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Technical Specification

Digital Audio Broadcasting (DAB); MOT Slide Show; User Application Specification

European Broadcasting Union   Union Européenne de Radio-Télévision

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Foreword

This Technical Specification (TS) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE 1: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The Eureka Project 147 was established in 1987, with funding from the European Commission, to develop a system for the broadcasting of audio and data to fixed, portable or mobile receivers. Their work resulted in the publication of European Standard, EN 300 401 [1], for DAB (see note 2) which now has worldwide acceptance. The members of the Eureka Project 147 are drawn from broadcasting organizations and telecommunication providers together with companies from the professional and consumer electronics industry.

NOTE 2: DAB is a registered trademark owned by one of the Eureka Project 147 partners.

Introduction

The user application Slide Show provides the user with a sequence of slides which carry information in form of images. The slides will be presented on an appropriate display.

The main use for this user application will be in context with a programme service component. Examples are:

- news programme items complemented by photos from the reported events;

- programme items with popular songs accompanied by the photos of the favourite groups or the covers of the CD the songs are taken from.

The user application may also be provided as a data service component and may show e.g. the panorama, to be seen from different mountains, so to inform hikers and skiers about the different local conditions and to support them in deciding where to pursuit their sporting activity best.

The slides may carry not only photos or graphics, but also text. However, the Slide Show user application is optimized for conveying photos and graphics, but not for text. So text has to be rendered and sent as an PNG or JPEG image. If the application provider wishes to convey text adapted and optimized to the DAB transmission chain and to the resources at the receiving terminal, he is advised to make use of either the user application "Dynamic Label" or the user application "Broadcast Web Site" [4].

Once activated the Slide Show is a service provider driven user application, i.e. it does not require any interaction from the user of the corresponding service component, but each slide appears automatically on the display and will be replaced under the control of the service provider according to the needs of his service.

The user application Slide Show can be realized in the following ways:

- in the PAD of a programme service, with no separate identifier nor a separate label; in that case it is no (secondary) component of the programme service;

- as a secondary data service component of a programme service, i.e. belonging to a 16 bit "mother" programme service, with its own identifier (SCId) and possibly its own service component label; in that case it is transported in packet mode (TMId = 11) with DSCTy = MOT and available in a particular subchannel;

- as the primary service component of a data service (i.e. with a 32 bit Service Id);

- as a secondary data service component of a "mother" data service with its own identifier (SCId) and possibly its own service component label; in that case it is transported in packet mode (TMId = 11) with DSCTy = MOT and available in a particular subchannel.

1 Scope

The present document describes the protocol required to create the DAB user application "MOT Slide Show".

The "MOT Slide Show" user application applies the DAB-MOT protocol [3] and allows a service provider to deliver a sequence of slides which carry information in form of images.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

[1]   ETSI EN 300 401: "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

[2]   ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered Tables".

[3]   ETSI EN 301 234: "Digital Audio Broadcasting (DAB); Multimedia Object Transfer (MOT) protocol".

[4]   ETSI TS 101 498: "Digital Audio Broadcasting (DAB); Broadcast website".

[5]   ISO/IEC IS 15948: "Information technology - Computer graphics and image processing - Portable Network Graphics (PNG): Functional specification".

3 Abbreviations

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

CD	Compact Disk
DAB	Digital Audio Broadcasting
FIC	Fast Information Channel
FIDC	Fast Information Data Channel
FIG	Fast Information Group
JPEG	Joint Pictures Expert Group
MOT	Multimedia Object Transfer
MSC	Main Service Channel
PAD	Programme Associated Data
PNG	Portable Network Graphics
UA	User Application
UTC	Universal Time Coordinated
WIRC	WorldDAB Information and Registration Centre - a WorldDAB office for co-ordinating the technical developments of DAB

4   Maintaining tables of registered values

The present document contains identifier fields that require values to be registered. Registered value lists associated with data broadcasting specifications for DAB are maintained by the WorldDAB Information and Registration Centre (WIRC). Since the lists and tables contained within the present document might be outdated, please refer for the most actual versions to TS 101 756 [2]. The present document describes also the procedures for registering values in an existing table as well as registering new tables.

5   Operation of the MOT Slide Show user application

The Slide Show user application simply conveys one slide at a time from the user application provider to the slide show terminal. After complete and error-free reception it is presented on the display as triggered by the user application provider and replaces the previous slide.

The exact details on the timing issues are given in clause 5.4.

5.1   Transport

The Slide Show user application applies the MOT protocol: Each slide, together with its parameters, is taken as one MOT object: it is segmented and its segments are transferred according to the rules of the MOT protocol. MOT headers and bodies are used.

A Slide Show may be transferred either in the PAD part of a MSC stream audio sub-channel or in a MSC packet mode data sub-channel.

Wireless broadcast channels like DAB may be disturbed and so bit errors may corrupt the objects. Therefore the objects should be repeated sufficiently, applying one of the repetition methods offered by the MOT protocol and/or the DAB system itself.

The slides will experience different delays (according to different reception conditions in different places), until the complete object is available in an error-free state to all the terminals within the intended coverage area. If the user application provider wants to ensure a precise start of the slide presentation, he has to start the transmission sufficiently in advance and to set the TriggerTime parameter to a value not equivalent to NOW.

5.2   Storage and memory management

The user application requires the receiving terminal to control basically four buffers, one buffer for re-assembly of the currently received segments of the incoming slide, one buffer for holding the slide for rendering (JPEG decoding for example), the third one for storing the image in a presentable format (i.e. bitmap) and the fourth buffer for holding the slide currently being presented on the display.

Figure 5.1 describes the way from the re-assembly to the presentation:
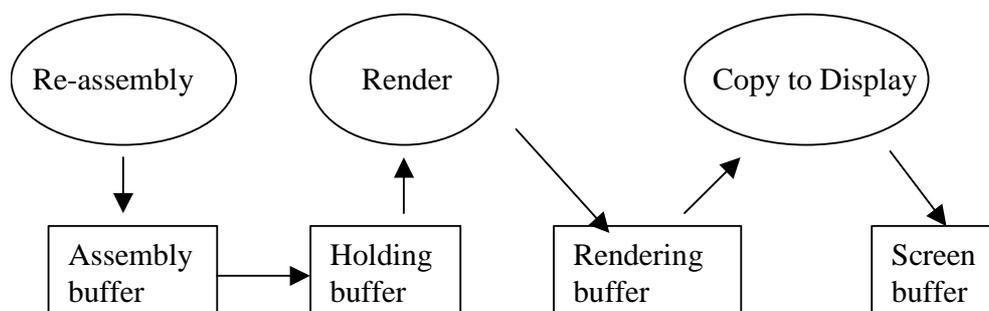
NOTE: When the TriggerTime is reached a slide would be copied from the rendering buffer to the screen buffer.

Figure 5.1: Buffer management model for a MOT Slide Show decoder

5.3   Presentation

The Slide Show user application works with one display only: it can present one slide at a time.

Before an object can be presented as a slide, its content has to be handled by the source decoder, e.g. in case of a JPEG picture it has to be processed by the JPEG decoder. The content decoding requires processing time which may delay the presentation, in addition to the transmission delay.

The presentation time of the new slide can be controlled by the user application provider, as will be explained below. However, there is no explicit way of removing a slide from the display. It can only be replaced by a new one. It is the task of the user application provider to ensure that the slides presented are always up-to-date and that especially at the junction between different programme items no obsolete information is left on the display. This, for example, can simply be realized by transmitting and displaying the station logo or an "empty" slide.

If a slide is completely rendered and a new slide is received before the old slide is triggered, then the old slide shall be discarded and the new slide shall be processed.

The provider can control the presentation start of a slide by using one of three options:

- TriggerTime: Now
  The slide is presented immediately after complete, error-free reception and content decoding. The presentation will vary at different terminals, because they will work under different reception conditions and with different processing speed. As a result, the start of the presentation may differ by several seconds or even tens of seconds.

- TriggerTime: UTC
  The desired precise TriggerTime is given in Universal Time Co-ordinated (UTC) and is sent (as part of the Header) together with the slide (Body) within the same object. This mechanism mandatorily requires the provision of FIG 0/10 in the FIC, which contains the exact UTC (not the Local Time!) as a reference value. Under normal operation conditions, all terminals will have the slide available before its signalled presentation start (TriggerTime). The presentation (copying the slide to the screen buffer) is triggered as scheduled and therefore independent from the variations of the reception conditions and the processing speed. This option, however, requires that the user application provider fixes the presentation time in advance, i.e. before the transmission of the object is started. This may be difficult, when the presentation has to be synchronized precisely to a programme service component, i.e. it has to be synchronized to the first beats of a music title, because in some operational environments this information is not available sufficiently in advance or because in live transmission the start of the new item is decided immediately before start by an operator, without look ahead time. This difficulty can be avoided, if the third option is applied.

- Header update
  The slide is transmitted as an object without any information about the TriggerTime, but sufficiently in advance, so that all terminals will have received and rendered the object. As soon as the user application provider has decided on the TriggerTime, a Header update object containing the TriggerTime (as UTC or as value "now") is transmitted. This Header update object will experience no significant transmission delay, because it is of relative small size.

The user application may be terminated by updating the FIG 0/13 signalling. DAB data terminals will usually react on the termination of an application by making another application automatically available for the user i.e. another secondary data service component or another application in PAD.

5.4   Timing issues

The model of a MOT Slide Show decoder shown in figure 5.1 implies:

While a slide is being rendered, its holding buffer must not be overwritten with the next slide (or Header update). If the processing power of the MOT Slide Show decoder is too low to process every slide, it shall not copy objects into the holding buffer before the rendering of the slide already contained in the holding buffer is completed. This means that the slow MOT Slide Show decoder will discard some slides, but display as many as possible.

The user application provider should try to give the MOT Slide Show decoder as much time as possible to render a slide before the next object is broadcast.

The lifetime of a slide inside the MOT Slide Show decoder is as follows:

```
              TT(n)           RT(n)          WT(n)          PT(n)

    +-----+------------+-----+-------+------+-------+------+-------+------------->
          |            |             |             |             |
    T0(n)         T1(n)         T2(n)         T3(n)         T4(n)
```
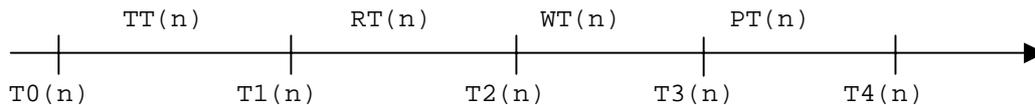
TT(n): Transmission Time period for object n. It starts with the first segment received from the object and ends when the object is completely re-assembled and copied into the holding buffer.

RT(n): Rendering Time period for object n. It starts when a slide is copied into the holding buffer and ends when it is rendered into the rendering buffer.

WT(n): Waiting Time period for object n. It starts when the slide is rendered and ends when it is copied to the screen buffer. The time when it is copied is determined by the TriggerTime parameter (either delivered together with the slide within the same object or transmitted as a separate object after the slide object).

PT(n): Presentation Time period for object n. It starts when the slide is copied to the screen buffer and ends when the next slide replaces this slide or the Slide Show is terminated (signalled in the FIC).

The provider knows the time instant T0(n) (start of transmission of object n), T1(n) (end of transmission of object n), T3(n) in the case that a TriggerTime not equivalent to NOW is signalled (start of presentation of object n) and T4(n) (end of presentation of object n, either identical with T3(n + 1) or with the dropped signalling of the user application in the FIC).

The user application provider should assure that T1(n) is later than T2(n - 1), which means that the previous slide is already rendered before the transmission of object n is completed. Unfortunately the provider does not know the T2 instances (end of the rendering process). In the case of TriggerTimes not equivalent to NOW (corresponding objects need to be transmitted sufficiently in advance, i.e. with a distance in time longer than the longest supported rendering time before the scheduled appearance of the slide on the display) the user application provider knows when the slide is displayed (T3(n - 1)) and therefore the transmission of a slide could be finished after T3 (n - 1), because then the rendering buffer will be available.

If TriggerTime NOW is signalled, the provider should estimate the rendering time and use the estimated point of time T3(n - 1) to determine when the holding buffer is available.

   NOTE: JPEG rendering times for current data terminal implementations (1997) are in the range of 2 s to 15 s, depending on the image complexity and computing power of the decoder hardware.

The transmission of an object can be started before the holding buffer is available, but it should not be finished before this buffer is available. So it is possible, for example, to broadcast all but the last segment of the object and transmit the last segment (and possibly repeat it) after T3(n - 1).

The user application provider also has to assure that T1(n) occurs after T3(n - 1), which means that the rendering of a slide is not started before the previous slide is copied into the screen buffer. That is, because overwriting the rendering buffer starts when new input enters the holding buffer.

Conclusion:

The transmission of an object (slide or Header update) should not be finished before the previous slide has been displayed. In other words: the end of the previous slide's transmission plus its estimated rendering time plus possibly a waiting time (resulting from a TriggerTime not equivalent to NOW) should have been expired before.

6 Interface to the Transport layer MOT

Slide Shows are implemented in the DAB system by transferring the slides including all necessary control information, as objects according to the Multimedia Object Transfer protocol MOT used with the two Transport Mechanisms "MSC stream audio" (PAD part) and "MSC packet mode data" (Transport Mechanisms "MSC stream data" or "FIDC" are not enabled).

MOT headers and bodies are used (MOT Directory shall not to be used).

6.1 MOT ContentTypes and ContentSubTypes

According to the MOT protocol, each object has to be characterized by its ContentType and ContentSubType. The user application requires this information in order to address the corresponding content decoders correctly. The following types are permitted for the use in the Slide Show user application:

6.1.1 ContentType "Image"

6.1.1.1 ContentSubType "JFIF" (JPEG)

The `image/jpeg` content type shall be deemed to indicate content conforming to the following restrictions:

- only baseline coding is used;

- progressive and/or multiscan coding is not used;

- arithmetic entropy coding is not used;

- the JPEG file must not contain more than 4 components (colour channels); each component is restricted to a resolution of 8 bit/component.

6.1.1.2 ContentSubType "PNG"

The `image/png` content type shall be deemed to indicate content conforming to version 1.1 of the PNG specification (ISO/IEC IS 15948 [5]). No extension "chunks" outside this PNG specification need to be supported.

6.1.2 ContentType "MOT transport"

6.1.2.1 ContentSubType "Header update"

In addition to the objects carrying the slides themselves, special objects with ContentType "MOT transport" and ContentSubType "Header update" can be used to transmit the TriggerTime for the presentation of the slide that is broadcast most recently. It is sent only, if that slide object has been broadcast or is being broadcast without a TriggerTime parameter.

The "Header update" object carries the following parameter:

- ContentName: This parameter is used to link the Header update to the slide object, the TriggerTime of which is to be updated.

  NOTE: The ContentName must refer to the slide that was sent directly before the "Header update". It is not possible to send multiple slides in advance and trigger any one of those. If the "Header update" does not refer to the slide in the holding/rendering buffer then both the "Header update" and the slide shall be removed from their respective buffer.

- TriggerTime: This parameter carries the update information, i.e. the TriggerTime parameter of the slide object. The TriggerTime parameter may carry either the value NOW or a value coded as UTC. There is only one value for the TriggerTime parameter allowed, i.e. the parameter may occur in the Header update object only once.

No further parameters are needed to be carried in the Header update object.

6.2   MOT Parameters for the slide objects

Only the MOT parameter ContentName is mandatory and must be used for each slide object that will be handled by the MOT decoder and the memory management of the Slide Show terminal.

6.2.1   ContentName

According to the MOT protocol the ContentName is needed for identifying and handling the object in the memory management. Therefore its use is mandatory within the Slide Show user application. While it is not mandatory for the ContentName to be changed with each slide, it is strongly recommended that this is done. This will prevent problems with object management throughout the processing chain (see model in clauses 2.2 and 2.3) and particularly with the Header update mechanism. Service providers should be aware that failure to change the ContentName may result in the receiver presenting the user application incorrectly.

If a service provider chooses to keep the ContentName constant and to use the VersionNumber mechanism to indicate a change of the slide, the fact that the TransportId must necessarily change means that all receivers, including new ones, should still correctly detect the change of the slide.

6.2.2   TriggerTime

The service provider controls the presentation of the slide by setting this MOT parameter. If a slide object is broadcast without any TriggerTime parameter, it can only be presented by the terminal, if this slide object is directly followed by a "Header update" object with the TriggerTime for that slide.

The parameter TriggerTime is permitted only once, i.e. if this object is to be presented later on once again, it has to be broadcast once again completely. It is not sufficient to send only the new TriggerTime (by a Header update or by sending a new header for that slide object), because the slide show terminal is not expected to store the object after this object has been replaced by the presentation of a new slide.

The TriggerTime parameter can take the value NOW or a value coded in UTC. If the TriggerTime is coded in UTC, the Slide Show terminal has to assure that the presentation of the slide can start at the given time instant.

6.2.3   Other MOT parameters

Other parameters possibly signalled in the MOT Header will be ignored by the Slide Show terminals.

7   Requirements and limitations

The following requirements and limitations have to be taken into account:

- The display resolution for presenting the user application Side Show should be 320x240 pixels at a colour/grey scale depth of 8 bits per pixel (1/4 VGA).

- The slide must be completely displayed on the 1/4 VGA screen without the need for horizontal and/or vertical scrolling.

- The maximum file size of a slide (JPEG or PNG) shall not exceed 50 kbit/s.

8   Restrictions that apply to pilot project receivers

The first implementation of Slide Show terminals rely on the parameter TriggerTime. By its presence it is indicated to the terminals, that a Slide Show user application is available and that this object is at least part of that Slide Show.

Therefore its use is mandatory, if those first implementations of Slide Show decoders are expected to present it. A further restriction is that they understand only TriggerTimes NOW. In order to recognize a new slide a changed ContentName or a changed VersionNumber (or both) is required by these first implementations.

History

Document history		
V1.1.1	July 2001	Publication