OAI High Speed and System Workstreams Update
OAI High Speed and System Workstream Update

Song Kok Hang, Principal Engineer, Intel
Bichen Chen, SI Engineer, Meta
• OAI Workgroup 2022 Scope
• OAM v2.0 Update
• UBB v2.0 Update
• EXP v1.0 Update
• OAM/UBB/EXP SI Challenges
OAI Workgroup 2022 Scope

- **Q4'2018**: OAM Concept, 25G-NRZ, PCIe G3, 450W, Air Cooled
- **Q2,2019**: OAM v1.0, UBB v0.4, 28G-NRZ, PCIe G4, 700W (450W), Air Cooled
- **Q2'2020**: OAM v1.1, UBB v1.0, 56G-PAM4, PCIe G4, 700W (450W), Air/Liquid Cooled
- **Q1'2022**: OAM v1.5, UBB v1.5, 112G-PAM4, PCIe G5, 700W
- **Q3/4'2022**: OAM v2.0, UBB v2.0, EXP v1.0, 112G-PAM4, PCIe G5/G6, 1000W, Air/Liquid Cooled
OAM v2.0 Update

- Dimension - 170mm (L) x 102mm (W)
- Two Input Voltages – 48V/54V and 3.3V
- TDP - 1KW with Dual Power Entries
- OAM/UBB Connector Stacking Height: 5mm or 8mm
- SerDes Speed – 112G-PAM4 (LR) and PCIe Gen6
UBB v2.0 Update

- Dimension ~ 655mm (L) x 417mm (W)
- Support 8x OAM and up to 8x EXP
- Support RoT Security Module
- End to End Loss Budget @28GHz – 28-30dB

OAM to OAM Loss Budget – 28-30dB
OAM Tx (8dB) + UBB (12-14dB) + OAM Rx (8dB)

EXP to OAM Loss Budget – 28-30dB
EXP Tx/Rx (6dB) + UBB (16-18dB) + OAM Tx/Rx (8dB)
EXP v1.0 Update

- Dimension - 160mm (W) x 150mm (H)
- Two Input Voltages – 48V/54V and 3.3V
- TDP – up to 400W
- PHY Retimer Config
  - 200W
  - One HS Connector (4 x8 SerDes Input)
  - 4 x8 Scale Out Ports (OSFP or QSFP-DD)
- Switch Config
  - 400W
  - Two HS Connectors (8 x8 SerDes Input)
  - 4 x8 Scale Out Ports (OSFP or QSFP-DD)
- Other Configs Supported – NIC, Remote Memory and more
EXP v1.0 Update

PHY Retimer Config

Switch Config

OAM/UBB/EXP SI Challenges

- **Scale Up**
  - Longest Trace Length - 13.5”
  - 800G PCB Material - 0.85dB/in
  - UBB WC Channel Loss - 11.5dB

- **Scale Out**
  - Longest Trace Length – 20”
  - 800G PCB Material - 0.85dB/in
  - UBB WC Channel Loss - 17dB
OAM to OAM Loss Budget – 28-30dB

OAM Tx (8dB) + UBB (12-14dB) + OAM Rx (8dB)

EXP to OAM Loss Budget – 28-30dB

EXP Tx/Rx (6dB) + UBB (16-18dB) + OAM Tx/Rx (8dB)
OAM/UBB/EXP SI Challenges

- SI performance of scale up channels with longest possible routing were studied by using post-layout simulation

Mimicking UBB layout

Mimicking OAM layout with 2.4mm coaxial connectors
OAM/UBB/EXP SI Challenges

- SI performance of scale up by using IEEE 802.3.ck COM
OAM/UBB/EXP SI Challenges

- SI performance of scale out channels with PHY retimer configuration were studied.
- EXP cards were routed and simulated (post-layout) by 4 participants, and cascaded with longest scale out routings on the UBB (post-layout).
- The cascaded channel were quantified SI metric of using IEEE 802.3.CK COM (CEI-112G LR equivalent).
scale out channel’s cascaded S-parameters comparison with PHY retimer configuration
scale out channel's comparison with PHY retimer configuration by using IEEE 802.3.CK COM

<table>
<thead>
<tr>
<th>Connector Vendor</th>
<th>HS layer counts</th>
<th>Longest routing on the EXP</th>
<th>COM (&gt;3dB)</th>
<th>ERL (&gt;9.7dB)</th>
<th>FOM  ILD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>3in – 4in</td>
<td>4.627dB</td>
<td>13.144dB</td>
<td>0.159</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.375dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>3in – 4in</td>
<td>6.448dB</td>
<td>13.3998dB</td>
<td>0.1081</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.417dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>3in – 4in</td>
<td>5.368dB</td>
<td>16.969dB</td>
<td>0.081</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.166dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>3in – 4in</td>
<td>4.852dB</td>
<td>16.032dB</td>
<td>0.1317</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.96dB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Call to Action

Get involved in the project:

OCP Server Project:  https://www.opencompute.org/projects/server

OAI Subgroup:  https://www.opencompute.org/wiki/server/OAI

OAI Mailing List:  https://oc-all.goup.io/g/OCP-OAI