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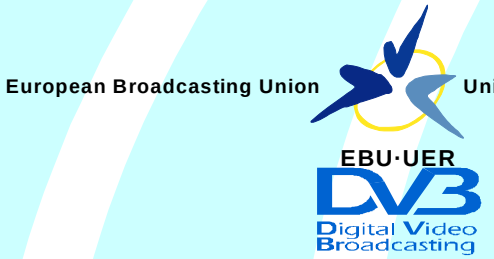
Technical Specification

Digital Video Broadcasting (DVB); Ethernet Home Network Segment



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Contents

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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: 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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Founded in September 1993, the DVB Project is a market-led consortium of public and private sector organizations in the television industry. Its aim is to establish the framework for the introduction of MPEG-2 based digital television services. Now comprising over 200 organizations from more than 25 countries around the world, DVB fosters market-led systems, which meet the real needs, and economic circumstances, of the consumer electronics and the broadcast industry.

1 Scope

The present document defines a wired Home Network Segment (HNS) based on Ethernet 100BASE-T, as described in the Architecture Framework document [1]. The specification defines how IP traffic for DVB services will be carried over the 100BASE-T Ethernet HNS, and describes how IP QoS is mapped to the Ethernet layer. All the IP related functionality such as initial registration and configuration (including IP address assignment) of a Home Network End Device (HNED) is defined in Draft IPI 2001-071 (see Bibliography). The present document applies to interfaces IPI-1, IPI-2 and IPI-3, as defined in [1].

It is not the intention to come up with a completely new standard but to refer as far as possible to existing standards. The present document should meet the existing commercial requirements as defined in CM255rev4 and DVB CM159R2 (see Bibliography).

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI TR 102 033 (V1.1.1): "Digital Video Broadcasting (DVB); Architectural framework for the delivery of DVB-services over IP-based networks".

[2] IEEE 802 (1990): "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture".

[3] IEEE 802.1D (1998)/ISO/IEC 15802-3: "IEEE Standard for Information technology; Telecommunications and information exchange between systems; IEEE standard for local and metropolitan area networks; Common specifications; Media access control (MAC) Bridges".

[4] IEEE 802.3 (2000): "IEEE Standard for Information technology; Telecommunications and information exchange between systems; Local and metropolitan area networks; Specific requirements; Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".

[5] IEEE 802.2 (1998): "IEEE Standard for Information technology; Telecommunications and information exchange between systems; Local and metropolitan area networks; Specific requirements; Part 2: Logical Link Control".

[6] IETF RFC 1042 (1988): "Standard for the transmission of IP datagrams over IEEE 802 networks", J. Postel, J.K. Reynolds.

[7] IETF RFC 826 (1982): "Ethernet Address Resolution Protocol: Or converting network protocol addresses to 48 bit Ethernet address for transmission on Ethernet hardware", D.C. Plummer.

[8] IEEE 802.1Q (1998): "IEEE standard for local and metropolitan area networks: Virtual Bridged Local Area Networks".

[9] IETF RFC 2998 (2000): "A Framework for Integrated Services Operation over Diffserv Networks".

[10] ETSI TS 102 813: "Digital Video Broadcasting (DVB); IEEE 1394 Home Network Segment".

3 Abbreviations

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

CD	Collision Detection
CoS	Class of Service
CSMA	Carrier-Sense Multiple Access
DHCP	Dynamic Host Configuration Protocol
DIX	Digital, Intel and Xerox
DNG	Delivery Network Gateway
DSCP	Diffserv Codepoint
DVB	Digital Video Broadcasting
HNCD	Home Network Connecting Device
HNED	Home Network End Device
HNS	Home Network Segment
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPI	Internet Protocol Infrastructure
QoS	Quality of Service
ToS	Type of Service

4 Topology of an Ethernet 100BASE-T Home Network Segment

Based on the description of a Home Network Segment (HNS) in the architectural framework specification [1], the 100BASE-T Ethernet HNS is based on a star architecture, with use of unsheilded twisted pair (UTP) cabling to connect between nodes. For an architecture overview see [2].

The Home Reference Model in [1] also introduces a Home Network Connecting Device (HNCD). A HNCD can act as a bridge, router or gateway and connects HNSs with each other. The 100BASE-T Ethernet HNS may be connected via a HNCD to another DVB HNS e.g. IEEE 1394 [10] or wireless.

The specification for a HNCD which interconnects IEEE 802 LANs (below the MAC service boundary) in a bridged format is defined in IEEE 802.1D [3]. The present document will apply to connection between two or more 100BASE-T Ethernet HNSs (e.g. an Ethernet switch or hub) and will apply also to bridging between a 100BASE-T Ethernet HNS and another HNS based on the IEEE 802 MAC layer e.g. a wireless HNS. The HNCD shall provide support for QoS via IEEE 802.1p (see clause 6).

An example configuration allows for a 100BASE-T Ethernet HNS to connect a Delivery Network Gateway (DNG) to Ethernet based Home Network End Devices (HNEDs). The DNG may present a single 100BASE-T interface to the Ethernet HNS (in this case a HNCD in the form of an external hub or switch is required to connect multiple terminals), or the DNG may provide multiple 100BASE-T interfaces (in hub or switch format). To provide guaranteed QoS it is recommended that a switched configuration is used. Note that the DNG may provide a bridged or routed connection.

The Ethernet Layer

Ethernet 100BASE-T is specified in IEEE 802.3u [4]. The 802.3 MAC layer shall be used with the use of CSMA/CD as defined in IEEE 802.3 [4]. The Link layer specified in IEEE 802.2 [5] shall be used.

Note that alternative legacy Ethernet Frame formats (e.g. DIX) will not be supported due to need to support IEEE 802 [2] framing for QoS.

Ethernet Physical Layer

HNEDs connected to the 100BASE-T Ethernet HNS shall support the IEEE 802 100BASE-TX Ethernet physical layer as defined in [4]. RJ45 Ethernet sockets shall be used.

5 Carriage of IP-based Traffic

Within the context of the architectural framework specification [1], all the IP-based traffic will transparently be carried over a 100BASE-T Ethernet network. Therefore, the interfaces IPI-1, IPI-2 and IPI-3 on a 100BASE-T Ethernet HNS shall comply to the IETF specification RFC 1042 [6]. The Address Resolution Protocol as defined in RFC 826 [7] shall be used.

For the addressing of Home Network End Devices (HNED) on a 100BASE-T Ethernet network DHCP shall be supported. Each HNED should be uniquely identified by its MAC address (48 bit Ethernet address). All IP-based functionality required to carry IP traffic over a 100BASE-T HNS and over a HNCD can be found in the network provisioning and IP addressing specification Draft IPI 2001-071 (see Bibliography).

6 Quality of Service (QoS)

The interfaces IPI-1, IPI-2 and IPI-3 on the Ethernet 100BASE-T HNS shall support IEEE 802.1p [3], with defined user priority classes. The IEEE 802.1p field shall be supported in an IEEE 802.1Q [8] compliant Ethernet frame. The marking shall be based on the DiffServ CodePoint (DSCP) marking method [9] as shown in table 1.

Table 1: DSCP Values and corresponding Ethernet IEEE 802.1p marking

Traffic type	IP DSCP value	Corresponding IP precedence	Per hop behaviour	Corresponding IEEE 802.1p User Priority value
Voice bearer	0b101110	0b101	EF	0b101
Video bearer (high priority)	0b100010	0b100	AF41	0b100
Video bearer (lower priority)	0b100100	0b100	AF42	0b100
Voice and video signalling	0b011010	0b011	AF31	0b011
Best effort data	0b000000	0b000	-	0b000
NOTE: In the context of DVB, the Voice bearer is used to identify DVB audio services.				

For a HNS based on 100BASE-T Ethernet these DSCP values are used to map a traffic type onto the corresponding IEEE 802.1p priority codes. Packets shall be marked using the Layer 2 Class of Service (CoS) settings in the User Priority bits of the 802.1p portion of the 802.1Q [8] header. These can be mapped to the IP Precedence/DSCP bits in the Type of Service (ToS) byte of the IPv4 header. Note that the 802.1Q [8] header adds an additional 4 bytes of data into an Ethernet frame header. The 802.1p priority field is one of the fields in the 802.1Q [8] header, and is a 3 bit field. Any switching device that implements the IEEE 802.1Q specification [8] can use the user-priority field to determine the scheduling class a packet belongs to.

Note that mapping the IP precedence field is easy, as it can be copied to the user-priority field directly, as both the fields are 3 bits long. It is not as easy to map the DSCP field to the user-priority field, as the DSCP is 6 bits in length and the user-priority field is only 3 bits in length. Therefore the IP precedence portion of the DSCP field cannot be copied into the user-priority field. Instead the DSCP field must be tested for values that match the DSCP value shown in Column 2. If the DSCP value does not match any of the values shown in Column 2, the packet must be marked with a user-priority value of 0.

Annex A (informative): Bibliography

CM255rev4 (21 March 2001): "Commercial Requirements for Multimedia Services over Broadband IP in a DVB Context".

DVB CM159R2: "Commercial Requirements for Delivery of DVB services over a Home Access In-house Digital Network based on Ethernet 100BaseT".

Draft IPI 2001-071: "Network Provisioning and IP Addressing".

History

Document history		
V1.1.1	November 2002	Publication