

Chair Lina Khan:

Good afternoon, everybody, welcome. Thanks so much for joining today's discussion that the FTC is hosting on cloud computing. I'm thrilled to welcome our panelists, whose breadth of expertise will help make sure that the FTC is fully grasping the intricacies of cloud computing, and is best positioned to approach its policy and enforcement work accordingly. I'd like to give a big thanks to our Office of

olicy, who helped put together today's panel. So, in collaboration with the FTC's Bureau of Consumer Protection and Bureau of Competition, our Office of Technology staff have done a tremendous job in developing key questions that prompt a wide array of stakeholders and get at our root concerns relating to competition and security in cloud computing.

Staying at the cutting edge of key technologies and new business developments has long been a core part of the FTC's mandate. Congress expressly designed the FTC with tools that would enable us to fully understand how new technologies, how emerging technologies were working, to make sure that our traditional authorities could keep pace. Today's inquiry is squarely part of that tradition. Cloud computing, as we all know, is now a central part of our economy. It's the engine that is driving the proliferation of data-driven services from video conferencing to streaming to artificial intelligence, and it now often serves as the scaffolding on which companies are storing data, rapidly processing information, and scaling their businesses. Disruptive technological innovations, too, are often built upon cloud computing infrastructure, and as businesses race to innovate and commercialize new AI tools, they, in particular, will continue to rely on cloud providers to develop and deploy their products on a massive scale.

We've also seen, however, that as large swaths of the economy become more reliant on the cloud, we've seen only a small handful of providers are currently equipped to provide this key infrastructure. And we want to make sure at the FTC, that we're fully understanding, what are the factors that are leading the market to be so concentrated in the hands of a few companies? And also, what are some of the downstream risks that might stem from that, that need to be on our radar, both on the competition side, as well as on the consumer protection and data security side? So some of the things that we're looking at, for example, are the high barriers to entry. We know that it can be extremely costly for companies to build the underlying infrastructure on which cloud operates, and that maintaining a network of physical data centers can be a huge investment. Among other things, new entrants would

providers are all large tech companies that have been able to substantially invest in their products over the last few decades, and these companies, in particular, have benefited from network effects that a large existing customer base provides the0 G[. WstvasaieitbmID 0>> 12 0 612 792 reWñBT74 11.04 Tf1 0 0 1 72.024 696.



At the Commission's

events page, and the panelists have also kindly agreed to just briefly elaborate here for the benefit of our audience. So what I'm going to do is to just go in alphabetical order, and so, we'll start with Salil.

Salil Deshpande:

Hey, everyone. So Hillary, you want us to elaborate on our bios?

Hillary Greene:

Yeah, this was the disclosure information that we talked about.

Salil Deshpande:

Ah, yes, yes, yes. So Hillary covered the bio sufficiently, and as disclosures, I am a venture investor, and I'm invested in companies, several that benefit from the cloud's behavior and practices, and others that are harmed by their behavior and practices. And aside from the venture funds, I'm also invested in US large cap growth funds that have Amazon, Google, and Microsoft as core positions.

Hillary Greene:

Great. And we next have ... I'll do my alphabet quickly here ... it's Frederic.

Frederic Jenny:

Good afternoon, everybody. I have written a report which was commissioned by CISPE, which is a trade

Also, thanks. On disclosures, in my capacity at UC Berkeley, I've received research funding in the form of unrestricted gifts from a number of technology companies that might be relevant in today's discussion. All the sources of those research gifts that have funded my work over the last eight years are actually listed on the website of the Center for Long-Term Cybersecurity at Berkeley. In my capacity as an advisor and consultant, which I've done, really since 1990, through both personal capacity and a bunch of firms. And currently, at the advisory firm, Breakwater Strategy, I should say, we do work in the technology sector writ large, we do not currently work for companies whose interests are directly impacted by any of the things I'll talk about today.

Hillary Greene:

Okay, great. Well, thank you, guys, and now, let's get started. Okay, Abby, I'm going to turn to you to start us off and help situate us, perhaps by providing an overview of the industry landscape for cloud computing, perhaps flagging main players in the market, and describing a little bit about what dynamics have contributed to the current marketplace structure. Abby, take it away.

Abby Kearns:

Well, thank you for having me, and I'm going to build on what Alex started, which was really a generalized description of cloud, and how cloud was used today. But cloud, the way we think about it, has been around since AWS launched in 2006, if you can believe it. So it's been some time that we've been talking about cloud, but to really simplify cloud, in my mind, I think of it, it's just somebody else's data center. So as Lina pointed out, there's a tremendous amount of capital expenditure require to build out these footprints, with servers, infrastructure, data centers.

And we've been building on that for years and years and years, but it wasn't until about 2016 that we really started to see significant traction in workloads moving to the cloud. And it was in 2016 that we had a confluence of a couple of different things. One, cloud native architecture, so architecting and application and your infrastructure, to actually take advantage of those things that Alex described, in

is a very big market that's getting bigger every year, it's not getting smaller. So there's no fixed pie that companies are competing for, it's actually just getting bigger and bigger as more and more companies are leveraging the cloud. And when we talk about leveraging that cloud infrastructure, we're not talking simply about taking workloads that we're running in a data center and moving them to the cloud. We're actually talking about new software that's being developed in the cloud to run these unique services and these unique capabilities.

So it's actually, that pie is getting bigger every year. Obviously, we're seeing a ton of that momentum with AI driving new applications, new usage patterns, new capabilities. But, at the end of the day, we're starting to take more and more advantage of that. And then, one thing I actually wanted to mention is, in 2016, we started talking about the concept of multi-cloud. So we've talked about single points of failure here, we've talked about resiliency, but multi-cloud really became a strategy that more and more organizations started taking advantage of to really either take advantage of unique, native services in the hyperscale cloud providers, or to actually have ultimate optionality. And I should probably end, since I've kind of rambled here for a minute, with who those providers are. And today, the top three are Amazon's AWS, Microsoft's Azure, Google's Google Cloud platform, and with a fourth provider being Oracle's Oracle Cloud infrastructure. I know I had five minutes, I was trying to keep it to five minutes.

Hillary Greene:

I sound like a tyrant, but thank you. And now we're going to turn to Frederic. Please, what I'd love for you to do, sir, is with that foundation, what types of anti-competitive or at least competitively suspect practices might one expect to observe? To what extent do you actually see them? What justifications have been offered? Can you start us off in that inquiry? Thank you.

Frederic Jenny:

Well, thank you very much for having me. I'm going to talk about one particular aspect of this sector in the sense that business firms are certainly users of cloud services as well as suppliers of those, and I'm going to talk about that business

cloud infrastructure service. Now, it is worth asking whether this highly concentrated situation and increasing concentration is an evolution that result from anti-competitive or unfair practices by the integrated providers or whether the result from the superior efficiency of the integrated providers. Now, from an analytical point of view, what are the anti-competitive practices which a dominant firm on a software service, for example, may have an incentive to implement?

I'll give you three examples. The first one is tying cloud infrastructure with software. I tell my clients, "If you want my software, you have to store your data on my cloud." This would be an example of tying. The second is bundling. That's creating a technical, or legal, or economic link between the two services offered. For example, if you use my cloud infrastructure, I will charge you less for the software service on which I am dominant or my software service will work better with your data. The third possibility, besides tying and bundling, is predation. And there the dominant firm on a software service can

compatibility of the software so that it will increase the cost of rival providers of infrastructure. And there are also example of this.

Hillary Greene:

I'm going to jump in here and thank you so much for that because you've now set the table with laying out issues about tying, bundling, predation. You've also flagged questions about when conduct is strategic in terms of it might be technical versus is it a business decision. And with a amply-laid table

Right. And so I'm going to turn to Frank, and before I do that I also want to put something else on the table. I think that part of the framework that's been set up is an important one, which seems to be the software as service having implications for infrastructure as service. And what I'd also like and invite people to consider is the extent to which infrastructure is service, what are ways that it can be entrenched through certain activities? How should we be thinking about it? I know that one of the issues that's come up with folks has been egress fees generally, and so I invite people to also opine on that. But we're going to turn to Frank and then if other people want to jump back in, please let me know. Frank.

Frank Nagle:

Sure, yeah. Before we move to that, I was going to pick up on a thread that I think Abby started but others have talked about, and that's the concept of multi-homing. Adding to Steve's list of important things, it's not just about the contracts, but it's about the tech itself too, and understanding why would somebody use one versus another or why might people be using both? And there was a Statista survey a couple thousand companies from 2022 that showed 80% of companies use AWS, but 80% of companies also use Azure, and then something like 40, 50% also use Google Cloud. And so nowadays, I think this was five years ago, this wasn't as much the case, but now everybody's using everything.

And so when we think about that from a competition standpoint, we have to at least ask ourselves the question: has this become a commodity? I can go to any gas station and put gas in my car because it's been commodified. I don't think we're at the point where cloud has been commodified, but certainly one could start to think about how commodified is this? And back to Hillary, the direction you were going, is that different in different layers? Certainly the layer that it'd be most likely to be commoditized would be infrastructure, less so when we're talking about platform or software as a service.

Hillary Greene:

Steve, I think you were going to jump in and head ... Nope, you're good? Okay.

Frederic Jenny:

Just-

Hillary Greene:

Yes.

Frederic Jenny:

... if I may, just a very short comment. A, I believe that those practices should be investigated. B, I think that we've got to be also sophisticated. There are quite a number of possibilities because of the fact that those services may be or may have to be used interoperable among each other that there may be technical reasons for which there are limitations, for example, on the license, on the use. But it's also possible that on top of these elements, which in itself makes the migration possibly difficult, there are also anti-competitive practices to create moats around there. And I think that the role of competition authority is really to try to distinguish what is technically justified from what is an additional obstacle which has no reason except to try to develop market power.

Hillary Greene:









Now, the way that the cloud is architected, and we heard this a little bit earlier, using containers and separate access or separate customers, it would be quite hard for an attacker to actually pull this off unless there was some serious bug in the backend. But when we think about cybersecurity, we often talk about risk as the intersection of likelihood and impact. And so although the likelihood of this maybe fairly small, the impact would be huge. When we think about competition and market concentration, these single points of failure represent a potential weakness in the overall system.

Now, on the flip side, we talked a little bit about economies of scale and how to provide these cheap services, these companies need to be at this scale, but we can also think about some other benefits like something, for lack of a better phrase, a single point of patching. So if we think about email for example, if a security vulnerability is found in Gmail, Google just develops a patch and loads it to all their servers, and then instantly all Gmail users are protected. But if you use Outlook on your desktop, Microsoft has to develop a patch and then everybody has to install it individually. And so there's trade-offs with this centralization and with this single point of failure. We also have this single point of patching that can be potentially a good thing.

And so when we think about trade-offs in this space, often the most salient are thinking about who the customers of the cloud providers are. So big companies have large IT budgets and can spend a lot on security on their own, but smaller companies, they don't. And so when we think about what benefits whom, often when we think about this investment of cybersecurity by the cloud providers, the biggest beneficiaries are the small companies. And so when we move into thinking about who's responsible for cybersecurity, we see the different cloud providers taking slightly different tack. So AWS says, "We're responsible for the cloud itself. You are responsible for everything that's in the cloud, you the customer." Meanwhile, Google and Microsoft have a slightly more tiered approach depending on if they're talking about SaaS or PaaS or IaaS.

So again, to bring everything together here in the context of the RFI and the open questions, I think that cybersecurity is going to be super important to the cloud providers, but it's unclear how much customers are actually willing to pay for better security. This has been a problem with cybersecurity free cloud, that we don't know how much people actually value security. Everybody says they value it, but are they willing to spend more money to actually get more security? And so even beyond that, thinking



I think CISA's done a great job over the last year of really starting to build that drumbeat of what we need to think about and the importance of security. We're starting to talk a lot more about the software supply chain, which Frank, when we think about open source, also software supply chain and security in

I remember back in the 1990s, we called this kind of innovation ecosystem a Cambrian explosion, lots and lots of new companies. And many of them go extinct and that's actually just fine from an innovation perspective. It's the explosion of innovation that we want. Cloud as a platform for LLMs should support that kind of thing. And I think actually just parenthetically, maybe we'll talk about it, I actually think that kind of multifaceted innovation is really good for managing some of our concerns around the downsides of algorithmic bias, fairness, deep fakes, and so on and so forth. But let me put that in a box for now.

So where are the risks to this vision? That's the question I ask myself about the cloud. And one way I like to think about this is to, maybe this is a very 19th century metaphor, to envision the cloud as an AI factory, like a factory where AI gets built. So what are the inputs that the factory needs? Needs massive compute power, needs lots of data and data engineering capability, reinforcement learning from users and so on and so forth.

But the reason I mentioned those three things is because they are all subject to significant economies of scale and they reinforce some of the natural monopoly tendencies in cloud that have come up a number of different times today. In that situation, nobody wants to compete over pure elastic factory capacity. And I think it's fair to say, and it's come up in some of the conversation, that the instinctual business practices of at least some of the hyperscale cloud providers reinforce that tendency as well as vertical integration.

And this is the point that I really want to end with because it's the most important. Vertical integration that segments the ecosystem can start to look like a pretty attractive alternative, and I think we see signs of that in today's AI environment. The number one issue for me here is the nature of some partnerships between small AI model innovators and hyperscale cloud providers. And so to be clear about that, look, I think it's absolutely prescient and smart business for big tech firms with amazing cloud businesses to invest in AI startups. On the other hand, it concerns me when those investments come in the form of cloud credits that are tied to a particular cloud provider and its specific architecture rather than the more conventional investments we might see from a venture investor. That kind of subsidy has the effect of tying a particular company's set of AI models to a particular cloud provider, which means that those two technologies overtime co-evolved together, in a way that I think Professor Jenny mentioned. And the further we go down that road, the harder it is to unbundle, the harder it is for the AI startup to run its models effectively and efficiently on a competing cloud platform. And I see a lot of signs of this in the industry.

Again, going back to the 1990s, we called it "walled gardens." It predisposes towards business strategies of silos and bundling, and it reminds me very much of something that we used to talk about, again, in the



choice and that therefore bundles can be a good thing. And I think that we are lacking, really, a good methodology to figure out when bundling is just an entire competitive tactic and can lead to restriction innovation, and when it is in fact something which meets the desires of consumers. So I think that antitrust has to work on this to try to find a better methodology.

Hillary Greene:

Great. Other folks? Since we're starting to get into things that are what I'll call cross-cutting, one of the things that has come up repeatedly is also this notion of when there is self-preferencing and what are the complicated calculus around understanding things that are self-preferencing. Another theme that has emerged, that I would love also if we could touch on a little more, is questions associated with lock-in and to what extent do we see that emerging within this space. Another concept that I'd love to flag for potential comments would be things relating to switching costs. These are things that have been present in the conversation that we had, but I want to sort of put a bow on it and put a name to it. Frank, please.

Frank Nagle:

Sure. Yeah. So I think, as you just pointed out, a bunch of the things we have been talking about are related to that. So the ability to move data is, if it's easy, then it's not locking people in and switching costs are low, but if it's costly then it is locking people in. And I think back to my gas station analogy, gas stations, again because it's a commodity the only way they have to keep you coming back is kind of location or rewards programs. And I don't think we would argue that rewards programs are anti-competitive, probably not. But are some of the other ways that we can think about lock-in happening in the cloud, bundling would be one and data transfer fees would be another.

I think the question is if we believe that the services are becoming more commoditized, is it going to be necessary for the cloud providers to do these things that toe the line to artificially increasing switching costs or artificially increasing lock-in that we don't like to see? I think that's one of the questions that we're at a point where that that's already starting to happen and it may increase, and that's concerning.

Hillary Greene:

Yeah. You said we're already sort of at a point where, what is happening? I'm sorry.

Frank Nagle:

Where the vendors are doing things to kind of artificially create lock-in and artificially increase switching costs. So to the point on data transfer fees, right, I agree it's not free for them to allow that to happen. But are they charging more than it probably costs them in terms of actual infrastructure to allow for data transferring? Probably. And that may be an interesting question for folks to opine on through the RFI.

Hillary Greene:

Right. And I want to get some more people's comments. But another word that I like to sprinkle like fairy dust in every conversation I've had with you guys is this question of innovation. What are the consequences for the conversations that we're having for innovation going forward? This is something that again has sort of bubbled up in our conversations, but I want to put a finer point on it—if that's something we want to make sure we are protecting, the ability to innovate going forward in competition for innovation. I see Frédéric has his hand raised, but I also wanted to flag something that Salil and I had talked about and invite him and others to bring it up, which is: there's the formal understanding of

antitrust, but also there is the layperson's understanding of antitrust and their own sensibility about competition. And I know that's something that you all have spoken to me about as well, so I thought I could invite folks to bring that up as well. Salil.

Salil Deshpande:

Well, my concern has been that if you look at each of these tactics and behaviors in isolation, you could argue that none of them is a problem. And if you look at each cloud in isolation, you could argue that none of them is a monopoly. But if you take the actions together and you take some of the clouds together, then you see the problem emerge. I think there is a problem. I can't quite describe the problem to my own satisfaction. There are occasions where these clouds seem to be using their privileged positions as the provider of network or infrastructure in their computing environments that allow them to engage in rent-seeking behavior for other software companies. And I'm wondering if our regulations are up to par address this new reality.

Hillary Greene:

Great. Other thoughts?

Salil Deshpande:

Yeah, I'd love to hear what the other panelists think of what I just said. Whether that concern even articulated in that way makes any sense.

Hillary Greene:

Okay. Salil has put something on the table.

Abby Kearns:

I would say I think it does make sense Salil. I just think it's a fine line between building value added services and capabilities and bundling those as solution and things that are actually shifting impacting the market. And I think that's a really, really tight line. Same with antitrust, there's a really fine line between market making and forcing people out. And I think that's probably in my head the most ill-defined right now in terms of where that line is because I do think the market has made certain choices about the cloud. I mean it's not like we haven't had other players that have built clouds. IBM wasn't that long ago. Verizon wasn't that long ago. These are companies that spent billions of dollars to also compete in the cloud and the market really chose those top three with a distant fourth with Oracle. That's just in the US if you think globally, Alibaba obviously has a massive footprint too.

And so I think for me, where it's not so clear is where that line is between where the market decides who the winner is based on where customers are gravitating, based on capabilities, natively integrated services, those solutions that they're bundling, versus what is actually really anti-competitive. And that's where it's not super clear in my head right now because I do think the market is making these choices.

Hillary Greene:

Okay. Steve, was that a hand?

Steven Weber:

It was. And I don't have an answer to Salil's very good question either. But I do want to say and maybe repeat that point that I think we ought to be looking at this right now from the perspective of these new

small AI application or large language model companies and from their perspective, do they see a competitive marketplace for the money that they need to spend and the services that they need to be able to access on compute and so on and so forth. We saw an estimate, I think it was from Gartner, that like 80% of the capital raised for AI startups is being spent on compute for training and deployment. Huge amounts of resource intense expenditure there. If the market isn't competitive from their perspective—they are in some sense the leading edge customer right now that I would pay a lot of attention to when I thought about: is the market competitive or am I being boxed in by different kinds of business model policies?

Hillary Greene:

Right.

Hillary Greene:

Great, thank you. Others, closing thoughts? Salil?

Salil Deshpande:

I effectively gave my closing remarks while posing that question to the panel. The only thing I'd add is we need to take a closer look at what the different markets are or delineate markets so that we can look at whether dominance or market power in one area is being used to gain advantage in another. For example, I would say that the base layer of what the clouds offer, which is compute, networking, and storage, is different than the next layer up, which is say databases. Those, I think, are different markets. But to the layman they all seem like infrastructure, they all seem like the same thing. So unless we get a clearer picture on the delineation of these markets, we won't be able to answer the question of whether market powers in one is being used to gain leverage in the other.

Hillary Greene:

