Desktop Virtualization is bound to reach $11.2B with 50 percent of US organizations migrating or considering migration to virtual desktops. One would think that Desktop Virtualization is poised to be a platform of choice for engineers. Yet, most engineering organizations have been very slow to virtualize their engineering desktops. Whether they are still living in a workstation-centric view of their infrastructure or they think that Desktop Virtualization solutions are not ripe for an engineering usage, these organizations are ignoring some of the most compelling benefits that Desktop Virtualization can provide.

This white paper explores how Desktop Virtualization can help engineering organizations increase their competitiveness while reducing their costs and provides a practical roadmap for building a Virtual Design Center for Electronic Design Automation (EDA) and CAD/CAM engineers.
Contents

1.0 The Third Revolution of Engineering Desktops.................................3

2.0 The Shift to Virtual Desktops ..........................................................4

   2.1 Virtualization 101 ..........................................................................4

   2.2 The rebirth of virtualization .........................................................4

   2.3 Desktop Virtualization .................................................................4

3.0 The Virtual Design Center: Virtual Desktops for Engineers ..........6

   3.1 A Virtual Design Center helps you do better engineering, faster ....6

   3.2 A Virtual Design Center will make your IT infrastructure more agile ....6

   3.3 A Virtual Design Center helps you reduce and control costs ..........7

4.0 Building a Virtual Design Center 101 .............................................8

   4.1 First, make a case .........................................................................8

   4.2 Second, identify your use cases .....................................................8

   4.3 Third, design your virtual desktop infrastructure ........................8

   4.4 Fourth, decide on your operational model ....................................9

   4.5 Fifth, choose your vendors ..........................................................9
1.0 The Third Revolution of Engineering Desktops

Before Electronic Design Automation (EDA) or CAD/CAM existed, engineers were drawing integrated circuits and mechanical parts manually and would do layouts on paper. All of that changed in the beginning of the 1980s. Carver Mead and Lynn Conway released their seminal “Introduction to VLSI Systems” that would pave the way to the entire EDA industry. Simultaneously, computing costs went down, driven primarily by the introduction of the personal computer. Thus began the first revolution of engineering desktops: the workstation era.

For the next 15 years, engineering desktops would get better and more powerful. Two categories of vendors would emerge: hardware vendors and software vendors. On the hardware front, famous companies like HP®, Silicon Graphics®, or SUN® Microsystems would offer powerful design workstations to suit the exponentially growing needs for computing and graphic power. On the software side, Cadence®, Synopsys®, and Mentor Graphics® would slowly rise to dominate the EDA category, while Siemens, Dassault Systèmes, Autodesk®, and Parametric would become the leaders on the Product Lifecycle Management (PLM) CAD/CAM front.

Although everyone was finding benefits in selling or using these new solutions, costs kept rising and became one of the main barriers to entry. The price to equip a single engineer could easily climb over $100,000. For instance, an HP workstation would average $45,000 while a license of Unigraphics would cost around $30,000. Add to that a plotter for $30,000 and training and support cost at $20,000, and you have the cost of an average engineering desktop clocking just above $125,000.

Simultaneously, the rise of the personal computer led to absurd situations where engineers would end up with two machines on their desk; a graphic workstation or an X terminal for their engineering-related tasks and a personal computer equipped with communication and office productivity software.

Those two phenomena—rising costs and the advent of personal office computing—led to the second revolution of engineering desktops: the emulation era. The coming of age of the PC in terms of graphic capabilities, combined with a steep decrease in mid-range server hardware, soon allowed organizations to remove expensive graphic workstations from the engineers’ desks and replace them with graphically powerful—but ten times cheaper PCs—equipped with terminal emulation software that would connect the user to the engineering solution running on a cluster of mid-range servers.

This architecture will remain the de facto standard for engineering desktops for the next 15 years. Today, a lot of engineering companies are still using it. However, a number of economic and technical factors have started to shift organizations toward a new model: virtual desktops. That is the third revolution of engineering desktops.
2.0 The Shift to Virtual Desktops

2.1 Virtualization 101

Virtualization has been around for a long time. Its origin can be traced back to the late 1960s in IBM® laboratories. The core principle of virtualization is to create a new layer of abstraction between the computing hardware and the operating system running on that hardware.

At the heart of the virtualization technology is a component called the hypervisor. The role of the hypervisor is to orchestrate the interactions of the various virtual images with the computing hardware. The hypervisor can take different forms and come as software, firmware, or hardware. It is the heart of the virtualization system which creates and runs the virtual machines.

The benefits of virtualization are quite substantial, starting with the ability to run multiple instances of an operating system on the same hardware, or the portability of a virtual image from one hardware environment to the other, provided that the same virtualization stack is available on both.

2.2 The rebirth of virtualization

It was only in 2005 that virtualization went mainstream in the IT landscape thanks to two parallel, yet distinct, developments in UNIX® and PC computing.

UNIX and Linux® server vendors considerably expanded their use of virtualization technologies which, until now, were reserved for high-end, expensive systems. The ever-increasing capabilities of hardware and the need to consolidate and manage large multi-processor server farms in order to reduce costs as well as the progress in hypervisor technologies all contributed to getting vendors such as Sun, HP, IBM, and SGI to provide virtualization as a core piece of their technology stack.

At the same time, x86 virtualization made great progress, led by the efforts of Intel® and AMD, to build virtualization extensions into their processors, facilitating the emergence of software solutions such as those offered by VMware®, Parallels®, Citrix®, or Microsoft®.

2.3 Desktop Virtualization

For a number of years, virtualization was primarily considered as a server technology. The reason was simple: servers were the candidate of choice to reap the benefits of virtualization and companies were eager to cut costs and centralize their server infrastructure into consolidated data centers. Soon, however, IT vendors and IT departments alike started to consider virtualization as a promising technology for the desktop.

On the contrary to server virtualization, however, Desktop Virtualization was never limited to slipping a hypervisor underneath the operating system. In fact, a
number of different technologies are often thrown under the moniker of Desktop Virtualization.

2.4 Virtual Desktop Infrastructure (VDI)

The principle behind Virtual Desktop Infrastructure (VDI) is relatively easy to understand: create a virtual image of the user desktop and host multiple instances of the virtual image on remote servers or blade PCs. Then a connection brokering service will hook each user to their assigned virtual image and allow them to interact with the virtual desktop through a remote display protocol.

2.5 Remote desktop services

In this architecture, user desktops are also hosted on a central server, however, the core difference with a VDI infrastructure is that they all run within a shared operating system environment—whereas VDI provides one operating system instance per user. Remote desktop services are accessed by users through a remote display protocol and can deliver full desktops or individual applications as needed.

2.6 Local desktop virtualization

This approach consists in putting the hypervisor on the client machine and having this hypervisor run a virtual machine instance locally on the user’s desktop. The virtual machine instance can be delivered from a central server or on a portable device, such as a USB key.

2.7 Desktop as a Service (DaaS)

DaaS is a delivery method for any of the Desktop Virtualization technologies mentioned above, which consists of providing these technologies via cloud computing through a Software-as-a-Service model. DaaS has become a mechanism of choice for organizations to enjoy the benefits of VDI without incurring the heavy investments required in setting up their own VDI infrastructure.
3.0 The Virtual Design Center: Virtual Desktops for Engineers

So how exactly does Desktop Virtualization apply to engineering groups? What are the benefits? Is it worth the investment? Those are some of the questions that most engineering desktop managers will be asking themselves as they are getting exposed to Desktop Virtualization technologies. Ultimately, it all comes down to one thing: why consider building a Virtual Design Center?

3.1 A Virtual Design Center helps you do better engineering, faster

Virtual desktop technologies radically transform the way you create and distribute desktops to your engineers. They also dramatically change the way your engineers work.

Virtual desktops have this unique quality that they can be both ubiquitous and totally transparent to your users. Building a Virtual Design Center and replacing your legacy desktops with virtual desktops will provide a lot of benefits to your engineering department:

- **Virtual engineering teams** will finally all be on an equal footing, using the same versions of the same tools in the same environment.
- With many organizations spread across different time zones and with budget falling, a virtual desktop infrastructure will help you **foster collaborative practices** between your engineering groups.
- Virtual desktops will greatly accelerate your **ability to onboard engineers quickly** and adjust your engineering infrastructure to the pace and the needs of the business.
- Removing geographical barriers between the users and their engineering applications will give you much greater latitude for **recruiting and retaining talent**.
- By giving engineers access to a better, faster, and always up-to-date version of their tools, you will help them **reduce time to market**.

3.2 A Virtual Design Center will make your IT infrastructure more agile

As our business environments become more and more elastic, it has become critical to align our IT infrastructures to a more agile model. Using virtual desktop technologies to build a Virtual Design Center will allow you to build engineering desktop policies and practices that are more flexible and more robust:

- One of the most obvious benefits of a Virtual Design Center is that it will **decrease your IT administrative overhead** by simplifying and shortening provisioning of user desktops and applications.
• At the same time, switching to a virtual desktop environment will **shorten your desktop refresh cycles**, providing you with the ability to roll out new software much faster.
• From a security standpoint, using a virtual desktop can help **reduce the surface of attacks**, giving you better control of your desktop security tools and practices.
• Their portability and rapid deployment abilities make virtual desktops also extremely well-suited for **setting up disaster recovery centers** where engineering tools can be redeployed to users in a matter of hours.
• Centralization of resources also makes a Virtual Design Center more efficient and capable of better **balancing the load of the computing infrastructure** based on the user or the business needs.

### 3.3 A Virtual Design Center helps you reduce and control costs

One of the key benefits of a Virtual Design Center is also economic. While the Average Cost Per Unit (ACPU) of a virtual desktop still outweighs the ACPU of a traditional PC, many industry analysts predict that the opposite will become true as virtual desktop technologies mature. Visiongain, in their report on “Cloud-based Virtual Desktop Infrastructure (VDI) Market 2012-2017,” estimates that the ACPU of a virtual desktop was $900 vs. $820 for a regular PC in 2012. However, in the same report, Visiongain estimates that virtual desktops ACPU will match the PC ACPU as soon as 2014, and that by 2017, a virtual desktop ACPU will average at $670 while the PC will remain at $760.

Those calculations, however, are not sufficient to adequately reflect the specifics of desktops in engineering departments. Yes, PC vs. virtual desktop ACPU's are important, but let’s not forget that these machines are meant to connect engineers to software whose license cost several tens of thousands of dollars. What is $10 or $20 in the grand scheme of things?

More interesting are the desktop management savings that an organization can yield by switching to a Virtual Design Center infrastructure. In their 2012 “Business Case for Desktop Virtualization” report, VMware calculated that switching to a virtual desktop infrastructure could save up to 7 hours per user per year in management tasks, representing 57 percent of the total time spent on administration. Not only is this number extremely impressive, but it also reflects benefits of Desktop Virtualization across all areas of desktop management: hardware and software deployment, user administration, application management, image management, user profile management, patching, data security, disaster recovery, data backup, helpdesk, and support.
4.0 Building a Virtual Design Center 101

So where shall you start in order to build your Virtual Design Center? The answer is both easy and complex, but there are a number of steps that you should consider when starting this project.

4.1 First, make a case

It may sound obvious, but there are more people than you think who skip this basic step. Making a case will automatically begin by building your end-user device strategy. You have to take a critical look at the next 5 to 10 years and decide where your business needs to be in the landscape of end-user devices. Ultimately, you are going to have to calculate the anticipated ROI of VDI to compare it with your current desktop strategy and decide which is best.

Of course, many factors will influence your calculation: hard costs, such as management costs, device costs, user and application provisioning, etc. There are also softer costs, or opportunity costs that you will need to evaluate before making a decision. For instance, how much would it cost you in opportunity if you don’t make your engineers mobile? How much effort would it take you to handle a disaster recovery situation with or without a virtual desktop infrastructure?

4.2 Second, identify your use cases

Assuming that you’ve decided to move ahead with your Virtual Design Center project, you will need to identify who among your engineers you are going to transition to a virtual desktop setup. Not every use case is well suited for a virtual desktop. Your job at this stage will consist in getting a deeper understanding of the requirements of your engineers and put those requirements in perspective with the market offering. This is not as easy as it seems. As you will soon discover, engineers crave for three things when they use their desktops: speed, speed, and more speed.

Although Desktop Virtualization technologies have made great progress when it comes to performance, you need to make sure that you’re going to deliver a solution that will provide the engineer with (at least) the same, if not a better user experience. For instance, engineers doing layout of chips and circuit boards spend a lot of time panning and zooming all over the screen. You need to ensure that whatever virtual desktop solution you will choose will support high-performance graphic rendering, otherwise you might negatively affect their productivity.

4.3 Third, design your virtual desktop infrastructure

There are many components that make up a virtual desktop infrastructure. You need to consider them all and decide how you want your design center to look. Among the various components that you’ll need to think about, here are the main ones:
• End-user devices: What are they going to be? Thin clients, tablets, mobile phones, PCs?
• Connection broker: That’s the piece of your infrastructure that will be in charge of routing and connecting users to the various resource pools in your virtual design infrastructure
• Remote Desktop Services vs. VDI vs. Local Virtual Machines: It is likely that you will end up with a combination of those, but you need to think about which piece will play what role in your VDI infrastructure.
• GPU-accelerated virtual desktop: If your use case involves complex, intensive real-time 3D rendering, this is going to be a must.
• Back-end: If you haven’t done so (and if that’s the case, you should probably start with this before diving into a virtual desktop project), make sure that your back-end application, networking, and storage infrastructure is fully ready to welcome a virtual desktop layer

4.4 Fourth, decide on your operational model

There are three major ways you could operate your virtual desktop environment: private hosting, Infrastructure as a Service (IaaS), or Software as a Service (SaaS).

In the private hosting model, you are going to own and operate the entire virtual desktop infrastructure. This model obviously has certain advantages because you control every piece of the puzzle, but it’s heavy on Capital Expenditures (CAPEX) and requires a significant time investment from the IT group to set up.

In the IaaS model, your VDI hardware infrastructure will be hosted in the cloud of a cloud service provider. You will, however, retain complete control over the installation and operation of your virtual desktop software infrastructure. This model is mostly interesting for organizations who need to scale their Virtual Design Center but who do not want to burn their CAPEX budget.

Finally, the SaaS model will let you consume someone else’s virtual desktop infrastructure hardware and software. Of course, you will end up customizing the desktop image to contain the software you will need, but it will be the less expensive option as it requires almost no CAPEX and minimal investment from your IT department.

4.5 Fifth, choose your vendors

As we discussed above, it is unlikely that you will end up with a single vendor who will provide you with the end-to-end Virtual Design Center solution. You will probably end-up assembling a collection of vendors based on their specialty and what issues they solve for you. Here are a few to get you started:

• Virtual Desktop software stack: Citrix, VMware, Microsoft, Red Hat®, Virtual Bridges™
• Virtual Desktop software and hardware: IBM, Dell®, Oracle®, HP
• UNIX Remote Access: OpenText (OpenText Exceed onDemand®)
• Connection brokers: Ericom, LeoStream™
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