Autodesk Vault Professional
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Strategies to Speed Collaboration and Data Management Using Autodesk Vault and Riverbed WAN Optimization Technology

Geographically dispersed teams using 3D for clear design communication may struggle to collaborate effectively because sharing data using common Microsoft Windows file directories can take too long. Autodesk® Vault helps solve this problem by improving access to the latest designs even across global, wide area networks (WANs). When WANs exhibit high latency, the combination of Autodesk Vault and Riverbed® WAN optimization technology utilizing Steelhead®, a powerful data store and deduplication appliance, provides an effective solution to help maintain fast and efficient design data access. Tests performed by Autodesk illustrate the value of this combination—the addition of WAN optimization may dramatically reduce file transfer by up to 99% without further requirements to upgrade or replace existing software or hardware.

Autodesk®

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Autodesk Vault for Global Design

Manufacturing and Architecture, Engineering, and Construction companies use Autodesk® Vault data management software products to organize, manage, and track data creation, simulation, and documentation processes. Autodesk Vault gives users more control over design data with revision management capabilities and helps them quickly find and reuse design data for easier management of their design and engineering information. Tightly integrated with Autodesk Digital Prototyping and Building Information Modeling (BIM) applications, Autodesk Vault is critical to efficient collaboration and accurate communication of technical information for workgroups distributed across the globe.

Beyond Windows File Sharing

The simplest (and default) method to design data sharing when using the Microsoft® Windows® operating system is to use a set of directories, or shared directories, to store files for designers to access. Design teams organize files through standard 'Cut', 'Copy', and 'Move' Windows commands. While very simple and straightforward, this method of file sharing is not optimum for the type of design files shared by teams located on different continents communicating across a wide area network (WAN). Autodesk Vault helps overcome this handicap by providing Autodesk Vault File Replication technology that optimizes design file sharing between geographically dispersed teams. In addition to File Replication, Autodesk Vault provides collaboration benefits through better design organization, more straightforward workflows, and clear communication over a common internet protocol (Port 80). These are just a few reasons immediate selection and deployment of Autodesk Vault is a good first strategy to speed collaboration and data management between geographically dispersed design teams. Even with Autodesk Vault in place, however, slow wide area networks may cause unacceptably slow design data sharing. The sections that follow describe a strategy to overcome this situation using Riverbed® WAN optimization technology, including the Steelhead® data store and deduplication appliance.

Slow Wide Area Networks

Over high latency networks, simple file sharing suffers long delays in sending and receiving data across the network. Design teams choose Autodesk Vault to gain speed advantages in such environments, but including WAN optimization further improves file transfer times substantially. Moreover, just like Autodesk Vault, WAN optimization technology, such as that available from Riverbed Technology, Inc., is an economical and easy-to-implement solution.

To illustrate the extent to which WAN optimization technology from Riverbed helps Autodesk Vault improve design collaboration over high-latency network connections, Autodesk conducted a battery of tests across several use cases and shares the results below.

Basic Autodesk Vault Operation

Whether a team is collaborating with a branch office on the other side of the world, a project group at an outside firm or simply a team member across the room, Autodesk Vault helps to streamline data management. A central database tracks all of the technical information—projects, designs, changes, versions, and more—that constitute engineering or design projects. Vault uses file stores to put large design files within close proximity to the designers responsible for them. Vault data replication automatically copies the most up-to-date information into the various file stores so remote users experience file access at local area network (LAN) speeds.

In extreme cases, network latency is so high automatic replication of Vault file stores cannot complete in the time available. As a result, Vault completes the replication on-demand causing response times for remote users accessing project data to be slower than otherwise expected.

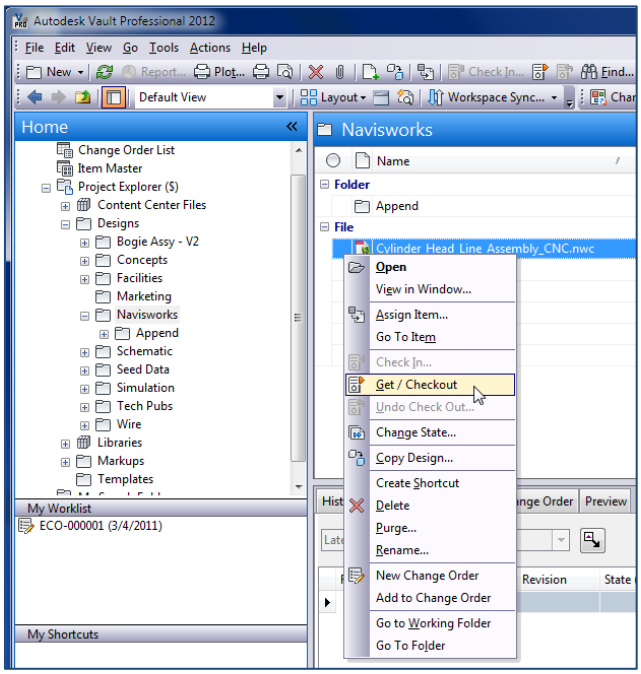

Figure 1 – Use Get/Checkout to retrieve a copy of a file managed by Autodesk Vault

General WAN Optimization Techniques

Generally, WAN optimization works by temporarily storing information sent over a network to avoid resending it when users request the same information again. WAN optimization involves a variety of methods including byte-level data storage, deduplication, compression, and protocol optimization. Actual methods and technologies vary by manufacturer. Riverbed (maker of the technology used in these tests) achieves WAN optimization through Steelhead, a powerful data store and deduplication appliance. A brief description of Riverbed's Steelhead appliance follows.

For proper setup, network administrators must install the Steelhead WAN optimization appliance at each edge of the network. During the initial file transmission over the WAN, the Steelhead appliance simultaneously stores the file contents on the appliances at each end of the network. Riverbed refers to the first transmission as the 'Cold' run. Even during a 'Cold' run, users experience faster transfer speeds due to the benefits of compression and latency optimization delivered by the Steelhead technology. Additionally, for subsequent runs, or 'Warm' runs, the Steelhead appliances compare the contents of the file against the contents stored during the 'Cold' run. Specifically, Steelhead technology compares Transmission Control Protocol (TCP) blocks. Transfer speed increases when the block comparison identifies matching (identical) blocks and sends small data references rather than the actual data over the WAN. As a result, Steelhead transfers only *changes* to the actual data over the WAN and thus dramatically reduces the transfer

duration. Throughout the entire file transmission, Steelhead maintains end-to-end communication to prevent stale data and/or data corruption.

Remarkably, the compression, optimization, and comparisons within the entire process outlined above execute at impressive speeds, helping to achieve dramatic improvements in data transfer performance.

Due to the nature of the WAN optimization as described above, one complete test requires four metrics:

1. Baseline[1] – measures duration of file transfer with optimization appliances disabled;
2. Cold – measures duration of first file transfer with optimization appliances active (fills data stores);
3. Warm – measures duration of same file transfer with optimization appliances active (compares data stores; sends difference);
4. Mixed – measures duration of slightly modified file transfer with optimization appliances active (compares data stores; sends difference).

Under normal WAN optimization conditions, the 'Baseline' run has the longest duration and the 'Warm' run has the shortest duration. Differences between the 'Cold' and 'Mixed' runs depend upon the amount of changes made to the original file.

Study Approach and Methodology

Engineers conducted separate tests for each use case by placing a WAN Simulator (with latency settings from 10ms to 200ms) and WAN optimization appliances (Riverbed Model 2050H) in different positions within a private T1(1.5Mb) LAN. Test servers used a Windows Server 2008R2 O/S, SQL 2008 R2 Enterprise database software, and Autodesk Vault Professional Server 2012. The client configuration included Windows 7 Enterprise, Autodesk Vault Professional Client 2012 with Autodesk® Inventor® Professional 2012, Autodesk® Revit® 2012, and AutoCAD® 2012 design applications.

Investigated Use Cases

Remote Client

The first use case studies the file transfer behavior that occurs with basic setup of Autodesk Vault. There is no remote server installed in this configuration but remote users do need active push and pull of design data. Companies typically configure Autodesk Vault in this way as a first iteration and may preserve this setup to serve remote users requiring infrequent access. Figure 2 shows the topology used to test 'remote client' access.

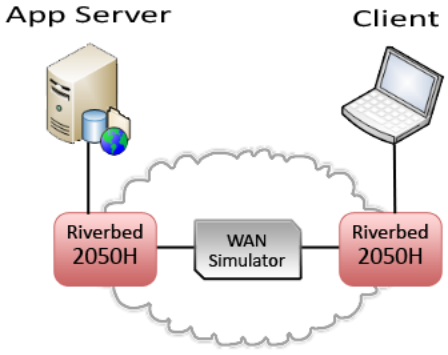

Figure 2 – Autodesk Vault Remote Client test arrangement

Server-to-Server

The second use case studies the file transfer behavior between intercontinental teams sharing design data. In this scenario, geographically dispersed design teams require high

[1] All 'Baseline', 'Cold', 'Warm', and 'Mixed' tests use Autodesk Vault, not simply the standard Microsoft Windows operating system 'Cut', 'Copy', and 'Move' operations.

performance collaboration and file transfer capabilities. Using a slightly more advanced configuration, Autodesk Vault accomplishes this by pushing files to each site to make the speed of viewing and modifying data nearly equivalent to the performance of receiving the data over a LAN.

A related scenario, on-demand replication, occurs when data does not warrant automatic distribution to all sites but remains available for occasional access. In this case, at the request of the remote user, the remote server may replicate a file from the main server to store and access it locally. Such Autodesk Vault server file replication creates the same high 'server-to-server' communications as studied in these tests. When WAN latency rises to an unacceptable threshold, however, both automatic and on-demand file replications result in slower response times. In such cases, WAN acceleration may be a solution to restore performance. Figure 3 shows the topology used to test 'server-to-server' communications.

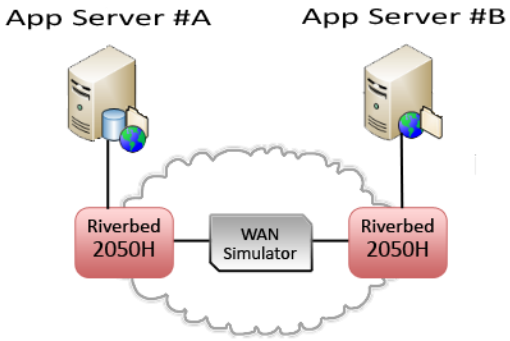

Figure 3 – Autodesk Vault Server-to-Server test arrangement

New Site with SQL

The final use case studies the data communication that occurs when a one-time, mass-replication of design data is required for the rapid deployment of new Autodesk Vault sites**.** To accomplish this task, administrators send a database copy (as replicated SQL) to each new Autodesk Vault server(s). This test investigates the advantages of WAN optimization for SQL traffic in addition to the study of large file transfers in the previous two use cases. Figure 4 shows the topology used to test 'new site with SQL' access.

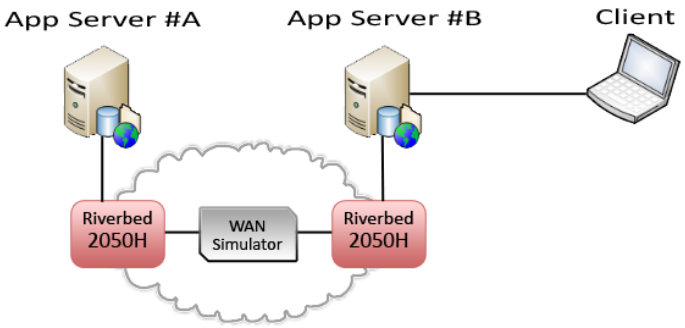

Figure 4 – Autodesk Vault New Site with SQL test arrangement

Design Applications and Data

This study used three popular Autodesk tools – AutoCAD 2012, Autodesk Inventor 2012, and Autodesk Revit 2012 – and customer data sets for each of the three aforementioned use cases. Figure 5 shows an assembled rollercoaster seat designed using Autodesk Inventor 2012 and built by Dynamic Structures, Ltd. The associated product structure (Table 1) shows the full assembly structure and details of individual files. The Autodesk Revit 2012 3D model used in the tests represents a complete building design and has an original file size of 273 MB. Last, the 24.7MB AutoCAD files used in the tests include two (2) AutoCAD® Civil 3D® 2012 files, one (1) AutoCAD® Mechanical 2012 file and one (1) AutoCAD 2012 file.

Figure 5 – Rollercoaster seat courtesy of Dynamic Structures, Ltd.

In addition to the datasets described above, the tests included select file changes performed in each tool to create slightly modified files for use in the 'Mixed' test runs.

Table 1 – File details of the Inventor Rollercoaster Seat Assembly

Original Files	MB	Modified Files	MB	Description of modification
22-Eidw_Torso_Restraint.ipt	5.05	22-Eidw_Torso_Restraint.ipt	5.05	
Arm Rest_L.ipt	1.078	**Arm Rest_L-02.ipt**	**1.284**	**Inserted multiple holes through part**
Arm Rest _R.ipt	1.134	Arm Rest _R.ipt	1.134	
Base Seat.ipt	1.874	Base Seat.ipt	1.874	
Head Rest.ipt	0.164	**Head Rest-02.ipt**	**0.281**	**Inserted multiple holes through part**
Restraint_Pipe.ipt	0.076	Restraint_Pipe.ipt	0.076	
Restraint_Pipe_R.ipt	0.076	Restraint_Pipe_R.ipt	0.076	
SeatAssy.iam	0.061	SeatAssy.iam	0.061	
Seat.iam	0.056	Seat.iam	0.056	
Side Bolster_L.ipt	0.62	Side Bolster_L.ipt	0.62	
Side Bolster_R.ipt	0.89	Side Bolster_R.ipt	0.89	
Torso Restraint.iam	0.052	Torso Restraint.iam	0.052	
Total Size	**11.13**		**11.45**	
Average Size	**0.93**		**0.95**	

Detailed Tests

Throughout testing, engineers initiated file operations using standard Autodesk Vault commands to transfer data over the simulated WAN setup, with Riverbed WAN optimization used exclusively for all of these tests. Selection of the performed operations carefully matches real-world design scenarios based on Autodesk industry experience.

Test 1: File Transfer (Remote Client)

User-initiated file transfer begins with check-in/add files or check-out/get files inside the design tool that subsequently sends and/or requests large files stored on a central server accessed over the simulated WAN. This test measures the effect of WAN optimization on the transfer of large files over a simulated WAN using remote client topology as shown in Figure 2.

Test 2: Browse Structure and Copy Design (Remote Client)

Data transfer begins when the user on a remote client initiates the Browse Autodesk Vault Explorer Client and Copy Design commands inside Autodesk Vault Professional. This test measures the effect of WAN optimization on the transfer of descriptive metadata over a simulated WAN using remote client topology as shown in Figure 2. The Test 2 Results section on page 9 of this study describes more about descriptive metadata.

Test 3: File Transfer (Server-to-Server)

Data transfer initiated by the start of multi-site replication or by an on-demand user request in Autodesk Vault Professional. This test measures the effect of WAN optimization on the transfer of all Autodesk Vault data over a simulated WAN using server-to-server topology as shown in Figure 3.

Test 4: Creation of New Autodesk Vault Site (New Site with SQL)

Data transfer begins when the administrator initiates the clone of the entire contents of a SQL Autodesk Vault database to a similarly configured SQL Autodesk Vault database at the other end of the network. This test measures the effect of WAN optimization on the transfer of SQL data over a simulated WAN using the new site with SQL topology as shown in Figure 4.

Remarkable Results

The test results provide abundant evidence that Autodesk Vault technology used in conjunction with Riverbed WAN optimization technology helps customers alleviate the collaboration challenges that arise from severe high latency connections between distributed workgroups. Throughout these tests, the addition of Riverbed WAN optimization technology remained invisible to users, required no user training or changes to procedure, and did not require changes to the existing hardware and software.

This study revealed significant performance improvements with Autodesk Vault and Riverbed WAN optimization technology present across a variety of use cases:

- Remote clients typically receive CAD data 30-40% faster on the first request;
- Repeat transmission of CAD data to remote sites occurs at least 95% faster;
- Product structure operations average 25-40% faster;
- A database clone to setup a new Vault location executes up to 78% faster.

The next sections describe the test results using combinations of authoring tool and test configuration.

Test 1 Results: File Transfer (Remote Client)

Remote client access to design data requires the least administration and setup of Autodesk Vault and, thus, makes this a popular initial configuration. The results of Test 1 and the corresponding charts below illustrate two positive aspects of this setup. First, the combination of Autodesk Vault and Riverbed WAN optimization technology provides consistently higher network transmit performance regardless of the authoring tool used to create the data. Second, the tests reflect classic WAN optimization whereby the cold metric outperforms the baseline metric, warm operation is the fastest, and the transfer of mixed data falls somewhere in between the measured cold and warm results.

Taking an average of the add and get operations specifically for Autodesk Inventor, cold performed 40% faster than baseline, warm an incredible 99% faster, and mixed produced a 94% improvement over baseline. The numbers for Autodesk Revit were a comparable 31% for cold and again 99% faster for both warm and mixed runs. The changes made within AutoCAD during our testing resulted in more changes to the design files themselves, so the result of the mixed test run is closer to the cold metric than for the other authoring tools. Nonetheless, the average of the cold add/get operations is 37% faster than baseline, warm an average 99% faster, and mixed delivers the same file 42% faster than baseline.

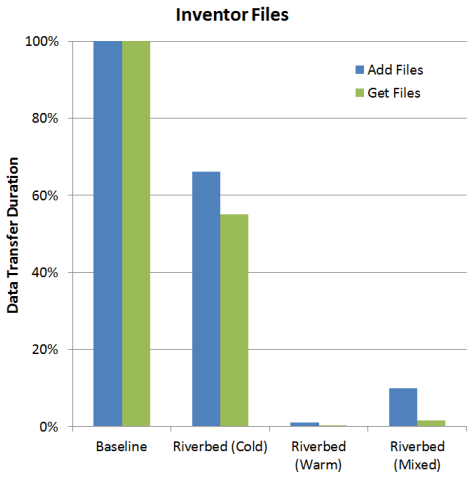

Figure 6 - Test 1 results using Autodesk Inventor and associated customer data

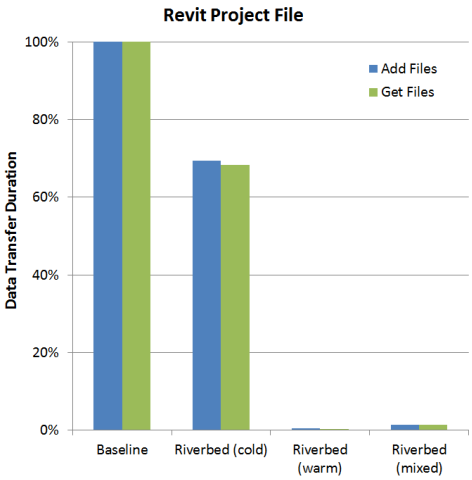

Figure 7 - Test 1 results using Autodesk Revit and associated customer data

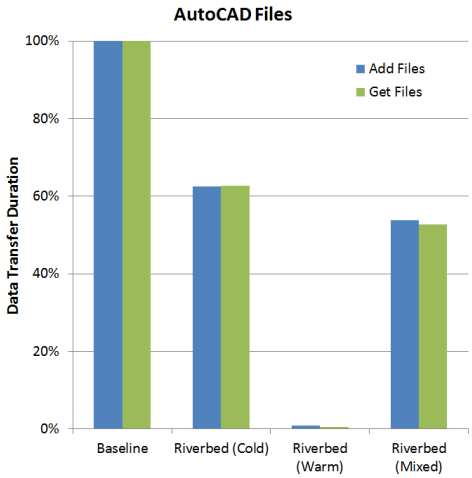

Figure 8 - Test one results using AutoCAD and associated customer data

Test 2 Results: Browse Structure and Copy Design (Remote Client)

In this second remote client test, a designer uses Autodesk Vault Explorer (VE) to browse an assembly product structure and perform a copy design operation to duplicate the product structure into a new variant, for example. Both of these operations are metadata-intensive, which means the information sent across the network is comprised of descriptive metadata (data about the data) originating from Autodesk Vault, re-sent for each inquiry (no concept of mixed data), and independent from the original authoring application. Again, the results of this test demonstrate the combination of Autodesk Vault and Riverbed WAN optimization technology offers significant advantages for global collaboration that requires use of the most current design data. Figure 9 to the right reveals an approximate improvement of 40% for the Copy Design function and 25% for the Browse VE over baseline results.

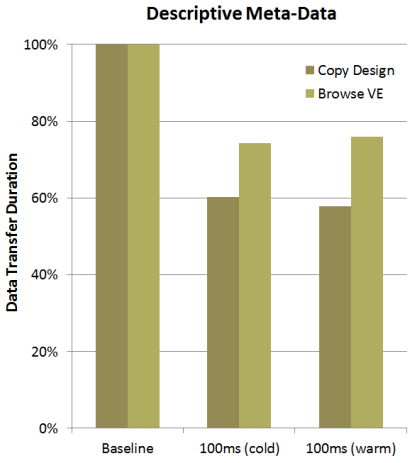

Figure 9 - Test 2 results of product structure inquiry and copy design from a remote client

Test 3 Results: File Transfer (Server-to-Server)

Though the topology of Remote Client (Figure 2) and Server-to-Server (Figure 3) are different, the data transferred across the WAN in Test 1 and Test 3 is nearly identical. Consequently, the results are also very similar. The chart to the right shows only Autodesk Inventor results. Like Figure 6 above, the chart shows cold transfer improves file transfer by 22%, warm transfer results by 95% and mixed file transfer improves by a respectable 86%.

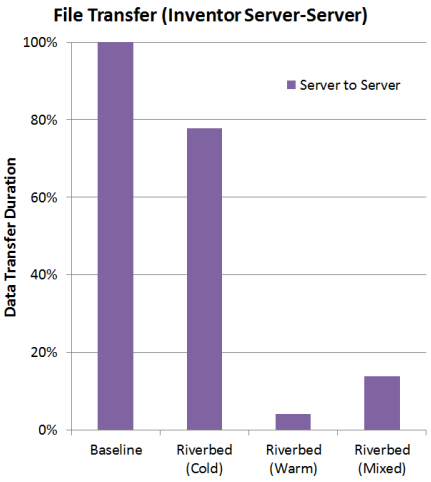

Figure 10 - Test 3 results using Autodesk Inventor and associated customer data

Test 4 Results: Creation of New Autodesk Vault Site (New Site with SQL)

The creation of a new Autodesk Vault server halfway across the world represents the ultimate in remote administration. Test 4 investigates the ability of the combination of Autodesk Vault and Riverbed WAN optimization technology to accelerate a third data type—movement of data files with SQL as required to clone an entire database. The results shown in Figure 11 on the right further demonstrate the combined solution performs well for this type of data. Since a database clone occurs only once, the cold metric is the most important and results in a resounding 78% improvement over the database clone baseline metric.

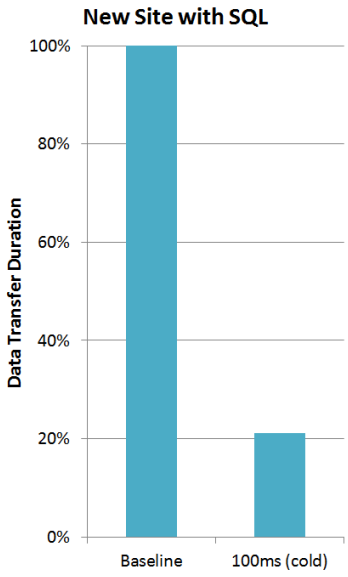

Figure 11 - Test 4 results sending database clone SQL statements to a new remote server

The results above display significant improvement in data transfer acceleration for the most frequent situations that geographically dispersed teams would encounter in their day-to-day use of Autodesk Vault.

Conclusion

In our view, Autodesk Vault provides best-in-class collaboration and data management solutions for workgroups distributed within an office building, between sites across town, or from one continent to another. Autodesk Vault helps all teams communicate using the internet to share data across publicly available wide area networks.

Poor network performance dramatically affects the ability of teams to collaborate by sharing design files. Autodesk Vault provides the ideal solution for many organizations. When high latency on a WAN impedes the operation of Autodesk Vault, the addition of WAN optimization technology helps companies reverse and overcome the effects of high latency to better deliver design data with the speed and response times that designers expect.

This study highlights significant advantages to using Autodesk Vault in conjunction with Riverbed WAN optimization technology. The results show improvements of up to 99% in the time required to resend CAD files over high latency wide area networks like those often encountered in some parts of the world.

For More Information

About Autodesk

Autodesk, Inc., is a leader in 3D design, engineering and entertainment software. Customers across the manufacturing, architecture, building, construction, and media and entertainment industries - including the last 16 Academy Award winners for Best Visual Effects - use Autodesk software to design, visualize and simulate their ideas. Since its introduction of AutoCAD software in 1982, Autodesk continues to develop the broadest portfolio of state-of-the-art software for global markets. For additional information about Autodesk, visit www.autodesk.com.

About Riverbed

Riverbed Technology, Inc. is the IT infrastructure performance company for networks, applications and storage. Riverbed WAN optimization solutions liberate businesses from common IT constraints by increasing application performance, enabling consolidation, and providing enterprise-wide network and application visibility – all while eliminating the need to increase bandwidth, storage or servers.