



FTP Application Note

Introduction

HyperIP is a WAN Optimization virtual appliance that operates on a VMware ESX or ESXi server to boost the performance of replication and file transfer applications. HyperIP for VMware mitigates TCP performance issues that are common when moving storage data over wide area network connections because of bandwidth restrictions, latency due to distance and/or router hop counts, packet loss, and network errors.

FTP (File Transfer Protocol) is a standard TCP file transfer application. It allows users to copy files between their local system and any system they can reach on the TCP/IP network. FTP over the WAN can be a frustrating experience when packet loss, congestion, or jitter is high. Those conditions cause significant amounts of data retransmission. Standard FTP does not handle retransmissions well because it must retransmit the entire file.

TCP link bandwidth issues and limitations

Several characteristics of TCP/IP cause it to perform poorly over lossy bandwidth and long distances:

❑ *Window Size*

Window size is the amount of data allowed to be outstanding (in-the-air) at any given point-in-time. The available window size on a given bandwidth pipe is the rate of the bandwidth times the round-trip delay or latency. Using a cross-country OC-3 link (approximately 60 ms based on a total 6000-mile roundtrip) creates an available data window of 155Mbps x 60ms = 1,163Kbytes. A DS3 satellite connection (540 ms roundtrip) creates an available data window of 45Mbps X 540ms = 3,038Kbytes.

When this is contrasted with standard and even enhanced versions of TCP, there is a very large gap between the available window and the window utilized. Most standard TCP implementations are limited to 64Kbytes windows. There are a few enhanced TCP versions capable of using up to 512Kbytes or larger windows. Either case means an incredibly large amount of "dead air" and very inefficient bandwidth utilization.

❑ *Acknowledgement Scheme*

TCP causes the entire stream from any lost portion to be retransmitted in its entirety. In high bit-error-rate (BER) scenarios this will cause large amounts of bandwidth to be wasted in resending data that has already been successfully received, all with the long latency time of the path. Each retransmission is additionally subjected to the performance penalty issues of "Slow Start".

❑ *Slow Start*

TCP data transfers start slowly to avoid congestion due to possible large numbers of sessions competing for the bandwidth, and ramp-up to their maximum transfer rate, resulting in poor performance for short sessions.

❑ *Session free-for-all*

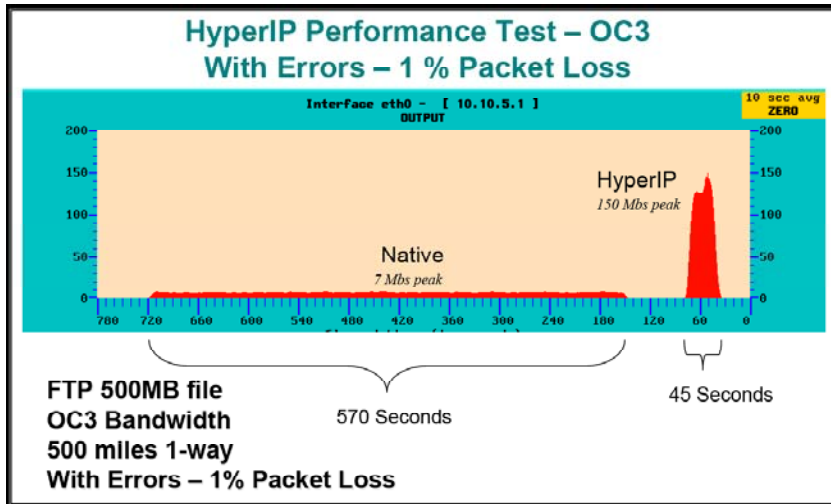
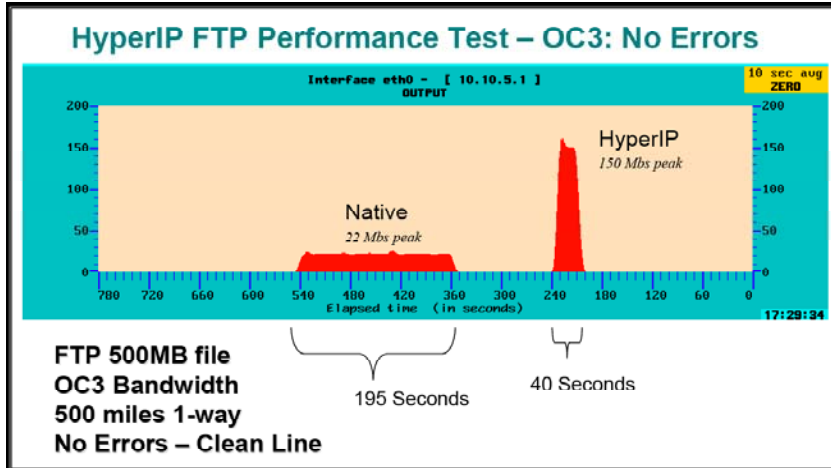
Each TCP session is throttled and contends for network resources independently, which can cause over-subscription of resources relative to each individual session.

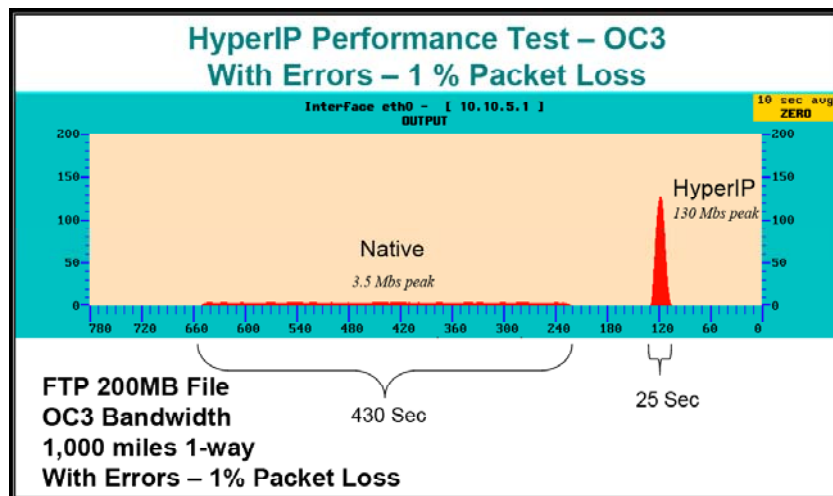
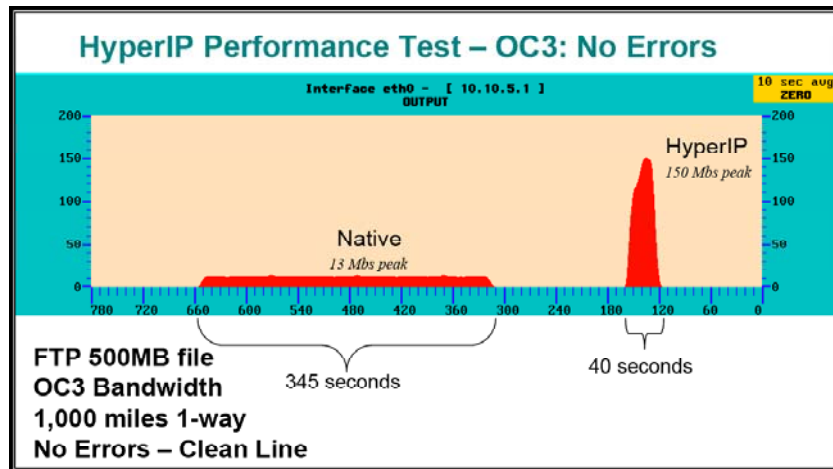
The net result of these issues is very poor bandwidth utilization. The typical bandwidth utilization for large data transfers over long-haul networks is usually less than 30% and more often less than 10%.



Implications for FTP on TCP/IP networks

Testing results with FTP have been outstanding. Bandwidth utilization approached 100% both without and with packet loss on an OC3 (155Mb/s) circuit.





While none of the above performance charts include compression the bandwidth utilization can be further reduced depending upon the compressibility of the data. Typical compression ratios range from 2:1 to 15:1 depending upon the data.

The cost effective solution: FTP and HyperIP[®]

HyperIP was designed specifically for large amounts of data over big bandwidth and long distance, to be highly efficient regardless of the BER congestion, or jitter. HyperIP is a standard TCP/IP network node requiring no modifications to LAN/WAN infrastructures and no proprietary hardware. It provides transparent "acceleration" across WANs.

HyperIP provides the following benefits:

□ Window size

The HyperIP transport protocol keeps the available network bandwidth pipe full. The results are over 90% efficient link utilization. It eliminates the discrepancy between maximum available bandwidth and the results provided by native TCP/IP.



❑ *Acknowledgement scheme*

HyperIP transport protocol retransmits only the NAK'd segments and not all the data that has already been successfully sent.

❑ *Slow Start*

Configuration parameters allow HyperIP to start transmissions at a close approximation of the available session bandwidth.

❑ *Dynamic adjustments*

When feedback from the receiver in the acknowledgement protocol is received, HyperIP quickly "zeroes-in" on the appropriate send rate for current conditions.

❑ *Session Management pipeline*

HyperIP® allows traffic from multiple TCP sessions to be aggregated over a smaller set of connections between the HyperIP devices, enabling a more efficient use of the bandwidth and less protocol overhead acknowledging many small messages for individual connections.

❑ *Adaptive Block-level Compression of Data*

HyperIP applies, as required, block-level compression of the optimized data allowing more data to be shipped over the WAN link, without having to upgrade the circuit. This software-based algorithm is much more efficient than packet-level compression and allows the Veeam Backup and Replication application to offload compression for more efficiency in the replication process.

Summary and Conclusion

HyperIP provides the highest possible throughput for FTP over TCP/IP WANs. It does this with a technology that provides:

- Bandwidth utilization that consistently exceeds 90 + percent regardless of packet loss, congestion or jitter
- 2:1 to 15:1 adaptive compression
- Elimination of TCP/IP network latency

FTP over TCP/IP with HyperIP is the solution of choice.

NetEx Software, Formed in 1999 as a spin-off of Storage Technology Corporation (StorageTek®), privately-held NetEx provides the world's fastest WAN optimization software in the industry, along with guaranteed data delivery. As a VMware Technology Alliance Partner, NetEx's VMware Ready HyperIP WAN optimization virtual appliance is leading the way in demonstrating impressive performance results for supercharging VMware applications worldwide.

NetEx works with some of the world's largest and most sophisticated organizations, including some of the most prestigious providers of financial, transportation, government, and telecommunications services. For more information about NetEx, NetEx/IP or HyperIP, visit www.netex.com.