FX Series 7.x

WAN Optimization

FX-5020c

FX-1010c

FX-4010c

FX-1005e

WAN Optimization: Delivering Fast Broadband QoE, Not Just High-Speed Connectivity

When it comes to Internet access over satellite, high-speed connectivity does not necessarily equate to a fast broadband user experience (as what end-users expect when connected onto 4G, wireless or wireline terrestrial networks). To users, a crisp web browsing experience, responsive user interaction together with rapid content display speeds are paramount for delivering a good QoE (Quality of Experience).

Due to the nature of the protocol used for delivering Internet content (i.e. TCP), satellite latency and satellite link (in Ka band) or Internet impairments (packet drops), can negatively impact a user experience regardless of bandwidth capacity. Furthermore, the problem is worsened today through feature rich browsers / mobile apps and inflated web pages media content: a typical web page nowadays routinely consists of 250+ objects of variable sizes, from a few KByte to over 10MByte, – and therefore HTTP/TCP connections, collected through more than 50 to 100 different servers. Without optimization, this content presents a slow and non-responsive user experience over satellite.

The Solution: Comtech WANOp

To mitigate the adverse effect of satellite latency on web browsing, a Protocol Enhancement Proxy server (PEP) needs to be put in line at both ends of the satellite link to process the user traffic. That is the role of Comtech WAN Optimization (WANOp) solution.

Unique to Comtech's WANOp solution is the focus on the end-user experience – in particular the Web browsing experience. Acceleration technology used to mitigate satellite delay has been around for a while, solutions which have been standardized as the SCPS-TP protocol, used by most vendors today. While SCPS-TP does a good job of maximizing the available link bandwidth and increasing file transfer speed (FTP applications), its efficiency is rather limited when it comes to the application that matters the most to end-users: web browsing.

This is where Comtech's WANOp solution comes to play: Comtech's WANOp uses a combination of techniques to deliver both lightning fast file transfer AND a true broadband web browsing / Internet access user experience.

Typical Users

- Internet Service Providers (ISPs)
- Telecommunications Operators (CSPs)
- Mobile Network Operators (MNOs)
- Satellite Service Providers
- Managed Services Providers Use

Common Applications

- Satellite Broadband Internet Backhaul (Maritime, Rural, Mobility)
- 4G/LTE Mobile satellite backhaul
- Corporate Networks Internet Access over Satellite (Oil & Gas, Mining, etc.)

Key Features

- Turbostreaming© dramatically improves file downloads and web browsing QoE across satellite links, enabling a terrestrial-like fast broadband user experience (> 100 Mbps)
- DNS caching substantially shortens web page rendering
- Work with ISP, Corporate VPN and Mobile (4G) backhaul, Internet access traffic
- 100% Layer2-Layer3 Transparent ("Wire-like" operation)
- Jumbo frames and multiple Layer 2 stacks support (VLANs, MPLS)
- Dual stack IPv4 and IPv6 support
- Layer 2/3/4 QoS - 3 level hierarchical queues with Priority, CIR, MIR settings
- Real-time dynamic traffic shaping with ACM enabled Comtech EF Data modems (for Ka- or Ku-band satellite links)
- Plug&play operation – minimal configuration, and no layer 3 IP routing information required
- High Availability platform (power supply redundancy, 1+1 system redundancy, line bypass, path redundancy)
- Scalability up to 5 Gbps and one million flows using Memotec's HX load balancer companion product.
- No license imposed throughput or sessions limitations simplifies network design and allows worry free soft upgrade.

COMTECH EF DATA

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redefining network efficiency

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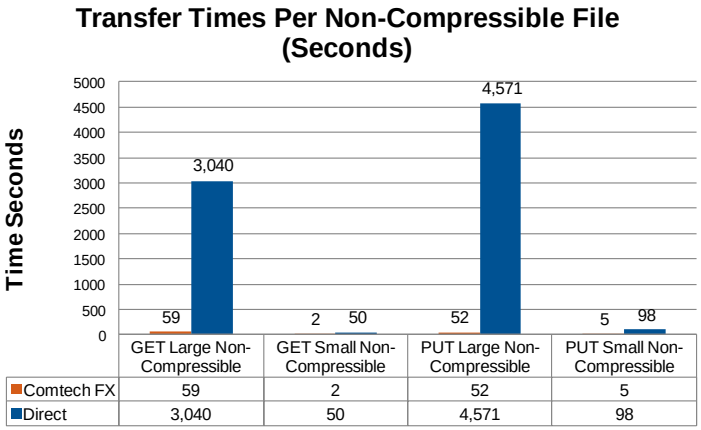
Turbostreaming©

Comtech's patented Turbostreaming technology is built around 3 concepts, ensuring faster content delivery for both small and large objects download over TCP connections, which is quite common on today's typical web pages. Turbostreaming enables also a more efficient use of HTS larger satellite link capacity by increasing **by a factor 3 or more** trunk traffic usage (for a given set of users).

- **TCP Connections Local Acknowledgment**: End user (Host) and Server TCP connections are terminated respectively at the remote and hub PEP servers. This enables fast local acknowledgment of the information received and faster connection setup. It also limits re-transmission in case of data loss at either end of the connection. Meanwhile, a proprietary protocol suited for satellite transmissions is used on the WAN segment, which mitigates the effect of satellite delay.
- **Persistent WAN Connections**: Local ACK of TCP connections combined with persistent TCP WAN connections reduce the delivery time of content and web browsing time **by 50% or more**.**WAN TCP Connections Multiplexing**: Turbostreaming enables multiplexing of large object downloads (or uploads) like HD images/pictures and videos onto parallel WAN connections, effectively multiplying the speed of these objects downloads / uploads across the WAN (available satellite link bandwidth permitting). Combined with expanded TCP window buffer size, Turbostreaming is able to reduce download/upload time by a factor of up to 65.



DNS Caching:

DNS caching is an important feature for providing enhanced user QoE across satellite links. A single web page rendering can require access to 50 - 100 different hosts, which may result in DNS lookup time to represent a significant portion of the web page total download time. Having a DNS Cache server locally at the remote location enables to reduce that time typically by half or more. With Comtech's WANOp, the DNS Cache is embedded into the WANOp software, making it un-necessary to have a dedicated DNS Cache server. In addition, unlike Comtech's DNS Cache, external DNS Cache Servers do not operate on 4G/LTE mobile backhaul applications, or various tunneled type of traffic (Layer-2 or Layer 3 MPLS VPN).

Layer2-3 Transparency:

Unlike ISPs, Communications Service Providers (CSPs) essentially provide a Layer-1/ Layer-2 connectivity services. They do not control the format or protocol stacks in which the information is being delivered, and they don't necessarily have access to the routing information (IP Layer 3 protocol) of the traffic they carry through their network. Therefore, they need to ensure full transparency to the Layer-3 routing information of their client's network. As such, the CSP client traffic will often be tunneled into one or more Layer 2 protocol stacks:

- One or two VLAN tags (QinQ); VLAN tags could also be used to segregate traffic per remote destination;
- MPLS tunnel with one or more stacked labels (used for traffic engineering, segregating traffic per customer or client's destination)

Contrary to most vendors PEP implementation, our WANOp "wire-like" operation is fully transparent to the CSP's client traffic, and operate on the different protocol stacks mentioned above:

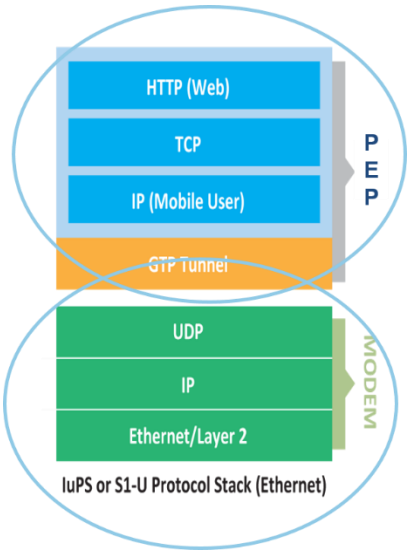
- No layer 3 IP routing information or configuration is required
- No layer 2 or layer 3 dependencies on the CSP or CSP's client networks (transparent bridge function)
- LAN-to WAN Layer 2 – Layer3 transparency (protocol headers remain unchanged)

Mobile Traffic: Support of GTP Tunnels and Dual Stack IPv6 and IPv4

4G/LTE user traffic and 3G Packet Core traffic are not directly accessible above the IP network layer. It is instead encapsulated within another layer called GTP depicted on the right, therefore preventing standard TCP acceleration (PEP) implementation to be applied to that traffic.

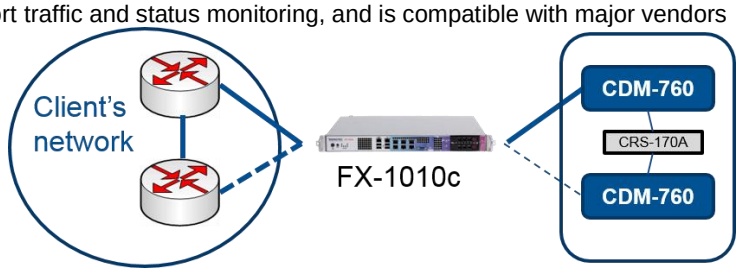
Unlike many acceleration devices, the FX WANOp PEP function has the ability to process the GTP layer to get access and to accelerate the mobile user (TCP) traffic, 4G/LTE or 3G Core, and does so whether the supporting IP layer (or client IP address) is IP v4 or IPv6. Both standard Internet traffic and 4G/LTE (GTP) traffic can be accelerated concurrently within the same appliance.

Note: A rapidly increasing numbers of MNOs are using IPv6 for the allocation of IP addresses to the mobile terminals, in particular smart phones, hence the importance of IPv6 support.

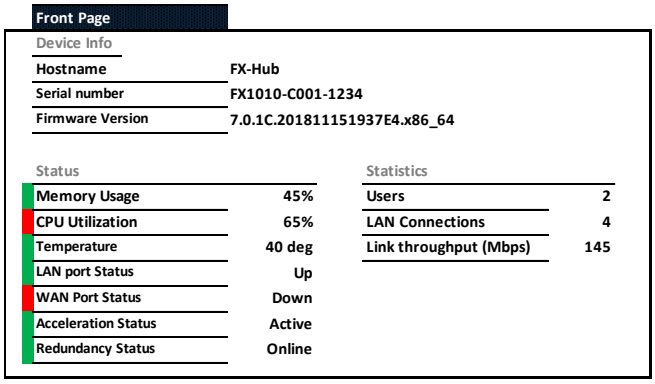


LAN/WAN Path Redundancy

When deploying a PEP server solution in-line (for transparency purpose), one of the challenges is to ensure path redundancy between the client's network switches or routers and the transmission network (satellite modems in this case). In order to solve the connectivity issue, the PEP server needs to offer two LAN interfaces, and two WAN interfaces, of which only one is active at any given time. Selection of the active Ethernet interface is done through using port traffic and status monitoring, and is compatible with major vendors Layer 2 standard mechanism (Cisco Flex link or EtherChannel for example).



The path redundancy works jointly with the fail to wire (line-bypass) feature in order to ensure continuous service availability (when in line bypass, traffic is passed through, but not accelerated). Both LAN/WAN interface pair are switched into line-bypass in case of system failure. The feature is also available when the units are configured as a 1+1 redundant system.



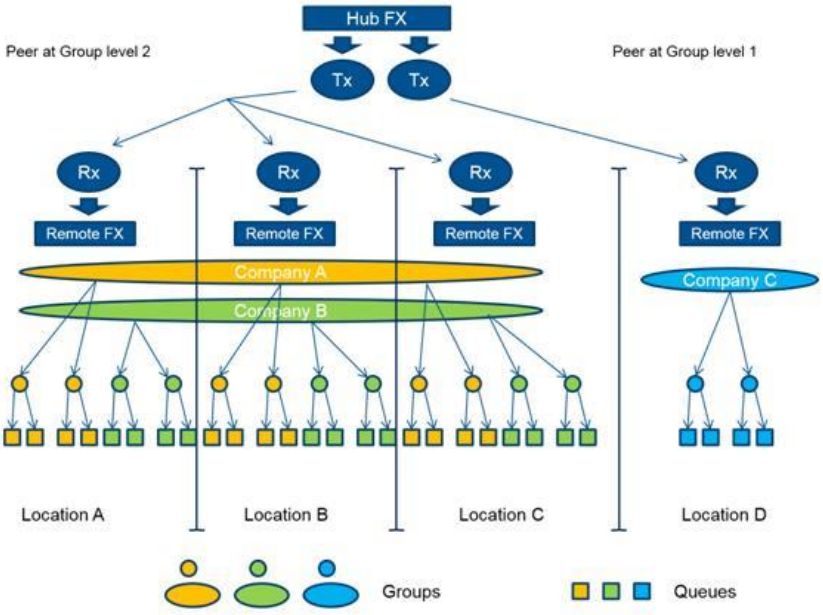
Simple Plug & Play Operation

With the introduction of the v7.x software release, the setup of Comtech's PEP system has been greatly simplified. Only a few parameters need to be configured for basic operation, and key information is displayed in one single screen (see below FX NetVue front page). Advanced configurations menus are available for optional features (like QoS, system redundancy) or tailoring the local PEP management interface configuration to the Service Provider's O&M control network. Configuration and monitoring functions are available through the system's local GUI, Comtech's NMS NetVue, as well as CLI.

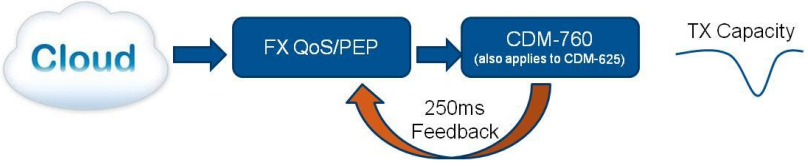
QoS and Dynamic Traffic Shaping

The FX provides traffic shaping on the WAN interface, with a flexible, three level shaper that supports point-to-point and point-to-multipoint links. Traffic shaping consists of a two-step processing, classification and drain. The FX supports many types of classification to allow working with multiple links, multiple users and multiple types of traffic. Classifying can be done with source/destination IP address, subnets, protocol type, Layer 4 ports, DSCP, VLAN* p/q and MPLS EXP bits. CIRs and MIRs can be established at each of the levels of classification.

(*) Note: With QinQ traffic, only the outermost VLAN label tag is taken into consideration for QoS purpose.



Draining of the WAN link output queues (or shaping) can be static according to the preset WAN TX link bandwidth value at configuration, or it can be dynamic, with the FX having the ability to regularly poll the associated modem to know the real-time data rate, using a configurable standard SNMP protocol OID. This is quite useful when working with ACM enabled satellite links where the WAN capacity changes rapidly and on a regular basis. Dynamic shaping oh the traffic therefore avoids random packet discards, which are detrimental to applications.



Detailed WANOp Software Feature List

- TCP PEP [Performance Enhancement Proxy]
  - ADC/REM Operation (Remote initiated TCP connection – download or upload)
  - Optional two-way operation (meshed network, server initiated connections) – require two appliances combined
  - Local TCP sessions acknowledgement
  - TCP/FTP Turbostreaming proprietary satellite link enhancement protocols and WAN acceleration (Download / Upload)
  - Persistent TCP WAN connections (Local TCP ACK / setup of TCP cnx)
  - Variable WAN TCP buffer window size per connection – automatically adjusted to fit link bandwidth.
  - Support HTTP, HTTPS, HTTP/2, SSL, FTP and Generic TCP traffic acceleration
- Support of GTP encapsulated protocol acceleration (4G/LTE access S1-U and 3G packet core – IuPS/Gn interfaces)
- Dual stack IPv4/IPv6 4G/LTE GTP Mobile traffic TCP acceleration (IPv4 outer IP Layer stack)
- Dual stack IPv4/IPv6 standard Internet access traffic TCP acceleration
- DNS Caching (including GTP encapsulated tunneled traffic)
- Full Layer 2-Layer 3 LAN-WAN transparency
- One-touch network operation (No Layer 2 or Layer3 network information required or configuration)
- Multi-layer 2 and 3 protocol stacks combination acceleration support (non-encrypted)
  - VLANs
  - QinQ (two VLAN tags)
  - MPLS (one or two labels)
- Jumbo Ethernet Frame support (up to 9,000 bytes MTU)
- 3 Tier Layer 2/3/4QoS
  - Per destination (VLAN, IP Subnet)
  - Per Traffic Type (VLAN p bits, MPLS EXP bits, IP TOS and Diffserv)
  - Per Protocol (UDP/TCP ports)
- Dynamic shaping
  - Based on modem real-time available TX throughput
- HA (High Availability)
  - Automatic hardware fail to wire (line-bypass)
  - Optional 1+1 system redundancy (in-line)
  - Optional dual path (LAN/WAN) connectivity (for path redundancy) – not supported on FX-1005e and FX-4010c.
- Traffic, PEP and DNS Cache Statistics[1]
- Passive Traffic Monitoring
- Management and Operation
  - Web GUI, CLI
  - Simple “one touch” configuration
  - Out-of-band management interface
  - Network Traffic Statistics
  - Comtech NetVue Operation (configuration, supervision)
  - Real-time LAN/WAN traffic capture (using standard PCAP format, readable by Wireshark software tool)

Note ([1]): Not all the statistics information is currently available through NetVue; may require additional SNMP enable monitoring software tool.

Specifications

Model	FX-1005e	FX-1010c	FX-4010c	FX-5020c
Form Factor	1RU	1RU	1RU	1RU
Weight	2.0 lbs. (1.2kg)	12 lbs (5.6 kg)	20.7 lbs. (9.4 kg)	15.5 lbs (7 kg)
Dimensions (h x w x d)	1.7" x 6.97" x 5.73" (43 x 177 x 145.5 mm)	1.7" x 17.0" x 12.0" (43 x 432 x 305 mm)	1.7" x 17.2" x 20.1" (43 x 438 x 510 mm)	1.7" x 17.2" x 16.9" (43 x 437 x 429 mm)
Nb Ethernet ports	4 x GE RJ45 (LAN, WAN, MGT, AUX)	6 x GE RJ45 (2xLAN, 2xWAN, MGT, AUX)	4 x GE RJ45 (LAN, WAN, MGT, AUX)	6 x GE RJ45 (2xLAN, 2xWAN, MGT, AUX)
Nb ports Line bypass (fail to wire)	1	2	1	2
Path Redundancy (LAN, WAN)	NO	YES	NO	YES
Rack Mount Kits	Optional (table top default)	Built-in	Built-in	Built-in
Traffic processing capacity in Mb/s (aggregated throughput TX+RX)	100	200	400	1,000
Licensing Tier* (in number of client TCP sessions accelerated)	2k, 4k, 10k, 20k	2k, 4k, 10k, 20k	30k	20k, 40k, 60k, 100k
Power Supply - UL Approved, FCC Compliant	Auto (100V-240V) AC Power with 60W external power supply adapter	Single or Redundant Hot Swap DC or AC Power consumption: 70W	Hot Swap 1+1 AC Power Supplies (100V-240V) Power consumption: 150W	Hot Swap 1+1 AC Power Supplies (100V-240V) Power consumption: 400W
Power Supply Safety/EMC Certifications	FCC Part 15 Subpart B Europe/CE Mark ROHS, UL (CA, US)	FCC Part 15 Subpart B Europe/CE Mark ROHS, UL (CA, US)	FCC Part 15 Subpart B Europe/CE Mark ROHS, UL (CA, US)	FCC Part 15 Subpart B Europe/CE Mark ROHS, UL (CA, US)
Environmental	Operating temp 0 - 40°C Storage temp -20 to 70°C Operating relative humidity 8 - 90% (non-condensing)	Operating temp 0 - 60°C Storage temp -20 to 70°C Operating relative humidity 8 - 90% (non-condensing)	Operating temp 5 - 35°C Storage temp -40 to 70°C Operating relative humidity 8 - 90% (non-condensing)	Operating temp 10 - 35°C Storage temp -40 to 70°C Operating relative humidity 8 - 90% (non-condensing)

Note (*): The appliance does not limit arbitrarily the traffic throughput or number of TCP sessions based on license: traffic (or rather client TCP sessions) in excess of the allocated license is simply pass through un-processed (not accelerated), within the limit of the forwarding capacity o the appliance, but the QoS features will always apply.

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