Question 6 - Difference between Distributed Memory Systems (Clusters), Shared Memory Systems, and General Distributed Computing

In a multiple processor computer, an important issue is: How do processors coordinate to solve a problem? Processors must have the ability to communicate with each other in order to cooperatively complete a task. There are two general approaches to address this problem.

One option uses a single address space. Systems based on this concept, otherwise known as shared-memory systems, allow processor communication through variables stored in a shared address space.

The other alternative employs a scheme by which each processor has its own memory module. Such a distributed-memory system (cluster) is constructed by connecting each component with a high-speed communications network. Processors communicate to each other over the network.

The architectural differences between shared-memory systems and distributed-memory systems have implications on how each is programmed. With a shared-memory multiprocessor, different processors can access the same variables. This makes referencing data stored in memory similar to traditional single-processor programs, but adds the complexity of shared data integrity. A distributed-memory system introduces a different problem: how to distribute a computational task to multiple processors with distinct memory spaces and reassemble the results from each processor into one solution.

Distributed Computing is a way of combining the processing power of thousands of small computers (i.e., PCs) to solve very complex problems that are too large for traditional supercomputers, which are very expensive to build and run.