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HIGH PERFORMANCE COMPUTING

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1. INTRODUCTION

High performance computing (HPC) is the ability to process data and perform complex calculations at high speeds. To put it into perspective, a laptop or desktop with a 3 GHz processor can perform around 3 billion calculations per second. While that is much faster than any human can achieve, it pales in comparison to HPC solutions that can perform quadrillions of calculations per second.

High-performance computing (HPC) as a term arose after the term "supercomputing".HPC is sometimes used as a synonym for supercomputing; but, in other contexts, "supercomputer" is used to refer to a more powerful subset of "high-performance computers", and the term "supercomputing" becomes a subset of "high-performance computing". The potential for confusion over the use of these terms is apparent.

Because most current applications are not designed for HPC technologies but are retrofitted, they are not designed or tested for scaling to more powerful processors or machines. Since networking clusters and grids use multiple processors and computers, these scaling problems can cripple critical systems in future supercomputing systems. Therefore, either the existing tools do not address the needs of the high performance computing community or the HPC community is unaware of these tools. A few examples of commercial HPC technologies include:

- the simulation of car crashes for structural design
- molecular interaction for new drug design
- the airflow over automobiles or airplanes

2. WHY IS HPC IMPORTANT?

It is through data that groundbreaking scientific discoveries are made, game-changing innovations are fueled, and quality of life is improved for billions of people around the globe. HPC is the foundation for scientific, industrial, and societal advancements.

As technologies like the Internet of Things (IoT), artificial intelligence (AI), and 3-D imaging evolve, the size and amount of data that organizations have to work with is growing exponentially. For many purposes, such as streaming a live sporting event, tracking a developing storm, testing new products, or analyzing stock trends, the ability to process data in real time is crucial.

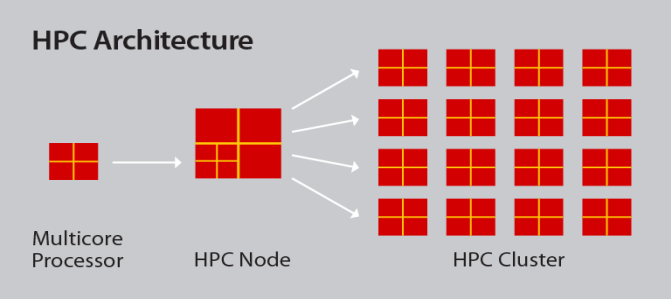
To keep a step ahead of the competition, organizations need lightning-fast, highly reliable IT infrastructure to process, store, and analyze massive amounts of data.

How does HPC work?

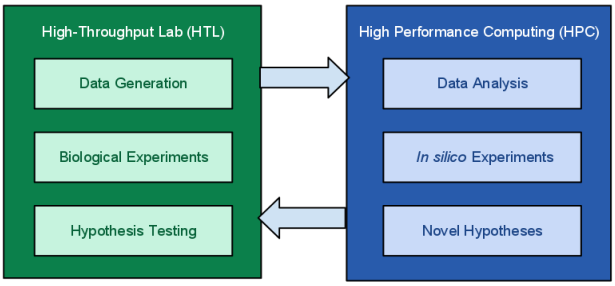
HPC solutions have three main components:

- Compute
- Network
- Storage

To build a high performance computing architecture, compute servers are networked together into a cluster. Software programs and algorithms are run simultaneously on the servers in the cluster. The cluster is networked to the data storage to capture the output. Together, these components operate seamlessly to complete a diverse set of tasks.



To operate at maximum performance, each component must keep pace with the others. For example, the storage component must be able to feed and ingest data to and from the compute servers as quickly as it is processed. Likewise, the networking components must be able to support the high-speed transportation of data between compute servers and the data storage. If one component cannot keep up with the rest, the performance of the entire HPC infrastructure suffers.



Need of High performance Computing :

1.It will complete a time-consuming operation in less time.

2.It will complete an operation under a light deadline and perform a high numbers of operations per second.

3.It is fast computing, we can compute in parallel over lot of computation elements CPU, GPU, etc. It set up very fast network to connect between elements.

Need of ever increasing Performance :

1. Climate modeling
2. Drug discovery
3. Data Analysis
4. Protein folding
5. Energy research

3. HPC USE CASES

Deployed on premises, at the edge, or in the cloud, HPC solutions are used for a variety of purposes across multiple industries. Examples include:

•Research labs. HPC is used to help scientists find sources of renewable energy, understand the evolution of our universe, predict and track storms, and create new materials.

•Media and entertainment. HPC is used to edit feature films, render mind-blowing special effects, and stream live events around the world.

•Oil and gas. HPC is used to more accurately identify where to drill for new wells and to help boost production from existing wells.

•Artificial intelligence and machine learning. HPC is used to detect credit card fraud, provide self-guided technical support, teach self-driving vehicles, and improve cancer screening techniques.

•Financial services. HPC is used to track real-time stock trends and automate trading.

•HPC is used to design new products, simulate test scenarios, and make sure that parts are kept in stock so that production lines aren't held up.

•HPC is used to help develop cures for diseases like diabetes and cancer and to enable faster, more accurate patient diagnosis.

4. NETAPP AND HPC

The NetApp HPC solution features a complete line of high-performance, high-density E-Series storage systems. A modular architecture with industry-leading price/performance offers a true pay-as-you-grow solution to support storage requirements for multi-petabyte datasets. The system is integrated with leading HPC file systems, including Lustre, IBM Spectrum Scale, BeeGFS, and others to handle the performance and reliability requirements of the world's largest computing infrastructures.

E-Series systems provide the performance, reliability, scalability, simplicity, and lower TCO needed to take on the challenges of supporting extreme workloads:

•Performance. Delivers up to 1 million random read IOPS and 13GB/sec sustained (maximum burst) write bandwidth per scalable building block. Optimized for both flash and spinning media, the NetApp HPC solution includes built-in technology that monitors workloads and automatically adjusts configurations to maximize performance.

•Reliability. Fault-tolerant design delivers greater than 99.9999% availability, proven by more than 1 million systems deployed. Built-in Data Assurance features help make sure that data is accurate with no drops, corruption, or missed bits.

•Easy to deploy and manage. Modular design, on-the-fly ("cut and paste") replication of storage blocks, proactive monitoring, and automation scripts all add up to easy, fast and flexible management.

•Scalability. A granular, building-block approach to growth that enables seamless scalability from terabytes to petabytes by adding capacity in any increment—one or multiple drives at a time.

•Lower TCO. Price/performance-optimized building blocks and the industry's best density per delivers low power, cooling, and support costs, and 4-times lower failure rates than commodity HDD and SSD devices.

5. HIGH-PERFORMANCE COMPUTERS :

Processors, memory, disks, and OS are elements of high-performance computers of interest to small & medium size businesses today are really clusters of computers. Each individual computer in a commonly configured small cluster has between one and four processors and today 's processors typically are from 2 to 4 crores, HPC people often referred to individual computers in a cluster as nodes. A cluster of interest to a small business could have as few as 4 nodes on 16 crores. Common cluster size in many businesses is between 16 & 64 crores or from 64 to 256 crores. The main reason to use this is that in its individual node can work together to solve a problem larger than any one computer can easily solve. These nodes are so connected that they can communicate with each other in order to produce some meaningful work.

There are two popular HPC's software i. e, Linux, and windows. Most of installations are in Linux because of its supercomputer but one can use it with his / her requirements.

Importance of High performance Computing :

1. It is used for scientific discoveries, game-changing innovations, and to improve quality of life.
2. It is a foundation for scientific & industrial advancements.
3. It is used in technologies like IoT, AI, 3D imaging evolves & amount of data that is used by organization is increasing exponentially to increase ability of a computer, we use High-performance computer.
4. HPC is used to solve complex modeling problems in a spectrum of disciplines. It includes AI, Nuclear Physics, Climate Modelling, etc.
5. HPC is applied to business uses as well as data warehouses & transaction processing.

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REFERENCES

- Jump up to:a b Brazell, Jim and Michael Bettersworth. "High Performance Computing". Texas State Technical College, 2005.
- Jump up to:a b c Collette, Michael, Bob Corey, and John Johnson. "PDF - High Performance Tools &

Technologies". Top 500 Supercomputer Sites, December 2004.

- The Oxford English Dictionary traces "supercomputing" as far back as 1978.
- Schulman, Michael. "High Performance Computing: RAM vs CPU". Dr. Dobbs High Performance Computing, April 30, 2007.
- US Department of Energy High Performance Computing. US Department of Energy.
- Jump up to:a b Morgan Eldred; Dr. Alice Good; Dr. Carl Adams. "A case study on data protection and security decisions in cloud HPC" (PDF). School of Computing, University of Portsmouth, Portsmouth, U.K.
- Sebastian von Alfthan. "High-performance computing in the cloud?" (PDF). CSC – IT Center for Science.

