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Technical Specification

Digital Audio Broadcasting (DAB); Internet Protocol (IP) datagram tunnelling

European Broadcasting Union



Union Européenne de Radio-Télévision

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DAB
Digital Audio Broadcasting



Reference

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Foreword

This Technical Specification (TS) has been produced by the 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, ETS 300 401 [1], for DAB (see note) 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.

1 Scope

The present document describes how to transport Internet Protocol (IP) (RFC 791 [2]) datagrams in a Digital Audio Broadcasting (DAB) (ETS 300 401 [1]) packet mode service component, a technique further on referred to as IP tunnelling.

The use of IP tunnelling provides DAB with a mechanism for the adaptation of Internet services to DAB and is also a key component for DAB services using two-way interaction with personal DAB as specified in TS 101 736 [4].

The use of IP tunnelling enables the use of IP as a common network layer protocol, end-to-end, for DAB data services.

The IP tunnelling through DAB is unidirectional. The tunnel is created from the packet mode encoder on the transmitting side, to the packet mode decoder on the receiving side, of the DAB system.

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] ETSI ETS 300 401: "Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".
- [2] RFC 791 (1981): "Internet Protocol (IP); Darpa Internet Program; Protocol Specification", J. Postel.
- [3] ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered Tables".
- [4] ETSI TS 101 736: "Digital Audio Broadcasting (DAB); Network Independent Protocols for Interactive Services".
- [5] ETSI TS 101 737: "Digital Audio Broadcasting (DAB); Interaction channel through Global System for Mobile communications (GSM) the Public switched Telecommunications System (PSTN); Integrated Services Digital Network (ISDN) and Digital Enhanced Cordless Telecommunications (DECT)".
- [6] RFC 761 (1980): "DOD standard; Transmission Control Protocol".
- [7] RFC 793 (1981): "Transmission Control Protocol (TCP); Darpa Internet Program; Protocol Specification", J. Postel.

3 Definitions and abbreviations

3.1 Definitions

For the list of DAB definitions see ETS 300 401 [1]. For the purposes of the present document the following terms and definitions also apply:

Fragmentation: method specified in the Internet Protocol for splitting an IP datagram into several new IP datagrams to adjust for limited datagram sizes depending on the physical network used as the Internet data link layer. At the end point is payload of the fragments reassembled and delivered to the Internet transport layer, as if it had been sent in a single IP datagram.

Interaction Channel (IC): telecommunication or data communication channel used in parallel with DAB to provide an individual bi-directional communication link.

Internet: international collection of IP networks, which are connected together, to virtually form a single global network. See also *IP network*.

Internet application layer: application layer in the Internet protocol stack. At this level users invoke application programs that exchange data with an application protocol. The Internet application layer interacts with one of the transport protocols in the Internet transport layer in order to send or receive data.

Internet data link layer: data link layer in the Internet protocol stack. This layer includes all the functionality that depends on the various physical networks which together build up the IP network.

Internet network layer: network layer in the Internet protocol stack. The primary task of this layer is to provide a mechanism for network independent communication from one machine to another. The Internet network layer uses the Internet Protocol (IP) to route datagrams between machines independent of the physical network the machine is connected to.

Internet Protocol (IP): network layer protocol used on the Internet. Provides routing of datagrams from a machine to another independent from the physical networks.

Internet transport layer: transport layer in the Internet protocol stack. The primary task of this layer is to provide communication from one application program to another, often called end-to-end communication. The transport layer uses a transport protocol to provide either connection-oriented or connection-less data transport. The most widely used transport protocols in IP networks are; the connection-oriented TCP and the connection-less UDP.

IP network: one or several connected physical networks, that uses the Internet Protocol (IP) on the network level. An IP network may, or may not, be connected to the global Internet. Sometimes an IP network is referred to as "an internet", spelled with a lower-case 'i'.

Maximum Transfer Unit (MTU): largest size of an IP datagram that can be accepted for transfer by the Internet data link layer.

Request For Comments (RFC): name of specification published by the Internet Engineering Task Force (IETF). Used for publication of Internet standards.

Transport Control Protocol (TCP): internet transport layer protocol that provides a reliable connection-oriented transport.

Tunnelling: technique in which a datagram is encapsulated in a protocol on higher or the same level and passed across the transport system. This could be seen as a tunnel between two nodes in the network, where the datagrams are encapsulated at the starting point and decapsulated at the end point. For IP tunnelling within DAB, the tunnel is created between the packet mode encoder and the packet mode decoder.

User Datagram Protocol (UDP): internet transport layer protocol that provides an unreliable connection-less transport.

3.2 Abbreviations

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

CA	Conditional Access
DAB	Digital Audio Broadcasting
IC	Interaction Channel
IETF	Internet Engineering Task Force
IP	Internet Protocol
MSC	Main Service Channel
MTU	Maximum Transfer Unit
RFC	Request For Comments
SC	Service Component
TCP	Transmission Control Protocol
TP	Transport layer Protocol
UDP	User Datagram Protocol

4 Overall Description

This clause gives an overall view of how IP datagrams are mapped into the DAB system when IP tunnelling is used. The specification of the Internet Protocol (IP) is done by IETF and is published in RFC 791 [2].

The protocol stack used for IP tunnelling in DAB is shown in figure 1. The IP datagrams are tunneled through a DAB packet mode service component (SC). This is done by encapsulating the IP datagram in an MSC data group on packet mode transport level, as described in clause 5. From the IP point of view the packet mode SC will act as the Internet data link layer. There is no support within the present document for the use of other DAB transport mechanisms than packet mode.

The definitions of Internet transport layer protocols are not within the scope of the present document. However, the most commonly used protocols in the Internet transport layer are UDP (RFC 761 [6]) and TCP (RFC 793 [7]). UDP can be used for datagram oriented unidirectional transport point-to-point, as well as for datagram oriented multicast and broadcast transport. TCP is used for connection oriented point-to-point transport and requires an interaction channel for the return flow of acknowledgements. See also TS 101 736 [4] and TS 101 737 [5]. It is also possible to use other protocols, than UDP or TCP, on the Internet transport layer. However, if the application layer requires uni- or bi-directional communication then it has to be taken into account. In the case of bi-directional communication an IC is required for the return link, see TS 101 736 [4] and TS 101 737 [5].

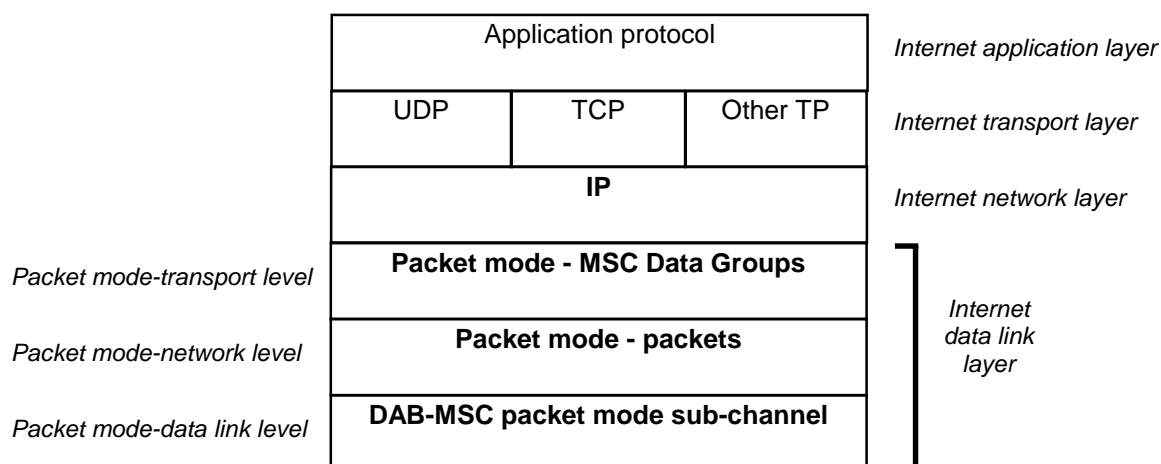


Figure 1: Protocol stack for IP-tunnelling in a DAB packet mode service component

5 Coding

5.1 General

The tunnelling of IP datagrams through DAB is to be done by encapsulating the IP datagrams into the MSC data groups. The encapsulation is done by carrying the IP datagram as payload in the MSC data group data field, as shown in figure 2. The mapping of an IP datagram onto an MSC data group is one-to-one, e.i. one IP datagram in one MSC data group.

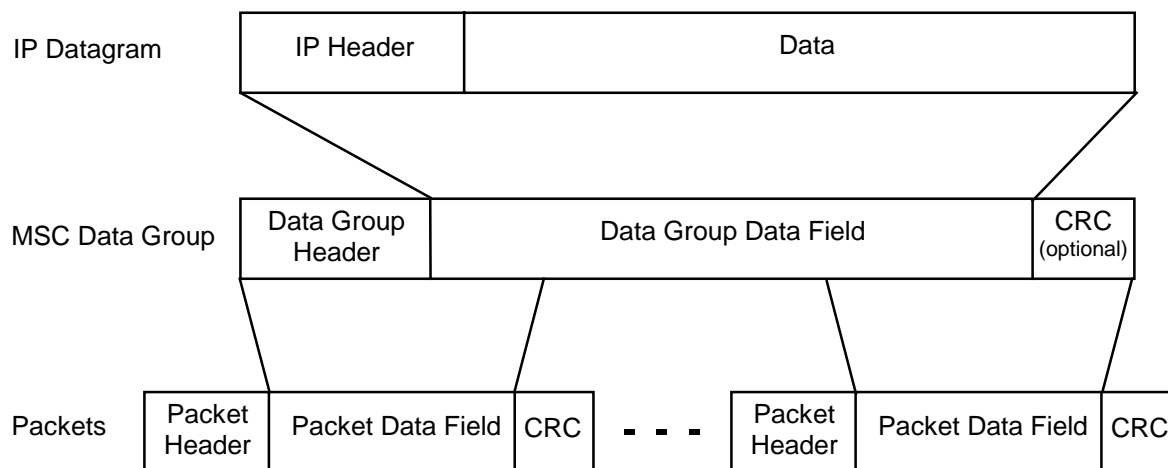


Figure 2: Encapsulation of an IP datagram in an MSC data group

5.2 Packet mode - network level

The coding on packet mode network level shall be done according to ETS 300 401 [1].

5.3 Packet mode - transport level

5.3.1 Coding of the MSC data groups

The coding on packet mode transport level shall be done according to ETS 300 401 [1]. For the following fields within the MSC data group special conditions shall apply when IP tunnelling is used:

Data group type: for IP tunnelling the following data group types are used:

$b_3 \quad b_0$

0 0 0 0: General data; used for encapsulated IP datagrams;

0 0 0 1: CA messages (see ETS 300 401 [1], subclause 9.3.2.1);

0 0 1 0: General data and CA parameters; used for encapsulated IP datagrams and CA parameters;

other: Rfu.

NOTE: The Rfu values of the DAB protocol field may be defined within TS 101 756 [3], without a formal update of the present document.

MSC data group data field: this field shall carry exactly one IP datagram. The size of the data field shall be set to the size of the IP datagram (incl. header and payload of the IP datagram). The transmitter side sets the maximum allowed size of the MSC data group data field, this restriction is referred to as the Maximum Transfer Unit (MTU). The MTU shall be in the range of 576 to 8 191 bytes. Where 576 byte is the smallest size of the MTU allowed by IP (RFC 791 [2]) and 8 191 byte is the largest size of the MSC data group data field allowed by DAB (ETS 300 401 [1]). If the size of an IP datagram exceeds the MTU the situation shall be handled as described in subclause 5.4.1.

5.3.2 Repetition of MSC data groups

Repetitions of data groups on packet mode transport level, as specified in ETS 300 401 [1], can be used to increase the probability of reception. If repetitions of MSC data groups are used, the packet mode decoder should forward a correct received IP datagram only once to the Internet network layer. Duplications of IP datagrams caused by the repetition on packet mode transport level should be filtered out, e.g. by using the Continuity index and the Repetition index. This since most IP implementations are not designed to handle multiple versions of the same IP datagram in such amount. On the Internet duplications of IP datagrams normally occur rather seldom.

5.4 Internet network layer

5.4.1 Fragmentation of IP datagrams

If the size of an IP datagram is larger than the MTU the IP datagram shall be fragmented (segmented) into several IP datagrams. The fragmentation of IP datagrams shall be done as specified by the Internet Protocol (RFC 791 [2]) itself.

NOTE: A fragment of an IP datagram has the same format as the original IP datagram, and shall therefore be handled as an ordinary IP datagram by the Internet data link layer. Hence, the mapping of an IP datagram fragment onto an MSC data group shall be one-to-one, e.i. one IP datagram fragment in one MSC data group, as shown in figure 3.

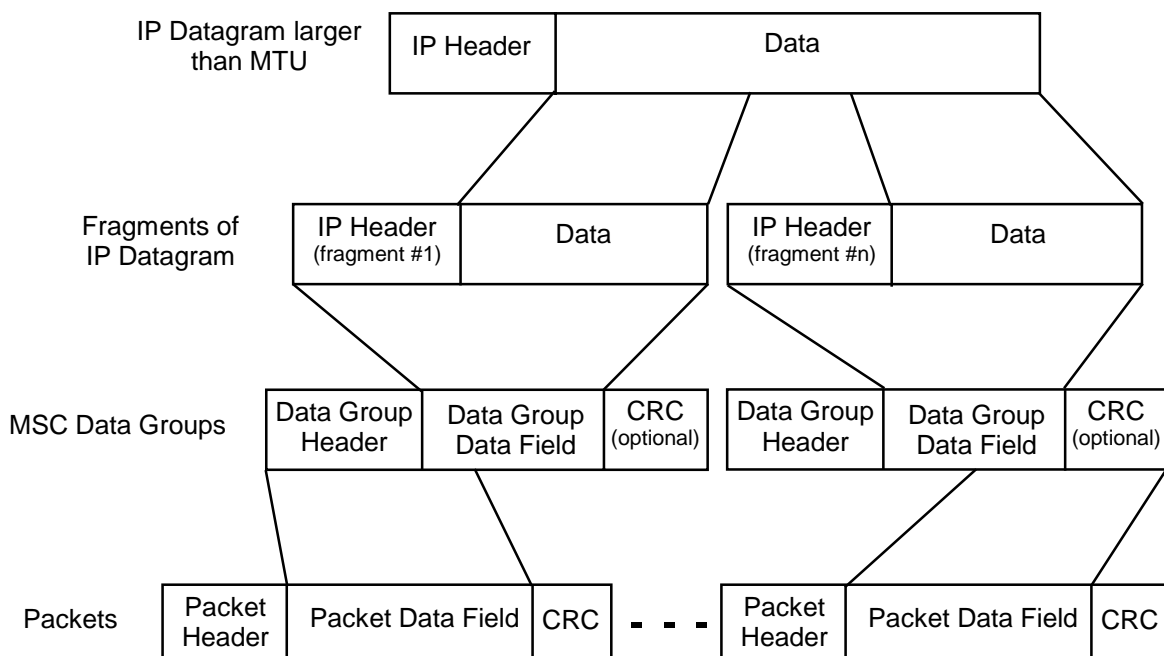


Figure 3: Encapsulation of fragmented IP datagrams in MSC data groups

5.4.2 IP version signalling

The IP version number of the IP datagrams is signalled within the header of the IP datagram, as specified in RFC 791 [2].

5.4.3 Internet transport layer protocol signalling

The Internet transport protocol used on top of IP is signalled within the header of the IP datagram, as specified in RFC 791 [2].

History

Document history		
V1.1.1	July 2000	Publication