



Systems & Integration Solutions

Embracing Open Technologies in the HPEC Market

Embedded Tech Trends
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CSPI Company Overview



- ▶ Diversified multinational technology company
- ▶ Founded in 1968
- ▶ Publicly Traded – NASDAQ: CSPI
- ▶ Known for
 - Long-term commitment to our customers
 - Consistent profitability
 - Integration of open architecture technologies into deployed solutions
- ▶ Business segments
 - Systems Segment (MultiComputer Division)
 - Service & Systems Integration Segment (Modcomp, Inc.)

Custom Technologies –Application Specific



Open Technology – Standards Based



Standardization has driven Interoperability and the broader acceptance of Open Technologies – Simplifies Application Portability

HPEC Market Characteristics



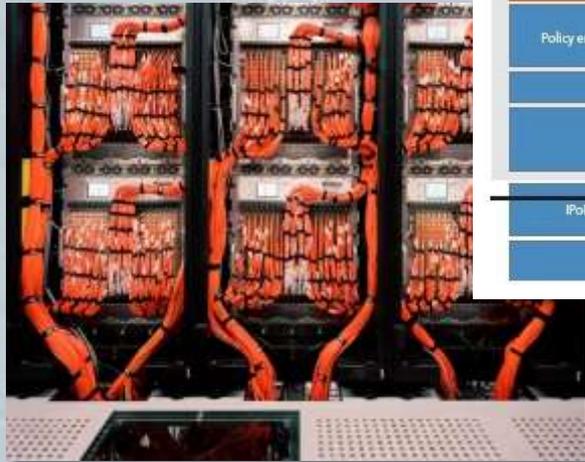
- ▶ Important Tenets
 - SWaP
 - Long Product Life Cycles (configuration & obsolescence management)
 - Long Term Support
 - Service Options (integration, qualification)
 - Reliable, deterministic operation
 - Deployable in benign to harsh environments

Open Technologies – Industry Standards

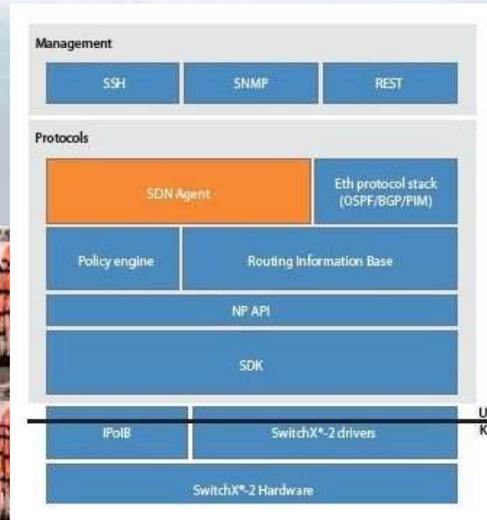
	Processing	Networking	Storage	Software
Enterprise	Throughput Oriented Many threads per core Large Memory capacity X86, Intel Xeon	Connect anyone, anywhere, anytime and on any device Ethernet	Network Attached , SAN	Application Specific (transactional) Windows, Linux
HPC	Compute Intensive MultiCore, Many-Core PowerPC X86, Intel Xeon GPGPUs	High Bandwidth Scalable Common Protocol for Inter/Intra Systems Myrinet, InfiniBand	High Capacity Storage Devices	Open Source MPI, OpenMPI OFED VSIBL, MKL, IPP Linux
HPEC	Embedded-Specific Silicon FPGA's VME, VXS, VPX/OpenVPX	Embedded-Specific Buses & Fabrics Low Latency	Limited Data Recorders	Real-Time Vendor Specific Math Libraries VxWorks

Adoption of standards enables us to leverage technology from new sources driving a shift from proprietary (full custom) to open solutions

HPC Network Technologies



Myrinet Cluster



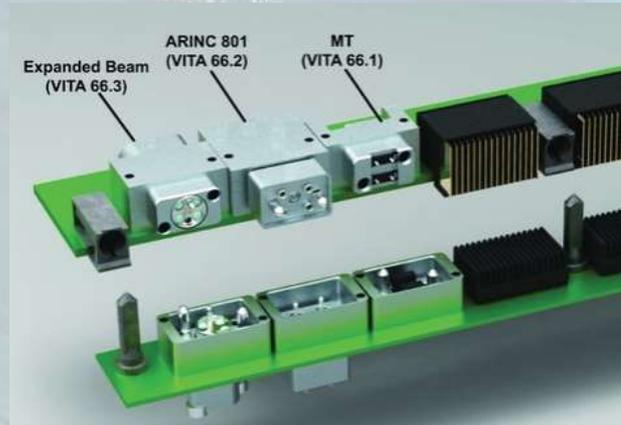
Mellanox SDN



Converged Fabric Switch

- ▶ Common Protocol for Inter/Intra System communication
- ▶ Network Supports Multiple Protocols InfiniBand, 10/40GbE
- ▶ Software Defined Networks

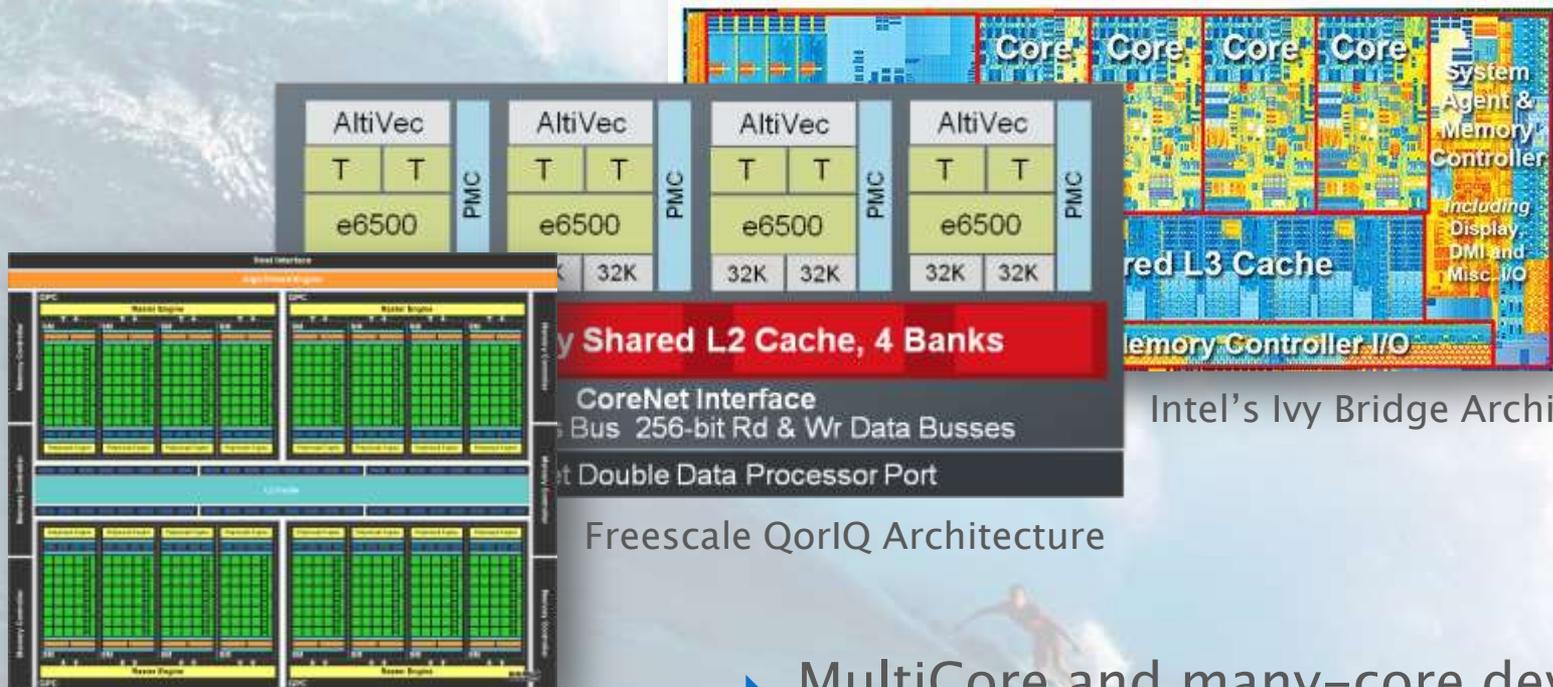
HPEC Network Technologies



Interconnect bandwidth requirements are driving optical technology.

VITA standards (VITA 66) are enabling high performance interconnect in COTS products.

Commodity Processor Technologies



NVIDIA Fermi / Kepler Architectures

Freescale QorIQ Architecture

Intel's Ivy Bridge Architecture

- ▶ MultiCore and many-core devices deliver constant increases in processing power
- ▶ Inter-processor communication has moved down into the silicon

HPC Software Technologies

With GPUDirect

Data only copied twice
Sharing pinned system memory makes system-to-system copy unnecessary

InfiniBand

CPU

chip set

GPU

GPU Memory

System Mem

Programming Intel® MIC-based Systems
MPI+Offload

- MPI ranks on Intel® Xeon® processors (only)
- All messages into/out of

Network

MPI

Data

Xeon

MIC

Offload

Common Tools and Programming Models

Your Application

Many-core

Intel® MIC Architecture - co-processors are ideal for highly parallel computing applications

Software development platforms ramping now

Use One Software Architecture

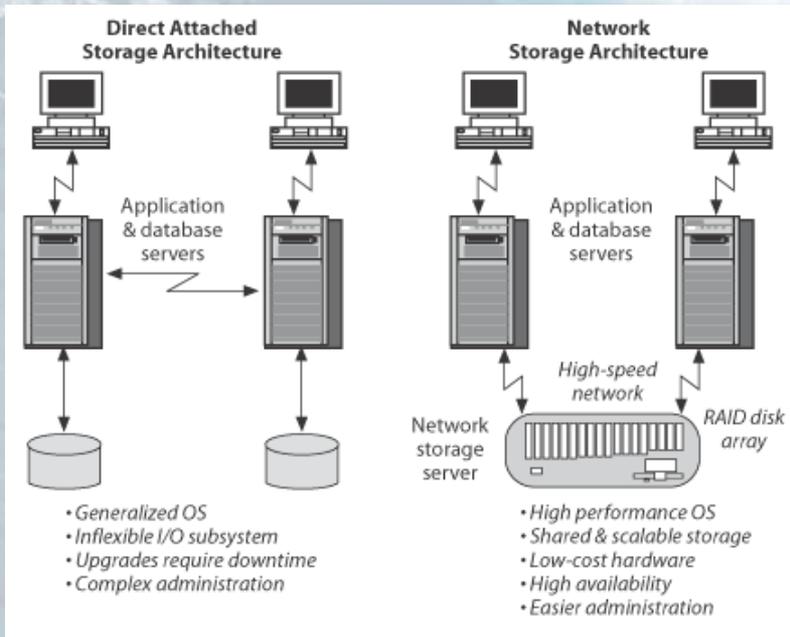
Use One Software Architecture Today. Scale Forward Tomorrow.

Today Tomorrow

Source: NVIDIA, Released with Cuda5

Industry Standard environments and tools to efficiently manage & schedule resources and communications

HPC Storage Technologies



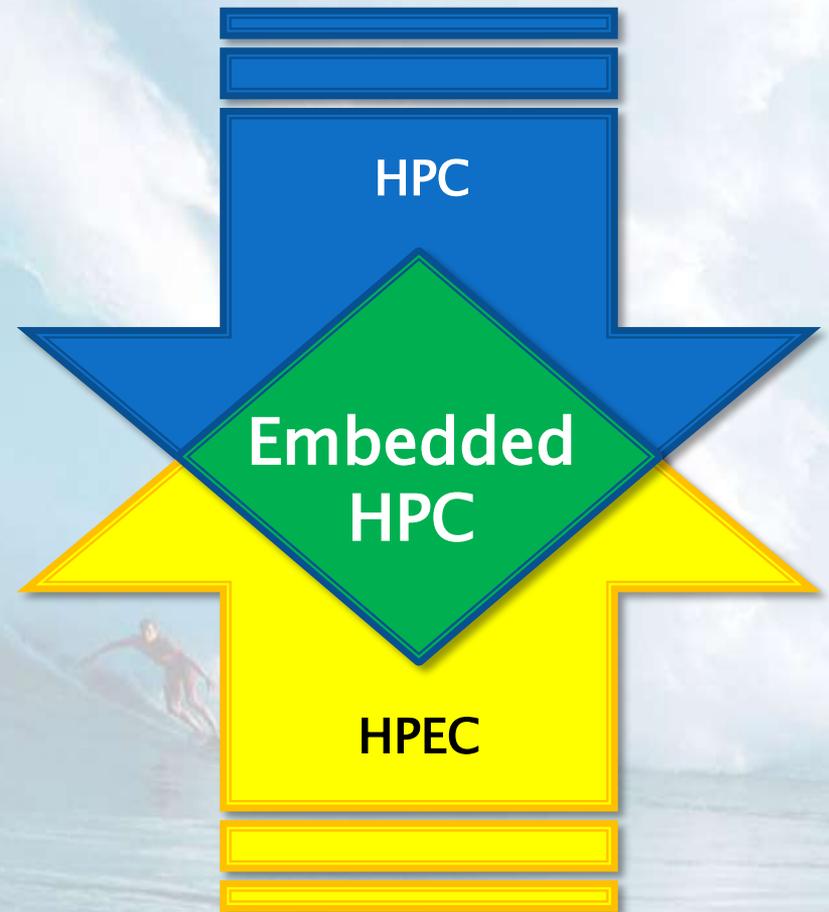
Source: <http://www.information-management.com>

Network Attached Storage optimizes data availability, scalability and manageability in a market with an ever increasing demand for storage and network bandwidth



HPC/HPEC Convergence: Embedded HPC

- ▶ Adopting Open Technologies
 - Processor Off-Load
 - Cluster Computing
 - HPC Architectures
 - Open Source Software
- ▶ Preserving Deployable Solutions
 - Life Cycle Management
 - SWaP
 - Real-Time Determinism
 - Compliance with HPEC Market Manufacturing Requirements



The Best of Both Worlds

Broader Perspective

- ▶ Technology Trends

- Use of Open Technologies is Pervasive

- Adoption no longer means selecting a “point” technology, but rather adopting the entire Infrastructure

- ▶ Market Trends

- Commodity Technologies

- Networks, Processors, Software and Storage

- Common Computing Challenges

- Demand for more processing power, data sets expanding, broader geographic reach, use of standards-based solutions

- Common Selection Criteria

- TCO, Performance, RAS



More than Convergence...

Pervasive Architectures,
Commodity Technologies and
Common Computing Challenges
are a powerful force overtaking
our Market.

Ride the Wave.

Open Architectures – Application Specific Solutions