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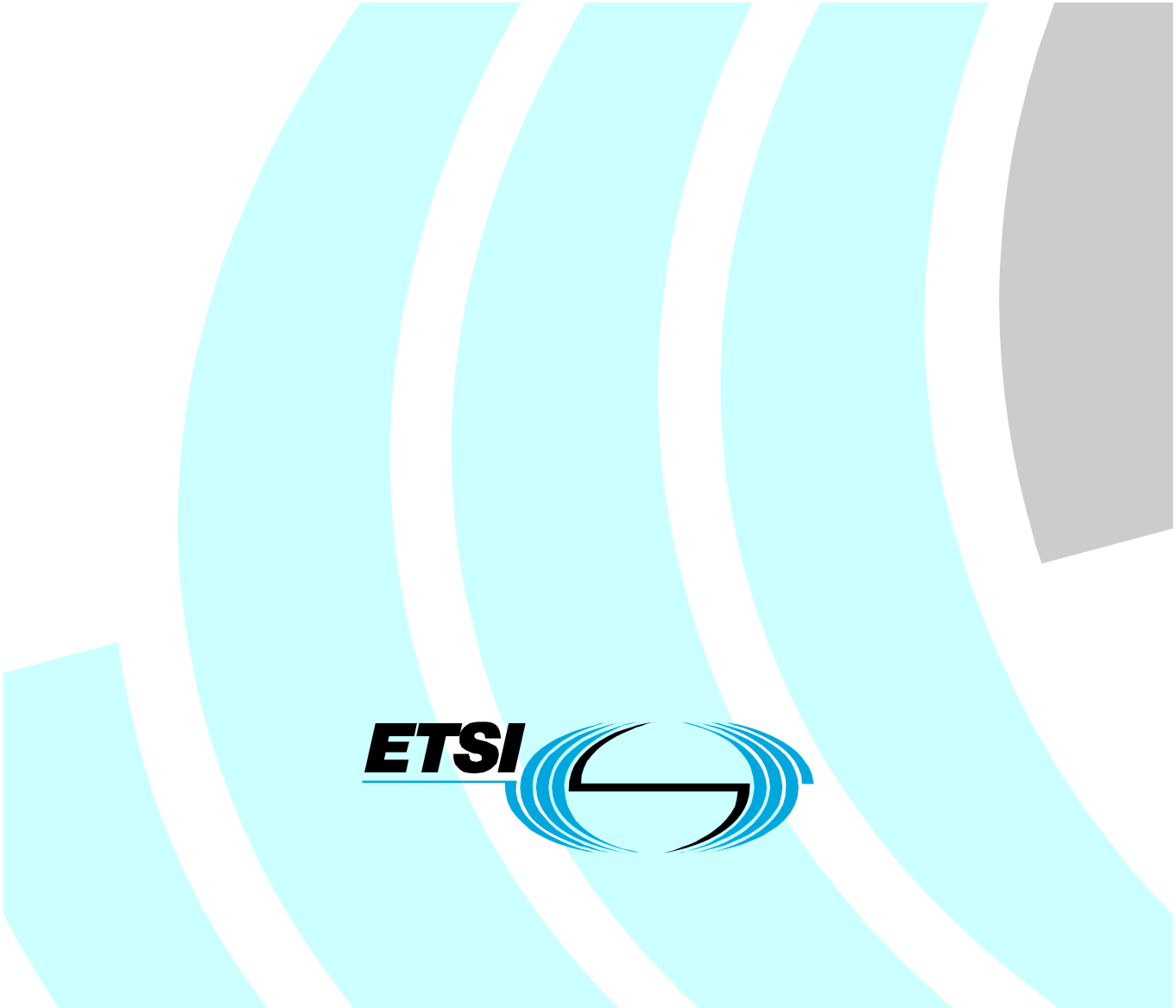
Technical Report

Media Content Distribution (MCD); Programme guide information distribution, situation and perspective



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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Media Content Distribution (MCD).

1 Scope

The present document is an analysis of the situation in the distribution of electronic programme guide and event information of associated television services.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 300 706: "Enhanced Teletext specification".

[i.2] ETSI ETS 300 707: "Electronic Programme Guide (EPG); Protocol for a TV Guide using electronic data transmission".

[i.3] ETSI TS 102 796: "Hybrid Broadcast Broadband TV".

[i.4] SMPTE 0259M: "Television - SDTI Digital Signal/Data - Serial Digital Interface".

[i.5] SMPTE 292: "1.5 Gb/s Signal/Data Serial Interface".

[i.6] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

[i.7] ETSI TS 102 822-3-1: "Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 1: Phase 1 - Metadata schemas".

[i.8] ETSI ETS 300 231: "Television systems; Specification of the domestic video Programme Delivery Control system (PDC)".

[i.9] ETSI TR 101 211: "Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)".

[i.10] ATSC A/65: "Program and System Information Protocol for Terrestrial Broadcast and Cable (PSIP)".

[i.11] ARIB STD-B10: "Service information for digital broadcasting system (English translation)".

[i.12] ETSI TS 183 063: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based IPTV stage 3 specification".

[i.13] ETSI TS 102 539: "Digital Video Broadcasting (DVB); Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)".

[i.14] ETSI TS 102 323: "Digital Video Broadcasting (DVB); Carriage and signalling of TV-Anytime information in DVB transport streams".

[i.15] Open IPTV Forum: "Release 2 Specification Volume 3 - Content Metadata".

[i.16] ETSI TS 184 009: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Rules covering the use of TV URIs for the Identification of Television Channels".

[i.17] IETF RFC 4078: "The TV-Anytime Content Reference Identifier (CRID)".

NOTE: Available at: http://www.ietf.org/rfc/rfc4078.txt.

[i.18] Open Mobile Alliance: "Service Guide for Mobile Broadcast Services".

[i.19] ETSI TS 102 822-2: "Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 2: Phase 1 - System description".

[i.20] ISO 15706: "Information and documentation - International Standard Audiovisual Number (ISAN)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

content producer: entity that created the content

content provider: entity that acts as the agent for and is the prime exploiter of the content

drive-by information: information overlaid on the video when changing channels, typically detailing the current and next programmes

linear audiovisual media service: audiovisual media service provided by a media service provider for simultaneous viewing of programmes on the basis of a programme schedule

linear audiovisual media service provider: natural or legal person who has the editorial responsibility for the choice of the audiovisual content of the linear audiovisual media service

network operator: operator of a public telecommunications infrastructure which permits the conveyance of signals between defined network termination points by wire, by microwave, by optical means or by other electromagnetic means

pay TV: any service in which consumers can elect to access specific content for a fee, such as pay-per-view, content rental, etc.

quality of experience (QoE): overall acceptability of an application or service, as perceived subjectively by the end-user

teletext: data delivery system within television transmission

TV URI: identification of a broadcast television channel

TV widget: an element of a graphical user interface, typically a third-party application displayed on a TV screen

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ARIB	Association of Radio Industries and Business
ATSC	Advanced Television Systems Committee
AVC	Advanced Video Coding
B2B	Business to Business
B2C	Business to Consumer
BCG	Broadband Content Guide
CE	Consumer Electronics
CRID	Content Reference Identifier
CSA	Conseil Supérieur de l'Audiovisuel
DTD	Document Type Definition
DTP	Desktop Publishing
DVB	Digital Video Broadcasting
DVD™	Digital Versatile Disc
DVR	Digital Video Recorder
EIT	Event Information Table
EPG	Electronic Programme Guide
ERT	Event Relation Table
ETT	Extended Text Table
FCC	Federal Communications Commission
FTA	Free-To-Air
FTP	File Transfer Protocol
GUI	Graphical User Interface
HBB	Hybrid Broadcast Broadband
HD	High Definition
HTML	HyperText Markup Language
HTTP	Hyper Text Transfer Protocol
ID	IDentifier
IPG	Interactive Programme Guide
IPTV	Internet Protocol TeleVision
ISAN	International Standard Audiovisual Number
ISBN	International Standard Book Number
ISDB	Integrated Services Digital Broadcasting
LIT	Local event Information Table
MPEG	Moving Picture Experts Group
OMA	Open Mobile Alliance
PSI	Program Specific Information
PVR	Personal Video Recorder
ROI	Return On Investment
SDI	Serial Digital Interface
SI	Service Information
STD	Standard
TCP/IP	Transmission Control Protocol/Internet Protocol
UC	Use Case
URI	Uniform Resource Identifier
VBI	Vertical Blanking Interval
VCR	Video Cassette Recorder
XML	Extensible Markup Language

4 Characteristics of programme information

Behind the generic term "programme information" are generally hidden two very different use-cases: Electronic Programme Guide and Event Information. They are commonly carried via the same technical means, hence the confusion, but their uses and requirements are different and require to be analysed.

4.1 Electronic Programme Guides

Programme guides provide users of television, radio, and other media applications with continuously updated information displaying scheduling information for current and upcoming programming.

Traditionally, these were **print publications**. The Radio Times debuted as early as **1923**. It originally carried details of the BBC™ radio programmes. Initially newspapers boycotted radio listings because they feared that people would listen to news on the radio instead of buying newspapers. Today most newspapers carry a selection of daily television and radio programming.

With the rapidly increasing spread of television receivers beginning in the 1960s, **electronic versions of programme information** were made available to viewers. They provide viewers with continuously updated on-screen menus displaying scheduling information. Their technological development happened in three phases:

- **Teletext** first made programme information available to viewers, when the BBC™'s Ceefax system debuted in **1976**. The first TV sets with integrated decoders came to the market in 1977. Today, Teletext [i.1] is still the main source of electronic programme information for most viewers, notably in the less developed countries.

Figure 1: Ceefax programme information from 1983

- **Non-interactive electronic programme guides (EPG)** are typically available for television and radio, and consist of a digitally-displayed, non-interactive menu of program scheduling information shown by a cable or satellite TV provider to its viewers on a dedicated channel; much like an airport display. They were first introduced in **1981** in North America, and this is where the term "EPG" was coined.

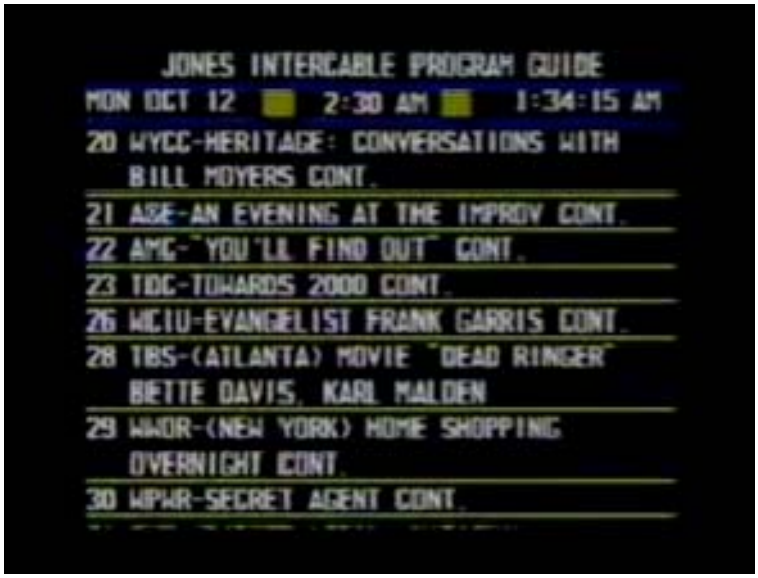

Figure 2: Electronic programme guide (EPG) from 1987

- **Interactive electronic programme guides (IPG)** - though often referred to as EPG - allow television viewers and radio listeners since the **early 1990s** to navigate scheduling information menus interactively. Selecting and discovering programming by time, title, station, or genre is managed through an input device such as a keypad, computer keyboard, or TV remote control. Its interactive menus are generated entirely within local receiving or display equipment using raw scheduling data sent by individual broadcast stations or centralized scheduling information providers.

Figure 3: Interactive programme guide (IPG) from 2011

- Nowadays, IPGs are more and more available on the **Internet**, either from sites specialized in programme information (sometimes affiliated to print publications), or directly from the television channel itself.

4.2 Presentation techniques

Already in 1997, ETS 300 707 [i.2] suggested partitioning of the programme information into vies that relate to proximity in both, time and space:

- This Channel / Multiple Channel / Full EPG
- Now & Next / Today / Full Listing

ETS 300 707 [i.2] also already suggested breaking up the data in a third dimension: type of content (sports, comedy, news, etc.). All these techniques are still in use today, although complemented by more advanced designs. Two basic use-cases underpin these presentation techniques:

- Searching for content by specific criteria or active recommendation.
- Drive-by information when zapping.

This information is often enriched with additional promotional material like teaser trailers, scene photos, web links, etc. The user experience for these supplemental elements of course largely depends on the capabilities of the receiver platform.

4.3 Value of programme information

The **past two decades**, the industry was busy with **bringing the content to the viewer**, i.e. of developing and deploying digital TV systems which enable broadcasters to offer more content, more diverse content, and all of that at lower costs. Now that viewers are presented with literally thousands of TV services, the challenge of **the immediate future** for the industry will be to **bring the viewer back to the content**. That means giving the viewers tools for finding, locating and selecting the content they are interested in. The technical tool for this is metadata, of which programme information is a part. If the viewer is not aware of "what is on", he is not going to watch it. Hence, there is some interest in high quality metadata:

- Content providers and broadcasters have an interest for establishing branding in the growing "sea of content".
- Advertisers have an interest for attracting customers to EPGs for selling ad-space.
- Verticals (pay TV, IPTV) need to provide QoE to sell their packages (a good EPG is part of this).

Despite this interest, corresponding investments are however not always made. Some reasons are provided in clause 5.2.

4.4 User security and privacy

Programme information can be a sensitive topic: one does not want its personal information, or information about what the user viewed or recorded, to appear publicly. Technical specifications have taken this risk into account.

5 Programme information flow

5.1 Ecosystem

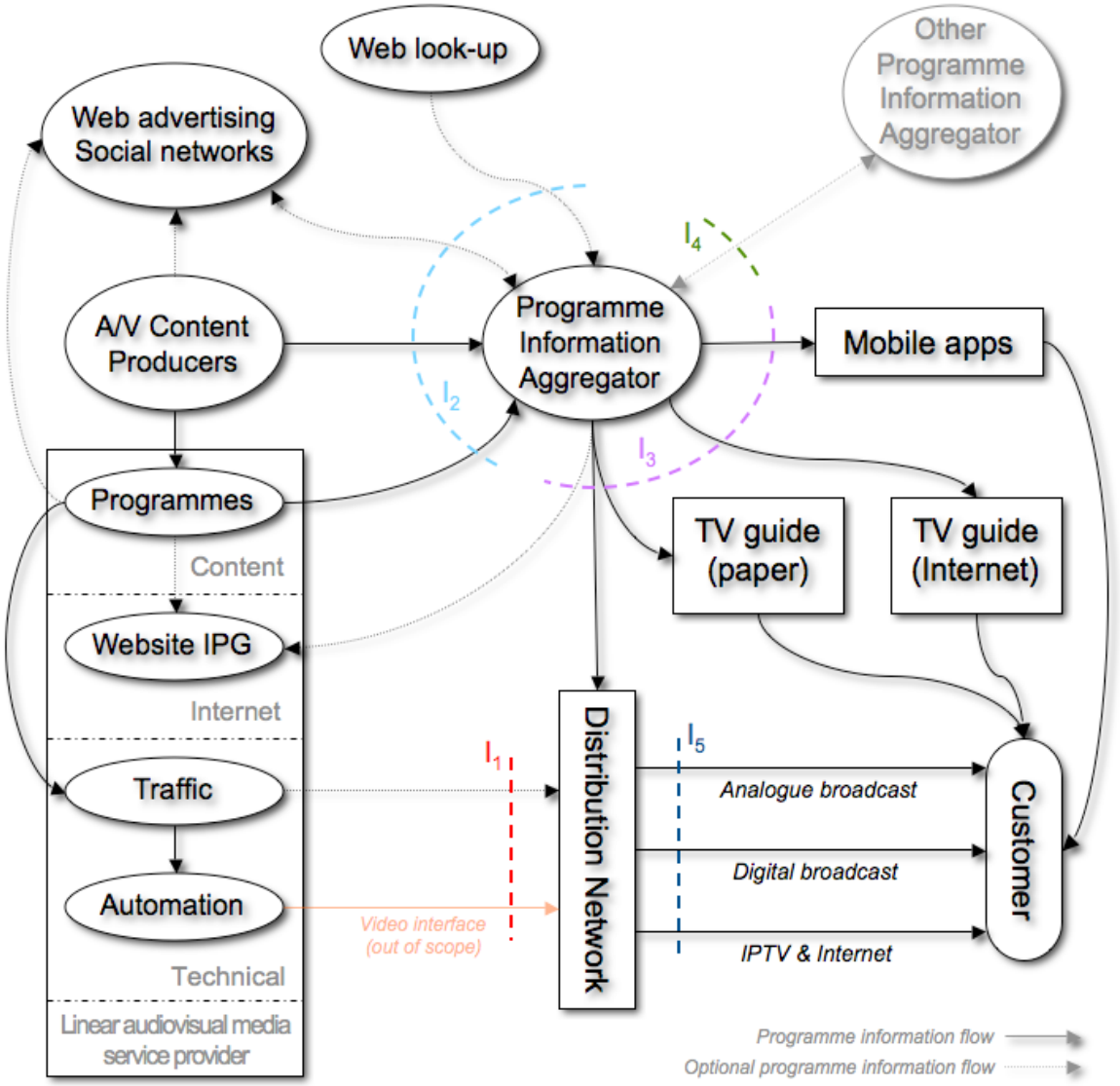

Figure 4: Flow of programme information highlighting interfaces between actors

The programme information originates from two sources:

- The content producer, which has information about the content itself, a synopsis, the cast, picture elements, feature films, etc.
- The programming division of the linear audiovisual media service provider, which decides when to air the programme.

The technical division of the linear audiovisual media service provider is, at some point, in possession of both the media content itself (tape or file), and the associated meta-data, which can act as programme information. It is then possible to pass both through to the distribution network at the same time (interface I_1). In practice though, often the programme information does not take this way.

The interviews that were conducted for the present document have revealed the role of a third-party company that we called the "Programme information aggregator". This actor gathers schedule information from numerous TV channels, and matches them with extended data supplied by the content producers (interface I_2). The consolidated information is then sold to TV guides (paper or Internet) and distribution networks (interface I_3). Sometimes it exchanges database extracts with other programme information aggregators (interface I_4).

The distribution network provides then the programme information to the customer, either in-band (DVB-style or Teletext) or out-of-band (HTML), to be rendered by the customer's terminal.

5.2 Challenges

From a consumer viewpoint, FTA linear audiovisual media service providers have overall not spent extensive effort in keeping programme information for viewers updated. From the weekly update schedule of the Radio Times, to a daily update schedule when introducing Teletext was already a big move. This has caused some viewer frustration, since short-term changes and live events today are typically not accounted for by the service providers. The viewers' frustration has recently experienced a considerable bump with the spread of personal, digital recording devices. Their operation turns out to be largely unreliable, especially in European countries. In the USA, the programme schedules are based on an hour-long grid which defines national and regional time-slots; slots cannot overlap.

In practice, frequent updates are conveyed between service providers and EPG aggregators. There are many technical and organisational obstacles for pushing these updates to the consumers. There are large variations of the frequency of consumer-level EPG updates between markets and even within markets. Frequent updates present a challenge for EPG aggregators, because they make high-quality editorial work virtually impossible.

Also, programme cancellation is becoming more and more frequent. Local regulators often prohibit cancellations; for instance in France most conventions passed with the CSA ask the linear audiovisual media service provider to communicate programmes 15 days in advance. This prohibition does not seem to hinder the trend; this is due to the competition between service providers: one wants to adjust its programme offer according to what the competitors are planning at the same time. linear audiovisual media service providers are also more and more challenged by Internet contents. In some cases, the programme schedule would need to be updated every two hours. Instead, some channels chose to communicate their cancellations once a day, always at the same hour. The phenomenon is common to all European countries, and tends to get worse in Southern countries, and with newer TV channels.

The present document details every interface of the schematic, and in particular tries to identify the elements that would need to be optimized in order to allow for live programme information updates.

5.3 Use cases

- **UC1: Synchronization of digital video recorders.** DVR devices are becoming more and more popular. However, programmes may slide a bit from their planned schedule, and consequently the user may miss the end of a recorded show. Programme updates should be transmitted in real-time until the end-user devices, so that DVRs can be re-programmed when needed.

- **UC2: Synchronization between traditional IPG data, and data coming from other means, e.g. HBB technologies or IPTV providers.** Most TV sets are able to extract programme information from specific tables in the incoming multiplex (clause 10.1), and display it on-screen via an internal IPG, or drive-by information. However there are nowadays other means to display programme information on modern TV sets:

  - via an interactive application bound to a specific channel, taking advantage of the IP connectivity of the TV set (applications using technologies such as HbbTV [i.3] already demonstrate such a use case);

  - via an IPG applet or so-called "TV widget": some TV sets allow third parties to develop external applications. Well-known brands in the programme information business already distribute such applications, which are independent from the TV manufacturer, and which do not make use of the in-band programme data;

  - via the connection of the TV set to the set-top-box of an IPTV provider. In that case the set-top-box displays an IPG and drive-by information according to data which are usually downloaded when needed from central servers (clause 10.2).

Programme information data from these different sources are not necessarily synchronized: updates and cancellations might not be taken into account in an identical way due to protocol differences; also the precision of the schedules may vary. There is a risk of bad service to the user, confronted with several versions of the programme information for the same channel.

- **UC3: Exchange of programme information between actors.** A lot of programmes are sold between channels of the same country, with different schedule windows, or between channels of different countries. The programme information therefore can be re-used, to some extent.

6 Interface I_1: Linear audiovisual media service provider to network operator

The technical division of a linear audiovisual media service provider usually features two separate functions:

- Traffic Control: It stores media file, associated meta-data (programme information) and playlists.
- Automation: It broadcasts the wanted file at the given time.

In system implementations, these two functions are provided together by service providers or network operators. The automation outputs a video signal, generally in SDI [i.4] or HD-SDI [i.5] format, to the network operator. The network operator encodes the signal to the target distribution format (MPEG-2, MPEG-4 AVC, etc.), and in some cases (DVB-style distribution over DVB-T/S/C) the encoded signal is multiplexed with other programmes and MPEG PSI/DVB SI tables. The network operator can then choose to provide a way for the service provider to change the signalling of the channel, and in particular the programme information data.

6.1 Out-of-band transmission of programme information

This operation is carried out-of-band, using a TCP/IP connection between the television master control room and the multiplexer hosted by the network operator. It is a multiplexer-vendor-dependant protocol. Typically, the first step is for the service provider to produce an XML file describing its service information; the XML DTD is proprietary, but is directly derived from the tables defined by EN 300 468 [i.6]; it is an XML mapping of the DVB structures. The XML file is either uploaded via FTP, and processed by the multiplexer at scheduled times (for instance once a day), or exchanged via a permanent TCP/IP connection.

The origin of the programme information is the traffic control; it is the only component storing programme meta-data, such as title, abstract, parental rating, audio configuration, etc. The meta-data are stored next to the content file itself, in a separate file of proprietary format.

However, in many cases, it is simpler to carry out cancellations (and other programme modifications) in the automation; it has the direct link with what is on air. But the automation has no interface with the network operator, and the traffic control is often unaware of cancellations. This is a first reason why live updates do not reach the network operators.

6.2 Limits

This interface requires the use of a multiplexer on the distribution side; in the world of IPTV, Internet TV or Mobile TV, it is generally unnecessary to remultiplex the signal from the encoder; also DVB-style programme information is rarely used (cf. clause 10). There is therefore no way for the linear audiovisual media service provider to upload programme information to such network operators. Instead, IPTV and Mobile TV operators typically obtain the EPG information again from an aggregator, in their specific format.

Often traditional network operators may prefer to get all their programme information from a single source (aggregator) because they feature hundreds of channels and it is easier that way.

7 Interface I_2: Inputs to the programme information aggregator

7.1 Interface $I_{2.1}$: Interface to audiovisual content producer/provider and news agencies

The difficulty of the I_2 interface, and the reason why the aggregators' position is precarious, is that there is generally no written contract between the content producer/provider and the programme information aggregator. The mission of the aggregator then greatly depends on the good will and availability of the linear audiovisual media service provider, or of some particular individuals.

Country specifics:

- **Germany**: There are clear tendencies by service providers to disclose programme schedules as late as possible. This is to give competitors less chance to launch competing programmes at the same time. This behaviour is linked to the market position, i.e. large, well-established linear audiovisual media service providers have less concerns than small ones.

  A wide variety of data formats is used for information exchange. This ranges from XML files, to plain-text emails, to fax copies. Some service providers tunnel the data through one of their broadcast channels, from where the aggregator picks up the information.

- **France**: There is also a clear tendency to disclose programme schedules as late as possible. Very small channels, sometimes benefiting from a niche market, have trouble getting exposure, and are therefore more willing to distribute accurate schedules. However biggest channels seem to be very concerned with competition, and are all the more reluctant to release schedules; sometimes only a partial amount of information (title and subtitles) is distributed, and empirical data formats are in use.

  The aggregators have to find other ways; they are usually in contact with particular individuals in the service provider's organization, who give information sometimes without approval of the hierarchy; during their vacations the job becomes harder. They complete the small amount of information they gathered with data released by the content producers, who are more eager to communicate about their productions. Those data include abstracts, cast, crew and multimedia content.

  Technically, this interface uses a large variety of formats and protocols. A few linear audiovisual media service providers prefer the PDF file format because they feel that it would be more difficult to process automatically and their competitors would have more trouble finding out what they are planning. Transport protocols include e-mail, telephone and fax.

  The exchange of programme information is a difficult matter, even inside service providers: some TV channels' websites, which feature an IPG, actually buy their own data from aggregators. Either the information is not available internally, or there is no will to structure it so that it could be used in an automated process. Thus, programme information aggregators are unavoidable.

Some organizations have each already tried to propose their standard interchange format: Bauer and Springer™, the French SPMI (Syndicat de la Presse Magazine et d'Information), Deutsche Mailbox. No standard has been successful so far. TV-Anytime [i.7] is the only standard format with some international market relevance.

NOTE: Work has already been undertaken in TISPAN to uniquely identify television channels by the means of the TV URI [i.16].

7.2 Interface $I_{2.2}$: Interface to Web advertising and social networks

Aggregators also interact with web advertising and social networks on behalf of linear audiovisual media service providers and content producers.

On the **aggregator's input** side, data is collected about "what is trending", i.e. how many people liked or recommended the content, how many people are friends or followers of an actor, director etc. related to the content. This is used to provide links to the social network sites in the EPG, e.g. "10 162 people like this" with an underlying link to actor's social network page.

On the **aggregator's output** side, the aggregator posts updates to social network pages advertising broadcasts of content. For instance an update would be posted on an actor's social network page along the lines of "Watch my latest movie tonight at 8pm on TotalTV." TV channels can take further advantage of this scheme by renting regular web advertising space on the social network pages, e.g. to attract consumers to the actor's pages, where they would find said "watch my movie" post. Aggregators then inform the social media operator of the post, and the social network operator will place related advertising on the respective web pages.

A **third variant** of social network interaction are **interactive applications on connected receivers.** These applications allow consumers to post updates relating to content they consume, record or just wish to express affection for, on their social network pages. After users have configured their social network account access data (user and password), GUI elements are activated in the receiver's EPG implementation for each of the accounts. If the user selects the respective button, the connected receiver connects to the social network and automatically posts a corresponding update (e.g. "I like the Jackie Chan movie on TotalTV tonight at nine. You should watch it, too.").

7.3 Interface $I_{2.3}$: Interface to generic Web data sources

As linear audiovisual media service providers often provide very minimal information about the content they plan to broadcast, aggregators often have to research complementary information on the web. Example sources include Wikipedia™, IMDb™, and fan pages. A prototypical use case is a long running series. Content producers often do not provide information about past seasons. Hence information regarding the season and episode are often only available from fan web sites.

8 Interface I_3: Delivery outputs of the programme information aggregator

The interface I_3 is simpler: there is a formal contract between the aggregator and the recipient of programme information, be it a TV guide or a network operator. The contract describes the technical means for the transmission, and the list of TV channels that have to be delivered.

8.1 TV guides (paper)

For historical reasons, programme information aggregators deliver pre-formatted data to TV guide editors, with DTP tags for software such as Xpress™ or InDesign™.

8.2 TV guides (Internet) and network operators

This interface is normally an automated transfer at precise times of the day. Usually programme information for the next N days is transmitted at the same time. It is generally a proprietary (e.g. XML) format transmitted over an FTP or HTTP protocol, one file per channel and per day. Some aggregators also propose their clients a web service in order to interrogate the database in real-time.

An XML file is governed by a proprietary DTD, which can be defined by the recipient or the aggregator. Aggregators usually have defined a file format they use in their internal exchanges, and which they propose to their new clients. In practice, a format defined by the client is however typically used. A great part of the work of the aggregator hence consists in interfacing its database with the file format used by the client. When the client is moving to another aggregator, it generally wants to keep the same file format, to avoid redeveloping its internal tools.

However, whichever format the exchange uses, the data models (e.g. title, abstract, actors, etc.) are similar: only the structure differs. The aggregator enriches the data acquired from the content provider, thanks to various sources; it also adds a level of cross-channel coherency: the same content categories are used, and also some aggregators define unique IDs for series. That way, the consumer knows that an episode he is currently watching belongs to a given series, from which another season (newer or older) is also broadcast on another channel.

Sometimes, a contractor requests for a customized data content (in particular a specific abstract, or opinions). The motivation behind is that a premium bouquet wants to provide their customers with data they would not get from other, lower-cost, network operators of the same country.

This interface, though proprietary it looks, is not preventing live updates. Some aggregators have confirmed that they were capable of managing live updates, and in fact are updating the data and publishing the updates back to the linear audiovisual media service providers several times a day. These updates do however not always propagate all the way to the consumers. Provided the XML DTD contains a few management fields (e.g. version, add, delete, update), it can be used in a live update environment. Only the transport protocol (push vs. pull) would need to be adapted.

9 Interface I_4: Between programme information aggregators

Programme information aggregators are often small, national, familial companies that operate apart of each other. At the time of writing, we count two aggregators in France, four in Germany, one in Belgium, two in Italy, two in Scandinavian countries, etc. A few aggregators however have a pan-European coverage, via a network of more or less independent subsidiaries.

An aggregator sometimes exchanges the programme information of a national content with a foreign aggregator (for instance, a Spanish aggregator could supply more details for *Un Dos Tres* to a French aggregator). However, it is not as simple as it looks: there are cultural differences between countries; *Derrick* in Germany is an action series, while it would be classified as a police series in France. Even in countries speaking the same language there can be differences. The database of the aggregator is designed to make it possible to store country-independent data alongside country-localized data.

The technical interface for I_4 is very similar to the interface to network operators I_3: it is a transfer of XML data. It is however made difficult by the absence of a universal identifier for TV programmes, such as the ISBN code for books, or the registration visa for movies. A lot of manual work has to take place to merge incoming file with the existing data of the database. Also programmes can have a different title and/or subtitle depending on the country; it is very difficult to avoid duplicates. These duplicates lead to redundant information in the aggregator's databases if the content has already been used on another service under a different name in the past. The ISAN initiative [i.20] tries to remedy this by proposing a globally unique content identifier.

NOTE At the time of writing, a new alliance has been announced in the U.S.A. to promote the Entertainment Identifier Registry (EIDR), which apparently gathers industry support. The registry would allow identifying movies and TV shows.

This universal identifier is a controversial topic, especially if it were to be used on the I_5 interface. There is some critique of ISAN; duplicates are not avoided by design, assignment capacity issues are expected, and it does not allow for branding. However there may be room for it on I_3 and I_4.

The TV-Anytime CRID [i.17] could help avoid most of the issues raised wrt. ISAN. The CRID associates a Uniform Resource Locator to an instance of a programme on a given distribution model. The same CRID can be shared between several instances (for instance the programme on the linear TV channel, and the catch-up TV programme via the Internet).

CRID and ISAN are complementary: the TV-Anytime specification shows examples of CRIDs using ISAN identifiers ([i.19] clause 5.5). However, in a semantic world, CRIDs could by themselves be used as a format to define globally unique identifiers in the provider's namespace; cross-reference outside of the provider namespace justifies the use of e.g. ISAN.

Country specifics:

- In **France**, the ecosystem also includes companies that contract with operators or TV guides, but buy their database from another aggregator. They can enrich the data with contents that they produce themselves, in particular multimedia contents and hyperlinks. Problems arise though when new data is merged from the other aggregator: it is difficult to avoid duplicates.

10 Interface I_5: Network operator to customer

10.1 Traditional broadcast operators

Traditionally, European **analogue** channels carry programme information in dedicated pages in the Teletext signal, which is carried in the VBI data. For VCR control, Programme Delivery Control (PDC, TS 300 231 [i.8]) is transmitted in the VBI data along with the Teletext.

In **DVB** countries, the IPG information is conveyed through DVB-SI's Event Information Table (EIT, EN 300 468 [i.6], TR 101 211 [i.9]). Different identifiers (table_id) are allocated for EITp/f information and long-term EPG data, and also for each service (table_id_extension). Slowly evolving from the weekly Radio Times schedule, the EIT data is typically prepared a few days in advance. Very few bouquets are using live update of their EIT data in Europe; therefore the programme information is often inaccurate or outdated. The effects on EITp/f data are even worse, since it is used in drive-by scenarios during zapping (i.e. the info banner does not match the viewed content). Live programmes (news, sport) often overrun, but the following programmes are hardly ever moved in the programme information.

In **ATSC** countries, the IPG information is conveyed through ATSC-PSIP's Event Information Table (EIT, A/65 [i.10]) and the Extended Text Table (ETT, A/65). The ATSC-EIT is largely inspired by the DVB-EIT described above. ATSC has however taken a different approach for extensive, descriptive text data. This is transmitted in the ETT, which is a flat repository of text messages; no ordering by time or service is implied. Since transmission of PSIP is not explicitly required by the FCC, the amount and quality of transmitted information varies largely. As a consequence, many receivers, especially recording devices have no IPG implementation. Often IPGs are offered as an additional service (often via the Internet) and at extra cost or linked to the purchase of specific device models.

In **ISDB** countries, the IPG information is conveyed through ARIB-SI's Event Information Table (EIT, STD-B10 [i.11]), the ARIB Event Relation Table (ERT, STD-B10), and the ARIB Local Event Information Table (LIT, STD-B10). The ARIB-EIT is largely inspired by the DVB-EIT described above. ARIB has extended from DVB's model in that the ERT provides for means of grouping and attributing programmes; and the LIT enables use of segments of programmes (which are referred to as "local events"). Both of these are apparently inspired by TV-Anytime data models. The quality of the programme information is comparable to that in DVB and ATSC countries. Therefore many viewers use the so-called "Data Service", which is a data broadcast service offering carousels of programme-related information. Since this includes advertising, broadcasters update these carousels frequently, which also benefits the programme schedule information also available on these data services. As of this writing, no information was however available about the use of data services outside Japan itself.

All broadcast formats have been designed in order to allow live updates of programme information data, by broadcasting new versions of the service information tables. This functionality is unfortunately rarely connected to the actual traffic controller.

10.2 New television carriers

10.2.1 IP-based standards solutions

TISPAN specifications [i.12] refer to DVB-BCG (TS 102 539 [i.13]); it specifies a profile [i.14] of TV Anytime metadata [i.7] to use to carry programme information.

OpenIPTVForum Release 2 specification, Volume 3 content metadata [i.15], also refers to DVB-BCG for programme guide data. It additionally allows to distribute plain DVB-SI tables [i.6] in-band to improve the response time of live updates of EITp/f information.

OMA Service Guide for Mobile Broadcast Services [i.18] defines an XML meta-data format. Clause 5.1.2.3 describes programme guide information associated to the announced content, embedded into the XML structure.

In all cases, these formats allow live updates of programme information data.

10.2.2 Non-standard implementations

A lot of IPTV providers have developed ad-hoc solutions and do not, or partially, follow existing specifications. However, they have a lot in common.

The in-band service information is not often used then. It is simpler to use a TCP/IP connection to retrieve programme information, generally in the HTML or XML format (proprietary).

The actual format of transmission greatly depends on the capabilities of the middleware and/or web browser of the receiving equipment owned by the consumer. In the case of IPTV, the network is vertical, with a few identified models of set-top-boxes, for which often ad-hoc solutions are developed. On the Internet, technologies like HTML are pretty much compatible between different clients.

Since data is generally pulled from the server each time the IPG is opened, or even on every channel change, nothing prevents live update, as long as the database is automatically updated.

11 Synthesis and conclusions

11.1 Hindrances to data quality improvements

Whilst clause 4.3 suggests a fairly **high perceived value of programme information** to service and content provider brands, there are **no general, end-to-end business models** for programme information.

The monetisation of programme information suffers from the Separated-Wheels-of-Fortune syndrome. On one side, there is a B2C wheel of fortune spinning between the broadcaster and the viewer. The viewer pays the broadcaster either through his broadcast licence fee, or by subscribing to a pay TV service. On the other side, there is a B2B wheel of fortune spinning between the broadcaster and the programme information provider. The broadcaster pays the provider for getting pre-formatted data, and the rights to use the information in his public services. But there is no interconnection between these two ecosystems that could make the one spin slower or faster, if the other one is changing speed. Hence broadcasters have little to no incentive for improving their programme information quality (increased spending on the B2B and operations side), as there is no measurable ROI attached to such improvement (increased revenue on the B2C side).

One option that has been suggested, was giving the broadcasters a share of PVR sales revenues to enable them to improve IPG information. This of course fell on not so fertile ground with the CE industry.

Another potential option is the establishment of supplementary programme information services as in North America (see clause 6.1). In turns out, though, that the providers of such services tend to choose proprietary solutions because:

- proprietary technology provides easy means of shielding consumers from competing offerings;
- proprietary technology allows service providers to benefit from hardware sales through royalties;
- proprietary technology puts the service provider in full control over the features and limitations of the system.

Trading programme information between aggregators is hindered by very different pricing levels throughout Europe. The most expensive sources for comparable information ask up to 20 times higher prices than the cheaper ones.

Restrictive handling of EPG information by content producers and providers also poses obstacles:

- Information only made available in the last moment to aggregators to prevent competitors from scheduling competing programmes for high profile events.
- Restriction of local copies of EPG data and their lifetimes in receivers.
- Legal obligations to delete copies of programme data.
- Exclusion of deep-links to catch-up archives by broadcasters.

11.2 The programme information aggregator

One may wonder whether the aggregator's predominant role in the distribution of programme information is legitimate, or whether it is only benefiting from the dissensions of the content providers and the lack of standards in an opaque domain. At first glance, one may think that the content providers should be able to provide the necessary information to promote their own programmes to the operators and TV guides, and that any unnecessary intermediate company impedes the reactivity of the information exchange, and might prevent live updates from being possible.

However, the present document shows that the aggregator performs a few important and different functions:

- Format adaptation (from almost anything to various flavours of XML or text-based encapsulation).
- Content enhancement (abstracts or multimedia contents).
- Cross-channel coherency (categories and IDs).
- Database design (takes into account different countries, languages, different titles, multimedia content, etc.).
- Database archiving (only 15 % to 20 % of the European programmes broadcast by TV channels are new).
- Database tools to enrich it and search through it.
- Editorial quality assurance.

In practice, not all of these tasks can be performed by the broadcasters or the network operators. In addition, the aggregator's goal is to try to automate what is not easily automatable, so that live updates would not be a problem to them.

11.3 Way forward

The present document shows that not all of these interfaces are possible to standardize. The following potential subsequent works have been identified:

- Standard data models for interfaces I_2 and $I_{4/}$
  - The $I_{2.X}$ sub-interfaces implement subsets of this data model.
  - Information missing in some of today's interfaces, or often not conveyed:
    - Links to catch-up TV archives, and expiry dates.
    - Usage rights information for the content and for the EPG information.
    - Parental rating.
    - Air-time/dates for recordability.

- Aggregator publishes through $I_{2.2}$:
  - Generic programme ID (e.g. CRID) to be referenced from Amazon™, Facebook™, Twitter™, etc.
  - Availability of content (Amazon™: "Watch it next week on SatTV, or order the DVD™ now").

- Programme identification by means of the TV-Anytime CRID.
- A standard XML format for interfaces I_3, with live updates capability.
  - EPG aggregators have no interest in standardising $I_{3:}$
    - Too diverse technologies are in use: too difficult to achieve harmonisations (investments!).
    - Format conversions make up large part of aggregators' added value proposition.
- From the aggregators' point of view, the PVR sales revenue share for the broadcasters would be the most logical way forward in terms of business model.

History

Document history		
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