

## ▼ High Performance Computing & Communications (HPCC)

### *Application Focused HPC*

**H**igh Performance Computing (HPC) is a key enabling technology of the scientific research and applications community and heavily depends on cutting edge advances to improve performance and capabilities.

Facing increasingly complex problems, many Northrop Grumman customers require a combination of leading-edge computer, storage, and network technologies to meet their mission objectives.

In response Northrop Grumman has built a mission focused HPCC research and development program with laboratories containing HPC and Storage Area Network systems and connected via dynamic optical network-communication circuits where customer applications can be optimized and extended with new capabilities. We make significant investments in HPCC architectures to determine the best solutions for our customers' missions and focus on their scientific, engineering, and research applications that require HPCC.

Northrop Grumman leverages HPCC to meet the mission requirements of customers throughout the Department of Defense (DoD), Intelligence Community, NASA, National Oceanic and Atmospheric Administration (NOAA), National Institutes of Health (NIH), Department of Energy (DOE), and other government agencies and research organizations. We deliver increased return on investment by helping customers better

utilize their resources through balanced systems integration and software design, model modernization, performance enhancements, and improved experiment management processes. We enable the customer to focus on meeting mission objectives, rather than on solving computer, networking and storage integration issues. Northrop Grumman customers can leverage the latest HPCC offering to enhance their computational environment; optimizing its usability to solve science and engineering problems required to meet mission objectives.

### **HPC Clusters, Environments, and Application**

Northrop Grumman maintains two 512-core clusters at its McLean, VA facility; a Penguin Computing system based on quad-core Intel Westmere processors and Scyld cluster management, and another based on the Intel Clovertown processors. The facility operates in a full data center environment with SAN storage, three types of networks (InfiniBand, Fibre Channel and IP), LDAP & Kerberos authentication and authorization, and Nagios infrastructure network monitoring and alerting.

Northrop Grumman contributes to advances in the Atmospheric Sciences,

developing weather forecasting systems, operational decision support systems, and adding unique capabilities to forecast and assimilation models in HPC environments. Additionally, working on NASA's Future Weather Architecture Study, Sensor Web Project, Earth System Modeling Framework (ESMF) and GEOS-SSII/GSI Data Assimilation Projects gives us an early appreciation of the growing challenges facing today's scientific organizations that rely on HPC to meet their research objectives.

Northrop Grumman has expertise in parallel programming and large-scale optimization including multi-core and GPU computing. We investigate programming models that include traditional MPI/OpenMP parallelization as well as Hadoop/MapReduce, elastic client-server, virtualization & cloud implementations. With dynamic on-demand high performance networking, these capabilities allow distributed computing applications that can connect Big Data computing and analytics projects.

With the recent emphasis on moving beyond computing and the generating and distribution of raw data, but on to understanding and then creating



actionable information out of the data, Northrop Grumman has created new technology stacks of hardware and software that address these challenges in innovative ways. These include geo-portals that serve multiple climate and environmental data products, as well as geospatial analytics tools that combine business intelligence tools, geographical information systems, and geospatial databases.

Northrop Grumman's approach is to investigate our customer's mission and the scientific algorithms associated in its solution set. We research which HPCC architecture is best suited for this solution and then help you develop the applications in the most efficient form.

## High Performance Networks

High Performance Networks (HPN) offering lambda services are new technologies that have only begun deployment in the past few years. An emerging alternative to traditional dedicated HPN is the dynamic circuit networking (DCN) pioneered by the DRAGON project. DCN allows users to provision dedicated circuits easily on-demand, while simultaneously offering low-latency and high bandwidth. DCN represents a departure from the more common shared bandwidth networking paradigms to which users are accustomed. Internet2 is now offering these services in their nationwide research and education network; however, integration of these services within the customer environment is not yet a common offering for most HPN vendors. Northrop Grumman has invested in developing user-friendly mechanisms to integrate DCN capabilities within our customer's networks delivering an affordable, low-latency high bandwidth solution. Northrop Grumman is a partner with Internet2; leveraging its DCN capabilities to establish reliable dynamic access to next generation optical communications for its customers and interested organizations. For more detail please see the "High Performance Network Architecture (HPNA)" data sheet.

## HPCC Facility

The Northrop Grumman HPCC facility located in McLean, VA, is a core engineering group and laboratory complex whose primary goal is the reduction of execution risk to our customers. We provide architectural consulting, education, proof-of-concept, prototypes, and concept development assistance as well as providing project support in HPCC. It also serves as the hub for the Transformational Research, Integration, and Demonstration (TRIAD) Northrop Grumman research network. In this role it serves to support and connect laboratories across Northrop Grumman to external networks, providing access to technologies and ongoing research as well as demonstrations of Northrop Grumman's HPCC technologies.

### Specifically, the Northrop Grumman provides the capability for:

- Evaluating and understanding various HPCC hardware and software capabilities
- Conducting demonstrations of Northrop Grumman solutions and HPCC capabilities
- Supporting rapid prototyping of HPCC solutions, to include assessment of alternative approaches
- Facilitating jump-start of new or enhanced technical capabilities where other means for this development are not present
- Support independent research and development (IR&D) activities
- Serving as the point-of-presence for Northrop Grumman's Internet2 consortium activities

A significant element of Northrop Grumman is our relationships with our vendors. We maintain active relationships with almost 150 vendors, many of whom have made significant investments in hardware and software assets located in the HPCC laboratory complex.

## The Northrop Grumman HPCC Differences:

- Uniquely positioned to integrate HPC and HPN technologies
- Significant investment in leading-edge HPCC architectures
- Active participant in the latest Optical Internet2 initiatives
- Proven success in delivering HPCC performance to our customers
- Experience adapting HPC applications to leverage accelerator technologies
- Vendor neutral with the capability to evaluate best value solutions for customers

### The Northrop Grumman HPCC Values:

- Not committed to a specific HW/SW architecture, but have extensive strategic partnerships with HPCC vendors to bring the best solution to the mission
- Extensive experience in providing integrated solutions to the HPCC application space
- Have an existing HPCC demonstration environment for solution and application testing and evaluation
- Our solutions and services permit the customer to focus and solve their mission and application needs
- Customers need not redirect their valuable technical/science resources to keep abreast of the HPCC market

Northrop Grumman can help meet your mission needs through HPCC.

## Contact Us

For more information, please contact

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