High-Speed Packet Processor for CDM-760 Advanced High-Speed Trunking Modem

Overview

Adaptive Coding and Modulation (ACM) is an important feature on many satellite links, enabling link margin to be converted to an increase in data throughput, thereby providing a service provider the ability to maximize the utilization of its leased satellite resource. However, when there are large variations in capacity, such as with High Throughput Satellite (HTS) links carrying packet-based content, ACM simply isn't enough. What is really needed are robust traffic shaping (also known as Quality of Service) and header compression techniques to be teamed with the ACM functionality.

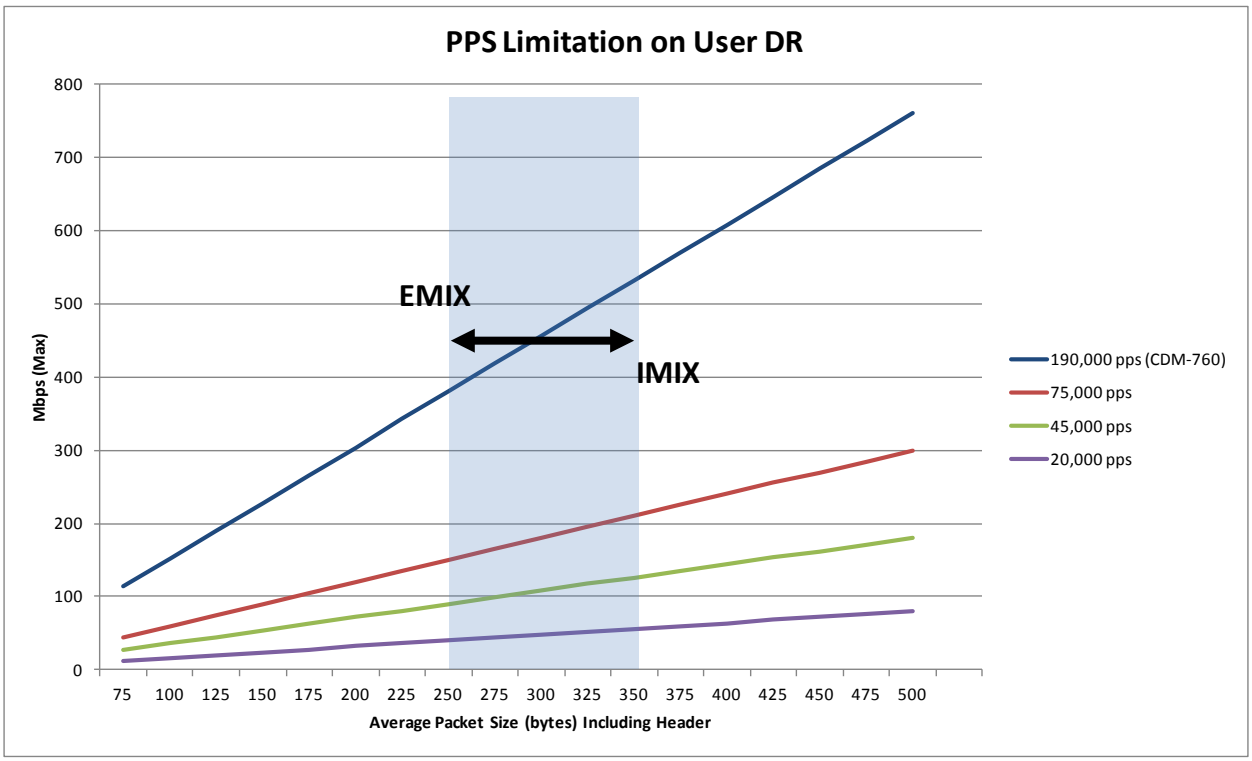
As packet-based content continues to dominate today's communication systems, traffic shaping is becoming a system level requirement for all network topologies. Traffic shaping is the engine that enables the transmission of the highest "value" traffic during periods of congestion, ensuring that the most important services are uninterrupted. Without it, all traffic is treated equally and even the most critical services can suffer. A site that has a terrestrial data rate that is greater than the satellite WAN capacity allocated to it will not operate properly without the proper traffic shaping, no matter the satellite network sharing mechanism, even with ACM implemented.

To address the need to provide an innovative ground equipment solution to team with today's spacecraft innovations, we developed a high-speed packet processor card for our award-winning CDM-760 Advanced High-Speed Trunking Modem. This new packet processor card enables full-featured traffic shaping and header compression. It has so much horsepower, it can run at the full data rate of the modem – no matter the IP traffic makeup – a real market differentiator.

The CDM-760 modem has long offered high-speed line-rate hardware based payload compression. The Packet Processor is specifically designed to augment this capability. It is purpose built to offer full rate Traffic Shaping and Header Compression.

>350,000 PPS

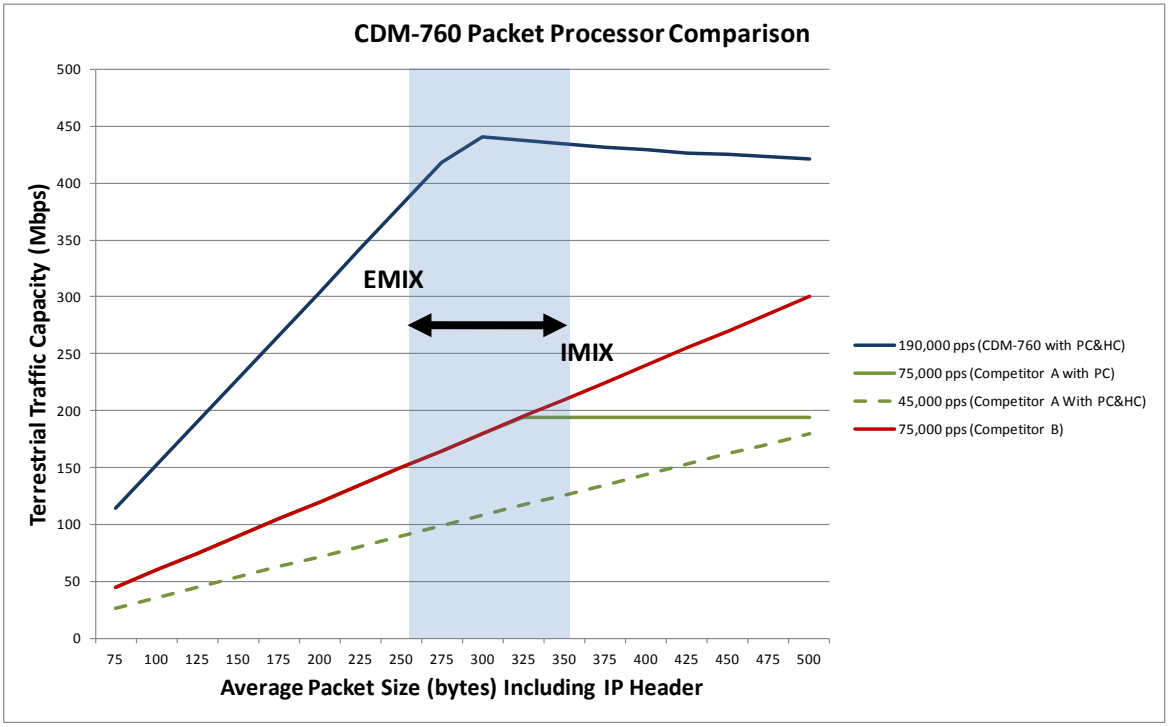
All of the benefits of traffic shaping, QoS, Header compression, routing etc. won't help you or your customers if the hardware that performs these functions can't keep up with the user traffic. When investing in a high-speed trunking modem, ensure that your investment can actually handle the traffic load. The CDM-760 high-speed packet processor accepts Ethernet frames from 64 bytes to 9,000 byte jumbo frames. When traffic shaping (QoS) and header compression are concurrently enabled, the packet processor will handle >190,000 pps simplex and >350,000 pps duplex, allowing the packet processor to run at the full capacity of the CDM-760's top speed of 314 Mbps simplex, 628 Mbps duplex rate.



The above graph depicts the direct impact on user data rate strictly due to PPS limitations on packet processors. We can quickly see that in order to calculate the total impact of a PPS limitation, it is important to understand what the average packet size is on your network. Two common models used for average packet size in a network are EMIX (Enterprise Traffic Profile) and IMIX (Internet Traffic Profile). These models show us that an average packet on an average network is somewhere between 250 and 350 bytes per packet.

The smaller the packet average, the more impact a PPS limitation has on the network and the more likely a modem will be PPS limited rather than data rate limited. Using the EMIX traffic profile, we can see that only the Comtech CDM-760 will be able to run at the modem's full rate. In fact, with an average packet size of > 220 bytes, the CDM-760 will not have a PPS limitation. Competitive offerings range from 20K PPS to 75K PPS WITHOUT all options enabled. This limits the speed of these modems to 50-150 Mbps regardless of the modem data rate specified.

To show a more complete picture on packet size and total user throughput we should also consider the impact of header compression and payload compression. Modems such as the CDM-760 offer these capabilities inside the product without the need for an external PC or processor. Header compression has a large impact on small packets where the header can account for 20-70% of the overall user traffic. Payload compression will boost overall throughput. These features use intelligence to dramatically increase user capacities. Unfortunately, unless you have a high horsepower processor, many of these features will lower the overall packets per second the modem can manage. The CDM-760 does not have this problem. Our specified packet per second rate is not impacted by the use of header compression or payload compression.



The above graphs depicts the real world impact of user throughput when comparing the CDM-760 modem with available header compression (HC) and payload compression (PC) vs. competitors with various options available.

Now that we have the horsepower needed to handle all user traffic rates, we can discuss the primary functions of the Packet Processor.

Packet Processor

The optional High-Speed Packet Processor enables efficient IP networking and transport over satellite with a processing engine capable of handling >190,000 PPS simplex and >350,000 PPS duplex. The Packet Processor performs header compression and Quality of Service (QoS) ensuring the highest service quality with minimal jitter and latency for real-time traffic, priority treatment of mission critical applications and maximum bandwidth efficiency.

The Packet Processor functions in Managed Switch Mode, operating as a layer 2 switch with VLAN and MPLS support.

Header Compression

The Packet Processor incorporates industry-leading header compression for Ethernet and IP traffic. In managed switch mode, header compression can reduce the 54 byte Ethernet/IP/UDP/RTP header to as little as 1 byte. For applications such as VoIP, header compression can provide bandwidth savings exceeding 65%. E.g. the 8 kbps G.729 voice codec requires 31.2 kbps once encapsulated into an Ethernet frame with IP/UDP/RTP. With header compression, the same voice call needs about 9 kbps – a saving of almost 70%. And, bandwidth requirements for typical Web/HTTP traffic can be reduced by 10% or more with TCP/IP header compression.

Supported Layer 2, 2+ Headers	Supported Layer 3 Headers
Ethernet	IP
Ethernet + VLAN	TCP
Ethernet + VLAN + VLAN	UDP
Ethernet + MPLS	RTP (Codec Independent)
Ethernet + MPLS + MPLS	
Ethernet + VLAN + MPLS	
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Traffic Shaping Functionality (QoS)

Traffic Shaping Functionality (QoS) – The High-Speed Packet Processor functions in a layer 2 mode of operation while performing the three processes that comprise traffic shaping:

Traffic shaping or QoS can be thought of as three separate processes:
1) Classification
2) Prioritization
3) Drain

- Classification of traffic is the basic mechanism by which a packet or frame can be sorted and associated with a particular group or priority. The more flexible a classification engine is, the more likely the high value services can be protected.

- Prioritization of traffic is a method of assigning various value levels to a particular packet or frame. Prioritization ensures that the packets / frames are "ordered" in such a manner that the highest level of protection is provided to the most valuable traffic.

- Drain – Once the packets or frames are classified and prioritized, it needs to be determined how to drain the traffic. Does your network require you to pass all high level traffic in a strict priority manner such that lower priority traffic could be "starved" in times of congestion? Or, can determinations be made about the maximum and minimum levels of service you can accept on a per classification basis? The CDM-760 Packet Processor gives the operator or service provider many options to choose from.

    - DiffServ – Industry-standard method of providing QoS enabling seamless co-existence in networks that implement DiffServ
    - Max/Priority – Provides traffic prioritization with the ability to limit maximum traffic per priority class
    - Min/Max – Provides a Committed Information Rate (CIR) to each user defined class of traffic with the ability to allow a higher burstable rate depending on availability
    - Max/Priority with Weighting Mode
        - Weights are applied all queues that have not reached their max BW limit
        - Once the max BW is reached, the scheduler will not drain any more data irrespective of its weights
    - Min/MAX with Weighting Mode
        - First serves the minimum BW
        - Once the minimum BW is met, the weights are applied until the Max BW is met
        - Once the max BW is met, the scheduler will not drain any more data

Classification	Prioritization	Drain
• DiffServ • MPLS • VLAN • Protocol • Source IP Address • Destination IP Address • Source Port • Destination Port	• Up to 8 different levels of prioritization • Weighting can be enabled per level	• DiffServ • Max / Priority • Min / Max • Max / Priority with Weighting • Min / Max with Weighting

The Comtech EF Data CDM-760 Packet Processor is a carrier-grade processor with horsepower and intelligence to match the full capabilities of the award-winning CDM-760 modem. The Packet Processor can be installed on order or upgraded in the field. All of the processor capabilities are included with the hardware; there are no data rate or feature limitations.

For additional information, please contact us.

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