

Jamjuree Cluster: A Peer-to-Peer Cluster Computing System

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Abstract. Peer-to-Peer computing, which aggregates idle computing cycles and storage space from PCs on the Internet, is a new approach to establish a high performance computing system. In this paper, we introduce Jamjuree Cluster, a cluster middleware suite that is an integration of cluster computing and peer-to-peer computing concepts. Jamjuree Cluster creates a single system image from PCs on a peer-to-peer network, and provides a parallel programming environment, file system, and batch scheduling like in a typical cluster system.

Keywords: cluster computing, peer-to-peer computing, JXTA.

1 Introduction

Cluster computing [1] and peer-to-peer computing [2] are two different approaches with the same goal to create scalable computing systems. The cluster computing approach is to build a computer system from commodity-of-the-shelf (COTS) hardware components connected with a local area network. The main objectives are high-performance, high-availability, scalability and cost-effectiveness. The cluster is controlled by cluster middleware to make all computers' resources (CPU, memory, and storage) work together as a single computer, or in other words, to create a single system image. Parallel programming environment and batch scheduling are available to support parallel and high-throughput computation, respectively. A computer cluster has centralized management and works in a client-server fashion.

Peer-to-peer (p2p) computing is an approach to gather computing resources and enable network collaboration. A p2p system typically consists of personal computers that connect to the Internet and arbitrarily participate in p2p activities. Due to fast growing processing power, storage capacity and network capability of personal computers, a global p2p network is potentially the largest pool of computing power. Nowadays, millions of people are using p2p file sharing applications or participating in distributed computing projects like Seti@home [3]. In its ideal concept, there is no centralized control in a p2p network. Every computer is equal and can act as a client and a server at the same time. However, in practical p2p systems, some mechanisms such as indexing can be performed more efficiently in a centralized manner.

Unlike computer clusters, most p2p networks at present are application-specific and based on different p2p architectures. In other words, there does not exist a general

purpose p2p system in use today. Also, most of them are built on different software frameworks. Although there is a mature programming framework such as JXTA [4], it only provides primitive components and protocols for building more complicated services and applications. These reasons make it difficult for a user to use many different applications at the same time and for a developer to create a new application that works with others.

We propose that there must be a higher-level framework than that is provided by an existing framework such as JXTA. This can be done by applying some concepts of cluster computing onto p2p computing. The target is a general-purpose p2p architecture that provides a single system image. We also introduce Jamjuree Cluster, a middleware suite that is a proof-of-concept.

2 Jamjuree Cluster Architecture

We decided from the very beginning to build our p2p-cluster system on JXTA, a widely-accepted p2p software framework, rather than implementing a new one. However, many extensions are necessary. First, we need a library and services on top of JXTA so that the middleware and applications can be developed more easily than using JXTA library alone. After that, some essential components are required to create a cluster-like behavior. These include a shared file system and a job scheduler.

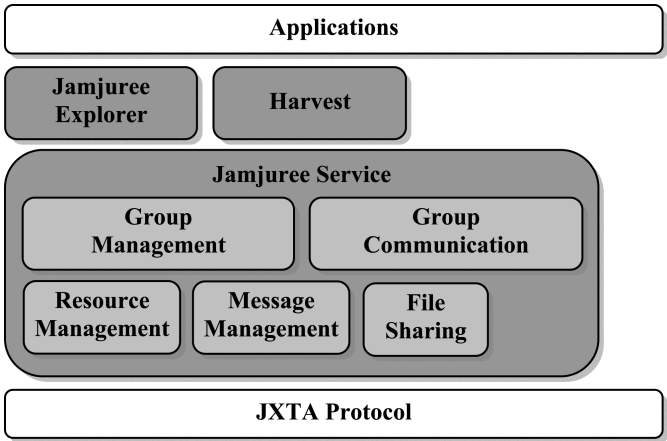


Fig. 1. Jamjuree Cluster Architecture

Fig. 1 shows the organization of Jamjuree p2p cluster architecture. On top of JXTA Protocol layer is Jamjuree Service layer that provides group-wise functionalities. On top of that is the clustering layer that consists of Jamjuree Explorer, a shared file system, and Harvest, a job scheduler.