Quality of Services Through Multi Protocol Label Switching in Peer-to-Peer Distributed Computing Systems

Behnaz Nahvi [1*], Akram Nouri Rad [2] [†]

[1] Dept. of computer, Karaj Branch, Islamic Azad University, Karaj, Iran.
[2] Dept. of computer Eng., Saveh Branch, Islamic Azad University, Saveh, Iran.

Abstract. Because of the bandwidth requirements, peer-to-peer networks are useful when delivering large files. Each of the two cores in distributed computing needs a mechanism to communicate with the other core that supports their bandwidth need, using P2P communication. In this paper, we propose MPLS packet-forwarding technology to reserve bandwidth in a distributed computing use peer-to-peer communication. The NS-2 network simulator used to evaluate the concept for a typical communications that must support several classes of traffics having Quality of Services as needs.

Keywords: distributed computing, Peer-to-Peer, Qos, MPLS.

1. Introduction

The peer-to-peer computing model represents a radically different and a plausible alternative for many large scale applications in Internet-wide settings. In this model, resources are shared between end-user processes themselves in a peer style, meaning that every such process potentially acts both as a client and a server [1]. The term Peer-to-Peer (P2P) refers to a class of systems and/or applications that use distributed resources in a decentralized and autonomous manner [2]. Four type of P2P computing shown in fig 1.
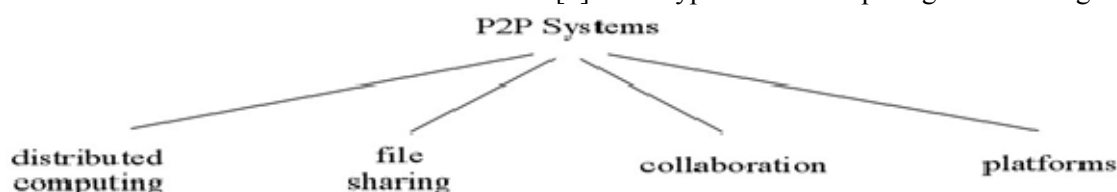

Fig. 1: Taxonomy of P2P Categories

These types of P2P computing were demonstrated as below:

- Distributed Computing

This type of P2P system is aimed at solving complex computing problems by breaking them into smaller tasks and executing them in parallel on a number of peers [3].

- File sharing

File sharing P2P systems allow users to locate the files of Interest according to their name and offer their own Files to others [4].File sharing is the simplest and the most widely-deployed Application in P2P systems. A file sharing application uses the P2P substrate to discover peers who have a requested file [5].

- Collaboration

Collaborative P2P applications aim to allow application-level collaboration between users. The inherently ad-hoc nature of P2P technology makes it a good fit for user-level collaborative applications [2].

- Platforms

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* Behnaz.Nahvi@kiau.ac.ir
† Noorirad@gmail.com

To date, the number of P2P platforms remains small. The only "true" platform in existence is JXTA, whose goal is to formulate standards and provide the P2P infrastructure [3].

2. Background

Distributed computing, the method of dividing large processing problems into Smaller tasks that can run on individual systems [6]. Distributed Computing is a way to cluster computers, so that they perform a common computation [7]. Boinc and Condor as the two distributed computing systems that represent Systems that have strong academic roots and current widespread use in a variety of Places [8]. That this tow distributed computing systems were demonstrated as below:

- Boinc

BOINC is a distributed data computation and storage protocol designed to take advantage of public-resource computing. BOINC is a distributed data processing system that incorporates client-server relationships to generically process data [9]. BOINC can be used with existing applications that can be distributed as the computing algorithm for the clients to process work units with. Work units are distributed to clients as they request them and clients report back with results. BOINC remains one of the most popular Platforms for volunteer wide area network distributed computing.

- Condor

Condor supports jobs that are not independently parallel. Condor is a mature platform that integrates readily with other systems (such as Grid Middleware) to provide integration into larger systems such as Grids [8]. Condor, a new system for distributed Computing. In contrast to the dominant centralized control model of the day, Condor was Unique in its insistence that every participant in the system remain free to contribute as much or as little as it cared [10].

3. Peer-To-Peer in Distributed Computing

There are few demonstrable general purpose distributed computing systems that use Peer-to-peer as an underlying architecture. Three representative samples are described here, the Gnutella Processing Unit (GPU), JNGI based on the JXTA framework and P-Grid [8]. These three distributed systems are demonstrated as below:

- GPU

Gnutella is an open source peer-to-peer protocol that is the basis for many popular file sharing applications today.

The open source Gnutella protocol is an ubiquitous distributed file-sharing protocol implemented by many file-sharing clients [11].

- JXTA / JNGI

JXTA is an open network computing platform designed for peer-to-peer (P2P) Computing by way of providing the basic building blocks and services required to enable anything anywhere application connectivity [12]. The JNGI implementation is a much-simplified version of the framework described in Framework for Peer-to-Peer Distribution computing in a Heterogeneous Decentralized Environment [13]. For the P2P overlay network we selected JXTA because it is currently an established and well supported open-source peer-to-peer mechanism [14].It also provides an easy interface for publishing and discovering data in a peer to peer manner [15].

- P-Grid

P-Grid (P2P grid) is a next generation peer-to-peer platform for distributed information management beyond mere file-sharing. P-Grid is a truly decentralized structured P2P system which does not require central coordination or knowledge [16].

4. Quality of Services in peer to peer systems

Quality of Service (QoS) requirements and the consequent satisfaction of users have guided the search for mechanisms that will enable the creation of grids furnishing non-trivial QoS requirements.

Without such mechanisms, grids would provide only best effort services [17].

With the growing deployment of P2P streaming systems providing performance guarantees is nowadays becoming critical for their future commercial success. There are a number of factors making this problematic. First of all, due to peers joining and leaving at arbitrary time P2P systems are highly dynamic in nature making it complicated to timely discover new peers. Next, being deployed over inherently best-effort Internet these systems may suffer from bad picture quality as modern compression and coding algorithms are highly sensitive to losses and delays experienced by streaming flows. Generating a lot of inter-domain traffic P2P systems are also highly undesirable for network operators. As a result, they are not expected to rely on network operators providing quality of service (QoS) support using conventional network layer mechanisms such as multi-protocol label switching (MPLS, [18]), differentiated services (DifServ, [19]), or combination of them (MPLS/DiffServ,[20]).

5. Simulation Framework

In this paper, we have modeled and simulated our P2P distributed computing architecture concepts with the widely used network simulator NS-2 [21]. NS-2 has been widely applied in research related to the design and evaluation of computer networks and to evaluate various design choices for communication of multiprocessor architectures and including the design of routers, communication protocols,. We use MPLS types of quality of services in P2P distributed system in Mesh topology to support of the bandwidth of communication that shown in Fig 2.
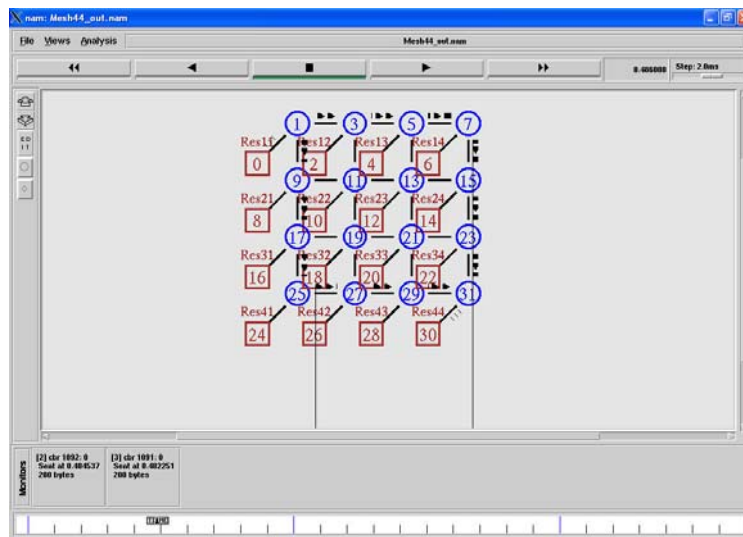

Fig. 2: Mesh architecture in P2P distributed computing.

The types of services that we can supports by MPLS for distributed architecture are:
- Real-time services with constraint
- Real-time services
- Signaling services
- High Best Effort services
- Best effort services

In IP, just we can consider Best Effort services for traffic but in MPLS, we have more services that mentioned previously. Whit the types we can support types of Quality of Services for our communication in multicore. We consider the network link was homogeneously. The links between switches has megabits/s. The bandwidth for Real-time services with constraint set to be 600-Kilo bit/sec and the bandwidth for Real traffic set to be 400-Kilo bit/sec, which starts at time 1.2 second. The bandwidth for signaling traffic set to be 300-Kilo bit/s that starts at before. The bandwidth for high best effort and best effort is equal to 300-Kilo bit/s that showed in Fig 3. Thus the traffic that we need is more than the bandwidth in the path 1_3_5_7_15_23_31 or 1_9_17_25_27_29_31 LSP (see fig 2). As shown in fig 3, at time 1.2 the real traffic started, but the traffic that this type of traffic needs is more than the traffic in the communication path. Thus, this traffic gets its remaining bandwidth from best effort and high best effort traffic that have less priority than real traffic.
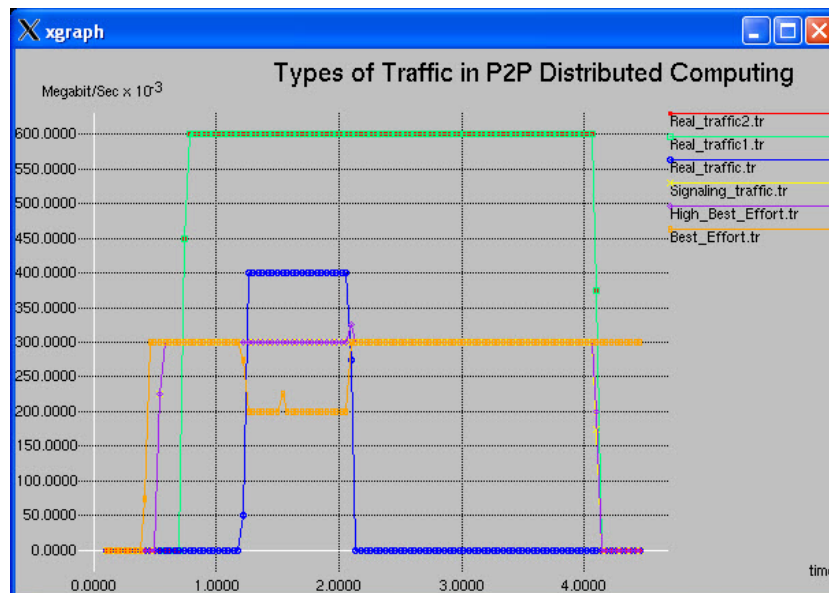
Fig. 3: Bandwidth use with types of service.

The High best effort traffic has more priority than Best effort traffic, thus Best effort traffic gets the remaining traffic (see Fig 3.) Equal to 50-Kilo bit/sec and the more bandwidth that Best effort traffic needs discarded until the time 2.2 seconds that Real traffic stopped.

6. Conclusions and future works

In this paper, we have discussed the major research challenges in P2P delivered computing platforms to providing QoS and supports Multi Protocol types of traffic. We have to present a novel communication in distributed computing platform that supports several QoS with multi protocol concepts, which adapted from the Multi Protocol-Level Switching technique with DiffServ.

7. References

[1]   P. T. Eugster, R. Guerraoui, A.-M. Kermarrec, and L. Massoulie, "From epidemics to distributed computing," IEEE Computer,(May 2004).

[2]   Milojicic D., Kalogeraki V., Lukose R., Nagaraja K., Pruyne J.,Richard B., Rollins S., Xu Z., and HP Laboratories Palo Alto, "Peer-to-Peer Computing". Technical Report, (2002).

[3]   Emir Halepovic, "Performance Evaluation and Benchmarking of the JXTA Peer-To-Peer Platform", August(2004).

[4]   P. K. Gummadi, S. Saroiu, and S. D. Gribble, "A measurement study   of Napster and Gnutella as examples of peer-to-peer file sharing systems," Computer Communication Review, vol. 32, no. 1, (2002).

[5]   Mohamed Hefeeda," Peer-to-Peer Systems",(2004).

[6]   Belay T. Beshah a, John Welter b, Kristian Morin b," Distributed Computing In Ground Processing" ,(2003).

[7]   Tiziano Mengotti," GPU, a framework for distributed computing over Gnutella", (2004).

[8]   Bradley Charles Goldsmith," Distributed Computing And Communication In Peer-to-Peer Networks" , (2010).

[9]   John R. Crumpacker," Distributed Password Cracking",(2009).

[10] Douglas Thain, Todd Tannenbaum, and Miron Livny," Distributed Computing in Practice:The Condor Experience",(2004).

[11] Gurpreet Dosanjh, Brody Lodmell, Alexander Van Der Star, Shane Wang," Gnutella Peer-to-Peer Security", (2007).

[12] Bhanu Krushna Rout, Smrutiranjan Sahu," Extending JXTA for P2P File Sharing Systems",(2009).

[13] Matthew Shepherd," Solving Quarto with JXTA and JNGI", (2003).

[14] Demetris G. Galatopoullos , Dimitris N. Kalofonos , Elias S. Manolakos ,"A P2P SOA Enabling Group Collaboration through Service Composition" In proc of ACM ICPS'08, Sorrento,(2008).

[15] Nathalie Furmento, Jeffrey Hau ,William Lee, Steven Newhouse, John Darlington," Implementations of a Service-Oriented Architecture on top of Jini, JXTA and OGSA", In Proceedings of UK e-Science All Hands Meeting,(2003).

[16] Rohit Vashishtha, Ankit Gupta, Piyush Gupta, Shakti Mishra, D S Kushwaha," A Decentralized Approach for Service Discovery & Availability in P-Grids", Journal Of Computer Scince And Engineering, (2010).

[17] Nick Antonopoulos, George Exarchakos, Maozhen Li, Antonio Liotta," Handbook of Research on P2P and Grid Systems for Service-Oriented Computing: Models, Methodologies, and Applications",(2010).

[18] E. Rosen, A. Viswanathan, and R. Callon. Multiprotocol label switching architecture. RFC 3031, IETF, (2001).

[19] S.Blake,D.Black,E.Davies,Z.Wang,and W.Weiss.Anarchitecture For Differentiated Services.RFC 2475,IETF,(1998).

[20] F.Le Faucheur,L.Wu,B.Davie,S.Davari,P.Vaananen,R.Krishnan, P.Cheval,and J.Heinanen.Multi-protocol label switching(MPLS) Support of differentiated services.RFC 3270,IETF,(2002).

[21] Information on www.isi.edu/nsnam/ns.