Mathieu (00:20.16)
Thanks for coming back, Pallavi, on the SSI Orbit podcast. This is the second time we're doing an episode together. I was just looking while preparing for this one. At the last one we did, and it was basically two years ago in October, 2023, we were recording this right at the end of October 2025. So it will come out in November, but it's basically been two years since we did the last one where we covered the launch of Bhutan's National Digital Identity Program.

And in that episode, we discussed the philosophical approaches, like how decentralized identity architecture was being followed, why privacy was important, how self-sovereign identity principles were being followed. And we had started talking about some key drivers for the program and some key use cases looking forward from 2023 onwards towards adoption.

So now that we're two years later, if we look at what's happened in the past two years, there has been quite impressive adoption of the National Digital Identity Program. I think some of the numbers I saw were about 420,000 users out of 770,000 eligible populations. So Bhutan is not a big country, but the adoption numbers are quite impressive, about 80 % of the eligible population within two years, which is kind of crazy. So I guess my first question is, how have the past two years been? I'm sure it's been crazy on your end, but I would be quite interested to hear about the journey in the past two years to hit such critical mass of adoption so quickly.

Pallavi (02:03.18)
Thank you so much, firstly, for having me. It's always so nice talking. But yeah, that's right. We've come a really long way. It's been two years and we've hit major milestones. We began by just issuing foundational ID from the Department of Civil Registration and Census, but now we've also moved on to expanding these use cases. We have completed integration with all of the major banks with insurance companies, and the telecommunications sector.

We also have completed integration with over 50, or I think that number must have increased by now, maybe around 70 public service providers. And not only on the use cases side, but we've also focused on enhancing the platform itself through new features, value added features, which is going to make the digital experience much more seamless and unified for citizens.

And apart from that, we've also moved from being a government funded project to spinning off as a startup that's held by Druk Holding and Investments. So a subsidiary under DHI. So that has also led us to redirect some of our strategic decisions around commercialization, creating business cases and generating revenue to ensure that the business is sustainable, if not making large profits, because at the end, this is a social project and NTI does act as a digital infrastructure for the nation.

So, but we also, because of this move to becoming a startup, we have had to change some of our strategic decisions as well. So it's been very interesting. We've moved really fast, but I think we've, like you said, we've hit over 80% of the population in terms of onboarding. So that has been amazing. I think mainly around getting users to adopt, I think the decision to not just provide verifiable credentials to the users, but also enabling them to access services ensuring there is inclusion in how business service providers also provide their services to citizens. I think those are some of the things that have really shaped adoption for NDI.

Mathieu (04:41.00)
Has there been any pushback from the population at all on this? I know coming from Canada and following stuff that's happening in Europe or throughout the world, I think Bhutan is a country that's structured perhaps differently governance wise than some other countries.

But I'd be curious of just better understanding the landscape of Bhutan from a political standpoint from legislation that's perhaps needed to make this happen and then how this gets pushed down because the type of adoption that was achieved sort of reminds me of a country like Singapore, for example, where there seems to be very tight integration between public sector and private sector. It might be useful to just dive a little bit deeper and so folks could understand maybe what is different or what is similar in Bhutan versus where our listeners may be located at.

Pallavi (05:42.05)
Right. So like Singapore, we also have a very integrated public-private sector, and that has definitely helped with adoption. But in terms of pushback, surprisingly, no, we have not really seen pushback. And I think that's mainly because we have the endorsement from not just His Majesty himself. This is coming directly from from his vision, but also other regulators like the Royal Monetary Authority for the banking and financial sector, the Bhutan Media Infocomm Authority for the telecommunications sector.

So there is a lot of regulation support in terms of the usability of NDI and the legal aspects around, for the very viable credentials or the digital signatures to get recognized in a court of law and that has definitely helped the public private sector interaction and integration has also helped.

And I think one of the major reasons that has really led to adoption and also very little amount of pushback is because a lot of the access to public services is mandated through the NDI platform. So now you probably cannot apply for your marriage certificate or get a police clearance without, you know, without actually using the Bhutan India wallet.

And these are services that are not used on a daily basis, but some of the government services or at least most of the government services do get used at least once a year. And that has really helped citizens onboard, not just citizens who are in the country, but also outside who might have to access government services, be it in terms of paying tax or applying for some sort of audit clearance or tax clearance.

Mathieu (07:47.03)
Were there already similar infrastructures in Bhutan where citizens or visitors already needed to use government or whatever mandated services? How much of a jump is this new digital identity wallet (NDI) program from what was there previously? And maybe there's a difference

also with the types of population in Bhutan. I know there's a large rural population as well. Just how much of a technical jump has it been from just a way of doing things for the population? Has it been a light jump and there's a new way of doing it that was already done online? Or is it really like skipping a lot of in-person paper-based processes and jumping straight to a digital first approach?

Pallavi (08:38.15)
So in terms of providing services digitally, there was always a system. But that is because Bhutan has a unique citizenship identifier and that was used to log in and access services. But now with NDI, it is more seamless and more unified across all service providers, be it government or private. So that is one difference.

And for a large part of the population, particularly those residing in rural areas, they were accessing services by manually visiting offices. And that required, especially those living in the highlands or in extremely remote parts of the country to travel really far distances and sometimes even on foot. So I think at least in terms of accessibility now with NDI, it is integrated even with basic services like passwordless login to access government services, but especially having your verifiable credentials issued by government organizations or even private service providers.

I think it has become much easier. It's become much cost effective and time saving and also all of the status and tracking of your applications for services is in one place through NDI. And I think that is really the jump. Earlier, while there was a digital way to access services, it was quite fragmented across different service providers. I think integration is what really makes life easier for the citizens.

Mathieu (10:27.04)
And what's the lift so that there's been? Obviously you talk about integration with public services, but also in the private sector you talk and again, I don't know the involvement of the government across these sectors. But when you start talking about financial services or telecommunications or other, I guess, major sectors, it's always quite difficult to push innovation with large private sector organizations who have their existing priorities and by nature, they're typically just not agile organizations and can move very quickly.

So it seems like the type of traction that was achieved in two years is quite significant and quite impressive. So I'm curious about the role that the Bhutan National Digital Identity Organization plays in terms of deploying these systems, like what are the different components? It would be interesting to understand what are the products that you're putting into the market, like the NDI wallet, I'm assuming is a major part. But then when you talk about some of the infrastructure pieces, like needing to have probably registries of issuers and needing to have issuance infrastructure and needing to have infrastructure for relying parties to be able to reliably consume credentials.

What does the NDI program provide versus what are the private sector entities doing in this case? And how does all of this become operational so quickly? I would be very curious.

Pallavi (12:09.20)
So when we started and we started, I wouldn't really necessarily call it sales, but just pitching to these private sector organizations and corporations to integrate with NDI, we had a very simple use case, which was passwordless login, just to streamline accessibility to the services they were providing.

And then we expanded that into issuance of verifiable credentials, be it mobile number as a VC or your banking credentials as a VC, employee credentials, which now is available for both civil servants and corporate organizations. So it was basically around issuance of these kinds of verifiable credentials and passwordless login.

But then what we did, the strategy we adopted was working very closely with these corporations, understanding their business problem, how to unify and ensure that there is end-to-end digital workflow, and also working very closely with regulators in each of these sectors so that we have their endorsement, we have their support, because without a legal backing, even if we were let's say, promising remote onboarding of customers without the endorsement of the regulators, that would not really be possible.

So we worked very closely with, for example, the Royal Monetary Authority for financial institutions. And then we worked very closely with the banks when we were just implementing passwordless login to understand their business workflows and what that entails. And maybe we'll come to it later, but when we talk about verifiable credentials and remote onboarding of customers, initially the verifiable credentials that were issued by the government, which is your foundational ID, your name, age, your permanent address and all of that, it was good enough for the banks. But in terms of regulation around EKYC mandates, NDI didn't meet those mandates.

Pallavi (14:25.12)
So then we understood from the regulators as well as the banks that it was crucial to have your passport size photo as well as an e-signature to go onto their system for them to be able to onboard customers remotely. And then we expanded our features to include a passport size photo, which we called an image as a verifiable credential as a credential into the wallet. So these passport size photos are self-attested in the mobile Bhutan NTI wallet, but it is not just a simple uploading of any photo into the wallet. So what happens in the process is, let's say I were to take a selfie of myself and upload it to, for example, your wallet, it will not get accepted because my photo during the self attestation process gets matched with the database that is held by the government.

So it ensures that there is 100% reliability that the photo I'm uploading and submitting for EKYC purposes is in fact mine. And the reason why we chose this kind of process as against, say, the government issuing a passport size VC passport photo as a VC into our wallet is because the banks and also the, for example, other use cases like your passport itself, the passport size photo has to be six months older and no longer than six months. So that way we specifically designed it in a way that we self attest it every six months and it gets matched to the image that is stored with the civil registrations database and then the banks can use this image to onboard customers.

And same for digital signature as well. We either can scribble our signature onto the NDI wallet or we can upload it as an image. And then when a customer remotely opens a bank account, now we ensure that all the EKYC requirements that are mandated by the Royal Monetary Authority to the banks is met.

So we worked very closely in understanding their business workflows, identifying where the gaps are, and then enhancing our platform with these features to ensure that we are automating compliance as well as simplifying their business workflows.

Mathieu (17:02.03)
That's super helpful to understand. So I'm assuming like the, the difficult thing in bootstrapping any one of these ecosystems is just having a good supply of verifiable data that's available to consume. And then it becomes much easier for third parties or different types of organizations to just want to consume data as a verifier or as a relying party because they're able to get benefit right away. So has that been the approach that the NDI program has said, okay, let's start issuing foundational credentials with time.

Like you just explained, you realize that there were certain credentials or attributes in credentials that were perhaps missing to meet regulatory or business needs. But has the starting point really been, Hey, bank ABC or Hey, telco one, two, three. Here's how you would just verify credentials. There's an existing supply of credentials available. You could add this as an option within your workflows to perhaps reduce costs, perhaps reduce fraud, perhaps reduce friction in user experience.

Has the process really been that of selling the verification benefits? And also on top of that, then does the NDI program provide the infrastructure for the private sector to be able to easily take that integrated. So like what's the model there?

Pallavi (18:31.23)
Right, so the approach to begin with was to simplify user experience for these service providers. And then the onboarding process, like you mentioned, for these organizations is, you know, they do have the entire ecosystem is the governance of it is managed by NDI. So, they go through a vetting process and then they are integrated through the trust registry into the NTI ecosystem. And then we ensure that they are part of that ecosystem and they enjoy the benefits of verification of credentials that are issued by other players in the same ecosystem.

So there is a trust associated with it because it is not any organization that is downloading an API, let's say from AWS Marketplace or Azure. But it is going through an entire vetting process which ensures trust and then it also helps these service providers improve their customer experience and reduce friction in how services are accessed.

Mathieu (19:48.14)
Makes sense. And are you seeing any tangible results or are there any key indicators of success that you're already getting from these financial institutions or telco providers on either more accounts being opened, perhaps like lower risk profiles for fraud? Are there existing results that you're already hearing from these implementers and adopters or consumers of these various NDI credentials in the space.

Pallavi (20:23.20)
Yes, absolutely. Particularly in the banking and telecommunications sector, we are seeing a larger number of onboarding. I'll give you an example of this bank, which is called the Bhutan Development Bank. It's a state-owned organization, and they target mainly rural employees and provide financial services and other services around loans and support to customers. So BDB was the first bank that integrated with NDI and used the EKYC services that NDI platform provided them with. And in three months, the bank witnessed onboarding of 3000 new rural customers.

So this is a completely online onboarding of customers. That is a huge number, particularly because its rural population, which means that it is also validation for NDI that we are seeing rural users use the platform. And this is making an impact in terms of financial inclusion, accessibility to loans and other financial services.

In terms of reduction in fraud, because we just recently launched our in-app OTP feature. So we are hoping to get some data from banks and telecommunication service providers to see how the P2P OTP that comes in directly into the NDI wallet is going to help reduce instances of fraud as against those OTP coming into your SIM because we are hoping to avoid or reduce some instances around SIM swapping and interception at the network level through our in-app OTP feature.

Mathieu (22:22.15)
Is the vision for this app to become a super app, like certain countries in the world have applications that manage identity, they have payments, they have a lot of peer-to-peer functionalities in it. Is the vision for it just to be a secure store of data that can be used by third parties or is the long-term vision for this to really have a lot more user journeys that are possible just within the application itself without having to go elsewhere.

Pallavi (22:58.16)
I wouldn't necessarily call it a super app in terms of digital payments and yeah, some of the features of super apps in other countries, but we are looking at because the North Star continues to remain that this is a digital infrastructure that is going to unify and ensure trust in digital interactions in the country.

So all of the layers that can come within this sphere of goals that NDI has to simplify to make the digital processes seamless to provide digital infrastructure, we are trying to incorporate these features. So just taking payments for an example, we are not moving into digital payments through NDI, but we are looking to ensure that NDI supports crypto payments or NFTs.

So including tokens in the form of NFTs or cryptocurrencies or CBDCs within the NDI app in the long term. So that is something that we are looking at. And also just expanding our use cases to land tokenization, holding your land assets, your digital assets as verifiable credentials in the Bhutan NDI wallet.

Mathieu (24:28.21)
It seems like to date the vast issuance of credentials have come from government authorities and third parties have really been using the credentials in the wallet as consumers, as verifiers.

Are you seeing interest from some of these consumers to start issuing credentials of their own into the NDI wallet and is that part of the broader growth strategy for your program is to have, whether it's financial service providers or telcos or whatever other private sector entities, whether it's employee credentials or accreditations or whatever, is the plan to expand adoption of NDI to be more than just, let's say government issued credentials towards, you know private sector or just context specific credentials that may want to be issued.

Pallavi (25:31.04)
Yeah, absolutely. So we are in fact already doing that. Initially, of course, it was just government entities issuing verifiable credentials, be it around your foundational ID, your permanent address, or even your mobile driver's license. But now we also have banking credentials coming from the banks. We are also looking to include your credit bureau in the country that gives you clearances around your loan history and all of that, getting that as a very viable credentials. We already have mobile number as credentials in the wallet. We are also now looking to help would fall under government itself, but we are also looking to issue health credentials so that individuals or users can access their health history, health credentials through the NTI app.

So that is part of a larger and long-term goal. But we are also already seeing interest from private organizations, very small private organizations with just maybe 50 to 100 employees or even less, even 20 employees wanting to issue employee credentials for their employees so that it's easier for, it's part of an employee experience so that they can access loans using these credentials, they can pay their utility bills, they can maybe book a flight for a business trip, things like that. So we are seeing interest from very small organizations, at least in terms of issuance of employee credentials, even academic credentials, training credentials for their employees as well.

Mathieu (27:31.01)
Do you see a future for NDI where there may be credential issuers that just start issuing credentials based on their own authority, on their own governance without going through the central governing body that NDI is managing in the trust registry? Do you see it becoming more

open or is it going to remain kind of a centrally managed registry of issuers and types of credentials?

Pallavi (27:56.13)
To be honest, within Bhutan, we are looking to be centrally managed through NDI. And then NDI, of course, we are regulated by the NDI governing body. But in terms of expanding our services globally, we worked very closely with PNG also to issue service passes for their citizens. And we are also exploring a partnership with countries outside of Bhutan.

So for these countries, we are exploring just providing NDI services as API or as transactables in the marketplace. But for Bhutan, I think, as of now, the strategy is still a very centralized module of issuance of credentials.

Mathieu (28:48.03)
Are you seeing any pushback or even if you're talking to different entities to issue credentials? I think in North America, as we're, as we have more more conversations with parties and get them becoming issuers of verifiable credentials, lot of the times issuers of credentials today before even doing verifiable credentials, their whole business model is predicated on being the authority for data and then getting paid basically to provide credit reports or access to data, that's the whole business model.

With verifiable credentials, once you issue data into a wallet, third parties can consume it as they wish. You don't have that same call home every time to get access to data. if perhaps, well significantly impacts the existing business models of high quality data providers today that are relied upon. In terms of broader adoption, are these some conversations that you're having with parties of what perhaps their business models change over time with this new infrastructure? Have these been conversations or even pushbacks that you've been getting from entities that want to participate in the ecosystem?

Pallavi (30:16.04)
Surprisingly, again, no, we haven't really seen pushbacks, at least in terms of issuance of credentials. I had anticipated from telecommunication service providers that there would be pushback, especially around mobile numbers as a VC. But we didn't really see that either.

I am anticipating pushback, at least in terms of our in-app OTF fee again from the telecommunication sector because that forms a part of their core business model. And also we also have P2P chat, which allows users to form a P2P channel of communication with service providers. So blast SMS's broadcast messages can directly now come to P2P wallets from the organizations or service providers to individuals.

So that would really be encroaching on the telecommunications service provider. So that's where I'm anticipating pushback in the near future. But as of now, not really. We haven't really seen any. I think where we still see some skepticism, I would say, is not in terms of issuing verifiable credentials or not even in terms of consuming these credentials. But despite having an

NDI act in place, despite having regulators of each of these sectors endorse NDI, we still see some skepticism around, you know, can I consume these credentials or can I remotely onboard my customers using data that comes from the NDI platform and not collect your, for example, our citizenship ID or even the digital signatures, is it valid? Will it hold in a court of law if a legal dispute were to arise in the future?

So skepticism in terms of legal backing, despite having one, I think that's where that's been one of our focus and that's one of the areas that we hope to resolve very soon. But in terms of pushback, we'll see from organizations are not really we haven't really seen that.

Mathieu (32:42.18)
With a lot of activity happening around digital identity throughout the world in North America or in the EU and Asian countries and Africa, how important is alignment of the NDI program to what's happening throughout the world? Are there learnings that your group has gotten from what's happening throughout the world? How important is making sure that there is interoperability or some alignment either from a legislative perspective, from a technical perspective? How do you interact with the rest of the world and has that been important?

Pallavi (33:23.22)
Yes, absolutely. Meeting global standards has always been at the forefront of designing any feature, coming up with any use cases. And we are constantly trying to keep up, at least, with what's going on, so that in terms of standards, we are aligned with the requirements, be it in European Union or be it in North America. And we are also looking to test out interoperability with at least countries that we have a good working relationship with.

So for example, the Digi Yatra in India, while we have completed integration with the airlines in Bhutan, it is mainly about accessing services within Bhutan. But now we are also testing out interoperability with Digi Yatra by providing boarding pass and visa as a verifiable credential into the NTI wallet, which we will test out if it can be verified by Digi Yatra in India because there's cross, you know, free movement between citizens of Bhutan and India.

So the travel is very seamless not necessarily just by air. There's also cross border movement happening by road. getting these credentials be verifiable through Digi Yatra app, I think that's going to be our first step in testing out interoperability, at least cross border interoperability in terms of legal acceptance of these credentials.

In terms of technical because we are trying to also keep up with what's happening in the Web3 space, like I mentioned earlier, all of our VCs were being written into the Polygon blockchain and we completed now integration with Ethereum. So this also enables interoperability between the two blockchains.

So issuance and verification across the two blockchains, Polygon and Ethereum to ensure there's technical interoperability in the blockchain space as well, to test out technical interoperability as well. So we are keeping up, are constantly testing these new features, testing these new use cases and then adapting accordingly based on the requirements because the laws also keep changing. Digi Yatra may have certain requirements today, but that might change into something else later. We're always trying to keep up and participate in the conversations that happen in India as well.

Mathieu (36:20.11)
It's interesting you bring up Web3, I think, at least from my perspective, having come from the whole crypto space. When I started on this journey and then evolved over time to working with a lot of different governments and doing national identity programs or local government identity programs, at least where I've been operating, there's a very clear separation between the public sector and the whole Web3 world.

So I would be quite interested to hear from the NDI perspective, why is Web3 or crypto important within the broader picture here? Is there a big adoption of crypto in Bhutan? You did mention central bank digital currency and stuff like that. What's the vision with Web3 versus, you these large entities that have been around for a long time, they have their ways of doing things that they're probably not really dealing with web three so much. How does web3 fit into the whole picture long-term?

Pallavi (37:34.08)
I think Bhutan has been very proactive, at least in terms of leapfrogging into these new emerging tech trends. So like you rightly pointed out, CBDC is the royal monetary authority. The central bank has been exploring CBDCs for Bhutan itself. There are also conversations for CBDC for GMC, which is the special administrative region within Bhutan. So users could hold these cryptocurrencies within the NTI app.

The government is not averse to moving into the Web3 space. If you would have witnessed or maybe not, the users might not have known as well. Even the tourism sector in Bhutan, tourism is one of our largest sources of revenue in the country and the tourism sector has also now accepted basically a Binance pay. Payment for all your tourism related activities, accessing hotel services, hospitality services, or even just food and all of that, you'll find these Binance pay scanners in even really tiny small restaurants in the country. So accepting crypto through the Binance Pay app is again one of the move in the Web3 space.

I think the government has tried to move along with emerging tech trends, especially in the blockchain and crypto space. And I think by integrating with Ethereum, Polygon, and even exploring other blockchains, not just a dual interoperability, but also multi-blockchain interoperability. I think that will be the strategy going forward as well.

Mathieu (39:34.08)
So there's use cases where to do payments via crypto rails, organizations that need to adhere to know your customer regulations may want to ensure that they're accepting IDs to be able to accept transactions type of thing. But then there's also use of different blockchains for the purpose of, I guess storing information that would be on your trust registry where if it's like

credential metadata, schema information, credential information, as well as perhaps even like your trusted issuers lists and using it as a public key directory or those kinds of the two different ways that your program is using something like polygon and something like Ethereum moving forward.

Pallavi (40:27.12)
That's correct. And just to add, I think I also forgot to mention, because I spoke about having, you know, accessing some of the services as foreigners in the country earlier. Going forward, tourists or foreign workers would also be issued with work permits or visas as a very viable credential and using that they can probably access, for example, digital wallets within other payment wallets within the country to make these payments or also use crypto payments services while meeting the eKYC requirements that is absolutely necessary for all these transactions.

Mathieu (41:14.21)
What has surprised you over the past two years since the launch? I think that we've talked a lot about adoption and successes. What has happened that you perhaps didn't expect or what may be some challenges as well that you could talk to the audience about?

I think most of our audience are digital identity related professionals that are really trying to push adoption. So really getting some feedback from you, learnings, perhaps challenges, the things that were unexpected, but now looking back today, kind of stand out to you.

Pallavi (41:54.15)
I think when we started on this journey, we were so focused on the conversation around decentralization, self-sovereign identity, privacy, and consent-based model when you're accessing services. But I think what really surprised me, not just for rural residents, but even for heavily tech-dependent users or citizens, is that these things don't really matter. I realize that they don't care. And it might be very different for maybe residents of Europe or North America.

But at least in Bhutan, think ease of use, customer experience, these are still far more important than decentralization because we have these like session-based passwordless login, which tends to expire after a certain period of time. Users were just frustrated. No matter how much we spoke about security, consent, or privacy, the conversation eventually did always come back to customer experience, frictionless access to services.

I think that is what surprised me the most. Then we also started after this realization, we did pivot some of our messaging strategy when we started promoting and doing advocacy around NDI, that it is, changing the strategy, messaging strategy to say things like, you know, you don't have to travel to physical offices to open a bank account, or you can do it from the comforts of your home and things like that worked far better than saying that this is decentralized or it's consent-driven or there's like, we support zero-knowledge proof. they didn't get it, not to say that we were using jargon, but even in the simplest of language, I think data security was not as important as we thought it would be for citizens. I think that's one of the biggest aha moments for me.

And then in terms of user adoption, we saw a huge spike when we introduced image as a very viable credential, signature as a self-attested credential, and surprisingly peer-to-peer chat when we released the P2P chat feature. We saw a huge peak in terms of onboarding onto the platform. And we realized that for a lot of people, opening a bank account was very restricted. It was restricted by their inability to, maybe physically visit a bank to open that account.

And I think that is one of the validation that we received that, you know, financial inclusion has actually been one of the greatest achievements with Bhutan NDI. And P2P chat surprisingly, and I think that is contradictory to what I just said, that they didn't care so much about security. But a lot of the people moved from WhatsApp and Messenger to using the NDI P2P chat communication channel. And our chat feature does not even support images or videos. It's just pure text-based messaging. But we saw a huge jump in terms of onboarding when we released that feature. So I think those are the two very interesting realizations in the past two years for me.

Mathieu (45:49.18)
That’s super interesting and I share some of those observations as well. I think you see from certain groups of people some pushback to government systems or pushback against systems that they maybe often could be wrong or right about that don't have privacy at the core of it. But I think maybe it's truer with younger generations that just from firsthand conversations I have, like, people don't care if their location is being shared with third party applications. They know their data is all over the place. It's almost like it's not as important to them.

So I wonder if you hear a lot of political pushback throughout the world. Like we saw more recently when the United Kingdom made some announcements there was major uproar or pushback, but it feels like a big majority of the population doesn't really care. And to your point, like if they just want things to be easier to do and they don't really care about privacy trade-offs, although you are built on open standards and open protocols that do take this to heart, but from a communication perspective, it's like as long as it's made clear that it's, reduces friction and there's benefits. It's easier to use. Like a lot of people just will use it just for that fact. And like, again, like look at how the use of, these large language model based chat systems have gone over the past few years. Like people have no problem dumping all sorts of data into there. Cause it's just there's less friction, they get a benefit right away. And like, you don't hear anyone really complaining about that.

Speaking about artificial intelligence, there's been a lot of adoption of these systems, both with consumers and enterprises within the past couple of years. Has that been taken into consideration with the NDI program? Are the use cases focused around AI? Is AI looking to be used within the different services? Has that become an important topic around the work that's being done?

Pallavi (48:25.04)
Yes, it has. So we are actually now starting to draft our midterm goals and some of the strategic decisions around where we want to take NDI and providing AI agents with identity as VCs for these AI agents has been one of the topics. I think that will go into our roadmap, maybe in a three to five year roadmap. So we are looking into it. But as of now, like in the immediate future, that's not something that we are working on. It's just something that we are exploring and we have that in mind to take that forward.

In terms of just I think immediately what we are focused on is, I think the conversation around inclusion still drives a lot of the decisions for NDI. And while a lot of people do use AI in Bhutan as well, I think inclusion of rural residents, still takes priority. So we have been focusing on other features like cloud wallet, which is going to be accessible from IT centers in villages so that users can just, even if they don't have smartphones, they can walk to these IT centers. They exist in basically all village areas. So they just go, they access it with their biometrics and then they onboard into the NTI platform.

It's not entirely SSI or decentralized because it is a cloud wallet but that does help improve accessibility of private and public services for these organizations. We are also working on developing guardian capabilities for children who have not reached the legal age to get a Bhutan NDI wallet. We are also looking at other features like voice support and dual language support. So that it's accessible for those who also do not understand English or are dependent on a guardian to access it for them.

We recently also launched a biocrypto QR codes, which is a printed QR code that goes into our fourth generation citizenship ID, the physical ID cards. And the biocrypto QR code is scannable only with the NDI mobile verifier wallet. So even if a person were to walk to a physical office to access a service, but they would not have the literacy to fill out a form, then they can just have the option of getting this crypto QR code scanned with the mobile verifier app and then onboarded just through that process.

I think I expanded my answer a little too long, but yeah, the AI agents are there. We have discussed it as part of the roadmap, but not immediately.

Mathieu (51:51.21)
So I guess end users, we could be clear that they don't value, the general end user doesn't value privacy and these SSI principles as much as we do in the space. If you just look at the way people adopt different technologies today, it doesn't mean that we shouldn't build with these in mind. And I know that that's been part of the mission of the NDI program is to build using open standards and open source technologies and privacy preserving technologies. End users may not care, but again, a lot of the listeners of this are professionals in the space.

What are some of the standards that have been picked and some of the open source implementations for exchanging credentials and communicating between you know, peer to peer between wallets or between issuers and verifiers and wallets? Do you mind expanding on some of the standards and technologies that have been implemented? And it seems like the stack is broadening and you mentioned a move to Ethereum or adding Ethereum as an option for certain use cases.

So maybe just for the audience here, like what was the tech stack that was picked for the NDI wallet and the infrastructure altogether?

Pallavi (53:22.04)
I'll touch upon it though I'm not an expert in this conversation, so I'll cover it as much as I can. But some of the standards that we have implemented or aligned with are W3C verifiable credentials. And then we also are using the NIST approved algorithm for biometrics. For P2P, it's mostly didcom. And then for our digital signatures for hashing of these documents, we are using SHA-256. But I think to dive further deep into all of these standards that we are using, I think we'll have to bring our governance lead into the conversation.

Mathieu (54:11.13)
No worries, no worries. So I think it is interesting to see such a large implementation of Didcomm for those who are Didcomm fans. I think this is a major implementation of that protocol, which is quite cool.

If we look forward now, we're recording this two years after the launch, we've seen good adoption and a lot of use cases being pursued. Looking forward to the next two years, if we were to do this again, where do you hope to be at that point? One is like, I'm sure you could go a lot deeper within existing partnerships with existing use cases where maybe they'll start pursuing different opportunities together, like whether it's with the same financial institutions or the same telcos. And then it seems like there's a lot of new opportunities that are being pursued as well.

So what would be the vision for the next two years? Where do you hope to be when we maybe have a conversation again in two years from now?

Pallavi (55:23.08)
I think it is to create a very trusted digital ecosystem that continues to be the North Star and it's just about expanding use cases and enhancing our features to make that possible. And also to meet some of our social goals around creating an ecosystem, both physical and digital, that is very trusted, that is very secure, and that is very responsible in its, you know, as its inherent nature.

So, something very basic, like for instance, providing age verification for bars and clubs or even convenience stores by applying zero-knowledge proofs through the mobile verifier app so that we can put some control around restricted substances or intoxicating substances just to ensure that the country itself is very secure and responsible in how services are accessed even in the physical world to even other broader aspects like ensuring that citizens experience end to end, have end to end digital experiences.

So something as broad as let's say, claiming insurance by having to prove that they are alive and maybe they got into an accident for instance, or claiming pensions after they have completed, they have reached their retirement age.

And also, high volume transactions or high value transactions like land or selling of your physical assets or your buildings, your property and things like that to facilitate e-voting from the comforts of their home while at the same time meeting the trust level that is needed for these kinds of activities democratic activities. I think that is where I would like to see it.

Even when we have made strategic decisions around the new features that we want to develop, it has been to help us take us to these larger and much more grand visions that NDI has. For instance, we have introduced a biometric verification feature, which basically does two things actually. One is it checks if a person is alive, if it is not a photo or a video or pre-recorded video of an individual being used to complete an authentication process. And it does a face search and matches it against the biometric database that is held with the Department of Civil Registration and Census.

So this feature can, you know, in the long term be used to complete voting from their respective kiosks or desks or even their homes thinking really far ahead in time, completing land transactions, purchasing buildings or properties and things like that I think these kind of added layer of verification is really going to enable that. And I think to be able to facilitate this ecosystem where even these really high-stake transactions can happen completely remotely and completely digitally, I think that would be the goal.

Mathieu (59:32.11)
That's fantastic. Pallavi, thank you so much for doing this again with me. I really appreciate your time and everything you've shared. I'm sure people, listeners are going to get a lot of good insights from this conversation. And I hope to do this again, once there's been more progress made and just continue to follow the results. It's been incredible over the past two years to follow the successes of you, your team, your program and Yeah, I tremendously appreciate you doing this.

Pallavi (01:00:03.22)
Thank you. Thank you so much. It's always so nice to talk about NDI and to just let people know of the things that we are doing, of our grand vision and just learn from others' experiences as well. I've been a long time listener of your podcast and it's so good to be able to come on myself and just have a chat with you. Thank you so much.