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By Jamie J. Gooch

The Gathering Cloud

As we put this special issue on cloud computing to bed, Amazon is explaining—and apologizing for—the outage of its Amazon Web Service and Elastic Compute Cloud data centers. The cloud service provider's problems temporarily took out popular web-based services from Reddit, Quora and Foursquare, and had an impact on many other businesses that have yet to be named.

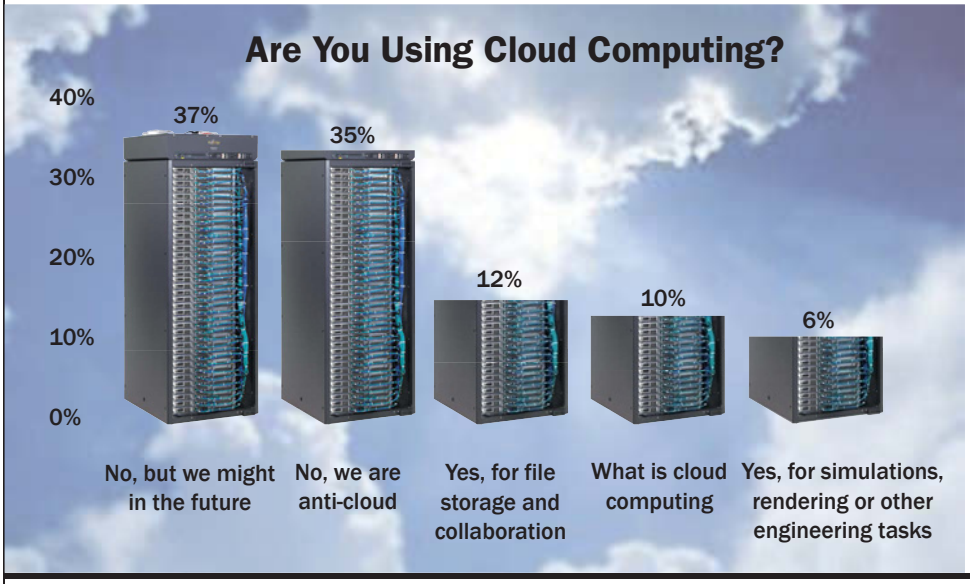
Hot on the heels of the Amazon cloud debacle came an admission from Sony that its security had been breached not once, but twice, possibly exposing up to 100 million of Sony Online Entertainment customers' names, birth dates and addresses, as well as some customers' credit card information.

Cloud computing, at its core, is a good idea.

The Silver Lining

Are these the high-profile, one-two punches to uptime and security that will knock out cloud computing? No. In fact, these are good things. These are the growing pains any new technology must experience on its way to maturity. Cloud computing, at its core, is a good idea. That's a statement many of you won't agree with, according to our research.

When asked via an email survey if they were using cloud computing, more than a third (37%) of *DE's* readers said "No, but we might in the future." Those open-minded respondents were offset by the 35% who said, "No, we are anti-cloud."



Why the Cloud?

Here's why I think many of those anti-cloud respondents will eventually come around:

1. **Convenience.** People are becoming accustomed to having 24/7 access to their data. In the age of Facebook and Google Docs, tomorrow's workers will expect to access their work data from anywhere.

2. **Portable functionality.** Computers are getting smaller, thanks in large part to their reliance on Internet-based services for much of their functionality. There are already mobile apps available that allow engineers to store and access product lifecycle management data, as well as view, edit and share DWG drawings and 3D models. More are on the way.

3. **Competition.** The cost and speed benefits made possible by the cloud will eventually force many companies to adopt it to keep up with their rivals.

4. **Maturation.** The security and uptime issues with the cloud will be addressed. As one *DE* survey respondent put it, "I believe the companies that host data in the cloud have better security measure than I can muster." High-profile breaches will serve to strengthen security over the long haul.

5. **Due diligence.** Companies that use the cloud will implement contingency plans in case something goes wrong at the cloud service provider. They'll also do their homework and demand that cloud service providers have adequate backup, redundancy and security measures in place.

Engineering on the cloud is still in its early stages. It's up to cloud computing providers to find the sweet spot of customer acceptance and functionality that will help cloud computing catch on in the enterprise. Not every application is suited to running entirely on the cloud, mainly because of security and bandwidth reasons. However, there is plenty of room for innovation by offloading certain data crunching to the cloud, accessing software on demand and enabling global collaboration.

And for the 10% of our survey respondents who answered our survey question with "What is cloud computing?" We hope the articles in this issue will answer that question for you. DE

Jamie J. Gooch *is the managing editor of* DE. *Send comments about this subject to de-editors@deskeng.com.*

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COVER STORY

Cloud Computing

20 The cloud is the computing buzzword of 2011. In this special issue, *DE* gets past the hype by explaining what cloud computing is, how it can benefit design engineers, and how to assess when cloud computing is the right solution for you. Though just getting traction, cloud computing is already being used by some design engineers. Read *DE's* Focus on Cloud Computing to learn where the technology is headed.

ON THE COVER: Combining modern, multi-core workstations with the on-demand processing power of the cloud promises to save time and expense for engineering firms. Images courtesy of iStockphoto and HP.

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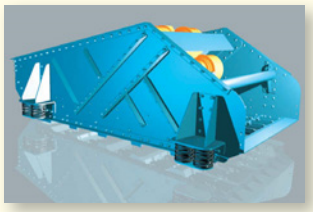

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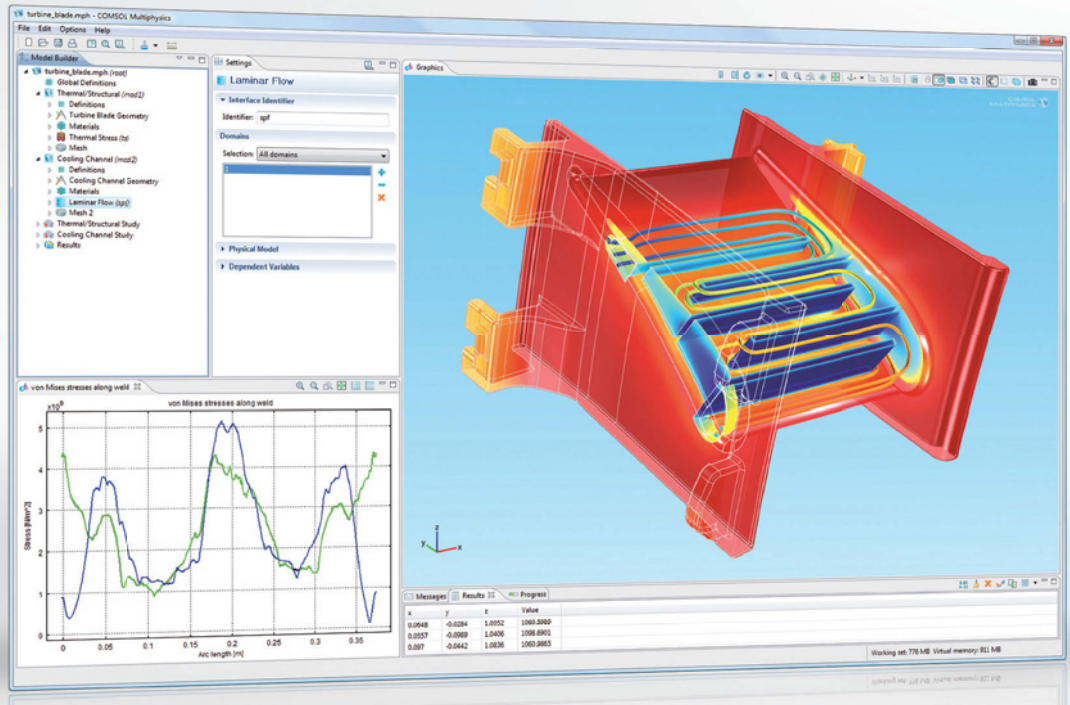

A stator blade in the turbine stage of a jet engine is heated by the combustion gases. To prevent the stator from melting, air is passed through a cooling duct in the blade.

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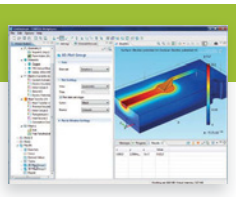

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Answers for industry.

SIEMENS

by Kenneth Wong

Autodesk tempts users with suite deals for 2012

In March, Autodesk introduced a number of suites—bundles of software selected with specific workflows in mind. Most of these suites come in three editions: Standard, Premium and Ultimate, priced progressively higher for the added products you get:

- Autodesk Design Suite.
- Autodesk Product Design Suite.
- Autodesk Building Design Suite.
- Autodesk Entertainment Design Suite.
- Autodesk Factory Design Suite.
- Autodesk Plant Design Suite.

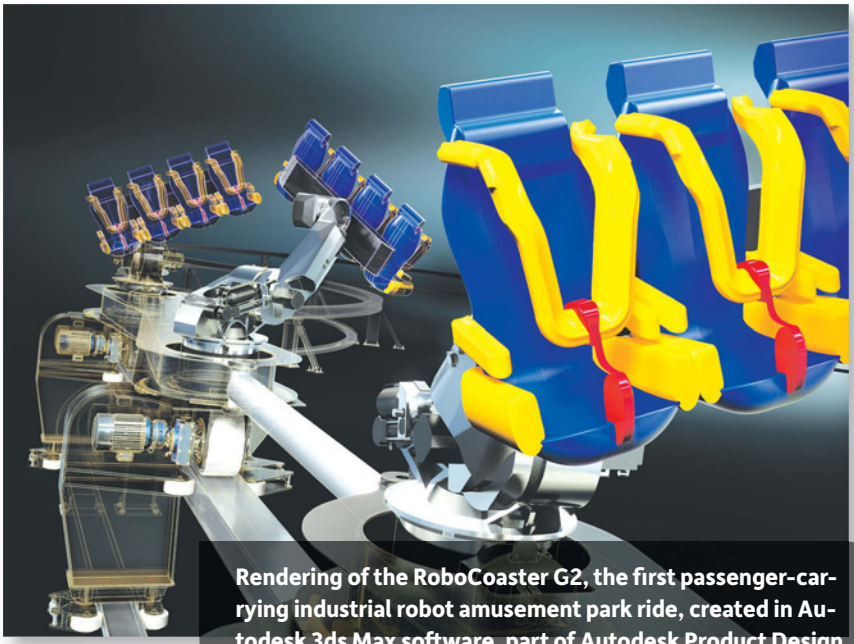
The company's bundle pricing appears to offer more bang for your buck (or more code for your cash). The Premium Edition Design Suite, for example, includes AutoCAD, Autodesk SketchBook Designer, Autodesk Showcase, Autodesk Mudbox, and Autodesk 3ds Max Design. Bought separately, these products would cost more than $9,700. Bundle pricing is $4,995.

Similarly, the Premium Edition Product Design Suite includes Autodesk Inventor, Autodesk 3ds Max Design, AutoCAD Mechanical, Autodesk Showcase, Autodesk SketchBook Designer, Autodesk Vault, and Autodesk Mudbox. If bought separately, they would cost more than $15,000. Bundle pricing is $6,495.

At Premium and Ultimate levels, Autodesk 3ds Max is included as the de facto visualization software in most suites. You'll find that Autodesk Inventor Fusion's editing methods have gradually found their ways into the bundles' geometry-editing tools.

Reclaiming Lost Grounds

Not satisfied with line drawings produced in AutoCAD, some Autodesk customers resort to Adobe Illustrator, Adobe Photoshop, ACDSee Canvas, CorelDRAW and others vector-raster drawing packages to give their lines and arcs artistic treatments. With tools to create and edit stylized splines and apply gradients and colors, Autodesk's SketchBook Designer may reclaim ground lost to these graphics packages. Furthermore, concept drawings created in SketchBook Designer's Splines will be easier to manage in other Autodesk packages like Autodesk Alias, laying the groundwork for complex surfaces.



Rendering of the RoboCoaster G2, the first passenger-carrying industrial robot amusement park ride, created in Autodesk 3ds Max software, part of Autodesk Product Design Suite 2012. ***Image courtesy of Dynamic Structures Ltd.***

More Eco Advisors

Autodesk is releasing a sustainability tool, dubbed Eco Material Advisor. The tool is the outcome of Autodesk's partnership with Granta, which specializes in material data. In its debut version, Eco Material Advisor will first appear in Autodesk's 2012 portfolio. It's expected to let you estimate energy use, carbon dioxide footprint, water use and materials cost based on your 3D design.

Like SolidWorks' Sustainability tool, Eco Material Advisor will let you compare the environmental impact of different design alternatives by using one as the baseline.

Question on Pricing

According to Hilde Sevens, a director of product management at Autodesk, "Subscription price is not going up, so please put that out of your mind."

The Autodesk press office clarified: "The customers who currently are on a subscription (say, for AutoCAD Inventor Professional) who would be receiving the Product Design Suite instead—for these customers, there is no change in their subscription pricing, despite now being on subscription for many more products. The subscription prices for the suites themselves, however, are higher than current subscription prices for standalone products (which is designed to reflect the greater value of subscription across all the products in the suite)."

It's unclear whether subscription customers who receive an automatic upgrade to a suite will be required to pay a higher fee. It's also unclear whether certain titles will remain available for subscription individually, apart from the suite offerings where they appear. DE

Teamcenter Mobility Comes to the iPad

The iPad army has knocked down the walls of product lifecycle management (PLM), guarded for years by Windows firewalls and desktop PCs. The mobile workforce has already left its footprint in the portfolios of Autodesk and Dassault Systèmes, spawning AutoCAD WS Mobile, SketchBook Mobile and 3DVIA Mobile, among others. This April, Siemens PLM Software opened its gates, offering up Teamcenter Mobility as its tribute.

In the official announcement of Teamcenter Mobility, Siemens PLM President Chuck Grindstaff said, "By making up-to-the-minute Teamcenter data available at the necessary point of activity, our customers can act immediately on accurate information and further reduce their design and production cycle times. This is entirely consistent with the vision of HD-PLM to help our customers make smarter decisions that result in better products, thus enabling them to establish the competitive advantage of being the first to deliver innovative solutions the market will embrace."

The application, now available for the iPad at Apple's App Store, comes in two versions: Teamcenter Mobility ($19.95) and Teamcenter Mobility Free. The free license is intended as an evaluation copy. It allows you to connect to Siemens PLM Software's Teamcenter server, allowing you to examine the application's features. The fee-based version lets you connect to your own Teamcenter server (version 8.3).

The application will let you:

- perform Teamcenter searches, filter, and sort to clarify your view;
- access the change-management dashboard to view changes and issues in pie-chart format;
- view task-lists, workflows and related documents (drawings and 3D JT models, for instance);
- view 3D JT models directly from a web page;
- view revisions and related items for each selected revision;
- auto-populate forms with user information; and
- review and sign off on pending approvals.

The app connects to the Teamcenter data store through secure socket layer and Wi-Fi. It also comes with an off-line mode, allowing you to download content and work where you may not have a Wi-Fi connection. But once you're connected to the network, the app will synchronize your updates with the server.

While computing-intense functions such as 3D modeling and sophisticated finite element analyses (FEA) are expected to remain on the desktop, many peripheral functions like data management, markup, annotation and presentation are swiftly moving into the mobile devices.

NEi's mobile FEA application, which I previewed in *DE's* April issue, is now available for download for free. Although it's not meant for complex FEA jobs, it lets users perform quick calculations based on load, stress and primitive shapes, making it ideal for field use.

In a Feb. 28 blog entry titled "The Mobile App Internet Wags the IT Dog: A Post For Content & Collaboration Professionals," Ted Schadler, a Forrester analyst who specializes in content and collaboration, advised, "To keep your workforce loving your business applications as they go mobile, you will have to redesign the fundamental architecture for delivering apps. The architecture of Client-Server (and Browser-Server) is inadequate. You will need to build from an architecture of devices and services. The mobile app Internet is that architecture: local apps (including HTML5 browsers) on smart mobile devices and cloud-hosted interactions and data."

Charles Curtis, another Forrester analyst, observed, "Five years from now, six in 10 U.S. workers—about a quarter of a billion people—will work virtually (Forrester's Content and Collaboration Forum 2011 announcement). DE

Teamcenter Mobility promises easy access to PLM data from mobile devices.

by Kenneth Wong

HP's entry-level workstation

Conventional wisdom in computing is, if your PC is an entry-level machine, it's not a workstation, and if it's a workstation, it's more expensive than an entry-level PC. But this season, HP, Dell and other hardware makers may try to disprove this notion by releasing units that are powerful enough for CAD and visualization—priced below $1,000. The rollout began with HP, which debuted its first entry-level workstation, the Z210, priced beginning at $569 (small form factor unit) and $659 (convertible mini-tower model). CPU choices for Z210 include Intel Xeon E3 and second-generation Intel Core i3/i5/i7 processors.

The Xeon E3 1200 processors contain Intel HD Graphics P3000 technology, providing you both general processing and graphics processing on a single die. The new processor series is part of Intel's strategy to elbow its way into the market, traditionally dominated by NVIDIA.

According to Anthony C. Neal-Graves, general manager of the Intel workstation unit, "That means visual and 3D graphics capabilities that were once only available to entry workstation users with discrete graphics cards will now be accessible to anyone with an entry workstation powered by Intel Xeon E3 family with Intel HD Graphics P3000."

To paraphrase, Intel is essentially saying that if you have a workstation running on Intel Xeon E3 1200, you don't need to buy a professional-grade graphics card. I have not done any benchmark testing, so I can't offer insights into performance comparison. However, if your graphics needs are not intense enough to justify purchasing a professional GPU (for example, an NVIDIA Quadro card or an ATI FirePro card), but you'd still prefer to get some graphics boosts for your visualization and rendering jobs, HP's new Z210 with Intel Xeon E3 1200 may be the workstation with the right mix or computing and graphics horsepower.

HP Z210 entry-level workstation, shown here in mini-tower model.

Like other HP workstations, Z210 comes with HP's Performance Advisor software, which lets you configure your machine's hardware environment and drivers to get the best from your design and engineering software. HP's tool-free chassis lets you reach into the heart of the machine to add, remove and upgrade hardware without using screwdrivers and pliers (quite literally, it prevents you from screwing up). DE

Invisible Interfaces

If ease of use and low learning curve are the desired attributes of a good interface, then the ideal interface has to be an invisible one. No buttons to push, no menus to navigate, no commands to type. The machine, or the computer, deduces your requests from your normal gestures and natural language, then delivers the data confidentially to your eyes, for your eyes only.

Sounds too far-fetched? Too Star Trek, too James Bond? Not at all. Such interfaces have been in the field, in operations for quite some time now. The headgear of a modern soldier, for example, is a networked computer disguised as a helmet. At the recent Congress on the Future of Engineering Software 2011 (COFES), Joseph Juhnke, president and CEO of Tanagram Partners, shared his firm's works for the Defense Advanced Research Project Agency (DARPA).

A soldier's headgear, part of Tanagram's Intelligent Augmented Reality Model (iARM) solution for DARPA, "encompasses an open source operating system supporting geo-location and triangulation, together with data services that integrate voice, video and image for facial/object recognition and pattern analysis. It is supported by a hardware platform integrating a computer processor, encrypted wireless, camera/video and visual display," explained Tanagram.

Juhnke is now working on developing the same type of equipment for firefighters. Tanagram uses Bloom Server, a geo-social asset management platform, as the engine behind its augmented reality platform. In addition to hosting and delivering data sets, Bloom Server may also be used to aggregate and turn 2D photos into point cloud data in 3D. The point cloud making up a building's facade, for example, may be extracted from 30 to 40 photos of the same facade, taken from varying angles. DE

Kenneth Wong *writes about technology, its innovative use, and its implications. One of* DE's *MCAD/PLM experts, he has written for numerous technology magazines and writes* DE's *Virtual Desktop blog at deskeng.com/virtual_desktop. You can follow him on Twitter at KennethwongSF, or email him via de-editors@deskeng.com.*

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Let There be Light

NewTek releases a new version of LightWave.

BY MARK CLARKSON

NewTek hasn't released a new LightWave since version 9.6, way back in January 2009. (See *DE's* October 2009 review at deskeng.com/articles/aaasmf.htm.) Given the amount of intervening time, though, version 10 seems a little light on new features.

Unlike almost every other 3D program, LightWave divides modeling and rendering into two separate applications, called Modeler and Layout. LightWave has long been criticized for this fragmentation of the application—but personally, I like it, as it allows me to focus on modeling when I'm modeling, without worrying about everything else in the scene.

If there are any major changes in Modeler, I couldn't find them. There has been some welcome tweaking of the interface, such as the addition of buttons for some common operations: inserting layers, for example, and moving and copying objects between layers.

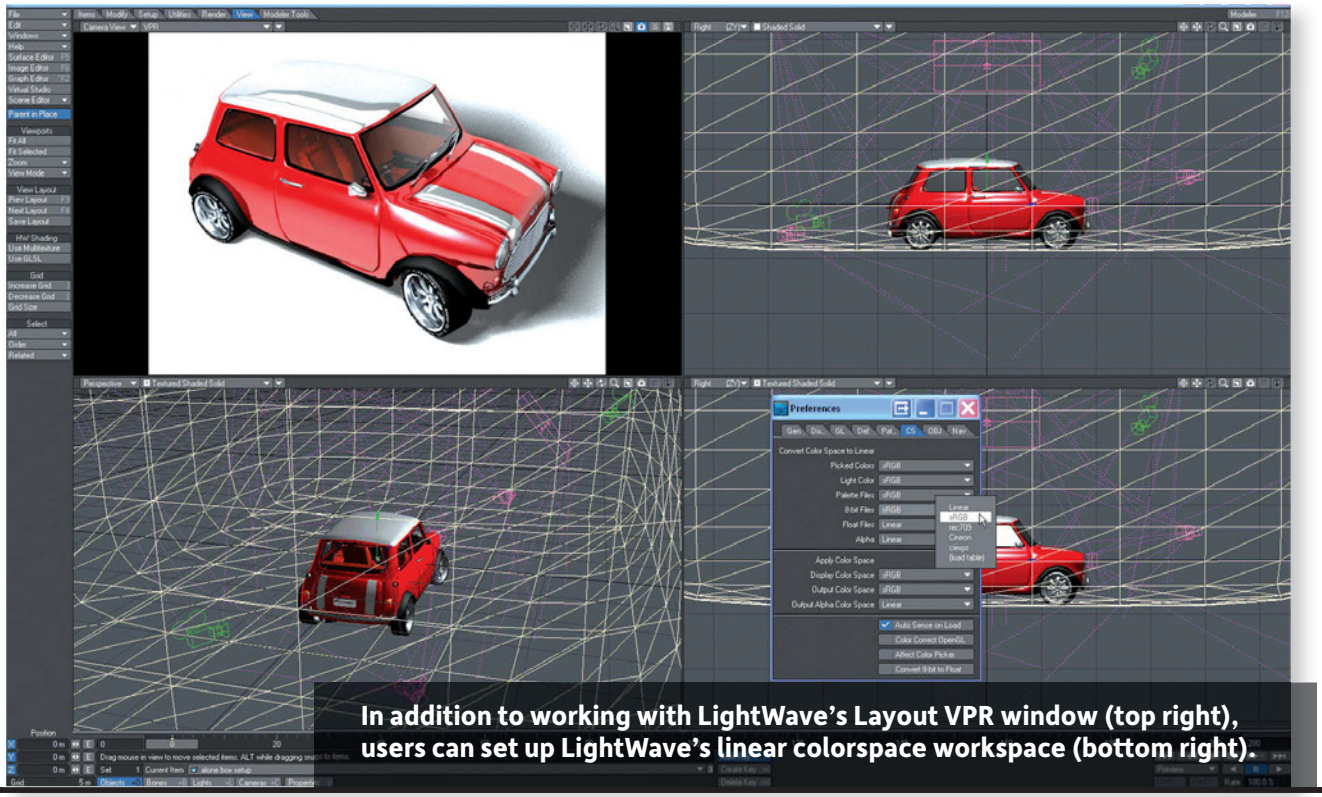
Layout also sports little touches that are easy to overlook at first glance. Some tabs have been renamed or moved around, some buttons have been added. Numeric input fields have been given new slider controls.

The renderer itself appears to be the same. An admittedly unscientific selection of test renders all showed the same results as version 9.6, completed in the same times.

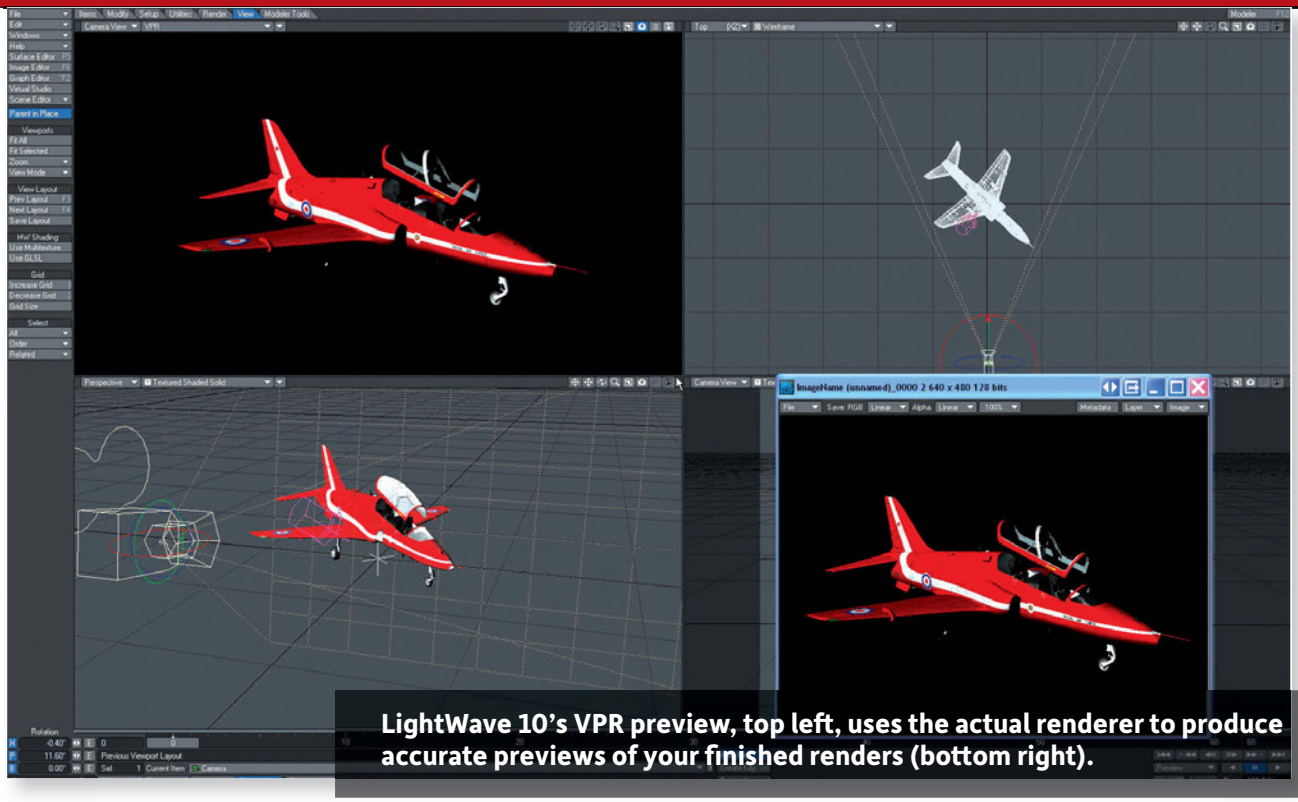
VPR is the Star

LightWave 10's most obvious improvement is Layout's new real-time Viewport Preview Render (VPR). Unlike LightWave's existing VIPER preview, which ignores many compositing and lighting effects, VPR uses LightWave's actual renderer: You see all the fur, fog, reflections, motion blur and volumetric lighting effects for a very accurate preview of the final render.

Here's where compute unified device architecture (CUDA)-enabled applications have really spoiled me. My Quadro 5000 has 3.5 gigs of high-speed RAM and 352 processors cores, and LightWave doesn't seem to be utilizing it effectively for VPR, relying instead on my CPUs to do much of the heavy lifting. Consequently, VPR is nowhere near the speed of, say, Bunk-speed SHOT (see my January 2011 review at deskeng.com/



In addition to working with LightWave's Layout VPR window (top right), users can set up LightWave's linear colorspace workspace (bottom right).



LightWave 10's VPR preview, top left, uses the actual renderer to produce accurate previews of your finished renders (bottom right).

articles/aaazmj.htm). Your results may vary. Demos I've seen running on Windows 7 and i7 processors were much speedier. My graphics card is hot, but my computer and operating system are, admittedly, pretty creaky. (I'm still running XP on a scant two cores).

VPR doesn't really let you interact with the render. You get no feedback on what it's doing. You can't focus in on a particular area. VPR also isn't very "smart" about when it needs to restart a render—opening a panel on a different monitor, or opening a non-overlapping window, for example, will often trigger an unnecessary redraw.

Linear Color Space

One of LightWave's most significant new features—its new linear color space workflow—is invisible at first.

Dealing with color spaces can be a pain, but it's a crucial part of producing photorealistic renders. You might have texture images coming in in one color space, a monitor displaying in another color space and, under the hood, the renderer itself working in yet another color space. The upshot is a lot of extra work to get your final images to look the way they ought to look—and they never really do look quite the way they should.

The big problem is gamma. A gamma curve, applied to an image, affects the brightness of that image's pixels, bringing it more closely in line with the way our eyes perceive those colors. These curves are embedded in most image files—and most monitors, as well—but they're typically ignored within the renderer itself. In other words, you're not using the images you think you are, and you don't get the results you expect. You end up turning up the lights, over-cooking reflections and specularity, or applying gamma correction to the final render.

LightWave 10 makes everything a whole lot easier with its new linear color workflow. All images are converted to a linear color space internally, where the renderer does all its work with them. The gamma curves are baked in, so that the renderer sees your textures the same way you do. Renders are converted back to the color space of your monitor or other devices.

FBX / Collada / MDD

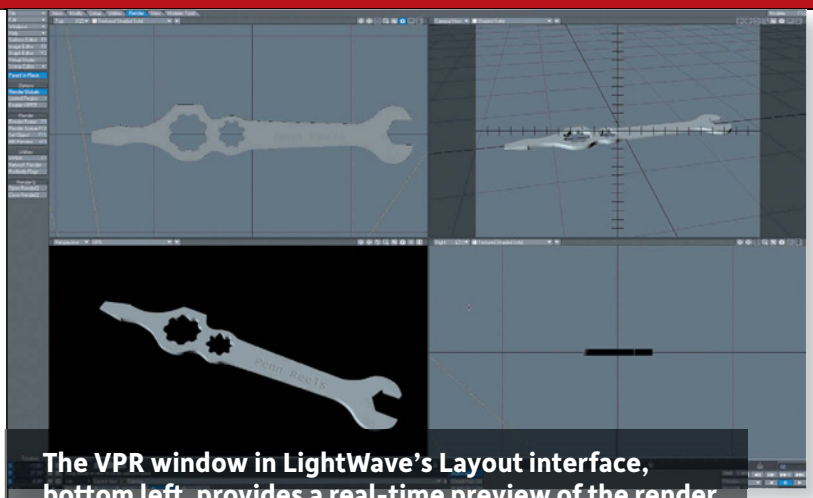
LightWave 10 improves the program's handling of several interoperability file formats.

LightWave 10's FBX performance is much better than 9.6's. Geometry now loads properly instead of scattering pieces through the scene. The resulting objects in LightWave are better organized.

I had less luck with textures, though. Image maps, colors, specularity settings and so forth were often ignored or assigned some … interesting numbers. (Glossiness = 393.2132%?) To be fair, moving complex files from one application to another rarely goes smoothly without first spending time and effort on tweaking your pipeline. LightWave isn't alone here, and it's much improved from previous versions.

I ran into a couple of new bugs in LightWave's Collada import and export—which worked pretty well for me in the previous version—but Newtek assures me that they've now been fixed.

LightWave's MDD format now supports Autodesk's geometry cache. MDD files are used primarily to move motion files around from motion capture and character animation—not something most of us do very often.



The VPR window in LightWave's Layout interface, bottom left, provides a real-time preview of the render.

Virtual Studio, 3D Mouse Support

LightWave 10 adds support for 3Dconnexion's 3D mice—in Layout, at least. It has also added support for the InterSense VCam virtual camera rig. In combination with VPR, the new Virtual Studio tool allows you to create a virtual set. The director can move his virtual camera around a real space and see the results instantly mapped to a virtual space in real time. While undeniably cool, this is more useful in motion picture and TV production than industrial design.

Documentation

Are there more new features hiding in LightWave 10? Probably. Features are no good to me if I can't find them, can't figure out how to use them, or don't know they exist in the first place.

Which brings us to the documentation. Brace yourselves.

Let's say you want to know how to implement bones. Bones do what you'd expect: Create a posable skeleton within an object for use in deforming it. So you press F1 to fire up the help system.

There's nothing in Contents about bones unless you drill down a ways—and you have to know where to drill down.

Do a search on "bones," and you'll get a list of every section that contains that word. The potentially useful "Add Bone" appears at the top of the list, through alphabetical serendipity rather than any rational ordering. The list also includes Display_Options, Navigate_Tab and Vertex Paint.

Search for "radiosity," and you'll get a confusing list ranging from Basic Light Attributes—which sounds promising, but doesn't actually contain any information on using radiosity—through an alphabet soup of Greek: Delta, Kappa, Sigma, Theta. Here's a hint: You actually want to open the Global Illumination tab from the Render Globals panel.

The discs include the actual program manuals in PDF form. However, entire sections are missing or referring to the wrong version of the program.

LightWave actually has a shallow learning curve, but you'd never know that from the documentation, which leaves you chasing your tail forever over the simplest tasks. I gave up and relied on Google and Internet forums.

Conclusion

This may seem like a negative review, but I like LightWave 10. I really do. Its renderer is first-rate, right out of the box with real-world lights and lenses, a nodal shader and, in this version, VPR and linear color workflow. LightWave's animation capabilities are probably well in excess of your needs, unless you do actual character animation. Plus, at $895, it's a bargain. Upgrades start at $495. There's just a little less new stuff to like than I was expecting—and some of the old stuff, especially the documentation, is getting downright decrepit.

I like the LightWave modeler bit, but because the majority of NewTek's R&D is going into Layout (and the development of CORE), Modeler is languishing. At this point, modo is a better LightWave modeler than LightWave. If you use LightWave primarily for creating geometry, there's no compelling reason to upgrade from 9.6 to 10.

If you're using LightWave to create final beauty shots, then VPR and the linear color workflow are worth their weight in gold. Download the free trial at NewTek.com/lightwave/lwtrial.php and give it a go. DE

Mark Clarkson *is a Wichita, KS-based writer. He can be reached at mark@markclarkson.com.*

INFO ➜ NewTek, Inc.: NewTek.com/lightwave/lw10.php

For more information on this topic, visit deskeng.com.

Dude, Where's My CORE?

NewTek announced CORE—a major relaunch of its LightWave product—a little more than two years ago, immediately after the release of the previous version of LightWave. It's taken longer to arrive than NewTek initially anticipated. In fact, it's still not here.

In going through the list of new features in LightWave 10, you'll note that a few of them—such as a new rigid body dynamics system and new UV mapping tools—are actually available only in CORE, which is still in beta at the moment. Its release seems imminent, but it's been that status for a while now.

Bits and pieces of CORE technology have shown up in LightWave 10, however: VPR and the new linear color space are the most noticeable of them.

If you purchase LightWave 10 now, you get access to the CORE beta program, as well as a copy of CORE when it releases later this year for no extra cost.

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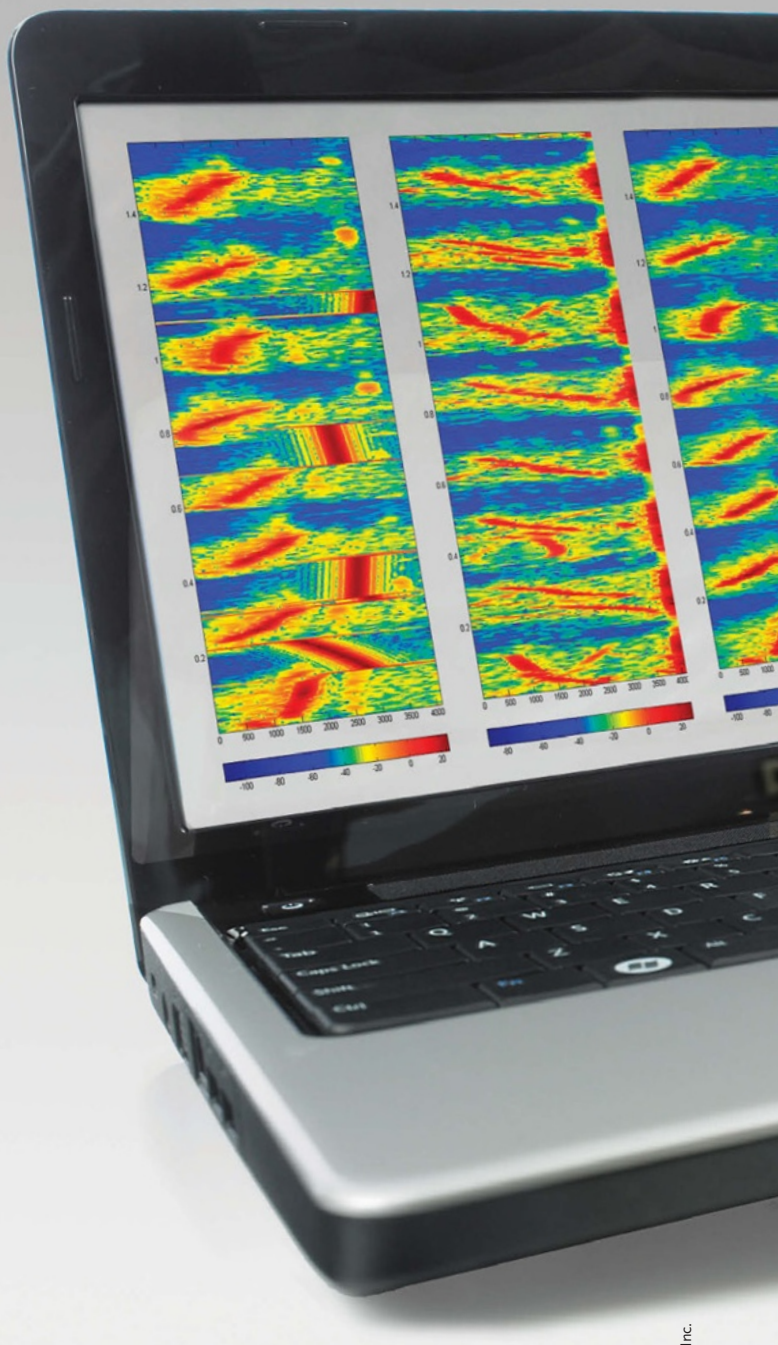

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Rapid Tech Choices for 3D Part Production

How users match materials and systems for building prototype or production parts.

BY PAMELA J. WATERMAN

Ever go into a certain ice-cream shop and find that 31 choices are almost too many? Designers and manufacturers may find the same problem when it's time to create either a prototype or an end product using rapid manufacturing systems. It's a good problem to have, but how do you choose among the dozens of possible fabrication techniques and raw material types?

DE asked officials and customers of four companies—Envisiontec, EOS, Roland DGA and ZCorp—what factors determined application choices. Their answers may help you decide which solution's flavor will work best.

"Jesse" by sculptor Frank Benson is a bust produced first as a mold-master on an Envisiontec Perfactory Xede system at Morpheus Prototypes, then cast in bronze. *Images courtesy Morpheus Prototypes.*

Organic Curves and Smooth Finishes

"A big part of what we do is trying to understand what (customers) are using the rapid prototype (RP) part for," says Shawn Zindroski, president and founder of Morpheus Prototypes, a California service bureau with multiple systems and more than 10 years' experience. "With the evolution of the systems and materials, 3D prints and RP models can be used not only just to look at, but also as functional models—looks-like, works-like models, potentially for short-run production or even production."

Zindroski says that although his company creates working parts for various industrial customers, much of his business involves organic sculpture- and art-based models, as well as toy models. For these applications, he likes the build speed and surface details of parts built on his Envisiontec Perfactory Xede to capture a model or character in its total integrity.

Envisiontec parts made from SI500 (an ABS-like photopolymer) can be painted for a final product/sample or used as patterns for tooling. The system's continuous, layerless z-build technology produces a surface accuracy ranging from 0.002 in. to 0.0006 in. without visible layering lines.

"It's a versatile machine for higher-accuracy surface models," Zindroski explains, "where we go from industrial applications to art-based applications." He adds that his biggest problem is helping users from the gaming and entertainment industries understand the nuances of ensuring proper part thickness or offsets when creating the 3D solid model.

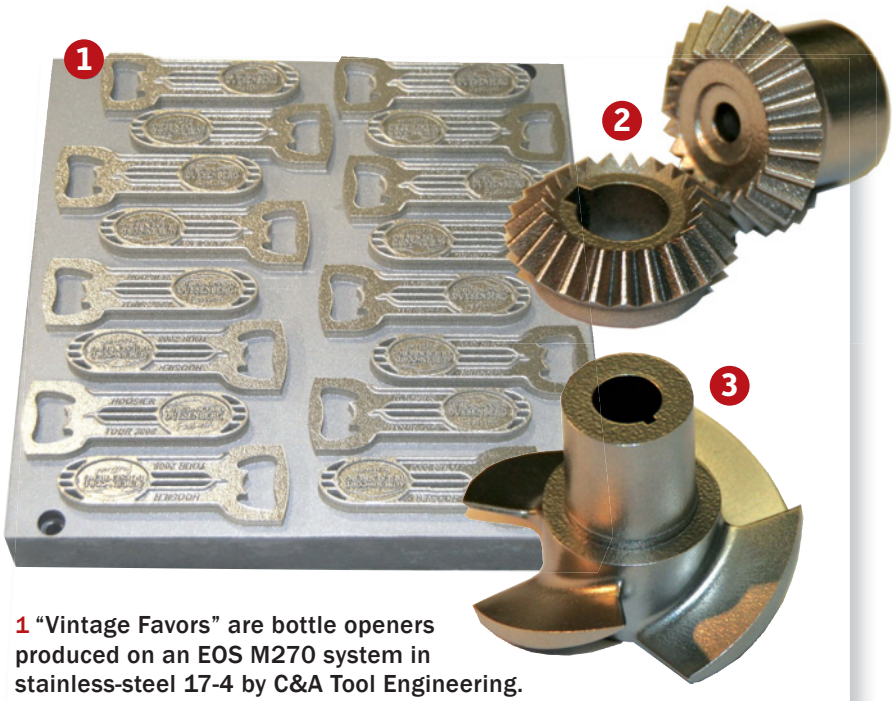
Modern Metal Masters

The phrase "Old World craftsmanship" may not immediately bring to mind additive manufacturing techniques, but it does evoke attention to detail. At C&A Tool Engineering, those words capture a point of pride suggested by the company's Swiss-chalet-like building architecture (in the middle of Indiana), and confirmed by the complex fuel-system, medical and aerospace components and tooling it produces. The phrase also aptly describes the capabilities of its EOS direct metal laser sintering (DMLS) systems.

C&A President Richard Conrow says that the need to

produce exacting geometry drove him to supplement his traditional machining tools with the first of eventually three EOS systems. Added to the challenge is the fact that many of his customers are involved in R&D. Such groups are downright secretive about the reasoning behind their specifications, or just how the product will be used. The company must be ready to handle any requirement, whether geared toward a prototype or final part. Versatile EOS systems provide a critical advantage.

"Most of our customers are looking for something functional," Conrow explains. "The degree of difficulty, quick turnaround time, size and weight all determine when using DMLS is appropriate. Many items absolutely cannot be machined." He says the medical field uses this technology more than most, and much of that activity is because of advancements in materials. Typical DMLS parts include titanium acetabular shells and stainless steel surgical guides.



1 "Vintage Favors" are bottle openers produced on an EOS M270 system in stainless-steel 17-4 by C&A Tool Engineering.

2 C&A Tool Engineering produced this finely detailed set of beveled gears in cobalt chrome on an EOS M270 system.

3 C&A Tool Engineering produced this finely detailed impeller in cobalt chrome on an EOS M270 system. *Images courtesy C&A Tool Engineering.*

C&A Tool built an entire impeller, including blades, hub, keyway and bore, using DMLS—with every part complete, down to its final finish. The cost and performance were competitive with traditional casting and machining processes. Conrow says he believes not all customers realize that this approach can maintain tolerances of +/- 0.002 in., and that today's systems produce fully dense parts.

The company also sees a strong role for DMLS technology in manufacturing tooling sets. The ability to create conformal cooling channels and rake angles offers critical improvements in tooling performance.

Conrow likens his metal-working specialty business to an art, and refers to C&A Tool's employees as master craftsmen. The team recently completed a custom order for 30 class rings on the EOS systems, so it's easy to believe.

Forming a Niche in Tooling

Sometimes the most successful companies start with an "aha" moment. When Jeff Ewert of Forming Solutions Inc. (FSI) was an engineering manager for a thermoforming company, he heard about the same problem over and over: The machine shops that made his prototypes lost production time whenever they had to clean aluminum residue out of the computed numerically controlled (CNC) machine to switch to using dense RenShape urethane foam. His lightbulb decision: set up a shop specializing in foam-type projects only, and avoid the cleaning problem altogether.

FSI's rapid system of choice from Day One, back in 2004, was an MDX desktop milling machine from Roland DGA. Although capable of handling a wide variety of metals, woods and other materials, the company uses it strictly for non-metal products such as RenShape, nylon, urethane, epoxies and phenolic plastics.

The Roland system is so compact and self-contained, in the beginning Ewert took the equipment to trade shows and even to the customer, producing prototypes "on the doorstep." Business success led him to open a permanent location called Forming Solutions. His former employer became his best customer, and his competitors started sending him their own foam jobs. Now FSI's system runs almost non-stop—especially lights-out, unattended, at night.

Within the niche market of thermoforming, FSI creates prototypes from about 6 in. on all sides to larger than 18x20 in. Ewert has even created larger parts by rotating them through different spindle orientations or bonding smaller pieces. Because of the durability of the materials handled by the Roland system, some of his customers use the molds for actual production runs of 50 to 1,000 parts; others use them to confirm fit and function before committing to expensive hard tooling.

Ewert says the MDX equipment lets him create parts "almost in a production scenario—but no two are alike." He points to the huge cost advantage of the Roland setup compared to that for a traditional CNC machine, or even to other desktop milling systems and adds, "I wanted the good name and quality."

Steps in the Right Direction

Just as a building is only as good as its foundation, a new shoe design depends on all the right attributes of its sole. Determining the details of that design is one of the many jobs of Toby Ringdahl, CAD/technical development manager for global footwear product development at Timberland Boot Co.

Forming Solutions Inc. (FSI) milled this medical prototype mold with snap-in components on a Roland MDX system. Material used was MB-4000 Urethane foundry board. FSI chose the Roland system for low-volume thermoform runs, producing good part clarity. The company ran 250 parts from this mold; more could be run without any problems. ***Image courtesy Forming Solutions Inc.***

1: The completed shoe-sole prototype.

2: Prototype Timberland shoe "last" being removed from the powder bed of a ZCorp 650 3D printer. ***Images courtesy Timberland Boot Co.***

Twelve years ago, Ringdahl managed the Timberland model shop, where two people devoted their time to handcrafting elements of shoe models from wood, Bondo and filler materials.

"It was all just to see what the part would look like before we opened the mold, which was built overseas," explains Ringdahl. "If it was incorrect, you'd start over again—and lose a lot of time plus the money."

It was a slow and expensive process for an industry that demands at least two complete product development cycles per year, and where naturally, Timberland wants to be first to market for any given style. Moving to laser-scanning of the handmade models and recreating them in CAD was the first step toward streamlining the design process.

In 2003, as a trial effort, Ringdahl started outsourcing 3D CAD designs to a service bureau running ZCorp 3D printers. Prototypes made on these powder-based systems were so accurate and insightful, by the end of the year he bought his own unit: a monochrome ZCorp 310 that immediately saw extensive use. In a single development season, his group may work on 20 to 24 sets of tools, printing several iterations each of outsoles and components to get everyone to agree on a shoe's form, fit and function, from design to product management to engineering.

"That's a lot of material we go through," adds Ringdahl, who has since upgraded his equipment—first to a ZCorp 510 color machine, and most recently, to the more automated 650 model. He says they run almost every day, printing prototypes not just of the soles but also of the "lasts"—the forms over which leather is stretched to make the shoes. (Production lasts are CNC-machined from recyclable plastic.) Color, resolution, speed of operation, cost of materials and cost of operations have all made the ZCorp system the best choice for his group's prototyping work, he says. DE

Contributing Editor **Pamela Waterman**, DE's *simulation expert, is an electrical engineer and freelance technical writer based in Arizona. You can send her e-mail to de-editors@deskeng.com.*

INFO

- **C&A Tool Engineering:** CAtool.com
- **Envisiontec:** Envisiontec.com
- **EOS:** EOS.info
- **FSI:** FormingSolutionsInc.com
- **Morpheus Prototypes:** MorpheusRP.com
- **Roland DGA:** RolandDGA.com
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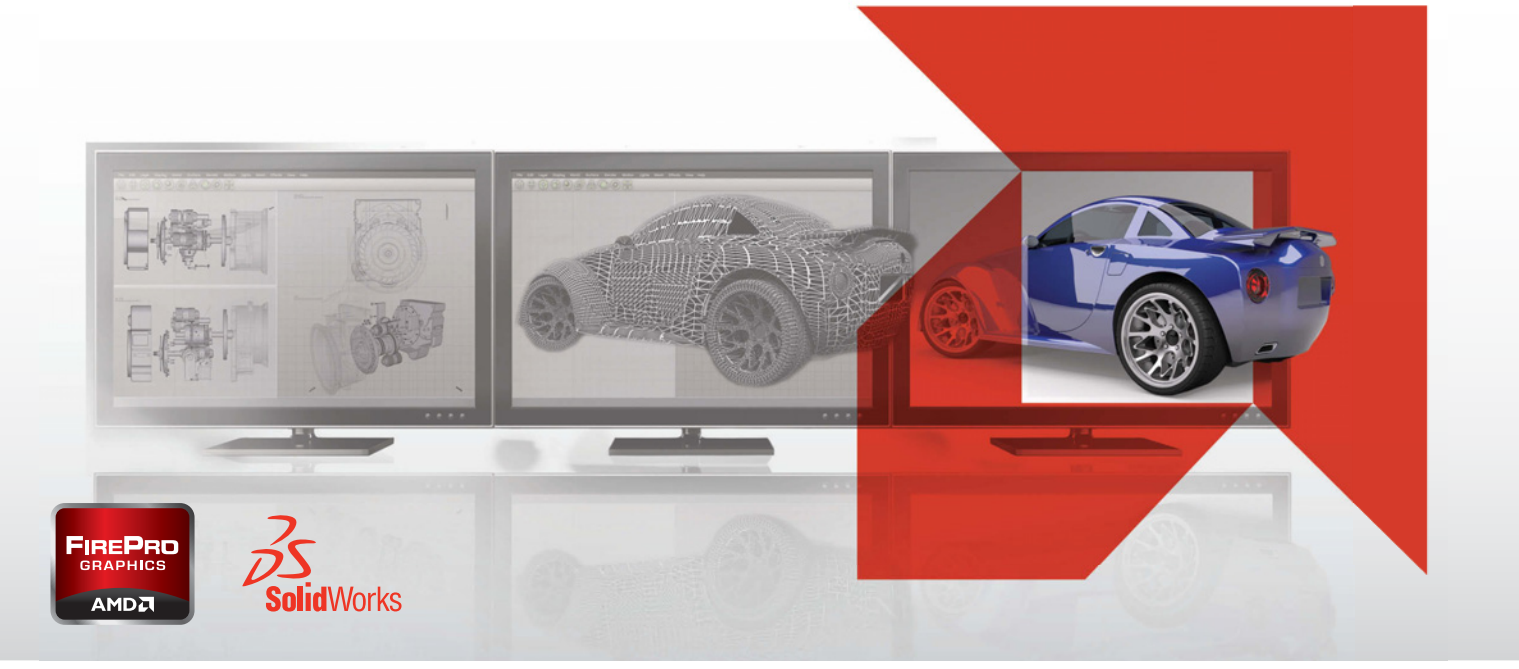

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Cloud Computing Forecast: Still Hazy

Moving to the cloud holds promise and risks for engineering companies.

BY BRIAN ALBRIGHT

Image courtesy of iStockphoto.

Cloud computing has caught fire with both chief information officers (CIOs) and the press, and nearly every industry software vendor has announced some sort of cloud-based offering or a cloud "vision," regardless of whether that vision has anything to do with an actual cloud computing service.

According to Gartner's 2011 CIO Agenda Survey, technology executives expect to expand their use of cloud and software-as-a-service (SaaS) technologies significantly. Three percent of executives currently have the majority of their IT systems running in the cloud; in the next four years, that number could leap to 43%.

There are three flavors of cloud computing that could potentially be of use to designers and engineers:

1. The hosted software model. Instead of having a licensed copy of an application on the designer's desktop, you access the solution via the Internet. In some cases, that may mean that the application exists on the software vendor's servers; in others, disparate locations within a company may share one instance of an application that exists on either a private or public cloud.

2. Cloud-based storage. This provides access to shared, external storage capacity.

3. Infrastructure-as-a-service (IaaS) or platform-as-a-service (PaaS) cloud offerings that offer server capacity on demand.

(See "Defining the Cloud" on page 41 for a discussion of more cloud computing terms.)

Most AutoCAD solution providers have announced some sort of cloud or hosted software offering, but engineers have been reluctant to embrace them. For energy- and resource-hungry simulation and rendering tasks, though, the IaaS model could have particular promise for the engineering community.

"I think that these kinds of engineering use cases are some of the most immediately compelling, because they are big expenditures," says Gartner analyst Lydia Leong. "If you can move some of the workload into the cloud,

you get agility and lower costs. As a supplement or alternative approach, it's quite attractive."

New Offerings Come with Risk

So far, only a small percentage of design firms are using cloud-based solutions for simulations and rendering. Slightly more have taken advantage of cloud services for file storage or collaboration activities.

A few technology vendors have even developed entire solutions around this concept. UK-based Dezineforce, for example, offers a hosted high-performance computing (HPC) design simulation platform that is available as an on-site appliance or cloud-based service. Consulting firm Intelligent Fluid Solutions used it recently to simulate the optimal position for turbines on a wind farm, saving the firm the cost of investing in an HPC cluster.

NEi Software, meanwhile, has developed a cloud-based solution called Stratus that allows engineers to run basic analysis projects and view outcomes on iPhones or iPads, as well as tackle some pre-finite element analysis (FEA) tasks.

Still, moving any operation to a set of outside computing resources has inherent risks in terms of security, reliability and cost. "The classic trade-off is security and control of having your own infrastructure, vs. having the versatility of being on a shared infrastructure," says Avi Freedman, chief technology officer of ServerCentral, a managed data center solutions provider in Chicago.

If you are thinking about tapping extra computing power in the cloud, you should conduct a thorough risk analysis to determine the potential impact of a failure or breach, and the probability of those risks. Once that's complete, work with the service provider to establish a mitigation plan for the most critical problems.

"People have to understand what the actual risks are, and try to separate those fears from the reality," Leong says. "Some risks can be technically mitigated, like ensuring that there is security in place. Some are part of the overall business risk that comes from having a lower-cost solution."

A Question of Bandwidth

For companies considering moving simulations or other computing tasks to the cloud, one primary obstacle is bandwidth. Uploading massive meshes and then downloading the post-data files can cause a bottleneck at the end-user level, depending on the type of internal network and WAN involved. If you are moving a terabyte of data over the Internet to the cloud, it can have tremendous ramifications for performance on both ends of the transaction.

"If you are trying to do simulation and modeling, and you have to upload 3GB of raw data, and you have a DSL line in your office, that's a bottleneck on your end that will be very difficult to manage," Freedman says. "Users don't necessarily need that high-speed connectivity, but the internal data center needs to be where it can get at high-speed access to the cloud."

> **"I personally approve of cloud computing, but my company ... behaves like the little old man that still keeps his money in a metal box under his bed. They don't trust technology when it comes to data security.**
> ***— DE cloud computing survey respondent***

That means companies have to evaluate exactly how much data traffic they expect to generate, and how often. Bandwidth is expensive, particularly if you are moving large amounts of data to and from some set of third-party servers miles away.

"You have to evaluate whether this particular type of high-performance computing is going to work well on this type of infrastructure," Leong says. "Look at the performance implications of not using a high-performance network interconnection. If it's slower, will it matter if it's cheap?"

There are some ways around this, including different approaches to compression, or accessing results remotely without actually downloading the data. Some cloud services providers also offer the option of accepting physical media, like tape drives (Amazon.com does this, for instance).

You also have to ensure that the provider can offer the computing capacity you need across its entire infrastructure, as well as evaluate the way the provider handles resource allocation.

"How are virtual machines sharing physical resources?" asks Kevin Mills, senior research scientist in the Information technology Laboratory at the National Institute of Standards (NIST). "That's something the user has no control over, and therefore you have a right to be concerned about it. Providers will tell you to test your system on their services to get a sense of how it will work. But if there's a resource allocation decision change between the time you test it and the time you want to run it in the future, the answers may all be different."

The Security Debate

By far, one of the biggest concerns companies have about outsourcing their IT is security. Many people are uneasy

SCRUTINIZE CONTRACTS, SERVICE CAPABILITIES

Because you are handing your data over to a cloud provider, contracts have to include language about service and uptime guarantees, how security breaches or temporary loss of service will be handled, how data will be backed up and managed, and what will happen in the event you decide to switch providers or end the contract.

Gartner has identified a number of cloud service contract deficiencies, including contracts that do not include the typical legal, regulatory and commercial requirements of an enterprise contract; contract terms that generally favor the vendor, and are highly standardized; contracts that are often opaque and lack detail; and contracts that sometimes don't include clear service-level commitments.

1 Determine how (or if) the provider will back up the data you send, and how many live copies of the data will exist. Companies will need to take on some of this responsibility by creating their own back-ups, or even using a different cloud provider to handle back-ups.

"In a dedicated cloud environment, customers almost always design in a back-up to their data center, even if it's asynchronous," says Avi Freedman, chief technology officer of ServerCentral. "It really varies widely. Some companies keep a repository, but they don't have the server capacity to turn everything on. Most companies don't do that because the whole reason they are outsourcing is that they don't want to run that kind of power in their own data center."

2 Examine the provider's ability to keep an eye on your resource utilization and possibly provide alerts. "What kind of monitoring do they do?" Freedman asks. "Will they monitor the application or performance to let you know you are capacity-constrained?"

If there is some kind of failure, how quickly can the vendor provide recover data? How does it measure performance and uptime? Application performance may vary, based on the geographic location of the servers and the system architecture.

Every vendor seems to measure this differently, but sites like CloudSleuth (CloudSleuth.net) and CloudHarmony (CloudHarmony.com) have attempted to evaluate the performance of cloud providers under various use cases so that users can create realistic comparisons. CloudHarmony, in particular, has undertaken a number of benchmarking studies.

3 Pay particular attention to how the company awards credits in the case of an outage, and how long the continuous outage threshold is before credits are issued. These outage thresholds can range from 30 minutes to several hours, depending on the vendor.

4 Price is also important, but can vary wildly among vendors. There are generally charges based on computing use, storage capacity, and bandwidth usage, but rates can be applied in a variety of ways.

5 Monitor usage carefully, particularly when engineers in disparate locations are accessing services. "If your side of a computing job takes up 100 servers, and you forget to turn them off when you're done, that will be a big bill at the end of the month," says Gartner analyst Lydia Leong. "People severely underestimate how much user management will be required. You can't let all the engineers loose to buy whatever they want without supervision."

Other factors that can affect cost are a lack of scalability, and software license issues. Licensing is a challenge that the cloud community has yet to completely resolve: If you use a flexible cloud infrastructure to run an application, what ramifications will that have in terms of the number of software licenses you have purchased? Depending on exactly what you're utilizing a cloud provider for, you should make sure to investigate the issues with all of the vendors involved.

Last but not least, the service level agreement (SLA) is critical, because it will spell out what you can expect from the vendor—and what it will do if it doesn't measure up to those expectations. If the SLA is vague, ask for specifics in writing.

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> **Cloud, schmowd! I like to keep my data where I can see it.**
>
> **— DE *cloud computing survey respondent***

about working on machines that are not under the physical control of the engineer or the company.

Security breaches do happen—even to large, experienced companies like Google and Amazon. Logic dictates that cloud service providers will have the best security money can buy, but illogical things happen. To protect your business, demand transparency from the service provider as to what types of security, encryption and authentication it is employing. If there is some type of breach, there should be language in your contract indicating how the provider will respond, and how it will compensate you for your loss of service (if there is a loss) through credits. However, if the breach involves sensitive customer data of some sort, the owner of the data ultimately bears responsibility to those customers.

You should also determine what controls the provider has in place to prevent internal security breaches (limiting administrative access for employees, for example).

Evaluate the Vendor

Even if the potential service provider meets all your criteria, you still have to decide whether it will be a reliable partner, and remain in business for however long you need to purchase its services. That can be difficult to determine. There aren't really any cloud-specific industry standards or certifications to look for, although most providers adhere to typical data center certifications, or may have specialty certification like PCI (for retail payment) or HIPAA (for healthcare).

Find out whether the provider is using solutions that it has developed on its own, or if it's using open source or other underlying technology. "With cloud computing, if you are buying from a vendor that developed internally, that has risks—and you have to be comfortable with that," Freedman says.

Also keep a close eye on the provider's financial solvency. Many cloud companies have entered the market with cut-rate pricing to attract new customers, but some

of them are not cash flow-positive or profitable.

Have an honest discussion about what will happen to your data in the event the provider goes belly up. It may be possible to continue using the technology even after the provider has dissolved, particularly if your application or data has been locked into a proprietary solution. In some instances, vendors might provide what's known as "solution escrow" so that if they go out of business, customers can still access the underlying code or network system architecture. This reassures customers that they won't be left high and dry if the provider goes out of business.

Although IaaS or other cloud-based services could potentially help companies save money and increase performance, they have yet to establish much of a foothold in the engineering community. For companies that are considering making the move into the cloud, careful investigation and testing should be the first steps in that migration. DE

Brian Albright *is a freelance journalist based in Columbus, OH. He is the former managing editor of Frontline Solutions magazine, and has been writing about technology topics for 14 years. Contact him via de-editors@deskeng.com.*

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- **SGI:** SGI.com/products/hpc_cloud/cyclone
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- **VPS.net:** VPS.net
- **Windows Azure:** microsoft.com/windowsazure

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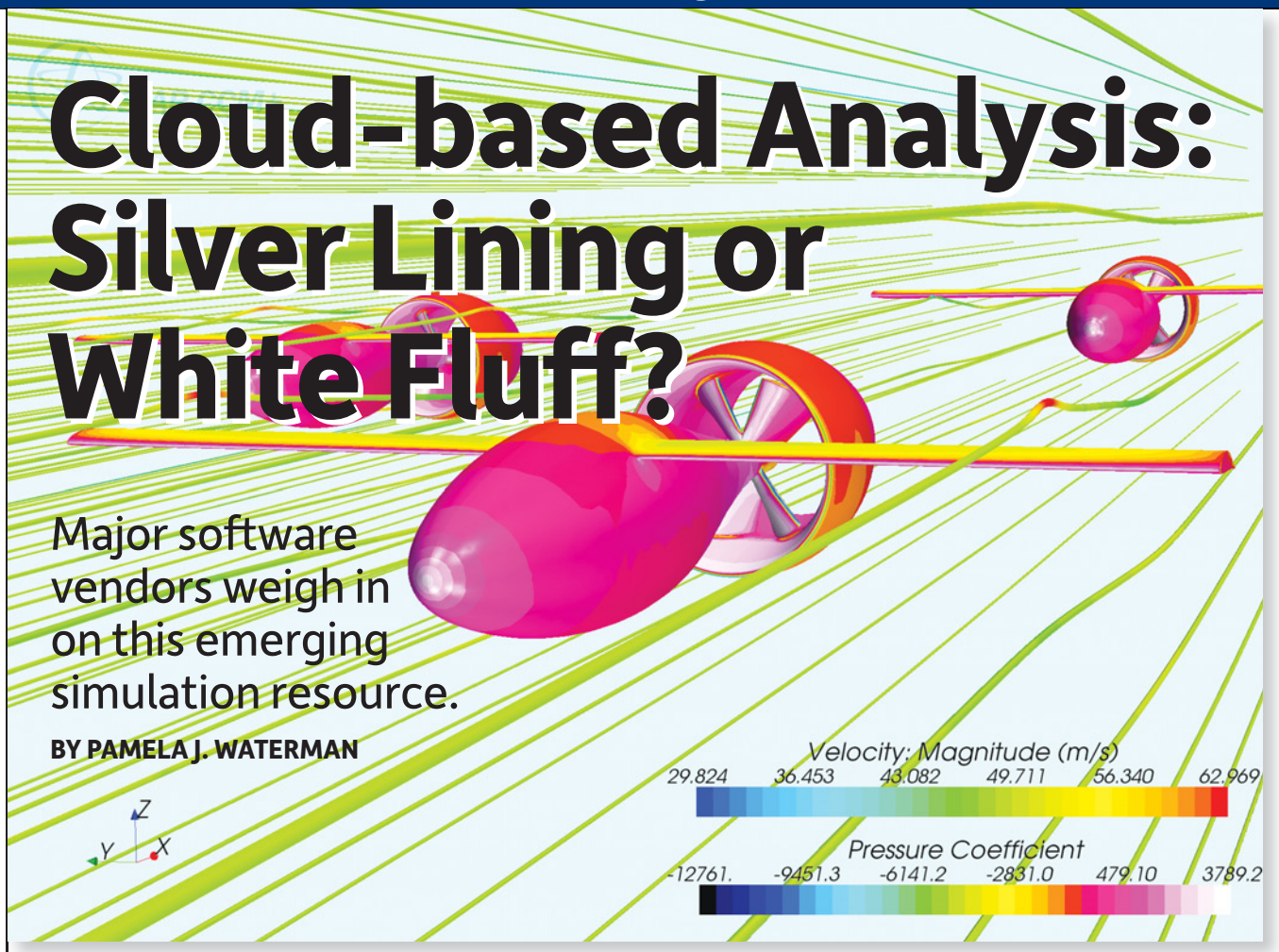
Cloud-based Analysis: Silver Lining or White Fluff?

Major software vendors weigh in on this emerging simulation resource.

BY PAMELA J. WATERMAN



Velocity and pressure values of a formation flight of Pusher UAVs demonstrating the complexity of analysis well suited for computation on a cloud-based system. Analysis performed with CD-adapco's STAR-CCM+ Power-on-Demand cloud-computing services. *Image courtesy CD-adapco.*

Trying to get a handle on cloud-based engineering analysis can be like trying to get a fistful of a real cloud. The edges are undefined, the shape keeps changing, and it's hard to see what's right in front of you. Current software-vendor opinions and solutions range from not addressing the topic to "working on it" to fully supporting multiple levels of cloud-based services based on more than a year's experience.

DE spoke to five major vendors deeply involved in finite element analysis (FEA) and computational fluid dynamics (CFD) to view cloud-based analyses in action.

Approaches to Cloud Computing

In 2008, CD-adapco took the first steps toward expanding user resources for its STAR-CCM+ CFD software by creating Power Session, a pricing structure that gave users access to unlimited computation resources (as many cores as desired) for a single fixed fee.

The approach's success led to user requests for multiple simultaneous sessions for such projects as design-of-experiments. As a result, in March 2010, CD-adapco introduced a new product-license plan that incorporates cloud-computing, called STAR-CCM+ Power-on-Demand. This option allows users to run a STAR-CCM+ Power Session simulation using any on-demand service among public, private or hybrid clouds, and fills two purposes.

"First, the user has access to the software by the hour," says Jean-Claude Ercolanelli, CD-adapco's senior vice president of product management. "We don't count the number of processors that are running or the number of sessions running at the same time. We're giving him access to perform a large number of runs at the same time on an unlimited number of cores, for very quick turnaround time." Either CD-adapco or the user can upload the software to the cloud.

Power-on-Demand fills a second need, too. "It often happens you have the need for a 'burst' capacity—maybe something for a new project where you need answers as quickly as possible," Ercolanelli explains. "Because this

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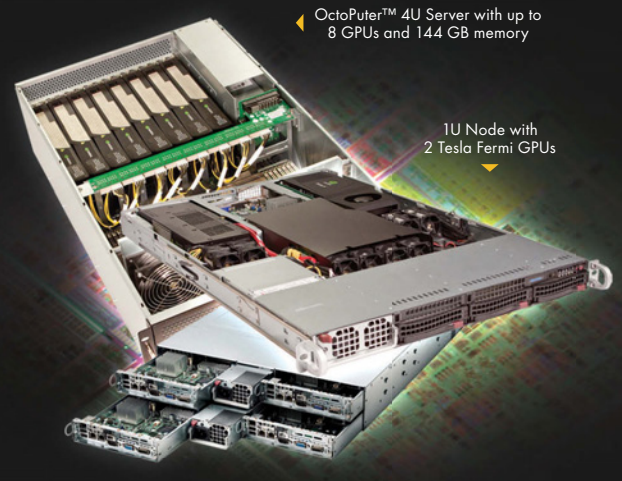

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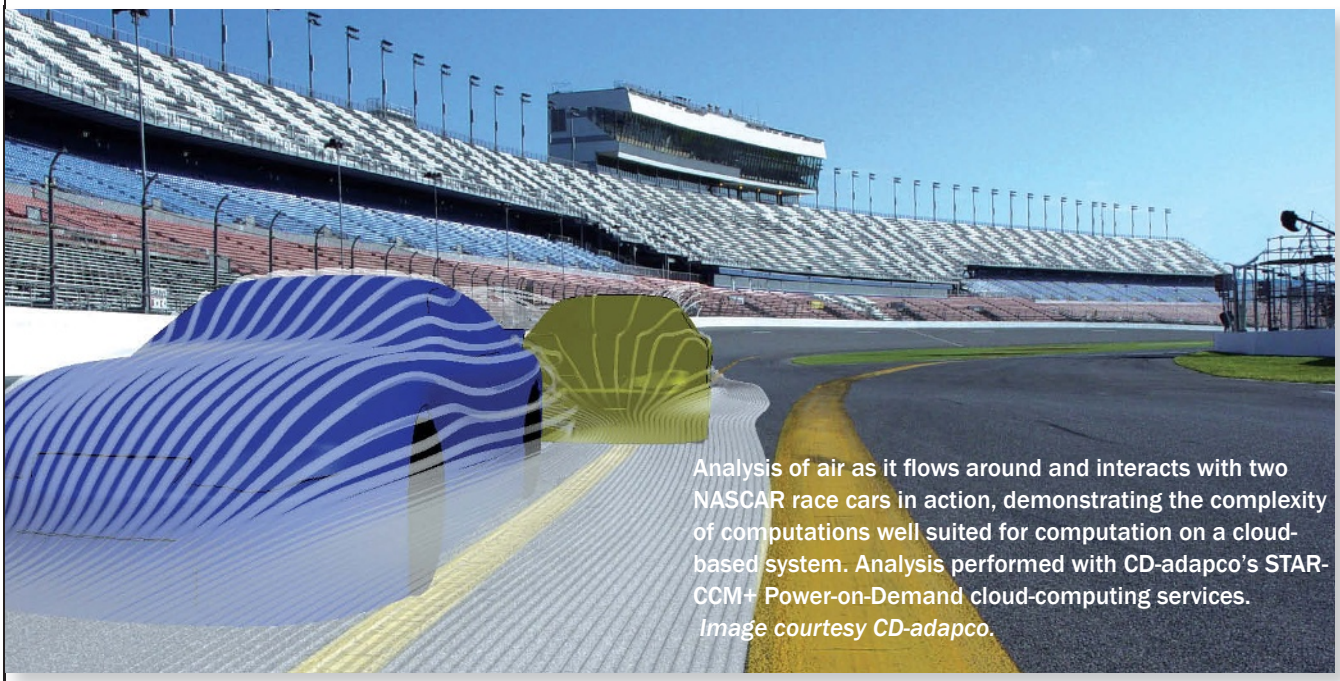

Analysis of air as it flows around and interacts with two NASCAR race cars in action, demonstrating the complexity of computations well suited for computation on a cloud-based system. Analysis performed with CD-adapco's STAR-CCM+ Power-on-Demand cloud-computing services. *Image courtesy CD-adapco.*

What's the Real Benefit of Simulation on the Cloud?

Even more exciting than having the power to process larger simulation models in less time is the opportunity to extract more knowledge from the process of simulation itself. As Autodesk's Bob Williams says, "Simulation does three things: design validation, predicting performance and optimizing designs. Validating design has been done forever, even in 2D. With parallel processing and distributed computing, designers and engineers started using simulation to predict performance more often, incorporating multi-physics and considering more factors. The really untapped area of simulation is all about optimization.

"Historically, because of the time and hardware resources involved, companies were lucky if they did one or two iterations on a part or design," he continues. "If we can remove that barrier and let users study many, many iterations, then we can truly start leveraging the concept of using simulation to optimize designs."

is usage by the hour, it falls into another budget (than regular licenses). A project budget can be used to just run it for the time needed, and be very flexible, very effective." Time-use data is sent to the customer.

Users may still want a local license for CAD import, model preparation and other interactive steps. Interestingly, although cloud power is better suited for pure number crunching, some users employ Power-on-Demand for all their work.

SIMULIA is taking a community approach to building its cloud services. The company believes the ability to flexibly use common resources across a functional group—in a department, organization or supply chain—should be the overall goal, and using a cloud-based system is just one element to achieving it.

A community-style platform, whether open to an industry or private for a specific project, lets users in both the modeling and simulation worlds readily communicate information that describes models, results and possible scenarios. Parent company Dassault Systèmes has hundreds of such communities in a mix of public and private versions.

Finding an efficient community concept to manage, manipulate, understand and visualize data may indeed involve a cloud-based system, although today's general-purpose (GP) clouds are not yet optimized for high-performance computing (HPC). However, SIMULIA officials believe the currently limiting issues of compute speed and data transfer are not inherent in the cloud concept and will be overcome, so the company is beta-testing a cloud-based version. Most likely, the configuration will have dedicated HPC clouds connected to GP clouds, with a collaborative, managed environment invisible to the user.

Autodesk has made efforts across its entire platform of design, visualization and simulation products to branch off into both software-as-a-service (SaaS) and cloud computing, or as the company often says, infinite computing. Autodesk's simulation portfolio, which includes Autodesk Inventor Professional, Autodesk Simulation, CFdesign and Autodesk Moldflow, already takes advantage of some level of cloud operation.

"If you think about the history of simulation in general, this is really the

> **On one hand, I'm uneasy about having my work on a machine that I don't physically control. However, I can see the possibility of being able to use software on a per-use basis, which would not be used frequently enough to warrant paying for a regular license to have it on my own machine.**
> — DE *cloud computing survey respondent*

next logical step," says Bob Williams Autodesk product marketing manager for simulation. "Simulation providers have done different things to continually keep up with what's available with hardware, such as supporting increasing RAM and distributed computing, making a very direct connection between hardware and simulation software. Yet those resources are still limited by the hardware a company has. If you take the same concept and move it to the cloud, it removes all those barriers."

Autodesk Moldflow software includes a feature called Design of Experiments that previously wasn't extensively used, but is now popular on the cloud. Williams points out that in the past, you simply lived with your power limitations; now, users can create more realistic simulations with fewer simplifications.

Autodesk Moldflow use on the cloud has been by invitation to customers and for no extra fee. Inventor Optimization technology was wide open to Inventor users for about a year, also for free, and hundreds of users have performed thousands of simulations on the cloud. Autodesk is working to find an appropriate cost structure for the future, perhaps with monthly licensing. At the same time, the company has no intention of eliminating its desktop software products.

ANSYS officials believe that the primary technical issues in using centralized HPC systems or cloud resources are related to remote access. Simulation files are large, so moving them from user to server and back again is clumsy and time-consuming. One solution is to let customers store the data in an HPC resource while maintaining control over access and intellectual property (IP) protection. Centralized fail-proof licensing, job scheduling and workload prioritization, however, are still viewed as challenges.

For hosted clouds, the company offers a "bring your own license" approach, letting ANSYS customers use licenses they already own, or additional peak-capacity licenses, on any physical system. The new parallel licensing model enables a simulation to execute on thousands of cores without a per-core license.

Moving to a fully public cloud raises additional customer questions about technical, licensing, security and IP challenges. ANSYS is currently in a prototyping phase, testing and benchmarking the overall user experience to understand the technical barriers to adoption.

Toolbox Math in the Cloud

A different angle to this topic comes from The MathWorks, the MATLAB people. Users can already scale up their work across local desktop processing cores with MATLAB's Parallel Computing Toolbox. High-level constructs let users parallelize MATLAB applications without requiring message-processing interface programming. The Toolbox provides eight "workers" (MATLAB computational engines) to execute applications locally on a multi-core desktop.

Without changing the code, users can run the same application on a computing cluster or a grid-computing service, using MATLAB Distrib-

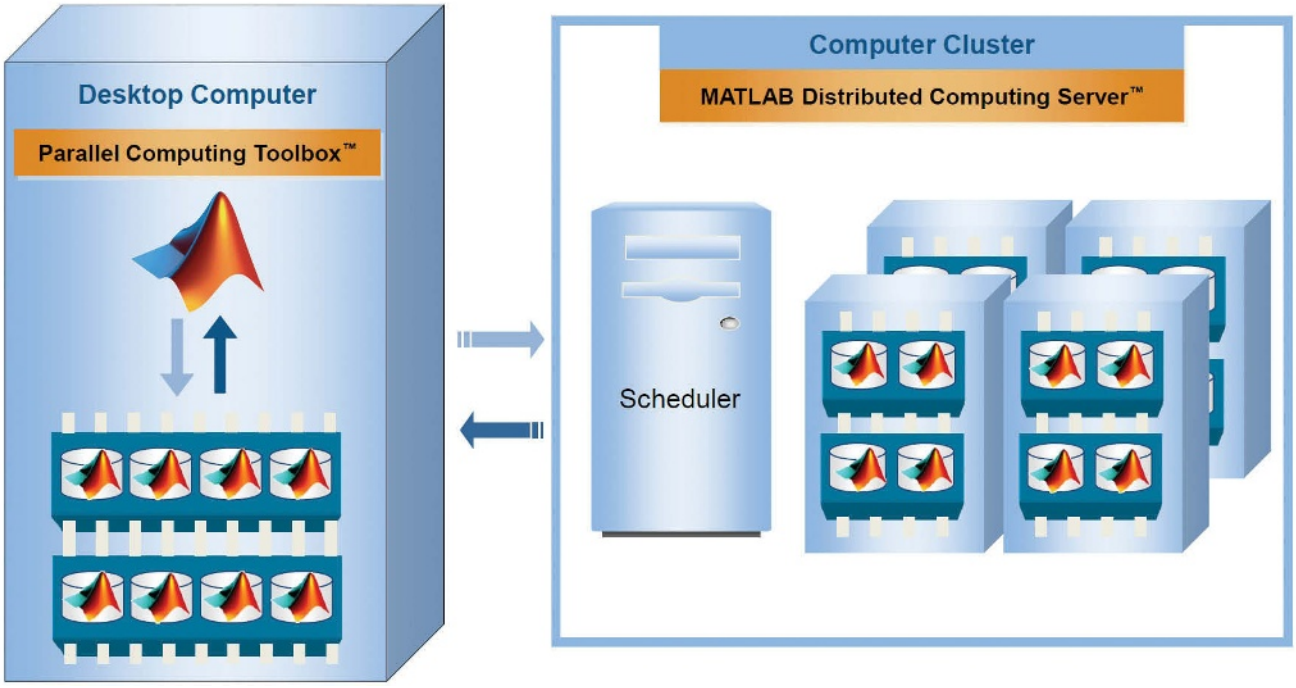

Diagram showing how MathWorks MATLAB parallel computing workflow that lets users perform scalable, cost-effective analyses using MATLAB workers on a computer cluster. Users develop parallel MATLAB applications using MathWorks Parallel Computing Toolbox on their desktop computers and scale them to a computer cluster running MATLAB Distributed Computing Server software. *Image courtesy MathWorks.*

uted Computing Server (MDCS) software. A single user license can run on any cluster as long as users have paid for the given number of workers. Perpetual licenses are standard—a real bonus.

Expanding on this approach, users can take their own MDCS and put it on their preferred cloud structure. Silvina Grad-Freilich, MathWorks' manager of parallel-computing marketing, says that thousands of MATLAB customers have already downloaded the company's online white paper titled "Parallel Computing with MATLAB on Amazon Elastic Compute Cloud." She notes that because security is a big issue, users might want to read Amazon's own paper on the subject. MathWorks is also piloting a pay-per-hour licensing utility model.

Cloud Status Report

What issues are still not clear through the mist? One area that has held back simulation on the cloud is the difficulty in analyzing all the data afterward. Today's users generally must download very large files for post-processing and interactive visualization. However, SIMULIA officials believe that new technologies for rapid remote visualization and smart searches will emerge. These innovations will be key to helping users manage and manipulate the increasing amounts of data generated from ever more scenarios.

Security is another hot topic. The typical agreement between the user and the cloud server (rather than the analysis software vendor) makes many people uncomfortable.

> **It's just another effort by the industry to tie customers into a subscription versus license. They lose sleep at night knowing how many people are using two- and three-year-old versions without paying another dime. — DE *cloud computing survey respondent***

Others disagree, pointing, for example, to Amazon's years of experience with the task. SIMULIA's experts have even talked to customers who look to cloud storage as a way to control data, avoiding theft and loss of data from mobile devices and laptops.

Operating in the cloud offers the benefits of scaling and accommodating company growth, saving compute and IT costs for per-seat software upgrades—and even saving on electricity and cooling systems for in-house HPC servers. In fact, CD-adapco notes that many customers, particularly new ones, are choosing them simply because of these cloud-based service advantages.

Private. Hosted. Public. And you thought the three cloud types were cirrus, stratus and cumulus. We're all learning. Stay tuned to the *DE* weather report for the latest updates on cloud computing. DE

Contributing Editor **Pamela Waterman**, DE's *simulation expert, is an electrical engineer and freelance technical writer based in Arizona. You can send her e-mail to de-editors@deskeng.com.*

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Rendering on Someone Else's Server Farms

Tempting possibilities in cloud computing are tempered with caution.

BY KENNETH WONG

When the magic of storytelling takes over, time melts away. This year, as you watch the return of the unlikely martial arts hero Po in *Kung Fu Panda 2* or the adventures of *Puss in Boots* in the upcoming *Shrek* spinoff, the narrative and stunning imagery (screened in 3D where available) might help you escape the daily humdrums for roughly two hours. But for digital artists and filmmakers at DreamWorks, time is the nemesis they wrestle with constantly.

The size of the digital asset for the original *Shrek* was a whopping 6 terabytes. By contrast, a single sequence in *How to Train Your Dragon* amounted to more than 6TB. An entire movie could easily run up to 90TB or more today. Counted in rendering times, the original *Shrek* (2001) took 10 million to 15 million computing hours to complete. When *Shrek Forever After* (2010) came along, the added complexity and sophistication bumped the rendering time required up to 55 million hours—the equivalent of 6,278 years ("Luring Hollywood to Cloud Computing," Dec. 2, 2010, *Bloomberg Businessweek*).

Fortunately, DreamWorks has found a workaround. Animators' secret to defeat time is apparently cloud computing. The animation studio borrowed computing resources from Cerelink, a New Mexico-based IT firm specializing in providing on-demand, high-performance computing (HPC) over broadband networks. The firm was responsible for providing roughly 200 million hours of rendering time on its servers to complete a portion of *How to Train Your Dragon*. Last July, DreamWorks and Cerelink signed a multi-year agreement for the animation studio to use what Cerelink describes as "elastic cloud."

Most visualization demands confronted by design and engineering firms—from rendering photorealistic images of 3D CAD assemblies to producing high-definition animations of mechanical operations—probably won't come anywhere near what DreamWorks needs. But the same usage model—accessing remote servers to complete renderings—is quickly gaining ground.

A 3D scene with a Jeep traveling through a tunnel, rendered in Bunkspeed SHOT. Earlier this year at SolidWorks World, the company announced Bunkspeed Cloud, a feature that allows users to publish a 3D scene to a web-hosted server so others may view and interact with the scene.

Bunkspeed Branches into Cloud

In 2010, when SolidWorks revealed it had been exploring the concept of CAD in cloud, it inadvertently set off a firestorm in the blogsphere. Earlier this year in San Antonio, during the company's annual user event, SolidWorks' new CEO Bertrand Sicot did damage control. He assured users that "It will never be an either-or choice for you. We will always offer locally installed desktop CAD. In the end, the market will tell us [what it wants] … the market is you."

While CAD on cloud—running a full-featured 3D modeling program remotely from a browser—has proven to be problematic due to bandwidth limitations and the not-so-parallel computing tasks involved, rendering, a highly parallel process, seems ideally suited for cloud computing.

Just a few corridors away from the main stage at SolidWorks World this year, Bunkspeed, which develops and markets the rendering software SHOT, got ready to showcase its

new offering called Bunkspeed Cloud. Available from within SHOT Pro, the feature lets you upload your 3D scene into a remote server—the proverbial cloud.

"Now, anybody can view it from anywhere, as long as they have an Internet connection and the password," wrote Leon Carpenter, Bunkspeed Ambassador (yes, that's his title), at blog.bunkspeed.com. "This would allow for remote management reviews or allow sales teams to show products live and interactive on their iPads. I can even imagine that someday, soon, all 3D content on the web will be live and interactive."

Bunkspeed Cloud runs in an NVIDIA GPU-powered cloud environment, sitting on mental images' RealityServer platform. Because the lion's share of computing takes place on a remote server, users accessing and interacting with the web-published 3D scene do not need to be on a powerful machine.

Virtual Photography from a Browser

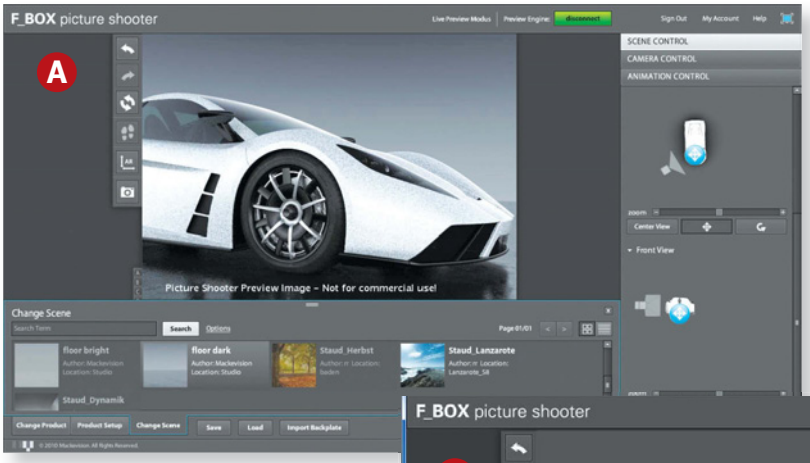
Like Bunkspeed, Germany-based Mackevision anticipates a need for people to render and take digital photographs of 3D objects straight from a browser window. Its offering, F_BOX Picture Shooter, requires no installation, download or client app. All you need is a secure log-in and a password—and the latest version of Flash, because that's what the program uses to send and receive instructions from your machine.

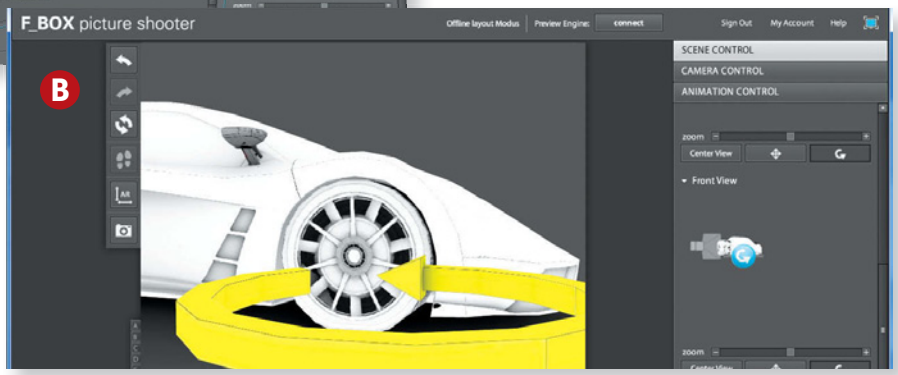
Once you log in, you get access to Picture Shooter's simple, intuitive interface. You can grab and move your camera around the object to get instant perspective updates. You're using someone else's machine—Mackevision's remote server cluster, far more powerful than an average desktop—so your local machine won't become sluggish when you turn on ray-tracing. It comes with some basic animation functions so you can create, for example, the virtual equivalent of a dolly shot around a specific 3D model. Once you're happy with your composition, you may go into the Order Picture window to specify the resolution, format and delivery method you'd like (most will probably choose email).

The application is primarily intended for manufacturers who need to churn out multiple versions of the same product (for instance, six color variations of the same luxury vehicle model). In this case, the account holder may preload the vehicle model with a range of colors possible, then start generating still images using Picture Shooter. The account holder may also provide trusted digital artists with the necessary credentials to generate images.

3ds Max with Remote Rendering

In March, Autodesk began introducing bundles of software put together with specific workflows in mind. (For more, read "Autodesk Tempts Users with Suite Deals," April 4, 2011, at the Virtual Desktop blog.) They are usually available in three versions: Standard, Premium and Ultimate—priced progressively higher for the added products you get. One prominent feature of the suites is, in Premium and Ultimate bundles, you get Autodesk





A & B Mackevision's F_BOX Picture Shooter lets users create digital photographs of a 3D asset hosted on a remote server. Results of real-time interaction with the 3D data and scene composition are rendered on the remote server, leaving your local machine's CPUs and GPUs free.

> **"Especially for CAE, the ability to offload these CPU intensive tasks as an optional feature is something we look forward to utilizing. — DE *cloud computing survey respondent*"**

3ds Max, the company's flagship visualization software.

This is also the same package that caused a lot of excitement last year at the NVIDIA GPU Technology conference, when Ken Pimentel, director of visual communication solutions, media and entertainment, Autodesk; Michael Kaplan, VP of strategic development, mental images; and NVIDIA CEO Jen-Hsun Huang previewed a browser-based rendering function.

In their presentation, Pimentel, Kaplan and Huang used a standard laptop to access a web-hosted 3ds Max architectural scene (hosted by PEER 1) from a browser and render it with nearly real-time speed. Once the scene has been uploaded, the only data a user needs to send to interact with the scene is its virtual position, represented by the mouse pointer. All rendering takes place in the cloud (during this demonstration, Autodesk and NVIDIA used 32 Fermi-class GPUs hosted remotely).

"[Cloud-hosted GPUs] are all running exactly the same iray software that comes with 3ds Max," said Kaplan. "We can guarantee that the image that you get from [the cloud-hosted iray renderer] is exactly the same, pixel for pixel, as what you would get from 3ds Max."

Clouded Judgment, or Judgment Day?

Earlier this year, when *DE* conducted a quick survey with a questionnaire, we found out there's an almost even split between readers who're open to exploring cloud-hosted services and products and those who're determined to shun them. While 37% chose "No [current cloud deployment], but we might in the future," 35% chose "No, we're anti-cloud."

Coincidentally, when Microsoft conducted its own survey, "Cloud as an Engine of Growth," it found a nearly even split between IT decision makers in manufacturing who "know just a little bit about [cloud]" (31%) and those who "know a fair amount about it" (30%). Microsoft's numbers, collected among 437 IT decision makers in manufacturing firms, also revealed that 26% of the respondents "plan to implement [cloud-hosted collaboration tools] at a future date," while 11% "will be implementing in the next year," and 23% "have no intention of implementing this."

The numbers suggest there is just as much hope and enthusiasm as skepticism and reservation about the use of cloud-hosted solutions and on-demand computing. Because your ability to interact with remote servers—the backbone principle in cloud computing—depends on a vendor's commitment to keep the servers running 24/7, the service provider's history of reliability, its historical record of uptimes and downtimes (hopefully more instances of the former than the latter), could become a testament of its credibility.

A recent Amazon EC2 cloud service outage in April, which brought down some of its customers' sites and services—among others, the location-based social networking app Foursquare—gave the cloud-computing movement a black eye. According to Amazon's service health dashboard (status.aws.amazon.com), its data centers in northern Virginia experienced outage for nearly three full days. The in-

cident, no doubt, gave critics ammunition. For small- and midsized design and engineering firms considering cloud-hosted data storage and visualization as ways to compete with bigger rivals that can afford to maintain in-house rendering farms, the Amazon outage was an alarm bell.

Lew Moorman, chief strategy officer of Rackspace, a specialist in data center services, characterized the incident as a "computing equivalent of an airplane crash." He conceded that it was a major episode with widespread damage, but airline travel, he pointed out, is still safer than traveling in a car—meaning cloud computing is still more reliable than data centers run by individual companies ("Amazon's Trouble Raises Cloud Computing Doubts," *The New York Times*, April 22, 2011).

"Every day, inside companies all over the world, there are technology outages," said Moorman. "Each episode is smaller, but they add up to far more lost time, money and business."

The question is not whether cloud computing is foolproof (nothing is), but whether it offers enough benefits to offset the calculated risks inherent in this model, and whether your service provider has a robust plan to keep you in operation during times of crisis. DE

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Author's Note: Some sections of this article were published as separate blog posts at the Virtual Desktop blog.

Cloud Capabilities /// Sponsored by Sabalcore Computing, Inc.

Sabalcore Brings *Real* HPC Cloud with Support

Increase production while reducing costs.

BY JOHN D. VAN WORKUM

HPC Cloud represents a shift toward flexibility in the way companies utilize high performance computing environments. The main difference is that with HPC Cloud, computational needs are met by the purchase of CPU hours rather than CPUs. This provides engineers and development planners the privilege of essentially a "pay as you go" plan. Gone are the days of making appeals to management for the large amounts of capital needed to purchase a in-house cluster. Instead, only small amounts of money are needed to start a new project and processing power can be rapidly increased. HPC Cloud is an attractive solution to the costly problems associated with owning and supporting a large computer cluster.

Sabalcore supports CAE

Sabalcore Computing Inc. is a leading provider of High Performance Computing Cloud services for small- to medium-sized organizations. Design engineering customers use the service in much the same way as they traditionally would with an in-house cluster solution, but Sabalcore allows them to forgo the costly task of purchasing and managing a HPC facility themselves. Sabalcore customers can run virtually any software application, whether it be open-source, commercial, or internally developed. Some of the popular CAE applications used with Sabalcore HPC Cloud include ANSYS, STAR-CCM+, CFD++, and OpenFOAM.

Leverage Technical Experience

Using a High Performance Computing Cloud service has many benefits over purchasing or leasing hardware. Foremost, initial costs are reduced dramatically. By treating CPU hours as a consumable commodity, budgeting and planning become much easier and more flexible. A company not only gets access to high performance hardware (such as Infiniband), it also gains the experience and knowledge-base of its HPC service provider. Sabalcore offers its customers more advanced and technically challenging solutions to their unique problems, thereby saving them time and money. By using an HPC Cloud provider such as Sabalcore, a customer reduces risks, has access to it's knowledge-base and technical experience, and saves time and money. DE

John D. Van Workum *is president of Sabalcore Computing, Inc. For more information email john@sabalcore.com or visit www.Sabalcore.com.*

CFD in the Cloud

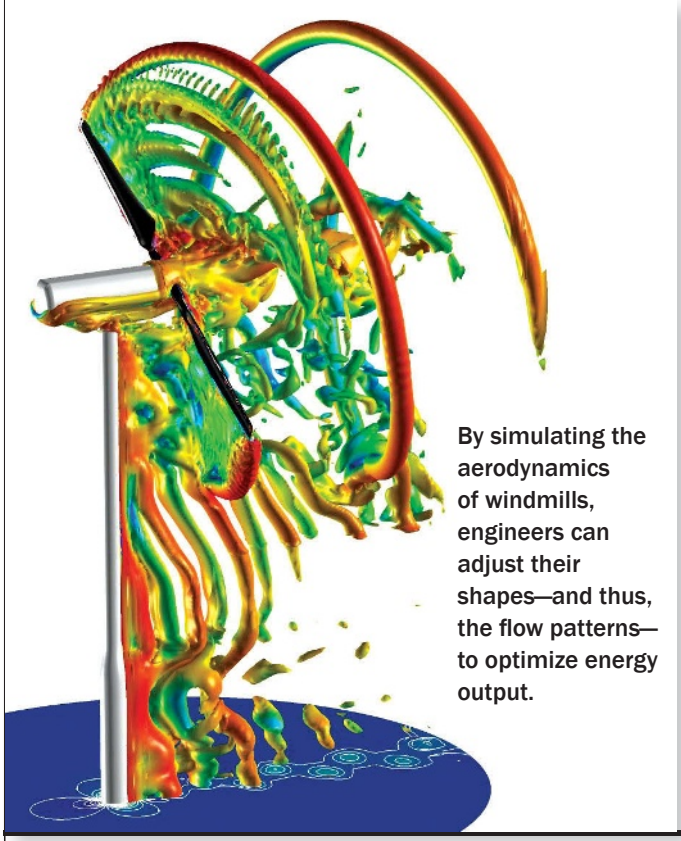
With cloud computing, issues like software incompatibility and server space are minimized.

BY MIKE HUDSPETH

It can be really frustrating trying to keep up with the computer Joneses. Every "x" number of months, software companies introduce new versions of their products and we are expected to jump up on their shiny bandwagon. They expect us to plop down our hard-won cash to upgrade to a new, improved program. And it's rarely cheap.

Some companies solve this problem by upgrading every other version. But the learning curve for the new features can be intimidating after such a long time. Many companies wait for the first or even second dot release before they upgrade so the inevitable software bugs can be identified and, hopefully, worked out.

But unfortunately for later adopters, some companies they do business with upgrade immediately and they may find themselves with file compatibility issues. You know what that means: You can open up an older version of a file in newer software (within reason), but you often can't go back and open a newer version with older software. If you have a vendor that upgrades before you do, you won't be able to read their files. That could force you to upgrade as well. That's just the way it is, right? Not necessarily. One possible solution is cloud computing.



By simulating the aerodynamics of windmills, engineers can adjust their shapes—and thus, the flow patterns—to optimize energy output.

Defining the Concept

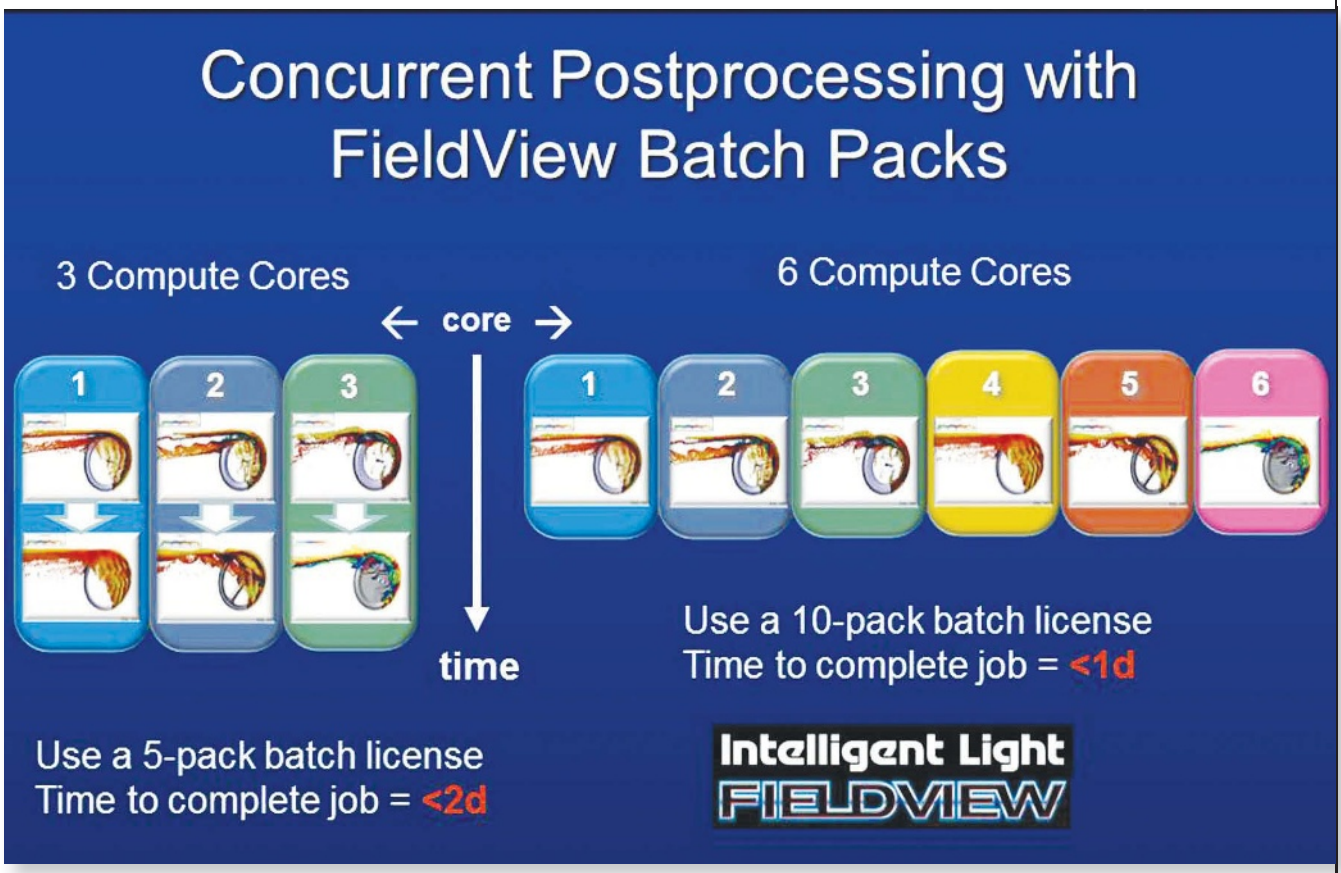
Cloud computing is when you use applications on the Internet to store or manipulate your data. That covers a lot of ground. There are many sites on the web where you can achieve data backups. While that is a fairly simple enough thing, cloud computing goes way beyond just that. It also has to do with the software you use. You need not install expensive software on your computer anymore. You can run your data through software that lives outside your company, on someone else's servers.

Intelligent Light, makers of FieldView CFD (computational fluid dynamics) software, a post-processing program that helps you understand important flow features in your designs, have several real-world examples of using cloud computing.

"We collaborated with a government agency and R Systems (for high-performance computing cloud access) to perform wind turbine simulations for power generation and wake interference studies," notes Steve Legensky, general manager at Intelligent Light. R Systems is a cloud provider that offers the raw computing power and data crunching software to help you plow through virtually any complex problem.

Legensky notes that the project's simulations were both steady—basically, snapshots in time—and unsteady—more like video—and resulted in more than 1.4TB of data.

"With this volume of data sitting on cloud machines at R Systems, it was impractical to move the data for post-processing," he continues. "The data was post-processed on the cloud systems in both batch and interactive mode. For interactive mode, a remote laptop accessed the servers, and FieldView was run in client-server mode to achieve high performance without moving the data off the servers. This addresses the major challenge facing the use of CFD on cloud systems."



Running multiple processors on a single problem can shorten processing time significantly, according to tests conducted by Intelligent Light with its FieldView CFD software.

Reinventing the Wheel

Intelligent Light is also participating in ongoing research into the aerodynamics of bicycle wheels for racing bikes, originally at the request of the American Institute of Aeronautics and Astronautics. It's a project that's taken several years, and continues to this day.

In the most basic terms, Intelligent Light is studying a rotating wheel and how it affects the flow of air around it. Even at the speeds professional cyclists achieve, air acts very much like a liquid. It makes eddies and vortexes that create drag on the cyclist. This is considered to be a very complex problem. Generally under-analyzed in wind tunnel testing, it is difficult to observe many aspects of the airflow around the wheel. There is only so much you can see. The wheel turns and has a moving ground plane.

What's the payoff? Customers believe it is possible to move from 10th place to third place in an iron-man race by careful aerodynamic tweaking.

"Torque was a tricky thing to identify," admits Roger Rintala, strategic marketing manager for Intelligent Light. "We used different wheel designs, angles of attack, angles of rotation. When we ran the simulations, we saw some really interesting flow physics that didn't really make sense, things like negative drag."

Helicopter blades have some similar concerns. Processing was tricky—not because the files were so large, but because there were so many of them. People were creating more data than they could take in.

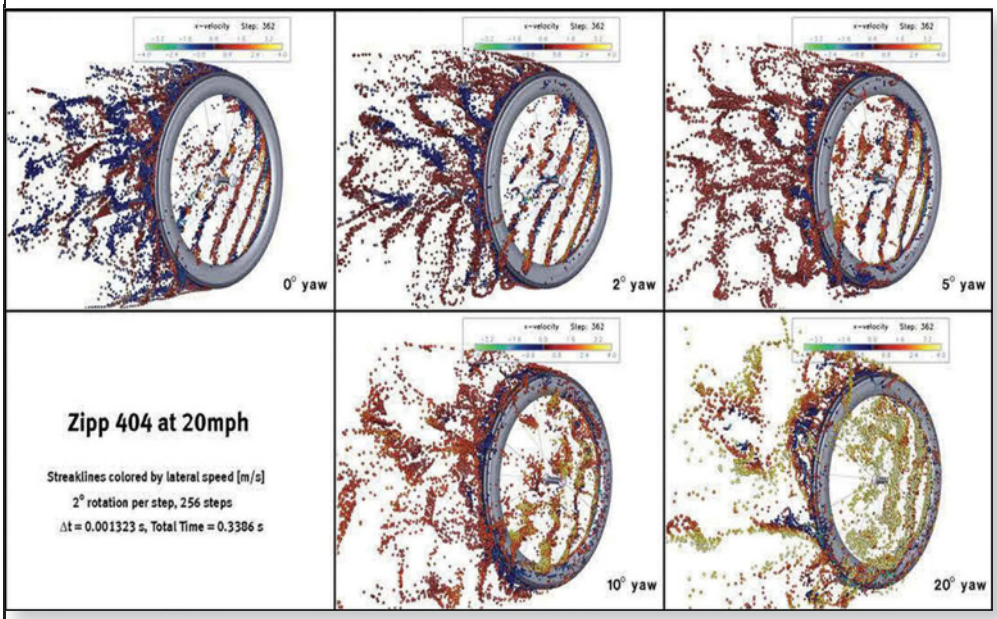
"This research has over 23,000 individual time steps analyzed," says Rintala, breaking it further into 90 design points from multiple wheels, speeds and yaw angles, 256 time steps each.

Think of a time step as an individual frame of movie film—a still image, if you will, of what is going on. It's not just file size that becomes an issue. Speed of number crunching can be just as, if not more, important to a project schedule. Unless you have your own private render farm, you're going to tie up a lot of computing resources for long periods.

Now, however, you can offload a lot of your processing to companies on the web. That will free up your computers for other processor intensive jobs.

FieldView on the cloud is scalable. It takes advantage of high-speed servers.

"Remote calculations were run in batch on the servers, and utilized both co-processing (between the post-



Intelligent Light ran several series of analyses on different designs of racing bike wheels. The entire series of data was numerically compared and analyzed. Animations were even produced with concurrent processes.

processor and solver) and concurrent post-processing," says Legensky. "The concurrent post-processing utilized FieldView batch licenses to run an average of 40 post-processing jobs simultaneously on the server in an automated workflow. In this case, the total data size required data to stay on the server—but the sheer volume of simulation data, in terms of cases and design points, combined with the need for direct numerical analysis across the range, presented the most important challenge and drove the need to post-process in automated batch processes. By running multiple instances of FieldView concurrently on multiple cases, the cluster resource was used to dramatically reduce the time to complete the tasks and bring the results in on time."

The batch licenses mentioned here refer to the FieldView Batch Packs, available to all FieldView users.

"When purchasing these licenses, users can run 5, 10, 20 or 200 instances of FieldView at a fraction of the cost of the interactive FieldView software they use on their desktop [which starts at around $25,000]," Legensky adds. "In fact, the batch-packs can be purchased at up to 90% off the price of standard FieldView licenses."

Of course, the workflow is normally customized for the user's requirements. Each customer asks for something different. The FieldView software itself doesn't have to be customized, though. It can handle the volumes of data thrown at it. You don't have to worry about maintaining your large data sets over the net. FieldView has the capability of producing much smaller file sizes that can still be viewed (there is a free viewer) just like the bigger files. Intelligent Light uses a number of methods to reduce file size. The firm can take a data set measuring in gigabytes and reduce it to megabytes without losing the ability to get productive use out of it. Interactive queries then become possible—the "what if" scenarios.

FieldView is entirely about post-processing. Users can choose whatever solver program they want to use. The solver spits out raw data; FieldView interprets that data into something the user can understand. You can model multiple flow systems to make up an entire system.

Think of an automobile. What systems must operate efficiently to make it go down the road? Obviously you need fuel flow, but you also need coolant flow, and certainly airflow. The exhaust has to go somewhere. Heat will move about the engine. The air conditioner and heater must function. There's a lot that has to work, and work well. With FieldView on the cloud, working with multiple processors, you can model everything about a car down to the nth degree.

And lastly, with software like FieldView, you never have to worry about not having the most up-to-date version of your software. Intelligent Light maintains its software constantly. It is always the latest.

When you need to get a job done and you're looking for world-class computing power, on a budget and the clock is ticking, cloud computing just might be the thing to try. DE

Mike Hudspeth, *IDSA, is an industrial designer, illustrator and author who has been using CAD and design products for more than 20 years. He is* DE's *expert in ID, design, rapid prototyping, and surfacing and solid modeling. Contact him via de-editors@deskeng.com.*

INFO ➜ **Intelligent Light:** iLight.com

➜ **R Systems:** RSystemsInc.com

For more information on this topic, visit deskeng.com.

Deploying Your Engineering Applications Over a Private Cloud

EASA brings the benefits of cloud computing to almost any application, while avoiding the logistical and security concerns of a public cloud.

BY SEB DEWHURST

The "Cloud" usually refers to a "public" or "external" cloud, accessed over the Internet, with an off-site provider. The possibilities for engineers are truly exciting, but there are some questions which we need to consider:

- Are the engineering applications which I use even available in the cloud?
- Is it acceptable to run critical engineering models (my company's intellectual property) in a public cloud?
- What do we do if the service fails, as Amazon Web Services did during April 2011?

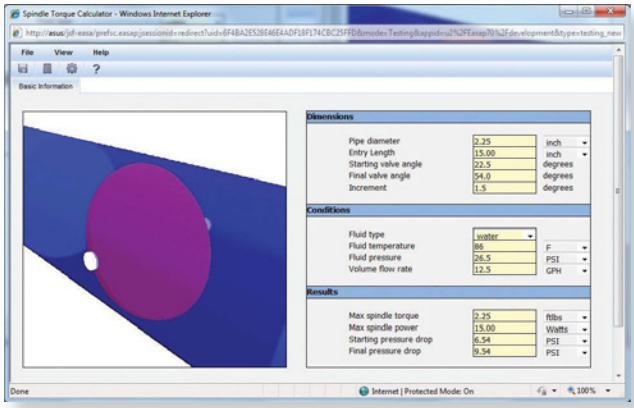
Organizations frequently opt to avoid these issues by using private (or "internal") clouds, while still achieving many of the benefits of cloud computing.

EASA – an Easy Path to a private Engineering Cloud

Once installed on a server on your network, EASA becomes an internal cloud which hosts the applications and models your engineers and scientists use most frequently. Model "owners" use EASA to author and publish web applications that link to existing engineering models. No coding is required.

End-users need only a desktop or a mobile device with a browser. They do not need the underlying software installed locally. The EASA server not only hosts your web applications, but also provides a central repository of results, enabling users to collaborate when they need to.

EASA may also be used to integrate multiple engineering tools under one web application, making a process more seamless for users.



Frequently used Excel® spreadsheets, MATLAB® models, in-house codes, and CAE models can be exposed as web applications. Users need only a browser.

Spreadsheets on the cloud

Excel® may be the most commonly used engineering application. It is used to optimize operations, for preliminary design, engineering calculations, and for pricing and proposal generation. EASA enables you to transform spreadsheets into web applications suitable for multiple users, eliminating many issues which plague conventional spreadsheet usage:

- Version control is assured.
- Users can save their work to a central repository.
- Intellectual Property is protected; users cannot see inside the "master" spreadsheet. DE

Seb Dewhurst *is director of business development, EASA, Inc. To view case studies and videos, or to download EASA, visit easasoftware.com*

ABOUT US

EASA enables rapid creation and deployment of web applications to end-users on a corporate network. No coding and no additional server software is required.

You can codelessly author highly tailored web applications which connect to existing software, such as Excel®, MATLAB®, MathCAD®, FEA and CFD models, databases, as well as legacy codes.

EASA is in use at companies such as Canon, Corning, Hewlett-Packard, General Electric, Procter & Gamble, and Xerox.

EASA

Through **Thick** *and* Thin

Engineer uses on-demand analysis.

BY KENNETH WONG

Andrew Sears, a mechanical engineer from Balzer Pacific, knew analysis took time and patience. The last time he ran analysis on the design of a dewatering screen, used in concrete and asphalt processing industries to separate sand and dirt from rocks, it took his Dell Precision T3400 workstation (8GB RAM, 64-bit OS, Intel Core2 Duo processors) roughly eight hours to complete the job.

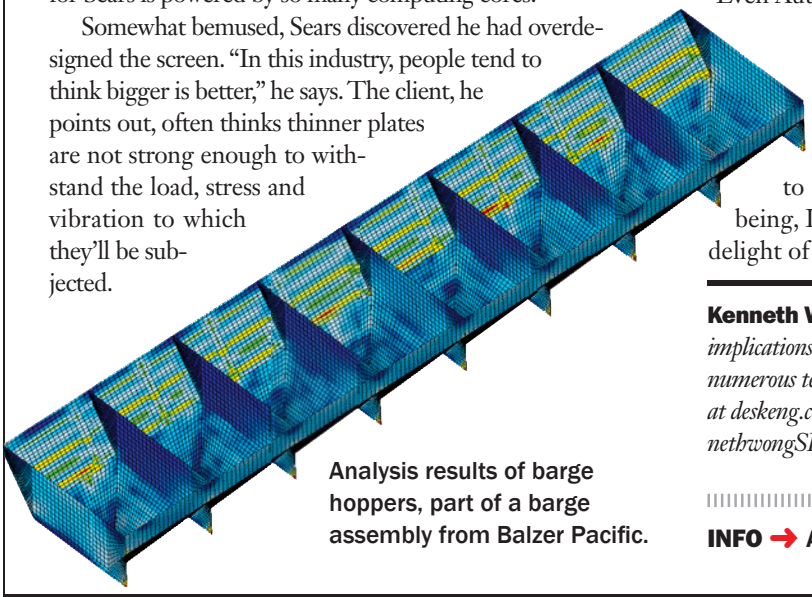
The purpose of the analysis was to figure out the ideal plate thickness, the configuration that satisfies the required factor of safety with the least amount of steel. Ultimately, Sears and his colleagues determined that the plate thickness was the best variable with which to experiment. Sears came up with four design options. The analyses on all four, he estimated, would take his computer about two days. Then he remembered a feature in Autodesk Inventor he'd heard about.

At the time, the Inventor Optimization feature was still a technology preview, downloadable from Autodesk Labs. For someone like Sears, the software could perform multiple simulations behind the scenes in the cloud, leaving the CPU cores in Sears' machine free for whatever additional software he needed to run.

With the utility, Sears could upload all four scenarios to the remote server, specify variable parameters and the desired factor of safety, then collect the results. So he did.

"It brought back the results in an hour-and-a-half," he recalls. That's because the remote server that did the number crunching for Sears is powered by so many computing cores.

Somewhat bemused, Sears discovered he had overdesigned the screen. "In this industry, people tend to think bigger is better," he says. The client, he points out, often thinks thinner plates are not strong enough to withstand the load, stress and vibration to which they'll be subjected.



Analysis results of barge hoppers, part of a barge assembly from Balzer Pacific.

A Balzer Pacific dewatering screen, designed in Autodesk Inventor.

Simple, Yet Secure

"Using the Optimization function is easier than using other analysis tools," observes Sears, who also uses Autodesk Algor. "The way that it's laid out, you click the first button, click the next button, click the third, and it's ready to go."

Sears would be the first to admit that the design of a dewatering screen is not exactly the stuff of industrial espionage. "But we are doing things that other companies might like to get their hands on," he says.

Eventually, he discovered just how secure the data was when he needed to contact Autodesk tech support with a question.

"Can you send us your model?" asked the support technician.

"What do you mean? I uploaded it to your [Optimization] server. Don't you have that?" Sears replied.

It turns out, the built-in security protocols don't discriminate. Even Autodesk officials can't easily access the bits and bytes Sears uploaded.

Autodesk has hinted it plans to augment its software with value-added web services. Inventor Optimization feature is one such example. So far, Autodesk has not revealed how it plans to charge for these services. So, at least for the time being, Inventor Optimization remains free—much to the delight of Sears. DE

Kenneth Wong *writes about technology, its innovative use, and its implications. One of* DE's *MCAD/PLM experts, he has written for numerous technology magazines and writes DE's Virtual Desktop blog at deskeng.com/virtual_desktop. You can follow him on Twitter at KennethwongSF, or email him via de-editors@deskeng.com.*

INFO ➜ **Autodesk:** Autodesk.com

Defining the Cloud

Coming to terms with cloud computing.

BY PAMELA J. WATERMAN AND JAMIE J. GOOCH

The "cloud" is aptly named. It seems as amorphous as a sky of scattered cumulous on a windy day. *DE* has collected the glossary of terms below to help give it definition.

"**Cloud computing** is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction," according to the National Institute of Standards and Technology (NIST).

That's a pretty good textbook definition. NIST goes on to say that cloud computing has five essential characteristics:

- On-demand self-service.
- Broad network access, including access via thin clients.
- Resource pooling, in which storage, processing, memory, network bandwidth, and virtual machines are serving multiple users.
- Rapid elasticity, meaning the ability to quickly scale.
- Measured service, which refers to the services being metered in some way – often via storage or bandwidth.

The elasticity point is key. Gartner, a research firm, calls it out in its definition as well. To quote the company's Daryl Plummer, managing vice president and Gartner fellow, cloud computing is "a style of computing where scalable and elastic IT capabilities are provided as a service to multiple customers using Internet technologies."

Delivering the Cloud

Bob Williams, Autodesk product marketing manager for simulation, says that you will hear two primary terms mentioned.

Cloud computing refers to actually using hardware on the cloud for numerical crunching, processing, etc.

Software-as-a-service (SaaS), which is more about the delivery method, is the way that you use and gain access to the software. It's a service model.

"Sometimes those two factors are combined together," Williams explains. "You may be using an SaaS version of software that's also doing all the heavy calculations using the cloud, but they don't have to be connected."

Two other service model variations are **infrastructure-as-a-service (IaaS)** and **platform-as-a-service (PaaS)**, which allow users to upload their own software to use on demand. NIST differentiates the two by limiting IaaS to provisioning "processing, storage, networks, and other fundamental computing resources, where the consumer is able to deploy and run arbitrary software." It defines PaaS as allowing cloud deployment of "created or acquired applications created using programming languages and tools supported by the provider."

Some definitions mention **utility computing** as a synonym of cloud computing. Utility computing is an older term used to describe on-demand access to storage and virtual servers.

> **"I think it would be good to define the cloud better. If I use almost anything on the Internet, it might be considered 'cloud computing.'"**
>
> **— DE *cloud computing survey respondent***

Different Types of Clouds

Looking from another angle, ANSYS developers think of cloud computing as any remote access to a computing infrastructure required for the effective use of simulation software. As such, the term includes a **private cloud**, such as enterprise customers with centralized high-performance computing (HPC) resources and distributed users; **hosted cloud**, in which remote dedicated HPC hardware is hosted by a third party, such as SGI Cyclone; and **public cloud**, such as Amazon EC2 and Microsoft Azure. Hybrids are also possible.

Hopefully that clears up cloud computing. DE

Contributing Editor **Pamela Waterman**, DE's *simulation expert, is an electrical engineer and freelance technical writer based in Arizona.* **Jamie Gooch** *is* DE's *managing editor. You can send them e-mail to de-editors@deskeng.com.*

Blue Skies

BY DREW GUDE

The cloud, which has so dominated recent news reports and conversations in the commercial and consumer sectors, is rapidly spreading to the design engineering arena. Already, engineers are able to schedule and manage their jobs via cloud-based software. Trials are in progress for cloud-based finite element analysis and optimization tools, and cloud computing potentially can transform the way designers develop, deploy, scale and support infrastructures for technical computing.

Customers of design-engineering firms—for the most part, manufacturers—are adopting the cloud in significant numbers, and are likely to accelerate the transformation among engineers by demanding the same kinds of cost and time savings from their vendors that manufacturers themselves are achieving from their own cloud-computing operations.

Because the cloud offers software, platforms and infrastructure via the Internet through metered access, or subscriptions, manufacturers have been slashing their computing costs. Instead of purchasing, maintaining and upgrading servers, networks and on-premises software, manufacturers can simply incorporate cloud-based applications in their business processes. Furthermore, they are gaining substantial productivity:

- cloud-based programs and systems are available to global companies 24/7;
- they have a higher rate of uptime than most technology installed in the manufacturers' own facilities; and
- they consistently offer the most up-to-date versions of software as soon as they become available, because the applications need only be updated on the cloud servers instead of on individual computers across the manufacturing enterprise.

Organizations have a choice, in fact, of using only cloud-based technology, only their on-premises applications and systems, or a hybrid of both. For hybrid applications, the cloud can add functionality or speed to on-premises software when they are used together.

The Results Are In

A recent Microsoft survey indicated not only that manufacturers understand the benefits of cloud computing, but that they are well along their timelines to implement it. Six out of 10 of the manufacturing IT decision-makers (ITDMs) responding indicated they plan to implement, or have already implemented, cloud-based collaboration tools. Nearly the same proportion is planning or is already using cloud-based productivity applications.

Interestingly, most of those surveyed indicated they are turning to the cloud for tools to manage their security and networks, as well as for file storage and backup. Nearly half of the manufacturing ITDMs are planning to implement or have already built cloud-based e-commerce platforms. While some organizations have hesitated to place their data in the cloud or rely on cloud-based applications because of concerns over security, manufacturing enterprises understand that those fears are largely unfounded. Data failures at individual companies are much more likely than an outage at a cloud provider.

One particular benefit of cloud-based computing is that it enables users to try a broader range of software without needing to commit to an expensive long-term license for applications that they will use only occasionally.

Case in Point

Overall, 44% of the responding ITDMs in manufacturing noted that adoption of cloud computing allows them to improve the bottom line of their company and save money. One organization that has reported these types of gains is Sensata Technologies, a global supplier of sensing, electrical protection, control and power management solutions. The Massachusetts-based company employs more than 9,000 people worldwide.

In examining ways to improve the efficiency of its technology and processes, Sensata's IT department decided to move its email messaging into the cloud, thereby slashing the costs of its on-premises messaging infrastructure while actually improving reliability and scalability. Over a period of four months, Sensata migrated 5,000 mailboxes and several hundred mobile accounts to the cloud. Employees gained the coincidental benefit of instantly upgrading to the most current version of the email application, while the company's savings were spectacular. Moving to online email cut Sensata's email costs in half, trimming $500,000 from its IT budget and freeing IT staff to focus on higher-value tasks.

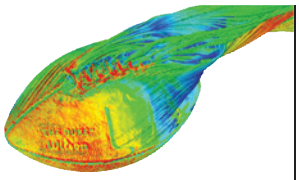
It's time for design engineers to move beyond reading about the cloud and conversing about cloud computing with colleagues; now is the moment to grasp a competitive edge by reaching for the cloud—for data storage, project scheduling, collaboration and innovations that will help make the earliest adopters the biggest winners. DE

Drew Gude *is director of U.S. High Tech and Electronics for Microsoft.*

INFO ➜ **Microsoft:** Microsoft.com

➜ **Sensata Technologies:** Sensata.com

Team Players



CD-adapco and R Systems help Wilson throw the perfect spiral.

Wilson Sporting Goods Co. and CD-adapco are looking to engineer the perfect football.

Armed with the knowledge gleaned from computational fluid dynamics (CFD) analysis of soccer balls, CD-adapco and Wilson are breaking new ground in the application of advanced engineering simulation technology to sports science. Wilson uses exclusive patterns and innovative technology to provide the best game football at every level of play. Operating the only dedicated football factory in the world, Wilson is investing in sports science and engineering simulation to push innovation in the design of its footballs.

Aerodynamics via CFD

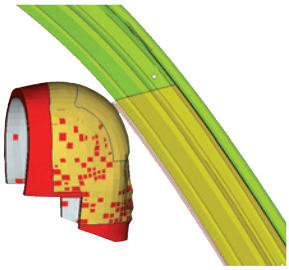
The first step of the project is to understand the aerodynamics of the balls in different game situations. This is where CD-adapco's 30 years of CFD expertise comes into play. CD-adapco's flagship software is STAR-CCM+, which allows engineers to effectively and efficiently simulate real-world engineering situations—ranging from manufacturing to battery design—with a high level of accuracy.

MORE ➜ deskeng.com/articles/aabbae.htm

Safety Made Simpler

ESI Group's automated process reduces the safety redesign period for an automobile from 8 to 5 months.

An automobile original equipment manufacturer (OEM) wanted to introduce an existing vehicle into the North American market, but its head impact deceleration was 20% above Federal Motor Vehicle Safety Standards 201 and 201U limits. The OEM hired EASi to re-engineer and redesign the interior to meet an internal target that required reducing deceleration to 20% below 201/201U limits. Traditional manual methods of determining impact zones, selecting impact points, computing impact angles, assigning initial velocities, etc., would have taken about one day per point for each of the 80 points typically needed for a 201/201U analysis. Using these methods, the entire design process, including the lengthy design approval process, would have taken about eight months.



EASi engineers substantially reduced the amount of time required to meet FMVSS regulations by using ESI Group's Visual-Process development environment to automate most of the 201/201U analysis process.

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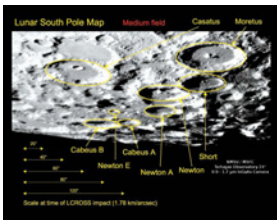
Microwaving Moondust with COMSOL



COMSOL permits calculation of the extraction of water from permafrost.

In 1999, NASA's Lunar Prospector revealed concentrated hydrogen signatures in permanently shadowed craters at the lunar poles. While scientists have long speculated about the source of vast quantities of hydrogen at the poles, recent discoveries made by NASA's Lunar CRater Observing and Sensing Satellite (LCROSS) are shedding new light on the question of water on the moon.

Preliminary data from LCROSS indicates the mission successfully uncovered water during the Oct. 9, 2009 impacts into the permanently shadowed region of the Cabeus crater near the moon's south pole. These findings could have far-reaching implications, as exploration is being expanded past low-Earth orbit.

The Importance of Moon Water

Water and other compounds found on the moon represent potential resources that could sustain future lunar exploration.

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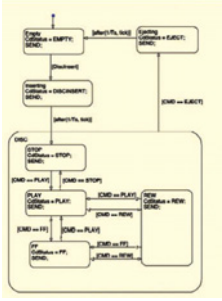
Keep the ECU Conservation Going



Modeling control logic and event-driven behavior aids in early detection of communication latencies.

Complex systems such as airplanes, automobiles and industrial machinery require multiple electronic control units (ECUs) to control the behavior of electrical subsystems. When these ECUs interact with one another, as well as with sensors and actuators on the plant, communication latencies can result. Often the latencies remain undetected until the system has been implemented in hardware, causing costly redesigns and delays to the project schedule.

The solution is to use a system model that combines finite state machines (to model the control logic) and discrete-event systems (to model the communication network). You can simulate the model to determine how robust the system is to spurious signals or real-time delays between the ECU and the communication bus well before software is implemented and integrated with hardware.

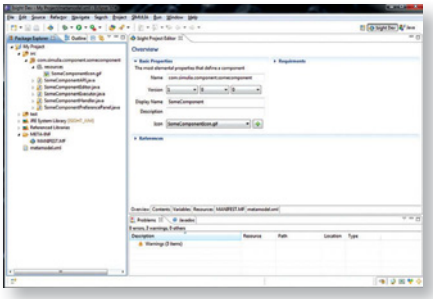
INFO ➜ deskeng.com/articles/aabbah.htm

➜ For the complete application stories visit deskeng.com/fastapps

Editor's Picks

by Anthony J. Lockwood

Each week, Tony Lockwood combs through dozens of new products to bring you the ones he thinks will help you do your job better, smarter and faster. Here are Lockwood's most recent musings about the products that have really grabbed his attention.



Dassault Systèmes' Isight from SIMULIA

Features enhanced open integration architecture to develop customized Isight components.

Isight provides designers, engineers, and researchers with an open system for integrating design and simulation models—created with various CAD, CAE and other software applications—to automate the execution of simulations. Dassault Systèmes says Isight allows users to save time and improve their products by optimizing them against performance or cost variables.

Through the Component Integration Program (CIP), SIMULIA is facilitating the delivery of components to ensure partner tools can be seamlessly leveraged as parts of Isight simulation process flows.

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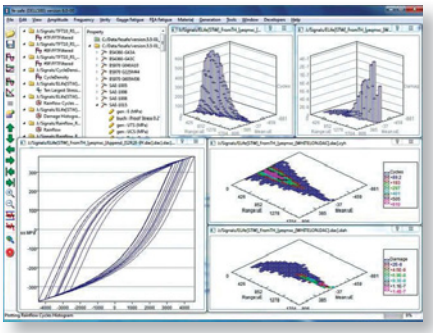

Analyze Fatigue in Composite Materials

Safe Technology's fe-safe/Composites launched in partnership with Firehole Technologies.

Safe Technology says its new fe-safe/Composites, developed with Firehole Composites, is up to the challenge of predicting the fatigue life of composite structures in a computationally efficient as well as robust manner. It works on the constituent level as well as the lamina level at every integration point in an FE model. It does not require exotic material data, it interfaces with what seems to be all the major FEA powerhouses, and it accepts many component loading file formats.

fe-safe/Composites sounds as if it is dragging composites into the mainstream analysis world, which could dispense with a lot of your frustration.

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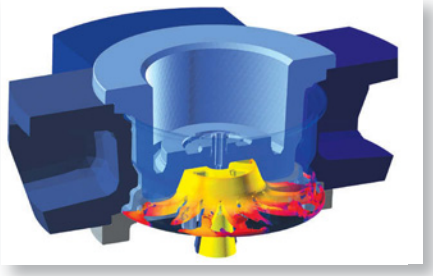
Océ Launches TDS750 Large-Format Printer

Features speeds of nine D-sized prints per minute and no warm-up time.

The Océ TDS750 is designed for the engineering office: fast, high-resolution printing, copying, and scanning. And I mean in your office. The Océ TDS750 is quiet, Energy Star compliant, and low ozone emitting. The latter means that you do not have to have a ventilated isolation chamber to use it.

The Océ TDS750 is also capable of dealing with all sorts of document sizes at a pretty fast clip: It can print nine D–size prints per minute and scan at 2 to 3 in. per second (black and white). Print resolution is 600 x 1200 dpi and scanning resolution is 575 dpi (600 dpi maximum).

MORE ➜ deskeng.com/articles/aaazxw.htm



Casting Simulation System Upgraded

CD-adapco and Access release STAR-Cast V1.08.

CD-adapco and its development partner, Access have jointly announced the release of version 1.08 of their industrial casting simulation system STAR-Cast. Among the many attributes that STAR-Cast seems to have are ease of use and power. That's a combination that tools for multidisciplinary analysis of industrial castings and processes are not generally described as offering.

STAR-Cast leverages the technology deployed in CD-adapco's STAR-CCM+ and STAR-CD high-end CFD solutions. Access brings to STAR-Cast deep expertise in metallurgy and casting processes.

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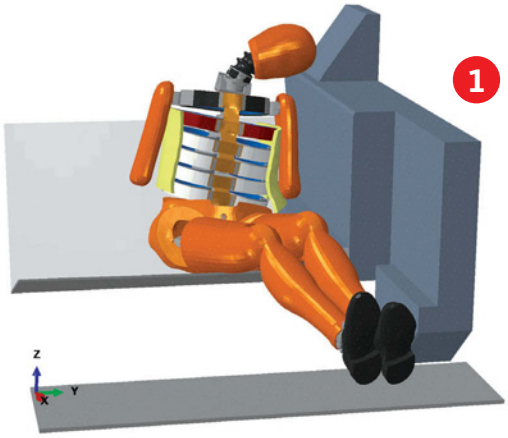
SPOTLIGHT

Directing your search to the companies that have what you need.

Tools of the Month

New Products for Engineers



1 Dassault Systèmes Announces Abaqus Side Impact Crash Dummy

Dassault Systèmes (3ds.com) has released the Abaqus WorldSID (Worldwide Side Impact Dummy) 50th percentile male dummy model from SIMULIA. Vehicle safety engineers are able to use the new WorldSID model from SIMULIA to develop vehicle designs that enhance side impact protection and reduce injuries to occupants. Moreover, virtual crash tests involving simulation models for the vehicle and dummy can be carried out many times, much faster, and at less expense than physical crash tests on costly vehicle prototypes. The model is representative of the average male in terms of height, mass, and proportion.

Omnify Software Launches New Empower PLM Solution

Omnify Software (omnifysoft.com) has announced the next generation Empower PLM (product lifecycle management) solution, version 5.0. This product release boasts a browser-based platform that the company says further enhances user accessibility, system performance and scalability to support the product design and development needs of small to midsize manufacturers. All Empower modules have been transitioned to web browser applications, eliminating any client installation and expanding operating system/platform support.

Siemens PLM Software's Teamcenter Supports Microsoft SharePoint 2010

Siemens PLM Software (siemens.com/plm) has announced that the community collaboration capabilities built into its Teamcenter software now support Microsoft SharePoint 2010. Through its alliance with Microsoft, Siemens PLM Software has been able to progressively integrate Teamcenter capabilities into its customers' standard desktop environment, the company says.

2 FARO Launches FARO Edge Measurement Arm

FARO Technologies, Inc. (faro.com) has introduced the FARO Edge and V4 Laser Line Probe. The FARO Edge is a portable measurement arm that allows manufacturers to verify their product quality by performing inspections, tool certifications, CAD-to-part analysis, and reverse engineering via hard probing and non-contact laser scanning. The Edge features an integrated personal measurement assistant. With its built-in touchscreen and on-board operating system, the Edge provides stand-alone basic measurement capabilities. A laptop is no longer needed to perform simple dimensional checks, or to optimize system performance. Taking advantage of the Edge's multi-function, quick-change handle port, the V4 Laser Line Probe integrates to become part of the arm.

Luxology Ships modo for SolidWorks Kit

Luxology (luxology.com) has announced a new tool that facilitates the use of the company's modo software for visualization by SolidWorks users. The new modo for SolidWorks Kit simplifies the importation of SolidWorks models into modo while maintaining user interface conventions familiar to SolidWorks users. Inside modo, users are presented with a SolidWorks-style layout and navigation controls, along with drag and drop support for changing materials and selecting lighting environments.

Omega Releases Universal Wireless Transceiver Module

Omega's (omega.com) new series UWTC-REC6 connects and adds wireless sensor capability to meters, controllers, recorders or data loggers. It features an analog output signal and is powered from the host instrument or external power supply. Prices start at $69.

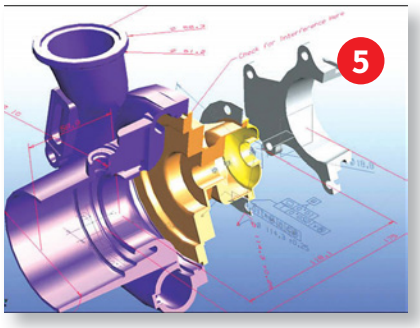
3 New Power PMAC Motion and Machine Controller

Delta Tau Data Systems' (deltatau.com) Power PMAC Motion and Machine Controller has a full-featured, real-time operating system. With the Power PMAC operating as a hub, users are able to interface with almost any remote device via the Power PMAC's open hardware and software architecture, according to the company. The unit can be used as a dedicated controller or a general-purpose computer that provides built-in routines to command the occasional move through the use of programming languages. The controller can be programmed in several languages simultaneously, including the Power PMAC's built-in Script Language. Other languages accepted include G-Code, MatLab/Simulink, LabVIEW and EPICS.

TransMagic Ships R8 sp5

TransMagic Inc. (transmagic.com), a developer of 3D design data repair and conversion software, has announced the release of TransMagic R8 service pack 5. The enhanced Assembly Browser in TransMagic now

offers access to more metadata and information. These new features are optimized to assist professionals in finding and using the data they need. In addition to processing massive files, TransMagic R8 sp5 turns multi-gigabyte assemblies into a virtual design database, allowing parts and sub assemblies to be exported and re-used.



4 CWAV Releases Multifunction Test Tool

CWAV, Inc. (usbee.com) has announced the release of the USBee RX Test Pod to its product line of PC-based electronic test tools. The USBee RX is a programmable multifunction mixed-signal oscilloscope (MSO), logic analyzer with I2C, SPI, Async, SDIO, 1-Wire, USB, I2S and CAN protocol decoders, digital signal generator, frequency counter, and integrated multilevel protocol analyzer in a USBee Test Pod. The USBee RX has two analog and 18 digital input channels, 100MHz sampling, 512 million byte internal buffers, real-time sample compression, Dual 10-bit ADC's, simultaneous 100Msps 8-channel Digital Signal Generator, 8Msps Analog Signal Generator, +/-60V protection on all inputs, variable logic thresholds and USB over current protection.

Autodesk Adds 3D Mouse Support

3Dconnexion (3Dconnexion.net) has announced that Autodesk (autodesk.com) has added native 3D mouse support in AutoCAD 2012. Autodesk Showcase 2012 was also added to 3Dconnexion's portfolio of supported applications. AutoCAD 2012 support includes 3Dconnexion 3D mouse compatibility in the full line of AutoCAD products.

5 Okino Ships CAD Conversion and PLM 3D File Conversion Tools

Okino Computer Graphics' (okino.com) software products have been certified for Autodesk Inventor 2012 software. Okino's PolyTrans|CAD allows cross conversion between many MCAD, DCC/Animation and VisSim 3D file formats and programs. Okino says its Inventor importer solution allows crack-free geometry, hierarchy (assembly data) and materials to be transferred from native disk-based Autodesk Inventor files or from a running copy of Autodesk Inventor directly into any Okino data-conversion-compliant program. Okino has also released its newest v5.6.1 set of JT PLM/MCAD bidirectional import and export converter modules. The JT converter modules allow geometry, hierarchy, materials and texture mapping data (assembly data) to be imported and exported to native JT disk-based MCAD files. The JT importer module also allows PMI graphical data to be imported and then re-exported to such compatible Okino export file formats as SketchUp and U3D, among others. DE

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Accessibility

1 CorelCAD is available for both Mac and Windows platforms. It is also available in a number of languages, including English, German, French, Italian, Spanish and Portuguese. Versions in Czech, Polish, Russian, Turkish, Simplified Chinese, Traditional Chinese, Korean, and Japanese will be available this summer. The program features export to PDF, ACIS 3D, DWF, and more.

2D and 3D Design

2 Along with a set of 2D drawing features, CorelCAD includes a set of 3D solid modeling tools. Users can add 3D solid primitives to their design and use Boolean operations to unite, intersect and subtract bodies. Users can also extrude or revolve 2D entities, sweep 2D entities along a path, or loft between 2D entities to create solid objects. Solids can be sliced and intersected, and edges, faces and bodies of 3D solids can be edited.

Native DWG Support

3 Corel has partnered with Graebert GmbH to develop and market CorelCAD. As a result, existing CAD users will see familiar command bars, aliases, menus and toolbars. In addition, CorelCAD works natively with the AutoCAD DWG file format, eliminating the need for an import/export process to read and write files in DWG.

Customizable Workflows

4 CorelCAD is customizable to meet the needs of a variety of sectors and projects. Without any programming knowledge, users can fine-tune the user interface to their needs. Custom workspace configurations can then be saved in user profiles and deployed throughout an organization to tailor the user interface to specific project needs.

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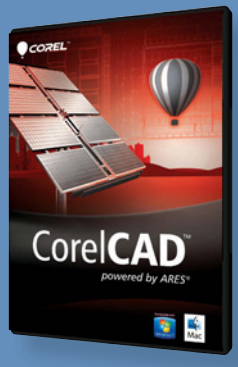
- *2GB hard disk space*
- *1024 x 768 display (1280 x 800 recomended) with 16-bit video card*

For more information, visit corel.com.



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