Building a Phased Plan for End-to-End FCoE

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Server Virtualization - # Driver of ELX Value

- #1 Driver of 10Gb Deployment
- Core to Cloud Computing
- Top Catalyst for Convergence
- Emulex Software Differentiation
- Driver of Bandwidth Aggregation
10GbE and Converged Networking Adoption

10Gb LOM and Adapters for Blade Servers
50% of IT Managers Cite Virtualization as the Driver of 10GbE in Blades

10Gb NAS and iSCSI
Drive IP SAN Storage for Unstructured Data

Rack Server Fabric-based Computing
Drive 10Gb UCNAs into Servers

Broad Rack & Blade 10GbE Adoption
10GbE LOM and NDC

1-2 Socket Server via Network Daughter Cards

FCoE Storage 25% of I/O
10GbE LOM Everywhere

Sources:
Dell’Oro 2010 Adapter Forecast
ESG Deployment Paper 2010
IDC WW External Storage Report 2010
IT Brand Pulse 10GbE Survey April 2010
VM Density drives more I/O throughput

What would you estimate is the average number of virtual machines per physical x86 server in your environment today? How do you expect this to change over the next 24 months? (Percent of respondents, N=463)

<table>
<thead>
<tr>
<th>Category</th>
<th>Today</th>
<th>24 months from now</th>
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</thead>
<tbody>
<tr>
<td>Less than 5 virtual machines per physical x86 server</td>
<td>26%</td>
<td>8%</td>
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<tr>
<td>5 to 10 virtual machines per physical x86 server</td>
<td>36%</td>
<td>24%</td>
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<tr>
<td>11 to 25 virtual machines per physical x86 server</td>
<td>24%</td>
<td>23%</td>
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<tr>
<td>More than 25 virtual machines per physical x86 server</td>
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</tr>
<tr>
<td>Don't know</td>
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### VMware – The Most Important IT Company

<table>
<thead>
<tr>
<th>CPUs</th>
<th>Cores</th>
<th>VMs/Core</th>
<th>Gb/Sec</th>
<th>Total GB</th>
<th>LOM Ports</th>
<th>UCNA Ports</th>
<th>HA Ports</th>
<th>Extra CNAs</th>
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<tbody>
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<td>6</td>
<td>0.15</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>4</td>
<td>8</td>
<td>0.20</td>
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<td>8</td>
<td>10</td>
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<td>4</td>
<td>8</td>
<td>4</td>
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<tr>
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<td>8</td>
<td>14</td>
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<td>5</td>
<td>10</td>
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<td>8</td>
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<td>307</td>
<td>2</td>
<td>11</td>
<td>22</td>
<td>11</td>
</tr>
</tbody>
</table>

*Every 8 VMs/System Drives the Need for a Extra UCNA Adapter!*
I/O Industry Road Map

Unified Storage
Ethernet High Performance Computing
Value Added I/O Services

Fibre Channel
Converged Networking
Universal LOMs

2010
2011
2012
2013

8Gb
10Gb
10Gb
10Gb

16Gb
10GBaseT
10GBaseT
10GBaseT

32Gb
10Gb
40Gb
10Gb

PCI Gen3
SRIOV
MRIOV

Multi-fabric Technology
Low Latency RDMA Over CEE
Ultra Low Latency

Encryption I/O Management

16Gb
40Gb

40Gb
100Gb

Ultra Low Latency
Busting the Convergence Myths

Rip & Replace Required…

Convergence Cost > 2 Networks…

LOMs Can’t Do Storage…

Convergence is More Complex…

Convergence Means Performance Tradeoffs…
No Rip and Replace Required

Future Proof

LAN

NETWORK CONVERGENCE

SAN

Protects Your Management Investment

Protects Your Configuration Investment

Protects Your LAN & SAN Investment
Convergence Cost > 2 Networks

Before Convergence

After Convergence

100% 100%

28%* 42%*

80%* 28%

* Data from Emulex Convergenomics Calculator
Convergence is too Complex...

Deploying 6 NICs and 2 FCoE Ports

Consolidation of Networks, Conservation of Power, Controlling Costs…
Convergence Is More Complex

Before Convergence 140 Cables

After Convergence 60 Cables

(Based on 2 LOM, 8 IP and 4 FC Ports on 10 Servers)
Convergence Means Performance Tradeoffs

40 Gb/Sec

- Wider Track: More Data Lanes
- No Virtualization Conflicts
- Capacity for Provisioning

900K IOPS/Sec

- Faster Engine: More Transactions
- More VMs/CPU
- QoS you demand
- Performance for Storage
Convergence in the Data Center
24 Months of Convergence

- HP FlexFabric
- IBM Virtual Fabric
- Cisco UCS
- VMware vNICs
- Virtual Switch
- ESX HW iSCSI
- ESX FCoE
- VM vStore
- Blade Switches
- Blade PTMs
- TOR Switches
- Core Directors
- HP iSCSI/FCoE
- NetApp iSCSI/FCoE
- EMC iSCSI/FCoE
- DELL iSCSI/FCoE
- IBM iSCSI
- 10GbE LOM
- 10GbE CNAs
- HW iSCSI/FCoE
- x86 and Unix
- Blade and Rack

Converged
Fabric-based
Computing

Convergence
for Server
Virtualization

Converged
Switching

Converged
Storage

Converged
Adapters &
LOMs
Phase 1 – Host Based Convergence

The 1st Phase of Network Consolidation will Occur in the Server Rack
Phase 2 – Network Cores Converge

The 2nd Phase will Consolidate IP and FC Networking
Phase 3 – Storage Convergence

The 3rd Phase will Converge Storage
Case Study: Major Transportation Company

Opportunity Came When Moving Data Center to New Location

Focused Goals For Improvement
- Energy consumption
- Physical material costs
- Simplify infrastructure to three supported operating systems: ESX, Windows, Linux
- Cabling complexity
- Cabinet density

Consolidate new and existing corporate applications for business and technical advantages

Business and technical justification for full network convergence utilizing 10GB and FCoE to fully leverage virtualization capabilities
Proof of Concept Environment

Bar Pod

NEXUS 5000

Front NetBackup Master/Media

ILo

Pod

CISCO 4928

CISCO 4928

CISCO 4948

CISCO 4948

CISCO 3560

CISCO 3560

CISCO 4948

DMX4-950

NAS

Pod

NEXUS 7000

CISCO 6500

CISCO 6500

NEXUS 7000

MDS 9222I

MDS 9222I

MDS 9134

MDS 9134

DMX4-950

Environmental Sensor

Lantronix SLC48

PDU (x6)

4Gb FC Fiber

GigE Copper

GigE Fiber

10Gige Fiber

10 Gige Twinax

Rs232 Copper

Server with FCOE CNA

Server with 10Gbe NIC & FC HBA

(26 servers)
Deployment

Server Info:
HP DL380G6
RedHat 5.4, ESX 4.0/4.1, Win 2003 x64, Win 2008 R2 64
Real Savings with FCoE

<table>
<thead>
<tr>
<th>Adjust the Organization Profile</th>
<th>(Restore Defaults)</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Without Convergence</td>
<td>With FCoE Based Convergence</td>
</tr>
<tr>
<td>Number of Servers</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Number of LAN Connections Per Server</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Number of SAN Connections Per Server</td>
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<td>2</td>
</tr>
<tr>
<td>Number of Converged Ethernet Connections Per Server</td>
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<td>2</td>
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</table>

Additional Configurable Parameters

### Cost Benefits with FCoE Enabled Convergence

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<tr>
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<th>$2,000,000</th>
<th>$3,000,000</th>
<th>$4,000,000</th>
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</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>Converged</td>
<td></td>
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</table>

- **24% Savings in Switch & Adapter**

### Power Utilized (KWH)

<table>
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<tr>
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<th>$20,000</th>
<th>$40,000</th>
<th>$60,000</th>
<th>$80,000</th>
<th>$100,000</th>
<th>$120,000</th>
<th>$140,000</th>
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<tbody>
<tr>
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<td>Converged</td>
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</table>

- **42% Savings in Power**
Convergence - By The Numbers…

- **28%** % Savings on Capital Cost with Network Convergence
- **50%** percentage of 10GbE ports shipped on all servers by 2H CY12
- **49%** 2009-1014 10GbE Market CAGR
- **80%** % savings in cable costs for network convergence
- **48** average number of VMs per server by 2012
- **77%** of IT Managers adding a 2nd NIC/UCNAs to servers
- **50Gb** I/O bandwidth/server will grow to 50Gb by 2013
- **42%** % of power and cooling savings with convergence