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An MPEG-based Widget System for CE and Mobile Devices

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***Abstract* — This paper presents the architecture of a Widget System capable of streaming, adapting and aggregating widgets. It is designed for CE and mobile devices based on the MPEG-4 Scene Description Languages, enabling streaming and usage of interactive and animated rich media data in the widgets and relying on the MPEG-21 standard to provide adaptation means.**

I. INTRODUCTION

The consumer electronics world is currently witnessing three major changes at the same time. First, CE devices (portable media players, photo frames, digital TV) and mobile devices are evolving rapidly and an increasing amount of these devices can already display rich media content, including audio, video, animated and interactive graphics. Consumers therefore expect the same quality of user interfaces (UI) as they are used to on desktop computers. Moreover, they expect user interface consistency on all their devices.

A second change lies in the fact that, thanks to home networking protocols like UPnP [1] or DLNA [2], devices in the home now discover each other and exchange content as in the Web4CE standard [3]. As a consequence, consumers expect to be able to view and control their home devices from any rendering device, and especially from high definition TV screen. In particular, they want to be able to exchange and share their user interfaces between devices.

Finally, user interfaces in the desktop computer and mobile worlds are changing. From large and monolithic applications, user interfaces are now becoming composed of single-purpose and small applications called widgets [4]. Hence, users will soon create personalized user interfaces as they now do with their iGoogle page [5].

Given these three parallel evolutions, it should be possible to port desktop user interface paradigms on CE devices. However, existing solutions are not fully satisfactory. The Web4CE standard relies on a limited subset of HTML to describe widgets and does not yet consider 2D or 3D graphics, animations and audio/video in the widgets. Desktop widget solutions are not interoperable and are designed with the processing capabilities of desktop computers connected to the Internet in mind. Additionally, because of the heterogeneity of CE devices, there is a need for a widget system adaptable to the device characteristics (screen size, processing power, and input capabilities) as well as to user preferences (language, theme, skins…). Moreover, in a home networking scenario, widgets could be used to display time varying information (room temperature, Blu-ray Disc player status). Such scenario could be satisfied with existing technologies but requires AJAX [6] oriented infrastructures (Web Servers, frequent pull requests, XML parsing) which may not be appropriate for constrained devices. Therefore, a widget system for the home network should also allow efficient processing, streaming and updating of widgets data in push scenarios.

In this paper, we present an architecture using MPEG technologies to satisfy the above requirements. The proposed system is based on the MPEG-4 Scene Description Languages (BIFS [7], LASeR [8]) for the description of widgets because they allow designing and streaming of rich user interfaces; and on the MPEG-21 standard [9] for the description of device and user characteristics. Additionally, we propose a way to combine these two languages to enable adaptation and personalization of the widgets.

The rest of this paper is organized as follows. Section II presents some use cases for our widget system. Section III describes the architecture of this system and discusses its advantages. Finally, Section IV concludes this paper.

II. USES CASES FOR AN MPEG WIDGET SYSTEM

A. *Widget Aggregation and Communication*

Fig. 1. Example of aggregation of and communication between two widgets coming from two different devices on a DTV. Each widget shows the file system of its corresponding device. A picture is transferred from one device to the other by a drag and drop operation on the DTV.

With the growing number of personal CE devices and their increasing capabilities, exchange of data between complementary devices is becoming a daily, yet tedious task; picture or music exchange usually implies several operations (connecting to a PC, multiple exchanges of single files …). Fig. 1 shows how CE devices could deport their interfaces as widgets on a touchable DTV, and how a large touch screen could provide a convenient way to browse and exchange content by simple clicks and drag&drop operations. The realization of this use case requires some level of communication between the widgets and the DTV.

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B. *Downloadable Widgets*

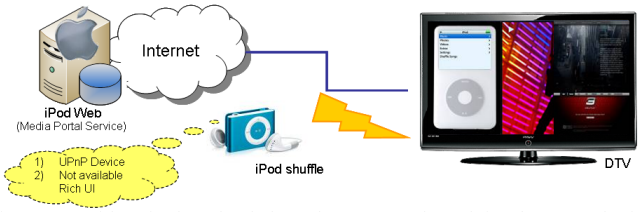

Fig. 2. A widget is downloaded on the DTV and used for the control of a UPnP device which does not have Rich User Inteface.

For cost and complexity reasons, some devices manufacturer may not feel the need for embedding a widget in their devices. In our system, as shown in Fig. 2, the widget used to control the device may not be located in the device but may be downloaded from another (trusted) source. This implies that widgets can be designed separately from the device, allowing for custom UIs and community exchange. This also requires higher level of interoperability and potentially CE manufacturer certification.

III. Architecture of the MPEG Widget System

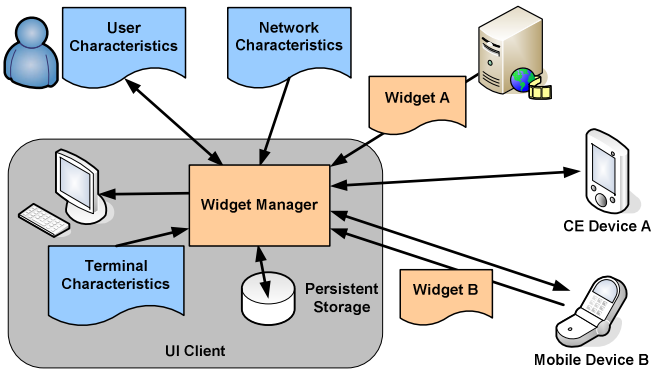

Fig. 3. Client/Server Architecture for the MPEG-based Widget System

A. *Client-Server Architecture*

Fig. 3 shows the Client-Server architecture of the proposed Widget System. User and Network characteristics as well as Terminal Capabilities are described using MPEG-21 UED [9]. Interfaces similar to DCCI [10] are used for access and storage. Widget locations are given to the UI Client as part of the device discovery process. In this system, the device control relies on a combination of exchanges of UPnP/DLNA messages and MPEG-4 Scene Description data.

B. *Client-side Architecture*

Fig. 4 gives additional details about the architecture of the User Interface Client. This architecture is currently being validated in the GPAC Player [11]. The UI Abstraction Layer is responsible for the device discovery process and address resolving. The Widget Manager handles loading of the discovered widgets, establishing communication with their respective devices for UI streaming and rendering, in a traditional MPEG-4 architecture. At any time, the widgets and their manager may query UED and private data or ask for

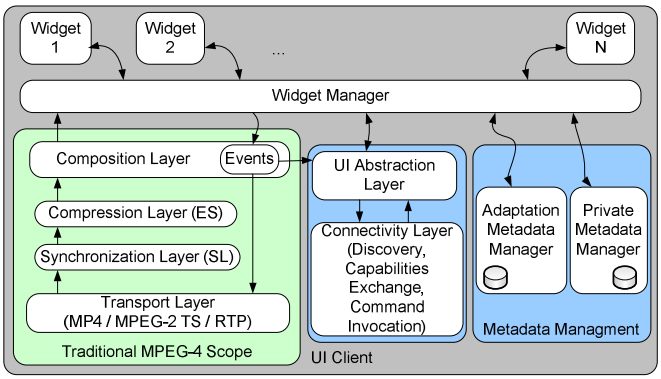

Fig. 4. Architecture of the User Interface Client.

alerts whenever a change in metadata occurs. Interactions are filtered by the Widget Manager, which passes events between widgets or back to the connectivity layer for UPnP control.

IV. Conclusion

In this paper, we show that, by using MPEG technologies, we can build a simple system allowing flexible, customizable and exchangeable user interfaces with low complexity requirements, therefore lowering CE devices costs. This work is currently being investigated as an exploration activity in the MPEG standardization group and will lead to new standards.

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