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When and Why to Invest in Render Management

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Introduction

Building a rendering system can often be accomplished as an organic process by simply adding processors to handle the job; however to efficiently build a rendering system and get the best ROI,one has to map out in advance the goals and requirements.

The following examination looks at two case studies that used a combination of SGI® hardware and PipelineFX® Qube!™ render management package. In both cases there were systems in place but adding render management helped improve the efficiency of the organizations using the system. This white paper looks at the process involved in building the systems and identifies the base requirements for an effective rendering system.

Turnkey power

When looking at the results of a visualization program today, it can be hard to remember that what you are looking at is not real; it is computer graphics (CG). CG not only makes the imagination come to life, it helps the automotive, aeronautic, and other critical design industries save millions in design and prototyping costs, it enables scientists to visualize problems, it helps the oil and gas industry find new reserves, it improves time to market, and it helps save lives. The same technology that helps to create realistic visualizations also works behind the scenes processing vast amounts of information to solve complicated problems.

As different as all these tasks and industries are, there is a point of intersection where they all face similar challenges. First and foremost the men and women who are working with huge amounts of visual or database information (datasets) want to do their jobs, not build, maintain, and program systems. Increasingly, as the capabilities of computers expand and budgets expand more slowly, computers have to pay for themselves. So, they are often called upon to do a variety of tasks rather than be dedicated to a particular project, group, or task. Finally, they've got to scale. People don't want to throw away what they have; they want to build on to what they've been using. Above all, they just want to keep working.

The organization and planning to build a system for an upcoming project might well create the following wish list.

We want a system that:

1. Is easy to implement
2. Works within the system we've already built
3. Is able to handle a variety of tasks
4. Is stable — and causes no down time
5. Is easy to configure and use, and works with existing programs
6. Is extensible

7. Is scalable
8. And doesn't require a large IT staff to operate or maintain

The organizations in the following examples might well have been working with a similar wish list. Although the work load in these two cases are very different, both organizations needed systems that could handle a variety of tasks and they needed to be manageable.

Making systems work

Vanguard Studios, under the helm of CEO John Williams, specializes in big animation; it's the home of *Shrek* and *Shrek II*. The company's latest film is *Space Chimps,* a CG feature film starring the voices of Andy Samberg, Jeff Daniels, Kenan Thompson, Stanley Tucci, and Patrick Warburton about astronaut Chimpanzees on a mission of their own.

As decisions were being made about the cast members, the crew at Vanguard began to build their computer system for the movie. The team took a step back and decided to revamp Vanguard's current render farm. The company had a system of 1U white box machines based on dual core processors running Renderman. Vanguard Studios had previously worked with Alfred, the Pixar Render Management system. However, when the production team in Vancouver started looking for computer artists for the project, the company found more engineers had experience working with PipelineFX Qube! render management package.

Indeed, in tests Qube!'s suite of features, such as the ability to manage multiple tasks, significantly improved the entire render workflow. Qube! allowed Vanguard to add a new level of automation including features for fast turnaround of render tests, asset check-in/check-out, the ability to build dailies, manage compositing jobs, file conversion and compression, model turntables, and lighting and pre-vis. Also key to the work that Vanguard is doing is the ability to customize the system. The Qube! APIs are in Perl, Python, and C++ and that allows filmmakers to extend the system. Vanguard has also created a custom GUI in Python and they're creating custom jobtypes. It's common for studios, working against heavy deadlines, to perform customizations on the fly.

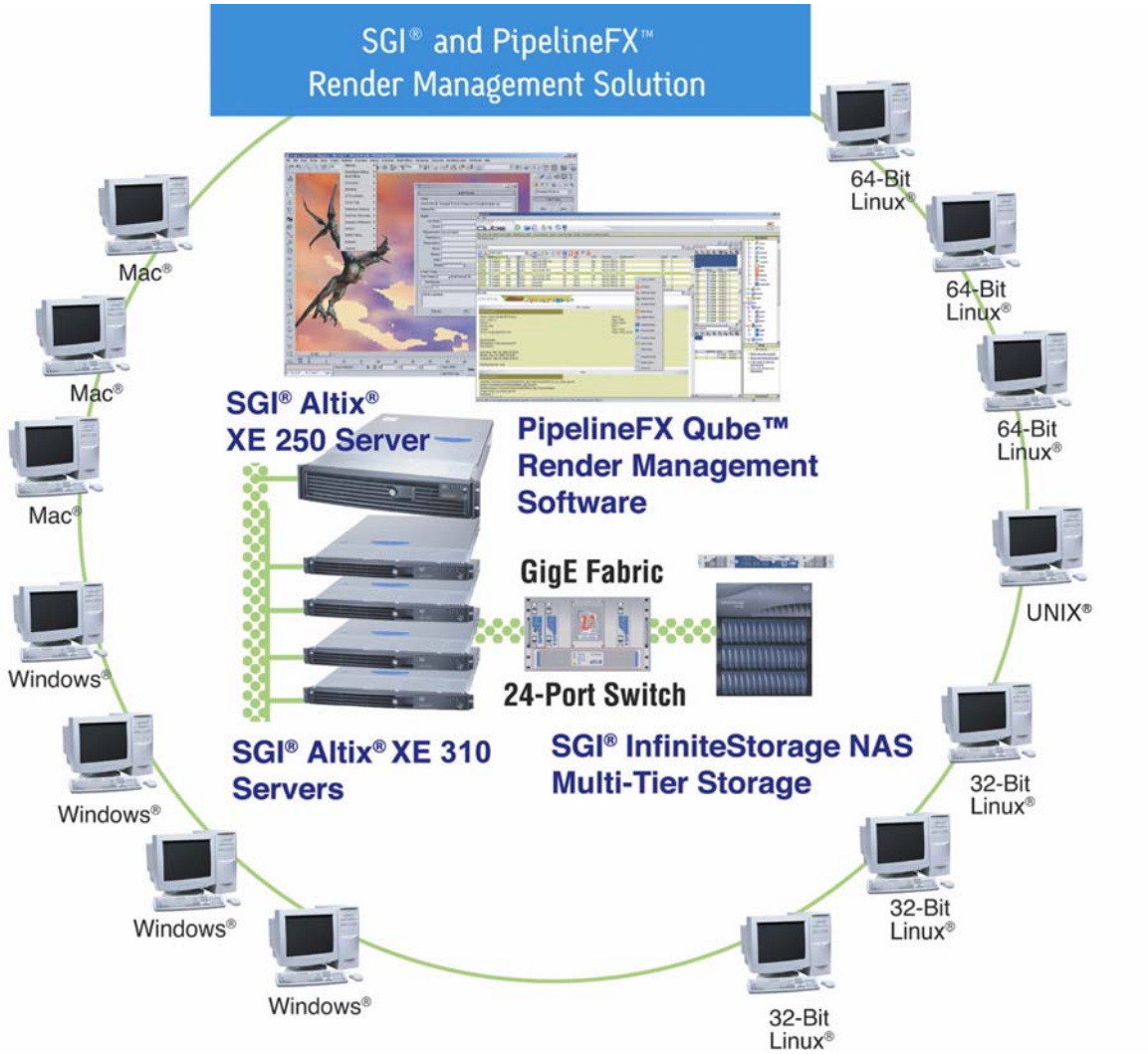


Figure 1: The combination of SGI® Altix® XE system and PipelineFX Qube! render farm management software makes it easy to work all the computers out on the network. Desktop systems can go to work at night when everyone leaves. When they get back, workers can access finished builds on the centralized storage.

In addition, Vangaurd was able to use Qube! as a plug-in to all the most commonly used content creation software they were familiar with. Vanguard animators could access the Qube! jobtype and submit jobs from within their application without breaking the flow of their work because Qube! has plug-ins for Adobe's After Effects, Autodesk's 3ds Max and Maya, Newtek's LightWave, Softimage' XSI, The Foundry's Nuke and many more.

Using Qube! allows Vanguard to easily monitor the progress of jobs and keep the pipeline full. The more iterations an artist can perform the more work can be done to improve characters and scenes. Lighting studies for example may require heavy duty rendering but the people depending on the output can't go forward until it's done. Qube! enabled the Vanguard team to set the studies up to run overnight so the team could be back on the job in the morning.

Vanguard managers were also able to track a running history to see how long every aspect of production is taking — a major benefit for bidding on future jobs.

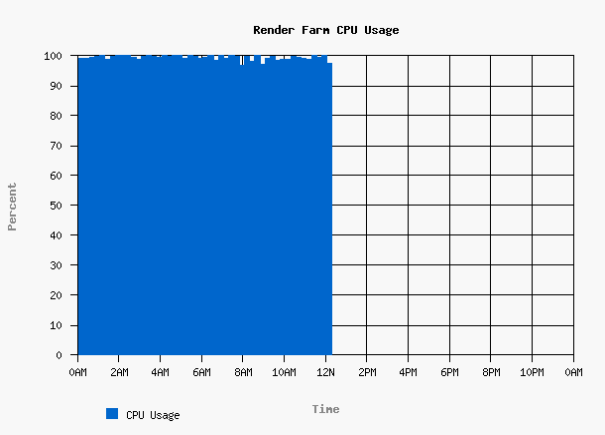
But just as important as any one feature is, the flexibility of the system proved to be its big selling point. Vanguard could manage all its work on one farm.

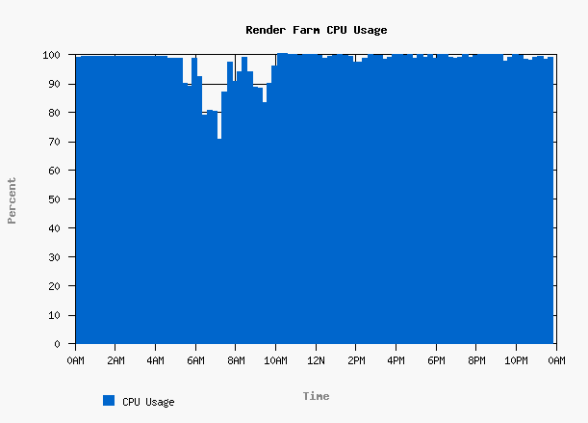
Along with Qube! came PipelineFX's CEO Troy Brooks who came to the project as a consultant and helped set up and run tests for hardware systems. Brooks tested the older configuration using low cost white box machines but he and Vanguard decided on SGI Altix XE310 servers to run with Qube! The two companies have worked together to design the PipelineFX Qube! Render Management system for Vanguard but Brooks says that in his role as the Pipeline Supervisor for Vanguard he would have gone with the white boxes if they were able to deliver the same kinds of benefits. “Ultimately, it came down to a shoot out,” he said. “The IT department put the SGI machines head-to-head against new versions of the generic machines they had been using and the SGI systems had better performance.”

The question is not solely one of price versus performance although that metric is the baseline. In addition, the system had to fit within a limited amount of space, it had to be power efficient and it had to run cool — everyone is aware of the cost of electrical power today, and it’s not going down. The Altix XE310 system is a dense platform with two nodes in each 1U rack-mountable unit, bringing up to 16 cores in a single rack unit. Each node has two sockets, which can run dual or quad-core Intel® Xeon® 64-bit processors, in addition to integrated InfiniBand and GigE network interfaces. By combining two unique nodes in one box, each with their own network interfaces, the SGI design provides much greater bandwidth per processor while maintaining density and power efficiency. This gives Qube! more control over routing the data to the cores as fast as possible. The efficiency of the system is such that Vanguard found they could do more with less processing cores and that saves money on several fronts.

Renderman is typically licensed on a per-core basis, with one license of Renderman covering two cores. The faster throughput and power of the SGI systems enables Vanguard to do more with fewer processor cores — and fewer Renderman licenses — which provides considerable savings.

The Vanguard team is heavily into production now. In step with the “keep it moving” attitude of high-paced film production, the *Space Chimps* team are finding the system is enabling them to keep the work flowing and people working rather than waiting around for the computers to finish. “We don’t have any time for evaluating new technology or trying new stuff,” said Brooks.





With Qube! managing the farm the entire rendering capacity of the studio is running at nearly 100%. The artist workstations automatically became Workers in the evening and returned to being workstations at 8am.

Out in the real world

One doesn't tend to think of the film industry as being one of the most cost conscious industries in the world, but any production supervisor will tell you that it is. What's also true is that university scientists and researchers often find themselves working in very cost-restrictive environments. Researchers at the University of Hawaii developed the Papaya Genome project as a means of bolstering one of Hawaii's most important cash crops — the Papaya; the fifth largest crop in Hawaii. A decade ago the crop was almost wiped out by the papaya Ring Spot Virus. The papaya was saved from extinction on the Island by genetically modifying the fruit to create a Ring Spot resistant transgenic or hermaphrodite variety.

Two years ago, researchers at the University of Hawaii initiated the Papaya Genome project to sequence the Papaya genome to discover more efficient approaches of cultivation and also to create information on the fruit's genetic makeup to enable broader export of the product. For instance, European countries may require detailed information on the positions of the transgenes in the papaya genome in order to approve the fruit for import.

After significant evaluations and planning, the group chose the SGI Render Management system because it was able to perform a lot of different tasks for the University and still fit within the University's budget for the project. Richard Lewis, PipelineFX VP of sales helped the University define their requirements. "This is a big project for a relatively small facility," he said. "Just the job of sequencing the genome is enormous, but the university needed more."

The Papaya Genome is made up of 372 million base pairs that make up its nine chromosomes. Dr. Maqsudul Alam who heads the Papaya Genome project wanted a computer that could run the entire two-year project from start to finish and at the same time serve the University's bioinformatics research community.

Prior to selecting the SGI system the researchers had been sharing time on the free National Center for Biotechnology Information (NCBI) multi-thousand server cluster on the U.S. mainland. The NCBI offers research access to gene and protein sequence information from several open-source Life Sciences databases including Blast, ClustalW and Fasta. As a shared

resource the NCBI is free but it can also be slow because of the demand and scheduling on the system and also because memory is not shared across the clusters.

Essentially, working with genome information is a matter of working with huge databases. A typical papaya base pair assembly run can use 40GB of memory and 150GB of disk space and take seven to 10 days to calculate. The need for very large and highly scalable disk storage is obvious. After the Altix system was installed, which is built using SGI® NUMAflex® architecture and provides access to a huge amount of shared memory, Lewis noted that the researchers were able to load whole 50GB databases in memory.

Additionally, Dr. Alam was dealing with systems like Blast, ClustalW, and Fasta™ database applications that are only available as command line tools. He wanted to be able to take advantage of open APIs to develop Web-based interfaces to be able to pre-load standard databases into memory for faster searches.

Not insignificantly, the University of Hawaii team was delighted to discover that PipelineFX had its headquarters in Hawaii. Having a local partner is a considerable advantage in Hawaii where flights to the mainland are at least five and a half hours.

The University opted for the SGI® Altix® 350 computer system, SGI® InfiniteStorage TP9300 Fibre Channel storage and PipelineFX Qube! render management and batch queuing software because it was a proven configuration and they knew they wouldn't burn up critical time trying to get things working. As a result, over the course of the project the University was able to scale up the TP9300 from 4TB to 16TB. The additional investment was easy to make because it was incremental.

The system fits well into a University setting where a project goes on for years but students may come and go. It's important to be able to train researchers how to use the system and keep the processes flowing. The scalability of the system allows the University to add more storage, memory, and processors to take on even larger sequencing projects.

Getting started and scaling up

It's useful to return to the six challenges outlined at the start of this paper to see how they are addressed in the actual systems at work.

1. Easy to implement — The combination of Qube! render farm management software and SGI hardware is a turnkey system that often requires little customization.
2. Needs to work within the system that's in place — The Altix XE 240 server and its retinue of servers can be easily introduced into systems that are already up and running. The Qube! render farm management tools enable a system to take advantage of the Linux, Windows, and OS X systems that are already in place.
3. Must be able to handle a variety of tasks — The SGI PipelineFX Render Management system features permeable clusters. Processors can be dedicated to specific tasks and specific departments. Qube's management tools let jobs be assigned, and re-assigned or moved up and down in the queue. Processors can likewise be dynamically assigned.

4. Must be stable — no down time. In the movie business there is no time for a crash but why should anyone tolerate unstable systems? Both the University of Hawaii and the Vanguard team required stability of their systems.
5. Must be easy to configure. Can it work with the programs we're already using? The Qube! software works as a plug in to all the major visualization products. In addition, Qube! also supports command line input to allow easy customization.
6. Scalable — the system is scalable on every level. The Vanaguard team can still use their white box servers in the SGI Render Management Bundle. In addition adding more memory or processors is a matter of plug it in and go.

If there was one word to sum up the demands of distributed computing customers, it would be flexibility. Jobs change as they progress; success leads to growth; and nothing stays the same. When defining a system for the present, it's important to look ahead to what's needed for the future and it might not hurt to check back with others who have gone before. People who are already working with the SGI Render Management system plan on moving forward with the system.