ViaSat’s experience in the deployment of DVB RCS-based Broadband Applications

ViaSat Brings Your Network To Life

ESTEC, Noordwijk, September 11, 2007

Guillermo Bosch
Regional Manager, Western Europe
Roma, Italia
guillermo.bosch@viasat.com
Introduction to ViaSat

- Long-term growth & profitability
- Headquarters in San Diego, California USA
- Major facilities near Atlanta, Washington DC & Baltimore
- US Monolithics subsidiary in Chandler, AZ
- ECC subsidiary in Cleveland, OH

Other offices in:
- Boston
- Beijing
- Spain
- New Delhi
- Rome
- Sydney & Canberra
ViaSat Brings Your Network To Life
Strong financial numbers

- Celebrating our 20th year
- $860M new orders in past two fiscal years
- Record revenue, earnings, and orders in FY06
ViaSat Brings Your Network To Life

Complete Network Extension

*Design & Engineering*  
*Consulting*  
*Systems Integration*  
*Support Services*

**Plus:**  
Ground Systems  
Maritime  
Consumer

Telephony  
Internet  
Intranet

Gateways  
Antennas  
Net Control  
Voice  
Data  
Video  
Fixed Portable  
Low rate Broadband  
Remote Terminals  
Transceivers

**ViaSat Brings Your Network To Life**
Present VSAT Services

**Vertical Markets**

- Healthcare
- Distribution
- Oil & Gas
- Finance Ins., RE
- SOHO
- Healthcare
- Consumer Retail Environment
- SCADA
- Brokerage Banks Representatives
- Remote Workers Telecommuters Employee Networks
- Connectivity
- Transponders Internet
- Web Applications
- Browsing Intranet Web Caching Email Secured Messaging
- Content Delivery
- Music/Audio Video Digital Files
- Third Party Services
- Credit Authorization Data Mining POS Integration Fin Mgt - Database
- E-Learning
- Solutions

Connect communities of markets, as subscribers, with relevant services and with other markets. Open the network to 3rd party applications, services & content providers.

ViaSat Brings Your Network To Life
Value-Added Services

ViaSat Brings Your Network To Life

Value-Added Services

Internet Access
Email
Web Caching
E-Learning
Content Aggregation
Music
POS/Credit Consolidation
IP Casting
Email

Other Wireless Nets
Video Conferencing
Hosted Apps
E-Comm
Data Mining

Solutions, consulting and development.

Ensure efficient interfaces with 3rd party applications and content providers.

Online applications that are important to our customers’ day to day data communications

ViaSat Brings Your Network To Life
Current applications support:

- Internet Backbones
- Public Network Backbones
- Broadband On-demand
- Private Network Backbones
- Videoconferencing

LinkStar DVB-RCS:

- One Way: 300M, 30M, 3M, 300k, 30k, 3k, 300, 30, 30-
- Low Bandwidth: MPEG Video, Streaming Video, Streaming Audio, IP Multicast
- High Bandwidth: Confirmed Delivery, Data Broadcast

- Two Way: 2-way Paging, SCADA
- Two Way Asym: Newswire, Stock Ticker, Paging
- Two Way Sym: Internet Access, Intranet Access, Kiosks, Distance Learning

ViaSat Brings Your Network To Life
Satellite Services under the ISO-OSI perspective

End-to-end services

Basic Services (DVB-RCS)
- Management of flow of information over the network
- Interface flow control, spoofing
- Access method and coding
- Atmosphere, outer space

Teleservices

Bearer Services including Supplementary Services

Application
Presentation
Session
Transport
Network
Data Link
Physical
Transmission Medium
LinkStar is DVB-RCS certified

- LinkStar DVB-RCS
  - Satlabs interoperability certification testing successfully completed in April 2006
LinkStar

Interactive Enterprise VSAT with 3 Mbit/s
DVB-RCS Compliant Return
“LinkStar is standard way to reach more of the world with multimedia broadband”
LinkStar - Enabling Service Providers...

- **Standards-based**
  - Outbound conforms to DVB-S/DVB-S2 standard
    - Can have receive-only sites in network
  - Inbound field-upgradeable to DVB-RCS standard

- **Scalable**
  - 70Mbps on outbound; 3.3Mbps on inbound
  - Multiple outbounds and inbounds in same network

- **Efficient bandwidth utilization**
  - Turbocoding offers better performance than conventional coding schemes
  - Only 8.6kbps required for signaling for all remotes on one inbound carrier

- **Maritime operation**
  - Dynamically compensates for moving platforms in real time

- **Robust**
  - Offers local and geographic redundancy for the hub
Lower cost version of LinkStar hub
- C-250 supports 250 sites
- C-500 supports 500 sites
- All inclusive single rack design (upto 6 GCUs)
- 10 Mbps maximum outbound rate

Lower minimum data rate
- Rates down to 1 Msp
- Enabled by LinkStar–HS RCST with ultra-high stability internal oscillator

Field upgradeable to
- Standard LinkStar
- DVB-RCS

Same features as standard LinkStar
LinkStar – Empowering End Users...

- **IP Multicast - in both directions**
- **IP Header Compression**
  - VoIP header compression maximizes efficiency for VoIP traffic
- **VLAN Tagging & DHCP Relay**
  - Multiple VLANs per VSAT
  - Simplifies network private addressing
  - Maintains data integrity & security
  - Automatic IP address assignment
- **Load Balancing**
  - Dynamically balances the load among all inbound carriers based on traffic activity at remote terminals
- **Pointing Tool**
  - Enables easy installation and commissioning of terminal
Advanced Bandwidth-on-Demand algorithms for optimum inbound bandwidth usage

- **Committed Information Rate (CIR)**
  - Ensures guaranteed bandwidth
- **Bandwidth on Demand (BOD)**
  - Reserves bandwidth on demand, from common pool
- **Slotted Aloha**
  - Fast response time for bursty traffic
  - Efficient for narrowband/transactional traffic
- **CIR Reallocation**
  - Provides guaranteed bandwidth when needed
  - Bandwidth available to common (BOD) pool when not needed
LinkStar Remote Terminal – one box solution

Satellite Modem
IP Router
TCP Accelerator
QoS/Prioritization

Ethernet Switch
LAN

PCs
SIP Phones

ViaSat Brings Your Network To Life
LinkStar DVB-RCS Customer Implementations
Private Networks based on LinkStar DVB-RCS

Communications solutions:

- **Connectivity:**
  - Point-to-Point
  - Secure Intranet
  - Extranet
  - Secure VPNs

- **Value-added services:**
  - Content distribution
  - Voip, Video conferencing
  - Security, monitoring and control
  - Storage, Backup, and Disaster Recovery
  - Emergency networks
Skylogic’s Coverage from the Atlantic to the Pacific

ViaSat Brings Your Network To Life
Solutions for Maritime Applications

- Payphone
- ATM
- solution on board SuperFast Ferries

Photos courtesy of Eutelsat
Deployment of maritime antennas aboard ferryboats

Photos courtesy of Eutelsat
Star Cruises Maritime solution

- Ship-to-ship and ship to shore communications for Star Cruises
- Sends on-board closed circuit video to hub in Malaysia
- Up to 20 times the industry standard data rate
- Full integration project finished one month ahead of schedule
- LinkStar
GSM A.Bis with ViaSat Linkstar - IP

Remote City

BTS

E1

ViaSat Linkstar

Remote City

BTS

E1

ViaSat Linkstar

Main City

PSTN

E1

MSC

E1

BSC

E1

ViaSat Linkstar Hub

ViaSat Brings Your Network To Life
LinkStar Applications - WiFi

- SiriCOMM WiFi service for truck stops
- “SIRICOMM” Hybrid Satellite and WiFi Network builds travel web portal” customer case study
The D’Appolonia Telemedicine network

ViaSat Brings Your Network To Life
Telemedicine Application by D’Appolonia (Genova)

Ultrasound application on board
Telemedicine Application by D’Appolonia (Genova)

- X-ray application
- Vidorconferencing with the doctor
Opensat’s Mobile solutions on vans

ViaSat Brings Your Network To Life
OpenSat’s Fly-drive solution
Monterosa Emergency
Italy’s Civil Protection Network

ViaSat Brings Your Network To Life
Monterosa Emergency (cont’d)
ViaSat Brings Your Network To Life

Retail, Point-of-Sale

- Largest drug store chain in Canada – 800+ locations
- Credit/debit cards, prescriptions, e-mail, sales data, software, music & advertising
- Customer loyalty card program
- DVB overlay for in-store television network, with no service interruption
- **LinkStar** upgrade completed
- Managed by Immeon
LinkStar offers

- Credit card verification
- Inventory update from gas station and co-located mini-stores
- Supervisory data collection from tank farms and pipelines
- Interactive voice between corporate facilities and remote sites
- Corporate office connectivity
  - E-mail
  - LAN interconnection
  - Centralized database access
  - Batch data transfers
- Administration /management
Shell Gas Stations

- Historically, Gas station traffic was only light traffic (e.g., point of sale transactions).
- Now gas stations generate both light traffic (e.g., point of sale, lottery) as well as broadband (Cyber Café, corporate Intranet).
- LinkStar’s advanced “Application triggered BOD” automatically shifts from rapid response slotted aloha to high speed “Bandwidth on Demand” channels in response to specific customer application needs.
eMxico - linking Mexican citizens to the Internet and other sources of information and knowledge.

Develop Mexico’s IT industry, foster internal market for ITC products, promote adequate regulatory framework and digitize government services.

Objective: local Internet access at a US$ 40.00 per month, per site.

LinkStar best-suited, price-performance

3,500 remotes installed in 6 months

Typically 24 Mbytes total traffic during day, 5 million page views per week

With INTERDirect, a private ISP company owned by Grupo IUSA
E-Mexico 3200 Vsats
Multi-Tenant VPNs

- CapRock core business in oil exploration communications, but others need high reliability, portability, and customer service: government, construction, maritime
- Initiated IPXpress service with LinkStar
- VLAN Tagging enables multiple virtual private networks from a single terminal
  - Privacy
  - Security
  - Auto Authorization
- Ruggedized for quick deployment anywhere
Intralot – International lottery communications company

Won first U.S. contract for Nebraska State Lottery

Critical that network is reliable and stable. Tens of thousands lost in revenues and penalties for every minute of outage

**LinkStar** chosen as platform. Redundant hubs in ATL and SD.

Three seconds per transaction over satellite

Pre-planning with ViaSat NOC staff led to 1,200 sites installed in just 40 days

Managed by Immeon
ONI USFK Intelligence Network (CIVN-K) – Government Application

STAR (ISP) Architecture

JICPAC / IDC-Hawaii - Survival Hub and Network Connections

Oahu - Hawaii

Satellite

66Mbps

4.25Mbps

LinkStar® User's Terminal

Send  Receive

Send  Receive

ViaSat Brings Your Network To Life
Is DVB-RCS ready for the mass market?

- **Mass Market requirements**
  - High service quality and reliability
  - Broadband (average over time)
  - Low CPE price
  - Low service price
  - Ease of installation
  - Least possible hardware maintenance
Quality of Service

- Mandatory for time sensitive applications like voice over IP (VoIP) and videoconferencing
- Prioritization for both satellite access and IP layers
- LinkStar can set priority, or honor priority set by external device
  - Ensures end-to-end QoS
- 6 classes of service
  - Expedited forwarding
  - Assured forwarding (4 classes)
  - Best effort
- Integrated into LinkStar remote
Customer Support Services

- **Customer Care Center**
  - Global response
  - 24 x 7 Support

- **Complete Training Services**

- **RMA & Repair Support**

- **Service Contracts**
**LinkStar**<sub>S2</sub> **Bandwidth Savings**

- **DVB-S2**: Up to 30% less satellite resources than DVB-S
  - Lower Eb/No for more transponder capacity
  - Smaller, lower cost VSAT antennas
  - 8PSK modulation and turbo coding for less satellite bandwidth

**Comparison**

- **DVB-S2**: 10 Mbps (8PSK, FEC = 9/10)
- **DVB-S**: 10 Mbps (QPSK, FEC = 7/8)

- **Bandwidth**
  - DVB-S2: 3.8 MHz
  - DVB-S: 6.2 MHz
LinkStar S2A “ACM” Technology

DVB-S2 ACM Bandwidth Savings vs DVB-S2 non-ACM
36 MHz transponder, 99.7% link availability, 40 degree elevation angle

ITU-R P.837 rain regions
- 20 mm/hr rain - e.g. California USA
- 40 mm/hr rain - e.g. Greece
- 60 mm/hr rain - e.g. Buenos Aires
- 80 mm/hr rain - e.g. Nigeria
- 100 mm/hr rain - e.g. Brazil Amazon
- 120 mm/hr rain - e.g. Malaysia

Transponder Saturated EIRP (dBw)

% Bandwidth Savings

0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%
47 dBw 48 dBw 49 dBw 50 dBw 51 dBw 52 dBw

40% 46% 40% 33% 33% 28%
**LinkStar S2 “DLA” Technology**

- **LinkStar S2 “DLA” – Dynamic Link Adaptation eliminates wasted satellite capacity for rain margin**
  - Upstream carrier operates at most bandwidth efficient symbol rate & coding during clear sky
  - Rain faded sites automatically undergo two dimensional rain compensation
Only a few years ago...

- a dramatic reduction of the costs of the user terminal from 20,000 € to less than 600 €
- a remarkable decrease of the antenna size for user terminals

ViaSat Brings Your Network To Life
Broadband service

- Broadband is bandwidth intensive
  - but bandwidth is a variable cost
What is True Broadband?

- **Not** peak speed, but average speed per terminal on the network.
- **Not** data broadcast
- Two-way **unique** data
- Just like terrestrial alternatives, such as DSL, ISDN, 2-way cable
Need for Space **Systems**

- **Broadband satellites**
  - Spot beams
  - Opposite of broadcast!

- **Compatible ground earth terminals**

- **Advanced technologies**
  - Frequency re-use,
  - Coding,
  - Spatial processing

- **Not just inexpensive terminals!**

- **Lots of low cost bandwidth**
The principal ideas

- Distributors should be able to rely on on-site installers:
  - in case of shortage at own resources
  - for the roll out of international networks
  - to save travel and accommodation costs
  - to ensure short reaction time for maintenance

- All installers have to participate to a product training
  - to ensure minimum qualification and competence for installation
  - to reduce time for help line and hub commissioning

- Systems Integration specifies
  - RF cables,
  - connectors
  - measurement equipment to ensure reliable terminal operation
Sample terminal installation workflow: must be optimized

**START**
- Install Antenna (provisional LNB)
- Find Satellite
- Mount Final Outdoor Electronics
- Optimise Pointing & Polarisation
- Install IFL Cables & Modem
- Set IP Address on Portable PC
- Configure Modem
- Acquire Forward & Verify Reception
- Contact NOC for Commissioning

**NOC will**
- Set New IP Address on Portable PC
- Verify Connectivity (ping)
- Verify DNS Function (browsing)
- Verify Up- and Down-load Speed
- Connect User Equipment
- Complete and Submit Questionnaire
- Verify Cross-Pol Line-up EIRP (cw)
- Start Telnet Session
- Put Final IP Address

**FINISH**

ViaSat Brings Your Network To Life
Savings in installation costs

- **Pointing Tool**
  - Enables easy installation and commissioning of terminal
- **Usage of 75cm antennas whenever possible in Ku-band or less in Ka-band**
- **Optimization of Installation workflow (autocommissioning)**
- **Targeting an end-user self-installation process**
Small Antenna Sizes are essential

90 cm antennas

75 cm antennas

90 cm antennas

ViaSat Brings Your Network To Life
Next-generation services

- Next Generation Services on a DVB-RCS environment
  - Communication on-the-move
  - Broadband on-the-move
Single System for Joint Net-Centric Broadband On-the-Move

ViaSat Brings Your Network To Life
Comm on the Move (COTM)

- **Airborne, Shipboard, & Ground Systems**
  - Broadband data rates: 10Mbps by 512 kbps
  - Secure Data
  - Secure Voice

- **Commercial & Military Satellites**
  - Typically Ku-band
  - Capable X & Ka-band
On-the-move demo

ViaSat brings your network to life.
Mobile Broadband Trends

Today:
• Airliners
• Bizjets
• Gov’t vehicles

2006 - 2008:
• Smaller jets
• Trains
• Yachts

2009 & beyond:
• Small yachts
• Personal jets
• Automotive

Ku-band

Ku/Ka
LinkStar S2 Mesh Interoperability with LinkWay S2

- **DVB-S2 Outbound** enables interoperability between LinkStar S2 and LinkWay S2 terminals.

- **LinkWay S2** terminals provide mesh connectivity in LinkStar S2 network.

High speed DVB-S2 Outbound broadcasts to both LinkStar S2 and LinkWay S2 terminals.
ViaSat, Your Choice!

ViaSat Brings Your Network To Life
Any Questions?

Thank you!