



**ViaSat**

Malcolm Warren, Regional Director for Asia at ViaSat Inc., explains how in today's satellite industry market demands drive satellite networking and terminal technology.

serving an evolving market

# via satellite

▶▶ **The world markets** are changing in customer type, available spending power per capita, and overall numbers. This change requires significant corresponding changes in satellite networking design and technology to address these markets, and a focus on a path into a new generation of technology that will help enable their growth.

For years most satellite terminal manufacturers have left it to their customers to figure out the best

way to use the boxes they produced. Features that looked cool in the lab were packed up into a chassis and pushed out to the market. Whether those features made sense to customers was not always well understood or even carefully considered in the haste to produce.

Fortunately, the market is now shifting in favour of enterprises and consumers. New, innovative satellite communication systems are available that cater to the applications they want to implement and the economic goals they need to meet to be successful.

"The concept that one system, or one standard, can address the diverse needs of the consumer, business, and mobile marketplace is not realistic," says Mark Dankberg, Chief Executive Officer (CEO) of ViaSat Inc. and last year's Satellite Executive of the Year. "The most successful route is to tailor the technology to the specific application and business requirements of the customer."

Let us look at some of the ways new satellite terminal technology is evolving to meet the needs of customers.

**Meeting the wide adoption of IP networking**  
With Internet Protocol (IP) as the dominant protocol for networking, the huge Research and Development (R&D) resources behind the terrestrial networking industry pushed its technology ahead of the satellite world. To compete, satellite terminals must include the

"The real source of market promise is not the wealthy few in the developing world or even the emerging middle income consumers. It is the billions of aspiring poor who are joining the market economy for the first time."

C.K. Prahalad, Harvey C Fruehauf Professor of Business Administration and Professor of Corporate Strategy and International Business, University of Michigan Business School



same features that terrestrial customers have come to expect, at similar costs. Of course in some instances, there is no terrestrial alternative, but those instances are shrinking as the developing world implements more fibre and wireless connectivity to its cities, towns, and villages.

Efficient broadband or thin route communications, Quality of Service (QoS), secure Virtual Private Networks (VPNs), quality Voice-over-IP (VOIP) performance, and fast access to the network without latency are key customer expectations that satellite networks must provide.

New satellite systems combine broadband access and a high-speed return channel to satisfy bandwidth-intensive applications. These new systems combine techniques such as Dynamic Bandwidth Resource Allocation, Application Specific Bandwidth on Demand with guaranteed QoS - and Transfer Control Protocol (TCP) acceleration features for more operational efficiency, lower operating costs, and higher speed compared to Time Division Multiple Access (TDMA) systems using older technology. These networks can automatically increase the speed of the return channel as long as required, to give customers the throughput and response they need, which is ideal for VoIP applications as well as infrequent large file transfers. The technology enables operators to run a network with less satellite bandwidth, reducing the cost of entry to satellite communications by saving upfront costs in leasing transponder capacity.

But maximum bandwidth or data speeds are not always a requirement. With all of today's emphasis on broadband, yesterday's equipment vendors may have forgotten completely about thin route applications. Actually thin route data is still a very real market and

need among many customers. The most advanced satellite terminals feature new technology for slotted Very Small Aperture Terminal (VSAT) Random Access Scheme [ALOHA] small slot size CIR that enables low bandwidth applications to have immediate access to the network, minimising latency. Slotted ALOHA operation is particularly suited to transactional applications such as lotteries, Point Of Sale (POS), remote telemetry (oil/gas pipelines), equity trading, fuel filling stations, and Automated Teller Machines (ATMs).

Another challenge facing operators of complex networks is managing multiple Virtual Local Area Network (VLAN) endpoints. In these complex networks, service providers may support several end customers from a single remote terminal. Examples of this type of topology can be found in office buildings, oilrigs, shopping centres, cyber cafes, and ad hoc networks such as those used by the media, construction industry, and trade shows. In these networks, each customer wants and expects a private connection to the 'home office' just as they would in a hardwired building. Innovative

*A SKYLink antenna.*

*Photo courtesy of ViaSat*

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VSAT products can accomplish this 'VLAN tagging' of packets by integrating new IEEE 802.1Q protocol extensions and Dynamic Host Control Protocol (DHCP) relay features to interface with standard terrestrial switches and routers, enabling satellite technology to seamlessly interface with IP Multi-Protocol Label Switching (IP-MPLS) VPNs.

These 'multi-tenant' VPNs are completely secured from other customers' services routed by the same VSAT hub and automatically authorize users as they log in and request access to network resources. Each customer can receive their own custom level of privacy and service. These types of features are very important for service providers that need to host multiple customers' private networks from a common hub, while retaining their individual identification for routing packets to each of the hosted clients.

When researching potential VSAT vendors, customers should always look for other features that match up with standard attributes of their terrestrial networking equipment.

#### Hubs sized to fit any network

For hub-spoke ('star' architecture) VSAT systems the basic rule for hubs used to be 'one-size fits all.' For large systems with thousands of remote installations, the typical US\$1 million to \$500,000 investment made sense, but what about smaller networks? With terminal and satellite bandwidth reducing in costs, satellite communications seemed to be within reach of more customers, but often the network hub investment continued to be a stumbling block.

Hubs now come in a variety of sizes and types, with prices at affordable levels as low as \$100,000. These scaled-down hubs come in a single-rack design and are limited to 250 or 500 network nodes, but include all the same options for fast return link access, bandwidth efficiency, user-friendly network management, IP acceleration, and networking. Direct Video Broadcasting-Return Channel via Satellite (DVB-RCS) compliance is also available as a software upgrade option. These scaled down hubs can be upgraded simply to a full sized hub that can support up to 10,000 sites.

#### Competing with terrestrial consumer broadband

Perhaps the most obvious case of the new customer orientation in satellite terminal design is that of providing broadband Internet to consumers. Trying to fit old VSAT technologies into successful service provider business models has failed more than once because old technology failed to address several of the key cost drivers. Namely costs of customer premises equipment (modem), satellite bandwidth, customer service, and network operations.

Instead, a new approach looked at the business model first, then developed the satellite ground system to make that model a viable reality. Even with the considerable resources and sound technology behind the move to adopt DVB-RCS as the one satellite networking open standard, customer demand for performance and low-cost have been the fuel and engine behind the emergence of a new Data Over Cable Service Interface Specification (DOCSIS®) - for-satellite consumer standard. Network providers have determined that they must be able to compete on price and service with terrestrial alternatives such as Digital Subscriber Line (DSL) and cable modems and scale this for very large networks numbering in the tens or hundreds of thousands of network nodes.

The DOCSIS-for-satellite broadband system, based on the widely adopted coaxial cable modem standard, is available for both Ku- and Ka-band operation. ViaSat's SurfBeam® broadband system, developed in conjunction with US consumer broadband provider WildBlue, is the only DOCSIS-based product on the market, with a new third generation DOCSIS satellite modem now entering production. Major operators including WildBlue, Intelsat, Eutelsat, Telesat, and SES Americom, along with several service providers around the world, have lined up behind the technology. Over 170,000 terminals are on order to date and initial installations have been operating in the field for over one year.



The primary way that DOCSIS brings a new set of economics to broadband-by satellite is by building around third and fourth generation products developed for the cable modem and Direct-To-Home (DTH) satellite markets. Consequently, DOCSIS can be deployed with mature Operating Support System (OSS) and Broadcasting Satellite Service (BSS) systems offering automated service management, provisioning, customer service representative support, customer troubleshooting, billing, and more. Highly integrated and high-volume production chipsets greatly reduce the costs of the indoor Satellite Modem (SM).

Recently ViaSat has begun delivering an enhanced SurfBeam system that will increase system capacities even further. The DOCSIS hub, called the Satellite Modem Termination System (SMTS), features a new 'blade' design whereby each blade provides eight return channels (upstreams) per forward channel (downstream). Each upstream channel can accommodate thousands of customers. Advanced modulation and turbo codes are combined with powerful, dynamic fade mitigation techniques to offer over 2.25bit/s/Hz on the forward channel. These features result in a capacity 100 per cent to 150 per cent higher per transponder at Ku-band compared to competing VSAT technology. Conventional broadband VSAT technology has scaling issues for large networks, resulting in large capital investment at the hub and high day-to-day operating costs. SurfBeam addresses these two key areas very effectively. A new multi-rate forward channel mitigates Ka-band rain fade and makes Ku-band operation much more efficient than other Ku-band VSAT systems.

For large, consumer networks the economics of the system are very convincing; lower capital investment per customer, a low-cost hub, and terminal costs in the hundreds, rather than thousands, of dollars. Plus mature, low-cost customer service, back office, and network operations software is already in place from wide use in the cable modem industry.

#### Consider the outdoor electronics too

Often forgotten in satellite terminal innovation and cost reduction is the outdoor radio frequency electronics. This part of a complete satellite terminal is often a significant part of the cost, especially with indoor unit costs declining rapidly.

The lowest cost and most advanced Ku-band and Ka-band 1Watt to 3Watt Block Upconvertors (BUCs) are priced at less than half of what they were just a year or two ago. The technology behind the price reduction is state-of-the-art Monolithic Microwave Integrated Circuits from chip designer US Monolithics, that highly integrate BUC functions, take less power to run, and are designed specifically for high-volume production. In conjunction with radio manufacturer NJRC, US Monolithics is responsible for a new level of ODU performance and low cost.

#### The mobile networker

More and more customers also want their network connections to be mobile. How can that be accom-

plished with satellite? One obvious requirement is for smaller antennas. Vehicles simply can't accommodate a typical VSAT antenna, even at small, sub 1-metre sizes. And even a Boeing 747 will burn away profits in the form of fuel if it has to carry a sizeable antenna, not to mention the questionable safety of mounting large device on its fuselage.

Innovation in satellite waveforms has overcome this hurdle. An example is the spread spectrum technology used by Connexion by Boeing to bring Internet connections to commercial airliners and ARINC SKYLink that provides a similar technology and service to bring mobile broadband connections to private business jets. Boosting satellite transmission power in a traditional system would cause interference on adjacent satellites, but ViaSat's CRMA coding similar to the CDMA cell phone standard enables higher power per bit without interference, so that a smaller antenna is viable. The antenna used for the ARINC service is about 24 -inches wide, yet still yields broadband data speeds.

Designed for the airborne market, both systems are being extended to other mobile applications for maritime and land vehicle use for both commercial and military customers. New applications are evolving in the car industry and for passenger ships and trains.

#### Following cell phones and computing

Overall the trend in satellite communications technology is toward more capability in the user terminal at a lower price, and at lower operating costs. Future trends can be expected, similar to the computing and cell phone industry, where the hardware becomes a commodity to the consumer, at affordable prices, while still being a very powerful tool to run and deliver the latest applications. ■



*Previous page: a DOCSIS modem.*

*Below: a MTI Ku-band Block Upconverter (BUC)*

*Photo courtesy of ViaSat*





*Below: a LinkStar terminal*

*Photo courtesy of ViaSat*

## Airtel Enterprise Services selects LINKWAY for advanced networking of airports in India

ViaSat has been selected by the Airports Authority of India Satellite Networking Project to provide a ViaSat LINKWAY® broadband satellite communications network to connect 80 Airports in India with a single, more advanced network. The network will be implemented by Airtel Enterprise Services, the enterprise arm of India's leading telecom group, Bharti Tele-Ventures Ltd. (BTVL).

Airports Authority of India (AAI), an organization under the Indian Government Ministry of Civil Aviation, is responsible for managing all airports in India. As part of making the airports more advanced to meet increasing travel needs, AAI is building communications infrastructure to operate all its air-traffic related applications on a common network, based entirely on satellite communication. This network, called the Dedicated Satellite Communication Network (DSCN), is expected to not only fulfill the need for the more typical voice, fax, LAN data, and video applications across all airports, but is primarily focused on meeting more specialized communications and networking requirements. Those requirements include exchanging RADAR data and aeronautical messages between airports, remote monitoring of VHF air-ground communication equipment and telemetry, and satellite navigation of Ionosphere models and error correction.

Airtel Enterprise Services CEO, Mr. Rajiv Sharma said, "The aviation industry in India has completely transformed over the past decade. Given the spurt in air traffic, a state-of-the-art communication network is imperative. I am sure that Airtel Enterprise Services, with its expertise and technology, will implement a highly reliable satellite communication network for AAI."

The LINKWAY system is an MF-TDMA mesh networking product for making direct connections between locations with a single satellite "hop" and no central hub. LINKWAY satellite modems include ViaSat Dynamic Bandwidth Resource Allocation technology that cuts satellite bandwidth costs through advanced coding techniques and on-demand assignment of satellite bandwidth across the network. Quality-of-Service features enable customers to set priorities for different types of IP services as well. ■

### **About Airtel Enterprise Services**

Airtel Enterprise Services is a strategic business unit of Bharti Tele-Ventures Limited, established to provide end-to-end, world class communications to large corporations and enterprises. For more information visit [www.airtelenterprise.com](http://www.airtelenterprise.com).

