An Adaptation Architecture of Multimedia Documents for Management of the Quality of Service

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Abstract: The democratization of the means of wireless communication coupled with advanced technological hardware can now offer portable devices that fit in the hand with a capacity of computation and means of wireless communication such as mini PCs, PDAs, mobile phones and even wireless sensors. Distributed multimedia applications are a challenge as they try to meet the constraints of the multimedia document, so that the network provides no guarantee of quality of service (QoS). We propose to adapt multimedia documents based on changes of context. In this paper, we present an architecture that aims at adapting content and presentation of multimedia documents in the context of the user. We develop an adaptation service cannot only detect and solve the problem of heterogeneity between incompatible components, but also to manage the adaptation with preferences of the user. We propose to see the adaptation as a non-functional property, provided by an administrator and handled by an adaptation manager QoS.

1 INTRODUCTION

Nowadays, the concept of multimedia presentation has become increasingly widespread and used in various fields such as education, advertising and sales presentations.

A multimedia presentation system is an integrated computer system, characterized by its ability to process information expressed in several media, such as audio, video, image, graphic, text, etc. Their main function is to present media objects synchronously according to a specified scenario.

Grace to developments in the field of communication between computers, media objects that are part of a single multimedia application can be distributed on different servers, either on the same site or on different sites. Because of its large size and the vagaries of the flow digital connections, access to an object can undergo a more or less important and a random value.

Therefore, the quality of the presentation of these objects can be degraded due to non temporal deadlines. Another crucial point is the risk of loss of data that a media object can undergo during remote access and behavior of objects cope with this loss.

Thus, access protocols used to access media objects must reflect the real-time nature and behavior vis-à-vis the loss of data. In addition, communication channels must provide the bandwidth required to handle large volumes that characterize these media objects.

To provide users of fixed or mobile terminals personalized services, context sensitive and adaptable infrastructure is required for the provision of services designed for this purpose.

Adaptability is then defined as the ability of media objects to meet the quality of service rendered. Objects such as video clips and images can be adaptable (according to the coding used) they tolerate degradation in the quality of their presentation (eg. reducing the number of colors used) based on available system resources. The multimedia communication needs services able to face heterogeneity on several levels: the context, the access devices, the communication network, the user, etc. It is necessary to integrate capacities to deal the heterogeneity problem, and to answer the changes of the context caused by the user, the application, the network or the access device. It is necessary therefore to develop platforms capable of ensuring the execution and the monitoring of multimedia applications.

On the other hand, objects like text and sound are most often not adaptable to the requirements of quality of service they do not tolerate any loss of content or data. Define the quality of service of

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component assembly is to define all the properties, characteristics and performance of the service provided to the customer and compared to the expected service by the latter. (Dalmau et al., 2004).

Quality of service (QoS) defines the service capabilities to operate in good conditions in terms of availability, performance, etc. The researchers propose different ways to group the QoS parameters in different categories.

In the remainder of this article, we present in Section 2 and 3, the adaptation of multimedia documents and ensuring quality of service in multimedia presentations, and then we propose a model of software architecture for the presentation of multimedia documents adaptable. We then present the process of adapting multimedia documents.

2 ADAPTATION OF DOCUMENT MULTIMEDIA

A multimedia document is a combination of media available to users. These documents are available on the Web from a database and the user can interact with a multimedia document through its interfaces.

The database must store specific structures and generic documents. It should also provide the context of media and stored in a database (Profile Media). For each category of media, different encoding formats exist (for ASCII text; jpeg, gif, tiff, png, for images, MP3, Wave for audio, mpeg and avi for videos).

Because of recent technological advances, users have nowadays a great variety of new tools and platforms that allow access to information anywhere and anytime. Progresses in the means of access are accompanied by a particularly striking change of content. As the means of access to information is very heterogeneous content servers cannot be sent in the same way for all customers. There is therefore a need to adapt content to meet the characteristics of each customer target (Lemlouma, 2004).

Different contexts multimedia presentations introduce multiple constraints on the presentation itself.

Limitations of bandwidth between the client and the server, for example, can lead the customer not to play two videos at the same time, as well as the limitations due to the display that can lead to similar constraints (Laborie et al., 2005.).

An important criterion for a multimedia environment is its ability to accept a variety of formats and even offer some form of scalability so as to take account of new formats.

Adaptation is a process (see Table 1) to change the media type (transmoding), the encoding format and / or media content (transcoding).

Table 1: Type of media and technical adaptation content.

category	Transcoding	Transmoding
Text	-format conversion -font size reduction - change of police, color ...etc.	-text-to-audio transformation
Image	-data size reduction -dimension reduction -color depth reduction	Image to text
Video	-frame rate reduction -spatial resolution reduction -temporal resolution reduction	-video to image transformation -video to text transformation -video to audio transformation
Audio	- change sampling - format conversion	-audio to text transformation

Other types of constraints can be introduced by the user preferences, content protection and terminal capabilities. Constraints imposed by the client are called profile. Profiles can be expressed in terms of restrictions on the language used to specify the target documents or in terms of additional constraints imposed on the objects.

For example, if the platform has a screen with limited capacity, it will be not possible to present two images simultaneously on the same screen (Lemlouma and Layaïda, 2001), (Villard, 2001). To satisfy these constraints, multimedia documents must be adapted before being presented.

Several types of adaptation can be envisaged as local adaptation (related to the different multimedia objects) and global adaptation (related to the organization of the content of the presentation).

From the profile and initial document, the step adaptation should produce a document that meets the constraints expressed in the profile. This adaptation is usually performed by a program processing document (Lemlouma and Layaïda, 2001); (Villard, 2001).

The adaptation of content is generally defined as the process that transforms content from its initial state to a final state in order to satisfy a set of constraints (Lemlouma, 2004).

Indeed, researchers interested in this field distinguish two types of adaptation:

- Adaptation of the logic service as the work presented in (Marquet et al., 2002) and (Brain, 1999), where the service is represented by a set of components. The adaptation is then to modify the assembly of these components by adding,

deleting or replacing a component.

- Adaptation of service content (Boszomenyi et al., 2003); (Lemlouma, 2004). These are all forms of adaptability choosing the change of content provided by the service, depending on the context.

A typical form of the adaptation of the content is to change the encoding of a media stream, or a change in the presentation of a service, according to the context.

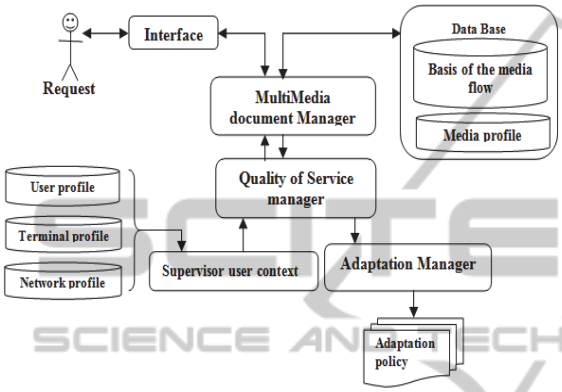

Figure 1: Architecture adaptation for a multimedia document to user's context.

The abstraction of computer systems has led to propose many languages, portable tools and abstract to define paradigms of creating scenarios, that is to say, the temporal relationships between elements of the multimedia document.

The media industry has focused on the effectiveness of storage and rendering information monomedia, increase that is more felt in the parallel computing power of computing platforms increased rapidly.

In modern optical networking and multimedia content distribution, scenarios have expanded features associated with this release as service quality, interactivity and dynamic adaptation to network constraints. These multimedia systems have in turn changed network protocols by incorporating their concepts and techniques.

To ensure a good quality of service, the system shall be capable of transmitting and transforming complex multimedia content to be compatible with the capabilities and preferences of the end user.

Guaranteed quality of service (QoS) is the ability to provide and guarantee different priorities to different users, different applications or to different data streams in a communication system.

These priorities applied to data streams are characterized by guarantees on flow, delay, jitter, loss probability of data packets and bit error rate.

These guarantees quality of service make sense when the transmission capacity of the system is insufficient in relation to the entire flow of data to be transmitted (Nivor, 2009). QoS is also related to the hardware and software entities used for the realization of an application. Indeed, it may reflect the ability of these entities to provide a service with different levels of quality, so in different ways.

In the case of distributed multimedia applications, we can, for example, transmit a video stream with different qualities depending on the network bandwidth used (compressed stream, image size, resolution, color or black and white) (Bouix, 2007).

3 ARCHITECTURE FOR THE PROVISION OF ADAPTABLE MULTIMEDIA PRESENTATIONS

In this section, we present an architecture that can handle the dynamic adaptation of multimedia documents in the context of the user.

As shown in Figure 1, the provision and adaptation of multimedia document constitute the heart of the features offered by this architecture. Four components are represented: the interface, the multimedia document Manager, Quality of Service (QoS) Manager and the Adaptation Manager working together to find a consensus on the best adaptation of multimedia document,

3.1 Interface

The component interface captures the context of the user, and provides user interaction with the manager of the multimedia document. It is used by a terminal heterogeneous environment; it is a major player in the architecture. This is the player that allows the terminal to communicate with the rest of the system to receive the content and present it to the user. The user may at any time change the configuration using the interface of the client application.

3.2 Multimedia Document Manager

This component intervenes in the process of discovery and research of multimedia document. It manages the coordination of the functions necessary for a presentation of multimedia documents customized and context sensitive. It provides access

to content and communications that occur typically between the client and the server. The multimedia document manager receives requests from client applications and server response content.

It also ensures the transmission of requests from clients to servers in the same manner and server responses to client applications. Often these responses are adapted or modified before they are delivered to their final destinations. Two databases are associated with multimedia document Manager: Media Profile and multimedia streams. The diversity of the media and its characters and their various uses suggest that what is needed more than before is to define an abstract description to represent the different types of the media. The media profile contains information relating to each type of media, such as available format, the possible passage between the format and the types of the possible adaptation.

3.3 Adaptation Manager

This component ensures the adaptation of document content and it allows the identification of the best scenario. This is accomplished through the application of a set of processing methods and structural content adaptation (see Table 1). The adaptation is in most cases dynamic and depends on the values that are the dimensions of context such as the client application used, the formats accepted by the client, the screen size of the terminal, etc.

3.4 Quality of Service Manager

It cooperates with other entities of the architecture in order to make the best decision for adaptation. A component must allow for a description of the multimedia document adaptation in some cases, this description is the document itself (eg SMIL document). The supervisor of context user uses a cache management to keep track of terminal characteristics and changes they undergo. The identification of these features (profiles) is based on the IP address of the terminal.

To dynamically adapt to a multimedia user context we use a QoS manager which allows a manager to select the adaptation scenarios multimedia document content requested by the user.

The QoS manager uses as input, the terminal profile and the network profile, as it is present in the user context. It also uses user preferences of media for multimedia document, based on the information captured by the Interface and transmitted by the multimedia document; it also needs the context of the media. Based on this information used as input, it defines the list of possible scenarios. When the user logs in via the appropriate interface, the latter captures the user's context of explicit and implicit and stores it in a database called (User Context), which consists of three profiles:

- The user profile that is composed of static characteristics (name, etc.), evolutionary characteristics that are defined by the environment (location, time, etc.) and preferences (text, image or video);
- The terminal profile which has, firstly, the context of the material (type of the device, the screen size, etc.), and on the other hand, the context of the software (operating system, formats, etc.);
- The network profile that exposes information about the network type, characteristics, etc.

To provide adequate adaptation interfaces, we used the standard CC / PP (Composite Capabilities / Preferences Profile) W3C (World Wide Web Consortium). This standard is of great flexibility, allowing us in the future to define our context integrating physical disabilities of the users and the specific needs of each application. CC/PP uses RDF, one of the key specifications of the Semantic Web. CC/PP is the first recommendation that is based on RDF. The use of RDF for CC/PP has many advantages: scalable vocabularies, decentralized vocabularies, and simple integration of the interface from different sources (Derdour et al., 2009).

To describe the description of our users, we used the CC/PP with an extension to take on consideration the physical characteristics of the user and the objectives of transferring multimedia flows. The descriptor is presented as follows:

```
[User_Profile]
|
+--ccpp:component-->[Terminal]
| |
| +--rdf:type----> [Plateforme_Materiel]
| +--display_Width--> "....."
| +--display_Height--> "....."
| +--display_color--> "0/1"
| +--capacity memory--> "....."
| +--CPU speed--> "......MH"
| +--Connexion_supported--> [Types]
|
| +--Media_Accepted--> [Types]
|
+--Audio----->"0/1"
+--Vidéo----->"0/1"
+--Text----->"0/1"
+--Image----->"0/1"
|
+--ccpp:component-->[Logiciel_Used]
+--ccpp:component-->[Navigateur_Used]
```

+--ccpp:component-->[physical_Used]
+--ccpp:component-->[Need_Media]
|
+--*rdf*: user_ preferences ---> [Types]
+--Audio----->{"0","1","2","3","4",}
+--Vidéo-----> {"0","1","2","3","4",}
+--Text----->{"0","1","2","3","4",}
+--Image----->{"0","1","2","3","4",}

+--*rdf*: quality----> "High / average/ bad"

The interaction between the user and the multimedia document does not directly but by a multimedia documents manager via an interface. When the user starts interacting with multimedia documents, multimedia document manager checks the compatibility between the user's context and the context of the Media. If the two are not compatible, the multimedia document manager triggers the QoS manager. It recovers media from multimedia document manager, and from the supervisor the user context to define scenarios.

The process of defining the scenario of a multimedia document is complicated because the object is to build a dynamic object whose behaviors vary from one presentation to another due to reactions to interactions of the reader. We have proposed the use of a selection algorithm to choose one of the plurality media content when the multimedia content is to be adapted to the context of a user and the characteristics of the device (Shahidi, Ning, Hamid Aghvami, 2010).

4 ADAPTATION PROCESS OF MULTIMEDIA DOCUMENT

A multimedia document is always described as an assembly, according to a specified scenario, called static traditional media (text, graphics), as well as continuous media (animation, audio and video), Structured Media (HTML, SMIL, SVG), and even programs as applets or scripts. A good scenario is characterized by a good combination of several multimedia elements which can give a better result for the presentation of information.

An adaptation cycle of the multimedia document is initiated by a user sends a request to the Multimedia document Manager, comprising a reference to a multimedia document and a reference to the context.

5 CONCLUSIONS

To run a multimedia document on multiple platforms, it is necessary to adapt, that is to say, turn what it is compatible with the characteristics of the target device and the preferences of the target user.

This article deals with the provision of adaptive multimedia documents, it is intended to propose an architecture that allows users to discover and implement context-sensitive multimedia presentations. This paper presents an architecture which adapts, based on a user context, multimedia composites. These documents are tailored to the preferences of the user, the terminal capabilities, the location of the user, and finally to network resources available.

In continuation of our work, we plan to implement the selection algorithm scenarios. Note that, for the moment, we do not support streaming: the adaptation of multimedia documents must be completed prior to delivery to the end user. The streaming will be introduced later.

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