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Advanced VSAT Solutions Bridge Point-to-Multipoint (BPM) Overview

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Overview

The purpose of this document is to provide an overview for the Advanced VSAT Bridge Point-to-Multipoint (BPM) mode. Overall, the intent of the Advanced VSAT BPM feature is to make the Advanced VSAT Solutions appear as a “Sky Ethernet Switch”. This will allow for a greatly simplified network deployment.

In BPM Mode, all L2/L3/L4 protocols such as VLAN, MPLS, IPv6, OSPF, and BGP will flow through the network as they would through an off-the-shelf Ethernet switch.

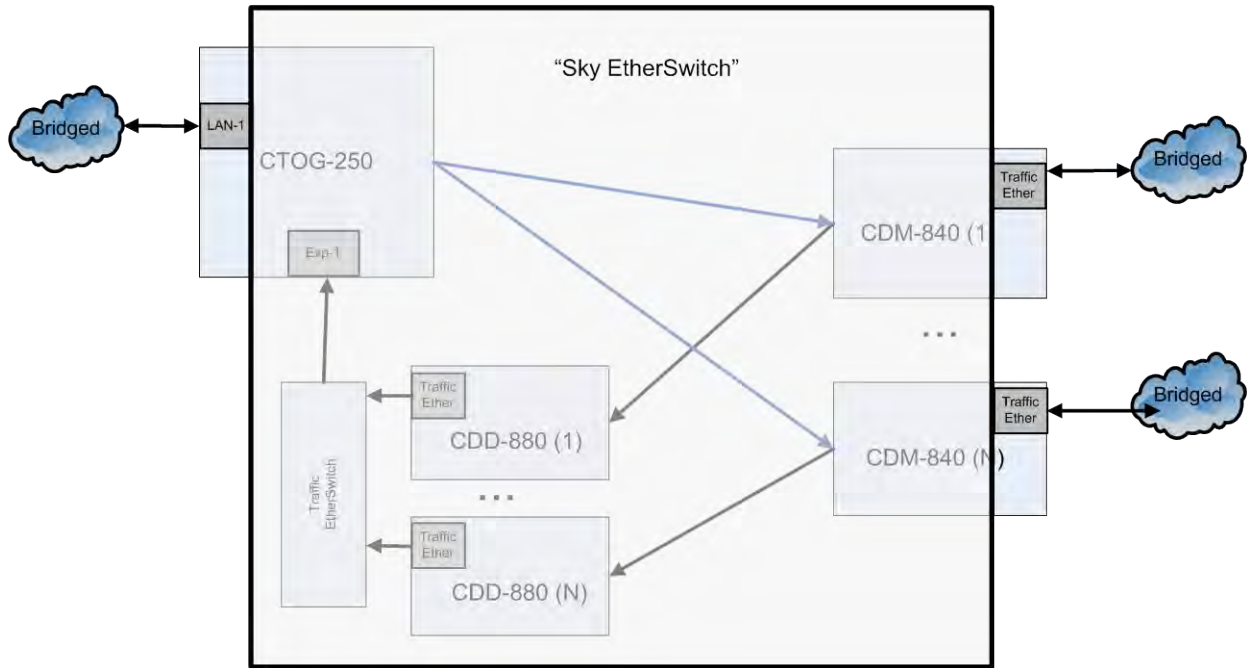


Figure 1. Advanced VSAT BPM “Sky Ethernet Switch”

List of Terms

- ACM/VCM: Adaptive Coding and Modulation / Variable Coding and Modulation.
- Bridge Mode: Advanced VSAT network working mode that configures the traffic ports of the CTOG-250 and the CDM-840 to function as a bridge.
- Comtech Dynamic Routing Protocol (CDRP): Comtech EF Data's proprietary protocol that automatically synchronizes the CTOG-250's route table with the CDM-840's LAN connected routes (i.e. the routes that are directed to the LAN ports of the CDM-840).
- CTOG-250: Comtech EF Data Traffic Optimization Gateway 250.
- Entry Channel Mode (ECM): Shared Aloha channel used in Vipersat dSCPC mode to allow remote terminal to gain access to the network.
- Flat Network: A network in which all devices are directly connected to each other and all devices are on the same IP subnet.
- IGMP: Internet Group Management Protocol
- Private VLAN Edge (PVE): Configuration option available in commercial Ethernet switches that is used in BPM to connect multiple CDD-880s at the hub to a single CTOG-250.
- Router Mode: Advanced VSAT network working mode that configures the traffic ports of the CTOG-250, CDD-880, and CDM-840 to function as a router.
- Single Hop on Demand (SHOD): Comtech EF Data technology that allows for dynamic creation of single hop mesh connections from one CDM-840 to another CDM-840. *Requires the Comtech EF Data Vipersat Management System (VMS).*
- VLAN Access Mode: Mode only available in CDM-840 that forces the traffic interface to carry traffic for only one user-configured VLAN.
- VLAN Trunking Mode: Default mode for BPM where all packets (with and without VLAN tags) arriving at the CTOG-250 and CDM-840 pass through the system without modification. A trunked port can pass two or more VLANs on the interface.

Supported Network Configurations

The following section describes the supported network topologies in BPM mode.

Flat Network

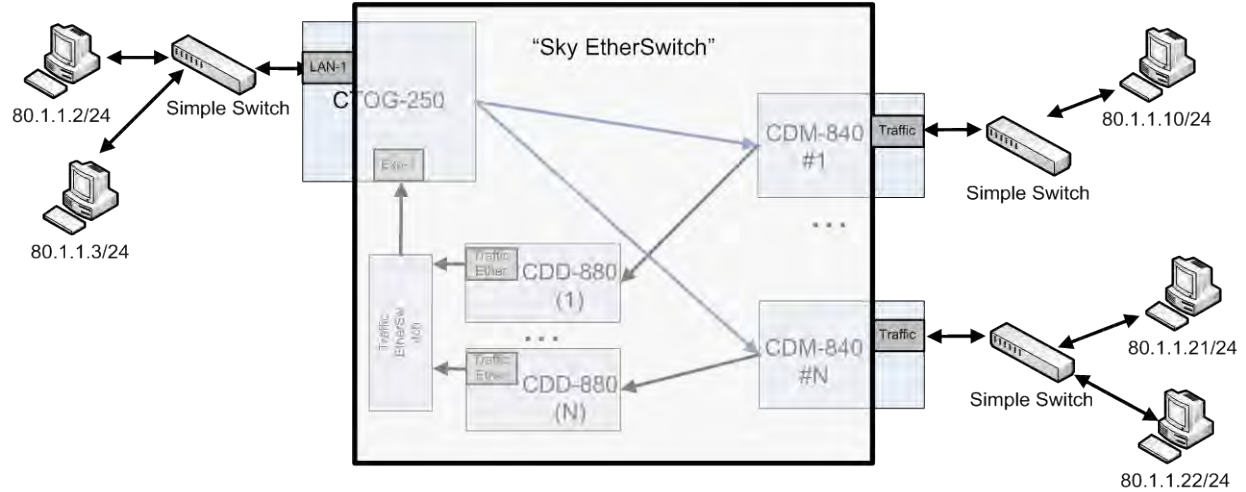


Figure 2. Supported BPM Topologies – Flat Network

In a flat network, all devices are on the same IP subnet. This would be an extremely easy topology for simple and/or small networks.

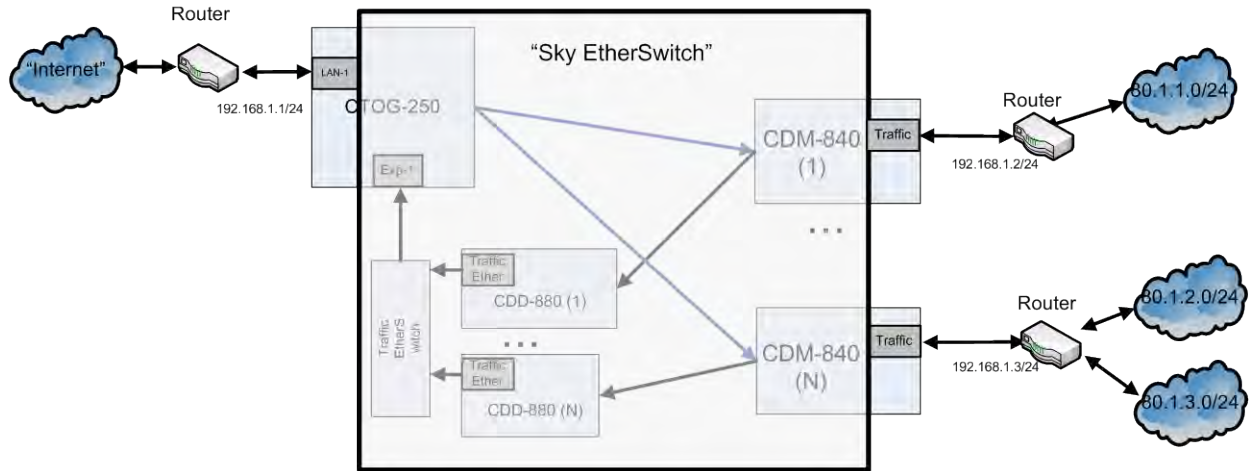


Figure 3. Flat Network with Routers

Another variation of the flat network is to include routers at each site. With this topology, the routers can be placed on the same subnet as if they were connected to the same Ethernet switch, and all core routing protocols such as OSPF, RIPv2, BGP, VRRP, etc. will function as expected.

VLAN Trunking

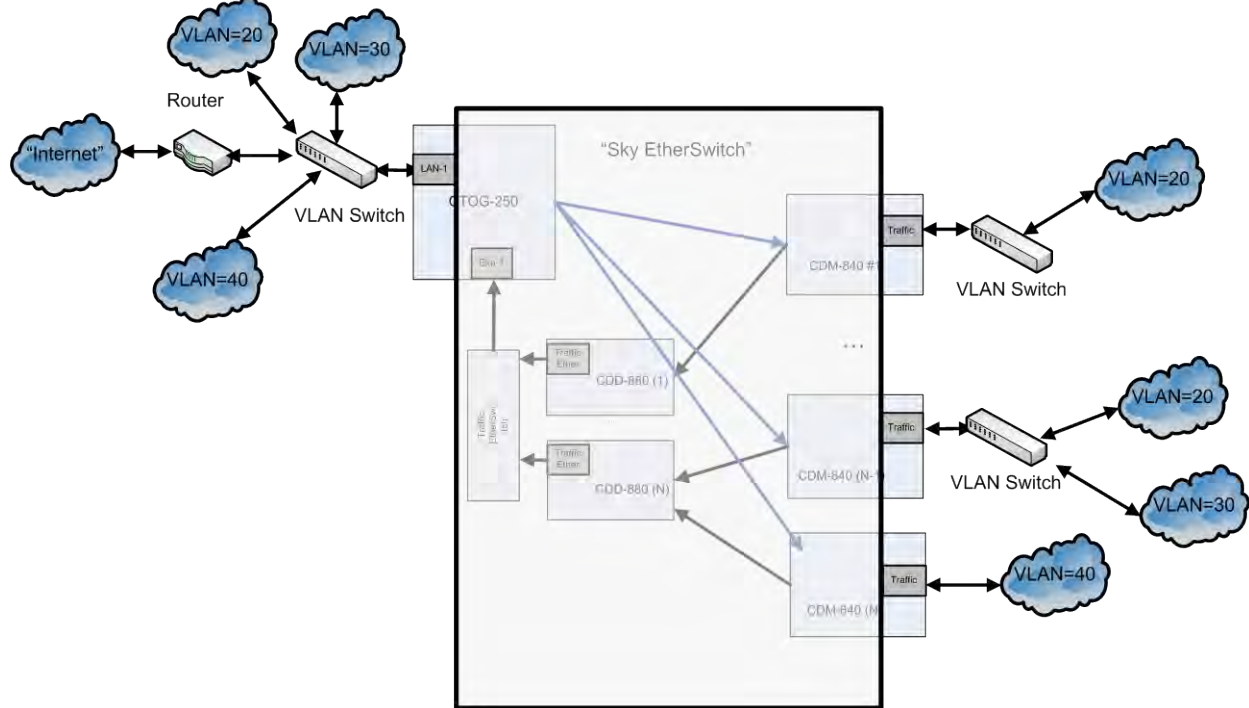


Figure 4. BPM with VLANs

In a VLAN-enabled topology, the hub side equipment will function as a VLAN trunking interface. Outbound packets (hub to remote) can be mapped to the desired QoS group (see **“BPM and Group QoS with Outbound ACM/VCM”** section later in this document).

By default, the CDM-840 equipment can function as a VLAN trunk and pass all traffic received on the WAN and traffic LAN ports. In this mode, it is expected that the user will have a VLAN-enabled Ethernet switch at each remote to properly break out the VLAN into the desired network topology.

In addition, the CDM-840 can be optionally configured in access mode with a user assigned VLAN ID (see **“IEEE 802.1Q Support”** section later in this document).

Packet Processing

Traffic Network / Ethernet Switch Behavior

The Advanced VSAT BPM feature functions as a learning Ethernet switch when the “Working Mode” is set to BPM. BPM has the following basic functionality:

- MAC addresses associated with each segment/port are learned by inspecting the source MAC for packets arriving at each Ethernet port
- Once the port association for a MAC address is learned, an Ethernet switch will not transmit Ethernet packets with that MAC address to other segments/ports
- Broadcast packets are sent out all interfaces

For the Advanced VSAT BPM mode, it is important to note that the CTOG-250 and CDM-840s will learn MAC addresses and avoid any unnecessary transmission. In BPM mode, the CDD-880 functions as a receive-only pass-through to the CTOG-250.

Management Network

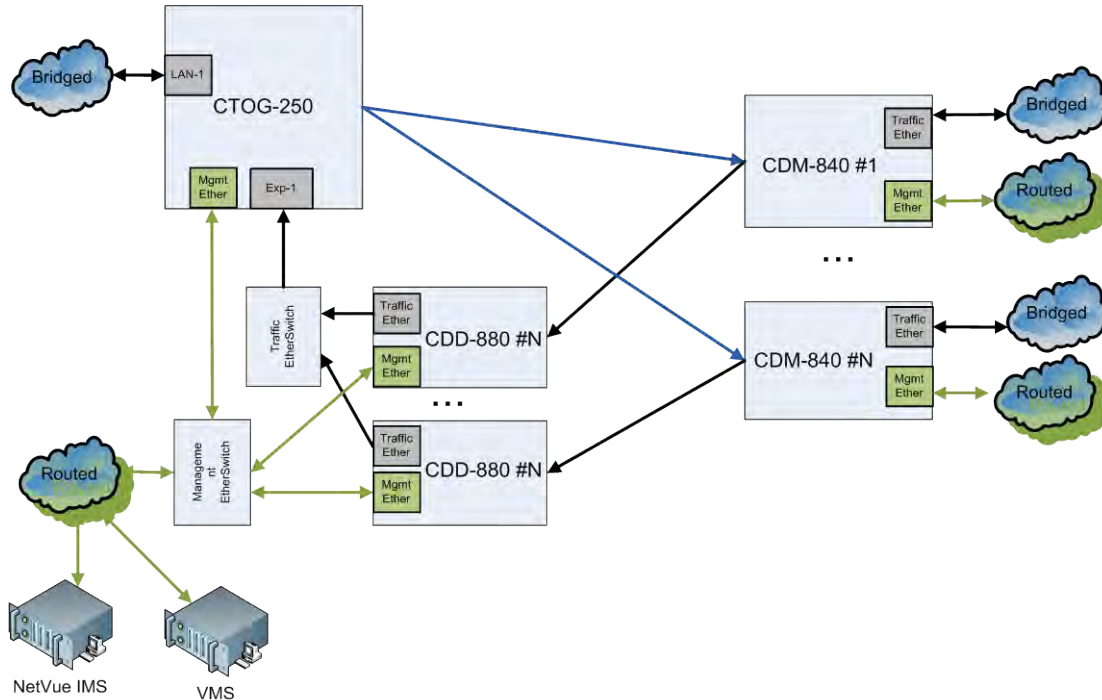


Figure 5. Management Network in BPM Mode

While the Advanced VSAT BPM feature supports bridged traffic ports, the management ports for all of the units will be in router mode.

When in BPM mode, the traffic ports on the Advanced VSAT units do not have IP addresses (as would be expected from an Ethernet Switch). Therefore, the units cannot be managed (SNMP, Web, Telnet) or pinged from this interface.

When the CTOG-250 is configured in BPM working mode, CDRP will continue to operate as expected to populate the CTOG-250 with the routes required to manage the remote CDM-840s via their management IP addresses. The Return Link Routed Management Traffic is usually handled by entering a default route (0.0.0.0/0 “toWAN”) in the CDM-840’s routing table.

As in “router” working mode, it is required that CDRP be enabled for ACM/VCM on the DVB-S2 outbound carrier to work for management traffic destined to each remote.

User traffic on the traffic ports does not require CDRP, as BPM will automatically and seamlessly handle ACM/VCM for this traffic.

When operating the network with NetVue Integrated Management System or Vipersat Management System, the Advanced VSAT units (CTOG-250, CDM-800, CDM-840 and CDD-880) will be managed through the management network using the management Ethernet port and management IP addresses.

IEEE 802.1Q Support

The following section describes the Advanced VSAT support for IEEE 802.1Q. This includes VLAN Trunking, Access mode and double tagging support.

VLAN Trunking

The Advanced VSAT hub equipment always functions in VLAN trunking mode. Trunking mode means that Ethernet packets received by the CTOG-250 LAN-1 interface will be passed to the appropriate remote CDM-840 unchanged and unfiltered.

Likewise, when the CDM-840 is in trunking mode, the VLAN tags will be passed through the CDM-840 unchanged and unfiltered.

The CDD-880 is a receive-only pass-through in BPM mode. As such, the CDD-800 will receive the packets from the remotes and pass them to the CTOG-250 for processing and forwarding.

Access Mode Support

As part of 802.1Q support, the CDM-840 supports configuring the traffic port in either trunk or access mode. Access mode allows the CDM-840 to function as a VLAN edge switch to add and remove VLAN tags to connect a distant end network with other networks.

- All packets received at the traffic Ethernet port will be tagged with the assigned Access Port VLAN ID.
- All packets received from the WAN with the matching VLAN ID will have the VLAN tag removed and the packet will be passed out the traffic LAN port.
- In Access mode, the CDM-840 will drop all packets it receives at its Traffic LAN port that already has a VLAN tags.
- In access port mode, packets received from the WAN that do not have a matching VLAN ID will be dropped.

(It should be noted that this is not normal behavior as once the MAC address has been learned at a given remote, all other remotes will perform a hardware-level filter on the packets.)

Multiple VLAN Tagging Support

The Advanced VSAT platform supports processing Ethernet packets with multiple stacked VLAN tags, with the following limitations:

- At the CTOG-250, only the outermost VLAN ID will be used for mapping to the appropriate QoS groups.
- In trunking mode, L2 header compression will only compress packets with one or two VLAN headers. Packets with more than two VLAN headers will be allowed to pass, but only the first two VLAN headers will be compressed.

Multicast BPM Behavior

In BPM mode, multicast packets are forwarded in two directions:

- **Outbound Path (CTOG-250 ► CDM-840):** Multicast packets arriving at the CTOG-250 will be passed out the WAN to all CDM-840s using the “VCM Only MODCOD” option for the matching QoS group (based upon VLAN or subnet).
- **Return Link Path (CDM-840 ► CDD-880 ► CTOG-250):** Multicast packets arriving into the CDM-840 traffic port are automatically passed out the CTOG-250’s traffic port only. Internet control messages such as OSPF, RIP and BGP that fall into the 224.0.0.0 - 224.0.1.255 address range are automatically passed out both the CTOG-250’s LAN and WAN ports.

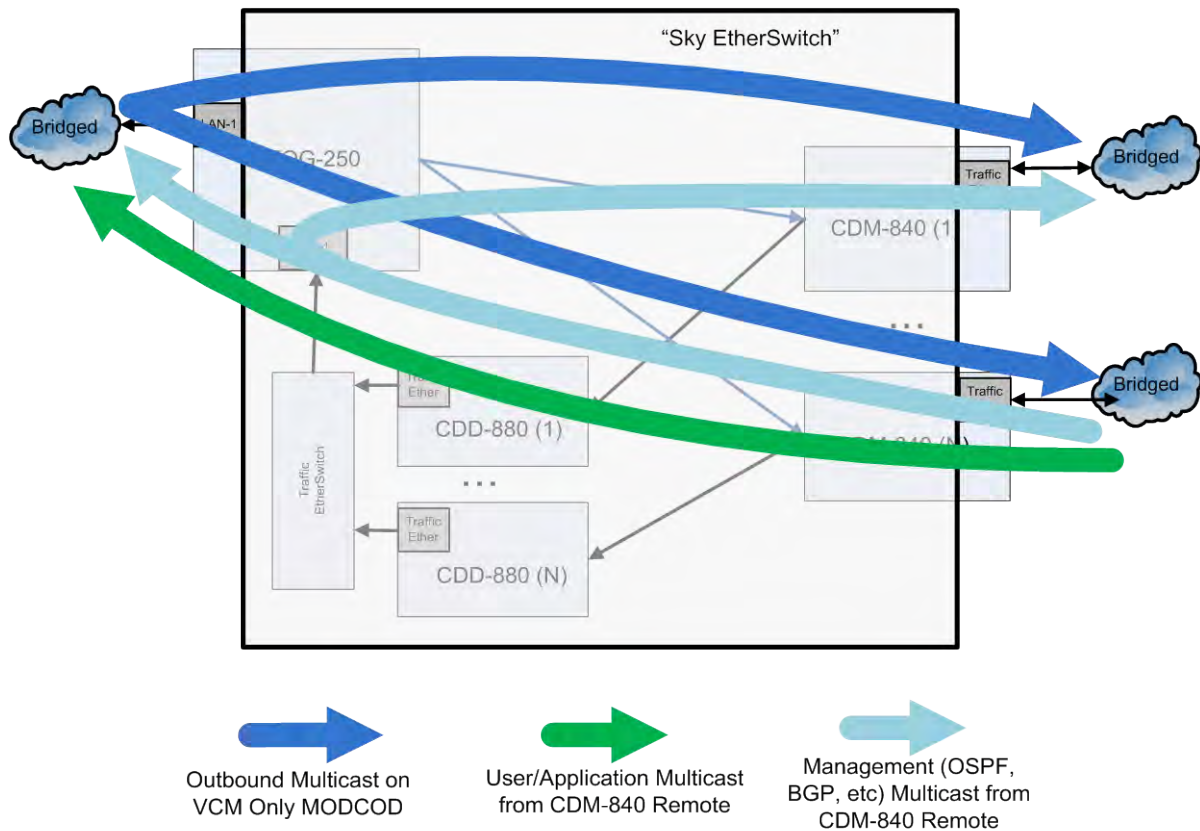


Figure 6. Multicast Behavior in BPM Mode

If required, the user can create QoS rules with “Filter All” enabled to filter undesired Multicast from traversing the satellite network for both the CTOG-250 and the CDM-840.

Multicast Management/Routed Behavior (no change)

In both BPM or router modes, multicast packets arriving at the management port of the CTOG-250 and CDM-840 must be configured to be transmitted to the WAN by adding a multicast-specific route table entry with a “/32” subnet.

Packets arriving at the CDM-840 downlink will be passed out the CDM-840 Ethernet port based upon the following criteria (configurable via NetVue or web page for each CDM-840):

- **Downlink (outbound from the hub segment) Multicast All** – All downlink outbound multicast packets will be passed to the traffic LAN interface of the CDM-840 unit.
- **Use IGMP**– Only remotes that have IGMP clients enabled with the multicast address will have the multicast packet passed to the CDM-840's LAN port.

BPM and Group QoS with Outbound ACM/VCM

ACM/VCM on the outbound carrier works with BPM by seamlessly matching packets to the correct remote site.

While no configuration is required, the user is provided the ability to use a VLAN ID to associate a packet to a QoS group. This powerful functionality allows the user to partition the outbound carrier capacity.

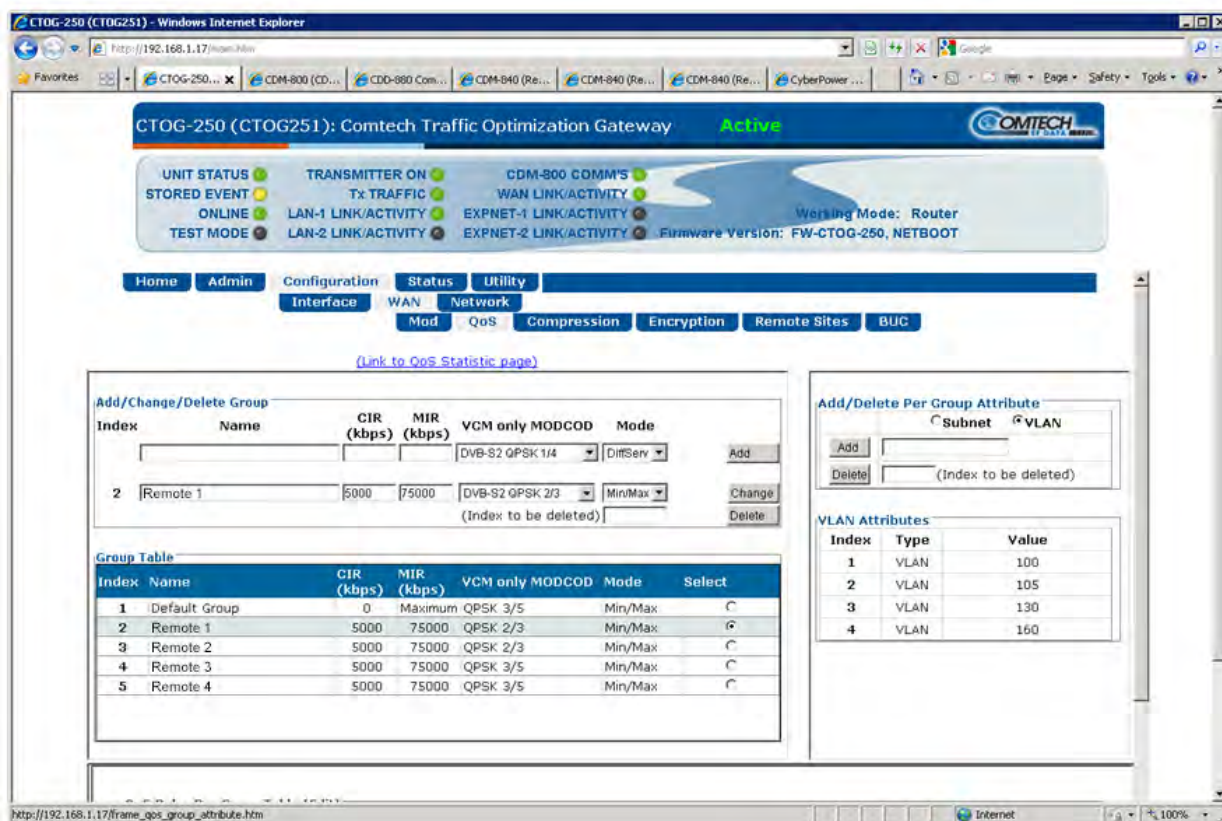


Figure 7. Configuring VLAN to QoS Group Mapping

Once a QoS group has been added, the user can add up to 32 VLAN tags per QoS group. To avoid overlaps, a VLAN can be added to a single QoS group only.

If the packet has a VLAN tag, then the group membership will be decided based only on VLAN matching. If no VLAN match is found, then the packet will be placed into the default QoS group.

If the packet does not have a VLAN tag, the system will attempt to use the QoS group subnet attribute definitions to match the packet to a correct QoS group.

Hub Network Configuration

The user must configure the hub network defined here, in order for BPM to function as expected.

It is required that the traffic management switch use Private VLAN Edge (PVE) – also known as “protected port” – to map the CDD-880’s traffic port to the CTOG-250’s expansion port 1. This is required to properly manage the behavior of passing Ethernet packets from the CDD-880s to the CTOG-250 in BPM Mode.

The CDD-880s will be connected to “private” ports and the CTOG-250 must be connected to the “uplink” port.

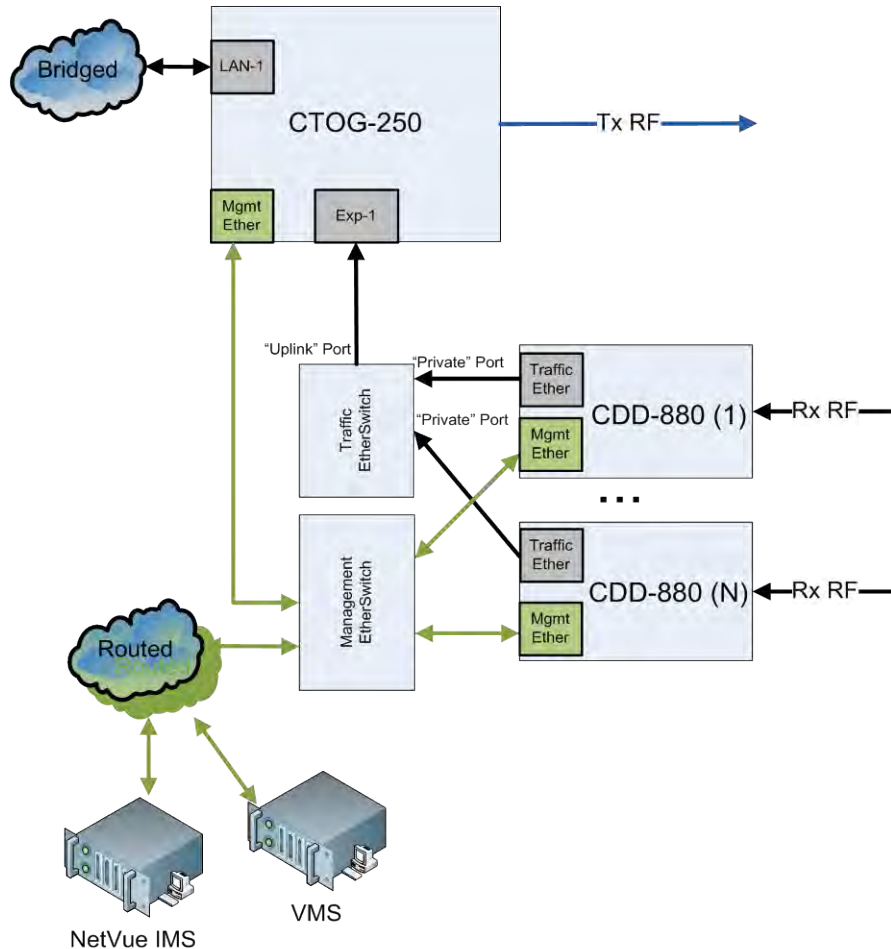


Figure 8. Hub Network Configuration

The management network portion of this diagram is suggested, but is not strictly required. However, it *is* strictly required that the following be true:

- The management IP for all units have IP connectivity to the NetVue and VMS server’s IP address.
- CDM-880s have a packet path to the management IP address of the CDM-840s.
- CDM-840s have a packet path to the management IP address of the CTOG-250.

Compatible Features and Detailed Specifications

Advanced VSAT BPM mode is compatible with the following features:

Feature	Comments
Group QoS (CTOG-250) and QoS (CDM-840)	
Header Compression	<p>Includes the following L2 Protocols:</p> <ul style="list-style-type: none"> Ethernet 2.0 Ethernet 2.0 + VLAN-tag + VLAN-tag 802.3-raw 802.3-raw + VLAN-tag + VLAN-tag 802.3 +802.2 +VLAN-tag 802.3 +802.2 + SNAP 802.3 +802.2 + SNAP + VLAN-tag + VLAN-tag <p>Includes the following L3/L4 Protocols:</p> <ul style="list-style-type: none"> IP, UDP, TCP, RTP
Payload Compression	
RANOP with E1	
dSCPC with VMS	
Entry Channel Mode (ECM)	
AES-128	
Return Link ACM	
ACM/VCM on the Outbound	
Comtech Dynamic Routing Protocol (for the management network)	
Multicast	
IPv6 (Traffic plane)	
VLAN trunking	
VLAN Access Mode on the CDM-840	
CTOG-250 and CDD-880 device redundancy with the VMS	

Advanced VSAT Bridge Point-to-Multipoint Overview

Advanced VSAT BPM mode is compatible with the following features:

- Group QoS (CTOG-250) and QoS (CDM-840)
- Header Compression
 - L2 Protocols
 - Ethernet 2.0
 - Ethernet 2.0 + VLAN-tag
 - Ethernet 2.0 + VLAN-tag + VLAN-tag
 - Ethernet 2.0 + MPLS
 - 802.3-raw
 - 802.3-raw + VLAN-tag
 - 802.3-raw + VLAN-tag + VLAN-tag
 - 802.3 +802.2
 - 802.3 +802.2 +VLAN-tag
 - 802.3 +802.2 +VLAN-tag +VLAN-tag
 - 802.3 +802.2 + SNAP
 - 802.3 +802.2 + SNAP + VLAN-tag
 - 802.3 +802.2 + SNAP + VLAN-tag + VLAN-tag
 - 802.3 +802.2 + SNAP + MPLS
 - L3 Protocols
 - IP
 - UDP
 - TCP
 - RTP
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- Comtech Dynamic Routing Protocol (for the management network)
- Multicast
- IPv6 (Traffic plane)
- VLAN trunking
- VLAN Access Mode on the CDM-840
- CTOG-250 and CDD-880 device redundancy with the VMS

The following features are **not** supported in BPM mode:

- The stand-alone CDM-800 does not support BPM due to packet per second limitations
- Dynamic Mesh
- CDD-880 port diversity

Key specifications for the Advanced VSAT BPM working Mode are as follows:

Attribute	Value	Comments
Maximum Ethernet Frame Size	2018 Bytes	Includes FCS but not the preamble
Working Mode	Routing or BPM	All units in the network MUST be configured the same
Traffic Port	Bridge in BPM Mode Routed in Router Mode	

Attribute	Value	Comments
Manage Port	Always in Router Mode	Applies to CTOG-250, CDM-840, CDD-880
VLAN Access Mode Support	CDM-840 will support VLAN Access Mode for a single VLAN ID.	Access Port VLAN ID = 1..4095
WAN Labels	1-2047	Must be unique across all CDM-840s that shared a CTOG-250 outbound carrier. Seamlessly provides hardware level filtering to improve network performance

Conclusion

The Advanced VSAT Bridge Point-to-Multipoint feature and functionality enable the support of network architectures requiring IEEE 802.1Q standards in many very simple but powerful network deployments.

This is made possible in the Advanced VSAT Release 1.5.1 while taking advantage of all of the features and benefits of the Advanced VSAT Solutions platform.

For additional information, please contact us.

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