

CFdesign HPC

A productive design effort needs rapid simulation turn-around, regardless of the complexity of the device. The days of running a “verification analysis” at the end of the design cycle to make sure everything works as hoped are long gone. Modern design engineering in today’s competitive environment demands that early and frequent simulation be an integral part of the design cycle.

The CFdesign Team is intimately aware of these challenges, and is constantly looking for ways to take full advantage of the latest computing technology. The advent of distributed computing technologies has paved the way for **CFdesign HPC**.

Benefits

The CFdesign HPC Module allows you to conduct **more** design studies in **less** time.

Many software vendors showcase metrics such as “improved performance” when discussing their distributed computing solutions. The more important factor, though, is the **amount of time** saved for each analysis throughout the design process.

Time saved = time that can be used to conduct additional analyses. Additional analyses lead to:

- **Deeper innovation**
- **Better designs**
- **Greater business impact**

The hardware investment needed to leverage the power of HPC does not have to be extreme. For example, a multi-core, Nehalem-based system can be purchased for a relatively modest investment. When coupled with CFdesign HPC, the time saving benefits are significant.

Of course, the costs of a multi-node cluster environment are not prohibitive for many companies, and the HPC Module provides significant time savings benefits for clustered networks as well.

HPC for Upfront CFD

CFdesign HPC brings **High Performance Computing** to the world of Upfront CFD. In simple terms, it is the ability to run many models quickly by leveraging modern multi-processor computing hardware. There are two fundamental classifications of HPC hardware: Compute Clusters and Multi-core Computers.

- A compute cluster is a group of computers (often called “nodes”) connected with a high speed network, typically INIFIBAND (a type of high-performance Ethernet).
- A multi-core computer is a computer that contains more than one cpu core.

When an analysis is run with the HPC Module, the model is broken into equal-sized pieces, and distributed across either the nodes of a cluster or the cores of a multi-core computer. After each part is computed, they are returned to the originating computer, the master array is rebuilt, and the results are displayed.

The Microsoft MPI (Message Passing Interface) manages the communication between all cores and nodes. MPI is hardware-aware, meaning that it automatically detects the type of distribution needed (multi-core or multi-node), and configures the appropriate messaging protocol. For a multi-core computer, MPI distributes via memory copies for each core. For a cluster, MPI distributes via memory copies for each core and sockets for each node.

Blue Ridge Numerics and Microsoft have worked closely to optimize the implementation of MS MPI as the messaging protocol of CFdesign HPC. By leveraging the Microsoft-tuned version of the MPI message libraries, originally developed by Argonne National Laboratories in the early 90’s, the HPC module is on the technological fore-front of Windows-optimized high performance computing solutions.

CFdesign uses MPI technology for clusters and multi-core computers. This uniform approach is an important point, as it allows BRNI to include single-computer HPC support for up to four cores in the standard CFdesign package. To leverage the time-saving benefits of additional cores, simply add the HPC Module to your CFdesign product configuration.

Implementing HPC

If a powerful computing technology is extremely difficult to implement and maintain, its value can be severely diminished. To combat this, the CFdesign HPC module contains a substantial level of automation designed to make installing and configuring on multi-core computers and clusters as straight-forward and painless as possible.

CFdesign HPC is designed from the ground up to utilize Windows Operating Systems. Any supported Windows OS can be used to leverage multiple cores on a single machine. Cluster implementations require Windows HPC Server 2008.