Digital Video Broadcasting (DVB) Applications

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INTRODUCTION

The topic of Digital Video Broadcasting (DVB) applications (including both infrastructures and services) is a very broad one. It encompasses not only the transmission and distribution of television-program material in digital format over various media, but also a range of related features designed to exploit the capabilities of all possible underlying technologies. Within a fully converged environment, DVB can contribute to the effective penetration and adoption of a variety of enhanced multimedia services (Fenger & Elwood-Smith, 2000) based on various forms and types of content (with major emphasis given to the audiovisual sector; European Commission, 1999). Moreover, DVB intends to support optimized solutions for different communications platforms. Europe has adopted DVB for use across all relevant technical platforms. In fact, Europe has the highest density of TV homes in the world and is leading the deployment of digital TV (European Commission, 2003a) through DVB. The focus provided by a common set of technical standards and specifications throughout the European Union (EU) has given a market advantage and spurred the deployment of digital television services. Market expansion will be determined by the rate at which broadcasters are enabled to develop services and by the cost of Set-Top Boxes (STBs) or integrated television equipment.

Current European policies have provided a market advantage and accelerated the development and deployment of modern applications based upon specific features of existing infrastructures, also taking into account the needs of the European citizens with those of the media, telecommunications, and equipment industries (European Commission, 2002).

In particular, as for the European framework, all applicable technical specifications for digital broadcasting are currently promoted under the scope of the DVB Project. Those specifications are then offered for standardization to the relevant standards body, that is, ETSI (European Telecommunications Standards Institute) and/or CENELEC (European Committee for Electrotechnical Standardization): The latter deals with the consumer equipment aspects while the former with all other aspects.

CURRENT STANDARDIZATION INITIATIVES: THE DVB PROJECT

The DVB Project (officially formed in September 1993) is a market-led consortium of public- and private-sector organizations in the television industry, comprising over 300 broadcasters, manufacturers, network operators, software developers, and regulatory bodies from more than 35 countries worldwide who are committed to designing global technical standards for the delivery of digital television. Its aim is to establish the framework for the introduction of MPEG-2- (Moving Pictures Experts Group-2) based digital television services. All promoted works foster market-led systems, which meet the real needs and economic circumstances of the consumer electronics and broadcast industry (Reimers, 2000).

In the course of recent years, a considerable list of specifications has been developed very success-

fully; these can be used for broadcasting all kinds of data as well as sound, accompanied by possible types of auxiliary information. Some of the specifications aim at the installation of appropriate bidirectional communication channels via the exploitation of existing networks (Nera Broadband Satellite, 2002). Due to the huge complexity of the surrounding "environment", different factors have to be taken into account when planning services or equipment. However, the aim is the creation of a coordinated digital broadcast market for all service delivery media. The Project is not a regulator or "government-driven" (top-down) initiative. Working with tight timescales and strict market requirements, the project intends to achieve considerable economy of scale, which in turn ensures that, toward the expected transformation of the industry to digital technologies, broadcasters, manufacturers, and, ultimately, the viewing public will benefit.

The work does not intend to specify an interaction channel solution associated to each broadcast system, especially because the interoperability of different delivery media is desirable. Therefore, any potential solution for the interaction channel applies to satellite DVB (DVB-S), Cable DVB (DVB-C), Terrestrial DVB (DVB-T), Master Antenna Television (MATV), Satellite Master Antenna Television (SMATV), Microwave or MMDS (Multi-Channel Multipoint Distribution Systems) DVB (DVB-MS/MC), or any future DVB broadcasting or distribution system.

As a consequence, progress realized up to now has developed a complete family of interrelated television systems for all possible transmission media at all quality levels (from standard definition to high definition, including the enhanced definition 16/9 format currently being widely deployed in Europe). The standards also cover a range of tools (Valkenburg & Middleton, 2001) for added-value services such as pay-per-view, interactive TV (i-TV), data broadcasting, and high-speed, "always-on" Internet access.

OPTIMIZED SOLUTIONS FOR DIFFERENT TECHNICAL PLATFORMS

The basic components of DVB are the use of MPEG-2 packets as digital "data containers" and the critical, relevant Service Information (SI) surrounding and identifying those packets. DVB can deliver to the home almost anything that can be digitized, whether this is High-Definition TV (HDTV), multiple-channel Standard-Definition TV (SDTV, i.e., PAL, NTSC, or SECAM), or broadband multimedia-data and interactive electronic-communications services.

The video, audio, and other data are inserted into fixed-length MPEG Transport Stream (TS) packets. Packetized data constitutes the payload, which can carry any combination of MPEG-2 (video and audio).

Thus, service providers are free to deliver anything from multiple-channel SDTV, 16:9 wide-screen Enhanced-Definition Television (EDTV), or single channel HDTV to multimedia data broadcast-network services and Internet over the air.

The complete "system" can be seen as a "functional block" of clusters of equipment performing the adaptation of the baseband signals, from the output of the MPEG-2 transport multiplexer to the corresponding channel characteristics. The following processes are generally applied to the data stream: (a) transport multiplex adaptation and randomization for energy dispersal; (b) outer coding (e.g., Reed-Solomon); (c) convolutional interleaving; (d) inner coding (e.g., punctured convolutional coding); (e) baseband shaping for modulation; and (f) modulation.

However, to make a fair assessment of the impact of DVB, it is essential to consider its presence on three fundamental and distinct platforms, that is, satellite, cable, and terrestrial or microwave.

The satellite system, DVB-S, is the oldest and most established of the DVB standards family, and it arguably forms the "core" of the great success in the market. The satellite system is designed to cope with the full range of satellite transponder bandwidths and services (ETSI, 2003a). The DVB-C cable system (ETSI, 1998) is based on DVB-S, but the modulation scheme used is Quadrature Amplitude Modulation (QAM) instead of quadrature phase-shift keying (QPSK; as in the previous case). The system is centered on 64-QAM, but it also allows for lower and higher level systems. In each case, there is a trade-off between data capacity and robustness of data.

Under a similar approach, the terrestrial DVB-T system specification is based on MPEG-2 sound and