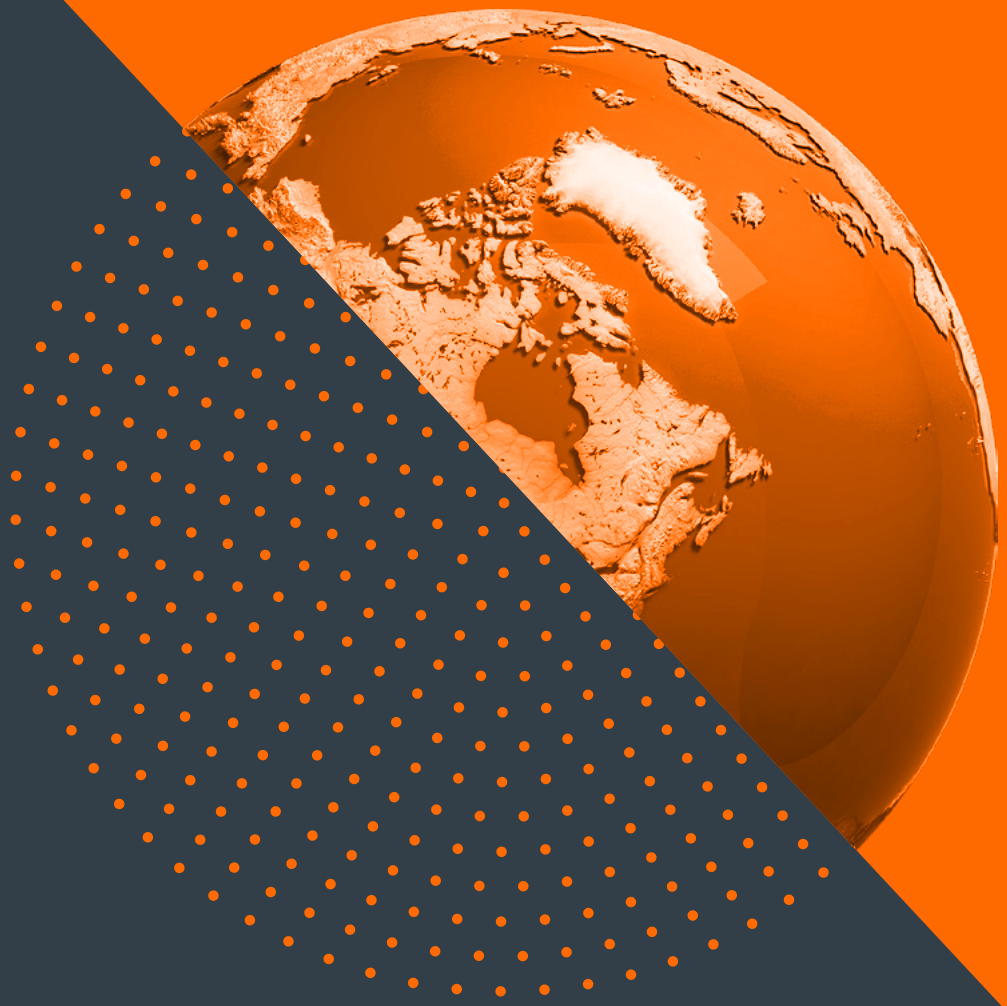

Accelerate Your Business with HPC

Lenovo

Your business has the talent, expertise and potential to achieve great results and your IT infrastructure's computing power should never limit that. To grow your business beyond the ordinary and to instead drive innovation to new levels, you can't rely on traditional data center infrastructure. High-performance computing (HPC) systems are being deployed across many areas of business at companies across the globe to handle demanding workloads, provide big data and analytics solutions, and maximize business growth.

Although many still think they're only useful for research or academia, HPC solutions can be purpose built and optimized for your business needs. They can help to accelerate innovation, whether it's precisely modeling a new drug, driving simulations to improve manufacturing, improving the efficiency and success rate of explorations, achieving greater manufacturing efficiency, or gaining new insights into IoT data. This best-practice guide will help you evaluate and consider the best approach to adopt HPC for your business needs as well as the solution components to be considered in its implementation.

HPC Cluster Solution Considerations

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Future Proof Your Business with HPC

intel

HPC Cluster Solution Considerations

Compared with other IT solutions, HPC offers increased workload capability, accessibility and availability to a variety of users within your organization. These feature sets can be game changers in terms of performance. The HPC services you choose to implement support a flexible range of compute workloads from shared HPC clusters to fully virtualized environments. Whereas older HPC solutions were considered rigid in their use cases addressing only a singular issue, choosing a modern HPC solution should provide flexibility to process business, scientific, and technical workloads with ease.

Another benefit of HPC computing is its ability to accommodate multidisciplinary workloads and collaboration, which reduces computation silos. There are several factors to weigh when considering the right HPC solution for your business, which we'll examine in the following sections. One of the largest, overarching requirements for a provider is first-class service and support with experience in your business domain.

Extreme Workload Capability and Flexibility

A growing number of businesses rely on HPC clusters from initial-stage research to large-scale analyses and other business processes. This enables innovators to conduct highly complex analytics more efficiently with greater accuracy and deeper understanding. Across all business environments, scientific, manufacturing, and engineering problems are being driven by computer simulations. These include: seismic simulations, computational fluid dynamics, materials science, drug trial data analysis, population health predictions, energy, and weather modeling.

These simulations require increasingly complex models, which drive unique workload demands that traditional computing infrastructure can't handle. To meet these needs, evaluate HPC solutions and infrastructure that provide advanced workload-optimized capabilities so they can accelerate innovation while remaining cost-effective. Whereas most HPC solutions are built to tackle demanding data-intensive applications, look for a flexible HPC solution that adopts a building-block approach for infrastructure deployment. Boosting your business' compute capabilities, expanding its storage capacity, and accelerating results should be as simple as adding nodes to an existing chassis.

Reliability and Efficiency

In innovation-driven business scenarios with large groups of users relying on your infrastructure, it's critical to ensure the highest levels of reliability and uptime. According to Industry analyst firm, Information Technology Intelligence Consulting (ITIC), and its latest Global Server Hardware Reliability Report, 98% of organizations say that a single hour of downtime costs over $100,000; 81% of respondents indicated that 60 minutes of downtime costs their business over $300,000 and a record one-third or 33% of enterprises report that one hour of downtime costs their firms $1 million to over $5 million. Choose an HPC solution that offers predictive failure, self-analysis, and diagnostic capabilities that not only ensures easy serviceability and supports uptime to the fullest, but doesn't end up as added cost.

However, reliability and continuous operation shouldn't force you to compromise on efficiency. Look for energy-saving features that enable advanced cooling and temperature monitoring functions. For example, some HPC providers offer specialized technology for infrastructure that needs to operate in extreme environments.

Advanced Security

Sophisticated security threats require a holistic security strategy and solution that protects HPC system users, connected components, network interconnect, and the large volumes of data that pass through them. With security always a top priority, consider HPC solutions with a built-in set of security features and practices to protect your business from the software down to the hardware and firmware components.

Additionally, your HPC security solution needs to scale to encrypt large numbers of storage volumes, and be powerful enough to securely decrypt data on access. Some clustering technology includes health-check services built in that monitor your HPC and data center environments non-stop. Evaluate HPC partners based on their knowledge of and compliance to security standards and regulations around data collection and storage, and user safety.

Scalable Data Storage

One of the key technology areas to consider for HPC storage expansion is energy efficiency. The better your cluster is at managing power requirements and heat dissipation, the denser your system storage can become. Extreme density results in large volumes of data placed closer to the compute nodes that need them, which improves performance and scale. Also consider the types of storage supported as requirements may vary depending on OS, application, and database software your business needs to run.

A building block approach to storage expansion with a built-in data migration strategy is often the best approach for HPC system success. Choose a provider that understands and can support your specific storage requirements today, and into the future.

Optimized Bandwidth and Communication Fabric

HPC systems require high bandwidth, high speed communication fabric to move massive amounts of data. Whereas some HPC applications require access to large data volumes for deep analysis, other applications utilize highly parallel processes. Examples include modeling and simulations, where communication and coordination across large numbers of GPU nodes improves scale. To accommodate this type of processing, your HPC cluster solution should be selected on the basis of network or interconnect, memory, and processor speed for a given application set.

Integration with Existing Infrastructure

An often overlooked HPC requirement is its ability to integrate into the rest of your business and IT infrastructure, including both HPC and traditional data center technology. Beyond technology, find a provider who can fit a solution into your existing business processes, introducing new efficiencies along the way without requiring you to undertake costly reimplementation efforts. HPC solutions that are based on and support open standards often result in a more usable, less disruptive, implementation.

Support and Services

It's easy to focus on technology and solution specifications when choosing an HPC partner. However it's just as important to ensure you'll receive the right level of support as you transition to or expand your HPC system. Having a provider as a partner who's easy to work with, has expertise in your specific business market and verticals with a high level of ongoing technical support will reduce time to implementation and ensure you maximize the value of your investment.

You need a solution provider that engages with you to provide a holistic and well integrated solution, not point technology pieces. Look for an industry expert for your market to make sure your bespoke HPC solution is exactly that: designed with focus and profound understanding of your goals.

Maximizing Scalable HPC Infrastructure

Only HPC solutions with powerful servers, storage, and management capabilities with the latest processors and fabric are equipped to handle data-intensive workloads and drive innovation faster. Having a solution with market leading network and storage components capable of handling the vast amounts of data your business is generating or using increases your business capacity for accurate analytics. A full-stack, market-ready HPC solution fine-tuned to your industry's emerging requirements will give you that competitive edge.

You should be able to start as small as you need, while taking a building-block approach to HPC that combines storage and compute. Properly scalable HPC infrastructure solutions combine hardware, software, and bandwidth with a powerful distributed management solution to keep it simple. Some supported technologies to look for include elastic storage management and Intel Cluster Ready solutions.

Vertical Market HPC Solutions and Examples

An HPC solution with support for open source applications drives quicker results across industries. According to Andy Lin, Vice President of Strategy at Mark III Systems, AI and Machine Learning represent a fundamental shift in how data is interpreted. Most organizations don't have the skills or the infrastructure to design, build and train AI models, let alone deploy and utilize them. Choosing an HPC partner with the infrastructure and expertise across markets to meet the challenge can be the difference between success and failure.

The same goes for other markets and verticals, where a provider's capabilities should complement your own domain knowledge. Having the flexibility to choose different HPC infrastructure, software solutions and libraries as well as management systems are key to success. For example, CINECA, an IT services, support and research consortium, chose an HPC supercomputing cluster to support its work in artificial intelligence, machine learning, and automation. Their criteria included compute power and data processing throughput to span both research and industry to support its joint research with tier-one automotive manufacturers. Although CINECA is an example of a large HPC installation, knowledge gained here is applicable to HPC systems of all sizes.

The implemented solution was carefully co-designed by CINECA and its HPC provider to include multiple microprocessor architectures, ensuring that the organization can support a diverse range of research workloads. Rapid data transfer between nodes is delivered through an innovative communication fabric architecture, which boosts overall performance. Beyond just the raw processing power of HPC, the real success has been the collaboration with their HPC provider, which is not common among all vendors.

Similar requirements led to the successful rollout of an HPC system for advanced research at the University of Notre Dame. Collaboration with their provider was critical to support advanced oceanic and atmospheric research, including materials analysis. Having enough capacity and reliability to support the projects and programs across the entire university was an important criteria to meet. "The [HPC] System gives us the platform we need to keep up with ever-growing data demands," explains Dr. Jarek Nabrzyski, Director of the Center for Research Computing at the University of Notre Dame. "It's very reliable – with the HPC environment it gives results on time, every time."

HPC for Manufacturing and Engineering Analysis

Consider an HPC solution that scales as your manufacturing needs grow. Speed of implementation and expansion are key qualities to address changing demands and fluctuations in your manufacturing line output. It should also be able to power 3D modeling and simulations to optimize entire processes from design through manufacturing, working across the entire value chain: facilities, equipment, and related business processes.

Your HPC evaluation should lead you to a solution that's both powerful and flexible so you can deploy low-cost, high-performance engineering clusters for computer-aided engineering (CAE), using a domain-specific, building-block approach. Look for specific simulation software and standards support, such as ANSYS, with ease of deployment. Other required support includes fluid dynamics, impact analysis, and 3D virtual desktop (VDI) solutions.

HPC for Oil and Gas

HPC systems are proven solutions that lead the way for faster, more thorough exploration. Not all system providers can offer the expertise and guidance from a dedicated oil and gas, and energy team. With proper HPC system performance, you can drive previously unattainable results in simulations and seismic processing.

For energy companies, the need is to reduce research cycle times when evaluating choices in energy generation and mining, while also performing deeper analysis on data. These are not mutually exclusive goals with HPC if your infrastructure can provide quick access to the data you need with real time analytics results. It should also be flexible enough to handle the different types of workloads research analytics require.

HPC for Life Sciences and Healthcare

HPC is accelerating progress in Life Sciences by making it simple to access and process huge volumes of data in real time. This type of workload complexity with patient health potentially at stake requires the most powerful HPC solution available, whether you're new to HPC or experienced. Your HPC provider needs to fill the IT gap to meet the challenge.

With healthcare devices and remote monitoring on the rise, data storage and management challenges are huge. HPC is the only reasonable path forward. A scalable HPC solution enables greater collaboration across entire companies with access to research results sooner. Healthcare innovation requires high-performance compute with large memory systems, and supporting software, from an HPC system designed to deliver.

For example, Caris Life Sciences, a leading biosciences company, evaluated available HPC technology based on its ability to analyze patient data as quickly as it's collected. With terabytes of data generated and then analyzed each day, only solutions that supported massively parallel compute workloads were considered.

HPC for Financial Services

Evaluate low-latency HPC infrastructure combined with enterprise-class security built-in for a low-risk financial services backbone. While many organizations increase their risk as they move to the cloud, in many ways an on-premises HPC delivers cloud benefits while keeping sensitive data and algorithms in house.

HPC support for deep analysis on huge volumes of data and ultra-low latency processing is needed to support risk analysis and avoidance, deep market insight, and high-frequency trading systems. Ensure your HPC provider is constantly working to reduce latency towards zero, data and processing improve throughput, while reducing complexity and supporting regulatory requirements. Your provider should serve as a partner, helping you to manage risk and capitalize on business opportunities.

Future Proof your Infrastructure and Business with HPC

Business professionals, researchers, and data analysts are constantly collecting data and chasing results, providing responses and direction along the way. A challenge in one area can have a compound effect across your organization, as data center infrastructure is a shared resource. For companies managing these activities, finding the right HPC resources in terms of technology and expertise is rapidly becoming more important, to maintain their edge in innovation and against competition.

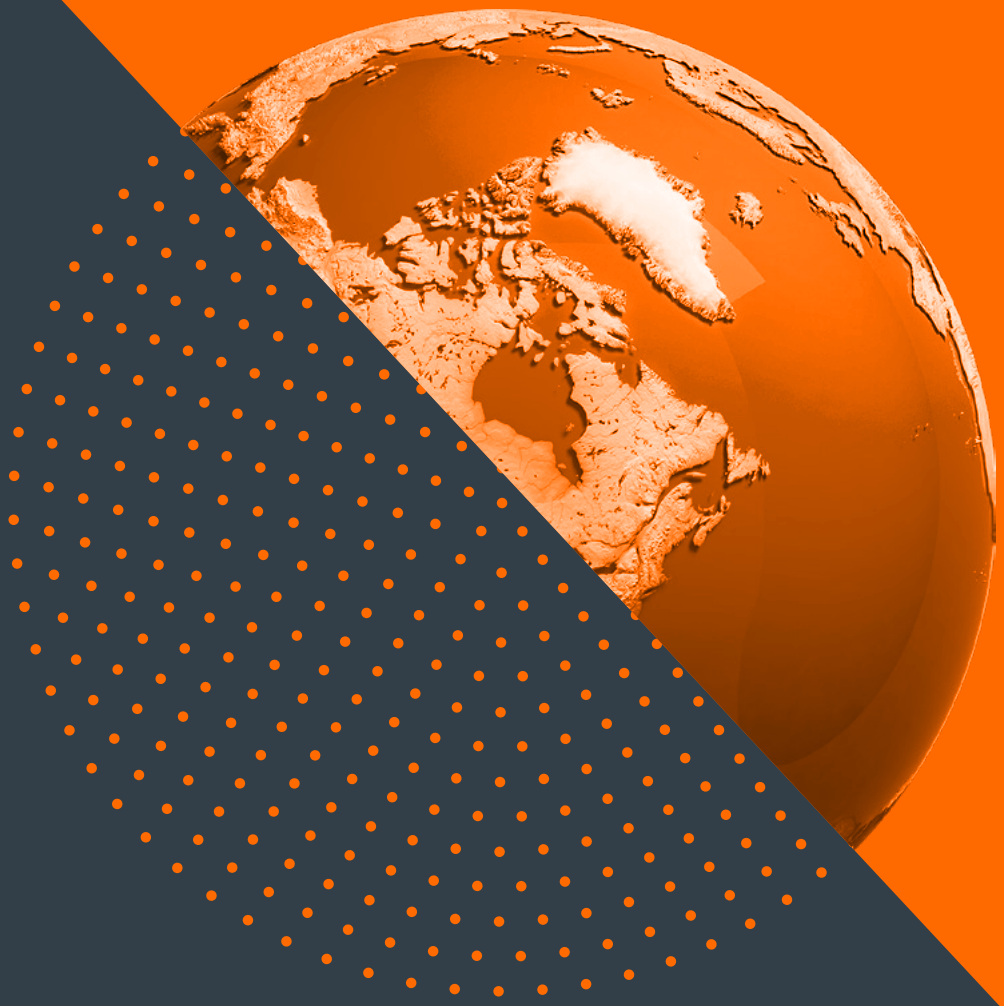
An HPC system should be chosen for its ability to accommodate the wide range of workloads from various business units across the organization, its overall reliability, its ability to integrate with systems and data already on hand, and quick implementation time. The end result is an advanced solution ready for both research and business demands with power for today and tomorrow's needs, all within budget.

Additionally, the right solution provider is one that adopts a comprehensive approach, enabling you to choose when, where, and how to integrate new HPC capabilities to extend or replace what you have now. Having the right HPC tools with the aforementioned features can meet the demands of your mounting workloads today and in the future.

To Choose the Right HPC, Choose the Right Partner

Lenovo understands the challenges that businesses face today when growing their data center IT infrastructure. Growing workload diversity and ongoing optimization in the face of new workload requirements (i.e. IoT predictive analytics, machine learning, and artificial intelligence) are creating a resurgence of highly specialized technologies that place unprecedented demands on existing data center. Addressing these emerging challenges, Lenovo makes it easier to deploy and manage clusters through a highly flexible framework of innovative, reliable, and scalable HPC technology and services. Partnering with Lenovo for HPC means faster innovation and lower all-around risk with high-performance, highly responsive technology that can scale-out massively. Lenovo also provides access to its benchmarking teams and laboratories so you can run and benchmark your application on a trial Lenovo HPC system before you commit. You get access to Lenovo experts' feedback on how to achieve improved, more reliable results. Lenovo makes it easy to get access to these results.

When it comes to demanding workloads, scalability and flexibility, a Lenovo HPC cluster is the cost-efficient choice. Through deep collaboration with its customers, Lenovo ensures each HPC deployment meets your needs in performance, energy efficiency, price-performance, and deployment. An HPC solution from Lenovo brings it to the next level, future-proofing your data center, keeping you in control of your IT, and forming a true partnership that enables your ongoing success.



We adapt. You succeed.