

# Meeting the need for offline digital payments

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00:25

Hello and welcome to the omfif podcast. My name is Lewis McLellan. I'm the editor for the digital monetary Institute here at omfif, and today we're going to be discussing offline payments. It's a topic that, although not new, has gathered a lot of momentum in the past few months and a year or so, because, in part, central banks are working very hard to deliver central bank digital currencies, and many believe the offline payments are going to be a critical feature of those if they are to be successful. With me, I'm delighted to have Chief Evangelist at G and D, Lars Hupel, and G and D have a lot of experience in this space, not only with their Filia platform for central bank digital currencies, but they've also launched Filia unplugged, which brings offline capability to digital payment systems as well. So a lot to break down today, let's jump right in. Lars, thanks for joining us today. Great to have you. Thank



01:22

you. I'm happy to be here.



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So let's start off with a little bit of context, offline payments as a concept. Can you break that down a little bit? I think it's easy to assume what we know what that means. We understand what the words mean individually, but think it's not necessarily quite as simple as payments without internet access. Can you break down a little bit the types of payments that we're talking about when we say offline payments?



01:47

Yeah, a pleasure. Fundamentally, it's about the ability to pay, right? We want people to be able to pay in any scenario, be that with Central Bank digital currencies or with some other payment instruments. Now the analogy that we like to make is with cash, obviously, because GND is also very strong in a cash business, it's wonderful for proximity payments between two people, you and me, somewhere out in the desert, we can make a payment. And the kind of other end of the spectrum would be card payments, which works both for proximity situations. So for example, I go to a shop and I buy something, and also works for E commerce, right? So basically, we got two ends of the spectrum already covered here. But currently there is no means of payment that combines the convenience of both, right, the convenience of cash, that it works offline in any scenario, and the convenience of card payments, where you don't have to carry the cash around. And yeah, so this is the gap that we're talking about here when we talk about digital offline payments. And the Bank for International Settlements has kind of created this terminology in their Polaris Project, where they distinguish three degrees of offline. They talk about staged offline, intermittently offline and fully offline, and I think I have a few moments to break that down. Fully offline means there's no online connectivity whatsoever, no mobile reception, no nothing, and you do that forever. So cash would be a fully offline means of payment, because you never go online with cash, and then you have intermittently offline, which describes the payment instrument where you can make some offline transactions, even consecutive offline transactions. So I could pay my friend, and then a friend could pay someone else or offline. But eventually you're going to have to go online to sort of reconcile, or like, send those payments to a backend system. The payments already settled offline, but you still want to kind of do some sort of reconciliation afterwards. And then there's the staged offline where the payment is not really settled. You can make a payment offline, but for example, the merchant who receives the payment cannot immediately use that money to pay someone else. So that would be in traditional cart rails where you can actually make these offline transactions, but they only settle when the when the when the merchant actually uploads this transaction to some backend system. So for cbdc, we're kind of aiming for the intermittently offline so kind of for the middle ground in here. But as you mentioned, also in the direction there's more and more interest also about equipping other payment rails with this intermittently offline functionality, including private money. So for example, if you have in a country an instant payment system, for example, pix or UPI, then there's also some interest in providing these offline capabilities, because for now, they don't work offline at all.



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Right, that makes sense. I just wanted to go a little bit more into this question of intermittently offline versus fully offline. Can you talk a little bit about why, why it's important to have this, you know, requirement for it to be reconciled offline versus just having it entirely offline the whole time?



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Yeah, that's a that's a good question. And I think the. Easiest way to explain this security, right? Banknotes also don't circulate offline forever. Eventually they'll come back to the central bank, and then they're validated and they're checked if they're actually authentic or counterfeit. So I think in particular, central banks have a strategic interest in making sure that there's no

counterfeit, counterfeit money in circulation, that everything is secure and that you have kind of like a safety net, a digital safety net, to make sure that all the transactions use genuine money. And if you have a fully offline system, that is very hard to achieve, because you will never be able to position to actually look at the payment token and say, Well, this is good or not right. So, so you potentially have a high risk in the intermittently offline approach, where you demand some kind of reconciliation, you do these sort of technical checks every once in a while, maybe every two weeks, or something like that. You can say, maybe you can do 10 offline payments, something like that. This does not mean that you need to disclose any kind of metadata. So it's not necessary for this reconciliation check to upload that I have paid at a grocery store, that amount of money for this in this purpose. Now it's just about checking the actual payment instrument. So it's checking that the 10 Euro token that I have handed over to the grocer is actually valid 10 euros. So this has to happen occasionally, not all the time, but occasionally, in order to get a high degree of security that central banks rightfully



06:23

expect, I see that makes sense to sort of preserve the integrity, correct. Yeah, update the knowledge. Okay, great. And can you talk a little bit about why central banks, I guess, in particular, are treating this as a topic of strategic importance. I mean, I guess it's pretty obvious. In countries with remote areas where they don't necessarily have internet connectivity, or it's not widespread, or it's not reliable, then it makes sense there. But in countries where that's not the case, if it's pretty universal and reliable, we're still seeing some interest in offline payments. Can you talk a little bit about why that is? Sure,



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this topic about internet connectivity? Yes or no, this comes up quite a lot. So it's a fair it's a fair question to ask honestly, right now, we have only one truly inclusive means of payment, which is cash, right? And there's nothing like cash available in the digital space. And like, if you look globally, there's 1.4 billion adults that remain unbanked. Even in the Eurozone, in Europe, there's significant population, that of adults that could have bank accounts, and they don't have bank accounts, and that doesn't even talk about children or some unemployed people or tourists on that which don't have local bank accounts. So if you're if you're saying, Well, you know, everyone can get a bank account, it's under still excluding some people. So it's not just about the connectivity, but it's also about this kind of accessibility, this inclusivity. Case in point, if I want to get a credit card today or a debit card, I need to go into a contract with some kind of third party provider. There's no such thing as a government run payment scheme. There's always this sort of friction that is introduced, and there's good reason for that. If I get a credit card, the intermediate wants to know that I am credit worthy, right? So they don't want to give me a line of credit without knowing me. They wouldn't give a 10 year old child a 2000 pound credit line, of course. So there's, there's good reasons for that. There's also other other factors here. For example, if I'm a merchant and I want to accept payments, they're charging fees for that, potentially some minimum fees in some countries. This could be prohibitively expensive. These countries give you proliferation of alternative schemes, like the, for example, UPI in India. But basically, long story short, if you're only focusing on on the topic of internet connectivity, and say, we have internet connectivity, it's why people can pay digitally. You are excluding, still, some members of society, and that's not a that's not a good thing. So offline payments, as we see it, are one piece of the puzzle towards digital payments without having a

bank account or without having account with some kind of private provider. And this is why I also mentioned we can also think of offline payments, not just in the context of cbdc, not just in the context of like in the context of like, a government run system, but also in as an add on for, for, for other systems that are interested in expanding the franchise, if you want, and ultimately, if you have more people who can pay. This is good for the economy, right?

 09:16

Yeah, absolutely. And I think it's interesting reliance on, it's also, you know, something that the development banks care a lot about, right? That's always something that they're trying to, trying to get people, the number of people able to use different payment systems up and relying on on physical cash alone, for them, that often means they don't get credit access and things like that. So, yeah, getting people into other services, seems like a good idea,

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but you also sorry, so just one more point, because you brought it up. It's also about providing choice for consumers, right? So ideally, in a hypothetical society as a consumer, I can decide freely between having using cash, using instant payments, using CBW. You see using credit cards or any one of these other payment rails. So fundamentally, I think it's about providing that choice and having this choice also makes for more equitable payment ecosystem, right? So I can, I can as a consumer, I say, Well, I prefer cash because I like carrying this around with me. I immediately see how much money you have someone else as well. Then I have to go to the ATM. So I prefer to use card payments and someone else as well. I travel a lot, so a credit card is quite nice for that purpose. So you have all of these choices, and they're we're not seeing them as somehow competing, we're seeing them as complementing each other,

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yeah, and that choice not being made for you by the circumstances.

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Correct? Yeah, correct.

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So yeah, certainly can see the advantages there. It is something, however, that we hear a lot from, particularly the central banks, when we did our survey of central banks the end of last year, that it's something that they find difficult to deliver, that they need a lot of help with, that there are some technical challenges around. Can you walk us through what some of those challenges are? Why? Why people are struggling

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with this? Yeah, that's it's definitely, it's definitely a big issue. Some people have said that having a full blown retail cdbc rollout with full offline capability is a tall order. It's already kind of a big order. When you don't have offline capability and you're adding that additional issue on top. Well, I mean the existing payment rails, if you look at them, they have only some degree of offline capability, which I mentioned that, for example, for traditional car payment rails, you cannot spend this consecutively. So I give the money to the merchant, but the merchant would have to wait maybe for two to three days until they can pay someone else. So this intermittently offline payment capability is really a novel concept, so it has no equivalence in the current payment ecosystem. So yeah, I totally understand where it is, where this is coming from. This, this line of thinking now from our side, from GD side, from the very beginning, we considered how to handle secure consecutive offline payments, and we also spoke with a lot of central banks. And this journey started already many years ago, back when it wasn't even called cdbc, back when it was called regulated digital payments. I'm not sure if anyone in the audience still remembers that term, but cdbc is actually a fairly recent term, so the requirements we gathered there was that this offline payment needs to come with a very simple and intuitive user interface. Because cash, everyone can use it, even children can use it. So this is what we should be aiming for. Second, it needs to be available through some kind of form factors that are cheap, low cost and universal. So some people might want to run it on their existing smartphone, but if someone does not have a smartphone, and it should also be available on smart cards, small, cheap form factors. The third point is, obviously the topic of privacy, which, in particular in the advanced economies, is a big topic, right? So you want to have something like privacy comparable cash, cash like and what we came up with solve all of these, these topics together, is a token based system, so you have individual tokens, which you could think of like as banknotes. They have some kind of value attached to them, and then you can pass those tokens around between wallets. And the key point here is that those wallets need to have some kind of hardware security, and we can enable this hardware security in all of these form factors that I mentioned. Now, the reason why we're doing that is because I mentioned, you want to make sure that there's no counterfeit money, no no fake tokens circulating the system. So you need to have this trust somehow for a bank note, you can just look at the bank note, and you can, you know, look at the security features, and you can wave it around, you can see the hologram, and then you're somehow satisfied that it's a good banknote. In the digital world, you can do that. So that's why we need this hardware security. Now, you put those tokens on these hardware wallets, and then they can transact freely with each other, and we've kind of demonstrated that this works. So from a technical perspective, I think a lot of the boxes have already been checked. There's still, of course, the question of a rollout in a particular country. So I totally understand that this is still a matter of discussion, because all the countries are different. So kind of To summarize, I think the technology is there? What's missing now is, like, the remaining gaps to be addressed. What are the form factors in a given country? What are the privacy expectations in the given country? What? What are users familiar with? Like, how do users currently do their transaction and then try to imitate that somehow? So I think this is has to do a lot of this user research, with with convenience and so on all of these accessibility topics. Yeah,

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I think that's something that we we hear a lot in the in the general DMI areas, right? The the technological challenge is solved, but there's a surprisingly big gap between that happening and. And central banks having made all the policy decisions and decided exactly what they want from it, and, yeah, that does seem to take longer, and there's a limited way of

generalizing from from one central bank to another, right? Everyone's got their own their own preferences. And in light of that, can you talk a little bit about the pilots that you guys have been involved in and maybe some of the differences in requirements that people have had there.



15:22

Yeah, so I will start this answer with a short anecdote. As part of my job, I travel around the world quite a bit, and I work with central banks very closely. And I've been, for example, in Ghana to work there on the offline pilot that we did with the bank of Ghana. But I was also in Hong Kong, where we did a pilot project together with Standard Chartered Bank, and in both countries, I faced the same problem when I had to get from the airport to the to the hotel, which is that the taxi drivers only wanted to accept cash. And the reason why they wanted to take cash is not because they wanted to commit tax fraud, but because they needed to refuel their car after a few rights. And if you pay with car, then they will they can't refuel their car. They need to wait for a bit. And they don't have that kind of working capital, as the economist would say, they don't have this kind of working capital to just, you know, do that for two or three days. So in both countries, or in both regions, like Ghana as an emerging economy and Hong Kong is kind of very advanced, technologically advanced, you have the same problem. So some points do generalize this consecutive offline payment seems to be a big topic in many jurisdictions, right? So that that much for the for the anecdote, right? So let's talk about the Ghana project. First. I guess when we did the pilot there, we actually had a few surprises in terms of payment patterns, right? So there were a lot very long chains of offline payments that we that we saw, let's say you're a citizen somewhere, doing your your grocery shopping. You go to a small street merchant, and then you buy some, some, some some rice, some, some other food items. And then that street merchant goes to a bigger merchant, like some some kind of big food vendor, and pays there, and then that food vendor goes to a farmer, and then that farmer goes to a wholesale supplier. So we have all of these long chains of offline payments. We certainly did not anticipate that, but it was a very important learning for us, and in particular, also learning in what kind of form factors people are using. So in Ghana, we included a lot of people in the pilot who have never done a digital payment in their life before. So all they ever used was cash. So for them, the smart card was a very important form factor. Now if you look, for example, in Hong Kong, well, people have smartphones in Hong Kong, right? So, so, so maybe the smart card is not that an important form factor there. Still in Hong Kong, we did the survey in the set about 80% of the consumers saw the value in the offline payment of this hypothetical Hong Kong of cbdc. So that was kind of an important learning, also from us seeing that even in these technologically advanced regions, you have that sort of thing. And then maybe also the Bank of Thailand project. So there, they were also more concerned with smartphones. We piloted both smart cards and smartphones there, and they gave us some really good feedback, because they were talking about the amount of transactions that you can do while you're disconnected. So they were quite happy with that. And on the other hand, they also found that handling NFC payments can be somewhat tricky, because you have to kind of hold the card to a card reader. And in some in some countries, people are used to that. In other countries, people are not used to that. In Thailand, a lot of people are used to QR code payments, so they are very happy with how that works. So they're used to that. And NFC was not so, apparently, was not so so common. Whereas in Hong Kong, people could pay with NFC, no problem, because they're used to that. So I guess a long winded way of saying, all of these pilots had very different characteristics. There were some some commonalities. But again, these pilots, as we see, is very crucial to learn about the behaviors of people. Ultimately, you want to provide a public utility, you want to be able to provide people

with the ability to pay. And in order to do that, you need to understand how they're paying now and what pain points they have, and then you try to tailor your pilot project to address these pain points.

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Yeah, I guess that's a really interesting challenge, because you can do all the work you want on the security and the settlement and so on. But ultimately, this is a tool that people have to use every day, hopefully. And I guess one of the challenges is, if you're going to get people to adopt it, is integrating it with how people are already using money, because, presumably, quite difficult to get people to behave in a way they're unfamiliar with.

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Yeah, that's totally true. So you could say that there's really no one size fits all role. Strategy. So this is why we at GND, we typically suggest a phased approach, where you include the stakeholders from the very beginning. So we have done a few consulting projects, also in terms of digital payments. And what we always start with is like, get the banks on board, get the merchants on board, get a few end users on board, you know, you want to talk to them. And then you start with a small pilot, and you test your hypothesis. Hypotheses, and then you figure out the payment patterns. And maybe you do not a survey, maybe you do maybe you do data analytics on the data that you've collected. That's what we've done in bank of Ghana, to figure out the the payment patterns, right, to run some analytics on that. And also, what you kind of mentioned is that the integration and the interoperability is a big topic, and this is also where the countries differ the most. In my personal opinion, every country has an existing payment system. They have an existing RTGS. They might have an existing instant payment system. All of these things exist. They have ATMs. In African countries, you have a lot of mobile money agents. So all of these very heterogeneous ecosystems are already there. And one thing that I find particularly charming about this adding offline capability to existing payment schemes is also that you have new intermediaries, new types of intermediaries, like telcos that could provide these kinds of services. So when we do these cdbc projects, we're also trying to talk to the non standard players. I want to say, like, obviously, they have a big role to play, the telcos, but like, they're typically not seen as banks, right? But there's no reason why they couldn't also provide financial services, and some of them already do provide financial services, so we think this is a good way to increase the reach and the merchants, of course, if you don't have the merchants on board, they don't accept your payment method, and then you can't use it, right? So, so the merchants are kind of one of the most important aspect of, you know, actually using it on the ground. They need to, you know, upgrade their POS terminals, for example, even if they have not been designed with offline payments in mind. So, so this is also another important piece of the puzzle. So I guess this is my way of saying that if you want to, if you want to transform the payment ecosystem, you have to first understand the payment ecosystem, right?

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Yeah, absolutely. I think, yeah. Bringing you know, telcos and other other new entrance in is, I think, typically good from a from a policy perspective as well, right? It should be good for competition. It should be, yeah, generally leads to good outcomes when you have new, new

providers entering, kind of lowering the barrier to entry and providing services. We've kind of touched on it a little bit, but perhaps we should go into a little bit more detail. Obviously, offline payments is fundamentally, we've talked about the sort of non technical aspects of making sure people can use it. But fundamentally, that you do need technology, you do need hardware to deliver this is that something that you can integrate with what's already out there, or does it need, you know, full overhaul? What does the rollout for the technology side of it look



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like? I guess the answer is yes and no, though we're always trying to build on existing technology as much as possible. At its most fundamental level, we believe that secure, offline payments require secure elements, right? So you want to have industrial strength, secure hardware in order to store the tokens, in order to ensure that only authentic wallets are operating a system, and that no one can, you know, use a custom wallet that's called a custom wallet that, for example, disrespects certain limits set by the issuer and so on. So you want to make sure that all of this is captured in hardware. And this is not a new idea. We have not invented the idea of using secure elements for payments. If you look at the industry right now, that the card industry uses secure elements, the identity is used secure elements. If you have, for example, a national ID card, there's very high chances that there's a secure element in there. Your phone has a secure element. The SIM card is a secure element, and so on. So, so piece of hardware are incredibly widespread. They're incredibly common. And people are just they have three or five of them on them at any given point in time or and if they don't, you just give them a smart card, right? The smart card are is relatively inexpensive. It's also nice, because the smart cards can be issued directly to the to the consumer. So you can directly say, you know, this is the code that's running. These are the policies with it. If you have to go on existing device, or if you want to go on existing devices, which you should, then it's a bit harder. For example, if you want to put cbdc tokens on on an iPhone, you would have to talk to Apple. If you want to put it on on a Samsung phone, you would need to talk to Samsung and so on. But you can also put it on on the esim, for example. Esim is very easy because you can just download it as a consumer. So it's really not big of a hassle, and that is also not a novel idea. So. We have also admitted that if you look at Japan, for example, Suica card, or in Hong Kong with the Octopus card, both are kind of designed to be like these transit cards, but you can also use them for payment, and they are also available in smart cards as a mobile wallet, in the secure element, as a SIM card, and all of these things. And if you're looking now at the news, if you have been following the news, Apple has also now provided access to the secure element of the phone, of the iPhone, not to everyone, not everywhere. So there's still an early phase of the rollout. But as a developer, let's say you want to equip your your payment scheme, your instant payment scheme, with offline capability. You could talk to Apple, you could apply for that access. I think this is a positive trend in the market, because it enables technology vendors to leverage the secure hardware that was so far a lot more restricted in the Eurozone. When we talk about the digital Euro, there's also this draft legislation on digital Euro that's currently being considered by the Parliament, and that one also says that the vendors should give access to the secure hardware in those devices, be the SIM card or another type of secure element. So I think from a specification point of view, we are already very close, because all of the secure elements have very strict specifications. They all behave in similar ways. They have similar interfaces. So we're ready to deploy on those. And now it's up also to the manufacturers and the regulators to kind of step up and say, Okay, we are happy with this use case, and you're

writing access in the most diverse way that you could think of, right? So that you have all of these different form factors. And if someone doesn't have a smartphone, then they can still have a smart card, right? So we can still equip them with that. Yeah, yeah. It's

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very interesting here that a lot of the technology is already out there. But yes, I did see that about Apple, and I guess that was fortunate, because would have been a big problem for the digital Euro legislation if Apple wasn't, wasn't providing that, you know, provider like that, of such scale. So I guess that's probably not a coincidence, but fortunate timing. So, yeah, well, I we're getting close to the end here, but I guess let's look a little bit into the future. How are people, you know, people's attitudes have changed a lot to what they expect from payments over the past five years or so, or maybe a little bit longer. But I don't think we're at a final point by any means there. So what are you expecting in terms of changes to people's attitudes towards payments and what they expect there going forward?

 27:36

Yeah, I think, honestly, we see much broader changes right now, not just focused on on end users and consumers and so on. So we're seeing kind of this, this, this idea of tokenization, which sort of permeates the entire payment industry, no matter what you're talking about, anything that affects the end user, or if it's affects, for example, wholesale payments, right? Because wholesale payments are still there. We have not talked about wholesale at all in this podcast so far, but no matter where you look in the industry, everyone is talking about tokenization. So it's kind of driven by many different market participants and also from many different perspectives, right? So a stockbroker is interested in very different things than a merchant, but still, they both suffer from some kind of restrictions in existing payment systems, right? So, for example, the stock broker also suffers from the fact that very often they can't instantly settle their payments. So you sell a lot of you sell a large bond, and then you have to wait two days for the payment to come in. Obviously, that's a problem a very different scale and a taxi driver in Hong Kong, but it's still kind of similar, similar reasons for these issues. So I think this token based digital money, if you call it retail cbdc, if you call it deposit tokens, if you call it stable coins, whatever really has this potential to transform the entire financial ecosystem. And retail cbdc is just once, one piece to this puzzle, and ultimately they might have different technologies. So I don't expect the digital euro to work in the same way as the digital pound, or some kind of new stable coin in the euro area, whatever, or wholesale CDC. They would all probably have different technological design choices, but ultimately they could work together to make the system more efficient and more transparent. Even if you look, if you zoom in again on the on the antiresist and offline payments will contribute also to the resilience in case of outages or some kind of natural disasters. So this is also an important aspect that's talked about a lot, how to increase resilience of the system. If you look at all of these different pieces of the puzzle that I've just mentioned, it's clear that it needs to coexist, and they need to cooperate, and they need to integrate with each other. And once again, a reference to the Bank of International Settlements, they call the system fintonet As the analogy to the internet. So they think. Of the internet as as kind of value that you can route to multiple entities. And you know that value can, no matter if the value is an offline token or a stock or whatever, you can kind of route it through the system. So I think this is like a broader context that we're talking

about here. And I think, simply put, our mission from gng is to build trust in this new system, both from the offline perspective, what was the main focus of this podcast, but also for the other layers that will come together there.

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Yeah, absolutely, yeah. Very exciting time in payments. We'll have to leave it there. As you said, there's a lot more we could be discussing offline payments, and is just a part of the puzzle wholesale. We haven't, we haven't touched on but a great deal to be discussed going forward. Thanks for your insights, Laura, it's

 30:49

been great to have you here. Thanks for having me,

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and thank you to you all for listening today. If you're interested in this topic, you can look up G and D's philia unplugged project on their website, and get a lot more information about how they're solving for this consecutive secure, offline payments challenge and why it's important. Omfif, we've got a lot more to come on this topic. In slightly away from the retail payment space, we have our digital assets report, which is launching on the 17th September. So you've able to find that on our website. We also have our future of payments report coming at the end of the year, and a report with G and D on CBDCs and the urgency of pursuing that as a payment solution, which will be coming in the new year. Hope you enjoyed today's podcast. Thank you for listening. Goodbye.

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