



### Overview

With the advent of High Throughput Satellite (HTS) and ever-growing beam capacities, it is now possible to transmit more than a Gigabit per second over a single satellite beam. However, such large throughput may exceed the individual transmit / receive capacity of the ground based modem equipment. Further complicating the issue is the use of ACM (Adaptive Coding and Modulation) where a link or links are adjusting their MODCODs (Modulation and Coding) in real-time, thereby dynamically changing the link capacity on a per carrier basis.

### Solution: HX Series Dynamic Load Balancing

Solving this issue, Comtech now offers the HX product to its portfolio of WAN Optimization (WANOp) solutions. The HX performs a dynamic load balancing function based on user IP flows\*. The HX enables to create a single virtual Layer 2 connection (“trunk”), grooming together multiple individual links or paths between two network end-points, while ensuring that packets belonging to the same flow will always follow the same path. Such implementation avoids the issue of packet re-ordering and enables to operate with parallel paths of different speed and latency at very high throughput rate. It also enables to add Comtech’s FX WANOp software function in-line between the load balancer and the modem.

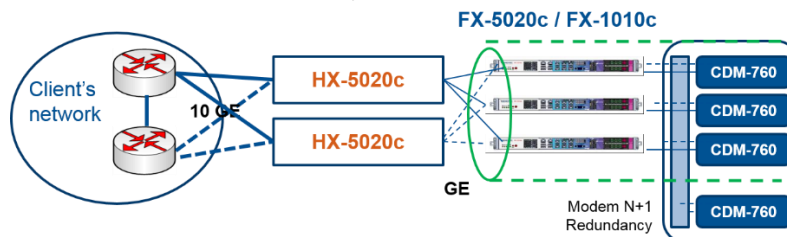
#### Typical Users

- HTS Satellite Service Providers

#### Common Applications

- Satellite Broadband Internet Backhaul (Maritime, Rural, Mobility)
- 4G/LTE Mobile Backhaul

Below is an example of a High Availability (HA) satellite hub site using two redundant 1+1 HX-5020c load balancers, and FX-5020c or FX-1010c WANOp appliances with end-to-end path redundancy:



Typical High Bandwidth Satellite ISP Point of Presence (PoP) Implementation

The HX is designed to operate on high capacity links (backhaul trunks), supporting thousands of IP flows. It can also operate with N+1 (or N+p) WAN link redundancy. Traffic from the failed link will be redirected on the other remaining operational links.

Flows are balanced using IP address(\*) and optionally port numbers information to ensure packet flow remain together and continue on existing paths, while providing a good efficiency of the load balancer across the different links for backhaul applications. For the few flows that do not have an IP address (for example, Ethernet ARP request), the HX uses then the Ethernet MAC address to perform the load balancing.

In order to maximize the load balancing accuracy and throughput of each individual links, the load balancer monitors each link and takes into account the actual real-time load of each link, allocating new flows based on the link with the maximum capacity available. That information is directly collected from the modems, therefore taking into account the effect of ACM on each individual link (critical when operating in Ka or Ku band, which is commonly the case of HTS satellites).

(\*) Note: in the case of GTP encapsulated user mobile user traffic, the IP flows considered are the inner IP address of the Mobile terminal (UE).

The HX can also be directly connected to the modems without having a PEP appliance in between. Reciprocally, the HX can also be deployed combined with Comtech’s WANOp function within the same appliance. An HX with internal PEP functionality offers the equivalent performance of Comtech’s FX-5020c.

The HX is able to manage multiple virtual bonded links within the same appliance (hub site for example), operating in point to multipoint mode.

The HX is designed to operate with Comtech’s new TPS WANOp and supports the same Layer2 –Layer 3 protocol stacks combination.

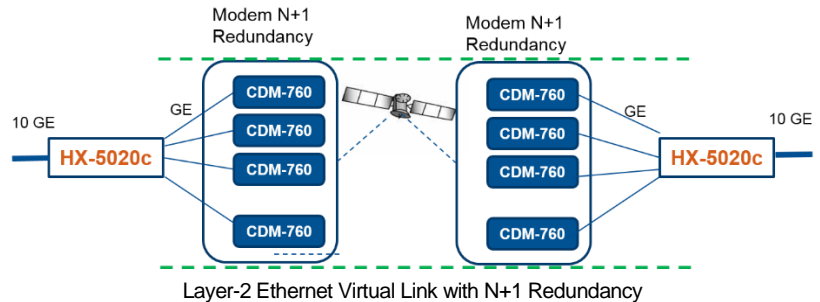
## Key Benefits

- Enable to scale satellite links in order to match the capacity requirement of high throughput / high capacity backhaul links
- Compliant operation with PEP appliances providing acceleration and other flow base processing functions
- Can be integrated with Comtech's WANOp solution in one single appliance
- 100% Layer2-Layer3 Transparent ("Wire-like" operation)
- Jumbo frames and multiple Layer 2 stacks support (VLANs, MPLS, L2 & L3 VPNs)
- Dual stack IPv4 and IPv6 support
- Real-time dynamic traffic shaping with ACM enabled Comtech EF DATA modems
- Plug&play operation – minimal configuration, and no layer 3 IP routing information required
- High Availability platform (power supply redundancy, 1+1 system redundancy, path redundancy)

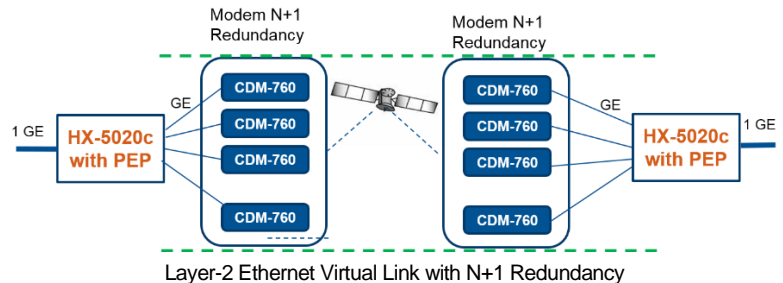
## HX Modes of Operations

The HX load balancer can be implemented in several ways:

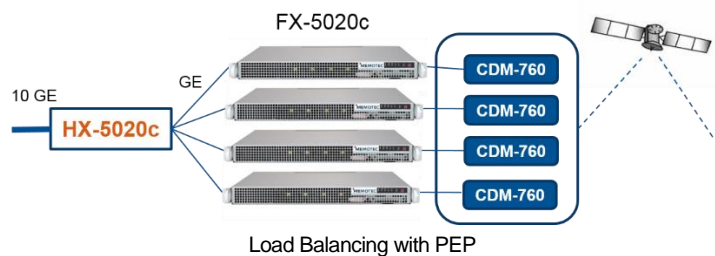
- **Link bonding** – Delivering one virtual link aggregated capacity:



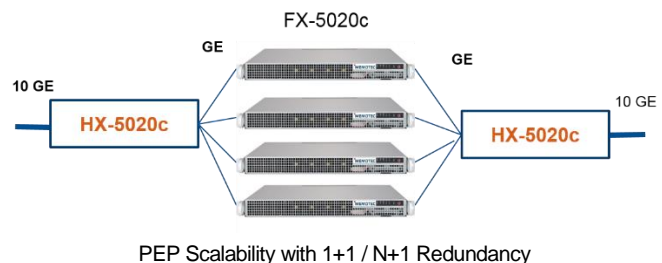
- **Link bonding combined with PEP** – If throughput capacity does not exceed 1Gbps, then the HX and FX features can be combined in one single appliance:



- **Load balancer** (flow based) – In this case, the PEP function (or any other flow processing server function) is located between the load balancer and the WAN. This is the case for aggregated link capacity exceeding 1 Gb/s (TX+RX).



- **PEP scaler** – If the throughput or number of TCP sessions processing requirement exceeds the capacity of the PEP server appliance, the HX can then be used to scale the PEP server up to 8 times, similarly to what WCCP does. The advantage of the HX solution is that it is L2/L3 stacks full transparent and supports MPLS, L2/L3 VPN & VLANs with QinQ.



## HX Load Balancer Features

- Support up to 8 WAN links
- Per flow (Layer 3) load balancer
- Support for asymmetric bandwidth (TX/RX) and different speed links
- Support of real-time individual variable link throughput (modem links with ACM)
- Multi-layer 2 and 3 protocols combination acceleration support
  - VLANs
  - QinQ (two VLAN tags)
  - MPLS (one or two labels)
  - Layer 2 MPLS-VPN: [Ethernet] [VLAN]\* [VLAN]\* [MPLS] [MPLS] [Ethernet] [VLAN]\* [IP]
  - Layer 3 MPLS VPN: [Ethernet] [VLAN]\* [VLAN]\* [MPLS] [MPLS] [IP]
- (\*) Note: [VLAN] tags are optional
- Full Layer 2-Layer 3 LAN-WAN transparency
- Support of both IPv4 and IPv6 dual stack operation
- Jumbo Ethernet Frame support (up to 9,000 bytes MTU)
- One-touch network operation (No Layer-2 or Layer-3 network information required or configuration)
- Standalone operation or combined with WANOp
- Dual path LAN connectivity (for path redundancy)
- Optional 1+1 system redundancy
- Management and Operation
  - WEB GUI, CLI
  - Simple “one touch” configuration
  - Out-of-band management interface
  - Network Traffic Statistics
  - Comtech NetVue Operation (configuration, supervision)

## Specifications

Model	HX-5020c
<b>Form Factor</b>	1RU
<b>Weight</b>	15.5 lbs (7 kg)
<b>Dimensions (h x w x d)</b>	1.7" x 17.2" x 16.9" (43 x 437 x 429 mm)
<b>Nb Ethernet ports</b>	12 2xSFPs GE/10GE MMF - LAN ports and 10 x GE RJ45 [8xWAN, MGT, AUX]
<b>Path Redundancy (LAN, WAN)</b>	Yes
<b>Rack Mount Kits</b>	Built-in
<b>Traffic processing capacity in Mbps (aggregated throughput TX+RX)</b>	5,000
<b>Max. number of processed load balanced flows</b>	1,000,000
<b>Power Supply - UL Approved, FCC Compliant</b>	Hot Swap 1+1 AC Power Supplies Auto (100V-240V) Power consumption: 400W max.
<b>Power Supply Safety/EMC Certifications</b>	FCC Part 15 Subpart B Europe/CE Mark ROHS, UL (CA, US)
<b>Environmental</b>	Operating temp 10 - 35°C Storage temp -40 to 70°C Operating relative humidity 8 - 90% (non-condensing)



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