The **Ultimate Guide** to CAD File Collaboration

by Robert Green

Understand the benefits and drawbacks of current CAD file sharing technologies — including the high cost of doing nothing — to select the best solution for your company.

You are paying to manage your CAD files even if you think you aren't!

The scenario plays out every day at engineering, architectural, and manufacturing companies all over the globe: Far-flung teams of design professionals labor in different cities, requiring that they share huge CAD project files over slow wide-area network (WAN) connections. These teams are often composed of both internal and external (contract) employees — some working at well-equipped headquarters and others in branch offices with lesser network infrastructure — all forced to work at the sluggish pace their WAN dictates. Frustration abounds, teams lose focus, and design professionals spend more time worrying about file transfer speed than about their designs.

While many senior management staffs think all is well, CAD professionals know better as they suffer with dropped connections and glacially slow WAN download rates — typically less than 5% of local-area network (LAN) rates — that impede projects. Even worse, WAN deficiencies can lead to damaged files and the specter of working with incorrect versions, which in turn can lead to substantial rework costs or even bring projects to a standstill.

Anyone working with large CAD files over a typical corporate WAN knows the approach simply doesn't work well.

Yet even with so many companies suffering through these issues, there is surprisingly little agreement on how best to handle the limitations of CAD file collaboration over corporate WANs. This whitepaper will define the issues, identify common file collaboration pitfalls based on company size, and provide some basic cost data to help you determine which type of CAD file collaboration solution is the best fit for your CAD environment.

THE COST OF DOING NOTHING

Unfortunately, the variety of choices — all with some sort of disadvantage to work around — leads many companies to put off dealing with CAD file collaboration and continue to suffer with all the issues of slow WAN speeds. This do-nothing option seems safe to many companies because it is how they've always operated and requires no investment in hardware or software. In fact, many companies actually believe they save money by doing nothing

Glossary of File Collaboration Terms

Technical papers tend to confuse most everyone with undefined acronyms and terms. Here's a rundown of a few terms used throughout this paper, which the author hopes will help you better understand CAD file collaboration technologies and make a case to your management about obtaining the right solution for your company.

Branch office. A separate office (with a separate network server) where project team members are located to support a project conducted at the headquarters.

CAD project files. The collection of models, parts, drawings, supporting data (including Microsoft Word and Excel files and Adobe graphics files), and folder structures required to make everything work. Note that CAD project files may refer to mechanical models, BIM models, civil earthwork files, or conventional 2D CAD files — it is a product-agnostic term.

File collaboration. When multiple people can access the same file from multiple WAN locations and version control is strictly maintained.

File sharing. When multiple people can access the same file from multiple WAN locations.

Headquarters office. The company location with the majority of network storage, servers, and IT administrative support resources. Generally headquarters has the highest head count but is not necessarily where all CAD work takes place.

Version control. Ensuring that no team member works on the wrong version of a file.

Wide-area network (WAN). The global network that connects headquarters to branch offices.

WAN bandwidth. The connection speed between offices on the WAN. The higher the bandwidth, the faster files move between offices.

to deal with WAN-based CAD file collaboration issues.

In fact, doing nothing leads to huge amounts of wasted productivity as users perform file management tasks and fix errors rather than designing, all the while growing increasingly frustrated with the situation. (See "The Real Cost of Ignoring File Management," below.)

CAD FILE COLLABORATION OPTIONS

If CAD professionals interact with team members at other locations, CAD files typically must be accessed and shared via the company WAN. This raises questions about how best to do this, such as:

- What are the available tools and technologies?
- What are the advantages and disadvantages of these tools?
- How will these tools affect CAD users?
- How difficult are the tools to implement?
- What will it all cost?

By analyzing options technically and financially, a company can make intelligent decisions about collaborative CAD work over a WAN. To understand the options available, you must first examine the most commonly used methodologies, then move to alternate technologies that aren't in common use, all while examining issues of cost, complexity, and user impact of each.

Manual file copying to remote offices. In this approach, a company maintains a master set of CAD files at the headquarters office and periodically copies them manually to branch offices using e-mail, simple directory folders, or FTP boxes. While this method is easy for the user (because it doesn't require learning new data-management software) it can be quite labor intensive since someone (typically the CAD or project manager) has to track which files have been copied and updated then keep them all in sync at all locations. Given how often CAD files can change in an active

79%

. . . of users report that their organizations still rely on e-mail to share and collaborate with CAD files — an outdated and inadequate tool for that purpose.

Source: CAD File Sharing and Collaboration survey conducted by Cadalyst and sponsored by Peer Software, February 2015, based on 435 respondents.

project environment, the threat of working with an outdated file is substantial.

Automated file copying to remote offices. In this approach, a company maintains a master set of CAD files at the headquarters office and a timed service or script is used to copy the files automatically to and from the branch locations — typically overnight. Compared with manual file copying, this approach is equally easy for users yet is not labor intensive; however, the risk of inadvertent file overwrites and other errors is higher.

Shared cloud directories. Here, a company maintains a master set of files on a globally shared cloud service (such as Box or Dropbox), so manual copying and syncing files is no longer required. The problem with cloud architectures is that they

The Real Cost of Ignoring File Management

What if you just ignore the issue of file management and continue using e-mail and other old technologies to keep your files organized? Every company has different metrics, but every company will end up paying more to NOT manage files than finding a solution.

Let's look at a company with 100 CAD users in four offices who earn an average of $40/hour and spend 30 minutes each per week waiting on collaboratively managed CAD files delivered via a WAN connection.

$$100 \cdot 0.5 \text{ hr/wk} \cdot \$40/\text{hr} \cdot 48 \text{ wks/yr} = \$96,000$$

This company is actually losing $96,000 a year in productivity due to slow WAN-based CAD file management! And, if the company has four CAD coordinators — who earn $60/hour on average and spend about three hours per week dealing with versioning problems/errors — the company is spending an additional $34,560:

$$4 \cdot 3 \text{ hrs/wk} \cdot \$60/\text{hr} \cdot 48 \text{ wks/yr} = \$34,560$$

That adds up to a grand total of $130,560 per year spent dealing with CAD file management.

You are paying to manage your CAD files even if you think you aren't! With annual labor expenditures like these, the do-nothing option demonstrates that refusing to deal with the problem is a real drag on productivity and project profitability — as well as demotivating for the project team.

File Collaboration Tool Comparison Chart								
Method	Investment	Scalable	Fast Open/Save	Conserves WAN Bandwidth	Version Control	Easy to Use	Easy to Implement	Total Cost of Ownership
Copying Files to Remote Offices	Labor cost						●	Moderate
Shared Cloud Directories	Subscription	●					●	Moderate
Content Management Systems	$80,000/100 users				●			High
Hardware-based WAN Optimization	$10,000–$30,000 per office	●		●	●	●		High
Distributed File Replication	Labor cost (~$1,000 per office)		●	●		●	●	Moderate
Collaborative File Management	$5,000 per office	●	●	●	●	●	●	Low

force everyone to work via the corporate WAN to an Internet-hosted cloud server. Users then experience slow WAN transfer speeds, and even data throttling, as they use their CAD tools.

Collaborating with CAD files in cloud-based topologies lessens the user's need to worry about file management, but it raises the question of who owns the file and who can edit it. Cloud-based file collaboration for CAD is just beginning to address the versioning and file management problems that users face daily, and it has done nothing to improve WAN transfer speeds.

Content management systems. In this approach, a company deploys a software solution such as Microsoft SharePoint, Autodesk Vault, or a product lifecycle management (PLM) system such as Bentley Systems' ProjectWise to handle CAD file versioning via a check in/out system. These often include other tools such as bills of materials and cost estimators, which many users may not need.

These systems are complex and typically have a centralized file repository which hinders file access performance by requiring updated files to be downloaded and saved over the WAN, or have limited batch replication capabilities to branch offices, in many cases defaulting to a single daily update.

In this scenario, users have to interact extensively with the content management system in addition to their CAD software. Users often view these types of systems as a barrier and try to work around them — essentially resorting to manual file management and the drawbacks that come with it. To help prevent such workarounds, many of these systems encode CAD files, requiring integration with the CAD program — but this in turn can require users to change workflows and how they use certain tools.

From an IT perspective, content management systems require expensive software, additional SQL licenses, extensive configuration, additional application servers, and user training, making them very expensive — $80,000 is not uncommon for a four-site, 100-user implementation — and highly disruptive to implement. Additionally, encoding CAD files essentially locks data into the system, making it very difficult and potentially costly to stop using the content management system later, if desired.

Hardware-based WAN optimization. With this approach, a device (such as Riverbed Technologies' Steelhead) is placed at each office — at a cost of $10,000 to $30,000 per location. These products employ techniques such

as compression and data de-duplication to speed up WAN connections between a location with a central data store (usually a headquarters data center) and the other offices.

Unfortunately, they don't include built-in file locking and version management capabilities. They depend on permissions and file version management to be handled by servers and individual applications utilizing files on the central data store.

While compression and a limited cache at each location improve network performance and save some time required for branch office users to retrieve files and save them back to the central location, the improvement is less noticeable for CAD users working with large files experiencing revisions.

Hardware-based WAN optimization products are also vulnerable to unreliable WAN connections which can quickly offset any performance improvements, and must be a consideration for locations with limited or unpredictable WAN connectivity.

Distributed file replication and synchronization. In this approach, companies use Microsoft's Distributed File System Replication (DFSR) technology, which is included with Windows servers to automatically copy and synchronize the master set of files between headquarter and branch offices, so users can work with a locally available file set. Each time a user at any location modifies a file, DFSR automatically synchronizes it so everyone at all offices has the latest changes. The glaring problem with DFSR is that if everyone has permission to edit the shared CAD files, then "whoever saved last wins," and version control

of CAD files becomes as hard to manage as in automatic copying workflows.

From the user's point of view, using DFSR yields a local set of files that loads and edits much more quickly than WAN speeds, and the user doesn't have to learn any new software. DFSR is included with Windows servers so there is no additional software cost and only minimal implementation time involved.

Collaborative file management. This approach is a hybrid technique that borrows key functionalities from the other methods explored previously to create an easy to use but fully functional WAN file management environment (e.g., PeerLink from Peer Software). The goal is to handle the fundamentals of eliminating file overwrites while speeding up users and providing some way to control the whole process, all while being as unobtrusive for the user as possible.

Collaborative file management systems (like distributed file replication and synchronization systems) keep files up-to-date automatically at all locations while file locking prevents accidental file overwriting. And, to achieve the fastest possible synchronization (like hardware-based WAN optimization) only the bytes that have changed in an edited file are actually transmitted so WAN traffic is greatly reduced. Finally, a stripped down approach to version tracking (like a bare bones content management system) is used to track file edits with basic approval logic and logging so team leaders know who's changing what and when.

THE IDEAL SOLUTION

So, we now understand that we must do something about file collaboration, but what would be the

74%

. . . of users who access CAD files remotely are less than satisfied with the performance of their networks.

Source: CAD File Sharing and Collaboration survey conducted by Cadalyst and sponsored by Peer Software, February 2015, based on 344 respondents who rated experience on a scale from "very dissatisfied" to "very satisfied."

ideal solution? Based on the information presented in prior sections, we can arrive at the following required characteristics:

- **Automatic distributed file replication.** The software must automatically update and maintain a local copy of shared CAD files at each office to avoid the lost time and frustration caused by a slow WAN.

- **Optimized WAN replication.** Local copies of shared CAD files should be updated with only the bytes of data that are actually changed during editing, greatly reducing the amount of time users must wait for files to be replicated over the WAN.

- **Version tracking.** Versioning eliminates the possibility of working on the wrong file. As the CAD project manager makes or permits changes to shared files, the history of the

PeerLink: A Collaborative File Management Solution

An example of collaborative file management is PeerLink from Peer Software. PeerLink is a software-based solution that seeks to meet optimal system criteria with its purpose-built DFSR+ technology which achieves WAN optimized replication and version management with performance levels much like hardware-based acceleration, but without the hardware expenses.

PeerLink uses software agents installed on Windows servers located at each office location including branch offices and those of partners and subcontractors. Using PeerLink means that only the portion of the CAD file being edited is efficiently transferred over the WAN and synchronized in real time at each location. No more entire files being transferred each time they change, and no more batch file transfers to wait for.

For most users, PeerLink works in the background — just open and work with your files on your local Windows server without the need to learn complex content management software, and enjoy the data transfer speeds of a LAN vs. a WAN. Sync occurs when you save or close a file. More importantly, PeerLink maintains version control and prevents "whoever saved last wins" problems.

A PeerLink license costs a straightforward $5,000 per office, which includes the first year of maintenance and support. The installation process consists mainly of defining folders on your current servers that are to be shared and replicated. There are no additional servers or other hardware to buy, no SQL clients to license, and no vaulted or encoded drive volumes to deal with.

changes should be tracked so proper version control can be maintained.

- **Easy to use.** Users should simply be able to work in their CAD applications. They don't want to learn and use another software package to retrieve the files they need. A solution that avoids this bottleneck will help eliminate user frustration and keep the focus on using CAD.
- **Efficient to implement.** Time is money, so the less IT time required to implement a solution, the better.
- **Affordable.** No company wants to spend more money than necessary, so an optimal solution would be as inexpensive as possible.

DRAWING CONCLUSIONS

When considering all the variables involved with CAD file collaboration, it becomes clear that a myriad of tools are available to solve different portions of the problem, but most have weaknesses that can lead to loss of version control or are too slow to be practical. If we consider systems that meet most of the criteria we set out for an ideal solution, we conclude the following:

Option 1. It is possible to implement a **content management system** that achieves solid version control, yet will be highly expensive to implement, is not as fast as hardware/DFSR technology, does not address file access performance issues due to a centralized data repository, and requires substantial work process changes for the CAD user. The typical cost to equip four sites is approximately $80,000, plus a maintenance and support subscription.

Option 2. Implement a **hardware-based WAN acceleration solution** that achieves the highest WAN speeds, preserves current CAD work processes but doesn't fully address performance issues involved with a centralized data repository, and is very expensive. The typical cost to equip four sites is approximately $60,000, plus a maintenance and support subscription.

Option 3. Implement a **collaborative file management solution**, which achieves the highest WAN speeds, provides true version control, is minimally disruptive, and is the least expensive to purchase and install. Equipping four sites typically costs approximately $20,000, plus a maintenance and support subscription.

Of course, any solution that doesn't achieve true version control runs the risk of unforeseen loss of file control that can lead to rework costs and project delays — those costs not being included in the estimates above.

THE ROI CONCLUSION

Going back to our sample calculation of the cost of doing nothing, we saw a typical four-site company losing $130,560 in productivity per year by manually controlling WAN-based CAD files. We can now use the costs for the options above to arrive at a return on investment (ROI) percentage for each case.

Using the equation:

$$ROI = \frac{\text{Speed Savings} + \text{Versioning Savings}}{\text{Cost}}$$

The conclusions are easy to draw:

We arrive at these numbers:

Option 1.

$$\text{ROI} \quad \frac{0 + \$34,560}{\$80,000} = 43\%$$

Years to payback = 2.31

Option 2.*

$$\text{ROI} \quad \frac{(0.25 \cdot \$96,000) + \$34,560}{\$60,000} = 98\%$$

Years to payback = 1.02

Option 3.

$$\text{ROI} \quad \frac{\$96,000 + \$34,560}{\$20,000} = 652\%$$

Years to payback = 0.15 (or 8 weeks)

*The 25% improvement noted in Option 2 is an estimate provided by Peer Software.

- Implementing any of these options gives you good return and rapid payback on your investment when compared with doing nothing.
- Option 1 has no WAN speedup but does add version control.
- Option 2 speeds WAN transport but doesn't optimize collaborative synchronization or version control.
- Option 3 gives high-speed, full syncronization and version control, thus giving the best overall return.

SUMMING UP

The task of managing CAD files in a collaborative WAN work environment is a big challenge for almost all geographically distributed companies. However, by learning the basic terms of the problem and acquainting yourself with the available strategies and tools, you can determine the best solution for your company and make a case for it in terms that your senior management will understand. ◆

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