Ethernet Is The New Fabric-of-Choice for Storage Expansion

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If NVMe is the future, what fabric would replace the traditional SAS/SATA backplane?

* Marvell market view
Options for NVMe Expansion

- **NVMe All-Flash-Array**
  - ToR / FC Switch
  - Connectivity
  - Compute
  - DDR
  - PCIe Switch
  - NVMe
  - NVMe
  - …
  - NVMe

- **Composable NVMe (1.0) FBOF**
  - ToR / FC Switch
  - Connectivity
  - Compute
  - DDR
  - Connectivity & Compute
  - DDR
  - PCIe Switch
  - NVMe
  - NVMe
  - …
  - NVMe

- **Composable NVMe (2.0) EBOF**
  - ToR
  - Connectivity
  - Compute
  - DDR
  - Ethernet Switch
  - NVMe
  - NVMe
  - …
  - NVMe-oF

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Open. Together.
## NVMe expansion: Fabric Comparison

<table>
<thead>
<tr>
<th></th>
<th>Ethernet (EBOF)</th>
<th>PCIe (FBOF)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connectivity</strong></td>
<td>NVMe-oF SSD Ethernet Switch</td>
<td>Compute, DDR, PCIe Switch</td>
</tr>
<tr>
<td><strong>Switch Throughput</strong></td>
<td>6.4Tb/s (25Gb/s ports) 12.8Tb/s (50Gb/s ports)</td>
<td>3TB/s (Gen3 x96) 6TB/s (Gen4 x96)</td>
</tr>
<tr>
<td><strong>Latency</strong></td>
<td>SSD + Transport (80~400us)</td>
<td>SSD only (60~200us)</td>
</tr>
<tr>
<td><strong>IOPS</strong></td>
<td>SSDs (24SSDs = 16MIOPS)</td>
<td>Bound by Compute/DDR (24SSDs = 10MIOPS)</td>
</tr>
<tr>
<td><strong>Oversubscription</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Daisy chain shelves</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Proposed Architectural Changes

Existing FX-16 (PCIe fabric):

Future Ethernet eFX-16 (RDMA/TCP fabric):
Proposed Architectural Changes

Existing FX-16 (PCIe fabric):

Future Ethernet eFX-16 (RDMA/TCP fabric):

Better Scalability!
**Better Rack TCO**

Existing FX-16 (PCIe fabric)  
Future eFX-16 (Ethernet fabric)

<table>
<thead>
<tr>
<th>ToR (Switch)</th>
<th>1</th>
<th>4</th>
<th>2</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Node (Server)</td>
<td>Utility Node (Server)</td>
<td>Head Node (2S 500W)</td>
<td>Head Node (2S 500W)</td>
<td>Head Node (2S 500W)</td>
</tr>
<tr>
<td>FX-16 (50W)</td>
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</tr>
</tbody>
</table>

- **50% more capacity**
- **30% less power**
- **20% lower rack cost**

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Summary

• Ethernet has many advantages for NVMe Storage expansion
• Call for action:
  • Future EBOF FX-16 proposal (eFX-16?)
  • Possible EBOD DX-88 proposal (eDX-88?)
  • Standardization of SSD connectors with ethernet
  • Technology demonstration at Marvell booth