EPISODE 12

[INTRODUCTION]

[0:00:00.3] JM: Bitcoin is under-appreciated even to this day. The public focus is usually on the speculative value. What's the price of Bitcoin? Bitcoin has functional value as a technology platform. If I want to make 100 transactions with my bank for a single cent, the bank won't allow it. Our current financial infrastructure is not setup for micropayments.

Bitcoin is built with micropayments in mind. As Bitcoin works through its governance issues and its scalability problems, we will see gradual improvement in financial liquidity between people and machines. 21 is a company that has raised $120 million to make Bitcoin useful to developers. This is a long-term project and the first step of that project is to get Bitcoin in the hands of users.

To fulfill that end, 21 is developing services that encourage people to make small digital transactions. The first service is the 21 messaging services where users can pay to send messages to people who are unlikely to respond to an unsolicited email. For example, if I want to send an email to a venture capitalist pitching my company, I am more likely to get a response if I pay that venture capitalist $20 to read my message through 21 rather if I send a cold email from my email address.

Balaji Srinivasan is the CEO of 21 and he joins me for a conversation about the potential of Bitcoin and the objectives of the company that he is building.

Software Engineering Daily is having our third meet up; Wednesday, May 3rd at Galvanize in San Francisco. The theme of this meet up is fraud and risk in software. One of the guests is going to be the data science head of Coinbase. If you're interested in Bitcoin, if you're listening to this episode because of that, then you might like that talk at the meet up.

We're going to have great food. We're going to have engaging speakers, and as always, a friendly, intellectual atmosphere. If you want to find out more, go to softwareengineering.com/meetup. Now, let's get on with this episode.

[SPONSOR MESSAGE]

[0:02:17.3] JM: For years, when I started building a new app, I would use MongoDB. Now, I use MongoDB Atlas. MongoDB Atlas is the easiest way to use MongoDB in the cloud. It's never been easier to hit the ground running. MongoDB Atlas is the only database as a service from the engineers who built MongoDB. The dashboard is simple and intuitive, but it provides all the functionality that you need.

The customer service is staffed by people who can respond to your technical questions about Mongo. With continuous back-up, VPC peering, monitoring, and security features, MongoDB Atlas gives you everything you need from MongoDB in an easy-to-use service. You could forget about needing to patch your Mongo instances and keep it up-to-date, because Atlas automatically updates its version.

Check you mongodb.com/sedaily to get started with MongoDB Atlas and get $10 credit for free. Even if you're already running MongoDB in the cloud, Atlas makes migrating your deployment from another cloud service provider trivial with its live import feature. Get started with a free three-node replica set, no credit card is required. As an inclusive offer for Software Engineering Daily listeners, use code sedaily for $10 credit when you're ready to scale up. Go to mongodb.com/sedaily to check it out.

Thanks to MongoDB for being a repeat sponsor of Software Engineering Daily. It means a whole lot to us.

[INTERVIEW]

[0:04:13.7] JM: Balaji Srinivasan is the CEO of 21. Balaji, welcome to Software Engineering Daily.

[0:04:18.0] BS: Hi Jeff, it's great to be here.

[0:04:19.3] JM: Bitcoin is under appreciated even to this day. The public focus is usually the speculative value and this is true even among software engineers. I know that 21 is working to make products that are usable by everyday people because you want to get Bitcoin in the hands of everyday people so it starts becoming a utility rather than just a unit of speculation. The first product in that category is the inbox product. Explain what the 21 inbox product does.

[0:04:55.8] BS: Absolutely, Jeff. The concept behind the 21 inbox product is that you can now get paid to read email and complete messages and tasks online, and the reason that's interesting is, right now, there have been two ways that people have obtained digital currency, the first is mining it. The second is buying it.

This is a third way to get it, which is earning it. Utility of Bitcoin by earning it, by performing a micro task is that you don't need to put a piece of hardware there and you don't need to whip out your credit card. They're spending your stored wealth nor electricity, or what have you. Now, there are situations where you want to mind or buy digital currency, but this third complementary way is very interesting if we can scale it up. Certainly, people answer millions and millions and millions of emails and messages per day. It's a way that we think you can actually mainstream Bitcoin and get into the hands of lots of people pretty quickly if it's works at scale.

[0:05:59.7] JM: If we envision a world where celebrities have used this on regular basis, some regular people have used this on a regular basis, and you've got, say, 10,000 who now have a little bit of Bitcoin on their digital wallet. What can you do in that world that you couldn't do before?

[0:06:19.1] BS: Great question. I think the world really changes once we start to get not 10,000 people with it, but on the order of a million to 10 million people, because right now where Bitcoin is, it's sort of top-down in terms of growth. That is to say, there is an early group of, let's say, between 10 to 100,000 people that was a community from, say, 2009 to 2013. That's a very, very rough estimate. Maximum, a million people, but that's probably on the high side.

Then, from 2013 today, it's exploded, but it's also sort of tapped out. Basically, the community at large, maybe is maximum 10 million people who hold digital currency based on summing up all the wallets and so on online. It's not 100 million. It's maybe 10 million. Most those folks are sort

dilettantes who have bought 50 bucks, or 100 bucks worth of it. They're just kind of holding on, so just checking it out.

We need something transformative to get to the next one or two orders of magnitude to get to 100 million and then a billion users. What changes once you have a million people who have earned Bitcoin by just replying to a message or filling out a survey? The first thing is they have gone in Bitcoin on root to do something else of utility. That itself will increase the valuation of Bitcoin, because, right now, the valuation of Bitcoin and under digital currencies is primarily based on its speculation value and its store value value rather than its use value.

Those are interrelated in so far as Bitcion is digital gold. The only thing that you require of it is that you can purchase it, you can hold the private keys, and then later at some point in the future, you can exchange it for either fiat and then food, or then food directly. That's actually the application that's being — It's being used for in places like Venezuela where the currency is in crisis.

The digital gold application is one and then the second is speculation about in the future, digital currency will take over the world. They'll be used for all types of things. That's actually gotten the entire industry very far in the sense that if you sum up cryptocurrency market cap today, that's $20 billion if you ad Bitcoin and Ethereum and all the other guys together, $20 billion coming up from nothing in 2009. If you thought of that as a startup sector, that would be one of the most successful startup sectors out there.

Only Uber, or Airbnb are comparable in terms of their startup vintage years. It's bigger than maybe cloud source. Dropbox is 10 billion, or they're about to — Maybe adding Google Drive, but it's comparable to cloud storage, which is massive, right? Where it is already is actually very, very impressive, but there's still probably two orders of magnitude left to go for this digital currency thing, maybe more, because the use cases still haven't come out there.

To return to your point, that's kind of stating the frame. Let's say you do have a million people and they have now obtained Bitcoin for answering a message. A critical aspect of what we're doing is that it's not just useful to take Bitcoin and go and sell it on an exchange and get dollars back, you can then reuse the Bitcoin within the system to go and buy somebody else's time.

That might seem like a small thing, but it's actually a big thing, because what that means is that 21 become a Bitcoin sink in the sense that folks put Bitcoin in the system and then they earn Bitcoin in the system and they keep the Bitcoin in the system rather than selling it for dollars. What that does is it actually shifts the price of Bitcoin up, because of Bitcoin sink, it means there's constant demand.

Another way of thinking about this is if you take a small country, like Estonia, tithes time tat had about 1.2 million people, or it has, and Estonia up until about 2011 used its own currency called the Krone. What that showed is that a small country of about 1 million odd people could actually have its own currency in which the butcher, or the baker, or the candle stick maker all pay each other in Krone.

What's interesting about this is all these folks were geographically located in the same spot, but they have balances or had balances in Krone all year $10,000 per person, or more, because they had worked and had a stored balance and they had a diversified set of professions. They were butchers and bakers and candle stick makers and what have you.

Now, the Bitcoin community even though it's about 5 to 10-X larger, it has limitations that that Estonian community does not. It has spread out worldwide rather than concentrated in one place. The balances of people have on hand are not $10,000 worth per person, but they're basically a few bucks, maybe 100 bucks. The diversity of skills is not really there. You're talking mainly technology people, software engineers, venture capitalists, folks like that. You don't have a lot of seamstresses or bakers or what have you in the mix.

As such, it actually have a use case which knits this disparate community together. You need to start thinking about products that could be sent back and forth along the edges which are uniquely useful in the context of digital currency.

At argue, that's not going to be a cup of coffee because if you've got somebody in Japan and somebody in Brazil who are both Bitcoin holders, a cup of coffee is a physical good and it's hard to send between them. However, what both of these people and often values each other's time. If one is a software developer and one is a venture capitalist, or one is an engineer and the

other is a recruiter, and so on and so forth. The entire technology base like information economy is really about the value of other people's time.

Now, you can imagine a million person community even if they're mostly technologists and engineers and so on having many different reasons why they might want to buy somebody else's time. For example, you want to buy the time of a thousand Facebook users for beta testing your app, or a thousand product and users for giving you an early review of the app before it launches, or you want to have 100 CV's responds yes-no to your message as to whether or not you'd get funding, or a thousand Stanford students and they say yes-no as whether you could recruit them.

These are things where you're buying people's time but you're using digital currency to do it, you're buying a digital product, namely time, with a digital currency. It's a significant value, because human time has value. Yet it's this entire model where you've got a pointillistic distributed community with small balances. This is product that's intrinsic and inherent and native to that world.

[SPONSOR MESSAGE]

[0:12:54.3] JM: Software engineers know that saving time means saving money. Save time on your accounting solution. Use FreshBooks Cloud Accounting Software. FreshBooks makes easy accounting software with a friendly UI that transforms how entrepreneurs and small business owners deal with a day-to-day paperwork. Get ready for the simplest way to be more productive and organized. Most importantly, get paid quickly.

FreshBooks is not only easy to use, it's also packed full of powerful features. From the visually appealing dashboard, you can see outstanding revenue, spending, reports, a notification center, and action items at a glance. Create and send invoices in less than 30 seconds. Set up online payments with just a couple of clicks. Your clients can pay by credit card straight from their invoice. If you send an invoice, you can see when the client has received and opened that invoice.

FreshBooks is also known for award-winning customer service and a real live person usually answers the phone in three rings or less. FreshBooks is offering a 30-day unrestricted free trial to Software Engineering Daily listeners. To claim it, just go to freshbooks.com/sed and enter Software Engineering Daily in the How Did You Hear About Us section. Again, that's freshbooks.com/sed.

Thanks to FreshBooks for being a sponsor of Software Engineering Daily.

[INTERVIEW CONTINUED]

[0:14:35.1] JM: It makes sense to start with the type of communication, for example, a software engineer communicating to a VC, "Hey, I packed together this product. I want to pay you 30 or $20 so that I can communicate with you." But it's of course to move down market. You can imagine plenty of smaller payments being facilitated. What I like about that is that it is descriptive. Once you get to the lower end where it's like, "Okay. I have to pay a really popular florist 10 cents to get them to even look at my proposition for my wedding because they're so popular."

This gets us towards a public understanding of what a micropayment is. That, to me, is the main burden of people understanding the value of Bitcoin, because most people do look at it essentially as tulips. Even software engineers and venture capitalists are like, "Yeah, I own a little bit of Bitcoin just because I want to understand this space a little bit." "Okay. What do you understand?" "I understand it's going up and down in value." They don't get the micro payment thing.

Explain what a micro payment is and why Bitcoin enables it from a fundamental technological perspective.

[0:15:55.5] BS: Right. Okay. Great question. One this is I will say that folks who — When they talk about learning about the space. Obviously, they see it goes up and down. Before talking about micro payments, there is one other thing that they may learn which is actually very useful, which is that in Bitcoin, possession is 10-tenths of the law in the sense that if you have private keys, you hold the money in a way that's extremely different from pretty much anything else

we're used to, because if you have a credit card and you don't really have the money, because your credit card be stopped by the bank. It can be stopped by the credit card company. It can be stopped by many other kinds of parties; by fraud protection law when you're overseas.

Bitcoin is most similar to cash, but it's cash that no individual government can devalue because it is this international entity. Essentially, because of block chain is a leger that's on all these different machines. That is something which I do think it's not dumb to say one is learning about this space by buying and holding a little bit of Bitcoin. If the only thing you learn is — One learns is about private key, is it's actually a useful and very non-obvious lesson, I would say.

Then, second thing, let's talk about micro payments. What is a micropayment? What does Bitcoin make that feasible? There are different people who have different thresholds for what micropayments are and you could have it be as high as a dollar, but really people usually talk about it in the sense or even fractions of a cent.

What Bitcoin allows through technologies like payment channels and then something called the Lightning Network, which is almost like a grid or a web of payment channels in a sense. What Bitcoin allows is the ability to do micropayments by — One method is to put down a balance, like a deposit with an entity. Then, you can transact back and forth and have a small debit from that every time that you are purchasing something.

A way that you can generalize that is if you put down a deposit of let's say $10 worth with a hub, then any other micro payment that connects to that hub, you can now actually have settlement back and forth with that.

Essentially, what Bitcoin allows is for a certain class of applications, you can now have a lower threshold for payments going out. In theory, that's going to be very powerful, because right now the advertising support of the internet means that there's multiple intermediaries between the content producer and the customer. You have, at a minimum for example, an ad and support of webpage is at least two other parties who are Google and the advertiser.

One of the things that leads to is, as people have seen with the recent YouTube foofaraw, and the recent AdSense foofaraw, is that content owners can have their revenue drop 20, 25% due

to the bad actions of other content owners. It's not simply a relationship between you and the person who's surfing your webpage, it is something where you're vulnerable to all of these other parties in the network. The advertising support internet has a lot of issues where direct payment would be better.

I should say that while we can get micropayments to work in Bitcoin today, it is something which is very much in the early stages. It is going to be a while before that really, really gets out there. I don't think that the first application of micropayments, and let's say small payments, not exactly micro, but it's small international. I don't think the first application will just be to go and rip and replace the ad support internet.

The reason being, because that works for all its faults, it works. It's that massive scale. There's large incumbents defending it, et cetera. Instead, what I think the application is going to be is to monetize a previously unmonetizable area. That's say, to take a greenfield and turn that into something which is now generating and throwing off a lot of cash. Then, later, you can go kiddy corner and come back in to the advertising support model.

As just sort of a historical analogy, Google did not start by going against Microsoft in its core businesses of Office and so on, instead Google went to search, which is totally different. It built a massive multibillion dollar business. Then, with the money from that, it funded Google Docs and Google Sheets and Google Slides and so on, and Gmail, which are all attacks against Microsoft's core businesses.

It took a while. It took a sweet time in doing that and built up a strong business first before trying to attack the incumbent. In the same way, I think it's very interesting to think about businesses which are enabled by digital currency that are not as easy to do or not as lucrative in the previous model.

[0:20:50.2] JM: when I make most of my purchases these days, I'm going through Visa, or Mastercard, or some other sort of intermediary and they charge me a toll for using their services, or they charge the merchant a toll, which ends up charging me as well. That is to provide a network of insurance that an anti-fraud mechanisms. There are tax, but are in some sense a tax worth paying because otherwise there'd be much more fraud. The world in which

we have lightning networks and side chains probably is cheaper because the trust and verification systems are more decentralized. They are more granular and distributed as I understand. I haven't looked into this space too much.

How different would payments look? I do want to get into online advertising perhaps, but just — If we talk about just payments and we compare a world in which Bitcoin and other cryptocurrencies have achieved large penetration and large scale adoption, how much different is our everyday financial transactions relative to the current model of Apple and Visa and Mastercard and the other monoliths?

[0:22:18.7] BS: Okay. Here I think one sort of good analogy or way that I think about it at least. If you were growing up in the 80s or even the early 90s, there was a time in which you could enumerate all of the communications that you initiated in the course of a day. You could say, "Okay. I made this many phone calls and I basically reached out to these many people."

Now, today, you cannot enumerate the number of electronic communications you make in a day. If you go and open Chrome and Specter, when you just go to techcrunch.com, you're hitting 200 sites for all of these ad pixels and so on. There are so many HTTP requests are being made on your behalf. Every time that you hit enter when you chat with somebody in electronic communications being initiated.

On a daily basis, every IoT device you have, every fitness tracker, every time that you use Google Maps and you send you GPS location and so on and so forth, you're initiating probably thousands, if not tens of thousands of electronic communications per day when 20 years ago you could count them on one hand.

Sort in the same way, I think we're going to see something similar with payments once micropayments comes about, because currently for the most part you can count how many transactions you initiate on a daily basis. You can go to your bank account and you can see, "Oh, I used my credit card for this. I wired this person." It's a countable number. It's a useful thing for you to be able to go and log that.

Once we have true micropayments, you are going to find yourself giving a high-level instruction like, "Oh, go and buy something to the computer." Then, all these auction behavior, all these biding logic and so on will happen under the hood. In the same way that you give a high-level instruction fetch techcrunch.com and then 200 page request happen under the hood. You'll probably put a cap or a limiting, get this, but spend no more than 5 bucks, then come back to me with it.

For example, here's a spreadsheet, here's the names of a bunch of people, please get me all their emails. Spend no more than 5 bucks. That's like a very simple data analytic thing where you're drawing on some distributed work. You're calling some distributed API effectively. Maybe your system goes and talks to 20 machines and says, "Okay. What's the lower price for this? Translate this from English into French. Photoshop this image and make it redder," or whatever.

Any kind of machine instruction that you can give like this, your computer can now buy and maybe sell machine resources to other machines around the world. I think that's what happens once payments become truly electronic. They become like communications.

[0:24:59.1] JM: For people who are listening to this and they still don't understand the connection between the block chain distributed ledger technology and how that enables smaller amounts of money to be transacted upon. How would you explain that?

[0:25:16.3] BS: Good question. I would say the fundamental thing about the block chain is that it is a conceptual programmatic unification of many different kinds of payment methods. Let me again explain by analogy with the internet. Prior to the internet, you have physical mail and you had television, and you had telephony. You had the U.S. Postal service, physical mail, and you had television, NBC, and you had telephony, which is AT&T.

Then, after the internet, everything moved into packet switched information. With packet switched information, you could have Gmail and you could have YouTube and you could have Skype, or you could have something like Google Hangouts which kind of combines all of them. You have an email and then you could have a call and a video chat at the same time.

These previously disparate communication methodologies through the mechanism of packet switching were just turned into really the same thing. I am sending this information to this other person and I need to pre-authorization from anybody. Any computer can send and receive packets to any other computer. There is no license from AT&T required. There's nothing required other than an internet connection.

That's what basically digital currency in the block chain allow. Any single device that can connect to the internet can get a dial tone from the block chain. You can download a blockchain if you have an internet connection, and you can write to the block chain if you have a private key that has some Bitcoin or digital currency associated with it. That is completely different form how the typical banking system works. It is simply not the case that if you have a policy of a bank account. Most people in the world are in fact unbanked. In fact, more people in the world today now have smartphones than bank accounts, which is actually not something most people now about.

As such in the same way that you had to do a deal before with AT&T in order to do communications-related transactions, you currently have to do a deal with a bank to do payment related transactions. That chokehold basically is what prevents many different kinds of transactions from happening, because banks are no more built for that than AT&T's phone lines were built for many, many small packets being sent back and forth. You needed fiber optics. You needed other kinds of pipes.

As a rough analogy, if you tried to send 10 million micropayments back and forth, the bank would ban you for fraud and you wouldn't be able to do that — First, you wouldn't be able to initiate that many payments. The bank would ban you for fraud.

Second is the fee is associated with them would be too high since you're eventually going through the bank and so on and so forth. Now, the way that people can get around that to some extent is they virtualize it. Google for example will record every single page impressions you've had. It's like a virtual currency, and then will payout on a time average basis.

For example, after 10,000 page reviews, you use, $3 of whatever it is. It's like they're maintaining their own virtual currency within the Google ecosystem. They're not trying to do a

bank-to-bank transaction and settlement every single time and so they're building a credit for you by writing to their database. That's a higher throughput thing than trying to actually to do a settlement.

However, there's many issues of that, one of them is that when you do that, you promote centralization in the sense that Google can freeze your funds, or PayPal can seize your funds. Anytime you're doing things that are off-chain for a long period of time where you don't have custody of it, you've run the risk of them saying, "Oh, you had 300,000 page views and you've $400 in your account. Guess what? Google has frozen it and you can't cash it out," and that happens to many, many people many times.

There's other issues as well, but another one is that, often payouts from Amazon Mechanical Turk, or PayPal, or Google only happen, let's say, every 30 days. You can't just get the money right away. What that means is that if you've got a business that's based on the velocity of money, for example you need to collect all the money here before you go and buy some goods there to then struck the next step in your supply chain, if the settlement has to be fast, then you can't execute the next step. You're looking puzzled. Let me try and give a concrete example.

[0:29:31.3] JM: No. No. I'm not puzzled. What you described with — You basically described TransferWwise. TransfeWise in terms of a thing they set up, "Okay. We're holding Jeff's money in a transfer-wise account in Australia, and so that, Jeff, if you need 15 microtransactions to Australia, we will make it seamless for you to make all 15 of those. We'll bundle those into so that it doesn't get rejected."

[0:29:58.5] BS: Yeah. TransferWise is an awesome company. We're investors in TransferWise. Taavet is a great guy. My friend and colleague, Ben, is on the board, so I have nothing bad to say about TransferWise. Great company.

[0:30:07.4] JM: You didn't say it wouldn't work, you just said it was centralizing.

[0:30:10.1] BS: Basically, companies like that are essentially doing the absolute best they can given the legacy payment Rails we have. They are a virtualized layer. It's as if we did all kinds of

hacks and stuff on top of phone lines, but fundamentally if you can replace phone lines with fiber optics, you can do a different kind of thing.

[0:30:34.0] JM: Sure.

[0:30:35.9] BS: Here is another analogy. This is a kind of thing that you would not be able to do with the current system, but I think that you will see within five years or so, especially — You might be able to do this with Ethereum today, actually. Basic idea would be — Let's say you have a million people around the world and each of them wagers 10 cents per day and puts them into a single smart contract, and so they just hit a button to basically wage your 10 cents a day, and they are in Nigeria, they are in India, they are in Brazil, they are in Japan, et cetera. At 10 cents per day at a million people, that's $100,000 a day, and then this algorithm picks one of them at random and pays them back out.

Now, what's cook about that is digital currency relative to the existing payment system is really good for payments that are very large, very small, very fast, very international, and very automated, or some combination thereof. What that particular example has is it has very small, fast, and international payments in, because you're receiving a million payments of 10 cents from a lot of places, and then very fast, automated, large international payments out because then you're paying out $100,000 to one of people on a bunch of countries.

That kind of application would be impossible with the current banking system, because the fees and the scale would kill you in terms of the inbound. The sheer number of countries you have to support for a fast $100,000 wire would kill you on the outbound. There's no way you'd see that with —

[0:32:04.6] JM: You think that would be the case even there were 20 companies like TransferWise that were mediating transactions on top of the core financial technology.

[0:32:14.0] BS: Yeah. It's something like that basically be the — What it does is it gets you into a box within the current system where you might be able to hack one aspect of it or another, but you start acting like five of them, it just starts to become something where the current system is just not really setup for that. That's an example. It's not exactly an artificial example, but it's

something where small, fast, international payments in; large, fast, automated, international payments out. That's just not that easy to do especially on that time scale. If you want that to happen within the course of a day, an international wire takes like three days.

You might say, "Okay. Balaji that sounds like a hypothetical example." First is I think something like that would be one of the most popular applications on the internet, frankly, because it's just bets and free money, but the second thing is something like that is also a toy application for a new kind of like real time crowd funding.

Imagine if you could collect money as quickly as you can collect 7,000 up votes and then actually spend it on something. The latter aspect, yes, you can collect money on a GoFundMe, or a Kcikstarter, or something, but the settlement is instantaneous, and that means you can't spend it instantaneously, and that means you can't write a program to spend it instantaneously. That means that there's whole applications that we aren't seeing, because the settlement part is not happening in real time.

I think that there's very new kinds of things that could happen if you could have a program that could just immediately start spending the money after you've gotten it. For example, you can crowd fund something and as you're crowd funding it, you're seeing the page populate with what you just bought. The money is being spent by a program, or something, and you're seeing it populate. Those are the things that will happen once we can get some of the latency down and that's going to be something that I think digital currency will allow.

[0:34:04.7] JM: Okay. Speaking of that, the transaction throughput right now is obviously quite low on the Bitcoin network.

[0:34:11.9] BS: Yup.

[0:34:12.9] JM: Explain why that throughput is slow.

[0:34:15.8] BS: The throughput currently, at the absolutely maximum, people have quoted seven transactions per second, but that's really an upper bound. It is this very much discussed

block size issue where there is a limit to the block size in the Bitcoin network, and that limits the number of transactions that can happen per day.

Now, if you are somebody who cares mostly about the digital gold or store of value application, then you don't really care about the block size issue very much, because you buy $50,000 worth of Bitcoin once a year and you sell it three years later. Your transaction volume is extremely low. You don't really care if the fee is one cent, or 50 cents, your vision for the system — All you care about is that you can get it out at some point and that the private keys work and so on and so forth.

That leads people towards a small-seed conservative model where they say, "Look. Digital gold is enough. If we just get the gold, gold has a $2 trillion market cap. Boom! Let's just go and compete with that."

That is both the reason that that transaction volume is low and why some people don't think that that's big a problem. Conversely, if you want the Bitcoin economy to grow very large with actual transactions happening within Bitcoin, you have one or two options. The first is so-called second layer solutions, and these are Lightning and so on and so forth. Now, I'm a big fan of the guys who developed lightning. I think that the technology is good. Payment channels are interesting. All these stuff is interesting, but it is a whole second layer.

It is a whole second layer that is as different from Bitcoin in many ways as — I don't know. The OS from the raw hardware. It's not exactly the right analogy, but it's basically a huge caching and system of intermediary hubs and deposits.

[0:36:17.1] JM: Not to mention, centralized.

[0:36:18.3] BS: Yeah. Potentially, centralizing. These hubs are potentially centralizing, but let's just say it has properties of the current system. It's just a different system. It's s whole second system with all that entails, and it's not just the existing system expanded. On the other hand, it allows you to maintain the stability of the current system and then push all the risk and theory to that second one. If you're a digital goal kind of person, Lightning seems like a good solution.

You basically push the risk up to the second layer of the high throughput stuff and you leave the lower layer intact. Fine. Okay.

There is another solution for this, which is "increase of block size", and this is — I would say probably where most corporations, venture-funded corporations in Bitcoin are. Probably where most venture capitalists are. They think the block size should be increased, because basically the Bitcoin network should handle lots of traffic. Their argument is in favor of that. One of them is that the block size does not directly — There's a premise that often people put which is that is a small block size means greater decentralization. If you look at the network, there are — You measure the Gini coefficient. Gini coefficient is a measure of inequality.

What's interesting is you can call — Inequality, you can call it centralization. They're not exactly the same thing, but they are actually kind of related, and normally those are concerns of different political factions, but you can use some of the same measures to measure them.

If you measure the Gini coefficient of, let's say, miners, developers, exchanges, stakeholders, et cetera, the degree of inequality of centralization, there a most centralization with miners, and the second most with developers, and third most with exchanges, and the fourth with stakeholders in the Bitcoin community. Roughly speaking, you can argue that, but I think that that ordinal ranking would hold.

What that means is that the premise that the small block size is causing decentralization is just simply not accurate, I don't think, because you have mining centralization already. What the small block size main theory do is that you've got more nodes out there, but nodes are the bottleneck. They're not the most centralized component right.

Even if, for example, you took the number of nodes just theoretically down from 10,000 to 1,000 but you've increased the number of miners of significance, from 10 to 100, the overall decentralization of the system would increase as measured by the number of people you have to get into the room to compromise the system.

From a system's lower perspective, I think that that's an interesting concept that you basically think of, "Okay. How do I measure the centralization of a system? I measure the Gini coefficient

of every individual component and the number of folks you need to get into a room in order to break that system. Trading off, where we have an excess in one area for an increase in decentralization of the other might be a good tradeoff."

With that said, then, there's a counterargument, which is certainly true that a large block size certainly does not necessarily mean that you're going to see more miners, or more significant miners. Anyway, I didn't mean to digress, but just what my thoughts are.

[0:39:41.3] JM: No. No. Let's digress. The whole block size debate, every time I try to look into it, I just down the rabbit hole and I don't know what the answer is and it feels like a very — Something that's going to be very hard to know until we're looking at it retrospectively what was the right decision, but we can at least look at the ways that the Bitcoin community is handling the governance. What does that tell you about the community? Are you content with how the community is handling this debate, or do you feel like it's unhealthy and politically toxic?

[0:40:25.1] BS: Yeah, it's something where it's been fairly rancorous within Bitcoin. Here is an argument, a counterargument, and then a counter-counterargument. The obvious point, the obvious argument is, "Wow! There's a lot rancor and negativity and so on within the two main competing factions within the Bitcoin space right now, the big blockers and small blockers." That's the obvious point.

The counterargument is despite this, and despite this going on for two years, Bitcoin set an all-time high, or close to, and it's been proclaimed dead many times and the thing just keeps going. Maybe what all the fighting is doing is just attracting a lot of attention to it. The no publicity is good publicity argument, or no publicity is bad publicity. In addition, what it has done is basically indicated people, "Well, this thing is so bulletproof and bombproof that it's just really hard to politically attack." There are folks who will do a soft fork, and a hard fork, and a miner associate soft fork and so on. There are so many different ways, like in this rock, paper, scissors game of checks and balances, that it's just gridlock.

There's a theory — Lots of folks in the U.S. believe that gridlock is actually good. Gridlock is survival, right, because it means then the garment can't do anything. If you don't want the garments to do anything, then you're pro-gridlock. There's a thesis on that. It's a respectable

school of thought. The gridlock is good thesis, where you don't really — This is small-c conservative who just wants their digital gold, and then you don't care what's happening. Who cares?

If you're just in a time capsule — There's been so many controversies about Bitcoin for the last eight years. It's actually insane. There's the Bitcoin is Dead website and so on. This would be the counterargument.

Then, the counter to the counterargument is to say, "Well, yes, it's true that Bitcoin's had an all-time high, but that's certainly like Steve Ballmer saying that, "Hey, Microsoft profits are an all-time high." While Microsoft profits are an all-time high, the innovation has gone somewhere else and there's Zcash and there's Ethereum and there's all these infighting within Microsoft. There's all these infighting within Bitcoin. Yes, we're still coasting on the momentum of the past but we have lost the innovation of the future, or we're in danger of losing it.

Then, what is needed is the right leadership. The way that Satya had totally turned around Microsoft, actually. He has done, and not to digress, but absolutely insane job for a company of that scale. He's done a really, really amazing job.

[0:43:10.6] JM: Or the way that Vitalik has led Ethereum the entire time.

[0:43:13.0] BS: Yeah, exactly. That's right. Vitalik has gone — You have to give Vitalik his props. He took Ethereum from nothing to where it is today. He took it through the DOA. He took it through very, very, very tough times. He had to layoff lots of people before the Ethereum crowd fund. He managed to navigate all the legal issues and so on. He's not yet gotten any issues on that score.

[0:43:33.0] JM: Steve Jobs of cryptocurrency?

[0:43:34.7] BS: He's good. We'll see where things land up. The thing is that he's definitely made an impact. The interesting question to me is where each technology lands from a niche perspective. Ethereum's big advantage is it's easy to program with. Its big disadvantage I would

argue is that it is centralized and it is something where one person can — As we saw with DAO, basically reversed the immutable system.

For all the digital gold people, Ethereum is a non-starter, because it is something where if it gets political hot enough — The DAO — Yes, there's political heat around the DAO, but that was — In the grand scheme of things, nothing compared to something like the financial crisis.

[0:44:28.8] JM: Sure.

[0:44:29.2] BS: Right? The financial crisis was — I don't know. If you measure by newspaper articles, or scale of impact, a thousand to 10,000-X greater?

[0:44:36.2] JM: people still look back. That was handled so poorly. Whereas most people with the DAO are like, "I'm happy with how that went."

[0:44:42.5] BS: Yeah, exactly. But the issue is that it is not so much that the DAO issue is handled — I think given under the circumstances, like Ethereum, or Vitalik did what he had to do. One of the issues was had he just let it stand, the DAO attacker would have had — Whatever, 10% of 14% of Ethereum and over some large take, like 4%. I forgot the exact number.

Then it would have been very difficult to rule out an eventual proof of stake algorithm, because they would have had the DAO attacker being able to vote on all these stuff. That's probably not the guy you want to have 4% of Ethereum governance or whatever the percentage was.

He was in a bit of a hard place there. It was an issue because they talked about the immutable code of the DAO and all that type of stuff. The best decision was made at that time, I think, in retrospect. With that said, what it did was it made a very obvious to any regulator watching, or any large company, or any government agency watching, and they're certainly watching at this point, that, "Okay. We have kind of a game plan for how we would unwind any transaction on the Ethereum network."

You know what? That is a feature. Undo is a feature. The question is though; how far do you go with that? One issue with the code immutability thing that, still, I don't know what the answer is on this, but I may throw it out for consideration. With an algorithm like Quicksort, you can write it down and have it be done and then it's like this immortal kind of thing. It can go on Donald Knuth's book of algorithms and it basically doesn't change from 1970 till today. Maybe you might have to modify it for some integer overflow thing where it didn't contemplate such large datasets, but that's basically about it.

Most business logic is not like that. Most business logic — Amazon's website —

[0:46:44.5] JM: CodeWrite.

[0:46:44.4] RL: Yeah. Not just CodeWrite, but also dependencies just that — Any kind of website or any kind of code of any complexity. As your listeners know, a lot of the work is in the maintenance and the modification of it in response to users. As it grows, you're going to have to change it. For all kinds of unanticipated reasons, humans are just unpredictable. Business has changed all that.

That suggests is that the class of code that you actually want to decentralize and make immutable is a limited class, because if you decentralize and make it immutable, you cannot edit it anymore. At least if you are editing, you sort of defeated the point of decentralizing it and making it immutable.

Hence, what you want to decentralize and make immutable is maybe the Quicksort type stuff, or maybe just like the raw contract, and then you got to really, really, really, really get it right, because if you're constantly updating it in the Ethereum block chain, well, okay, there's a record of you updating it. I guess that's better than nothing, but it's not that much different form having a centralized company that you just trust. If you trust somebody to keep updating the contract or the code on you, well, you're trusting them.

The room for exactly where decentralized code execution gives a 10-X advantage over centralized code execution is not yet obvious to me. I don't know what that application is. I think that — We'll see if we're right about this, but I think that what we're doing with the inbox at 21 is

going really, in some ways, two years or three years earlier and saying, "Okay. We have a decentralized currency that now works, that's robust. How do we make an application with that that is 10-X and that's different from what's come before?" It's been hard to get people paid out. Just the payments bit alone has been hard.

I think that in the future, as we get that, when we get a million or 10 million people that have digital currency balances, then, I think some of the smart contract stuff and so on becomes interesting. I think that, at least right now, it's not obvious what you'd want to decentralize from a code execution standpoint and if you don't know what that is, then it's not obvious what the gain is over just using it for pure payments.

[0:49:03.3] JM: We play out Bitcoin and Ethereum towards the future and we assume Bitcoin remains this ossified digital gold and Ethereum continues to moves fast and hard fork whenever they need to. The Ethereum people tell me, "Oh, Ethereum will become a place where smart contracts are formed and Bitcoin is used as a medium of exchange for those smart contracts," and some of the Bitcoin people will tell me, "Oh, Ethereum will be transacted on the Bitcoin network."

I feel like I'm ill-equipped to even really understand those statements, or maybe I'm not even wording them correctly, but give me a sense for the synergies of the Ethereum world and the Bitcoin world once we're in — If you play this forward 5, or 10 years, or however long you need to get to the point where people are actually using these things, for utility rather than raw speculation.

[0:50:07.6] BS: Yeah. If you look at where the gold market is, it's a 2 trillion market cap, and that's like a hundred-X where Bitcoin is. If the only thing Bitcoin is it wins digital gold, that's a world historical importance. That's a very good application and shouldn't be dismissed. Not that one is dismissing it.

Ethereum by its nature, because it's programmable, because it's [inaudible 0:50:31.6] incomplete, because it is reversible. I'm trying to beat a dead horse with the DAO thing, but it's set a precedent for how the network would work. Because of that, it may be, for example, the actual second layer. That is to say, it might be — Right? It might be something where you hold

most of your money in Bitcoin and then you had an exchange like ShapeShift and you transfer some of it into Ethereum as your checking account. Bitcoin is your banking account. Ethereum is your checking account. That's one model.

Another model is that we have a bunch of different cryptocurrencies just like we have different social networks, and then it's just not obvious which one wins, but there's a Facebook and there's a LinkedIn and there's a Pinterest and there's an Instagram, there's a Twitter and there's this and there's that. In the same way, I think there's a Bitcoin and there's —

[0:51:23.8] JM: Those are so balkanize. Sorry to interrupt you, but those are so balkanized and they resist synergies often times. Facebook certainly resists synergies.

[0:51:32.6] BS: That's true. I would say cryptocurrencies have or two really critical aspects of them which are, first, you can, from the beginning, sell them for a fiat and then bring it back into another cryptocurrency. There is an exit, export all your data in a way that Facebook or LinkedIn never had. That's one.

With a very unified format, namely a wire of whatever, or 100,000 or a $1 million to your bank account. Boom! You could just export it all to your Ethereum, or all your Bitcoin.

Because of that, I'm very bullish on debility for value to flow back and forth between cryptocurrencies in a way that it couldn't really between social networks. The lock in is less with any individual cryptocurrency, that's number one, I would say. Number two is I believe in sort of a meta-political view in a sense that the right governance model for cryptocurrency, we don't know yet. Maybe, probably the right answer is to just experiment with a 100 different kinds of governance.

There's proof of work with Bitcoin, and Ethereum wants to move to Proof-of-Stake, and there are some issues, by the way, with Proof-of-Stake which they're well aware of and they're working on. One of those issues is basically that if you have Proof-of-Stake then you could have a chain which can just keep getting extended by the stakeholders. This is the so-called stake-grinding problem.

What that can lead to is a hydra of competing chains and you can't just distinguish between them by saying which is the longest chain in validating the hashes? Instead, you have to effectively ask Vitalik or somebody very trusted which one is the Ethereum chain. That introduces trust into the system. Whereas Bitcoin, you can pull the network, you can look for the longest Bitcoin chain and you can validate all the hashes going all the way back to t = 0. It is literally an algorithm that I can write in a few hundred lines of code that I can confirm mathematically without any human involvement based only on the fact that I know the difficulty shy hashing.

The cool thing about that, the Proof-of-Work is you literally don't need to trust anybody. You would not have been able to fake this data structure without an enormous amount of computational power. The amount of computational power that's required to get to this point can be computed from it and you can also see if there's a fake hash, or something like that. Proof-of-stake isn't like that [inaudible 0:53:57.4] trust.

There's a third model which people are now discussing in the context of Bitcoin which is what I would call proof of work change, or unpredictable proof of work change. With proof of work, ultimately, where power goes to is it goes to miners, because they ultimately are the ones who are approving transactions. People can argue at this point, but that's where the greatest degree of centralization is in Bitcoin right now and the second greatest to developers, but basically a miner can approve or disapprove transactions and they have a lot of leverage in the space.

With Proof-of-Stake, arguably, the power goes to stakeholders and the largest stakeholder and then you trust the largest stakeholder. Then, with changing proof of work, the concept there would be something where developers would periodically change the proof of work function in such a way as to resist so-called [inaudible 0:54:49.4] in datacenters and so on.

Doing that would basically mean that you have one of two things. Either, A; you publish the proof of work change schedule in advance and probably somebody can figure out how to put that into a chip. If you publish what the proof of work is going to be from every year from now until 2100 and you put that out there, that is an algorithm. Probably, somebody could put that into a sufficiently complex chip, or what you do is every six months you pull from a vat of entrails and you say, "Oh, this is what the proof of work is going to be."

If you do that, now you have truly defeated [inaudible 0:55:27.7], because it's unpredictable. But where power now rests is with something that's similar to the Fed Open Markets Committee, because the group of developers that is figuring out what that new proof of work is going to be is sort of similar to the Fed Open Markets Committee figuring out what the interest rates are, and then there's a huge incentive to know what proof of work they're going to pick, because then you could have your chips ready in advance and so on and so forth.

Door one sort of leads to centralization by miners; door two, centralization by stakeholders, door three, centralization by developers. I think what the answer is is basically that centralization is tolerable so long as there is an exit. The exit is sell your coins, get cash, start a new coin. As long as there's constant, I'm bullish on the   cryptocurrency as a whole.

[SPONSOR MESSAGE]

[0:00:00.3] JM: Spring is a season of growth and change. Have you been thinking you'd be happier at a new job? If you're dreaming about a new job and have been waiting for the right time to make a move, go to hire.com/sedaily today.

Hired makes finding work enjoyable. Hired uses an algorithmic job-matching tool in combination with a talent advocate who will walk you through the process of finding a better job. Maybe you want more flexible hours, or more money, or remote work. Maybe you work at Zillow, or Squarespace, or Postmates, or some of the other top technology companies that are desperately looking for engineers on Hired. You and your skills are in high demand. You listen to a software engineering podcast in your spare time, so you're clearly passionate about technology.

Check out hired.com/sedaily to get a special offer for Software Engineering Daily listeners. A $600 signing bonus from Hired when you find that great job that gives you the respect and the salary that you deserve as a talented engineer. I love Hired because it puts you in charge.

Go to hired.com/sedaily, and thanks to Hired for being a continued long-running sponsor of Software Engineering Daily.

[INTERVIEW CONTINUED]

[0:57:43.3] JM: With had Numerai on the show recently to discuss how they were using their own in-house crypto — Have you looked at Numerai by the way?

[0:57:52.9] BS: It's a hedge fund — Right. Yeah.

[0:57:54.7] JM: They have this interestingly — Where they introduced their own cryptocurrency to incentivize long-term thinking in the participants in the data science tournaments that they hold for their crowed-sourced hedge fund. The reason I found it interesting was just because maybe I just don't know this space very well, but it was the first time where I actually saw, "Okay. Here is somebody actually building a utility —" Actually, it was a smart contract, but a smart contract in a way that makes a lot of sense. It actually is a unique form of utility. I guess I have a couple of — Are you starting to see smart contracts that actually make sense that are getting deployed?

[0:58:39.5] BS: I know of Numerai. I don't know whether or not they are — I'm not familiar with exactly what they're doing in terms of smart contracts. If their smart contract is a coin that they had themselves control, that's —

[0:58:56.6] JM: That's not in Ethereum.

[0:58:57.5] BS: It's on Ethereum.

[0:58:58.5] JM: No. It's on Ethereum.

[0:58:59.4] BS: It's on Ethereum. Okay. Okay. If it's on Ethereum, then maybe it's a good use of smart contracts. I don't know. I haven't looked into it. I would say that, in general — And this is certainly not a criticism with Ethereum, it's not a criticism with the community. I'm bullish on them long-term.

In general, I have not seen a production smart contract. By that, what I mean is something where there are serious amounts of money flowing through it. The serious amounts of money flowing through the space are basically in three things. First; crowd funding. Two; exchanges. Third; mining. That's where the tens of millions of dollars are. There has not really been an application yet that is working on their areas. We'll see if there —

[0:59:41.4] JM: Is that because they can't think of it, or people are afraid to deploy it?

[0:59:45.5] BS: I think it's like actually — A lot of these things are very obvious in retrospect, but they're not obvious in foresight. For example, in 1990, Google was not an obvious application. Rather, it was certainly not as obvious that it'd be as profitable as it is.

Facebook, not obvious that it'd be as profitable as it is. There is lots and lots of good ideas that sound like good ideas that came up in the 90s that only eventually the prerequisites came into place for them. I think there's plenty of concepts people are talking about with respect to smart contracts that will all eventually work, but that first one that really works is it's not going to be obvious, I think what that is until it's gotten to ten or hundred million dollars in revenue.

[1:00:32.6] JM: Is that because people aren't thinking of them right now, or because —

[1:00:36.8] BS: There are lots of people working on it.

[1:00:38.3] JM: Okay.

[1:00:39.2] BS: Yeah. There's tons — I see lots and lots of pitches for them. I would say though that basically — In general, you usually don't want to build a business on bleeding edge technology. The reason for that is it's unstable. As an analogy, for example, my first company that I started was a genetics company. Doing very well. With that company at the time, this is 2008, or thereabouts, there was a choice in the community between — Or where most the attention was. The coolant smart contracts for the genomics community at that time was so-called complex diseases. That is, what are the jackfruits of diabetes and obesity and all these things which are multi-factorial and so on.

The thing is the more multi-factorial, the more complex it is, the more loose the genetic correlation because, of course, the same person can be both skinny and fat and in different points in their life. Hence, it's not a purely genetic thing. There are environmental variables, which means your signal is already reduced and so on and so forth.

Because it was hard, it was interesting to academics, and that's why they worked on it and that's where all the energy was and the focus and so on. What we decided to do was actually take all the stuff which had already been nailed, that was already working, at least what in academic defines are working, which are all the Mendelian diseases, like cystic fibrosis and [inaudible 1:02:03.7] and so on. Those were things that have been in the textbooks for decades and that people had known how to test for for years, but no one had bundled them all together, productized it, use modern technologies, not bleeding edge, but two years old, three years old, and then used them actually in clinical practice to reduce the cost of things.

Just doing that, we've actually ended up changing clinical practice. Literally, a month ago, a guideline came out saying expanded carrier screening is now recommended for all women. That was, in its own way, a very controversial thing back in 2010, 2009 when we first proposed it. We've literally changed clinical practice at counsel.

The complex [inaudible 1:02:43.5] stuff has still not fully been solved almost 10 years later. Progress has been made. I'm not saying it hasn't been made, but it's still not something I would say you can productize yet. This is similar to when I started teaching stats at Stanford, there's an older professor, he's a friend of mine and he said, "Balaji, any problem that you find interesting is too hard. Don't assign to the suits."

Because if you find it interesting as somebody who is living and breathing computational statistics all day, it is definitely too hard for somebody who's just learning it. The same way, if there's a technology you find interesting, that means there are some uncertainty in it and that means it's probably too hard to use in production. You really want something which is two years old, three years old, not so old that you don't get any technological advantage out of it, but now so new that you're the one who is stubbing your toe on all the infrastructural things, because when you're — Actually, as you know, when you're developing software, it's about, "Hey, has somebody on Stack Overflow seen this bizarre bug that I've seen?" If somebody else has

skinned their knee on that and already done that, then you can go and deploy it. I think smart contracts are still in that stage and will be for a little while. I'd say, sending and receiving Bitcoin, turning it into the fiat, the infrastructure has been built for that now and I think now we'll start to see applications because infrastructure is set.

[1:04:07.1] JM: Last question. What are the pieces of Bitcoin infrastructure, whether you're talking about software or a hardware that people are not working on that you wish people are working on.?

[1:04:20.2] BS: I'd like to see a resolution for this block size issue. That's an obvious one. I think that — I think that what we're working on would be — Is certainly one thing I'd like to see which is allowing people to actually earn digital currency for doing things. If they can earn digital currency doing things and they're getting it for free, they're more generous with. They're more likely to experiment with it. We can add a plug in, for example, very easily so that people can earn not just Bitcoin but Ethereum and Zcash and so on.

You go to 21 and you can get any digital currency you want simply by filling out some surveys and clicking some buttons. We can have a menu of new digital currency, new digital currency of the week that you can just play around.

[1:05:04.0] JM: What's the next thing that you're going to build on in addition to the messaging system?

[1:05:08.0] BS: Good question. We have a bunch of things coming over the next couple of weeks. One is we're going to make it such that you can forward any email that is an unsolicited commercial email to 21 or 21.co. What we will do is we will send a balance to that person saying, "Hey, go to 21.co, Jeff Meyerson, because Jeff is really busy right now, and pay it and get in touch with Jeff."

This way you can clean out your inbox and every week you forward 100 emails there and maybe five of them turn into balances where they actually want to get in touch with you and they're willing to pay for your time. It's basically —

[1:05:49.7] JM: That's great.

[1:05:50.3] BS: That's great, right? Save time, make money, very easy to understand. Instantly, because, just forward to 21, 21.co, very easy to remember. It works in Outlook. It works in Gmail. It works in Hotmail, whatever, Yahoo Mail, all these things, mobile web, all these stuff. No plugins or anything like that. That's one thing that we're launching and I can add you — All Software Engineering Daily people, we'll send in a link to the list so you guys can try that out earlier.

[1:06:12.2] JM: That sounds great.

[1:06:13.6] BS: Okay. Second thing that we're adding is basically dozens and dozens of new lists. You've probably seen that you can contact famous individual people like Mark Anderson, Ben Horowitz and so on and you can also contact lists of VCs and angels and whatnot on the 21 site. Okay.

We're launching now our lists where it's like thousands of Facebook users, or thousands of Bitcoin holders, or thousands of engineers, thousands of Stanford students. With one click you can now contact thousands of people. If you're launching a new old coin, guess what? You can now contact a thousand Bitcion holders and pitch them on the old coin. Or if you're recruiting a Stanford student, you can one click contact a thousand Stanford students and get a yes-no on a decision.

You're basically buying an action from people at scale in a way that hasn't really been possible in the internet before. You could certainly run ads before, but this is an ad. You only pay if you get a reply. If you show it to them and they don't do anything, then you don't pay anything.

[1:07:11.4] JM: That's great.

[1:07:12.7] BS: What's cool about that from the buyer's, obviously, has some value. You're able to script thousands of human beings. From the seller's side, it has value because we think of each list that you can apply to. For example, apply to the Stanford students' list, or apply to the Python developers' list, or apply to the Facebook users' list. Each list has a price associated

with it. If you apply to the VC list and you join, the price will be, let's say, $50 per reply, because that's a very elite hard to get on to list.

If you applied to, let's say, the Python engineers' list, it might be $5 per reply, or $10 per reply. If you apply to the Facebook user list, it might only be like 10 cents per reply, because there's a billion Facebook users. Each of these lists, it's like a micro job where the Python engineer list might give you 100 emails a year at 10 bucks a reply. That's like a thousand bucks a year as a micro job. It's not a full job and it's not a micro task, it's something in between. You qualify for it once. You fill out the application. If you get on to it, you have a steady stream of work which you can just complete from your own convenience. That's the second thing we're launching. We've got more, but those are I think two pretty interesting things.

[1:08:27.9] JM: Okay. Balaji, thanks for coming on Software Engineering Daily. It's been a pleasure.

[1:08:31.9] BS: Okay. Great. Guys, go and sign up at 21.co.

[1:08:34.8] JM: Yes.

[END OF INTERVIEW]

[1:08:46.3] JM: Thanks to Symphono for sponsoring Software Engineering Daily. Symphono is a custom engineering shop where senior engineers tackle big tech challenges while learning from each other. Check it out at symphono.com/sedaily. Thanks again Symphono for being a sponsor of Software Engineering Daily for almost a year now. Your continued support allows us to deliver this content to the listeners on a regular basis.

[END]