**Course: Advance Bio Informatics**

**Module Title: Introduction to High Performance Computing**

**Module No: 137**

**High Performance Computing**

**Definition:** High-performance computing (HPC) is the use of parallel processing for running advanced application programs efficiently, reliably and quickly. The term applies especially to systems that function above a teraflop or 1012 floating-point operations per second. The term HPC is occasionally used as a synonym for supercomputing, although technically a supercomputer is a system that performs at or near the currently highest operational rate for computers. Some supercomputers work at more than a petaflop or 1015 floating-point operations per second.

High Performance Computing most generally refers to the practice of aggregating computing power in a way that delivers much higher performance than one could get out of a typical desktop computer or workstation in order to solve large problems in science, engineering, or business.

It turns out that defining “HPC” is kind of like defining the word “car” — you probably know what a car is, but I bet you’d be hard pressed to write a concise, simple definition of one that means anything. Also, note that HPC is actually used in two ways: it can either mean “high performance computing” or “high performance computer.” It’s usually pretty clear from the context which sense is being used.

**The anatomy of a high performance computer**

A helpful way to help understand what high performance computers are is to think about what’s in them. You have all of the elements you’d find on your desktop — processors, memory, disk, operating system — just more of them. High performance computers of interest to small and medium-sized 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 have from two to four cores. HPC people often refer to the individual computers in a cluster as nodes. A cluster of interest to a small business could have as few as four nodes, or 16 cores. A common cluster size in many businesses is between 16 and 64 nodes, or from 64 to 256 cores.

The point of having a high performance computer is so that the individual nodes can work together to solve a problem larger than any one computer can easily solve. And, just like people, the nodes need to be able to talk to one another in order to work meaningfully together. Of course computers talk to each other over networks, and there are a variety of computer network (or interconnect) options available for business cluster (see here for an overview of cluster interconnects).

**Usage of HPC:**

The most common users of HPC systems are scientific researchers, engineers and academic institutions. Some government agencies, particularly the military, also rely on HPC for complex applications. High-performance systems often use custom-made components in addition to so-called commodity components. As demand for processing power and speed grows, HPC will likely interest businesses of all sizes, particularly for transaction processing and data warehouses. An occasional techno-fiend might use an HPC system to satisfy an exceptional desire for advanced technology. HPC is an abstraction of underlying structure it represents where end user is able to access it without concerning about details and administrative issues.

Single computing source shared among different users at the same time. Practice of aggregating computing power in a way that delivers much higher performance than one could get out of a typical desktop computer.

**Need of HPC**

* U.S. healthcare orgs:

150 Exabyte’s data

* Kaiser Permanente:

44 petabytes

* 3 billion nucleotides

To solve the data issue

* Solution:HPC

There are two major computing concepts related to HPC.

1. Grid Computing
2. Cloud Computing

**HPC Classification**

Other way to define HPC is using main memory

1. Distributed memory architecture(DMA)
2. Shared memory architecture

Following are the available systems which come under the umbrella of HPC.

Dedicated

Supercomputers

Cluster systems