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Conference Debate Session V:

The Future of the Datacenter – and Finding the Right Cloud Balance

Introduced and chaired by Steve McDowell, Principal Analyst &

Founding Partner, Nand Research

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Featured Speakers:

Analyst Chair: Steve McDowell, Principal Analyst & Founding Partner, NAND Research
Manish Mehta, CTO of Security, ServiceNow
Michael McNerney, Marketing VP, Supermicro
Prof. Martin Curley, Chair of the UN Digital Health Symposium

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
Good morning, everybody. So I'm Steve McDowell, Principal Analyst and one of the founding partners at NAND Research. NAND is a boutique analyst firm we help technology providers bring the right solutions to market and we also help enterprise IT make more informed decisions about what they put into their infrastructure. And today we're going to talk about the challenges of deploying IT infrastructure and kind of a hybrid multi cloud world. And to help us do that we have some great panelists to help drive the discussion. I'll let them introduce themselves, but maybe we'll start with you, Michael. Thanks.

Michael McNerney, Marketing VP, Supermicro
Hi, everyone. My name is Michael McNerney. I come from Supermicro. I'm responsible for marketing and network security at Supermicro.

Manish Mehta, CTO of Security, ServiceNow
Hey, this is Manish Mehta. I'm CTO of security at ServiceNow. And as you may know, ServiceNow is not just a ticketing company, it's a cloud-based platform that helps our customers to the digital transformation

- 1 -

with workflows that go across the enterprise, from everything from it to CFOs to know HR and workplace safety and everything. So very excited to be here.

Prof. Martin Curley, Chair of the UN Digital Health Symposium
Good morning, everybody. My name is Martin Curley. I'm a professor of innovation at Maynooth University. I'm also chairing the UN Digital Health Leadership (inaudible). I've just recently left my role as director of digital transformation with the Ireland health service. But I'm a strategic advisor to a number of companies in the tech world that are looking at using edge computing to really transform things. And one example is a company from the west of Ireland that has the ambition to be disrupted, computing capacity in a canopy across modern cities. Thank you.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
Excellent. This is a great set of panelists. We have a hardware vendor, we have a service provider, and an IT user. Before we get into discussion, just going to set a little context. So the rise of cloud both as an operating model, and a business model is disrupted how we think about IT infrastructure, it's changed how we think about spending money. conversations about budget now are very op x versus capex. It's changed how we deploy workloads, we used to think about applications, even applications on hypervisors. But today, it's all about cloud native Kubernetes, DevOps, aiops, the list goes on and on. But I think most fundamentally, Cloud has changed how we think about IT architecture, and it's changed our expectations of what we will change our expectations of infrastructure and infrastructure management, , the tools around cloud have enabled us to build a truly virtual push button Infrastructure, where workloads can run anywhere, we can scale on demand, we can push a button and deploy resources at the edge anywhere in the globe. And at the same time, we're embracing and having to learn which can be challenging - new technologies that are forcing organizations out of their comfort zone. And this is just a short list, understanding, adopting AI, we can spend a week on talking about the impact of AI on digital transformation, and IT infrastructure, you know, aiops in the software defined data center infrastructure as code, extending infrastructure to the edge where we can get faster time to value from the data that's generated and consumed at the edge. ESG concerns right? As IT guys, we never thought about sustainability, right? This is new, this is a new way to think, and embracing cloud native technologies. It's a complex world, much more complex than maybe it's ever been. And adding to this complexity is the reality that every enterprise now has an IT infrastructure that, in part at least embraces the cloud. You know, cloud was once seen as a Nirvana, it was going to solve all of our problems will push our workloads to the cloud, and we'll pay a monthly fee. But it's not the complete answer. And we've learned along the way. And I think there's really three phases of the cloud era, which we're in now right. Now, the public cloud market began exploding about a decade ago, it was entered. I think Amazon went into business with AWS around 2007. We didn't really start seeing broad enterprise adoption, so maybe a half a decade later, as we kind of worked out the kinks and trusted the technology. But it began exploding and why not right, it promised a world where I can push a button and my infrastructure is just there. Ready to build a datacenter? Virtually. And who wouldn't want that? But then we started recognizing some of the downsides of cloud costs easily spiral out of control hard to predict governance and cybersecurity a very big concern, certainly in recent years, right, where is my data living? How's it being protected? What

control Do I really have over it? But I think more critically, the model collided with the reality that workloads and data want to be close to those who consume those workloads and data, that's part of the push to the edge, right as part of the repatriation to bring my cycles closer to home, which is when we entered kind of the repatriation phase, not that we gave up cloud, but we began pulling back, we began doing more on prem, more blended solutions. And I think if you watch corporate earnings, you know, Microsoft, Google Azur all in the last quarter predicting, not a downward trend, but more of a levelling off, everybody's predicting less public cloud usage more on prem. So we're in the repatriation phase. But there was a glitch right, Cloud has a really nice business model. It's consumption based, it's pay as you go, I don't have to buy servers, I can scale on demand. And that's addictive. That's addictive to IT buyers, that's addicted to IT administrators. But workloads want to come home, or some workloads want to come home. And Cloud providers began defending against repatriation with on prem offerings, we have things like AWS outpost, and the OEMs are defending against Cloud Migration with on prem as a service option like HP (inaudible). And it's great to have choice, but it's led to an infrastructure that's become a messy blend of multiple clouds, each with their own management plane each have their own capabilities. It's a tough world. So where does that leave us poor IT folks. Right? For all the promise of flexibility. The hybrid multi cloud world is one of tremendous complexity, and more questions than answers, I think still, for IT architects, and we have to adapt to realize the benefit and value promised by all of this. And that's what we're here to talk about today. So I'm going to ask my first question, I'll direct it to Michael, Supermicro, which is in a cloud driven, Software Defined world. Does hardware matter?

Michael McNerney, Marketing VP, Supermicro
Thanks, Steve. So I think the interesting thing happening in the hardware space right now, on the hardware side, I think does hardware matter anymore? What's interesting is the amount of innovation happening at the hardware level today it's absolutely incredible. Like every single subsystem Storage, Networking processors, GPUs, everything is increasing and performance, increasing and efficiency at such dramatic levels. And it's hard to see if you're, you know, sort of buried under a cloud buried under software. But that level of core capabilities that's happening in hardware is absolutely incredible. And there's going to be companies who are able to sort of take advantage of that, when we talk about edge, you know, bringing inferencing to the edge, bringing the amount of compute that's coming to the edge, how do you take advantage of that and your models. So I think the hardware doesn't really matter anymore. I think what's interesting is as it's improving, order of magnitudes, what your expectations of hardware might not be your competitors, right. And they might be able to leverage these technologies to develop new services, develop services, and new locations that you didn't even think were possible. So I think on the hardware side, it's an exciting time to be alive in the hardware world, just because of the amount of innovation happening there.

Manish Mehta, CTO of Security, ServiceNow
I just have an advantage of working at a company that was actually an edge company before ServiceNow. So I can say a little bit on the hardware side. At certain point, you don't have a choice to go to a particular cloud provider, if you have to be closer to your consumer. Because there is no presence. Therefore you are forced to build your own thing. It could be a single box. It could be something as simple

as a single box versus a rack or something. So whatever your ad site however, (inaudible) your ad site is, what does hardware matter? Absolutely does matter. Because at the end of the day, the capabilities you want to push all the way to the edge will ultimately depend on the capability of the hardware. What kind of (inaudible), can you run on it?

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
Okay, so Martin, I want to twist it just a little bit because you're on the opposite side of the coin from your two co-panelists. You drive digital transformation projects, healthcare focused, how much do you care about what the infrastructure is, as you drive those projects forward?

Prof. Martin Curley, Chair of the UN Digital Health Symposium
Well, as an ex Intel employee, and ex Intel, shareholder, I know hardware matters, you know, people aren't buying as much Intel as they used to. It actually does. I thought the point that Tom Bianculli made yesterday was really important in terms of actually moving the computer to the point of care or to the point of need. So I think what Michael said in terms of the amount of innovation that's going on is really amazing. And it's quite transparent, actually, to users. But the miniaturization that's happening is just phenomenal. So I'm involved in advising a company called Westfire. And they have a very simple product, which is a solar sensor that sits on top of streetlights, the big install base around the world. But we have a product that we're working on, which will almost put a data center at the top of a streetlight, you're going to have a 5G cell, your CCTV, lots of different things that can be done. So the hardware innovation that's happening is going to enable all sorts of new possibilities. And we talk about a distributed computing canopy, overlaid in autocross systems. And when I was at Intel, we tried to do this in London. And we were actually quite successful, but the installation costs were prohibitive. And the hardware costs are prohibitive. But now with the advances in technology, and by using standard NUMA sockets, you know, this technology can be installed very easily can even be done by a drone. So, yeah, hardware is (inaudible) is still going to matter. I think one of the big challenges is we've had Moore's law, and you know, compute productivity has dramatically improved. With Software Productivity has nowhere near kept pace with that. Now, I know we had a speaker yesterday talking about low code, and that certainly is improving productivity maybe can develop 10 times faster with 70%, less of the resources, but the Software Productivity is really lagging, you know, the rate of innovation that's happening in hardware, Steve,

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
that's quite the world. We talked about edge, we talked about cloud, he talked about drones. In a virtual infrastructure that embraces edge, and core and cloud, we don't always know where our data is, right? How do we think about and Manish, I'm going to throw this to you, how do we think about cybersecurity, and cyber resilience in this kind of ephemeral world where my data could be anywhere?

Manish Mehta, CTO of Security, ServiceNow
Yes, the data could be anywhere, but you better know where your data is. And because you can be in lots of trouble, including regulatory troubles. So one of the ways to do this is at this point, except that your

- 4 -

environment is going to be hybrid, you may even move and jump your providers for X number of reasons. The most important part is you architect with a shim layer, think of it as a shim layer abstraction layer in a way that allows you to move across, and therefore you have a proper identification of every compute every granular compute has, it kind of ties into zero trust, but has identity of its own. And once you have that, you know, which identity is holding what kind of data at that point, you will have traceability and in some cases, you are required to have that in as a compliance.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
Yeah, and Martin. Like any place, I don't think there's any segment where this is more critical than health care. How do you look?

Prof. Martin Curley, Chair of the UN Digital Health Symposium
I was thinking actually the session that Paul Hughes ran yesterday on resilience, like I think we need to brace ourselves what COVID did to healthcare, actually, you know, the way we live globally is very likely going to happen to our global infrastructure, the equivalent of COVID is going to come and we're really going to struggle so we best be really prepared for that and figure out, what are our backup systems to make sure we can run

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
so a lot of talk about bringing processing closer to the edge faster time to value for the data, right? We're doing it all out there where it lives. How real is this? Michael? How are we looking at edge from kind of Supermicros perspective?

Michael McNerney, Marketing VP, Supermicro
We think from the edge, I mean, what's interesting about it is, it's the cloudification of the edge not to sound too trivial, but are to sort of cliche. We're seeing the same sort of innovation, that power sort of cloud in the data center, you know, moving to the edge. So same industry standard hardware, open software architectures, all of this is moving from where traditional telco environments were built out, and the telco. So to own the edge network, we're now seeing the same sort of standard software standard tools. And that's going to engender this entire development community to be able to sort of develop applications for the edge, and not necessarily have to be a telco expert not have to understand network stacks, to the degree that we have to in the past. So I think when we think about the edge, and the innovation happening in the edge, it's really that same cloudification, right, that same, bring industry standard hardware down to the edge, bring open software tools down to the edge and allow that development community to sort of to flourish. And by the way, there's nothing on the edge that isn't connected back into the data center back into the user services. So you'll see this more as a continuum. And what's interesting about that, as you see the same tools then being used in the cloud, and used in the edge, and again, everything just gets easier to do in that regard. And, you know, just I think you'd see this tremendous amount of new services come out of that, that architecture.

Manish Mehta, CTO of Security, ServiceNow
And it's also a requirement for lots of 5G is a good example. Most 5G providers want this edge, but at the same time, not the old school telco thing, where, every software upgrade requires probably a truck roll or something to the tower. So folks want the software to be manageable, upgradeable very quickly. And I think it helps to sort of extend the cloud into the Edge locations. And most folks, at least I know, are following that where, you know, they're able to sit at a certain central place, and be able to manage those devices, and the hardware being a commodity helps.

Prof. Martin Curley, Chair of the UN Digital Health Symposium
I think actually just, building on that, our cars now, our data centers on wheels, you know, 60 - 70%, more of the value of the car is actually in the software and the processors, and shortly, they're actually going to be part of our internet. Bob Metcalf talked for a long time about the internet, but I think that's actually going to happen. So we're going to have these multi-functional devices. So, it's a car, it's mobility as a service, it's a data center. It is also an energy storage device. This, you know, hybridization, it's not just across the cloud, but it's across, you know, multiple sort of usage models, it's, it's all going to be very exciting, it's going to need an awful lot of manageability. But cybersecurity is going to be absolutely crucial. We certainly can't afford an autonomous vehicle, you know, to be hacked, I think Tesla has shown what's possible in terms of their over the air updates. And a lot of the other more traditional automotive manufacturers. Well, we'll have to follow, but it's going to be hugely exciting. Well, the things you mentioned, Steve, yesterday was a trade off between flexibility and complexity. And that I think, is the most interesting trade off that needs to be managed to audit solutions that are available, given unprecedented flexibility. But then, in terms of the complexity, you mentioned, the idea of what is the management plane, and that's really where the rubber hits the road where the crux is moving forward.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
So one of the key drivers of edge expansion are AI capabilities, right? If I'm going to retail and I have 300 cameras, and I want to do real time, you know, image processing for loss prevention, for customer tracking, whatever, I need to do that on prem. And it's almost impossible now to read tech press without worrying about AI. So there's two ways to look at AI. One is from the business benefits, which we won't address, but the other is from the impact to the infrastructure and how I deploy it and how I manage it. how impactful is AI to the modern data center? I'll start with you, Michael, you're probably closest to this,

Michael McNerney, Marketing VP, Supermicro
Certainly the adoption and acceptance of AI has gotten very exciting these days. Right. So, I'm trying to say something that we haven't heard a million times. I think the interesting thing on the AI side at some level is where is that developer community? Do you have the people in house to do the work right? How many companies have data scientists working on? So I think I think that's going to be, you know, one of the big challenges is how do you make that technology more accessible to sort of mere mortals, if you will. So I think that's one of the first hurdles you're seeing there. I think every company, every market will have, you know, AI integrated into their tools and services. And again, it's sort of cliche to say it, so we certainly see that in the market. And see that building out. So we definitely see a tremendous upside for that. I think

it's interesting, you know, and are so in on the hardware side of the business. You know, everyone's talking about economic slowdowns, economic downturns. And, you know, just recently we've seen just this sort of demand to build large scale AI clusters, sort of go through the roof, right, so we're seeing projects get funded, where tradition over the last couple of quarters has been sort of slowing down, hang on, we're holding off on our investments. And so we see companies aggressively investing in their AI strategies, right, we see these companies sort of like taking the leash off of AI again, because before it's all economic uncertainty, Now, sure, we're going to hold our IT budgets, except for the AI project. Go go go. So it should be obviously a very interesting time ahead. And you know, companies are going to have to adapt and make sure they're adopting these technologies across the board.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
I'm going to tweak this a little bit for you Manish. So deploying AI is impactful, especially on the learning side, right? GPUs are expensive - probably the most expensive thing I can put in my data center which generates heat. You know, it's harder to cool. This may be an area where cloud is better than on prem. When you look at it, Manish, from your perspective, as an application provider? Do you look at on prem versus cloud for AI? Or how does AI impact your thinking about?

Manish Mehta, CTO of Security, ServiceNow
I think long term, it's not going to be an option for especially companies like ServiceNow, because there are lots of data that is basically can be used in a positive way to provide much better experience to the customer. However, I think most companies will have to start slow, and perhaps even start in cloud because they don't know exactly, even if they start building how it should look like before they start putting big money around it. So I think most companies start in cloud, they basically either even use some of the services provided by the cloud provider. And then once they find maturity, they realize the economies of scale, they know because AI, obviously, it's going to scale very quickly. So then they come back, and, you know, then they build it internally probably find that optimal place.

Prof. Martin Curley, Chair of the UN Digital Health Symposium
Yeah, I think AI at the edge is really important, and particularly in healthcare, being able to respond in real time when you see an image or something. But see, one of the issues I wanted to bring up was in terms of you know, with your on prem or cloud is sustainability. So in Ireland 16% of our national grid, our regeneration is servicing data centers. If all of the data centers that are currently planned are built by 2030 that will be 70%. So 70% of Ireland's electrical capacity will be servicing data centers now. In Ireland, we're on track to be about 70% of our energy is going to come from consumables or from renewables. And one thing is I think, because demand is just going to go up and all sorts of new applications and one of the design constraints that we'll need to introduce what is the most sustainable design in terms of power consumption and all sorts of unsustainability. So whether it's appropriate to do that on prem, or from sustainability standpoint are the you know, the advantages of datacenter in terms of how their power, the miniaturization, etc, where you replace that. So I think that's going to become increasingly important. I think, as human beings in five years' time, we're going to be generating about 100 times more data per

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person, than we currently have, all sorts of different IoT devices. And that's got to be stored somewhere and it's got to be, you know, stored and actually analyzed in a very sustainable setting.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
So that's a nice segue five years ago, IT people didn't talk about sustainability, we didn't care. We run big, hot, powerful servers. Now it seems like it's baked - every enterprise every, certainly every public company, has an ESG strategy. We're seeing ESG metrics baked into RFPs and RFQs. Again, we'll start with you, Michael, we'll go left to right. How is how is the new focus on ESG impacting how we deploy infrastructure?

Michael McNerney, Marketing VP, Supermicro
It's a great topic. It's something we talk about quite a bit. And I'd actually sort of flip this around most of the customers we talk to about sort of green and green computing. It's an economic discussion. It's Hang on, how do I lower operating costs? How do I get here, and oh, by the way, it's green, too. So everyone likes to put the green envelope on it. But by running more efficient servers, finding more efficient ways to cool with free air, there's simple things like just turn the temperature up in your datacenter, right, it's like the systems are built to run at higher temperatures, you don't need to be in the 68 degrees. And you know, these kinds of motions, really help. So one of the things we've seen with a lot of our customers, there's the ESG mandate. And what I say is, oh, that's, you know, hey, I'm going to put some solar panels on my, on my building on top of my building, I'm good to go. And then we think of this sort of resource savings element, which is, how do I leverage efficiency, green elements to reduce costs. So we see this in power consumption, we see this and how do I cool a data center? We see it in refresh cycles, right? So, we talked about forklift upgrades in the data center, how do we not sort of do a forklift upgrade, but upgrade the parts of the system that actually need to be upgraded, reducing the waste reducing things like this, and great for the environment, great for Mother Earth, as my CEO likes to say, but also nice for the pocketbook. Right? And that's really the compelling argument. And it just makes this happen? Well, I think of it has to be this, oh, it's a corporate mandate, I gotta do this ESG thing, then it's, it's a little bit slower pace. But when companies recognize the actual commercial benefit, or cost benefits, is when these things really move fast.

Manish Mehta, CTO of Security, ServiceNow
I don't have the exact numbers. But we definitely do talk a lot about ESG internally. And to take Michael's point. Ultimately, it's good for your pocketbook as well, if you're doing you know, good optimization, or even refresh cycle in this way. So definitely have those kinds of efforts going on.

Prof. Martin Curley, Chair of the UN Digital Health Symposium
And, Steve, I think actually, sustainability in general, is an opportunity it has been waiting for - it is going to move from the back room to the boardroom. Because through automation and substitution of resources and all sorts of smart things. It can be actually one of the main or digital, main drivers of actually achieving a sustainable future. So I think it's a such a fantastic opportunity for the IT industry, the data center in this industry, you know, the continuing innovation that we're seeing and in hardware, and there's such an amazing set of tools that can be deployed to make, our world a lot more sustainable. So I think

- 8 -

sustainability of the compute platform is one thing, but the 10x opportunity is using it to actually solve a lot of the world's sustainability problems.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research
So we could go deep on any of these topics, or we're just scratching the surface around the challenges and complexities of the hybrid cloud world. But rather me ask questions, let's throw it to you. With questions for the panel.

Hector Pizarro, Diario TI
I have a question for Professor Curley. there's growing concern among organizations like Greenpeace, from individuals, organizations, and even governments about the environmental impact of datacenters because of their energy consumption, how do you see going green for the sector is working or will work? Is it going solar or wind powered? Cheaper? Is it more expensive? What are your predictions on that issue?

Prof. Martin Curley, Chair of the UN Digital Health Symposium
It's a great question. And I think the use of renewables and just from my own country in in Ireland, there is a big debate, how many data centers can we have? But it seems like we're growing data centers, we're also growing our share of renewables and that was a big technology challenge. You know, the worlds solve that electricity grids that you had more than 50% of their power coming from renewable sources, you know, became one balance. still unstable. Now that problem has been fixed. And you know, in Ireland, we're on track to 70% renewables. And I think the Nordic countries are also doing, really well on renewable. So it's not only we can take our eye off the ball, it's no, it's no panacea. Because data centers do have their own carbon footprint. But if I can save a journey, for example, I can do a telehealth call consultation. Rather than, doing a physical journey to a hospital, that's probably a 10x saving in terms of carbon footprint. So I'm optimistic. I think the use of renewables and solar and wave energy is the next big opportunity. People have been working on it for 20 or 30 years, we haven't a breakthrough yet. But I think it's coming warmer able to harness the oceans, countries like Norway, and Portugal, and Ireland, and Scotland that have massive wave energy resources will be leaders, they'll become very attractive locations for data centers.

Unknown Speaker
Thanks, can the panel comment a little bit on the need for different levels, different service levels required from data centers as we move forward into an AI world? The sophistication of AI and large language models, you know, the cost involved there really requires us to sort of take a tiered approach to looking at the compute required and stuff. So how does the data center have to evolve in the face of that, particularly edge data centers?

Michael McNerney, Marketing VP, Supermicro
I think the idea of sort of having these tiered data centers and how do you address this? I think Manish talked about it a little bit in terms of, how do you start and how to use scale, the infrastructure, at the end of the day, it will come down to delivering the compute as efficiently as possible. And so What's strange

about this, what's interesting about this is there's the idea of like a low power servers, something like doesn't really make any sense, because you just use more of those low power servers to complete the same amount of compute. So we think you'll see tiered data centers, the adoption of AI in the data center in terms of model building versus sort of model execution, or inferencing, is going to be a challenge, right? I've got a build by models versus I'm running my models, you know, how do I do that? Certainly there's a role for, hybrid cloud and those kinds of scenarios. You know, one of the things we've seen with some of our customers has been, you know, the idea of, running models that aren't necessarily core or you know, skunk work kinds of projects. And so having equipment around, so I'm trying to, I'm not sure how to address exactly, you know, how you do this, or how you tear this, I do see that, you know, as you mentioned, as you look at putting all this technology in a data center, does AI become sort of a sport for the rich, right? It's like, hey, I can afford to do this. But you know, small companies and up and coming companies really can't afford to build large language models can afford to build a GPU cluster, can afford to pay the online bills for this. So does there become sort of this threshold where new companies just can't compete? And I think that's a real challenge, right? I think there's a real challenge out there to saying, I'm saying this, and I saw something the other day, I think it was an article saying some of these startups are looking like, CPU isn't that efficient at running the GPU workloads. But I got a bunch of laptops, it's like SETI for, SETI for AI. Right. That's okay. Let me run a few of my things here. So I definitely see that tiered structure is going to get challenging, especially as those costs for large language models are So high.

Antony Savvas, IT Europa
I'm just wondering, Anthony Savvas from UK, IoT Now IT Europa. I'm just wondering, how the geopolitical situation is going to affect things? Because is there any need, for example, Google to spend, $500 million on a data center in Singapore when previously was about being close to China. People seem to be getting cut off now. I'm just wondering whether the political situation in the West in the east is going to affect the market and what the requirements to the business markets are going to be.

Prof. Martin Curley, Chair of the UN Digital Health Symposium
I'm not sure any of us are qualified to actually answer that. But undoubtedly, it is a factor, it is. I'd be really interested in your opinion, but it is undoubtedly a factor.

Manish Mehta, CTO of Security, ServiceNow
And also you thinking of moving your computer at the end of the day, regardless of what the underlying reasons are. It could cause political systems or political environment. So I think that, in some ways boils down to architecture as well. Because Are you able to rip out something from one place and put something somewhere else, right. So if your architecture allows that, which is what I was saying in the earlier one, that if you have that shim layer, that allows you to move your computer and it could be because your vendor is locking you in or something, it could be that reason as well, then you have architected well. And at that point, your move will not be as, as painful.

Michael McNerney, Marketing VP, Supermicro

And I always think that the information has a way of sort of getting through the systems getting through the blocks. Is it Starlink? Is that the Elon sort of network? I mean, just all of a sudden global network, global satellite networks, are replacing national satellite networks. It's like, oh, how do you get access here? So I feel like there's clearly sort of a balkanization if you look at the Great Wall and some of these other firewalls and how we're getting around them, and countries trying to control that. But I also think there's this counter force, which is that information is going to get through right and there's just when there's a desire for information, it typically finds a way through and so I think we'll continue to see that play out over time and how do you combat that? I think we'll see some ups and downs but at the end of the day, sort of data wants to be free and people want it so they're going to get it somehow.

Steve McDowell, Principal Analyst & Founding Partner, NAND Research

data wants to be free. good note to end on. Want to thank Martin, Manish and Michael Of course, thank you guys for doing the panel and thank you for your attention and interest.