



HOW WILL
APPLICATIONS
PERFORM OVER
YOUR **WAN?**

APPOSITE TECHNOLOGIES

Smoothing the Transition to 10 Gbps

WAN Emulation Made Easy



The Transition to 10 Gbps

1. THE PROBLEM - Application Performance
2. THE SOLUTION - Performance Validation
Using WAN Emulation
3. EXAMPLES
4. OUR PRODUCTS – Netropy WAN Emulators
5. ABOUT US

High Bandwidth Networks

More bandwidth => better network architecture

Allows centralization

- ✓ Centralized servers, centralized storage
- ✓ Easier to manage
- ✓ Better security, better backup, more flexibility

New performance challenges

- x Applications have to run over WAN
- x VDI required for some or all applications
- x Some applications won't work well

Higher Bandwidth = Higher Throughput???

Low Bandwidth:

- Application performance bandwidth constrained
- Easy to test, easy to understand

High Bandwidth:

- Application performance limited by latency, packet loss, other network conditions.
- Expensive bandwidth goes underutilized due to application limitations
- Real testing needed

Higher Bandwidth = Higher Throughput???

Have application developers tested and optimized for WAN conditions?

- Most application developers have little understanding of networking
- Vendor QA focused on functional checkbox testing on local network
- Some vendors far better than others

Result: some products will work well, some won't

Need to benchmark as part of product evaluation process

Need to optimize as part of implementation process

Testing not optional for project to succeed

High Bandwidth Networks



WAN Acceleration:

- If bandwidth constrained, compression has big benefit
- Vendor with best compression wins performance comparison
- If not bandwidth constrained, compression has no benefit
- Performance limited by protocols and transactions
- Vendor with best protocol acceleration and transaction reduction wins performance comparisons
- Different acceleration products may be needed

Anticipating Problems

Datacenter – datacenter communications

- Backup / disaster recovery
- Storage replication
- Database synchronization

Moving data at high speed

Datacenter – branch office communications

- Datacenter / server consolidation
- Datacenter location transition
- Cloud computing
- VDI
- Server & storage centralization

Centralizing IT Operations

Examples

- File Transfer & Asset Delivery
- Replication
- VDI
 - Zen Desktop vs Windows Remote Desktop
- VoIP
 - Cisco phones
 - Internet phones

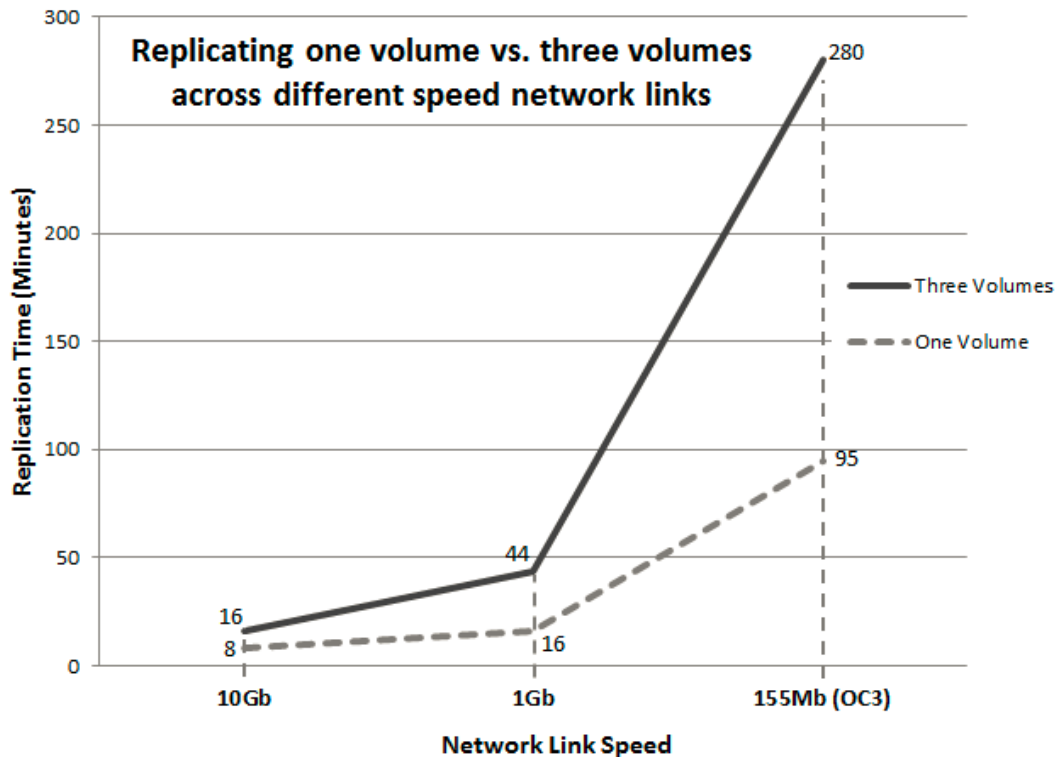
File Transfer & Asset Delivery

Bulk data transfer, large file over 10 Gbps WAN

Distance	Avg. Throughput
Local (10 ms)	801 Mbps
Intercity (25 ms)	396 Mbps
National (50 ms)	210 Mbps
Cross continent (100 ms)	105 Mbps
X-continent with loss (100 ms, 2% P.L.)	7 Mbps

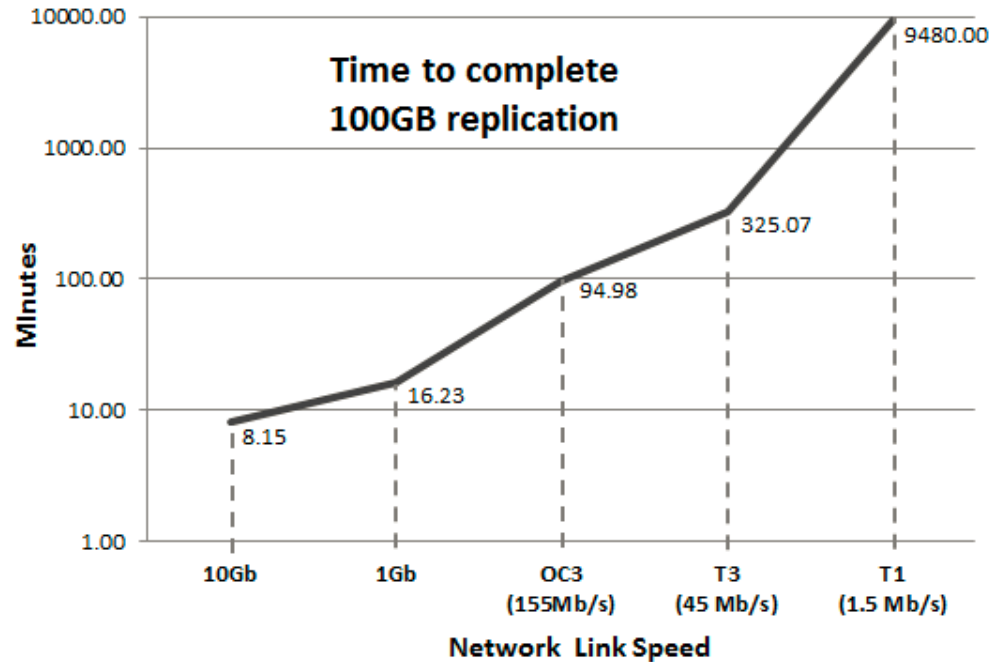
+ Latency, not bandwidth is the limiting factor

Replication



From Dell Document:
Dell EqualLogic Auto-Replication:
Best Practices & Sizing Guide

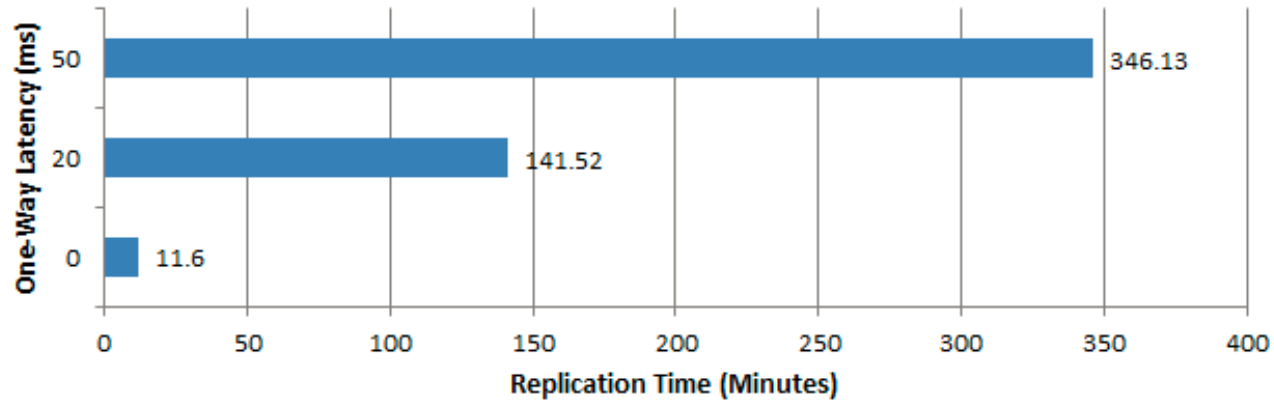
Replication



From Dell Document:
Dell EqualLogic Auto-Replication:
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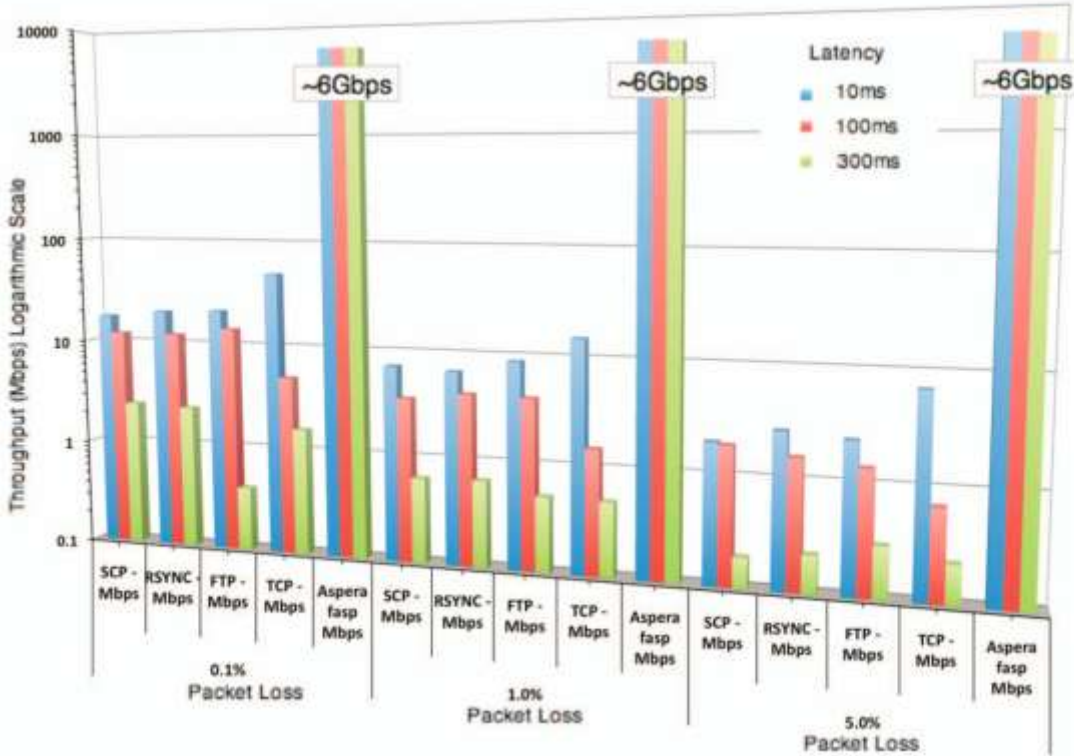
Replication

**Effect of Latency on Replication Time
Across an OC3 (155Mb/s) Link (Replicating 10GB)**



From Dell Document:
Dell EqualLogic Auto-Replication:
Best Practices & Sizing Guide

Replication



From IBM BlueArc:
A High-Performance Storage &
Ultra-High-Speed File Transfer Solution

VDI

- Zen Desktop Example
- Windows Remote Desktop

Performance depends on network conditions

Similar products from different vendors may behave very differently

VoIP



Cisco phones

Internet phones

Hear the difference!

Application Performance Validation

Test applications on the LAN

- x Does not show problems caused by WAN conditions

Send equipment to remote sites to test on production network

- x Expensive and time consuming
- x Can only test limited sites and conditions
- x Not repeatable

✓ **Test in the lab by simulating WAN conditions**



What Makes Apposite's Products Different?

- Easy to use
- Affordable and cost-effective
- Professional quality, performance, and precision

Apposite WAN Emulators

Test the Effect of WAN...

- Bandwidth
- Latency & Jitter
- Loss
- Congestion

...On Application

- Throughput
- Responsiveness
- Quality

Linktropy wan emulators



Cost effective and easy to use
high-precision WAN emulators

Netropy network emulators



Advanced emulators for
complex network topologies

Netropy Models



N60: Complex networks up to 1 Gbps



N91: 4 separate 1 Gbps emulation engines



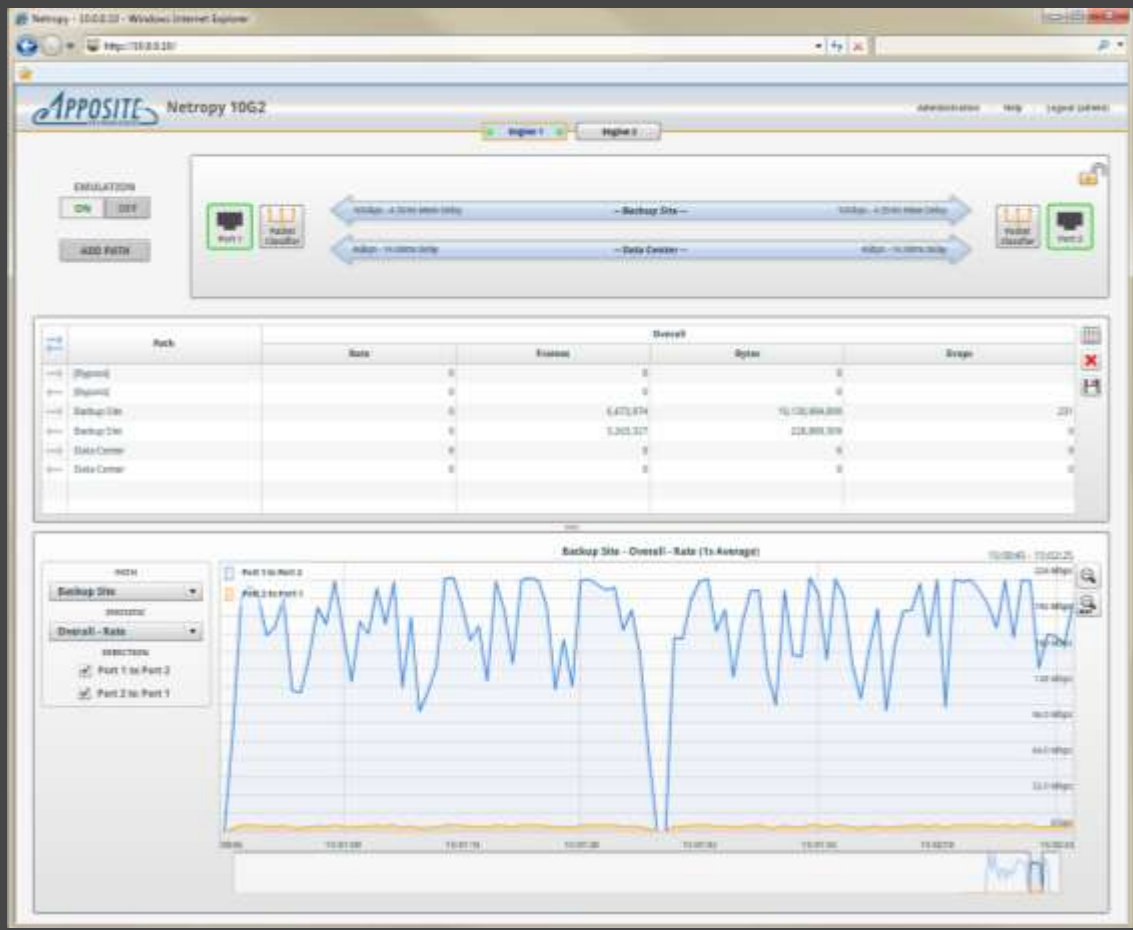
10G1: One 10 Gbps emulation engine



10G2: Two 10 Gbps emulation engines



40G: World's First 40 Gbps WAN Emulator



Netropy GUI

Netropy Configuration

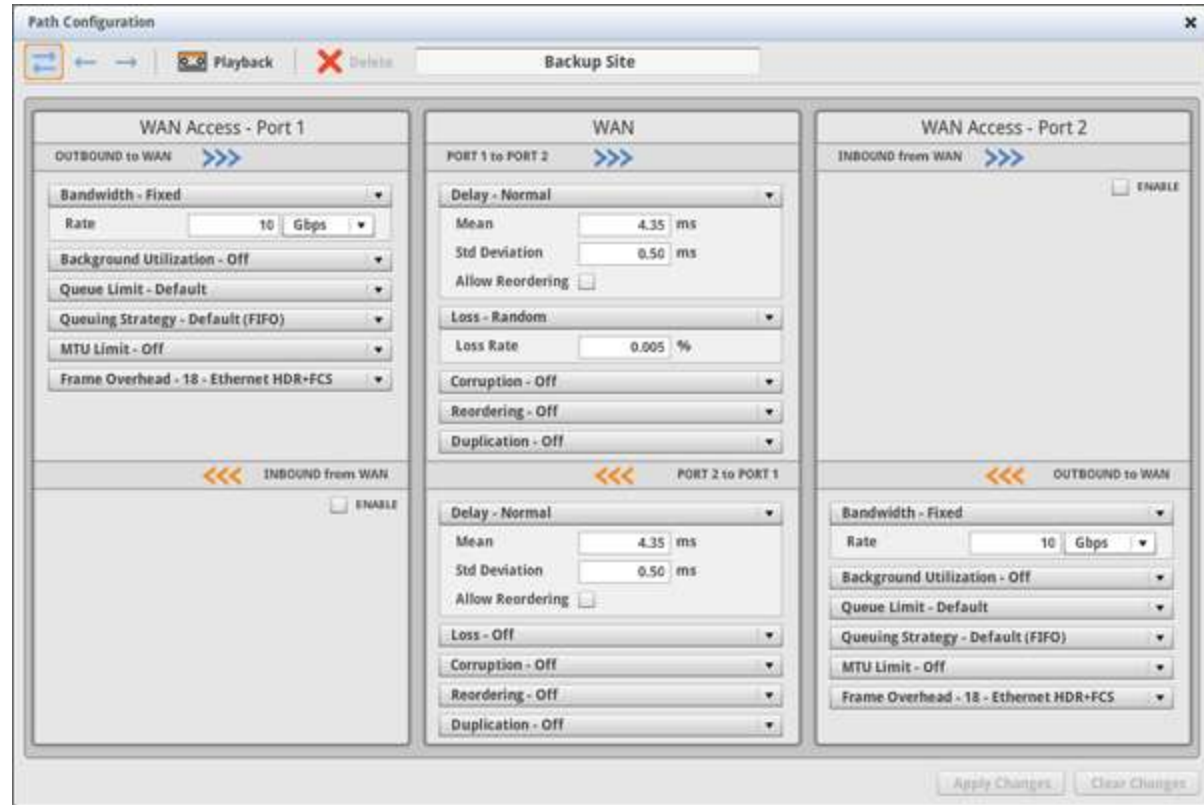
The screenshot displays the Netropy N91 configuration interface. At the top, the logo for APPOSITE TECHNOLOGIES is visible on the left, and navigation links for Administration, Help, and Logout (admin) are on the right. Below the logo, the text 'Netropy N91' is displayed. A horizontal bar contains four engine status indicators: Engine 1 (active), Engine 2, Engine 3, and Engine 4. The main configuration area shows three paths between Port 1 and Port 2, each passing through a Packet Classifier. Path 1 is labeled '-- Path 1: New York --' and has a bandwidth of 155Mbps and a delay of 25.00ms. Path 2 is labeled '-- Path 2: Chicago --' and has a bandwidth of 100Mbps and a mean delay of 37.00ms. Path 3 is labeled '-- Path 3: San Francisco --' and has a bandwidth of 1Gbps and a delay of 2.20ms. On the left side of the interface, there are controls for EMULATION (ON/OFF) and an ADD PATH button. On the right side, there is a lock icon.

- Emulate up to 15 separate WAN links through each pair of physical ports
- Up to 4 separate pairs of ports depending on model
- Assign packets to link based on IP address, VLAN or other packet identifier

Netropy Configuration

Link parameters:

- Bandwidth
- Latency & jitter
- Loss & corruption
- Reordering & duplication
- Congestion
- Queuing & QoS
- Fragmentation
- Packet overhead



Netropy Recorder

- Capture and record live network conditions with Windows utility
- Replay recorded link conditions in Linktropy Player



NETROPY RECORDER



NETROPY PLAYBACK

ENTERPRISE

DEVELOPERS

GOV'T/MILITARY

TELECOMS



- Private company founded 2005
- Based in Los Angeles, near UCLA
- Core team of pioneers in TCP/IP development and WAN acceleration
- Leader in network simulation products
- Inc5000 Fastest Growing Companies
- 2000+ Customers:
 - Enterprises
 - Network Equipment and Application Vendors
 - Telecoms Service Providers
 - Government & Military Organizations



ABOUT US