

ACCELERATING INSIGHTS WITH INDUSTRY LEADING HPC/AI SOLUTION PORTFOLIO AND CUSTOMER SUCCESS STORY

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AGENDA

- WW Use Case
- It's a New Era
- From Edge to Core and Exascale
- HPC/AI Portfolio
- Recipe for Next Generation HPC/AI Computing

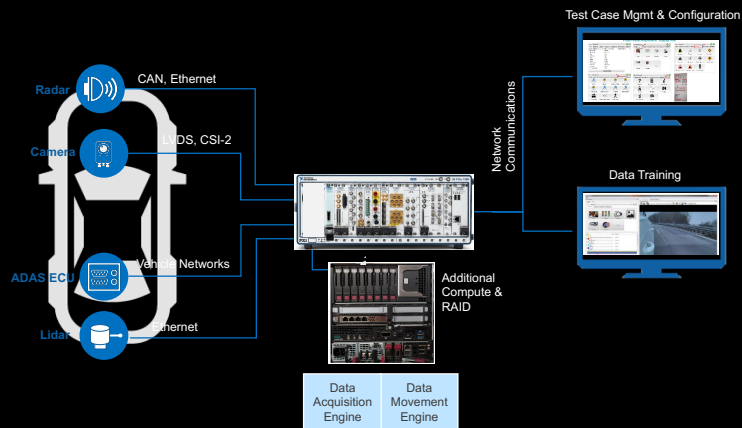


ZENSEACT (FORMER ZENUITY) PROGRAM

AUTONOMOUS DRIVING DATA PLATFORM

HPE provides Zenuity, a leading developer of software for self-driving and assisted driving cars, with core data processing services that allow the Customer to gather, store, organize and analyze the data it generates globally from its network of test vehicles and software development centers.

[Press release](#)



HPC/AI FOR CRYOGENIC ELECTRON MICROSCOPY (CRYO-EM)

2017 NOBEL PRIZE IN CHEMISTRY

Jacques Dubochet
Joachim Frank
Richard Henderson



For developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution

Cryo-electron microscopy (cryo-EM) provides 3D structural information of biological molecules and assemblies by imaging non-crystalline specimens (single particles)



From "market spinach" to...



"Structure, mechanism, and regulation of the chloroplast ATP synthase", Hahn, Vonck et al., **Science** 2018

Visualization with UCSF Chimera

Need

High performance storage and compute infrastructure for Cryo-EM facilities supporting drug design and other structural biology research.

Challenge

Cryo-EM microscopes produce upwards of ~3 TB/day.

Storage and compute systems for the 3D reconstruction quickly become overwhelmed and create bottlenecks that increase time to discovery and market.

Solutions

HPE Apollo 6500 Gen10 with NVIDIA V100 GPUs.

Cray ClusterStor's fast, scalable storage speeds up the entire workflow—from data collection to final structure.

ACCELERATING SCIENTIFIC DISCOVERY AT THE PAWSEY SUPERCOMPUTING CENTRE

- Supporting Australia research
- National and international collaborations
- Key role in ambitious Square Kilometre Array (SKA) telescopes project
- Key research including
 - Medical research—rapidly and accurately detect coronary artery disease and inform treatment well before fatal heart attacks occur
 - Artificial intelligence—developing AI to help farmers reduce the amount of herbicide required in a field by up to 90%
 - Radio astronomy—detecting gravitational waves from black hole mergers within seconds



HPE providing compute, storage, software and interconnect solutions

- HPE Cray Supercomputer + Cray ClusterStor E1000
- **16 Racks** = 8 x High Density HPE Cray EX cabinets + 8 x standard 19-inch racks
- **+200,000 Compute Cores**
 - 1,600 compute nodes (each with 2 x AMD “Milan” 64-core CPUs)
 - 192 AMD GPU nodes (each with an AMD 64-core CPU + 4 x AMD Instinct GPUs)
- **14 PB Storage**—2 x Cray ClusterStor E1000 Lustre filesystems: Over 3PB of Flash & 11PB of HDD storage.
- **Slingshot interconnect** (up to 800Gb/sec quad injection bandwidth per node)

EXASCALE ERA

**BIG DATA
ANALYTICS**

X

**ARTIFICIAL
INTELLIGENCE**

X

**MODELING &
SIMULATION**

RUNNING ON ONE MACHINE IN MISSION-CRITICAL WORKFLOWS



**IT'S NOT JUST A MACHINE,
IT'S A NEW ERA**





“The confluence of AI with traditional simulations is going to transform the very nature of High Performance Computing. That’s the thing that I think is going to be yet another sea change in how we do science.”

“We’re not doing our grandfather’s HPC here.”

RICK STEVENS

ANL ASSOCIATE LAB DIRECTOR



HPE - PREPARED FOR THE EXASCALE ERA

New Software

- Converged Workflows
- New standards in manageability
- Cloud Experience

New Compute

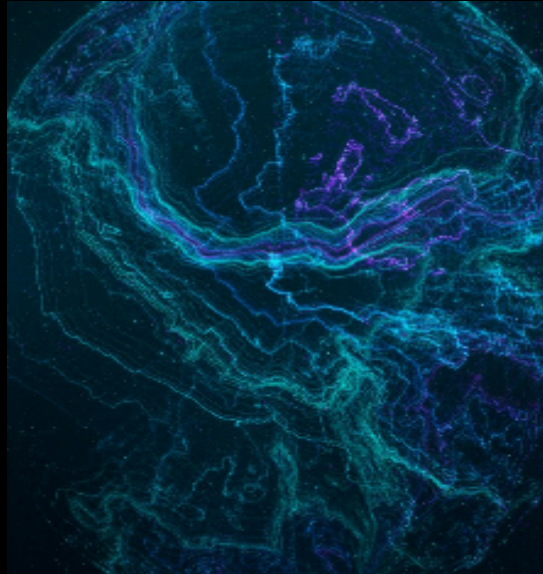
- Diversity of Processors
- Data-Intensive Applications
- Reimagined the Interconnect

New Storage

- Intelligent Data Management
- Efficient Performance
- Unprecedented Scalability

New HS Interconnect

- High Bandwidth
- Adaptive Routing
- Congestion Management
- Ethernet Compatibility



TOWARD EXASCALE HPC/AI SYSTEM



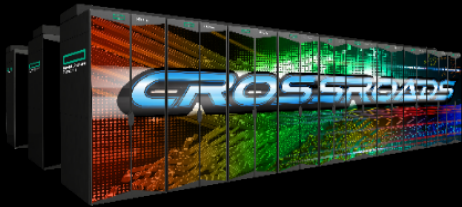
SIZE

\$100M +

ANNOUNCED

30-Oct-2018

AMD Milan EPYC CPU &
NVIDIA GPU with
Slingshot interconnect



SIZE

\$100M +

ANNOUNCED

1-Oct-2020

Intel Xeon Sapphire
Rapids CPU with
Slingshot interconnect



SIZE

\$600M +

ANNOUNCED

7-May-2019

Future AMD EPYC CPU &
Instinct GPU with
Slingshot interconnect



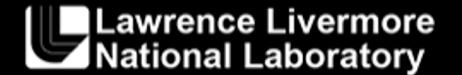
SIZE

\$100M +

ANNOUNCED

18-Mar-2019

Future Intel Xeon CPU &
Intel X^e architecture with
Slingshot interconnect



SIZE

\$600M+

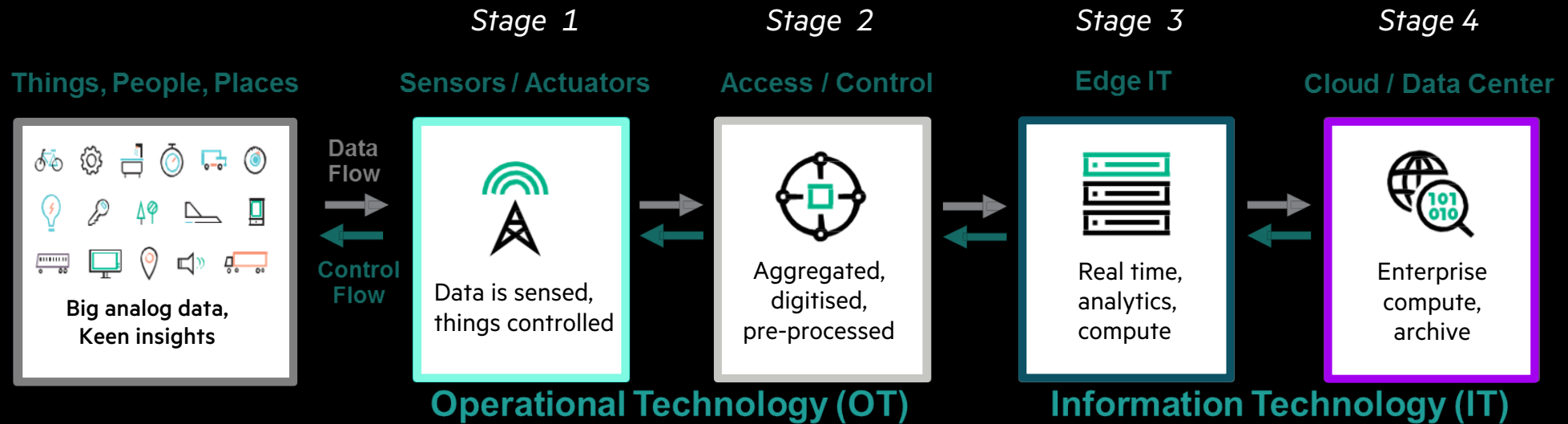
ANNOUNCED

5-Mar-2020

Future AMD EPYC CPU &
Instinct GPU with
Slingshot interconnect

Includes non-disclosed contracts already won
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EDGE TO EXASCALE COMPUTING SOLUTIONS



The Edge

“Converge OT”

- OT :**
- Control Systems
 - Data Acquisition Systems
 - Industrial N/Ws



Edgeline Systems

Data Center / Cloud

“Enterprise class IT”

- IT :**
- High performance compute
 - High-capacity storage
 - Systems management



High Performance Computing & Mission Critical Systems

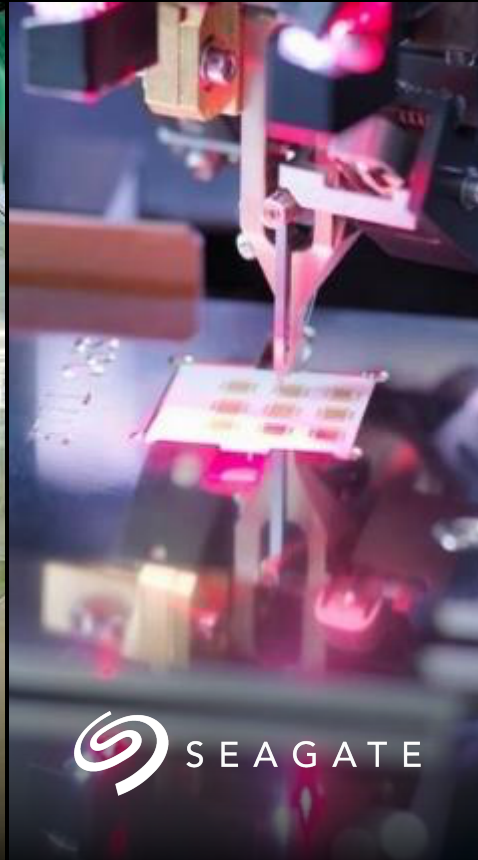
REDEFINED EXPERIENCES AND SMARTER OPERATIONS



Delivering enhanced experiences with a state-of-the-art, smart stadium



Creating more engaging employee experiences—and improving productivity



Using machine learning on microscopic images to inspect quality of wafers in the drive



Increasing data processing speed of its smart meters by 800%



Benefitting from a simplified architecture with built-in redundancy, failure recovery, scalability and interoperability



HPC & AI COMPUTE PORTFOLIO

Purpose-built supercomputing

HPE Cray EX supercomputers



The next frontier of supercomputing systems redesigned for HPC, AI, and converged workloads

HPE Cray supercomputers



HPE Superdome Flex



Scale-up, shared memory HPC, combines best of HPE and SGI technologies

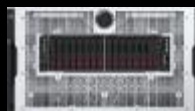
Accelerated HPC/AI

Accelerated compute platform for HPC and AI workloads

HPE Apollo 6500 Gen10 System



HPE Apollo 6500 Gen10 Plus System



Mainstream HPC/AI

Density-optimized, scale-out compute for HPC and AI workloads

HPE Apollo 2000 Gen10 Plus System



HPE ProLiant DL385 Gen10 Plus System



Edgeline

Range of platforms and capabilities engineered for the harsh edge environment

HPE Edgeline EL8000



Cray ClusterStor E1000  **Parallel storage system purpose-engineered for HPC and AI**

Integrated HPC & AI Software Portfolio including software development and acceleration environments, cluster management, data management, and system management

Everything available “as a Service” via HPE GreenLake

HPE HPC & AI SOFTWARE PORTFOLIO



SCALABILITY

Support for systems regardless their size and the pace they are growing.



PRODUCTIVITY

Optimize use of available computing resources.



PERFORMANCE

Optimize performance for all workloads regardless underlying architecture.



CLOUD AS AN EXPERIENCE

Everything –aaS. Resources available from everywhere, anytime.

HPE offers customers a comprehensive software portfolio for HPC and converged workloads

Proven track record of helping customers maximize the use of their HPC systems so they can get results faster

Application and Software Development Ecosystem	Development Environments	<ul style="list-style-type: none"> HPE Cray Programming Environment <ul style="list-style-type: none"> C/C++, Fortran, UPC, R, Python Compiling Environment 	<ul style="list-style-type: none"> Intel® Parallel Studio XE (w/Intel MPI) 	<ul style="list-style-type: none"> Arm® Allinea Studio 	<ul style="list-style-type: none"> AMD AOCC
	Debug & Performance	<ul style="list-style-type: none"> <ul style="list-style-type: none"> Debuggers Performance analysis & optimization tools Code parallelization assistant 	<ul style="list-style-type: none"> NVIDIA HPC SDK 	<ul style="list-style-type: none"> NVIDIA GPU Cloud 	<ul style="list-style-type: none"> GNU Compilers
	MPI	<ul style="list-style-type: none"> <ul style="list-style-type: none"> HPE Cray MPI 	<ul style="list-style-type: none"> Arm® Forge Professional 	<ul style="list-style-type: none"> TotalView™ by Perforce 	<ul style="list-style-type: none"> Vampir
Workload Management & Orchestration	<ul style="list-style-type: none"> Altair® PBS Professional® 	<ul style="list-style-type: none"> Slurm® 	<ul style="list-style-type: none"> Kubernetes® 	<ul style="list-style-type: none"> Containers: Docker®, Singularity 	
Remote Visualization	<ul style="list-style-type: none"> NICE DCV and EnginFrame 				
Storage File Systems	<ul style="list-style-type: none"> Cray ClusterStor E1000 Storage Solution (Lustre-based) 				
Data Management	<ul style="list-style-type: none"> HPE Data Management Framework (DMF) 				
System Management	<ul style="list-style-type: none"> HPE Cray supercomputer software <ul style="list-style-type: none"> HPE Cray System Management 	<ul style="list-style-type: none"> HPE Performance Cluster Manager 	<ul style="list-style-type: none"> Bright Cluster Manager® 		
Fabric Software	<ul style="list-style-type: none"> HPE Slingshot fabric manager 	<ul style="list-style-type: none"> Mellanox® Unified Fabric Manager™ 	<ul style="list-style-type: none"> Intel® Omni-Path Fabric Software 		
Operating System	<ul style="list-style-type: none"> HPE Cray Operating System 	<ul style="list-style-type: none"> SUSE® Linux Enterprise Server 	<ul style="list-style-type: none"> Red Hat® Enterprise Linux™ 	<ul style="list-style-type: none"> CentOS 	<ul style="list-style-type: none"> TOSS

NOBODY HAS ALL OF THIS!

Unrivalled expertise

HPC

AI

Edge Compute

Mission Critical Solutions

Hewlett Packard Labs

Differentiated IP & systems capabilities

High Performance Networking

Memory-Driven Computing

Fault Tolerant

Ruggedised

High Performance Storage & Data Management

Cloud native & full developer ecosystem

HPE Cray Programming Environment

Cloud native systems management & orchestration

Virtual NonStop (vNS)

Serviceguard

Converged workloads

Delivered at any size and any data center

Edge to Core to Cloud

On-premises

Colo

Public Cloud

CAPEX as-a-Service

Recipe for Next Generation HPC/AI Computing

1. Start with powerful Interconnect including

- Scalability
- Reliability
- Security
- Standard protocols to connect to external data sources
- Predictable and reproducible runtimes

2. Place in scalable infrastructure

- Efficient power conversion
- W3/W4 “free” cooling
- Upgradeable
- Cool 500+ Watt parts
- Power Management

3. Add Supercomputing Software

- Scalable
- Supported PE
- Support new workloads
- Sprinkle in some good ideas from the cloud world

4. Add Exascale-capable processor

- With PE software to support programmability

Cooking with  **Hewlett Packard**
Enterprise

THANK YOU

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