Design of An Assistant Gateway based on UPnP for Supporting Media Sharing Service in Cloud Environment

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Abstract. The rapid growth in multimedia content and smart devices, multimedia services are encountering many problems in home networks. Firstly, because of limitation of remote access function, media device do not provide smooth streaming services in remote places. To address these problems, we propose Assistant Gateway to support remote access functions for providing multimedia services in home networks and WLANs. To store, process, and manage large amounts of multimedia contents, cloud server is used in the basis of cloud computing technology. In proposed paper, Assistant Gateway is an important component. It can obtain multimedia content information from cloud server for sending it to users in home networks. Users can thus receive home media streaming services through Assistant Gateway using media device renderer.

Keywords: cloud computing, remote access, media streaming services, UPnP, Assistant Gateway

1 Introduction

Recently, many different types of mobile devices provide universal Plug and Play (UPnP) and Digital Living Network Alliance (DLNA) functions to provide multimedia services in a home network. UPnP and DLNA are standards for sharing and playing multimedia content among heterogeneous devices in a home network. However, these technologies only work in home networks. Remote access functions are not used efficiently and they have only been studied to a limited area. Recently, many studies aimed at supplementing multimedia content sharing and playing technologies with remote access functions in UPnP were conducted to provide convenient home media services anytime and anywhere. To process the rapidly increasing volume of multimedia content, we use cloud computing technology. We propose Assistant Gateway to support remote access functions and a cloud server to store and process large amounts of multimedia content in a home media system.

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There are remote controller and media device to control media device and display media streaming data.

The remainder of this paper is organized as follows: Section 2 discusses related work for better understanding. Section 3 describes the home media system and explains Assistant Gateway. Finally, Section 4 concludes the paper.

2 Related Work

Nowadays, much research is being conducted on multimedia content sharing and communication among home networks. Mahdi et al. propose a new service for multimedia sharing. This service provides content sharing among users within homes as well as remote access to content. The solution is based on the use of UPnP technology for multimedia sharing in a home network and the IP Multimedia Subsystem (IMS) for the session establishment and QoS management in the core network [1]. Hu et al. propose architecture to provide an efficient in-home media content distribution mechanism associated with the home gateway to enable local and P2P content sharing in home networks. This mechanism complies with UPnP conventions to support UPnP-compatible home applications and services [2].

3 Proposed Model in Home Networks

In a home media system, cloud is used for storing, processing, and managing a large amount of multimedia content. In addition, UPnP technology is used to access UPnP devices in a home network for sharing and playing multimedia content. Assistant Gateway provides stable multimedia services to users between a cloud server and a home network using UPnP technology. Assistant Gateway takes multimedia content information from cloud server for transmitting it to remote controller and collects media device renderer information using UPnP. Remote controller displays multimedia content information to users. Users can select multimedia content according to their information. Remote controller sends the multimedia content information to Assistant Gateway. Assistant Gateway selects a media device renderer using automatic device matching model. The core of this paper is Assistant Gateway to provide home media services in remote places. The following section will describe main functions of Assistant Gateway.

3.1 Assistant Gateway

Assistant Gateway manages user and multimedia information. To provide a safe personalized multimedia service, a login function is designed in Assistant Gateway. Thus, users can receive safe personalized home media services. Furthermore, Assistant Gateway stores and manages the OAuth-based authentication-id generated by cloud server for users. Using the authentication-id, Assistant Gateway can freely access to cloud server and obtain multimedia content lists and metadata. All of the
multimedia content is stored by users or shared by those related to these users. Assistant Gateway simultaneously obtains metadata with the multimedia content list for classifying the content. Multimedia metadata are composed of many attributes such as title, author, duration, resolution, date, size, and URL. They are efficiently stored and managed in a SQLite-based database that records multimedia content lists and metadata. Simultaneously, it stores and manages the multimedia seek time for providing gapless playback service to users. In addition, multimedia metadata are used for automatic device-matching functions.

Assistant Gateway uses the UPnP protocol for maintaining communication with media device renderer and providing multimedia content to users. To support multimedia services using UPnP, Assistant Gateway provides the functions of MS and RAS proposed by UPnP AV and RA architectures, respectively. Assistant Gateway maintains the Content Discovery Service (CDS) and Connection Manager Service (CMS) of MS to support multimedia services. CDS manages the multimedia content list and metadata that are sent from the cloud server to users. CMS is used for maintaining connections between Assistant Gateway and other UPnP devices. RAS is designed for providing users with multimedia content. Assistant Gateway using RAS provides remote devices multimedia content and media device renderer information within a home network. Assistant Gateway includes an RA Transport Agent and an RA Discovery Agent for communicating with remote devices. Both are part of the RAS. The RA Transport Agent constructs a safe communication channel between Assistant Gateway and remote devices. The RA Discovery Agent can receive information from remote devices and verifies synchronization service data for communicating with them.

For providing convenient multimedia services and user-friendly functions, Assistant Gateway offers an automatic device–matching function that uses the resolution of multimedia content for selecting an adaptable media device renderer. Although the UPnP protocol supports multimedia on demand services, users can receive convenient and efficient home media services because of the automatic device–matching function. Assistant Gateway executes a multimedia streaming service using the automatic device–matching function according to the result that is received from comparing multimedia content with the resolution of media device
renderer. The automatic device–matching function is only supported in a home network and cannot be used for remote devices. Therefore, remote devices can use multimedia on demand services only. In addition, for supporting efficient multimedia services, Assistant Gateway provides a multimedia gapless playback function to users. Using this function, Assistant Gateway can record the ending time of multimedia content to a database that is based on SQLite. When users play multimedia content for which the ending time was recorded, Assistant Gateway obtains the stopping time from the database and sends it to media device renderer for playing multimedia content continuously. Figure 3 shows structure of Assistant Gateway.

4 Conclusions

In this paper, we proposed cloud server to support personalized multimedia services using many kinds of functions and Assistant Gateway to provide home media services in home networks and WLANs. In addition, Assistant Gateway has a decisive role in a home network. It supports remote controller multimedia content information for users to select multimedia content. It also selects adaptable media device renderer depend on the multimedia content selected by users. According to Assistant Gateway, users can receive efficient and convenient home media services anywhere.

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