JXTA Based P2P Services for Mobile Devices

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Abstract

The JXTA was made in order to solve the problem of being generated with the computer platform suggested with the P2P(Peer-to-peer) method in the distributed computing.

JXTA makes a communication between the various network and the devices is connected to a network which possible. It was designed to the client having the minimum computing ability could attend in the peer-to-peer network.

However, for smoothly applying JXTA in the wireless environment, there is a limit with the limited resource of the Mobile Device.

By using the Relay of the JXTA based for the Mobile Device, this paper implemented the P2P service which is flexibly effective in the wireless network environment.

1. Introduction

The P2P (Peer-to-peer) communication rising as the new paradigm of a networking is the model which doesn't go through the server of a center and directly communicates by a client [1].

The Sun Microsystems resolution to resign Project JXTA is the computing platform of the P2P resource sharing method of utilizing as the computing resource by introducing the concept of this kind of P2P and altogether using the network infrastructure including the cellular phone, not only the personal digital assistant (PDA) but also the personal computer (PC) and server, and etc.

The JXTA technology can be applied to the various digital devices including the desktop computer, the server system,the electronics, an appliance, the network router, and etc. However, the JXTA technology applies

in the Mobile Device environment which is identical with PDA or the cellular phone due to the problem of the limited resources and there is a limit [2].

In this paper, we propose the P2P service applying the JXTA technology to the Mobile Device of the limited resource.

2. JXTA

JXTA is a set of open, generalized peer-to-peer (P2P) protocols that allow any networked device - sensors, cell phones, PDAs, laptops, workstations, servers and supercomputers- to communicate and collaborate mutually as peers.

The JXTA protocols are programming language independent,and multiple implementations, also known as bindings, exist for different environments.

JXTA has the following feature [3].

• Interoperability - JXTA technology is designed to enable peers provisioning P2P services to locate and communicate with one another independent of network addressing and physical protocols.

• Platform independence - JXTA technology is designed to be independent of programming languages, network transport protocols, and deployment platforms.

• Ubiquity - JXTA technology is designed to be accessible by any device with a digital heartbeat, not just PCs or a specific deployment platform.

One common characteristic of peers in a P2P network is that they often exist on the edge of the regular network, the edge often being occasionally connected devices that are assigned non static addresses (e.g. DHCP).

Because they are subject to unpredictable connectivity with potentially variable network addresses, they are outside the standard scope of DNS.

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JXTA empowers peers on the edge of the network by provisioning a globally unique peer addressing scheme that is independent of traditional name services. Through the use of JXTA IDs, a peer can migrate across physical networks, changing transports and network addresses, even being temporarily disconnected, and still be addressable by other peers[4].

2.1. JXTA Architecture

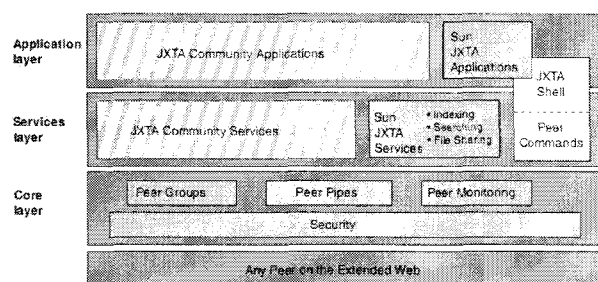The JXTA software architecture is divided into three layers, as show in Figure 1 [5][6].

Figure 1. JXTA architecture

• JXTA Core
The JXTA core encapsulates the minimal and essential primitives that are common to P2P networking. It includes building blocks to enable key mechanisms for P2P applications, including discovery, communication transports (including firewall and NAT traversal), the creation of peers and peer groups, and associated security primitives.
   • Services Layer
The services layer includes network services that may not be absolutely necessary for a P2P network to operate, but are common or desirable in a P2P environment. Examples of network services include searching and indexing, directory, storage systems, file sharing, distributed file systems, resource aggregation and renting, protocol translation, authentication, and PKI (Public Key Infrastructure) services.
   • Applications Layer
The applications layer includes implementation of integrated applications, such as P2P instant messaging, document and resource sharing, entertainment content management and delivery, P2P E- mail systems, distributed auction systems, and many others.
The boundary between services and applications is not rigid. One customer's application can be viewed as a service to another customer. The entire system is designed to be modular, allowing developers to pick

and choose a collection of services and applications that suits their needs.

2.2. JXTA Protocols

JXTA defines a series of XML messages, or protocols, for communication between peers. Peers use these protocols to discover one another, advertise and discover network resources, and communication and route messages [7].
   • Peer Discovery Protocol (PDP) -- used by peers to advertise their own resources and discover resources from other peers. Each peer resource is described and published using an advertisement.
   • Peer Information Protocol (PIP) -- used by peers to obtain status information from other peers.
   • Peer Resolver Protocol (PRP) -- enables peers to send a generic query to one or more peers and receive a response (or multiple responses) to the query. Queries can be directed to all peers in a peer group or to specific peers within the group. Unlike PDP and PIP, which are used to query specific predefined information, this protocol allows peer services to define and exchange any arbitrary information they need.
   • Pipe Binding Protocol (PBP) -- used by peers to establish a virtual communication channel, or pipe, between one or more peers. The PBP is used by a peer to bind two or more ends of the connection (pipe endpoints).
   • Endpoint Routing Protocol (ERP) -- used by peers to find routes to destination ports on other peers. Route information includes an ordered sequence of relay peer IDs that can be used to send a message to the destination.
   • Rendezvous Protocol (RVP) -- used by edge peers to resolve resources, propagate messages, and advertise local resources. used by rendezvous peers to organize with other rendezvous peers, share the distributed hash table address space, and propagate messages in controlled fashion (message walkers).
All of the standard JXTA protocols are asynchronous and are based on a query/response model. A JXTA peer uses one of the protocols to send a query to one or more peers in its peer group. It may receive zero, one, or more responses to its query.
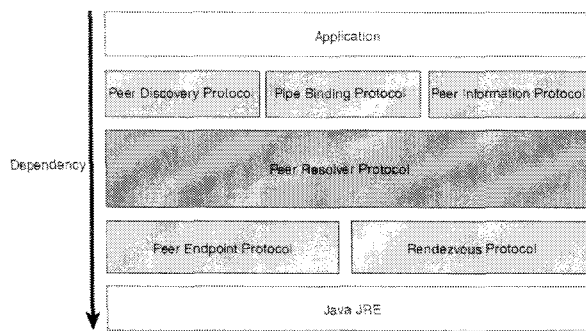
Figure 2. JXTA specification protocols hierarchy

In Figure 2, the six different protocols are shown in their relationships to each other. The illustration further shows how a Java reference implementation can be built between the Java JRE and an application [8].

These six protocols are all that is needed for individual peers to exist in a decentralized peer-to-peer environment that is self-forming and that has no need for a centralized server. Peers have the ability to exist on private networks behind firewalls, and can be assigned Internet addressable IP addresses or an address through the Network Address Translation process.

Network assumptions in the protocols were kept to a minimum to allow implementations on a variety of transport mechanisms.

3. JXTA Based P2P Services for Mobile Devices

For effectually providing the P2P service of the JXTA based on the Mobile Device of the limited resource which is like the processor power or the memory, many restrictions follow.

Therefore, the P2P service of the JXTA based which it flexibly operates in the Mobile Device by using Relay and JXME API of the JXTA based is implemented. Relay is an attach between the Mobile Device and the message conversion serene. The JXME API manages the message transfer between Peer in the JXTA application layer.

3.1. System structure.

A peer is any networked entity that implements one or more of the JXTA protocols. Peers can reside on sensors, phones, and PDAs, as well as PCs, servers, and supercomputers. Each peer operates independently and asynchronously from all other peers and is uniquely identified by a Peer ID.

Peers publish one or more network addresses for use with the JXTA protocols. Each published address is advertised as a peer endpoint, which identifies the network address. Peer endpoints are used by peers to establish direct point-to- point connections between two peers.

Direct point-to-point network connections are not always available between peers. Intermediary peers may be used to route messages to peers that are separated due to physical network boundaries. The network boundaries can be natural boundaries such as between Ethernet and Bluetooth networks or artificially created due to network configuration.

Peers are typically configured to spontaneously discover each other on the network to form relationships known as peer groups, which can be transient or persistent in nature.

JXTA Peers operate with the Client for comprising the JXTA network and the P2P Peer having the server function and Relay manages an attach between Mobile Devices in the wireless network environment.

3.2 The communication between the compositional element module.

Figure 4 shows the operation process of the JXTA P2P Service between the Mobile Device through Relay.
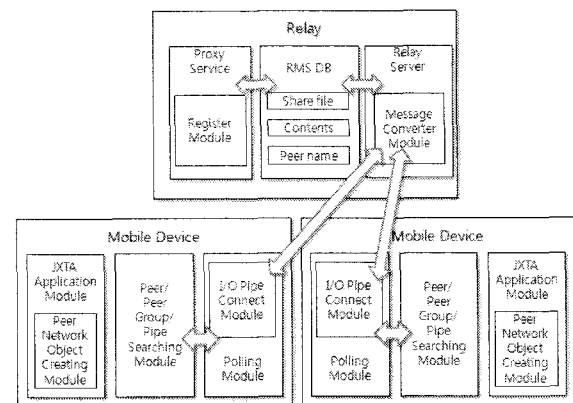
Figure 4. System structure

The Mobile Device transmits the advertisement message in order to inform Relay of its own presence.

Relay stores the information of the Mobile Peer in the RMS DB. If the new mobile peer is registered in Relay, the Mobile Device transmits a message through the Pipe which sets the new Mobile Peer and the connection through Relay and is generated.

Relay changes into the binary format at the extensible markup language format and transmits the message of 2 Mobile Peer through the Message conversion module.

The JXTA server is used as Relay in order to activate the P2P service using JXTA on the Mobile Device.

4. Conclusions and Future Work

JXTA provides the language which is abstract painting than the existing P2P protocol so that the various services the devices, and the transport network be able to use. Of course, the solution of the maximum which JXTA is for the implementation of the specific P2P application is not but JXTA provides the superior platform having the flexibility in the P2P application preparation.

This paper presented the resources which is limited by using JXTA, that is the independent P2P model, on the programming language and platform as the P2P service which it effectually applies to the Mobile Device environment.

The research for the pure P2P system in which a communication between the Mobile Device which doesn't go through Relay is possible should be after this continued.

5. References

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