EPISODE 702

[INTRODUCTION]

[00:00:00] JM: Cryptocurrencies are not very usable today. The main use cases for cryptocurrencies today are store of value, somewhat like what people use gold for, and speculation. One reason that the use cases of cryptocurrencies are so narrow is the problem of scalability. Cryptocurrencies have several scalability bottlenecks, but that's okay. Think about the internet in 1994. The consumer sitting at home with a dialup modem was bottlenecked on bandwidth between their home and the broader network. The physical network connections between our homes and internet company servers were much lower bandwidth than we have today. The servers at companies such as AOL were slow and expensive. The internet scalability problems were incrementally solved one-by-one. Different solutions to different scalability problems emerged in an iterative frothy process and then all of a sudden you're sitting on an airplane watching YouTube videos on a smartphone.

Watching YouTube videos on a smartphone would have sounded unbelievable to someone in 1994, and this is much like sending someone a penny across the internet is unbelievable today. If you want to send a penny across the world today, you will probably have to pay several dollars' worth of transactions costs. How absurd it is that we can send multipage emails? We can send videos to each other across the world for free, but we cannot send a penny of value to someone across the world for free. Someday you will be able to use cryptocurrency to send one penny to someone in another continent halfway around the world.

The transaction fee that you pay will be a fraction of a penny. This removal of financial friction due to transactions costs will change global economics, and certainly some of these value transfer, the ability to send one penny to someone in another continent can be achieved by centralized systems that are not cryptocurrencies, but the advantage of the cryptocurrency model is that is has the potential to be completely uncensorable so that we can have truly free market economics on the global stage.

Now, maybe this won't occur on Bitcoin. Maybe it won't occur on Ethereum, but we've had some major technological breakthroughs, which are why people are so interested in cryptocurrencies

that make it such that it looks like we might be able to build this kind of thing. So what stands between modern cryptocurrencies and that beautiful future world of micropayments? There's a large set of scalability problems, similar to the scalability problems of the consumer internet in 1994.

In today's show, we focus on one particular issue of scalability, block propagation time. Cryptocurrency transactions are verified by miners. On the Bitcoin blockchain, a set of transactions gets verified roughly every 10 minutes. These transactions represent a block on the blockchain. The miner who solves the cryptographic puzzle associated with the transactions in that block receives payment in the form of a block reward and the transactions fees that are associated with those transactions.

When you issue a transaction on the Bitcoin network, your transaction sits in the mempool, a list of pending transactions that have not been confirmed by the mining process quite yet. Miners around the world are simultaneously competing with each other to find a solution to a pending set of transactions sitting in this mempool. When a miner includes your transaction in the block and the miner discovered a solution to that block, your transaction will probably be accepted into the blockchain.

The reason that you're transaction is not guaranteed to be accepted is due to a time period known as block propagation time. Block propagation time is the time it takes for a confirmed block of transactions to makes its way through a blockchain network and be accepted by other miners who are going to then switch to mining another block of transactions.

If two blocks are solved at nearly the same time by different miners, the winner of the current block reward will be the miner whose block manages to propagate through the network the fastest. This is an unfortunate race condition.

BloXroute Labs is a company that is developing a blockchain distribution network, or BDN, much like a CDN pushes media files out to the edges of the web to make them faster to access. A CDN is a content delivery network. A BDN pushes out information to miners in the network. Of course, this means that the BDN could potentially be centralized infrastructure. In order to make the BDN effectively decentralized and trustworthy, bloXroute claims to have a provably trustable

network protocol to go with its token-based incentive system that keeps its goals aligned with that of the larger blockchain world.

Aleksandar Kuzmanovic is the founder of bloXroute Labs along with several founders, and he's also a professor of computer science at Northwestern University. The cofounders of bloXroute labs include former guest of the show; *Emin* Gün Sirer and Soumya Basu, the bloXroute founders have a strong theoretical background and they have a great reputation in the cryptocurrency community, which is unlike the vast majority of founders who have issued tokens, which is one reason why this episode is particularly interesting to me, because it's not very often you see people with really good reputations in the cryptocurrency community doing token related funding incentive models, because they're so new, they're so potentially risky, the could blow up in a lot of ways.

As we've heard in previous episodes, most of the founders of these companies that issue tokens cannot give a good explanation for why their protocol needs a token. Tokens are a great idea. They have been mostly applied as a mechanism to get rich quickly. So the ICO idea has really been besmirched by these get rich quick techno scam artists.

However, bloXroute has a credible explanation for their token and I asked some very pointed questions to Aleksandar in today's episode to try to vet the project for legitimacy, and his reasoning made sense. So I really enjoyed this episode. I think it was a good example of the positive potential of tokenization, and I hope you enjoy it as well.

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[00:07:15] JM: Data holds an incredible amount of value, but extracting value from data is difficult, especially for nontechnical, nonanalyst users. As software builders, you have a unique opportunity to unlock the value of data to users through your product or service. Jaspersoft offers embeddable reports, dashboards and data visualizations that developers love. Give users intuitive access to data in the ideal place for them to take action within your application.

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Jaspersoft is made by TIBCO, the software company with two decades of experience in analytics and event processing. In a recent episode of Software Engineering Daily, we discussed the past, present and future of TIBCO as well as the development of Jaspersoft. In the meantime, check out Jaspersoft for yourself at softwareengineeringdaily.com/jaspersoft.

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[INTERVIEW]

[00:08:48] JM: Aleks Kuzmanovic, you are a founder at bloXroute Labs. Welcome to Software Engineering Daily.

[00:08:53] AK: Thank you so much.

[00:08:54] JM: It's great to have you here and we had Soumya who was one of your cofounders on the show a while ago. We've also had *Emin* Gün Sirer who's also on your team on the show, and your team has a lot of highly technical expertise in blockchain technology, and you are working on scalability issues. So we often hear that blockchains don't scale, or Bitcoin doesn't scale. Let's talk about Bitcoin specifically. Why does Bitcoin have scalability issues?

[00:09:25] AK: Well, I mean, I'll start answering this philosophically first, and then my answer would be like the good news about Bitcoin is that it is a truly decentralized system, and what it means is that we often hear like, "Hey, no single entity controls this system," and this is really cool, but the price we have to pay for that is that basically, well, the system lacks scalability. What that really means in reality is that Bitcoin currently has three transactions per second, which is nowhere close to where it needs to be in case we want it to be used widely.

Then if I would have to go to the nits and grits of the thing, I can say that the real problem is the trustless peer-to-peer network that sits, which is how these nodes in Bitcoin are connected to

and basically each and every node has to check a lot of information that flows through the network. Has to make sure that the information that it receives is valid and has to propagate these to other nodes, and all these things are taking a lot of time, and this is what creates a lot of problems.

[00:10:32] JM: If we had scalable blockchains, if we had a scalable Bitcoin, for example, what would be able to do?

[00:10:40] AK: Well, initially, the Bitcoin was designed to disrupt the financial systems out there, like Visa and Mastercard and just looking at the numbers that we have, for example, Visa has a [inaudible 00:10:52] of 5,000 transactions per second, and then if you consider the number of cars in U.S. and assuming that each one will fill the tank once a week, just for that you need 450 transactions.

Then blockchains however are designed with much bigger goals that this in mind, okay? So one example are these micropayments that everybody is talking about. So consider a scenario in which for example you are – Somehow you create the viral video and then that video is downloaded by one million users overnight and assume that each user who sees that video is capable of giving you one cent, just one cent, for watching that video. By the end of the day, you're going to have $10,000 in your account, which is a much nicer thing than just being somebody who created a viral video.

Now, we can go much further beyond this and say that like today we are having this autonomous cars and artificial intelligence is having a significant impact. Well, if we can make an artificial car, a self-driving car, then for sure we can make these autonomous wiggles or autonomous systems to actually pay to each other on the fly, and it is believed that machine payments are going to be much bigger than what we have these human-based payments. So I can go on and on, but I'm going to stop here, because this is a never ending story. I think the things that we can do with Blockchains are really immense.

[00:12:24] JM: Right. I think we should drill on that just for a moment, because there is some acrimony, even in the engineering space where you would expect engineers to really understand this, where all you have to get with cryptocurrencies is micropayments, and you

have a massive innovation. Yet there is so much antagonism towards the cryptocurrency space, like what's the killer app. The stuff doesn't do anything. It's just tulip bulbs, etc., etc., etc., and it's kind of like saying in 1995, no, the internet is going to be a big deal. We're going to be sharing videos. We're going to be ordering groceries online, but we kind of have a lot of technical bottlenecks to solve, but they're all just like war of attrition. It's not like you release Facebook and it goes viral. It's like maybe we are a current crop of people who are internet entrepreneurs and investors and people who are commenting on this stuff, a lot of them are – They grew up in the Facebook age, or the Google age. So their idea of a successful piece of technology is something that gets built in a year or two years and then goes viral and then just takes off and has a continued meteoric rise. That's not how all technology works.

[00:13:40] AK: That's right, basically I'll give you an analogy. I'm a professor of computer science at Northwestern, and I know about the history of the internet, and then I can tell you that, for example, when people were designing the internet as it is today, the thing on the block was basically circuit switched or telephone network, right? Then people came with this idea, like, "Hey! You know what? We're going to use buckets and we're going to route them to the internet. It's going to work just fine." They were killed. Nobody believed them. People thought and it lasted for years that they were never given a chance to actually show that this can work. Eventually it worked and we are happy for that.

But I feel we have the same thing here with cryptocurrencies. I can say that, personally, I'm working on my interesting things in my career, but once I saw the power of smart contracts and all these distributed applications and the things that you can do with them, I really fell for it and so I'm a believer. So that's where I stand in this discussion.

[00:14:40] JM: If I issue a transaction on the Bitcoin network today, let's say it's for a penny. Let's say I want to pay a penny towards a video that is hosted online, because I want to support that video and maybe I want to pay with it on Bitcion, because this is the uncentrable payments network and there's something about this video that is politically sensitive or just took some guts for this person to post it, and I really want to support it through Bitcoin so that my payment can't get censored. If I want to pay a penny on the Bitcoin network today, I have to pay a fee that is much more than a penny. How expensive is that fee?

[00:15:20] AK: Well, I mean that's true. So this tells us that we aren't really very want to be with the cryptocurrencies. Hence, this is one reason why we need scale, right? Because once the thing is killed, then this is when the fees have to go down. Going back to your question, at some point I remember like in June last year or so, a fee for any transaction on a Bitcoin network was as high as $10 for a transaction, right?

In your case, if you want to send one penny and you have to pay $10, well that doesn't make much sense and, hence, you're not going to do that. So until we bring those fees down significantly, such that paying a fee for a transaction is much smaller, then what the amount that you're sending to another person is, it's not going to work fine at all.

[00:16:10] JM: Why are the fees so high? What am I paying for?

[00:16:13] AK: Basically, the way it works, is that there are these entities called miners. The entities that actually produce blocks in Bitcoin. So I'm not going to dive into much details. I hope that the people –

[00:16:26] JM: We have many other shows on the basics of Bitcoin, but maybe you could just refresh us on the fee expense.

[00:16:32] AK: I'm not going to go there, but, see? A block consists of, let's say, 2,000 transactions, and a block is mined once every 10 minutes. I'm just giving numbers just for example, okay? So assume however that instead of 2,000 transactions, somehow 3,000 transactions were created within 10 minutes, okay? That means that a miner will have to choose two out of 3,000 transactions and put them on the block.

So the miners are just rational people and they're just going to say, "Hey, you know what? I'm going to sort these transactions such that those that pay the highest fee, I'm going to put them first, because that money is coming to me, okay?

If, for example, you don't pay a fee or you pay a tiny, tiny fee and everybody else pays a larger fee, then your transaction is not going to be included in that single block, so you'll have to wait for another block, and another block in case you're not comparative. This is why you would have

to eventually either increase your fee such that your transaction is included in the block. Hence, when there are many transactions going on in the system and the capacity of the system cannot support it, then naturally the price of the fee goes up and this is what we see. Not just in Bitcoin, but in other cryptocurrencies.

[00:17:55] JM: So all of the payments that are pending, let's say I want to issue a one cent payment with a one cent transaction fee, I can put that into the mempool as a candidate to be accepted into a block. But none of the miners are going to accept that into one of their candidate transactions, because there're transactions that have higher fees associated with them. Every person can pay whatever fee they want and it's like they're bidding to have miners accept those transactions into blocks.

[00:18:30] AK: That is precisely what is going on. Of course, we shouldn't blame miners, because they're just rational players who are just saying, "Hey, I have two transactions. Alex just paid me $5 and Jeff gave me one cent. Well, I'm going to pick Alex's fee, because he's going to give me $5, right?" Hence, what is going on, it's a pure economic system where necessarily when there is not enough capacity to serve all these transactions, well, then the fees are going up.

[00:18:58] JM: Before we get into potential scalability solutions, I'd like you to articulate a term called block propagation time. What is block propagation time?

[00:19:10] AK: Okay. Basically, block propagation time is the time it takes for a block to propagate to the majority of the network. Let's say 90% of the network. This is typically used, in these scenarios when we talk about Bitcoin or any other blockchain for that purpose.

Basically what happens is assume you have one megabyte block created by a miner, I send that block to the network, to that peer-to-peer network and it goes. From one node to another, it keeps propagating each and every miner, each and every node in the network is checking like, "Is this okay? It is okay. I'm going to send this further." It takes time for this block to propagate to the network, okay?

Currently, it takes – I mean, statistics shows, it takes about 11, 12 seconds for a one megabyte block to propagate from a miner to the rest – Not to the rest of the network, but to the 90% of the nodes in the network. This particular parameter is very important, because if nodes are not on the same page about who did what, then it's hard to reach a consensus on what is the blockchain, or what are the transactions that are considered mined in this particular system.

[00:20:22] JM: So these different miners are competing to solve problems associated with a set of transactions and when a miner solves that problem, the miner wants to broadcast the solution to all the other miners so that they can claim the reward and we move on to mining the next block of the blockchain. If that multicasting that block propagation time was faster, how would that affect the overall transaction capacity of the Bitcoin blockchain?

[00:20:57] AK: Well, I mean, if that in the extreme case, assume there is infinite capacity. I mean, it's a theoretical term, but let's just assume for a second and assume there is no delay. Promptly, you can send things to others, then we no longer have a distributed system. We have a single – We have a bunch of nodes that can communicate to each other, assume a rack of servers sitting next to each other and not spread all around the world. If this is the case, this would give you a huge capacity, because the information is flowing promptly among these nodes, and hence they're all on the same page. They all have the same view of the network, and if they follow the blockchain rules, then it's easy for them to come to the consensus.

[00:21:42] JM: If you lower the block propagation time, if these miners are not competing anymore with conflicting views of the world, does it increase the transaction throughput?

[00:21:52] AK: That will definitely increase the transaction throughput, and this is actually where we are going with our startup. We are actually trying to build this network that would significantly reduce these propagation induced by the peer-to-peer network so that we can actually create these large – That we can actually create scalable blockchains.

[00:22:12] JM: Right. So I understand, the block propagation time, first of all, you have block time where right now that's 10 minutes. So block time is the difficulty of the network such that a solution to a block discovered roughly every 10 minutes on average. So block time is the gating factor for how long the window of time is to find a solution, and then once a solution is

discovered, you have this block propagation time that adds some additional latency. How does the length of time spent in block propagation time, this period where you can really get down the latency at bloXroute. How does that compare to that block time? It seems like that would be a much lower span of time.

[00:23:00] AK: I mean, these two parameters are quite related to each other. Basically, the first parameter that you talked about is the interblock time. This is the time the scale at which new blocks are arriving, okay? Block propagation time is the time needed for a block to propagate through the entire network, okay?

The smaller the block propagation time is, it becomes more and more possible to actually reduce the interblock time, okay? This basically is the way in which we can increase the throughput of the Blockchain, because the more frequent blocks are generated, more transactions are being approved. Hence, the system moves to more transactions per second.

[00:23:47] JM: I see, because there is a lot of competition going on in this 10-minute period. But if you had less – I guess if you pulled more of that effort, then you're going to shrink the absolute time that it takes, even though the block time is really a measure of difficulty. It's kind of not a measure of how long it will actually take, right?

[00:24:11] AK: Basically, to increase the throughput of a blockchain, you can do two things. One is either you can increase the block size so you can push, push more transactions in the system, or you can decrease the interblock time, or you can do both, right? Increase the block size and decrease the interblock time.

But all in all, basically given that the more you do that, the more you're constrained by the underlying network, okay? For example, currently in Bitcoin, a block is one megabyte and it takes 11 seconds, 11, 12 seconds to propagate these to 90% of the network. You increase the block size by 10, it's going to take 111 seconds to propagate these through the network. It's not perfect. It is still less than 10 minutes and it's not going to be nice, but it might still work, okay?

But if you decide to increase the block size by 100, let's say you want to push 100 megabytes block and you still are sitting with the existing peer-to-peer network, what is going to happen is

that the block propagation time is now going to be more than 1,000 seconds and it is going to be longer than this 10 minutes, which is the interblock time.

This is really the nightmare kind of scenario for any blockchain, which means that nobody can come to the consensus of what's going on, because every block is full and this really creates – When people say a blockchain unravels, this is such a scenario.

[00:25:37] JM: Right. Got it. How is block time decided, the block time of the network?

[00:25:42] AK: You mean the inter block time?

[00:25:43] JM: Inter block time, yes.

[00:25:45] AK: The inter block time is a parameter set by the particular blockchain. For example, in Bitcoin, it is around – Averages 10 minutes, and this is based on the difficulty of the [inaudible 00:25:56] puzzle that needs to be solved. On the other hand, for example, in Ethereum, it is much smaller. It's around 15 seconds. But the issue is that in Ethereum, the blocks are much smaller, okay? Hence, in this interplay of how big the – Hence, smaller blocks come in more frequently versus longer blocks coming less frequently, the effect is that Bitcoin has around three transactions per second and Ethereum somewhere between 7 and 15 transactions per second, right?

I mean, there are fundamental limits in how much you can move these things around, because if you do too much, which would be, for example, "Hey, let's forget about all of these and let's send 300 megabyte blocks once every 100 milliseconds." I mean, that's not going to fly, because the underlying network, the propagation itself is going to be so huge that it's going to be a complete collapse of the system.

[00:26:51] JM: When does the interblock time in a blockchain get changed, or does it ever get changed?

[00:26:57] AK: Basically, the parameters in a blockchain is decided by the designers of that particular blockchain. So there are ways to kind of change those parameters. For example, one

way would be to have a voting based on the caching power in a particular blockchain system. If, for example, more than two-thirds of participants, or players, or stakeholders in that particular blockchain decide to change parameters, then they can change them. This is one way to go. It happens rarely, because typically is not easy to get enough people to do that.

Another way to go would be to fork a blockchain. For example, Bitcoin cash is a fork of Bitcoin. What happens, at some point if you decide to change parameters, then it becomes an independent blockchain, an independent fork, but this is another way to kind of change the parameters in a blockchain.

[00:27:53] JM: Okay. So if we get block propagation time down to a really low level, like a very low latency, like a block propagation time is really small, then you're suggesting we could have blockchains that could have a much lower interblock time. As long as that interblock time is longer than the block propagation time, then you should be able to prevent the blockchain from unraveling.

[00:28:27] AK: Correct. That's exactly the case. With our approach, what we're doing is that we are – Actually, we are having a wide area experiment and we are actually coming to a case where we can say, "Listen, we can change this parameter safely so that you can increase significantly the block size." There are a few tricks that I have to explain further down the road. You can increase the block size. You can decrease the interblock time and it all still works, because the block propagation time is still much smaller than the interblock time, which really is the key thing that you need to worry about in this blockchain space.

[00:29:06] JM: If you did that hypothetically successfully, you probably wouldn't get Bitcoin, at least Bitcoin in its current form of governance to change, right? Do you think you'd be able to convince people that the interblock time should be –

[00:29:20] AK: Yeah. Yeah. Basically, our system is completely agnostic to – We can work for any blockchain, okay? So there's more than 1,000 cryptocurrencies and even a larger number of blockchains out there. So we aren't really – I mean, we are thinking of ourselves as being enablers in this blockchain community.

So it's really up to the Bitcoin community to say, "Listen, we really like these guys. We want to use this. This can work," or they are going to just say, "Hey, we don't care." I mean, I'll really leave that decision to individual blockchain communities out there, and we are really open to everybody. Hence, I can imagine that Bitcoin can say, "Hey, we don't like this approach," but I can also think that, for example, Bitcoin cash, guys who increase the block size and said like, "Hey, we can do this much better." I would guess that they would be somebody to like us given that we can enable this thing to happen.

At the same time, it really is up to an individual blockchain community to realize and kind of decide what is their blockchain good for. If Bitcoin says like, "Hey, we don't care about the scalability. We really want Bitcoin to hold value, like gold. So we don't need much transactions." That's their choice. Good luck with that. I mean, we have nothing against that. But what we're saying is that there is so many other blockchains out there that do need scalability and want scalability and we can give it to them. So that's our mission, more or less.

[SPONSOR MESSAGE]

[00:31:06] JM: Kubernetes can be difficult. Container networking, storage, disaster recovery, these are issues that you would rather not have to figure out alone. Mesosphere's Kubernetes-as-a-service provides single click Kubernetes deployment with simple management, security features and high availability to make your Kubernetes deployments easy. You can find out more about Mesosphere's Kubernetes-as-a-service by going to softwareengineeringdaily.com/mesosphere.

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One reason I am a big fan of Mesosphere is that one of the founders, Ben Hindman, is one of the first people I interviewed about software engineering back when I was a host on Software Engineering Radio, and he was so good and so generous with his explanations of various distributed systems concepts, and this was back four or five years ago when some of the applied distributed systems material was a little more scant in the marketplace. It was harder to find information about distributed systems in production, and he was one of the people that was evangelizing it and talking about it and obviously building it in Apache Mesos. So I'm really happy to have Mesosphere as a sponsor, and if you want to check out Mesosphere and support Software Engineering Daily, go to softwareengineeringdaily.com/mesosphere.

[INTERVIEW CONTINUED]

[00:33:25] JM: So we can start to get into some other scalability solutions before go deep on bloXroute. So we are going to talk about bloXroute and how you are lowering the block propagation time. What's nice about it is it is a kind of on-chain scalability solution, though that on-chain is kind of a fuzzy term. But let's talk about lightning network, which is you would probably say an off-chain scaling solution, or a second layer solution.

So my understanding of lighting network is instead of publishing your transactions directly to the blockchain, you might publish your transactions to a lightning network node. What a lightning network could do would be aggregate collections of transactions together and then publish an aggregation of transactions to the main chain, and in a way you have this layer of compression so that you have fewer overall transactions that need to be accepted into the main chain in order to get micropayments, for example. Maybe you have any differing definitions of lighting network, tell me what they are and tell me what your critiques of lightning network are.

[00:34:42] AK: Yeah. I think what you just said is fantastic. So I don't have much to add. No I'm joking. I will definitely talk about. Basically, for example, assume you and I are at Starbucks and

you're telling me, "Hey, Aleks, can you please borrow me $1. I want to buy something," and I borrow you $1 by using the lightning network. I mean, I want to borrow you $1 there.

Basically, the key idea behind lightning network would be like, "Hey, the rest of the world, a blockchain node in China really doesn't care about the fact that Aleks just lended Jeff $1. Not everything needs to go on-chain, okay? The way it works then would be something like this; I, for example – You and I make an agreement and I depot $10 in an account and you deposit $10 on an account, okay? This is a payment channel between me and you, okay?

Then I can send you money. I can give you $1 and you can give me back $1. Then I can give you $2. You can give me back $3. You and I can transact as much as we want without actually having to tell anybody else, because we locked $10 on that particular payment channel, okay?

Basically, this is the idea behind it. For some cases and for some applications, this is really the way to go. I mean, I'm not really political in this case, the fact that we are working on on-chain transactions and that others are doing off-chain kind of systems. I'm totally fine with that.

Now, the problem with that is – The issue is, for example, assume I want to apply this same idea when buying computers from Apple, then I would, for example, assume I deposit $1,000 on Apple and then I keep buying from Apple $100 items once every minute. Again, because I deposited $1,000, that is perfectly fine, because now I don't have to make on-chain transactions every time. But the question is do I really – Is it really good for me to have $1,000 deposited on Apple? That doesn't sound like a good idea.

Then another thing is what if I want to transact with somebody I never did that before? I always still – I still need to make on-chain transactions even if I'm sitting in this lightning network. Then to solve this problem, now they're going into the direction where they say, "Listen, how about I deposit $100 with entity X, and that entity X also has money deposited in Apple." Now instead of me going directly to Apple, I can go to these intermediary players. Which, again, it's not a bad idea, because you do have – Transactions can happen instantly, but at the same time, you still need on-chain transactions, which is fundamentally in this case as anything else.

We, bloXroute, we're completely compatible with any off-chain solution. If they can scale things up by a thousand times off-chain and we scale by 1,000 times on chain, then in total we're going to scale it up by 1 million times and we have no problem of doing that. We're happy to share kind of a fame of doing this jointly with lighting network.

[00:38:01] JM: So the problem with these relay networks you might say is that they are subject to censorship. Is that right?

[00:38:10] AK: Basically, there are relay networks both in on-chain and off-chain solutions. Basically, in on-chain solutions you have relay networks such as Falcon of Fiber, but basically you'll have these intermediary networks that are basically helping close the transaction, right? In on-chain case, they're basically, they help you propagate blocks, but in this lightning network, for example, you have this intermediate players that can decide, that can help you close the transactions. Yes, if they for whatever reason say, "Listen, I'm not going to do that," or if they fail, we have a problem again. But I leave that problem to the lightning network designers to kind of solve.

[00:38:55] JM: Okay. Well, we have – When we scale centralized systems, we have a lot of different methods of scaling in different places. We've got load balancers, we've got CDNs, we've got sharding, caching and all of these things are useful. So it's not a winner take all mode of scalability. At least it is not proven to be. So it's useful to have different people working on different scalability issues, and nice to know you can work with all of them. We could talk about things like sharding and proof of stake and DAGs, like Hashgraph. We hear about these other kinds of solutions. I don't think they're really worth going into here. We've done some shows on these, at least the Ethereum side of things, and I think you're probably interested in them, but they're unproven. Again, it's not a winner take all set of scalability solutions. So I would like to get into bloXroute, which is a blockchain distribution network. What does that mean?

[00:39:54] AK: We basically are – What Akamai is for the web, that's what we want to be for blockchains, and that means, like Akamai for those who aren't familiar with them, are a content distribution network that helps push data around so that when you're accessing the web, everything works fast. Not that I'm knowledgeable with, for example, YouTube, YouTube is like helping you download your video quickly from the web from a nearby server, and this is the

basic idea that stands behind bloXroute, which we call blockchain distribution network. It's not a content distribution network, but a blockchain distribution network. I was the one who came up with this title, and I think it's a good one.

Basically, what it is, it is a network that consists of servers or relays which are propagating information on behalf of blockchains, both transactions and the blocks, and it also has another piece, which are gateways, which is a software that typically sits next to a blockchain node, either Bitcoin or Ethereum or any other node for that matter. Basically, it is helping to interface all these difference blockchains with our network.

Of course, the key idea here is to minimize that block propagation time that you were talking about such that once we do that, then blockchains can safely either reduce the interblock time or increase the block size or do both, but with the end goal of really improving the scalability of their systems.

[00:41:41] JM: Describe how a transaction would propagate through the Bitcoin network, for example, with or without bloXroute. Describe the difference in how a transaction would make its way through the network, in the case that you did not have a blockchain distribution network and in the case where you do have a distribution network.

[00:42:03] AK: Right. Basically, in a Bitcoin network, for example, I just sent one Bitcoin to Jeff and then I sign it with my private key, and there is transaction, typically 500 bytes long. I send it the Bitcoin network. I send it to a blockchain node. A blockchain node looks at the transaction and then says, "Hey, this is a new transaction. I haven't seen this one before. Good. I'll keep this with myself, and then I'm going to send it to my peers." It sends this to eight other members in the network.

Each of these nodes receives these transactions, looks at that and says, "Oh! This looks good. This is a new transaction," and they keep propagating this transaction through the peer-to-peer network. Typically, the transactions doesn't reach each and every node eventually, but at some point, some miner includes these transactions in a block and it puts it in that block. It takes some time for this block to get propagated and this is how things work with the current system.

Now, with bloXroute, what happens is the following; a transaction, I send that same transaction to a blockchain node and assume that blockchain node has our gateway software and has direct access to the bloXroute network. Now, what is going to happen is that that transaction is not going to go from one peer to another in slow steps, but it's going to be swiftly, it's going to be distributed swiftly to the entire blockchain to all the blockchain nodes at a timescale of hundreds of milliseconds. Everybody is going to get that transaction, okay?

Moreover, that transaction, which is typically – I mean, there are different sizes, but their average size is about 500 bytes. Not only that, but our network is going to index this particular transaction. For example, we can say, "Hey, this particular transaction gets an I.D., and that I.D is going to be, for example, four bytes long. I will explain why this matter, okay?

Once this transaction reaches all the blockchain nodes and at some point, like it's happening today, Bitcoin miner mines a block, puts that transaction into the block and that block again comes to our gateway software, okay? Our gateway software looks at that block and says, "Listen, I've seen all these transactions already," okay? So instead of sending this roadblock, which is currently one megabyte, I can send a much smaller chunk of data, which could be maybe 50 kilobytes, because instead of using these 500 bytes long transactions, it is going to use 4-byte long transaction I.D., okay?

Hence, this is the first level, this is a compression that happens once the block comes to our gateway, okay? On top of that, that gateway is going to send that block swiftly to all the other nodes in the network, okay? Basically, it means what we're using is a thing called cut through routing. It's not a particularly novel thing. It's been used in switches, in networking switches for decades. Basically, once that 50 kilobyte blocks comes to our relay, the relay, because it doesn't have to check anything, it is simply going to propagate the bits of this particular byte even before all the bits have arrived to that particular node.

We're really, really achieving a very swift propagation of that block. Hence, in this way, by compressing the data on one end, by swiftly sending it through, we're capable of doing things far more efficiently than what is currently done with Bitcoin and other blockchains.

[00:45:49] JM: Yeah. I think as I understand it, you are really – When a node is selecting transactions that are candidates for blocks out of the mempool, or if they are working on solving a block that contains some set of candidate transactions, those miners might be working on transactions, or they might be selecting transactions from the mempool that have already been accepted by the network, which would be a waste of time. With bloXroute, those nodes would be made aware of that faster, because of cut through routing.

[00:46:28] AK: This is one thing that I think people are still not getting quite clearly about bloXroute. The fact that we are sending transactions, broadcasting transactions to everybody in the network, is of huge help to miners, because they are becoming aware of what is happening in the network pretty quickly. At the same time, once somebody is sending a block, they're going to receive it very quickly. Hence, they don't have to do spy mining and similar things because we're really helping with that. At the same time, once they're sending a block on the wire, that b lock is going to reach the network quickly. Hence, the probability that somebody else who may have just been doing the same thing as that particular miner is not going to – It increases the probability of winning that particular mining round.

So the bottom line is even without any – Forget about scaling. I mean, for now. Scaling is the end goal, of course, for us to reach for any blockchain, and I'm sure we'll be able to do it. Even before any scaling happens, we're providing a really useful service to the miners, to the users of that particular blockchain network.

[00:47:41] JM: Every node in the network that wants to have access to the blockchain distribution network, they add a gateway to their node, to their mining node, for example. What is the purpose of that gateway?

[00:47:59] AK: The purpose of the gateway is twofold. The first one is like it's just an interface to our network, right? So on one end, there is a blockchain network, there is a blockchain node, and basically to them, our gateway looks just like another node in that particular blockchain network, okay? On that end, the interfacing is helping – Like on one end, the blockchain node and our gateway are speaking that blockchain protocol. Hence, this is necessary for us to kind of stay compatible with the existing blockchains. Then on the other end, that gateway is speaking a different language, a different protocol with our relay.

This is an interface between any blockchain and our system, because our system is actually doing it. This is one feature of the gateway. Another important feature of the gateway is that it is doing this data compression and uncompression. Basically, it is accepting a roadblock, then it is creating a much smaller block, which is swiftly propagated. Once that small compressed block reaches the outgoing gateway, that gateway does the data decompression. It moves I.D. back to the original transaction data. Hence, a block comes swiftly and quickly to another blockchain node, and this is basically the – The service that we are providing, but these two things are very important for a gateway.

[00:49:29] JM: Here we bump against the same issue that we talked about with lightning networks earlier, where we are adding some centralization in exchange for higher throughput, where trusting the bloXroute distribution network. How do you overcome the centralization risk of that network?

[00:49:52] AK: Yes. This is the key invention behind bloXroute I would have to say, right? This key tussle of like, “Hey, what are you doing?” You have this completely decentralized system, which is basically built with the idea of decentralization, and then you say, “Hey, but we’re going to use this centralized blockchain distribution network. How does that all work? I mean, doesn’t this kill the very nature of the blockchains?”

Again, this is basically our key invention. What is that? I’d be very blunt with you. For example, assume Bitcoin network comes or Ethereum network comes on bloXroute and we’re going to have an API as soon as Q1 2019 and assume we start serving all these blocks and transactions the way I described before. Assume, for example, somebody comes. I don’t know, FBI, NSA, whoever is the authority or some other authority in some other country and tells us, “Hey, guys. We understand what you’re doing with these blockchains. However, we figured out that there is this one Bitcoin address,” for example, “and we know for sure that these are some very bad guys. These bad guys are involved in some very bad things, like drug trafficking or whatever.”

Whenever you see another time that is any transaction going on this particular address, please don’t forward that particular address and send it back to us. Tell us about that so that we can take care and understand what’s going on here.

Our answer, and this is really where it comes, like what is bloXroute. Our answer to them is going to be like we really don't like that these bad things happening on a blockchain network, but there's absolutely nothing we can do to help you here, simply because our network is designed such that we are incapable. When a block comes through the network, we don't see the transaction going on our block, because blocks in bloXroute are encrypted. They're completely encrypted. We don't see what's inside. Even if we wanted to, there is no way that we can dive in and say, "Aha! Hey, there is that transaction. Let's not propagate this block."

The way it works, thus, is that the gateways are encrypting the blocks. Hence, when blocks centers, our network that we control. We don't control gateways. But when they come to relays, we just see an encrypted block. We don't know what's going on inside. Once we completely distribute this block to all the other gateways and blockchain nodes, this is when the keys are released by the sending node. The keys that would help decrypt that particular block and figure out where the transactions and what happens, okay? This is a key thing that is really helping us to, on one hand, rip the performance of a centralized system, but at the same time keep that centralized system completely incapable of censoring the things that go through that particular network.

This is just one example. There are others. For example, somebody can say, "Hey, listen. We don't want you guys to have your servers in a particular country. Somebody comes, whoever, authorities and say, "Hey, we really don't want you here for whatever reason." The point is, even if these things happen, it doesn't stop the entire network to operate, because we have this idea of interact relay. That means, for example, a node in China can mine in your block. It uses our gateway software to compress the data. It sends that compressed data to a gateway in London. Then the London node encrypts on its own and sends a new block into the network, and the network itself has no idea of knowing who created this particular block. Where it comes from? What is mined in China or was it mined in U.S., or in Europe?

This is basically the design that we created with the very idea of creating this for blockchains, because if we don't have the ability to not sensor all these information, then we wouldn't be different than Chase, or any other centralized bank that can basically do whatever they like with their transactions.

[00:54:19] JM: That's cool. So you operate like a centralized network when there is no threat of censorship, and then you fall over to peer-to-peer routing in the event of the threat of censorship.

[00:54:34] AK: That is correct, but at the same time it's important to say that the blocks are always encrypted. So there's no way that we can be able to sensor or to delay or to do whatever, anything bad to the blocks, because we don't know what's inside. That's the default case. Then in a case where there is this larger scale censorship, this is where we get into this mode of peer-to-peer communications. The peer-to-peer network is kind of auditing our BDN, and if bad things happen, then they have mechanisms to kind of move things around and still achieve the performance and scalability.

[00:55:15] JM: Yeah. Now, it does seem like – Okay, so if I understand correctly, when you want to propagate blocks through bloXroute, first you're spreading out those encrypted blocks and then they get decrypted somehow as a function of time. When do they get decrypted?

[00:55:33] AK: The way it works is that a gateway sends an encrypted block. However, that gateway is also connected to its own peers to other nodes in that particular blockchain network, okay. So when a source gateway sends an encrypted block into the network, it hopefully gets propagated through the system. Then this particular gateway gets information from its peers, from its friends out there who are just sending a small piece of data, a cache, saying, "Hey, I just received a block. This is the block I received."

Once the source is confident that its block has reached others in the network, only then does it send the decryption keys, okay? Such that we have the scale at the same time, because the blocks are propagated quickly. At the same time, there is this privacy – I mean, I can put whatever I like in that particular block, and it's known only after it's already been distributed to the rest of the network.

[00:56:37] JM: But then doesn't everybody in the network need to act that they received those –

[00:56:44] AK: Not everybody. Basically, each gateway chooses some random number of nodes that it's connected to and some of them are publicly known and some of them are just known only to that particular gateway, okay? Hence, it's a pretty good sample of the block that I have sent, which particular places to reach. Once it reaches a sufficient number of endpoints, I'm confident that my block is doing just fine. This is when I send the decryption blocks. The decryption blocks can be sent both through the relay network or through peer-to-peers, and it's a very tiny, tiny amount of data. So it works just fine.

[00:57:27] JM: Okay. I think I understand it to some degree. Are there any unsolved theoretical problems or – And you look at this, I know you've been in academia for a long time and I know distributed systems academia is just ruthless in making sure that something works on a real theoretical level. The way that proofs are done can be quite thorough. I don't have too much experience in academia, but it seems quite thorough. Are there still unanswered theoretical questions or do you feel like the unanswered questions are more around implementation at this point?

[00:58:02] AK: No. They're no theoretical questions left. I mean, this is going to work just fine. That said, I mean, even when there are no theoretical questions, like when you go into implementation, and everything is crystal clear. There are still hiccups left in the bag. I mean, we have a great development team, but basically once you come from – Moving from an idea and an idea is what you and I are now talking about, like how does it work. Once you dive down into the implementation, often times – I mean, there are hiccups there, but we are really dealing very well with them.

This is way we believe and many people will tell you, if an idea is not simple, it's hardly going to work, okay? Even a simple idea where things are completely clear 100% in my mind, when it comes to implementation, it's still not – There are bumps left and right. But in our case, these aren't really fundamental. These comes in implementing software and this is something I'm sure your audience knows, much more than I know. This is why sometimes when you see a white paper or you go to a webpage of a shiny new coin, and if things looks complicated in theory, in practice they're going to be even more complicated, right? So this is why I think our theory is simple, which helps us – Gives us a hope. I'm telling you from the firsthand, the thing is going to work out there. So I have no doubts there, whatsoever.

[00:59:31] JM: Well, what you're describing, this is what really worries me about sharding and proof of stake in Ethereum. It doesn't feel like it's simple enough.

[00:59:42] AK: It's because it's not. When I'm teaching things, I tell them, "Listen, if you can't explain this to your grandmother in two minutes, you have a problem. Understand?" I think it is a really good rule of thumb. That said, I'm very positive like the Ethereum community. They are really the leaders. So I have no problems with what they're doing. I wish them to succeed, and we can help them, like let them do the sharding. Whatever we do with sharding, we can help them move the thing even further. So really we are kind of – We feel that we are kind of enablers. Some coins are better – Like have better performance than others, but we are telling everybody, "Listen, good luck with that. With us, you're going to be strictly better than you're doing now."

Sometimes it's 10X, sometimes it's 100X, sometimes it's 1000X. It depends, but we are – The problem that we are solving is common and exists fundamentally in each and every blockchain out there. Even beyond that, any kind of distributed consensus systems. We are happy to work with the community and to make this a success.

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[01:00:59] JM: Failure is unpredictable. You don't know when your system will break, but you know it will happen. Gremlin prepares for these outages. Gremlin provides resilience as a service using chaos engineering techniques pioneered at Netflix and Amazon. Prepare your team for disaster by proactively testing failure scenarios.

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[INTERVIEW CONTINUED]

[01:01:59] JM: You have a token. BloXroute has a token. Why does bloXroute need a token?

[01:02:05] AK: Running this network and running this operation is not an inexpensive effort, okay? For example, just consider Bitcoin, and the amount of data that we would have to push through our network, once it scales, can actually be very significant, okay? Basically, the way we have structured – The reason why we have token is that the way our network works is that once blockchain goes above 100 transactions per second, the users are free to give a tiny, tiny fee to our network that would help us move forward, okay?

But this is however not an altruistic. I think this is the way in which we feel that the incentives are aligned both for the miners and for the users and for bloXroute. BloXroute is leaving no the table to the users and the miners 99.9% of the value that we create. If we manage to scale a blockchain, we are going to push down the fees by 100 times expectedly. The miners are going to get 10 times more revenues and we are going to have a tiny, tiny amount of the fees.

Now, this time I'm not going to be mystic about this. A tiny amount of fee going to bloXroute, if you have a large scale system and you have tiny fees for each of the transactions, that ends up being a lot of money, okay? It measures in millions and billions of dollars. We didn't want it to look like, "Hey, this guys are here sitting on all these blockchains and they're sucking money out of this cryptocurrency world. So this is why we crated these BLXR token. The BLXR token current is an ERC20 token that sits on Ethereum. It has absolutely no utility. It is a security token.

The way it works, all these fees collected by bloXroute, 50% of them comes to us, to the bloXroute company, bloXroute Labs Inc., to actually operate our network. The 50% of the network goes on a thing called BLXR reserve. BLXR reserve is a pile of money consisting of the fees collected in this native cryptocurrencies, and whoever owns a BLXR can come and exchange their BLXRs for a proportion of percentage of that particular part.

For example, assume that a BLXR reserve consists of – Let's just this hypothetical, 10 million Bitcoins, and assume that there are 10 million BLXR ever mined, which is really the case. Then if you have 1 BLXR, you can come to us and exchange this for 1 Bitcoin. That said, the idea is

that this pile should grow overtime and it consists different cryptocurrencies associated with blockchains that we are serving. Basically, we are envisioning this to be a sort of a cryto index.

What does that mean? Well, currently, we don't know which of these blockchains of these cryptocurrencies is going to be the winner if any. We wish all of them to succeed. But the bottom line is that the one that is going to be used the most is the one that is likely going to be most valuable, right?

So our BLXR reserve, in a way, is going to be an indicator of which particular cryptocurrency is most successful, because we believe that our BLXR reserve is going to be dominantly filled with such a cryptocurrency. Basically, we are saying like maybe you don't know which will succeed at the end, and we don't know. I personally don't know. I have my favorite and non-favorites. But independently, we feel that we are tying BLXR to the success of that future winner in this cryptocurrency space. I'm sorry in case – And I know that my answer was a bit longer than expected, but I tried to do my best.

[01:06:12] JM: Wouldn't it be simpler if you just accepted Bitcoin or – For use of the network, you just charge a small fee for users to use your BDN.

[01:06:26] AK: That is correct. What you just said is exactly what we are doing. The fee that the users are paying is in the native cryptocurrency, right? If you're a Bitcoin user and assume bloXroute supports Bitcoin, then you as a user can choose. You don't have to. You choose to pay 10% of the mining fee, but you pay that in Bitcoins. You don't really use BLXR. BLXR is good for nothing. It only holds a value. The reason we did this is because we didn't want to compete with any of the cryptocurrencies. These are our partners, our clients, right? So we don't want to compete with them. Hence, we want to let them do whatever they are doing and fulfill their stuff. Principally, the fee to bloXroute is always paid in the native cryptocurrency. Is it Ethereum, in case you're using Ethereum, or is it Bitcoin, or is it anything else? That's the way it works.

[01:07:21] JM: But if you don't need a token for the fundamental scientific breakthrough for running the Blockchain distribution network, why would you introduce this token that seems like a complete adjunct to the fundamental value proposition of bloXroute?

[01:07:40] AK: The fundamental value proposition is like, “Hey, we want to scale blockchains,” okay? To do that, it can get expensive, okay? To do that, we would have to collect the money or collect the fees. However, once we do that, we realize that if this is really successful, well then the fees collected can be immense. We wanted to share this to actually let the broader cryto community to get a piece in this particular operation.

Basically, we are saying, “Hey, by buying a BLXR token, we are completely transparent,” okay. We are explaining how this works. Basically, this is a very lucrative deal in my opinion. Hence, we really are sharing our success with the rest of the world. Otherwise, if we were just to sell our equity, it would go quickly out, because – Basically, the token story here is helping us big time to kind of align incentives and let a broader community and people who believe in our project to not only like what we are doing, but to actually earn money in case we are successful.

[01:08:56] JM: So the people who have the tokens, they’re receiving distributions based on the fees of the BDN?

[01:09:04] AK: Yes, correct. 50% of whatever bloXroute makes goes directly into their pockets. I don’t know of any investor who wouldn’t like that. Can you imagine? 50% of the revenues go to your pocket as we speak. That’s fantastic.

[01:09:20] JM: Sure. Sure. Makes sense. What’s the model for the token vesting to the founders of bloXroute?

[01:09:28] AK: Basically, the company owns 20% of the BLXRs. 80% is going to be sold public in different rounds. In round one, it should be 20% of the token.

Now, the founders themselves own 8% of the BLXR and the other 12% is reserved for our employees and others. However, this vesting doesn’t come like immediately, like, “Hey, you know what? Let’s get this money and we’re done.” Basically, this is our basked and we have some performance to milestones that we have to fulfill before we can actually get these tokens. Basically, key milestones are to come up with operational network, milestone number one. Milestone number two is to get top 10 coins or top coins on to our network. Other milestone is to

have a proof of concept to prove that we can actually do all of these. I mean, this is all done in a very reasonable and a very responsible way. So nothing is going to happen unless we delivered what we promised that we are going to deliver.

[01:10:46] JM: Okay. So the lockup period is you absolutely get no tokens until you first get the operational network. That's the first milestone?

[01:10:55] AK: Correct. Actually, the first milestone is to show proof of concept, which is something that we are working on, which is to have a wide area implementation of our system that shows that we can actually scale Bitcoin and Ethereum to thousands of transactions per second. This is milestone number one.

[01:11:11] JM: That seems like kind of a low barrier though, because that's not an actual implementation. That's a proof of concept. If you contrasted that with a venture capitalist in traditional startup, like a traditional startup wouldn't be able to liquidate any of their shares until they really had a lot of traction.

[01:11:30] AK: Sure, sure. But this is where you get like one quarter – This is vested in the period of four years, however, okay? This would be the first kind of milestone that we need to reach. Trust me, it sounds easy, like when talking about it, but actually when having to actually do it, things gets much, much messier, okay?

I mean, whatever it is, we do have a venture capitalist, Jeff Bussgang is on our board, and he agreed to these terms. I mean, if it's good for him.

[01:11:57] JM: Yeah. Yeah, and I'll say the norms that have been set around venture capital, those are just previous norms. I'm kind of leaning into this just because I like to really scrutinize a lot of these projects. I think even if you looked at it as this is a laboratory that is well-funded and even if the project goes nowhere, you deserve to be paid. You deserved to be paid a lot of money. You're somebody who's invested a lot of mine share into building this stuff. Something like bloXroute is going to exist eventually. You should be able to capture some of the value that goes to that.

[01:12:33] AK: Sure! Absolutely. We are on the same page. I'm not sure what's the argument. Yes, absolutely.

[01:12:38] JM: No argument. I wanted to set up the highest critically of your project and then defend you.

[01:12:45] AK: Yes, yes, yes. But basically, we think that we are setting a pretty good threshold of how things should be done in the crypto world. I mean, in the early days I understand people were saying like, "Hey, this is fun. Let's get all the money upfront." I mean, I've heard various stories.

[01:13:03] JM: And you probably had a lot of chances to do that yourself.

[01:13:06] AK: Yes, but we really are kind of responsible to us and to the rest of the world. We really want to make this happen. Hence, if you really want to make this happen, then you have to be accountable, right? If you want to be accountable, that means, unless you do this – And the same thing holds for our employees and everybody else. We actually do have some really performance-based milestones, like, "Hey, it's nice that the theory works. Show it to me in practice." This is what POC is about.

The second thing is like, "Hey, you showed me that it works on a 1,000 node network. Well, put it alive there. Put it in the wild and let it run and show me that it works." That's the second step. Then the third step, "Okay. You are happy with it. Well, are you sure you can make others happy with it? Well, put them onboard." That's not an easy thing to do. So we have this milestones at which time the vesting period starts. After each milestone, we have four years to stick with the company, and I'm really – I mean, this is something that we agreed upon at our board, and I'm really happy that we did that, because I think that's the right thing to do, right? I mean, if you can't deliver, then what are we talking about here?

[01:14:20] JM: Totally. I mean, I love it, because the thing is I interviewed six or seven months ago when I did like a month of shows about different cryptocurrencies and ICOs and stuff. So many of them were just the bastardization of the ICO model. The ICO model is beautiful and it can work, but almost none of them made any sense. They made absolutely so sense and they

put a black eye on the idea of an ICO, on the idea of the whole industry. But your model makes sense to me.

[01:14:50] AK: Yeah, I completely agree with you. One of the reasons we went that way is that this is when we were kind of looking at the venture capitalist that we're going to through. We selected Flybridge, and they're really not a crypto font. They're really very traditional kind of font. In a sense, we are a crypto company, but we are also a very traditional networking company. We have to run a network. We like a new Akamai. You understand? To do that, you really have to do some things. It's not just like, "Hey, we released some point code." We really have to run that infrastructure, right?

So putting all these together, we felt like, "Sure, we want to have some access to the crypto world, because if we are going to operate in that world, so we don't want to be like sitting at the sidelines." But at the same time, we were thinking very thoroughly and said, "Hey, we do need some traditional venture capitalist, and let's do something traditionally, because we love the new models and the ICO," but some things like accountability, I mean that should be there anyways. That has nothing to do with ICO. That has to do with like, "Hey, what kind of company are you and are you really doing what you say what you're doing. We care about that, so that's why we chose to do that way.

[01:16:04] JM: I love it. Well done. I'm sure we will talk again in the future, Aleks. Really good to see the blend of conventionality and ambition and strangeness that I knew would eventually come to cryptocurrency. Although, I was having my doubts in some of the interviews seven months ago, but really happy to see you're a success.

[01:16:25] AK: Hey, thank you so much for the interview. I really enjoyed, and I think we covered pretty well the topics, and I look forward to talking to you or anybody else from bloXroute with you in the future as well.

[END OF INTERVIEW]

[01:16:40] JM: Azure Container Service simplifies the deployment, management and operations of Kubernetes. Eliminate the complicated planning and deployment of fully orchestrated

containerized applications with Kubernetes. You can quickly provision clusters to be up and running in no time while simplifying your monitoring and cluster management through auto upgrades and a built-in operations console. Avoid being locked into any one vendor or resource. You can continue to work with the tools that you already know, such as Helm and move applications to any Kubernetes deployment.

Integrate with your choice of container registry, including Azure container registry. Also, quickly and efficiently scale to maximize your resource utilization without having to take your applications offline. Isolate your application from infrastructure failures and transparently scale the underlying infrastructure to meet growing demands, all while increasing the security, reliability and availability of critical business workloads with Azure.

To learn more about Azure Container Service and other Azure services as well as receive a free e-book by Brendan Burns, go to aka.ms/sedaily. Brendan Burns is the creator of Kubernetes and his e-book is about some of the distributed systems design lessons that he has learned building Kubernetes. That e-book is available at aka.ms/sedaily.

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