Memotec FX Series 7

WAN Optimization


FX5020c


FX6020c


FX1010c


FX1005e

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 or 5G, 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 transmission impairments (packet drops), can negatively impact a user experience regardless of bandwidth capacity. Furthermore, the problem is worsened today through feature rich web pages media content, and inflated file transfer resulting from HD pictures / videos exchanges on social medias together with HD movie streaming. Without optimization, display of these content presents a slow and non-responsive user experience over satellite.

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.)

The Solution: Comtech WANOp

To mitigate the adverse effect of satellite latency on web browsing and HD media display, 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 QoE - Web browsing & video streaming– and Service Providers. Technologies to mitigate satellite delay have been around for a while. Solutions used by most vendors today are Layer 3 (IP/Routed) and based on SCPS-TP standard. 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. In addition, being Layer 3, those solutions prevent [satellite] Service Provider to offer Layer 2 network services, the most common approach for delivering protocol-transparent transport services to other Service Providers (ISPs) or large corporation VPN (Layer 2 VLANs or MPLS).

This is where Comtech's WANOp solution comes to play: Comtech's WANOp offers a Transparent Layer 2 solution, compatible with any protocol mix, supporting L2/L3 VPNs with overlapping IP addressing space, and uses a combination of techniques to deliver both lightning fast file transfer AND a true broadband web browsing, video streaming, Internet access user experience.

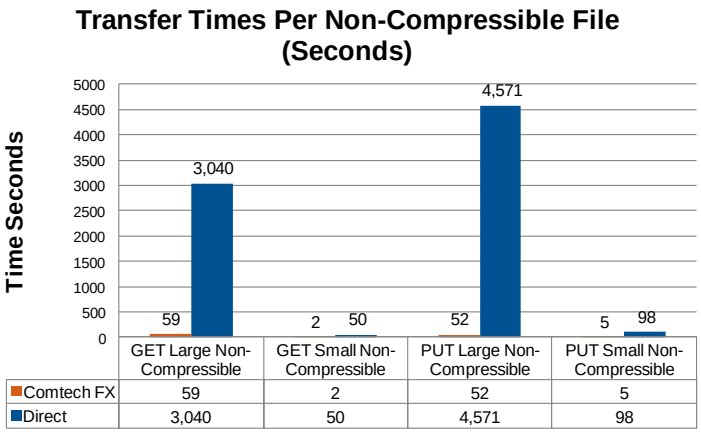
Features

- Turbostreaming© dramatically improves file downloads and web browsing QoE across satellite links, enabling a terrestrial-like fast broadband user experience (> 150 Mbps per user TCP session and up to 600 Mbps file transfer across 500ms GEO satellite links)
- DNS caching substantially shortens web page rendering by a factor up to two;
- Deliver acceleration across ISP, Layer2/Layer3 corporate VPN and Mobile (4G/5G) backhaul, Internet access traffic (including overlapping IP addresses)
- 100% end-to-end 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
- Optional Layer2-Layer4 IP traffic generic Header Compression and Packet Aggregation (VoIP/2G/3G IP traffic optimization)
- Optional payload compression: Byte Caching and GZIP compression
- 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 1.5 Gbps throughput and 200k TCP sessions accelerated
- No license-based throughput limitations simplify network design and operation

Turbostreaming©

Comtech's patented Turbostreaming technology is built around 3 concepts, ensuring faster content delivery for both small and large objects download through TCP connections, which is quite common on today's typical web pages. Turbostreaming enables 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 (last-mile and internet). 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 object downloads / uploads across the WAN (available satellite link bandwidth permitting). Combined with expanded TCP window buffer size, Turbostreaming reduces download/upload time of large files by a factor 100.



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 allows 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, Comtech's DNS Cache operates on 4G/LTE mobile backhaul applications as well as Layer-2 or Layer 3 VPNs (MPLS, GRE, mGRE), unlike external DNS Cache Servers.

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:

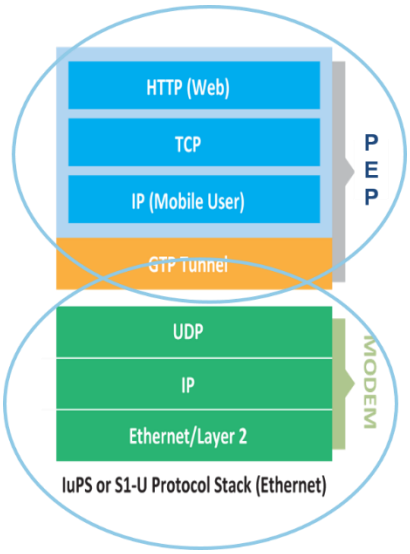
- One or two VLAN tags (QinQ); VLAN tags could also be used to segregate traffic per remote destination;
- MPLS tunnel with one or more stacked labels (used for traffic engineering, segregating traffic per customer or client's destination)
- GRE or mGRE tunnel Layer 3 VPNs.

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 and 5G user traffic, as well as 3G Packet Core traffic is 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.



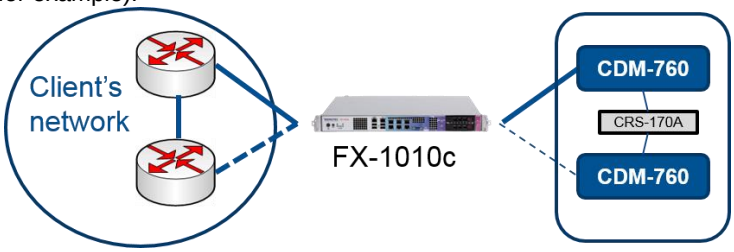
Unlike many acceleration devices, the FX WANOp PEP function has the ability to process the GTP layer to get access to and accelerate the 3G [at the Packet Core level], 4G/LTE or 5G mobile user (TCP) traffic and does so whether the supporting IP layer (or client IP address) is IP v4 or IPv6. Both standard Internet traffic and 4G/LTE/5G (GTP) access 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, specifically 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.



Front Page

Device Info

Hostname	FX-Hub
Serial number	FX1010-C001-1234
Firmware Version	7.0.1C.201811151937E4.x86_64

Status	
Memory Usage	45%
CPU Utilization	65%
Temperature	40 deg
LAN port Status	Up
WAN Port Status	Down
Acceleration Status	Active
Redundancy Status	Online

Statistics	
Users	2
LAN Connections	4
Link throughput (Mbps)	145

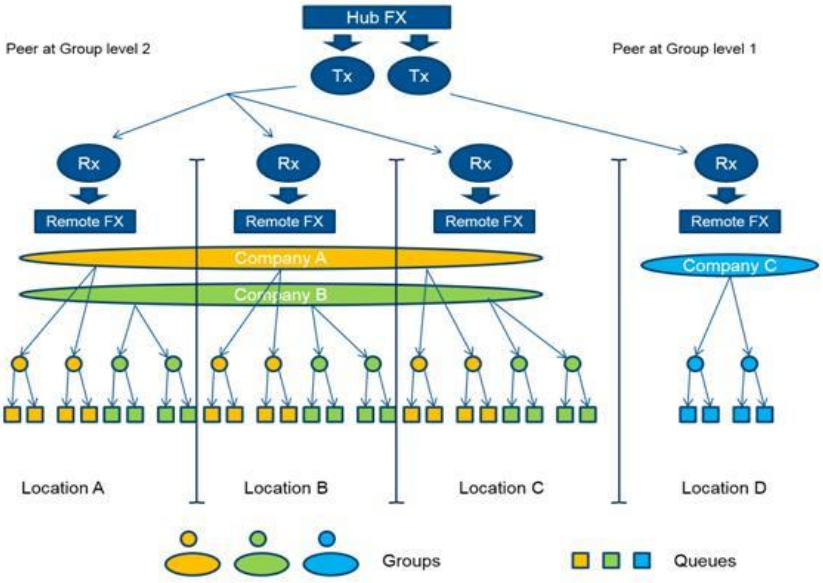
Simple Plug & Play Operation

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 FX NetVue front page display on the left). Advanced configurations menus are available for optional features (like QoS, system redundancy, compression) 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, standard SNMPv2/v3 driver interface, as well as CLI. Operator access and management interface is secured through authentication, ACL and encryption (SSH/HTTPS).

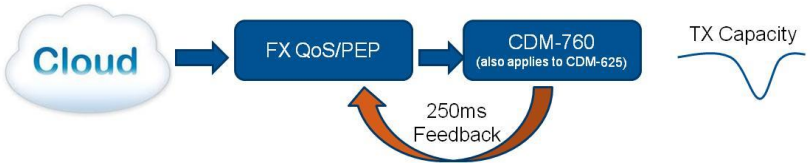
QoS and Dynamic Traffic Shaping

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.

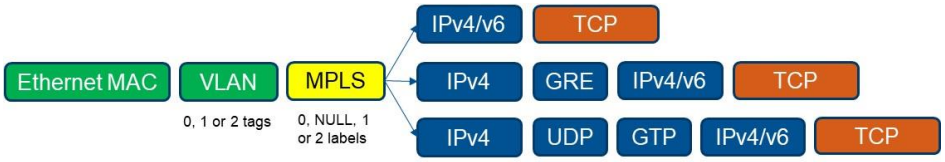


Draining of the WAN link output queues (or shaping) can be static according to the preset WAN TX link bandwidth value at configuration, or it can be dynamic, with the FX having the ability to regularly poll the associated modem(s) to know the real-time data rate, using a configurable standard SNMP protocol 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]
  - Point-to-point and Point-to-Multipoint STAR ADC/REM Operation (Remote initiated TCP connection – download or upload)
  - Point-to-point and MESHED network operation (two-ways TCP operation)
  - Local TCP sessions acknowledgement
  - TCP/FTP Turbostreaming proprietary satellite link Proxy Enhancement Protocol [PEP] (WAN acceleration)
  - Persistent TCP WAN connections (Local TCP ACK / setup of TCP connection)
  - Variable WAN TCP buffer window size per connection – automatically adjusted to fit link bandwidth.
  - Supports HTTP, HTTPS, HTTP/2, SSL, FTP and Generic TCP traffic acceleration
- TCP over Layer 3 IP acceleration:
  - Support of TCP over GTP protocol acceleration (5G/4G/LTE access S1-U and 3G packet core – IuPS/Gn- interfaces)
  - Support of TCP over GRE and mGRE protocol acceleration (Layer 3 IP VPN);
  - Support TCP over concurrent dual stack IPv4/IPv6 acceleration
- Support L2/L3 VPNs and MNOs concurrent overlapping IP addressing space;
- DNS Caching (including GTP and GRE encapsulated tunneled traffic)
- Full Layer-2 (L2) LAN-WAN transparency (transparent bridging) with L2/L3 QoS information preservation (VLAN p bits, EXP bits, DSCP field)
- One-touch network operation (No L2/L3 network information required or configuration)
- Multiple L2/L3protocol stacks combination acceleration support (non-encrypted)
  - VLANs (single tag)
  - QinQ (two VLAN tags)
  - MPLS (zero [NULL], one or two labels, per direction)



- Jumbo Ethernet Frame support (up to 9,000 bytes MTU) on WAN and LAN
- Standard to Jumbo frame/packets size conversion (LAN to WAN), to minimize packet overhead and PPS processing on WAN
- 3 Tier Layer 2/3/4 QoS
  - Per destination (VLAN, IP Subnet)
  - Per Traffic Type (VLAN p bits, MPLS EXP bits, DSCP field)
  - Per Protocol (UDP/TCP ports)
- Dynamic shaping
  - Based on modem real-time baseband capacity (MODCOD, Symbol-rate)
- Optional traffic optimization and compression:
  - Layer-2-Layer4 protocols Header Compression and Packet Aggregation (HC/PA) 1
  - Generic Packet Payload Compression (GZIP) 1
  - FTP file transfer payload compression (GZIP) and Byte Caching (Block mode) traffic optimization
- HA (High Availability)
  - Automatic hardware fail-to-wire (line-bypass)
  - Optional 1+1 system redundancy (in-line)
  - 1+1 hot swap power supplies (Optional on FX1010c; Not available on FX1005e)
  - Dual path (LAN/WAN) connectivity (for path redundancy) – available on FX-1010c, FX-5020c, and FX-6020c.
- Support TCP acceleration software Bypass (Filtering per flow, SA/DA, IP subnet or all TCP traffic)
- Traffic, PEP and DNS Cache Statistics
- Passive Traffic Monitoring (using Wireshark traffic capture)
- Management and Operation
  - Secured console and remote operator access (SSH/HTTPS) with authentication (Operator Name, Password and ACL)
  - Supported management interfaces: Graphical Web GUI, Command Line CLI, M2M SNMPv3 (for 3rd party NMS access)
  - Simple “one touch” configuration
  - Secured 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]): Header/Payload compression [HC/PC] is an optional feature and does not apply onto the TCP accelerated traffic. Use of the HC/PC feature may reduce the specified performances of TCP acceleration traffic processing (maximum number of TCP sessions accelerated, and/or, overall traffic throughput). Please, contact your Comtech’s representative for more information.

Specifications

Model	FX-1005e	FX-1010c
Form Factor	1RU	1RU
Weight	2.0 lbs. (1.2kg)	12 lbs (5.6 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)
Nb Ethernet ports	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
Path Redundancy (LAN, WAN)	NO	YES
Rack Mount Kits	Optional (table top default)	Built-in
Traffic processing capacity in Mb/s* (aggregated throughput TX+RX)**	140 (100x40)	250 (200x50)
Licensing Tier* (in number of client TCP sessions accelerated)	2k, 4k, 10k, 20k	2k, 4k, 10k, 20k
Power Supply - UL Approved, FCC Compliant	Auto (100V-240V) AC Power with 60W external power supply Power consumption: 22W	Single or Redundant Hot Swap DC or AC Power consumption: 70W
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)
MTBF (non-redundant/without failsafe) [years]	11.1	10.1
Environmental (values at sea level)	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)

Model	FX-5020c	FX-6020c
Form Factor	1RU	1RU
Weight	15.5 lbs (7 kg)	17.6 lbs (8 kg)
Dimensions (h x w x d)	1.7" x 17.2" x 16.9" (43 x 437 x 429 mm)	1.7" x 17.2" x 19.8" (43 x 437 x 503 mm)
Nb Ethernet ports	6 x GE RJ45 (2xLAN, 2xWAN, MGT, AUX)	6 x GE RJ45 (2xLAN, 2xWAN, MGT, AUX)
Nb ports Line bypass (fail to wire)	2	2
Path Redundancy (LAN, WAN)	YES	YES
Rack Mount Kits	Built-in	Built-in
Traffic processing capacity in Mb/s (aggregated throughput TX+RX)**	800 (600x200)	1,500 (1000x500)
Licensing Tier* (in number of client TCP sessions accelerated)	20k, 40k, 60k, 100k	20k, 40k, 60k, 100k, 150k, 200k
Power Supply - UL Approved, FCC Compliant	Hot Swap 1+1 AC Power Supplies (100V-240V) Power consumption: 400W	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)
MTBF (non-redundant/without failsafe) [years]	6.2	6.2
Environmental (values at sea level)	Operating temp 10 - 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)

Notes:

(*) The appliance does not limit the traffic throughput or number of TCP sessions based on license. Instead, traffic (or rather client TCP initiated sessions) in excess of the allocated license are simply pass through un-processed (not accelerated), within the limit of the appliance traffic forwarding capabilities.

(**) TCP Acceleration only (without Header/Payload Compression)

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