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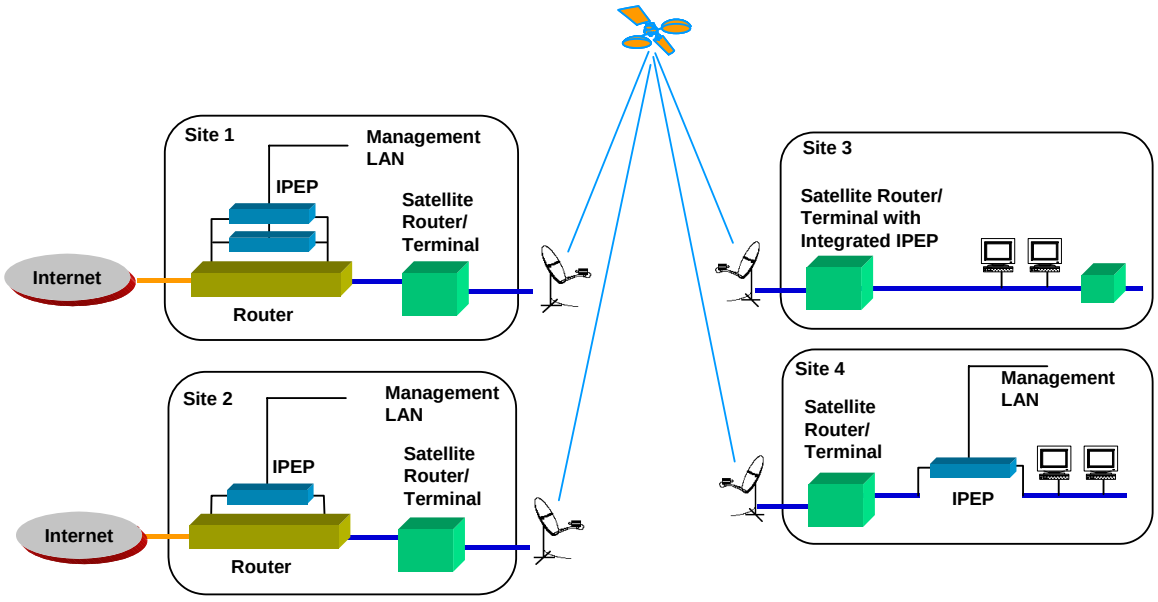
ViaSat IPEP Description and Comparisons

IPEP Description

IPEP, the Comsat Labs/ViaSat TCP Performance Proxy, is a hardware/software product, which accelerates TCP traffic over satellite links. Due to the high propagation delay of geo-synchronous satellites, most applications that use the standard TCP protocol for reliable end-to-end communications (such as file transfer, e-mail and web access) are limited to a maximum throughput of 64 kbps to 384 kbps, even when the satellite link rate is much higher. The IPEP technology, when used across a satellite network, removes this limitation without requiring any changes to end user equipment or software. Individual application throughput can be as high as the satellite link rate – up to 100 Mbps.

IPEP is available as a stand-alone unit with two 10/100BaseT ports. IPEP is also integrated into ViaSat's LinkStar VSAT terminal. The figure below shows various site configurations in a satellite VSAT network with IPEP.



The following is a list of some of the salient features of IPEP –

- Conforms to Split Connection TCP PEP (RFC 2488)
- Uses TCP, with RFC1323 extensions, as the reliable protocol over the satellite link. Does not use proprietary protocols or proprietary extensions to TCP.
- Uses RFC1323 compliant Large TCP Window Size over the satellite network
- A single TCP application can achieve full satellite link throughput
- Enhances all TCP applications, not just selected ones
- Completely transparent to end systems. Clients/Servers do not require any software or configuration changes.
- Can be used in configurations where IPEP is installed on one side of a satellite link only
- Designed from the ground-up for satellite DAMA networks, not just fixed rate point-to-point links
- Innovative flow control and congestion control procedures used to adapt throughput for each TCP connection as number of TCP connections and amount of available bandwidth change
- Fair sharing of bandwidth among multiple connections
- Works in satellite networks with heterogeneous mix of terminals, link rates and delays. Does not require explicit knowledge of network parameters.
- Additional features to improve Web browsing speed
- Uses Faster Connection Start, Faster Window Recovery, and Fast Connection Setup
- Maintains 3-way TCP connection-closing end-to-end semantics, so that applications such as banking transactions behave properly even during link failures. Also preserves relevant TCP and IP header fields such as TOS, decremented TTL and TCP ISS.
- Zero additional overhead, since packets over satellite are TCP/IP packets
- Routes/forwards non-TCP packets
- Supports configurable TCP ACK traffic reduction
- Intelligent shared buffer management reduces memory requirements
- SNMP Agent
- Command Line Interface (CLI)
- 1:1 Redundancy support with automatic switch-over
- Built-in satellite link rate/delay/error simulator for testing
- Simple to install, configure and manage
- In use in customer networks for over 5 years
- Number of simultaneous TCP connections supported: > 32,000
- Aggregate throughput: 100+ Mbps for IPEP-1000; ~200 Mbps for IPEP-2000 (not released yet)
- Maximum throughput per TCP connection: available satellite bandwidth

IPEP Comparison with SCPS-based PEP Products

The SCPS protocol is a TCP-backward-compatible protocol, which includes several SCPS-specific extensions to TCP procedures and messages, and was originally designed for use over deep-space and inter-planetary links. Extensions include support for very large delays, frequent link outages, high bit error rates, very asymmetric links, RFC1323 TCP enhancements, header compression and alternate retransmission procedures (SNACK).

A number of split-connection TCP-PEP products are available that use SCPS as the protocol over the satellite link.

Even though such products advertise all the features of SCPS, most of these features are not really relevant for TCP-PEP over geo-synchronous satellite links. The primary benefit of SCPS for TCP-PEP is support for large TCP windows (RFC1323).

In their primary role of TCP acceleration feature, both SCPS-based TCP-PEP and the ViaSat IPEP are comparable in functionality and performance, given the similar nature of the two solutions. When comparing performance of a single TCP connection across a point-to-point low BER satellite link, both products provide the same performance improvement.

However, the ViaSat IPEP is a superior product, given its design goals and heritage of use in large bandwidth-on-demand, TDMA mesh and star VSAT networks. IPEP software is “industrial-strength” software – it is robust, very efficient in its uses of processor and memory resources and very fast. The IPEP-1000 unit can support tens of thousands of concurrent connections and over 100 Mbps of aggregate throughput. The upcoming IPEP-2000 unit will support over 200 Mbps of aggregate throughput. Most SCPS-based TCP-PEP products cannot match that speed and performance.

The ViaSat IPEP contains some very innovative algorithms and procedures for performing flow control, rate control and congestion control of thousands of dynamic TCP connections, without having any explicit knowledge of the amount of dynamic satellite bandwidth available between site A and other sites. The throughput rate for each TCP connection is maintained at an optimal value in a fair, adaptive and reactive manner, while the number of TCP connections and the satellite bandwidth changes dynamically.

Convergence to optimal rates is very fast. Most SCPS-based TCP-PEP products require explicit knowledge of the amount of satellite bandwidth available between site A and site B. Some of the features of SCPS (e.g., elimination of slow-start, rate-pacing) are relevant for fixed point-to-point links and may reduce performance over dynamic bandwidth satellite networks.

The ViaSat IPEP contains some additional innovative algorithms and procedures for speeding up web-based interactive traffic. Most SCPS-based TCP-PEP products don’t.

The ViaSat IPEP works in satellite networks with a heterogeneous mix of terminals, link rates and delays. It does not require explicit knowledge of network parameters, such as link speeds or delays. Most SCPS-based TCP-PEP products require explicitly configuration of link rate and delay parameters.

The ViaSat IPEP contains a configurable satellite link rate/delay/error simulator, which can be used for test purposes. Most SCPS-based TCP-PEP products don't.

The ViaSat IPEP supports a 1:1 redundancy option, with automatic switchover, for use in mission-critical applications. Most SCPS-based TCP-PEP products don't.

Unlike SCPS, which is a (non-IETF) standard, the ViaSat IPEP uses RFC1323 compliant TCP with zero proprietary extensions to TCP. All of IPEP's procedures are "TCP-sender-side" procedure enhancements and do not require any TCP header extensions.

The ViaSat IPEP currently does not support TCP-SACK (selective retransmission), since most of our VSAT products are operated over relatively low bit error links with appropriate selection of FEC (Forward Error Correction) and dynamic power control. It is our experience that for networks with geo-synchronous satellites and non-mobile terminals, FEC and dynamic power control provide much better TCP application performance than selective retransmissions. SACK will be available in the next release of the IPEP software.

IPEP Comparison with Mentat PEP Products

Mentat produces a similar TCP-PEP product; Mentat uses a proprietary protocol (XTP) over the satellite link. Hence, it requires Mentat units on both sides of the link. XTP does not have many of the SCPS "enhancements". However, like all other TCP-PEP products, it uses large windows to speed up TCP connections.

Most of the comparisons between IPEP and SCPS-based TCP-PEP, described above, hold good for comparison between IPEP and Mentat as well.

The Mentat product supports data compression. An earlier version of our TCP-PEP product (the CLA-2000) supports data compression. However, extensive experience of operating the CLA-2000 over real Internet links has shown, that data compression is not very fruitful for Internet traffic, since the bulk of Internet traffic consists of compressed images, video and audio.