# OVERVIEW OF DVB-RCCL / DAVIC vs. MCNS / DOCSIS

White paper

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DVB DAVIC
Interoperability
Consortium Ô

## DVB and DAVIC

DVB (Digital Video Broadcasting Project), is an organization committed to the development of a global family of standards for digital television. This organization has been actively involved in the development of specific standards for the delivery over audio, video, and data services over cable and LMDS networks. Those DVB standards which pertain to these efforts include DVB-C (cable only) and DVB-RCCL.

DAVIC (Digital Audio Visual Council) is a non-profit organization created to develop standards for the delivery of interactive data services to cable modems and set-top boxes. Like DVB, this organization has been working on these standards for a number of years.

DVB has issued to ETSI a complete set of standards defining the OSI layers related to the provision of interactive services on cable and LMDS networks . ETS 300 802 defines networks independent layers for both media, while ETS 300 800 and EN 301 199 defines the network dependent layers for HFC and LMDS networks respectively. The downstream physical layer is defined in ETS 300 429 for cable and ETS 300 421 for LMDS.

The DVB-RCCL (Return Channels for Cable and LMDS) which has issued the specifications related to network dependent layers has worked in close relationship with the DAVIC Passband group in order to deliver the same standard for cable. The result of these efforts is the recent adoption by DAVIC of ETS 300 800 as the only standard for cable modem applications. This is a major step towards the production of common specifications between DVB and DAVIC.

These standards have been ratified by ITU as IITU T J83 annex A for ETS 300 429 and ITU T J112 annex A for ETS 300 800.

These standards as speared headed by DVB and DAVIC have been successfully adopted by major international standards bodies and provide a framework to deliver interactive services to set-top boxes as well as high speed data delivery to cable modems. Large multinational companies have endorsed these standards and are starting to demonstrate and deliver systems today.

## MCNS and DOCSIS

MCNS, a consortium consisting of predominantly North American multi cable service operators (MSOs) including: Comcast, Time Warner, TCI , MediaOne, Cox, Rogers CableLabs and Cablesystems, was developed to create a quick and safe standard for the transmission of data over cable networks. Although there was a standard being developed to do just that, called IEEE 802.14, the lack of progress motivated these MSOs to develop their own standard in the hopes of accelerating the market.

As MCNS involved the SCTE to get the standard forwarded to the ITU, DOCSIS or Data over Cable Specifications was approved.

Today, it is formed by about 35 vendors who are working on DOCSIS compliant products, primarily geared towards the delivery of data services over cable modems which, in North America, has become the major focus of the market.

CableLabs is an organization dedicated to the certification of DOCSIS based equipment.

## Market dynamics driving both standards

DVB/DAVIC have defined international standards for the delivery of interactive services to both set top boxes and cable modems. DVB and DAVIC began to produce specifications on return channels in 1995. Their approach was to develop a broad and flexible standard which would allow:

- low cost implementation in a STB when focusing on interactive TV applications
- efficient support of internet related applications, dedicated to cable modems
- evolution towards the support of video, data and voice on the same system
- integration of both LMDS and HFC technologies on the same system, e. g. compatible specifications on the MAC layer and above.

The DVB/DAVIC group continues to define these standards and many cable operators including ECCA (European Cable Communications Association) have become active endorsers of the efforts pursued. Companies in the newly announced DVB/DAVIC Interoperability Consortium have created products that use these flexible standards to create end-to-end solutions to deliver these interactive services. A number of cable operators throughout Europe are actively deploying DVB/DAVIC based solutions.

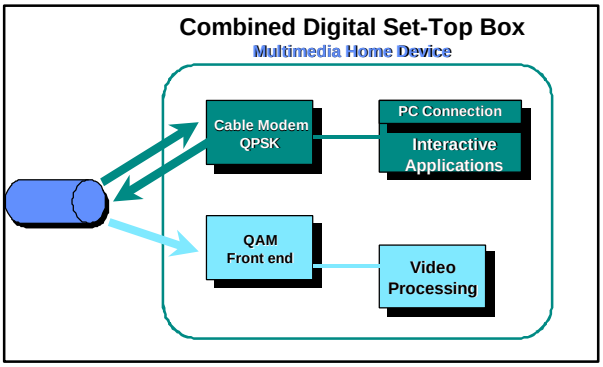
In North America the DOCSIS/MCNS standards were developed and geared towards the goals stipulated by the participating cable MSOs. As a result the number one charter was to develop a standard and products suitable for the delivery of data (IP traffic to be exact) to cable modems. Recently an organization was formed called OpenCable which started to define a retail model oriented set-top box using the DOCSIS standard for data, but interestingly enough also using the DAVIC standard. In other words the set-top box defined by OpenCable has DAVIC based components as well as DOCSIS components (DAVIC is defined as a 'core' requirement and DOCSIS as an extension per the OpenCable specification).

Due to the different market dynamics, DOCSIS/MCNS have a large number of cable modem manufacturers that will have compliant products later this year. In addition there are companies with CMTS (Cable modem termination systems) based on the DOCSIS/MCNS standard. However, there are only a few STB manufacturers as of the writing of this paper have announced plans to have a DOCSIS/MCNS based STB.

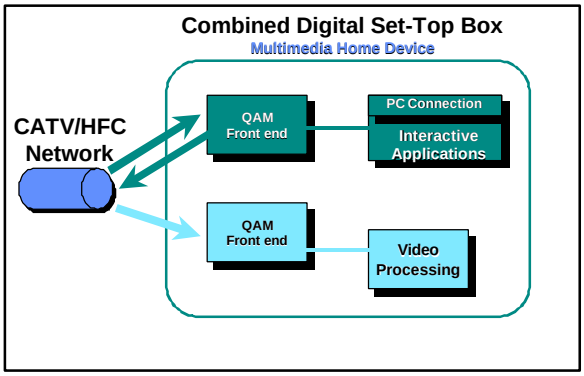
On the contrary, DVB/DAVIC has numerous STB manufacturers that are in the final stages of developing compliant STBs due out later this year/early 1999. In addition, a number of companies within the DVB/DAVIC Interoperability Consortium are actively trialing cable modems based on the DVB/DAVIC standard. As a result DVB/DAVIC offers a wider mix of both set top boxes and cable modems.

## Economics of the receiver

In the case of STBs and to understand the differences between a DOCSIS based STB and a DVB/DAVIC based STB, we can look at the pictures below.




DAVIC BASED STB




DOCSIS BASED STB

It is important for a fully flexible receiver device to support the simultaneous reception of video and data. DAVIC supports this mechanism through the use of an "out of band" channel. This feature, allows customers to deploy services that are not affected by the video. For example, by using an out of band (OOB) channel, DAVIC provides a way for customers to receive data and video separated. Such an application could be a stock ticker that continues to "float " on the TV screen despite the user changing channels.

To achieve the same results with DOCSIS, the STB manufacturer would be forced to install two QAM demodulators within it's STB raising costs. While this may be a problem today and could diminish with time as the prices and features get incorporated into single chipsets, it is nevertheless important in today discussion and for any customer concern with STB deployment costs.

In the case of cable modem applications, the cost and architectures of a DVB-DAVIC cable modem and DOCSIS cable modem are equivalent.

## Technical differences

As we described before, DVB/DAVIC and DOCSIS/MCNS are two standards defined by different organizations for the same purpose of delivering data to STBs or PC cable modems. While both standards look to deliver data services, the focus, due to market dynamics has been different. For STBs clearly DVB/DAVIC is a stronger choice today and for PC cable modems DOCSIS/MCNS is stronger today. As we look into the future, these two standards will inevitable look to strengthen to deliver data to PC cable modems and STBs respectively.

Following is a brief technical description of some of the technical differences of the two standards.

### IP Datagram Encapsulation Formats

- DVB/DAVIC is based on ATM framing; a very efficient IP over ATM mapping is defined using AAL5, an alternative being to use LLC/SNAP encapsulation

- MCNS, as dedicated to data transmission, is based on direct Ethernet Frames mapping on MCNS packets

### Downstream Modulation

DVB/DAVIC
- QPSK (Out-of-band channels)
- 16, 64, and 256 QAM (MPEG-2 transport) for In Band channels

DOCSIS
- 64 and 256 QAM (MPEG-2 transport)

### Upstream Modulation

DVB/DAVIC
- QPSK

DOCSIS
- QPSK and 16 QAM

### Downstream Spectral Efficiency

DVB/DAVIC
- 1.544 and 3.088 Mbps for out-of-band channels using 1 MHz and 2 MHz of bandwidth respectively. Each ATM cell is protected by an RS(55, 53) code. There are 3333 and 6666 ATM cells sent downstream per second for bandwidths of 1 MHz and 2 MHz respectively.
- MPEG-2 transport: RS(204,188); alpha = 0.15; Interleave depth = 12. Spectral efficiency is therefore 0.80136 * log2(QAM constellation size) in bps / Hz. (This is the net FEC coding rate, multiplied by the base two logarithm of the QAM signal constellation size, divided by one plus alpha).

DOCSIS

- MPEG-2 transport: RS(128,122); trellis coding rate = 14/15; alpha = 0.18 (64 QAM) or alpha = 0.12 (256 QAM); Interleaving = Yes, variable latency. The spectral efficiency is therefore 0.7943 * log2[256] for 256 QAM or 0.7539 * log2[64] for 64 QAM in bps / Hz.

## Upstream Spectral Efficiency

DVB/DAVIC

- .256 to 6.176 Mb/s for OOB channels (200 Hz to 4 MHz bandwidth)
- RS (59, 53) which protects each ATM cell from impulse noise
- ATM cell rate : up to 12000 cells / s at 6.178 Mb/s

DOCSIS

- 160, 320, 640, 1280, and 2560 Kilobaud in channels of width 0.200, 0.400, 0.800, 1.600, and 3.200 MHz respectively
- Upstream messages are protected using RS coding. The CMTS defines the strength of the FEC to be employed by the cable modem to be in the range t=0 (no FEC) to t=10. The length of codewords is also programmable based on shortened codes over GF(256).

## Access modes

- DVB/DAVIC supports contention, reservation and fixed bit rate access on the same channel
- DOCSIS doesn't support fixed bit rate access

fragmentation capability

- DVB/DAVIC supports variable fragmentation length (multiple of ATM packets), which allows very flexibly to support different quality of service;

- DOCSIS 1.0 doesn't support fragmentation mechanism, lea ding to problems when voice or delay sensitive services are transported together with data on the same upstream channel.

Security

Both DVB-DAVIC and MCNS have defined a security layer with unicast and multicast capability.

## Conclusion

Both standards can be used to communicate bi-directional IP traffic to either set-top boxes or to cable modems. For out-of-band downstream channels, DVB is clearly a superior choice since DOCSIS has not defined a solution in this space. For cable modems and for QAM data channels to set-top boxes, the two standards are essentially equivalent at a technical level. The DVB/DOCSIS decision should therefore be made based on availability, economics and political factors as discussed in this paper. And with regard to these factors, a DVB/DAVIC solution is a more attractive choice.