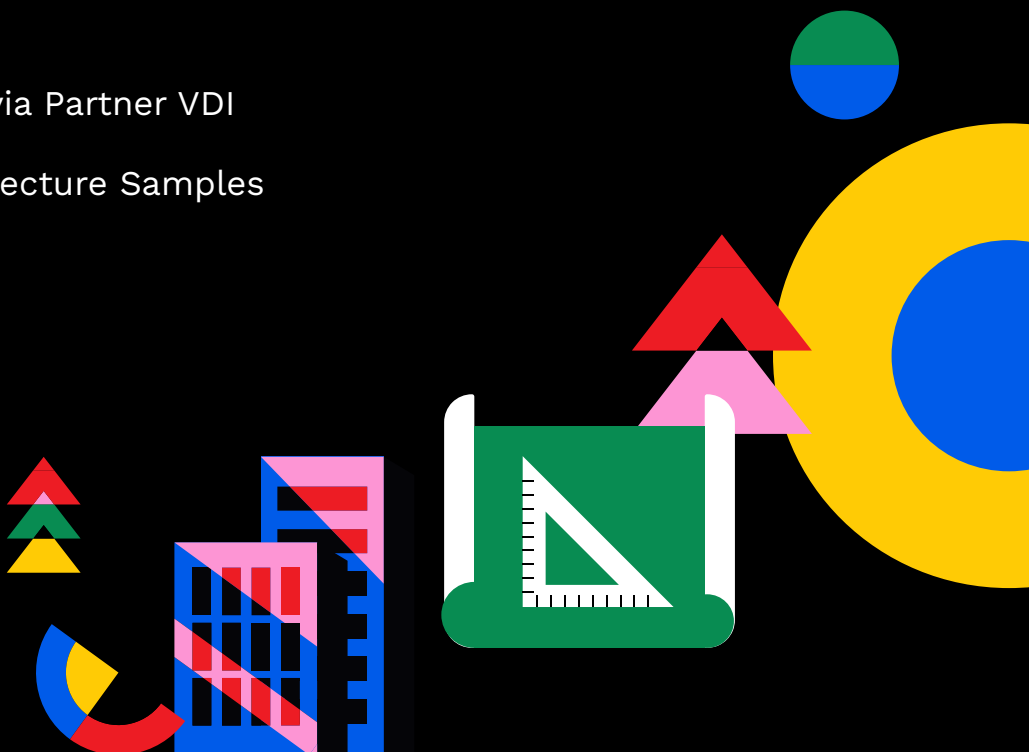




# AEC Reference Architectures and White Paper

# Table of Contents

<b>3</b>	—	Introduction
<b>4</b>	—	Technology Overview
<b>5</b>	—	Architecture
<b>6</b>	—	Autodesk AutoCAD / Bentley MicroStation
<b>6</b>	—	Civil 3D
<b>6</b>	—	Revit
<b>10</b>	—	Plant 3D
<b>10</b>	—	Bentley Open Plant & Bentley Open Roads
<b>10</b>	—	Bentley GEOPAK
<b>11</b>	—	ESRI's ArcGIS
<b>11</b>	—	Remote access via Partner VDI
<b>12</b>	—	Reference Architecture Samples







# Introduction

With over 280 customers in the Architecture, Engineering, Construction and Manufacturing (AEC-M) space, Panzura is the clear leader in powering productivity, accelerating time to value and protecting these specific workloads.

This document is a set of reference architectures around the primary software applications within the AEC-M space. It details how Panzura's technology creates efficiencies, lowers costs, and reduces project completion times by utilizing unique data management technology to enable high performance.

AEC-M firms need to be able to collaborate in real-time on industry-standard applications such as Civil 3D, Microstation, and Revit, regardless of where their users are located. These applications are notoriously difficult to operate between sites, as the way they operate means any distance between the stored file and the user creates significant delays in each and every file operation, adding many minutes to the time it takes to open and save files.

**These delays don't only suck up productive time; they contribute to file and model corruption, consuming even more user and IT time on corrective action.**



# Technology Overview

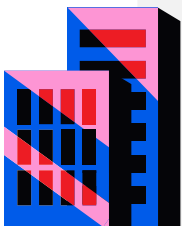
**Panzura CloudFS allows users to work together on files and projects as if they're in the same room,** even if they're located in different cities, states, countries or continents. With patented methods of moving data across vast distances, CloudFS is the only hybrid cloud data management platform capable of global data consistency in real time. Firms using Panzura create high performance environments that allow them to efficiently achieve deadlines, and outpace their competitors.

**CloudFS empowers complex applications to overcome the effect of latency between sites,** eliminating delays in opening and synchronizing large files and projects. Users can work together across sites, making updates in real time, without risking overwriting each other. Not only does this speed up the process of generating and working on design files, but IT teams no longer have to reconcile different versions of the same file.

**Regardless of location, every user can open and save files quickly,** as well as trust that they are working on the most recent version of any file. Traditional methods of achieving this type of file consistency across sites may include using such utilities as rsync, FTP, DFS/R, and Robocopy, but they are inefficient, and cannot come close to achieving timely consistency.

**Panzura solves the 'File Open' problem,** reducing BIM and CAD file open times from upwards of 20 minutes to as little as 8 seconds.

**Panzura enables Revit project teams to work together on the same project from different locations in real-time,** Element Borrowing across sites. This allows them to tap into the value of their talent anywhere in the world and optimize expertise wherever it exists rather than having to rely on the resources of a single office or the relocation of employees to a different office.

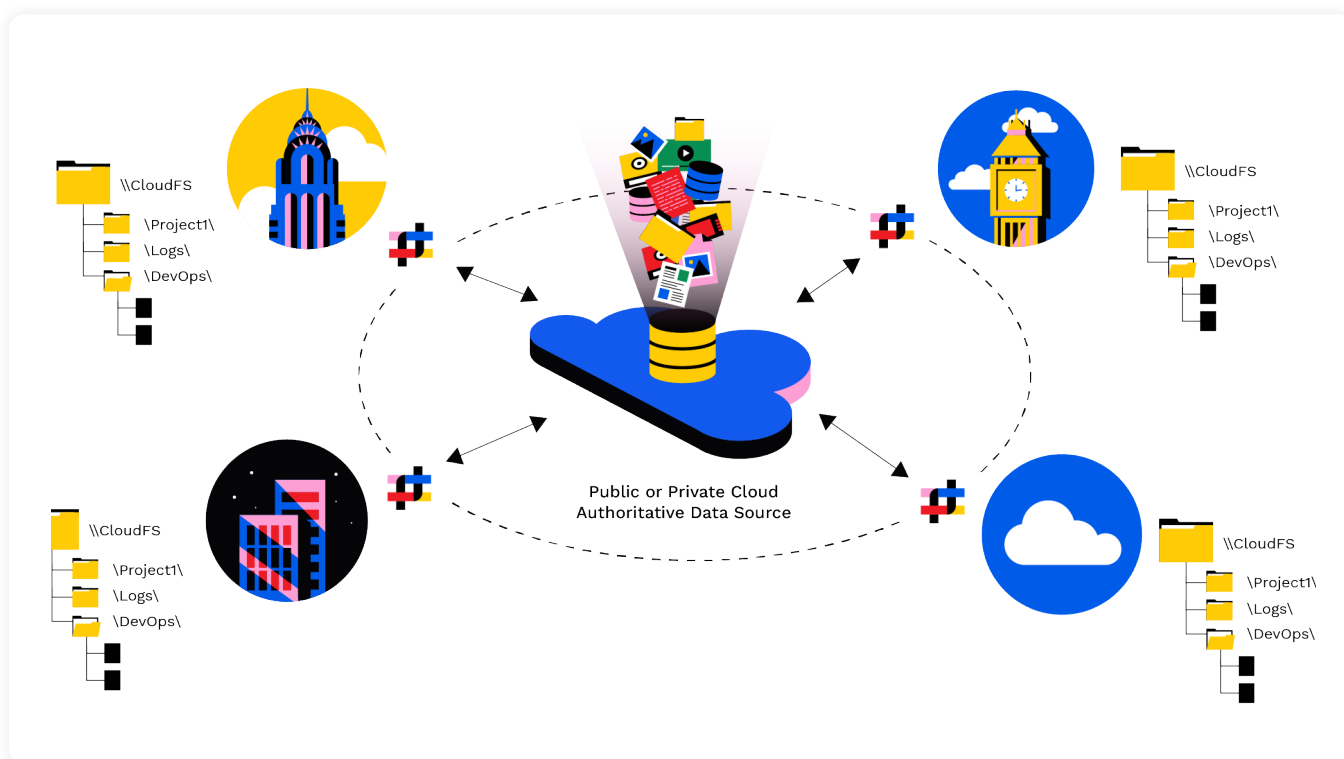


In addition to the obvious performance benefits delivered by Panzura, the immutable file system CloudFS offers exceptional data durability by preserving data integrity, creating immunity to ransomware, and eliminating the need for backups.

## The below products work within the standard Panzura architecture.

This means that there is a central cloud bucket as a single authoritative source for all data. Each location has a CloudFS node that provides access to the cloud data. Each CloudFS node caches the data being worked on by users at that location, which provides the same user experience as working from a standard file server on the LAN. Lock management available within the software application is completely handled by Panzura across the entire global CloudFS system in the same way it would be in a LAN environment.

Below is a simple diagram of how Panzura is laid out (not a reference architecture).





## Autodesk AutoCAD / Bentley MicroStation

Both of these are standard CAD applications and are the base for several vertical products built on top of them. Both have a concept of referencing multiple other files as background images. These can be other CAD files, images, or many other file types. Panzura's technology for syncing data ensures that these background images are always the latest version of the file even if it was modified fractions of a second prior to another user reading the data. This is significant because when working collaboratively with others on a project, files can be updated, often having the latest version of a file can avoid conflicts and errors. Normally such responsiveness would require both collaborators to be located within the same office building. With Panzura's CloudFS, collaborators can be anywhere in the world.



## civil 3D

Civil 3D is Autodesk's Civil design product built on top of AutoCAD. For the most part this product works very similarly to AutoCAD. One feature within the product is Sheet Set Manager and it is significant because every user that has a file in the project open, also has the Sheet Set Manager file open. As changes are made, the application quickly changes permissions for that user from read to write, makes the changes, and then changes permissions back to read-only. Panzura is fully capable of supporting these advanced file behaviors and keeping your data completely secure.




## Revit

Panzura empowers real-time collaboration on shared Revit models over multiple sites or offices. Our global file system enables Revit's file locking and byte-range locking to work in real time across sites, regardless of location or distance between them.

Several environmental variables determine the quality of the user experience when collaborating on Revit models. These include network topology, bandwidth and latency between sites, number of simultaneous users working on the model, and organization of worksets within the Revit model.

Revit stores the location for the model within the model itself. This is how it knows if the model has been moved and prompts to resave the model as a new central if it is moved. This location is embedded as a UNC path that begins with the server name (i.e. \\server\share\ProjectA\model.rvt).



Since the path begins with the server name, this creates an issue when multiple users are working across multiple nodes, each with their own server name. Even though Panzura keeps the models in sync, the server name would change with each user at different sites. For this reason Panzura recommends the use of DFS to create a common namespace across multiple sites.

## Size Doesn't Matter

The size of the Revit model is not a significant factor when working with the Panzura global file system, because the Revit model itself is not transferred across the WAN or to the cloud. Only changes to the model are transferred. Response time of the network is a much more significant factor and has a greater impact on the user experience.

To help manage the latency between sites working on the project, identify the sites with the greatest latency. The following chart provides some latency ranges and what the typical experience is like when users have the same Revit model open simultaneously in these ranges.

<b>Low</b>	0–40 ms	Very close to LAN behavior. With this latency, using Revit is similar to working in a single office.
<b>Medium</b>	40–80 ms	Users may occasionally observe minor delays for certain operations, such as borrowing an element for the first time, but this level of latency is typically acceptable even in a production environment.
<b>High</b>	80–120 ms	Noticeable delays occur for certain operations. Productive work is still possible, but working in a production environment can become frustrating for some users.
<b>Extreme</b>	120–200 ms	Significant delays occur in some Revit operations. Editing operations are possible, but other workflows need to be adjusted using the guidelines in the following section.

## ► Configuring Panzura Smart Cache

Panzura controllers maintain a disk cache of the most actively used files within the global file system. The best performance is achieved when the Auto Pre-populate setting is toggled on. This setting can be found on the Configuration page for each controller under Smart Cache Settings.

This feature identifies files that have been accessed by users on this controller and when those files are modified on other nodes, this controller will proactively download those changes, keeping the latest changes cached on this controller.

The screenshot shows the Panzura configuration interface. On the left is a sidebar menu with the following items: System Settings, Network Settings, Monitoring, Encryption Settings, CloudFS Settings, SMB Settings, NFS Settings, Snapshot Settings, **Smart Cache Settings** (highlighted with a blue bar), High Availability, Active Directory, License Manager, and Disk Expansion. The main content area is titled 'Smart Cache Settings' and contains two tabs: 'Cache Settings' (selected, with a magnifying glass icon) and 'Cache Policies' (with a globe icon). The 'Cache Settings' tab is expanded, showing the following configuration options:


- Cache Settings**  
Manage the intelligent read cache. Select the percentage of storage to allocate for the cache, as well as the maximum percentage to allow.
- Enable Smart Cache**: Toggled ON (blue slider).
- Enable Auto Pre-populate**: Toggled ON (blue slider).
- Percent of Storage for Cache**: 40 (input field).
- Maximum Percent of Storage**: 66 (input field).
- Enabling Cache All on Cloud Read can help reduce subsequent cloud reads by keeping all the blocks contained in a downloaded cloud object for future use.**
- Cache All on Cloud Read**: Toggled ON (blue slider).

## ► Bandwidth Guidelines

It can be difficult to determine bandwidth requirements due to the number of variables involved. The number of people working, the type of work they are performing, and the applications they use can all influence bandwidth requirements.

The following general guidelines can be used as a starting point. We recommend that you perform tests to monitor bandwidth in your environment to create more accurate requirements. Keep in mind that Panzura can work with much lower bandwidth than what is shown here — these requirements are based on supporting Revit and other highly collaborative applications.





These requirements are based on users at multiple locations who are collaborating on the same model. If all users are in the same location (connected to the same controller) requirements will be much lower.

**Requirements:**

- 1 user using Revit – 10 Mbps minimum.
- 5 users using Revit – 20 Mbps minimum.
- 20 users using Revit – 50 Mbps minimum.

## **Model Migration**

When first working with Panzura, it is common to copy projects from other locations or servers over to the Panzura controller. The following are recommendations when first moving and working on these projects.

1. Copy the whole project over. Particularly important are all the CAD files that reference each other. Even if they are in different folders, the goal is to get all referenced files for a particular project onto the Panzura controller.
2. After the files have been copied over, follow this procedure for each Revit model (make sure that no one creates a local copy of the model prior to completing these steps).
  - a. Open the Revit model and check the Detach From Central checkbox.
  - b. Choose the Preserve Worksets option (unless you don't want to keep existing worksets).
  - c. When the model opens, choose Save As. In the Save As dialog, click Options. Set backups to at least 10 and select Create New Central.
  - d. Save the file over the existing model. Keep the file open.
  - e. Open the Manage Links dialog. For each link, choose Reload From. Browse to find the link on the Panzura Controller. This must be done for each link, even if the link type is listed as Relative. When projects are moved, relative links are not always resolved properly by Revit and might be loaded from a remote location, which can negatively affect load times. Re-path the links on the Revit tab and the CAD Files and Image Files tabs.

- f Save the file again. Because you currently have the model open directly on the server, there is no need to sync with central in this case.

3. Close and Save the Revit model.
4. Open all AutoCAD files and re-path all cross references.  
Confirm that paths are set to the Panzura controller.
5. The model is now ready to be opened by multiple users.



## Plant 3D

Plant 3D is another vertical product built on top of AutoCAD. Most file operations are the same as basic AutoCAD. Plant 3D has a feature called Project Manager which is similar to Sheet Set Manager in Civil 3D but has a very significant difference. Project Manager manages all of the files which make up a project. So all users editing files within the project have the same Project Manager file open. Unlike Civil 3D however, Project Manager uses a concept called Byte Range Locking. This is where an application can lock a small portion of the file for write, without locking out other users/applications writing to the file. Panzura has patented technology to support distributed Byte Range Locking locally or across multiple sites. So users can collaborate on Plant 3D projects no matter where they are located.



## Bentley Open Plant & Bentley Open Roads

These are basic CAD applications similar to AutoCAD and Revit and work without issue due to Panzura's ability to support all aspects of complex file locking.



## Bentley GEOPAK

GEOPAK is built on top of Microstation and allows multiple users to edit the same project files at the same time. Similar to other applications, GEOPAK uses Byte Range Locking to only lock and modify a small portion of the file at any given time, enabling other users to edit other portions of the file. Panzura's patented distributed byte range locking allows these applications to work across multiple sites.



ESRI's ArcGIS

ArcGIS is a challenging product to support. The product is built with the intention that data is saved on the workstation's local disk for performance reasons. Despite this, Panzura has managed to develop a solution that allows users accessing the same physical CloudFS node to work collaboratively on ArcGIS projects. Unfortunately, unlike other applications Panzura supports, working in different locations is not supported for ArcGIS. Different locations can have their own ArcGIS projects, but each location's projects are specific to that location. Each location that has ArcGIS users creates its own share for that location's data.

IronOrbit Workspot.

Remote access via Partner VDI

CloudFS works seamlessly with cloud-based workstations to deliver exceptionally fast performance unaffected by any shortcomings in users' personal internet connections. Cloud workstations minimize latency by locating the processing power within the cloud, and sending only keystrokes and mouse clicks between the user and the cloud.

CloudFS makes data immediately available wherever it is required to be, regardless of where it is actually stored — either on premises or within a public cloud. As shown in the standard architecture earlier in this document, CloudFS nodes can be deployed within cloud regions offered by any cloud provider.

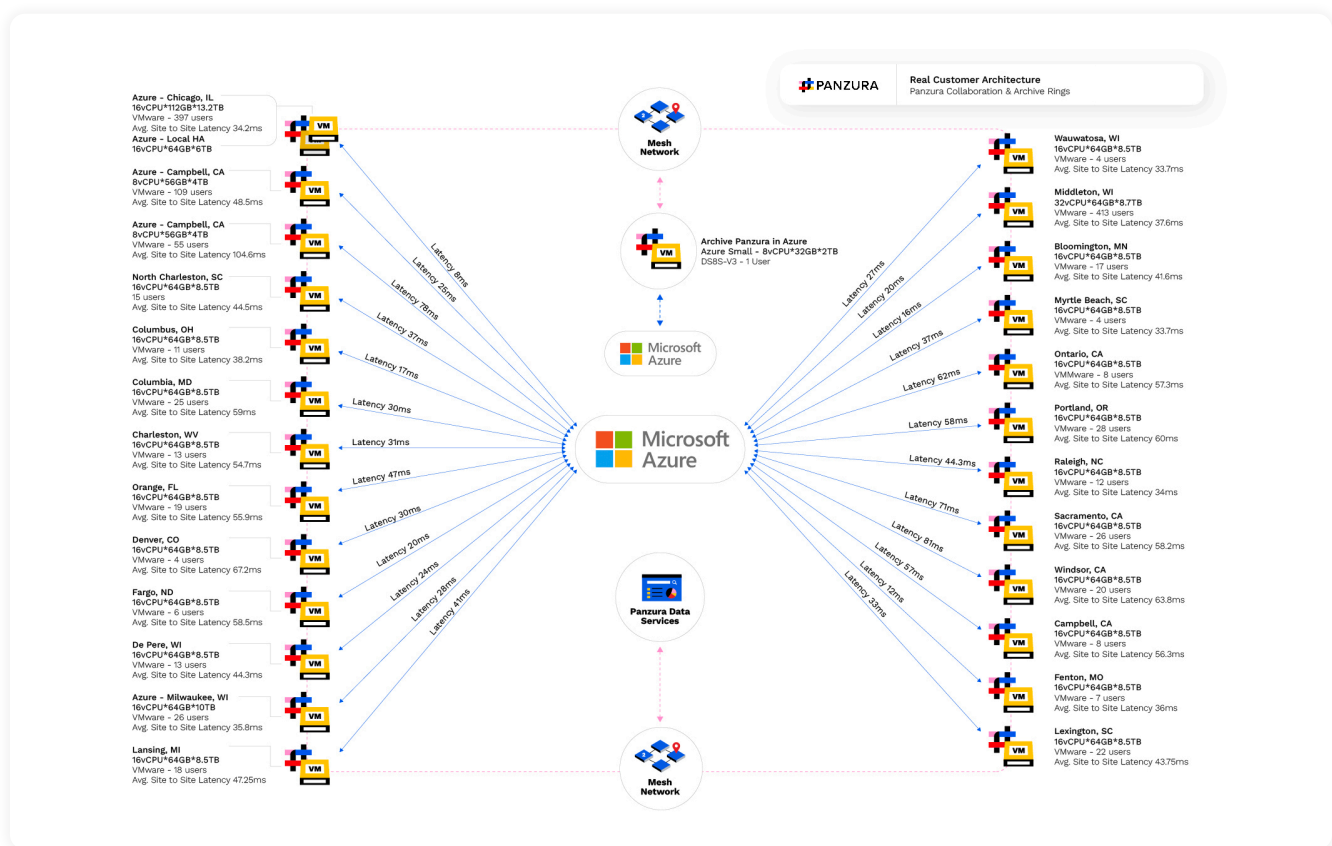


When deployed in conjunction with cloud workstations, CloudFS nodes are located within the same cloud region as the workstations. This puts data right next to the applications, and to the workstations' processing power, effectively overcoming the effects of latency.

# Reference Architecture Samples

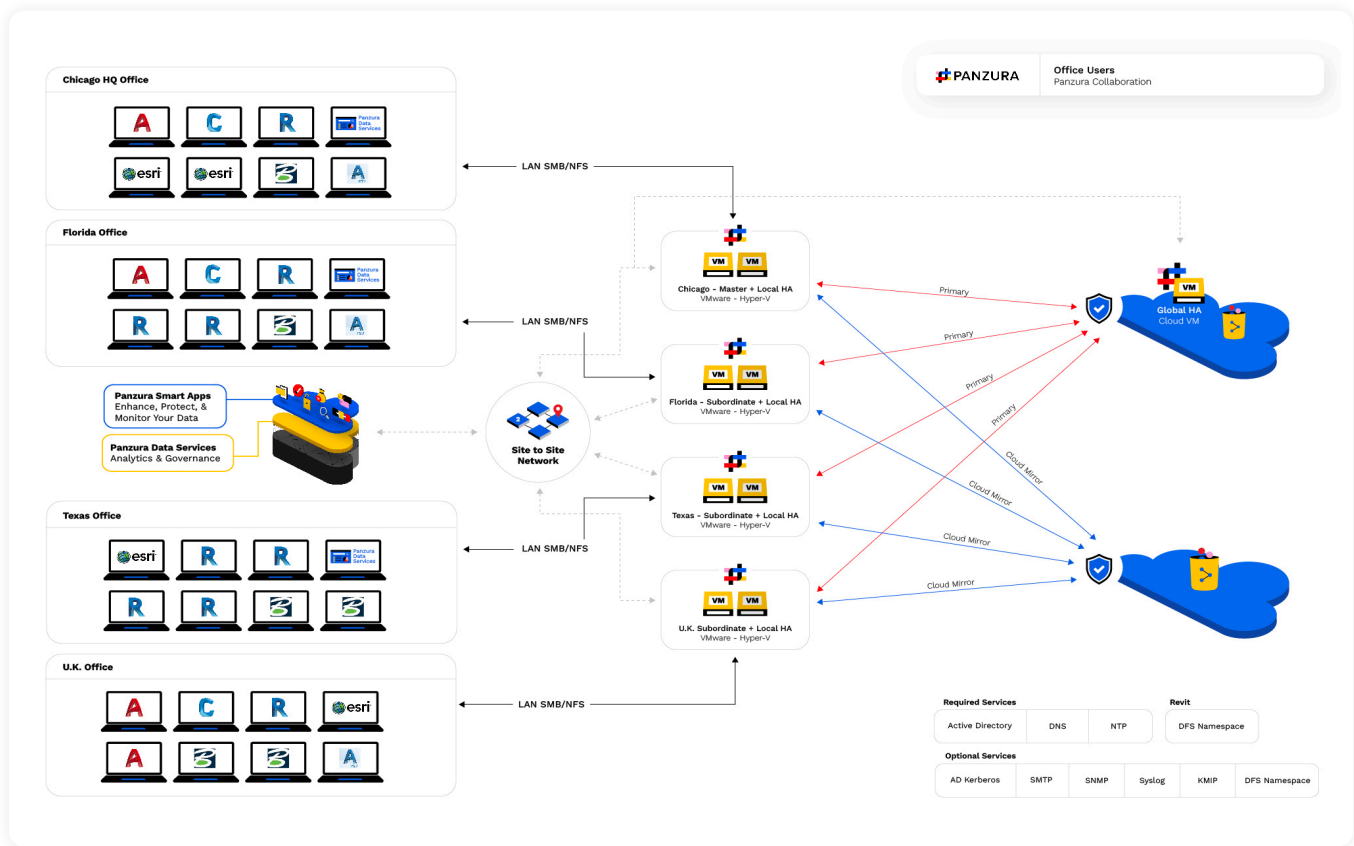
## Real Customer Reference Architecture

This is a national geographically dispersed Panzura Customer. Each office with local LAN performance for IT users, accessing the same authority and immutable data set; collaborating in real time with widely used AEC applications e.g. Revit.IT administrators monitoring the environment and their data life cycle with the intelligence of Panzura Data Services (SaaS). Leveraging a separate archive ring for long term storage of projects.



## Office Users Architecture

The below illustration is an example of an AEC workload, which includes an overseas location collaborating with various US locations, in real-time. This customer has implemented Panzura's Cloud Mirroring feature for off-site Business Continuity in the case of primary cloud failure, or inaccessibility.





**Chicago HQ Office**

VPN Link

Remote Users

LAN SMB/NFS

**Florida Office**

VPN Link

Remote Users

LAN SMB/NFS

**Texas Office**

VPN Link

Remote Users

LAN SMB/NFS

**U.K. Office**

VPN Link

Remote Users

LAN SMB/NFS

**Site to Site Network**

**Chicago - Master + Local HA**  
VMware - Hyper-V

**Florida - Subordinate + Local HA**  
VMware - Hyper-V

**Texas - Subordinate + Local HA**  
VMware - Hyper-V

**U.K. Subordinate + Local HA**  
VMware - Hyper-V

**Global HA Cloud VM**

**Cloud Mirror**

**Required Services**

Active Directory	DNS	NTP	DFS Namespaces
------------------	-----	-----	----------------

**Optional Services**

AD Kerberos	SMTP	SNMP	Syslog	KIMP	DFS Namespaces
-------------	------	------	--------	------	----------------

## Remote Cloud Office Users Architecture

The below illustration is an example of an AEC workload for remote users (offsite) that are working from home or at temporary job site leveraging high performance VDI services to collaborate in real-time. This customer has implemented Panzura's Cloud Mirroring feature for off-site Business Continuity in the case of primary cloud failure, or inaccessibility.

