Adaptive Wireless IPTV Development Platform

Antti Heikkinen Janne Vehkaperä Jukka-Pekka Laulajainen Johannes Peltola

VTT Technical Research Centre of Finland
Kaitoväylä 1, 90571, Oulu, Finland

ABSTRACT

In this paper, we present an adaptive wireless IPTV development platform which provides a cost-effective and realistic environment for testing and developing adaptive video transmission technologies and services. We describe the components of the platform and give examples of how the platform has been used. The platform supports adaptive video delivery to mobile users in various networks, e.g., WLAN, WiMAX, and 3G. Furthermore, the platform includes support for managing client mobility and quality of service (QoS). The environment comprises of a controlled laboratory environment including a network emulator as well as actual networks with wide coverage and regular users.

Keywords

IPTV, Wireless, Mobility, QoS, adaptive multimedia.

1. WIRELESS IPTV PLATFORM ARCHITECTURE

The wireless IPTV development platform shown in Figure 1 consists of a media server, test network, network monitoring tool, mobility management mechanisms, and video clients for different devices. The platform is built from off-the-self and custom components, but instead of being a static structure, new technologies such as applications, codecs, and protocols can be easily integrated into the platform.

Media Server

The media server can capture, encode and stream videos on the network. The media input can be for example a digital video broadcast (DVB) receiver, external video camera, media file, or a network stream. The media server includes several video codecs such as MPEG-2, MPEG-4, and H.264. Hence, we can use real-time transcoding to change the coding parameters of the video stream, adjust spatial or temporal resolution, or change the video format. Furthermore, the media server includes an interface for controlling data by initializing and adjusting the video encoder parameters during the encoding. The streaming server supports a large number of Internet protocols such as HTTP, TCP, UDP, and IPv6.

Test Network

The development platform includes a controlled network environment connecting the client devices to the media server. The network consists of a wired backbone network and several wireless access networks using different technologies. These technologies are IEEE 802.11g and pre-standard IEEE 802.11n wireless LANs, cellular 3G/HSDPA, and both IEEE 802.16d and e versions of WiMAX. As all the networks are included in the development platform, the network between client and server can be freely configured to best suit the research and development purposes. It is also possible to get information from different protocol layers on the network, which is infeasible when using commercial networks. However, separated laboratory network does not alone provide a very realistic environment for testing. To solve this problem, we have a rate control tool for inducing impairments like additional delay, jitter, bandwidth limitations, or packet losses to the network.

Mobility and Multihoming Support

In order to support mobility, the platform has been equipped with a home agent which is a key enabler for Mobile IP. The core network has been adapted for mobility experiments by deploying an emulated multi-operator IPv6 testbed solution.

Network Monitoring for Media Adaptation

The platform includes a network monitoring tool which monitors the client-server connections end-to-end and provides information about network conditions. This information includes parameters like delay, jitter, and packet loss and it can be used for adapting the applications to maximize the end user experience of the service, in this case to configure the encoding parameters at the media server.

End-user devices

The client applications receive and display the video stream. The platform is equipped with several video clients for different devices, for instance the VLC media player on PCs and PDAs. Current testbed setup includes several end-user devices such as IPTV STB (Kreatel), Laptops, Mobile phones (Nokia N95), PDA (Nokia N810). Video stream can be adapted to these end-user devices according the terminal profile which includes some information about the video format, resolution and bit rate. For example IPTV STB can receive video with higher resolution and bitrate than mobile phones.

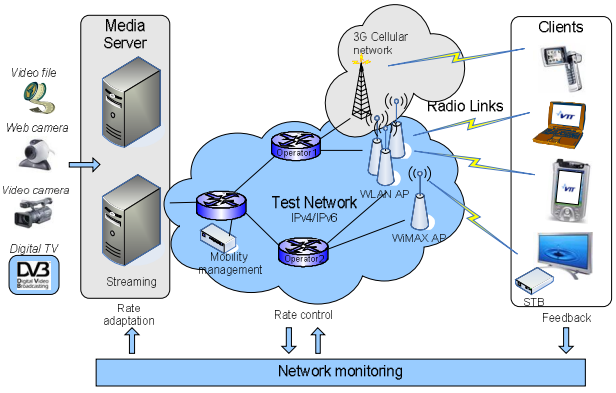

Figure 1. The architecture of the wireless IPTV development platform.

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