Success Story

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—Thoma Thurau,
Chief Engineer,
Shaw Brothers Studios

SGI® Technology Powers World's First Large-Scale Digital Film Remastering Center

The largest commercial digital film rejuvenation and remastering project in the world is under way at the Shaw Brothers Studios Remastering Center in Hong Kong, and SGI technology is an integral part of it. The center's client, Celestial Pictures, recently purchased a library of 760 Shaw Brothers' full-length feature films, shot from the late 1950s to mid-1980s. Opened in 2002, the center's mandate is to digitally remaster three to four films per week in two language versions (Mandarin and Cantonese); 60 titles are being finished in high definition (HD) and the remainder in standard definition (SD). Hong Kong-based Celestial Pictures, a subsidiary of Measat Broadcasting in Malaysia, holds all reproduction, remake, and sequel rights and will distribute the newly remastered versions via broadcast television, videocassette, and DVD.

Many of the films have been in the vault for up to 30 years, which makes setting quality

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standards and delivery schedules a mammoth task, requiring a true state-of-the-art facility. The center's equipment includes SGI®, IRIX®, OS-based Silicon Graphics®, Octane2™, and Silicon Graphics O2+™ visual workstations and SGI® Origin®, family high-performance servers—chosen for reliability, speed, performance, and above all, interoperability. The solution includes products from SGI applications partners da Vinci, Thomson, and Discreet that, together with the supercomputing power of SGI, provide the innovation and flexibility to swiftly move the archive of "the Hollywood of the East" from the beginning of the workflow to the final output.

Who Are the Shaw Brothers?

The Shaw Organization was founded in Shanghai in 1924 with the unique vision of creating silent films for distribution throughout Southeast Asia, with its many languages and dialects. The family business quickly expanded to Singapore and beyond (and into the "talkies" as well). Over the years they amassed 35 companies, including three major film production studios, and numerous film distribution companies, movie theater chains, and even amusement parks. The entire film archive is considered historically significant in Asia, and to connoisseurs of kung fu films everywhere, Shaw Studios is legendary.

Directors such as Quentin Tarantino, John Woo, and Academy Award®-winner Ang Lee (*Crouching Tiger, Hidden Dragon*), have credited Shaw Bros™ films as a major influence on their work. Shaw Studios also launched the careers of famous Asian actors including *Crouching Tiger*'s Chow Yung Fat (who starred in the Shaw Bros *Love in a Fallen City*) and Cheng Pei-pei, who costarred in *Crouching Tiger* and earlier appeared in the Shaw's 1967 classic action film *Come Drink With Me*. One of the first films the center remastered, *Come Drink With Me* was screened at the 2002

Cannes Film Festival. The film was digitally remastered over two weeks, in high-definition 1080/24p, and transferred back to film. With the surge of interest in digital preservation throughout the world's film community, the remastered movie was reportedly met with great praise at the festival.

The Challenges of Restoration

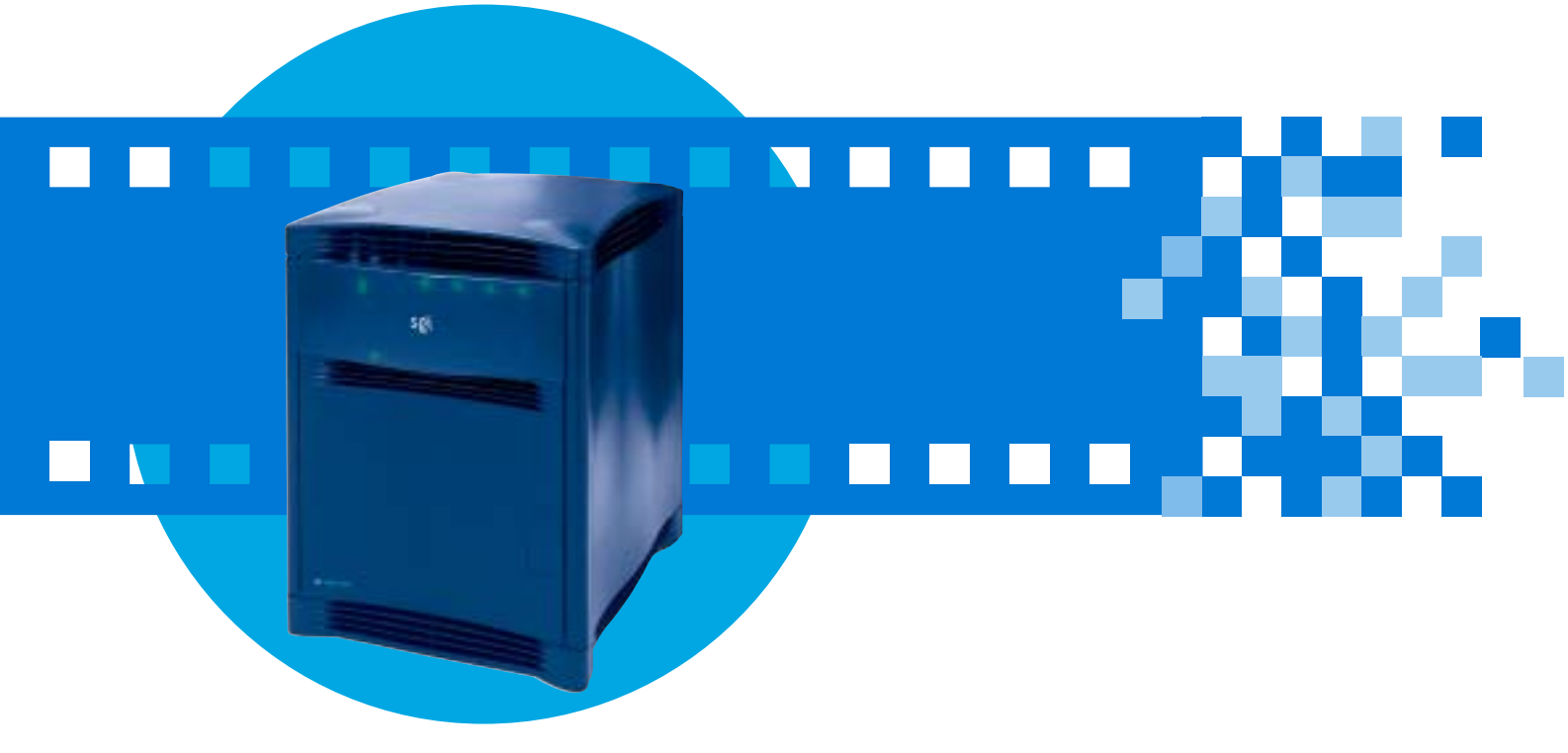
With a brand-new film, a quality standard is expected from the original negative, the content is known, and the director or director of photography is usually available to sit in with the color timer or editor. With an aging archive, almost everything is unknown and almost no one is available to give direction.

"Some of these films are 40 or 50 years old, so every time we open up a can to look at a reel of film, it's a new surprise," said Thoma Thurau, former chief engineer at Shaw Brothers Studios Remastering Center, who worked with the various vendors to architect and integrate the center. "We don't know what we're going to face. No matter how well you store it, film naturally will start decaying. Luckily, we've been able to catch it and start remastering digitally."

Plus, when the films were made, the original negatives were cut to accommodate censorship rules in different countries. After the release print was struck, the original negative was taped back together. The splice tape deteriorates and, over time, the frame before the splice and the frame after the splice change to a different color value and luminance value than the frames that precede and follow. Thurau notes some films had as many as 30 of these bad splices.

The High-Volume Tapeless Remastering Process

On average, each of the 760 films has 10 to 11 reels, and each reel runs about 10 to 12 minutes. The process begins at the Thomson Spirit telecine transfer bay, controlled by da Vinci's 2K color correction system. Using Discreet's backdraft™ 5.0 software on an SGI® Origin® 2200 platform as a clip server, the system is able to record each reel as a clip in its own dedicated library and partition. The operator also creates an HD D5 archive tape. The clips are then distributed to one of five revival for Discreet® systems by da Vinci—which perform an automatic pass on each reel to clean up much of the dirt, scratches, and other imperfections—via a HIPPI network that runs at twice real time. Each revival system is running on a Silicon Graphics Octane2 workstation with VPro™ V12 graphics, 2GB of RAM, and dual CPUs. All the transfers are done in the background using a hubless or remote system architecture to "look" into the system and push/pull clips. The main transfer CPU is a Silicon Graphics® Octane® system that acts as a remote terminal to look into the other systems to push/pull clips.



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Fifty-six Linux®, CPUs run the automatic pass, and 12 additional MIPS® CPUs can be used in combination to assist in processing. The automatic process uses artificial intelligence to make pixel comparisons on each frame, often in real time.

"One of the problems we faced early on with the kung fu films was that we were getting artifacts or pixelization during scenes containing a lot of action," said Thurau. "An actor would be throwing a punch, and the system would think that the unusually fast motion was dirt. da Vinci's revival team adapted the system's algorithms to take care of this unique fast-motion issue. As a result, we were able to run all of our reels of film through the system, running on the Silicon Graphics Octane2 system, in an automatic mode, eliminating a lot of the 'interactive' work—sometimes more than 50%—that our staff would have done manually otherwise."

When the auto pass is complete, staff members use revival's interactive mode, going through the film frame by frame to complete the process. The reels are then sent to one of three Discreet® smoke® systems that edit together the reels for compiling, audio synchronizing, title compositing, and final QC prior to the last color grading. For final color correction, the remastered film is transferred to a second clip server, an SGI Origin 2200 system running backdraft. In addition, an SGI DIVO card, an option that provides digital uncompressed video I/O to output SD, is controlled by a da Vinci 2K. The clip servers are not dedicated to the rooms and can be logged on one of two Silicon Graphics O2+ computers acting as remote terminals for output or input anywhere in the center.

"For the sheer volume of the work we do here—often with 15 to 20 films on our system at a given time, each reel holding 15,000 frames—you can imagine the nightmare of keeping track of all the frames," Thurau concludes. "Being able to keep it all in a single file format has great advantage. The SGI, da Vinci, and Discreet systems all fit very nicely together, creating a high-volume, flexible, tapeless, remastering center."

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