HPC & Big Data Strategy & Portfolio Overview

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Businesses are transforming – need to be more agile to compete today
Empowering a data driven enterprise with HPC, Big Data & IOT

Use Cases
- Generating real time insights with simulation, modeling & analysis
- Analyzing high volume machine data from connected devices
- Sorting unstructured data including images, audio and video
- Dealing with your data – back up, archive and recovery – to manage risk and compliance

The ability to collect, store, process and analyze all of this data presents a huge opportunity to those who are equipped to understand and use it.
A Data-Driven Organization is unstoppable

<table>
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<th>Benefits</th>
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<td>New business models</td>
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<td>Improved customer experiences</td>
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<td>Differentiated products and services</td>
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<td>Improve operational efficiency</td>
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<td>Increased workforce productivity</td>
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<td>New sources of data and insight &quot;things&quot;</td>
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Big Data and HPC Portfolio Strategy
Design and Deliver Comprehensive Solutions with purpose-built platforms

1. Innovate, design & deliver the best-in-class hardware and software to support foundational infrastructure needs of the Big Data customers.

2. Provide vertical solutions by building software stack and partner ecosystem.

3. Enable Advisory Services to help manage customer’s technology journey.

Drive HPC and Big Data across all Enterprises
Design Principles for HPC and Big Data Innovation

**Application Driven, Cloud-ready, Code Modernization**

- Innovative application platforms
- Admin, user & application control options
- Unified physical & virtual infrastructure
- Modernize code to take advantage of new technologies

**Workload-optimized Systems**

<table>
<thead>
<tr>
<th>Deep Learning</th>
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<th>Big Data</th>
<th>Mobility</th>
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<td>Performance</td>
<td>Scalability</td>
<td>Efficiency</td>
<td>Scalability</td>
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<tr>
<td>Simplicity</td>
<td>Performance</td>
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**Converged, Composable, Open, Software Defined, Secure**

- Modern common architectures
- Modular technologies
- Common management
- Protect Digital Enterprise with Encryption
HPE Apollo and Moonshot Servers
# HPE Apollo platforms & solutions optimized for HPC and Big Data

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<tr>
<th>Platforms</th>
<th>HPE Apollo 8000</th>
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<td>Rack Scale HPC</td>
<td>Enterprise Bridge to Scale-Out Compute</td>
<td>Server Solutions Purpose Built for Big Data</td>
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## Solutions / ISVs

### HPC Workloads
- **Energy / Oil and gas**: Halliburton
- **Health / Life Sciences**: BIOVIA
- **Financial Services**: Redline
- **Manufacturing CAD/CAE**: ANSYS
- **Academia / Research**: Custom Apps

### Workloads
- **Media / Mobility**: Media
- **Object Storage**: Ceph
- **Data Analytics**: Cloudera

### Big Data Workloads
- **Object Storage**: Cleversafe
- **Data Analytics**: Hadoop

### Custom Apps
- Schlumberger
- Paradigm
- Gaussian

## Technology Partners
- Intel
- Mellanox
- NVIDIA
- Seagate

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HPE Software (i.e. Vertica, HPE Haven), HPE Enterprise Services
HPE Apollo 2000 System
The Enterprise Bridge to Scale-Out Architecture

Density optimized for traditional datacenters
- Up to 4 powerful servers in 2U chassis – 2X he density of 1U servers
- Traditional racks and cabling for existing datacenters
- Cost effective in any configuration

Configuration flexibility for a variety of workloads
- Mix and Match servers for workload optimization
- HPC performance with accelerators, top bin CPUs, fast HPC clustering
- Storage flexibility and a broad range of I/O options for workload optimization

Simple at scale
- ProLiant enterprise-class management and operational tools
- HPE iLO Management saves administration time and cost
- HPE Advanced Power Manager (APM) enables more efficient capacity per rack
- HPE Insight CMU to monitor, manage and optimize compute clusters of any size

Now supporting Intel E5-2600 v4 processors!
HPE Apollo 6000 System
Rack Scale HPC

Leading performance per $ per watt
• Up to 4X more performance per $ per watt using 60% less rack space with up to 20 front accessible servers in 5U

Rack scale efficiency
• Scale by chassis or rack with a singular modular infrastructure, external power shelf dynamically allocating power to help maximize rack-level energy efficiency and easy management

Flexibility to tailor the workload for lower TCO
• Selection of compute, accelerator, storage, and networking to fit workload needs while increasing cost savings

Now supporting Intel E5-2600 v4 processors!
HPE Apollo 8000 System
Advancing the Science of Supercomputing

Leading teraflops per rack for accelerated results
- 4X teraflops per square foot than air-cooled systems
- > 250 teraflops per rack

Efficient liquid cooling without the risk
- 40% more FLOPS per watt and 28% less energy than air-cooled systems
- Dry-disconnect servers, intelligent Cooling Distribution Unit (iCDU) monitoring and isolation

Redefining data center energy recycling
- Save up to 3,800 tons of CO2 per year (790 cars)
- Recycle water to heat facility

Now supporting Intel E5-2600 v4 processors!
HPE Moonshot Systems

Solution Focused
- Targeted high resource utilization
- Tight integration with software stack
- Unique value for specific workloads

Highly flexible fabrics
- Multiple low latency fabrics
- Supporting current and future capabilities
- Integrated networking

System-on-a-chip
- Performance at low power
- SOC technology with accelerators
- M.2 SSD flash memory

Dense form factor
- High compute density
- Capability for mixed cartridges
- Hot-plug components
- Significantly less cabling

Chassis
- Up to 45 hot-pluggable server cartridges
- Can support up to 45 10Gb ports of network bandwidth per switch (2 switchers per chassis)
- Simple cable management

HPE Moonshot 1500 System

Cartridges
- m300
  Atom™ C2750
  8 cores, 2.4GHz

- m350
  (4) Atom™ C2730
  8 cores/SoC, 1.7GHz

- m400
  ARM 64bit
  8 cores, 2.4GHz

- m700
  (4) AMD Opteron™ X2150
  4 CORES, 1.5ghZ

- m710p
  Xeon E3-1284L v4
  “Broadwell-H”
  4 cores, 2.9-3.8GHz

- m800
  (4) TI Keystone II based
  66AK2H, A15
  4 cores, 1GHz
HPE Apollo 4000 Systems
Server Solutions Purpose Built for Big Data

Apollo 4200: Bringing Big Data storage density to enterprise
- **Leadership storage density** with 224 TB in a 2U server
- **Fits traditional enterprise/SME rack server datacenters** – deploy today, no cost of change
- **Balanced capacity, performance, and throughput** with flexible options – disks, CPUs, I/O, and interconnects

Apollo 4500: Optimized for storage density and performance for Big Data
- **More capacity in smaller form factor** with up to 68 HDDs in a single node server, adding 26% more storage capacity per rack
- **Enhanced option flexibility**
- **Improved serviceability** through simplified cabling to reduce deployment and management time

**Now supporting Intel E5-2600 v4 processors!**
What’s New at HPE
Recent Additions to the HPE Apollo Family
Deliver Automated Intelligence in Real-time for Deep Learning
Unprecedented Performance and Scale with HPE Apollo 6500 High density GPU solution

Customer Benefits
HPE Apollo 6500 is an ideal HPC and Deep Learning platform providing unprecedented performance with 8 GPUs, high bandwidth fabric and a configurable GPU topology to match deep learning workloads
- Up to 8 high powered GPUs per tray (node), 2P Intel E5-2600 v4 support
- Choice of high-speed, low latency fabrics with 2x IO expansion
- Workload optimized using flexible configuration capabilities

Use Cases
- Video, Image, Text, Audio, time series pattern recognition
- Large, highly complex, unstructured simulation & modeling
- Real-time, near real-time analytics

Automated Intelligence delivered by HPE Apollo 6500 and Deep Learning software solutions

Faster Model Training Time, Better Fusion of Data*

* Benchmarking results provided at or shortly after announcement
HPE Apollo 6500 Solution Innovation
System Design Innovation to maximize GPU capacity and performance with lower TCO

**New Technologies, Products**

- **Deep Learning, HPC Software platform Enablement**
  (CogX, Café, CUDA, Google TensileFlow, HPE IDOL)

- **Cluster Management Enhancements**
  (Massive Scaling, Open APIs, tight Integration, multiple user interfaces)

- **HPE Apollo 6500**
  - Dense GPU server optimized for Deep Learning & HPC Workloads
  - Density Optimization
  - High Performance Fabrics

**Unique Solution Differentiators**
- GPU Density
- Bus Architecture
- Power & Cooling Optimization
- Manageability
- TCO
Enable Open Storage Innovation for Massive Parallel Workloads
Lustre based flexible, resilient HPE Apollo 4520 with open software & management

Use Cases
For seismic processing, media content distribution, scientific research
To retain large quantities of processed data (10-15TB/week)
For thousands of clients to access data simultaneously

Real-time Insights delivered by HPE Apollo 4520 with IEEL

Lower TCO with Cluster in a Box*

Customer Benefits
Storage Cluster optimized for parallel processing with extreme density and flexible scalability and resiliency (Cluster in a Box)
- HPE Apollo 4520 is designed for PB-Scale data sets
- Deployment services for installation of Intel Enterprise Edition of Lustre
- Highly flexible big data storage server optimized for parallel processing, leverages Intel Xeon E5-2600v4 Series processors
- Maximum parallel storage capacity with up to 23 LFF drives per node (2 x 23 / 4U chassis)
- Open Infrastructure Innovation with storage tiering, data compression and RESTful APIs

* Benchmarking results provided at or shortly after announcement
HPE Apollo 4520 innovation with Lustre for HPC

Architecture Innovation for open infrastructure innovation with system scalability & resiliency

New Technologies, Products

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<th>Parallel File System</th>
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<td>HPC Scalable Storage Solution</td>
<td>High Performance Parallel File System optimized for flexibility &amp; simplicity, tuned with OpenZFS</td>
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<td>HPE Apollo 4520</td>
<td>Highly flexible storage server optimized for parallel processing</td>
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Unique Differentiators

- Enable Open infrastructure innovation
- Flexible Configurations
- Scalable architecture
- Resiliency via failover capability
Optimized Performance targeting Financial Services Industry
The Confidence to Achieve HPC Innovation in Financial Services Industry

Performance optimized solutions that address today’s Financial Services Industry challenges and fuel innovation

HPE Innovation Delivering Optimized Performance

- Optimize HFT workload performance with HPE Trade and Match Server using Apollo 2000 running at maximized frequency
- Regulatory compliance of enterprise-wide data archive made easy with HPE Risk Compliant Archive; iTernity iCAS for compliance, Scality RING for efficient data archive, density optimized HPE Apollo 4000 server family
- Maximize trader productivity and enhance customer experience with superior compute and graphics performance of HPE Trader Workstation
Maximize Performance and Agility for High Frequency Trading
HPE Trade and Match Server Solution to accelerate financial trading speed

HPE Internal Benchmarking using Monte Carlo Speedup by +17-26% and Black Scholes Speedup by +11-28% with the Trade and Match Server solution, March 2016. Houston, TX

Use Cases

Optimized Performance
Trade and Match Server for FSI with HPE Apollo 2000

- To reduce latency by collocating servers on the same network
- To minimize system latency for trading operations
- To perform better at maximized frequency

Customer Benefits

Gain competitive differentiation for high frequency trading workloads with Extreme Performance Compute solutions
- Optimized for HFT applications that perform better at higher frequency (up to 45%) and with lower core count – save costs
- Avoid overprovisioning with ability to tune and optimize for improved frequency – save time
- Designed to minimize system latency for trading operations – save time
- Safer and cost-effective air-cooled approach, not a risky liquid-cooled solution – save costs

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Maximize Performance and Agility for High Frequency Trading
HPE Trade and Match Server Solution to accelerate financial trading speed

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Thank you