Understanding Multi-Stream

VESADisplayPort Workshop, Taipei  May 2013

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Multi-Stream Basics

- MST Extension
- MTP (Multi-Stream Transport Packet)
- VC (Virtual Channel) Payload
- Video Stream Symbol Mapping within VCP
- Addition/Deletion of Streams
- MST Topology Management
MST (Multi-Stream Transport) Extension

- De-coupling of Virtual Channels between stream sources and stream sinks from physical channels

**NOTE:** Widths of the arrows imply stream bandwidths
MST Extension (continued)

- Micro-Packet-based, time-division multiplexing to enable transport of multiple AV streams over a single physical connection
  - In theory, up to 63 AV streams transportable concurrently
  - Not “one stream per lane”
  - No synchronicity assumed among streams transported over a single physical channel
    - E.g., Streams may have different frame rates (24Hz / 25Hz /50Hz/ 59.94Hz /60Hz / 72Hz /75Hz…)
  - Addition/deletion of a stream without affecting the remaining streams
  - Packetizing overhead as small as 1.6%
MTP (Multi-Stream Transport Packet)

- The unit of Micro-Packet in MST Mode
  - 64 time slots long
    - 1\textsuperscript{st} time slot of MTP used as MTP Header
    - Remaining 63 time slots allocated to carry streams
      - Carries 00’s when unallocated for a stream transport
  - 1024 MTP’s constitute a “Link Frame”
    - 1 Link frame = $2^{16}$ time slots long

![Diagram of MTP and Link Frame]
VC (Virtual Channel) Payload

- VC Payload = Time slots within MTP (excluding MTP Header) allocated for transporting a stream
  - One AV stream per VC Payload
- Example: 1080p60Hz, 30bpp over 4-lane, 5.4Gbps/lane Main Link
  - Pixel bandwidth = 148.5Mpixels/sec * (30/8) bytes/pixel = 556.875Mbytes/sec
  - 1 time slot per MTP = 540Mbytes/sec/lane * 4 lanes / 64 time slots per MTP
    = 33.75Mbytes/sec/time slot
  - VC Payload time slot count for this stream over this Main Link (VCP1)
    = CEIL (556.875 / 33.75) = 17 time slots
Video Stream Symbol Mapping within VCP

- Active video pixel data framed with BE and BS Control Symbols
- When no pixel to transport (e.g., video blanking period), insert SF (Stream Fill) control symbols
- MSA (Main Stream Attributes) Packet to replace SF symbols once per vertical blanking interval to describe video stream attributes

**NOTE:** Stream symbols carried in a VCP form the above when concatenated across MTP's
Addition/Deletion of Streams

- One stream at a time
  - Time slot allocation change agreed on between TX and RX via sideband communication
  - Addition/deletion of a VC Payload over Main Link synchronized between TX and RX by inserting ACT (Allocation Change Trigger) symbol in four consecutive MTP Headers preceding the change

**NOTE:** Four MTP Headers preceding the allocation change carry ACT symbol sequence
GUID

Global Unique Identifier

- Topology Management Layer identifies each MST device in a branching unit
- MST device may perform more than one function i.e. USB hub.
- GUID identifies the physical unit that contains multiple functions
  - Source assigns 16-byte GUID unless the device already has one
DP Audio Transport

- Available bandwidth supports 4Kx2K 60Hz progressive, YCbCr444 30bits per pixel and 2 streams of 192kHz, 22.2ch audio
- Audio transport without video supported
- Multi-Stream allows routing of multiple audio streams to multiple audio rendering devices
- Audio inter-channel synchronization across multiple audio rendering devices supported
  - Aligns real-time clock of each device in 100-ns precision via GTC (Global Time Code)
  - Audio stream source device to specify the presentation time of an audio frame in the audio stream packet
MST Topology Management

- **Node addressing through discovery procedure**
  - Topology Manager (typically a DP Source device) discovers the path to the other DP device
  - Plugging/unplugging of a device handled without resetting the address set of the entire link

- **Supports topology containing multiple DP Source and Sink devices**
  - Initial main focus: a single DP Source device driving multiple displays

![MST Topology Diagram]
Multistream Reference

Multi-Stream Use Case Example 1.0

1 Example MST Topology without Audio Stream Sink

This document covers how an MST DP Source device and a device containing MST Branching Unit are to interact to perform typical topology and payload bandwidth management functions in the following logical topology.

Figure 1-1: Logical Topology Covered in this Document
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MST Compliance Test Introduction

- MST Compliance Test Introduction
  - Protocol Test
    - Source
    - Branch Sink or Hub
    - Multi-Stream Sink
  - Interoperability Test
    - Source
    - Branch Sink or Hub
    - Multi-Stream Sink
MST Compliance Test Introduction

- 5 Configurations for Protocol Test
  - Configuration A
  - Configuration B
  - Configuration C
  - Configuration D
  - Configuration E
MST Compliance Test Introduction

- Protocol Test
  - Configuration A

- Video
- Audio
- HBR2
- DPCD 1.2
- Payload Allocation
- GUID
- EDID
MST Compliance Test Introduction

- Protocol Test
  - Configuration B

PC

Branch Sink 0

Branch Sink 1

Position 0

Position 1

Position 2

Aux Monitor 0

Aux Monitor 1

TX Link0 RX

TX Link1 RX

✓ Video/Audio/HBR2/DPCD 1.2
✓ Payload Allocation/GUID/EDID
MST Compliance Test Introduction

- Protocol Test
  - Configuration C

Position 0
- PC
- TX Link0 RX
- Aux Monitor 0
- ✓ Video/Audio/HBR2/DPCD 1.2
- ✓ Payload Allocation/GUID/EDID

Position 1
- Branch Sink 0
- TX Link1 RX

Position 2
- Branch Sink 1

Position 3
- Branch Sink 2
- Aux Monitor 1
- TX Link2 RX

Position 3
- Aux Monitor 1
MST Compliance Test Introduction

- Protocol Test
  - Configuration D

Position 0
PC

Position 1
Branch Sink 0

Position 2
Branch Sink 1

Position 3
Branch Sink 2

Position 4
SST Sink

- Video/Audio/GUID
- HBR2/DPCD 1.2/EDID
- Payload Allocation
MST Compliance Test Introduction

- Protocol Test
  - Configuration E

Position 0

PC

Aux Monitor 0

- Video/Audio/GUID
- HBR2/DPCD 1.2/EDID
- Payload Allocation

Branch Sink 0

Branch Sink 1

Branch Sink 2

SST Sink
## Interop Test Matrix

**Branch Sink**

<table>
<thead>
<tr>
<th>Pos 0</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos 1</td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
</tr>
<tr>
<td>Pos 2</td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>BS0</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
</tr>
<tr>
<td>Pos 3</td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
<td><strong>BS1</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
</tr>
<tr>
<td>Pos 4</td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>BS2</strong></td>
<td><strong>DUT</strong></td>
<td><strong>DUT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pos 5</td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
<td><strong>SST</strong></td>
</tr>
</tbody>
</table>
# MST Compliance Test Introduction

Reference: DP 1.2a Standard

<table>
<thead>
<tr>
<th>DisplayPort Address</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000h</td>
<td><strong>DPCD_REV</strong>: DPCD revision number</td>
</tr>
<tr>
<td></td>
<td>Bits 3:0 = Minor revision number</td>
</tr>
<tr>
<td></td>
<td>Bits 7:4 = Major revision number</td>
</tr>
<tr>
<td></td>
<td>10h for DPCD Rev.1.0</td>
</tr>
<tr>
<td></td>
<td>11h for DPCD Rev.1.1</td>
</tr>
<tr>
<td></td>
<td>12h for DPCD Rev 1.2</td>
</tr>
<tr>
<td></td>
<td>A DP device with uPacket RX with a DPCD Revision number of 1.2 and above must support GUID at DPCD Addresses 00030h ~ 0003Fh. Furthermore, a DP Sink device with DPCD Rev.1.2 with a stereo display capability support (as declared in EDID and Display ID) must support the handling of 3D Stereo inband signaling using Video_Stream_Configuration (VSC) Packet.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: The DPCD revision number does not necessarily match the DisplayPort version number.</td>
</tr>
<tr>
<td>00001h</td>
<td><strong>MAX_LINK_RATE</strong>: Maximum link rate of Main Link lanes = Value x 0.27Gbps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Read/Write over AUX CH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Only</td>
</tr>
<tr>
<td>Read Only</td>
</tr>
</tbody>
</table>
# MST Compliance Test Introduction

Reference: DP 1.2a Standard

<table>
<thead>
<tr>
<th>DisplayPort Address</th>
<th>Definition</th>
<th>Read/Write over AUX CH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Link Configuration Field</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00100h</td>
<td>LINK_BW_SET : Main Link Bandwidth Setting=Value x 0.27Gbps per lane&lt;br&gt;Bits 7:0 = LINK_BW_SET&lt;br&gt;For DisplayPort Version 1, Revision 1a, only three values are supported. All other values are RESERVED.&lt;br&gt;06h = 1.62Gbps per lane&lt;br&gt;0Ah = 2.7Gbps per lane&lt;br&gt;14h = 5.4Gbps per lane&lt;br&gt;The Source may choose any of the three link bandwidths as long as it does not exceed the capability of DisplayPort receiver as indicated in the receiver capability field.</td>
<td>Write/Read</td>
</tr>
<tr>
<td>00101h</td>
<td>LANE_COUNT_SET : Main Link Lane Count = Value&lt;br&gt;Bits 4:0 = LANE_COUNT_SET&lt;br&gt;For DisplayPort Version 1, Revision 1a, only the following three values are supported. All other values are RESERVED.&lt;br&gt;1h = 1-lane&lt;br&gt;2h = 2-lanes&lt;br&gt;4h = 4-lanes&lt;br&gt;For 1-lane configuration, Lane 0 is used. For 2-lane configuration, Lane 0</td>
<td>Write/Read</td>
</tr>
</tbody>
</table>
MST Compliance Test Introduction

Check Link Training = HBR2

Link may not train to HBR2 if bandwidth need is lower
**MST Compliance Test Introduction**

Check for DPCD Revision= 1.2

---

### Unigraf DisplayPort AUX Channel monitor report

#### AUX CHANNEL TRANSATIONS AND EVENTS

<table>
<thead>
<tr>
<th>Transaction ID</th>
<th>Time</th>
<th>Event Type</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>DPA-400 INFO</td>
<td>Start: HPD=Low INO=High IN1=High IN2=Hi</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.05</td>
<td>Unknown Event</td>
<td>Changed: HPD=High</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7368.77</td>
<td>Source Native</td>
<td>Req RD 1 bytes from 0x000000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7368.83</td>
<td>Sink Native AUX_ACK, 1 bytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7368.96</td>
<td>Source Native</td>
<td>Req RD 5 bytes from 0x680000</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7369.02</td>
<td>Sink Native AUX_ACK, 5 bytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7369.15</td>
<td>Source Native</td>
<td>Req RD 1 bytes from 0x680200</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>7369.25</td>
<td>Sink Native AUX_ACK, 1 bytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>7369.34</td>
<td>Source Native</td>
<td>Req RD 1 bytes from 0x68029</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7369.41</td>
<td>Sink Native</td>
<td>AUX_ACK, 1 bytes</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>7369.56</td>
<td>Source Native</td>
<td>Req RD 16 bytes from 0x000000</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7369.76</td>
<td>Sink Native</td>
<td>AUX_ACK, 16 bytes</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>7369.93</td>
<td>Source Native</td>
<td>Req RD 3 bytes from 0x000200</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>7370.05</td>
<td>Sink Native</td>
<td>AUX_ACK, 3 bytes</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>7370.18</td>
<td>Source Native</td>
<td>Req RD 1 bytes from 0x00330</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>7370.27</td>
<td>Sink Native AUX_ACK, 1 bytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>7370.37</td>
<td>Source Native</td>
<td>Req RD 16 bytes from 0x00080</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>7370.43</td>
<td>Sink Native</td>
<td>AUX_ACK, 16 bytes</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>7370.56</td>
<td>Source Native</td>
<td>Req RD 1 bytes from 0x0050a</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>7370.75</td>
<td>Sink Native</td>
<td>AUX_ACK, 1 bytes</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>7370.85</td>
<td>Source Native</td>
<td>Req RD 4 bytes from 0x002002</td>
<td></td>
</tr>
</tbody>
</table>

#### TRANSACTION DETAILS

**4 AUX_ACK, 1 bytes**

- **Info**
  - Time: 7368.03ms
  - Event: Native
  - Source: Sink

- **HEX Dump**
  - 00 12

- **Content decoder**
  - Line #4: 7368.83ms
  - AUX_ACK, 1 bytes
  - DPCD_REV[8:0] (DPCD revision number)
    - 0x0000 = 0x12
    - DPCD v1.2
MST Compliance Test Introduction

Check for EDID from Sideband Messages

<table>
<thead>
<tr>
<th>Sink</th>
<th>Native</th>
<th>AUX_ACK</th>
<th>7 bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>237</td>
<td>0x507.20</td>
<td>Sink T.</td>
<td>Sb Reply</td>
</tr>
<tr>
<td>238</td>
<td>0x507.36</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>239</td>
<td>0x507.42</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>240</td>
<td>0x430.70</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>241</td>
<td>0x430.85</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>242</td>
<td>0x440.03</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>243</td>
<td>0x440.10</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>244</td>
<td>0x472.93</td>
<td>Unknown</td>
<td>Event</td>
</tr>
<tr>
<td>245</td>
<td>0x473.66</td>
<td>Unknown</td>
<td>Event</td>
</tr>
<tr>
<td>246</td>
<td>0x473.89</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>247</td>
<td>0x473.98</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>248</td>
<td>0x474.21</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>249</td>
<td>0x474.27</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>250</td>
<td>0x474.43</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>251</td>
<td>0x474.53</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>252</td>
<td>0x474.72</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>253</td>
<td>0x474.62</td>
<td>Sink</td>
<td>Native</td>
</tr>
<tr>
<td>254</td>
<td>0x475.04</td>
<td>Source</td>
<td>Native</td>
</tr>
<tr>
<td>255</td>
<td>0x475.10</td>
<td>Sink</td>
<td>Native</td>
</tr>
</tbody>
</table>

---

Show printer friendly format... Show report information...
**Check Allocate Payload**

<table>
<thead>
<tr>
<th>Line</th>
<th>Code</th>
<th>Source</th>
<th>Native</th>
<th>Req WR 16 bytes to 0x01000</th>
</tr>
</thead>
<tbody>
<tr>
<td>918</td>
<td>10244.99</td>
<td>Source</td>
<td>Native</td>
<td>Req WR 16 bytes to 0x01000</td>
</tr>
<tr>
<td>919</td>
<td>10244.99</td>
<td>Source T. SD Req.</td>
<td>DOWN REQ - REPLY: ALLOCATE PAYLOAD</td>
<td></td>
</tr>
<tr>
<td>920</td>
<td>10245.44</td>
<td>Sink</td>
<td>Native</td>
<td>AUX DEFER, 0 bytes</td>
</tr>
<tr>
<td>921</td>
<td>10245.92</td>
<td>Source</td>
<td>Native</td>
<td>Req WR 16 bytes to 0x01000</td>
</tr>
</tbody>
</table>

**Content decoder**

```
Line #933 - 10247.90ms
DOWN_REQ - REPLY: ALLOCATE PAYLOAD

-- Sideband message header --
Link_Count_Total = 1
Link_Count_Remaining = 0
Broadcast_Message = 0
Path_Message = 1
MSG_Body_Length = 6
Start_Of_MT = 1
End_Of_MT = 1
Message_Sequnce_No = 0

-- Sideband message validity check --
MSG_Header_CRC = 5 [Good]
MSG_Body_CRC = 7 [Good]
Header Reserved (Zero) fields = Good

-- Message Transaction decoded --
ACK
Request_Identifier = 0x11 [ALLOCATE PAYLOAD]
Port_Number = 6
Virtual_Channel_Payload_ID = 2
Payload_Bandwidth_Number = 689
```

**Graphics driver may allocate all remaining bandwidth to the last device in the chain**
## MST Compliance Test Introduction

### Check GUID

<table>
<thead>
<tr>
<th>Time</th>
<th>PMID</th>
<th>Sink T.</th>
<th>Sd Req.</th>
<th>UP REQ - REQ: CONNECTION STATUS NOTIFY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1037</td>
<td>56493.89</td>
<td>Sink T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1038</td>
<td>56494.05</td>
<td>Source T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1039</td>
<td>56494.11</td>
<td>Sink T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1040</td>
<td>56494.24</td>
<td>Source T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1041</td>
<td>56494.24</td>
<td>Source T.</td>
<td>Sd Reply</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1042</td>
<td>56494.37</td>
<td>Sink T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1043</td>
<td>56494.50</td>
<td>Source T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1044</td>
<td>56495.42</td>
<td>Source T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1045</td>
<td>56495.55</td>
<td>Sink T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1046</td>
<td>56495.67</td>
<td>Unknown Event</td>
<td>Changed: HFP-Low</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1047</td>
<td>56495.67</td>
<td>Unknown Event</td>
<td>Changed: HFP-High</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1048</td>
<td>56495.63</td>
<td>Source T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1049</td>
<td>56495.73</td>
<td>Sink T.</td>
<td>Sd Req.</td>
<td>UP REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1050</td>
<td>56495.83</td>
<td>Source T.</td>
<td>Sd Req.</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1051</td>
<td>56495.93</td>
<td>Sink T.</td>
<td>Sd Req.</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1052</td>
<td>56495.94</td>
<td>Source T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1053</td>
<td>56495.99</td>
<td>Sink T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1054</td>
<td>56495.10</td>
<td>Source T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1055</td>
<td>56495.11</td>
<td>Sink T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1056</td>
<td>56495.12</td>
<td>Source T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1057</td>
<td>56495.19</td>
<td>Sink T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
<tr>
<td>1058</td>
<td>56495.20</td>
<td>Source T.</td>
<td>Sd Reply</td>
<td>Up REQ - REQ: CONNECTION STATUS NOTIFY</td>
</tr>
</tbody>
</table>

### Content decoder

- **Line #1037 - 56493.89ms**
- **UP REQ - REQ: CONNECTION STATUS_NOTIFY**

  **Sideband message header**
  - **Link_Count_Total** = 1
  - **Link_Count_Remaining** = 7
  - **Broadcast_Message** = 1
  - **Path_Message** = 0
  - **MSG_Body_Length** = 20
  - **Start_Of_MT** = 1
  - **End_Of_MT** = 1
  - **Message_Sequence_No** = 0

  **Sideband message validity check**
  - **MSG_Header_CRC** = 6 (Good)
  - **MSG_Body_CRC** = 193 (Good)
  - **Header Reserved (Zero) fields** = Good

  **Message Transaction decoded**
  - **CONNECTION_STATUS_NOTIFY** (0x02)
  - **Port_Number** = 1
  - **Global.Unique_IDentifier** = 0x10de90700000000217ed295500000036
  - **Legacy_Device_Plug_Status** = 0
  - **Display_Port_Device_Plug_Status** = 1
  - **Messaging_Capability_Status** = 0
  - **Input_Port** = 0
  - **Peer_Device_Type** = 3
MST Compliance Test Introduction

- Interoperability Test

Position 0
PC

Position 1
Branch Sink 0

Position 2
Branch Sink 1

Position 3
Branch Sink 2

Position 4
SST Sink

✓ System Sleep/Monitor Sleep
✓ HDCP/Hot-Plug
✓ Power Cycle
Live Demo about MST Compliance Test

Test Equipment for Demo

MST Source

Aux Monitor

Branch Sink

Let’s GO
Live Demo about MST Compliance Test

Test Configuration A for Demo

MST Source

Aux Monitor

Branch Sink

Let’s GO
Live Demo about MST Compliance Test

Test Configuration B for Demo

MST Source

Aux Monitor

Branch Sink

Let’s GO
One Stop Logo Solution at Allion

Bus Interface

Radio Frequency

OS, Content & Storages
Live Demo about MST Compliance Test

Thank you!