High Performance Computing in Practice

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High performance computing is the lifeblood of the modern economy. The world is heralding towards the fourth industrial revolution, which is blurring the lines between the physical, digital, virtual and biological worlds. Soon, telling which is which will be hard.

If coal and steam engines were the drivers of the first industrial revolution, the drivers of the fourth industrial revolution are software and data that enable emerging technologies such as 5G, machine learning and artificial intelligence, Internet of Things, blockchain, virtual reality, biotech, robotics and 3D printing. This technology revolution is transforming society, relationships, healthcare, businesses and even governments, at a magnitude that the world has never seen before.

As emerging technologies become the primary driver of the economy, companies face a unique challenge. ODPi is the Open Data Platform initiative, a nonprofit organization accelerating the open ecosystem of big data solutions. According to ODPi, by 2020, the accumulated volume of big data will increase from 4.4 zettabytes to roughly 44 zettabytes or 44 trillion gigabytes.

Today, organizations not only face the challenge of churning the data their machines and users generate to extract business value, but also the lack the capabilities to consume and create that data. All new and current businesses have to face this challenge. The problem cannot be solved by the most powerful workstations. The solution needs something much bigger.

That is where high performance computing (HPC) enters the picture. A few years ago, the digital transformation movement forced every company to become a technology company. The arrival of this revolution forces organizations of all sizes to embrace HPC as a critical part of their strategy. In fact, it would not be an overstatement to say that HPC is at the heart of the fourth industrial revolution.

What is High Performance Computing?

HPC is the aggregating and pooling of computing resources to achieve much more parallel computing power than a single machine can provide. The three core components of a HPC environment are compute, network and storage. An HPC system is typically a cluster of computers or nodes, networked together into a cluster and connected to storage. Software is at the heart of HPC and currently Linux dominates the market. Almost all of the world's top supercomputers (a term interchangeably used with HPC) run Linux.

HPC can be achieved in both on-premises and cloud environments; however, there is a clear advantage, for both pricing and performance, of cloud vs on-premises. An HPC cluster running in the cloud can scale to larger numbers of parallel tasks than most on-premises environments. Cloud-based HPC is so much better that Elon Musk, CEO of SpaceX, is betting on it for his HyperXite project, which is building the next generation of consumer and commercial transportation.

Why does Everyone need High Performance Computing?

HPC was initially used by the scientific and research community to solve its unique problems. But today, every business needs HPC in some capacity. HPC is no longer limited to crunching numbers for research organizations. Now HPC is a critical part of modern business to deliver needed services. It helps businesses stay competitive and innovative.

HPC is imperative for machine learning, artificial intelligence, business intelligence, cognitive intelligence, research organizations, autonomous vehicles, robotics, biotechnologies, space exploration, transportation, factories, security, defense, oil and gas, governments, media industry and futuristic concepts such as hyperloop.

High Performance Computing for Healthcare.

The healthcare industry is relying more on machine learning, deep learning and, especially, HPC in the field of cancer research. HPC is enabling researchers to work on precision medicine to offer customized treatment to each patient. Pharmacogenetic or genomic medicine would not exist without HPC.

Medical professionals need to churn massive amount of genomic data and EHRs collected on patients to gain insights into patterns. Next-generation DNA sequencing (NGS) is to medicine what digital transformation is to businesses. NGS enables medical professions in precision medicine for diseases like cancer. NGS would not be feasible or affordable without HPC. Deep learning and machine learning enable healthcare researches to gain insight into this data to create precision medicine.

Organizations like the Pittsburgh Supercomputing Center are using SUSE powered supercomputers to work on multiple projects ranging from fluid dynamics to climate modeling and genomics. One of the organization's most ambitious projects is fighting Dengue Virus. Another such organization is CSIRO, which is using SUSE powered supercomputers for bionic vision research to restore sight to people with profound vision loss.

"With scientists able to deploy scientific workflows themselves, we only have to provide the basic infrastructure," said Dr. Borries Luberacki, head of HPC operations at the GMI. "They can test and evaluate tools independently, and only turn to us when they need additional support."

Read full SUSE Success story here:

Pittsburgh Supercomputing Center

GMI

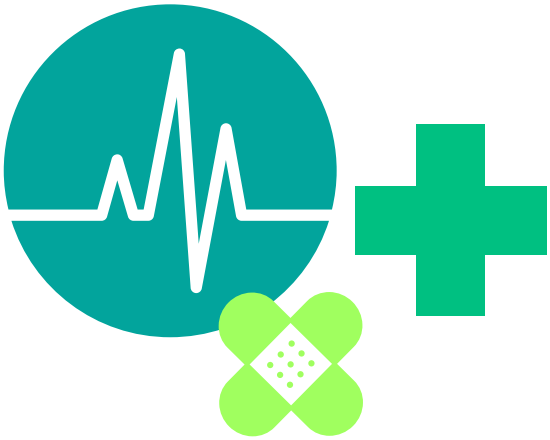
High Performance Computing for Energy.

Traditionally, HPC is used by the oil and gas industries, which rely heavily on big data to discover new reservoirs of gas.

“We clearly saw that the price-performance of SUSE Linux Enterprise Server on the SGI platform was better than the competing OS options,” said Diego Klahr, HPC engineer at Total. “We also ran SUSE Linux Enterprise Server on our previous supercomputer, so it was not surprising to see the strong performance and stability.”

Tokyo Institute of Technology (Tokyo Tech) has multiple research labs in which its team conducts research for nuclear reactors. The institute’s supercomputer Tsubame 2.5 features 4,200 GPUs installed in its 1,442 compute nodes. At 5.7 petaflops, SUSE powered Tsubame 2.5 is known for the best performance of any cluster-type supercomputer in Japan.

“SUSE Linux Enterprise High Performance Computing enabled Tsubame 1.0 to gain many users and become the leading large-scale cluster-type supercomputer in Japan,” said Professor Satoshi Matsuoka, Global Scientific Information and Computing Center, Tokyo Institute of Technology.



HPC is also critical to renewable energy. Windmills will not remain operational without HPC. Operators need to analyze data coming from windmills to optimize and maintain the structures, as well as be more cost-effective.

Read full SUSE Success story here:

Total

Tokyo Institute of Technology

High Performance Computing for Pure Science.

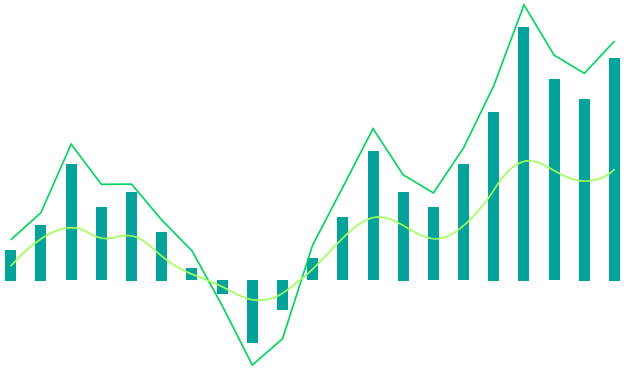
LRZ, an institute of the Bavarian Academy of Sciences and Humanities, leverages HPC for scientific research like understanding the origin of the universe. LRZ's newly build SuperMUC-NG is one of the most powerful supercomputers in the world. It consists of 10 'islands' of computing nodes, with a combined total of 311,040 computing cores and a peak performance of 26.9 petaflops.

Powered by SUSE Linux Enterprise High Performance Computing, SuperMUC-NG offers scientists with unrestricted access to high performance computing environments so they can use the needed tools to process a massive amount of data more efficiently.

"The broad compatibility of the SUSE operating system, our longstanding relationship with the company, and our own experience with the platform gave us real confidence that it would work well with the new hardware," said Dr. Herbert Huber, department head of High Performance Systems of LRZ.

Read full SUSE Success story here:

Leibniz Supercomputing Centre



SUSE Linux Enterprise High Performance Computing Prowess.

These organizations need an enterprise-class, high performance, highly scalable, open-source operating system designed to utilize the power of parallel computing for modeling, simulation and advanced analytics applications.

With its HPC product, SUSE empowers these organizations to accelerate innovation with a broad ecosystem of hardware and software partners, delivering cohesive HPC stacks for the latest supercomputers. Users can achieve high scalability, efficiency and performance by utilizing Linux clustering and the power of parallel computing running on a wide range of hardware.

High performance computing at the heart of the fourth industrial revolution, and SUSE is most equipped to help companies of all sizes to embark on their HPC journey.

For more information, contact your local SUSE Solutions Provider, visit us online or call SUSE at:

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