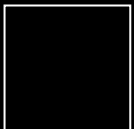


The Importance of Graphics Computing in Creating High-Performance XR Environments



Mechdyne
ENABLING DISCOVERY

The engine for insight

Extended Reality (XR) includes Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) technologies. Working within these digital environments can yield staggering insights and tremendous efficiencies, but to generate maximum value – over the longest possible time frame – XR systems need to be built on the strongest possible foundation of computing power. That muscle enables a wide variety of users to render and manage massive, disparate data sets in ways that unlock understanding. Even more than the display itself, computing power is essential to delivering an experience that's truly immersive and natural.

If you're contemplating the creation of any type of large-scale XR system, it's important to partner with a technology provider who understands this and has both the in-house expertise and manufacturer relationships necessary to deliver High Performance Extended Reality (Hi-PerXR).

Every element is essential. The source – your data – has to be rich and usable. And, of course, the display must be vivid and responsive. But the magic happens somewhere in between, within the video chain and the VR engine – the computer – that translates data into an experience so realistic that you leave one reality and enter another.

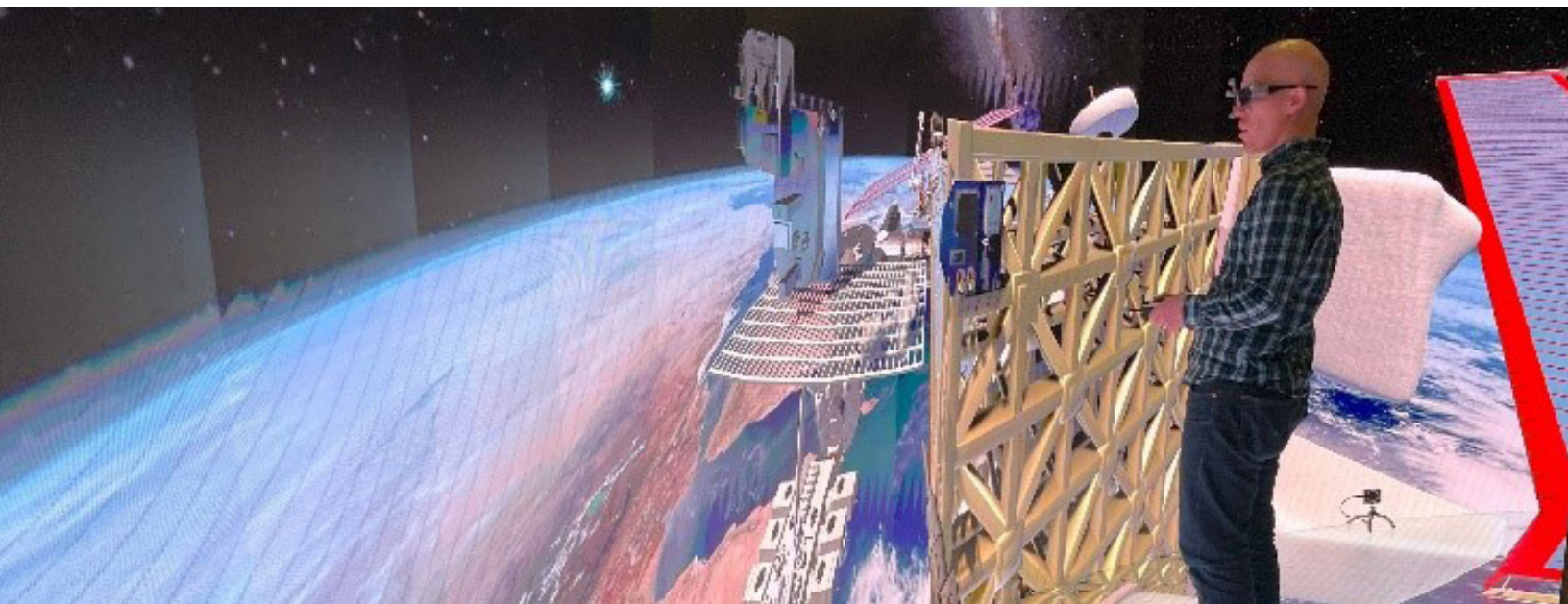
Highly detailed models and expansive virtual environments can include multiple display elements, multi-planar display surfaces, 3D viewing, interaction technology, and more. Combined, they need powerful computing and expert synchronization.

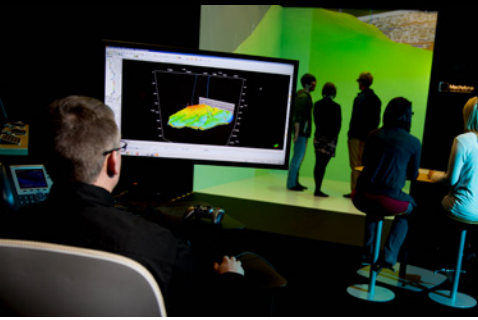
Computing power is the foundation of effective Extended Reality systems

It all begins with discovery – asking the right questions not only to identify and understand the client's anticipated use cases, but to help them consider additional possibilities to further increase the utility of their investment.

"Scalability and flexibility are key to ROI because they expand use cases and utilization," says Chad Kickbush, general manager of integration at Mechdyne. "You don't build for the next six months, but for the next three to four years and beyond. That mindset is at the heart of fully realizing the value of your system."

The best way to prepare for the future, Kickbush advises, is with a computing system that's as flexible as it is powerful. It's crucial to remember that a large-bandwidth 3D signal pushes through cables, switchers, and encoders. Ample computing power is needed to drive 3D signals to ensure that the signal originates correctly, then passes through the distribution channels and computers without getting degraded. And if you want your data to span across multiple displays, reaching multiple collaborative partners, that's going to entail even more complexity and require additional computing power.





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— **Chad Kickbush**, Mechdyne General Manager of Integration

Many organizations seeking to create complex immersive and VR environments aren't strangers to virtual reality. Often, they have experience with HMD-controlled VR, or they've rendered 3D imagery on a single display. What they tend not to realize, however, is just how great a leap they're making in the transition to a full-scale VR environment involving, say, multiple curved screens that require images to be broken apart and stitched together through the software and hardware.

“Taking a 3D image to a single display is relatively easy, but if you want to scale it up, curve it and reconfigure it, the challenge is much more complex,” adds Kickbush.

Clients are often frustrated by the viewing experience of an under-powered VR system, which can be compromised by eye separation, increased ghosting, and staccato imaging. In some cases, the shortcomings aren't just annoying, they're nausea-inducing. As a result, users begin to shun the equipment. Or maybe they'll use it simply as a large display and abandon its 3D capabilities. Whether unused or under-utilized, the system will never have a chance to earn its keep.

Power and flexibility at Thomas Jefferson University

Thomas Jefferson University was determined to realize full value from its new Gutman Library Advanced Media Center, a multi-functional, Hi-PerXR environment designed by TJU and Mechdyne to accommodate multiple users handling a wide variety of data. In-depth discovery enabled Mechdyne to map out strategic objectives and a breadth of anticipated use cases for the facility. Next, Mechdyne engaged Idaho-based Silverdraft Supercomputing to ensure the system had the computing power, scalability, and flexibility not just to meet stipulated requirements, but to handle yet unidentified use cases.

“Computing is essential to successful immersive and VR environments,” explains Kickbush. The system must balance graphics and resolution in the core system, plus the peripherals that will be connected and synched together. “This really is a different beast,” he adds. “The graphics capabilities that might work for an HMD will be inadequate

Multiple inputs of complex data are made possible by Silverdraft's high-performance computing



in a complex XR environment used for graphics-intensive gaming, virtual production, VR research and the like." All that and more were part of TJU's mandate for the Advanced Media Center.

"Silverdraft was the natural partner for us on this project," adds Kickbush. "After all, we weren't about to create a unique immersive environment that should perform like a race car and put a used, four cylinder engine in it."

TJU provided a vivid example of the importance of planning for future use cases and the demands of multiple users mining diverse data. Prior to completion of the Advanced Media Center, the school discovered that its high-performance computing lab, sporting powerful PCs paired with 8K monitors, had been appropriated by a student group of e-sports enthusiasts for off-hours use. "This came up in the discovery process," says Mechdyne solutions architect Gary Quesbarth, "and because we identified the use case at an early stage, we were able to design the Advanced Media Center with computing power ample to accommodate e-sports activity at a negligible extra cost.

"Similarly, we were able to build on the broadcast component of e-sports to create virtual production capabilities for the theater and fashion design departments, enabling them to render designs in amazing detail and produce real time events with world-class graphics," adds Quasebarth. "Incorporating multiple use cases into one system hadn't been attempted before. It's testimony to the power of

discovery, which if done right can enable new, multi-disciplinary uses at an extremely low cost."

Computing at the speed of consciousness

To create the user experience TJU demanded, Mechdyne relied on Silverdraft's track record in solving the toughest visualization problems across industries, with a particular emphasis on liberating creatives, such as VRX artists, directors, and producers, from the constraints of subpar-performing hardware.

"Silverdraft's purpose is to enable creators' stream of consciousness," says company founder and CEO Amy Gile. "You can't wait for compute. That breaks creativity and interrupts workflow. You need a level of processing power that keeps up with your thinking [and will perform in a manner] that your brain buys into what's being visualized. If you're in a virtual environment and frames are falling out or its not photo-real, your brain won't believe any of it."

That experience, contends Gile, "is critical not just to supporting users' creativity, but really for them to be immersed in a way that they can make decisions based on what they're seeing."

Mechdyne partnered with Silverdraft to ensure the Advanced Media Center delivered actionable utility by removing all barriers to understanding. For Gile and Mechdyne solutions architect Gary Quasebarth, the key lay in a design

High-performance multi-application systems benefit from advanced staging, ensuring all elements meet the requirements of each use case before installation. Necessary modifications can be made during this time.





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— **Gary Quasebarth**, Mechdyne VR Solutions Architect

that delivered sustainably high performance with state-of-the-art computing efficiency and thermal management, via an architecture capable of handling not just today’s data loads, but tomorrow’s as well.

“People tend to look at compute as pieces and parts in a box,” says Gile. “That’s not what we do or are. We’re about the full solutions – what’s being done, the applications, the specific tasks, and then the quality and level of components that are being put in the systems.”

It’s important to note, adds Gile, that “we’re not integrators. We look at the compute behind the solution, focusing on what’s driving the pieces so that we can optimize the best compute solution. Our partnership works because Mechdyne is highly knowledgeable. They have a strong understanding of what the client wants to achieve, and we come back with a recommended compute solution that integrates into that workflow.”

Close collaboration on solutions enables the client to maximize system productivity. Imagine a server that can virtualize multiple workstations, or a workstation whose GPUs can run multiple headsets simultaneously during the day and work in unison as a rendering station in the evenings. Silverdraft brings the power and architecture necessary to achieve such tasks, while Mechdyne integrates those capabilities into the larger solution.

What you need in an XR partner

In creating a high performance, extended reality environment that can meet the needs of multiple users, it’s critical to partner with a technology provider who understands the full array of challenges that will have to be addressed. This is an environment, after all, where the traditional rules for theater display and presentation systems go out the window. Not only are users much closer to the displays, but the system surrounds them. Those charged with delivering a truly engaging experience need both a keen understanding of the intended use cases and the ability to integrate all the components into a high-performing whole.

“Detail is everything,” says Mechdyne 3D display technology

consultant Kurt Hoffmeister. “If a spatial, graphics compute system driving a VR display is being taxed, it will have trouble reproducing the full resolution in sufficient detail. If the display rate begins to drop, it can’t draw as many new images per second as are needed for a satisfying interaction. Likewise, if the graphics are good but the frame is ‘chunky,’ or moves in steps instead of smoothness, that distracts from the experience and breaks down the sense of immersion.”

The consequences of poor fidelity and inadequate frame rates can be more than distracting. They can lead to disorientation and what’s called “simulator sickness,” which is akin to motion sickness.

Having the right partner can ensure you build in the correct amount of computing power to fit the client’s workflow. “This is crucial,” says Hoffmeister. “Mechdyne’s success in creating high-value extended and virtual reality environments rests in large part on our ability to create systems that effectively accommodate users’ workflows, rather than forcing them to bend to the technology.”

Engaging the services of a partner with documented, end-to-end expertise in Hi-PerXR system design and integration has another benefit as well. “The client can take advantage of lessons learned, and possibilities realized, from their technology provider’s work on other projects,” explains Kickbush. “It’s also desirable to have a vendor-neutral partner who’s open to all available hardware and software options and has the real-world experience to look beyond published specs and recommend what’s actually going to work.”

The big takeaway for those who want to tap into the power of virtual reality is not to settle for a prospective technology partner who offers a cookie-cutter approach to complex VR. It might be tempting to adopt a more templated system vs. one created to meet your unique needs, but any cost savings are apt to be demolished by the tradeoffs that come from forcing users to change fundamental aspects of how they work.

“It’s critically important to understand the interdependent nature of XR solutions. Brute-force computing power only goes so far in creating effective 3D immersive facilities,” says

Quasebarth. “When you’re looking at true 3D immersive visualization, understanding the eye-tracking, the intricacies of rendering, and the particular challenges of GPU clustering requires specialized expertise – something we’ve amassed over 25 years. We actually invented clustering of PC and GPUs to correctly render canvases for the Unity gaming engine, and we’ve also pioneered distributed clustering to enable far-flung use groups to experience the same content.”

The combination of power and finesse that the right technology partner brings to XR is elemental to its success. ROI will be even greater if that partner has the resources to ensure that the end user will be at home with the system. To this end, Mechdyne provides on-site personnel to guide clients not only at system launch but at any time such expertise is needed. They may be on hand for a few weeks or months or return after a few years to provide education, perform maintenance, convert content, and help to tailor the system for new use cases.

The importance of looking ahead

The market for graphics computing and content is changing rapidly. As the metaverse begins to take shape, new uses cases are presenting themselves by the day, and AI portends even more sweeping changes. “This is a new ballgame for immersive environments,” says Quasebarth. “It will profoundly – and rapidly – change how we develop content and deliver it in immersive environments. The ease with which a Snap-chat user can create fantastic graphics on their phone is fast

coming to the professional realm. Think of the vistas seen in a series like The Mandalorian. Using AI, you can create back-grounds for virtual production sets in a fraction of the time it took formerly.”

The upshot: Demand for advanced visualization technology will grow exponentially, and with it the need for powerful computers to render the graphics that AI will drive. “If I can go to Snapchat and create quality content, but when I go to my multi-million-dollar visualization system and can’t even figure out how to turn it on, you know that a transformation is coming. Making content development simple and powerful is a sea change. No longer do you have to spend all this money on a platform and need to have a PhD to run it,” says Quasebarth.

Physically and metaphorically, this all connects to hardware capability. “Being able to render 3D content on a tablet or TV is one thing,” Quasebarth adds. “But if you take it to large canvases, you need exponentially more horsepower. Now, hardware manufacturers like Nvidia and Silverdraft have always been high-performance GPU companies. The difference is that today’s graphics require more power than ever before and will have to be easier to use than ever.” Combine those requirements with the need for scalability and flexibility to accommodate multiple users and optimize ROI.

“The single best advice I can provide is,” says Quasebarth, “to partner with a pro who can translate your strategic objectives into a system robust enough to power your progress.” □

Solution design should take future goals into account, so foundational components can be upgraded as the visualization industry and applications evolve. Planning can enable the virtual environment to remain relevant for a long time, increasing ROI.

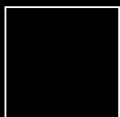


Mechdyne is one of the world's most innovative providers of visualization hardware and software, audio visual and information technologies.

We ensure success by focusing on client specifics and objectives first, and technology second. In order to solve our clients' challenges, we create comprehensive, customized solutions that include technical design consulting, software, hardware, technical services, and full turnkey system integration.

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- Planetariums & Space Sciences
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