GARY GENSLER: So payments part two we're going to chat a little bit about the overview today. Readings, of course as we always do. And then what was yesterday? Does anybody want to tell me what yesterday was? Kelly?

AUDIENCE: The 10th anniversary.

GARY GENSLER: 10th anniversary of bitcoin. What else was yesterday? It was Halloween. No, it is not my birthday again. Stop that, Tom. So we're going to chat a little bit, we're going to have some fun about happy anniversary or birthday. Would you call it a birthday or anniversary? Anniversary? OK. Birthday, all right.

There's no established vocabulary really in this field. So--

AUDIENCE: Birthday comes in January.

GARY GENSLER: What's that?

AUDIENCE: Birthday comes in January.

GARY GENSLER: The birthday-- Hugo, why's the birthday come in January?

AUDIENCE: Birthday marks [INAUDIBLE]. So the music is [INAUDIBLE].

GARY GENSLER: Riham?

AUDIENCE: Birth means death at a point in time in my mind, so anniversary [INAUDIBLE] is better.

GARY GENSLER: You got-- did you get that? Birth also connotes death. Did I have that? And so Rahim was saying she would go with anniversary. But we have birth over here. We're going to chat a little bit about that and try-- the existential.

Then we're going to talk about payment systems and the sort of some of the pain points. And we'll have a lively discussion. What do you think the pain points are in the payment system? I,

of course, will have listed some, but your input's the most important. How does blockchain fit into this payment system, and why so far haven't there been any really economy-wide or system-wide adoptions yet? So one might even say what are the pain points of blockchain technology that there has not yet been some of those adoptions?

We're going to chat a little bit about some blockchain payment companies, and there are not many. I mean, there are many white papers but there are not many that have actually taken off. And then wrap it up.

So the study questions which we're going to sort of dig into rather than right now but just what lessons can be taken. So for my layer two help us. We're going to come back to these when we sort of dig into the paint points. What are the opportunities in cross-border and so forth, and the trade offs of using permissioned versus permissionless systems.

So happy anniversary, happy birthday for some, 10 years ago. It's remarkable. Actually, some people say it was November 1st because I think when it actually got on the website it was November 1st in parts of the world.

So what do we know about the 10th anniversary? Just some fun statistics. This has all happened in 10 years. So the price is around $6,300 to Bitcoin out of nothing, Satoshi Nakamoto. And it's $110 billion in size. We might not all know each other in 10 years, but write down for yourself on a piece of paper-- this is a real exercise I'm asking you to do for yourself. Write down for yourself and put this piece of paper somewhere or put it on your laptop. You can put it down, where do you think the price of Bitcoin will be 10 years from today on the 20th anniversary?

And remember this course in 10 years, and look back, and laugh at yourself. Just we won't all know each other. Maybe there'll be a group chat, but-- what's that Alit? You don't want to guess where it is-- you don't need to share it with me. No, no, but write down and think about it. Where do you think this will be in 10 years? Is this a hard question?

[INAUDIBLE]

Alpha, do you want to share your number with the class?

AUDIENCE: We're even just debating directionally, it's really going to be higher or lower.

GARY GENSLER: Well, how many people think it'll be lower in 10 years? OK, I'd say it's about 30%, 35%. How

many higher? Yeah, that's 60%, 65%. Alin, you-- you did two Alin split, right?

AUDIENCE: Think it's going to be 0.

GARY GENSLER: I think that would be lower. [LAUGHTER]

AUDIENCE: It is, because in 10 years the system might change so dramatically it might be unfair to even call it bitcoin.

GARY GENSLER: Fair enough. It might have evolved into something else. Back here please.

AUDIENCE: I just want to comment. Isn't the real question market cap, because that's what people are actually using the currency for? Because the question of what's the price going to be presupposes a set number of shares of coins or tokens. So the way that people are mining coins in the future also depends on the price.

GARY GENSLER: So I think you raise a really good question. If you're writing something down you could write down the market cap rather than the price. You could say-- I mean, in the Leeds case you would still say 0 for both, but you might say that-- of course. Because it depends on how many coins there are, how many shares there are. Does anybody want to take the other side from this-- the other Alin?

AUDIENCE: I think it'll have zeros-- it'll have zeros in the price.

GARY GENSLER: It will have zeros in the price. Hugo?

AUDIENCE: Well, I just want to respond to the other comment. Do you know exactly how many bitcoin there will be in about 10 years from now?

GARY GENSLER: Do we actually know how many bitcoin there will be in 10 years?

AUDIENCE: Yes.

GARY GENSLER: Hugo says you do because it's written in the code. Remind me your first name? Isaac.

AUDIENCE: So I think one is mining. I know that some folks may have a better technical background on mining and the way you dedicate resources based on price. But I'm seeing a shake-up ahead, so maybe not. The other piece of it, I think, is just thinking about the flow. Thinking about the bitcoin that's actually being traded or transacted. If there's a restricted market cap, it's similar to looking at big cap stocks trading in China. You know, you don't actually get a real price.

GARY GENSLER: While I agree with those, there's one other reason we might not know the--

AUDIENCE: People could stop mining.

GARY GENSLER: People could stop mining.

AUDIENCE: In five years if it's zero.

GARY GENSLER: Oh, that's if it really just dwindles out. Nobody wants to expand. But what's one other reason why it could be a different number that-- Shimon?

AUDIENCE: Fork.

GARY GENSLER: A fork. There could be a consensus amongst 51% of the parties on this node to change the what I'll call monetary policy. We've seen that twice in Ethereum. Ethereum was having a certain mining or block reward. They cut it in half once-- or they cut it from 5 to 3, and I think now they're going from 3 to 2. It was not in the original Ethereum.

So there could be a consensus. It's not written about a lot, but it could be either what's called a fork or it could be so almost unanimous that everybody went for a change in the monetary policy. All right, so that's just a little bit of fun. Some other quick numbers and facts. There's 17.3 million coins right now. So 17 million coins have been mined so far, 550,000 blocks roughly. 189 gigs.

Transactions per day, quarter of a million transactions. And then if I've got my decimals right, the hash rate is 10 to the 18th times 50. That's seven trillion times harder than when it was in 2009. There's seven trillion more computational power in Bitcoin now than there was nine or 10 years ago.

It takes about 1/3 of 1% of the world's electricity, and there were some nice comments overnight in the discussion for this class about whether that's a good thing or not. And maybe it's not a good thing. So that's Bitcoin anniversary.

A couple other things, unique addresses. There's a little bit over 500,000 unique addresses-- Bitcoin addresses. So if there's tens of millions of people that have Bitcoin and only half a million Bitcoin addresses, what does it mean about the probably 20 or 30 million people that believe they own Bitcoin but don't have a Bitcoin address? Where do they own it? James?

AUDIENCE: In an exchange?

GARY GENSLER: Yeah, on an exchange. Or in some custodial-- in essence relying on somebody else if there's a half a million unique addresses, but it's thought there's 20 to 30 million accounts. 10,000 nodes. And bitnodes is a website where you can see where the nodes are. And it's concentration of where the actual nodes are.

So pretty spread around. There's not any alpha in Ethiopia yet. In fact, I don't see-- what's that? Do you see two in Kenya?

AUDIENCE: Yeah, there's two little dots.

GARY GENSLER: Anybody from Greenland? No. And of course, it's spurred this whole thing-- we've seen this map before, but initial coin offerings. $28 billion roughly raised. Again, we don't know if the numbers are right but this is what this 10 year anniversary or 10 years since it all started.

This means there's a lot of capital chasing this field right now. So anybody want to write down whether they think ICOs are still going to be around in 10 years? How many people think initial coin offerings will be around? About half. And so the other-- oh, I know where Alin is, but where are the rest of you?

I don't actually know. I think they're going to slow down. I think in 2019 and 2020 they'll slow down because so many will have failed, the market will sort of adjust and say, well, we're not going to invest in these unless there is a much better business model. And so it's spurred, this is just a bucket of other coins. There's 1,600 odd coins, probably 1,500 plus of them will fail or maybe all 1,600. But 1,500 plus will probably fail.

I might be done with-- oh yeah, crypto finance. Actually there's not as much volatility as there once was. We're slowly getting a more stable coin. It doesn't mean it will stay this way, but to the extent that Bitcoin stabilizes in pricing and stabilizes for a long period there might be a little bit more use of it. But I wouldn't read-- six months does not make enough history to say that the volatility's out of this thing.

All right, so let's go back to payment systems. So now I'm going to ask, what are the pain points? I mean, maybe just putting up the chart tells you where the pain points are, but this is the chart we talked about Tuesday as to what some of the challenges are. Anybody want to give me some thoughts on this-- this was a consumer on one end and a consumer on the other end, it happens to be a US model. But it's not that different in most countries. But what

pain points could blockchain help address in this complex system? So pain points. Anybody want to give me-- Brodish.

AUDIENCE: There are too many intermediaries in the system, which means that too many parallel ledgers.

GARY GENSLER: So multiple intermediaries with parallel ledgers. What else?

AUDIENCE: I guess the usual suspect would be high costs.

GARY GENSLER: So high cost, usual suspect. World Bank estimates it's between a half a percent and 1% of world GDP, which would be, I guess, about $400 to $800 billion a year. Zan?

AUDIENCE: Speed of execution.

GARY GENSLER: Speed of execution. So what do you mean when you say speed of execution and payments?

AUDIENCE: I guess the ability for a counterparty to receive the money and be able to spend it.

GARY GENSLER: So the final settlement-- sometimes it's authorization, clearing, settlement-- but final settlement often doesn't occur for a couple of days.

AUDIENCE: But I would then like for the customer perspective just closing three seconds.

GARY GENSLER: So it's a really interesting-- there's a bifurcated market. From the customer's perspective, there's great speed of settlement. For the merchant's side, the merchant might not have that is what you're highlighting. Sorry.

AUDIENCE: So are those for the bank? Like if I have never had a bank account and [INAUDIBLE] so it's very difficult for me to go through all this process.

GARY GENSLER: All right, so financial inclusion. So we had cost, financial inclusion, latency at least for the merchant side, lots of intermediaries as Brodish said. There's a lot of ledgers-- there are multiple ledgers that might have some reconciliation and cost to them. Sure, Sean.

AUDIENCE: Real time FX settlement.

GARY GENSLER: Real time FX settlement. What do you mean there?

AUDIENCE: When you have one currency, it basically can convert the-- if you have the US dollar [INAUDIBLE] to Russian ruble. And then if you can pledge that into one kind of cryptocurrency,

you could actually resize you know that token, you can settle the trade right away.

GARY GENSLER: So I think I'm with you. It's basically cross-border. Jumping from one currency, one fiat currency to another, which happens to be technically jumping from one ledger system-- the US dollar ledger system, did you say ruble? Ruble. Do they have ledgers there? Yeah, they have ledgers there.

You know, as a background story, I used to attend the financial stability board meetings in Switzerland from time to time. And when Russia was going to have the next G20 meeting-- I think it's next going to be in Argentina, but that was the year is going to be in Russia-- the deputy governor of the central bank wanted to have a dive into issues that were in my area, the derivatives space. So I got to know something of that. They do have ledgers is what I just want to say. I did know this.

So what are some of the things? I heard from you cost, delayed settlement especially for the merchant side. I didn't hear anybody talk about charge backs. So does anybody want to tell me about why merchants are not happy what's called charge backs, or is this something more a US thing? Brodish?

AUDIENCE: So we saw the last class that out of $100, $2.75 was being given to the friend of. Multiple interpreter is like the issuing bank and the [INAUDIBLE].

GARY GENSLER: So there's a lot of cost, 2 and 3/4 percent in the US, when it's crossed the credit card rails. But one of the features is charge backs.

AUDIENCE: There's just a lack of finality to the transactions. So I think you talked about the example of the campaign after the campaign was over having people claiming the charges were fraud or whatever and having to give back [INAUDIBLE].

GARY GENSLER: Right. So merchants don't really have finality. Jack.

AUDIENCE: Sometimes charge backs are recourse for things that weren't actually spent. So doesn't this kind of affect what-- consumers might not be as willing to enter a transaction that has that level of finality.

GARY GENSLER: All right. So I think-- remind me your first name?

AUDIENCE: Dan.

GARY GENSLER: Dan. So Dan and Jack really have the two sides of this. From the consumer-- I'm sorry, Jack's the consumer side, and Dan's the merchant side. From the merchant, they want finality of settlement. They want, I've sold you a good-- I was working on a campaign. We weren't selling a good, but we got a donation and we wanted to know that $2,700 was there. Or I sell a good, a cup of coffee, and it's done.

But from Jack's perspective, well, I might not have gotten a good or service. I'm going to dispute it. You say that I'm a monthly subscriber to the New York Times. I'm not a monthly subscriber to the New York Times. I don't want to pay the $15 a month because I'm not getting the New York Times, and it's called a charge back.

And so it's really consumers and merchants are a little bit on the different side, but in the US that's part of that 2 and 3/4 percent. But merchants, probably in the US at least say, I'd rather not be there. And then it's whether customers are going to push back. Fraud, of course.

Privacy I didn't hear anybody say, but the current payment rails actually in the modern computer age gives everybody along the chain, a lot of information about all of us. Now, many of us don't mind it. I still want to use my Visa card, and I want to use my bank account, but know that we are all giving up a little bit of our personal identity because they know how we spend. And based on those spending patterns, they can know whether we like guns or we don't like guns.

And in the political space there's people sort of look at those things. Or how you live your life in many ways. And in good ways, too, because it means they can market to us what books we want to read, and what wines we want to drink. But it's privacy, as well. Financial inclusion was mentioned. Rahim?

AUDIENCE: To the privacy is cyber attacks and identity theft. So I will say this is a big pain point.

GARY GENSLER: So I should-- good. I agree with you. Cyber attacks and so forth. So with all these pain points the question is, will blockchain help address some of these or all of these?

So then we go back to benefits of blockchain. What are the two big benefits that you keep hearing me spout about whether it's from Christian Catalini's paper or just-- Kelly?

AUDIENCE: The cost of the network and then the cost of the verification.

GARY GENSLER: Yeah, so verification cost and networking cost. We're not going to go back through this, but

can lowering the verification cost address basically some of these pain points, including this cybersecurity one? And where does that fit together? I mean, Alon?

AUDIENCE: I would add, does blockchain add problems? So it may solve some problem but add other problems. And then we need to nab those problems and seize them.

GARY GENSLER: You're ahead of me. No, no, it's good. It's good. In fact I'm going to go, challenges. Which problems you're going to add.

AUDIENCE: Scalability.

GARY GENSLER: Scalability. What other problems? Brodish I've heard from, over here.

AUDIENCE: High transaction costs.

GARY GENSLER: High transaction costs, one blockchain.

AUDIENCE: Takes some days to process the transaction. It's slow.

GARY GENSLER: So it's slow. So scalability is slow. It might be high transaction costs. Alexis?

AUDIENCE: And interoperability.

GARY GENSLER: Interoperability. So it's all our friends. Stephanie?

AUDIENCE: There's also the issue of error resolution.

GARY GENSLER: Error resolution. Good one.

AUDIENCE: Like when consumers are trying to fix something wrong with like fraudulent card transaction or something. Like with blockchain, if it's immutable you can't do that.

GARY GENSLER: Right, so it's this trade-off. It's a little bit like what Jack was saying about charge backs. From the customer's side there might be an actual error-- it's a different type of error, but an error, and I want to be able to say, I'm not taking the New York Times any longer. I'm sorry to the New York Times, I'm just picking. But you're saying there could be true error. Shimon, did you--

AUDIENCE: Isn't like the core system where we have these delays in, is that really technologically advance-- sort of a business issue in the sense that [INAUDIBLE] finality opens up a lot of exposure for fraud. So the core level that we see will probably go up a lot if someone could

game the system, get their cash out at the same time. It'd be very hard to trace it back.

GARY GENSLER: So Shimon's raising, maybe we have delayed settlement. Maybe we don't have immediate finality because as a market feature we want some delayed settlement to protect against fraud, to make sure that there's not errors as Stephanie says. Maybe there's a delay for business reasons. But-- Kelly? Now, anybody want to take the other side? I want somebody to take the other side. This Alin.

AUDIENCE: I mean, I'm biased, I'll admit it. But I think that basically that says let let's have an inferior system out there because it's good. And it's like, yeah, I mean, I think to some extent you do want-- there are benefits to having a delayed settlement. But there are also a lot of benefits on having finality, so why not have both? You don't need just have an inferior settlement kind of system out there and say, OK, this is established. You can also bring another solution right beside it that actually offers finality for people who want it.

GARY GENSLER: All right, so if everybody remembers, Alin works at the digital currency initiative. Used to work in payments. He's admitting he might have a little bit of a bias, but he's saying, fine, you want some delayed settlement. But shouldn't we have an alternative? Because not every market will want delayed settlement. Eric?

AUDIENCE: Yeah, but I just wanted to tie these two points of view to another challenge, which is the issues on the handling of governance. In the case of [INAUDIBLE], for example, there's a little bit of more elaborate governance of the distributed arrangement of the blockchain. That decision between going from supposedly a theft close-- a fork. So handling a centralized arrangement is much easier than a blockchain [INAUDIBLE].

GARY GENSLER: Rhys?

AUDIENCE: Another challenge is the government regulation on the anti money laundering and the [INAUDIBLE].

GARY GENSLER: Yeah, right. So-- Kelly?

AUDIENCE: I'm not sure if this ties into the finality of it, but one of the articles talked a little bit about the fact that there is an issue with managing liquidity given the speed of the transactions, especially at the corporate level where the value of the transactions are much higher. There's a bit of an opportunity cost trade-off there.

GARY GENSLER: Right. So we're going to chat about that in a minute about the liquidity in particularly using a cryptocurrency as a bridge between two fiat currencies. But it has somewhat to do with the volatility of cryptocurrencies. But I would say to this point about-- I'm coming back to Alin versus Dan, or Shimon, really-- sorry, different debate.

I think that this new technology is coming along at a time where we can shorten settlement, and a lot of the delayed settlement in payments, in Wall Street, and securities we used to have that you would do equity trades transaction day plus five days. Before I was born, too, long time ago. Then it went to transaction day plus three. And in Europe they went to transaction plus two days-- two days for settlement of securities trades somewhere 10 or 15 years ago, and the US caught up. The US was behind and just went to transaction plus two days.

But I think technology could be t plus 0 in securities, and in payments you could go to real time payments. The US Federal Reserve had a big process where they got public comment, and they're moving towards what's called real time payments by 2020. Now, maybe it will be adopted in 2021 because it'll take longer to roll out, but I think that technology does provide that it will be more options.

And in some cases, the markets will stay with delayed settlement because it's just history, it's just legacy. And other times it will stay with delayed settlement because they actually prefer it. I think in the securities world some people actually prefer delayed settlement. We'll talk about this in a few lectures, but they'd prefer it because it allows shorting of securities. When you actually borrow somebody else's security and sell it, you usually sell it before you borrow it. And so the whole parts of our capital markets that are built around delayed settlement, because you usually sell, borrow, and settle rather than borrow, sell, and settle.

AUDIENCE: So if you put securities lending on a blockchain, then you're able to immediately point to the varo that you get and trace that back. When you then have securities lending on a t0 and you can short on t0, know exactly what securities will be borrowed?

GARY GENSLER: I think that it is technically feasible to move stock borrow onto a blockchain. I'm agreeing with that. But the question is whether the economics of that market-- whether the market participants want to actually arrange the borrow before they sell because currently they sell before they arrange the borrow.

AUDIENCE: But they have to get the locate on that same day, right?

GARY GENSLER: Well, when it's t plus 2 depending upon-- I'm sorry I'm speaking finance here, but maybe you'll help me.

AUDIENCE: Well we have to give-- I used to be in sales and training. We had to get a borrow, like a reference number, before someone shorted something so they couldn't short. I don't know if it's changed, so I don't know.

GARY GENSLER: No, it might be that I'm the old season dog that was-- now that you're saying they're tighter. But--

AUDIENCE: If a client wanted to short something, they would call me, and then I'd have to call the market maker, get a borrow, get a reference number. And they would carve off that amount, whatever they wanted to borrow, so it wasn't available for anyone else. Then they sold it. So it was like-- it was done on a ledger, but yeah.

GARY GENSLER: So the market may already be moving towards it.

AUDIENCE: So I work in the securities lending desk that he used to call. That's what I'm saying. And that came into effect after 2008 with the no naked short selling. And so then you had to get the locate on teaser on the same exact day that you borrow. But you didn't actually need to borrow the stocks until t3.

GARY GENSLER: So you just had to have the locate.

AUDIENCE: You just need to have a good locate on it.

AUDIENCE: So you couldn't double lend.

AUDIENCE: But I guess my question was if you moved that securities lending transaction to a blockchain, you could immediately borrow it and be able to trace that. And then when it came against recall--

GARY GENSLER: So for those of you that are not as close to the world of finance, and stock loan, and stock borrow, the point of the discussion is that markets have evolved built upon delayed settlement. And the delayed settlement may well have been because they all evolved from paper, not computer days. So we had authorization, clearing, settling in the payment world, but in stock borrow you had to actually locate a security to sell.

It sounds like there's some market evolution post-2008 that you actually had to add an

identifier, though you didn't have to borrow. My point is that all of this can be put on a blockchain, but there's also economic market realities as to whether somebody wants to. And I think, let's see, if you're Dan you don't want charge backs but Jack still wants them. And in the delayed settlement Shimon wants to keep his delayed settlement, and Alin wants to go the other way. And I suspect that in some markets, let's go with Dan and Alin are together, that finality will be important.

And what blockchain allows, it allows for the economics of finality to be a fair debate in a sense. A level whereas in the past you couldn't even have the debate because it was so paper intensive. So blockchain changes that economics. Let me go back a slide to say why-- what are the possible suitability of payments to the blockchain technology world? And these were some that I threw out.

Payment systems use ledgers. Geez all right, that's the sweet spot. They use ledgers. In fact, that's what Satoshi Nakamoto started this whole thing on. Multiple parties certainly want to read, and in a lot of circumstances multiple parties want to write to the ledger. Like actually record to the ledger.

So it's kind of right in the middle of this. You might be able to lower verification costs, but more importantly verification costs are really critical to the economics of payment. That you have the money that you say you have, or the value. You're sending it to this account and not that account.

So in a sense, I look at this and I go, this feels like fertile ground that hasn't yet been plowed. Because 10 year anniversary-- or birthday-- we're still not there. But any other thoughts? I mean, micro payments is another, but Alin, you're the expert.

AUDIENCE: Yeah, I mean, the one thing that I think is exciting to some of the folks in the DCI, myself included, is the fact that we can attach codes to these movements of value. So you can program these chunks of money.

GARY GENSLER: And are you saying attach code to identify it's Kelly's payment, or it's James' payment, or are you saying identify code in the form of smart contracts?

AUDIENCE: Basically it's smart contract. Just say, hey, you know what, I'm going to release the funds of this individual side and this individual side at the same time, and then you get the money, right? And that adds an additional layer of complexity that traditional payments of the Visa,

MasterCard variety don't have. So you get a whole new layer, for lack of a better word, of possibilities. When you start adding, OK, I'm going to I'm going to give you something if it's sunny outside. OK, we can make that happen real time.

GARY GENSLER: We didn't have a real--

AUDIENCE: Would that eliminate some cost and-- I mean, with the Visas and whatnot?

GARY GENSLER: Can you say a little louder just so we--

AUDIENCE: I get his point, yes, but I mean, it will eliminate the trust issue, which is with the Visa?

GARY GENSLER: I'm not sure I get why.

AUDIENCE: The cost, and the transaction movement, and the validation. Wouldn't that be eliminated? Yes, you have a smart contract. It's adding a layer. But on the other hand, it's eliminating some layers from the other process, as well.

AUDIENCE: Yeah, so assuming-- so the onus is on the technologies that build this to make sure that you don't lose functionality that you have in a Visa world because otherwise nobody would use this whole new way of doing payments. So it's assumed that you may take part of what the technology offers and then add additional functionality.

GARY GENSLER: I'm going to say I'm pretty relaxed about the open laptops. I get less relaxed about people texting during class, and I know that we're all multitaskers. But I'm the most relaxed you can imagine, but I'm starting to get a little on my edge here. Tom?

AUDIENCE: So I get that blockchain allows for smart contracts, and it's obviously a much more brute force system where you're talking about like attaching code or the payments are automated. I think of like I set up an automatic payment of my cable bill every month. And so it's like as soon as that payment comes to me, I pre-authorize it to go through. So why can't you, in a non-blockchain setting, establish basically a smart contract that's got some more--

GARY GENSLER: A conditional payment?

AUDIENCE: Right. So do you have to have a blockchain to have a smart contract?

AUDIENCE: Sorry, if I could respond to that. One of the coolest use cases that I've heard-- and I'm not going to name any entities, but you know, this blockchain-based let's say company for lack of

a better word who wants to pay their employees. And I said, look, you join me here now, we're going to make a smart contract that basically is going to pay you for your services for the next three years period. That's it. There's no additional at such a such frequency.

And we sign a contract now and that's it. You're going to get paid, right? And then you start working and you actually have a very ensured way that I will get paid that nobody can stop it. Today you don't have that. There are many things that will happen-- you know, management happens, you know, whatever happens I can find a way to-- got to get around all of that, right? That's kind of useful to make sure that, hey, I'm going to get paid for [INAUDIBLE]. That's useful.

AUDIENCE: Do you have to then put aside-- like if I am your employer, I have to put that three years worth of salary into a lockbox and I can't do anything with it for those three years?

AUDIENCE: Yeah, if you're escrowing three years more work.

AUDIENCE: It's a limitation. All of this is a limitation. It's not like you suddenly have free money, it's all good for everyone, right? But there are useful things that show up-- usable things that we never thought about. So I think all I'm saying that there are a lot of possibilities. And I don't know the right use case for it. And I don't know, it's just an example that I thought was like, that's pretty cool, I could use this.

But you know, you're right. I mean, there are many implications. But just the very fact that you have a whole new area to explore, to me that's exciting. Like we've seen what the system does. We've seen it, right? Like we bank 90% of the people. If you're in the 10%, that's kind of sucky. But for the [INAUDIBLE], this kind of works, right?

You know, you have deep lines too, it's awesome, right? But we've hit the ceiling of what we can do with this system. Maybe there's an additional approach. Let's see what happens there.

GARY GENSLER: I invited Alin because we needed a little bit more maximalism in the room I'm sorry, James?

AUDIENCE: But think back to the point earlier, it's do we really need blockchain to do a lot of the stuff that smart contracts promised to do? I mean, I set up my-- in the UK, our system [INAUDIBLE]. That happens, that just disappeared from my account at a certain time period. Doesn't involve blockchain. I could see some benefits of blockchain, but again, a lot of the smart contracts, can we not already use existing systems, make those systems better?

But this goes back to the whole payment system. There are a lot of players in the field that haven't been innovating the last 20 years, what we read. But can they not make existing systems so much better without the use of blockchain?

GARY GENSLER: So the question is, do you really need blockchain or is it just going to be a catalyst for sort of the legacy systems to kind of do what they otherwise technologically could have done but it's a kind of sharp kick in the backside to kind of do a little bit better?

AUDIENCE: That's a really good point, right? That's something that we debate a lot about them. And it actually is as we sit now, it's absolutely possible that this would be the way, right? So one example that shows up frequently is BitTorrent. So BitTorrent, for those of you who don't know, it's a way in which you share video online and nobody-- it has a lot of problems with it, but it catalyzed and change the entire distribution of media, right?

It has a lot of problems so it didn't work out the way folks thought it would, but it still kind of changed the whole industry. And it is absolutely possible that blockchains will take that path. It's unclear now, but it's absolutely possible.

GARY GENSLER: So blockchain could be just a catalyst like BitTorrent was, and then all of a sudden at the end of the day we got Apple-- what do they call it? Apple Store, thank you. But Zan, were you're trying to--

AUDIENCE: Yeah well, I was going to build on that. I think I've already seen that happening. Like I was looking into Swift recently and I think after blockchain in the past few years they launched the Global Payments Innovation Initiative. Which seems like, all right, we recognize that our infrastructure is legacy and we need to do something to kind of keep current. And they've spent and invested a ton of money in unifying standards across the messaging platform and making it much easier to use. So not a blockchain solution, but has certainly been an event.

GARY GENSLER: Right, so it's been a catalyst for Swift. Ripple has been a catalyst for Swift that we're going to talk about in a minute, but others have been as well. But I still would challenge the group-- and it's sort of what we're all trying to do here-- are there still opportunities that an append-only log, that you're appending, you're adding information to the registry or the ledger, you're not deleting it-- well, this is going to be good-- and you need a consensus of multiple parties writing to the ledger. A special guest.

AUDIENCE: Hi, it's Sri. Many of you know me.

GARY GENSLER: Sri many people might now is Priya's significant other-- husband, I think.

AUDIENCE: But that's not why he's here.

GARY GENSLER: He's not here-- he's here as a payment expert.

AUDIENCE: No, that's the reason why I'm here.

GARY GENSLER: No, but you are a payment-- do you want to introduce--

AUDIENCE: Well, I'm not an expert. I work for MasterCard, and I happen to be Pria's husband, as well. I've been in this industry for a few years.

AUDIENCE: Priceless.

AUDIENCE: Price?

AUDIENCE: Priceless.

AUDIENCE: Priceless. Exactly, we're still running that.

GARY GENSLER: So you're at MasterCard payments, and give us your thoughts on this.

AUDIENCE: So I'm actually in the opposite camp from this blockchain and cryptocurrency for a few reasons.

GARY GENSLER: So you're in a minimalist camp?

AUDIENCE: You can call it minimalist. I believe that you can do everything that blockchain promises it does using the currency systems we have. There are a couple of reasons for that. Number one is crypto is expensive average per transaction. You can always secure transactions in systems we have today using technologies that exist, but you don't need to have a Bitcoin or a blockchain, as an example.

So interlockability that you're talking about when it comes to Bitcoin and the other kind of advantages about distributed measures, everything can be accomplished through the systems we have today. They just don't choose to do it because it's expensive, and it will be expensive when you scale blockchain to the millions of people in other industries you have. It will become expensive there, as well.

So the two main things that are important in payment systems are acceptance and scale. Simple. If you achieve the acceptance and scale to blockchain, sure. That'll work, and everybody will be using blockchains, and Bitcoins, and it'll all work. The problem is it's taken us 40 years to achieve acceptance of scale with Visa and MasterCard, and [INAUDIBLE] of this whole ecosystem. It's taken a long time. And it's working.

And if you want to replace that with this new system and achieve the same level of acceptance and scale, think about how big of an effort that is. It's almost impossible. And the amount of dollars you would have to spend on that, why?

GARY GENSLER: So I see a few people want to take-- Hugo are you going to take the other side?

AUDIENCE: I can start, sure.

GARY GENSLER: And then we're going to move on, but I want to hear the other side. And I thank you for being willing to speak up, because it's really helpful. And I don't know your role at MasterCard, but it's just-- what's that?

AUDIENCE: Product management.

GARY GENSLER: Product management. But you're speaking for yourself personally or MasterCard?

AUDIENCE: MasterCard is dabbling in blockchain as well, so I'm speaking for personally.

GARY GENSLER: Because MasterCard actually filed a patent with the US Patent Office for crypto fractional banking. And Bank of America has 43 patents in the crypto space, and Visa's filed for patents in the book. So you have Visa, Bank of America MasterCard, and others filing for patents on blockchain fractional banking payments and so forth. So it's sort of an interesting side. We'll get established Professor Lessig.

AUDIENCE: Just one qualification on this. It kind of depends on who you are right now. I mean, because this is all true as a description of banking in the developed world, but to the extent you're talking about these transactions outside the developed world then the coefficients on these variables changes significantly. So if you have no reliable legal infrastructure, then blockchain technology becomes a real plus relative to a world where you have a very reliable infrastructure, which is obviously developed.

GARY GENSLER: So what Larry shared with us is, well, there's a lot of different countries-- 180. There's 1.7

billion people still not banked in the world. Half of sub-Saharan Africa, for instance. So there is still a challenge there. I'm sorry, Hugo, we--

AUDIENCE: I was going to say something similar. Like I appreciate the argument but it kind of sounds like, it's not broke, don't fix it. Like we've spent so much money building this system. So you know it works now, but like, let's not look at what technological innovation can add.

AUDIENCE: Well no, that's not what I meant. What I meant was it's not if it's not broken, don't fix it. We have achieved so much in the payments world over the past 40 years. Improve it while maintaining the goodness of the infrastructure that exists today, instead of blockchain is just a rip and replace the whole thing which doesn't solve a purpose.

AUDIENCE: Sure. I don't think that blockchain is the, like, one stop shop for everything. I'm more on the Bitcoin maximalist side where I think, sure, if you have a global currency where you can go anywhere, and use it, and it's self-sovereign and you can do all that, that would be great. I know like MasterCard and Visa have an interest in saying, well, we've spent so much money, you can use MasterCard and Visa in most places in the world. But what happens if you go into the middle of some village in India or sub-Saharan Africa or wherever, and they don't take a credit card. But they have a cell phone with a Bitcoin wallet, I can still transact there. And yeah.

AUDIENCE: You can transact with a real currency, also.

AUDIENCE: Right, but then they have to go through the process of changing that and [INAUDIBLE].

GARY GENSLER: So let's take Brodish and then we'll-- this is a good debate, by the way.

AUDIENCE: Since the discussion came to India, so-- [LAUGHTER]

GARY GENSLER: So we have our expert now.

AUDIENCE: So there could be a third solution, as well. So we have once we're in the readings of the last class, as well, the united payment interests in India, which is not a blockchain solution. So the government of India has actually promoted a new entity called a payment bank, which is like a no frills, no service kind of bank to promote financial inclusion. And based on that, just using a unique identification number and just a mobile device you can make any sort of payments of any denomination.

It can be very, very local currency as well, and you can do all of that at real time basis without

any of these intermediaries. And those are low cost transactions without leveraging on the blockchain technology.

AUDIENCE: So what you need an [INAUDIBLE] card?

AUDIENCE: You need a [INAUDIBLE] card, which is more than-- it's more than 95% coverage in the country.

AUDIENCE: What's the name of the card? Just like, do you need some form of identification?

GARY GENSLER: So India's really been at the cutting edge in the last, say, two to three years partly because they could leapfrog some of the card rails. There was not broad adoption or access Sri has talked about in India for credit cards. And so similar to what we saw in Kenya And we talked about on Tuesday in China where companies, private sector, leapfrogged, in India it was more if I believe it was the government sector rather than the private sector said we want to bring a great many of the population into a system.

So they created a unique ID system. I can't remember the name of each of these. That's the card. They created a payment-- IMSP, if I got that right?

AUDIENCE: IMPS was the older one. Now it's UPI. United payment interface.

GARY GENSLER: A payment system, which is not 270 basis points but probably is measured and single to low double digit basis points. Your actual pay, everybody in India, your employment goes into this. And there's biometrics as well to the ID system.

Now there, might be cybersecurity risks that this is all then in a sense somewhat centralized. But India sort of leapfrogged. It's kind of interesting. But we've had a lively debate. Is finality something we want or not? Is charge back something we want or not? Can you do this all without blockchain, or is blockchain something that's needed? And of course, the question even if blockchain's really kind of neat and good, will it just get the incumbents to move a little bit more into innovation and lowering their costs? Do you want to close this one out?

AUDIENCE: I think I may add something else. It's censorship resistant. So everyone can be exchanging Bitcoins without any government forbidding it.

GARY GENSLER: Now, it's an interesting thing. If it's censorship resistant to you must extend me credit and you can't decide whether I get credit based on my race, or religion, or ethnicity, and so forth, that's

probably something a broad group of people would say, that's pretty good. But if it's censorship resistant to being like you can drug traffic society might say, well, that's not what we want. So it's an interesting set of-- when the technology allows you to be censorship resistant but society says, well, there's still some social cohesion about drug trafficking, or child labor. And I'm using the ones that are easy to hold onto, so it's a little interesting debate. Yes?

AUDIENCE: So when we're speaking about the underdeveloped and developing part of the economy, and payments, and blockchain--

GARY GENSLER: Professor Lessig's comments.

AUDIENCE: Yes. And I think one thing that we haven't addressed is the last mile, which is liquidity. And so even if blockchain addresses, let's say, the accountability of the transfer, what it doesn't address is the actual liquidity and utilization in the last mile on the ground, which is very essential to a developing economy.

GARY GENSLER: Right. Sorry, remind me-- Aviva. So Aviva, are you saying last mile like that somebody could actually use this cryptocurrency in a store to buy their grains, or their goods for the week right to keep their family--

AUDIENCE: Yeah, so that doesn't solve the problem of adoption and scalability.

GARY GENSLER: Right. Fiat money-- and before we had paper money, we had coins and everything-- money is a social construct. We've talked about that. And beyond its advantages that it's used for taxes, and it's good for all debts public and private in most countries, it really is exactly what Aviva's saying. That society at large says, I will use this as a unit of account. That whether it's my employment, or the milled goods I'm buying to feed my family, it's this unit of account that over hundreds of years people adopt until they don't.

I don't know how long in Venezuela, though I keep using their currency as a unit of account. So sometimes there's last mile problem is even with fiat currency, but I not only hear you, I share your thoughts that where is the adoption in the last mile, if you well said.

So just we talked about the challenges. What are some companies? Well, there's in crypto-- and I'm listing two or three. But if you wanted to talk about others, I just listed in crypto there's startups. BitPay is one of the most popular ones where it was basically saying to merchants, if you want to take Bitcoin, we'll convert your Bitcoin for you to fiat. And that's in essence what they're doing.

So I'm going to take it back to the Hillary campaign. We had some donors that wanted to give us Bitcoin. We're a merchant in a sense, but we also wanted to elect a president. And those donors might have wanted to give us Bitcoin. So one of my colleagues had to investigate, could we take Bitcoin, and what did it mean under federal election law, and things like that. And we looked at whether to hire BitPay or somebody like that.

We chose not to because we didn't think there was enough donors who really wanted to give us enough Bitcoin, and we didn't think we would freshen up Hillary's image because we were going to announce she's the Bitcoin candidate or something. Tom, did we miss it? Is this--

AUDIENCE: Could've won Wisconsin with that.

GARY GENSLER: We could've won Wisconsin with that. [LAUGHTER] OK. I'm going to be apologizing until my grave for that election, but this is it, right? But it's a real story. One of my colleagues investigated it. I'm not trying to throw him under the bus or anything, but it was just like, oh my gosh, the amount of time we would ad spend with Perkins Coie, the law firm, and what we would have to pay to kind of think this through.

And we can only take $2,700, so every day would be a different number of Bitcoin. It could not be more than $2,700 because there was no way that we were going to break the election laws. So ultimately, the project went away.

And the reason I share that story is for a lot of merchants right now, maybe as Aviva said in the last mile, the merchants are saying, I'm not sure I need to do this. But there's a way to do it. If anybody in this room starts a company and you say, I want to take crypto, there are companies out there that will provide you that interface and their fees. Does anybody know BitPay's fees? It wasn't part of the readings, but other than Alin? All right, Alin?

AUDIENCE: 1%.

GARY GENSLER: 1%. So if you are a merchant-- Starbucks, the Hillary campaign-- if you're a merchant and you say, I want to have less than 2.7%, I can have 1% fees. I want finality and I don't want charge backs depending upon which side of this you're on. They're trying to just do it as a lower cost solution. 1%. Pria?

AUDIENCE: Similar story, but maybe with a happy ending. So a lot--

GARY GENSLER: Happier than not winning the election? [LAUGHTER]

AUDIENCE: So far a lot of philanthropic organizations, this is becoming a very real issue. So the Silicon Valley Community Foundation recorded a 30% increase in its endowment due to digital assets donations. And it's happening in a few community foundations as well. It's a growing field of interest, and there even a story-- I mean, not a story, It really happened-- of one of the exchanges doing this service, converting the digital donations into fiat currency, and it crashed. Because the volume was just so much they could not-- even the trickle they could not keep up. But this is becoming a real thing now.

GARY GENSLER: And whether it's a large foundation or political campaign, there's also a little bit of reputational risk. Because you want to make sure that the funds are not illicit funds. So there's a little bit of a reputational risk that maybe a Starbucks wouldn't have when you're just buying a cup of coffee. Never run a Starbucks, but--

So the crypto exchanges and BitPay sort of provide a lot of services. E-wallet companies provide services. Sean?

AUDIENCE: I'm just curious, how does BitPay manage volatility? How does it cash out?

GARY GENSLER: How does it manage volatility?

AUDIENCE: So it only takes a 1% cut of the transaction value, but the volatility of which can go over 1% like every couple of seconds. So in that case, how do they manage?

GARY GENSLER: So they are arranged basically with a number of crypto exchanges. I once knew, but I don't know whether they have arrangements with three, or five, or whatever. And they basically are pricing right at the-- so they have sort of close to real time pricing.

So I'm going to buy a cup of coffee. The way the technology works-- and let's say it's-- what's a Starbucks cup of coffee, it's $5? It's pretty expensive, isn't it?

AUDIENCE: Depending on what you buy.

GARY GENSLER: What's your cup of coffee?

AUDIENCE: $2.25.

GARY GENSLER: $2.25, all right. But in real time, the app-- the BitPay app-- is computing what that is. And they

feel that within these seconds for them to convert at they take volatility risk. Is it possible that in some transactions the volatility eats up the whole 1%? Yes. But basically they have that in their pricing model. And then move basically Pria's Bitcoin to dollars, and the dollars goes to Starbucks. And they guarantee Starbucks $2.25 minus 1%.

Then there's startups actually getting in. But most of these-- at least the second, third, and fourth-- are kind of institutional services. Now, there might be retail services that I'm not-- Qurom was started by JP Morgan. I think it might even still be owned by JP Morgan. It was going to be spun out. But R3, Ripple, these are really institutions. Almost B2B or financial firm to financial firm right now.

I couldn't find a really good startup in the retail space, but two weeks from today you're going to have Jeff Sprecher and Kelly here, and you can-- Shrim, are you going to be back on November 15th? No? But you'll be able to challenge. They're going to have a retail payments system in their Bitcoin. So it'll be interesting.

One retail payment solution is if anybody walks over to building E14 there's a vending machine in the media lab right now that takes Bitcoin. Thank you, MIT. Thank you, the digital currency initiative. Thank you Alin. But there is literally-- if you want to describe it, you put a QR code up?

AUDIENCE: Yeah, I mean, so yes absolutely. So anyone who wants to do that, we can walk over there and look at it. It has cross change slots so we can transact real time between three different currencies. And--

GARY GENSLER: So you can take Bitcoin--

AUDIENCE: Litecoins, and you know, dummy US dollars we call it. But it's basically a stable coin, it's a stable coin.

GARY GENSLER: Stable coin. So Bitcoin, Litecoin, and a stable coin. And there's a vending machine sitting in the media lab. You put a QR code up, if I remember?

AUDIENCE: Yeah, so QR code on the machine. you scan, we published an app on Android and iOS. And you basically scan your home null or you computer, you allow your phone to control your computer, and then you can send money from your phone to your vending machine. Real time.

GARY GENSLER: But in that case, the vending machine receives the Bitcoin.

AUDIENCE: No, so we actually added an arduino as well that converts the Bitcoin into impulses that trick the machine to say, these are coins. So the vending machine actually gets-- we tell it--

[INTERPOSING VOICES]

AUDIENCE: Yeah.

GARY GENSLER: There you go. Check it out over in the media lab. It was rolled out for media lab members' week, actually, two weeks ago. And then there's incumbents-- ICE's startup Bakkt. I do put MasterCard on there, Sharim, I do. But it's remarkable how many patents are being filed. Hundreds of patents are being filed, but they're almost all by the incumbents.

Now, is that because they want to block others from getting in, or are they trying to create barriers to entry, or are they doing it because they see real prospect and opportunity, and they want to pursue it? It's probably a bit of both. Larry, you're shaking your head.

AUDIENCE: It's all barriers to entry.

GARY GENSLER: It's all barriers to-- you don't think it's any?

AUDIENCE: No, it's all barriers to entry and then the argument's like this. Our system's great, and guess what? The legal cost of pursuing your system is going to be through the roof, so.

GARY GENSLER: And we'll get some patents along the way.

AUDIENCE: No, those patterns are the legal costs. That's the point. The threat of the patent litigation is enough to stop any-- so if you're a venture capitalist, then they walk in like you make before your announcement, you're dead.

GARY GENSLER: Well, Bank of America has 43, so-- in the blockchain space, I read.

AUDIENCE: This is the strategy in every major incumbent complex, so it's nothing new here.

GARY GENSLER: So is it a sign that there's something really real here? That these startups might have something to be figured out? Visa's started a business to business payment connect in 2016. They've even announced-- Visa's even outside it hasn't had a lot of adoption. They're not sure. I think it's more permission than permissionless, by the way.

But this is kind of-- now, is anybody in their own readings, maybe Alin-- I mean, I'm not trying to be exhaustive, but there's not a lot of-- because of some of these issues back here, these are real challenges, but I would say these are real possibilities, too. Kelly and then Alin?

AUDIENCE: So what about some of the companies that sort of backed out? And I'm reading Stripe ended their export [INAUDIBLE] program. It sounds like a pretty defeated situation, but I don't really understand that much exactly why.

GARY GENSLER: You want to answer the Stripe question?

AUDIENCE: Yes, and Stripe is not Bitcoin. Stripe wanted to maybe use Bitcoin as a service. I mean, they're clients. They're not the startup. So I think backing up is-- it makes sense because they're clients. But there's many startups out there that are still here and not [INAUDIBLE].

GARY GENSLER: Yeah, and just as background, Stripe is a payment system provider. So they're not extending credit like a Visa, or MasterCard, or they're not a network like Visa or MasterCard where actually they don't provide the credit, the banks do. But they are a payment system provider that merchants would hire, Stripe, to interface with MasterCard, Discover, American Express, and others.

But why did Stripe decide not to continue on this? Partly they didn't see a lot of adoption is what I took. But Alin, you were going to--

AUDIENCE: Yeah, just a couple of-- couple things I wanted to. So this is a great list. I think it's a great starting point. And the rule that I think at some three months ago I had was in the cryptocurrency space, most non-speculation money-- so no like I'm going to buy low, sell high-- is coming from either exchanges or miners. So you got--

GARY GENSLER: Exchanges or mining.

AUDIENCE: Yes. So that's where the money's made. If you don't speculate, you're either a miner and you make money or an exchanger make money. The miner down I think would be interesting. I think I would put Bitmain over there because I think it's--

GARY GENSLER: Bitmain?

AUDIENCE: Bitmain. So Bitmain, for those who don't know, is going through an ICO, an initial-- sorry, IPO. Initial--

GARY GENSLER: Public offering. A traditional [INAUDIBLE].

AUDIENCE: They have a lot of money, there will be [INAUDIBLE] a very hefty rate. They want to stop producing AI chips, artificial intelligence chips. So they're very good at producing chips, and they will go-- they'll go into one of those.

GARY GENSLER: But is Bitmain in the payment space, using blockchain for pay?

AUDIENCE: I mean, they've invested in Circle, which is another exchange, so they're like-- they have a lot of money. They're trying to kind of place it towards other companies. So yeah, so exchanges of the finance or all these other [INAUDIBLE], there are a lot of exchanges that make money. And the other ones aren't.

GARY GENSLER: So I want to talk a little bit about cross-border. On Tuesday we put up a complex chart. I don't need to go through that again, but we all know and there's a lot of people here that probably send money back. When you're moving something overseas, you're moving from one fiat to another fiat currency, it takes some time. And the banking system over centuries has formed a way to do that to move from one money to another, or as we say, one ledger system to another ledger system, through correspondent banking.

And correspondent banking is a reasonably concentrated business. One student sent in the group chat last night that there's only really 10 banks in this field. I don't know if that's accurate, by the way, but it is a very concentrated business because they're large international banks. Whether it's 10 or 20, it's-- you know, and they can charge a little excess because they have to have correspondence. They have to have relationships with all the local banks, and they're taking some credit risk-- the correspondent banks standing in between-- some credit risk of the local banks on both sides in the US and so forth and in, let's say, Mexico if it's between the US and Mexico.

So one idea that's been around, it's widely associated with Ripple but it's not only associated with Ripple is this simple chart. What if I move fiat to crypto and crypto to fiat? Just call it a bridge crypto or bridge currency. I can say I can go from US dollars to Bitcoin, or XRP, you fill in the middle, and then move over to the other fiat-- Mexican peso, in my example. And might that take some cost out of the system?

We have Sean's issue earlier of volatility. If the crypto is fluctuating a lot, that causes some issues. If there's a lot of cost or friction, because now you're doing two currency exchanges

not one. I'm calling crypto a currency for this purpose. I know that crypto is not technically a currency, but for this moment let me just call it-- you have two currency exchanges, and thus you have two bid ask spreads to pay. Just the market makers you need to pay the bid ask spreads twice, and you have some volatility if the middle crypto is moving around.

But this simple diagram is a big part of what Ripple is trying to create with xRapid. xCurrent is a messaging app of Ripple's and it's competing with Swift. And it had some reasonable adoption. A lot of banks are starting to use it.

But don't confuse that with another product, which is an interesting product that kind of does this that goes fiat to crypto, crypto to fiat. So what problem, what pain points would this be solving if it worked in the cross border? Anybody want to remind the class what the-- Tom?

AUDIENCE: Well, this reduces the number of intermediaries. You don't have to have your bank engaged with a correspondence bank, which engages with a local bank, which then-- it sort of--

GARY GENSLER: All right, so it might. I'm going to say it might lower the intermediation because you still have on the two fiat sides your local bank and a bank, and to do the crosses you need some market making function which in Ripple's case they try to build into the application. And they have market makers to provide liquidity. There was a question somebody mentioned liquidity. Some liquidity. But it might lower the numbers of intermediaries. What else might it do?

AUDIENCE: There's usually between exchanging currency there's a balance between the settlement time and the fee that you pay. So if you want quick settlement you have to pay a higher fee, or you can accept a lower fee but it takes multiple days sometimes to catch over, so potentially it could solve that.

GARY GENSLER: So this is basically a way that you can shorten the settlement times. This can be done literally in seconds. I'm not saying that you wouldn't pay a little extra for it, but this can be done very quickly. If you have arrangements.

So some contend-- and I've spoken to them at conferences and so forth-- that big corporate treasuries are going to try to do this-- that the treasury function of Apple and others might take this up. The big banks say that's ridiculous. The big banks say, no, we can provide real-time cross-border cash movement between dollar and euro, and dollar and yen, and you don't need to interpose something in the middle.

AUDIENCE: Wouldn't that require huge amounts of cash reserves to be able to protect against volatility,

and not only volatility of the crypto, but the volatility of the actual fiat for that particular country [INAUDIBLE].

GARY GENSLER: So the question is, will it need a lot of liquidity, basically? You used a different word maybe, but--

AUDIENCE: Reserves.

GARY GENSLER: Reserves. But somebody who can make markets in size in crypto versus fiat, in crypto versus fiat, I think the answer is yes in terms of-- the only probably token right now that has enough liquidity in it to do this in size is probably Bitcoin. Even though Ripple is promoting this and it's sort of an interesting technology, they have a software, xRapid, that you can do this right now. They're promoting on XRP, but is there enough liquidity?

Could you move more than a million dollars? Probably not. You probably couldn't move $100 million payment without moving the market a lot. Shimon.

AUDIENCE: So back to finance, the only way--

GARY GENSLER: So back to finance, that's good from a finance professor.

AUDIENCE: The only way that this will work is sort of subject to the cost of arbitraging this, right? You don't care about the value of XRP provided that you're not validating arbitrage relationship between the two fiats, right?

GARY GENSLER: That's correct.

AUDIENCE: So whatever those frictions are, you won't be able to go underneath them. And if you're Apple, I don't see the treasury in a business case. If you're Apple and you're banking with JP Morgan Chase, I mean, they're probably quoting you, you know, bips. I mean, the two major currencies, the spread is like in bips.

GARY GENSLER: A bip is 1/100 of a cent, basically. I mean, it's very tiny. We'll get there, just a second.

AUDIENCE: I'm not sure that isn't the--

GARY GENSLER: So the proponents-- and then we'll come back-- proponents of this say, yeah, JP Morgan might solve Apple's needs between dollar euro, but are they really doing it between dollar peso, or dollar Kenyan currency?

AUDIENCE: Let's say they're not and the spread there is 10 basis points, 50 basis points. Well, that's going to be by construction, the spread, that's going to be [INAUDIBLE] arbitrage that will be allowed if you go that way to--

GARY GENSLER: All right, so Shimon's saying there's maybe a cost in friction. I think the proponents of this would also say there's a friction in time moving from dollars to peso. Remind me your first name?

AUDIENCE: My name's [INAUDIBLE]. Well, it's certainly true even in pesos or any currency, like, all these points that anyone's getting are extremely tight. But there's still probably like weekends, for example. Weekends they're just not quoted at all. So if there's a major event that's happening over a weekend that's going to change the value of your asset or your currency, then you can't trade until Sunday night when Hong Kong opens. And so there's still like a 36-hour time period that is completely [INAUDIBLE].

GARY GENSLER: So the worldwide currency markets are depending upon banks, and banks do actually have holidays. I know it's sometimes hard to believe, but. And so there's a question of-- so there's a question of friction which Shimon would say if it's even if it costs you half a percent it better get inside of that. There's a question of settlement delay, this could be faster. But you're saying they could change that-- JP Morgan can change that. And then there's weekends. Do you have 160 some hour week? I'm going to go to Alexis and back here.

AUDIENCE: I was just thinking like-- because this system like India at the end of the day, it depends on the a fixed rate on the two fiat rate on the normal markets, right? So even if we can't trade on a Sunday, the rate is going to change on the tax form based on, I don't know, the assumption of what the rate is going to be tomorrow. It's going to adjust, normally you should adjust, right? Because as has been raised before, adjust for new arbitrage take place.

So even if it's possible, doesn't this system add more risk in terms of two different risk-- fiat-crypto, crypto-fiat? And just there will always be the underlying risk of fiat to fiat because it's always based on a price on the private--

GARY GENSLER: Hold your question because I want to see if the other-- yours comes in. I got it, it's the risk.

AUDIENCE: I was just going to bring up the accessibility for non-first world countries or unbanked countries. And I would be less concerned about moving like a yard and more concerned about, OK, well maybe I could transact like sub-$100--

GARY GENSLER: Do you want to translate for the room what a yard is? My Goldman Sachs days I knew what a yard is, but some of the non-bankers.

AUDIENCE: It's $1 billion.

GARY GENSLER: $1 billion. Now you can work on-- what trading floor to did you work on?

[INAUDIBLE]

Citi. Now you can work on Citi. A yard is $1 billion. At Goldman Sachs it's floor 2.

AUDIENCE: Yeah, oh boy.

GARY GENSLER: We measured it differently, yeah.

AUDIENCE: But I think if you wanted to transact maybe like under $100 from dollars to whatever, no large bank is going to open an account and do that for you. You're going to have to do that-- like a commercial bank, if you have access to it, there's a really wide spread there. So you can do this through an app through a Stablecoin, or Ripple, or whatever, you're going to be able to do it for cheaper if you're making like micro transactions.

GARY GENSLER: So I'm going to react and then trust bring it all together and summarize. It's the last slide, so. Alexis' point about risk, I agree. I think that all of these points are valid that there is additional cost. There's two hops in this example, and there's additional risks.

So the real business case question is, is there enough value added on the other side? Are you shortening settlement cycles? Can you do it on the weekends when you otherwise couldn't do it? Could you move small dollar amounts, maybe retail?

Because Western Union still charges something like 8% to 10% to do cross-border remittances. So send some money to the Philippines, and do it only for a couple of hundred dollars, and you're probably spending 10%. Could somebody build inside of those types of-- now, $200 movement 10%'s $20. You still have to bring transaction costs down-- fixed transaction costs down.

But if you can bring the fixed transaction cost down and have enough liquidity, it's kind of-- I wouldn't count this out. I'm one who sort of doubts it will be in the heart of treasury function that Apple will be using it between dollar and euro, but I want to say just the wide spectrum

and just an interesting-- can crypto be a bridge currency, and might it be in the world of stable value?

I hope-- I mean, this was a good discussion because this is what the rest of the semester is about. We're going to take use case by use case and really debate, and through it the learning objective is for all of us to leave with a little critical reasoning skills about when does an append-only log with consensus amongst multiple parties and maybe a native token make sense? That's usually called blockchain, but Aline doesn't let me call it blockchain technology anymore.

Next Tuesday is election day, so I'm going to make my pitch. If you're a US citizen, please vote. If you're not, I'm not going to ask you to vote but please vote. Participate in our incredible thing called democracy, but we're going to talk about central bank digital currencies. And so I think we're doing this over two sessions, as well. So next Tuesday is going to be a lot about central banking and so forth. So thank you. Happy anniversary, Bitcoin.

[APPLAUSE]