DVB-RCS standardization

status and perspectives

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EN 301 790 RCS Standard v.1.4.1 approved

ETSI EN 301 790 V1.4.1 (2005-04) (117 paper pages/0 soft pages)
One-step Approval: OP 20050826 Start: 2005-04-27 End: 2005-08-26
Technical Body: JTC BROADCAST
EBU/CENELEC/ETSI on Broadcasting
Title:
Digital Video Broadcasting (DVB);
Interaction channel for satellite distribution systems

ETSI EN 301 790 V1.4.1 (2005-04) - (935 kb) - 117 pages [N] REN/JTC-DVB-169 BROADCAS	Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems
Greek title:	Ψηφιακή βιντεοεκπομπή (DVB) - Κανάλι διάδρασης για δορυφορικά συστήματα διανομής

Background

- In September 1997 an Ad Hoc group invited by ESTEC met to develop a standard for a Satellite Interactive Terminal (SIT).
- The group consisted of representatives of
  - **ESA,**
  - **Eutelsat,**
  - **Hispasat,**
  - **Intelsat,**
  - **SES,**
  - **Telenor,**
  - **Telesat and**
  - **Teracom**.
- The task was to prepare for **the early provision of interactive, multi-media services** by means of complementing existing Ku-band digital broadcasting systems with Ka-band return links.
- The key development would be a **Satellite Interactive Terminal (SIT),** comprising an outdoor unit with a small antenna, low-power transmitter and integrated receiver, and an indoor unit, in the form of a set-top box or a PC card, containing the DVB decoder and the modems and control systems,
- This should interface with a home entertainment centre or a multi-media personal computer (PC) or a local area network (LAN).

Open standard

- The objective of the Ad Hoc group was to achieve an **open standard** which would allow operators to implement different service provisions with the same SIT hardware.
- In Europe there is one recognized standards organization for the field of telecommunications and broadcasting, **ETSI** (the European Telecommunications Standards Institute).
- ETSI standards are prepared by different Technical Committees (TCs). Of relevance for the standardization of the SIT two committees were
  - **TC SES**, Technical Committee on Satellite Equipment and Systems, and
  - **the JTC**, the Joint Technical Committee, which at that time had representatives of ETSI and EBU, the European Broadcasting Union. Presently, the JTC also has representatives of CENELEC, Comité Européen de Normalisation Electrotechnique. Standards in the field of Broadcasting are within ETSI dealt with by the JTC:

Incorporation in the DVB work program

- Draft version 2.9 was completed 1 April 1998.
- Standardization via JTC and preparation of the documentation by the DVB organization.
- According to the rules of procedure of this organization any activity should be approved by the DVB Commercial Module (**CM**), and the technical work by the Technical Module (**TM**) and its ad hoc groups.
- At the 32nd meeting of the Technical Module on 20 to 21 January **1999**, it was reported that an agreement on a Commercial Requirements document for interoperability of Satellite Interactive Terminals (SIT) was to go to the Commercial Module for approval

Start of work

- The Technical Module agreed to initiate a subgroup DVB-SIT to be chaired by Richard Catchpole (Nortel Networks).
- The first meeting was held at the EBU in Geneva on Friday, 5 February **1999**, and the basis of the work was document “Definition of a Satellite Interactive Terminal for use in a DVB system” Issue 1, dated December 1998.
- It was formally introduced to the meeting as a contribution by DVB member SES Astra, document DVB RCS/SIT 003, later numbered as TM RCS 003.

RCS first version

- To align with DVB titling practice, it was agreed that the group request a change of its title to DVB-RCS, i.e. DVB Return Channel for Satellite.
- After TM approval, some editorial modifications and completion of Section 6.8.2 it was sent to the DVB office as DVB-TM2267 r3. Rev14, dated **03 April 2000** and with modifications dealing with the turbo code permutation parameters (set of some new parameters and possibility to update them) was sent to DVB office for ETSI editing.
- The RCS-standard was approved according to the ETSI procedure, voting by the national standards organizations and approved as EN 301 790. It was published in **December 2000** as version 1.2.2.
- According to DVB practice a Guideline Document for the implementation of the RCS system was prepared. and finally approved by the ETSI Joint Technical Committee, JTC, for publication as an ETSI Technical Report TR 101 790, on **21 July 2001.**

DVB- RCS for use with regenerative satellites

- On **12 and 13 October 1999** a Second Ad-hoc Group was convened by ESTEC. The Mission Statement was "**to promote standardisation of terminals for regenerative satellite multimedia systems through the fostering of commonalities in the Satellite Access Terminal (SAT)".** The activities should cover both geostationary and non-geostationary satellites in the FSS and BSS. It should work with a variety of regenerative multimedia satellite systems.
- The report of the second Ad Hoc group, was presented to the DVB TM as document RCS-295, by ESA on **17/18 January 2001**. The reaction by the TM was favourable and RCS was given the task to incorporate the RSAT elements into the system. An important consideration for the updating was to maintain **"backwards compatibility".** The opportunity was also taken to incorporate some other modifications which opened for terminals which could be manufactured with lower cost, also here while maintaining the backwards compatibility.
- The revised standard **EN 301 790 v.1.3.1** was approved by the ETSI One-step Approval Procedure in **November 2002** and published in **March 2003**.
- Also the guideline Document, TR 101 790 was updated.

(3. version) Incorporation of DVB-S2

- The forward link via satellite has been based on the DVB-S standard, EN 301 421.
- New standard, usually referred to as DVB-S2, described earlier, ETSI: EN 302 307: *"Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications"*
- The DVB TM decided to initiate an update of the RCS standard to enable utilization of the new features of the second generation forward link.
- The work was completed by TM-RCS and approved by correspondence on 17 November 2003. The standard was subsequently approved by the TM on 24 November 2004. It was sent to ETSI for publication and is now approved, and **backwards compatible**.
- The Guideline Document TR 101 790 was also updated and approved the DVB TM on 16 March 2005.

Document title

ETSI EN 301 790 V1.4.1 (2005-09)

European Standard (Telecommunications series)

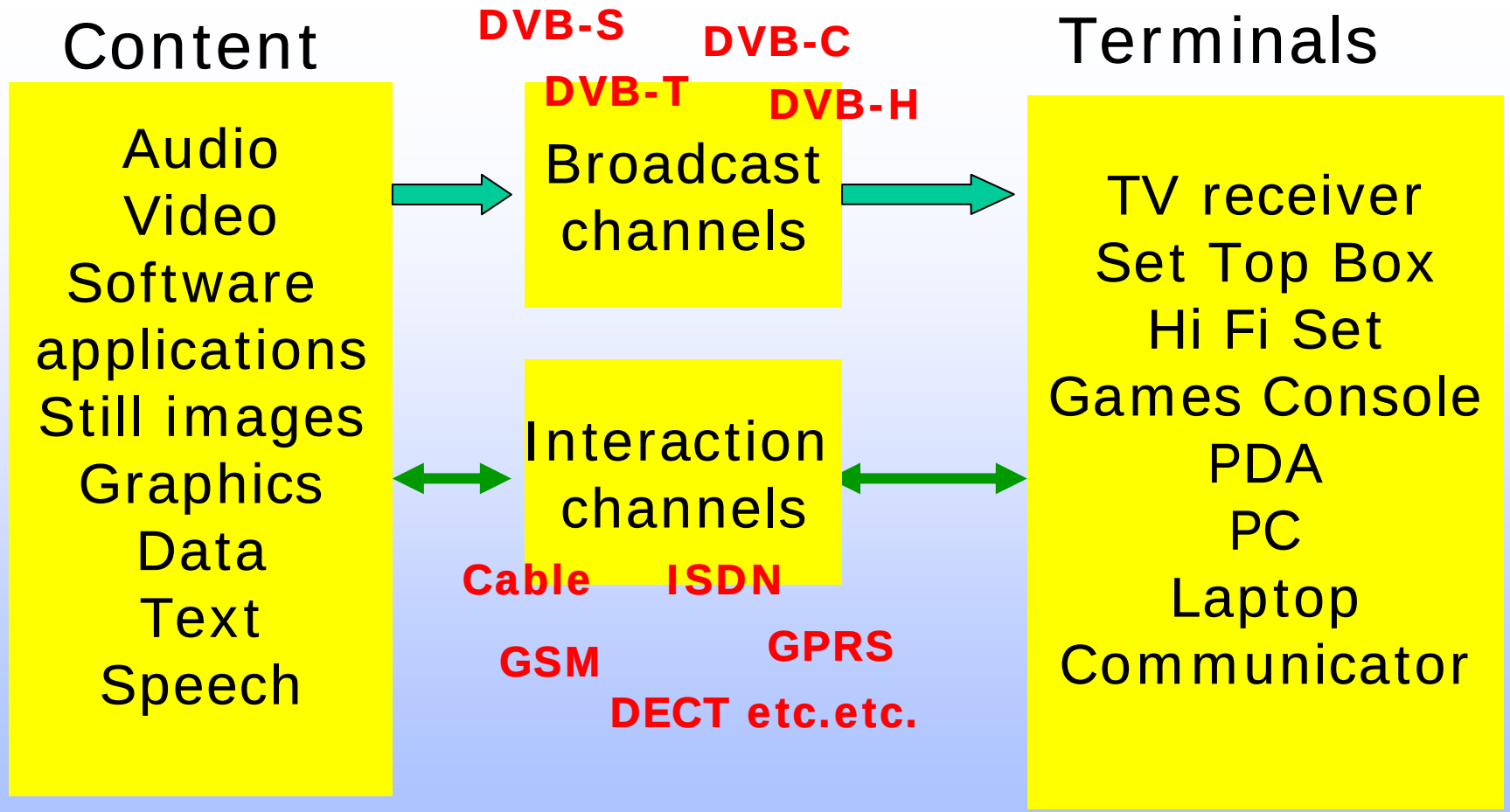
Digital Video Broadcasting (DVB);
Interaction channel for satellite distribution systems

European Broadcasting Union — Union Européenne de Radio-Télévision

EBU·UER

DVB

Broadcast systems with interaction



DVB-RCS

Where are we now?

We have a complete system for

- for interaction, using DVB-S and DVB-S2
- for meshed communications via regenerative satellites
- for certain mobile applications

Where do we go from here?

Two conflicting considerations:

The stability of the standard

- The use of new technology.
- Adaptation to new applications

A variety of mobile applications

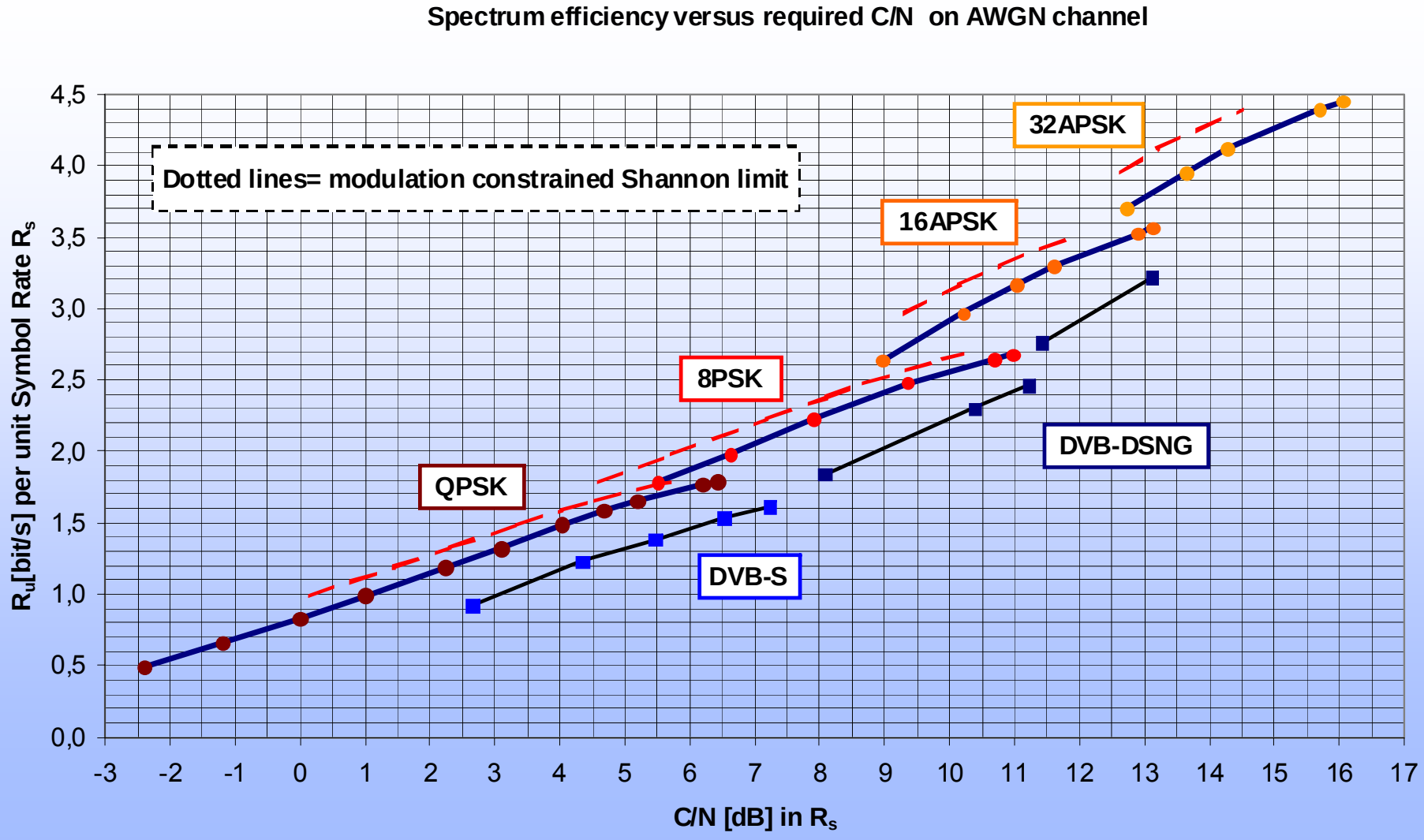
- The car market
- Bus and train (captive audience, shared use,)
- Maritime
  - Private boats, yachts
  - fishing vessels
  - public transportation, passenger ships, cruise ships, less sensitive to terminal cost and size
- Aeronautical, about 5000 equipped planes accessible market with 1,5 mill passengers
- Both civilian & Military/public safety applications

Suitability of DVB-RCS terminals already proven for mobile in some specific conditions (in particular experiments of DVB-RCS transmission on ships using Ku-band antenna on stabilised platforms have already been performed and demonstrated feasibility and performances.

THE IMPACT OF MOBILITY

- Radio frequency matters
  - Ku-band is allocated to mobile on a secondary basis
  - off-axis EIRP is a major constraint when small antennas are considered ⇒ spectrum spreading
- Physical layer
  - RCS technology well adapted to low fading. For channels with high fading, shadowing, modifications will be required
  - DVB-RCS covers most of the synchronization requirements in mobile environments
  - Doppler compensation for aeronautical applications
- Mobility management
  - DVB-RCS signaling provides enough support for mobility
  - Inclusion of DVB-S2 provides a new frame for forward link handover
  - Further considerations for return link handover

The use of DVB-S2 for the forward link



FIFTH Project

Fast Internet for Fast Trains Hosts

Alenia SPAZIO A FINMECCANICA COMPANY

TRENITALIA

UNIVERSITY OF BRADFORD MAKING KNOWLEDGE WORK

Rai

DLR Deutsches Zentrum für Luft- und Raumfahrt

CiaoLabTechnologies

RadioLabs Consorzio Università Industria - Laboratori di Radiocomunicazioni

Target: delivery of TV and Internet to fast trains by satellite (DVB-S and DVB-S2 on the forward link, DVB-RCS on the interaction link)

Channel model

- Over trains, high-cost, directive antenna with mechanical tracking may be used (Ku-band reception)
- Strong variations of the signal power
  - Multipath fading (present, but negligible)
  - Signal shadowing (partial or total)

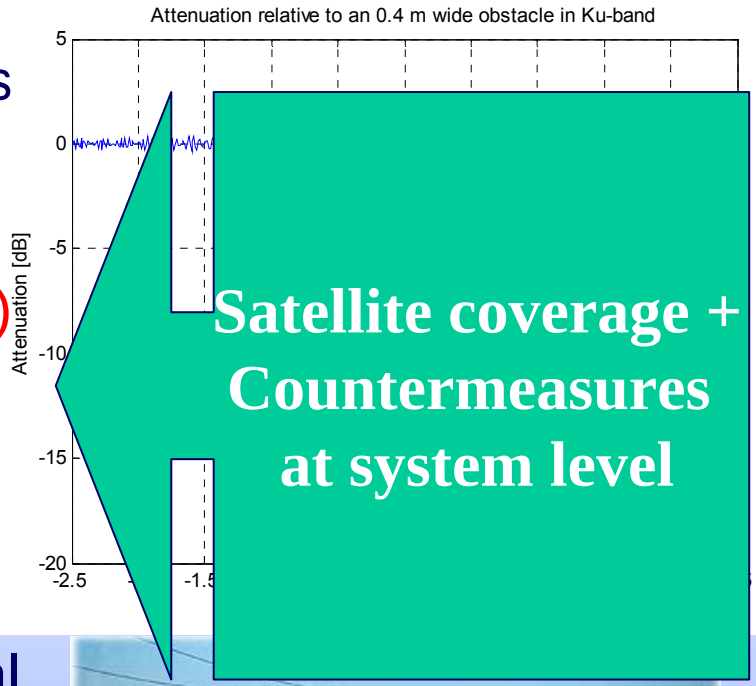
    - *Buildings*
    - *Trees*
    - *Bridges*
    - *Tunnels*
    - *Etc…*

Source: Alberto Morello

Channel model (Ku band, GEO)

- **Line-of-sight** (few dB fading)
  - rain (3-6 dB fading, few events per years, duration of minutes) and scintillation
- **Non line-of-sight** (deep fading)
  - Short (tens of ms) periodic fading due to power supply catenaries
  - Medium to long (tens of ms to tens of s) Sporadic fading. Rural and Suburban: foliage, bridges,..
  - Very Long (few s to several minutes) sporadic interruptions: tunnels, hills, houses

Source: Alberto Morello



Satellite coverage + Countermeasures at system level

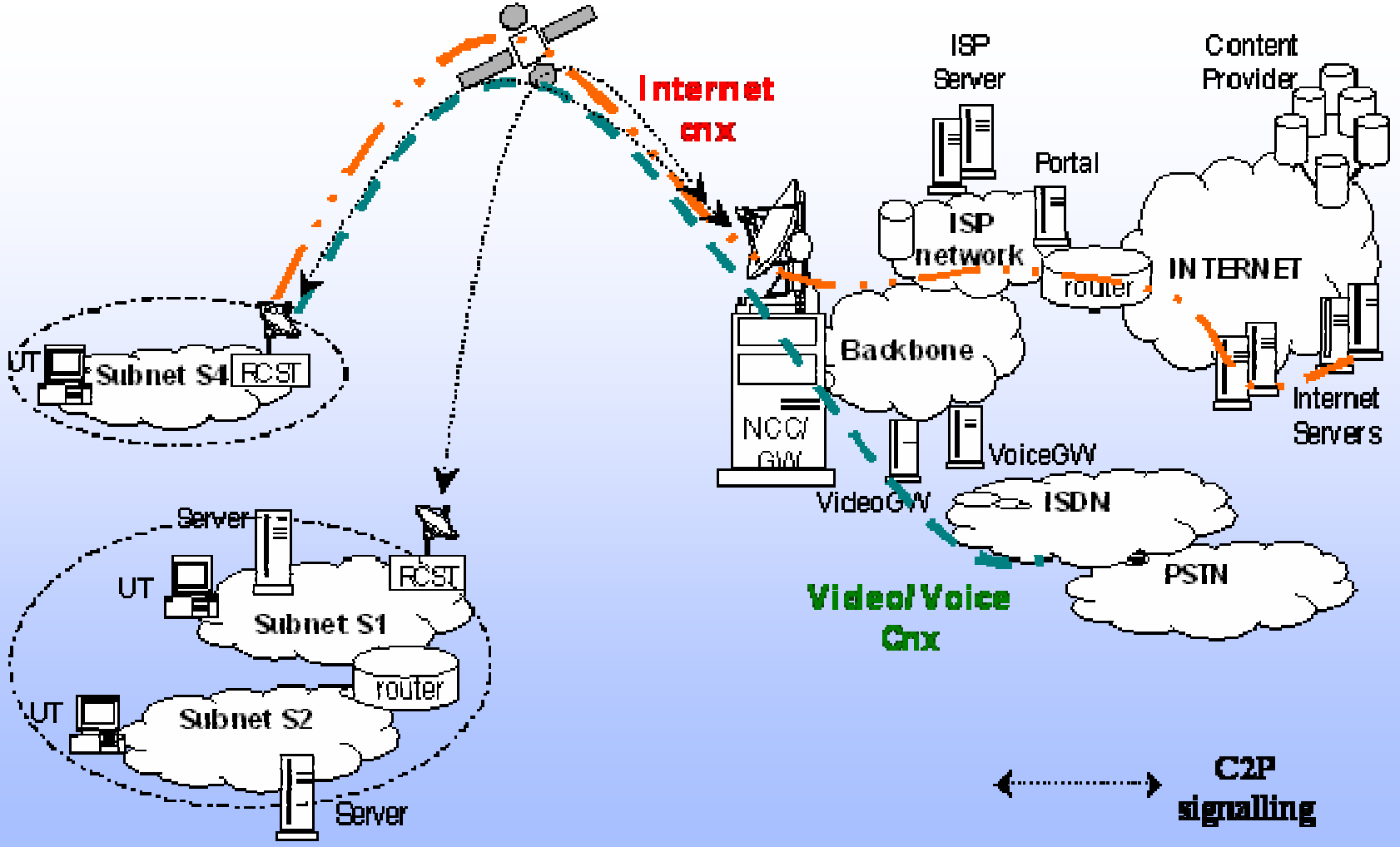
Terrestrial coverage: DVB-H Wireless-LAN

Possible use of a DVB-RCS Connection Control Protocol

Enhancement of the control plane of DVB-RCS systems by:

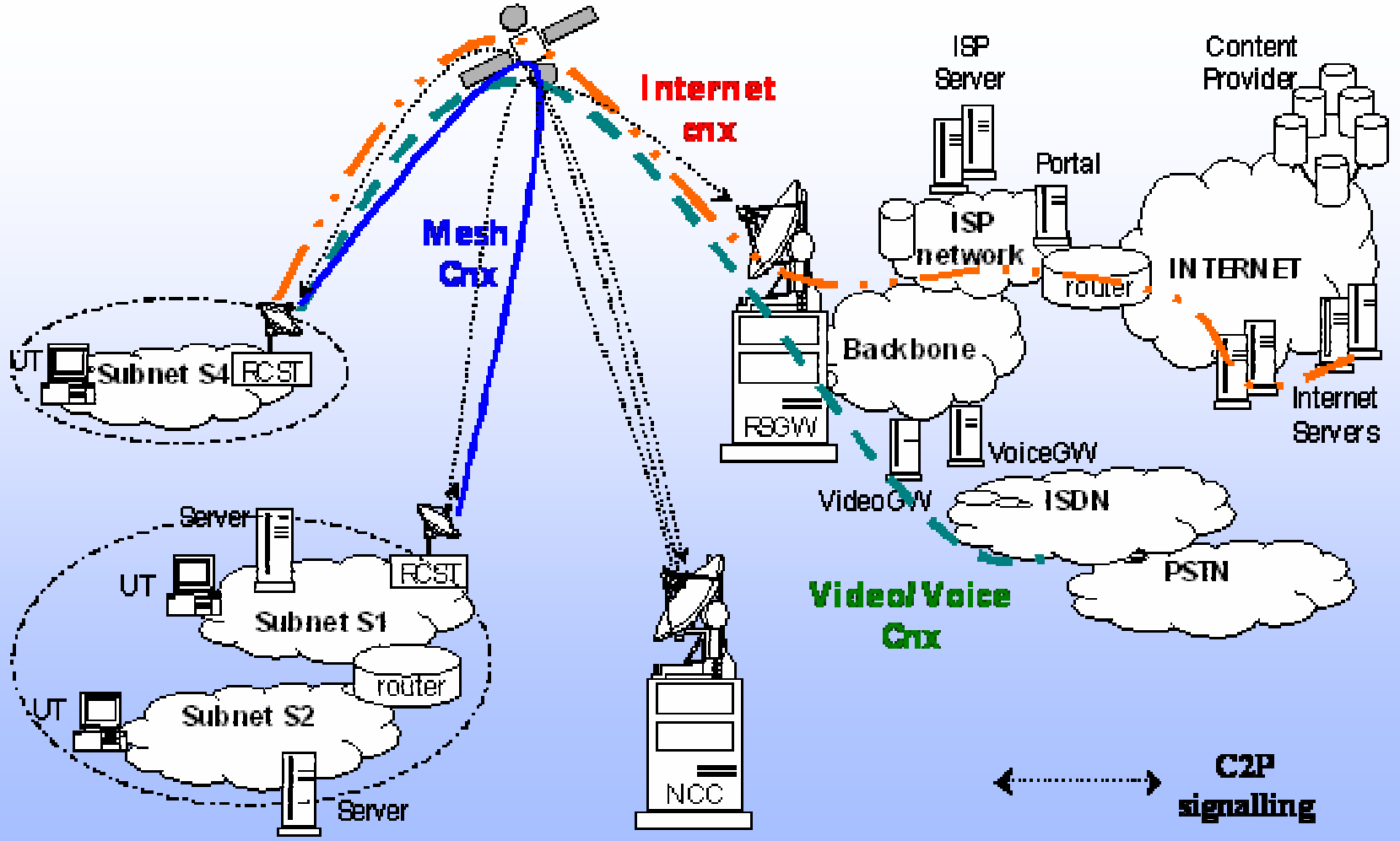
- Dynamic control of the set of communicating parties in mesh and star communications
- Quality of Service driven dynamic allocation of bandwidth resources to communications
- Dynamic allocation of PID and VPI/VCI
- Configuration of the Route_ID
- Assignment of the Channel_ID
- Identification of the destination hub in multi-Gateway configurations

Scenario 1: Star Transparent Networks



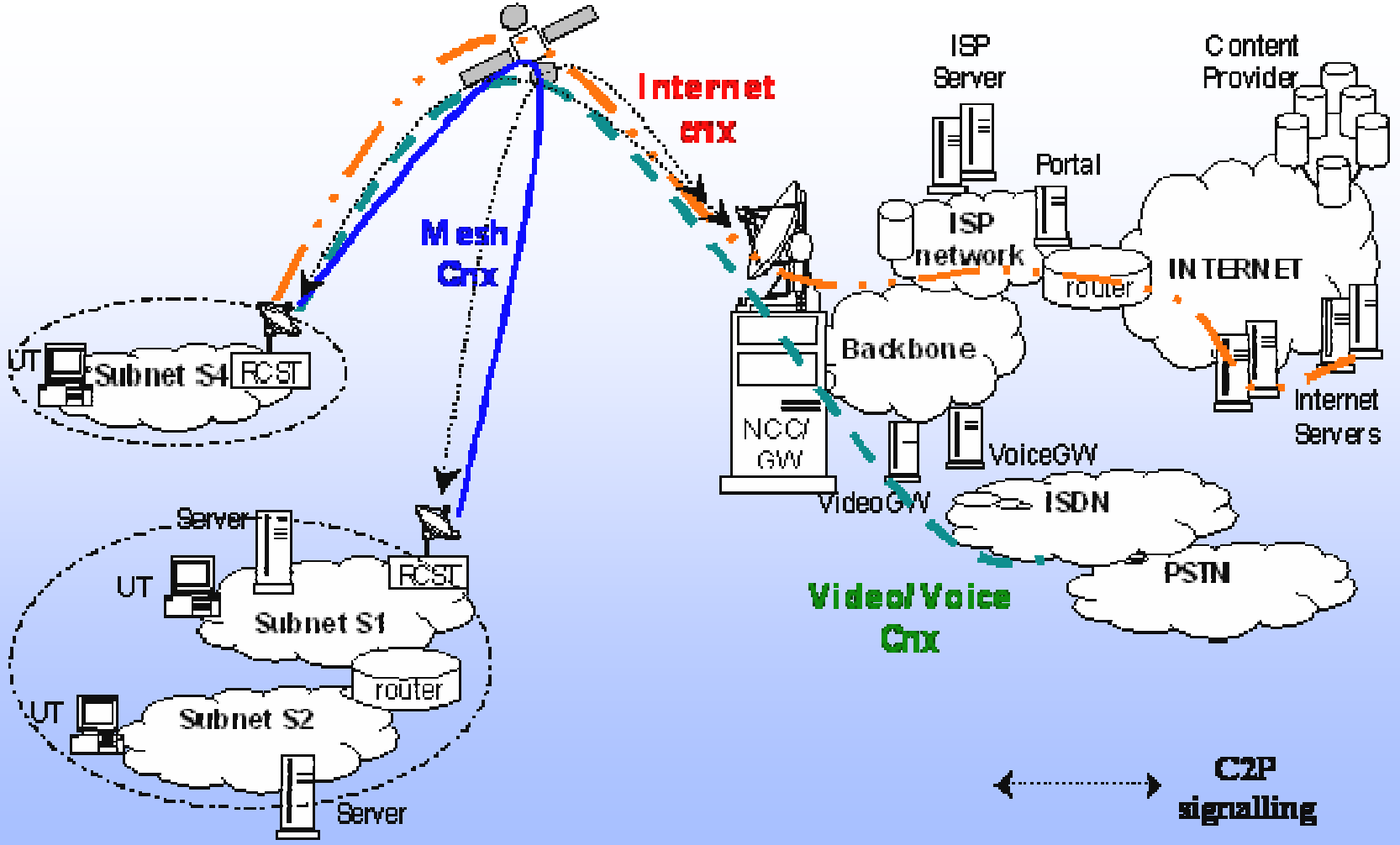
Source: Viasat

Scenario 2: Star / Mesh Regenerative Networks



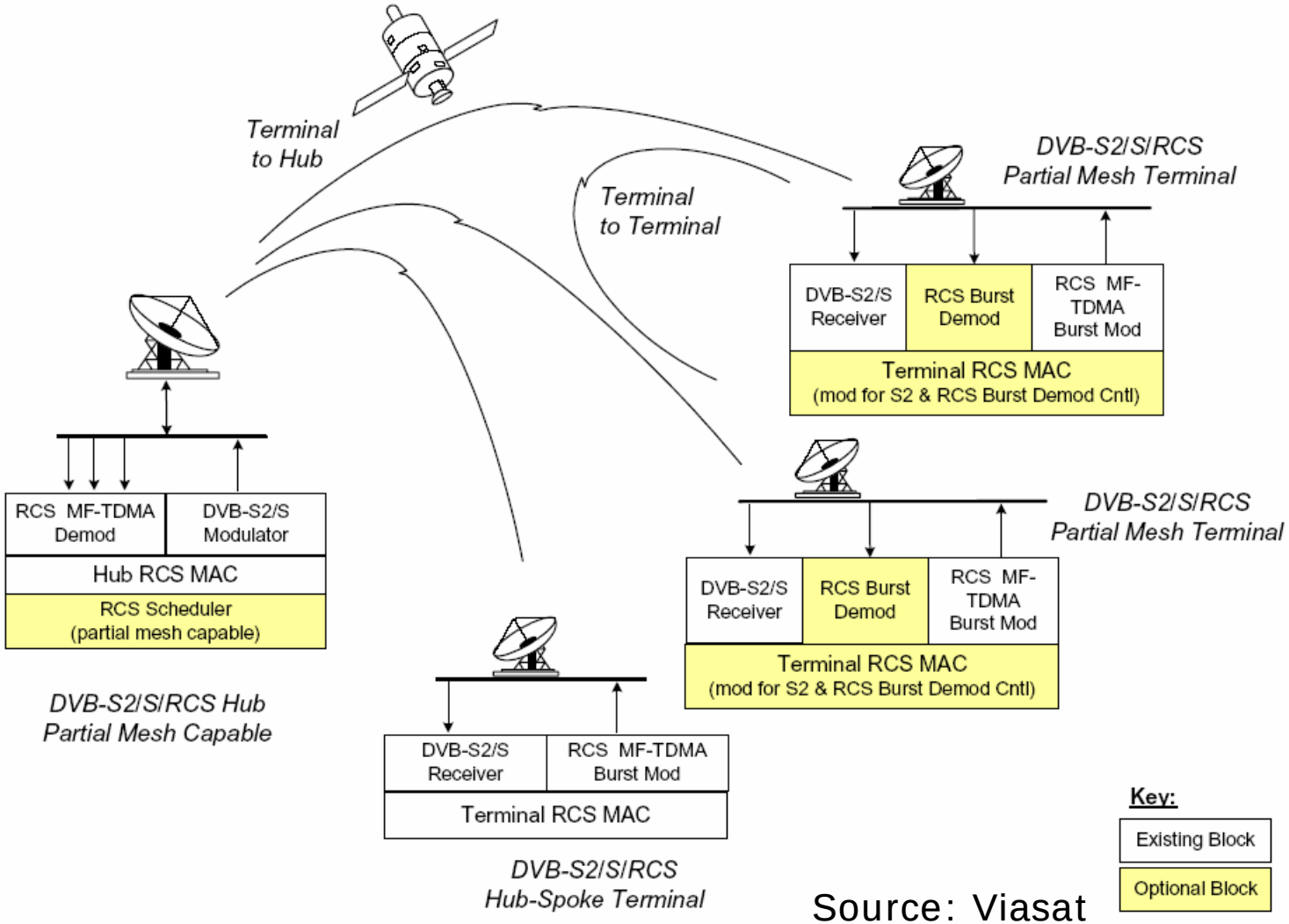
Source: Viasat

Scenario 3: Mesh Transparent Networks



Source: Viasat

Hub-Spoke and Peer-to-Peer



Source: Viasat

How to proceed

- DVB is commercially driven
- Modification of the standard will only take place following a decision by the DVB Commercial Module, DVB-CM