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Agenda

- System Introduction
- System Entities
- Network Topology
- Network Architecture
- System Capabilities

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SkyEdge II Introduction

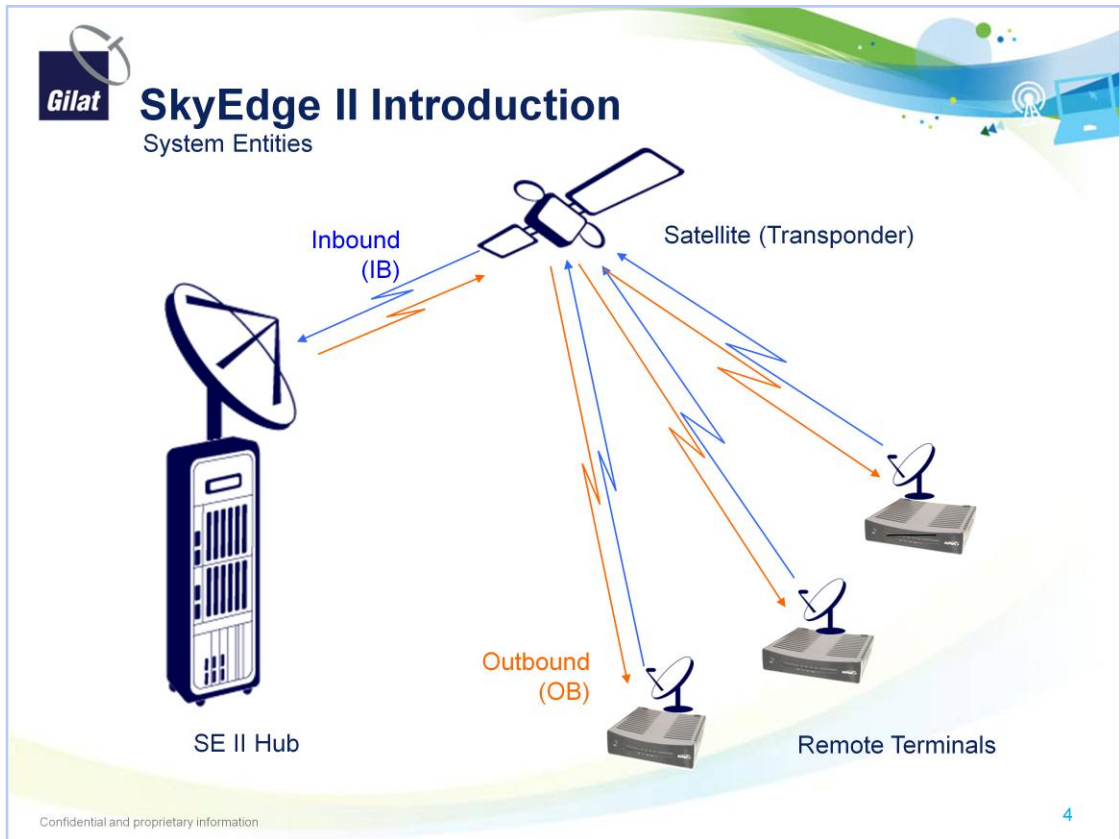
System Introduction

- **SkyEdge II is a modular two-way satellite communication system**
 - **Allows connection between several remote terminals to the Internet/Extranet or to each other**
- **SE II system has three main components**
 - **The hub, satellite/transponder and remote terminals**
- **Supports two types of transmissions**
 - **Inbound are all the transmissions from the remote terminals to the hub**
 - **Outbound are all the transmissions from the hub to the remote terminals**

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Each satellite has several transponders on it. A transponder is an automatic device that receives, amplifies, and retransmits a signal on a different frequency.



Every transmission from Earth to the Satellite is called Uplink.
Every transmission from the Satellite to Earth is called Downlink.
Every Uplink and Downlink path is called a hop.
Therefore – OB from the hub to a VSAT would be one hop. IB from a VSAT to the hub would be one hop.



SkyEdge II Introduction

System Entities

- Remote Terminal
 - Indoor Unit (IDU) – VSAT
 - Outdoor Unit (ODU) - Antenna Dish, Linear BUC and LNB
- Hub
 - Center of the SEII system
 - Responsible for two main functions:
 - Manage and control the network elements
 - Aggregate and distribute IB and OB IP traffic

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VSAT (Very Small Aperture Terminal)

BUC (Block Up Converter) Tx section of the ODU

LNB (Low Noise Blocker) Rx section of the ODU



SkyEdge II Introduction

Network Topology

- SkyEdge II hub enables system VSATs to communicate via satellite links:
 - Internet/Intranet networking (VSAT-to-Hub)
 - Each other (VSAT-to-VSAT)
- System supports three basic topologies:
 - Star
 - Mesh
 - Multi-star



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Star Topology – all user traffic is going through the Hub. VSAT to VSAT traffic is double hop.

Mesh Topology – Traffic generated by the user, can be transmitted between VSATs in one hop. Hub is needed only for session initiation, signaling and closure. User traffic is not going through the Hub. Mesh and Star topologies can be implemented on the same Hub.

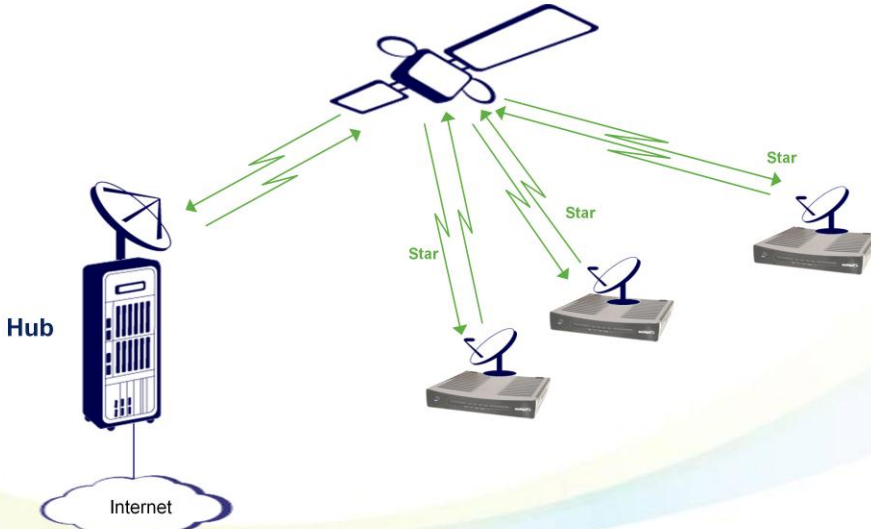
Multi-Star Topology – several star topology networks implemented in one hub, each one has a different gateway. All managed by the same NMS.



Network Topology

Star Topology

- Each VSAT always communicates through the Hub to the internet/intranet or to another VSAT (double hop)



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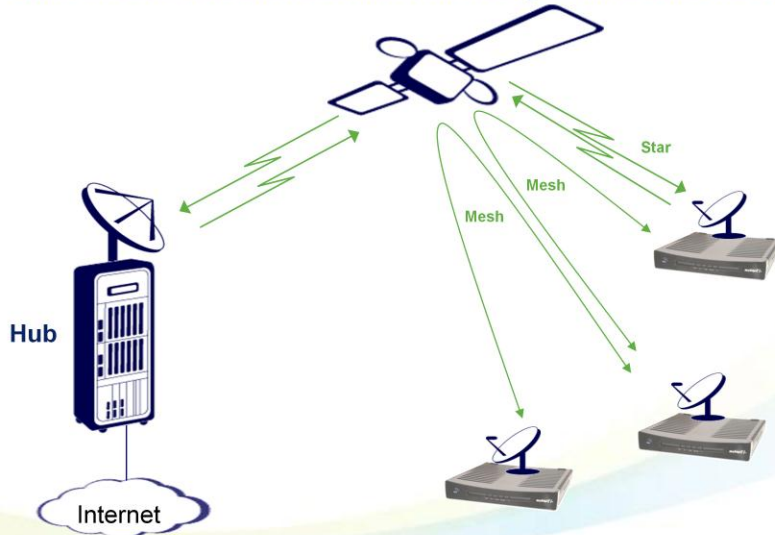
Star VSAT to VSAT communication – 2 hops



Network Topology

Star and Mesh Topology

- In Mesh connectivity data can be directly transferred between VSATs, while channel allocation and network management is done via the hub.



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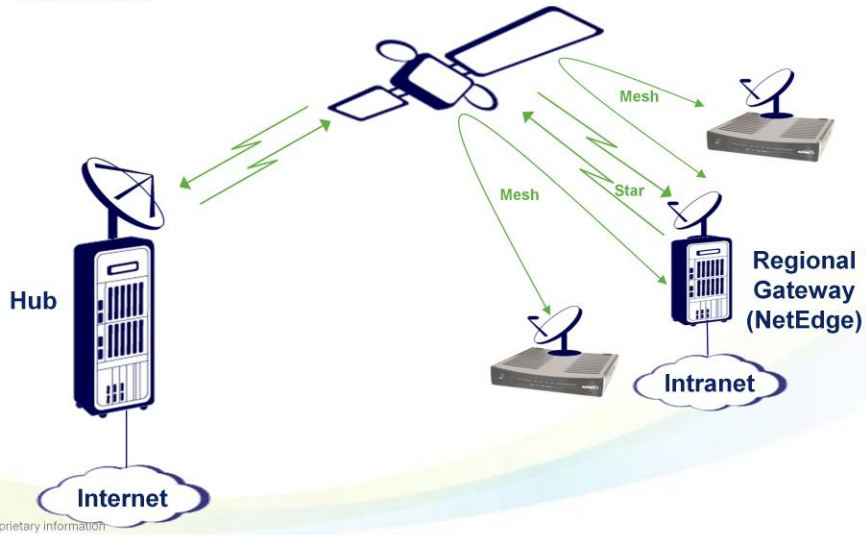
Mesh VSAT to VSAT communication – 1 hop



Network Topology

Multi-Star Topology

- In Multi-star connectivity data is transferred between VSATs, using a common gateway. Channel allocation and network management is done via the hub.



A Multi Star hub will have one central hub, and several regional gateways.



SkyEdge II Introduction

Network Architecture

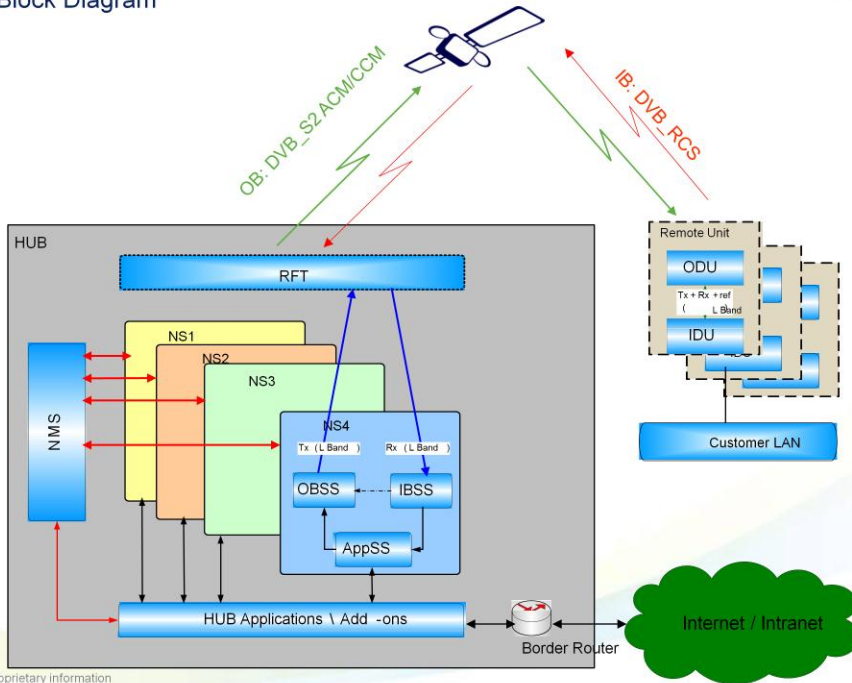
- **The SE II hub consists of one to four Network Segments (NS)**
- **A NS is a subnetwork that manages three physical subsystems**
 - **Inbound Subsystem (IBSS)**
 - Demodulates and Decodes the traffic coming from the VSATs (Inbound)
 - **Outbound Subsystem (OBSS)**
 - Multiplexes and Modulates the traffic towards the VSATs (Outbound)
 - **Application Subsystem (AppSS)**
 - Provides means to distribute traffic to or from the Internet/Intranet and gives optional QoS services

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Network Architecture

Block Diagram





SkyEdge II Introduction

Outbound – General Description

- **Carries Unicast and Multicast data, VoIP traffic, synchronization information for the return (Inbound) channel and network control traffic.**
- **The VSATs recognize and extract the traffic which is intended for them**
- **The SE II OB is based on DVB-S2 (EN 302 307) standard**
 - **Supports two operation modes:**
 - **Constant Coding and Modulation (CCM)**
 - FEC coding and modulation (MODCOD) is constant
 - **Adaptive Coding and Modulation (ACM)**
 - FEC coding and modulation (MODCOD) differ in a frame to frame basis

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DVB-S2 is the second generation of DVB system for broadband satellite services.
MODCOD combination of Modulation and FEC



SkyEdge II Introduction

Outbound – MODCOD

MODCOD

Modulation Schemes

- QPSK ----- 2 bits per symbol
- 8PSK ----- 3 bits per symbol
- 16APSK ----- 4 bits per symbol
- 32APSK ----- 5 bits per symbol

Coding (FEC)

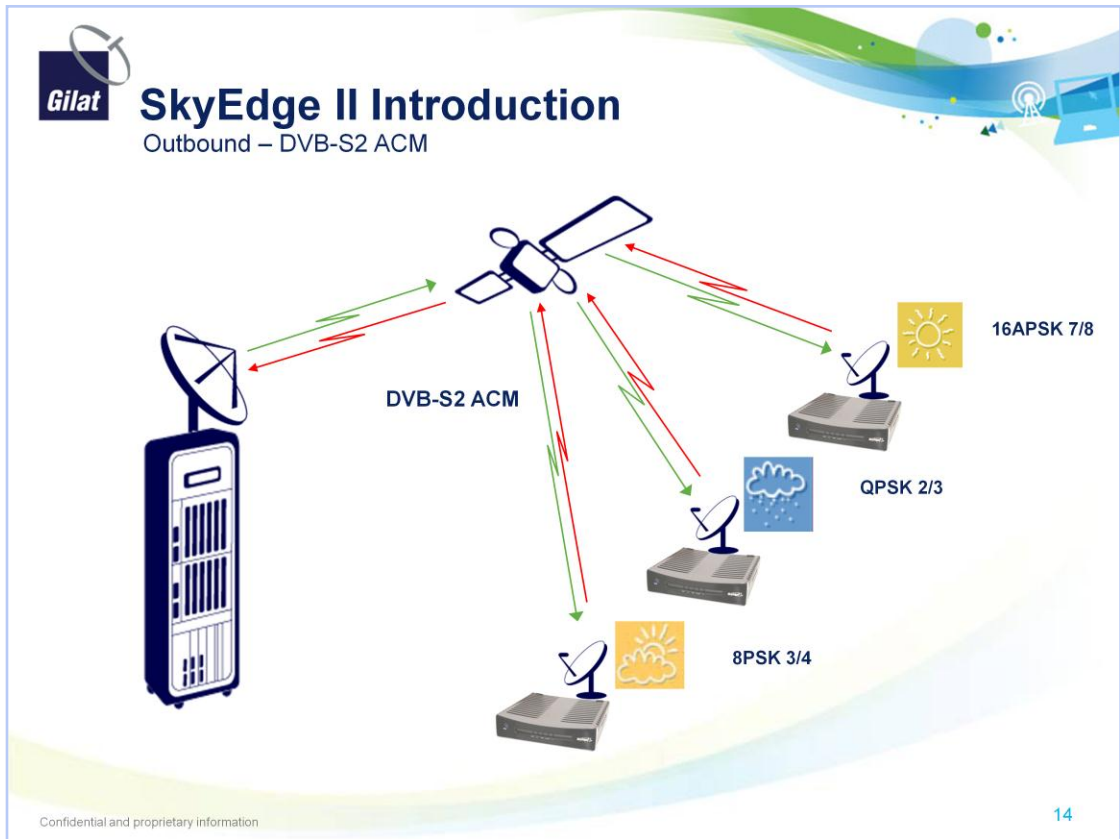
- LDPC / BCH Forward Error Correction Codes
- 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9 and 9/10

QPSK1/2

Robust

16APSK8/9

Efficient



In ACM mode different MODCODs (combination of Modulation and forward error correction coding) are used to transmit to each VSAT according to the measured Es/No. The total OB bit rate changes dynamically according to the MODCOD used.

In this example we have one Hub and three VSATs. Each VSAT has a very different weather condition. According to their Es/No measurements the Hub will transmit to each one using different MODCODs. If the weather condition worsens, a more robust MODCOD will be selected from the MODCODs configured in the system.



SkyEdge II Introduction

Inbound – General Description

- The IB channel carries
 - User traffic, VSAT initial logon, maintenance information and capacity requests
- Based DVB-RCS standard (EN 301 790)
- Uses (Multi-Frequency Time-Division Multiple Access) MF-TDMA
 - Reservation based access scheme – No collisions
 - The IB allocation plan is published to the VSATs over the OB channel
- Modulation schemes QPSK and 8PSK
- Multiple IB channels of different types

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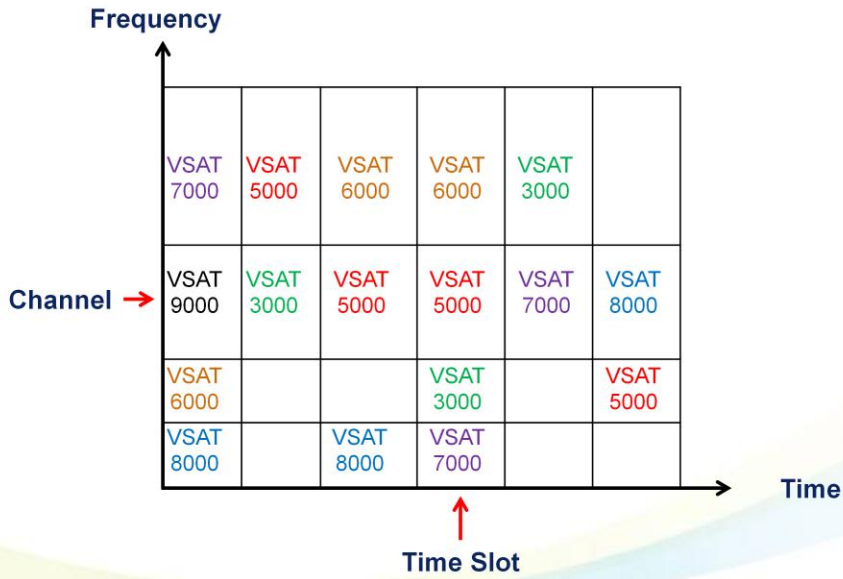
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Capacity Request is the request for allocation of to send traffic. The types of requests are based on the type of traffic that each VSAT has to transmit.



SkyEdge II Introduction

Inbound – MFTDMA



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A VSAT transmits at a specific channel (frequency) at a specific time (Time Slot)



System Capabilities

- Up to Four Network Segments (NS)
- 30000 VSATs per Hub
- Outbound capacity:
 - Up to 54 MHz, 45 Msps, 135 Mbps per NS
- Total Inbound capacity
 - Up to 12.288 MHz, 10.24 Msps, 26.333 Mbps per HSP in Star
 - Up to 18.432 MHz overall per HSP (Star and Mesh).

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Minimum CCM OB symbol rate is 300 ksps (short frames).

Minimum ACM OB symbol rate is 1.5 Msps (short frames)

