HP Converged Infrastructure solutions help DreamWorks Animation create great films and blaze a path toward Instant-On

Studio turns to HP technology to deliver more than 60 percent greater throughput and help break new ground faster than ever.

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>
> **Ed Leonard, CTO, DreamWorks Animation SKG**

Objective

Boost rendering throughput while minimizing power consumption and streamlining data center requirements

Approach

Onsite testing showed that HP server blades, storage, networking, and cloud services would boost efficiency and defer power capacity upgrade.

IT improvements

- More than 60% greater rendering throughput
- More than 30% higher performance per watt
- Minimized server administration through remote management
- Service-level agreements in backup and archiving met or exceeded
- Search and retrieval of usable assets in seconds instead of days

Business benefits

- Multi-million-dollar data center upgrade deferred
- Key enabler to render capacity for an increased production slate
- Enhanced creativity from the ability to support more rendering
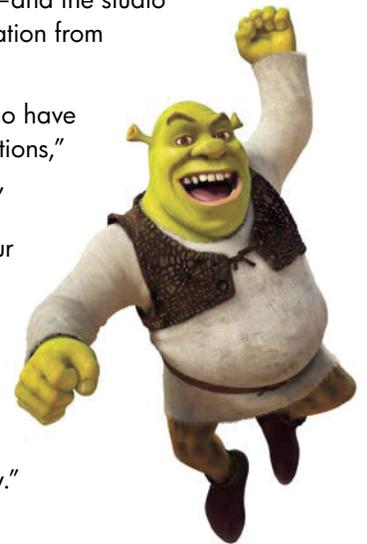
Popcorn, please

It is one of life's most universal pleasures: enter a movie theatre, sit back in a comfortable chair, watch a screen, and be swept away.

DreamWorks Animation SKG delivered this an unprecedented three times in 2010. Out of tens of thousands of titles released in over 100 years of cinema, two DreamWorks Animation movies (*Shrek 2* and *Shrek the Third*) are among the top 25 all-time highest-grossing films.*

There are plans at DreamWorks Animation to set more records—and the studio needs more acceleration from technology.

"We hire people who have unbounded imaginations," explains Ed Leonard, CTO, DreamWorks Animation SKG. "Our job as technologists is to position technology as a creative enabler as opposed to a constraint to our filmmakers' creativity."

*"All Time USA Box Office," www.imdb.com/boxoffice/alltimegross, visited January 5, 2011.

"Every pixel on screen needs to be designed, approved, created, rendered, and lit with specific intention," says Leonard. "Everything is created from pure imagination in a computer graphics movie. And that's why we're so reliant on compute and our partnerships with Intel and HP. You can only put as much on screen as the compute capacity allows."

What's next?

To keep up with those creative imaginations, DreamWorks Animation keeps increasing demands on its compute capacity, with

- **Bigger movies.** The original *Shrek* used six terabytes of data. *How to Train Your Dragon*, nine years later, used over six terabytes for a single sequence—more than 90 terabytes in total.

- **More movies per year.** As the largest animation studio in the world, DreamWorks Animation currently produces an average of five films every two years.

- **Stereoscopic 3D.** As seen in DreamWorks Animation's most recent release, *Megamind*, stereo 3D is the best way to experience computer-animated films. This new standard was championed by DreamWorks Animation and has set a new bar for the high-quality theatrical experience. It requires separate images for each eye, which boosts rendering requirements by 30 percent.

- **Ever-more-ambitious artistic visions.** Filmmakers keep seeing new possibilities as technology evolves.

These challenges add up

The overall effect is that the studio produces more movies each year—as many as 12 are in production at any one time—and each title requires more data, more creativity, and more rendering. As a result, compute capacity was needed fast—and available power at the studio's Glendale, California data center was running out.

Then HP introduced the HP ProLiant G6 server blades with the Intel® Xeon® processor 5500 series.

The results need to be seen on screen. *How to Train Your Dragon, Shrek Forever After*, and *Megamind* were all released in 2010.

"We did *Monsters vs. Aliens* (2009) on the previous generation of hardware," explains Derek Chan, head of digital operations at DreamWorks Animation. "But with three movies with significant schedule overlap and that were all 3D, we couldn't have done them without the power of Intel's Xeon processor 5500 series and HP's ProLiant servers."

The overall compute capacity at DreamWorks Animation is getting larger and larger, and room for the imagination is getting bigger.

More than 60 percent greater rendering throughput

Approaching deadlines made the animation technology team evaluate four or five options for increasing compute capacity, Chan explains. "We started to draw up all kinds of plans to move servers around, shift the load, and look for new data center space at other locations," he notes. "Meanwhile, testing in our environment showed that HP ProLiant BL460c G6 Server Blades with Intel Xeon processor 5500 series have a total throughput more than 60 percent greater than the Intel Xeon processor 5400 series, the previous generation."

A key factor behind the gain is the improved memory bus architecture in the Intel Xeon processor 5500 series, Chan points out.
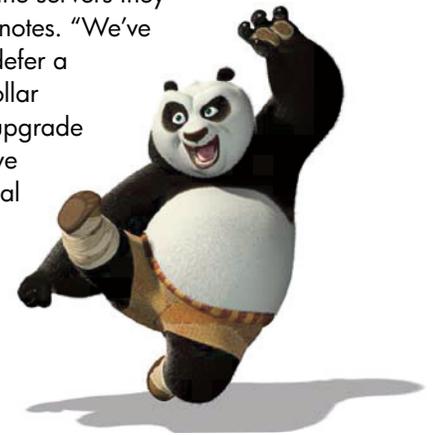
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Avoiding a multi-million-dollar infrastructure upgrade

The new G6 servers are also more energy-efficient, Chan adds. "With our render loads, HP ProLiant G6 server blades deliver 30 percent better performance per watt than the servers they replaced," he notes. "We've been able to defer a multi-million-dollar infrastructure upgrade that would have added electrical capacity to our Glendale campus. And we've added headroom that has enabled us to take on projects such as rendering a TV special in addition to our movies."

Boosting creativity with faster rendering

Faster results enable more creativity, notes Lincoln Wallen, head of R&D at DreamWorks Animation. "Tying together multiple server blades is a key step toward the ability to do more interactive rendering and visualization," he explains. "Until now, there's been a fairly long turnaround time from when an artist creates the description of what they want their scene to look like to when they can actually realize their vision on the compute farm."

The wait has been cut. "Using a 'mini-farm' of servers, lighting artists can re-shade a part of their scene in a matter of seconds to minutes, as opposed to hours or days," Wallen notes.

Turnaround times will get even faster as DreamWorks Animation developers re-architect their toolset to take advantage of next generation parallelization using multi-core Intel Xeon processors. The result, Wallen says, is that "earlier in production, we'll be able to animate in higher resolution and have a fully lit environment. This is something we don't do today until the end. Now we animate a few characters at a time in a very sparse environment." The change will give artists the opportunity to realize the director's vision much more rapidly.

Making bigger dreams real

Already, artists are adding far more detail to scenes than they have been able to do in the past. The original *Shrek*, released in 2001, required five million CPU render hours. A decade later, *Megamind* consumed 54 million render hours—a 10-fold increase.

When creative teams can put more detail onscreen, they can surprise audiences with new levels of vividness. In *Megamind*, for instance, two figures with superpowers fly in a high-speed chase through the streets and skies of Metro City. The force of their acceleration—and the speed at which the city shoots by—becomes more visceral because of the variety and realness of the scenery whipping past. To create it, the production team wrote special "City System" software that automatically drew all the non-specific buildings in the city, generating more than 61,000 buildings and 29,000 road segments. The roads are populated with 120,000 moving cars.

The detail is astonishing. In one scene, a character with superpowers hurls an entire skyscraper at a foe. The building flies through the air and then slides like a missile across the ground toward the camera, generating a dust cloud calculated in more than 13.5 billion discrete locations. In other scenes, massive crowds are important. To make them real, DreamWorks Animation used HP computers to fill a plaza with nearly 60,000 animated people, individualized by simulating more than 5,000 types of clothing.

Three ways to grow

To be able to deliver this level of detail on tight deadlines, DreamWorks Animation turns to three strategies for sourcing compute capacity.

One is a converged infrastructure solution based on HP servers, with a migration underway to HP networking (from core to edge) and dynamic storage. Says Derek Chan: "DreamWorks Animation has invested in making sure that our infrastructure is responsive to our business. That has meant moving from a siloed world of IT where you had workstations and servers and network and tools to a world in which that's all converged together, and it can be integrated and packaged as a service back to our business."

Teams at the company's northern and southern California and India sites are no longer isolated, Leonard points out. HP Halo Telepresence and videoconferencing solutions enable them to work as if they were sitting across from each other, manipulating the same application. Also, where it once took them three months to switch artists between films, a common platform now gives them the flexibility to switch immediately.

Clouds are the future of rendering

A second strategy for adding compute resources is to render remotely using infrastructure-as-a-service (IaaS) providers. DreamWorks Animation already rendered three million hours for *How to Train Your Dragon* and *Shrek Forever After* at a remote location where power costs significantly less than it does in southern California.

Leonard notes that the experiment has been "a huge success, working proof that high performance computing clouds are not only possible but practical... the future of rendering." In fact, in 2010, he adds, "DreamWorks Animation utilizes about 5 percent of its rendering capacity from the cloud. In 2011, we intend to move more than 50 percent of our rendering capacity into the cloud."

A hybrid drive towards "Instant-On" production

HP Enterprise Cloud Services will provide additional compute capacity to DreamWorks Animation in a hybrid delivery model. HP Hybrid Delivery supports a variety of sourcing options to provide enterprises maximum flexibility in how they deploy technology services.

The goals at DreamWorks Animation are to give filmmakers what they need in real time and to become an Instant-On Enterprise—one that embeds technology at every opportunity and thrives on innovation, agility, optimization, and the ability to manage risk to its advantage.

Remote management saves time

Key to driving the added compute capacity is HP remote server management capabilities. "Using HP iLO 2 Advanced Pack and the HP ProLiant Onboard Administrator, we can do almost everything from remote locations that we could do standing in front of the server," notes Scott Miller, staff engineer at DreamWorks Animation. "We can power cycle, upgrade software, firmware—all those kinds of tasks remotely." This enables IT staff to minimize server administration time and focus on more valuable tasks.

"In our environment, HP ProLiant G6 server blades have a total throughput more than 60 percent greater than the HP ProLiant G5 server blades, and deliver more than 30 percent better performance per watt than the servers they replaced."
Derek Chan, head of digital operations, DreamWorks Animation SKG

A new edge from storage

DreamWorks Animation uses an HP StorageWorks 6400 Enterprise Virtual Array (EVA6400) to host a backup database and an HP StorageWorks EVA6400 as a disk-based staging pool for backup. Together the systems provide 100 terabytes of storage.

"The HP StorageWorks EVA storage systems enable us to support more primary storage and faster tape drives than we could before," Miller says. "We're able to meet or exceed our service-level agreements for backup and archiving."

The systems were simple to deploy, Miller says. "HP storage management [HP Command View EVA software] tools provide dynamic allocation of capacity," Miller adds, "which lets us add or remove LUNs without affecting the underlying disks—and we can add disks on the fly."

"Using a 'mini-farm' of servers, lighting artists can re-shade part of their scene in a matter of seconds to minutes, as opposed to hours."
Lincoln Wallen, head of R&D, DreamWorks Animation SKG

Retrieving images in seconds instead of days

Another key need at DreamWorks Animation is to have cost-efficient storage for a 70-plus–terabyte movie once it is finished. Not long ago, completed productions were migrated to tape to reclaim costly primary storage space.

But assets on tape are harder to search and retrieve, and that's a drawback if a sequel is being made. To speed up search and retrieval, DreamWorks Animation evaluated network attached storage (NAS) options and chose the HP StorageWorks X9720 Network Storage System.

"Because floor space is an issue, we are very excited the X9720 can fit 820 terabytes into just two rack spaces," says Miller.

The HP X9720 system can also use up to 16 ProLiant server blades as a filer or NAS head that takes requests from applications. Some competing NAS systems, in contrast, have only one NAS head.

"Retrieval time with the X9720 is interactive," Miller observes. "For tape it could have been days. We found this system at just the right time because *Madagascar 3* is already underway, and we needed fast, cost-efficient retrieval for *Madagascar 2* assets."

"Over the last several years, the move toward higher definition content and richer customer experiences has driven explosive growth of our file content," says Chan. "The only way for us to efficiently manage the mountain of file data is by using scale-out file systems like those from HP StorageWorks. The HP StorageWorks X9000 system enables scalability and automated tiering of information to help balance cost and performance so that we can archive information for long-term storage and enable high-speed graphic rendering within the same global namespace for easy management."

HP has been a strategic partner of DreamWorks Animation ever since 2001, when the companies worked together on *Shrek* and it went on to win the first-ever Oscar for an animated film.

Hardware
- HP ProLiant BL460c G6 Server Blades
- HP BladeSystem c7000 Enclosures
- HP StorageWorks 6400 Enterprise Virtual Array
- HP StorageWorks X9720 Network Storage System

Software
- HP Integrated Lights-Out 2 Advanced Pack
- HP Command View EVA software

Operating system
- Red Hat Enterprise Linux

Network protocol
- 10-Gb Ethernet at the core
- 1-Gb Ethernet to the desktop

HP Services
HP Technology Services for:
- Service and support
- Managed print services
- Halo telepresence and video conferencing solutions

"HP is increasing our capability of producing a final product that is always state-of-the-art CG animation—great storytelling combined with stunning visuals," Leonard says. "And that's what audiences expect. They want to see something in the theater that is better than what they saw last year in every way, including story, character design, and amazing visuals."

"Art is never finished, only abandoned"

The most recent improvement being made is summed up by a quote from Leonardo da Vinci: "Art is never finished, only abandoned."

"It's one of my favorite quotes," Miller says. "The notion behind it is that an artist really wants to fine-tune the product, but often has to stop because of some other external force, like a release date or some other schedule pressure."

HP solutions like the G6 server blade enable artists to test more iterations of an execution in a short amount of time, adds Miller. "Having faster tools for better turnaround means artists can iterate more and create a finer piece of art, and maybe not have to abandon it so soon—or be able to fix something that there wouldn't ordinarily have been time to fix," he says.

The end result is that DreamWorks Animation was able to release three movies—*How to Train Your Dragon*, *Shrek Forever After*, and *Megamind*—all in one year, 2010. "Five years ago," Miller notes, "doing one movie every two years was considered very ambitious."

Adds Leonard: "In the original *Shrek* movie, the dragon presented quite a challenge to produce because of the compute capacity required to animate, render, and light it. *How to Train Your Dragon* includes hundreds of dragons, some with more than four times the animation controls, and combined with wind, rain, smoke, explosions, and of course lots of great fire-breathing effects. We wouldn't be able to consider the full potential of a movie like *How to Train Your Dragon* without the compute capacity of HP servers—we would have had to dial back."

As DreamWorks Animation CEO and director Jeffrey Katzenberg says, "Technology has truly become our paintbrush, a paintbrush that keeps becoming more and more powerful, fueling a creative explosion."

IT is enabling the company to keep up with the ever-increasing demands of its creative team. And in darkened theaters everywhere, audiences are sitting down to munch popcorn and be the final judges of the results.

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