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Title: Initiating Work on P2P IPTV

Summary

This contribution proposes Q2/SG13 initiating a new draft recommendation work on P2P based IPTV system.

Discussion

1, Introduction

ITU-T FG IPTV has been created to coordinate and promote the development of global IPTV standards. Significant goals have been achieved by investigating different aspects of IPTV, such as IPTV architecture and service requirements, IPTV network control, QoS, interoperability, security, etc. taking into account the NGN [1]. Nevertheless, it is still worthwhile to examine and explore some new network technologies, for example, peer-to-peer (P2P) technique, to improve the classical IPTV system and even leverage more IPTV services.

Classical IPTV system usually adopts the client/server (C/S) model to provide IPTV services including BTV and VoD. However, due to the limited capabilities of media servers, such as limited network bandwidth, limited storage capacity, limited processing capability, etc., a single media server is able to serve only a limited number of IPTV service subscribers in the C/S model. These “bottlenecks” of the classical IPTV system would force the IPTV service providers to continuously upgrade their IPTV systems in order to serve more and more users simultaneously.

In recent years, P2P technique is considered as a good solution to construct networks with its inherent advantages over the C/S model, such as good scalability, better failure tolerance, better load balancing, etc. With P2P technique, the IPTV service providers would effectively deploy services. Consequently, we would like to propose to initiate work on P2P based IPTV system.

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2, P2P model vs. C/S model

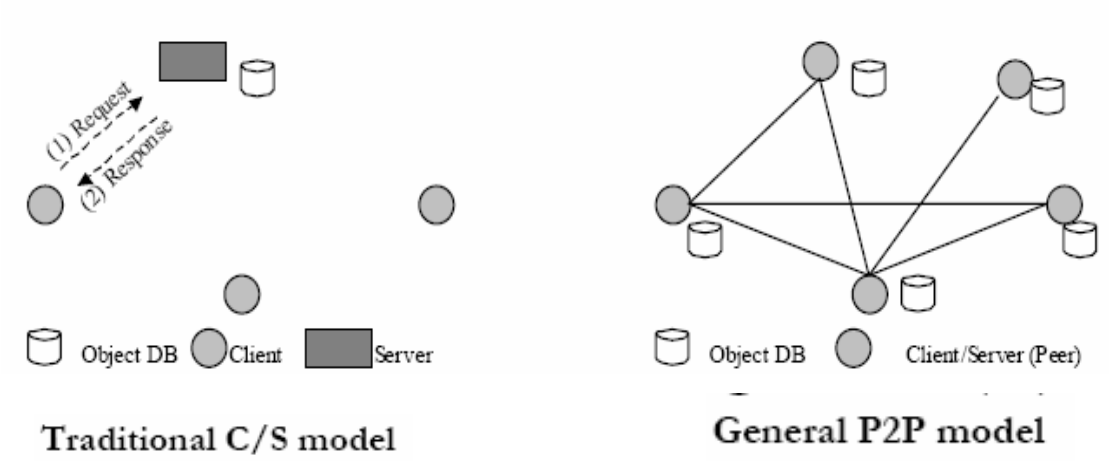

Figure 1, comparison of P2P model and C/S model

Classical IPTV system is essentially a distributed C/S model (left part in Figure 1) where the service providers usually deploy media server near to the users to store a large amount of content and process the users' requests and, hence, ensure feasible QoS and QoE. As a result, the cost of upgrading IPTV system in C/S based IPTV system would become more and more expensive as the number of users grows. A good solution to fill the gap between the limited media servers and growing IPTV service requirements is to combine the classical IPTV system with P2P model (right part in Figure 1) where many low cost media servers and subscribers are organized in a peer-to-peer manner [2] to provide better scalability, failure tolerance and lower upgrading cost to the IPTV system.

3, P2P media delivery control

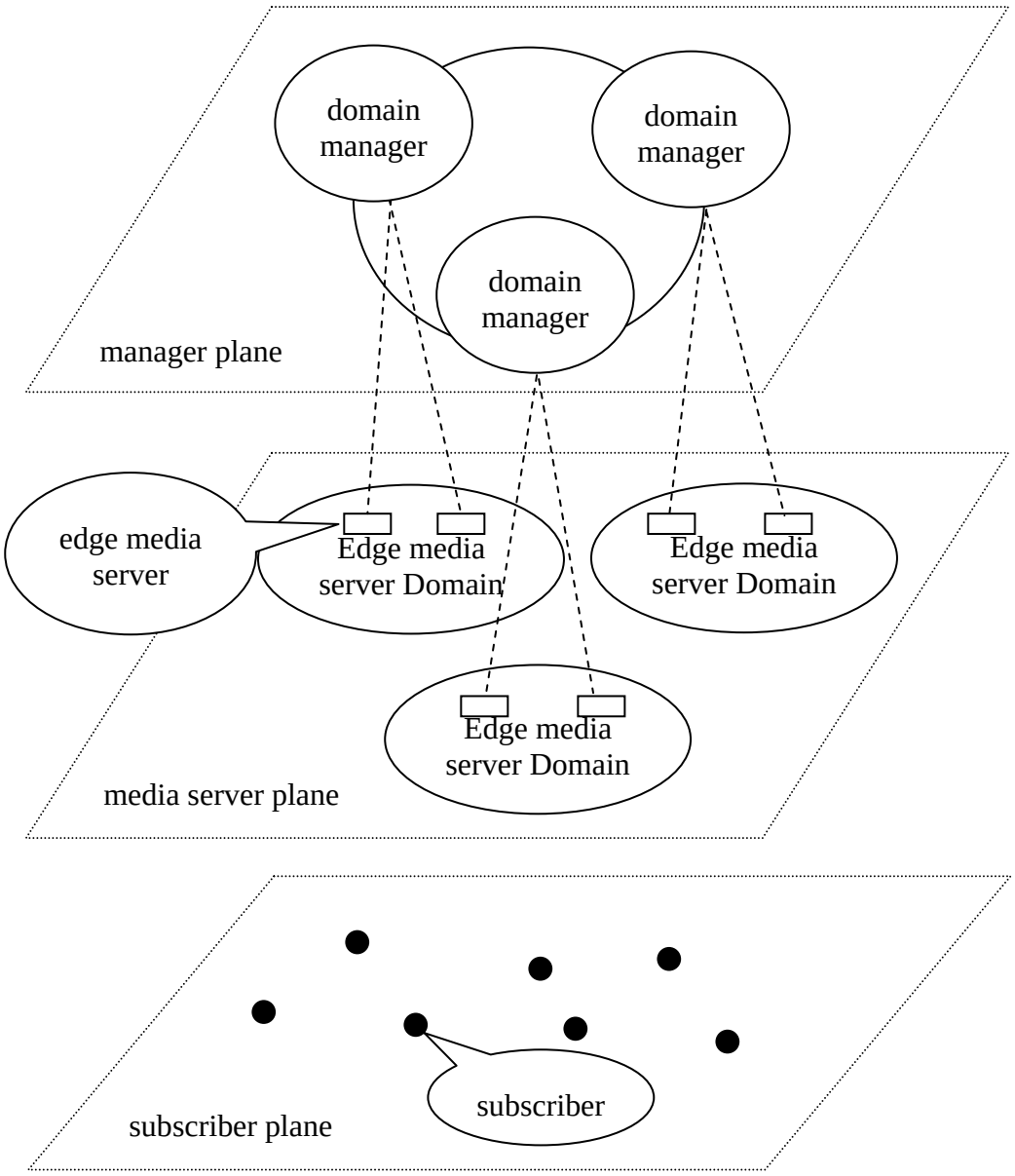

Figure 2, P2P media delivery control

As shown in Figure 2, P2P media delivery system adopts P2P technique to organize subscribers, edge media servers and domain manager. Subscribers are organized by P2P methods to serve each other. Each edge media server domain consists of many edge media servers which apply P2P methods to implement media delivery functions, such as content distributing, content locating, topology and content maintenance, etc. without the help of centralized server. Edge media server domains are organized again by P2P methods to accomplish media delivery function in a wider scope, i.e. among different domains. Note that, each edge media server domain corresponds to a domain manager which not only acts as an agent to support P2P functions among domains, but also manages the information of the edge media servers in the domain.

4, P2P IPTV system architecture

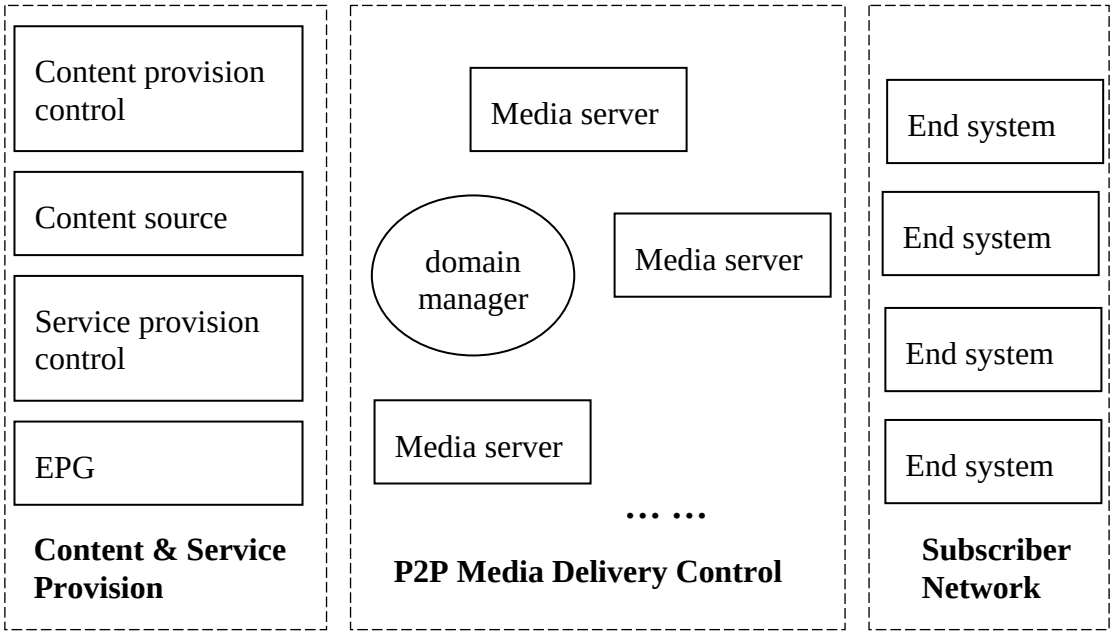

Figure 3, P2P IPTV system architecture

As shown in Figure 3, P2P IPTV system architecture includes three main subsystems: content and service provision, P2P media delivery control and subscriber network. Content and service provision subsystem is further composed of the following four main functional components.

(1) Content source: IPTV contents, e.g. media streams are stored, formatted, encrypted and further transported to the media servers.

(2) Content provision control: manage the information of IPTV contents, such as their metadata, stream parameters, etc. and further pass the information to the EPG.

(3) Service provision control: produce IPTV services according to the policy by the IPTV service providers or the requests from the subscribers.

(4) EPG: interact with both IPTV subscribers and content provision control to handle content requests and display content information.

P2P Media delivery control subsystem mainly consists of media servers and media server domain manager which adopt P2P technique to implement IPTV content delivery functions, such as content storage, content distributing, content locating, content serving, etc.

Subscriber network subsystem mainly consists of end system (e.g. PC client, STB) which acquires IPTV contents from the P2P media delivery control subsystem or other subscribers, and serves others.

5, Work items

In order to efficiently support the above mentioned P2P IPTV system, research efforts should be taken in a wide scope from media delivery control to system architecture. We propose initiating the following work items.

- **More functional components in P2P IPTV system architecture**: Except for the P2P IPTV functional components addressed in Figure 3, there should be more components specific in different aspects of P2P IPTV, such as IPTV content/service rights

management, AAA, IPTV content/service policing, etc. All these specific components need to be properly defined and well organized to facilitate a more efficient P2P IPTV system.

- **Interface definition between different functional components in P2P IPTV system architecture**: Interface between relevant P2P IPTV functional components should be carefully defined to describe the IPTV content/service information transported among the components and the actions of the components upon receiving/sending the information.
- **Functional requirements of edge media server in P2P media delivery control**: Edge media server should be designed such that the P2P methods for distributed structure, such as content distribution, content locating, as long as peer maintenance mechanisms can be implemented without the help of centralized server.
- **Interaction between edge media servers and domain manager in P2P media delivery control**: Interaction between edge media servers and domain manager should be multi-folded. On one hand, the domain manager should manage the information of edge media servers, e.g. server load, server capabilities, topology of servers, etc. On the other hand, the domain manager should be able to handle the content requests either from certain edge media server or from other domain manager to act as an agent of global content locating.
- **Functional requirements of domain manager in P2P media delivery control**: Except for managing the information of the edge media servers in the domain, the domain manager should be designed to support the P2P functions among the domains, e.g. launching, routing and relying P2P content requests among domains in the case that such a content cannot be found in local domain.
- **Consideration of organizing subscriber networks by using P2P technique**: More focus should be put on utilizing the capabilities of subscriber side networks to facilitate a more efficient P2P IPTV system by deliberately scheduling the content among a large amount of subscriber systems. An example would be providing the PC clients with P2P functions such that the IPTV content can be served simultaneously from multiple sources and, thus, the load of service provider network is further reduced.

6, Conclusions

Classical IPTV system has some shortcomings due to the C/S model where high cost sever has to serve more and more users simultaneously. We propose initiating work on P2P based IPTV system where both groups of low cost servers and subscribers are respectively organized and cooperate in a P2P manner to implement IPTV services without continuously upgrading IPTV system. The purpose of this proposal is to provide a clear guideline for P2P IPTV system architecture/functional requirements, P2P media delivery control, as well as identifying some potential work items for further research.

Proposal

We propose Q2 /SG13 initiating a new draft recommendation work on P2P based IPTV system.