BIM on a WAN

The building industry's move towards the use of distributed building information modeling (BIM) is straining their existing wide-area networks (WANs). This white paper explores a specific technology that speeds up the performance of applications and data across WANs and is currently being used to support BIM across a WAN.

Most building design tools are based upon legacy drafting or object-oriented CAD technology; file-based applications with computational or practical limits constraining the size of the output files. A purpose-built BIM solution like the Revit® software platform uses a completely different technology to define a building project: an interconnected database of building information. Globalization dictates that these data-intensive building information models must be shared between distributed design teams, as well as clients and contractors. And new BIM applications serving engineering disciplines (such as Revit® Structure and Revit® MEP), have further underscored the need for design collaboration across distributed teams.

If project teams are in the same company, everyone can work together on a single shared model. If there are multiple teams or disciplines working in different organizations, the Revit platform approach lets each of them cross-link their models - creating a shared, distributed building information model. In some cases, the teams swapping or sharing models are networked together in a local area network (LAN). But in all likelihood, they're separated by geography and/or organizations, and using a WAN.

Networks 101

LANs are computer networks that span a relatively small area. Computers within a LAN are able to access data and devices anywhere on the LAN. This means that many users can share data, applications, and resources (like printers). Most LANs are confined to a single building or group of buildings.

WANs are computer networks that cover a wide geographic area. Computers connected in a WAN often use public networks, like the telephone system. They can also be connected through leased lines or satellites.

LANs are capable of transmitting data at very fast rates, much faster than data can be transmitted over a WAN. Bandwidth, also called throughput, and latency together determine the perceived speed of a network connection. The bandwidth (the amount of information that can be transferred over a connection in a given period of time) of a WAN is much smaller than a LAN, perhaps 1% to 0.05%. Making matters worse, the latency of a WAN (the amount of time it takes for a response to return from a request) is much higher than a LAN, typically 100 to 1,000 times higher. All this means that moving large files across a LAN is fast, but across a WAN can be painfully slow.

Autodesk®

Networked BIM

Getting back to BIM, for firms with widely distributed teams using a WAN, the LAN-to-WAN bottleneck has encumbered their sharing the building information model in an easy and fluid way.

Revit Worksharing offers team members a range of collaboration modes, all of which hinge on access to a shared master building information model that acts as the distribution point for publishing work to the rest of the team. To begin Worksharing, users get a copy of the central building information model and save it as a local file on their own hard drive or LAN network. As they modify the model, they save their changes to this local copy, and then at certain points publish their work to the central file ("save to central" in Revit terminology).

When this happens the changes in a user's local file are copied across the network to wherever the central file is located and incorporated into the master building information model, allowing all other team members to then reload those changes into their own local file. At the same time, changes that the rest of the team has "saved to central" are downloaded to the user's local building model.

The discipline-specific portions of a distributed building information model can range from fifty to a few hundred megabytes, depending on the size and complexity of the project. Moving this much data across a LAN isn't an issue, but it can pose problems across a WAN.

Firms with team members located in far flung offices have tried various workarounds to avoid WANs. For example: using Windows® Remote Desktop to access a computer on the same LAN as the central file; or burning CDs/DVDs and sending these via overnight delivery services back and forth between offices - defeating the purpose of a central building model. Or sometimes they just co-located team members or flew talent around the globe as needed.

Figure 1:

Network appliances enable disparate design teams to work on distributed BIM projects, such as this office project by Little.

Making WANs Seem Like LANs

Our global economy has made WAN performance ripe for improvement, so in recent years we've seen the introduction of network "appliances": hardware and software solutions that speed up the performance of applications and data across WANs; making a WAN perform more like a LAN without upgrading bandwidth. Riverbed Technology (*www.riverbed.com*) is a pioneer in this field. Their Steelhead appliances can accelerate applications over WANs by up to 100 times, and reduce WAN traffic by up to 95%.

Riverbed appliances are being successfully used by companies sharing large Revit building information models - allowing disparate workers to more easily collaborate on a building project. One recent example of this is Little.

Little

Little (*www.littleonline.com*) is a national architecture and design firm headquartered in Charlotte, NC. They have 8 locations and almost 350 employees. Chris France, the CIO of Little, installed their first Steelhead appliances in December 2004. The original motive for deploying Riverbed appliances was to enable collaboration on AutoCAD® software-based building projects with architects in different cities. Not only was this goal achieved, but Little was also able to centralize and accelerate their backup of data in remote branch offices.

Little is now in the process of converting from AutoCAD to Revit Architecture and so in early 2006 they decided to use Revit Architecture over their Steelhead-enabled WAN links on an existing Revit project: a three story office building, approximately 83,000 sq. ft., slated for construction in Florida. Project team members are located in 3 different offices – Washington, D.C.; Charlotte, North Carolina; and Orlando, Florida. The 62-MB central file resides in their Washington office.

France reports, “The results have been excellent. With Steelhead appliances deployed, our architects in Charlotte and Orlando can open and save this Revit Architecture file from our D.C. office in a few minutes – only about 2x the time that would be required over a LAN. The Riverbed-enabled link was getting pretty close to LAN-like performance, even from a remote office.” In another example, France reported close to a 10x speedup when saving changes to the central file across a WAN using Riverbed appliances.

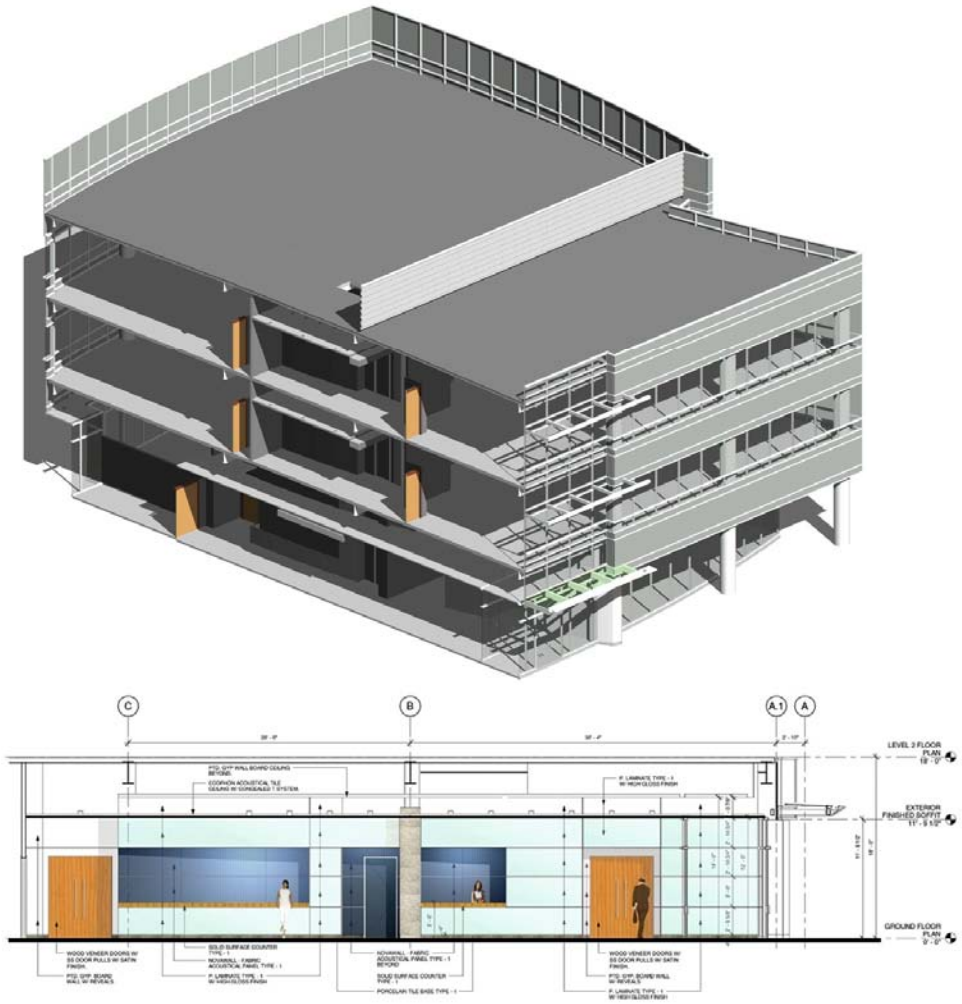

Figure 2:

Network appliances from Riverbed Technology can make a WAN perform like a LAN. Their appliances allow Little’s architects, working on the building shown here, to save their changes to a central Revit file across a WAN in about 2x the time that would be required over a LAN.

Saving and reloading changes to the central file are only done a few times a day, so these time savings may seem mundane. But the larger the project and the scope of the changes, not to mention network traffic - the wait times made collaboration across a WAN extremely frustrating. As France puts it, “Revit Architecture is critical for us; we see it as the next step to help us deliver better designs faster to our clients. Now with our Steelhead appliances we can involve the right people in our organization – regardless of their location – in a project whenever and wherever they’re needed.”

Summary

The building industry’s adoption of BIM is pushing the limits of their existing network infrastructure. Using appliances like those offered by Riverbed solves the problem of shared access to a building information model across a WAN. By providing optimizations that are orders of magnitude greater than what users experience today, Riverbed’s appliances are changing the way project teams work – enabling a distributed building information model and allowing a workforce located around the world to collaborate as if they were next door.

About Revit

The Revit platform is Autodesk’s purpose-built solution for building information modeling. Applications such as Revit Architecture, Revit® Structure, and Revit® MEP built on the Revit platform are complete, discipline-specific building design and documentation systems supporting all phases of design and construction documentation. From conceptual studies through the most detailed construction drawings and schedules, applications built on Revit help provide immediate competitive advantage, better coordination and quality, and can contribute to higher profitability for architects and the rest of the building team.

At the heart of the Revit platform is the Revit parametric change engine, which automatically coordinates changes made anywhere — in model views or drawing sheets, schedules, sections, plans… you name it.

For more information about building information modeling please visit us at http://www.autodesk.com/bim. For more information about Revit and the discipline-specific applications built on Revit please visit us at http://www.autodesk.com/revit.

Autodesk®