Abstract

The great explosion of Internet and the rapid advancement of the related technologies, such as the World Wide Web (WWW) and Java, have created an interest of researchers in the development of Internet based system management and application services. Today, web services are widely involved in all aspects of daily life as millions of users use Internet. These users appeal for high scalability, availability, and reliability of hosts (nodes) to provide rapid response and high throughput for their applications running at any time. In this scenario load balancing is a vital concept. Basically, it is the distribution of the total computational load across available hosts in a network. These hosts may have centralized control (Cluster and Grid) or may be without centralized control (Ad Hoc networks). The distributed hosts can be organized in different scopes. They can be integrated into a cluster of hosts linked via local area network to act as a powerful server or they can be deployed at different sites over wide-area network to form a part of the Grid. The hosts forming the network may be heterogeneous in terms of their processing power, storage capacity or some other metrics. Thus, in heterogeneous networks load balancing is necessary for getting a quick response time for an assigned task.

In this thesis the key concepts used in load balancing using Mobile Agent Technology (MAT) have been discussed. Mobile Agent (MA) is a software program that can migrate on its own or under host control from one host to another in the heterogeneous networks and continue execution without human interruption. In other words, the program running at a host is able to suspend its execution at an arbitrary point, transfer itself to another host, or
request the host to transfer it to its next destination and resume execution from the point of suspension, is called Mobile Agent. After being dispatched, a MA becomes independent of launching host and can operate asynchronously and autonomously.

Also comprehensive taxonomies that cover various aspects of load balancing, load transfer, overhead generated, etc. have been discussed. The taxonomies are mapped to various networks not only for validation but also to understand their goals and methodology in a better manner.

We have designed and implemented a secure and fault tolerant load balancing multiagent system (SFLBMS) across different types of networks. An extensive simulation is done using Platform for Mobile Agent Distribution and Execution (PMADE) along with other tools depending upon the type of network. For experimenting the developed system, two types of networks are chosen—one which has centralized control (Cluster and Grid), second which is free from centralized control (P2P and Ad Hoc). A set of MAs are chosen to balance the load on different types of the networks. Each MA executes a specific type of algorithm designed for load balancing on a specific type of network. A brief outline of the presented work is as follows:

- We have considered Input/Output (I/O) data intensive applications for load balancing on cluster and designed a load balancing algorithm for such applications. (Chapter 4, Section 4.2.2, page 46)

For applications running in parallel mode on grid and demanding resources that are on distributed servers forming the grid, a multi level distributed tree algorithm is designed. (Chapter 4, Section 4.3, page 53)
- A load balancing algorithm for P2P networks is designed (Chapter 5, Section 5.3, page 70)
- An algorithm for route discovery and load balancing using MA in Ad Hoc network is developed (Chapter 6, Section 6.2.2, page 81)
- For discovering the services in Ad Hoc networks, a service discovery protocol is developed (Chapter 7, Section 7.2, page 94)
- Mobile agent assisted checkpointing algorithm is designed for fault tolerance (Chapter 8, Section 8.4, page 110)
- Genetic algorithm for optimal resource utilization on Grid is designed (Chapter 8, Section 8.7, page 118)
- An intrusion detection algorithm is developed for detecting intrusions in Ad Hoc networks (Chapter 9, Section 9.5.2, page 141)

All the algorithms are implemented and tested over SFLBMS and also a comparison is made with some existing systems.