



TRANSFORMING BUSINESS ANALYSIS THROUGH HPC, AI, AND DATA ANALYTICS INTEGRATION

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Convergence of HPC/AI and Data Processing into Enterprise Markets

Data processing today involves analyzing massive amounts of data which organizations may process onsite or in the cloud. But the typical cluster system hardware and software used in many organizations cannot handle the processing needs of the new age of big data.

High performance computing (HPC) systems, often called super computers, use parallel processing techniques to process complex computational problems. HPC systems, originally used in academia and government research, are now being built and used across businesses and organizations. According to Hyperion 2019 research, “The total HPC market including public cloud spending grew from \$22B in 2013 to \$26B in 2017, and is projected to reach \$44B in 2022.” 1]

Specialized [artificial intelligence \(AI\), machine learning \(ML\), and deep learning \(DL\) software](#) is typically used to analyze and determine patterns in the data to aid in making business decisions. Hyperion 2019 research finds that, “The HPC-Enterprise market convergence will drive HPC products into the broader enterprise market. Competitive forces are driving companies to aim more complex questions at their data structures and push business operations closer to real time. The HPC and commercial sectors are also converging around a shared need for extremely data-intensive AI-ML/DL workloads, both on the simulation and analytics side.” 2]

HPC, AI, and Data Analytics Solve Customer Pain Points

In this age of data-driven analysis, many organizations are looking for a comprehensive solution to handle all of their processing needs. They need computer systems that have a workload optimized architecture that can process varying workloads. For example, a company in the medical industry currently has separate computer systems and software for each department but needs an integrated solution to meet all department needs. In addition to handling general processing needs, they need an HPC-level computer system capable of performing HPC and deep learning tasks to analyze their massive number of records and data.

But selecting hardware and software for such a system and implementing the system is a daunting task. First, they need to determine the computer system design and architecture requirements for general data processing versus HPC, AI, and data analytics workloads. Internal staff may need more information

on the hardware technology required for an HPC system. In addition, the organization must do an evaluation among multiple vendors and then select one or more vendors to implement the new system.

Once system components are selected, there are still a number of time-consuming system deployment, tuning and training tasks. **What this organization needs is a vendor who can provide an end-to-end solution to meet their needs from system selection through installation and training.**

Introducing Quanta Cloud Technology (QCT)

[Quanta Cloud Technology \(QCT\)](#) is a leading cloud data center solution provider with solution centers in Taoyuan, Taiwan and San Jose, California. QCT has complete solutions in these areas: Private Cloud, Virtual Desktop Infrastructure, Software Defined Storage and Data Analytic Platforms (HPC/DL). QCT can deliver standard and open SKUs of server, storage, networking, and rack systems under a single roof. In addition, QCT can also provide in-factory assembly for full rack delivery. **QCT's modular architecture design meets a wide range of processing needs**—from general data processing up through designing an HPC cluster optimized for massive scalability and performance to run HPC and deep learning workloads.

QCT Provides End-to-End Support to Implement the System

QCT provides a complete solution to meet the needs of organizations across a wide range of industries in building and implementing a new cluster. The solution includes assistance in these areas: solution evaluation, architecture design and solution deployment as well as proof-of-concept (POC), support, education and cluster scale out services.

The QCT Optimized and Scalable High-Performance Computing / Deep Learning Solution

According to 2019 Hyperion research, “Important HPC capabilities include scalable parallel processing, ultrafast data movement and ultra-large, capable memory systems.” 3] QCT provides these capabilities with their cutting-edge HPC / DL solution that integrates adaptive hardware with software stacks, industrial-leading applications and deep learning frameworks. This unique solution combines QCT's best-in-class infrastructure with high-bandwidth and low-latency interconnect. The solution offers seamless connectivity with parallel file systems, to provide a scalable cluster architecture for supercomputing users.

QCT HPC/DL Infrastructure Platform

“QCT’s hardware can empower the most complicated workloads. Within QCT’s in-factory integration and validation, we’re able to do full-rack delivery that could greatly reduce on-site service complexity. In addition, we use our expertise in implementing industry best practices in power usage, network cabling and thermal design,” states Stephen Chang, Senior Director of R&D at QCT.

Michael Quan, Director of Pre-Sales at QCT, indicates that QCT offers a wide range of servers to meet customer needs including GPU-accelerated, big memory, high density CPU, and storage servers. Quan states, “We provide state-of-the-art servers, supporting the latest Intel® Xeon® Scalable Processors and Intel® Optane™ DC Persistent Memory Modules (DCPMM). Starting from our single node 1U to 4U QuantaGrid series up to our multi node QuantaPlex series of servers.”

For a small scale general purpose system, QCT delivers an all-in-one server for the compute node, storage node, and utility node. On a large scale cluster, the compute node can be divided into the central processing unit (CPU) and the graphic processing unit (GPU) if the customer needs graphic acceleration, while the storage node may be adapted to parallel file systems and hierarchical storage management.

The QCT HPC/DL Solution’s infrastructure includes the compute node, storage node, utility node, and interconnect with an extensive selection of hardware and software as shown in Figure 1.

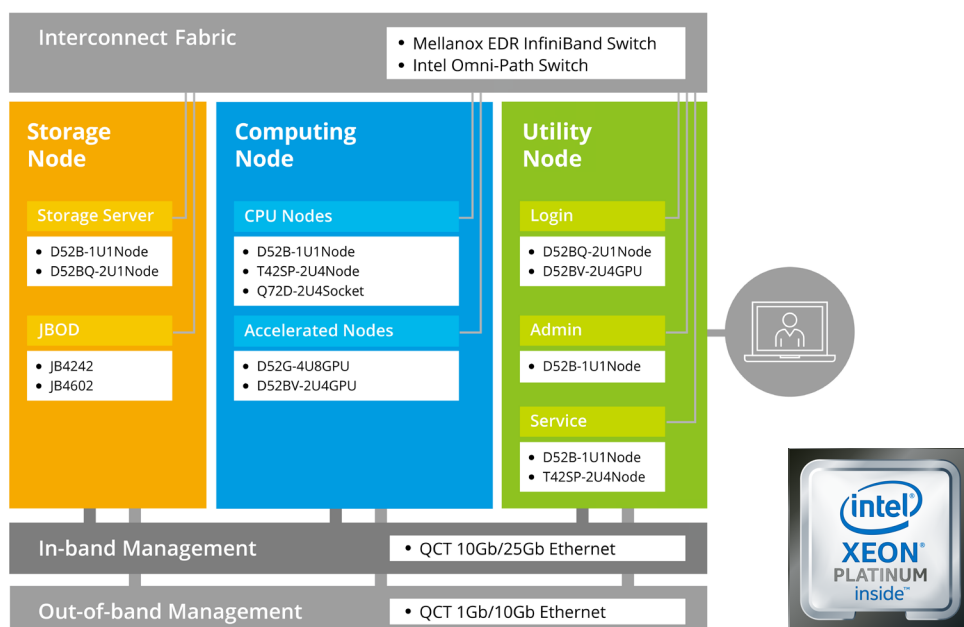


Figure 1. QCT HPC/DL Infrastructure

HPC/DL Software Solutions and Cluster Starter Kit to Speeds Time-to-Market

The increased use of HPC, AI, and data analytics by organizations and businesses is also occurring in software, customers are looking for an integrated software platform to accelerate their business transformation. There is an ecosystem of global partners with HPC, AI, and data analytics solutions to help organizations solve their complex data processing and analytics needs. QCT is a part of this ecosystem through their partnership with leading software companies and active involvement as a contributor in the HPC open source community.

QCT has a strong partnership with software giants like Microsoft, Red Hat, and VMware, and provides customers a wide variety of solutions for cloud services and software defined storage (SDS). In addition, QCT has extensive experience in implementing software for HPC systems. QCT is technology partner with Altair and ThinkParQ and a silver member of OpenHPC.

“The QCT QxSmart HPC/DL solution is a fast and reliable way to build a HPC or deep learning environment across many industries, while reducing the time and effort to implement projects so customers can focus on the things that matter most,” according to Stephen Chang, Senior Director of R&D at QCT.

QCT provides a HPC/DL Cluster Starter Kit deployment tool that simplifies processing tasks and shortens cluster implementation time to help speed customers time-to-market. The Starter Kit integrates a software stack, workload package, parallel file system, and firmware update function into a single tool as shown in Figure 2.

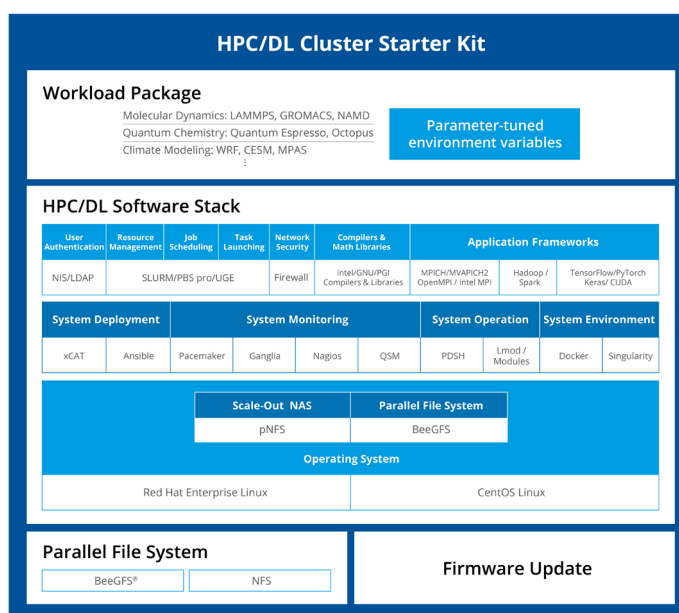


Figure 2. QT Starter Kit and Workload Package

The HPC/DL Workload Package supports applications used in molecular dynamics, quantum chemistry and climate modeling often used in HPC work. In addition, the HPC/DL Software Stack includes operating systems RHEL or CentOS, system deployment, monitoring and operation tools, as well as the application framework, and workload manager.

Popular deep learning frameworks could be supported by the QCT HPC/DL Starter Kit, so that customers are able to leverage deep learning frameworks such as Keras, TensorFlow, and PyTorch to empower their business.

A parallel clustered file system that spreads data across multiple storage nodes is frequently used in HPC systems—Lustre and BeeGFS parallel files systems are available options for QCT HPC/DL systems. The workload manager provides an easy to use dashboard that speeds work for users, system administrators, and developers.

How the QCT Starter Kit Helps Users

When end users create a job script, they must spend time seeking the best combination for MPI library and compilers for the best performance on their applications. Users can simply leverage QCT's Starter Kit, which includes job script templates and pre-defined environment variables. The only thing they need to do when using the kit is to define how many resources (CPU/memory/disk) need to be used for the job and then submit it to the workload manager. The system automatically gathers idle resources to compute the job and notifies the end user. The Starter Kit saves time for the end user and makes their job easier.

How the QCT Starter Kit Helps Developers

When creating code, developers typically have to log into the system each time environment variables change to test the results in various programming environments. With the Starter Kit, environment variables are easily changed through module files, using pre-defined MPI library and compilers. This results in a decreased effort for the developer and an increased return-on-investment (ROI).

How the QCT Starter Kit Helps Administrators

The role of the system administrator is to maintain the system and make sure that everything is stable. Typically, administrators need to log into each node to check status to maintain the system. With the Starter Kit, an administrator can monitor all nodes on a dashboard, get automatic event warning notifications, and use distributed management tools to control all nodes at the same time. The QCT tools simplify IT administration, streamline cluster deployment, and make system monitoring and management easier.

Value of QCT HPC/DL Solution

Drive Differentiation on Demand

- Get a customized architecture with modularized architecture design for high performance compute
- Easily scale-out infrastructure based flexible scale-out solution

Reduce Effort Spend on System Integration

- Greatly reduce time spent on system integration with advanced rack level integration, expertise in thermal and cabling design
- Shorten implementation time from weeks to days with QCT's HPC/DL starter kit that integrates a software stack, parallel file system and applications

Faster Time-to-Value

- Speed software installation with a pre-integrated solution for multiple industrial applications
- Simplify daily tasks with comprehensive software tools for simplified management

Accelerating Weather Research and Forecasting (WRF) Case Study

The [weather research and forecasting \(WRF\) model](#) is a numerical weather prediction (NWP) system used extensively for research and real-time forecasting throughout the world. To run WRF simulations, researchers must compile and build all WRF programs which is a complex and time-consuming process. QCT created a WRF solution that included all required libraries with their best practices in optimizing performance and simplifying operations, and provided the pre-compiled and pre-optimized WRF modules for users to run their simulations on the QxSmart HPC/DL Solution, QCT's in-house HPC system. See the [QCT case study](#) for more details on how to use the QCT WRF solution.

After System Deployment: QCT Support, Training, and Scale-up Services

The work for an organization doesn't end once a system is installed. There are a number of system deployment and tuning tasks that must be completed. These tasks are often time-consuming and issues may cause disruption of the computer system operation or even impact customers. In addition, staff must be trained on how to use the new system and learn how their workloads are affected.

QCT provides support and training to help customers resolve issues with post-system deployment. They also offer hardware maintenance services and can provide proof-of-concept services and expertise to help an organization scale up existing hardware to run as an HPC/DL cluster.

Conclusion

In today's current data-driven environment, organizations must analyze massive amounts of data and answer complex questions to gain business value from their data. But their typical hardware and software may not handle their processing needs. Organizations require HPC-level computer systems with optimized architecture that can process varying workloads—from general data processing through HPC, to deep learning processing.

QCT is a leading cloud data center solution provider with modular architecture designs to meet the most stringent HPC, AI, and data analysis requirements.

"QCT remains committed to offering our customers the latest technologies that will aid in the processing of their most demanding data center workloads," said Mike Yang, President of QCT. "Whether it's critical data in the cloud, AI, databases, high-performance computing, or in-memory analytics, adding support for Intel's 2nd Gen Intel® Xeon® Scalable Processors, formerly codenamed Cascade Lake, in combination with our QuantaGrid and QuantaPlex servers provide unprecedented performance and reliability."

References

1] HYPERION RESEARCH UPDATE: Research Highlights In HPC, HPDA-AI, Cloud Computing, Quantum Computing, and Innovation Award Winners, Earl Joseph, Steve Conway, Bob Sorensen, and Alex Norton, Presented at the 2019 ISC19 Conference, Slide 30.

2], 3] HYPERION RESEARCH UPDATE: Research Highlights In HPC, HPDA-AI, Cloud Computing, Quantum Computing, and Innovation Award Winners, Earl Joseph, Steve Conway, Bob Sorensen, and Alex Norton, Presented at the 2019 ISC19 Conference, Slide 76.

Accelerating Weather Research and Forecasting (WRF) with QCT: Hurricane Irma Case Study, Nov 17, 2017, <https://blog.qct.io/hpc-application-casestudy-hurricane-irma-with-wrf/>

About QCT

Quanta Cloud Technology (QCT) is a global data center solution provider. We combine the efficiency of hyperscale hardware with infrastructure software from a diversity of industry leaders to solve next-generation data center design and operation challenges. QCT serves cloud service providers, telecoms and enterprises running public, hybrid and private clouds.

Product lines include hyper-converged and software-defined data center solutions as well as servers, storages, switches, integrated racks with a diverse ecosystem of hardware component and software partners. QCT designs, manufactures, integrates and services cutting-edge offerings via its own global network. The parent of QCT is Quanta Computer, Inc., a Fortune Global 500 corporation.

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