Configure ELAM on UCS

Contents

Introduction

This document describes the use of Embedded Logic Analyzer Module (ELAM) tool within the Unified Computing System (UCS) 4th Generation Fabric Interconnect (FI) 6454, and how to best use it.

Prerequisites

There are no prerequisites for this document.

Requirements

Cisco recommends that you have knowledge of these topics:

- UCS 6454 Fabric Interconnect

Components Used

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Infomation

UCS 4th Gen FI has the capability to run ELAM captures. An ELAM capture comes embedded on the ASIC.

ELAM tool allows real time view of the packets being forwarded at the ASIC level. You can view the details of a packet such as:

- Ingress and Egress Interface
- Maximum Transmission Unit (MTU) Size
- VLAN Tag
- MAC and IP Address of the Source and Destination Device
- Packet Drop and The Cause
- Quality of Service (QoS) Marking

ELAM provides details of packet forwarding. It is nondisruptive to the data plane.

Configure

Log in to UCS via Command Line Interface (CLI).

Run these commands:

```
#connect nxos a|b

#attach module 1

#debug platform internal tah elam asic 0

#trigger init asic 0 slice 0 lu-a2d 1 in-select 6 out-select 1

#set outer ...

#start

#report
```

> **Note**: 4th Gen FI is a single rack unit with one single module (module 1) with one ASIC (asic 0) and one slice (slice 0). See the output below.

```
RCH-SV-FFAIII-A(nx-os)# show hardware internal tah interface ethernet 1/30
########################################
IfIndex: 436222464
DstIndex: 6028
IfType: 26
Interface name Ethernet1/30
Asic: 0
Asic: 0     <<<<<
AsicPort: 49
SrcId: 98
Slice: 0    <<<<<
PortOnSlice: 49
Table entries for interface Ethernet1/30
```

For ELAMs where the trigger is based on packet attributes "lu-a2d 1" is used. Value 6 and 1 will be used for "in-select" and "out-select" respectively for out interest

The "set outer" command is our filter, this is where we define and tell the FI what packet we want to capture, there are a bunch of options and we can be as granular as needed:

```
module-1(TAH-elam-insel6)# set outer ?
  arp   ARP Fields
  fcoe  FCoE Fields
```

```
  ipv4  IPv4 Fields
  ipv6  IPv6 Fields
  l2    All Layer 2 Fields
  l4    L4 Fields

module-1(TAH-elam-insel6)# set outer l2 ?
  cfi            CFI Setting
  cntag_vld      CNTag Information Valid
  cos            Class of Service
  dst_mac        Destination MAC Address
  qtag_vld       VLAN Tag Information Valid
  snap_vld       SNAP Header Information Valid
  src_mac        Source MAC Address
  vlan           VLAN Id (Present only in case of FEX)
  vntag_dvif     VNTAG Destination vif
  vntag_looped   VNTAG Header Looped Valid
  vntag_pointer  VNTAG Header Pointer Valid
  vntag_svif     VNTAG Source vif
  vntag_vld      VNTAG Information Valid

module-1(TAH-elam-insel6)# set outer ipv4 ?
  checksum       Checksum
  dscp           Diff. Serv. Code Point
  dst_ip         Destination IP Address
  ecn            Explicit Congestion Ntfn
  fragment-off   Fragments Offset
  header-len     Header Length
  more-frags     More Fragments Available
  next-protocol  Next Protocol
  packet-len     Packet Total Length
  pyld-len       Payload Length
  src_ip         Source IP Address
  ttl            Time to Live
  version        Version
```

Once the filters have been defined, run the command **start** to run the ELAM tool. If nothing that fullfills the filter condition has been captured then, this is seen:

```
module-1(TAH-elam-insel6)# report

ELAM not triggered yet on slot - 1, asic - 0, slice - 0
```

> **Note**: The "set" command will survive across ELAMs, a good practice is to run a "reset" command everytime we intend to capture traffic with different IP, MAC, etc.

Example

1. Ping from VM 172.16.35.31 to gateway 172.16.35.126:

```
RCH-SV-FFAIII-A(nx-os)# attach module 1
module-1# debug platform internal tah elam asic 0
module-1(TAH-elam)# trigger init asic 0 slice 0 lu-a2d 1 in-select 6 out-select 1

param values: start asic 0, start slice 0, lu-a2d 1, in-select 6, out-select 1

module-1(TAH-elam-insel6)# set outer ipv4 src_ip 172.16.35.31 dst_ip 172.16.35.126
module-1(TAH-elam-insel6)# start
```

```
GBL_C++:  [MSG] rocky_elam_wrapper_init:54:asic type 8 inst 0 slice 0 a_to_d 1 insel 6 outsel 1
GBL_C++:  [MSG] rocky_elam_wrapper_enable:149:asic type 8 inst 0 slice 0 a_to_d 1
GBL_C++:  [MSG]   - writing
data=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000056
08118F800000
00000000000000000560811BF000000000000000000000010000000000000000000000000000000000000000000000000000000
0000000000001
GBL_C++:  [MSG]   - writing
mask=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000007F
FFFFFF800000
00000000000000007FFFFFFF800000000000000000000038000000000000000000000000000000000000000000000000000000
0000000000001

module-1(TAH-elam-insel6)# report

HOMEWOOD ELAM REPORT SUMMARY
slot - 1, asic - 0, slice - 0
============================

Incoming Interface: Eth1/33
Src Idx : 0x1002, Src BD : 35
Outgoing Interface Info: dmod 1, dpid 4
Dst Idx : 0x604, Dst BD : 35

Packet Type: IPv4

Dst MAC address: 8C:60:4F:CD:FD:7C
Src MAC address: 00:25:C5:00:00:1E
.1q Tag0 VLAN: 35,  cos = 0x1

Dst IPv4 address: 172.16.35.126
Src IPv4 address: 172.16.35.31
Ver     =  4, DSCP    =    0, Don't Fragment = 0
Proto   =  1, TTL     =   64, More Fragments = 0
Hdr len = 20, Pkt len =   84, Checksum       = 0x5f19

L4 Protocol  : 1
ICMP type    : 8
ICMP code    : 0

Drop Info:
----------

LUA:
LUB:
LUC:
LUD:
Final Drops:
```

Verify

The packet with src_ip 172.16.35.31 and dst_ip 172.16.35.126 is on VLAN 35 and arrived on port 1/33 (incoming interface) and was destined (outgoing interface) to interface "dpid4" ...the what? "dpid" is the ASIC port internal identifier and the mapping can be found with "show interface hardware-mappings":

```
Incoming Interface: Eth1/33
Src Idx : 0x1002, Src BD : 35

interface Ethernet1/33
  description S: Server, Port-channel 1025
```

```
  no pinning server sticky
  switchport mode fex-fabric
  priority-flow-control mode on
  fex associate 1
  channel-group 1025
  no shutdown

Outgoing Interface Info: dmod 1, dpid 4
Dst Idx : 0x604, Dst BD : 35


RCH-SV-FFAIII-A(nx-os)# show interface hardware-mappings
Legends:
       SMod  - Source Mod. 0 is N/A
       Unit  - Unit on which port resides. N/A for port channels
       HPort - Hardware Port Number or Hardware Trunk Id:
       HName - Hardware port name. None means N/A
       FPort - Fabric facing port number. 255 means N/A
       NPort - Front panel port number
       VPort - Virtual Port Number. -1 means N/A
       Slice - Slice Number. N/A for BCM systems
       SPort - Port Number wrt Slice. N/A for BCM systems
       SrcId - Source Id Number. N/A for BCM systems

--------------------------------------------------------------------------
Name       Ifindex  Smod Unit HPort FPort NPort VPort Slice SPort SrcId
--------------------------------------------------------------------------
.
Eth1/13    1a001800 1    0    4     255   48    -1    0     4     8
```

This "dpid 4" also corresponds to what the "show hardware internal tah interface ethernet 1/13" suggests:

```
RCH-SV-FFAIII-A(nx-os)# show hardware internal tah interface ethernet 1/13
########################################
IfIndex: 436213760
DstIndex: 6096
IfType: 26
Interface name Ethernet1/13
Asic: 0
Asic: 0
AsicPort: 4     <<<<<
SrcId: 8
Slice: 0
PortOnSlice: 4  <<<<<
```

The packet was identified as an Internet Control Message Protocol (ICMP) by the ELAM Layer 4 (L4) Protocol. Refer to list of IANA protocol numbers. You can also filter with a specific MTU size. ELAM triggers only when the exact MTU is hit.

```
module-1(TAH-elam-insel6)# set outer ipv4 src_ip 172.16.35.31 dst_ip 172.16.35.126 packet-len
1500

Dst IPv4 address: 172.16.35.126
Src IPv4 address: 172.16.35.31
Ver     =  4, DSCP    =    0, Don't Fragment = 1
Proto   =  1, TTL     =   64, More Fragments = 0
Hdr len = 20, Pkt len = 1500, Checksum       = 0x1758

L4 Protocol  : 1
ICMP type    : 8
```

```
ICMP code    : 0
```

ARP request from the Virtual Machine (VM) to upstream network, with the MAC addresses set as filter:

```
RCH-SV-FFAIII-B(nx-os)# attach module 1
module-1# debug platform internal tah elam asic 0
module-1(TAH-elam)# trigger init asic 0 slice 0 lu-a2d 1 in-select 6 out-select 1

param values: start asic 0, start slice 0, lu-a2d 1, in-select 6, out-select 1

module-1(TAH-elam-insel6)# set outer l2 src_mac 00:25:c5:00:00:1e dst_mac ff:ff:ff:ff:ff:ff
module-1(TAH-elam-insel6)# start
GBL_C++:  [MSG] rocky_elam_wrapper_init:36:asic type 8 inst 0 slice 0 a_to_d 1 insel 6 outsel 1
GBL_C++:  [MSG] rocky_elam_wrapper_enable:95:asic type 8 inst 0 slice 0 a_to_d 1
GBL_C++:  [MSG]   - writing
data=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000
00000015820463E004B8A00003C00000000000000000000020000000000000000000000000000000000000000000000000000000
0000000000001
GBL_C++:  [MSG]   - writing
mask=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000
0000001FFFFFFFFFFFFFFFFFFFE000000000000000000000380000000000000000000000000000000000000000000000000000000
0000000000001

module-1(TAH-elam-insel6)# report
HOMEWOOD ELAM REPORT SUMMARY
slot - 1, asic - 0, slice - 0
============================

Incoming Interface: Eth1/33
Src Idx : 0x1002, Src BD : 35
Outgoing Interface Info: dmod 1, dpid 4
Dst Idx : 0x604, Dst BD : 35

Packet Type: ARP

Dst MAC address: FF:FF:FF:FF:FF:FF
Src MAC address: 00:25:C5:00:00:1E
.1q Tag0 VLAN: 35,  cos = 0x1

Target Hardware address: 00:00:00:00:00:00
Sender Hardware address: 00:25:C5:00:00:1E
Target Protocol address: 172.16.35.110
Sender Protocol address: 172.16.35.31
ARP opcode: 1

Drop Info:
----------

LUA:
LUB:
LUC:
LUD:
Final Drops:
```

The packet is identified by the system as an ARP, this is especially useful when there is an incomplete ARP entry either at the VM or gateway level.

If applicable, the TCP/UDP ports will be listed as well, SSH is tested here:

```
RCH-SV-FFAIII-B(nx-os)# attach module 1
module-1# debug platform internal tah elam asic 0
module-1(TAH-elam)# trigger init asic 0 slice 0 lu-a2d 1 in-select 6 out-select 1

param values: start asic 0, start slice 0, lu-a2d 1, in-select 6, out-select 1

module-1(TAH-elam-insel6)# set outer ipv4 src_ip 172.16.35.126 dst_ip 172.16.35.31

module-1(TAH-elam-insel6)# start
GBL_C++:  [MSG] rocky_elam_wrapper_init:36:asic type 8 inst 0 slice 0 a_to_d 1 insel 6 outsel 1
GBL_C++:  [MSG] rocky_elam_wrapper_enable:95:asic type 8 inst 0 slice 0 a_to_d 1
GBL_C++:  [MSG]   - writing
data=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000056
0811BF0000
00000000000000000005608118F8000000000000000000000010000000000000000000000000000000000000000000000000000
000000000000001
GBL_C++:  [MSG]   - writing
mask=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000007F
FFFFFF8000
00000000000000000007FFFFFFF8000000000000000000000038000000000000000000000000000000000000000000000000000
000000000000001

module-1(TAH-elam-insel6)# report

HOMEWOOD ELAM REPORT SUMMARY
slot - 1, asic - 0, slice - 0
============================

Incoming Interface: Eth1/14
Src Idx : 0x604, Src BD : 35
Outgoing Interface Info: dmod 1, dpid 44
Dst Idx : 0x1002, Dst BD : 35

Packet Type: IPv4

Dst MAC address: 00:25:C5:00:00:1E
Src MAC address: 8C:60:4F:CD:FD:7C
.1q Tag0 VLAN: 35,  cos = 0x0

Dst IPv4 address: 172.16.35.31
Src IPv4 address: 172.16.35.126
Ver     =  4, DSCP    =    0, Don't Fragment = 0
Proto   =  6, TTL     =   64, More Fragments = 0
Hdr len = 20, Pkt len =   60, Checksum       = 0x27f5

L4 Protocol  : 6
TCP Dst Port : 22
TCP Src Port : 15067

Drop Info:
----------

LUA:
LUB:
LUC:
LUD:
Final Drops:
```

Troubleshoot

Drops are recorded as well. The FI drops an ARP request:

```
RCH-SV-FFAIII-B(nx-os)# attach module 1
module-1# debug platform internal tah elam asic 0
module-1(TAH-elam)# trigger init asic 0 slice 0 lu-a2d 1 in-select 6 out-select 1

param values: start asic 0, start slice 0, lu-a2d 1, in-select 6, out-select 1

module-1(TAH-elam-insel6)# set outer l2 src_mac 00:25:c5:00:00:1e dst_mac ff:ff:ff:ff:ff:ff

module-1(TAH-elam-insel6)# start
GBL_C++:  [MSG] rocky_elam_wrapper_init:54:asic type 8 inst 0 slice 0 a_to_d 1 insel 6 outsel 1
GBL_C++:  [MSG] rocky_elam_wrapper_enable:149:asic type 8 inst 0 slice 0 a_to_d 1
GBL_C++:  [MSG]   - writing
data=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000971400007BFFFF
FFFFFFFC00001
GBL_C++:  [MSG]   - writing
mask=0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000003FFFFFFFFFFFFFFF
FFFFFFFC00001

module-1(TAH-elam-insel6)# report
HOMEWOOD ELAM REPORT SUMMARY
slot - 1, asic - 0, slice - 0
============================

Incoming Interface: Eth1/18
Src Idx : 0x603, Src BD : 35
Outgoing Interface Info: dmod 0, dpid 0
Dst Idx : 0x0, Dst BD : 35

Packet Type: ARP

Dst MAC address: FF:FF:FF:FF:FF:FF
Src MAC address: 00:25:C5:00:00:1E
.1q Tag0 VLAN: 35,  cos = 0x1

Target Hardware address: 00:00:00:00:00:00
Sender Hardware address: 00:25:C5:00:00:1E
Target Protocol address: 172.16.35.99
Sender Protocol address: 172.16.35.31
ARP opcode: 1

Drop Info:
----------

LUA:
LUB:
LUC:
LUD:
  MC_RPF_FAIILURE
  SRC_VLAN_MBR
Final Drops:
  MC_RPF_FAIILURE
  SRC_VLAN_MBR
```

The FI receives an ARP request on port 1/18 (this is an uplink port) with a source MAC of 00:25:c5:00:00:1e which is learned locally on a virtual Ethernet (vEth) ports. This condition triggers a Reverse Path Forward (RPF) drop. Notice that the **Outgoing Interface Info** reports **dpid 0** which is a drop.

VLAN 35 is not allowed on port 1/18 and this also triggered drop **SRC_VLAN_MBR.**

```
RCH-SV-FFAIII-A(nx-os)# show run interface ethernet 1/18

interface Ethernet1/18
  description U: Uplink
  pinning border
  switchport mode trunk
  switchport trunk allowed vlan 1
  channel-group 105 mode active
```

Related Information

- **ELAM Overview**
- **Technical Support & Documentation - Cisco Systems**