Carleton University: Bringing visualization and collaboration to new levels

Overview

- ***Business Challenge***
  Carleton University wanted to offer professionals who work with large, complex three-dimensional data sets such as architectural models a better way to collaborate over long distances. The university saw that if remote users had ability to view and manipulate the 3D models in real time, they would be able to work together more effectively and creatively than is possible using traditional methods.
- ***Solution***
  The Carleton Immersive Media Studio (CIMS) became one of the developmental test sites for new IBM rendering technology that combines common, off-the-shelf graphic hardware with powerful rendering software and high-speed network connectivity. This first-of-its-kind solution keeps the massive data sets used in 3D models centralized, while efficiently transporting the rendered images across the network.
- ***Key Benefits***
- *90 percent reduction in cost of deployment*
- *Enables unprecedented levels of remote collaboration*
- *Utilizes open standards to allow access by any application software*

The untapped power of 3D visualization

Many industries rely on vast data sets that are best presented visually, in three dimensions. Medical professionals are making increasing use of 3D imagery to better understand physical anomalies in their patients. The aerospace, automotive and maritime industries now rely on 3D CAD software for design instead of flat blueprints. Architects, too, are now able to "build" entire communities virtually in 3D before ever breaking ground on a real building site.

The value of working in 3D is that it's a more easily grasped way of representing reality. Interpreting a two-dimensional image or blueprint and extrapolating it into the third dimension can lead to misunderstandings that hold up the creative process.

> *"Working remotely without the ability to truly collaborate hampers the communication process. We need to be able to interact with one another better."*
>
> – Dr. Stephen Fai, associate professor, director of CIMS

Business Benefits

- Reduces cost of deployment by 90 percent compared to competing solutions
- Enables unprecedented levels of remote collaboration in the manipulation of 3D visual data in real time
- Utilizes open standards to allow access by any application software
- Minimizes network traffic by storing data models centrally
- Supports a wide variety of display hardware, from fully immersive room-sized displays to laptop screens

Working with 3D data sets and models, however, has been cumbersome at best due to technological limitations. This is a growing challenge because many industries have become distributed. Engineering and architectural firms, for example, now consist of offices that may be thousands of miles apart. This has significant implications when the need arises to work together on a single set of data.

The limits of network bandwidth coupled with the sheer quantity of the data make the sharing of data in real time effectively impossible. Further, the quality of graphic rendering hardware and software has not been adequate to provide the kind of speed and definition needed by many professionals.

A remote work session at an architectural firm, for example, involves video conferencing and asynchronous file sharing. The entire 3D model of a structure has to be transferred to all parties involved in the session, which means that it is impossible for the various parties to work together to actually manipulate it. Each group can see and alter its own model, but there is no common ground.

"This is a real limitation on the design process," says Stephen Fai, PhD, associate professor at the Carleton University School of Architecture and acting director of the Carleton Immersive Media Studio (CIMS). "When face-to-face, architects and other professionals use physical models to work out design details quickly. When interacting remotely, we lose that traditional way of working together to some extent, which hampers the communication process. We need to be able to collaborate with one another better."

> *"This technology will help us raise interpersonal communication and collaboration to a new level, which will foster not only better understanding but greater creativity as well."*
>
> – Dr. Stephen Fai

A new approach to remote rendering

IBM's Watson Research Laboratory in Hawthorne, New York, has been working on improving high-end computer graphic capabilities for some time, initially through the development of new hardware solutions. The burgeoning video game industry, however, was moving so rapidly that commonly available graphic hardware soon presented a new opportunity.

IBM researchers decided to make the most of the speedy and relatively inexpensive new graphics adapters and changed strategy, abandoning the idea of a hardware-based solution. The IBM rendering solution would now make use of common, off-the-shelf (COTS) hardware, while taking advantage of increasingly sophisticated rendering software technologies that were becoming available. The basic idea was to make high-speed, high-quality rendering of even the most complex 3D data set available to any graphically oriented application, at low cost.

That's where Carleton University, located in Ottawa, came in. IBM had a long-standing relationship with Carleton, and was looking for test sites for its new rendering solution. With funding assistance from the Canadian Foundation for Innovation, Carleton and IBM worked together to create the Carleton Immersive Media Studio (CIMS), which combines the concept of remote collaboration with high-end rendering to provide a first-of-its-kind capability.

The initial solution is centered around a rendering "farm" of commonly available hardware, running IBM Deep Computing Visualization (DCV) software and displaying images on IBM IntelliStation® thin clients. An important capability of the DCV software is its ability to support any kind of graphic display, from the smallest laptop screen to enormous, multipanel immersive video environments. By tying together readily available and inexpensive hardware, the overall solution is much less expensive than a proprietary, dedicated solution would be – about 10 percent of the cost.

What makes the CIMS solution unique is not its support for large display or its cost-effectiveness. Rather, it is the way in which it facilitates collaboration through a new way of moving images across the network. Only the graphics are sent, not the entire model; all of the applications and data are centrally located. This makes the most of limited network bandwidth, and allows all parties involved in a remote work session to share access to a single 3D data set and the application tools they need to manipulate it through Web services.

CIMS is a center of innovation in 3D modeling and design, with capabilities that go beyond rendering, bringing together tools and expertise in photography and video, computer-based imagery, and laser scanning of physical objects. For example, CIMS is working on an immersive environment where collaborators in similarly equipped facilities can experience the same 3D environment, such as "walking through" a new building.

The bandwidth-efficient approach positions the solution to take full advantage of next-generation, high-speed network capacity as it becomes available, which will eventually enable CIMS to offer users fully immersive graphic environments and large, complex, high-definition renderings generated remotely.

CIMS is focusing on leveraging existing COTS application software to derive maximum user benefit from the powerful technology. For example, there is a free, simple 3D software tool available on the Internet called Google Sketchup. By making its graphics compatible with this application, CIMS can more readily share its rendering work with a broad audience. A student on the other side of the continent could easily download and install the Sketchup software, and gain access to an architectural model rendered and hosted at CIMS.

Key Components

Software

- IBM Deep Computing Visualization

Hardware

- IBM IntelliStation

Resources

- IBM Watson Research Center

Why it matters

The Carleton Immersive Media Studio was one of the original development sites for breakthrough IBM graphic technology that enables the efficient transport of 3D imagery across the Internet while keeping the underlying data centralized. This gives geographically dispersed professionals in fields such as architecture – who rely on complex 3D models – an unprecedented ability to work with massive data sets collaboratively, in real time. The new capability holds promise for more rapid breakthroughs in research and faster development of new technologies.

The impact of collaboration

Stephen Fai highlights some of the ways in which the technology can be of benefit. “Being able to make more effective use of 3D imagery helps facilitate understanding. For example, one of our projects has been to create a highly detailed model of Old Montreal. This is of interest to historians and educators because it lets them experience what it was really like. The model allows us to accurately document the building methods and materials that were used, which will help us preserve our cultural heritage. But of more practical benefit is the fact that this documentation can teach future architects ways of doing things that would otherwise have been lost – ways that might be better and more environmentally responsible than the way we’ve been doing things.”

Fai says that the enhanced ability to collaborate in 3D is where the real potential lies. “Right now architects and contractors still rely on 2D drawings, but that’s changing,” he notes. “Some of the world’s leading architects are advocating for a move to 3D representation at all levels. The current state of the art simply isn’t capable of supporting that shift, however. This technology will help us raise interpersonal communication and collaboration to a new level, which will foster not only better understanding but greater creativity as well.”

For more information

To learn more about how IBM can help transform your business and help you innovate, please contact your IBM representative or IBM Business Partner.

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Produced in the United States of America
6-08

ODC03076-USEN-00