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[INTRODUCTION]

[00:00:00] JM: Proof of work cryptocurrency mining, like that used on Etherium and Bitcoin blockchains, requires huge amounts of energy to validate transactions and generate new tokens. The alternative, proof of stake, needs large deposits of assets to be staked upfront in order to work. While both consensus protocol types have their own drawbacks, they're the current industry standards. The company, Spacemesh, developed a new consensus protocol with a goal of powering an energy-efficient, decentralized, secure and scalable smart contracts global computer and a cryptocurrency in the permissionless settings. They call their protocol proof of space time, which works on a blockmesh structure rather than a blockchain. The Spacemesh protocol allows newcomers to contribute to the security of the cryptocurrency network via unused storage space on their hard drives, driving down energy consumption and enabling anyone with a computer to contribute. In this episode, we talked to Anton Learner, core team lead at Spacemesh. Anton was previously an embedded software engineer at Citaro, and was a senior storage engineer at Dell before that.

Our first book is coming soon. *Move Fast* is a book about how Facebook builds software. It comes out July 6, and it's something we're pretty proud of. We've spent about two and a half years on this book. And it's been a great exploration of how one of the most successful companies in the world builds software. In the process of writing *Move Fast*, I was reinforced with regard to the idea that I want to build a software company. And I have a new idea that I'm starting to build. The difference between this company and the previous software companies that I've started is I need to let go of some of the responsibilities of Software Engineering Daily. We're going to be starting to transition to having more voices on Software Engineering Daily. And in the long run, I think this will be much better for the business, because we'll have a deeper, more diverse voice about what the world of software entails.

If you are interested in becoming a host, please email me, jeff@softwareengineeringdaily.com. This is a paid opportunity. And it's also a great opportunity for learning, and access, and growing your personal brand. Speaking of personal brand, we are starting a YouTube channel as well. We'll start to air choice interviews that we've done in-person at a studio. And these are high-

quality videos that we're going to be uploading to YouTube. And you can subscribe to those videos at YouTube and find the Software Daily YouTube channel.

Thank you for listening. Thank you for reading. I hope you check out Move Fast. And very soon, thanks for watching Software Daily.

[INTERVIEW]

[00:02:59] JM: Anton, welcome to the show.

[00:03:00] AP: Thank you for having me.

[00:03:02] JM: Let's start by talking about proof of work. Proof of work is the oldest known mechanism for doing distributed consensus for a currency, for cryptocurrency. What are the problems with proof of work? And what are the alternatives to it?

[00:03:21] AL: So, okay. Let's start by just explaining like in a higher level what is proof of work? Basically, it's some sort of lottery thing where we need to produce a certain number that basically answers some sort of a condition. Proof of work, basically, you need to produce the number with a certain amount of trailing zeros. So it's a lottery, because most CPUs or GPUs need to calculate a lot of numbers until what they do is basically they produce a lot of random numbers until they find a number that answers this condition.

So, basically, what this causes is, basically, it's making your GPU or whatever CPU work really, really hard randomizing numbers. And once in a while, you find this number. So this causes very high energy consumption. So we know that currently, proof of work algorithms, such as Bitcoin, take almost 2% of the energy produced on Earth, which is quite a lot. And, basically, this is the major problem of it. Besides, there are also other problems such as – Because now there's a lot of designated hardware to produce proof of work. So the cost of these components is very expensive. And there are a lot of miners, which take in a lot of these components, and basically they use them. They use them for quite a long time. And they produce also a lot of like waste by producing these components and running them down and then buying some more. So it's kind of very wasteful and not like Earth friendly, this whole process of proof of work. And it's

becoming a big problem, because of the popularity of proof of work protocols, because proof of work is, I think, the most easy and straightforward protocol to sustain blockchains.

[00:05:36] JM: And the more recent popular alternatives to proof of work are proof of stake and proof of space and time. Maybe there are some other proof of X algorithms I don't really know about. Tell me about the costs and benefits of proof of stake. And then we'll get into to proof of space and time.

[00:06:00] AL: So proof of stake, basically, it switches the need for randomized numbers. And it basically allows miners to mine and produce blocks into a blockchain using like a staking algorithm, which means that you stake a certain amount of money. And you follow the rules of the protocol. If you don't follow the rules of the protocol, so your stake is taken from you, and this is like the fine you need to take for not following totaling the rules of the protocol. So this, on one hand, it's a big improvement from proof of work, because it doesn't require a lot of calculations to be done. It doesn't require as much energy to be wasted for nothing, basically. But on the other hand, this hurts certain key aspects of a blockchain, which is decentralization.

So decentralization is very important for the security of a blockchain, because if a blockchain is not decentralized and it's very centralized, so some miners may collude and basically decide to not take in some transactions or prefer some transactions over others, and basically turn the entire blockchain and its state to their benefit.

So, basically, when using proof of work, so you basically give more power to miners who have the stake to put in. So the stakes, I don't know exactly how much you need to stake right now in like leading the protocols, or like how much Etherium wants you to take, but I know it's not a small amount of money, meaning that small miners and like home miners don't really participate in this protocol. So this, in fact, like causes some sort of centralization of the power to miners that have enough money to stake. So this is the major issue with proof of stake currently.

[00:08:13] JM: All right. Well, that leads us to proof of space and time. Describe what proof of space and time is.

[00:08:20] AL: So, proof of space and time is exactly what it sounds. Instead of generating random numbers and trying to win some raffle, you take some space on your computer, and you prove that you have stored the space for a certain amount of time that the protocol decides. And after this amount of time has passed, you're eligible to participate in the consensus of the blockmesh, in our case, in Spacemesh's case, and produce blocks. So, basically, proof of space time works a bit differently than the two other protocols we've mentioned before, because it doesn't require a lot of calculations or computations to be done constantly. You have an initialization phase where you basically write down some sort of hash and data structure on your hard drive. And after which, you publish to the network, a proof that you have stored this space. Then we have certain time servers that are called poets. And they basically take this proof a miner has published and they store it for a while as much as the protocol states they should. And then after this time has passed, they release another proof that they have stored this for a while. And if you still have the storage, you're allowed to participate in the protocol and create a block and eventually collect a reward for the block you've created.

So, as opposed to the other two algorithms we've mentioned, it doesn't take a lot of energy, as I said before, and it's not prone to centralization as much. Because although miners do get rewards and the possibility to create blocks, according to the space they have stored, a gigabyte on my home computer is the same as a gigabyte on a large server.

Also, at all times, small miners will be able to participate in this protocol, and thus sustaining this decentralization requirement for a blockchain or a blockmesh that keeps the network more secure and less prone to collusion of malicious miners.

[00:10:59] JM: How do the costs to the infrastructure available or the environment, or I guess I could just say costs more generally. Like if we think of the overall cost structure of the Bitcoin network, I think of the overall cost structure as all these mining facilities that have to be run, and the cost of electric power. How do the cost comparisons balance out between proof of space and time algorithms and proof of work algorithms?

[00:11:34] AL: So, we haven't done this calculation in particular, but what I can say is that, like from an energy consumption aspect, proof of space time has a lot less impact, and also from a customized hardware aspect. As I said, Spacemesh doesn't require any custom hardware,

because it doesn't really matter like on what storage device you store your proof. And as opposed to Bitcoin, for example, where you need custom-made hardware to mine and participate in the protocol. And that currently, like none of us, unless they have some designated hardware, can actually participate in this protocol, Bitcoin, I mean.

In Spacemesh, by design, made it easy for home users to join and participate in the protocol. And thus not requiring like any extra hardware to be added. So this is like we haven't done the exact calculation. And we do know that there is some wear to hard drives. But the way we structure this protocol is that writing to the hard drive and reading from it is not done like on a daily, or hourly, or minute base, it's done every once in a couple of days, which will wear the hard drive down, but a lot slower than, let's say, an async that's mines Bitcoin, because it's always on and it always needs to produce these numbers to participate in the protocol.

[00:13:28] JM: Alright, we've laid out some scientific motivation for building a new currency on this different proof model for the ledger. But I'd like to motivate the conversation even further still before we get to Spacemesh specifically, the idea of our multi-currency future. So the idea of a world in which there is not just fiat, there is not just Bitcoin and Etherium, but there are actually a wide variety of tokens and currencies that we are all transacting with. I want to get your perspective on what this world looks like, because you are working on a currency that is based around proof of space and time. And I'm guessing your perspective is that the currency in which this world thrives, the new currency that you're working on, is not disjoint from a world in which Etherium and Bitcoin survive. Like you are envisioning a world in which there are multiple currencies. They play different roles. They do different things. They function within different platforms. I'd like to get your perspective on what that world looks like.

[00:14:48] AL: So, you're correct, that Spacemesh visions a future where it resides alongside other protocols and other currencies. Like, personally, I don't believe there will be that much protocols and that much currencies as we have today. Some of them will eventually cease to exist, because they serve no utility for people that use it. And, well, the situation right now is that we have a lot of more of the same currencies. But there are several currencies, which do serve a specific cause, like some of them are more secure in terms of – More anonymous, I'm sorry. Some of them allow you to run applications on top of the blockchain on this distributed ledger or distributed decentralized system in general. And I envision the actual like coins or protocols that

survive that these will be the ones that actually serve a utility and are sustainable for a long time.

So, currently, as I see it, although Bitcoin has been around for like 12 years or something like that, we're still at the beginning of understanding how this whole blockchain thing works and what benefits we can get from it. And like, right now, we're experimenting. Like there are a lot of projects that are being developed right now. Some focus on anonymity. Some focus on speed. Some focus on the size of the ledger itself. And all of them are good, because I think that, eventually, ideas will move between projects to create a better, and more sustainable, and secure, and small currency that will allow us to actually use it and like not destroy the planet while doing that, or being affected by some sort of collusion or some sort of like corruption of nodes.

So, right now, we're just seeing the beginning of it. And I think that there are several very, very good ideas and good projects that are being developed right now that the technology that is developed right now will be used and, I think, like joined with other technologies of blockchain to create something that is really sustainable and that we can actually rely on and use as a viable alternative to the current fiat infrastructure and model in general.

So, like I envision this like as several groups of people that research different aspects of this new world, we found out about like 10 years ago. And so we're researching and we were working on it and we're trying and failing and succeeding. And, eventually, we will evolve into something that combines most of it and I think benefits from all these projects altogether.

[00:18:15] JM: Okay. I think we have given sufficient preamble to talking about Spacemesh. Tell me what the approach to a new currency that Spacemesh is building is taking.

[00:18:31] AL: I mean, I think Spacemesh is taking into consideration the past of blockchains in general. And it's taking like the downsides of the current protocols or the protocols that existed before Spacemesh was founded. As we said, the high-energy consumption, but also the lack of decentralization also of miners, but of coin holders as well. I mean, in Bitcoin, for example, most of the Bitcoins and the majority of the coins in the system are held only by several wallets. And this is due to the restfulness nature of Bitcoin. I mean, the strongest survives, and the strongest

gets the rewards. And whoever has the more GPUs and whoever can produce blocks faster and is found in key points is the miner that gets most of the coins, which is a bit of a problem if you want your coin to be used if only several wallets contain most of the coins. It means that a lot of other miners didn't get it and they're like left out of the game. So this is one problem we've identified in blockchains in general. And the other is the barrier to enter the blockchain, so decentralized protocol. And it's based on large amounts of miners to join. This is a very good for the network security.

So as we said before in previous protocols, unless you have a lot of money to stake in proof of stake, or unless you have a very powerful mining machine and you're located in certain regions that power is cheap for you, and etc., etc. So only then it will be profitable for you to mine and participate in the protocol. So this is another problem we have that the normal user can't even join and can't like get in on this protocol actually. So these are two key points. And also, basically, there are rewards. And this all comes down to rewards. And if you don't have the currency, you probably won't use it. So, Spacemesh has learned from the past and from these protocols. And we believe that proof of space time basically solves these problems, because it offers everyday people and everyday machines the opportunity to mine the coin. It's not very CPU or GPU intensive. It won't consume a lot of power, such as Bitcoin miners. And this all contributes to the security of the system, because if you have a lot of home miners, it's harder to collude and to divert the global ledger to your direction or some sort of direction. And. also, it's harder to corrupt miners and have them disallow some transactions and promote other transactions. So this all is like a holistic system that is basically making blockchain sounds like better, but it emphasizes the good parts of blockchain. It emphasizes the security. It emphasizes the distribution. It emphasizes the decentralization. And this is all thanks to proof of space time and the way we've built our protocol that is not like specifically a block chain, where in each point in time, only a single block is created. We are a blockmesh, and in a certain point of time, many blocks are created.

So instead of having one miner, decide on which transactions to take in right now and to add to the global ledger, and one miner receiving the rewards for this block, we have many miners, as much as 200, and maybe 800 miners that will add transactions to the block mesh at a certain point in time, and will receive rewards for them. So it basically makes it more robust and less prone to corruption or centralization basically.

[00:23:45] JM: I want to take a moment to step back here and talk about crypto entrepreneurship in 2021. We can definitely go deeper into Spacemesh. But I think what this really interesting time where, basically, people like you, teams like you are on, groups of very smart people, can essentially place a really big bet on this space and the opportunity for discovery. And kind of a lot of a lot of the research that's being done is somewhat speculative. And you're betting on a really big potential outcome. You're betting on this currency eventually taking hold as a really lucrative and meaningful and powerful endeavor. I'd like to know a little bit about the economics of how you manage a project like this responsibly, intelligently. Take me inside the management of a nascent cryptocurrency development project.

[00:24:54] AL: So, I'm going to tell you from my perspective. Obviously, I'm not a founder of Spacemesh. But from what I've seen. So it's like, as you said, we're exploring some uncharted territory right now, also in Spacemesh, and I think in a lot of projects in the blockchain community. And some of it is like pure research. Like most of what we do in Spacemesh is communicating with our research team, like we have a development team and a research team. And we're going back and forth. Like the research team may come up with some algorithm, and then we will implement it. And then we will test it and see its strengths, see its weaknesses, see if it fits, like working on, I don't know, a PC or something. And then we go back sometimes to the drawing board. And we've had like algorithm that have been replaced for three times already. And this is like, I think, the uniqueness of the blockchain industry, because it's still mostly experimental.

And we're doing things, and we're thinking about things that haven't been done before. And we're trying to make like, I think, each project, and Spacemesh also is trying to make the best and most, I think – I wouldn't say convenient, but a blockchain that is sustainable both in terms of running it and using it if you're a user that wants to transfer coins, or if you're a miner that wants to mine. So all of these projects are now – Again, they're funded a lot from this entire ICO phase we've seen, but now there are more serious projects, which are funded like a startup by VCs and by angels, hat want to do something different, that want to explore another – Explore some field in blockchain. Like we have a lot of projects that, as I said, do many different things. And this is a bit different from regular startup, that you know who your clients are and you know what you'll give them and you know like what your value proposition basically to your clients.

But in the blockchain, it's more trying to make blockchain better, and more usable, and more robust, and more popular, also, obviously, among users. So it is different. But it's still a normal, I don't know, startup company case for Spacemes, except that we've started this path. And we don't exactly know where we're going to stop and what we'll produce eventually. But we're working on it.

[00:28:17] JM: I remember back in 2017 or 2018, I was interviewing a lot of these companies from the previous crypto boom. And one of the things that was a little disconcerting to me was the idea that you would have instant vesting, or very fast vesting of tokens, which I felt misaligned incentives with people who are long-term or purported to be long-term shareholders in protocols. What are your thoughts on token vesting?

[00:28:50] AL: So, I think that Spacemesh have learned from the mistakes of these companies as well. Now, we have basically a way to put contracts on blockchains. And I think it's a really great idea to do the token investing in a publicly visible contract that basically can tell everybody how much of the coin the actual company or the people who have built it are taking in at each point in time.

I do agree that it's concerning. And there were some projects that you didn't know what's going to happen and whether or not they're just capitalizing on this ICO boom, and they're producing coins just to sell them stuff as they can and like cash out of it without any actual need or want to contribute to the blockchain community or to the their own blockchain. And it is concerning both for users, miners, and people who don't know about blockchain and don't trust it. I mean, it sure does make you think twice about getting into blockchain in general. And I'm sure it doesn't reassure you in this whole field to hear about these companies who just did ICOs and raised a lot of money and then disappeared once they sold all their coins.

And as I said, Spacemesh has learned from the past mistakes. And like, I think, also Spacemesh, but other mature projects have learned from what's happened in the ICO boom. And now they have a more solid approach. I mean, basically in Spacemesh, we'll have a contract that states how many coins will be put back in the company. And it's not going to happen like in one shot. It will be like a lasting investing program that will put coins in the company's wallet for, I think, 5 or 10 years. And also, we have like 60 safety measures that we

want to put out to the world that we are here to stay, and we trust our protocol. But we do need, I mean, some coins to sustain a protocol. But this is not the main goal. The main goal is to signal the world that we are here. We're here to stay. And we're not trying to cash out as fast as possible. And this all will be visible and straightforward to everybody. So we hope this will assure our users that we're not a scam basically. And I think it's all lessons from the past that a lot of companies did this whole behind the scenes and they have like coin initial –

[00:32:16] JM: Initial coin offerings? ICOs?

[00:32:18] AL: Yeah, ICOs is like pre-mined coins. This is what it means. A lot of companies had pre-mined coins that basically said that, from the start, from the genesis of this blockchain, this company holds this much coins. And I can see where this is not reassuring to newcomers and users of this blockchain to know that, "Okay, this company now already has this much coins. And it can cash out whenever it needs or want." We've taking this whole into consideration when structuring our, also, reward distribution and the way we find our company.

[00:33:06] JM: It's a great answer. So coming back to the engineering side of things, proof of space and time for Spacemesh, Give me a description for what the deployment of the Spacemesh network will look like. What will be the rollout process? And then what will the early days look like?

[00:33:31] AL: So, in the early days, we obviously need certain amount of storage invested in the system from day one. So we don't know how many external users we have. So we have – We'll bootstrap with some of our own miners. But it will always be a certain percentage of the entire network. Meaning that the more external users will join, the less of our miners will deploy. So this is the initial thought to create our own miners and bootstrap the network with it. But we encourage home miners and also like big whales and everybody to join the network from genesis and start mining like from day one.

We definitely don't want to have like a major stake in the system in terms of Spacemesh. We do want and we do encourage the actual decentralization of our network. So I guess we'll have some storage ready. And we'll monitor the way external miners join. And according to that, we'll

decide how much storage we stage as opposed to how much storage there is from external miners.

[00:35:08] JM: And can you walk me through the steps for a transaction? What will a transaction look like on Spacemesh?

[00:35:20] AL: Again, as a lesson from the past, Spacemesh has joined its wallet with the miner, which we feel is very important, because if you have coins, but you don't have wallet, so it's kind of tricky, although you'll have a standalone wallet. And if you have a PC, so why not mine? I mean, you cannot mine in just transactions. But if you have some storage left, why not mine?

So, basically, once you have coins, or you have received coins, you can use either our app to create a wallet and transfer coins the same way you do it on all other blockchains. Basically just have the address of the recipient and you send them the amount of smesh you want. Smesh is the name of the coin. And, basically, you can do it with our app or a CLI wallet, which we'll also release. Or you can even do it on your own if you have your public and private key. So each transaction is basically assigned with a predefined format of some a blob of bytes that you can send to an API gateway or any miner, which will then publish it with the gossip network to all the miners.

So, basically, you can do it in either way. And it's very straightforward the same way as any other blockchain wallet. And you can also do it like programmatically, which I think is cool. So you can also build apps that do it. As long as you have your private key, which is the most important thing, you can do it from anywhere.

[00:37:27] JM: What are the biggest unanswered engineering questions you have within Spacemesh?

[00:37:34] AL: I think like the scalability is something we need to keep testing and try. As I said before, Spacemesh supports multiple blocks at a certain point of time. And it supports many miners creating these blocks. So it's interesting to see how the network reacts when we add more miners or add more blocks to a layer, we call it, and see how it affects both home users,

like home PCs that participate in the protocol. And also, like large whales, large miners, that will participate in protocol.

So this is like the one thing we need to roll out to see how it works. I mean, we will test it, obviously, and we are testing it now. But there are things that are unknown to us. Like, for example, how many transactions will there be in a certain layer or in a block? And how many miners will actually participate in this?

Also in Spacemesh, in particular, we have several consensus protocols. And we are now benchmarking these consensus protocols so that we know how much network traffic it will take also from my home user and from a large miner. And it's very important to us to know these parameters, because we do want people to be able to participate in the protocol while using their PCs for anything else.

So on top of that, the protocol consists of many participants at a time and it produces many blocks at a time. We want it to be able to run on your computer without actually disturbing you like playing online or just using your computer for normal stuff. So, we're like exploring this and seeing how our software actually affects different setups. And we're making adjustments accordingly.

[00:40:08] JM: At this point, we are, I think, a month or so or maybe a little bit more into the launch of Chia coin. How long is Chia coin been launched at this point?

[00:40:18] AP: I think, yeah, a month, maybe two? I don't know.

[00:40:21] JM: Okay. So I've been talking to some people about Chia coin. I haven't looked in Chia coin too much. I kind of want to do a show about it. But I think this is probably the furthest to market proof of space and time protocol that we have. I don't know if you would agree with me. You could let me know. But I'd love to hear your perspective on Chia coin. What it does? Like what are its novel innovations and what's its viability?

[00:40:45] AL: Okay. Actually, before Chia coin, we had File coin, which kind of works the same way. You stake storage, and you participate in the consensus according to the storage you've

staked. But, indeed, Chia is the first coin to roll out with proof of space protocol. I don't know if they are doing proof of space over time. But I think that Chia is like the first project that offers a more sustainable blockchain.

I mean, I've been hearing like things about Chia. I mean, I don't want to dress talk show something. I mean, there are some things we see about Chia that we have taken into account when built when building our blockmesh, which we see is now bothering users in Chia. I mean, the reward time for staking, I think, a terabyte – I don't want to really get into the specifics, because I don't remember remembered them exactly. But the reward time is very – You need to wait a lot of time to get a reward. Like three years or something for a basic setup, which is something we have thought of beforehand. And we do it a bit differently.

So, Chia is like the first project that actually puts out proof of space to the work, which is good, because I think more sustainable projects like these need to be created in order to eventually find the sustainable protocol that will allow us to stay in a blockchain or a blockmesh for not 10 years, but 100 years. I mean, eventually, like at least this is how we think about it. We don't think about our blockmesh as a phase, as something that will be around for a couple of years and then we'll be gone. We try to structure it and build it in a way that will be sustainable for a very long time, because this is one thing I think is very much needed if you intend to either replace the current Fiat system or to accompany it in a good way. So you need your protocol to be sustainable for a very long time.

And I think there are a lot of good things that have been done in Chia, because they are much more green, and they also have this green theme where you harvest and you seed, and you eventually like get rewards. But I think there are several points that are now a bit missed in Chia in terms of getting rewards, maybe in terms of the storage usage. Meaning like they do intensive reads and writes from the storage. And I think like these are the things that need to improve also in Chia, and in other space time protocols, such as ours, which we are working on as we speak.

[00:44:30] JM: Well, it's been a wide ranging conversation. As we draw to a close, do you have some broader predictions about what the next few years are going to bring when it comes to crypto and DeFi?

[00:44:46] AL: So, yeah, DeFi is also like a new and exciting aspect of blockchain, like decentralizing all sorts of financial instruments and doing it like automatically on contracts is something that is very exciting to see how it evolves. Personally, I do think there is a place for it in our world, because I think, – Well, basically, we all have identities in our real life. And we have our friends, and we have our job, and we have our like life, but we also have an online identity. And the thing about online identity is that it's not related or tied up to any geographic identity, or any – It can be not tied up to. And sometimes it's anonymous, or like just the nickname.

And I feel there's a lot of freedom in blockchain in particular, and also in DeFi, if you want to talk about that. But I feel like blockchain is the evolution of our online lives. And it supports us with the decentralization and like the notion that there's not a single identity or a single authority that can tell you why you can or cannot do on the Internet. And I think it's crucial for this notion to stay, for this freedom to stay online. And I feel that all the recent developments done in blockchains and the way blockchains evolve, now they evolve into decentralized finance, which is also good, because it makes it a lot less prone to collusion or control of some people with interests.

I mean, I think it will evolve like more into other areas such as our culture, art, identity in general. And I think like we didn't know we needed it until we've created blockchain. And ever since we've created blockchain, I don't think it will go away. Because I think people will always need this device or this path that is not controlled by any central authority that allows them to do what they want to do without any judgment or any like specific strict rules of some identity.

Sometimes, I mean, it may be for bad causes. But I try not to look at the bad causes, because I think there's a lot of good to be done in blockchain. Because I think like, overall, centralization and putting all the power in one state, or one leader, or one bank, or one, I don't know, hedge fund is risky. And eventually it doesn't benefit us like the normal regular people who don't have a lot of power in our hands on a daily basis. So I don't know if it answered your question, but –

[00:48:39] JM: It does. It does. That's a great summary. Thank you so much for coming on the show, Anton. Great talking to you.

[00:48:44] AL: Cool. I loved it. Thank you so much for this interview.

[END]