

Data sheet

HP Apollo 8000 System



Advancing the science of supercomputing



September 2014

The HP Apollo 8000 System is a high-performance computing solution that uses innovative warm-liquid cooling technology to fuel the future of science and technology—with a “green” answer to some of the industry’s toughest challenges.

The possibilities are limitless

Supercomputing is being restricted by the very thing that enables it: technology

Supercomputers are the engines that drive the discoveries that truly impact all of our lives. The massive compute power they provide allows leading research institutions in government, academia, and industry to run the simulations and analytics that are behind the most amazing advances in science and technology.

But while the human imagination is limitless, the massive space and energy requirements of traditional supercomputers are becoming limiting factors on the growth of supercomputing power—and slowing the pace of innovation. The clock is always ticking to find the answer, find the cure, predict the next earthquake, and create the next new innovation. Therefore, high-performance computing (HPC) is always striving to find the answers faster to engineering, scientific, and data analysis problems at scale.

HP is passionate about driving technology to commercialization in the areas most important to our customers—and society

As a leader in HPC solutions, HP looks at emerging trends to understand where our industry—and our world—is headed. We invest in a forward-looking, ambitious research agenda for tomorrow, to fuel the next generation of HP products, services, and solutions, delivering breakthroughs that can transform current businesses and create new ones.

That innovation is what inspired HP to break through the barriers of traditional supercomputing to enable a high-density, energy-efficient, HPC solution that uses a groundbreaking warm-water liquid cooling system to deliver faster, more energy-efficient, and more sustainable infrastructure for research computing workloads than ever before.

So now you can change the world with your research—and your lower energy footprint.

Increase performance density, efficiency, and sustainability

Because liquid cooling is 1,000X more efficient than air cooling,¹ the HP Apollo 8000 System allows you to take advantage of higher performance components. We also brought the heat extraction closer to the processor, which further enhances computational performance capabilities. That allows extremely dense configurations that deliver hundreds of teraflops of compute power in a very compact space with up to 80 kW of power (4 x 30A 3ph 480AC) supporting up to 144 servers per rack.

Liquid cooling not only enables higher-performance components, but also allows you to use the heat transferred to the water for facilities heat—reducing costs and your carbon footprint. When the National Renewable Energy Lab (NREL) deployed an HP Apollo 8000 System, they slashed their costs by \$1 million USD a year, while putting their money where their values are.¹

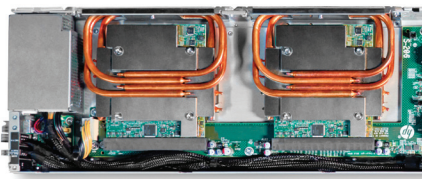
HP’s new dry-disconnect server technology keeps components cool and dry. Other HP innovations include a power distribution system that exceeds ENERGY STAR® Platinum certification, and the HP Apollo 8000 intelligent Cooling Distribution Unit (iCDU) Rack that’s more capable than competing solutions.

“For us, warm-water cooling was the key approach to making the efficiency targets work. As a cooling medium, liquids have about 1,000 times the efficiency of air. A juice glass full of water has the cooling capacity of a room full of air. And the pump energy needed to move that juice glass of water, to eject the heat from the system, is less than the fan energy needed to move that room full of air—much less.”

— Steve Hammond, director of Computational Sciences, National Renewable Energy Labs

¹HP case study, “National Renewable Energy Lab slashes data center power costs with HP servers,” December 2013

HP Apollo 8000 System



System configuration

Multiple HP innovations make the HP Apollo 8000 System stand out from the competition. It leads the way in teraflops per rack for accelerated results. Its efficient liquid cooling is delivered without the risk, while paving the way to data center energy recycling and a more sustainable future.

- Innovation—Dry-disconnect server trays contain sealed heat pipes that cool server components while keeping them dry
- Innovation—The HVAC power distribution system eliminates most conversion steps to exceed ENERGY STAR Platinum certification levels
- Innovation—The HP Apollo 8000 iCDU Rack maintains sub-atmospheric pressure for operational resiliency and serviceability
- Innovation—Quick-connect, modular plumbing kit can be operational quickly as opposed to multiple days or weeks

Components at-a-glance

The HP Apollo 8000 System is available with a scalable starting configuration of one HP Apollo f8000 Rack and one HP Apollo 8000 iCDU Rack. This converged system has up to 144 x 2P servers per rack with plenty of accelerator, PCIe, and throughput options.

HP Apollo f8000 Rack	HP Apollo 8000 iCDU Rack	HP ProLiant XL730f Gen9 Server	HP InfiniBand Switch for HP Apollo 8000 System
<ul style="list-style-type: none">• Standard rack footprint• Up to 144 servers/rack• Disaster recovery (DR) integrated fabric with simplified cabling• Utility module provides 80 kW of power input• Eight hot-plug 10 kW power rectifiers• Three-phase, high-voltage AC power for efficiency• Integrated liquid cooling with multi-level sensors for monitoring and intelligent rack isolation• HP Apollo 8000 System Manager provides environmental rack monitoring and power management, along with HP Integrated Lights-Out (iLO) and HP Advanced Power Manager	<ul style="list-style-type: none">• Dense, half-rack solution with 26U available in the top half of the rack• Avoids/limits the use of power-hungry chiller units• Reduces PUE and increases energy savings• Facility water intake, ASHRE-spec water• Vacuum pump maintains pressure, so liquid stays in place• Quick-connect plumbing kit for easy installation• Tri-loop technology maintains water pressure while isolating the facility and secondary water loop• Supports up to four HP Apollo f8000 Racks of IT• Available in N and N+N redundancy mode	<ul style="list-style-type: none">• 2 x 2P nodes per compute tray, Intel® Xeon® E5-2600 v3 series processors• Up to 256 GB per node HP DDR4 SmartMemory 2,133 MT/s• One SSD, up to 1.6 TB• One InfiniBand FDR port/server• One GbE NIC/server• No controllers• 1,200 W input power per tray• Component-level cooling with dry-disconnect server trays• Reusable energy providing additional savings to the overall energy bill• Heat sinks and jackets protect processors and memory, with heat pipes to ensure heat transfer• Hot-plug, independent server trays• HP iLO Management Engine	<ul style="list-style-type: none">• 36-port InfiniBand FDR switch, each tray has 18 QSFP uplinks and 18 downlinks for node connectivity• 4–8 per rack based on configuration• Integrated in the rack for simplified cabling and network topology

HP Services

Site assessment, deployment, and support

HP Technology Services is ready to engage as you consider the HP Apollo 8000 System. HP Consulting Services can help you analyze and prioritize needs for power and cooling, as well as more detailed design and data center implementation planning. HP recommends Factory Express services to oversee the implementation of HP Apollo 8000 Systems from the HP factory floor to the data center floor. And our HP HPC specialists are ready to configure software solutions and any third-party integration needed. Once the new HP Apollo 8000 System is in place, HP gives you easy access to expertise for routine hardware replacements and the ability to get assistance fast if a more complex situation arises.

- HP Datacenter Care is a flexible, comprehensive, relationship-based approach to personalized support and management of heterogeneous data centers. With a structured framework of repeatable, tested, and globally available services, your team can leverage HP's experience supporting complex environments, global support partnerships, and technical expertise. You get exactly the services you need—when and where you need them—in a single agreement.
- HP Financing for HP Apollo 6000 and 8000 Systems – Having access to technology on terms that align to your business needs is critical, and HP Financial Services is uniquely positioned to help accelerate your move to the data center of the future with a broad portfolio of flexible investment and transition solutions. Maximize your current data center environment, and access the latest high-performance computing technology when you need it. HP Financial Services offer:
 - Simple transition from existing technology to HP Apollo 6000 and 8000 Systems
 - Dual usage of existing and new equipment to ease the transition
 - Flexible payment plans to quickly access HP Apollo 6000 and 8000 Systems more economically
 - Removal of existing technology and recovery of remaining value to help support the transition to new HP Apollo 6000 and 8000 Systems
 - Technology refresh approach to allow for future scalability and upgrades
 - Expert support for secure data removal from legacy equipment
 - Flexible terms to meet business needs
 - Available globally where HP Financial Services conducts business²

² Financing and service offerings available through Hewlett-Packard Financial Services Company and its subsidiaries and affiliates (collectively HPFSC) in certain countries and is subject to credit approval and execution of standard HPFSC documentation. Rates and terms are based on customer's credit rating, offering types, services, and/or equipment type and options. Not all customers may qualify. Not all services or offers are available in all countries. Other restrictions may apply. HPFSC reserves the right to change or cancel this program at any time without notice.

Technical specifications



HP Apollo f8000 Rack

Server	Each rack supports up to 72 HP ProLiant XL730f Gen9 Server trays (two nodes per tray)
Networking	Each rack supports a total of eight HP InfiniBand switches
Power	80 kW input power per rack ships standard with N+1 or N+N redundancy support depending on configuration of the servers Input: 380–415 VAC for international standards and 480 VAC for North American standards (4 x 30A power cords per rack)
Management	HP Apollo 8000 System Manager HP iLO Management Engine (iLO 4 v2.00) Rack level HP iLO network consolidation
Typical configuration	72 HP ProLiant XL730f Gen9 Server trays and eight HP InfiniBand switches, 16 Ethernet SFP+ cable kits, associated rack plumbing kit, and utility module (includes HP Apollo 8000 System Manager, 2 x 40 KW power shelves)
Weight	4,700 pounds (or 2,132 kg) max 2,914 pounds (1,322 kg) max with no server trays
Dimensions (WxDxH)	24 in x 56.18 in x 94 in (607 mm x 1427 mm x 2,382 mm)



HP Apollo 8000 iCDU Rack

Cooling	An iCDU rack supports a maximum of 320 kW or up to four HP Apollo f8000 racks
Power	Input: 380–415 VAC for international standards and 480 VAC for NA standards (1 x 30A power cord per rack)
Management	HP Apollo 8000 System Manager
Redundancy	Supports N, N+N redundancy
Configuration	<ul style="list-style-type: none"> Each iCDU rack ships with one CDU at the bottom of the rack and associated rack plumbing kit. Also, the iCDU rack is configurable to add 48-port HP 5900 Ethernet switches. Secondary plumbing kit is ordered one for every three racks (f8000 and iCDU) in the solution. Optional IT equipment may be added to the top half of iCDU provided power and cooling requirements for additional IT are supplied
IT equipment	26U of standard 19" rack space for network switches or server nodes
Weight	2,188 pounds (993 kg) with no hose kits or IT equipment installed
Dimensions (WxDxH)	24 in x 57 in x 94 in (607 mm x 1427 mm x 2,382 mm)

Technical specifications (continued)



HP ProLiant XL730f Gen9 Server

Server	Each XL730f tray comes standard with two 2P servers
CPU	Intel Xeon E5-2600 series, E5-2695v3, E5-2690v3, E5-2680v3, E5-2670v3, and E5-2683v3
Memory	16 DIMMs per server, max 256 GB HP DDR4 SmartMemory 2,133 MT/s
Network	Integrated NIC: Single port 1 GbE per server InfiniBand Adaptor Kit: Single ConnectX-3 Pro InfiniBand FDR port per server
Storage	One small form factor (SFF) SSD per server Supports 80 GB, 120 GB, 240 GB, 480 GB, and 1.6 TB SSD
Boot	SSD and network
Minimum configuration	Two CPUs per server, single InfiniBand FDR adaptor, two DIMMs per CPU (up to eight DIMMs max)
Power	Max of 1,200 W of HVDC to 12V conversion per ProLiant XL730f Gen9 Server tray
Management	<ul style="list-style-type: none"> • HP Apollo 8000 System Manager • HP iLO Management Engine (iLO 4) – dedicated iLO network support • HP Advanced Power Manager • HP Insight Cluster Management Utility
OS	RHEL, SLES, and CentOS



HP InfiniBand Switch for Apollo 8000

Switch type	Mellanox 36 port QDR/FDR10/FDR integrated leaf module
Ports	Each tray has 18 QSFP uplinks and 18 downlinks for node connectivity
Speed	Up to 56 GB/s InfiniBand FDR per port
Cabling	Front cabled uplinks with rear cabled node connectivity
Form factor	1U half-width tray
Power	Maximum 250 W per tray (Preliminary estimates)
Management	Embedded only

Customize your IT lifecycle management, from acquisition of new IT, management of existing assets, and removal of unneeded equipment. hp.com/go/hpfinancialservices

HP server management software

HP Apollo 8000 System Manager

With HP Apollo 8000 System Manager, you can see and manage shared infrastructure power, and facility and environmental controls, from a single console. Save by avoiding spend on serial concentrators, adaptors, cables, and switches. Flex to meet workload demands with dynamic power allocation and capping.

HP Insight Cluster Management Utility (CMU)

An efficient and robust utility for the management of HPC and hyperscale clusters, HP Insight CMU is an efficient and easy-to-use tool for cluster administration. HP Insight CMU is used at some of the largest HP cluster deployments, supporting multiple Top 500 sites, where it is not only valued for its capability to install, modify, and update images rapidly but also for its ability to identify and isolate performance issues.

HP Integrated Light-Out (iLO) Management Engine

The HP iLO Management Engine with Integrated Lifecycle Management provides new levels of performance and quality of service. Monitoring the health of HPC solutions usually requires running monitoring software on the systems and stealing cycles from primary computational tasks. With Active Health and Agentless Management, all the monitoring is performed on the iLO Management Engine, allowing extensive monitoring without impacting performance.

The HP Apollo 8000 System in action

National Renewable Energy Lab slashes power requirements with HP

NREL researchers are focused on a future built around clean energy. That's why they partnered with HP to build an HP Apollo 8000 System for the lab's new HPC data center, which was designed to be one of the world's most energy-efficient data centers. It provides an astounding amount of compute power while breaking new ground in energy-efficient computing with a liquid cooling system developed by HP. And the data center is designed to capture the "waste heat" from computing systems so it can be used to heat facilities on the NREL campus.



“Strong partnerships between our national laboratories and America’s private industry, academia, and entrepreneurs will help reduce the effects of climate change, increase the production of clean energy, and accelerate the development of new technologies.”

— Ernest Moniz, U.S. Energy Secretary⁶

Resources

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Why HP for Supercomputing

HP has a consistent track record of redefining the server market to meet the next wave of computing requirements. We are the only company with IP across all three of the technology areas (servers, storage, and networking) needed to address the challenges of high-density computing. As a result:

- HP holds the number one position of entries on the Green500 supercomputers list with 195³
- HP holds the number one position of entries in the Top 500 supercomputers list with 196⁴
- HP is number one in the HPC market, according to IDC⁵
- The HP Apollo 8000 System, called “Peregrine,” designed for NREL, has petascale computing capability (1.2 quadrillion calculations per second peak performance), representing the world’s largest computing capability dedicated solely to renewable energy and energy-efficiency research⁶

Get started on the data center of the future, today

If your research requires advanced supercomputing technology to solve the greatest challenges of our day, don’t delay. Contact your authorized HP representative to see how we can build the engine that drives your next great advancement.

Learn more at
hp.com/go/apollo

³green500.org

⁴top500.org

⁵IDC: careers.idg.com/www/pr.nsf/ByID/MYAR-9HJMPN

⁶energy.gov/articles/energy-secretary-moniz-dedicates-clean-energy-research-center-new-supercomputer

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