An Intelligent TV-Anytime Based Video on Demand System

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Abstract

This paper describes an Internet based video on demand service. To allow an efficient search in the pool of videos available in the server, some metadata in conformity to the TV-Anytime scheme is added to the content. The main objective of this system, besides enabling access to a set of films, is to allow an efficient management of the available network resources.
Keywords: *Video-on-demand, TV-Anytime, Network Management, Metadata.*

1 Introduction

Internet is currently being used to deploy a set of services whose main objective is to allow the access to information to a large number of users at a reasonable price. Not only is Internet available anywhere at anytime, but it is being used by an increasing number of users asking for new services and new media.
This scenario led to the emergence of new business markets namely in the area of multimedia. Small video producers have now an excellent vehicle to make their

productions available to a larger population without having a significant increase in costs.
However, creating multimedia assets requires also the implementation of mechanisms that enable efficient search and access.
The work described in this paper presents a video-on-demand (VoD) service that enables efficient search by using TV-Anytime metadata to describe content. Moreover, access to the service is integrated with an intelligent management system that makes real-time decisions based on the network load. These decisions enable the service provider to assure that the quality of service contracted by the clients is satisfied: not only is the access to a server dependent on the contract but the quality of the downloaded material is dynamically adjusted depending also on the resources available in the network link and the type of client connecting to the system.

2 Multimedia Description Schemas and the TV-Anytime Standard

The increasing number of media documents available in the Internet requires the implementation of mechanisms that enable its efficient search and access. A lot of different initiatives have being happening towards the definition of schemas that enable the description of multimedia content [1]. This extra information, known as Metadata, is expected to contribute to increase the value of the available assets by enlarging the number of accesses.
Due to a large number of areas facing the problem of describing content, having a different set of initial requirements, a number of quite different solutions have been proposed. Some of them have decided to provide a limited number of metadata elements to be used broadly. Some others are rather application oriented and provide an extensive number of elements organized in different manners.
An example of a simple solution that is expected to work in different areas is Dublin Core Metadata Initiative [2]. This initiative standardized a set of 15 main metadata elements that can be extended based on the needs.
More complex solutions, oriented towards multimedia content, were proposed by other organizations: P/Meta [5] [6], SMPTE Metadata Dictionary [3]and DMS1 [4], coming from the broadcast world, and MPEG7 [8] coming from the multimedia community.
Another solution coming from an industrial forum with more than 100 companies and 500 individuals participating is the standard known as TV-Anytime [7] [9] (TVA), already published as an ETSI international standard. This standard defines not only a metadata scheme able to describe content to be delivered to a set of different terminals (mobile phones, PDAs, personal video recorders, etc), but also the architecture and communication aspects to be considered when implementing a TV-Anytime compliant system.

The forum is organized in various groups dealing with the following aspects:

- Business Models
- System, Transport Interfaces and Content Referencing
- Metadata
- Rights Management and Protection.

TV-Anytime has defined a unique document structure (Figure 1) to aggregate programme descriptions, user descriptions or classification schemes (e.g. Content/genre, Action-Type, ContentCommercial, HowRelated, TVARole).

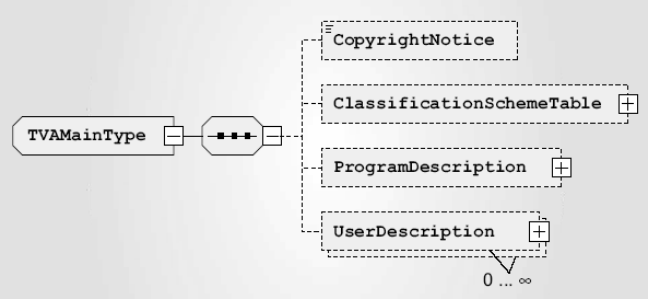

Figure 1 – TVA main schema

A TVA system is articulated around the Content Referencing Identifier (CRID). A CRID relates to a specific content/programme instance, or to other CRIDs themselves referring to other different instances. The CRID is also the link between a content instance and its associated metadata [9][11].

To enable some flexibility, TVA uses XML as the representation language and allows the refinement of the descriptions by adding extra information. Figure 2 presents the main structure used for describing a Programme.

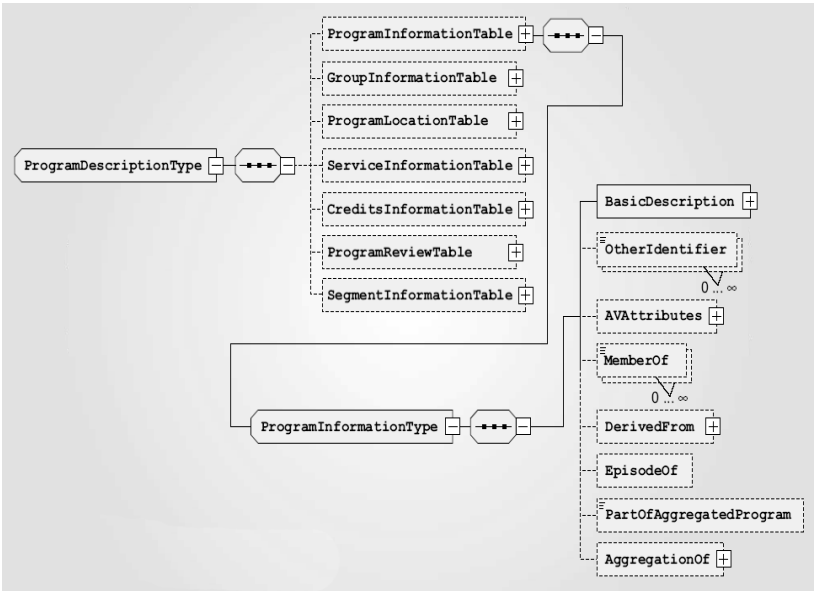

Figure 2 – Programme description schema

3 System Architecture

Besides enabling the access to videos available in a service provider, the system developed includes a module that provides feedback concerning the network load at each of the server links.

Clients, classified as “Gold” or “Silver”, depending on the contract, will both have access to high quality material if network resources are available. However, “Silver” clients will have the quality of their service decreased when the resources fall behind a threshold. By automatically decreasing the quality of the material delivered to these clients, the system assures that “Gold” clients will have a quality of service that is compliant with their contract.

The application was developed using Java based technologies as presented in Figure 3.

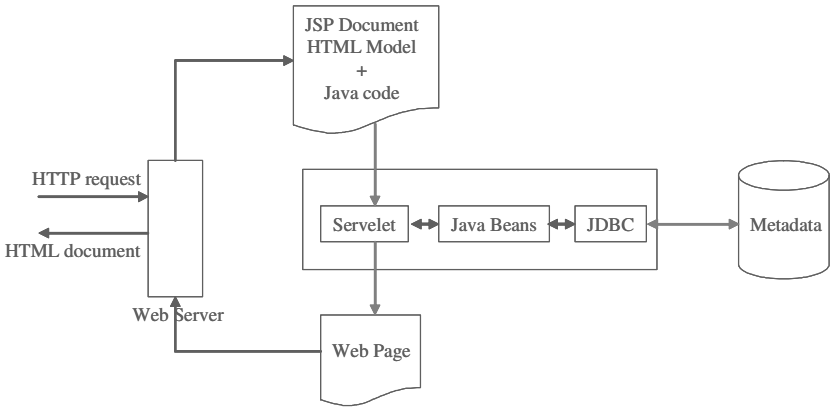

Figure 3 – Software architecture

To reduce processing delay, material available for searching and downloading is available in the VoD system in two different qualities: a high resolution quality version always delivered to Gold clients and a low quality resolution version delivered to Silver clients on bad network conditions as illustrated in Figure 4. Physical location of the material is automatically obtained due to the CRID identifier.

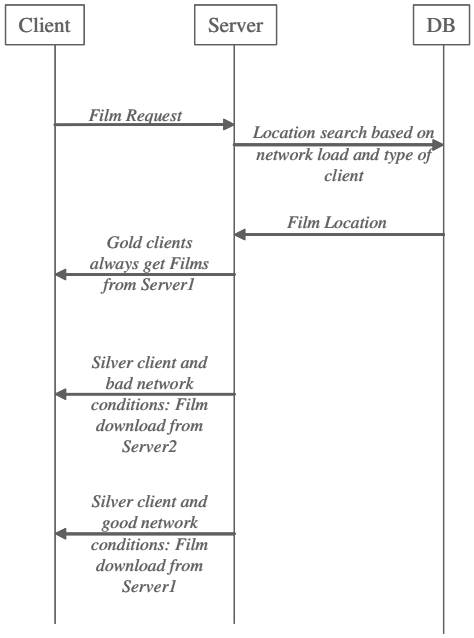

Figure 4 – Definition of the server location based on type of client and network conditions

4 Testing Scenario

Some video material was described according to the TVA standard (Figure 5) and made available for searching.

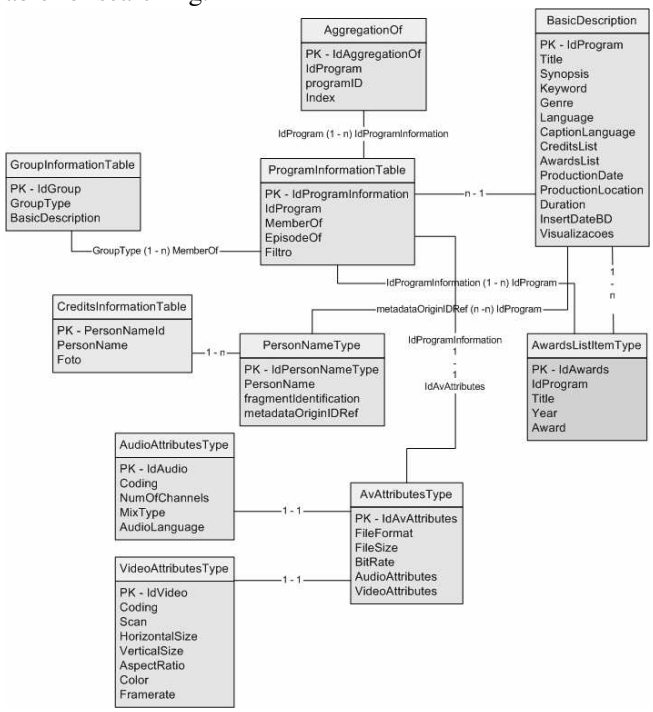

Figure 5 – Partial view of the TVA schema implemented to describe programmes

Users registered to the system were classified as Gold or Silver and provided a set of information (Figure 6) to be used by the system to automatically propose some potentially interesting films at login time.

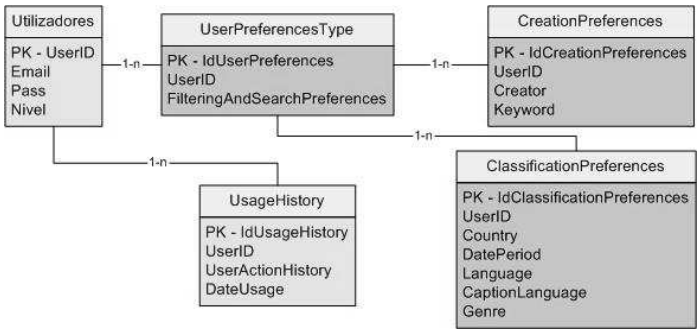

Figure 6 – User description schema

The prototype was tested in the laboratory environment presented in Figure 7

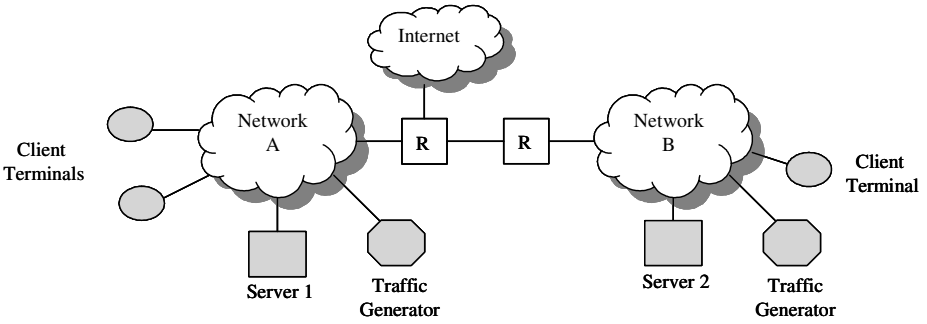

Figure 7 – VoD testing scenario

Attached to each of the networks a set of clients could access video material available in the system. Different users, classified either as Gold or Silver, were defined and could access the VoD service for searching and previewing videos.
High quality versions of the content were available from "Server 1" while low resolution versions of the same material were available from "Server 2".
Traffic Generators responsible for modifying the load on the networks were also connected to the system. An SNMP agent was responsible for monitoring the network conditions in each of the routers'ports.

5 Conclusions

The system presented in this paper uses TVA for describing both the content and the users. It also implements the concept of CRID allowing the transparent reference to different versions of the same content. The tests conducted in the presented scenario showed that Silver Clients would get different qualities of the content depending on the network load. This functionality is expected to enable the deployment of a service that automatically adapts itself to the contract conditions, enabling a real-time re-configuration of the system.

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