Technical Review

Accelerating Time to Decision with Vcinity Ultimate X

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Abstract

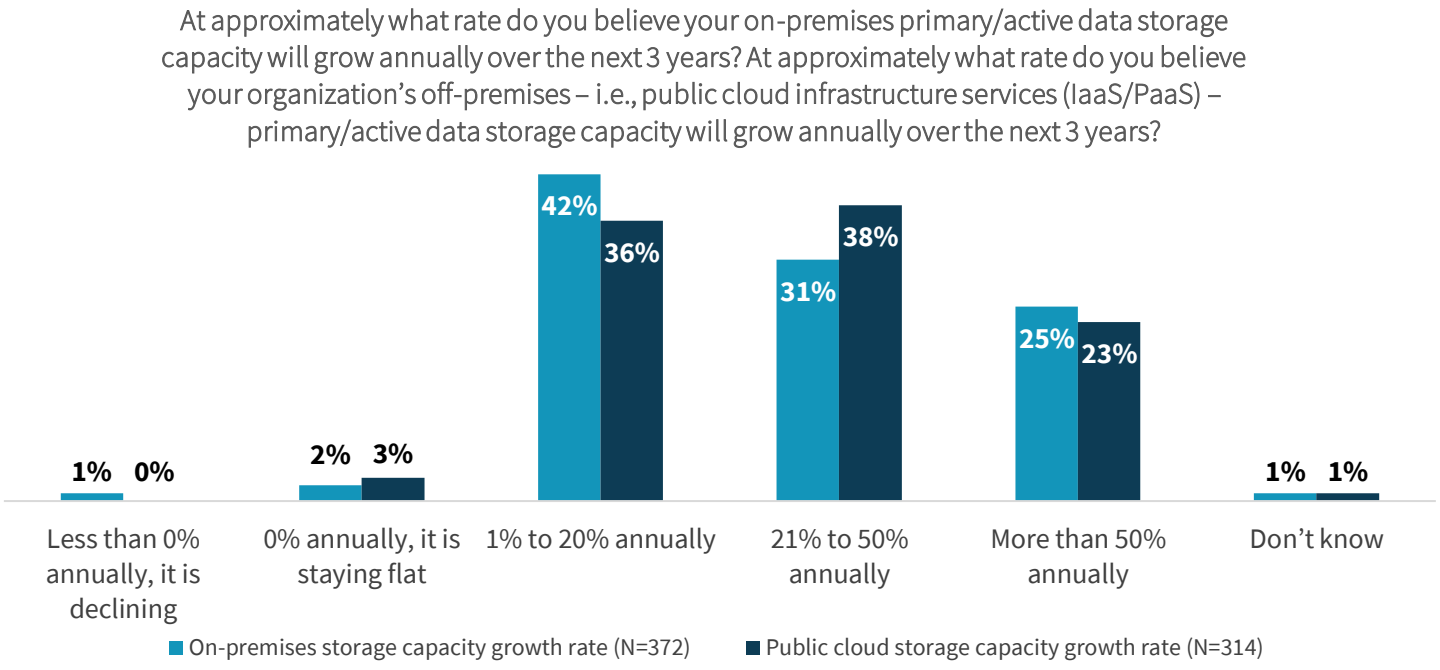
This ESG Technical Review documents hands-on validation of Vcinity Ultimate X (ULT X). The report explores how Vcinity turns your WAN into a global LAN with near real-time performance for collaborative, data-intensive application workflows or for when you need to execute against data over long distances.

The Challenges

Data is fueling the growth of digital transformation in an increasing number of enterprises. Deriving new insights from that data is top priority for the IT decision makers within those organizations with goals of accelerating real-time decision making and optimizing customer satisfaction.

A recent ESG survey of IT storage decision makers indicates that 25% of IT organizations expect to grow on-premises data by more than 50% annually over the next three years, and 23% of organizations believe that off-premises primary data will grow by more than 50% annually over the next three years (see Figure 1).[1] A broader ESG survey of IT purchasing decision makers revealed that improving data analytics for real-time business intelligence and customer insight is one of the top three most-cited business initiatives that will drive the most technology spending in 2020.[2]

Figure 1 Anticipated Annual Growth of On- and Off-premises Storage Capacity in the Enterprise



Source: Enterprise Strategy Group

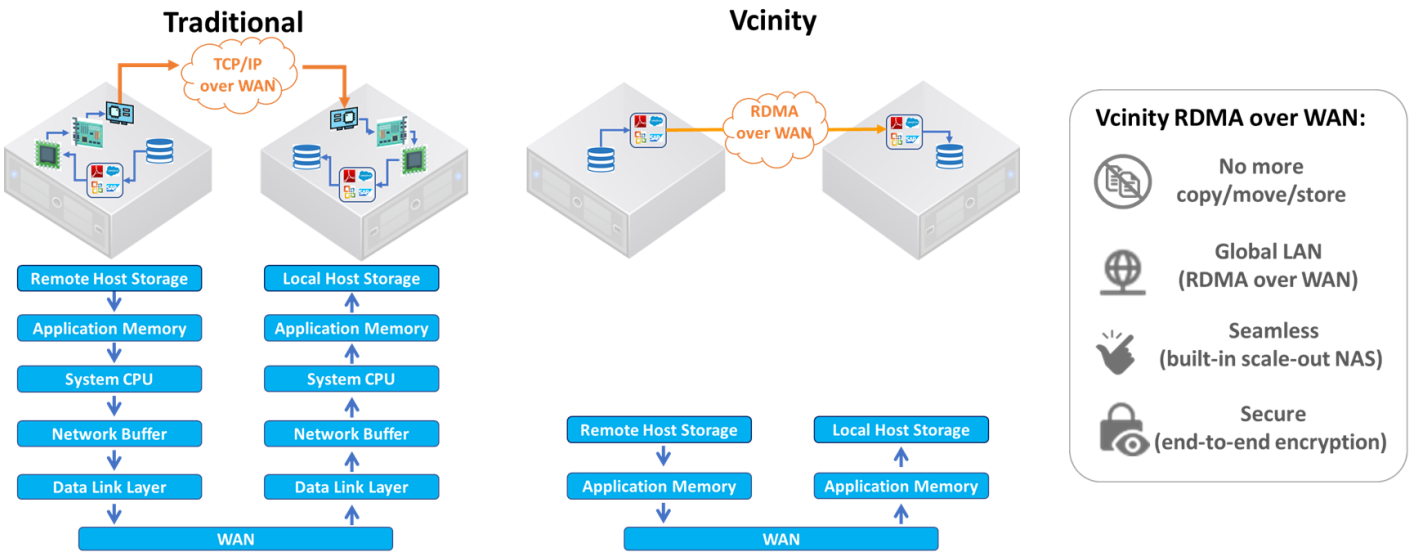
As organizations generate more data, end-users face the challenge of accessing that data in near real time—especially when the data sets are large and the WAN connection between the end-user is long (e.g., intercontinental).

[1] Source: ESG Master Survey Results, *2019 Data Storage Trends*, November 2019.
[2] Source: ESG Master Survey Results, *2020 Technology Spending Intentions Survey*, December 2019.

The Solution: Vcinity Ultimate X

Vcinity Ultimate X (ULT X) is an enterprise-class networking solution with a built-in scale-out file system that turns a WAN into a global LAN. Vcinity uses remote direct memory access (RDMA) technology to eliminate the overhead of a traditional TCP/IP stack running over a WAN (see Figure 2).

Figure 2. Vcinity Ultimate Access



Source: Enterprise Strategy Group

RDMA, which is sometimes referred to as "zero-copy networking," enables direct memory access from one compute node to another with no CPU or operating system intervention. ULT X combines RDMA over WAN technology with a field-proven scale-out network attached distributed parallel file system (currently IBM Spectrum Scale or Lustre) with a goal of eliminating the copy/move/store paradigm associated with large data set workflows over long distances.

Vcinity's RDMA over WAN technology was originally designed for high-performance computing and military applications that needed to access and process large data sets over thousands of miles of high-bandwidth WAN connections (e.g., 10/40 and 100 Gbps, and now 100 Gbps dense wave division multiplexing (DWDM) wave). To meet the strict security needs of these applications, Vcinity has developed line rate encryption technology, which uses a different set of keys for each multiplex data transfer and a separate key for each transfer session.

The Vcinity family of ULT X hardware appliances, and a software-only solution that can be deployed in a virtual machine or the public cloud, combines the field-proven heritage of the Vcinity family of RDMA over WAN adapters with the seamless simplicity of a field-proven scale-out NAS solution. Integrating ULT X with existing applications and distributed workflows is as simple as changing a mount point or a directory name, since ULT X looks like a NAS device connected to the LAN.

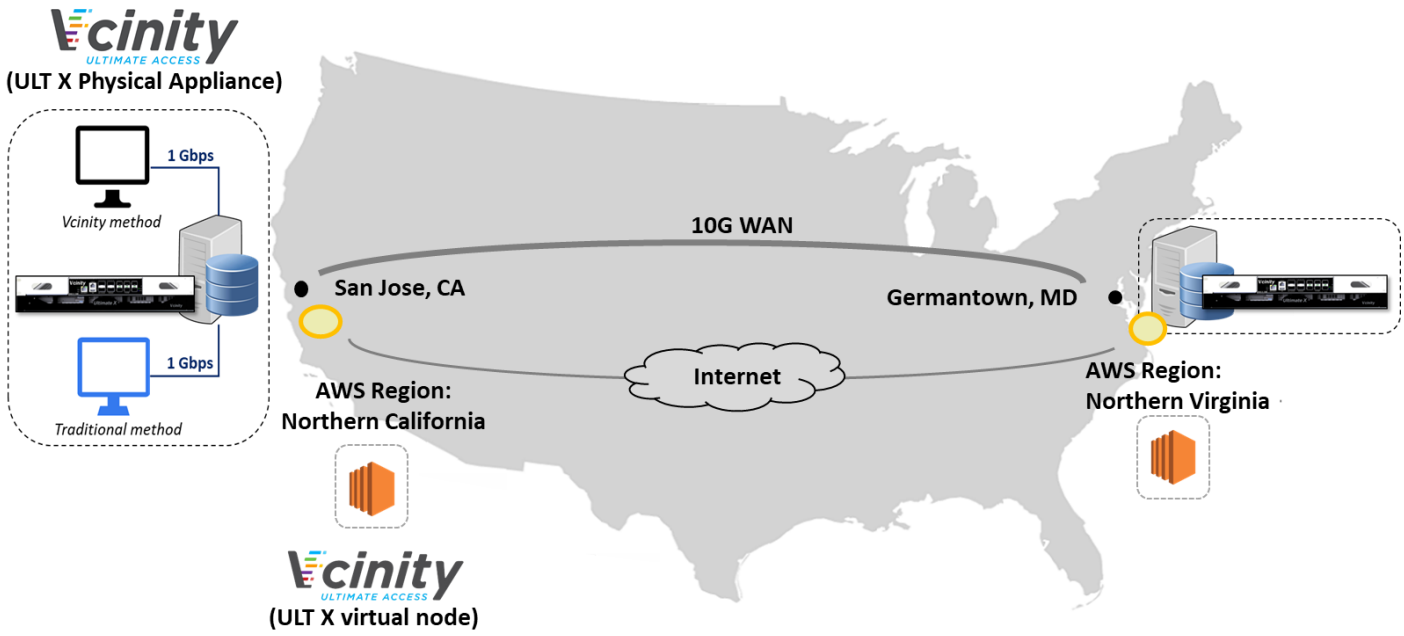
The early adopters of ULT X in enterprise-class organizations are using Vcinity to accelerate the time to access and gain insight from large data sets over long distances (e.g., oil and gas exploration, media and entertainment post-production, and pharmaceutical research). ESG anticipates broader adoption for Vcinity's solution for general purpose applications and workflows that flow through service providers and public clouds in the years ahead, as evidenced by its initial successes.

ESG Validated

The ESG validation test bed is summarized in Figure 3. Two physical appliances (ULT X-1100) were deployed in Vcinity offices located in San Jose, CA and Germantown, MD. A 10Gbps dense wave division multiplexing (DWDM) wave was used to create a 10Gbps WAN connection between the two offices. The traditional TCP/IP method was compared to the Vcinity method from two clients that were connected to the ULT X appliance with a 1Gbps Ethernet LAN network in San Jose.

The virtual software-only solution (ULT X-1000v) was deployed in Amazon Web Services (AWS) EC2 instances located in the AWS Northern California and Virginia regions. Each 1000v connected to the internet with a 1Gb link, as the 1000v is currently limited to 1Gbps throughput. The instances were connected to each other over the public internet.

Figure 3. Vcinity Test Bed



Source: Enterprise Strategy Group

ESG validation testing began with an emulation of a Vcinity customer environment in the oil and gas industry. The company analyzed seismic survey data collected by ships to determine where to drill for natural resources. Data sets captured during a typical seismic survey voyage ranged from multiple petabytes to exabytes.

Data scientists who rendered and analyzed the seismic survey data were in Houston and Rio de Janeiro. Without Vcinity, it would take at least a week to transfer the seismic data to the data scientists over a WAN with traditional TCP/IP technology. In the meantime, the ship would remain idle as the crew waited for the data scientists to determine where the next survey should be done.

Instead of waiting for the data to be copied, moved, and stored over the WAN, the company resorted to exporting the data to removeable hard drives (copy), sending the hard drive overnight via plane (move), and copying the data to a locally attached network attached file system (store). While this approach expedited the process, data scientists still had to wait to get their data.

As shown in Figure 4, the company deployed Vcinity appliances in Houston and in Rio, eliminating the copy/move/store overhead. Time to analysis and insight reduced from days to minutes. According to Vcinity, data scientists experienced the same performance when accessing data as if the data were local, despite the fact that it was located thousands of miles away.

Figure 4. Seismic Survey Data Transfer in the Oil and Gas Company

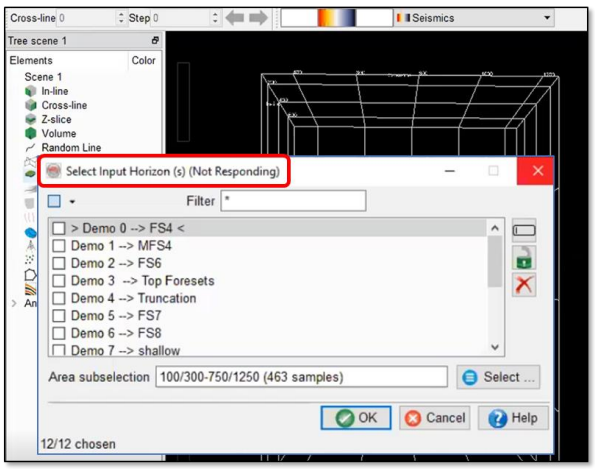
Source: Enterprise Strategy Group

No More Move/Copy/Store of Data

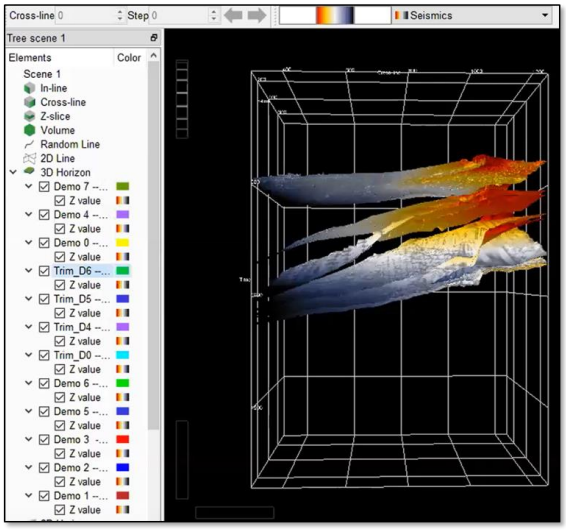
To simulate the case study, ESG evaluated the seismic rendering responsiveness for data scientists with the physical test bed (San Jose, CA to Germanton, MD over a 10G WAN) and an open source seismic rendering application (OpendTect v6.2.0) running on a standard Windows desktop connected at 1Gbps over the LAN. We compared the time it took to select and render 12 seismic layers with Vcinity versus with traditional TCP/IP. We observed that the application read the data much more quickly with the Vcinity method. As a matter of fact, the rendering completed with Vcinity before the application opened the data layers with TCP/IP. The application actually hung with a ***Not Responding*** message during this phase of the test with the traditional method (see Figure 5).

Figure 5. Rendering Seismic Data Using OpendTect v6.2.0

Traditional TCP/IP over WAN – still opening files



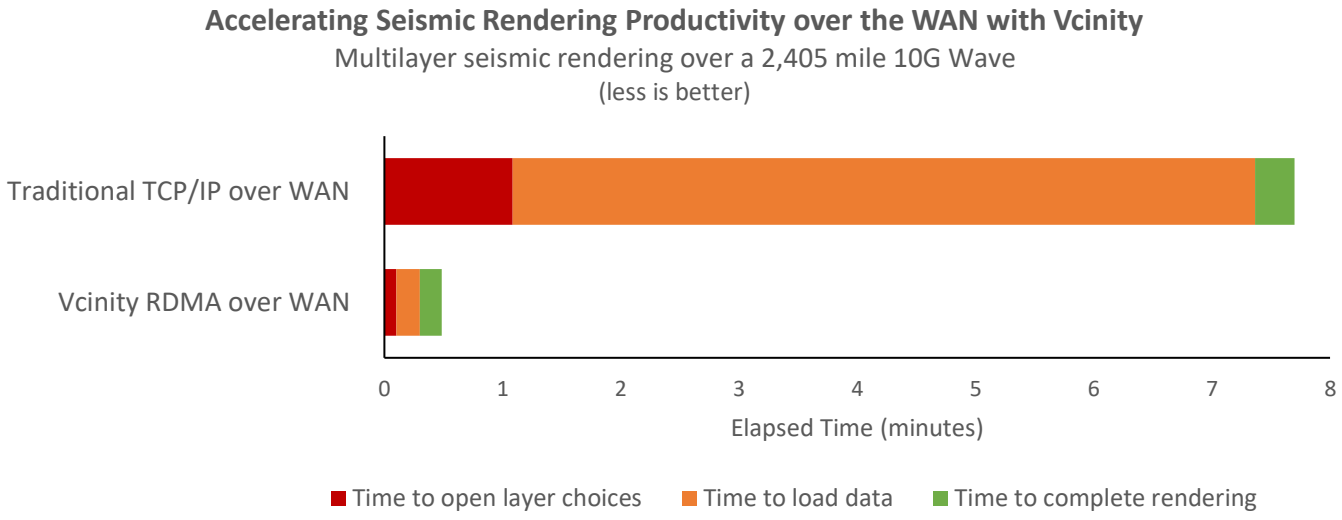
Vcinity RDMA over WAN – rendering complete



Source: Enterprise Strategy Group

ESG quantified the Vcinity acceleration by comparing the elapsed time that it took to open layer choices, load the data, and render the seismic image with both methods. As shown in Figure 6, Vcinity was 94% faster than TCP/IP when accessing a data set that was 2,405 miles away (29 seconds compared with 7 minutes and 42 seconds). As the seismic data scientists had reported, accessing data located thousands of miles away was, for all intents and purposes, as fast as accessing data stored locally.

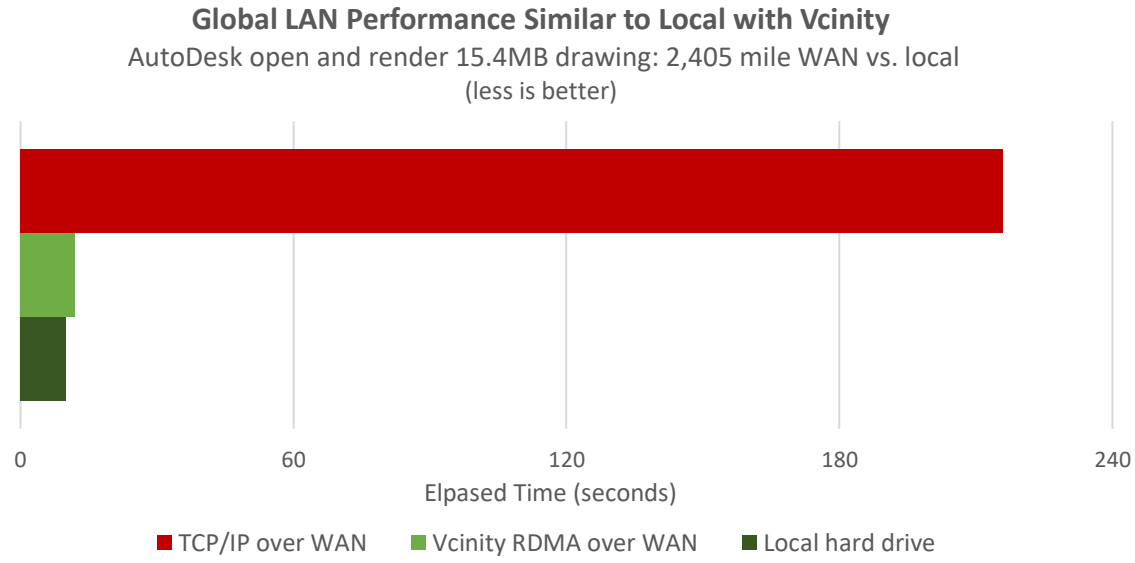
Figure 6. Accessing and Rendering Seismic Data – Traditional TCP/IP over WAN vs. Vcinity RDMA over WAN



Source: Enterprise Strategy Group

ESG then ran another test with a goal of proving that users of the Vcinity ULT X solution can access data located thousands of miles away practically as fast as a local data set. We compared the time that it took to open and render a 15MB AutoDesk rendering of a ship design in a local directory to the time that it took to open and render the same file located more than 2,000 miles away, using both Vcinity and traditional TCP/IP (see Figure 7). For this test, we used the Vcinity ULT X-1000v deployed in AWS EC2 instances located in California and Virginia.

Figure 7. CAD Rendering



Source: Enterprise Strategy Group

We observed that the elapsed time using Vcinity 1000V was 95% faster than the TCP/IP method (12 seconds versus 3 minutes and 36 seconds) and only 2 seconds slower than the local method. In ESG's opinion, this proves that the Vcinity method enables access to data located far away as quickly as accessing data stored locally.

Why This Matters

Organizations that run data-intensive applications—big data analytics, IoT, machine learning, and artificial intelligence—can only provide competitive advantage when end-users can access relevant, up-to-date data as quickly as possible, regardless of where the data is generated and stored. Any delay in accessing such data can lead to untimely insights and decisions that incur unnecessary costs or lost revenue.

ESG validated that the Vcinity ULT X node can enable enterprises to build out a "global LAN," granting data access across any physical distance without having to move or copy data to storage local to the end-user. We compared how quickly we could access data cross-country using Vcinity ULT X against transferring and accessing data via traditional WAN. We found that data access via Vcinity ULT X was 94% faster than using the traditional approach.

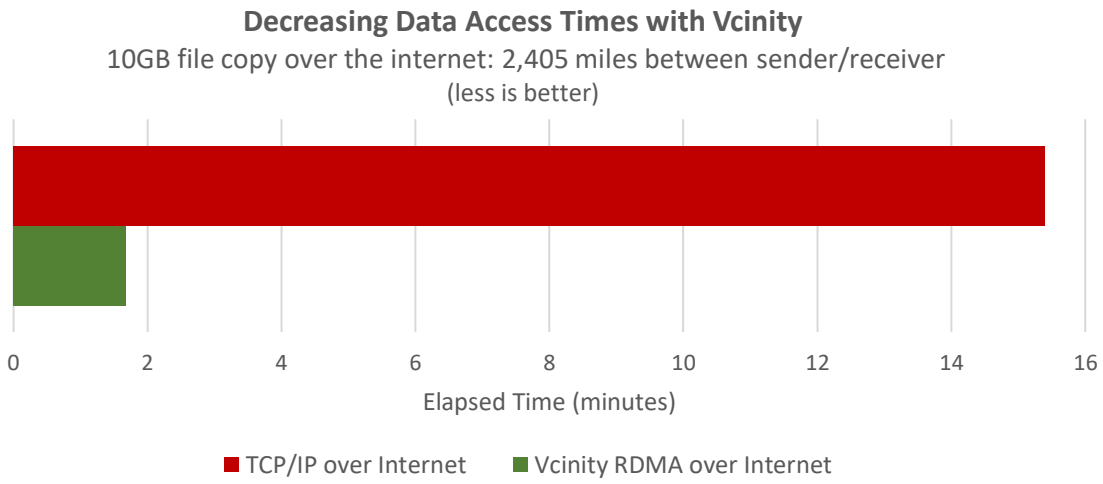
ESG has not seen any other technology that enables data access, regardless of where the data is stored, as quickly as the Vcinity ULT X solution.

Optimizing Network Goodput

System administrators typically use network utilization and network throughput as the key performance indicators of an application or a shared file system that's running over a traditional TCP/IP network. Network utilization and network throughput measures the rate of *all of the data* that's flowing over the network, including protocol overhead. Goodput, which measures the rate of *the useful data*, subtracting the overhead data, that's flowing over the network, is a better metric when comparing an RDMA solution with a traditional TCP/IP solution.

ESG compared the goodput of Vcinity RDMA with the Vcinity ULT X-1000v deployed in AWS over the internet to traditional TCP/IP over the internet (see Figure 3). Using File Manager, ESG copied a 10GB file from Virginia to Northern California, comparing transfer time using the Vcinity method and TCP/IP. Figure 8 shows the elapsed time when copying a 10GB file from an EC2 instance in the Northern California AWS zone to Virginia. Using the Vcinity method, the elapsed time was 101 seconds (less than two minutes). Using traditional TCP/IP, the elapsed time was over 15 minutes. The Vcinity method decreased transfer time by 89%.

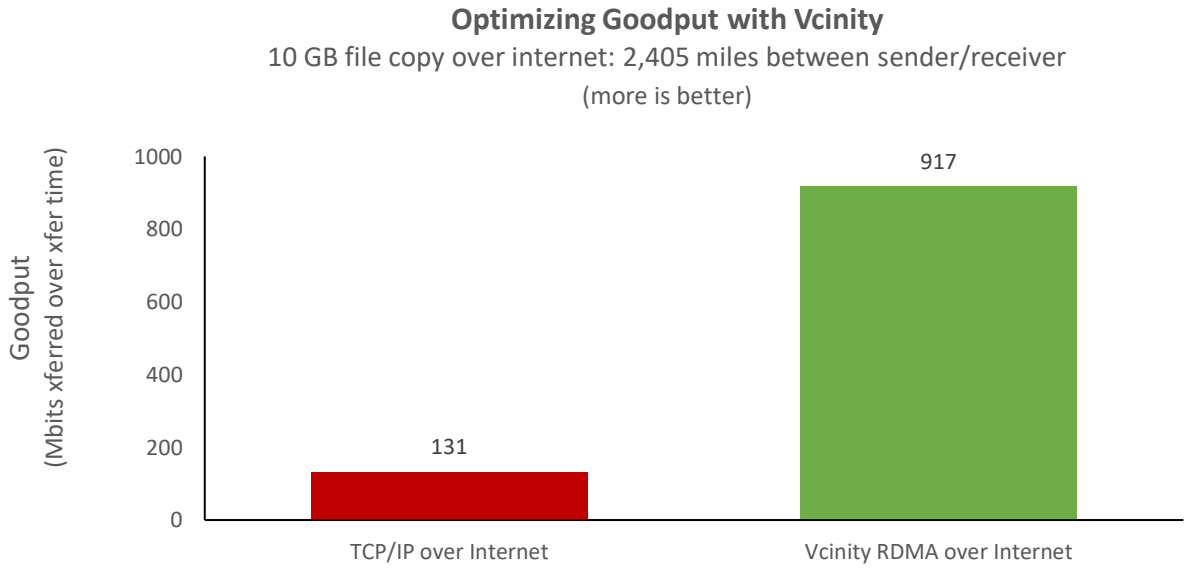
Figure 8. Copying a 10GB File between Two Vcinity 1000v – Elapsed Time



Source: Enterprise Strategy Group

The goodput was calculated by dividing the number of bits in the 10GB file that was transferred by the elapsed time that it took to copy that file. As shown in Figure 9, Vcinity RDMA goodput over the internet was 7x higher than TCP/IP (917Mbps versus 131 Mbps).

Figure 9. Copying a 10GB File between Vcinity 1000v – Goodput



Source: Enterprise Strategy Group

The goodput achieved during this Vcinity RDMA over internet test correlates well with academic research that documents 80% of line goodput for RDMA over Converged Ethernet (RoCE), a network protocol employed in data center networks.[3] ESG observed line rate goodput levels of 80% or more (and network utilization of 90% or more) during multiple tests.

[3] *RoCE Rocks without PFC: Detailed Evaluation*, Alexander Shpiner, et al, August 21, 2017

Why This Matters

While the stated throughput of a given network link is typically quoted as a performance metric, goodput, the useful bits transmitted per unit of time, is a more useful measurement to consider when moving data over WAN distances. High goodput means that more data is transmitted over time, without the burden of protocol overhead. This translates into end-users having access to data sooner.

ESG validated that Vcinity can sustain significantly higher levels of goodput than a traditional TCP/IP solution between ULT X virtual software since Vcinity bypasses layers in the TCP/IP stack. When compared to moving the same file between VA and CA using traditional TCP/IP, goodput increased by 7x with Vcinity.

The Bigger Truth

A recent ESG survey indicates that the vast majority of IT storage decision makers (71%) feel that storage strategies are critical to their core applications/business processes and can lead to a competitive advantage for their organization (versus 27% who believe storage is tactical and 2% who believe it's a necessary afterthought).[4] Fast data access at consistent performance levels must be considered when making such an investment in order to fully benefit. Fast access for collaborative data-intensive applications over a wide area network has historically been solved with a copy/move/store paradigm, which increases cost and decreases time to value (e.g., sending removeable hard drives by plane).

Vcinity ULT X turns your WAN into a global LAN with RDMA over WAN technology that skips layers of the TCP/IP stack and delivers near real-time access to industry standard NFS and SMB file shares over long distances.

ESG validated how Vcinity enabled fast access of shared large data sets located in Maryland for seismic data scientists and CAD engineers who are sitting in California. Seismic rendering completed 18.9x more quickly than traditional TCP/IP with ULT X hardware appliances connected over a 10Gbps WAN. A rendering of an AutoDesk ship design file completed 17.7x more quickly than traditional TCP/IP with ULT X software running in AWS EC2 instances connected via the public internet. ESG demonstrated that working on a remote CAD design located thousands of miles away was practically as fast as working locally (only 2 seconds slower to load and render). In another round of testing on the AWS test bed, ESG measured Vcinity goodput of 917 Mbps over the internet, which was 7x better than traditional TCP/IP. ESG has yet to see any alternative solution that enables data access, regardless of where the data is stored, as quickly as the Vcinity ULT X solution.

If you're thinking this all sounds too good to be true, you're not alone. When ESG first heard Vcinity claim that it makes remote data access over global distances feel local, we asked for a demo to prove it. Even then we were dubious: From ESG's founder Steve Duplessie to ESG analysts with decades of networking industry experience, we all had the same initial reaction of disbelief. ESG's validation testing experience of RDMA technologies in local and storage networks has proven the benefits of eliminating TCP/IP overhead. Up until now, we weren't aware that anyone had figured out how to leverage similar technology over WAN speeds of 100 Gbps, 200 Gbps, or more. We hadn't yet learned that Vcinity has been refining this technology for demanding HPC and military customers for over a decade.

If you're thinking this sounds like WAN optimization and emerging SD-WAN technologies, you're not alone. While the goal of accelerating application performance for collaborative workloads over distance is similar, WAN optimization typically leverages a combination of technologies including caching, deduplication, and protocol optimization to accelerate access over a TCP/IP connection. The Vcinity RDMA over WAN approach slips under the TCP/IP stack and avoids nearly all the protocol overhead and handshakes between senders and receivers. The first bytes of a large file data transfer over a Vcinity network incurs the speed of light latency of a packet travelling over a long-haul network. After that imperceivably small delay, applications are simply accessing memory in a remote server with a predictably low level of overhead for security, latency (after the first byte), and fault tolerance.

[4] Source: ESG Master Survey Results, *2019 Data Storage Trends*, November 2019.

If you think Vcinity sounds expensive, you're not alone. You can attempt to increase goodput by purchasing and laying down additional WAN links, yet the incremental benefit is minimal. That said, it's easy to cost justify if the benefits of near real-time access to remote data helps you save (or earn) more than the cost of a Vcinity solution as we've demonstrated with the seismic survey example in this report. It's easier to cost justify if you can scale down to meet modest application acceleration requirements with a lower bandwidth WAN connection or a virtual version of the Vcinity technology running over the internet.

If your organization has collaborative data-intensive applications that would benefit from near real-time access to a shared file system over a long-haul network, ESG believes that you should consider Vcinity ULT X with a goal of accelerating the digital transformation of your business.