



# Inter-rack Timing

This chapter provides the details about inter-rack timing in the Cisco NCS 4000 Series Router.

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## Introduction

In a MC system the source and destination ports of the cross connect can be across racks. Inter-rack (or cross-rack) timing allows the timing information to be passed across racks for segmentation and re-assembly needs.

## Verification of Inter-rack Timing

### Procedure

**Step 1** Verify the inter-rack timing configuration, using command **show running-config frequency synchronization**

**Example:**

```
RP/2/RP0:MC_FLT+4+1# show running-config frequency synchronization
Thu Mar 22 11:33:30.986 IST
frequency synchronization
clock-interface timing-mode system
```

**Step 2** Verify FPD Status for Timing-FPGA and ECU-FPGA, using command **show hw-module fpd <fpd-name>**

**Example:**

```
RP/2/RP0:MC_FLT+4+1#show hw-module fpd Timing-FPGA
Thu Mar 22 13:47:18.695 IST
                FPD Versions
                =====
Location   Card type           HWver FPD device      ATR Status  Running Programd
-----
0/RP0     NCS4K-RP            0.1   Timing-FPGA      S CURRENT   3.82    3.82
0/RP1     NCS4K-RP            0.1   Timing-FPGA      S CURRENT   3.82    3.82
```

```

1/RP0    NCS4K-RP      0.1  Timing-FPGA      S  CURRENT      3.82   3.82
1/RP1    NCS4K-RP      0.1  Timing-FPGA      S  CURRENT      3.82   3.82
2/RP0    NCS4K-RP      0.1  Timing-FPGA      S  CURRENT      3.82   3.82
2/RP1    NCS4K-RP      0.1  Timing-FPGA      S  CURRENT      3.82   3.82
3/RP0    NCS4K-RP      0.1  Timing-FPGA      S  CURRENT      3.82   3.82
3/RP1    NCS4K-RP      0.1  Timing-FPGA      S  CURRENT      3.82   3.82

```

```

RP/2/RP0:MC_FLT+4+1# show hw-module fpd ECU-FPGA
Thu Mar 22 13:47:25.868 IST

```

```

          FPD Versions
          =====
Location   Card type           HWver FPD device           ATR Status   Running Programd
-----
0/EC0     NCS4K-ECU2          0.2   ECU-FPGA                 CURRENT      4.08   4.08
1/EC0     NCS4K-ECU2          0.2   ECU-FPGA                 CURRENT      4.08   4.08
2/EC0     NCS4K-ECU2          0.2   ECU-FPGA                 CURRENT      4.08   4.08
3/EC0     NCS4K-ECU2          0.2   ECU-FPGA                 CURRENT      4.08   4.08
RP/2/RP0:MC_FLT+4+1#

```

**Step 3** Verify that all the FPDs on LC are in **CURRENT** state, using command **show hw-module location <LC location> fpd**

**Example:**

```

RP/2/RP0:MC_FLT+4+1# show hw-module location 0/5 fpd

```

```

          FPD Versions
          =====
Location   Card type           HWver FPD device           ATR Status   Running Programd
-----
0/5       NCS4K-2H10T-OP-KS  0.2   Backup-ZYNQ              BSP CURRENT
0/5       NCS4K-2H10T-OP-KS  0.2   CCC-FPGA                 CURRENT      1.50   1.50
0/5       NCS4K-2H10T-OP-KS  0.2   CCC-Power-On             CURRENT      1.14   1.14
0/5       NCS4K-2H10T-OP-KS  0.2   DIGI1                    CURRENT      2.03   2.03
0/5       NCS4K-2H10T-OP-KS  0.2   DIGI2                    CURRENT      2.03   2.03
0/5       NCS4K-2H10T-OP-KS  0.2   Ethernet-Switch          CURRENT      1.02   1.02
0/5       NCS4K-2H10T-OP-KS  0.2   GRIMA                    CURRENT      1.51   1.51
0/5       NCS4K-2H10T-OP-KS  0.2   PLX-8649                 CURRENT      0.11   0.11

```

**Step 4** Verify Slice Manager Status for all Active LC VM's, using command **show controllers slice-control all location <location>**

**Note**

Additionally verify that the Clock Status on all LCs is **External**.

**Example:**

```

RP/2/RP0:MC_FLT+4+1# show controllers slice-control all location 0/LC1
Thu Mar 22 14:36:42.685 IST
CARD 0 IS OFFLINE
CARD 1 IS OFFLINE
CARD 3 IS OFFLINE
CARD 8 IS OFFLINE
CARD 10 IS OFFLINE
CARD 11 IS OFFLINE
CARD 12 IS OFFLINE
CARD 13 IS OFFLINE
CARD 14 IS OFFLINE
=====
Slice Controller Context: 2
=====
Inserted           : Yes

```

```

Physical Slot number : 3
Logical slot number : 2
Board type           : 5408a5 (BOARD_TYPE_SCAPA_1x100GE_CPAK_10x10GE)
Slice oper state     : OPERATIONAL
Bao Version          : 0.1.59
Hotplug status       : ONLINE
PCI Bar Address      : 0xb064000000
MSI                  : c9
PLLs locked          : Yes
PLLs Init Status     : PLL Initialized
PLLs Reset Status    : PLL Reset Skipped
Clock Status         : External (RP0)
Hardware ID          : |e08:3_e_2.0

```

**Step 5** Verify that there are no TE alarms in the system.

Following is the list of TE alarms:

- CLOCK\_PORT\_STATE\_CHANGE
- TIMING-PCI-ERROR
- TIMING-LOAD-ERROR
- TIMING-PLL-VAL-ERROR
- CLK-PORT-STATUS-CHNG
- TIMING-FPGA-SEU
- TE-PORT-UNAVAILABLE
- TIMING-ISOLATED-RACK

**Step 6** Verify TE Port Topology, using the output of command **show controllers timing controller te-port**

a) Verify that state of all the physical links. **Link** value should be is **Good**

**Note**

If any of the TE Link is in **No State**, please check the physical connections.

b) Verify that the **Peer Rack** is discovered as per the topology.

c) From the **FSYNC Mastership** value, verify that only one rack converges as PRIMARY and remaining as SECONDARY.

**Note**

FSYNC Mastership value should not be ISOLATED or SLAVE-READY or LISTENING or LEARNING.

d) Verify from the **TE state** value, that all ports (TE0-E, TE1-E, TE0-W, and TE1-W) are in FORWARDING or MASTER or BACKUP or ALTERNATE state.

e) TE State for primary rack should have value FORWARDING for all TE ports.

f) TE State for secondary rack should have values MASTER – BACKUP – FORWARDING – FORWARDING or MASTER – BACKUP – ALTERNATE – ALTERNATE for TE0-E, TE1-E, TE0-W, and TE1-W ports respectively.

g) Verify that **Delay** value is not zero.

**Example:**

```
RP/2/RP0:MC_FLT+4+1# show controllers timing controller te-port
```

Thu Mar 22 11:43:01.307 IST

FSYNCDIR TE-Port Setting: Rack 0

```

FSYNC Mastership Rack 0: MASTER
      TE0-E          TE1-E          TE0-W          TE1-W
TE state : FORWARDING  FORWARDING  FORWARDING  FORWARDING
Rx Signal: No          No          No          No
Link      : Good      Good      Good      Good
PeerRack : 1          1          3          3
PeerPort : TE0-W      TE1-W      TE0-E      TE1-E
DELAY(ns): 240      240      235      240

```

FSYNCDIR TE-Port Setting: Rack 1

```

FSYNC Mastership Rack 1: SLAVE
      TE0-E          TE1-E          TE0-W          TE1-W
TE state : FORWARDING  FORWARDING  MASTER      BACKUP
Rx Signal: No          No          Yes         Yes
Link      : Good      Good      Good      Good
PeerRack : 2          2          0          0
PeerPort : TE0-W      TE1-W      TE0-E      TE1-E
DELAY(ns): 235      240      240      240

```

FSYNCDIR TE-Port Setting: Rack 2

```

FSYNC Mastership Rack 2: SLAVE
      TE0-E          TE1-E          TE0-W          TE1-W
TE state : ALTERNATE  ALTERNATE  MASTER      BACKUP
Rx Signal: Yes        Yes         Yes         Yes
Link      : Good      Good      Good      Good
PeerRack : 3          3          1          1
PeerPort : TE0-W      TE1-W      TE0-E      TE1-E
DELAY(ns): 240      235      240      240

```

FSYNCDIR TE-Port Setting: Rack 3

```

FSYNC Mastership Rack 3: SLAVE
      TE0-E          TE1-E          TE0-W          TE1-W
TE state : MASTER     BACKUP      ALTERNATE  ALTERNATE
Rx Signal: Yes        Yes         Yes         Yes
Link      : Good      Good      Good      Good
PeerRack : 0          0          2          2
PeerPort : TE0-W      TE1-W      TE0-E      TE1-E
DELAY(ns): 235      240      240      235

```

### Step 7 Verify Frequency Synchronization Selection Status, using the output of command **show frequency synchronization selection**

- a) Verify value for SYSTEM\_T0\_SEL. Following are valid output combinations:
  - If BITS or Frequency Synchronization source is configured then one of them should be in LOCKED state.
  - If BITS or Frequency Synchronization source is not configured then the Internal Clock can be in FREERUN or HOLDOVER state.
- b) Verify value for RACK<rackid>\_SEL. Following are valid output combinations:

- If <rackid> is Primary Rack, then it should have either BITS or Frequency Synchronization in LOCKED state or Internal in FREERUN or HOLDOVER state.
- If <rackid> is Secondary Rack, then it should be LOCKED to TE port always..

**Example:**

```
RP/2/RP0:MC_FLT+4+1# show frequency synchronization selection
Thu Mar 22 11:41:09.870 IST
Node 2/RP0:
=====
Selection point: SYSTEM_T0_SEL (6 inputs, 1 selected)
  Last programmed 17:05:34 ago, and selection made 17:04:19 ago
  Next selection points
    SPA scoped      : None
    Node scoped     : SYSTEM_T4_SEL
    Chassis scoped  : None
    Router scoped   : None
  Uses frequency selection
  Used for local line interface output
  S  Input                                     Last Selection Point          QL  Pri  Status
  ==  =====
  1  Rack0-Bits0-In                           2/RP0 RACK0_SEL 1             PRC  9   Locked
     Rack2-Bits0-In                           2/RP0 RACK2_SEL 3             SSU-B  9   Available
     Internal0 [2/RP0]                         2/RP0 RACK0_SEL 2             SEC  255 Available
     Internal0 [2/RP0]                         2/RP0 RACK1_SEL 3             SEC  255 Available
     Internal0 [2/RP0]                         2/RP0 RACK2_SEL 4             SEC  255 Available
     Internal0 [2/RP0]                         2/RP0 RACK3_SEL 3             SEC  255 Available

Selection point: SYSTEM_T4_SEL (2 inputs, 1 selected)
  Last programmed 17:06:27 ago, and selection made 17:04:19 ago
  Next selection points
    SPA scoped      : None
    Node scoped     : None
    Chassis scoped  : None
    Router scoped   : None
  Uses frequency selection
  Used for local clock interface output
  S  Input                                     Last Selection Point          QL  Pri  Status
  ==  =====
  1  Rack0-Bits0-In                           2/RP0 SYSTEM_T0_SEL 1       PRC  9   Locked
     Internal0 [2/RP0]                         n/a                             SEC  255 Available

Selection point: RACK0_SEL (2 inputs, 2 selected)
  Last programmed 17:06:27 ago, and selection made 17:04:19 ago
  Next selection points
    SPA scoped      : None
    Node scoped     : SYSTEM_T0_SEL
    Chassis scoped  : None
    Router scoped   : None
  Uses frequency selection
  S  Input                                     Last Selection Point          QL  Pri  Status
  ==  =====
  1  Rack0-Bits0-In                           n/a                             PRC  9   Locked
  2  Internal0 [2/RP0]                         n/a                             SEC  255 Available

Selection point: RACK1_SEL (3 inputs, 1 selected)
  Last programmed 17:05:42 ago, and selection made 17:04:59 ago
  Next selection points
    SPA scoped      : None
    Node scoped     : SYSTEM_T0_SEL
    Chassis scoped  : None
```

```

Router scoped : None
Uses frequency selection
S  Input                               Last Selection Point          QL  Pri  Status
==  =====
3  Internal0 [2/RP0]                   n/a                            SEC 255 Available
   1/TE0-W                             n/a                            PRC 100 Locked
   1/TE1-W                             n/a                            PRC 100 Unmonitored

Selection point: RACK2_SEL (4 inputs, 2 selected)
Last programmed 17:05:36 ago, and selection made 17:04:24 ago
Next selection points
  SPA scoped      : None
  Node scoped    : SYSTEM_T0_SEL
  Chassis scoped : None
  Router scoped  : None
Uses frequency selection
S  Input                               Last Selection Point          QL  Pri  Status
==  =====
3  Rack2-Bits0-In                       n/a                            SSU-B 9 Available
4  Internal0 [2/RP0]                   n/a                            SEC 255 Available
   2/TE0-W                             n/a                            PRC 100 Locked
   2/TE1-W                             n/a                            PRC 100 Unmonitored

Selection point: RACK3_SEL (3 inputs, 1 selected)
Last programmed 17:05:39 ago, and selection made 17:04:45 ago
Next selection points
  SPA scoped      : None
  Node scoped    : SYSTEM_T0_SEL
  Chassis scoped : None
  Router scoped  : None
Uses frequency selection
S  Input                               Last Selection Point          QL  Pri  Status
==  =====
3  Internal0 [2/RP0]                   n/a                            SEC 255 Available
   3/TE0-E                             n/a                            PRC 100 Locked
   3/TE1-E                             n/a                            PRC 100 Unmonitored

```

**Step 8** Verify the clock data table for the BITS-In or TE interfaces, using the output of command **show frequency synchronization clock-interfaces**

- Verify that for primary or backup TE Ports, the INPUT should in UP state with proper QL Value.
- Verify that QL Value (Quality) is not DNU.

**Example:**

```

RP/2/RP0:MC_FLT+4+1#show frequency synchronization clock-interfaces
Thu Mar 22 12:27:11.744 IST
Clock interface Rack0-Bits0-In (Up - BITS 2M)
  Assigned as input for selection
  Wait-to-restore time 5 minutes
  SSM supported
  Input:
    Up
  Configured QL: Opt-I/PRC
  Effective QL: Opt-I/PRC, Priority: 9, Time-of-day Priority 100
  Supports frequency
  Output is disabled
Next selection points: RACK0_SEL

Clock interface Rack0-Bits0-Out (Unknown state)
  Wait-to-restore time 5 minutes
  SSM supported and enabled
  Input is disabled
  Output:

```

```
Selected source: Rack0-Bits0-In
Selected source QL: Opt-I/PRC
Effective QL: Opt-I/PRC
Next selection points: None

Clock interface Rack0-Bits1-In (Unknown state)
Wait-to-restore time 5 minutes
SSM supported and enabled
Input:
  Down - not assigned for selection
  Last received QL: None
  Supports frequency
Output is disabled
Next selection points: RACK0_SEL

Clock interface Rack0-Bits1-Out (Unknown state)
Wait-to-restore time 5 minutes
SSM supported and enabled
Input is disabled
Output:
  Selected source: Rack0-Bits0-In
  Selected source QL: Opt-I/PRC
  Effective QL: Opt-I/PRC
Next selection points: None

Clock interface 0/TE0-E (Up - Inter-Chassis Sync)
Wait-to-restore time 5 minutes
SSM supported and enabled
Input is disabled
Output:
  Selected source: Rack0-Bits0-In
  Selected source QL: Opt-I/PRC
  Effective QL: Opt-I/PRC
Next selection points: None

Clock interface 0/TE1-E (Up - Inter-Chassis Sync)
Wait-to-restore time 5 minutes
SSM supported and enabled
Input is disabled
Output:
  Selected source: Rack0-Bits0-In
  Selected source QL: Opt-I/PRC
  Effective QL: Opt-I/PRC
Next selection points: None

Clock interface 0/TE0-W (Up - Inter-Chassis Sync)
Wait-to-restore time 5 minutes
SSM supported and enabled
Input is disabled
Output:
  Selected source: Rack0-Bits0-In
  Selected source QL: Opt-I/PRC
  Effective QL: Opt-I/PRC
Next selection points: None

Clock interface 0/TE1-W (Up - Inter-Chassis Sync)
Wait-to-restore time 5 minutes
SSM supported and enabled
Input is disabled
Output:
  Selected source: Rack0-Bits0-In
  Selected source QL: Opt-I/PRC
  Effective QL: Opt-I/PRC
Next selection points: None
```

**Step 9** Verify SYNCE\_IN interface status using following substeps:

- a) Verify that the SYNCE interfaces are not in Operationally Down State using command **show frequency synchronization interfaces brief**

**Example:**

```
RP/0/RP0:MC_OTN#show frequency synchronization interfaces brief
Thu Mar 22 14:42:52.032 IST
Flags: > - Up                D - Down                S - Assigned for selection
        d - SSM Disabled      x - Peer timed out     i - Init state
        s - Output squelched
Fl  Interface                  QLrcv  QLuse  Pri  QLsnd  Output driven by
==== =====
>   TenGigE0/9/0/2            DNU    n/a    100  PRC    Rack2-Bits0-In
>S  TenGigE0/9/0/8            PRC    PRC    200  PRC    Rack2-Bits0-In
>S  TenGigE2/4/0/2            SSU-A  SSU-A  100  PRC    Rack2-Bits0-In
>S  FortyGigE2/15/0/6         PRC    PRC    10   PRC    Rack2-Bits0-In
```

- b) Verify that the SSM packets are being sent and received using command **show frequency synchronization interfaces**

**Example:**

```
RP/0/RP0:MC_OTN# show frequency synchronization interfaces
Thu Mar 22 14:45:46.452 IST
Interface TenGigE0/9/0/2 (up)
  Wait-to-restore time 5 minutes
  SSM Enabled
  Peer Up for 02:24:29, last SSM received 0.717s ago
  Peer has come up 1 times and timed out 0 times
  ESMC SSMs      Total  Information  Event  DNU/DUS
  Sent:          8672          8671      1      0
  Received:      8672          8668      4      8645
Input:
  Down - not assigned for selection
  Supports frequency
Output:
  Selected source: Rack2-Bits0-In
  Selected source QL: Opt-I/PRC
  Effective QL: Opt-I/PRC
  Next selection points: RACK0_SEL
```