Simulation in the Cloud: A Path to Democratize Simulation

CIMdata Commentary

Key Takeaways:

- *Autodesk Simulation 360 is a distinctive solution that effectively delivers cloud-based simulation.*
- *Innovative delivery and low cost of entry will serve to democratize simulation to a broader base of users and companies.*
- *The cloud can be a simple, cost effective way to deliver simulation resources.*
- *There will continue to be a need for highly utilized internal computing resources for some simulation requirements.*

The importance of simulation is expanding as companies move to full digital product development. Performance assessments using digital prototypes can have immense payback in terms of product development time, cost, and quality. Thus, companies are moving to implement "simulation-driven design," using simulation early in the design process to develop, evaluate, and validate design concepts. Many of these same companies wish to democratize simulation: making it pervasive, integrated into their product design process, and available to a much larger constituency of users. To do so, they must overcome barriers of complexity (e.g., usability, IT integration, and custom computing resources), accessibility, and cost. CIMdata believes that these barriers are impeding the adoption of simulation at smaller companies. Such companies often do not have the resources and expertise to acquire and maintain an IT infrastructure that includes high performance computing (HPC) clusters for simulation. Moreover, small companies may not have a high enough volume of work: Overall IT costs then rise because of low utilization of software licenses and compute resources.

Some companies are skeptical that remote resources are indeed appropriate for simulation. So, remote solutions for simulation have been available for decades with limited adoption. Service bureaus failed in the 1980s as customers acquired their own resources. In the 1990s some companies purchased capacity at National Supercomputing Labs, but that also waned. Grid computing, Software as a Service, and other trends (fads?) have had minimal success in providing simulation resources as a commodity. Early attempts to deliver remote simulation failed because it was difficult to package the large quantity of information and data sets needed for the simulation; the cost and performance of moving simulation input and output over the network, the cost of the dedicated remote computing resources, and the difficulty for simulation analysts to work with or control the information and simulation processes remotely. Now, we have the Cloud. One might well ask, "What's different this time?"

Internet and cloud technologies and associated costs have changed dramatically over the years. Hosted HPCs using grid, parallel, and linked microprocessor systems provide massive computing power at a fraction of the cost, compared to solutions of previous years. Networks are significantly faster and can quickly transfer larger simulation-related files and other data between user work tools (e.g., desktop or even laptop computers) and the HPC in a very secure manner.

Autodesk has introduced Autodesk Simulation 360, which is designed to deliver simulation via the cloud. Autodesk Simulation 360 reduces the complexity of obtaining and using remote resources for simulation, as well as the price of entry. It provides, in essence, a "pay as you go" resource that is cost effective and simple to access for both simulation analysts and occasional users. Usage is governed by "Cloud Units," which are consumed when a solution is run. The usage basis is per job, and is not dependent on job size or simulation time (i.e., CPU hours). Autodesk Simulation 360's advantage is not so much that it is cloud-based, but that it can dramatically lower the barriers to entry for more widespread use of simulation. Companies may access simulation resources easily, and with no additional investment in their local infrastructure for resources such as compute clusters.

Autodesk's vision is to enable "always on" simulation that can be used to provide guidance as a design is developed.[1] They have provided innovative tools that demonstrate the drive to democratize simulation capability for a wider audience. For example, Autodesk ForceEffect Motion[2] is an iPad application for static analysis of structures and kinematic analysis of mechanisms. Project Falcon[3] is a wind tunnel simulator that accepts geometry in an open format (STL) generated by most modeling systems.

Autodesk Simulation 360 includes much of the capability of Autodesk's mechanical simulation portfolio, including FEA tools for static stress, linear dynamic analysis, mechanical event simulations, and computational fluid dynamics (CFD) tools for fluid flow and thermal simulations. The Simulation 360 bundle includes desktop licenses and cloud access—solutions that can be run from either place.

According to Autodesk, "Autodesk Simulation 360 complements design applications, allowing for simulations early and often to predict and optimize design performance." To that end, Autodesk Simulation 360 is well integrated into Autodesk's desktop simulation applications: Moldflow, CFD, and Mechanical. Pre- and post-processing are done on the user's local workstation. There is no practical difference in the workflow whether the actual simulation is executed locally or in the cloud. Importantly, executing simulation in the cloud does not consume local resources, freeing the engineer to continue working on other tasks. Autodesk also points to improved scalability: multiple simulations, perhaps for an optimization, can run in parallel in the cloud versus having to run sequentially on a local workstation. Remarkably, there is no load balancing or job submission application to deal with. Autodesk's cloud implementation is much less complex for the user than most companies' internal compute cluster interfaces. Installation of the desktop thin client is also very simple, with no configuration setup required.

For some companies, data security is an issue and they will not allow any of their data outside their company firewall. Autodesk has addressed the security issue with an ISO 27001-compliant approach. No user data is stored in the cloud, and data transfers involve encrypted transmission of CAE data. This provides enhanced data and IP security with minimal hassle for the end user. Additionally, license entitlement and compliance are managed by the system and are not a user concern. CIMdata believes that many companies

[1] CIMdata White Paper. Breaking Down the Barriers to Simulation: Autodesk Broadens Simulation Offerings (March, 2012) download at: https://plmforesight.cimdata.com/download/index.cfm?download=BreakingDownBarriers&company=

[2] For more information see: http://itunes.apple.com/us/app/autodesk-forceeffect-motion/id512045820?mt=8

[3] For more information see: http://labs.autodesk.com/utilities/falcon

will be satisfied by the level of security offered by Autodesk Simulation 360. As with e-commerce, data security concerns will abate with time and experience.

The remaining barriers are the issues of total cost, data transfer times, and the need for special computing resources. Costs will have to be evaluated by the users. Certainly, Autodesk Simulation 360 lowers the entry cost barrier. The business case will depend not only on the cost to a company of provisioning their own resources, but also on their utilization rate of both the hardware and the software. By reducing the upfront investment for simulation, Autodesk helps customers reduce financial risk and achieve faster payback from the use of simulation.

Other factors that may impede adoption of simulation in the cloud are file size and the need for specialized computing resources. Simulation output files are frequently very large, perhaps in excess of 10 GB. Routine transfer of files of this size (over the public network) is not feasible. Also, HPC machines and compute clusters used for technical computing are often specialized, and are not commodity resources. These two factors may put a practical limit on the size of simulations performed in the cloud.

Autodesk Simulation 360 continues Autodesk's initiative to make simulation more accessible to companies of all sizes. It provides Autodesk customers with interesting and innovative options. Autodesk believes that the cloud will change the delivery model for engineering software, fueled by the trends and user requirements for social business collaboration and mobility. However, larger companies tend to have in-house resources like compute clusters and HPC clouds that are highly utilized. CIMdata does not view Autodesk Simulation 360 as a replacement for such resources.

Autodesk Simulation 360 provides a reasonably complete suite of simulation capability in the cloud. Autodesk delivers that capability in a form that is well integrated and which removes the complexity of using remote resources for simulation. The barriers to entry of price and setup complexity are dramatically reduced. Autodesk Simulation 360 has the potential to democratize simulation by making simulation resources easily available to a broader range of companies and end users and with a compelling economic value proposition.

Companies that need to expand their use of simulation and to do more simulation earlier during product design and development are candidates for Autodesk Simulation 360. The offering is especially attractive to companies with limited investment and support resources for their simulation and analysis needs.

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