GRID COMPUTING - INTRODUCTION

In today's pervasive world of needing information anytime and anywhere, the explosive Grid Computing environments have now proven to be so significant that they are often referred to as being the world's single and most powerful computer solutions. It has been realized that with the many benefits of Grid Computing, we have consequently introduced both a complicated and complex global environment, which leverages a multitude of open standards and technologies in a wide variety of implementation schemes. As a matter of fact the complexity and dynamic nature of industrial problems in today's world are much more intensive to satisfy by the more traditional, single computational platform approaches.

Grid Computing equates to the world's largest computer …

The Grid Computing discipline involves the actual networking services and connections of a potentially unlimited number of ubiquitous computing devices within a "grid." This new innovative approach to computing can be most simply thought of as a massively large power "utility" grid, such as what provides power to our homes and businesses each and every day. This delivery of utility-based power has become second nature to many of us, worldwide. We know that by simply walking into a room and turning on the lights, the power will be directed to the proper devices of our choice for that moment in time. In this same utility fashion, Grid Computing openly seeks and is capable of adding an infinite number of computing devices into any grid environment, adding to the computing capability and problem resolution tasks within the operational grid environment.

To further illustrate this environment and oftentimes very complex set of technology challenges, let us consider some common use case scenarios one might have already encountered, which will begin to examine the many values of a Grid Computing solution environment. These simple use cases, for purposes of introduction to the concepts of Grid Computing, are as follows:

- A financial organization processing wealth management application collaborates with the different departments for more computational power and software modeling applications. It pools a number of computing resources, which can thereby perform faster with real-time executions of the tasks and immediate access to complex pools of data storage, all while managing complicated data transfer tasks. This ultimately results in increased customer satisfaction with a faster turnaround time.
- A group of scientists studying the atmospheric ozone layer will collect huge amounts of experimental data, each and every day. These scientists need efficient and complex data storage capabilities across wide and geographically dispersed storage facilities, and they need to access this data in an efficient manner based on the processing needs. This ultimately results in a more effective and efficient means of performing important scientific research.
- Massive online multiplayer game scenarios for a wide community of international gaming participants are occurring that require a large number of gaming computer servers instead of a dedicated game server. This allows international game players to interact among themselves as a group in a real-time manner. This involves the need for on-demand allocation and provisioning of computer resources, provisioning and self-management of complex networks, and complicated data storage resources. This on-demand need is very dynamic, from moment-to-moment, and it is always based upon the workload in the system at any given moment in time. This ultimately results in larger gaming communities, requiring more complex infrastructures to sustain the traffic loads, delivering more profits to the bottom lines of gaming corporations, and higher degrees of customer satisfaction to the gaming participants.
- A government organization studying a natural disaster such as a chemical spill may need to immediately collaborate with different departments in order to plan for and best manage the disaster. These organizations may need to simulate many computational models related to the spill in order to calculate the spread of the spill, effect of the weather on the spill, or to determine the impact on human health factors. This ultimately results in protection and safety matters being provided for public safety issues, wildlife management and protection issues, and ecosystem protection matters: Needles to say all of which are very key concerns.

Today, Grid Computing offers many solutions that already address and resolve the above problems. Grid Computing solutions are constructed using a variety of technologies and open standards. Grid Computing, in turn, provides highly scalable, highly secure, and extremely high-performance mechanisms for discovering and negotiating access to remote computing resources in a seamless manner. This makes it possible for the sharing of computing resources, on an unprecedented scale, among an infinite number of geographically distributed groups. This serves as a significant transformation agent for individual and corporate implementations surrounding computing practices, toward a general-purpose utility approach very similar in concept to providing electricity or water. These electrical and water types of utilities, much like Grid Computing utilities, are available "on demand," and will always be capable of providing an always-available facility negotiated for individual or corporate utilization.

Grid Computing environments must be constructed upon the following foundations:

- Coordinated resources. We should avoid building grid systems with a centralized control; instead, we must provide the necessary infrastructure for coordination among the resources, based on respective policies and service-level agreements.
- Open standard protocols and frameworks. The use of open standards provides interoperability and integration facilities. These standards must be applied for resource discovery, resource access, and resource coordination.

Another basic requirement of a Grid Computing system is the ability to provide the quality of service (QoS) requirements necessary for the end-user community. These QoS validations must be a basic feature in any Grid system, and must be done in congruence with the available resource matrices. These QoS features can be (for example) response time measures, aggregated performance, security fulfillment, resource scalability, availability, autonomic features such as event correlation and configuration management, and partial fail over mechanisms.

There have been a number of activities addressing the above definitions of Grid Computing and the requirements for a grid system. The most notable effort is in the standardization of the interfaces and protocols for the Grid Computing infrastructure implementations. We will cover the details later in this book. Let us now explore some early and current Grid Computing systems and their differences in terms of benefits.