Success Story

Artificial Intelligence: A.I.

SGI Sweeps Academy Award® Visual Effects Nominations for Eighth Year in a Row

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—Jon Labrie, Chief Technical Officer, Weta Digital

For the eighth consecutive year all films nominated for an Academy Award for Distinguished Achievement in Visual Effects relied on the power of SGI® high-performance computer graphics systems to create the year's most unforgettable images.

The amazing worlds and cyborgs of *Artificial Intelligence: A.I.* and the harrowing air and sea battles of *Pearl Harbor* were made possible by the creative artistry of Industrial Light + Magic (ILM), a division of Lucas Digital Ltd. The Academy of Motion Picture Arts and Sciences (AMPAS) also nominated Weta Digital, a New Zealand company that built a state-of-the-art production facility based on SGI systems, to produce the film trilogy of *The Lord of the Rings*. The first film of the series, *The Lord of the Rings: The Fellowship of the Ring,* was not only nominated for visual effects but also garnered 12 other Academy Award nominations, including Best Picture.

In addition, two films nominated in the brand new AMPAS category of Best Animated Feature Film were also created using SGI visual workstations and servers: Disney/Pixar Animation Studios' *Monsters, Inc.*, and PDI/DreamWorks' *Shrek*, both critically acclaimed for advancing physical and emotional realism in computer animation.

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Artificial Intelligence: A.I. and *Pearl Harbor*

SGI IRIX® OS-based compute power provided the multi-Academy Award-winning artists of ILM with the means to create, design, animate, photo-realistically light, and render the amazing array of visual effects that enhance two of the nominated films. Using proprietary software written on Silicon Graphics® O2® visual workstations as well as off-the-shelf 3D modeling and animation software, ILM completed 200 shots on *A.I.* and 160 shots on *Pearl Harbor*. ILM, which has used SGI systems since 1988, uses more than 500 Silicon Graphics O2 visual workstations networked to an 800-processor SGI Origin® 2000 series system with 400GB of storage.

ILM artists working on *A.I.* used a variety of software from Alias|Wavefront, an SGI company, relying heavily on PowerAnimator™ for modeling, Maya® for procedural animation, and Avid Softimage primarily for animation, supplemented with a large amount of ILM's proprietary software—all running on Silicon Graphics O2 systems.

"*A.I.* had one of the broadest ranges of visual effects that I've ever been exposed to," said Doug Smythe, ILM associate visual effects supervisor for *A.I.* "We did literally every kind of shot you can think of, including simple wire removal, blink removal, and digital creature work of all kinds; digital enhancement of live action; all the CG eyeballs and prosthetics in the Flesh Fair shantytown; complete digital environments such as the excavation; combinations of miniatures with live action and computer graphics, such as Rouge City; and, of course, the furry teddy bear.

Pearl Harbor

ILM's visual effects work for *Pearl Harbor* included three main sequences: the aerial tour de force of the Battle of Britain; the devastating Pearl Harbor attack (including populating the sky with CGI planes, the 3D all-digital ships in Battleship Row, the water they float on, and a library of digital sailors); and many shots in the Tokyo raid sequence at the movie's climax.

Using Silicon Graphics O2 systems, artists adapted ILM's proprietary fluid dynamics, originally written on O2 systems for last year's Academy Award nominee for visual effects *The Perfect Storm*. For the volumes of smoke in *Pearl Harbor*, ILM adapted its fluid dynamic volumetric software to generate very complex smoke plumes, which filled the battle sequences. All the procedural animation tools were written in Alias|Wavefront™ Maya, which also handled the crowd placement for the digital sailors. ILM proprietary software, written on Silicon Graphics O2 systems, was also used for crash dynamics, lighting, and rendering.

"All of our code was written in the software we developed for the O2 systems. They're great," said Michael Bauer, ILM's CG supervisor on *Pearl Harbor*. "They are integral to our work."

The Lord of the Rings: The Fellowship of the Ring

Weta Digital has been working on the *Lord of the Rings* film trilogy for more than four years, producing more than 1,200 visual effects shots. The films each require dozens of digital human and humanoid characters plus lead creatures who are entirely CGI-created, vast CGI landscapes, battle scenes with hundreds of thousands of animated characters, and more special effects than you can shake a wizard's staff at.

Artificial Intelligence: A.I.

The Lord of the Rings: The Fellowship of the Ring

In excess of 150 artists, keyframe animators, modelers, digital paint artists, motion editors, compositors, and numerous software engineers were provided with 150 Silicon Graphics® Octane® visual workstations, which run Alias|Wavefront Maya as the facility's core 3D application; an eight-processor Silicon Graphics® Onyx2® system running Discreet inferno for compositing; and 80 dual-processor Silicon Graphics® 330 and Silicon Graphics® 230 Linux® OS-based workstations, which are used for a combination of paint, rotoscoping, and compositing duties. Two SGI file servers using SGI® TP9400 storage arrays, StorageTek Tape Robots, and SGI® 2000 series server technology provide a combination of 4TB of online storage and more than 20TB of nearline storage as a global storage repository to support workstation information sharing.

"What we're about is the ability to move large amounts of information around the facility all day, every day, and we rely on SGI to help us do that. Ninety percent of our equipment is SGI," said Jon Labrie, chief technical officer of Weta Digital. For nearline and offline storage Weta Digital uses DMF, the SGI hierarchical storage management system, which is already managing 50TB of information. "SGI DMF has greatly simplified our management of the thousands of tapes needed to store the bulk of the data," Labrie added.

From the beginning of preproduction, Weta Digital also used the Octane visual workstations to write extensions to Maya, creating proprietary technology including Massive, a custom-built crowd animation or "artificial ecology" system developed on IRIX and now ported to Linux, which draws from a huge database of motion-capture data.

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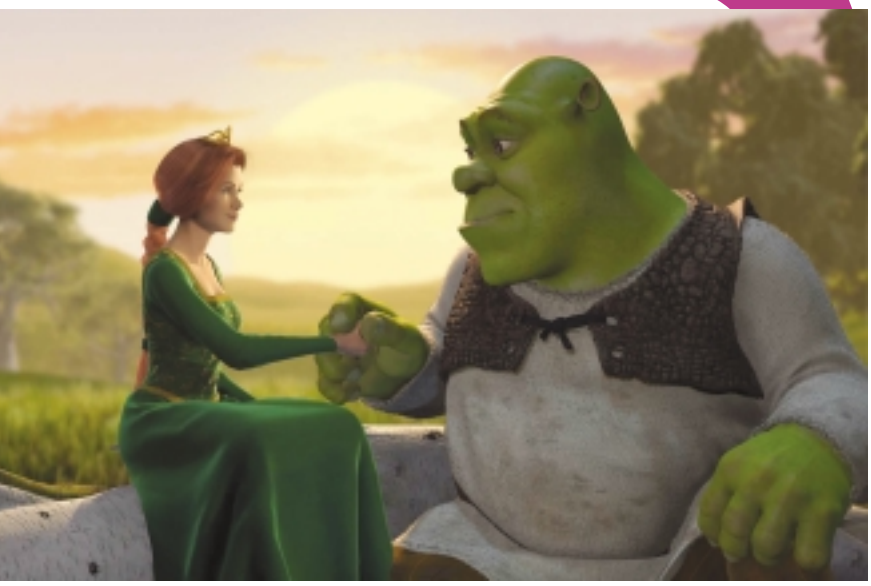
Weta's primary rendering resource is based on SGI® 1100 and SGI® 1200 Linux OS-based servers. Having started with 32 dedicated processors, the facility currently runs 192 dual-processor SGI servers rendering frames 24 hours a day, seven days a week.

Monsters, Inc.

SGI's longtime customer Pixar Animation Studios created a monster box office hit, Disney/Pixar's *Monsters, Inc.*, using Silicon Graphics® Octane2™ IRIX OS-based visual workstations. In preparation for the production of *Monsters, Inc.*, Pixar Animation Studios purchased 250 Silicon Graphics Octane2 visual workstations in July 2000, barely a month after the powerful new line of high-performance visual compute workstations was introduced. Pixar used SGI workstations for interactive graphics applications throughout the studio, including 3D modeling, painting, compositing, and animation. Silicon Graphics Octane and Octane2 workstations were also used to create and run new lighting tools designed for the film.

Building the final character models for *Monsters, Inc.* was a difficult and complex task, performed using the



Shrek

Silicon Graphics Octane2 workstations. "Sulley [the monster voiced by John Goodman] is covered with shaggy blue fur consisting of millions of individual hairs," said Darwyn Peachey, vice president of technology, Pixar Animation Studios. "All that hair was positioned and styled interactively on the Octane2 workstations, and the motion of the hair was computed using our proprietary algorithms for dynamics simulation."

In addition to the 250 Silicon Graphics Octane2 visual workstations, Pixar Animation Studios uses a Silicon Graphics® Onyx® system with InfiniteReality® graphics for high-resolution display and playback.

Shrek

DreamWorks' latest all-CG animated feature, *Shrek*—entirely created with SGI technology—has been critically hailed as a high-water mark in human character animation, both in movement and the translucent quality of the skin. To bring some of the film's most memorable "human" characters—Princess Fiona and Lord Farquaad—as well as Shrek and Donkey to life, the talented artists at PDI/DreamWorks used mostly Silicon Graphics O2 desktop workstations, the same machines they used for *Ant z*.

The best thing about relying on SGI technology "is the solidity of the overall platform, which has really made SGI workstations attractive to us over the years," said Dan Wexler, a member of PDI/DreamWorks' R&D team. "The most powerful features of the SGI systems are their robustness, their stability, and the total solution that they provide in terms of being able to integrate three-dimensional graphics, video, and audio." Although *Shrek* relied on a great deal of traditional SGI IRIX hardware, it was also the first DreamWorks production to embrace Linux technology. Linux OS-compatible platforms from SGI helped make PDI/DreamWorks' transition as painless as possible. "We've traditionally been on IRIX operating systems and have used a wide variety of SGI machines for a long time," Wexler reiterated. "Our SGI machines gave us an advantage in terms of being able to port software to Linux before the work on *Shrek* started."

Rendering *Shrek*'s complex imagery was also a joint hardware effort. "We have a whole bunch of SGI Origin 200 servers, but the majority of the render farm on *Shrek* was in fact based on the Linux OS," DreamWorks' head of technology, Ed Leonard, states. "We purchased 168 SGI 1200 2U dual-processor Linux OS-based machines. Ultimately our decision to use Linux [or any other technology] is based on its ability to bring more horsepower to the making of great films, and SGI certainly played a key role there—and in the making of *Shrek*."

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