HPE Services for HPC and Liquid Cooled solutions

EurOpen

Martin Papik, May 2023

QUICK FACTS ABOUT

HPE

$27.8B

Revenue
3%
(2021 vs 2020)

~60.400

Employees
(2021)

#19

Fortune 100
Best Companies
to Work For®
(2022)

ATLANTIS
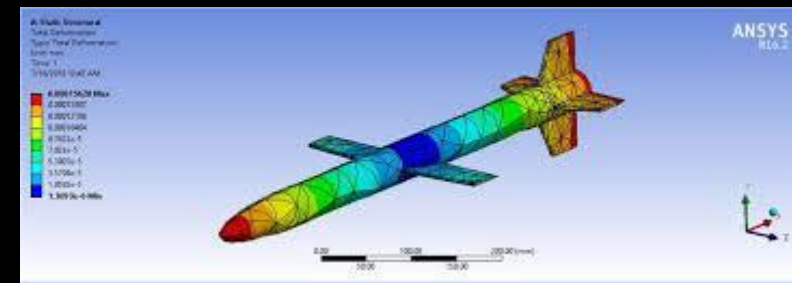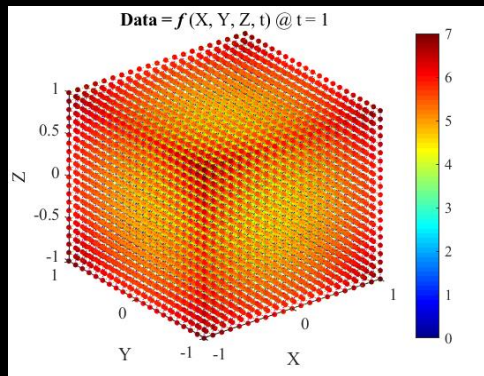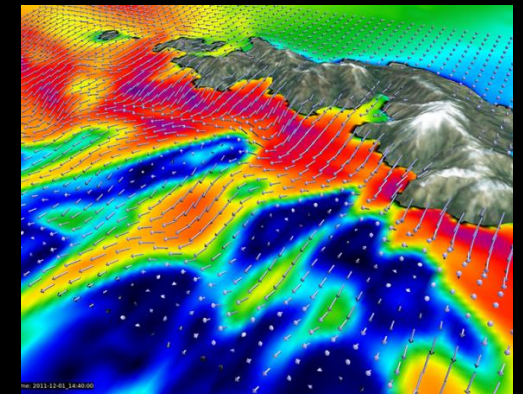
HIGH PERFORMANCE COMPUTING MARKET

- Human genome sequencing

- Nuclear Stockpile Simulation

- Airplane/car manufacturers

- Military systems, Security/Intelligence

- Rendering farms, Entertainment industry

- Oil & Gas, reservoir simulation, seismic...

- Chemistry

- Banks, Financial markets

- Formula 1

- Weather forecast

- Universities – Theoretical Science
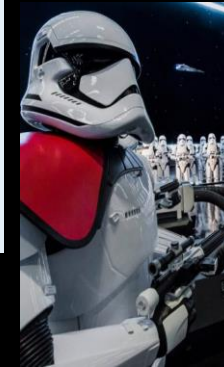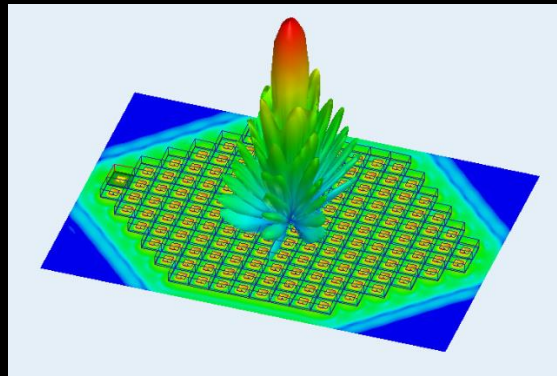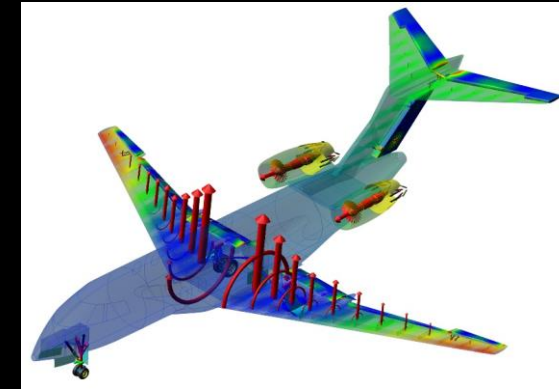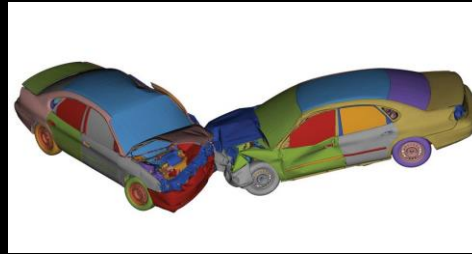
WHAT DO THESE COMPUTE PROBLEMS HAVE IN COMMON?
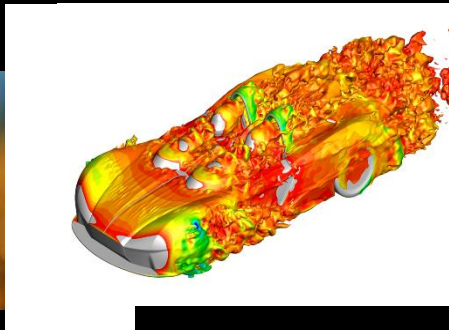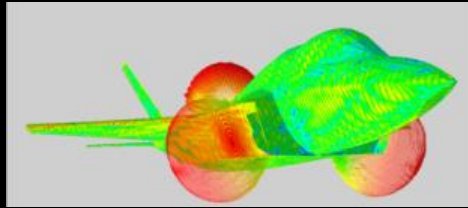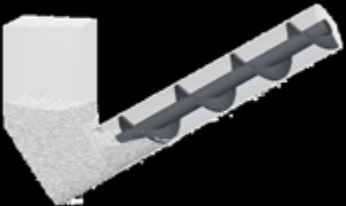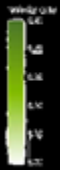
-High complexity
-High number of coupled / related tasks
-Single node memory exhaustion
=> **Divide et Impera** is possible solution

Philip II of Macedon

Challenging to distribute across multiple nodes in an HPC cluster. Want to **solve „holistically" as one virtual node.**

Compete for "fat nodes" (with more processors/memory), **compounding time and effort to discovery**

Or too big for the one node

    If memory is exhausted, simulation fails (hours wasted)

    Use smaller models, reducing accuracy and increasing prototype costs/time to production

PARALLELISM

Parallelism means doing multiple things at the same time: you can get more work done in the same time.

Less fish ...

More fish!

MPI

	Cray MPI	HPE MPI
Fabric	Slingshot *Support for InfiniBand in June 2020*	InfiniBand
Packaging	Cray Programming Environment	HPE Message Passing Interface (MPI)
Platforms	Cray Supercomputers *HPE Apollo & HPE ProLiant DL in June 2020*	HPE Apollo, HPE ProLiant DL
More facts	Tuned for AMD, Intel, Arm and GPUs CrayPAT optimizes rank ordering Works with Cray's Linux Environment XPMEM and Huge Pages OS: Cray Linux Environment, RHEL	Tuned for AMD, Intel, Arm and GPUs MPI profiling and guided placement tools Boost runtime performance for any MPI app w/o recompile OS: RHEL, SLES, CentOS, TOSS

Why HPE go into Liquid?

HPE Server Solutions for Liquid Cooling systems

HPC LIQUID COOLING - OVERVIEW

Hybrid Cooling solutions

How it works:
Liquid to air cooling AND direct liquid cooling (slow convergence into Direct Liquid technologies)

ARC Rack   +

Apollo 2000 DLC and XD (near future)

Direct Liquid Cooling solutions

How it works:
Coolant flows through cold-plates to extract heat directly from all server components

Cray EX Lite

Cray EX

HPE Server Cooling Options

Air Cooling

100% heat to air
0% heat to liquid

OR

Direct Liquid Cooling

30% heat to air
70% heat to liquid

OPTIONAL
ADDITIONAL COOLING

Can be used with air cooled or liquid cooled servers →

RDHX
Rear Door Heat Exchanger

Uses facility water to neutralize exhaust hot air back to room neutral temperatures

OR

ARCS
Adaptive Rack Cooling Solution

Encapsulates the IT via sealed racks and uses facility water to cool air-cooling system

Requires Facility Water

HPE HYBRID LIQUID COOLING – AIR/DLC

DLC - Direct Liquid Cooling provide to the hottest components in the server such as the CPU/GPU, memory DIMMs while using air cooling to cool the remaining low heat components

- Rack comes with pre-installed rack mounted CDU and manifolds

- Can be 100% liquid cooled when accompanied with RDHX or ARCS

- Racks can be populated partly and scale over time (Scale UP and OUT). They come pre-filled with coolant.

- Supports top or bottom feed facility water (universal)

- Easy to adapt DC

HPE Cray XD 2000 + ARCS

The HPE ARCS uses a closed-loop, room-agnostic design capable of cooling fully populated racks, even with top bin CPUs. The horizontal airflow of the HPE Adaptive Rack Cooling system fully supports Apollo, XD, DL, and ClusterStor E1000, and industry-standard front-to-back hardware.

- Allows for in-rack IT cooling without adding to the heat load in the data center.

- Implementation of variable speed fans within ARCS enables improved energy efficiencies by providing the right volume of airflow to all IT regardless of mounting position or workload.

- Acoustic benefits and reduced number of water taps bring advantages over other rack-level cooling products.

- ARCS enables customer datacenter power density to increase without need for facilities upgrades.
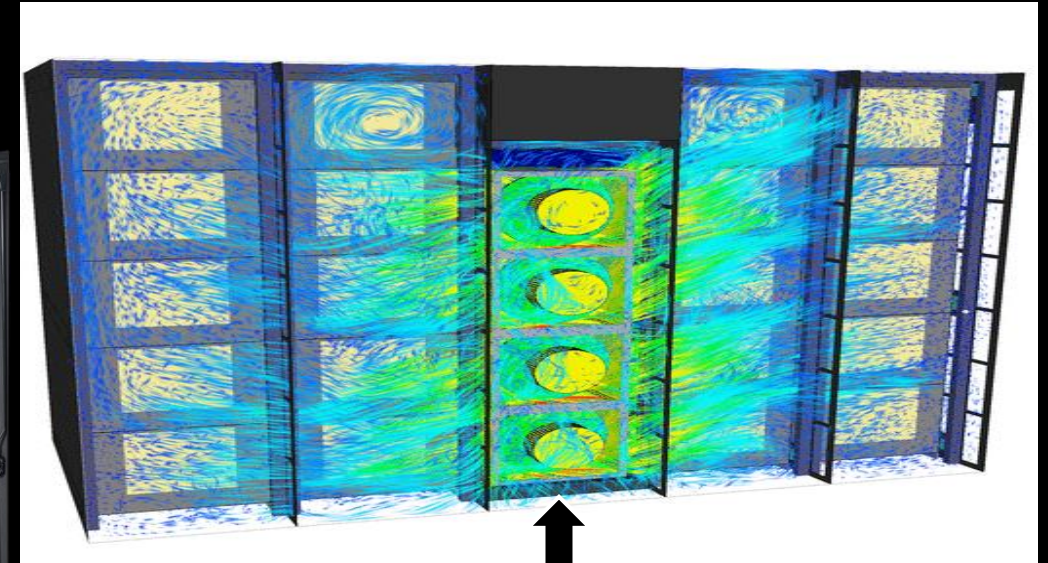
HPE ARCS Cooling Unit Rack

HPE CRAY EX LITE

Cray EX Lite provides DLC (Direct Liquid Cooling) to all components in the server, including CPU/GPU, memory, voltage regulators, etc.

- Mainly AMD based CPU and GPU design now
- Racks can be populated one chassis at a time and scale over time. Pre-filled with coolant and ready to connect to existing system.
- Dedicated in-rack CDU, allows additional Cray EX Lite cabinets to be added to the existing cluster over time
- Up to 96 nodes per cabinet
- **Integrated liquid cooled switches**
- **100% liquid cooling solution**
- Supports top or bottom feed facility water

HPE CRAY EX
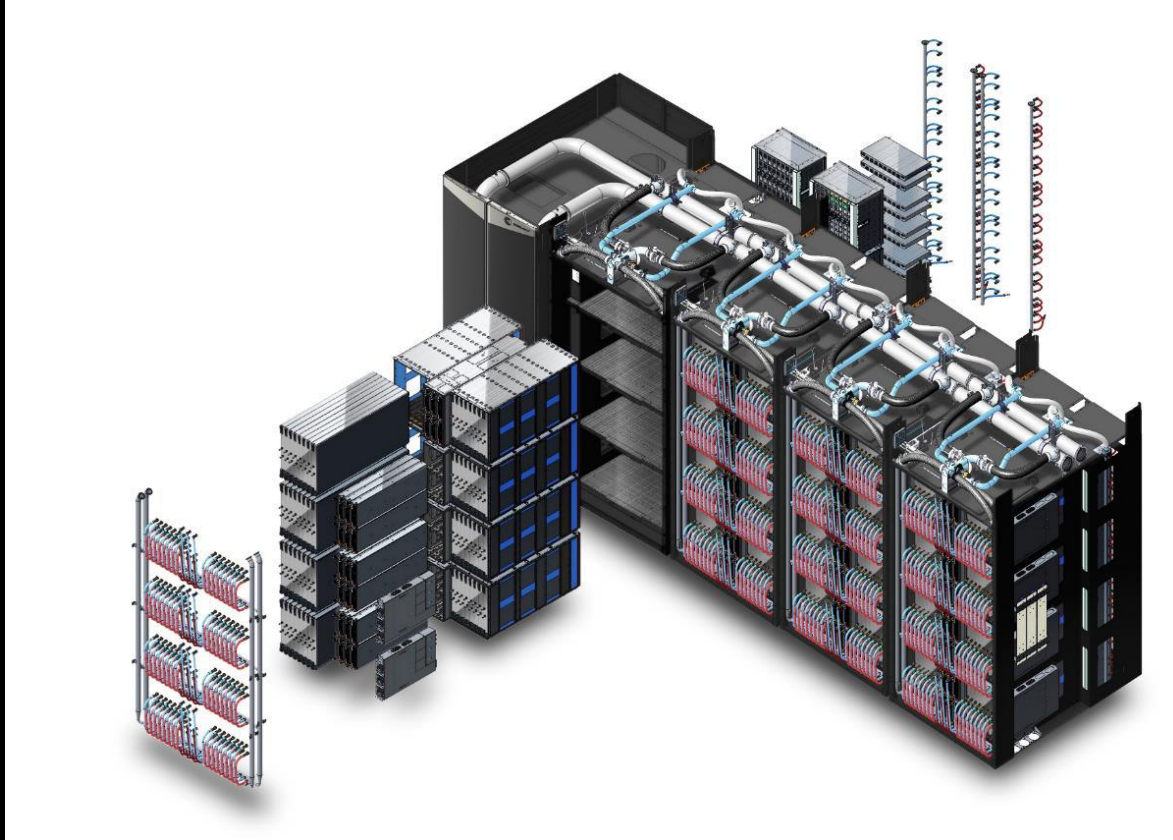
Cray EX provides DLC (Direct Liquid Cooling) to all components in the server, including CPU/GPU, memory, voltage regulators, etc.

- Supports the latest top bin CPU & GPU technology
- Best option for high performance computing deployments exceeding 1000+ nodes
- Large row-based CDUs manage coolant for multiple cabinets
- **Up to 256 nodes per cabinet**
- **1 CDU per 4 Compute racks**
- Racks are heavy and nonstandard dimensions – special DC requirements
- **Management rack with DL3x5 need to be supplied for HPCM and other sw.**

EX4000 Front

- Spring-return Valve Actuators
- Overhead Coolant Plumbing and Environmental Sensors
- 6X2 Rectifier Shelf
- 2X2 Rectifier Shelf
- Chassis 6/7
- Compute Blades
- 2X2 Rectifier Shelf
- Chassis 4/5
- Coolant Supply and Return Manifolds
- Chassis 2/3
- Four PDU Circuit Breakers
- 2X2 Rectifier Shelf
- Chassis 0/1

EX4000 Rear

- Secondary Coolant Loop Plumbing to Switch/Peripheral Blades and CMMs
- Switch/Peripheral Blades
- Cabinet Environmental Controller (CEC)
- Chassis 7/6
- Coolant Supply Manifold
- Chassis Management Module (CMM)
- Chassis 5/4
- Blank Panel
- Chassis 3/2
- Chassis 1/0

Blade Detail

- EX425
- AMD based
- 4 servers per blade
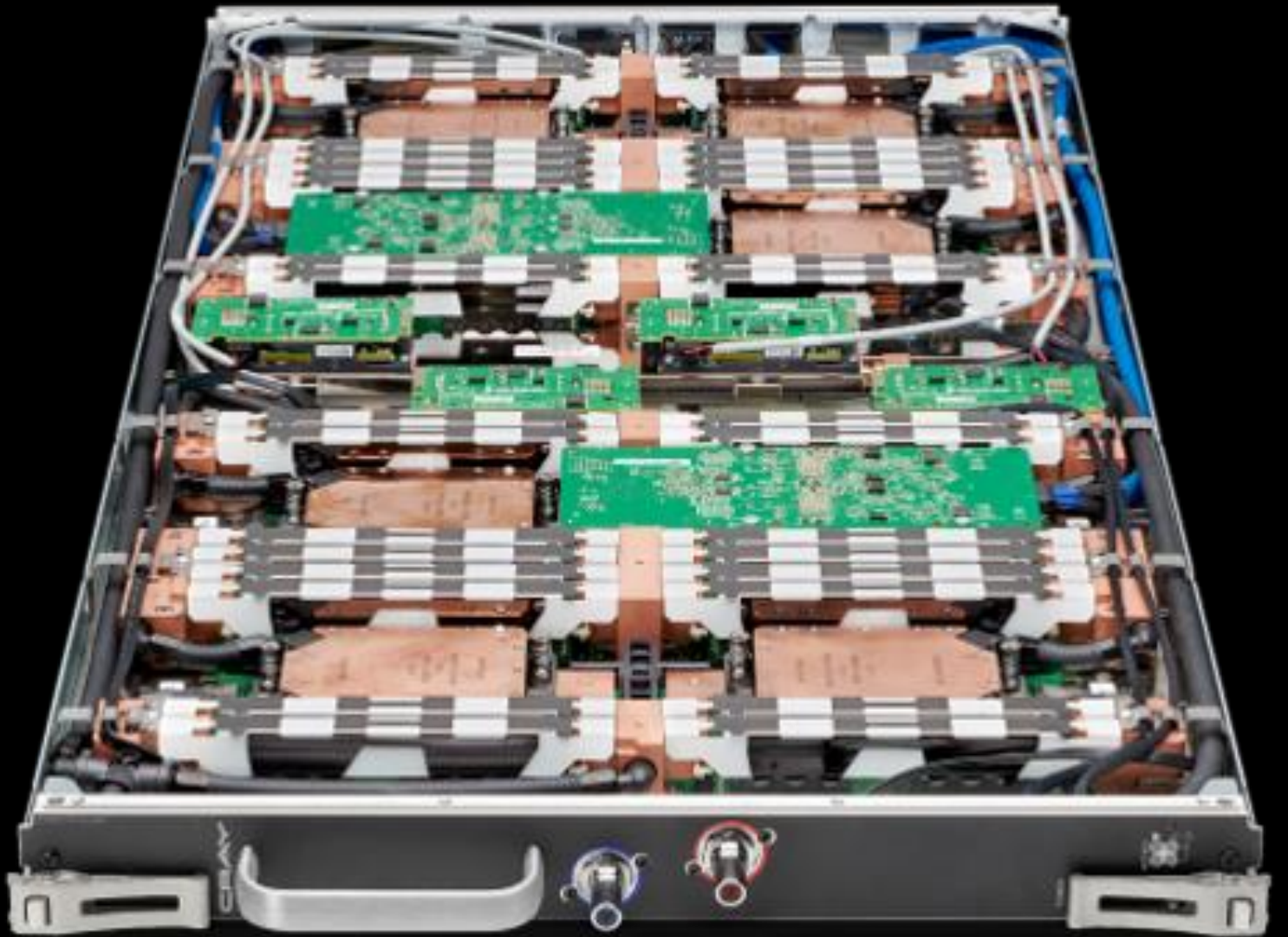
EXASCALE HPC GOAL COMPLETED 2022!!!

El Capitan, an HPE-built, AMD-powered exascale system, is on track to deliver at least **2 exaflops** of peak performance.
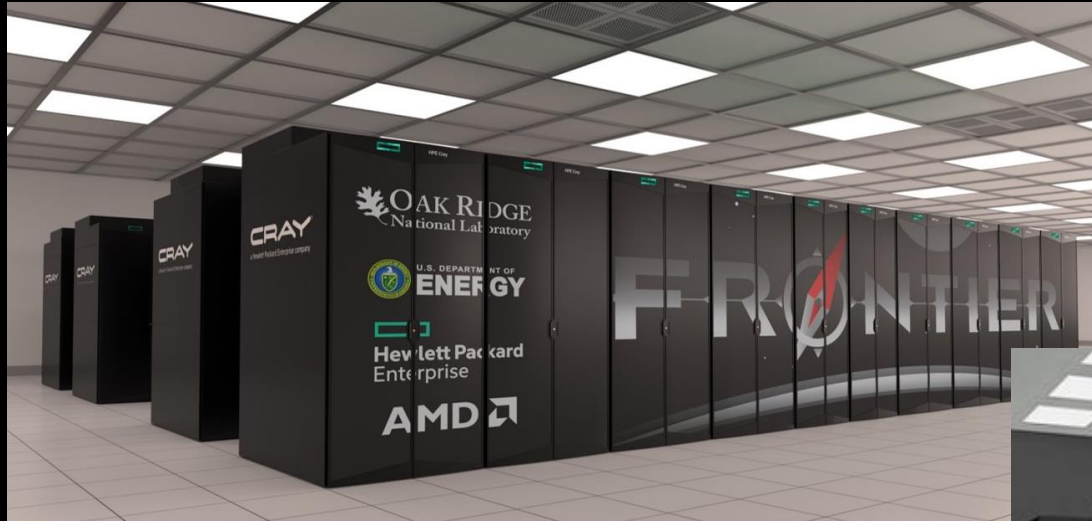
HPE CRAY EX
-Up to 64 compute blades, and 512 processors per rack
-Flexible bladed architecture supports multiple generations of CPUs, GPUs, and interconnect
-100% direct liquid cooling
-Scales to 100s of cabinets

Comprehensive software portfolio for HPE Cray XD systems / GIC services for HPC

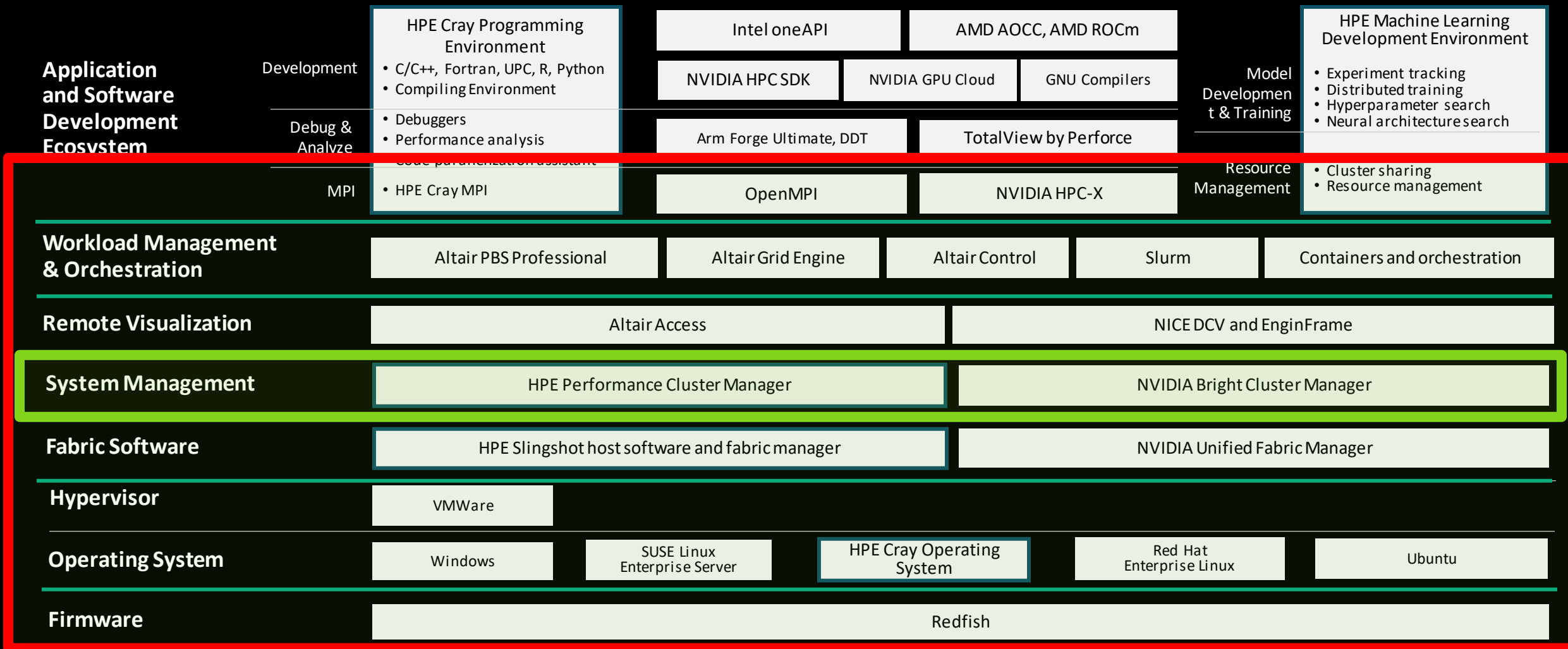|						
Application and Software Development Ecosystem	Development	**HPE Cray Programming Environment** • C/C++, Fortran, UPC, R, Python • Compiling Environment	Intel oneAPI		AMD AOCC, AMD ROCm	**HPE Machine Learning Development Environment** • Experiment tracking • Distributed training • Hyperparameter search • Neural architecture search
			NVIDIA HPC SDK	NVIDIA GPU Cloud	GNU Compilers	Model Development & Training
	Debug & Analyze	• Debuggers • Performance analysis Code parallelization assistant	Arm Forge Ultimate, DDT		TotalView by Perforce	
	MPI	• HPE Cray MPI	OpenMPI		NVIDIA HPC-X	Resource Management • Cluster sharing • Resource management

Workload Management & Orchestration	Altair PBS Professional	Altair Grid Engine	Altair Control	Slurm	Containers and orchestration

Remote Visualization	Altair Access	NICE DCV and EnginFrame

System Management	HPE Performance Cluster Manager	NVIDIA Bright Cluster Manager

Fabric Software	HPE Slingshot host software and fabric manager	NVIDIA Unified Fabric Manager

Hypervisor	VMWare

Operating System	Windows	SUSE Linux Enterprise Server	HPE Cray Operating System	Red Hat Enterprise Linux	Ubuntu

Firmware	Redfish

NEXT MISSION: SPACEBORNE COMPUTER-2

LAUNCHED: 20-FEB 2021 ABOARD NORTHROP GRUMMAN'S NG-15

Thank you

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