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Abstract

Large numbers of channels and cheap hard disks are changing the way that audio and video content is being viewed and listened to. The TV-Anytime Forum was set up to develop standards to address the opportunities and challenges of this new world. This paper gives an introduction to the TV-Anytime Forum and the specifications it has produced. The core technologies being developed within the Forum are described, and how they may be used. Several TV-Anytime applications and services have that been implemented within the myTV project are then described

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TV-ANYTIME – USING ALL THAT EXTRA DATA

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Large numbers of channels and cheap hard disks are changing the way that audio and video content is being viewed and listened to. The TV-Anytime Forum was set up to develop standards to address the opportunities and challenges of this new world. This paper gives an introduction to the TV-Anytime Forum and the specifications it has produced. The core technologies being developed within the Forum are described, and how they may be used. Several TV-Anytime applications and services have that been implemented within the myTV project are then described.

INTRODUCTION

There is now a huge amount of choice of content available to the viewer and listener. More channels are opening up, and new technologies mean more content is available via new means. For example, broadband access is increasing and digital storage of programmes on hard disks is becoming more commonplace. Personal Video Recorders or Personal Digital Recorders (PDRs) are now well known and more manufacturers are producing them. So, if the amount of content and methods of access are changing, do we need to do anything about it?

First, to whom does it make a difference that the world is changing? The broadcasters and content providers care because they want to make sure their content is found, enjoyed and rightfully used . The users care, because they are faced with a staggering choice and few tools to make it easy to find the content they are interested in. The consumer equipment manufacturer cares, because the viewer/listener wants access to the new services, and the manufacturer does not want to make a different device for every single market. So would a common standard for describing content, and how to find it, help? The TV-Anytime Forum [1] was assembled to address this very question.

This paper will introduce the TV-Anytime Forum, the specifications being developed and the basic principles behind these specifications, from the author's perspective. The paper will then go on to describe some of the applications and services that were developed within the myTV [2] project to implement and test the ideas of TV-Anytime.

TV-ANYTIME

The TV-Anytime Forum is a world-wide organisation formed to develop open standards for finding, acquiring and rightfully using audio-visual content. The Forum consists of over 80 member organisations with many others actively participating. The specifications produced are intended to be transport delivery system agnostic, such that these standards can be used world-wide. Several specifications have already been produced and are available for download from the TV-Anytime web-site[1].

Organisation

The Forum is organised as several working groups, operating in parallel, each with its own set of responsibilities. The groups meet at the same time, using plenaries to share decision-making. These groups are briefly introduced below, followed by a more detailed description of their main work.

The Business Models group is intended to set the scope of the technical work of the Forum and ensure that the specifications meet business needs. The Content Referencing group has developed the core functionality for pointing to items of content and retrieving them.

The Metadata group has developed the essential standards for describing audio-visual content and the relationships between these items of content. The Systems and Transport group have brought together the technical specifications to show how they would work, and are now pursuing how the standards will be delivered over existing delivery systems (e.g. DVB, ATSC, IP). The Rights Management and Protection group ensures that the content will be rightfully used.

Business Models

One of the concerns of the TV-Anytime Forum has been to address the business implications of these new technologies. Many see the increase in use of PDRs and other devices as a threat to their current business models. The Business Models group has set out to address these issues in a positive way, by listing the opportunities the technologies provide. As technologies such as hard disk storage continue to evolve, business models may well have to adapt to take advantage of them. The involvement of companies and organisations from all parts of the industry has been actively sought and used. The Business Models group has defined a list of scenarios that TV-Anytime specifications should support, and mapped these scenarios to the specifications. This work is used to monitor the technologies of the technical groups and steer the direction of the Forum.

Content Referencing

The central idea of content referencing is to be able to point unambiguously to an item of content in a location independent way. The identification system is required to be de-centralised and simple to operate. The result of this work is the creation of the Content Reference Identifier (CRID), and the idea of location resolution.

The CRID is an unambiguous pointer to a piece of content. It is generated with the purpose that it will be resolved to an instance or instances of content, available on a particular broadcast service at a particular time or available directly from a server. It is not necessarily a permanent identifier to be used for all time (such as the V-ISAN) - its scope is for the acquisition of content that the author considers worth identifying. It may resolve to multiple instances (such as repeats), if the author considers them to be identical for the purposes of acquisition.

The CRID is defined as a plain text string, compliant with the specification for a Uniform Resource Identifier (URI).

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crid://<authority>/<data>
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The "authority" is in the form of a DNS name as this is a widely available registration authority. But it is important to note that the registration of such a name is not required. The authority component may also contain an optional field that allows another service to operate under the same DNS name. The data component is a string whose content is entirely at the discretion of the CRID authority. There is no implied hierarchical component to the naming structure, although the CRID authority may wish to do this.

The process of location resolution implies that a CRID will resolve to other CRIDs or, ultimately, to locators. A locator is the description of the physical location of an instance of a piece of content referred to by a CRID. The locator is transport system specific and is similar to a Uniform Resource Locator (URL). In the case of a broadcast system, it defines the service, time, duration and any event identifier of the content, which of course may change. This is one reason why the CRID is useful as a pointer to content.

The process of location resolution is enabled by the use of Resolution Authority Records (RARs). These RARs describe where one can find a particular resolution service for a particular resolution authority.

Metadata

The principal idea of TV-Anytime metadata is to describe content such that a user, or an agent on behalf of the user, can understand what content is available and thus be able to acquire it. The specification is defined in terms of an XML Schema.

The current specification defines a document structure which contains several parts describing information about: programmes, groups of programmes (e.g. series), how programmes may be segmented, a schedule for a service, a service and its components, the preferences of the user and a cast list. Several of these elements are described in more detail below.

The ProgramInformation section contains the essential information about programmes, describing attributes such as the title, synopsis, genre, audio/video parameters and membership of any groups. The genre scheme is based on a hierarchical, multi-dimensional model, derived from earlier work in the EBU. This scheme can be used in a flexible way to describe the nature of content.

Work is continuing on defining a targeting scheme to allow information providers to describe content in terms of the target audience.

The specification describes a very flexible grouping

scheme for programmes. A programme is allowed to belong to many groups, and each group is allowed to belong to many others. The allowed structure is shown in a simple entity-relationship diagram below. The groups are taken from a list of types (such as Series, ProgramConcept, otherCollection, etc) and a set of attributes (such as bounded and ordered). This allows the information provider to describe the close relationships between programmes in a series, but also allows them to group series together. Other arbitrary groups are allowed, so that a 3rd party metadata provider could describe concepts such as the best movies for that week.

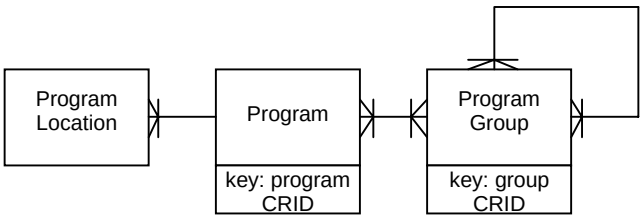

Figure 1 Program grouping

One of the advantages of storing programmes on a hard disk is that one can have random access to parts of the stored content. The segmentation part of the specification allows a metadata provider to delineate and describe the parts of a continuous piece of content. This can be useful for highlighting significant events (e.g. goals of a football match), describing different articles in a magazine-like programme or enabling new forms of content such as non-linear drama. Similarly to the grouping structure above, segments can be grouped together in different ways.

The specification also defines a method of listing all of the content (CRIDs) available from a particular service, essentially the current idea of a linear Electronic Programme Guide (EPG).

An important aspect of enabling straightforward access to new services is describing the preferences of the user. The user preferences scheme allows the box to store the preferences of the user in a standard way. Users could then decide to share their preferences with a service provider so that content or perhaps advertising could be directed to the user. The user could also take their preferences with them when they travel.

Systems and Transport

The Systems and Transport group are responsible for pulling together the specifications developed within the Forum, showing how they might be used and developing relationships with delivery mechanism authorities such as DVB, ATSC and ARIB. Their document, while being informative, shows how a TV-Anytime system can be constructed.

Rights Management and Protection

The aim of the Rights Management group is to ensure that the rights of the content owners are respected and supported through the lifecycle of the content. The model currently being pursued is to a have a core set of functionalities in a TV-Anytime capable box that includes a mandatory common cipher that can be relied upon to be present, but of course allows other security measures to be implemented. This difficult specification is still being worked on.

MYTV

The myTV project [2] is a European Commission funded project whose aim was to implement, validate and test a TV-Anytime platform and services. The project started in January 2000, just after the TV-Anytime Forum started, and finished in December 2001. The goals of the project were:

- Implement a consumer platform with built-in local storage
- Develop TV-Anytime services exploiting this platform
- Provide true interoperability, both across different service providers and across different box manufacturers

The project partners included broadcasters, set-top box manufacturers, technology providers and a university. The implementation, services and applications were shown as part of a complete end-to-end system at IBC 2001.

Implementation

Within the project two prototype set-top boxes were developed, based on the DVB MHP Java-based open standard. These boxes extended the MHP APIs to allow access to the hard disk storage and to TV-Anytime services. By developing two boxes we could show the interoperability of applications developed to open standards. Also, each box could show that it has access to rich sources of data, provided in an interoperable way.

A protocol was also developed for delivering the metadata over DVB via the DSM-CC Object Carousel. Although the protocol is an early prototype, it showed a straightforward method of delivering metadata. The Content Referencing information was delivered by a

simple MPEG section-based protocol which is very lightweight and more suited to the dynamic nature of time-related information.

Services

Several data services based on the principles of TV-Anytime were developed. The two broadcasters in the project provided data services about their content via the Internet. This gave the boxes access to a complete set of metadata about the services provided by the broadcasters. The boxes could request information on a particular CRID, ask to resolve a CRID, search for programmes that matched a particular criteria and get a schedule for particular services. This gives broadcasters, and other information providers, an opportunity to make up-to-date and rich metadata directly available. This also enables third parties to provide enhanced services. Within the project a service was developed, which aggregated data from the broadcasters and enhanced the metadata with richer information about films.

Applications

Several interesting applications become possible, given an open architecture for the box and for the data that is delivered to the boxes. With a standardised set of metadata and identifiers for programmes, the box is able to search for interesting content everywhere.

As a result, new forms of finding and selecting content become possible. One that was developed within the project was the idea of trailer selection. Thus, when a programme promotion is playing, an application can determine the content that is referred to during the trailer (from an embedded CRID), and offer the user an opportunity to record this programme. As a CRID can refer to a group of programmes, a whole series can be recorded with a click of a button. If the CRID is embedded in the programme stream, then this mechanism will still work when the content is played back from disk.

A user interface to such data can be presented to the user on any device. Devices such as WAP phones were used to browse listings information from a third-party, which offered personalisation of the choice of content offered. The user was able to select the desired content and a request to record the particular CRID is then sent to the PDR. A similar web-based service was implemented, along with a direct connection to the box to allow manipulation of the PDR contents. With standardised metadata and content referencing the user is able to choose and find content from many different sources and still be sure of obtaining the content requested.

In order to present a reasonable view of the wide selection of content available to the user several TV-based user interfaces were developed in the project. Most of these interfaces provided some sort of "virtual channel" facility to simplify access to content. This virtual channel contains content that is available directly to users from their hard disk or from broadcast-like services, which is then personalised to the user or users of that box. Personalisation is one of the key features that standardised metadata allows. A content "navigator" resident in the box will allow the user to gain access to all facilities of the PDR.

Another application that was developed is a "downloadable navigator". Taking advantage of the open standard APIs provided by MHP, prototype myTV APIs to the storage and the data, a downloaded application can provide a rich and powerful alternative user interface. A screenshot of such a downloadable navigator is shown in Figure 2.

Figure 2 Downloadable Navigator

Such an application could provide a better interface to certain aspects of the data supplied. This is similar to installing particular software on a personal computer for a particular application.

An application was developed to take advantage of the fact that the programme is stored on a hard disk, using segmentation information. The "Latest News" application gives the user a personalised, up-to-date, news service. This allows users to select the types of news items they are interested in and the order in which the items can be played back. The user also has direct access to individual news items, along with pictures and textual information about the story.

Other applications that were implemented included using a WAP phone to browse a site with personalised content searching that suggested content to the user.

The user could then select the content and a message containing the CRID of the desired content would be sent to the PDR. Similarly, a third-party web-site provided extra information and a personalised service that allowed the user to program their box. The PDR could also be browsed directly.

OTHER SERVICES

Similar data services are now being provided via Digital Radio (DAB), with an XML service based on the same principles as TV-Anytime. Platforms are also becoming available for Digital Radio that include hard disk recorders to allow easy access to recording and playing back desired content.

CONCLUSIONS

An open standard for describing content, and how to acquire it, allows many interesting services and applications to be developed. The ideas of the Content Reference Identifier and standardised metadata are powerful tools for locating interesting content. Hopefully the ideas expressed in these specifications will allow users to find the content they are interested in.

The TV-Anytime Forum is currently defining requirements for the second phase of their specifications. This phase assumes a broadband connected world with ubiquitous storage both in the home and in the network.

REFERENCES

1. TV-Anytime Forum, http://www.tv-anytime.org
2. The myTV project, http://www.extra.research.philips.com/euprojects/mytv