

# An information sharing method among distributed peer activity management server on managing peer's activities in MP2P network

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**Abstract**— Since P2P (Peer-to-Peer) technologies has been widely deployed, P2P-based applications produce tremendous traffic to Internet service providers. It is hard to predict traffic pattern since data is exchanged between peers. This leads to burden to the ISP on designing network management plan. In order to solve problems caused by P2P application, there are several activities such as IETF ALTO and ISO MP2P Framework. IETF ALTO can provide underlying network information, and MP2P framework is capable of providing peer's status and activity preferences that are gathered by PAMS. By the way, it is need to consider avoiding bottleneck problem that will be caused if many reports are concentrated into a server. In this paper, we describe a distributed peer activity management method and related issues to be resolved such as synchronization, procedures for server discovery, and procedures for probing remote peer's status.

**Keywords**— P2P, MP2P, PAMS, Distributed PAMS

## I. INTRODUCTION

P2P network is a logical virtual network that resides on top of physical network. It is consists of multiple peers that are capable of receiving and sending data from/to other peer.

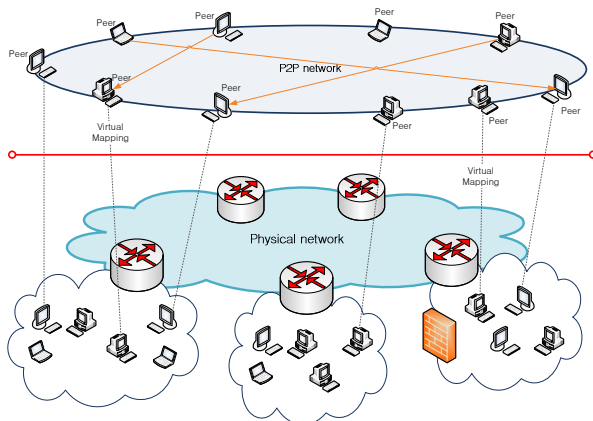


Figure 1. Overview of P2P network, ISO/IEC 20002

In general, the most common P2P applications is file sharing such as bittorrent, but theoretically, it is possible to

share any kind of resources. Another major characteristic of P2P network is that it performs contents-based routing rather than network address-based routing. Hence, the activities between peers may be unpredictable to ISP. Current P2P application chooses peer from peerlist that is retrieved from a tracker server without regarding the status of underlying network or remote peer's status prior to negotiate with remote peer. A tracker server maintains overlay P2P network information and participating peer information. Since P2P overlay network is consists of multiple peers, the tracker server should be able to keep the list of participating peers with a specific overlay network. Since it does not give any priority on providing the peerlist to requesting peer, it leads to degrade of performances.

According to ISO/IEC 20002[1], it has categorized characteristics of P2P and problems caused by P2P as follows.

### A. Characteristics of P2P Traffic

- Distributed resource sharing
- Content-based routing
- Self-organization and dynamic adaptation
- Scalability
- Load Distribution

### B. Problems caused by P2P applications

- Disregarding underlying network
- Load concentration on specific peer/networks
- High Churn
- Illegal distribution of content
- Absence of distribution control
- Absence of authentication
- Fairness and Differentiation

As well as ignorance of underlying network status, it does not consider the current status of remote peer when a peer chooses a peer for exchanging its content. This leads to degrade of performance and also it does not keep information to be used for providing incentives to resource provider. In P2P services, there are several studies on identifying selfish users. [2][3][4]

The peer activity management features can be used to provide additional features such as load distribution of peer, contents distribution control and especially fairness and differentiation.

## II. BACKGROUND: MANAGED P2P FRAMEWORK

ISO/IEC 20002 MP2P (Managed P2P) Framework provides a managed P2P network. It describes several requirements and framework model for managed P2P. It aims at ganting manageability to the existing P2P application as well as implementing MP2P application.

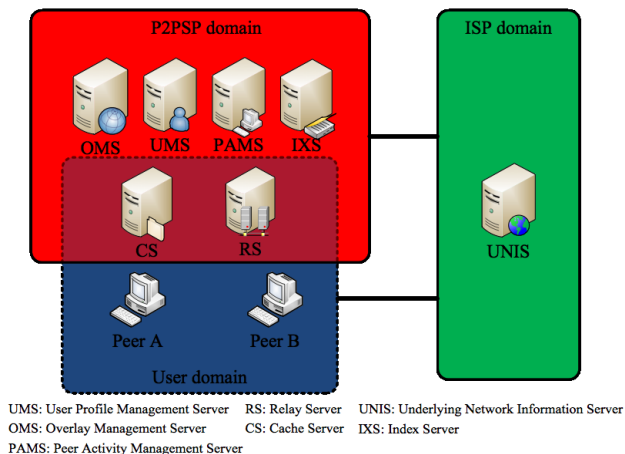


Figure 2. Components for MP2P Framework, ISO/IEC 20002

MP2P network consists of several components as shown in table 1.

TABLE 1. RELATED COMPONENTS OF MP2P, ISO/IEC 20002

| Server | Roles & Behaviour                                                                                                                                                                                                                                                                           |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OMS    | OMS manages the MP2P and provide optimized peerlist through interaction with UNINS and PAMS                                                                                                                                                                                                 |
| PAMS   | PAMS maintains the status information of each participating peers that are gathered from peers. PAMS shares status information with OMS in order to enhance the performance of P2P services.                                                                                                |
| Peer   | Peer shares its resources with other peer, and interacts with OMS and PAMS.                                                                                                                                                                                                                 |
| UMS    | UMS manintains user's information for managing p2p network. In other words, each user of P2P service has to have unique identifier. UMS maintains records about peer's activity for tracking service usage or billing information for further usage.                                        |
| IXS    | Index Server is used to provide service-specific information. In case of contents distribution, it contains the meta-information of contents. This information includes P2P network id, descriptions on contents, address of OMS. Index server is also used for contents or service search. |
| CS     | Cache server caches contents in order to stabilize the P2P-based service.                                                                                                                                                                                                                   |
| RS     | Relay server (RS) relays contents to assist the participant behind the NAT/firewall to properly participate in the P2P-based service.                                                                                                                                                       |
| UNIS   | UNIS provides the information of the underlying                                                                                                                                                                                                                                             |

network and network management policies.

PAMS can gather peer's status and activity information from peers, and gathered information can be used to enhance performance of overlay network and providing incentives to resource contributing peers.

ISO 20002 introduces a conceptual idea regarding PAMS for gathering peer's activities. This paper is focusing on enhancing performance and resolve bottleneck problem by using distributed PAMS.

## III. DISTRIBUTED PEER ACTIVITY MANAGEMENT SERVER

Since PAMS receives many reports from multiple peers at the same time, they may suffer from bottleneck problems. In order to avoid bottleneck problem, we have located several PAMS throughout the network for load distribution. When it comes to use distributed PAMS, there arise several issues such as synchronization among distributed servers, how to disseminate load, discovery of address of PAMS and so on.

Figure 3 shows an example of distributed PAMS behaviours. In figure 3, we assume there are two regions (region A and B) possess more than one peer, and each region is managed by a PAMS respectively. Peers within a specific region should report its activities to the designated PAMS.

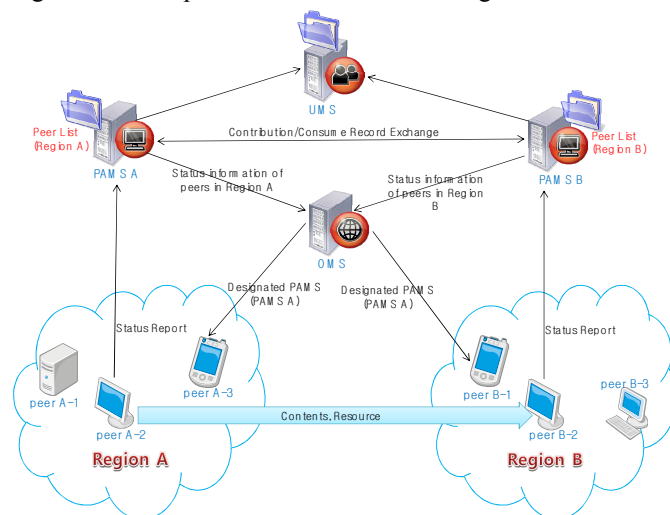


Figure 3. Architectural model for P2P-based streaming service

The PAMS receives peer's activity information and maintain them into local database. The collected information is used by OMS (Overlay Management Server) and other peers. The OMS managed the overall status of overlay network by use of peer's activity information. When OMS gives peerlist, it performs optimizations by retrieving peer's status information from PAMS. In order to report peer's status and activity information to a specific designated PAMS, it is required to provide the address of designated PAMS for a specific peer based on its peer-id. In order to assign peers and manage distributed PAMS, there is a special overlay network based on DHT among PAMSs. Each PAMS manages and

shares distributed hash table for managing peer's status information.

Figure 4 shows an overall operations using distributed PAMS and it shows the benefit of using PAMS.

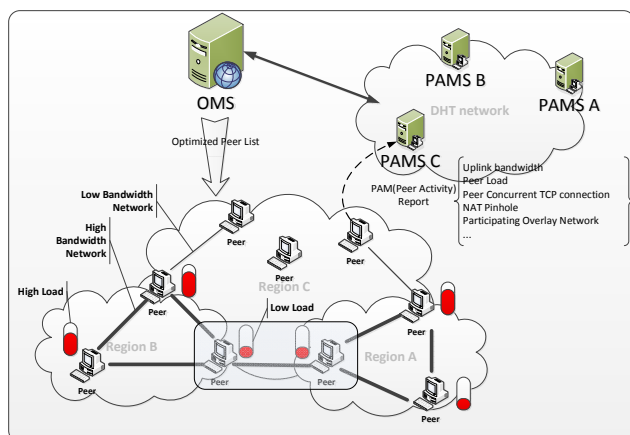


Figure 4. Optimized peer selection by use of distributed PAMS

It shows system status of peer and network status between each peer. Each region is managed by a PAMS, and peers report its status to a designated peer. OMS also interacts with PAMS to optimize peerlist by considering the status of peer. We have omitted procedures of interaction with UNIS (Underlying Network Information Server) adapting underlying network status for simplicity. By making use of peer's status information, a peer can choose most appropriate remote peer that has lower system load and enough bandwidth.

#### A. Procedures for requesting the address of PAMS for a newly joining peer

PAMS can be located in P2P service provider's domain and acts independently. Hence, we have separated them logically, and assume that OMS already knows the entry point of DHT network for PAMS. Figure 5 shows procedures for designating PAMS to a newly joining peer.

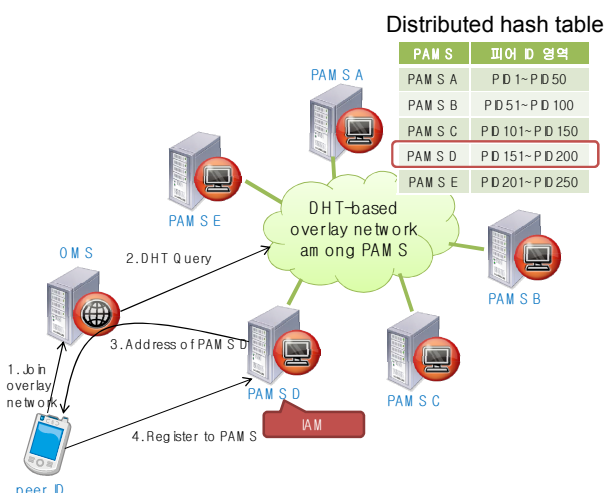


Figure 5. PAMS discovery procedure for newly joining peer

1. When a peer boots up, it requests the address of PAMS to OMS. It is also possible to process discovery procedure of PAMS by itself if PAMSs are operating independent with P2P service provider.
2. When OMS receives a query for PAMS discovery, it finds appropriate PAMS for a joining peer by making use of peer-id on calculating hash-value. For this, it sends probing message to adjacent PAMS. The probing message contains an address of OMS for returning response.
3. When a PAMS receives a query from OMS or other PAMS, it checks whether the hash-value is for it or not. If not, it sends the request to the adjacent PAMS. This procedure will be repeated until it finds appropriate one. When a PAMS returns a response to OMS, OMS notifies the address of PAMS to newly joining peer.
4. When a peer receives an address of PAMS from OMS, it registers itself to the PAMS. When a peer registers itself to a PAMS, it receives reporting policy that describes frequency of report, event types to be reported immediately and so on. After registration, it sends its status and activity report to this server.

#### B. Probing remote peer's status through DHT by peers

There can be two type of method for querying peer's status. The one is to retrieving peerlist from OMS. When a peer request peerlist to OMS, PAMS calculates optimal peerlist for the requesting peer based on the information acquired from PAMS. The other is to query to the DHT network of PAMS by peer. This is useful in case that P2PSP does not provide functionalities of PAMS. When a peer wants to know current status of other remote peer, it just sends probing request to its PAMS. When PAMS receive the request, it calculates hash-value with remote peer's peer-id. If the hash-value matches with that of PAMS, the server returns detail information. If not, it forwards to the request to other PAMS.

#### C. Retrieving optimized peerlist from OMS

When a peer joins a specific overlay network, it firstly sends join request to OMS, and OMS sends peerlist of the overlay network. On constructing peerlist, OMS interacts with UNIS and PAMS. Since we have adapted distributed PAMS, it is required to query status of candidate peers through DHT. This is useful in case that peer does not capabilities of probing remote peer's status. Hence, this will be adapted easily to existing P2P application with some modification in the tracker servers.

### IV. POLICY AND REPORT BETWEEN PAMS AND PEER

When a peer registers itself to a designated PAMS, PAMS gives policy information that will be used for indicating reporting policy. It suggest to peer how frequently and when it should send. A peer sends report to PAMS in accordance with the policy information.

### A. Reporting peer's status information to designated PAMS

The policy contains two types of reporting frequency; periodic and event-driven report as shown in table 2.

TABLE 2. REPORTING POLICY

| Category         |                     | Descriptions                                                                     |
|------------------|---------------------|----------------------------------------------------------------------------------|
| Reporting Policy | Periodic report     | - Network status<br>- System load<br>- Resource Usage                            |
|                  | Event-driven report | - Peer configurations<br>- Network configurations<br>- P2P behaviours/activities |

In case of periodic report, it describes how much frequently a peer should send reports for a specific type of data. Since dynamic information such as network status, system load and resource usage tends to dynamically change during P2P activities, it should be reported periodically. Besides of dynamic information, some static information, such as peer's configuration and pinhole of NAT, does not need to be reported periodically. This information will be reported in case of modification.

### B. Reporting peer's status information to designated PAMS

A peer sends its status and activity information when it meets the situation that PAMS has requested. Since peer's status/activity information is shared among distributed PAMS, it needs to use sequence number that increments itself whenever it sends report. It also includes expiration time because peer can leave abruptly without any notification. Table 3 shows information to be included within report from peer.

TABLE 3. INFORMATION TO BE INCLUDED WITHIN REPORT

| Category         | Descriptions                                                                  |
|------------------|-------------------------------------------------------------------------------|
| Meta information | - Sequence number<br>- Expires time                                           |
| Network status   | - Uplink/downlink bandwidth configuration<br>- Current uplink/downlink status |

|                 |                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------|
|                 | - Maximum concurrent number of TCP connection<br>- NAT pinhole for incoming request                                         |
| System status   | - System load<br>- Volume of storage can be shared                                                                          |
| Activity status | - Currently participating overlay network<br>- Volume of contribution(sent whom)<br>- Volume of consume(received from whom) |
| Peer Behaviour  | - Peer ID<br>- P2P service behaviour(join, leave, pause)<br>- P2P Activities(contribution, consume of resources)            |

## V. CONCLUSIONS

In this paper, we have presented distributed PAMS method for managing and manipulating peer activity information without suffering from bottleneck problems. Since peer status information is scattered into multiple distributed PAMS, procedures for PAMS discovery, probing remote peer's status and synchronization of distributed information are required. For this, we have provided related procedures for resolving these issues and information to be included within report.

## ACKNOWLEDGMENT

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