Ultimate X File Transfer Over Satcom Network
Moving data faster than conventional TCP/IP methods

EXECUTIVE SUMMARY

Challenge:

- Evaluate the performance advantage of moving information over a Satcom network through Vcinity's ULT X versus traditional TCP/IP methods.
- Benchmark the capabilities of ULT X through a combination of single and multiple file tests (with files of varying sizes from 100KB to 2GB) over a satellite link with a 530ms latency RTT, using three different commercial satellite modems.

Solution:

ULT X is a purpose-built enterprise data solution that can either provide remote access to or move any data, anytime, anywhere. Similar to terrestrial links, the ULT X takes full advantage of the satellite links including HTS links of 400+ Mbps capacity by providing very high utilization of the available bandwidth.

Results:

ULT X enables maximum link capabilities over existing satellite infrastructures. Test results show link optimization and data transfer time improved anywhere from 2x to >8x when compared to traditional TCP/IP methods.

Many satellite systems in use today with a 5-10Mbps outbound carrier and a 1-2Mbps inbound carrier are barely sufficient for surfing the web or checking email and are certainly not designed for moving data at rates needed by today's requirements. With the advent of High Throughput Satellite (HTS) and corresponding satellite modems, 400-500Mbps or higher throughput is now possible. However, the majority of this equipment is based on the TCP/IP protocol resulting in low utilization of the available bandwidth. Commonly understood limitations of standard TCP/IP performance are calculated using either the Mathis Formula[1] for connections expecting less than 1% packet loss or the Padhye Formula[2] that accounts for greater packet loss and other TCP factors. Based on these factors, additional bandwidth has no impact on the protocol's limitations. Using a simplified version of this formula, we calculate maximum TCP/IP throughput for the 530ms latency circuit as:

With a default window size of 64KB (65535 Bytes*8 bits = 524288 bits) / 530ms latency = 989,207 bits per second or < 1Mbps maximum throughput regardless of available bandwidth on the circuit.

Compared to the above, Ultimate X™ (ULT X) from Vcinity™ provides a much higher bandwidth utilization by achieving ~920Mbps throughput on a 1Gbps link with artificial latency of 530ms inserted. Even with protocol acceleration, conventional satellite networking equipment is limited to the amount of data it can efficiently move over a lower speed satellite link, regardless if the link operates at 400Mbps or more. Vcinity's ULT X is designed for terrestrial networks but operates equally well over satellite. It provides stability for lossy satellite links and improves throughput dramatically, resulting in very high utilization of the available bandwidth.

Environment

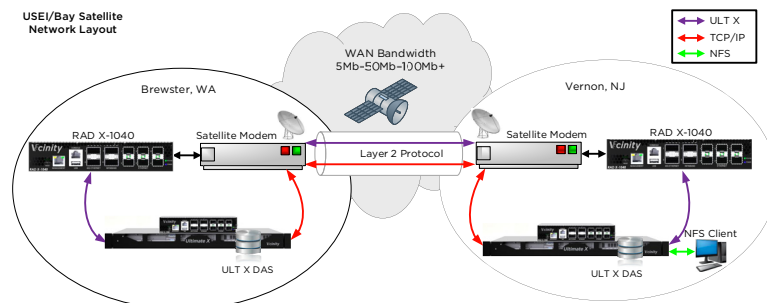The network configuration used for testing is shown in Figure 1.

Figure 1. Test Environment Network Layout

[1] http://ccr.sigcomm.org/archive/1997/jul97/ccr-9707-mathis.pdf
[2] http://conferences.sigcomm.org/sigcomm/1998/tp/abs_25.html

Using the configuration shown in Figure 1, three satellite modems from different vendors were used to test multiple characteristics and applicable data points. Each modem was configured to provide connectivity data rate options of roughly 5Mbps, 50Mbps and 100+ Mbps. Datasets include single or multiple files of sizes varying from 100KB to 2GB and were transferred using scripts with Linux "scp" copy command. The latency between the systems using the EutelSat's Satcom network and USEI teleports was measured to be 530ms.

Results

Vcinity's ULT X solution moves data significantly better and faster than conventional means of data transfer over satellites using TCP/IP. Key observations from the measurements on the Satcom links are:

- In high latency circuits, TCP/IP does not handle small file transfers efficiently in any scenario.
- The ULT X solution performs approximately 200% to >800% better than the TCP/IP protocol, with higher bandwidths displaying the greatest differences.
- Although TCP/IP works well with large files at low bandwidth, it fails in comparison to ULT X when moving large files overall.

- When moving large files with low bandwidth circuits (e.g., the 5Mbps test), TCP/IP does show acceptable performance; however, moving smaller files causes problems for TCP/IP, whereas ULT X handles both large and small files efficiently.

Figure 2 summarizes test results that compare the improvement obtained using ULT X versus the traditional TCP/IP protocol. The figure shows the multiple of improvement in transfer time of data based on the available bandwidth and datasets used.

Calculation for ULT X improvement over TCP/IP:

X Improvement = Transfer time (TCP/IP) / Transfer time (ULT X)

As part of the total benefit realized by ULT X, the results show ULT X provides a vastly more efficient workflow over high latency Satcom networks as compared to TCP/IP. ULT X helps move and access mission critical data faster within an extended enterprise spread across locations connected via Satcom links, thus solving the critical challenges of mission productivity, time and bandwidth resources.
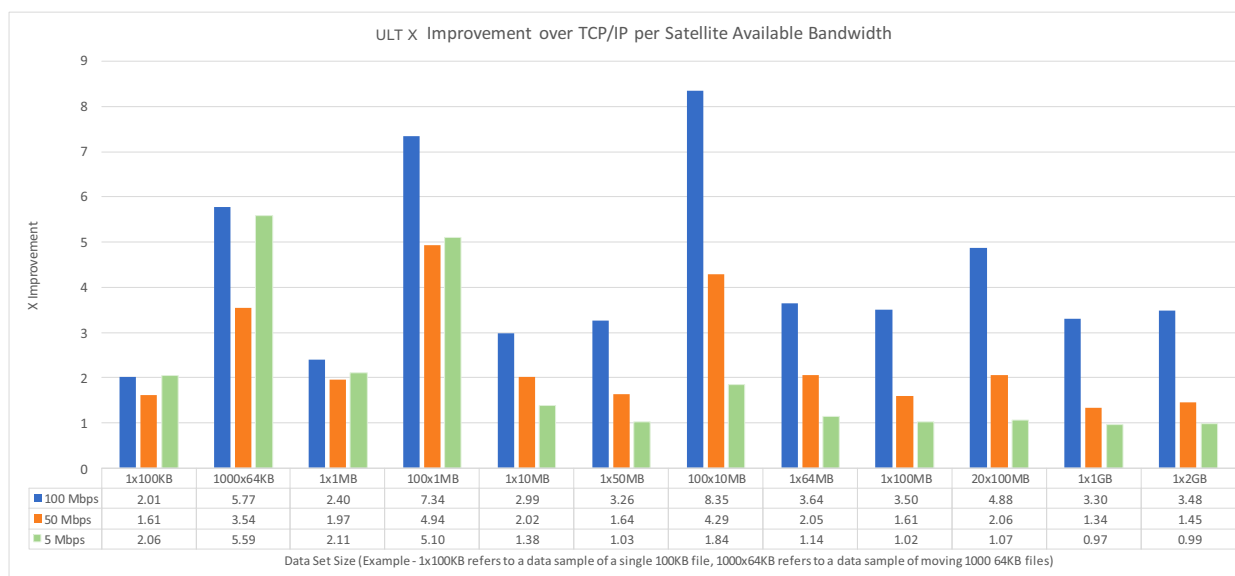

ULT X Improvement over TCP/IP per Satellite Available Bandwidth

Data Set Size	1x100KB	1000x64KB	1x1MB	100x1MB	1x10MB	1x50MB	100x10MB	1x64MB	1x100MB	20x100MB	1x1GB	1x2GB
100 Mbps	2.01	5.77	2.40	7.34	2.99	3.26	8.35	3.64	3.50	4.88	3.30	3.48
50 Mbps	1.61	3.54	1.97	4.94	2.02	1.64	4.29	2.05	1.61	2.06	1.34	1.45
5 Mbps	2.06	5.59	2.11	5.10	1.38	1.03	1.84	1.14	1.02	1.07	0.97	0.99

Data Set Size (Example - 1x100KB refers to a data sample of a single 100KB file, 1000x64KB refers to a data sample of moving 1000 64KB files)

Figure 2. ULT X Improvement over TCP/IP Summary

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