STEVE MUELLER: All righty, guys. How are we doing today? All right. It's kind of strange-- this room and that small. I have a loud voice by nature, so I'm a little surprised that I have to carry a mic. But you can't hear me, let me know. Or if I'm too loud, just raise your hand.

So thanks for coming. Today's session is all about how to Move Your Desktop to the Cloud with Amazon WorkSpaces. All right. This is the idea of using a remote desktop in lieu of a physical workstation or laptop. The machines that we've come to love and come to hate, right? I am Steve Mueller. I am the lead Workspaces specialist at Amazon. We will talk about our involvement with Autodesk University, and how Autodesk University is using Amazon WorkSpaces for its various labs and Answer Bar. And, of course, you can find us on the web with Twitter at @awscloud.

So first, just a raise of hands-- how many people know about Amazon Web Services, or AWS for short? Awesome. How many are actually-- just leave me up. How many are using AWS in some capacity? Interesting. And I'm guessing, for those who are still using it, and hands up-- I'm guessing, those are mostly for server, big data, data storage. OK.

AUDIENCE: Minecraft.

STEVE MUELLER: Minecraft. OK.

[LAUGHTER]

STEVE MUELLER: Yeah. So that's awesome thing. Threw me off. That's really cool. So what we wanted to come in and talk to u today was about what remote-desktop computing means to us. What end-user computing means to us. And I start this off by saying, hey, where have we come from with end-user computing?

Because when you think AWS, you think storage. You think virtual machines. You think databases. You think big data. But what you're not thinking about is desktops, historically. And what you're not thinking about are things like graphics desktops, and GPU-intensive desktops. All right. So AWS is more than just server infrastructure.

About three years ago, we moved into the end-user compute space, at the asking request of our customers. Who said, hey, you've got these awesome virtual machines out there. We would really like to be able to use these as desktops, replacing these physical desktops.
So we started the journey in about late 2014, and we’ve now got a portfolio of products that complement what we feel are the desktop, really, in the enterprise app space. So you’re looking at-- at the core of it, is a remote desktop. All right. And that is known as Amazon WorkSpaces.

And this is an offering that is Pay-as-you-go, monthly or hourly. And it’s based on Microsoft Windows desktop. You can use Windows 7, you can use Windows 10, or you can-- and use your own licensing, or you can let us pay for the licensing. And we’ll bill it back to you, as part of the package is offering. Very much in the like of what we do today in our core server offering, known as EC2.

And of course, along the side of workspaces, when you get into desktops, you realize I’ve got to publish applications. I’d like someplace to store my files and collaborate with my coworkers. I might want to be able to authenticate to this and tie it into my corporate directory. How many of you folks are actually administrators in IT? OK. So a good amount. So you understand what we’re talking about here, right?

So corporate integration-- the desktop has to feel like it’s part of your network. Side note to this, I’m actually running this PowerPoint on a WorkSpace itself. And that workspace is actually My Desktop at amazon.com, as an employee of Amazon. So we’re actually-- as we like to say, drinking our own champagne. Or some folks will say, eating our own dog food, in presenting to you on the WorkSpace story.

So what are WorkSpaces? What is WorkSpaces as a service, right? It is a remote desktop offering, where the desktops are based in the cloud. We’d like to focus, first and foremost, on what the user problems are. We don’t go off and invent, just because we think it would be an excellent space to go into. We really focus on what our customers ask for. The customers came back to us and said, what’s the number one problem for most with desktops? We lose it, right? Commoditization of this.

If I lose this in a taxi-- I live in New York. I’m done. My data is gone. And also, how do I work with my coworkers, when they’ve got these massive files sets? That USB key is only so big, and FedEx works only so fast. And my internet connection at home only has so much oomph. I want to put this stuff in the cloud and live next to it at what we will consider lightspeed.

So from a security perspective, you’re always in the cloud. You can access it securely. And
you take the risk off your desktop from being stolen, or of data loss. Those things that desktop administrators have to deal with. How many actually administer desktops in their current role?

OK. Awesome. From a WorkSpaces perspective, let me be very specific that we’re not the first in this industry. This industry has been well-worn by other players, who’ve gone before us, and who are still there. And they call this Virtual Desktop Infrastructure, or VDI for short. And it's traditionally, VDI that has lived what we consider to be on prem in a corporate data center.

And the challenge our customers brought to us, when they said, hey, we want to avoid data loss prevention. We want to be able to access this from anywhere, securely. But more importantly, VDI was really tough to deploy. In fact, the number one challenge with desktops in VDI is storage. The storage has to be fast. More specifically, what that translates to the end-user experience, is when I hit my Start Menu, or when I move my mouse and it moves my window. I don’t want to feel the latency. I think we could all agree, right? That if you’re moving a window and it’s dragging. Odds are high you’re going to say, I want to go find something faster. And you’ll leave it.

And the reality is, users and end-users have this choice. Right. Customer choice of-- I want to do my job fast. I just want the tool to work and get out of my way. And this end-user experience is what hurt traditional VDI. Because traditional VDI was hard to deploy. You didn’t have enough resources from computing. You couldn’t get enough desktops out there. You build this beautiful data center in Atlanta, a team in Malaysia comes up. How do I get closer to them? The latency is high. They’re telling me it’s terrible performance.

These are all the challenges that our customers brought to us and said you have to solve this. And make it simple to deploy, easy to manage, and give us the ability to scale, without worrying about physical hardware. And if anyone’s worked in this environment before, you understand what lead times look like for physical hosts. That you have to rack up for virtualization hypervisors. Right? Sometimes those lead times take months.

So our customers came to us and said, give us the ability to scale and give us the ability to consistently perform. I don’t want to know that this gentleman right here is running a desktop at 97% CPU. And he’s crowding everybody else out. I want his performance to be isolated away from hers. And finally, a theme that's consistent in AWS, for all who have used us, is that we like and our customers like Pay-as-you-go. And so our customers asked us to join the same theme and principle, that we carry in our other services-- which is, don’t make us pay upfront, necessarily. Don’t make us request 300 at one time. We just want to pay for the
desktops. And that is super important in a desktop environment. Why? Because a desktop environment, any service that deals with desktops is the most intimate service we could ever offer.

So I'll stop there. We don't know-- this is humans. Servers aren't humans. Humans work on servers. But humans work on desktops. And the employee who was with me today may go to another company tomorrow. I don't know if that person needs a desktop or not. And more importantly, if that person leaves the company, did that person take the desktop? Do I have a security issue? This is the realm that we're in. It's a very human service, when we stop and think about it. And all the human elements come into play, when the customers requested this from us. These are the areas that we focus on in our service offering. Bless you.

So what is desktop as a service? So the old school was called VDI, a Virtual Desktop Infrastructure. And most know what VDI means, if you're in the desktop space. The new world order is generally referred to as desktop as a service, or DAAS, D-A-A-S. And really, this is realizing Microsoft Windows desktops on AWS. And as our customers told us, give us a second chance to make desktops great again. Right? Let's realize the virtual desktop dream. There's so many things that we can do.

For me to be able to be very honest, here's the story. I was editing this slide deck, two minutes before I walked into this room. If I had to put it on somebody else's machine, that means I got to go get a USB, or I got e-mail it to something. Nope. I borrowed another laptop from a colleague, downloaded the WorkSpaces Client, signed in, and here we are. Right? Anywhere.

So this, of course, being the traditional replacement for VDI, our customers want to no hassle infrastructure. They want a capacity that went to scale. And they want a performance that was reliable and consistent-- and could be predicted. We talked about, of course, anywhere-access and industry-standard security. These are all super important things. Why is this relevant to the crowd that I'm talking to at Autodesk? When you guys are focusing on manufacturing and engineering and architecture.

Because at the end of it all, it comes down to desktop software, doesn't it? It comes down to large file sets. I'll talk about that in a minute. At Autodesk University, it comes down to-- hey, honey. I'm on my way home, but I'm running late. And you don't want to shut down the desktop because you're midstreaming a thing. But you know you got to get going because the kids have soccer practice. You want to just leave it as is, turn the device off that you're there,
or just simply disconnect. Go home, and resume, as if you were right in the office-- but still meeting the commitments at home. Right? That's the real human element here.

And the other element is, does anybody want to lose their files sets? No. No, no, no, no. Right? You need to be able to have those backed up. And the other thing in that file set spaces, they're so large. Right? Huge demand on disk. And disk is cheap. And disk is commodity in the physical world. But you have a hard time getting disk somewhere else. That's not easy. So if it can live next to you, and others can work on it with you-- as if the barriers of the physical world were not there, then isn't that the dream? Isn't that what we're really trying to shoot for, and isn't that why we're here speaking at Autodesk?

So fundamentally, the other thing that our customers wanted was-- they wanted the consumer model to really embrace and become corporate IT. The way of thinking of this is, all of my corporate IT customers-- those in the room here who may not be my customer, but you will appreciate this. We, first and foremost, start our day as a consumer, don't we? Right? We just happen to work in a corporate IT environment. And so this idea of device independence, or BYOD, is not new to anyone, but location independence is. The fact that I can work anywhere, from this network, from your network, and my files are still available to me. This is the mission statement of WorkSpaces. This is what we're shooting for in the remote-desktop world.

So why? Why do we go out and build? Why would our customers care about remote desktops? Well, we've already talked about secure resources. Amazon Web Services, by placing your desktop in there, and your data close to it-- we use industry secure protocols to access those desktops. So we use the standard protocols, technically, AES 256, IP SEC, and HCBS for what customers access for. And of course, a lower cost structure is what we're driving towards. Our goal, in the end, is to deliver a high quality experience. Minus the lag between my clicker and this.

Does anyone realize I'm remote? In fact, I'm on an HP laptop. Had I known that they had HDMI in here, I would have brought my Chromebook. Which is really impressive because my $410 device, that has nothing on all, except a browser, can now spin GPU workloads, as if I had a $4,000 machine in my hand. And that is, fundamentally, what we're going for here today with you. Right. And, of course, from your perspective, from your end-user's perspective, your users want instant access to apps.

By the way, let me dig into this a bit more specifically. One of the hardest things is moving
data, right? Will we all agree? We talk about data. We talk about loss of data, working with others. But the art of moving data-- how large are the Autodesk binaries?

We all agree they're sizable, yes? And they take a while to download. Right? Because internet is only so fast into our homes and our offices. One of the nice things about WorkSpaces is that you can download those from your WorkSpaces and AWS. And you have an access to a very large internet border.

So when you're downloading those 40, 50, 60-gig apps, you're no longer worried about what the local internet can support. You are worried, can I connect to my WorkSpace? And if so, then I'll let the AWS access to internet download those for me. Right? So for example, in Autodesk University this year, it turns out we actually built and provided WorkSpaces, as the default desktop of choice for the lab environments and for your certification exams. Who's been in the labs or certification? OK. Those are some very large binaries that we had to source in. And since we were in our WorkSpaces, we were able to easily download it from Autodesk, bring them into a repository, and then, move them around.

My favorite is really, what are the use cases we're focusing on? What do our customers want us to solve? I think, the most relevant one for all of us today is training in labs. One of the things that the GPU, or what we call the GPU customers, or graphics customers-- customers, such as yourself, or people such as yourself, say is, hey, it is difficult to acquire those five or $10,000 workstations, right? I mean, maybe not so much. But if your corporate requires a PO, it's a barrier to entry. I want to do something, and how many people have replaced their workstation last year? Last two years? And why do we replace it? How many did because of performance and need a new hardware? OK.

That's a barrier to entry to most. So if you want to learn the latest technology, and you need a hardware upgrade, that's a difficult process. You have to acquire it. You have to get funding, if you're corporate. You have to get funding from the home office, if you're not. Whatever the case may be. But WorkSpaces make excellent environments for trainings in labs. So let me stop here.

What we did for Autodesk University this year, in conjunction with Autodesk, was provide a V-default desktop experience for the labs, the certification exams, the answer bar, and the open lab downstairs. They are all running remote desktops. In fact, there are roughly 500-- I've got a couple of slides that talk about statistics. And we actually just launched graphics
WorkSpaces. More details on that in a minute.

And what we found was, not only is there a lot of IO in this environment-- but what we found is, we know that training labs is a super important use case. What if you could spin up a desktop and pay for it for six hours? And then have the GPU specs that you need, to test some software, or run through an exam and be done from a commodity piece of hardware.

And from a certification instructor perspective, or from a training perspective-- if you go out to the expo, we've seen a number of providers. How awesome is it for them to get to you, as a customer, and say, hey, we've got a training environment in the Cloud. Just download this, access it, and move on. And you don't even have to download those 30, 40, 60-gig installers anymore. Right? It's provided for you. You log into it, seamless, and easily, and secure. And you get back to it. And then, you trash that environment. You go again.

So it's super important use case, relevant to Autodesk University. There are definitely other use cases, that we focus on and our customers want-- call centers, right? We have one, in particular, where they want their call center members to log in to different WorkSpaces for different customers. And that's how they get in those customers' networks.

Mobile workers temporary workers-- we face this at Amazon. Acquisition, right? How many work in a company that has acquisition of small or large companies. Anyone? OK. The number one challenge, and that is bringing them into your network. At Amazon, we have this difficulty, as well. We now onboard our customers-- our acquisitions into WorkSpaces. Because they get into our network right away. And we can deal with the physical world of integration after the fact.

One of the things that we focus on, from a simplification perspective, is-- how do we make the heavy-duty lifting easy for you? So we handle the logistics. In the data centers today, we have seven regions where WorkSpaces is. I'll show you the map in just a minute. You can place your desktop in the geography closest to you. We happen to be in Las Vegas. I'm in a desktop today in Oregon. If I go to Germany next week, I'll place a WorkSpace in Germany, for that time being, if I like. And then destroy it, when I'm done. It's close to me.

From a storage perspective, we handle all the heavy lifting on that. This is the historical challenge, as I said earlier, about VDI. If the disk isn't fast enough, user performance is impacted. Right? And we do this all at a global scale, offering you the tools to monitor and run across a seven-geography network today. But the point in here is that Amazon WorkSpaces
will simplify deployment of desktops.

How many are actually using remote desktops today? Anyone? Keep them up. How many are using those with graphics processors? Still a lot. OK. Is it difficult to get to those if you've-- how many of those actually have it in multiple locations? Oh, two. OK. So we had this. Go down to two. Right. So that's the goal here. We want our desktop to be available anywhere, anytime, closest to me.

Don't worry. I think, we have a demo at the end. Yup. It feels familiar. Again, common theme. You launch what you need, you pay for what you use, and we handle all the rest. No more heavy lifting. The end.

From a Windows perspective, all of the standard management tools are here. So you will treat your workspace, like any other Microsoft Windows desktop environment. So color commentary from a customer once said, we don't know which ones are WorkSpaces, and which ones aren’t in our SCCM management tool. Of course they had hostnames, that would tell them. Or they had other ways of doing it. But the point was the physical and the virtual suddenly came together in one management pane of glass.

Because of that, they were able to integrate it with their corporate network. They were able to tie it into their Active Directory domain. They were able to apply GPO policies. All of the standard management tools and technologies that you know, you get to bring into WorkSpaces.

Distribution of software, which is super important, especially in Autodesk University, right? These are large apps and large installations. And often times, if we look at this event in particular, instructors like to bring software in at the last minute. Which is totally fine. Or there was an update yesterday that's important to the lab. So you need to be able to push your applications out to your desktops. Bottom line is, WorkSpaces get to use the same technologies that desktop administrators know.

From a provisioning perspective, I think the key here is that-- you got to make the image the way you want. And you get a provision thousands, if not more. And most importantly, they take about 30 minutes to get out. So you have a new GPU desktop, a graphics desktop in the Cloud, that I can give you in 30 minutes.

Can we get to Best Buy or back? When we get to amazon.com or back in 30 minutes? My
Prime now offering from amazon.com can't get me a graphics workstation physically in less than an hour. Right?

Just calling out some hardware configurations-- we do offer four configurations today. A very low-priced 1 CPU, 2-gig RAM for knowledge workers, call center employees is really the idea here. A mid-range one that has 4 gigs of RAM. We step it up for more performance set of users at 8 gigs. And as of this week, we have formally launched our graphics offering.

This one is based off the NVIDIA K520. It features 8 vCPUs and 16 gigs of RAM. Turns out that these are, in fact, the desktops that we are using at Autodesk University. So for those in the labs, and those in the certification exam room, the desktop you sit at is not the desktop you think it is.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Thank you for the feedback. So let me stop there. That's excellent feedback. We like to iterate.

And believe me that we're always listening to that type of feedback. I don't think we'll stop at 16. And I don't think we'll stop with at the K520. Right?

So getting out of the Autodesk University environment for a minute. Coming back to the security perspective for those who manage corporate networks. Those who are involved in corporate IT, you know that you have to generally make this look like VPN. So we do integrate with your MFA servers. How many actually manage desktops and have to talk to the radius or the MFA teams? Anyone? OK.

I got one guy. No problem. What we're talking about is that, when you log in your workspace, you should be able to log in with the same token, the same key, the same fob, the same virtual token that you do with VPN. So the workflow for the end-users is consistent with what they do today. We integrate with those MFA servers. Gemalto, RADIUS, a few others to name a few. From a security perspective, no data is stored on the local device.

So why is that important for us at Autodesk University? Because, if one of those desktops fails in the lab, we take the commodity piece of hardware that's sitting in front of you, we move it aside, we put another one in. We put it on Power. 8 seconds you boot. And you're back into that. That's normally a difficult process. That is disastrous in certification because if that happens in a certification room, you'll lose your progress and have to start over. Right?

From a security perspective, it's critical because if you lose that device, we don't have to worry
about wiping that device anymore and getting the data off. So lots of different perspectives on why no data local is important. But again, from a security perspective and from an availability perspective, it's one of the strengths of WorkSpaces.

We do use one of the industry's standard protocols for desktop streaming. Teradici PCoIP---how many actually work with Teradici PCoIP today in there---OK good. Citrix is out there, as well, with HDX, if you know them. But we license and use Teradici's protocol. And, of course, beyond that, from a streaming perspective, the actual disks on the workspaces themselves are customers who had a massive requirement of implementing storage volume encryption. So the concern from our server world is hey, we like AWS, we like living in the Cloud. But we want our data, at rest, to be secure. We want it to be encrypted. We either want to encrypt it with our encryption keys, or we want you to do it, as a convenience.

That same methodology, that same request, comes into the workspaces world. And yes, your data, in your desktop, living in AWS, can be encrypted with your keys, for free. With zero performance overhead. So if you're worried about Cloud offering, you're worried you like the idea of remote desktop, but you're worried about that data. You're worried about those death-star plans-- the colonel's recipe.

If you are engineering, we just talked to some folks internally today at amazon.com, who were here today. And they work at our fulfillment center design group. And there are some cutting edge designs that we're doing. They use all sorts of Autodesk software. Those types of things are super sensitive to a company. You don't want to show those plans. So encrypting your volumes in the Cloud is super important for customers.

One of the areas that is very near and dear to me is, why did we move to the Cloud? Why do we move our desktops to the Cloud yet? And the reality is because you want to cut commoditize your hardware. From the customer perspective, you might want to work from that iPad Pro-- that 13-inch. You might want to work from the Microsoft Surface. You might want to work from your normal HP laptop. Or your Kindle Fire. Or that Chromebook that you've been looking at.

The point being is that WorkSpaces supports almost every major type of device in the ecosystem today. So if you want to log into this from your desktop or laptop at work, and go home and bring up your engineering designs from your tablet-- that is well within the realm of possibility. If you want to watch a design in Revit being rendered from a $200 Chromebook
and make it feel like, as I said earlier, a $5,000 workstation. You can do it. You find a device that fits your needs. You bring it to WorkSpaces. We will support it.

On the back-end, for those who have to administer desktops or have to be interested in desktop management-- one of the most important things we can do is offer you custom metrics and alerts to things that might be happening in the desktop. Now, while this gives you the ability to become more proactive, what we really get into is, wouldn't be nice to know if somebody's desktop flipped unhealthy? And then, we would notify that user and possibly cut trouble tickets open.

What if somebody couldn't log in, or there was-- if I look at it another way, I notice a high swarm of log in attempt failures? Is that person not able to log in for various reasons? Forgot their password? Or do I have a deeper security concern, that I need to look into?

You could tie into other AWS services for notifications to these events. And become more proactive. That is very difficult to do-- our customers have told us in the physical world. But with Amazon WorkSpaces, when you move into the Cloud, you get to tie into the broader AWS offering. Let me get a little more specific to the event that we're at. In AU, we have a very large set of data for your labs. That data set is probably just under 200 gigs now. And it's growing.

Perspective, we started the event with 15 gigs, and now, we're at 200 gigs. And this is material that instructors bring to us last minute with USB. We have to take a USB. We have to take it from the physical world, move it to AWS. And then, make it accessible to all 500 workstations out there today. Because the workspace is an Amazon, or rather AWS, we got to tie into network shares, that are light-speed.

We have multiple file servers out here today that process upwards of 10 to 20 gigabits per second, as we're trying to push data sets out to the labs before the end-users get into the machines. So not only is it from a monitoring perspective, it also lets you tie into the broader AWS ecosystem.

As I said earlier, we are globally available in seven regions today. This is very important, we feel, in the desktop world. As it allows you, as the administrator, or you as a user, to select or provide your desktop closest to your needs. So today, in Las Vegas, the Autodesk university environment is coming out of Oregon. But if we were in New York, we would bring that to Virginia. So from an end-user perspective, if your user travels, you can provision the desktop closest to their location. And of course, we are certainly listening to customers with what
regions we need to move in next.

And again, as I said, why is this important? Because you can keep it close to your users. Or you can keep your desktops closest to your users, or your desktops closest to your apps. In an Autodesk world, this is very important. If you want to tie closest to your apps, it's not just about the apps. It's about files. How many use file systems, file shares, file servers that are based in the Cloud? How many want to use file servers? OK. How many have difficulty moving files around? OK. All right.

If we put it all together and get a little more technical than the marketering that's up here--what we're really talking about is, from a security perspective, this is AWS. Your workspace lives over here. And you will, most likely, have-- if you're an end-user, this will be transparent. If you're the administrator, this will be front and center for what you're focusing on. You will tie our Cloud offering into your corporate network. OK? Through a network integration.

And once you've done that, your WorkSpaces, your desktops have direct access to the interior of the corporate network. If you need to get to that internet site, or if you need to get to the file server, or whatever you need to do-- AWS looks like an extension to your corporate network. Your users will be able to log in from anywhere, securely, using standard protocols that the industry uses across all desktop offerings. And log in to these using Active Directory credentials and that MFA key that no one likes to carry.

And it's really important because then, you realize that I don't care where you are, and I don't care what device you are on. And more importantly, I don't have to worry if you lose that device or not. Because it's all here and nothing is stored locally. And as an administrator, you know that all you have to do is bring on additional WorkSpaces and additional regions and tie them behind the scenes. The end result is that, to the user, it's a simple let's log in and go. And if we actually want to see it in action, why don't we just kill our demo?

So this is me. This is me on a laptop that's not mine. Normally, I'd be worried about it. More importantly, what if I had a USB stick. I already said I was coming to the session, finalizing the slides and was concerned that I had to transfer data on to USB stick. I didn't have a USB stick, for number one. And number two, even if it was my laptop, I'm not so sure I'd want to put somebody else's USB stick in it, for security concerns.

So I simply log into my desktop. I've saved my credentials. That credential get saved for roughly 12 hours, long enough for the work force of the day. And here we are into my
corporate desktop. And most importantly, if I didn't say this earlier, my work stays there. Whatever state it's in.

So for you-- and again, I apologize. I'm not an AEC, or a manufacturing expert. But I have to believe-- if you've got large files that's open, and you've got larger renders, and you're in the middle of it-- you probably don't want to disconnect from that right away. Or you don't want to have to worry about shutting that down. You want the desktop apps to stay the same.

So here, we log back in. Everything exists. And I'm able to continue the slides. And for those who want to see that it's a real experience, we will actually take you out. You see that we've got my favorite icons, where I like them. I get to personalize it the way I want. I get to put my backdrop of choice. This is a view of Seattle. This tells me that I'm in a workspace on the west coast closer to home office, which is in Seattle. I've got a Start menu.

We all agree that looked pretty-- it looks and feels familiar to what we're all used to, yes? And I've got chrome. I've got my favorite Firefox. So again, I moved to this a year and a half ago, and I haven't looked back. I have not lived on a corporate-imaged physical device in a year and a half. I'm completely in the Cloud at this point. It's very familiar for me. So let me go ahead and continue and show you a demo of what the Autodesk University environment looks like with you with GPU.

First, let's talk about graphics workspaces. We announced this week, in anticipation of a lot of industry movement towards graphics workspaces-- you can find that our chief evangelist Jeff Barr blogged about this. I believe it was on Monday night.

The key specs here, as we've already gone over, is eight virtual CPUs today, 16 gigs of RAM, based on the K520 Nvidia. We use these Graphics WorkSpaces here at Autodesk University to Autodesk realize a completely remote desktop vision. That helps them in their business. And helps get files to you faster.

We have 500 Graphics WorkSpaces, today. These are in the six lab areas. They are in a certification exam. They are downstairs in the open bar. They are also downstairs at the answer bar. So would you walk up, you might not even know that you're in a remote desktop.

More importantly, if you've used those environments, you've seen the physical devices. There's a there a Dell wise 5030, what they call the P25, and HP's provided their T310. These are true stateless devices. There's nothing on them. It's silicon and firmware.
So if it's silicon and firmware here, I'm not worried about local viruses, am I? I'm not necessarily worried about theft, either. Because I don't have to worry about data that was on it. Now, apply that back to your daily workload. It's got to be frustrating to lose a desktop after all that work, right? And so you have to suddenly worry about, are my files backed up? And I don't understand, necessarily. I won't pretend to be an expert in how engineering workloads are. But USB sticks and USB drives were corporate backups.

So we're talking about stateless local clients. No data stored, access from anywhere securely, and really helping you get into the large files that you need. One other point to talk about here-- we have 500 desktops out here today. We have now lab data set that is approaching 200 gigs. We have to push that lightly. We have a very compressed time frame to get those lab files in order, and in place from the instructors.

By the time that those 500 users walk up, or those 300 lab users, or those 100 certification exams-- we have one of the really fun things about being in Amazon WorkSpaces is that we get to tie in to the larger AWS Cloud. So I have a very large server out there today that is running 16 NVIDIA K80, but more importantly it's got 732 gigs of RAM and 20,000 provision IOP drives.

What does this allow me to do? We literally blast the labs at times-- I have, just alone, 500 desktops coming into one server to get their 100 plus gig data sets. And that server holds up. And if I need more, or I've got a very evolving situation at the event, I just tap into more. I'm not worried about a physical server, a physical host, a physical virtualization hypervisor that could give me VMs. I know the resources are there.

It's not about desktops anymore. It's about understanding the flow of the trade Joe, and saying, hey, you know what? We need to react, adapt, and provide. And let's go just have it at the instructor and do what we want to do.

So suddenly I'm not even talking about desktops anymore, am I? I'm talking about-- the desktop disappeared. I'm talking about the experience of being in there, and now, doing what I need to do. And this has allowed us to deliver 500 desktops to AU 2016 this year-- and adapt and react to the situation.

Let's pull up a demo. Let's see if we have a demo here. First and foremost, this is what the-- who's actually worked with the Amazon Web Services Council? OK. Awesome.
For those who don't know-- I see one of my colleagues raise her hand. Let's actually get this into a little more zoom, so we can all see. So this is what it's like. This is an actual view into the production environment that's supporting AU 2016, right now.

So all of the people out there, this is life. So when I go to WorkSpaces, this is it. This is real. There's lab two, seat 24. That's lab one, seat one. There's 360. That's the Answer Bar, by the way. So those folks downstairs have no idea I'm even looking at their desktop from an infrastructure perspective, as we see here.

[LAUGHTER]

We are big fans of privacy. Yeah, we were cutting one earlier, and it errored out. But the point here is this. What I wanted to highlight was-- Autodesk, it actually said to us. We said, hey, how do you want to distribute software this year? Do you want to use that CCM? Do you want to create a custom image? And they said, we want to create a custom image for each lab environment. Right? And then we want to handle distribution behind that. The point is that they had the flexibility of creating custom images. And then, we can quickly, from command line scripting, provision an entire lab or a new desktop, if we need to.

And in a trade show environment, that's super important because if you get the call that you need to provision additional capacity-- to bring on maybe 4 or 14 more desktops, we have the ability to do that within 30 minutes from a command line, or from the console. And if we actually go ahead and pull-- let's actually pull one. Now, I'm not going to pretend to be an utter desk software expert. But I'm going to go ahead and log into a Graphics WorkSpace, from a machine that's not mine, that I don't know what's on, and show you what it GPU actually looks like behind the scenes.

[APPLAUSE]

And that's probably not for me. So let's actually go ahead and find one of those WorkSpaces. And we're going to actually pull out one of the WorkSpaces that we've gotten in spare. I'm going to get the connection information that I need, and we're going to go ahead and log right into it. So I'm going to disconnect from my actual corporate desktop, where the presentation is being run from. And I'm going to just simply switch into another desktop here.

AUDIENCE: [INAUDIBLE]
STEVE MUELLER: Great question. They do not. The question is, if you have the FlexNet servers, the licensing servers, do they have to be in AWS? And the answer is, no. They have to be somewhere, where your WorkSpace has network routeability and connectivity too. So that means, on prem possibility, AWS, or a mix of both. In this environment, that we’re actually looking at, FlexNet lives in AWS. So we have multiple servers, and it looks and feels and reacts, just like it would in a traditional environment.

So this is the actual experience of logging in. We don’t have MFA on this one. Because these are using the tradeshow floor. We don’t want this desktop, in particular, to have to force MFA, right? People need to sit down and log in. Now, I won’t pretend to know if we have data sets on this one. What would anybody like to see?

AUDIENCE: Revit.

STEVE MUELLER: Revit. That’s a popular one. Do I have Revit on this one? Of course, probably not.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Yes, we do. Matt, do you know if we have data sets? Sorry, to pull you into this.

AUDIENCE: I don’t know.

STEVE MUELLER: OK. Yeah, sorry.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Sorry? What was the question?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Got it. OK. Yeah, this is a desktop built for the presentation, and again, I’m not sure where the state of the file sets are. But here we go to launch. There should be samples, right? So, if somebody could help me understand where the samples are? I hate to pull you into this, but--

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: This one?

AUDIENCE: Yeah.

STEVE MUELLER: What does it do, by the way? I don’t know.
I'm a corporate guy. I'm a desktop guy. Ah, sorry?

AUDIENCE: It's going to blow up.

STEVE MUELLER: It's going to blow up.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: That looks like a brochure for a house on Zillow. What do we go to, guys? Help me understand. If somebody would actually like-- I love live demos. It scares my sales rep. But I love them. Anybody actually want to help him do it? All right. Sorry? Yeah, come on up. You're an instructor. Are you?

AUDIENCE: No.

STEVE MUELLER: OK, my bad. We're actually going to do a live demo with a real user, on a desktop, in the Cloud that I have no idea what we're doing.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, we need a mouse. Right. Of course. Let me get out of the way. Now, if this blows up, it looks bad on me. So we're in Vegas, so let's gamble it.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Parlay it, right?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, boy. Do we have a mouse by chance, Matt? Thank you. Let's get this gentlemen a mouse. Thank you. We got your mouse.

AUDIENCE: Ray trace.

STEVE MUELLER: What's Ray trace?

AUDIENCE: [INAUDIBLE]
STEVE MUELLER: Mm.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: You have a mouse now, yes. Does that help?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Sorry. Sorry?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Yeah, this is what Graphics WorkSpace is offering. It's the 8vCPU with 16 gigs of RAM. I'm sorry, what did we do?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Ah. OK. Is this normal? I don't know.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, OK. All right.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Really? Oh, again.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Ooh. Why?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: OK. All right. In the interest of time. Sure. Oh, now you did it. See, now he owns it. All right. He had him on the wireless, so I don't know what it's going to perform like.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: We have a gentleman who didn't realize you were remote. Is that true?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Yeah, you know what the truth is? There is a true story. That somebody actually gave us the
device and said, we need to reboot this one. Somebody kicked the power. And I was like, you
don't have to move the device. They didn't realize it was remote.

AUDIENCE: Just a quick question.

STEVE MUELLER: Yeah.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Ah. SAAS off. A vendor who's doing SAAS. And the question?

AUDIENCE: So was there any--

STEVE MUELLER: Thank you, by the way. Just keep going.

AUDIENCE: Is there any pros or cons to running their SAAS on our own WorkSpace?

STEVE MUELLER: It's a good question. That is a difficult one for me to answer, without specific data as to what
they do and what they offer. The question is, hey, I've got a SAAS vendor that we work with.
The vendor who's got an offering in AWS. And we might be here in traditional on prem. And
I've got this thing, where I'm trying to access their servers over the internet. But if I move my
desktops to AWS, can I access them a little more privately? That's where you're headed?

AUDIENCE: Right.

STEVE MUELLER: Yeah. Heard this is a popular request for customers in WorkSpaces. The answer is, it's hard to
say. Most likely, you will go through the public interface, right? It's up to the vendor of choice, if
they want to expose anything privately. That's something I'd like to follow up with you
afterwards and find out who it is.

But what he's saying is that, as the move world is-- this is a very important point that you touch
into thank you-- as the move world's more online in the SAAS offerings, if we move our
desktops there, as well, what can AWS do with the other ISP partners? To have a little more
private integration for speed of light interaction, correct? It's an interesting area that we're
exploring.

Is this performing, as anybody would expect?

AUDIENCE: [INAUDIBLE]
STEVE MUELLER: It's actually doing really well.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Yeah.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, yeah. Oh, yeah. I mean--

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: The point the gentleman brings up is, it's right there, the data, it's much faster to access. Let me put this in perspective. We had to unzip 20 to 22 gigs-- one that file was 20 to 22 gigabytes, right? How long does that take in a normal machine?

You have to have a pretty beefy machine. You're sitting there, grab a cup of coffee, right? Have dinner, come back. We didn't have much time, so we elected to do the unzip operation on a different server in AWS and at a really high disc throughput. And the unzip operation happened in less than a minute.

So we're talking about access-- it's not just about your WorkSpace when you get into it you will you will realize like, hey, wait a minute I want to do this and is taking a lot longer than I want what can I do now with the other AWS resources. And again, as I said earlier, the desktop experience will disappear, and you'll focus more on getting the job done, without worrying about things. The neatest thing is actually disconnecting and walking away-- and coming back in, and you're right there, where you started. So we agree that this is-- I want to just make sure we're on time here. This is what we would expect, is that correct?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Is there anything other than Revit anybody wants to see? OK.

AUDIENCE: I got a question.

STEVE MUELLER: Yeah, please.

AUDIENCE: What about local printing?

STEVE MUELLER: Ah, great question. Local printing. Depends on how it looks-- so how you're set up is. Is it
USB? Or is it network?

**AUDIENCE:** Network.

**STEVE MUELLER:** OK so your WorkSpace, as long as there's network connectivity to that printer, can and will treat that printer as it's just any other printer would be, in a physical Windows world. If you have a local USB printer, we support that, as well. Attachment of a local USB printer will look like a printer in your remote-desktop session. And you can print to it, locally.

**AUDIENCE:** [INAUDIBLE]

**STEVE MUELLER:** Oh, you broke it. Look, the truth is-- by the way, let's all give him a round of applause. Thank you. Thank you. We weren't even prepared for this. So thanks. Thank you, I appreciate it.

**AUDIENCE:** [INAUDIBLE]

**STEVE MUELLER:** It is.

[LAUGHTER]

True story-- the reason that this machine doesn't have data sets is because I actually did not make the-- I had every intention of bringing the Outer Desk IT guys, who are great at this event, and who know their software well-- to actually help us prep it. And he happens to hit an area that I haven't prepped for yet. So I appreciate that. There was a question here from the gentleman.

**AUDIENCE:** So if you need to transfer data from a USB to your desktop, what's that look like?

**STEVE MUELLER:** Yeah, this is really interesting, right? So to be honest, I've been doing the WorkSpaces-- I've been with WorkSpaces since it's launched. And I work with our largest customers in this. And I work with Amazon.com. I own that launch and our corporate WorkSpaces.

Something I hadn't thought of-- and let me answer this in a different way. We watched people come in to the Answer Bar, and they said, hey, here's my Cadrons on a USB stick. Mr. expert, can you plug this in and go? Now, behind the scenes, I had disabled USB integration like that, through GPO.

So coming back to tie into earlier, we didn't know if there was a local-to-remote requirement or not. So we disable it for security reasons. Turns out that the instructors also have to come in to
us last minute, and say here's my data sets for a lab in 30 minutes.

So the answer is twofold. We do support USB transfer from local devices to remote desktop for some devices today. OK. There is a different workflow that most will work through because protocol is better-- and that is, to upload the data into S3 and then, bring it down into a shared server repository or a fleet of servers that act as a central repo tied together.

The data point here is for Autodesk 2016. Our workflow, in this very specific example is-- we tried it with this local device and then into the remote. We didn't like the performance of it. Had nothing to do with our service offering. It was that we were getting infinitely better performance from our integration with S3.

So we take S3 for us, as our large cloud storage platform. It stored files of virtually any size. We take the USB key into a local and-- here's our workflow. We take the instructors walks up, says I'm in a hurry. Take the USB key, plug it into a local device, pull it out and say, OK. Here you go. Thank you very much.

We then, transfer that to S3, our large Cloud Storage Platform. Gigabyte file is taking us about 12 seconds in this network today. A gigabyte, in this network, today, to S3-- 12 seconds. That's because S3 supports file multi-part upload, which is paralyzing the workload, and we get an S3. And then on another WorkSpace here, we move it to the repo. In 30 seconds, we can move a gigabyte file for an instructor.

Why is that critical? I'm going to use your example here to playoff. That's critical because instructors come to us the last minute. And this is a time-sensitive and immediate environment. Would we all agree? Anybody that doesn't want to sit in their lab anymore? So good question. Other questions. Yes.

AUDIENCE: How do the Word get-- if you are on a laptop, and you need to go offline. So you want to get your files to your laptop, so that you can continue to work on your Word Document, or whatever because you're going to go out of service?

STEVE MUELLER: Ah, it's a good question. Yeah, the question is, how do I get my files off the WorkSpace, into a local environment? To be honest, that's a hard one for me to answer because it's at the design decision and religion of the company that you worked for. And I'm going to say a company, with the assumption that we're in a corporate world. This is a bigger issue than the technicals.
There are different ways to do this. USB transfer in certain devices is one. The workflow I talked about is another. The reality, though, is most corporations like tighter controls around what we consider to be data exfiltration. So it’s possible that the environment you’re working in-- the company working in-- and I won’t presume to know where you work--

AUDIENCE: The only person that does the problem [INAUDIBLE] is my boss.

STEVE MUELLER: There you go.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Right. So sometimes, the company or the boss-- the person writing the check-- let’s be very specific. That person may say, you know what, if we move to the Cloud, we did it because we want security. We don’t want those off prem. Or we want a vetted process where that happens.

AUDIENCE: He’s the person that forms it for offline.

STEVE MUELLER: Oh, OK. So there’s a couple different ways to tackle that problem. But it’s also, again-- the point being, it wasn’t just about technology. It’s also about process. Yes, I feel there was a follow on.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: You could, and again, there’s a couple different ways. For example, if you’re in a Zero Client today, you can actually take your USB stick, transfer it over. You can work through S3, which is a common route. You can actually store a set of storage gateways in your local environment, which will integrate with of AWS and will make it feel local. So there’s a few options.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Right.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Question.

AUDIENCE: What about limited bandwidth? So what do you need in order to run this [INAUDIBLE]?

STEVE MUELLER: Right. All right, I have five minutes. So thank you. I’m going to demo this one because I love
this one. We all agree Wi-Fi is tough or-- how many people agree that tradeshow phone calls are tough, right? People get on their cell phones and everything. So we’re going to switch to a hotspot right now. Thank you for asking this question.

AUDIENCE: It’s the biggest question for me. [INAUDIBLE]

STEVE MUELLER: It’s Pay-as-you-go. So if you want to use it for an hour, you pay for an hour.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Trial for an hour. Sorry, I’m trying to-- it’s hard with the light in my face. So Portable Wi-Fi Hotspot. We’re going to enable this. I am now on hotspot. I will show you there’s no man behind the curtain. Thank you for your mouse, sir. While we’re in session-- oh, man I forget what Windows 10 is. I’m a Windows 7 guy. Anybody remember where the Wi-Fi switch is?

AUDIENCE: Go down. Single click.


AUDIENCE: [INAUDIBLE]

[LAUGHTER]

STEVE MUELLER: No network access. And my sales rep, once again, is like, please, just come through for us. Please.

AUDIENCE: [INAUDIBLE]


AUDIENCE: [INAUDIBLE]

STEVE MUELLER: I don’t know what to do here. Just do what, I’m sorry?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, oops. Like that?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, sorry. If you want to-- thank you. Guys, we’re on my Android Phone Hotspot.
AUDIENCE: That's pretty good.

STEVE MUELLER: It switched out. So we do wait a period of time, try to keep network connectivity. But the answer is-- and if I really knew we had HDMI here, I would have brought my Chromebook to show you that I'm on a browser-based operating system, that cost me $400. And I can switch the hotspot and hit something that would be 5,000 to 10,000 in the real world.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: No. No, in fact I'm running on a Celeron version of the M Series Processor of the HP Chromebook 13. Did I screw something up?

AUDIENCE: Nope. [INAUDIBLE]

STEVE MUELLER: So here we are. Rendering over a hotspot. Yeah.

AUDIENCE: Do you have a choice of operating systems [INAUDIBLE]

STEVE MUELLER: So let me answer that offline. I have to go back and look at the specifics of our Graphics announcement, and what the terms are there. In general, the WorkSpaces service offering allows Windows 7 or Windows 10. But Graphics, I have to look at the details. Will We'll follow up with you on that. Thanks. Any other questions, as we close out?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, what do you do if a user gets locked out of Windows? Active Directory. This is actually a domain-joined instance in our-- in fact, the entire Autodesk University is main-joined, right? So you go back to AD using the tools you know and unlock. Yeah?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, yeah. We're very transparent about costs. Yeah. aws.amazon.com/workspaces/pricing, you will find all the information there.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Right. There's a one-time fee per month, and then, it's based on the hourly there. But our website is very transparent. Yeah? I feel like there's a swarm of questions over here.

AUDIENCE: Dual-screen is supported?
STEVE MUELLER: Again, specifics of GP, let me follow offline with you. What they finalize on the launch, I have to go back and be very specific about.

AUDIENCE: So it's not bandwidth, it's per hour?

STEVE MUELLER: Not bandwidth. It is per hour. Correct. We don't care how much you were-- in fact, that's a great question. This bandwidth from the WorkSpace to this computer-- that is free. You're not going to pay for that.

AUDIENCE: Is it possible to change the specs of the machine on the fly?

STEVE MUELLER: In general, we do not allow our end-users to change the specific hardware configuration.

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Right, right. Exactly. We go into a different instance type. The instance type available today with this is on the K520 at the APCPU 16 gig RAM. Yeah?

AUDIENCE: [INAUDIBLE]

STEVE MUELLER: Oh, it's only on an existing hard disk, but you don't have it elsewhere? That's a tougher one. That's a standard Windows problem. So treat it like a desktop problem. You either have to harvest or slap it off. And move on. Guys, listen I know there's a lot of questions. I'll be outside. Thanks so much for the hour.

[APPLAUSE]