

Improvement of JXTA Protocols for Supporting Reliable Distributed Applications in P2P Systems

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Abstract. In any distributed application, the communication between the distributed processes/nodes of the distributed systems is essential for both reliability and efficiency matters. In this work we address this issue for distributed applications based on JXTA protocols. After a careful examination of the current version of JXTA protocols, we observed the need for improving the original JXTA protocols, such as pipe services, to ensure reliable communication between peer nodes and the discovery and presence service to increase the performance of the applications. The re-implemented protocols have been validated in practice by deploying a P2P network using nodes of PlanetLab platform and testing each of the extended protocols using this real P2P network.

1 Introduction and Motivation

The reliability of distributed applications has been largely investigated by researchers of the distributed computing community. While reliability issues are generally well understood for operating systems and classical distributed systems and LANs (see e.g. [3]), there is still few work in addressing these issues for the emergent computational systems. With the development of Internet and other new technologies, distributed systems and applications are becoming the indispensable approach for solving complex problems. Therefore, the reliability issue is nowadays being investigated for Web-based distributed systems / applications (e.g. [6,13,11]) and Grid-based computing (e.g. [2,7]). Moreover, P2P systems are evolving towards an important paradigm for distributed computing. Each time more, P2P systems are used beyond file/data sharing applications, for developing large scale distributed applications that benefit from the immense

computing power contributed by millions of peers worldwide. Projects such as “Folding@Home on the PS3” by seti@home for studying the protein folding by utilizing the new Cell processor in Sony’s Playstation 3 are allowing to achieve performance previously only possible on supercomputers. The main challenge in developing large-scale P2P applications is how to develop efficient, scalable and reliable distributed systems from inexpensive unreliable computers contributed to P2P network by millions of individuals. One of the today’s technologies used in developing P2P systems is JXTA [1,9,10]. This is a recent technology, which has been used in several P2P projects [5] and is currently drawing the attention of many researchers and developers of the P2P and Grid computing. In particular the reliability and efficiency issue is being studied for JXTA-based applications (e.g. [4,12]).

This work is motivated by the need to support the development of efficient and reliable P2P applications using JXTA protocols. To this end, we have carefully analyzed the current JXTA protocols and report here several limitations of most important protocols of JXTA. After examining and pointing out such limitations, we further propose a solution to them through re-implementation/extensions without damaging the genericity of JXTA protocols. More precisely, in this work we have considered the following protocols and services: *Peer Discovery Protocol*, *Discovery Service*, *Peer Information Protocol*, *Peer Information Service*, *Peer Resolver Protocol*, *Resolver Service*, *Pipe Binding Protocol* and *Pipe Service*, *Endpoint Routing Protocol* and *Endpoint Service*. Our approach is validated in practice by deploying a real P2P network using the nodes of the PlanetLab platform [8], a planetary scale distributed infrastructure, and have experimentally evaluated the performance and reliability of the re-implemented protocols.

The rest of the paper is organized as follows. We give in Section 2 the evaluation of the JXTA protocols and their limitations. In Section 3 we present the re-implementation of the JXTA protocols; their experimental evaluation is given in Section 4. Finally, we conclude in Section 5 with some remarks and indicate directions for future work.

2 The JXTA Protocols and Their Limitations

2.1 The JXTA Protocol and Services

The services offered by JXTA library are based on its own protocols and serve as the starting point in the development of a P2P network using JXTA. Certainly, it is upon the developer to extend/implement these services according to his needs. JXTA offers essentially six protocols, each one with its corresponding services. In fact, in developing JXTA-based P2P applications, not all these protocols and services are necessarily used. These protocols and services are the following:

- *Peer Discovery Protocol* and *Discovery Service*, which serve to advertise the proper resources and to discover the resources of other peers.
- *Peer Information Protocol* and *Peer Information Service*, which are in charge of obtaining state information of local or remote peers.