CAD on the Cloud, Today and Tomorrow

Cloud-based computing is reshaping the ways that software, hardware, and networks are acquired and deployed. It has already transformed a variety of enterprise services, but adoption of cloud CAD is years behind. What are the potential advantages, and the reasons for resistance? And what can CAD users expect from cloud solutions in the near future?

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What's the current state of cloud CAD, and what can you expect in the future?

For most of this decade, computing has been dominated by one word: "cloud." At the enterprise level, cloud-based business process services from companies such as Salesforce, Google, and Oracle bring in annual revenue in the billions. Their products dominate many business processes, including customer management, logistics, human resources, web analytics, and more. Large companies appreciate the centralized compute and storage resources they provide, which make it easier to share data among employees, departments, and locations. Centralized subscription billing for software can be accounted as operational expense, instead of as a capital expense, which in many countries has tax advantages.

Technical software products — including CAD — are gaining cloud-based services, but adoption rates are lagging years behind enterprise services. Professionals who use software products to manage departmental activities (such as design review, visualization, document management, or product lifecycle management) are more likely to accept cloud services than those who use creative products, such as CAD or entertainment content creation. There is lively debate about the merits of the cloud whenever CAD users gather.

Why Is Cloud CAD So Polarizing?

Cloud-based computing is a paradigm shift. It requires rethinking how software, hardware, and networks are acquired and deployed. It offers — or, some would say, forces — new ways of working. It gives substantial benefits in areas such as collaboration, remote access, and low cost of entry, but it also takes away local control of IT and perpetual ownership of software, and raises concerns about data security.

CAD vendors are competing for mindshare from both sides of the debate. On one side are 35-year-old Autodesk, promoting its cloud-based Fusion 360 mechanical design software and a suite of supporting products as "the future of CAD," and start-up Onshape, with its browser-based mechanical CAD product created specifically for the cloud. On the other side sit the other CAD vendors; most are exploring cloud-based functionality but keeping the core design software on the desktop workstation. A few are resisting altogether the notion of moving design into a browser.

At the most basic level, cloud CAD refers to a professional drafting or precision modeling tool where the software is located on a remote server and is accessed via a web browser. In practice, there are some variations: Onshape is completely cloud-based and needs no local software to run on any device, whereas Fusion 360 requires a local app to manage relations between the server-based processes and the local device.

The Cloud Features That May Help You

The upsides of cloud-based CAD products are numerous, and depending on the needs of your business, may confer substantial benefits:

- Access to nearly endless numbers of CPUs and GPUs, and vast amounts of storage. For very large models or complicated rendering projects, extra server-based compute resources can be engaged as needed — and disengaged once the demanding project has been completed.

- Data backup is automated and continuous; cloud architecture ensures there are multiple copies of the data, so the loss of one server does not mean the loss of data.

- Cloud CAD software is updated instantly to all users; there is no such thing as "using an older version" of the software. Software-wise, everyone is on the same page at all times.

- Data can be accessed by any device that runs a browser and has Internet connectivity, whether that is a workstation in the office or a tablet computer at the beach.
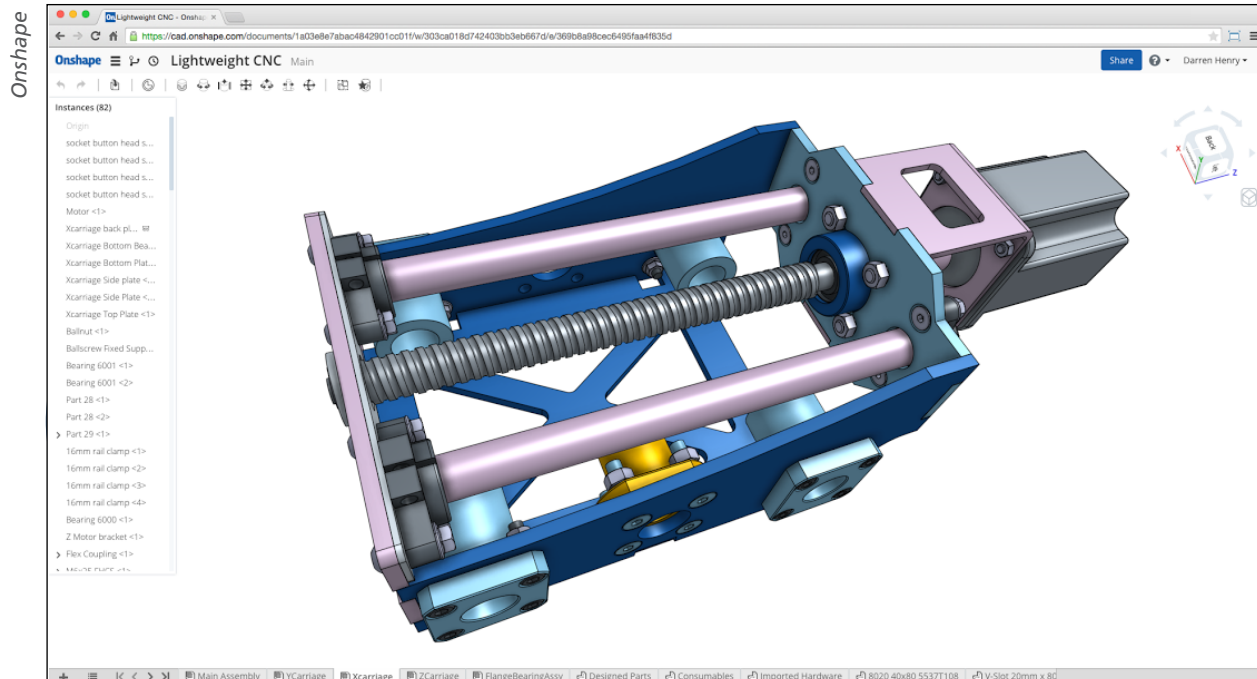
Onshape

» *Onshape promotes its browser-based mechanical CAD product as ideal for new engineering workflows, including remote collaboration and agile engineering.*

- Sharing work remotely for live review or design collaboration is much easier than with desktop CAD.

- Adding additional seats on short notice is a quick and simple process.

- Design teams can more easily apply new work methods, such as agile design, that are borrowed from software developers. Onshape's branching feature, for example, allows multiple variations on a design to stay linked.

The Downsides — and Distractions

For many CAD users, these features are not convincing advantages. Some of the points of resistance can be categorized as legitimate reasons to hold off on switching to cloud CAD; others, however, are unfounded concerns, or mere excuses made to avoid change. Allow me to rate the major complaints that are raised against cloud CAD:

Loss of Software Ownership: Valid Reason. Many small companies say they prefer perpetual licensing over subscriptions. This means they have a de facto preference for desktop over cloud-based software, since no cloud CAD product is available with perpetual licensing; they are all subscription (rental) licenses. The preference can be an excuse to not modernize, but more often it is about dollars and sense (pun intended). Depending on the particular software product and the details of the deal, it is sometimes cheaper to buy than to subscribe.

This debate impacts the decision on whether or not to move CAD to the cloud, but today it's mostly applied to desktop software.
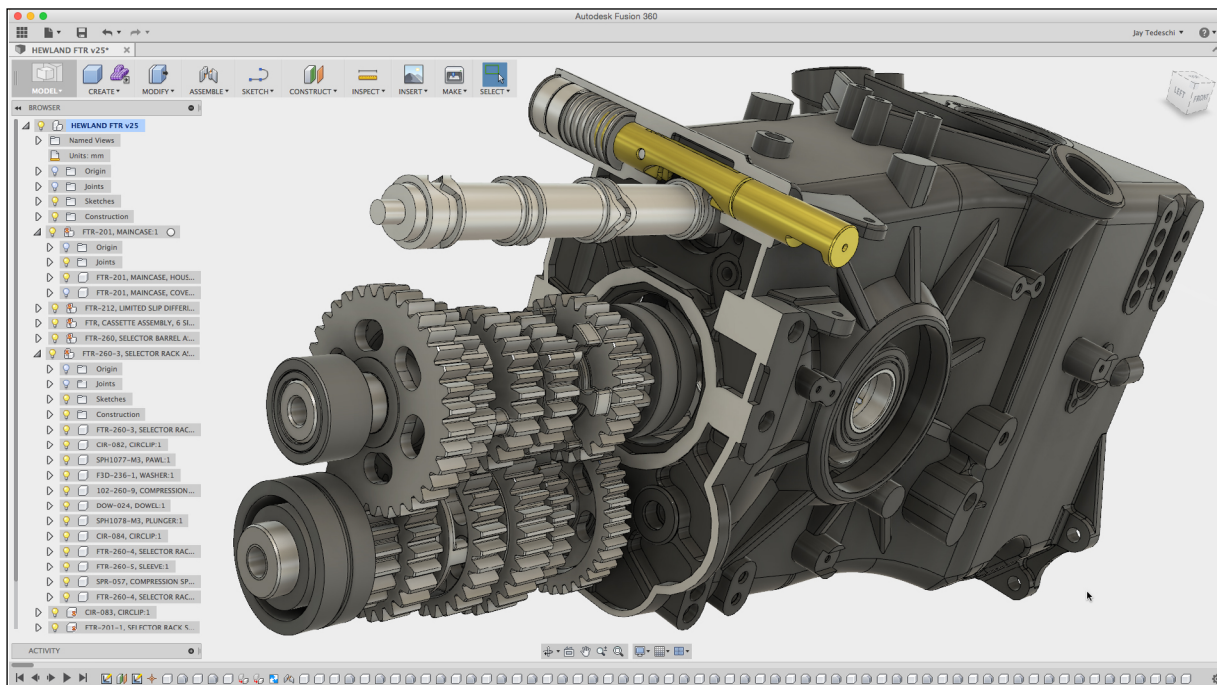
» *Autodesk Fusion 360 runs from the cloud, but uses a desktop or mobile app to control the user experience.*
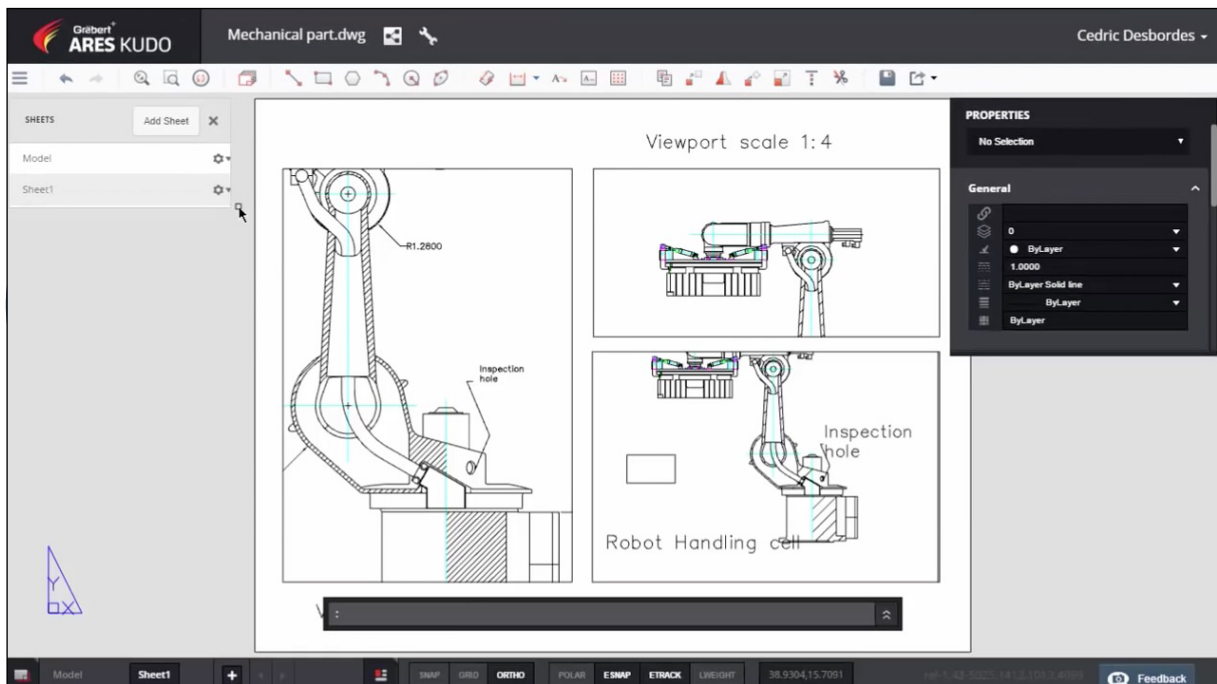
» *Graebert is extending its 2D DWG CAD platform to the browser with Ares Kudo.*

Autodesk is doing its best to make subscription attractive with "Collections" (its new name for Suites, its bundles of related software applications) and special promotions, but a considerable percentage of its customers are turning a deaf ear. A number of vendors, including Bricsys (BricsCAD), Dassault Systemès (Draft-Sight), and Graebert (Ares Commander), are offering customers a choice of perpetual licenses as well as subscription terms in an effort to woo disgruntled AutoCAD users. All three (and others as well) offer rock-solid DWG compatibility; Bricsys extends its compatibility guarantee to ARX files.

Decreased Data Security: Excuse. Never mind that the vendors hosting cloud CAD software employ world-class security experts. Never mind that we have all been doing our banking on the Internet for years. There are still engineering and design departments that claim it is too risky to allow engineering data beyond the company's own firewall.

> *Don't let the minimal security risk scare you away from cloud CAD*

The risk factor is simply overblown, and is not a reason to avoid cloud CAD; cloud service vendors have great security. Some companies claim government regulations tie their hands on the issue, and requirements are steep, but that restriction is becoming less problematic every day: Amazon, Microsoft, and the other cloud services offer government-approved ITAR-compliant security, for example. (ITAR is a very rigid security standard for aerospace.)

Fear of Data Lockdown: Excuse. No vendor would ever withhold a customer's design data for lack of payment on the software subscription; that would be the kiss of death. What's actually withheld is the customer's ability to use the software to alter that data, not the data itself.

Use a
combination
of cloud and
local computing
resources

Not all
cloud CAD
software is
cloud-based

Desktop Performance vs. Cloud: Debatable Reason. Collaboration and multi-platform are great advantages of cloud CAD; so is always having the latest version of the software. Performance, however, is not typically the reason people turn to the cloud. A really good workstation for 3D CAD work can be purchased for $2,000 today; for 2D, the price is even lower. Yes, there is infinite compute available in the cloud, but it comes at a price. There is no reason to move all computing to the cloud and leave local resources idle.

Workflow Changes: Excuse. Decades ago, when designs were still drawn on paper, AutoCAD and SolidWorks started out as the outrageous harbingers of unwanted design workflow change. It took a while, but eventually everyone realized the benefits of computer-based design. Today, companies struggle with finding and keeping good talent, with the cost of rapid swings in team size, and with the relentless pace of innovation in the marketplace. Cloud-based computing can provide talent access from any location, at any time. New forms of collaboration inherent in the cloud model make it easier to form temporary teams, and to adopt workflow changes that enable more rapid innovation.

The Players and the Products

What follows is a basic description of the leading professional cloud CAD products that are currently on the market or in beta testing (we have excluded cloud CAD products aimed at casual users). These products fall into two broad categories: cloud-aware and cloud-based. *Cloud-aware* generally means you upload/download CAD files for review, markup, or rudimentary editing; *cloud-based* means all geometry creation, from start to finish, is done by the server-based software.

Of these products, only CATIA on the cloud is equivalent to its workstation twin, in terms of functionality. Onshape is rapidly expanding its feature set, but neither it or Fusion 360 are yet as feature-rich as SOLIDWORKS or Autodesk Inventor. Although there are some BIM data management options, there is no 3D BIM solution available as a cloud service yet.

Onshape: With $169 million in venture capital funding and strong buzz, Onshape (the company and its product have the same name) stands out for its commitment to a purely in-the-browser CAD experience — and for its pedigree. (The founders are mostly the same guys who created SOLIDWORKS). Onshape has a free API, a user interface experienced MCAD users will appreciate, a rapidly growing feature set, and a growing circle of third-party plug-ins for milling, simulation, rendering, BOM management, and more.

Autodesk Fusion 360: For years, Autodesk has developed and promoted desktop-based Inventor as its 3D mechanical CAD flagship, but it has always been a distant second to SolidWorks. Now Autodesk is pouring resources into cloud-based Fusion. It differs from Onshape in one key aspect: it requires a locally installed app for best performance. (Onshape has iOS and Android apps, but they are merely portals to the product; they don't do on-device processing of CAD data). Autodesk bills Fusion as the evolution of CAD into an ecosystem that includes CAE, generative design, IoT

connectivity, and more. It is aggressively priced, and free to some qualified users, including students and hobbyists.

Autodesk 360: This family of products provide mobile access to DWG files, Revit-based BIM data, and a few mobile apps that do rudimentary simulations on mechanical parts.

Dassault Systemès CATIA on the Cloud: The current technology generation of the CATIA family has always been cloud-aware, but recently DS is making its flagship available as a cloud-based editor.

Graebert Ares Touch: A DWG CAD application for tablets and smartphones, Ares Touch uses cloud-based services such as Box, Dropbox, or Google Drive to store and share files. A browser-based version called Kudo is in open testing.

Dassault Systemès SOLIDWORKS Xdesign: Several years ago, SOLID-WORKS demonstrated SOLIDWORKS "on the cloud" but it was virtualization, which means the desktop software is running on a server and performs as if it were on the local desktop. (This could be a server within the customer's company, or at a cloud provider. For more information on virtual workstations, see the Herrera on Hardware series, "Harnessing the Cloud for CAD: The Case for Virtual Workstations.") Virtualization generally allows multi-tenant use, meaning more than one person can open the software, but that is not the same as cloud-aware and its collaboration advantages. Now SOLIDWORKS is testing a pure-cloud, general-purpose mechanical designer that could become the next generation of SOLIDWORKS. The company also has two specialized cloud products, Conceptual Designer and Industrial Designer.

In addition to the products created for the cloud, most existing desktop CAD applications can run in Frame, a software solution that runs desktop software from a cloud server. This alternative

Dassault Systemès SOLIDWORKS
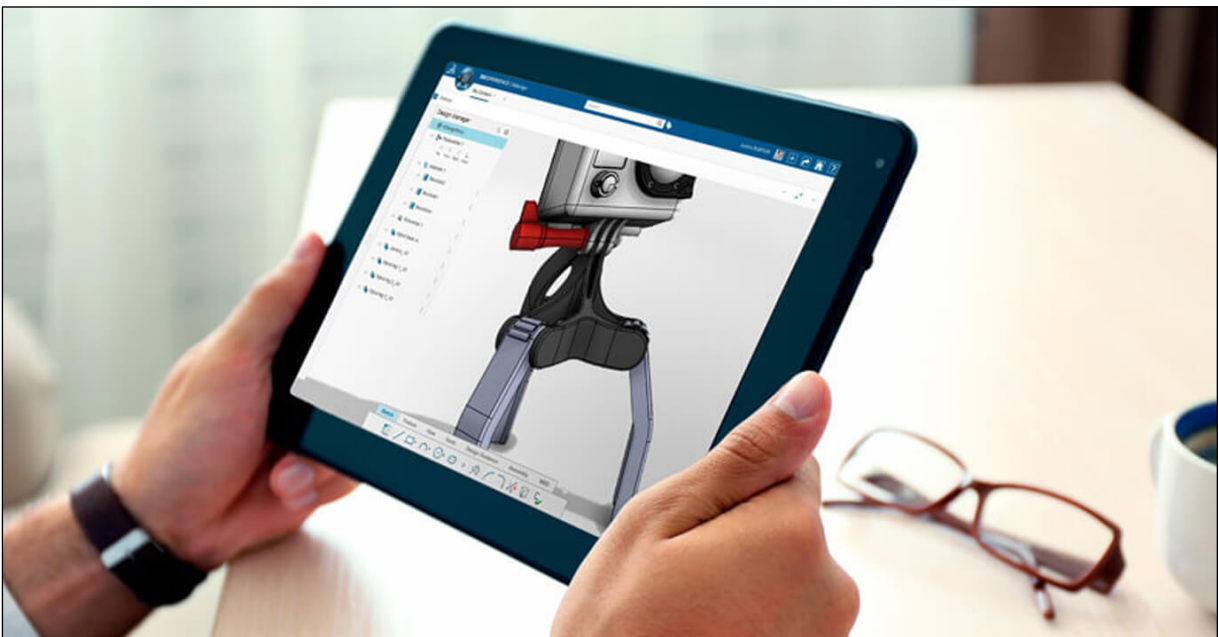
» *Dassault Systemès SOLIDWORKS Xdesign is a cloud-based mechanical CAD program now in development.*

provides the simplified approach to IT while allowing users to continue using their same CAD software. Several vendors, most notably Siemens PLM (NX) and PTC (Creo), also offer a "private cloud" approach to CAD that requires the NVIDIA Grid virtual GPU desktop infrastructure technology.

Looking Ahead

The cloud is not going away; it is a force of democratization as important today as the arrival of the PC was 35 years ago. Cloud technology lowers the cost to access high-performance computing, it simplifies IT management, and it will — over time — lower the overall cost of software. It enables new forms of collaboration, and makes possible true digitalization of engineering processes. Thousands of CAD users have already made existing cloud products like Onshape and Fusion 360 their primary CAD tool. For the most part, these users are either solo practitioners or in small companies with limited need to exchange models into desktop formats. But that will gradually change, as larger firms decide the benefits outweigh any perceived drawbacks.

The need for translation to existing desktop CAD formats is a productivity bottleneck that cloud CAD users and vendors will have to deal with for years to come. Translation and file exchange breaks the digital chain of simultaneous access to data for all team members and the "one source of truth" approach to design.

Although the numbers of products are about the same in both 2D and 3D, 2D cloud CAD products are less advanced. The problem is the need to stick with the DWG file format. True cloud CAD products don't use file formats as they exist on desktop products; they use databases. The Open Design Alliance has added cloud capabilities to its Teigha CAD kernel, which means there could be new and novel applications coming in the future to expand the ability to use 2D in cloud-aware ways.

As much as Onshape claims its "browser-only" approach is the only way, it is likely new players will take a hybrid approach, using both cloud and local resources. Hardware will continue to become more powerful and less expensive, providing continued incentive to build new tools and create new workflows that blend the power of cloud connectivity with the speed and flexibility of local processing. This hybrid model will also propel the next generation of simulation and analysis products, where fast local hardware will sometimes provide a better user experience than uploading models for analysis, especially for upfront simulation early in the design process.

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