Goldman Sachs Technology & Internet Conference

Company Participants

- Andrew R. Jassy, Chief Executive Officer, Amazon Web Services

Other Participants

- David M. Solomon, Chief Executive Officer, Goldman Sachs
- Heath Terry, Technology, Media, & Telecom Business Unit Leader, Global Investment Research, Goldman Sachs

Presentation

Heath Terry {BIO 3406856 <GO>}

Great. Thank you. We will go ahead and get started. My name is Heath Terry, I lead TMT Research for Goldman Sachs. As a Goldman Sachs employee, it's been a special point of pride over the last three years as first Roy Joseph and then David Solomon took center stage at the AWS re:Invent opening keynote in front of over 50,000 people. Having been in the audience for every re:Invent conference, it's now a particular point of pride for me to introduce Andy Jassy, Chief Executive Officer of Amazon Web Services. Andy joined Amazon in 1997, straight out of business school. And in 2003, he led that team in founding AWS, creating the world's undisputed leader in cloud computing. A company inside Amazon worth, according to our math, well over $0.5 trillion. Andy is joined in conversation by Goldman Sachs' CEO, David Solomon. Andy, David, welcome.

David M. Solomon {BIO 1503614 <GO>}

Good afternoon, everyone. And Andy, thank you for being here. You've got it a lot easier as we start this. When I was at re:Invent, you made me actually work before you put me on stage.

Andrew R. Jassy {BIO 15111610 <GO>}

They have a DJ before my keynote, it was quite good, by the way. People are still talking about your set.

David M. Solomon {BIO 1503614 <GO>}

Well, I mean, at 07:45 in the morning, it is not easy to DJ for 10,000 people.

Andrew R. Jassy {BIO 15111610 <GO>}

You had good energy.

David M. Solomon {BIO 1503614 <GO>}

It was 07:45 (Multiple Speakers) try your best. So let's dive right into it. You've been at Amazon for 22 years. And you founded AWS with little over 50 people in 2003. You're going to generate over $45 billion of revenue in the business this year and more than half of the company's profits. And so when you put the financials aside, but you just start to think about the scale of what you've built, kind of quantify for us a little bit the scale of AWS and how fast it continues to grow?

Andrew R. Jassy {BIO 15111610 <GO>}

Well, it's been kind of amazing adventure and the business now has a $40 billion revenue run rate, growing 34% year-over-year and we have millions of active customers, which we define as non-Amazon entity that use the platform in the last 30 days, but it's really a very broad and diverse group. It's -- in the early days of AWS, it was mostly start-ups building their businesses from scratch on top of AWS and these were companies like Slack and Instagram and Pinterest and Stripe and Robinhood and companies like that.

But what's happened over the last half dozen years is that the enterprise in public sector have very rapidly adopted AWS in the cloud and you see every imaginable vertical business segment now using the cloud, if you're in financial services, we work with Goldman and Capital One and Intuit and the Commonwealth Bank of Australia and healthcare at Johnson & Johnson and Merck and Pfizer and Bristol-Myers Squibb and manufacturing GE and Shire Electric, and Philips. It seems every imaginable vertical business segment now is using the cloud in a meaningful way. And in the public sector, we have 6,500 government agencies worldwide, 11,000 academic institutions and 29,000 non-profits. So very, very broad and fast growing customer base.

And there are -- other than looking at revenue and the trillions of requests that we get in the various services all the time, most of the -- it's a little hard to be able to track everybody's relative market segment share just because we're the only ones that really publish the full metrics. But we have a pretty significant market segment leadership share. And where we really kind of see the breadth is if you just look at your everyday life, if you look at ride sharing and if you use Lyft or Uber, Ola in India or Grab in Southeast Asia or MyTaxi in Europe, all running on AWS in the cloud. Or if you use media services, Netflix runs completely on AWS. And obviously Amazon Prime and Disney+, and you watch the Super Bowl and you watch the streaming on Fox Live on top of AWS. And if you use Peloton or if you use -- my son is a very big orderer of foods, so Postmates and Grubhub and DoorDash. There's just very pervasive impact every day in your life and yet we always say, and we really strongly believe it that it's still very early days in people moving to the cloud. And even though the business is growing fast and is a reasonable size, I think it's going to be very different 10 years from now.

David M. Solomon {BIO 1503614 <GO>}

Yeah. So -- and one thing that's fascinating to me to see the big businesses is this was a significant innovation in a large organization. I mean, at the time, Amazon much bigger now, but it was a large organization, it was a big innovation. What advice, and I think about this actually, what advice would you give -- Goldman Sachs is trying to innovate in its business, what advice would you give any larger company around innovating, building new business lines inside a strong organization?

Andrew R. Jassy {BIO 15111610 <GO>}

Yeah. Well, there are a few things -- a few things that have been helpful for us that I think -- it doesn't necessarily mean it'd be helpful for everybody, but I think they're generally useful principles. The first is you have to hire people who want to build. We disproportionately index in hiring builders and we think of builders as people who like to invent, people who look at different customer experiences and are honest about what's not working and try to reinvent those customer experiences. And people who really understand that launch is the starting line and not the finish line.

There are so many great people in technology who love get to launch and lose interest. And you really rarely catch lightning in a bottle, you have to keep listening to customers and iterating. So you got to hire the right types of builders. And then I think you got to organize them in teams that allow them to move quickly. I think one of the most important things we did in AWS in the early days was the natural place to build AWS would have been in our infrastructure team because we leveraged our data centers and network. And instead, we pulled completely out of that group of people that had to run the consumer business and that scale every day because the new businesses will always lose out to the existing surer bets.

So making sure you organize into a separable and autonomous teams as you can, where they own their own destiny and aren't burdened by having to run the core business you're running every day. And then you got to give those teams the right building blocks to be able to move really quickly. So I think one of the interesting things about Amazon the last 10 years is just how unbelievably quickly our consumer businesses have moved and they would tell you a big piece of that is being able to use those AWS building blocks that all our external customers use. And then you need a culture that encourages innovation. And that sounds fairly obvious like everybody wants to encourage new things. But I think at a lot of big companies, especially as you get bigger, the senior people walking into meetings where you're hearing a new idea are looking for ways to say no. Not because they are ill willed, it's just you get more conservative, it seems harder to imagine being successful on something new, it's hard to think about having one more team and effort that you have to manage.

And I would say that the opposite is really true at Amazon. All the senior leaders will tell you that their favorite meetings are the ones where we listen to new ideas, and we don't say yes to everything, but we say yes to a lot more than most. And we spend most of our energy in those meetings trying to problem solve with the team

to get to yes. And I think the last thing is, if you're going to invent, especially if you're in a significant existing business that's had some success, you have to be willing to tolerate failure. And if you hire great people and achievement-oriented people, it's sometimes a weird dichotomy. If I think about Amazon, there are a lot of type A people who hate to fail. And yet, if you're pushing the envelope, you're not going to get it right all the time.

And I always found our launch of the phone very culturally reaffirming. Those of you who may not have known, we launched a phone and it didn't exactly work. And yet because we like the inputs, the output was it didn't work. But the inputs were the team we hired, the plan we built, the customer conversations we had, the technology that was built, the timing. And because we liked all the inputs, even though it didn't work, we took the learnings and the technology we could reuse and reapplied it and then gave people a good landing spot. Because if you don't, all the great people will fear working on the new things because they'll worry they won't have a spot if it doesn't work out.

David M. Solomon {BIO 1503614 <GO>}

That's a really good point. You talked about -- you said we were early. There's a lot more adoption to go. First inning, second inning, I mean, how early are we?

Andrew R. Jassy {BIO 15111610 <GO>}

I would say that maybe, two outs, bottom of the first, runners on board. Runs in on both sides though. So I think that it's -- if you look at the total global IT spend, only 3% of it is in the cloud. But it's moving fast and it's growing fast. And so I think that it's -- we have this very strong opinion, which we've really seen play out faster than we imagined that in the fullness of time and I don't know if that's 10 years from now or 15 years from now or 20 years now. But very few companies will own their own data centers. And those that do will have much smaller footprints, only for workloads that just aren't worth moving because they're going to leave a mainframe to die or something that just has to be close to something like a factory latency wise. And all of that is moving to the cloud. So it's very early days. And I think that people will make moves. And when they make those moves, they will choose that time to modernize a lot of the older software. Look, we have lots and lots of customers who are moving away from mainframes and we have lots of customers who are moving away from the older guard commercial grade databases to things like Aurora and lots of folks that are moving quickly from modernizing from Windows to Linux. So you see all those types of moves, but you also see this huge explosion of SaaS providers who are building their products really organically right from the get-go on top of the cloud. So it's a very different world, still early days.

David M. Solomon {BIO 1503614 <GO>}

So you talked about some things that are obviously changing as we move from bottom of the first with two men on and move towards the ninth. What else changes? What -- how does it look when we get closer to the ninth inning, besides some of the changes you just mentioned, what else do we see?

Andrew R. Jassy {BIO 15111610 <GO>}

Yeah. I think for whatever it's worth, I'm not sure that we'll get in the ninth inning in my lifetime working. I think this is -- we are in a period of unbelievably fast growth. And if you think about what's changed in the 14 years since AWS launched and the pace of change has been really rapid. I think the next 14 years is going to be even more rapid. And so I think what it will look like is I think that you'll have most companies won't have data centers. I think that you'll see more and more compute that's done in a server-less model. I think a generation of developers will choose that as their programming model, so they don't have to think about clusters or servers. I think you'll see very different play with regard to what people use for databases, not just on the relational side where people are moving away from a lot of the more expensive and proprietary and punitive old guard providers, but also increasingly now companies don't use one relational database to satisfy all their database needs, they use purpose-built databases, it's why you see people using things like key value stores and in cash database and craft databases and time series databases.

So the databases will be different, almost every application will have machine learning and AI infused in it. There'll be billions, maybe trillions of devices that will live everywhere in our offices, in our homes, in factories and cars and planes and ships and oil fields and agricultural fields and all those devices are going to be collecting data and sending them to the cloud and doing analytics on them and then sending smarter actions back to those devices, so they can be more productive. Lots of tasks that humans do today kind of mundane tasks will be done by robotics applications, so humans focus more on higher level value-added activities. I mean, all kinds of ways, it will be different and we're also optimistic in the future that quantum computing will play a role as well.

David M. Solomon {BIO 1503614 <GO>}

So let's shift and we'll talk about artificial intelligence a little bit. And I know that it's a huge area of innovation that you're spending a lot of time on it. I think you have 10,000 people working on Alexa alone. Talk a little bit about kind of your vision for the direction that AI will play going forward, not just in the context of something like Alexa and in the context of what we've been talking about, but just more broadly, let's talk a little bit about the impact of AI?

Andrew R. Jassy {BIO 15111610 <GO>}

Yeah. I think that we've been working with AI and machine learning for over 20 years in Amazon. And you can kind of see it everywhere in our business, the recommendations you see on our retail side are fueled by machine learning. And if you look at the pick paths, the people in our fulfillment centers use to go get product and box it is used by machine learning algorithms. If you look Prime Air, our drones effort, if you look at Amazon Go, those are computer vision algorithms that drive it, if you look at Alexa obviously. So we've been doing it for a long time and it is deeply embedded in all of our businesses and all of our capabilities and yet we still have tons more ideas.

Now, today, there just aren't that many machine learning and AI expert practitioners out there and a lot of them that exist live at kind of the big technology companies. And so we're trying to -- I think collectively more and more are getting educated, but it's part of why in AWS a lot of the services and capabilities we're building there are to enable more companies to take advantage of that promise. And there -- we see it as kind of being three macro layers of the stack. That bottom layer is for expert machine learning practitioners, of which there aren't that many in the world, but these are people who are comfortable building their own models and picking the algorithms and training the models and tuning the models and deploying them and you have to keep running those models over and over again or they become stale. And we provide lots of ways to use all the popular frameworks and we build chips to make it faster, do training and to do inference and predictions, things like that. But because there aren't that many expert machine learning practitioners, the most important thing that we feel like we have done to make it much more accessible to every enterprise is to build this middle layer of the stack, which we built a service called SageMaker there, which enables every day developers and data scientists to much more easily build, train, tune and deploy machine learning algorithms in fractions of time before. I mean, if you look at Intuit now trains their fraud models in less than a week when it used to take them six months. These are big differences in what you can do.

And then the top layer of the stack are for people that don't want to have to build the models at all themselves. They actually just want to plug into a model that we've built and get answers back through application programming interface calls or API calls. And so these are things like here is some text, turn it to speech, here is some audio transcribe it to text. Take this text and translate it into lots of languages, take this transcribed translated text and tell me what's in it, so I don't have to read it. Let me do natural language processing, help me do internal search. If you have an Internet and you try to search on your Internet, it's pretty lousy at most companies. Can you use natural language understanding and natural language processing to change that? Help us -- you'll give us your personalization algorithms, give us your forecasting algorithms, all those are those services at the top layer that companies are really hungry to just plug into models from companies that are doing at a scale and have that data.

So I think most companies will operate at all three layers that stack. I would argue that that middle layer maybe the single most important just because most enterprises have so much data that they want to use predictive algorithms to get value out of.

David M. Solomon {BIO 1503614 <GO>}

So the transition we're talking requires significant investment. And one of the things, and I see it, it's obvious you got to build something new. We go build the Apple Card, we build it in the cloud. But when you're looking at legacy and you're thinking about upgrading and moving forward, there is a massive investment that's necessary. How do you talk about that investment to boards, the big companies, the founders of businesses to people running big business? How do you talk about the

investment and do it in a way that motivates people to make this investment quicker to move it along faster?

Andrew R. Jassy {BIO 15111610 <GO>}

It's a really good question and it's really relevant right now just the stage of adoption we're in in the enterprise and public sector, where I feel like we're at the early stages, the meat of that enterprise and public sector adoption. And I think that almost always the conversation starter in these discussions is cost. For most companies, if you can turn capital expense that you lay out for servers and data centers into a variable expense that you pay as you consume it, that's attractive. And then you get to turn that variable expense into something lower that you can do on your own because we have such large scale that we pass on in the form of lower price.

We've lowered our prices on about 75 different occasions in the last eight years. Largely in the competitive -- in the absence of competitive pressure just because the DNA inside of Amazon is to relentlessly work to take cost out and give it back to customers in the form of lower prices. So you turn CapEx to variable expense, it's a lower variable expense to what you could do on your own and then you get real elasticity instead of having to decide how much infrastructure to provision and either provision too little and have an outage if you exceed it, which nobody does. So what everyone does is provision for the peak, but there's a reason they call it the peak and you sit on all those wasted capital on the cloud. You just provision what you need. If it turns out you need more, you pay -- you scale up seamlessly. And then when you don't need anymore, you give it back and stop paying for it.

So cost is very different in the cloud than what existed before and that's compelling to virtually every company. But the number one reason that enterprises and public sector organizations are moving to the cloud is agility and speed and the ability to innovate at a much more rapid clip. And unless you operate in a business segment that has no competition, which is very few people, you have to move quickly and people are inventing at a rapid rate, not just start-ups, but also your competitors who are adopting the cloud. And so those are the two most compelling reasons that boards and leadership teams want to move. And then I think there is -- if you think about how to really just get off the dime and get going. A lot of the challenge it turns out isn't technical. You spend a lot of time talking about the technical pieces, but it's pretty trackable. A lot of the challenges frankly are leadership. And so the first thing that really has to happen is the senior leadership team has to decide that they really want to move, they have to have that conviction because inertia is a really powerful thing inside organizations. And there are often people in the middle of organizations that aren't as excited about moving as some of the others because they may be don't know what it means for their job or their scope or they were proud of what they built. And so you have to have senior leadership teams that are truly convicted about moving and that set an aggressive top down goal that force the organization to move faster than otherwise would.

My favorite example of this maybe is GE was making this decision that they really wanted to move to the cloud and their CIO at the time Jamie Miller decided that she was going to move 30 -- 50 applications to AWS in 30 days. And she got our

technology leaders together and said this is what we're doing. And she said for 45 minutes, they all told her how dopey that was and how it wouldn't work and why it didn't make sense. And she said, I just listened to them and said I heard you, but we are going to do it. So let's go. And they go to about 42 applications in 30 days. But in the process, they learnt their compliance model, their governance model, their security model and they had some successes and the ideas started rolling in, such that she could set a second really aggressive goal top down, which was to move about 7,000 applications to AWS in a few years. So you have to have the senior level conviction and an aggressive top down goal to force the org to move and that you mean business, where it's just really easy to dip your toe in the water for several years and wake up and realize your competitors are doing it and you're far away from it.

David M. Solomon {BIO 1503614 <GO>}

Good point. Talk about the competitive landscape, talk about the competitive landscape in cloud computing.

Andrew R. Jassy {BIO 15111610 <GO>}

Yeah. I think that every major technology company either has or is trying to build some kind of replica of what AWS has built in the cloud computing infrastructure space. And I've been working on AWS since the very start. So we've been in the market for 14 years or so and I have been working on it for I guess 16.5 years or so. And of the many big surprises, and there have been a lots of big surprises, probably the single biggest one for me is just how long it took for other large technology companies to build something that was -- that looked like what AWS was trying to do. And it just -- we were just trying to get to launch without anybody knowing because at the time, Amazon was really thought of just as a retailer. And we felt like if we didn't get to market first, it'll be harder for us to be successful and Seattle is a pretty small city. We know a lot of people on the other side of the lake and we were just trying to get the launch without anybody knowing. But we never imagined we'd have a six to seven year head start. And so we have a very significant market segment leadership share at this point.

And I think there are a few reasons for it. I think the first thing is we just have a lot more functionality in part because we started earlier and in part because we're innovating at a faster clip, and that really turns out to matter if you're trying to migrate all your existing applications on premises to the cloud or if you want to unleash your builders to build anything they can imagine. Having the right tool for the right job saves you time and money. And then we have a much larger ecosystem of partners, and it's not just the thousands of systems integrators that are helping enterprises move to the cloud, it's most ISPs and SaaS providers will adapt their software to work on A technology infrastructure platform, some will do two, very few will do three. And they all start with AWS just because of our leadership position. So you get to move to the cloud with a lot more of the software you used to using and want to use.

And then I think the maturity of the platforms are in pretty different spots. And we have an expression we use internally that there is no compression algorithm for experience and that's because you can't learn certain lessons until you get to different elbows of the curve and scale. And with the business that's a couple of times larger than the next few providers combined, you just learn those lessons of scale at a much earlier stage, in a way that you can't always convince your builders to worry about it. In the early days of the business, we used to have arguments about whether releasing something at a -- whether there was going to be a one in a billion chance that you would have an error, whether that was okay or not. And if you look at our scale now, we're in the hundreds of trillions of dice rolls at this point. And there's just no shortcut for getting there, you just have to get to that scale, it changes how you think about architecture and infrastructure.

David M. Solomon {BIO 1503614 <GO>}

Yeah. Amazon broadly has initiatives across a range of industries, a range of businesses. At times, and I see this in our business, that has to create channel conflict with what you're trying to do in some ways as competitors push and push around working with you. How do you deal with those issues? Would -- does this work better as an ecosystem inside of Amazon? Would it work better as an ecosystem outside of Amazon?

Andrew R. Jassy {BIO 15111610 <GO>}

AWS?

David M. Solomon {BIO 1503614 <GO>}

Yeah.

Andrew R. Jassy {BIO 15111610 <GO>}

Well, not surprisingly, we have a number of conversations about this topic. And what I always share when I get a chance to speak with customers about it is that there are really only two existing significant industries in which Amazon is disrupted. One is retail and the other is technology infrastructure. And in both cases, they were models that were pretty antiquated and customers weren't so happy with those models and somebody was going to end up reinventing them. And in those cases, it turned out to be us. But I would also say that if you look at the other companies in those spaces, it's actually a really great lesson for all of us as people come in and try new things in our areas. The companies that listen to what customers cared about and watched what they were reacting to and adjusted have done quite well in this new era. And the ones that didn't, that poopooed that wished it away that dissed it, but didn't spend resource on it are struggling.

And so I think if you have a great business with a great customer experience, simply because somebody else enters that space doesn't mean you're going to have some kind of business decline if you're listening to your customers and doing right by them and adjusting and being inspired by whatever is new. And I think also

sometimes people have this, there's this folklore or mythology around, if Amazon launches a business in a certain area it means that all the other businesses in those areas are not going to be successful. I just haven't seen it. I think we have some things we're working on the healthcare space and I think lots of healthcare companies are having a lot of success. I mentioned we launched something in the phone space and it didn't seem to have much of an impact on the leaders in the phone space. We have some things in the payment space and PayPal seems to be doing quite well.

And so, it's because these segments are so large, they're not winner-take-all, there is room for several companies to be successful. And again, if you're doing a good job for customers and you keep evolving, you'll be fine. And I think when you look at what's -- it's so hard for all of us to build businesses to sustain for long periods of time. I mean, look at how few companies have lasted. I mean, you guys are an exception. But looking at how few companies have lasted 50 years, let alone 100 years as being successful, it's so hard. And to me, the number one thing that you can do by far to give yourself a chance to be successful over the long term is to have good feedback loops from customers, so you know what they care about and then have the technology platform that allows your builders to keep evolving your business and customer experience as quickly as you need to. And there just isn't a platform that allows you to do that more easily by a long shot than AWS. So that's usually what we talk about and we talk those things through, people usually find some reason to that.

David M. Solomon {BIO 1503614 <GO>}

Yeah. So you've got an incredibly diverse set of customers on the platform, start-ups, fortune 500 companies, thousands of other companies, but also government agencies. And the relationship between technology companies and governments is getting increasingly complicated, with lots of scrutiny. What do you -- and it's a broad question, what do you think government's role should be in regulating technology as technology continues to expand and infiltrate business broadly?

Andrew R. Jassy {BIO 15111610 <GO>}

Yeah. It's a good question. And I think that we have to keep remembering that technology has and will continue to completely change our lives and what our customer experiences are and how we communicate with one another and really almost everything we do. And the vast majority is great for people, but there are ways that you can use technology that are irresponsible or that impact people's civil liberties or they are against the law. And when people use technology in an irresponsible or unlawful way, they have to be held accountable for it. And yet, I would say that you shouldn't ban technology just because it could be used irresponsibly. I mean, just think about -- look at all the evil things that have been done with computers and servers over the years, look at the Sony hack a few years ago. But imagine what our world would be like if we didn't allow people to use computers or servers, it would be a radically different world. And so, I think you don't ban technology because it could be used irresponsibly. I think you have to hold parties who use the technology irresponsibly accountable for it. And all providers,

ourselves included, have terms of service and we suspend people's right to use the technology if they're using it unlawfully or in a way that impact people's civil liberties, but there are a number of people who wanted to go further and they want more clarity and they want more delineation and regimentation, where they want the government to actually regulate the cases that the technology just cannot be used for. And we're very supportive of that and eager to work with government agencies that want to do it. But I think it's important when governments do that, that they are really thoughtful and targeted about what they're trying to protect against and don't over-regulate, where you can't get any of the value from the technology because there's a lot of it there for people.

David M. Solomon {BIO 1503614 <GO>}

It's complicated. I mean, it's hard to argue that we wouldn't benefit in certain areas from a better or clear framework. But in the history of regulation, generally when it's responding to something, as you say, it goes too far and it squelches opportunities.

Andrew R. Jassy {BIO 15111610 <GO>}

I agree with you.

David M. Solomon {BIO 1503614 <GO>}

And they've got to swing back in some way, shape or form. Information security, it's got to be a big focus at AWS, big focus everywhere. How do you think about information security at AWS and how are you building a culture around it?

Andrew R. Jassy {BIO 15111610 <GO>}

Well, the way you build a culture around anything is you have to pick the things that are most important in your culture and then you have to have lots of mechanisms that reinforce it. And so for us, security is unquestionably our number one priority and we will drop everything we're doing if we feel like there is something we need to do there to further buttress it. And I think everybody in our organization from the senior most leaders to the -- to all of the entry-level people in the organization understand that and we have a number of weekly and biweekly and monthly mechanisms, where we're all involved and working on it and thinking about it and figuring out areas that our customers want us to do more.

And so it's -- for us, it's unquestionably our number one priority. And then we have a number of mechanisms that we build to back that up. And then we -- there is a number of things our customers want us to do, expect us to do and ask us to do that we prioritize. So in the early days of AWS, there were a lot of certification people wanted, they want us to be ISO compliant and PCI compliant and HIPAA compliant and FedRAMP complaint. So a lot of certifications that we pursued. And we have all kinds of monitoring and protections of the infrastructure itself, but then we have very fine-grained identity access management for people to be able to secure who they want to use what, at what times, in what locations, in what ways and multi-factor authentication, web application firewalls and ways to know if there is any kind of

anomalous data movement or any unusual access to your account. I mean, all kinds of services that we continue to build.

And I would say in the early days of AWS, the first maybe six, seven years of the business, the biggest blocker for us in the enterprise was security, not because there was a problem with security in AWS, but people who have data that matters, it's also their number one priority. And so they were nervous about it. And I would often say, well, tell me what you're worried about with regard to security in the cloud. And they'd say, well, I'm worried I'm going to lose control of my data. And I would say, well, you know in AWS that you decide where the data goes, it doesn't move unless you want to move it, it looks just like a blob to us. But if you're extra-worried about it, you can encrypt it in motion or at rest. And they'd say, okay. And they'd say, well, I can't go down and touch the iron. And I'd say, well, how often you go down and touch the iron in your on-premises data centers. And if you go down to data centers, it's not like you know what you're touching a lot of times.

And so I just think it took time to see customers use it and use it securely and understand the features and capabilities. And I would say that in over the last five to six years, security has been one of the single most important sellers in people using the cloud. And I think most people come away looking deeply at our security, believing that they'll have a more secure posture in AWS than they would on-premises.

David M. Solomon {BIO 1503614 <GO>}

As a company, you've made a big commitment to climate change. Data centers, obviously, are meaningful consumers of energy and water. Balance the challenges and the costs with this growth and thinking about a more sustainable future.

Andrew R. Jassy {BIO 15111610 <GO>}

Well, I think that -- I mean, the climate has always obviously been important, but I think only increasingly so over the last few years as the crisis deepens. And I think that it's a big reason why we made the climate pledge that we did several weeks ago -- a few months ago. And for a company our size, and with our diversity of businesses, it's not easy, I mean, to -- we said we'd be 80% renewable energy in 2024, 100% renewable energy in 2030 and net zero carbon by 2040, 10 years ahead of the Paris Agreement. If you look at what -- the scale of Amazon and the diversity of businesses, it's a lot harder to do that than most other companies that you'll think about. And it's going to require -- it will for sure be expensive. But I think the way we think about it is that it will be much more expensive for the rest of the world if we don't all get behind this and fix this and it'll be a different world for our kids and grandkids if we don't.

It requires a lot of invention, much of which we're going to do the invention ourselves, but a lot of which we'll also do with third-party partners. And one of the reasons that we decided to be public about the climate pledge as early as we did was we really wanted to incent and to hopefully inspire more companies to invent in this space because we're going to need partners, all of us are going to need

partners to make this happen. And so, it's a very important priority. In the data center space, in the cloud computing space, I think sometimes people forget that cloud computing is just significantly inherently more energy efficient than on-premises data centers, in large part because our utilization is so much higher. So like if you look at 451 Research just did this study where they found that running in AWS was 3.6 times more energy efficient than running in the average on-premises data center. Or if you look at on the carbon intensity side, the electricity consumed, the renewables purchased to run the same task in AWS is 88% more carbon efficient than it would on-premises.

So the cloud is a much more environmentally friendly construct for data centers than most companies who are utilized at 10% to 20%, but still there is a lot that we're doing and we have to do to continue to be more energy efficient. And we got all kinds of invention we're doing around how to use water more thoughtfully and in more scarce ways. And we have over 70 renewable projects that we've funded inside of Amazon with 1,900 megawatts of power that we're generating. And so we have a lot that we're doing and a lot more that we're doing and it's an area that we are investing innovation resources in.

David M. Solomon {BIO 1503614 <GO>}

That's great, that's great. So just to finish. One of the challenges that we all have in our businesses, but at the scale you're operating at, you have it in spades is attracting people, retaining people that help make this all possible. How are you thinking about people management, talent at the scale you're operating at?

Andrew R. Jassy {BIO 15111610 <GO>}

That's a really good question. And, of course, the devil's in the details of all these things. And we have -- I've been at Amazon almost 23 years at this point. I've obviously drank the Kool-Aid, but it's kind of remarkable how many people we've had at the company so long. I mean long for us, we've been around 25-ish years. But I mean if I just look in AWS, the person who runs product development has been there for almost 22 years, the person who runs infrastructure has been there for almost 22 years, the person who runs our demand generation has been there for 14 years. We've had kind of almost a naturally strong retention of our people. And I think a big piece of it and a lot of what we focus on when we think about how to keep people hungry and motivated and excited about working at Amazon over a long period of time is you have to be intentional about what your culture is going to prioritize and who you want. And for us, as I mentioned earlier, we disproportionately index in hiring builders. That's who we want at the company.

And so -- and we don't think of builders as just technologists. To me there, you have people who are unbelievable operators who are inventive in operations and change the way you think about being able to get something done for the cost structure or the time frame it takes to get things done. We want builders in everything that we do. And so, what we try to do in our culture and everything we talk about as a senior leadership team is how do we build the type of company and the type of culture that allow builders to build. And that is all the thing -- when we talk about process that we

don't like, a bureaucracy that we might see creeping in, a lot of it is we want to knock that out because we want to make it the world's best place for builders to build. And I think that there really are a few places like Amazon if you're a builder and that's what we spend most of our time trying to figure out.

David M. Solomon {BIO 1503614 <GO>}

Yeah. I appreciate. Andy, it's really great of you to come spend time with the group here today. Appreciate your thoughts. Thanks for being with us.

Andrew R. Jassy {BIO 15111610 <GO>}

I appreciate you having me. Thank you.

David M. Solomon {BIO 1503614 <GO>}

Absolutely. Thanks a lot.