SatNet DVB-RCS vs. Proprietary VSAT Systems

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1. INTRODUCTION

The VSAT systems considered in this brief paper, from SatNet and from vendors offering a proprietary system, support satellite-based fixed broadband access networks ranging from consumer–oriented to professional and enterprise models. The SatNet system is one of the community of DVB-RCS compliant vendors which are participating in the DVB-RCS and SatLabs forums to support standards evolution (such as the recent inclusion of DVB-S2) and ensure interoperability between their systems. Proprietary systems are either based on TDMA technology or MF-TDMA technology (this varies from vendor to vendor); they come with limited resource allocation performance and without the possibility of being interoperable with any other vendor.

2. SATNET DVB-RCS KEY FACTS

Some key facts about the SatNet DVB-RCS VSAT products are noted in this section:

- **Current State of the DVB-RCS Standard**: proponents of the standard, which includes SatNet, are on the verge of achieving true, meaningful interoperability at all communications layers; this is building on the success achieved in the last 6 years at the physical and data link layers. In some systems, the flawed argument of leveraging off a terrestrial technology is made, but significant portions of the terrestrial technology had to be re-designed for use over satellite. On the other hand, DVB-RCS was designed from the ground up to support all IP applications as effectively as proprietary systems and in most cases, even more effectively.
- **Actual Speeds**: SatNet equipment is just as fast on the Return Link and significantly faster on the Forward Link than all other systems; the speed has been assessed where it matters, i.e. at the user network interface level (i.e. Ethernet) and takes into account the processing capability of the terminal equipment.
- **Private Networks**: SatNet's approach to assign capacity to terminals according to quality-of-service rules and priorities, allows efficient sharing of capacity while still preserving the system resources and security aspects between private networks. Alternatively, it can assign fully dedicated capacity to each private network both on the outbound and inbound, if required, thereby creating a "fully" private network, as some of our competitors may wish to call it.
- **Secure Communications**: SatNet can accelerate TCP/IP traffic by using performance enhancement proxies (PEP) together with the protection of encryption.
- **QoS/VoIP**: SatNet equipment allows the management of QoS (Quality of Service) at both the terminal level and the system level. SatNet terminals can prioritize high priority traffic such as VoIP in a number of ways, depending on the Service Level Agreement (SLA) established by the operator for each terminal. Some proprietary systems offer limited quality of service capabilities – designed for consumer "best effort" services.
- **Low Operating Costs**: any system using a proprietary outbound requires an entire new carrier for any outbound VSAT traffic, whereas a DVB-RCS system can piggy-back incrementally on and/or statistically multiplex with any existing DVB-S/S2 carrier. Proprietary systems were designed for specific applications, such as small, bandwidth wasteful, military type networks at one extreme, and throughput and performance limited consumer type networks at the other extreme. Scalability costs and the stability of scaled solutions were instituted in SatNet's Hub design right from the start.

3. SATNET ADVANTAGES

Key advantages in favour of the SatNet DVB-RCS solution are:

(a) **Open Standard Solution:** SatNet's solution features open standard DVB-RCS equipment, which means that customers benefit from having multiple vendors for both Hub and Terminal equipment, capable of interoperating with equipment offered by SatNet. In addition, SatNet's solution uses a standard DVB-S and now DVB-S2 outbound transport stream, thereby leveraging the customer's existing infrastructure when based on the DVB standard.

(b) **Bandwidth Efficiency**: SatNet's solution offers unrivalled bandwidth efficiency, thereby minimizing recurring operational costs for the customer. Compared to some proprietary solutions, SatNet offers:

a. Ability to use existing DVB-S/S2 outbound transport stream, which could save on the order of 3MHz or more compared to non DVB-S/S2 systems – There is no need to add another outbound carrier to handle 2-way remote terminal synchronization, assuming that the customer already operates a DVB carrier.

b. Statistical multiplexing of bandwidth on the outbound carrier, where any bandwidth not used for video at any given time can be used as additional shared capacity for any two-way data service operating over the same carrier.

c. Dynamic bandwidth allocation scheme on the inbound carrier(s), which allocates and released bandwidth per remote terminal, according to the needs of each remote terminal – Competitor solutions will likely require a fixed amount of bandwidth to be dedicated to each terminal in order to guarantee performance for VoIP, costing on order of 2MHz of additional capacity.

d. Ability to schedule events in advance that will allow more dynamic allocation of bandwidth for different sites based on each event's requirements.

e. Real MF-TDMA on the inbound carrier(s), with the bandwidth reallocated based upon rules and demand 40 times per second – Pseudo-MF-TDMA and TDMA Terminals from proprietary systems re-assign bandwidth much less dynamically and from one return link carrier to the next – not slot-by-slot sharing of inbound carriers like in DVB-RCS. SatNet's MF-TDMA is up to 25% more efficient than other systems.

f. Adaptive carrier rates on the inbound will allow more throughput per MHz on the inbound during clear sky conditions – In other systems, one typically has to calculate link budgets with worst case rain fade, and therefore have to limit system performance to this worst case or budget for larger and more expensive terminals.

g. Full DVB-S2 implementation: DVB-S2 is 30-40% more bandwidth efficient on the outbound thus achieving even higher efficiency.

(c) **Scalability**: SatNet's solution offers low-cost scalability options:

a. Multi-carrier demodulator (MCD): Where the Hub offering of several proprietary systems (and some DVB-RCS ones as well) needs a card for each return link carrier (or a very limited number), SatNet can pack up to 96 return link carriers into a single card. SatNet can demodulate up to 480 carriers with 1:1 redundancy in a single-rack system. Not to mention, that same card can simultaneously demodulate at different return link bit rates. No matter how SatNet competitors decide to price their products, they cannot hide the fact that several racks of equipment would be required to even come close to this kind of capacity. Therefore, any of SatNet's competitors would be much more expensive in delivering this scale of Hub.

b. Multi-beam: SatNet's system is designed for modularity, meaning that for a modest additional cost, a single Hub can support multiple beams (at the same or different frequencies) on a single satellite.

c. Multi-satellite: SatNet's system can support three completely independent satellites from the same Hub for a modest additional cost, thereby potentially providing hemispherical coverage from a single Hub and increasing the potential return on investment for the Hub.

d. Terminal population: SatNet can scale its Hub to support thousands of Terminals, without any additional software license costs.

e. Hub cost: SatNet offers a Pay-as-You-Grow™ approach which allows service providers to grow their satellite system as they expand their network and the number of remotes. This allows customers to start with a low-entry cost system, either DVB-SCPC or DVB-RCS. SatNet's Hub product range now effectively ranges from tens to tens of thousands of terminals. Some proprietary systems were designed and promoted only for large network sizes (ie. several 1000's of SITs), others only for small systems (up to 50 SITs).

f. In contrast to SatNet, several other systems have no provision for site diversity.

g. The IDUs of many other systems cannot power a 4-watt ODU, whereas SatNet's IDU can.

(d) **Lower Operating Costs**:

a. All of the advantages stated above translate into lower operating costs for the customer.

b. Interoperability of all SatNet Terminal models. This is often not be the case with other systems.

c. SatNet has no hidden costs in the price at which we sell our Hub and Terminal products.

(e) **Higher Availability**:

a. SatNet's Hub supports hitless hot redundancy compared to, what appears to be, a cold redundancy approach to which several of our competitors are limited to. This means service interruptions and unknown times to repair.

SatNet has deployed over 50 systems worldwide, and several thousand of remote terminals, over the last 5 years. SatNet has a world-class systems engineering team that can help optimize product configurations for customer needs. DVB-RCS has deployed almost 100 systems worldwide, and almost 20,000 remote terminals, providing a collective experience easily surpassing that of many of the other systems. Further, DVB-RCS benefits from an R&D pool that includes all of the world's major broadcasters, whereas technology advancements with proprietary systems rely on the success of a single private enterprise.

Appendix
An illustrative cost savings example made possible by SatNet's hub implementation

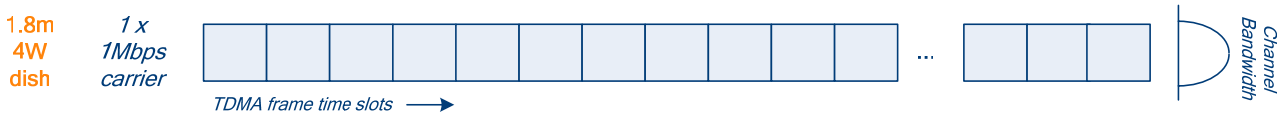
The following provides an illustrative example of remote terminal and hub equipment cost savings made possible by deploying a SatNet DVB-RCS system; this illustrates the low cost scalability advantage of the SatNet solution. Refer to the figure below and the accompanying explanation further.

Scenario 1: 10 terminals, 1Mbps total inbound

Implementation #1: 100kbps average, 1Mbps peak per terminal

Competition: 1 line card, 1Mbps carrier, DAMA rules are applied similarly

SatNet: 1 demodulator card, 1Mbps carrier, DAMA rules are applied to manage the available bandwidth (CIR, etc.)



Implementation #2: 100kbps average, 256kbps peak per terminal, 6dB improvement in the inbound link budget

Competition: 4 line cards each supporting a single 256kbps carrier, DAMA rules ...

SatNet: a single demodulator card supporting 4 x 256kbps carriers, DAMA rules ...

Note: competition does not support dynamic MF-TDMA.

Scenario 2: multiply by 8: 80 terminals, 8Mbps total inbound

Implementation #1: 100kbps average, 1Mbps peak per terminal

Competition: 8 line cards each supporting 1Mbps carrier, DAMA rules ...

SatNet: a single demodulator card supporting 8 x 1Mbps carriers, DAMA rules ...

Implementation #2: 100kbps average, 256kbps peak per terminal, 6dB improvement in the inbound link budget

Competition: 32 line cards each supporting a single 256kbps carrier, DAMA rules ...

SatNet: a single demodulator card supporting 32 x 256kbps carriers, DAMA rules ...

Scenario 1:

Looking at an initial scenario where there are 10 user terminals sharing a 1 Mbps inbound channel. The implementation which would be recommended by the competition is to run the inbound channel at 1 Mbps to minimize the number of line cards. The alternate implementation for this same capacity is to divide this into 4 channels of 256 kbps each. The same aggregate is reached, but the peak is reduced to 256 kbps. This is probably a reasonable peak at this loading anyway. The advantage to the customer is 6 dB of EIRP requirement knocked off of the BUC and the antenna. Shown here is a 1.8m/4W going down to a 1.2m/2W. The SatNet system does not lose any efficiency here and the hub does not require any additional hardware. The exact same amount of bandwidth is still available. The competition's system can accomplish a similar configuration, but it comes at a price: the competition has to add 3 more line cards at >$20,000 each (?); further, they do not actually support full dynamic MF-TDMA on the fly.

Scenario 2:
The previous scenario is multiplied by 8. There are now 80 user terminals sharing 8 channels of 1 Mbps each on the inbound. The implementation which would be recommended by the competition is to run 8 simultaneous channels at 1 Mbps in order to minimize the number of line cards. They would probably argue for an even higher bit rate, driving the SIT size up even higher. The alternate implementation for this same capacity is to divide this into 32 channels of 256 kbps each. Similar to scenario 1, the same aggregate is reached, but the peak is reduced to 256 kbps. Once again, the advantage to the customer is 6 dB of EIRP requirement knocked off of the BUC and the antenna. Shown here is a 1.8m/4W going down to a 1.2m/2W. SatNet's system doesn't lose any efficiency here and the hub does not require any additional hardware, while the exact same amount of bandwidth is available. The competition's system can accomplish a similar configuration, but with the obvious drawback of putting in 8 line cards in 8 x 1Mbps implementation ($$) and 32 line cards (!) in the 32 x 256 kbps implementation ($$$).

In conclusion, as the network size expands, the obvious scaling advantages of SatNet become very clear: Combined with the ability to reduce SIT costs without impacting hub costs on the SatNet system must drive the customer to the conclusion that the SatNet system is much more efficient for any network above 10's of active terminals.