

<b>Demetri Kofinas:</b>	00:00	Today's episode of Hidden Forces is made possible by listeners like you. For more information about this week's episode, or for easy access to related programming, visit our website at <a href="https://hiddenforces.io">hiddenforces.io</a> and subscribe to our free email list. If you listen to the show on your Apple podcast app, remember, you can give us a review. Each review helps more people find the show and join our amazing community. With that, please enjoy this week's episode.
<b>Demetri Kofinas:</b>	00:31	What's up everybody? I'm Demetri Kofinas, and you're listening to Hidden Forces, where each week I speak with experts in the fields of technology, science, finance, and culture. To help you gain the tools to better navigate an increasingly complex world, so that you're less surprised by tomorrow and better able to predict what happens next.
<b>Demetri Kofinas:</b>	00:54	My guest this week is Joe Lubin, the co-founder of Ethereum and founder of Consensus, a blockchain venture studio dedicated to building developer tools, decentralized applications, and solutions for enterprises and governments, meant to harness the power of Ethereum's world computer. I've wanted Joe on for a while. I can't think of anyone else who's made a bigger bet on the future of blockchain technology than he has. He has a wealth of experience, and we touch on some of that, including his time as a middle schooler in Toronto, programming computers using optical mark readers and punch cards. I ask Joe for his opinion on the comparisons made between the internet revolution of the 1990s and the revolution in today's public ledger protocols and permission list databases.
<b>Demetri Kofinas:</b>	01:44	We get into some of the technical challenges confronting blockchain engineers. Both for the base layer, as well as for layer two, and when he expects to see an implementation of scaling solutions that will enable the majority of applications being built at Consensus today to run atop the Ethereum virtual machine.
<b>Demetri Kofinas:</b>	02:03	Additional topics include SEC regulations, artificial intelligence, and questions about specific applications in the areas of news, music, and team organization. With that, let's get right into this week's conversation.
<b>Demetri Kofinas:</b>	02:22	Joseph Lubin, welcome to Hidden Forces.
<b>Joe Lubin:</b>	02:24	Thank-you. It's great to be here.

**Demetri Kofinas:** 02:26 It's a pleasure having you on the show. I've seen many of your talks on the internet. I've never actually been to a Consensus conference, but I've probably just watched my fair share online the past week. Of course many in our audience will already know you. But when I was thinking about how I wanted to structure this conversation beforehand, I thought, "The one thing that I haven't ...". Well there are a number of things hopefully that this interview will bring out that haven't been spoken about before. But one of them is that, I don't know much about you. I was shocked to learn the extent of your experience. Also, you look a lot younger than you are. You've actually been around, and you went to college -

**Joe Lubin:** 03:02 So you're saying I'm old?

**Demetri Kofinas:** 03:04 Well I was born in 1981. I'm assuming you were born in 1970?

**Joe Lubin:** 03:09 '64.

**Demetri Kofinas:** 03:09 Really? That means that you actually were out of college when the internet hadn't even come out yet.

**Joe Lubin:** 03:14 That is basically true. Essentially the web protocols were invented in '89, and I had graduated in '87 with a degree in electrical engineering and computer science. But I was still at Princeton basically on research faculty, and doing robotics and machine vision and AI stuff. I do remember, we used to hang out in a computer graphics lab. I remember when some of my friends got excited about HTTP and HTML, and essentially Web 1.0 was starting to become a thing. It wasn't really until '92, '93 that I even heard about it.

**Demetri Kofinas:** 03:55 That's so interesting. Well I did read about your background in robotics and AI. I wanted to talk to you about that, because the '80s were really a time when there was a flourishing of interest in AI, robotics, and VR. It's interesting also, because that's sort of seen a resurgence, right? In recent years.

**Joe Lubin:** 04:10 Sure.

**Demetri Kofinas:** 04:11 But we'll get to the web, because I want to talk about that. Where were you born? What's your background?

**Joe Lubin:** 04:16 I was born and grew up in Toronto.

**Demetri Kofinas:** 04:18 In Toronto. You went to Princeton '83 to ... What was your interest like? What were you interested in before that? Were you interested in technology?

**Joe Lubin:** 04:26 Yeah, I was interested in technology. I drew a lot and painted, and wrote a lot and played lots of sports. I did get involved with computers sort of early. In junior high school I was sort of in a math class or a math program. They put a few of us in front of a computer. That was my first exposure. You would have this phone and you'd have this thing that looked like a telephone handset. It would be connected to the computer, and it was basically an old style modem. We would dial the number and then put this handset on this receiver thing, and then the phone -

**Demetri Kofinas:** 05:10 Just like in War Games.

**Joe Lubin:** 05:11 Yeah, very much like that. The computer would beep beep beep across the phone line, and it was calling into University of Toronto's computer center. We started doing some very rudimentary things -

**Demetri Kofinas:** 05:24 In high school.

**Joe Lubin:** 05:24 In, I think that was eighth grade. That was junior high school. Then I went to a public high school in downtown Toronto, and had a pretty sophisticated computer science program there. I basically did about two years of computer science in high school. It was very different though. We had these cardboard cards and we would write programs -

**Demetri Kofinas:** 05:49 Punch cards.

**Joe Lubin:** 05:49 It wasn't even punch cards. We were filling out bubbles with pencil, and so you're trying to write these lines of computer code by filling out bubbles on these cards. I would carry around these ridiculous stacks of cards. Eventually I and a few people got really sophisticated and we rode our bikes to the computer center at the University of Toronto. We would use their card punch machines, and so we wouldn't have to fill out the bubbles anymore. We could use these massive machines and punch cards. We could punch like two cards a minute basically, and write one line of computer code every -

**Demetri Kofinas:** 06:27 That was a nice experience. I can see you -

**Joe Lubin:** 06:27 Three or five minutes.

**Demetri Kofinas:** 06:29 I see you really smiling when you're saying this.

**Joe Lubin:** 06:31 Yeah. I haven't really thought of this -

**Demetri Kofinas:** 06:31 You seem to -

**Joe Lubin:** 06:32 For a long time. We would take these stacks of cards and then we would walk over to the card reader. It would flip through the cards super-fast, and then we'd walk over to the printer which was this massive device, with the white and green computer paper. The computer would basically run our program and print output right there. It wouldn't get output to a screen. It would get printed out and put on paper.

**Demetri Kofinas:** 06:57 What was that experience like for you? Encountering a computer -

**Joe Lubin:** 06:59 It was fun.

**Demetri Kofinas:** 07:00 At an early age in that way.

**Joe Lubin:** 07:01 It seemed kind of cool and kind of cutting edge for pretty slow moving stuff actually.

**Demetri Kofinas:** 07:07 Do you remember feeling really excited by computers, and that's what made you want to study computer science when you went to college?

**Joe Lubin:** 07:13 It was interesting that you could interact with a device and program the device. There were I guess vistas to be explored. One of the projects that I tried to do that I didn't end up succeeding all that well on was just creating a little football game. It was setting up a set of rules, and having two players sort of take turns doing stuff according to the set of rules. I didn't finish it, but I got a decent way down the road and got some of it done for my high school computer science class. It seemed pretty cutting edge back then.

**Demetri Kofinas:** 07:52 That's a very rare experience for someone in this field. How many people do you find, do you find other people you know that have had experience this early in computers and in the internet? Do you find it to be useful drawing on that experience and being able to compare one sort of revolution in information technology to what might be another one? Maybe the second one?

<b>Joe Lubin:</b>	08:12	Sure. At the risk of harping on a theme, yes. I speak with lots of old people like myself, and actually many more younger people. But there are lots of people that I could have a conversation with and resonate with who had similar experiences, who are in their -
<b>Demetri Kofinas:</b>	08:28	In blockchain.
<b>Joe Lubin:</b>	08:28	Late 40s or 50s or 60s, who just grew up using the same technologies. Experienced the same sorts of transitions. Definitely lots of those people have made it into blockchain. We at Consensus have a lot of cryptographers and just people who have been I guess building out some of the foundations of the technology for quite a long time.
<b>Demetri Kofinas:</b>	08:54	Do you feel like the comparisons between the '90s internet and today are overblown? Are they overstated in terms of ... Are we much earlier in the '90s than people sort of say? Everyone talks about waiting for a Netflix moment. Is that really comparable? Can we say that we're in '97, '98?
<b>Joe Lubin:</b>	09:11	It's a reasonable comparison. It will rhyme to some degree, but it will be very different as well. The internet was building on not much of a foundation really. The internet protocols, the web protocols were essentially moving from these walled garden systems to these open systems, and really building the foundations of those open systems. Now we're building on the foundations of those open systems, and so there's just so much more tooling that's available. So much more, orders of magnitude more sophistication that's available. Bringing a trust layer basically.
<b>Joe Lubin:</b>	09:49	Building shared collaborative trustworthy infrastructure to the web protocols will introduce new paradigms in how we build systems and how we build information infrastructure for the planet. Either public world computer, decentralized protocols that are interacting with one another, or corporate and consortium networks. The foundations will be different and better, but we're moving literally orders of magnitude faster than we were then. It's going to be really hard to map, say 2018, 2019, 2020, onto whatever '95 or '98, so.
<b>Demetri Kofinas:</b>	10:30	When you say open do you mean the fact that the intranets existed before the internet, and that we didn't start with permission blockchains, we pretty much started with permissionless blockchains? Is that what you mean? Or are you talking about open source?

**Joe Lubin:** 10:41 Yeah, so back then we were moving from a walled garden world, an AOL world or a non-networked computer world, and building this network computer. Sun Microsystems, the network is the computer. That was a massive paradigm shift. The paradigm shift of moving from something like AOL which was controlled by a centralized organization. Your entire experience was controlled. To these open protocols, essentially the world wide web protocols. That was a major transformation.

**Demetri Kofinas:** 11:14 Mm-hmm (affirmative). How did you get into this space?

**Joe Lubin:** 11:17 Into the blockchain space?

**Demetri Kofinas:** 11:18 Yeah. Into blockchain.

**Joe Lubin:** 11:20 I have been a technologist for a long time. Also did work in the financial industry, so it was kind of impossible for me to miss Bitcoin when it showed up.

**Demetri Kofinas:** 11:30 Were you interested in money before as a sort of intellectual construct? As sort of, the intellectual history of money and the issues of sound money? Were you coming at it from that area? Or were you really coming in it more from the technology side?

**Joe Lubin:** 11:42 Both. Definitely both. Definitely did some reading, as many of us did in the period from say 2000 to Bitcoin. Early 2011 was when I first started paying real attention. I was aware of it before then. I think I just encountered it, like many people, on slash dot where there was the occasional reference to it. I think I finally said, "I should read the whitepaper", early 2011.

**Demetri Kofinas:** 12:13 When did you meet Vitalik?

**Joe Lubin:** 12:14 That would be I think the first day of 2014. I grew up in Toronto, he grew up in Toronto, and I was visiting my family over Christmas in December, 2013. I spoke with a guy named Anthony Diiorio, who is another founder of the Ethereum project. He just shared with me that this guy Vitalik, who I was aware of through his excellent writing, had put together a whitepaper describing a platform called Ethereum and I should check it out.

**Joe Lubin:** 12:47 I went a few days later to a meetup. I spoke with Vitalik for quite a while and read the whitepaper that night. The project was coalescing from a handful of people and a whitepaper into a project. I stayed close to the group. We sort of organized our communications on Skype and some in person meetups in

different places around the world, and really formed the project towards the end of that month. The end of January.

- Demetri Kofinas:** 13:15 When you first read the Bitcoin whitepaper, was there a point before you started reading Vitalik's work that you were thinking about a virtual machine, and maybe using this technology to create a permissionless distributed database?
- Joe Lubin:** 13:27 I and many many other people were thinking about that. There were various different attempts, various different groups that are trying to figure out how to build everything on this new sort of breakthrough in trustworthy database technology. I wasn't alone. I think Sergio from Roots Doc, he put together an early attempt that was interesting, and the Master Coin people, and Next and others had roughly the same ideas. But they weren't building it out in what I would call a human scalable way. It really required specialist engineers to build new applications on the system. By that I mean -
- Demetri Kofinas:** 14:12 There was no programming language that ran on top of it.
- Joe Lubin:** 14:15 Yeah. By that I mean, people were trying to create new applications, but build those applications right into the protocol rather than, like the internet, like the web, have a clean protocol layer and then an application layer where you don't need to understand the plumbing. You don't need to understand the guts of the protocol layer in order to be very functional with developer tools at the application layer.
- Joe Lubin:** 14:39 That's one of Vitalik's key insights. Basically instead of adding a new button to a pocket calculator, which is what those other projects were doing, Vitalik's idea was, take a full computer and stick in it every node of a peer to peer network and enable all the world's programmers to figure out what problems they want to solve, and go ahead and solve those problems. Rather than relying on a small set of protocol priests to build solutions for everybody at the protocol layer.
- Demetri Kofinas:** 15:07 How plugged in are you on these sort of ongoing attempts and challenges to solve the scalability problem? The scalability issues around blockchain?
- Joe Lubin:** 15:18 Significantly plugged in. We have so much going on at Consensus and there's so much going on in the Ethereum ecosystem that it's incredibly hard to stay on top of everything. But at Consensus we have somewhere close to 40 protocol engineers -

**Demetri Kofinas:** 15:34 That are working just on the base layer?

**Joe Lubin:** 15:36 Yeah, basically. Working on a new Ethereum client. Working on scalability approaches. Paying close attention to Casper and Sharding. Building enterprise Ethereum extensions, or essentially ways for enterprises to have systems where subsets of actors can be privy to subsets of transactions to essentially have privacy and confidentiality on top of an Ethereum network. I'm quite aware, not at a bits level and not at a code level right now. But it's a fast moving space. Whether you're talking about Casper or proof of stake in Sharding, which will scale the layer one of the ecosystem.

**Joe Lubin:** 16:27 Essentially we're seeing things as trust emerging from the radically decentralized layer one, and in this next phase that is just getting started, scalability emerging via a whole lot of different technologies at layer two. These technologies are sort of organized and finalized or netted out on layer one, or layer one can serve as a security backstop. If any of these layer two technologies get into trouble, people can be fully confident that they can pull their tokens of value out into layer one.

**Demetri Kofinas:** 17:01 Layer one would be Sharding and Casper?

**Joe Lubin:** 17:04 Layer one I refer to as just the trust layer, which is radically decentralized Ethereum. You could call Bitcoin layer one also. It is also radically decentralized but it's very hard to build anything on top of Bitcoin. None of the other protocols are really radically decentralized at this point, and so they're not good layer one solutions.

**Demetri Kofinas:** 17:25 Well that actually brings a lot of questions. One has to do with this notion of centralization versus decentralization, because it's a fuzzy term. I mean we think, a lot of people think of it in very stark clear terms, but it's actually a bit fuzzy. I think as we've moved along we've found that where you try to decentralize in one place, you end up centralizing somewhere else. I wonder, to what extent can you have a truly decentralized system created by human beings?

**Demetri Kofinas:** 17:44 That's a philosophical question. But I wanted to stay on one point before we got to that, which is, something like Casper for example, FFG or CBC. That would address issues of consensus at the base layer, at the layer one, right?

**Joe Lubin:** 17:57 Yep.

<b>Demetri Kofinas:</b>	17:58	Sharding would also be part of layer one, correct?
<b>Joe Lubin:</b>	18:00	Yes.
<b>Demetri Kofinas:</b>	18:01	State channels would be, or plasma, that would be layer two?
<b>Joe Lubin:</b>	18:05	Yes. That is correct.
<b>Demetri Kofinas:</b>	18:06	Okay. Maybe we can then circle back and then maybe can drill into these a little bit more. But in this question of centralization versus decentralization and maybe at large the question of the challenges of scaling this database architecture in a permissionless way, have you been humbled by that experience. Have you found it to be more challenging than you expected? Or did you expect it simply to be challenging in ways that you couldn't foresee, and that's been really the experience of trying to engineer this?
<b>Joe Lubin:</b>	18:31	I don't think it's unexpected. I think we understood that we were building a remarkable machine, but it was going to be a very immature, essentially proof of concept remarkable machine for quite a while. On that remarkable machine we built things that are actually really useful for lots of people. Fungible tokens, non-fungible tokens. Different kinds of crypto assets. An adjacent music industry platform. A bounties platform. Ways of supporting open source systems. Naming services. Registry services. There's atomic swap protocols. Parameterized insurance products. There's so much going on that's actually really useful. Whether it's on the public blockchain or whether it's that same technology being used in more private contexts.
<b>Joe Lubin:</b>	19:20	We built a proof of concept and we built a platform that enables us to figure out what it is to build decentralized applications and what it means to try to build companies around decentralized applications. I don't think anybody was under the impression that we were going to build world scalable infrastructure in the first year or the first three years, or maybe the first five years of the ecosystem. Very similar to how the world wide web evolved. But we are, as we have for decades, we are bumping up against scalability issues. Engineers always do that. Software engineers always do that. We're always maxing out what's available.
<b>Joe Lubin:</b>	20:00	As we build more exchange systems and especially game systems, we're going to use those activities to push out the technology to increase scalability. When we have something like Crypto Kitties, it shows us exactly where in our protocol we

need to pay attention to. It shows us where in specific client implementations we have to pay attention, and we can get busy and either fix some issues around those things, or suggest new architectures for better scalability.

- Demetri Kofinas:** 20:34 Your point being that because you're looking, the really interesting use cases are not games, but they're use cases that are important for humanity let's say. Or survival -
- Joe Lubin:** 20:42 Games are interesting use cases too.
- Demetri Kofinas:** 20:44 Yeah, sure. For sure. But I'm saying you can screw up a game and it's not going to destroy the world.
- Joe Lubin:** 20:48 That's a good point. Exactly.
- Demetri Kofinas:** 20:49 The point being, it's a good way to trust the robustness of the network. You know, with Vlad and Vitalik we spent a lot of time going through Sharding and state channels and plasma and CBC and FFG. We touched on POS just a bit. But one of the questions I didn't ask them, and I think it's relevant also, particularly just given the volatility of the price of Ether and all the cryptocurrencies is, because so much supply is already on the market, in a proof of stake system if you were to implement POS, how would you do it in a way where you wouldn't risk, for example, having as a result of volatility in the price, having market cap drop to such a point where your system becomes vulnerable? In a way that it wouldn't under proof of work. Does that make sense?
- Joe Lubin:** 21:27 It sounds like you're saying, how do you ensure that there's sufficient issuance of new tokens?
- Demetri Kofinas:** 21:35 No. What I mean is, no. What I mean is, let's say if your network security is derived by the market cap of the token or the currency that's out there -
- Joe Lubin:** 21:44 All other things being equal. But if you have a better Consensus mechanism or a Consensus architecture, then you can reduce the amount of value that's required to secure a network at a certain level.
- Demetri Kofinas:** 21:58 Mm-hmm (affirmative).
- Joe Lubin:** 21:58 If you're using proof of work, you may need a lot more value securing that network than -

**Demetri Kofinas:** 22:04 If you don't have finality.

**Joe Lubin:** 22:05 Then a better, yeah. Finality itself makes it much less expensive to ensure the security of the network.

**Demetri Kofinas:** 22:12 How long, and then I want to get into your sort of particular applications that you're most excited about. Because there are a few that I am. At least conceptually. Whether it's that one particular application that you guys are developing or the category itself. How long do you think it's going to be before, a conservative estimate, I'm sure you get asked this all the time. It's probably an annoying question but I've got to ask it. How long do you think it will be before the network can operate at a scale where the vast majority of applications you guys have been developing will be deployable in a meaningful way?

**Joe Lubin:** 22:46 What an annoying question. I don't think that's the right way to think about it. It's not about the network, like the Ethereum layer one architecture being able to support a whole lot of different applications. We're going to see different and innovative architectures emerge to subserve different kinds of applications. There are probably 20 different layer two technology projects going on right now. Some of them are in use. Some of the state channels work is in use. Loom's doing interesting things. There are a bunch of different plasma implementations and new ones being invented essentially every day.

**Joe Lubin:** 23:28 There will be projects that span over layer two and layer one that will I believe be very significant for people in 2018. Before the end of this year.

**Demetri Kofinas:** 23:41 Am I overestimating the technical challenges with implementing layer two solutions without a more robust layer one solution? Like state channels for example. People talk about that as being a solution. But if you have, just a simple example would be like Lightning Network or something. The way that that's been proposed for Bitcoin. If you have all these different sort of tabs open, I mean it's kind of like, I mean as I understand it a channel is like a tab. Like I go to a bar and I open up a tab for the course of a month.

**Joe Lubin:** 24:10 Sure.

**Demetri Kofinas:** 24:10 Just for payments for example. How would you scale that if you have all these different tabs that are open? Because that's essentially credit. Those are credit channels.

**Joe Lubin:** 24:18 Sure. The analog of Lightning for Ethereum is the Raiden network. You can set up a Raiden network that's positioned on just one node, like my own micro Raiden network. Or you can have a multi node network, which is being worked out by our friends at Brain Bot right now. I think they're getting close to a major release.

**Joe Lubin:** 24:41 You're right, the one major issue is that you have to commit a bunch of capital to a lot of different channels so that IM You and IM Kara have fluid interactions with one another. The issue there is that it can be very expensive if you have to commit a bunch of capital to a bunch of channels. There are ways of using the same capital in different situations. I think we can move towards a world in which we don't need capital in a channel that I'm using to buy my coffee on a daily basis. That can be a capital free channel, and the vendor doesn't really stress too much if something goes wrong and they don't get paid for the coffee that I was purchasing from them.

**Demetri Kofinas:** 25:26 Isn't that though, am I thinking of it the wrong way when I think about counter party risk? When I think about it in terms of counter party risk?

**Joe Lubin:** 25:33 I think you've got it. I think you're right. But the question is, is my coffee vendor going to care very much about using a highly secure channel with zero counter party risk? Or are they going to make it easy for me to buy my coffee and -

**Demetri Kofinas:** 25:47 That's a great point. Obviously you're right. Depending on the use case it wouldn't be that big of a deal. You're not particularly worried about the guy who comes every month or the girl who comes every month to purchase some coffee. But for larger use cases, let's say more traditional financial use cases or other uses cases where more capital is being committed, am I overestimating the level of complexity that that generates in the system, that could create problems for scaling that? If you have all these inter-channel communications?

**Joe Lubin:** 26:13 Yeah. I think these are unsolved issues. I'm not a state channels expert, and it's not just the raw state channels technology. It's the crypto economics of setting up all these systems so that they are sufficiently secured, yet not overly secured. Not overly collateralized or capitalized. That's, I think it's still kind of a research topic. We're going to build out iteration after iteration, and we'll run into scalability issues and other kinds of issues, and we'll learn from those things.

**Demetri Kofinas:** 26:46 I recommend for listeners who haven't heard the Vitalik Vlad conversation to go to that if they want to get more technical. You gave a great talk, it probably isn't your only talk Joe, but you gave this great talk that I watched online where you talk about the nature of the firm and how that's going to change. That's one of the really interesting things about this space. Thinking about how the future is going to look if we can get the database side working.

**Demetri Kofinas:** 27:12 We're already adopting decentralized use cases like Uber and Air B&B. People are already actually comfortable with that kind of a thing from a user standpoint.

**Joe Lubin:** 27:20 Sure. In a sense those companies move us towards the sharing economy. But I don't really consider them legit sharing economy. They really are resource and service aggregators with a huge intermediary in the middle between the resource providers and the consumers. That intermediary is sucking up a huge amount of value.

**Demetri Kofinas:** 27:42 Right.

**Joe Lubin:** 27:43 One could imagine as we build out this technology with better scalability, better privacy, better confidentiality, that something like the Uber corporation could be replaced by something much much smaller. A bunch of people, but a set of smart contracts and very little intermediation, and very little capture of value through that intermediation so that the providers, the drivers, can offer their services much more directly. Or even purely directly. It could be a group of altruistic grad students that set something like this up.

**Joe Lubin:** 28:21 Let's say that group sets something up. It starts to gain a little bit of traction in some college town, and migrates to some other college town. It draws more and more talent to it. Then this group does a token launch.

**Demetri Kofinas:** 28:34 Right.

**Joe Lubin:** 28:35 Suddenly the riders and the drivers are able to own the ride sharing system that they're participating in. If it becomes successful, then the tokens that they're owning that represents the business logic of the system become in demand, and not only do they contribute some of their capital to the system, but they contribute their effort and their usage of the system. That's what drives value creation in that network business model.

<b>Demetri Kofinas:</b>	29:04	That's like the token economics, which is I think, people talk a lot about the technology. But I think maybe one of the most underappreciated innovations is the way in which capital formation is disintermediated. The process of capital formation is disintermediated, right? Because you don't have a firm that's going out and raising capital, bringing it back and deploying it. You have an ecosystem that is able to generate capital through the value of its token, right?
<b>Joe Lubin:</b>	29:32	Yes.
<b>Demetri Kofinas:</b>	29:32	Which is fascinating. My point about Air B&B and Uber was to say that interestingly enough, this time around I don't think that this would apply to the internet in the '90s. We have people already thinking about and living their lives in this sort of a way, to use an overly used term, decentralized way. Our work systems are changing, like We Work and all this stuff, right? It's very different. People are used to working different ways, but the database hasn't caught up. That's the way I feel.
<b>Demetri Kofinas:</b>	30:01	What I think is so exciting is that we can actually get that in that place. The adoption, I think there's an underestimation by many people maybe outside of this space the speed with which adoption could happen if the technology is solved.
<b>Joe Lubin:</b>	30:13	Yeah. Great insight. Basically we've been constructing and living in a society where we've had slow communication and expensive decision making processes because of the slow communication systems, and top down command and control organization throughout society is probably the most effective organizing paradigm in that sort of context. Now we have this new database technology. This new trustworthy database technology that facilitates collaboration. Suddenly we have both rich networks for instantaneous communication, and based on this new database technology, this way for many different actors, even up to half of which could be malicious, to make decisions that we can all trust.
<b>Joe Lubin:</b>	31:07	That sets a foundation for us to create a gig economy where we can essentially, you're talking about the nature of the firm. Instead of forming large firms where lots of the transactions are more efficient and less expensive to do inside the firm, we can externalize lots of those operations, lots of those transactions, so that they're actually more efficient to do in a free market economy. I expect, and I think you already hinted that we're seeing this already, the atomic functional units in our society are going to be shrinking more and more so that we focus on our core competency, and it's much more efficient to

externalize all the other functions to somebody else who has different core competencies.

- Joe Lubin:** 31:52 The costs of coordination, the costs of negotiation, the costs of legally entering into agreements, those things are all trending to zero. All of those can be accomplished essentially with a smart contract infrastructure on this new trustworthy database layer.
- Demetri Kofinas:** 32:11 Yeah. I think that's also one of the most bullet signs for the space. The fact that the cultural practice, that the adoption has happened before the technology has even caught up to the extent to which people actually want to live and work and -
- Joe Lubin:** 32:22 Sure, yeah. Lots of people, and you and I are sort of a self-selected group. Lots of people are very excited about the technology. But most of the world still runs in the older more centralized more siloed style.
- Demetri Kofinas:** 32:37 Right. You know what? I just remembered something. When you were talking I wanted to ask you about AI, because you have this interest in AI. I assume it's an ongoing interest. I mean you had it when you were in college.
- Joe Lubin:** 32:46 Yeah.
- Demetri Kofinas:** 32:46 How important are developing a set of protocols for computing data across a network? Network wide, which is, we didn't have this before, right? Right now if you have information that's being sent across the internet, it has to be captured and processed on a server. That's where all of that data processing and computation are going to happen.
- Demetri Kofinas:** 33:06 What this database architecture would allow is on some level of network wide computation, right? It that like an accelerator for artificial intelligence?
- Joe Lubin:** 33:15 I'm not really sure what you're saying. Are you saying, do we need to bring all of this data into a centralized architecture to teach up some models?
- Demetri Kofinas:** 33:24 No. I'm saying one of the ways I think about distributed ledger technology is that it will do for data computation, theoretically speaking and at scale, right? It can do for data computation and storage and processing what the internet suite of protocols did for communication.
- Joe Lubin:** 33:39 Okay.

**Demetri Kofinas:** 33:40 Combining that with the innovations that are happening in artificial intelligence, A, we know how important it is to have something like this for this IoT world that we're coming in for, right? Not just in terms of being able to use those devices, but actually having that level of security. I mean, do you think about that aspect of it? Up until now we were talking about the gig economy and what it means for us as human beings.

**Joe Lubin:** 34:01 Yeah.

**Demetri Kofinas:** 34:02 But the fact that we're deploying all of these intelligent devices around the world that are increasingly interconnected and connected to the internet, how essential is getting this right because of IoT and because of AI?

**Joe Lubin:** 34:12 It definitely has implications for IoT and AI. We are, because of this new trustworthy database structure, we're moving towards being able to do decentralized storage incredibly efficiently, and decentralized compute. Whether it's trustworthy compute or heavy compute. We have systems like Sonm and iExec and Golem running on Ethereum right now. We're moving towards a cloud fog infrastructure where there will be all sorts of different sub-straits for storage and computation. Those things will be organized, paid for, etc., on Ethereum or other blockchain systems. Some on their own protocols. That will absolutely be a paradigm shift for how we use data.

**Joe Lubin:** 35:02 We collect data. Essentially we do need identity for different devices. We do need mechanisms for ensuring that data feeds or oracles are coming from the right place, and you can use trusted enclaves and hardware security modules and stuff like that to understand the identity of a device that's spitting out some data. You need to encrypt that. You need to set up channels so that they're not man in the middle attacked or something like that.

**Joe Lubin:** 35:32 Implications for AI are very interesting. I think lots of people are concerned that the AI arms race is being engaged in by too few actors, and again it goes back to what I was talking about. Having all the data and having all the compute. That gives you a tremendous advantage. It's not really the algorithms that are interesting these days, although there may be some transitions between deep learning and genetic learning or evolutionary learning and one shot learning techniques. There may be some innovative stuff going on now or soon. But really, we I think because of blockchain technology, I think we're going to move to a world where we have better, perhaps more universal access to huge amounts of data.

<b>Joe Lubin:</b>	36:20	I argued before that the internet, as awesome and societally transformative as it is, is broken. It's broken because there was never an identity construct. That enabled entities like Facebook and Google, and those are great services, and they've been in many ways excellent for society and in some ways a bit concerning for society. But it enabled them to construct identity to serve their business models, and that has ended up being somewhat exploitative in many cases.
<b>Joe Lubin:</b>	36:52	With GDPR, with Cambridge Analytica, with essentially the realization that some of these business models are broken, we are I believe going to see a movement from these siloed walled garden systems where these big entities are in control, to these networked business models. Basically blockchain business models where you sell a token. It's a protocol based open platform. A new kind of identity, self-sovereign identity where I'm establishing the root of my identity on a blockchain and I am encrypting aspects of my identity and retaining full control of those aspects, and selectively and granularly disclosing them in situations that I designate.
<b>Joe Lubin:</b>	37:32	What that sets up is a world in which the higher value data is fully in our control. I may still spray some crappy data at Google and at Facebook in order to use their services, but I'm not going to put my financial information, my personal health information, my sensitive communications on there. But I may choose to monetize those thing by placing them either identified or de-identified on data markets. The implications there are that the AI arms race could be much much broader. It might not be just a small handful of companies and countries.
<b>Demetri Kofinas:</b>	38:10	You're saying because many actors will have access to the data.
<b>Joe Lubin:</b>	38:12	Because the really good data is going to be under our control as we move to a web three world. We're going to be able to disclose it, maybe to a research study if we want to. Maybe we want to monetize it. But -
<b>Demetri Kofinas:</b>	38:25	The democratization of data.
<b>Joe Lubin:</b>	38:26	The good stuff will be available to anybody who can access it from a data market.
<b>Demetri Kofinas:</b>	38:31	Let's switch to what you guys are doing in terms of building out applications to run on top of this virtual machine. What use cases are you most interested in? What companies are you most passionate about? I've picked up from conversations or

talks that you've given that you're a bit of a music junky. I mean, we all love music. I don't know who doesn't love music. But -

<b>Joe Lubin:</b>	38:53	I used to be, yeah. I find that when I was doing things like writing software I would have lots of time to listen to music during the day, and -
<b>Demetri Kofinas:</b>	39:01	What did you listen to?
<b>Joe Lubin:</b>	39:02	What did I listen to?
<b>Demetri Kofinas:</b>	39:03	Yeah. What did you listen to?
<b>Joe Lubin:</b>	39:03	All over the map, really.
<b>Demetri Kofinas:</b>	39:04	What did you like listening to when you were working? Do you have a type of music that you like to listen to when you work?
<b>Joe Lubin:</b>	39:08	In the last few years I spend an enormous amount of time talking to people all day long. It's not -
<b>Demetri Kofinas:</b>	39:15	Like now.
<b>Joe Lubin:</b>	39:15	Exactly.
<b>Demetri Kofinas:</b>	39:17	I've seen Ujo Music Civil, which I'm very interested in, for many reasons. I mean I have a background in that. But also I think it's so important for society to have an information source that isn't corrupted by advertising. But Open Law also seems interesting, and I'm very curious to learn how you guys run your organization. Because there's that thing you guys call the traditional management nullification tools. It sounds very interesting.
<b>Joe Lubin:</b>	39:39	How'd you find out about that?
<b>Demetri Kofinas:</b>	39:40	Oh, I do my research. But tell me, I mean I'd rather let you tell me which ones you're most excited about and what you think sort of is, not just most exciting, but also that you expect to see deployed in a shorter period of time.
<b>Joe Lubin:</b>	39:55	I would have chosen those. Those are really good choices. Our Viant supply chain track and trace team is doing some really interesting stuff with some big companies. GlaxoSmithKline, Proctor & Gamble, World Food Program.

<b>Demetri Kofinas:</b>	40:08	You guys sent some sushi over the Atlantic didn't you, using that?
<b>Joe Lubin:</b>	40:10	We did. Exactly. They built an app that basically could trace exactly where it is. The next phase for that is to build temperature sensing into it so that you know for certain that your yellow fin tuna was never at a certain temperature throughout its whole trek. Civil is an incredibly exciting project. Civil is a platform for ethical sustainable journalism. It sets up a constitution, and essentially it invites newsrooms to form themselves, and there are quite a few newsrooms of professional journalists that have formed already. The network itself is not out and live right now. The token hasn't been launched yet. But still, these newsrooms are getting started without being actually attached to the Civil network yet.
<b>Joe Lubin:</b>	40:59	It enables people to essentially curate a list of journalists and newsrooms that they trust. The newsrooms can be regional in focus and topical in focus. The token incentivizes people to watch over the newsrooms and make sure that they are conducting their business ethically. The token itself will enable things like tipping, discourse on top, sort of social network based discourse on top of the actual news, and analytic services, and data integrity services, and fact checking services, etc.
<b>Joe Lubin:</b>	41:39	We're incredibly excited. It's getting a lot of traction from some very serious news organizations, and very serious journalists that left news organizations that they don't consider all that serious anymore.
<b>Demetri Kofinas:</b>	41:51	That's interesting. They work with Consensus in house?
<b>Joe Lubin:</b>	41:54	Civil is a company in its own right, and there's a foundation as well. Consensus is heavily involved in helping Civil build out its network.
<b>Demetri Kofinas:</b>	42:04	Maybe this would be a good time for you to actually explain, we already talked a little bit about sort of how you started it. What is your vision for it? What's your hypothesis? Why have you made such a huge bet, and tell us a little bit about how it's organized and how the organization runs.
<b>Joe Lubin:</b>	42:15	A year into the Ethereum project we were about to release version one of the protocol, and there weren't a lot of people building at the application layer. Started gathering some people who wanted to build some applications, and started building a few. It was clear that it was very hard to build applications on

Ethereum with essentially no developer tools, and really in an ecosystem that didn't yet exist. The protocol version one wasn't even released yet.

**Joe Lubin:** 42:44 Some of the people that were building applications started building developer tools. Other people stood up systems. Arin Davis was actually not at Consensus at the time. But at that point if you wanted to run an application, you could run it in a web browser. But you would first have to tell your customer, "Please go to the Ethereum website and download the client and spend six hours or three days syncing the client, and then you can use our software". That was not really a tenable way of building and releasing software.

**Joe Lubin:** 43:22 A project called Meta Mask essentially built Ethereum into the web browser so that it could basically connect to Ethereum. You still had to have Ethereum on your laptop. A team called Infura within Consensus started building infrastructure for all of our projects so that we could reach out across the internet. Either through RPC or Restful interface, our different applications could connect to this infrastructure and be sort of guaranteed to have transactions picked up and processed.

**Joe Lubin:** 43:54 That was very exciting in house at Consensus, and it soon grew very interesting to many projects outside of Consensus. It currently handles a shocking amount of queries. The Ethereum ecosystem currently handles about a million transactions per day, and that's about 80 percent of all the transactions in the, call it the fully decentralized blockchain space. There's some other protocols that are much less decentralized that claim higher transactional throughput.

**Joe Lubin:** 44:27 But when you're building applications, you need much more than these transactions. These writes against the database. You needs lots of reads and lots of different queries. Infura currently handles somewhere between eight and 10 billion queries per day from Ethereum and IPFS and that ecosystem. Which is about twice what Google handles.

**Joe Lubin:** 44:47 Anyway. A bit of an aside. But we started building that infrastructure, and we built core components like identity and reputation and governance tools, and accounting systems. Then we sort of got to where we really wanted to get to, where we started putting together these network business models. Ujo Music. The idea is that you set up a network with different actors and people and companies in different roles, and they emerge a set of products and services in this network business model. You can sell a token.

**Joe Lubin:** 45:23 About two months ago Bill Hinman, director of corporate finance at the SEC, said nice things about Ether. That it's not a security. But more importantly he laid out a set of statements pointing to the fact that you could in fact set up this network business model, protocol based open platform, and sell a token that would be considered a consumer utility token and not a security if you structured the token properly and if you marketed it properly, so you're not marketing it in enormous quantities to speculators.

**Joe Lubin:** 45:58 If people are participating in these networks and adding their effort to these networks, then that could be a network business model and not essentially a security investment. In the same way that I would put money into a company and expect some group over here to generate a return for me. The product side of the company consists of that infrastructure work and a whole bunch of different projects that are building those network business models. We also have a lot of people doing enterprise, government, central bank, consulting, education, and a bunch of capital markets.

**Demetri Kofinas:** 46:34 You basically built out an ecosystem of human capital that understands the space better than anywhere else.

**Joe Lubin:** 46:40 That is hopefully correct. I think that's a reasonable statement, but there are a lot of other projects in our ecosystem and adjacent ecosystems that are doing -

**Demetri Kofinas:** 46:51 Similar sort of -

**Joe Lubin:** 46:51 Very similar things, yeah. I think the Ethereum ecosystem is orders of magnitude bigger.

**Demetri Kofinas:** 46:57 More developed.

**Joe Lubin:** 46:58 Yeah. More developers.

**Demetri Kofinas:** 46:58 It's been around longer.

**Joe Lubin:** 46:59 More developers and more developed, and is growing much faster than any other ecosystem.

**Demetri Kofinas:** 47:06 How many of the projects that you guys have in house are teams that came to you from outside looking for help or looking for funding or something like that? Versus how much of this sort of just kind of comes together from all the different connections you already have?

**Joe Lubin:** 47:21 There really is a spectrum. We have lots of endogenously generated projects. Projects that came to us early that have been transformed with Consensus. We have projects that want to be mostly in Consensus but they're already a fully formed company. They may already have investors, and so we still consider those partial spoke projects. We're venture investing in lots of projects and token launching lots of projects. Whether they're our own in house projects or external projects.

**Joe Lubin:** 47:53 We security audit lots of projects. Our accounting team is doing a lot of work for lots of projects. There are lots of ways to interact with Consensus services. It's definitely a spectrum of whether we think of something as core or something as using only a limited set of our services. We think actually that as we wrap our different products and services in APIs and we use Open Law to attach service level agreements to the APIs, we can have all these things sort of stand-alone, become even more autonomous, and they're quite autonomous within Consensus already. But when we get good at that, a project could come along and use five or 10 of our different projects through their APIs and essentially permissionlessly attach themselves to the Consensus mesh of projects and companies.

**Demetri Kofinas:** 48:48 Do you have a strong network of investors that, there are a lot of crypto funds for example that are going up in this space. Do you interact a lot with investors who are focused on investing in projects in this space? Also with regulators. How closely are you in touch with these different groups?

**Joe Lubin:** 49:04 About equally I guess. We do speak to lots of investors, and I guess it's more the venture investing side that keeps in touch with those groups. We have many -

**Demetri Kofinas:** 49:14 I'm sure they want to be in very close touch with you guys.

**Joe Lubin:** 49:17 So we make lots of investments, and so that team stays in touch with other investors who are putting money into the space. For quite a long time, even during Ethereum, we were interacting with different venture funds who were just trying to understand the technology or deploy money in the technology. Yeah, we still have lots of those conversations. It's not clear to me whether we speak to regulators more or investors more. Maybe, it's probably about equal. We definitely around the world speak to different kinds of regulators. Whether it's a securities industry or other kinds.

**Demetri Kofinas:** 49:53 Do you find that there's been more regulatory clarity in the last year, let's say? I mean you mentioned obviously Hinman's

comments. But more broadly, do you feel like we're kind of at a place now where we're on the verge of getting some important clarity and regulations in the United States?

- Joe Lubin:** 50:07 I think we've got a lot of pretty high quality clarity, in my opinion. The SEC has been very clear that, I guess Jay Clayton, Mr. Clayton indicated that they wouldn't grandfather anybody. That, big surprise, they're going to enforce securities law roughly like they have for many decades. There will be lots of projects that sold securities, unregistered securities to Americans, that have received communications or will receive communications. My thesis is that the SEC doesn't want to kill blockchain for America, and so they have to be very careful. Sort of have to thread the messaging needle where they present some positive statements about Bitcoin, about Ethereum, about consumer utility tokens.
- Joe Lubin:** 50:53 I think we're still in that phase where the SEC is communicating that, "We understand this is something new, and it's going to be an incredibly valuable technology. But we also have rules, and all the projects out there need to pay attention to rules that are in place to preserve the sanctity of markets and consumer safety". I'm pretty comfortable in this country and in various countries around the world that the securities law issues are pretty close to resolved. I do think that there are going to be some bad times for some projects going forward. But I think that's going to be a very good thing. Getting clarity with respect to regulation is going to really kickstart or re-kickstart the token ecosystem.
- Demetri Kofinas:** 51:43 Well it'll be very helpful to get rid of a lot of the scam-y companies in the space. That would be great for everybody.
- Joe Lubin:** 51:47 Sure, yeah. A lot of projects with the naïve technologists and naïve entrepreneurs felt that this was very different. Maybe it's because it was in a global context. Maybe they were just excited about the potential of the technology. I guess the barrier to entry was so low, you really could just cut and paste a token launch, and many fraudulent projects did that. But it was just -
- Demetri Kofinas:** 52:14 Well and investor euphoria too.
- Joe Lubin:** 52:16 Yeah.
- Demetri Kofinas:** 52:16 People were willing to buy all sorts of things they didn't understand.

<b>Joe Lubin:</b>	52:18	For sure.
<b>Demetri Kofinas:</b>	52:19	Also the complicated nature of the technology made a lot of people feel like they couldn't understand it, so they were just -
<b>Joe Lubin:</b>	52:23	Yeah. Massive information asymmetry.
<b>Demetri Kofinas:</b>	52:24	Didn't want to miss out.
<b>Joe Lubin:</b>	52:25	Absolutely.
<b>Demetri Kofinas:</b>	52:25	Joe, I really appreciate you coming on the show. Thank-you so much.
<b>Joe Lubin:</b>	52:28	It was a pleasure. Thank you. Enjoyed it.
<b>Demetri Kofinas:</b>	52:30	Thank-you.
<b>Demetri Kofinas:</b>	52:31	That was my episode with Joe Lubin. I want to thank Joe for being on my program. For more information about today's episode, or if you want easy access to related programming, visit our website at <a href="https://hiddenforces.io">hiddenforces.io</a> and subscribe to our free email list. If you're a regular listener to the show, take a moment to review us on Apple Podcasts. Each review helps more people find the show and join our amazing community.
<b>Demetri Kofinas:</b>	52:59	Today's episode was produced by me and edited by Stylianos Nicolaou. For more episodes you can check out our website at <a href="https://hiddenforces.io">hiddenforces.io</a> . Join the conversation at Facebook, Twitter, and Instagram, <a href="https://twitter.com/hiddenforcespod">@hiddenforcespod</a> , or send me an email. As always, thanks for listening. We'll see you next week.