

```

3. FWD Stats

```

RP/0/RP0/CPU0:fretta_2#show fwd statistics all location 0/0/cpu0
Thu Apr 20 20:51:50.347 UTC
RECEIVE STATISTICS SUMMARY:
rx_pkts: 10008
punt_pkts: 10008
ingress_total_drops: 0
TRANSMIT STATISTICS SUMMARY:
inject_pkts: 10002
tx_pkts: 10002
egress_total_drops: 0

```

4. SPP

```

show spp node-counters location 0/0/CPU0

fretta/classify
  forwarded to spp clients:          10006
  forwarded NPU packet to NetIO:     10006
  dropped in classify node:           22
  Fwded to CoPP sampler:              2
  PUNT ARP:                           2
  PUNT IFIB:                          10006
  IFIB IPv4_STACK:                   10000
  IFIB RAWIP6_FM:                     6
-----
client/inject
  pkts injected into spp:             10002
  NetIO->NPU injected into spp:       10002
  NetIO->NPU PROTO ARP:                2
  NetIO->NPU PROTO IPV4:               10000
-----
socket/rx
  ether raw pkts:                     10030
-----
socket/tx
  ce pkts: 10002
-----
client/punt
  punted to client:                   10008
-----

```

5. Check if the packet is sent out to wire.

```

RP/0/RP0/CPU0:fretta_2#show controllers gigabitEthernet 0/0/0/16 stats
Thu Apr 20 21:20:22.593 UTC
Statistics for interface GigabitEthernet0/0/0/16 (cached values):

```

Egress:

```
Output total bytes          = 1140270
Output good bytes           = 1140270

Output total packets        = 10004
Output 802.1Q frames        = 0
Output pause frames         = 0
Output pkts 64 bytes        = 1
  Output pkts 65-127 bytes   = 10003
Output pkts 128-255 bytes   = 0
Output pkts 256-511 bytes   = 0
Output pkts 512-1023 bytes  = 0
Output pkts 1024-1518 bytes = 0
Output pkts 1519-Max bytes  = 0

Output good pkts            = 10004
Output unicast pkts         = 10000
Output multicast pkts       = 3
Output broadcast pkts       = 1

Output drop underrun        = 0
Output drop abort           = 0
Output drop other           = 0

Output error other          = 0
```

6. Interface stats

```
RP/0/RP0/CPU0:fretta_2#show int gigabitEthernet 0/0/0/16
Thu Apr 20 21:21:37.942 UTC
GigabitEthernet0/0/0/16 is up, line protocol is up
Interface state transitions: 1
Hardware is GigabitEthernet, address is 008a.964a.7040 (bia 008a.964a.7040)
Internet address is 1.1.16.2/24
MTU 1514 bytes, BW 1000000 Kbit (Max: 1000000 Kbit)
  reliability 255/255, txload 0/255, rxload 0/255
Encapsulation ARPA,
Full-duplex, 1000Mb/s, link type is force-up
output flow control is off, input flow control is off
Carrier delay (up) is 10 msec
loopback not set,
Last link flapped 01:00:13
ARP type ARPA, ARP timeout 04:00:00
Last input 00:56:58, output 00:56:58
Last clearing of "show interface" counters never
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  10004 packets input, 1140270 bytes, 0 total input drops
    3 drops for unrecognized upper-level protocol
  Received 1 broadcast packets, 3 multicast packets
    0 runts, 0 giants, 0 throttles, 0 parity
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  10004 packets output, 1140270 bytes, 0 total output drops
  Output 1 broadcast packets, 3 multicast packets
  0 output errors, 0 underruns, 0 applique, 0 resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
```

Echo Reply: Local Node(LC): RX

LPTS(HW) -> SPP(LC) -> NetIO/Forwarder(LC) -> LPTS PreIFIB Lookup -> SPP(LC) -> CE(LC) -> SPP(RP) -> NetIO(RP) -> IP I/O (RP) -> ICMP (RP)

1. Check if packets are coming in from wire.

RP/0/RP0/CPU0:fretta_1#show controllers gigabitEthernet 0/0/0/16 stats
Thu Apr 20 21:17:28.176 UTC
Statistics for interface GigabitEthernet0/0/0/16 (cached values):

Ingress:

| | |
|--------------------------------|----------------|
| Input total bytes | = 1140270 |
| Input good bytes | = 1140270 |
| Input total packets | = 10004 |
| Input 802.1Q frames | = 0 |
| Input pause frames | = 0 |
| Input pkts 64 bytes | = 1 |
| Input pkts 65-127 bytes | = 10003 |
| Input pkts 128-255 bytes | = 0 |
| Input pkts 256-511 bytes | = 0 |
| Input pkts 512-1023 bytes | = 0 |
| Input pkts 1024-1518 bytes | = 0 |
| Input pkts 1519-Max bytes | = 0 |
| Input good pkts | = 10004 |
| Input unicast pkts | = 10000 |
| Input multicast pkts | = 3 |
| Input broadcast pkts | = 1 |
| Input drop overrun | = 0 |
| Input drop abort | = 0 |
| Input drop invalid VLAN | = 0 |
| Input drop invalid DMAC | = 0 |
| Input drop invalid encap | = 0 |
| Input drop other | = 0 |
| Input error giant | = 0 |
| Input error runt | = 0 |
| Input error jabbers | = 0 |
| Input error fragments | = 0 |
| Input error CRC | = 0 |
| Input error collisions | = 0 |
| Input error symbol | = 0 |
| Input error other | = 0 |
| Input MIB giant | = 0 |
| Input MIB jabber | = 0 |
| Input MIB CRC | = 0 |

2. LPTS Counters

RP/0/RP0/CPU0:fretta_1#show lpts pifib hardware entry brief locatio 0/0/CPU0

| | | | | | | | |
|----------|---------|--------------|---|------------------|---|---|------------------|
| 0.0.0.0 | 0.0.0.0 | 0 | 1 | ECHOREPLY | 0 | 0 | ICMP-app-default |
| Local LC | LOW | 10000 | 0 | | | | |

3. SPP on LC

RP/0/RP0/CPU0:fretta_1#show spp node-counters location 0/0/CPU0

Thu Apr 20 21:01:31.974 UTC

```
fretta/classify
  forwarded to spp clients:          10006
  forwarded NPU packet to NetIO:    10006
  dropped in classify node:          24
    Fwded to CoPP sampler:          1
      PUNT ARP:                      1
      PUNT IFIB:                     10006
    IFIB RAWIP4_FM:                 10000
    IFIB RAWIP6_FM:                  6
```

```
-----
client/inject
  pkts injected into spp:           10002
  NetIO->NPU injected into spp:      2
  NetIO->CPU injected into spp:      10000
    NetIO->NPU PROTO ARP:            2
    NetIO->CPU PKT LPTS:             10000
```

```
-----
socket/rx
      ether raw pkts: 10031
```

```
-----
socket/tx
      ce pkts: 10002
```

```
-----
client/punt
      punted to client: 10007
```

4. Netio on LC

RP/0/RP0/CPU0:fretta_1# show netio chains gigabitEthernet 0/0/0/16 location 0/0/cpu0

<12> (ipv4) Stats IN: 10000 pkts, 1140000 bytes; OUT: 0 pkts, 0 bytes

Protocol SAFI counts:

```
-----
```

| Protocol | SAFI | Pkts In | Bytes In | Pkts Out | Bytes Out |
|----------|-----------|---------|----------|----------|-----------|
| ipv4 | Unicast | 10000 | 1140000 | 0 | 0 |
| ipv4 | Multicast | 0 | 0 | 0 | 0 |
| ipv4 | Broadcast | 0 | 0 | 0 | 0 |
| ipv6 | Unicast | 0 | 0 | 0 | 0 |
| ipv6 | Multicast | 0 | 0 | 0 | 0 |

```
-----
```

5. FWD stats on LC.

RP/0/RP0/CPU0:fretta_1#show fwd statistics all location 0/0/CPU0

Thu Apr 20 21:04:27.767 UTC

RECEIVE STATISTICS SUMMARY:

rx_pkts: 10007

punt_pkts: 10007

ingress_total_drops: 0

TRANSMIT STATISTICS SUMMARY:

inject_pkts: 10002

tx_pkts: 10002

egress_total_drops: 0

RP/0/RP0/CPU0:fretta_1#

5. SPP on LC to send to SPP on RP.

RP/0/RP0/CPU0:fretta_1#show spp node-counters location 0/0/CPU0

Thu Apr 20 21:01:31.974 UTC

```
fretta/classify
  forwarded to spp clients:          10006
  forwarded NPU packet to NetIO:     10006
  dropped in classify node:           24
  Fwded to CoPP sampler:              1
    PUNT ARP:                          1
    PUNT IFIB:                          10006
  IFIB RAWIP4_FM:                    10000
  IFIB RAWIP6_FM:                      6
```

```
-----
client/inject
  pkts injected into spp:            10002
  NetIO->NPU injected into spp:       2
  NetIO->CPU injected into spp:       10000
    NetIO->NPU PROTO ARP:              2
    NetIO->CPU PKT LPTS:               10000
```

```
-----
socket/rx
  ether raw pkts:                    10031
```

```
-----
socket/tx
  ce pkts:                            10002
```

```
-----
client/punt
  punted to client:                  10007
```

6. SPP on RP

RP/0/RP0/CPU0:fretta_1#show spp node-counters location 0/rP0/CPU0

Thu Apr 20 21:06:33.045 UTC

```
socket/rx
  ether raw pkts:                      10002
  mgmt interface pkts:               16651
```

```
-----
socket/tx
  ce pkts:                            10000
  mgmt interface pkts:                14
```

```
-----
fretta/classify
  forwarded to spp clients:           26651
  forwarded CPU packet to NetIO:      10000
  forwarded Mgmt packet to NetIO:     16651
  dropped in classify node:            2
```

```
-----
client/inject
  pkts injected into spp:             10014
  NetIO->NPU injected into spp:       10000
  MGMT_IF injected into spp:          14
  NetIO->NPU PROTO IPV4_PREROUTE:    10000
```

```
-----
client/punt
  punted to client:                   26651
```

7. Netio on RP.

RP/0/RP0/CPU0:fretta_1#show netio clients location 0/RP0/CPU0
 Thu Apr 20 21:05:05.977 UTC

| Counters | Errors/Total |
|---------------|--------------|
| Output | 0/10031 |
| Input | 0/25872 |
| Puntback | 0/0 |
| Jump | 0/0 |
| Driver Output | 0/10014 |

| Mutex Bypass Counters | Total |
|-----------------------|-------|
| Egress handled | 0 |
| Egress chainwalked | 10018 |
| Egress dropped | 0 |
| Ingress handled | 10000 |
| Ingress chainwalked | 0 |
| Ingress dropped | 0 |

| XIPC queues | Dropped/Queued | Cur/High/Max |
|-----------------|----------------|--------------|
| OutputL | 0/10004 | 0/1/6000 |
| OutputH | 0/14 | 0/1/3000 |
| Puntback | 0/0 | 0/0/6000 |
| PMutex_egressL | 0/10004 | 0/1/6000 |
| PMutex_egressH | 0/14 | 0/1/1500 |
| PMutex_ingressL | 0/0 | 0/0/6000 |
| PMutex_ingressH | 0/0 | 0/0/1500 |

| ClientID | Input Drop/Total | Punt Drop/Total | XIPC InputQ Cur/High/Max | XIPC PuntQ Cur/High/Max |
|---------------------|------------------|-----------------|--------------------------|-------------------------|
| ipv6_icmp | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| icmp | 0/10000 | 0/0 | 0/1/1000 | 0/0/1000 |
| clns | L 0/0 | 0/0 | L 0/0/1000 | 0/0/0 |
| | H 0/0 | | H 0/0/1000 | |
| eth_mgmt | 0/0 | 0/0 | | |
| ipv6_io | 0/0 | 0/4 | 0/0/1000 | 0/1/1000 |
| ipv6_nd | 0/4 | 0/0 | 0/1/1500 | 0/0/1000 |
| l2snoop | 0/0 | 0/0 | 0/0/1000 | 0/0/0 |
| ether_sock | 0/0 | 0/0 | | |
| icmpv6_unreach_jump | 0/0 | 0/0 | 0/0 | |
| raw | L 0/0 | 0/0 | L 0/0/1600 | 0/0/0 |
| | H 0/0 | | H 0/0/1600 | |
| tcp | L 0/0 | 0/0 | L 0/0/1600 | 0/0/0 |
| | H 0/0 | | H 0/0/1600 | |
| udp | L 0/307 | 0/0 | L 0/1/1600 | 0/0/0 |
| | H 0/0 | | H 0/0/1600 | |
| arp | 0/15565 | 0/0 | 0/4/1000 | 0/0/1000 |
| mpls_io | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| lspv_server | 0/0 | 0/0 | | |
| ipv4 | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |
| ipv6 | 0/0 | 0/0 | 0/0/1000 | 0/0/1000 |

Key:
 L = queue for lower priority packets
 H = queue for higher priority packets

8. IP IO

```
RP/0/RP0/CPU0:fretta_1#show ipv4 traffic brief
```

```
Rcvd: 0 admin unreachable, 0 network unreachable
0 host unreachable, 0 protocol unreachable
0 port unreachable, 0 fragment unreachable
0 time to live exceeded, 0 reassembly ttl exceeded
0 echo request, 10000 echo reply
0 mask request, 0 mask reply
0 redirect, 0 parameter error
0 source quench, 0 timestamp, 0 timestamp reply
0 router advertisement, 0 router solicitation
10000 total, 0 checksum errors, 0 unknown
```

9. Interface stats:

```
RP/0/RP0/CPU0:fretta_1# show int gigabitEthernet 0/0/0/16
Thu Apr 20 21:22:12.822 UTC
GigabitEthernet0/0/0/16 is up, line protocol is up
Interface state transitions: 1
Hardware is GigabitEthernet, address is 008a.964b.7040 (bia 008a.964b.7040)
Internet address is 1.1.16.1/24
MTU 1514 bytes, BW 1000000 Kbit (Max: 1000000 Kbit)
  reliability 255/255, txload 0/255, rxload 0/255
Encapsulation ARPA,
Full-duplex, 1000Mb/s, link type is force-up
output flow control is off, input flow control is off
Carrier delay (up) is 10 msec
loopback not set,
Last link flapped 01:01:11
ARP type ARPA, ARP timeout 04:00:00
Last input 00:58:03, output 00:58:03
Last clearing of "show interface" counters never
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
10004 packets input, 1140270 bytes, 0 total input drops
  3 drops for unrecognized upper-level protocol
Received 1 broadcast packets, 3 multicast packets
  0 runts, 0 giants, 0 throttles, 0 parity
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
10004 packets output, 1140270 bytes, 0 total output drops
Output 1 broadcast packets, 3 multicast packets
0 output errors, 0 underruns, 0 applique, 0 resets
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions
```

```
RP/0/RP0/CPU0:fretta_1#
```

Local Ping

<TBD>