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The ultimate interactive satellite standard?

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By Stephen Cousins

The second generation interactive satellite system, DVB-RCS2, has been developed to target the consumer market, but are its boosted performance, new IP features and cheaper equipment strong enough to rival proprietary technologies, asks Stephen Cousins

Digital Video Broadcasting - Return Channel via Satellite 2 (DVB-RCS2) is the next generation of the interactive on-demand multimedia satellite communications system first introduced in 2000 by the DVB consortium.

Still the only open multi-vendor platform for interactive services, the system is natively developed for IP services and features new operational modes, faster transmission, strengthened integrity control, enhanced security and improved quality of service system architecture.

Earlier this year, DVB approved the first three of four specifications for DVB-RCS2 (named Second Generation DVB Interactive Satellite Services), which have been submitted to the European Telecommunications Standards Institute (ETSI) for formal standardisation.

Significantly, DVB claims the inclusion of Continuous Phase Modulation (CPM) technology in the standard will enable the use of cheaper amplifier components in modems, making the technology suitable to build cost-effective terminals for the high-volume consumer market. Its status as an open interoperable standard could also help satellite and network operators to mitigate the risks of being tied to a single vendor. However, some claim DVB-RCS2 is destined for the same fate as the first generation, which failed to achieve success beyond smaller professional and military networks, and that proprietary developed systems offer greater added value to customers.

Antonio Acidiacono, director of innovation at Eutelsat, says he can't see a consumer market for the technology: "Ten years of research and development has meant improvements to the transmission system, but even these are not revolutionary... What's crucial is that DVB-RCS2 is be able to deliver the economies of scale associated with producing hundreds of thousands of terminals, but the interest is just not there yet. We are likely offer it to customers for VSAT applications, closed user groups, or limited scale deployments where the impact of buying smaller numbers of terminals is not so great."

The first generation, DVB-RCS, was developed by the DVB Project, an industry-led consortium of broadcasters, manufacturers, network operators, regulatory bodies and others, set up to promote standards within the industry. The standard was designed to enable two-way radio communications between satellites and end-user terminals via a forward and a return channel, effectively creating a satellite-based ADSL data link without the need for the land-based cables.

It defines a complete air interface specification for a two way satellite broadband scheme utilising VSAT and has undergone several modifications, the most significant being the introduction of DVB-RCS+M, which added support for a variety of types of terminal including mobile and nomadic terminals.

In the intervening years, changes to physical layer techniques and the stabilisation of IP standards highlighted the need for more fundamental changes to DVB-RCS, which the DVB Project decided could only be implemented in a consistent way by defining a second generation system.

Another main driver was to develop cheaper modem technology for use in the consumer market says Harald Skinnemoen, chairman of the Technical Module for DVB-RCS2: "DVB-RCS has been strong with governmental and military services, but it hasn't been a big hit with the consumer market. The imperative to create a technology that could succeed in the consumer market was one of the commercial requirements for the new standard."

Enhancements and improvements

The four formal ETSI specifications for Second Generation DVB Interactive Satellite Services are: TS 101 545-1 'Overview and System Level Specification'; EN 101 545-2 'Lower Layers for Satellite Standard'; TS 101 545-3 'Higher Layers for Satellite Specification'; and part four will follow later and include guidelines for implementation and use.

The standard defines the MAC and physical layer protocols of the air interface used between the satellite operator hub and the interactive user terminal as well as the network layer and the essential functions of the management and control planes of the terminal.

A major enhancement is the inclusion of advanced Adaptive Coding and Modulation (ACM), which optimises modem performance to match available capacity. ACM allows more granular and flexible just-in-time timeslot adaptation to

boost capacity and availability by up to 40% over the first generation system, says Skinnemoen. The forward link modulation scheme is DVB-S2, and the return link modulation schemes are CPM, QPSK, 8PSK and 16QAM.

In addition, recent coding developments have enabled the creation of a 16-state turbo code for QPSK, 8PSK and 16QAM, further increasing performance.

As well as linear signals, DVB-RCS2 can also handle non-liner signals by utilising Continuous Phase Modulation (CPM), which requires cheaper amplifiers than linear technology and may result in lower cost terminals. A DVB study found comparable QAM/CPM performance up to about 1.5 b/s/Hz with a stable amplifier, while instabilities made CPM relatively better.

DVB-RCS2 supports IP version 6 (IPv6), and utilises Generic Stream Encapsulation (GSE) on both the forward and return link to dramatically reduce levels of encapsulation and improve efficiency. Unlike the traditional MPEG Transport Stream, GSE fragments packets of IP audio, video and data just in time so they fit exactly onto large or small free transmission payloads, without the intermediate fixed ATM or MPEG TS layer.

This DVB-native carriage of IP significantly reduces required overhead comp-ared to MPEG TS, says Skinnemoen: "GSE gives you more flexibility in terms of how you define your transport layer. It means you can adapt lower layer parts more efficiently to the actual traffic. It's one of the major strengths of DVB-RCS2 that it has this flexibility to adapt to almost any kind of application from low rate data to powerful government services."

Improvements to higher layer specifications include better security, the result of a careful review of all technologies and overall architecture to help guarantee confidentiality, integrity and non-repudiation performance. The quality of service (QoS) system architecture has also been enhanced, with support added for cross-layer optimisation and performance-enhancing proxies. A future update will add mesh and mobile specifications realised in the platform DVB-RCS+M.

Although the DVB-RCS2 standard has yet to be approved by ETSI and it may be a couple of years before we see enabled terminals on the market, it is already causing excitement, claims Skinnemoen: "I have a feeling people are happy with it. The next generation Inmarsat satellite system's developer iDirect has been very involved with work on DVB-RCS2 and it will now take the lead on integrating the mobile specification. SES Astra has also taken part and has openly said the stand-ard is what the world needs right now."

The performance enhancements achieved via CPM are a technological leap ahead of the previous generation, adds Tom De Baere, communications director at Newtec: "The linear modulation used in DVB-RCS required a certain power backoff in order to prevent distortion, which inherently made the material used for the transmitter and indoor terminal equipment more expensive to produce as they had to produce more power. The CPM scheme is much more efficient."

Shaking off a bad reputation

However, DVB-RCS2 may struggle to shrug off the first generation's reputation as a technology for smaller networks he adds: "They are playing to a different market segment, we operate large networks with thousands of terminals, but DVB-RCS is focused on smaller networks with higher requirements in terms of layer 2 and 3 functionality, which is suitable for specific markets like the military."

It's a sentiment shared by Doron Elinav, VP of business development at Gilat Satellite Networks: "DVB-RCS had a lot of backing in its early days with satellite operators, service providers and government agencies promoting it, but over time support weakened. Ultimately the success of the second generation will depend on whether satellite operators and service providers prefer an open standard over proprietary products. If an anchor customer stands firm on the requirement of DVB-RCS2, then the standard will have a huge impact on the market."

Interoperability has its advantages - larger volumes of amplifiers and antennas can be produced, driving down the cost of hardware, and operators get to mitigate the risks of having to rely on a single terminal vendor. And with around 30 organisations across the industry working on DVB-RCS2's development, the technological advances are likely to be much greater that those made at individual companies, says DVB's Skinnemoen: "Technical teams at individual satellite

companies are relatively small compares to those in the 3G world, for example. The likelihood is you achieve something better with more contributors. Most universities also utilise DVB-RCS as a common reference."

Speaking with those involved in the development of RCS2 reveals a conflict of interests that could ultimately determine the fate of the open standard. Satellite operators such as Eutelsat, Astra and Newtec have all shared their knowledge and expertise to further the standard's development, yet each simultaneously fights to distance itself from it and promote a stand alone proprietary product.

But creating a business model based on the incompatibility of technology isn't the right solution, argues Skinnemoen: "The satellite market is very small, so if one operator allows the possibility for other to compete with their network, they effectively destroy the business case for everyone. I'm not a strong believer in that. You can still differentiate and preserve those markets whilst utilising a common satellite technology like DVB-RCS2.

Today's situation is similar to the regional codes introduced to DVDs in China, Europe and the US to prevent them from functioning outside of each region. It was costly and unnecessary."

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