GETTING THE JOB DONE 'RIGHT' STARTS WITH FINDING THE RIGHT PC

BIM BOX

BIMBOXUSA.COM | ATGUSA.COM

ATG

WHAT IS THE RIGHT TOOL FOR YOU?

"Give me a lever long enough and a fulcrum on which to place it, and I shall move the world."

Archimedes

We live in a digital world and in the AEC industry, our computer is the main tool we use to engage in the digital environment. As in every trade, a person's ability to produce comes down to their experience and skill, as well as the tools used to execute on those skills. When you pair an expert with the right tool, amazing things can happen. Too often in the AEC industry we forget about the second piece of the equation.

Not all job titles/workflows require the same machines, and ensuring each person has the right tool for their job is critical to that person's ability to execute at a high level. A typical BIM Manager is not going to need the same machine as a laser scanning technician.

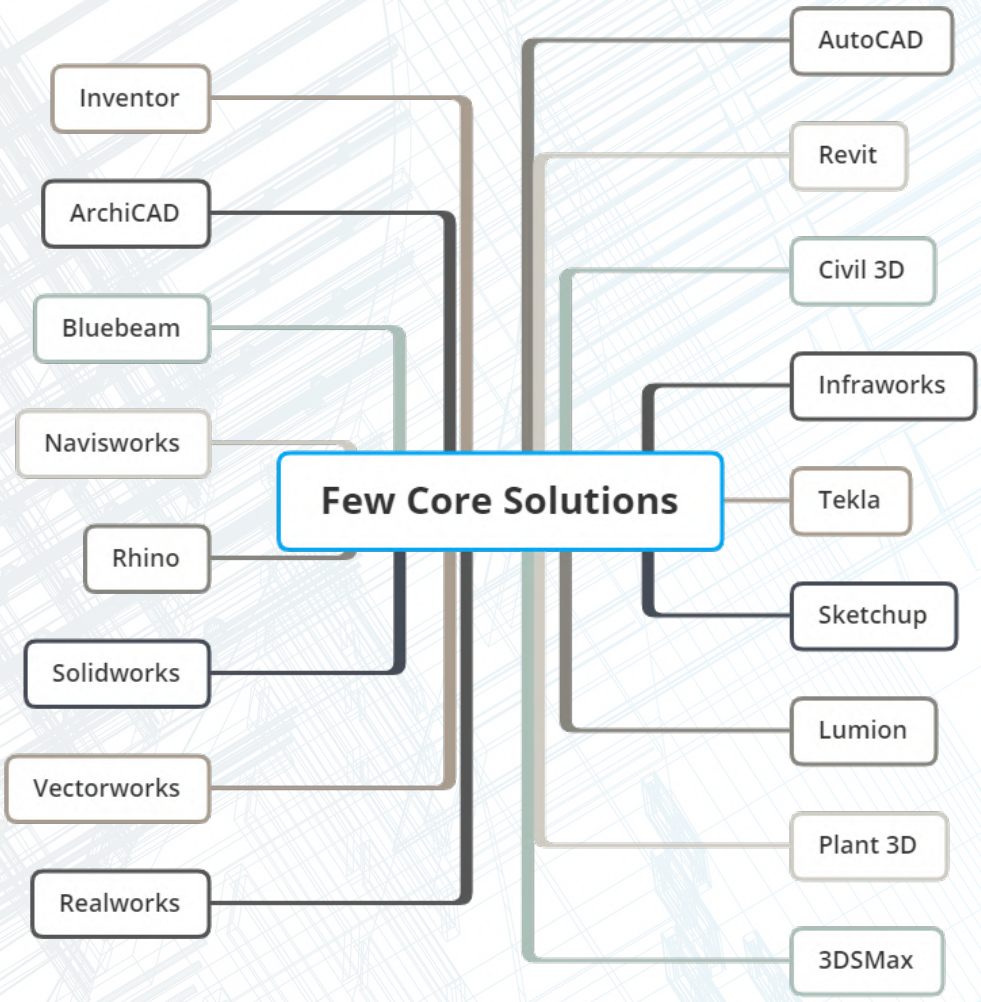
This whitepaper will provide an in-depth look at how different software utilizes hardware, define several different user types, and provide recommendations for each. We understand companies define user types differently. The five we have chosen are commonly found in the AEC space. If you would like to have a detailed breakdown created based on your company's unique user types, please reach out to ATG for a consultation.

WHAT IS THE RIGHT TOOL FOR YOU?

"Few core applications"

These applications only leverage a few cores, which is typically because the processing cannot be broken out into multiple processes. The main reason for this is that each calculation is dependent on the previous. A great example would be a database. Database driven programs are typically few core solutions because updating one cell creates a cascading effect to all the other dependent cells. The software in this list is relying heavily on a few cores to do all the work. The key performance driver for these solutions is speed, i.e. "Clock Speed." The higher the clock speed, the better the performance.

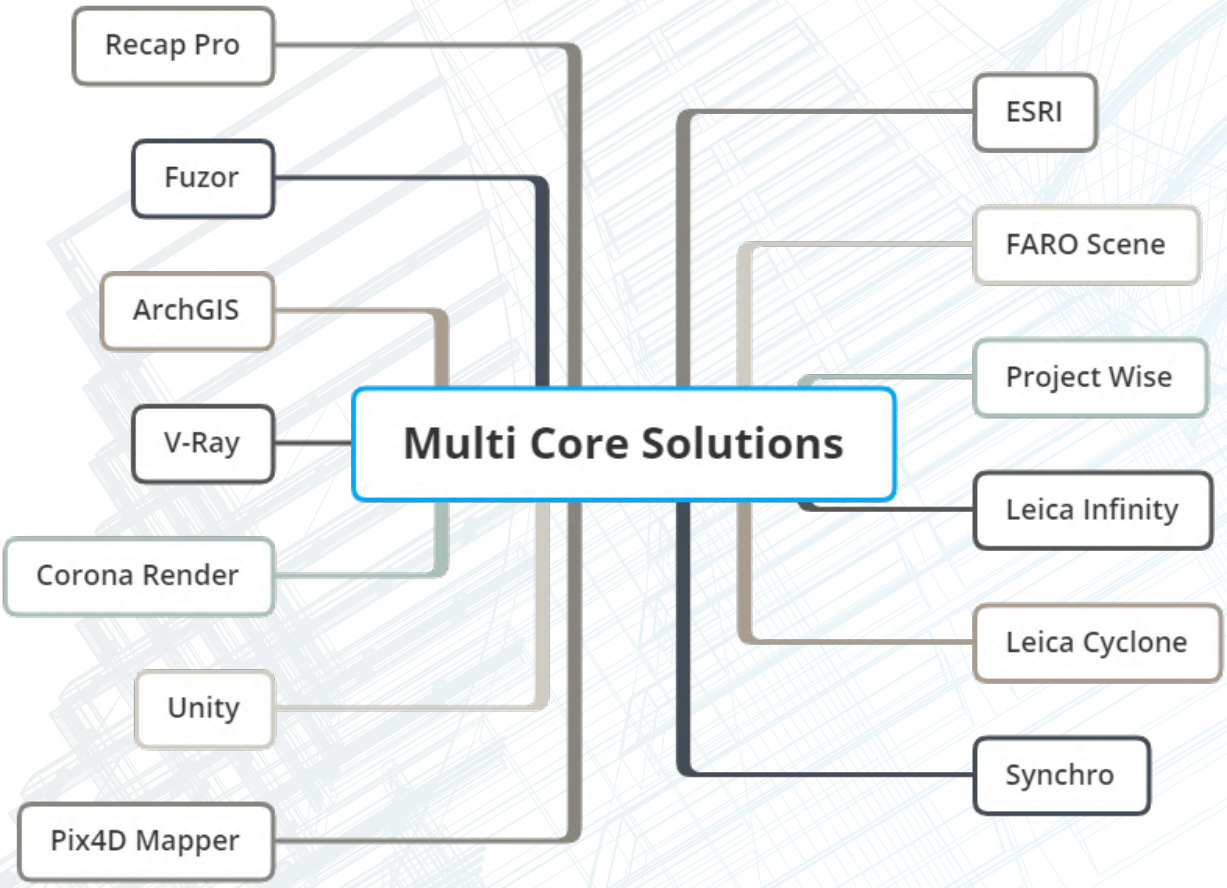
The recommendation for few core applications is the Stryker II. With eight cores, sixteen threads, and an all core clock speed of 5.2GHz, it is the fastest production system available giving users the most responsive AEC workstation ever built.



Common Few Core Solutions used in the AEC world

MULTI-CORE SOLUTIONS

These Solutions, often called referred to as Parallel Solutions, split processing up into many parts that execute simultaneously to accelerate processing. The independent parts can be calculated without dependency, such as ray tracing and or distance calculations. Reality capture software, rendering engines, GIS software and Adobe products are parallel in nature.



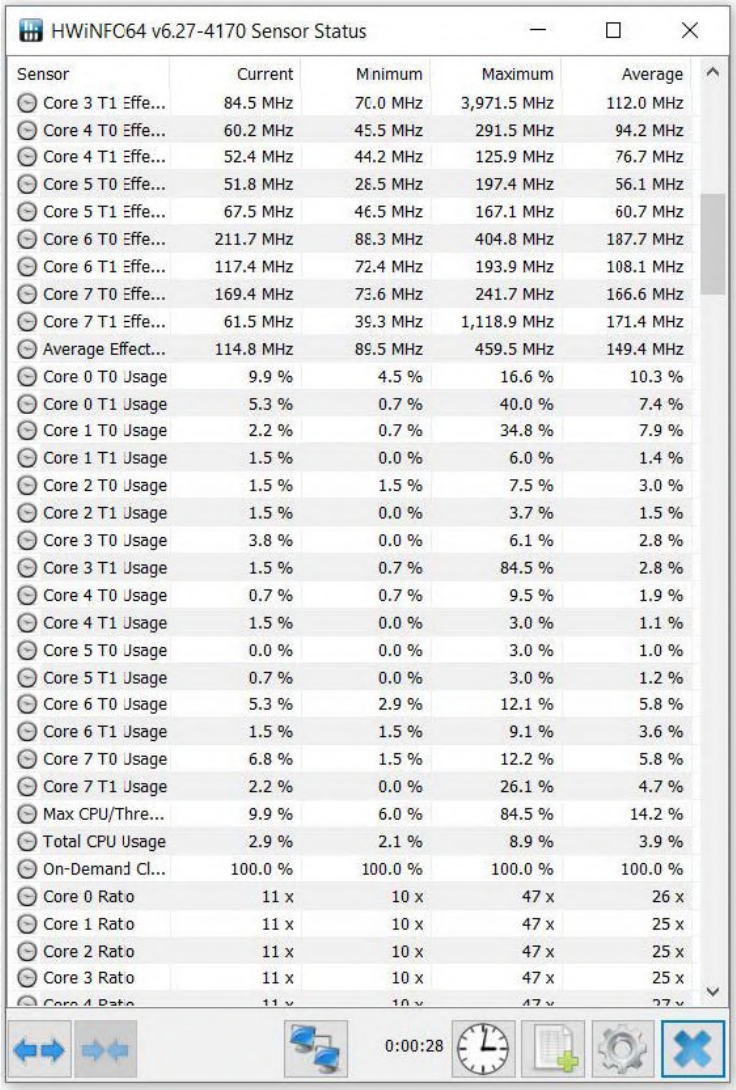
Common Multi Core Solutions used in the AEC world

MULTI-CORE SOLUTIONS

While there are a lot of solutions that consider themselves parallel, most still have portions of processing that jump between parallel and few cores. EX.1 There are a few laser scanning registration programs that are highly parallel for **60-70%** of the processing time, but then drop down to using a few cores for the remaining. For this reason, we must select a processor that has an optimal core count and clock speed ratio to achieve the best performance.

A good rule of thumb is, *the higher the core count, the slower the processor*. The lower the core count, the higher the clock speed. There are also programs that boast of being completely parallel, and they may leverage many cores and threads, i.e. over 20, but do not scale out to the nth degree. Meaning that if you had a 64-core processor, they would not use all the available cores. This is primarily because not many people have 64-core processors and not many software companies optimize code to scale out that far. Additionally, it is challenging on the software development side to efficiently break out processing to effectively use all the resources. At BIMBOX, we test and evaluate different processors to find the optimal core count/ clock speed selection for the applications and user types to ensure we are making the best recommendation for the end user. In many instances, throwing more cores at a parallel solution is not always the best idea, as there is a diminishing return on clock speed which reduces the performance of the few core applications our clients might be using as well. If a client uses parallel applications for **60%** of their time and few cores for **40%**, we cannot negate the need for higher clock speed for performance in the remaining **40%**.

The recommended system for Parallel processing is the Osprey. With 24 cores, 48 threads, clocked at 4.4Ghz, it provides users with a high clock speed for when they are using few core solutions and a massive amount of threads for when they are using parallel solutions giving them the best of both worlds.

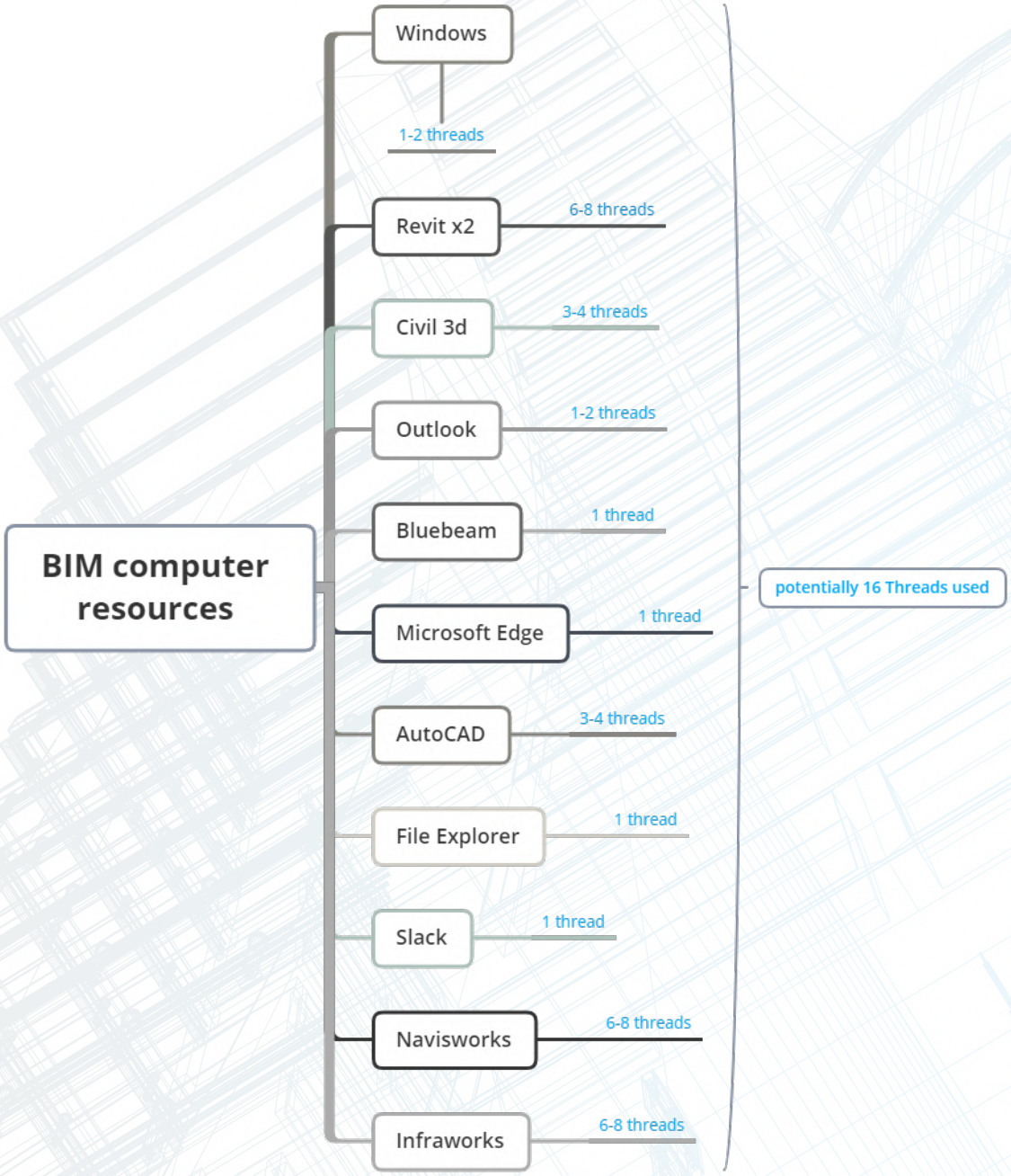


Sensor	Current	Minimum	Maximum	Average
Core 3 T1 Effe...	84.5 MHz	70.0 MHz	3,971.5 MHz	112.0 MHz
Core 4 T0 Effe...	60.2 MHz	45.5 MHz	291.5 MHz	94.2 MHz
Core 4 T1 Effe...	52.4 MHz	44.2 MHz	125.9 MHz	76.7 MHz
Core 5 T0 Effe...	51.8 MHz	28.5 MHz	197.4 MHz	56.1 MHz
Core 5 T1 Effe...	67.5 MHz	46.5 MHz	167.1 MHz	60.7 MHz
Core 6 T0 Effe...	211.7 MHz	88.3 MHz	404.8 MHz	187.7 MHz
Core 6 T1 Effe...	117.4 MHz	72.4 MHz	193.9 MHz	108.1 MHz
Core 7 T0 Effe...	169.4 MHz	73.6 MHz	241.7 MHz	166.6 MHz
Core 7 T1 Effe...	61.5 MHz	39.3 MHz	1,118.9 MHz	171.4 MHz
Average Effect...	114.8 MHz	89.5 MHz	459.5 MHz	149.4 MHz
Core 0 T0 Usage	9.9 %	4.5 %	16.6 %	10.3 %
Core 0 T1 Usage	5.3 %	0.7 %	40.0 %	7.4 %
Core 1 T0 Usage	2.2 %	0.7 %	34.8 %	7.9 %
Core 1 T1 Usage	1.5 %	0.0 %	6.0 %	1.4 %
Core 2 T0 Usage	1.5 %	1.5 %	7.5 %	3.0 %
Core 2 T1 Usage	1.5 %	0.0 %	3.7 %	1.5 %
Core 3 T0 Usage	3.8 %	0.0 %	6.1 %	2.8 %
Core 3 T1 Usage	1.5 %	0.7 %	84.5 %	2.8 %
Core 4 T0 Usage	0.7 %	0.7 %	9.5 %	1.9 %
Core 4 T1 Usage	1.5 %	0.0 %	3.0 %	1.1 %
Core 5 T0 Usage	0.0 %	0.0 %	3.0 %	1.0 %
Core 5 T1 Usage	0.7 %	0.0 %	3.0 %	1.2 %
Core 6 T0 Usage	5.3 %	2.9 %	12.1 %	5.8 %
Core 6 T1 Usage	1.5 %	1.5 %	9.1 %	3.6 %
Core 7 T0 Usage	6.8 %	1.5 %	12.2 %	5.8 %
Core 7 T1 Usage	2.2 %	0.0 %	26.1 %	4.7 %
Max CPU/Thre...	9.9 %	6.0 %	84.5 %	14.2 %
Total CPU Usage	2.9 %	2.1 %	8.9 %	3.9 %
On-Demand Cl...	100.0 %	100.0 %	100.0 %	100.0 %
Core 0 Ratio	11 x	10 x	47 x	26 x
Core 1 Ratio	11 x	10 x	47 x	25 x
Core 2 Ratio	11 x	10 x	47 x	25 x
Core 3 Ratio	11 x	10 x	47 x	25 x

Example of a Multi Core program being monitored

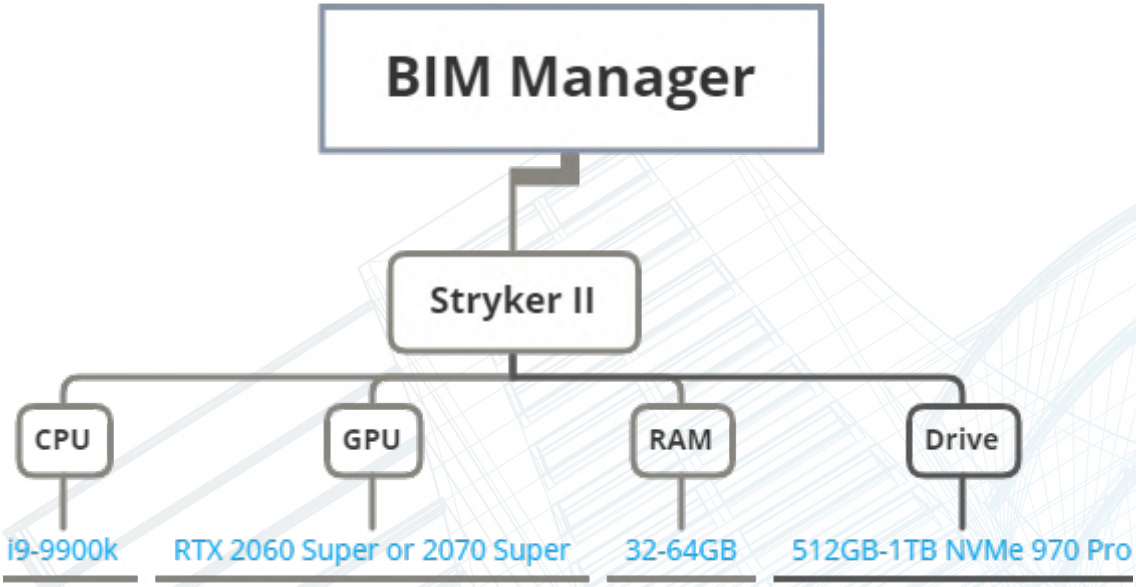
BIM MANAGERS

So, what is the *right tool*? There are many different roles in the industry that require different amounts of power, depending on which software is used. To help us better understand what we need for the specific workflows let us look at what some common software's different job roles and resources require daily.



Example of resources used in a typical BIM Manager's workstation

BIM MANAGERS

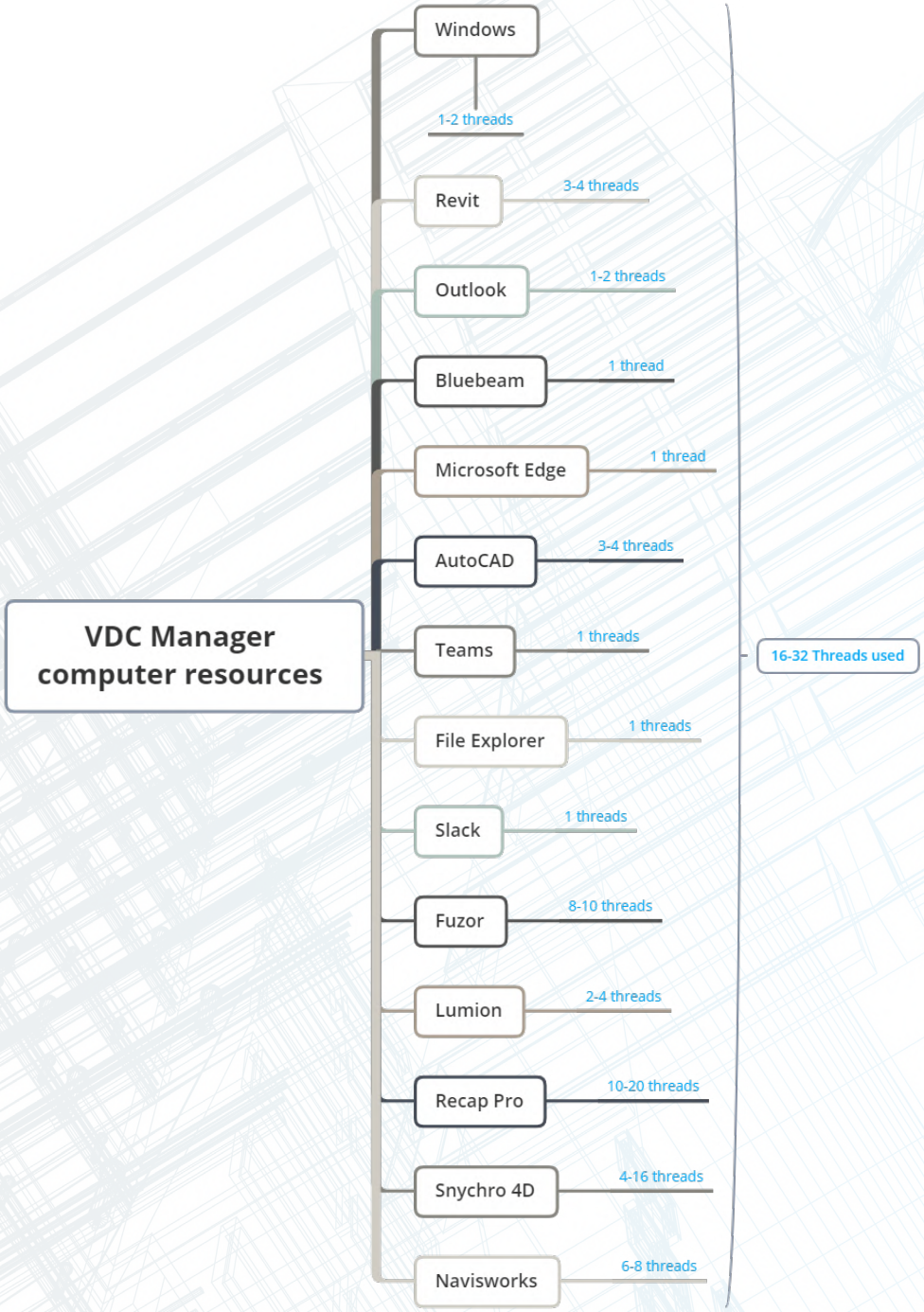


Recommended System for a BIM Manager

BIM managers spend their time in Revit, AutoCAD and other design authoring tools, which are primarily few core applications. In many cases they will have multiple instances of these programs open at once and will still need a fair amount of resources to maintain the multiple instances. The 9900k is the fastest processor and the best solution when working daily with few core solutions and multiple instances due to its eight cores and 16 threads. At BIMBOX, with our direct die process and custom cooling, our Stryker II with the 9900K, running at a 5.2GHz all core clock speed, offers the best experience for BIM managers. For the software defined with this role, the 2060-70 Super Nvidia GPUs are more than enough for a great experience and lag. For **80%** of users, 32GB of RAM will be more than enough. Users working with larger models as well as multiple lined files may want 64GB of RAM. Keep reading to find how much RAM you will need.

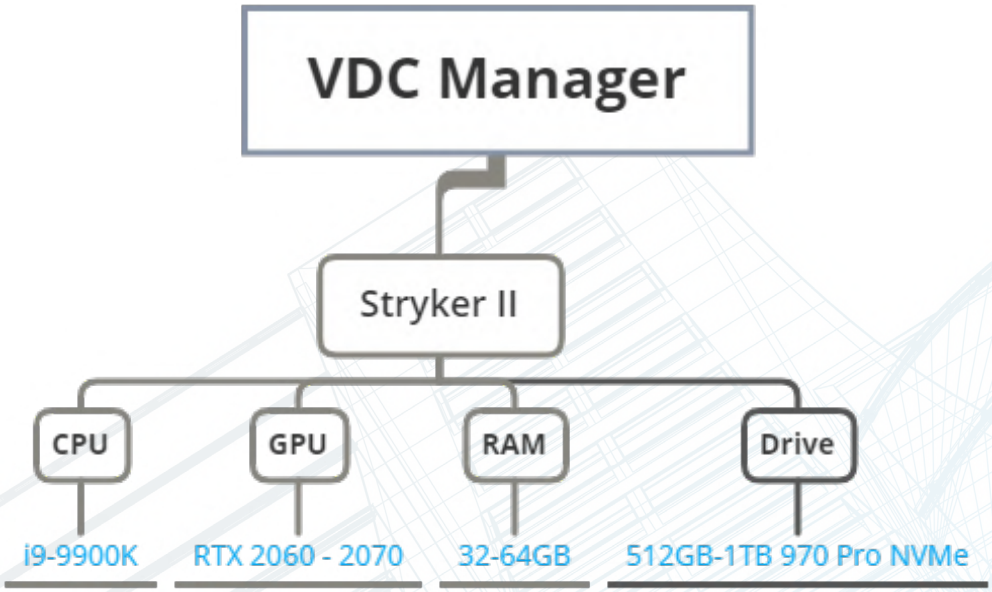
VDC MANAGERS

VDC managers are like BIM managers with the addition of R&D. This user type is often spearheading future workflow initiatives and may need more resources. If their workflows and daily programs are more in line with a BIM manager, the recommendation would be the same as the BIM manager's Stryker II system. If their role involves more R&D, we recommend moving to a system with more resources to ensure a great experience.



Example of resources used in a typical VDC Manager's workstation

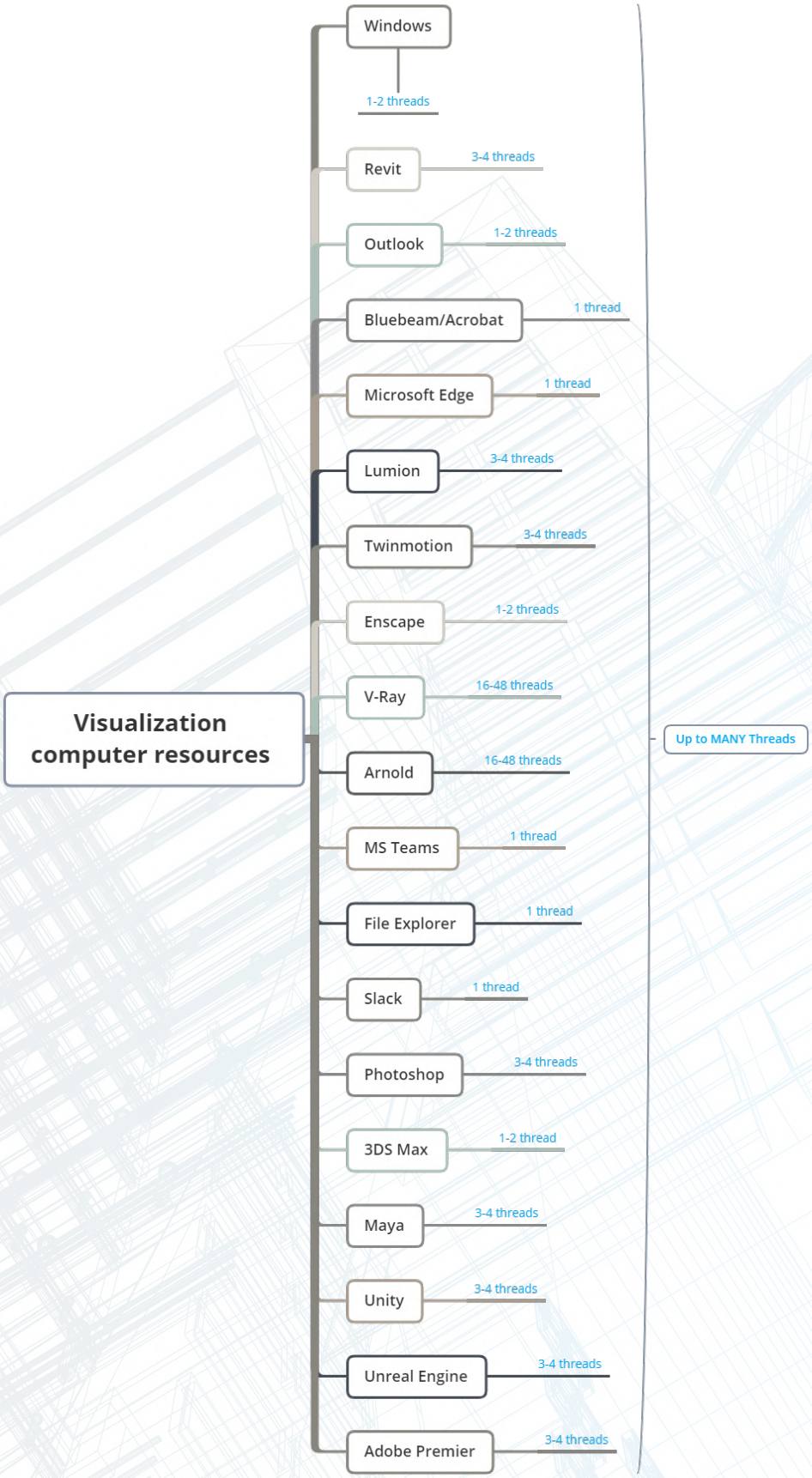
VDC MANAGERS



Recommended system for a VDC Manager

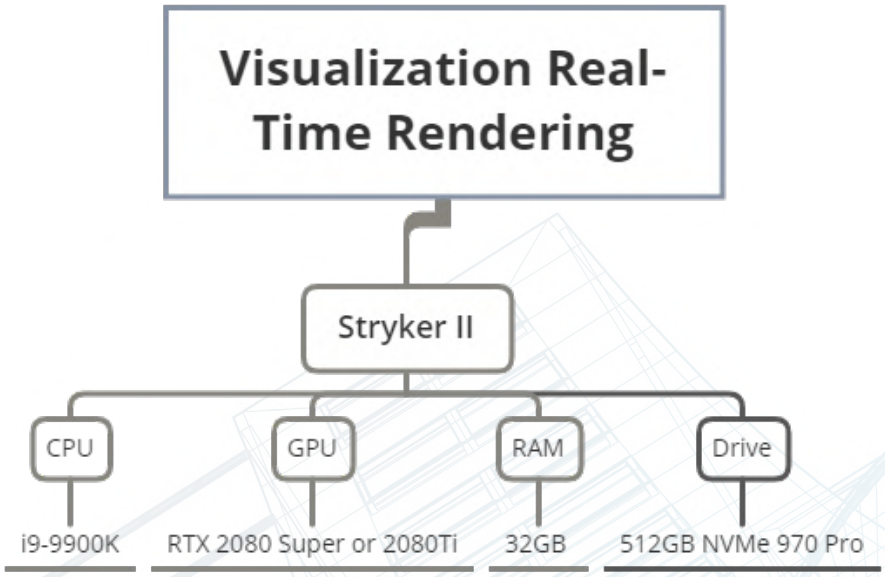
We recommend increasing the RAM to 64GB and upgrading the GPU to an RTX2080 Super. In some cases, you will need to jump to a high core count AMD Osprey system for more resources. Reach out you your local ATG rep to setup a consultation with a BIMBOX technical specialist to find what's right for you.

VISUALIZATION

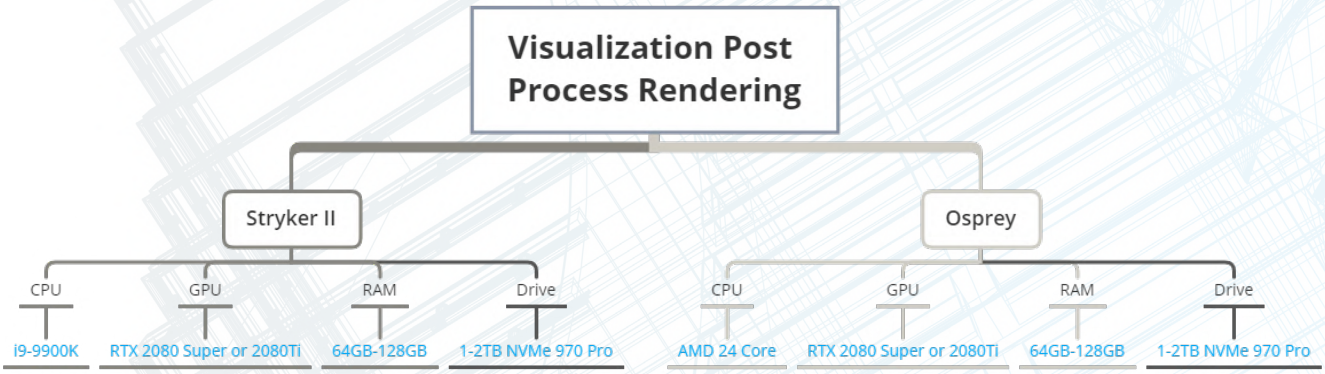


Example of resources used in a typical Visualization workstation

VISUALIZATION



Recommended System for Real-Time Rendering

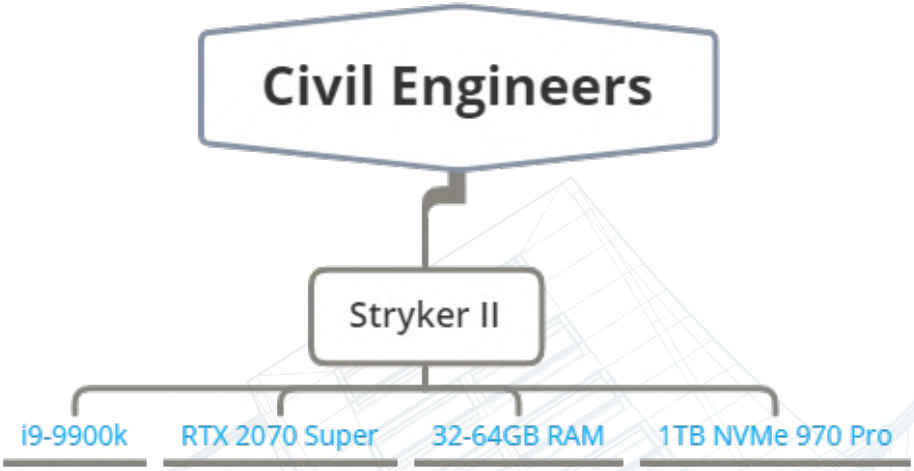


Recommended System for Post-Process Rendering

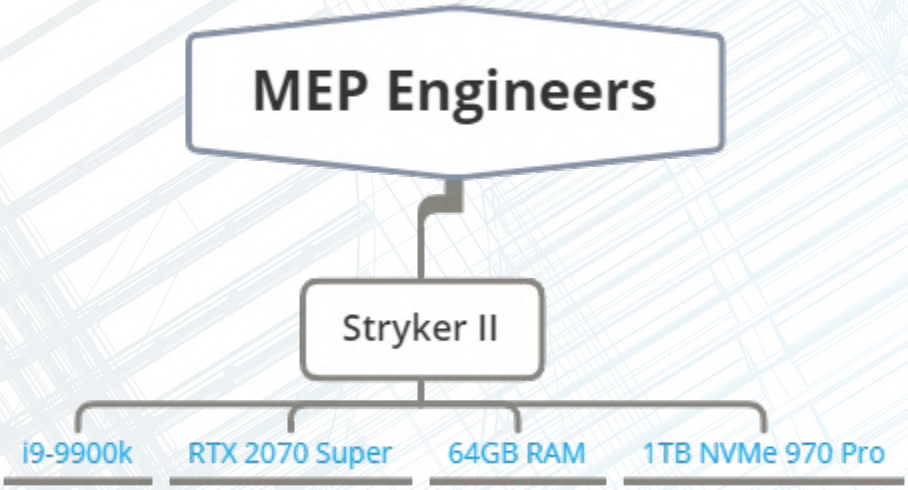
When it comes to visualization machines, we must look at what that process looks like. They receive a model and must make it look as real as possible, this will usually require long animations or still renderings, real-time render walk throughs and VR presentation, along with having other daily programs open utilizing resources. Depending on the type of Visualization you are doing will determine some of the components in your system. If you are mainly working in *few core applications* like real-time rendering with Enscape, some Lumion, Twinmotion and Photoshop, your machine will be the same as BIM Manager's Stryker II system.

For more post process rendering type work with *parallel process applications* like V-Ray, Corona, heavy Lumion and Twinmotion scenes, Unreal/Unity and Adobe Premier work. Let's look at bumping up to the RTX 2080 Super or 2080Ti and a minimum 64GB and more storage Stryker II system. This will be a good machine to have a consultation about and see if we should bump up to the Osprey system.

MEP & CIVIL ENGINEERS



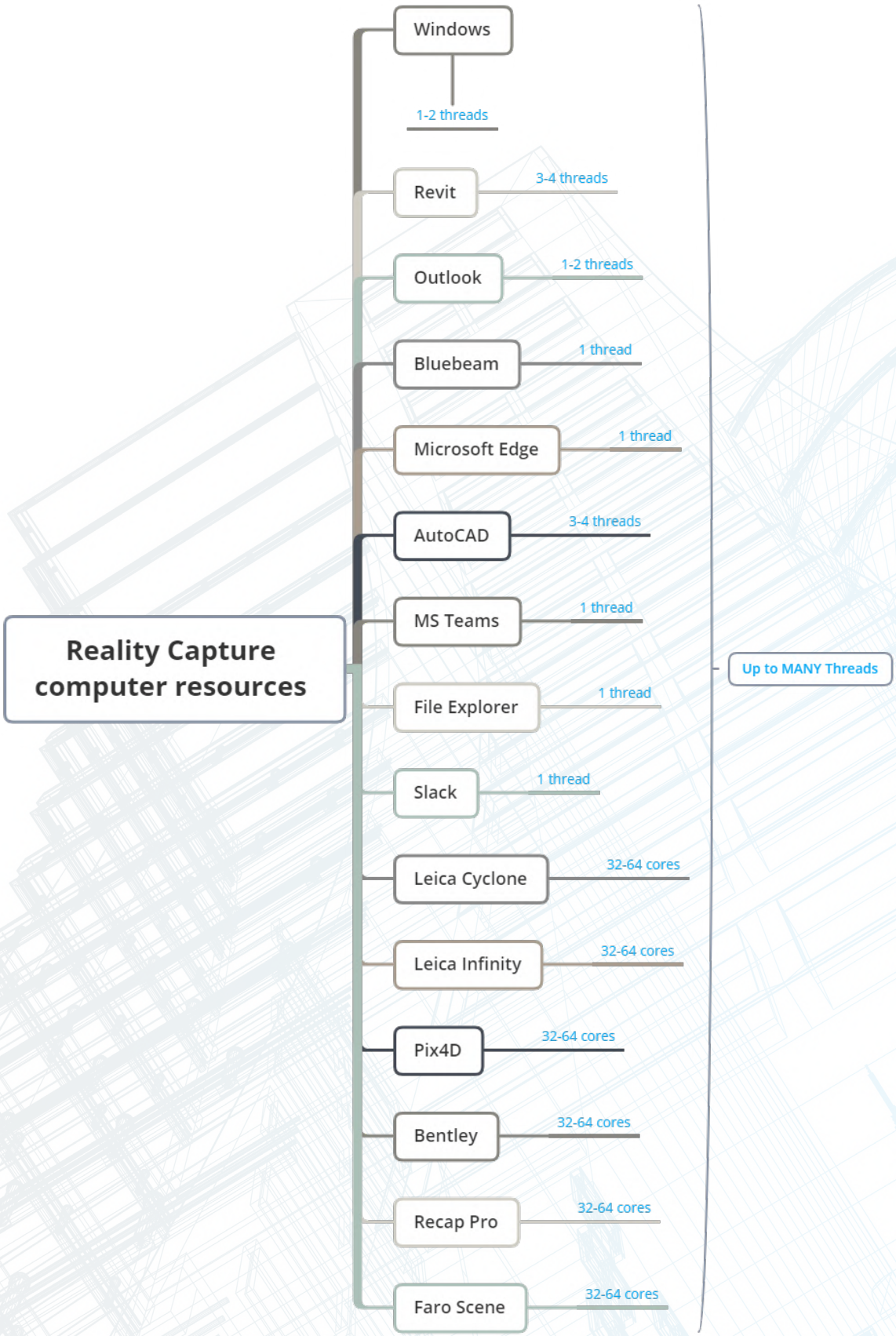
Recommended System for Civil Engineers



Recommended System for MEP Engineers

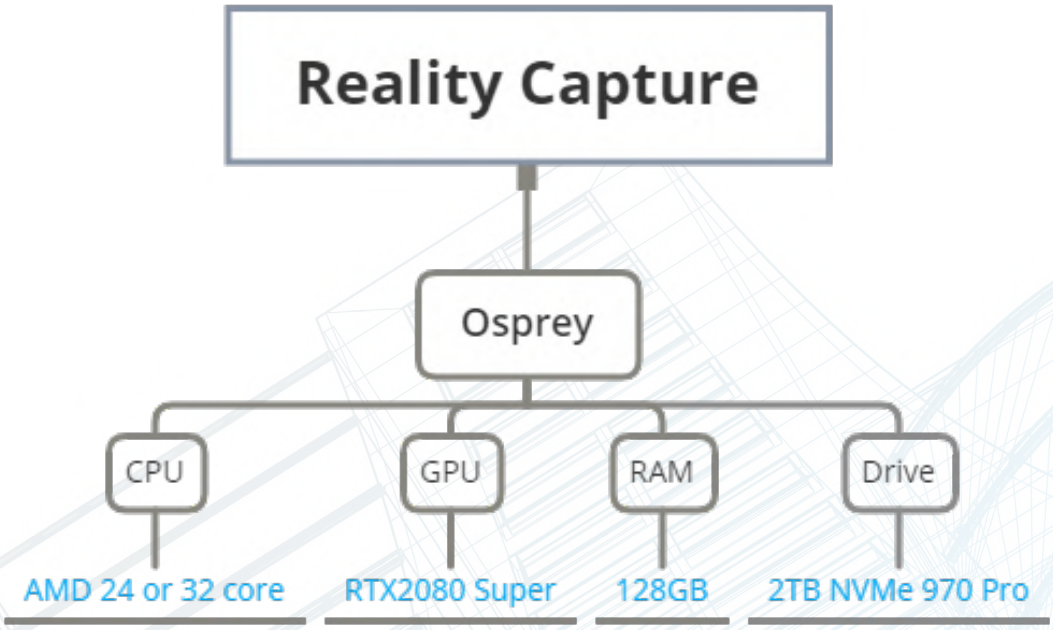
When it comes to specing out engineeing systems, we have to understand that whether they are electrical, mechanical, plumping or civil, they are all working with a lot of information in their models. We recommend our Stryker II system with at least 64GB of RAM for any MEP system. MEP models can get very complicated and heavy in file/data size. Most of the time they will be working multiple linked files of different disciplines. For civil engineers, we recommend our Stryker II system with at least 32GB's of RAM and an RTX 2070 Super GPU. For civil engineers working with LIDAR and large terrestrial scans, we recommend 64GB of RAM and a 2080 Super. In the map, we can see both systems will have a recommended i9-9900K, 2070 Super and at least a 1TB NVMe 970 Pro drive.

REALITY CAPTURE



Example of resources used in a typical Reality Capture workstation

REALITY CAPTURE



Recommended system for Reality Capture

When working with reality capture data such as point clouds, LIDAR, large terestiral scans and photogrammetry, you will need a system that can crunch through all of the data you are working with and have a lot of storage space. The 24-core 48-thread Osprey system with a 4.4GHz all core, has an amazing core to clock ratio. It will process 68 scans from a Faro 330 in 15 mins, which is perfect for doing reality capture work, where a dual Xeon Dell system might take up to 4-5 hrs.

UPGRADING RAM

Recommended upgrades:

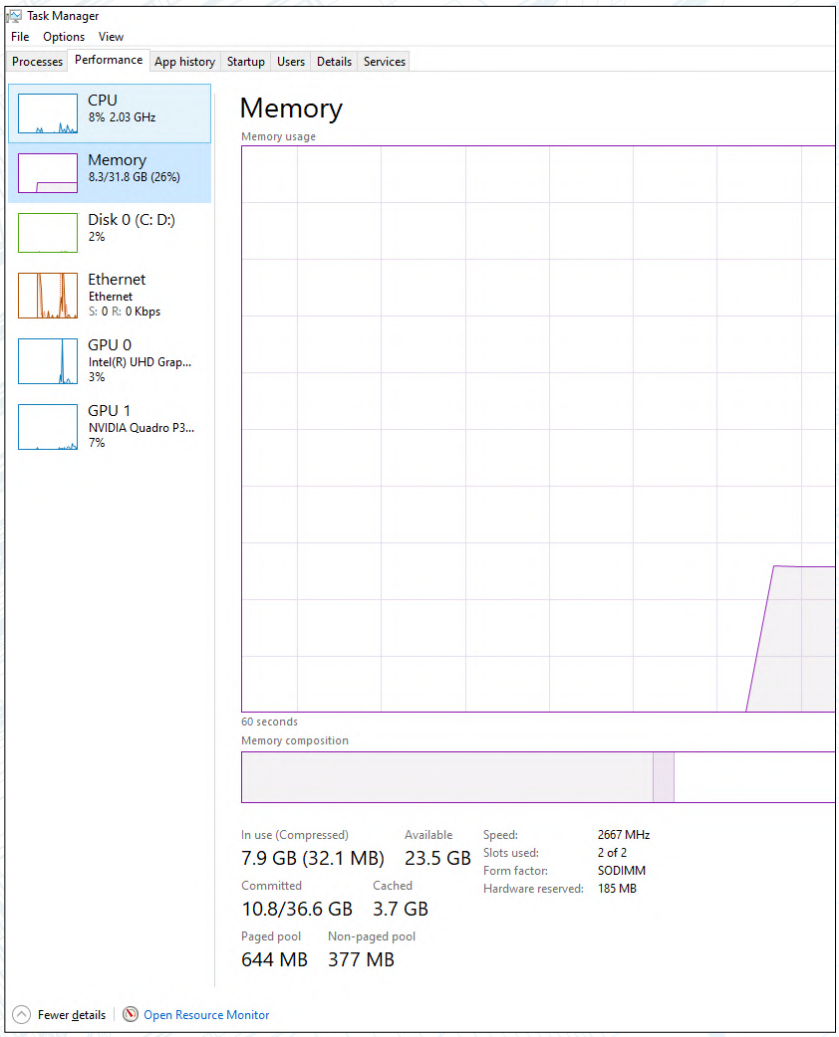
It can be difficult to know what to upgrade your system to, and when to do so. There is not a lot of information out there about what the software needs to perform well. Here is breakdown of some recommendations when considering upgrading critical components in your system.

Upgrading RAM: The task manager is a good way to find out how much RAM you will need. Launch the windows Task Manager, launch every program that you normally would have on a regular day with models loaded into each, and see how much RAM is being used. If you are seeing that you have 80% of your RAM being used up, it is time to upgrade (screenshot on right).

Up to 32GB of RAM: If you are doing more than just Bluebeam and reviewing drawings. Good for 80% of users out there.

Up to 64GB of RAM: Look at upgrading if you are working with larger files (700MB+), multiple linked models, big MEP models. MEP models can get very big and have lots of data/polygons that require a lot more RAM.

Up to 128GB of RAM: For users that are doing heavy point cloud registration, Adobe video work, Recap Pro will use 40% of your available RAM to Register scans. Adobe video editing products are RAM hogs and will use as much as you want to throw at it.



Task manager tab

UPGRADING GPU

Upgrading GPU: Depending on what your job duties are, the 2060 Super or 2070 Super is perfect for about 80% of users out there. Look at bumping up to a 2080 Super or 2080ti if you are doing heavy viz/adobe work.

Up to RTX 2070 Super GPU: The 2070 Super is a great card, this is the card that we spec out for about 80% of our clients because a vast majority of users in the AEC space are not doing heavy renderings to warrant the need for the 2080, 2080ti. Most of the software that people are using daily in the AEC world are not utilizing the GPU hardly ever.

Up to RTX 2080 Super GPU: Typically, we would like to see users jump up to a 2080 if we start pushing big files to VR, doing bigger Lumion/Twinmotion projects, V-Ray/Arnold/Corona renderings, Working with LIDAR and or larger terrestrial scans.

Up to RTX 2080ti: For users who need bigger performance gains, jump up to a 2080Ti - push big files to VR, do bigger Lumion/Twinmotion projects, V-Ray/Corona/Arnold Still renderings or animations, Stadium projects, Adobe Premiere Pro, After Effects. Massive Point Clouds, LIDAR, large terestiral scans, photogrammetry models.

NVIDIA Geforce graphics cards

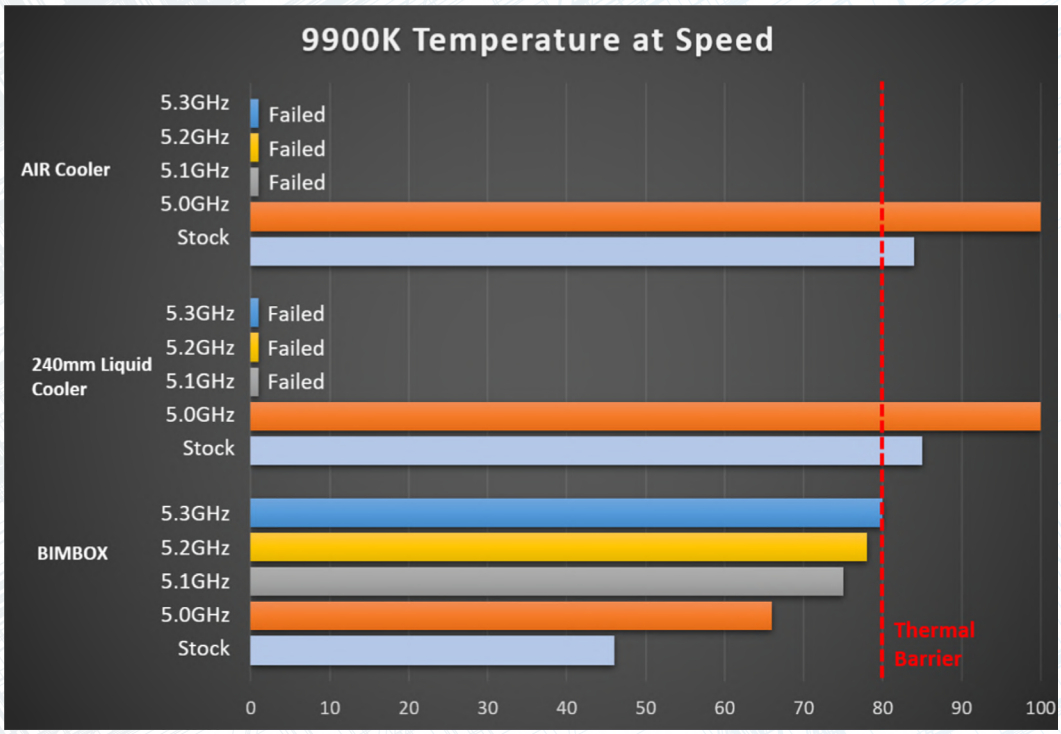
Now that we have a good understanding of what types of systems different role need/require. Let us go a little further and look at what the different components of the machine are and what they do.

CPU — CLOCK SPEEDS & CORES

The application(s) you use determines what is most important to a system, i.e. higher core count processors typically have slower clock speeds. Balancing core needs and clock speed is critical for user optimization. The fewer cores = the higher clock speed. The higher core = lower clock speeds.

The CPU executes command lines from software, i.e. "Wall tool in Revit, Draw Polyline in AutoCAD etc. etc."

The clock speed is at what rate it can execute those commands, the higher the clock speed, the better the software will run. We will frequently see specs that say, "boost clock speeds to 5.0GHz" That just means the CPU will jump to that speed for a split second and then jump back down to a lower speed to stay cool. The i9-9900K is a phenomenal CPU that can overclock very high and has Hyperthreading (Hyperthreading is when the CPU splits each physical core into virtual cores, this helps makes the processor more efficient). It just gets hot, so to maintain high clock speeds the CPU must be continuously cooled. Below is a graph that will show the 9900k Temperatures at various speeds with different cooling options. With "few core driven solutions" the higher the clock speed, the better experience we will have in the software. This is the processor of choice for BIMBOX Stryker II desktops. BIMBOX can get a steady 5.2GHz all core clock speed by utilizing their patented Direct Die cooling process.



Example of 9900K temperature with different cooling

GPU & RAM

GPU — Visualization is Key for any AEC software. Autodesk shys away from GeForce cards. Through extensive testing we will talk about why GeForce cards are ideal for AEC workflows.

Refresh rate is the key performance factor when anything in the viewport is regenerating. I am sure we have all experienced before, when we pan/zoom on a model or lines, it takes some time for the model to Re-Gen. GeForce cards offer the highest available refresh rate for 3d applications and real time rendering. Quadro cards are not as fast and are typically used for long, drawn-out processing.

RAM: Capacity, Speed & Latency

Everything runs on RAM, so faster speeds and lower latency provide the best experience. When I do a command in a software, they will be thrown to RAM. The CPU finds that command on the RAM, and then the RAM sends it back to the CPU to complete the command.

- **Speed:** Is measured by how many cycles per second it can perform. For example, if RAM is rated at 3200 MHz, it performs 3.2 billion cycles per second. You will often see a speed of 2400MHz or 2933MHz speed RAM, which is common in systems on the market. BIMBOX stock RAM is 3600MHz speed.

- **Latency:** How long it takes to access a specific set of data.

Making sure that you have enough RAM to load your Revit projects into RAM is a huge factor. Having more RAM than you need in your system is not beneficial and that money could have been put to other components in your system.

Example of RAM installed in motherboard

STORAGE & MOTHERBOARD

Storage

The single most important component on any system. This is where all your programs are installed on, including Windows itself. The single biggest roadblock to a system.

Capacity vs speed – Most people know capacity, i.e. 1TB or 2TB, capacity does nothing for performance.

We need drives that will maintain the optimal read write speeds for the 8+ hours a day we work.

Example of NVMe drive

Motherboard

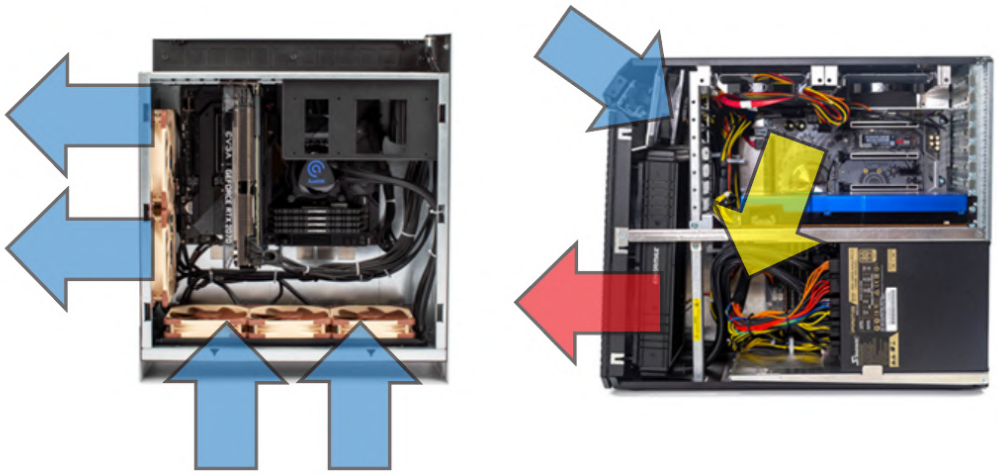
The motherboard is the foundation of a system that holds everything together and makes each component talk to each other.

High Speed LAN, USB Ports offered, upgradability, VRM performance, RAM compatibility,

Example of a motherboard

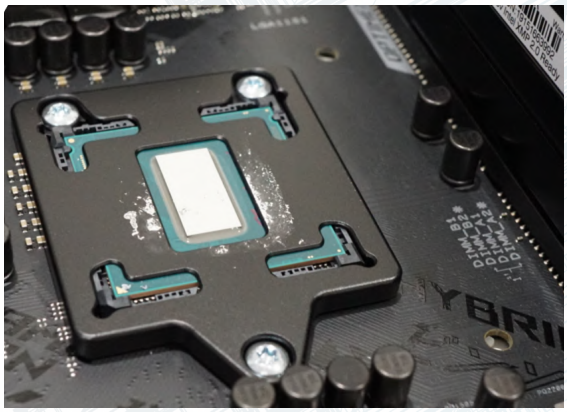
DIRECT DIE COOLING

Now that we know what the components are that make up a computer, how are they all housed together? How a system is cooled is extremely important when it comes to computers. Think of the case as an oven, There are lots of components inside of it that get hot and the heat has to go somewhere otherwise the heat is just sitting in there and the components get hot and start to slow down. Here is an example of a BIMBOX case vs a traditional case you would see in AEC firms.



Example of airflow in BIMBOX versus a typical computer in an AEC firm

The BIMBOX case is specifically designed for Positive Pressure Airflow, paired with a massive 360mm liquid cooling system, and with direct die technology, enables our systems to run fully unconstrained at extreme clock speeds.



Example of Direct Die delidding process

DIRECT DIE COOLING & ROI

To achieve and maintain a **5.2GHz all cores** on our i9-9900k CPU and **4.4GHz all cores** on our 24-core AMD CPU, BIMBOX will modify the Intel and AMD CPU by removing the heat spreader (silver cap that has the info of the processor on it), buffing the die of the CPU to bare metal and mounting a water cooler directly on to it. By doing this, we see a 20-degree temperature drop. We can overclock all cores without ever hitting the thermal barrier. Any process or application that is driven by the CPU will be able to perform at higher speed than a standard PC. This process is called Direct Die Cooling and is patented exclusively by BIMBOX.

ROI can be reflected in several ways and is gained by the following:

First – Our clients see a hard number ROI from a reduction in time when loading and saving files. In many instances, the time saved by moving from their existing "big box" systems to a high-performance workstation, can be anywhere from 45 seconds to 120 seconds. That is close to one minute per loading file, 1-2 minutes loading linked files and double that time when saving. They do this five times a day, so the savings is ten minutes per user per day. In an office of twenty, this is 200 minutes per day, at a billable rate of $100/hour, that is $333 in saved downtime per day, a little over $1600/week. That works out to $250,000 over three years. Less the cost of the hardware, $124,000, the net ROI is $126,000.

Second – The second way our clients calculate ROI is increase in speed. If the high-performance workstation, i.e. Stryker II, is 40% faster at Revit, and their user utilizes Revit 50% of the day, they can increase their annual output by 20%. Let us be conservative and make that improvement 10%. Let us assume they bill their employee out at $100,000 per year, and that a 10% increase in output would mean a $10,000 increase to billable revenue. With the same office of 20, that would create a $200,000-year one ROI, and a $600,000 three-year ROI. Less the cost of the hardware, $124,000, the net ROI is $476,000.

Third – The third way clients effectively gain ROI is through increase in time to produce quality work. For a coordination manager, a reduction in time to load models gives them more time to review clashes. For a BIM manager, faster Revit environment gives them more time to redline a model instead of waiting for things to load. For a laser scanning technician, being able to register scans and review the same day scans were made makes the data more relevant and empowers the process. This method of viewing ROI is most often felt by the end user and is the reason BIMBOX has such a high retention rate.

Often, the actual ROI will fall somewhere between the 1st and the 2nd and will always include the 3rd. These ROI's are achieved through the high-performance hardware, as well as pairing the right hardware to the end user's workflow.

BIMBOX BENCHMARK

Curious how your system stacks up to a BIMBOX? We partnered with some of the best in the industry to create the all new BIMBOX Benchmark. Previously there was only the Revit RFO benchmark, which did not put the stress of a full 8hr day on your machine to get a good representation of how your daily machine would perform. Now the Industry Standard BIMBOX Benchmark for Revit, is designed to push systems to the limits, with multiple linked files and point cloud data.

Download now:
https://www.bimboxusa.com/revit-benchmark

Reach out to your local account representative at ATG USA to set up your consolation today.

ATG believes you deserve more than *just* an Autodesk Reseller. We're here to be your complete AEC technology partner. Check out these resources for more information or visit our website at www.atgusa.com:

Whitepapers
ATG Workflows & Solutions Blog
ATG YouTube
Contact ATG

Follow ATG:

Applied Technology Group is a Platinum Autodesk Business Partner. Founded in North Little Rock, Ark., in 1992 as a local computer services company, ATG has grown to become a leading design technology partner with the purpose of assisting customers in maximizing the value and adoption of advanced technologies so they can perform competitively in the AEC sector. ATG collaborates with customers across the Gulf South, Midwest and Southwest through partnerships with 3DR, Autodesk, Leica, Microsoft and Panzura. Learn more about our company at www.atgusa.com. Autodesk and the Autodesk logo are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries.

3201 Highway 161 • North Little Rock, AR 72117 • **800.935.4894**

atgusa.com