P2P Network Simulation System for Performance Evaluation in Convergence Networks

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Abstract—P2P(Peer to Peer) network is a distributed network architecture composed of participants that make a portion of their resources directly available to other network participants, without the need for a central server. Currently, convergence network industry using wired and mobile are grows rapidly. So P2P protocols will be used between mobile and wired network. But current P2P protocols are focused on the wired networks only and there are no simulators for performance analysis of mobile P2P. In this paper, we design a P2P simulation system for performance analysis of P2P protocols in mobile, wired and convergence networks. It is constructed by a well-known mobile network simulator and wired based P2P protocol simulator. Finally we have implemented a smart TV test-bed using our P2P test-bed for convergence networks.

*Index Terms*—mobile IPTV, overlay, P2P, super peer.

I. INTRODUCTION

THERE are many network simulators for performance evaluation of low-layer networks. But it is not support P2P simulating. So we were searched about P2P simulators. However many P2P simulators are support mathematics evaluation only[1]-[4]. Current users use many multimedia data and they try to find the data through P2P networks. Thus, we must research for performance improvement of P2P. To do this, researchers will need simulator for performance evaluation of P2P protocols. So we had researched reliable simulation environment for performance evaluation of P2P protocols.

In this paper, we study the existing network simulators and paper that studied about P2P networks. Next we suggest P2P simulation test-bed using existing network simulator and P2P application.

II. PAPER SIZE AND FORMMAT

Napster is a representative P2P system[5]. Itis communicated between nodes without the centralization

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server. So contents provider is not needed heavy processing in server system. But it is tricky to manage, and retrieve data. Therefore there are many P2P protocols for enhancement of the weak points. The P2P protocols are separated unstructured and structured by retrieving and managing technology.
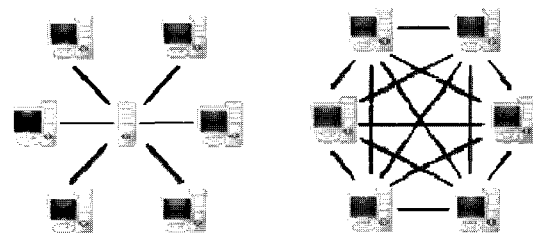
(a) Client/Server   (b) Peer-to-Peer

Fig. 1. Structure of Client/Server and P2P Network

A. Structure of P2P

1) Unstructured P2P

Unstructured P2P manner bordering the central server or peer to send a query to search for resources, and peer-to navigate[6][7].

Of the initial resources to a central server that holds the address of the peer approach is used to tell Napster scalability of the week, but the problem was achieved. The central device adjacent without a search query flooding as a peer to peer approach Pure P2P model was used to find the problem of traffic was heavy.

To compensate, the proposed hybrid P2P model, a system with multiple super-peers configured with a hierarchical structure, then the super-peer resources efficiently between queries flooding to traffic to reduce the signal was used.

2) Structured P2P

This technique has the maximum number of searches $O(\log N)$ search data so that the number of peers without any impact on search efficiency can be increased arbitrarily. How to use these technologies Pastry, Tapestry, Chord ring based approach and addresses of the n-level space, how to use the Distribute CAN, and the existing Chord ring form of the address space is organized hierarchically and the Viceroy there is[8][9].

B. P2P Systems

1) Hybrid P2P

It is very simple structure. The central server of hybrid P2P network is managed meta-information only. Therefore it is not used central server when happened file transmission between with peers. So advantages of this structure are rapidly routing and reliability searching of data. The weak points are increasing load in central server and stopping network during central server broken. In conclusion, it is same to general client/server structure when peer connection and management.
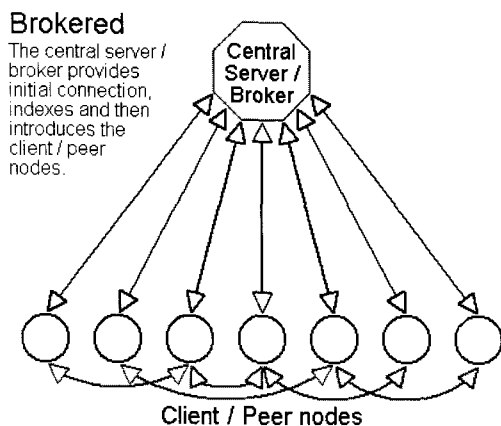

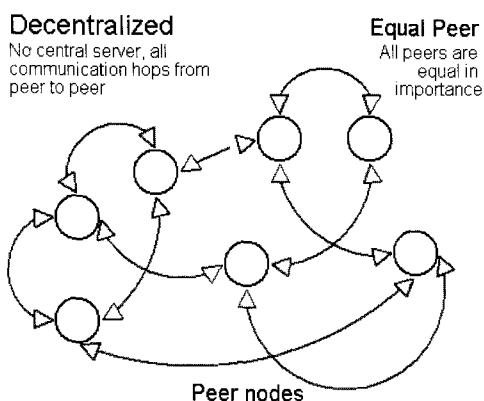Fig. 2. Structure of Hybrid P2P

2) Pure P2P

Fig. 3. Structure of Pure P2P

The mainly concept of pure P2P network is that all nodes are equal and decentralized structure. So all nodes have same role and not exist central server. So it is enhanced weak point of Hybrid P2P. But there are two weak points. It is difficult of routing and guarantee of reliability about searching result. But network shutdown is impossible because all nodes are used by server and client. However network management is very difficult.

3) Super peer P2P

The super peer P2P network has advantages of hybrid P2P and pure P2P[10]. But implementation of this structure is very difficult. And it is not ensure access of all peers and super peer selection is difficult. However it can be used as efficient protocol in IPTV system if contents provider is designated as super peer.
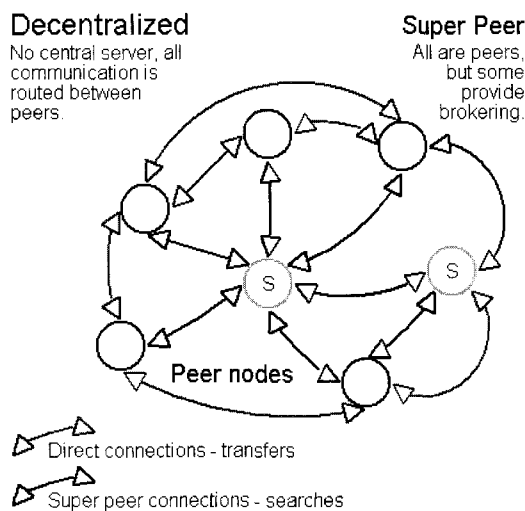

Fig. 4. Structure of Super peer P2P

III. MOBILE NETWORK SIMULATORS

There are many mobile network simulators now. It is analysis of performance considering a variety network-layer but P2P protocol is not supported. In this chapter introduced current networks simulators.

A. NS-2

NS-2 is open source software[11]. So it is free and easy to change protocols. And it is support variety protocols. But this UI(User Interface)is difficult.
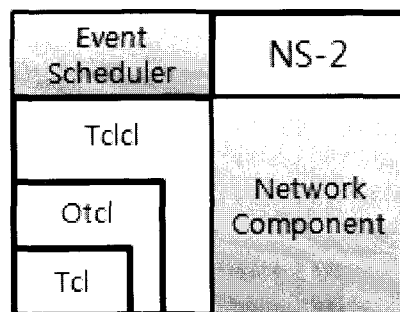

Fig. 5. Structure of NS-2 simulator.

B. QualNet

QualNet is commercial simulator[12]. It made by Scalable networks corporation. It is same to NS-2 simulator and has easy UI. So many researchers are using it. QualNet had designed for network simulation only. So simulation speed is very fast.
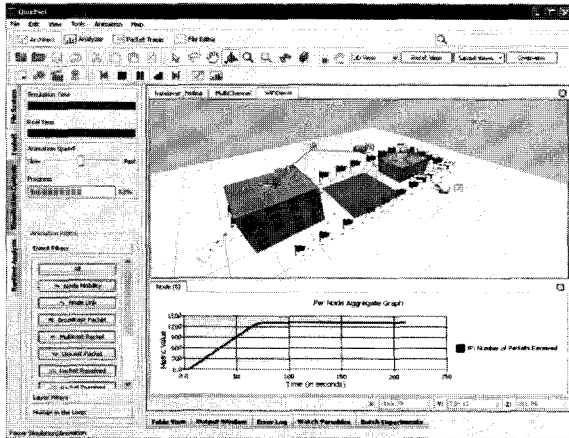
Fig. 6. QualNet visual mode.

C. OPNET

OPNET is commercial software too[13]. It is older than QualNet and NS-2. But this simulation speed is slow than another simulators. And it was not designed for network only. So many researchers who study network protocols are not use this simulator.

D. OMNeT++

OMNeT++ is supported a powerful GUI environment. It is used for simulations of IT system, Queuing, network, hardware structure, business process, etc. And it is widely used as an academic purpose. OMNeT++ is available for free that is using non-commercial only.

IV. P2P SIMULATORS

Through paper that analysis about P2P network protocols, most papers do not use a P2P simulator. It was using self analysis such as mathematical evaluation or self development simulators but these simulators are not exactly. Thus, current P2P protocol researches are need reliable simulator for performance evaluation of P2P.

None	146
Unspecified	71
Custom	43
NS-2	8
Chord (SFS)	7
Javasim	2
Peersim	2
Aurora	1
CSIM 19	1
Modelnet	1
Nab	1
Narses	1
Neurogrid	1
P2PSim	1
SOSS	1
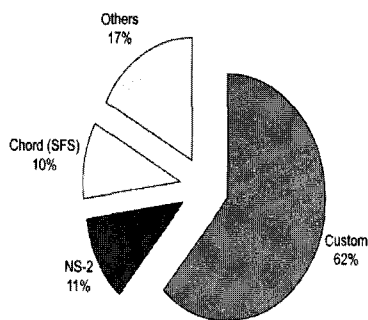
Fig. 7. Frequency of using P2P simulators.

TABLE I
P2P PROTOCOL SIMULATORS

Simulator	Language	Project Activity	License
P2PSim	C++	Active	GPL
PeerSim	Java	Active	LGPL
Query-Cycle Simulator	Java	Inactive	Apache
Narses	Java	Inactive	GPL-like
Neurogrid	Java	Inactive	GPL
GPS	Java	Inactive	Open-Source, No license
Overlay Weaver	Java	Active	Apache
DHTSim	Java	Active	GPL
PlanetSim	Java	Active	LGPL

V. P2P SIMULATION SYSTEM

In this chapter, we suggest a P2P simulation system using EXata Emulator and famous P2P application.This test-bed is convergence model that use current network simulator (EXata) for analysis of low level networks and famous P2P application(uTorrent) for analysis of P2P level network.

TABLE II
STRUCTURE OF SIMULATION SYSTEM

System	Role
EXata Emulator	Configuration of network topology Perform Simulation
Connection Manager	Connection with client and emulation server
P2P Protocol	Implementation of P2P protocol
Application	Data transfer

A. EXata Emulator and Connection manager

EXata Emulator has made by Scalable Networks. EXata is a network emulator that runs simulation on QualNet virtual simulator using actual PC(Personal Computer). So we change network environment of actual PC in QualNet simulation topology. Through this emulator, we study heterogeneous network system on same system.
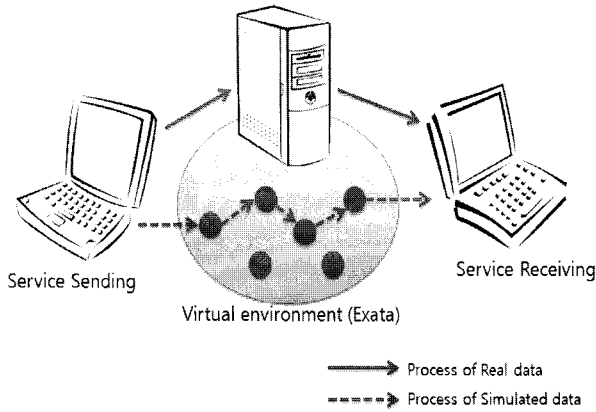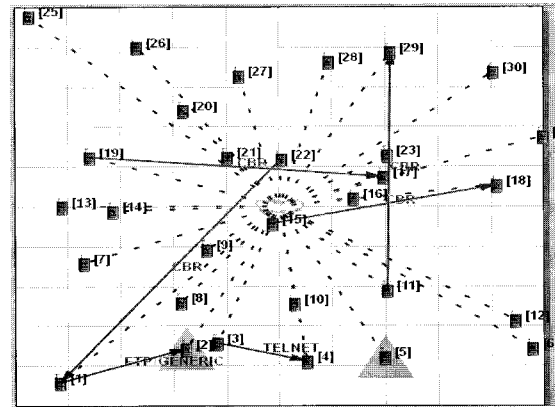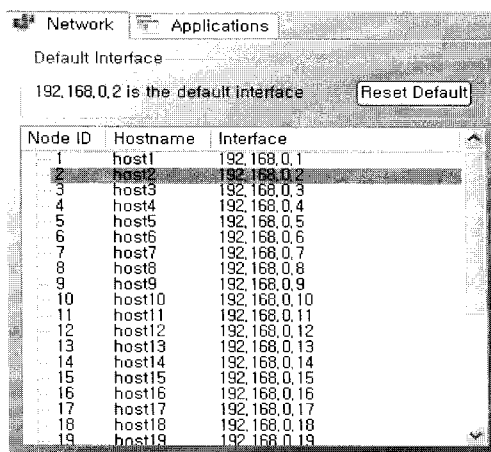
Fig. 8. EXata emulation system.

Fig. 9. Connection manager.

B. P2P protocols and application

On the actual PC that runs EXata emulator and connection manager, it will install famous P2P application such as uTorrent. Through this, we will research P2P protocols. In this system, we can study various P2P protocols through changing P2P application only. If it wants change network environment such as changing 3G network to WiFi network, you change network topology in QualNet simulator only.
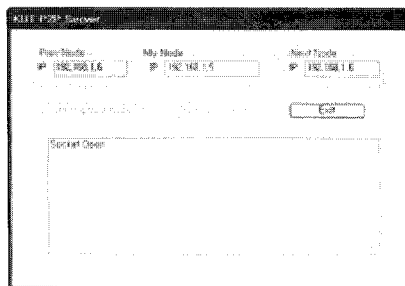

Fig. 10. P2P protocol system.

Fig. 11. Connect with QualNet topology and actual PC.

C. Performance Evaluation

For performance evaluation of simulation system that organized with emulation system and P2P protocol, we were linked two client and one simulation server. After that, we were tested simulation system as change the settings.
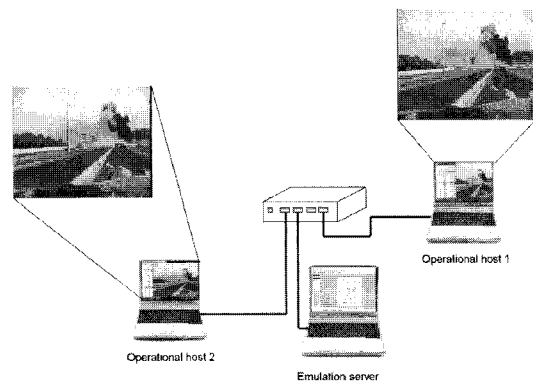

Fig. 12. Structure of simulation system.

For performance evaluation of simulation system that organized with emulation system and P2P protocol, we were linked two client and one simulation server. After that, we were tested simulation system as change the settings.
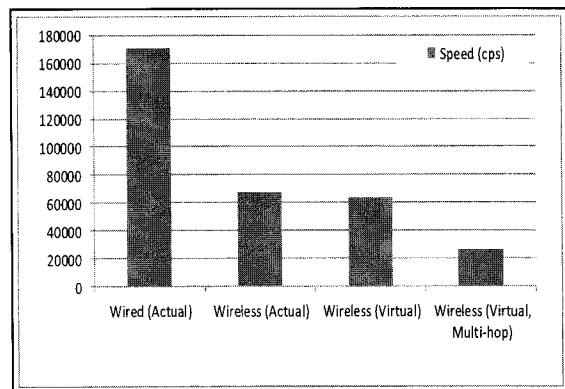

Fig. 13. Data transfer rate.

The first graph in figure 13 shows transmission speed between tow devices in actual wired network. It shows high speed because actual environment was connected by wired network. Second graph of figure 13 shows transmission speed in actual wireless (WiFi) network.

The third and last graph shows transmission speed at changing environment as simulation software. The second and third graph shows same result because it is WiFienvironment(virtual and actual)
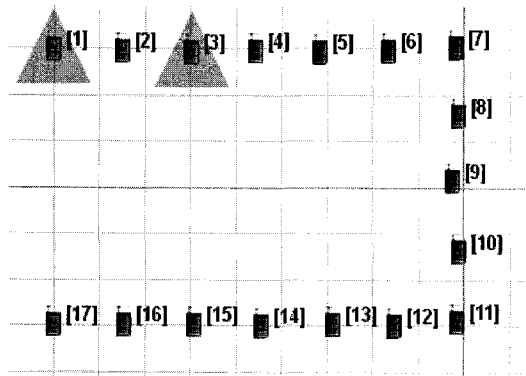

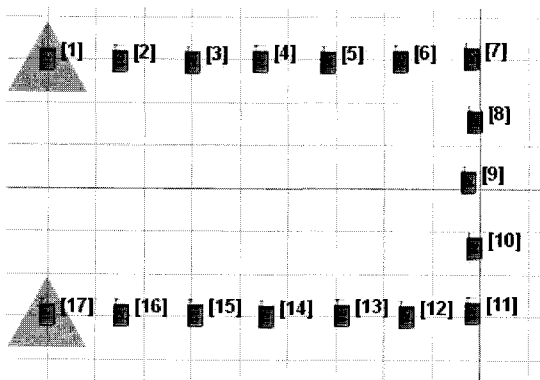Fig. 14. Transfer of adjacent nodes.

Fig. 15. Transfer of non-adjacent nodes.

Finally we were tested data transmission through multi-hop that changing the setting of virtual nodes. Figure 14 is organized as close nearly between the sender and the receiver. But in figure 15, interval between sender and receiver is not nearly. So result in third and last graph of figure 13 is different. Thus we can test various environments easily using P2P simulation system.

VI. CONCLUSTIONS

Through this simulation system, we can reliable performance analysis of P2P protocols because it is use existing reliable systems(QualNet network simulator and P2P application). And it is easy to change network environment and protocols.

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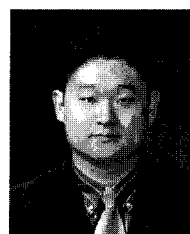
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