Bringing IMS Services to the DLNA Connected Home

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Abstract.
DLNA is a leading standard for consumer electronics devices. But it does not enable remote devices to connect to services in the home, using the IMS-based networks now being rolled out by telecom companies. We present a solution for interworking DLNA and IMS, and discuss the implications. We also describe how to enable IMS services on DLNA devices.

INTRODUCTION

DLNA [5] is emerging as the driving standard for the control and coordination of media services in home networks. The number of DLNA compliant devices already ranges in the hundreds, with a steady stream of new devices emerging on the market. But while DLNA is a successful technology inside the home network, it is not designed for global connectivity.

At the same time, in the telecommunications sector, the IP Multimedia Subsystem (IMS) [2], [3] has emerged as a strong contender for managing multimedia services in telecoms networks. IMS provides authentication, authorization, and other security functions, as well as quality of service. These services are typically implemented in fault-tolerant, high-reliability servers.

IMS has found multiple uses outside the VoIP services it was originally targeted to provide, for instance in messaging, presence information, and IPTV.

DLNA, while a technology to enable simple and easy sharing and viewing of media in the home, is constrained when it comes to enabling access to services outside the home, since it does not have functions to discover services in the wide-area network. Nor does it have the security functions required to authenticate and authorize devices towards the network. DLNA, as based on UPnP, also does not have a notion of a user, since the technology only tracks the device.

The strong necessity of interoperable home devices has enabled DLNA to gain wide acceptance, but at the same time this is what is holding it back from use with services which require wide-area technology.

Requirements of an interconnection Function

The interconnection between the IMS network and the DLNA network is managed by the Home IMS Gateway – the HIGA. The HIGA provides devices like DLNA devices with a way to connect to the IMS network without having an IMS client [12]. By this principle, the HIGA enables all IMS services to be leveraged by DLNA devices.

The HIGA contains added functionality compared to current home networks and residential gateways (RGW) [1]. It is equipped with an ISIM issued by the IMS operator, which is tied to the identity management.

It also has an identity model, which enables the mapping of multiple users and services onto one single IMS private identity [12]. IMS enables the adaptation of media to devices, by providing functions for device characteristics description; and it supports means to setup communication sessions with guaranteed Quality of Service over the network.

In IMS, it is the user, not the device, who is authenticated to receive access to services. In DLNA, and the UPnP protocol which it leverages, it is the other way around. Hence, the HIGA Identity Management function supports mapping of device identities in the home LAN to user identities (IMPU's) in the IMS network.

When used with DLNA devices, one of the primary uses of the HIGA is to open the appropriate ports in the NAT. The home network is assumed to be behind a NAT, which is controlled by the HIGA, using for example UPnP IGD. This enables NAT traversal for both signaling and media traffic, though HIGA is typically not involved in the media plane.

There can be several types of signaling in a home network, involving different protocols which have different features, for instance the notion of sessions. Sessions represent a duration of connection [6], and are enabled by SIP. DLNA, on the other hand, is oriented towards transactions, and HTTP as the underlying protocol is by definition stateless and no persistence is assumed.

In case of SIP clients, the HIGA converts IMS messages to SIP messages and vice versa, which means adding or removing the IMS-specific parts of the SIP signaling when it is addressed outside the home network. However, this will not enable DLNA devices to connect to use IMS services. To do that, an additional function has been added to the system: The IMS-DLNA Gateway.

This gateway translates the messaging and protocols from the IMS signaling, to the DLNA signaling, and additional semantics on top of HTTP such as SOAP. The semantics of the messages also have to be translated. In addition, this module of the HIGA has to act on the media plane. The emerging IPTV architectures under definition in e.g. TISPAN, DVB, Open IPTV Forum, and ITU-T are based on RTP as the transport protocol for media streams, whereas DLNA devices use HTTP by default [16].

IMS Services in DLNA environments

IMS Services Gateway

IMS enables a number of specific services, such as Push to Talk over Cellular [8] (PoC), Immediate Messaging (IM) [9], or IP Multimedia Telephony [10], and IPTV [16]. These are not available on non-SIP devices today. But they can be made available as native services using an API. This takes the integration of IMS and DLNA devices one step further than the IMS-DLNA Gateway.

One way of exposing IMS functionality to UPnP devices is to define new UPnP functionality (according to [4]), the UPnP - IMS Services Gateway (ISG). The ISG exposes the IMS services to UPnP devices, for instance by providing a SOAP API addressable over UPnP. The use of the ISG will enable UPnP devices to invoke IMS sessions and to exchange event notifications with the IMS core using relevant functions of the HIGA.

Given the increasing tendency to use the Web Services paradigm in CE devices, we have been developing a conceptual Web Services ISG interface. The interface defines an abstraction layer enabling multimedia devices supporting arbitrary home networking technologies to access IMS services. The interface consists of modules or wrappers responsible for different technologies such as CEA-2014 [14], UPnP Remote User interface (RUI) etc. Each module exposes functions which map to methods in the underlying SIP stack or a high-level API e.g. JSR 281 [15]. The services accessible via the interface would depend on the device's capabilities such as the presentation layer, communication protocols, media rendering and serving capabilities.

IMS-based IPTV

As discussed in [13] and [16], television is one of the future services where IMS can be leveraged. The IMS systems enables the setup of a control infrastructure, which lets the user control the media in a way which gives the same service experience as today's terrestrial TV – while at the same time enhancing it to include new functions for personalization and interactivity.

Adding these features are crucial to the success of IPTV, enabling service providers to add value, instead of just moving the traditional TV experience into a different kind of cable.

Making this available to users of DLNA devices, however, requires conversion both of protocols and signaling. This is one of the functions of the IMS-DLNA Gateway.

Presence

A presence and instant messaging system [9], [11] allows users to subscribe to information about each other and be notified of changes in state, and for users to send each other short instant messages. This typically includes information like happy/sad, available/not available, etc.

In the IMS presence system the authentication and authorization features of IMS are leveraged to determine who is allowed to subscribe to information, and also who is able to get which information. The same system can be used to manage the user's personal profile, which can be used as a basis for personalization of services.

Making this available to users on DLNA devices requires the translation of the signaling and data from the SIP-based infrastructure for presence to the HTTP-based infrastructure of DLNA.

Conclusions

We have presented an open standards based solution for interconnecting DLNA devices with IMS-based services.

All above-mentioned services can not be realized on a DLNA device, since they require signaling of a type which the DLNA device is not set up to manage. However, by including the HIGA, the home network can become a part of the IMS network of the operator. We also introduced an IMS-DLNA gateway, and added an IMS Services Gateway which enables the user of the DLNA device to leverage services on the IMS network.

Combining DLNA and IMS to provide the strengths of both the flexible home network and the managed global telecommunication networks has been the key goal. It also supports secure remote access to home services and to personal media from any IMS device.

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