Understanding High Performance Computing Clusters – Benefits, Considerations, and Applications

Across all industries and a wide variety of applications, computing systems are now dealing with enormous amounts of data. Not only this, but these systems are also expected to perform complex operations quickly and effectively. In other words, the modern world depends on HPC, or high performance computing.

So how do we secure the high computing performance necessary to power our society? Increasingly, businesses and industries are turning to high performance computing clusters to make this happen.

What Is a High Performance Computing Cluster?

A cluster is essentially a collection of HPC units operating together to provide optimal processing power. As data volumes grow and as businesses and management teams learn to expect more from their hardware, such high computing performance setups are in ever higher demand.

High performance computing clusters are made up of three primary features:

- **The computing units themselves**

Each HPC unit will include at least one server and a data storage component. These components are connected and orchestrated by the networking infrastructure. As processing power is a priority in any high performance computing cluster, you will need to use servers with the appropriate level of capability — such as the HPS-621U2A with Intel 621 Chipset. This will need to be backed up with ample data storage capacity and high bandwidth networking equipment.

- **The software layer**

Hardware and software working together is always a core concept of any IT setup, and high performance computing clusters are certainly no exception. Within the cluster, the software layer makes it possible to manage and monitor the performance of the cluster during operation.

- **The storage units**

Storage and maintenance are key concerns for facility managers operating a high performance computing cluster. While slimline, but still high performing, technology like the HPM-621UA scalable processor can reduce the size and weight of the hardware, we're still talking about a huge amount of equipment here. Your facility will need to have enough floor space and enough sturdy racking and shelving units to safely house the server banks and computing hardware.

The Benefits of High Performance Computing Clusters

What kind of benefits can you expect from high performance computing clusters?

- **Enhanced Performance**

Perhaps the most obvious benefit of HPC clusters is the huge increase in computing power these structures provide. Facilities are effectively able to maximize the computing performance they have at their disposal, simply because they are not working with a single computing unit but a multitude of computing units working in harmony.

- **Easy Scaling and Flexibility**

Clusters can be built in a modular format, which basically means there are multiple computing nodes orchestrated by a software layer. This is highly advantageous, as it enables quick scaling when facility managers need more processing power — they can simply add another node to the network. At the same time, teams can scale back on processing power when required by removing a node.

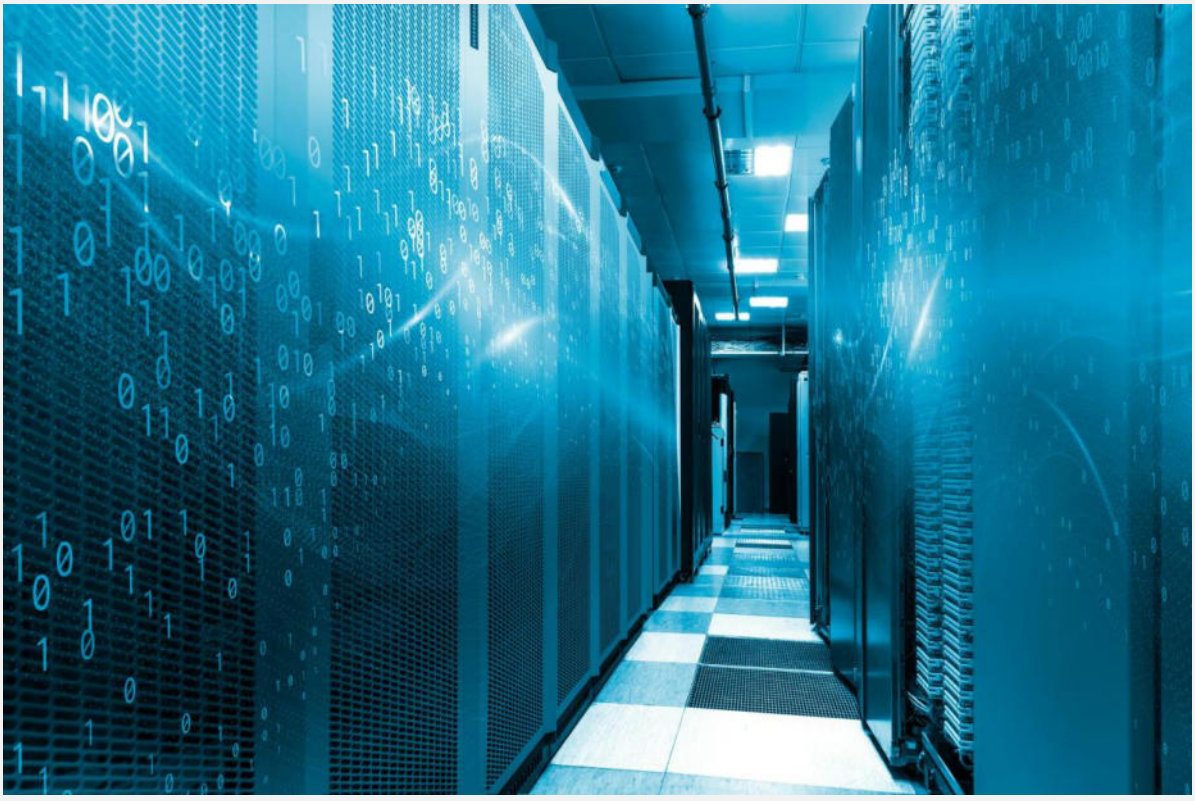
- **Improved Redundancy**

The software layer ensures that computing nodes work together as an orchestrated whole, but these nodes are still individual CPUs. This offers a level of redundancy to the cluster. If there is a problem with one of the nodes, the cluster can continue to operate at a lower capacity. The node can be removed, repaired, or replaced without taking the entire cluster offline.

- **Better Resource Utilization**

As the software layer is providing effective orchestration between the cluster's constituent nodes, there is some flexibility when it comes to resource utilization. Software can assign a collection of nodes to a specific application, reducing operating costs and leaving the remaining nodes free for other applications. Using high efficiency components — such as the HPM-621DE server board — can further improve cost-effectiveness when operating the cluster solution.

Applications of High Performance Computing Clusters



So how can we use these high performance computing clusters to the optimal advantage? In fact, there are many different potential applications. Below, we're examining just a few examples to give you a taste of what's possible.

- **Healthcare Applications**

High performance computing clusters can be used to analyze huge amounts of healthcare data, supporting vital projects like cancer drug development and early patient diagnoses.

- **Engineering Applications**

A balance is needed in disciplines like aeronautical engineering. Projects need to achieve high levels of power and capability while also reducing carbon footprints. This requires huge amounts of data, as development and design teams test and analyze a range of different options during the prototyping stage. HPC clusters make this possible.

- **Transportation Applications**

If self-driving vehicles are to be introduced onto our roads, they need to effectively learn about the environments they will be operating. High performance clusters make this machine learning possible.

- **Urban Planning Applications**

The Internet of Things has revolutionized urban planning, as data can now come from a variety of different sources right across the city. However, this translates to an enormous volume of data, and high performance clusters are required to make sense of this massive volume.

Key Considerations

Of course, there are a few different considerations if you're thinking about running HPC clusters:

- **Capability considerations** — How much capacity is required, and how much is the cluster capable of? Building a cluster with high performance computing units based on HPM-SRSUA server boards, for example, can significantly boost capability levels.

- **Spatial considerations** — Do facilities have enough room and enough infrastructure to house high performance computing clusters?

- **Energy considerations** — How will the facility maintain power to the cluster? How will they back up this power delivery in the event of an outage?

- **Cooling considerations** — Do facilities have the cooling infrastructure to keep the cluster at a safe and operable temperature?

- **Alternative consideration** — Do facilities really need to host an HPC cluster on-site? Would a cloud computing service, leveraging a cluster located at a different site and renting processing capability, be a better option?

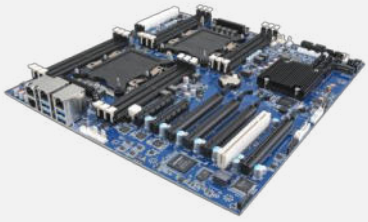
Related Products

Avalue HPS-621U2A

Single 2nd Gen. ® Xeon® SP processor with Intel® C621 chipset, 500W, 4 x RJ-45, IPMI2.0 workstation

Avalue HPM-621UA

Single 1st and 2nd Generation Intel® Xeon® Scalable Processor ATX Server Board with Intel® C621 Chipset and IPMI2.0. Processor supports up to 150W TDP



Avalue HPM-621DE

Dual 1st and 2nd Generation Intel® Xeon® Scalable Processors EATX Server Board with Intel® C621 Chipset and IPMI2.0. Processor supports up to 150W TDP

Avalue HPM-SRSUA

Single 4th Generation Intel®Xeon® Scalable Processor ATX Server Board with Intel® C741 Chipset and IPMI2.0. Processor supports up to 270W TDP