



**ALL-PARTY
Parliamentary
Group on
Blockchain**

INTEROPERABILITY & SCALABILITY

EMERGING STANDARDS & POLICIES

Blockchain applications - regulation, policy & strategy



LOCKCHAIN

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APPG Blockchain: <https://uk.bicpavilion.com/about/appg-blockchain> |
appg-blockchain@biginnovationcentre.com | @appg_blockchain

Big Innovation Centre: www.biginnovationcentre.com |
info@biginnovationcentre.com | @BigInnovCentre

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1. APPG Blockchain Evidence Meeting on Interoperability & Scalability

1.1. Purpose

The purpose of the All-Party Parliamentary Group on Blockchain (APPG Blockchain) is to ensure that industry and society benefit from the full potential of blockchain and other distributed ledger technologies (DLT), making the UK a leader in Blockchain/DLT's innovation and implementation.

This Report of the seventeenth Evidence Meeting explores the interoperability and scalability of the current blockchain networks. The report provides a summary of the takeaways from the meeting.

The Video recording of the session is available on our websites:

- APPG Blockchain <https://uk.bicpavilion.com/about/appg-blockchain> and
- Big Innovation Centre www.biginnovationcentre.com/

1.2. Details of the Meeting

- Date, 23rd February 2021
- Time, 17:30 – 18:45pm GMT
- Location, Virtual House of Commons
- Participants, 57 attendees

1.3. Panellists: Evidence Givers, Chair & Secretariat

The evidence meeting was chaired by the APPG Blockchain Chair Martin Docherty-Hughes, Member of Parliament.

Big Innovation Centre is the Secretariat for the APPG on Blockchain, led by CEO Professor Birgitte Andersen and Fernando Santiago-Cajaraville as the Project Manager and Rapporteur.

Building a robust Blockchain ecosystem is part of the APPG Blockchain mission. Assuring representations from across stakeholders, The APPG meeting on digital assets had evidence givers from:

- *Consulting industry – Deloitte UK*
- *Blockchain Industry – Iota Foundation, Applied Blockchain & Quant Network*
- *Regulator – EU Commission*

Evidence givers



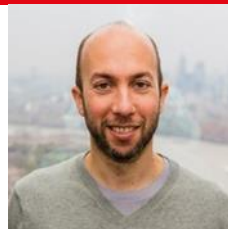
Tyler Welmans
Blockchain Lead
Deloitte UK



Dr Navin Ramachandran
Member of the
Board of Directors
IOTA Foundation



Dr Luke Riley
Head of Innovation
Quant Network



Adi Ben-Ari
Founder & CEO
Applied Blockchain



Dr Pēteris Zilgalvis
Head of Unit for
Digital Innovation
European
Commission

Chair



Martin Docherty-Hughes MP
House of Commons,
UK Parliament

Secretariat



Secretariat:
Professor
Birgitte Andersen
CEO
**BIG INNOVATION
CENTRE**



Rapporteur
Fernando
Santiago-Cajaraville
Project Manager,
**BIG INNOVATION
CENTRE**

2. Background

The seventieth APPG on Blockchain evidence meeting on Interoperability & Scalability aimed to explore the interoperability and scalability of the current blockchain networks.

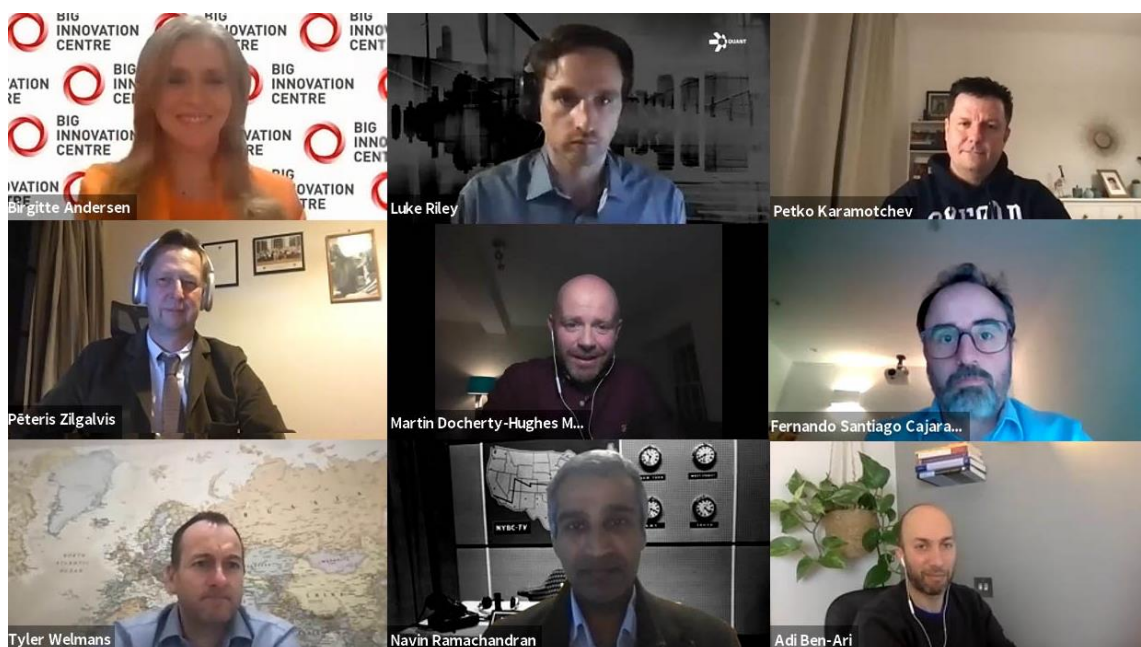
Interoperability among Blockchain is how different Blockchain networks communicate, transfer and access data between them. Although, currently, this kind of communication among Blockchain networks is quite limited, although not impossible, interoperability is almost inexistent.

We are facing the risk to create new extraordinary large data silos instead of removing them. Replace current intermediaries for huge and dominant new few ones

Regarding interoperability and scalability of Blockchain networks, our speakers addressed the following questions,

Interoperability & Scalability

- Is there a need to establish interoperability standards that allow Blockchain projects to communicate with each other?
- Is there a role of the Government in fostering the future success of Blockchain interoperability?
- Are there 'bottlenecks' (technical and non-technical) in the scalability of Blockchains for mass adoption?



3. Meeting Takeaways

3.1. Interoperability is a vital challenge that has to be tackled

For many reasons, interoperability between networks is currently one of the main challenges of Blockchain technology. Interoperability is exceedingly difficult, and there are many reasons why,

- Keeping data consistent between two networks when you do not have a cross-network consensus protocol is complex.
- Different permission systems and different networks,
- Different storage architectures.
- Several types of smart contracts.

Current Blockchain architectures do not allow communication among networks.

We have a soup of different platforms covering various aspects of life cycles of sometimes the same assets (A. Ben-Ari)

Distributed ledgers themselves are designed to be data silos (L. Riley)

Standards for interoperability need to be put in place. This need to be established at the international level and with a joint agreement among the stakeholders (policymakers, standardisations bodies, academia, blockchain industry players & civil society).

It is the coordination of multiple governments and interested parties across the world that will make a difference. (N. Ramachandran)

Initiatives to set up interoperable standards are always great, but not in isolation. (N. Ramachandran)

There are incipient solutions in the market, as a blockchain services network. However, there is a vast work to do as nowadays we are early to the process.

A Blockchain services network should be built with interoperability in mind from day one because different technologies can provide different features. (L. Riley)

3.2. Interoperability is not just a technological issue

The type, purpose of the networks, and focus will make interoperability needs differ substantially from one area to another.

Across that landscape, the interoperability needs differ considerably. (T. Welmans)

Interoperability is also a human factor because interoperability is about passing data and then understanding and acting on it

Interoperability is a more human factor (N. Ramachandran)

Interoperability should be not only focused on technical areas and technical connectivity. Interoperability is a broader term that needs coordination in the legal or business models areas on top of technical solutions. The barriers for interoperability need to be assessed specifically for each industry.

Interoperability goes beyond technical interoperability. There is a need for interoperability in the business, legal, and many other domains. (T. Welmans)

3.3. Government needs to act

Government should take a role in the standardisation of the Blockchain applications. Government should guide the industry in the form of policy and in time regulation. The net effect will be to enable greater adoption and interoperability.

Government can play a particularly crucial role in providing governance and supporting the broader formation of industry standards. (

The UK Government should establish a UK blockchain services network for domestic services usage and international trade purposes. (

The current lack of a regulatory framework is potentially a barrier to the development of the Blockchain industry. Just the UK Blockchain industry accounts more than for the rest of Europe together. Regulations should be put in place to scale up ongoing projects. However, these regulations should be focused on the activity and not on the technology itself.

Government should stay away from specific technologies. The most important thing for Government is the data. (A. Ben-Ari)

The UK Government can follow the example of other economic areas trying to solve some of the Blockchain industry's problems. Partnership with international standardisation bodies and setting up regulations is one way. Experimentation with the technology is key.

The EU intend to have a clear legal framework for a flourishing private sector blockchain in Europe. (P. Zilgalvis)

The UK Government should establish a UK blockchain services network for domestic services usage and international trade purposes. (L. Riley)

4. Evidence Giving

4.1. Tyler Welmans, Blockchain Lead, Deloitte UK



Introduction

Deloitte continues to see the development of new and overly exciting blockchain networks on both the public and the decentralised side of the spectrum and new private and corporate distributed ledgers.

Some of those ledgers enable digital asset exchange, and others focus on the secure exchange of business information. Some decentralised ledgers are only accessible to permitted members with access control and often small numbers of nodes.

Interoperability

"Across that landscape, the interoperability needs differ considerably."

Networks that are used to transfer digital assets or secure and allow custody and exchange of digital assets, from cryptocurrencies to Central Bank digital currencies, focus and need for asset interoperability and asset portability. In these cases, interoperability has focused on the ability to

extract and move an asset from one network to another or, indeed, the ability to initiate a transaction, which may begin in one network and trigger events in another network.

However, enterprise Blockchain networks may be more interested in interoperability of other kinds, for example, the ability to receive a signal or an update from a sensor, which could be in a crate or shipping container, which may need to communicate with multiple supply chain distributed ledgers.

Scaling

Similarly, when we talk about scale, the scaling considerations vary pretty considerably. There are many different networks, particularly in public and in the decentralised space, which are reaching or experiencing difficulties coping with the demand. As a result, the number of transactions supported is lower than processed within a private enterprise network.

Deloitte authored a paper in conjunction with the World Economic Forum last year, describing the types of interoperability needed. However, it goes beyond just technical interoperability. The need for interoperability in the business, legal and other domains beyond purely technical connectivity can be as critical.

Interoperability goes beyond technical interoperability. There is a need for interoperability in the business, legal, and many other domains.

For example, in the energy supply chain industry, one of the barriers to interoperability was that different organisations had different names for products or physical commodities involved.

Governments

As much as the technical challenges are real, the Government can support where some bottlenecks can be unblocked. For example, in digital assets and digital identity, we already see Governments doing some work as running consultations with industry, responding to feedback from industry and society. We have seen this with the launch of the UK digital and identity attributes framework.

Government is also guiding the industry in the form of policy and in time regulation. The net effect will be to enable greater adoption and interoperability. Digital identity is key to connecting blockchain platforms and beginning to unlock more efficiently, cutting out the complexity in how people get access to blockchain platforms in the first place.

Collaboration with the governments usually starts abstract and ultimately makes a difference in how blockchain evolves in the UK. For example, in the European Union, we see some exciting projects, with public and private sector partnerships working, helping to bring us towards what may be common standards and common infrastructure.

Government can play a particularly crucial role in providing governance and supporting the broader formation of industry standards.

4.2. Dr Navin Ramachandran, Member of the Board of Directors, IOTA Foundation



What does interoperability mean, and what stops it from happening? Is it a technical limitation, or is it a more human factor?

Interoperability is a more human factor

Interoperability is a human factor because interoperability is about passing data and then understanding and acting on it. For example, sending an email is not proper interoperation. What IOTA sees in lots of industries is that interoperability happens at a considerably basic level.

Initiatives to set up interoperable standards are always great, but not in isolation.

There are about nine or ten different initiatives around the world working on different standards.

Unfortunately, Blockchain can make interoperability harder because it is hard enough for companies to interface to share data. Furthermore, if Blockchain is added on top, the process can be more challenging to share legacy data.

Data sharing is relatively easy. We can take a copy of our data and hand it over to another chain. However, in Blockchain networks, value and tokens are harder because if we send a token over to the other network

There is a lot to be worked on, and it is incredibly early in the process. There will be standards bodies to get involved. For example, Iota Foundation is working with the Object Management Group on some areas.

The risk we always face is that if there are existing standards, building a new one means to have n+1 standards, and no one uses it.

It is the coordination of multiple governments and interested parties across the world that will make a difference.

However, the industry should be cautious with the concept of having an interoperability chain that will act as a hub for everything. It might brilliantly, but the risk is to replace one go-between for another.

Scalability

To understand scalability, we have to understand how blockchain itself works and where are the bottlenecks.

The concept of blockchain is that blocks are processed, one by one by one. Each block contains information that is processed. The amount of data in each block (the block size) or the block time (how regularly these are processed) is designed to balance the two to get a secure system.

Whenever a system works in serial, the system will be slow, and there will be bottlenecks.

In modern data processing, the old serial data processing does not happen anymore. For example, Twitter, Google, Facebook are running parallel computation systems, with databases that do not rely on everyone seeing the same thing at the same time.

For blockchain to work, everyone has to know the current state of the ledger, what transactions are valid, then they all act together and move to the next transaction. All the miners need to be coordinated in the network to move to the next transaction.

Iota Foundation has moved slightly away from the blockchain towards a Directed Acyclic Graph (DAG).

DAG allows parallel processing, and everyone in the network does not need to know or agree about everything simultaneously. For example, Iota can have a system where UK transactions

happen with a local agreement, French transactions with another one and US with another one. Locally this works, and over time all the networks agree on what the state is. This is called eventual consistency.

Eventually, consistency increases the complexity in the entire process however increase the scalability of the systems.

Smart Contracts

Chains do not just deal with value transactions or just data, and they execute contracts.

Smart contracts are automatically running contracts that run in the background, but they rely on the same ledger. If a ledger can only handle seven to 15 transactions a second and your demand is higher, it can end up halting the network

Iota approach is not to run all the contracts at the base level one (base ledger) but to run it off-chain, in another system, and deposit proofs back into the main ledger level.

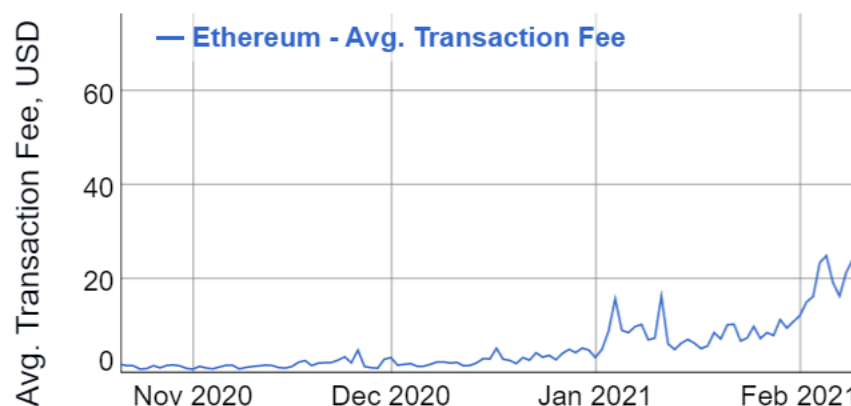
Limits to Scalability

What limits the scalability of use, and what stops people from taking this technology and running with it?

We need to understand what miners are and the role miners play in the network to understand this. Miners are the validators in the network. They act in consensus to say what is valid and what is not, which is a valuable service. Yet when you have this service, you need to reward these miners.

With the need for reward comes the need for tokens. Unfortunately, we have seen from personal experience that many corporate entities cannot hold cryptocurrency tokens to participate in the network, as it becomes problematic.

We are seeing right now what happens when you hit the limits of scalability. The graph shows what has happened to the Ethereum price as it hit the limits of scalability. It has gone from a few cents to \$30 per transaction yesterday (22nd February 2021). Additionally, volatility makes things a lot more complicated, not allowing businesses to forecast their costs.



Lack of scalability is not a bug is a feature of the system

When the system reaches that scalability limit, the way to slow people down is to put the fees right up. It is a mechanism that works for the miners and network but may not be suitable for the rest. As well, it makes the miners block upgrades because a network upgrade requires lowering the fees. Progression of the net can be blocked.

The other factor stopping adoption is energy consumption, although this only applies to the proof of work chains.

The bitcoin energy consumption now is more than the combined usage of Amazon, Google, Microsoft, Facebook, and Apple.

This is not a bug; it is a feature of the network. The network relies on computation to secure the network. If you own 51% of the network computation, you can attack the network. As the price of some of these assets rises, the honeypot to attack the network gets increasingly attractive; consequently, as the price rises, the energy required to secure the network rises.

The end goal would be that you would need to control 51% of all the energy in the universe to secure a network like this.

Waste

Specialist computational systems require mining rigs and specialised equipment that become defunct after a while. As a result, the bitcoin network's e-waste is equivalent to what Luxembourg throws in the rubbish every year.

The consumption of silicon by specialist computational systems to mine Bitcoin creates a silicon

shortage right now, affecting the automotive industry. Moreover, from a computing point of view, many gamers cannot get graphics cards for an extraordinary demand from Bitcoin mining.

Concluding Remarks

Iota has removed the concept of miners and fees; no tokens or fees are needed to use the network. As a result, the energy costs are minimal. With the latest system upgrade, 450 million Iota transactions can be done with the energy required for one current Bitcoin transaction.

Additionally, the hardware use is standard. So, once it is not used for that, it can be reused for something else. Having a broader vision of the impact of Blockchain, not just the scalability of the platform, but sustainability and the impact on the world resources are essential.

4.3. Dr Luke Riley, Head of Innovation, Quant Network



The UK Government should establish a UK blockchain services network for domestic services usage and international trade purposes.

Blockchain services and networks are starting to be seen at national and multinational levels around the world. With a tremendous digital services sector, the UK should be utilising and leading the blockchain services networks.

Commercial apps, departmental government apps and educational apps can be all integrated into a DLT API gateway. This is one of the categories established by the World Economic Forum for interoperability and Quant's interoperability method. That is a traditional API server but connected to multiple resources underneath where some of those resources are distributed ledger networks.

There are many types of applications that can be used on top of blockchain services networks. For example, high-level applications as Central Bank Digital Currencies (CBDC), state payments, citizen services or identity services. Also, by allowing other nations or other entities onto the network, we can start to have international trade and cross border applications.

It can be made simple for all organisations to connect to any distributed ledger, using the same interaction method with the same API endpoints and using the same data objects on request and the same data objects in the response. This can be an effective system.

Why is blockchain and displeasure interoperability even a question?

Distributed ledgers themselves are designed to be data silos. If you have data or smart contracts on a distributed ledger that natively reaches out to another technology resource and comes back with a response, and if that reaches out request occurs on different nodes in the network, a different time, the system will end up with every node in the network has inconsistent data.

They were made as data silos to get around this problem, and they have restricted methods to interact with other technologies.

Why would we want to interact and between distribute ledgers?

There are many reasons distinctive features are provided by different distributed ledger technologies that might already be a decentralised app on one network. We might want to put an app on a different network. We might want these two to talk together.

For instance, we might be developing an app that connects to different networks with the same domain, like the supply chains. However, these different networks may be based on two different technologies.

Interoperability

Interoperability is exceedingly difficult, and there are many reasons why,

- Keeping data consistent between two networks when you do not have a cross-network consensus protocol is complex.
- Different permission systems and different networks,
- Different storage architectures.
- Several types of smart contracts.

All these things make the data translation interaction a lot more complex. However, a blockchain services network can smooth the integration of these technologies and can minimise the complexity of the interoperability.

Scalability

Scalability from a development perspective is the force process step that any organisation will go through to develop an app on a distributed ledger.

Blockchain services networks can help speed up processes and eliminate friction, but organisations should be happy to use a network with a consortium trust model. The steps

proposed are,

- **Try and identify the technology** to use the networks. This is a time-intensive or expensive task, lots of organisations may give up now, at this stage. If they realised they needed a permission network. Still, they do not have the organisational aspects of building the necessary consortium; they might not even continue and forget about blockchain technology for now. However, an established blockchain services network will have possible networks to connect to reasonably immediately.
- **Start building their chain** aspects, such as smart contracts or the type of transactions they want to do in the network. This is time-intensive and requires very specialist skills, which can be highly costly to find. With a blockchain services network, correct services in an API can smooth this process. Standard smart contracts that can be deployed, standard ways to invoke and use smart contracts on multiple technologies.

Additionally, developing an app implies having everyday application aspects like databases, UX, etc. Databases and files can also be embedded into a national blockchain network if required.

Interaction with every type of node is very bespoke, taking time to understand. In addition, different libraries with different technologies are needed. However, an API gateway interface can reduce the complexity of using these bespoke libraries in various parts of the solution.

Concluding Remarks

A Blockchain services network should be built with interoperability in mind from day one because different technologies can provide different features.

Build it in a standardised way from day one, using emerging standards such as the one developed by an ISO Technical Committee 307.

Building applications for multiple distributed ledger technologies have even more steps involved than the previous technology, evaluate all the several types of interoperability categories that are available and decide which one is appropriate for the organisation

Unless people like the UK Government produce services infrastructure for this type of thing now, we can eliminate most of the time and cost.

4.4. Adi Ben-Ari, Founder & CEO Applied Blockchain



Blockchain for us is about group security of historical transactions

It has a group that guards the history of transactions and history of data. This is what it boils down to; everything else is built on top of that. Immutability is excellent for records of ownership, where we have things at stake, and we prefer a group to look after it than a single party.

Problems

Blockchain is not particularly good for storing data

The reason is that these are distributed systems. We are taking a database and replicating it. If an attacker now has multiple targets instead of one target, it is not suitable to put data. Blockchain is not a technology for data privacy, and Blockchain is not a technology for parties to show data through them. Unfortunately, we see this quite a lot; therefore, we do not think Blockchain is for or good at.

Scalability

In terms of scalability, public blockchains are particularly slow at the moment due to their heavy consensus requirements.

However, once we close a group, know the parties dealing with, and consider it a trusted group, we can have a lighter consensus mechanism that makes things quicker.

It is a little bit of a trade-off because if the very reason we are using these distributed ledgers in the first place is for group security, then making these groups minuscule in pairs of parties undermines the very advantages of using a Blockchain in the first place.

What are the solutions?

We should minimise what we put on a chain and what we use it for

It should be used for work or ownership, where the value of those ownership records is high. We should not put lots of data on there and throw all our business processes inside because there are far more efficient technologies available for doing that. Minimising what we put on a blockchain, we find that they are much more scalable.

We should maximise what we do outside of the chain and just put evidence into the Blockchain itself

Zk-Rollups, which means let us do more outside the chain, is preparing things using cryptography and putting evidence into the Blockchain itself. It makes Blockchain lighter and therefore more scalable. It can even be more interoperable.

Interoperability

We now have a soup of different platforms covering various aspects of life cycles of sometimes the same assets.

We have supply chains for certain products, financing networks for financing the development and production of those same products, insurance networks for insuring those same products. Yet, none of these things is connected on different technology platforms that have to work with each other—this evolving commercial space is challenging.

Through looking to try to solve the problem, we have very incompatible technology platforms. All the different Blockchains are fundamentally built using different technology, so they are not designed to talk to each other, and they are vastly different.

The data itself necessarily has not to be standardised. It is the evidence about that data required in a blockchain where we need to focus on. This might make things much more straightforward.

Then dealing with assets and tokens interoperability does not just mean moving a record around. It means we have to appreciate that wherever this asset or token has been moved, that record is the current master record for ownership of the asset.

If we are looking to solve a data problem, Blockchain is not the place for this.

This kind of movement is now vastly different to just moving or copying a bit of data from one Blockchain to another. This is a more challenging problem, and there are many technical solutions out there for this.

The provenance of the records

We have ownership records, but we might also want to know what to validate properties of the history of a specific asset. For example, is it a green asset? Did a particular manufacturer produce it? Was it produced a certain way? Do we have some evidence about its history?

These records should be expressed to be verified and scalable, so we do not need a lot of data. We probably want them to be private, preserving because we do not want to give away commercially sensitive information. All of these generate another problem, space and identity.

There is a range of solutions out there, bridges and bridging networks. If you do not want to trust one bridge and there are even enclaves now, which provide another method of witnessing and validating things. There are some standard groups, and the most important is the technology-agnostic groups that focus on things like identity. We can then overlay those onto any blockchain solution or even a non-blockchain solution.

Zero-knowledge proof

It is an advanced form of cryptography. We developed assets that we could deploy the diverse types of blockchains with Hyperledger fabric. We can move those assets across because they were not expressed in the technology of the blockchain. They were expressed just using cryptography. As long as we have the mass libraries available on different Blockchains to verify these, we can just move them around. This is one part of some kind of interoperability.

Recommendations

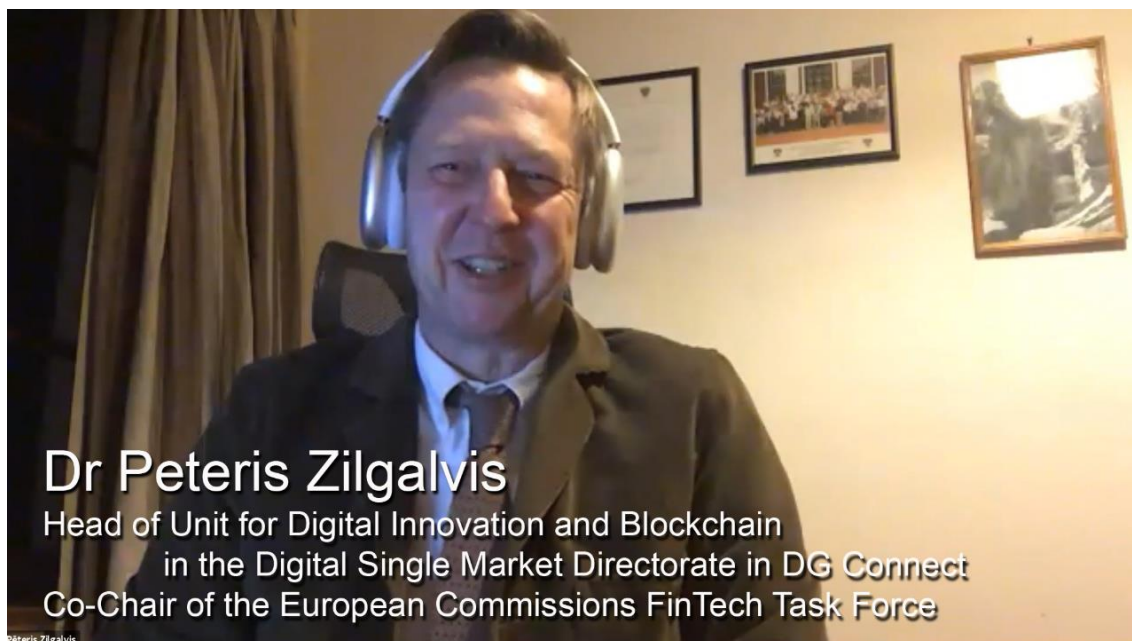
Government should stay away from specific technologies. The most important thing for Government is the data.

The digital data exposed for the Government should be in the form of digitally signed data so that the provenance and proof of the authenticity of the data are provided. This is nothing to do with blockchain. It is just cryptography. However, blockchains can consume that, and smart contracts can build logic around that.

The Government needs to provide something using standard cryptography that any blockchain application can then consume.

This will provide massive value for minimal cost, does not hinder scalability, and is interoperable as well.

4.5. Dr Pēteris Zilgalvis, Head of Unit for Digital Innovation, European Commission



Introduction

Part of the EU ambition for blockchain is to have sustainable Blockchains. Part of our fintech Action Plan is the EU Blockchain Observatory Forum, a think tank collecting information, projects and issuing in-depth reports.

Following a recent workshop on Central Bank Digital Currencies (CBDC), with the Bank of Canada and the Bank of Japan, along with the European Central Bank, the EU commission is now issuing a report on Central Bank digital currencies with more workshops coming up.

The Digital Innovation Unit is the one that represents the European Commission in the ISO technical committee 307, which is a crucial tool for interoperability. Also, in Europe, the EBSI (European Blockchain Service Infrastructure) is working in relevant applications as Self-sovereign ID or Education Credentials.

Use-Cases within the EU Blockchain Partnership

We have the European Blockchain Partnership, which is now twenty-nine countries. It has all 27 EU Member States, Norway, and Liechtenstein, building a European blockchain services infrastructure; this is not piloting; this is deployment.

Self-sovereign identity

This year we plan to deploy the first use cases on self-sovereign identity. It will give the citizens control over their identity, which compliments the classic e-identity issued by EU states.

It will be our identity on the internet, other credentials that you might want to put together as diplomas. We support students and academics struggling and working across borders, as well as people in the midst of their careers. This is intended to help people, not even carrying a physical diploma to show it or send scans and then get verifications from universities.

Timestamping and Documents Audit

Audit documents certification, transparency, and time stamping of documents are other strengths in a blockchain. Finally, REGtech, regulatory reporting, where we see this as a more efficient and transparent way for the regulated entities to deal with reporting requirements and for the supervisor authorities to get information more quickly.

We will be moving on to use cases and small and medium enterprise *bonds financing* for SMEs, a silent procedure, and the *European social security card*.

These use cases are all starting right now. We have international cooperation with Canada and Australia, particularly in the digital ID project. We are looking forward to working more with other international partners, for instance, in the G 20 context coming up.

Legal Framework

The EU intend to have a clear legal framework for a flourishing private sector blockchain in Europe.

These are the markets in crypto assets that bring in the utility tokens, the so-called stable coins, and security tokens that stay covered by MiFID. The approach is a risk-based balanced approach. Where there is the least risk, there is a lighter regime. Then there is a supervisory mechanism at the European level because of the main level of impact.

The EU Commission will be producing a new regulatory proposal on the EU, where the self-sovereign identity will be a part of it. In the upcoming Data Act, we look to have some text on smart contracts to ensure that they are not fragmented across the single digital market, and they can be utilised as either legally binding or just as software on the blockchain, without having to have different registration requirements or different ways of being authorised or utilised.

Digital Skills

The EU is also investing in research, innovation, and skills. Basic digital skills and advanced digital skills are identified as strength areas within Europe; however, there is room for improvement. It is a significant area to work with our international partners.

Interoperability

The EU is working with the private stakeholder community; For instance, the EU has partnered with the International Association of Trusted Blockchain Applications, which is international, not simply European. They are also working in areas like standards and interoperability from the side of the private sector stakeholders. The European Commission is a Co-chair of its Governmental Advisory Board, and one of the areas we are looking at is standardisation and interoperability.

For the Commission, interoperability is a core part of the infrastructure of our public services, and we are looking, together with the partners, exactly which kind of interoperability between the blockchains themselves, between the tokens is needed.

To some extent, it is an exploratory mechanism, even while implementing to have the right level of interoperability in areas such as the internet. However, it is not worth trying to make absolutely everything interoperable and, for instance, in some cases for security reasons.

Concluding Remarks

We want to ensure that the values and approach of the European Union are considered in technologies, and technologies are not utilised to reduce citizens' freedom.

We want to ensure that the values and approaches of what we could call democratic countries, the OECD, the G7 and the European Union, are considered in technologies. That could have been used for surveillance or other uses that should be in a system of the rule of law, confined to lawful uses, and not utilised in a way that reduces the freedom of citizens.

5. Speaker Bios

APPG BLOCKCHAIN EVIDENCE MEETING INTEROPERABILITY & SCALABILITY: EMERGING STANDARDS & POLICIES TUESDAY 23 FEBRUARY 17:30 - 18:45 PM LONDON-TIME - GLOBAL WEBINAR



EVIDENCE GIVERS FROM LEFT TO RIGHT

- **Dr Luke Riley** is the Head of Innovation at **Quant Network**
- **Dr Navin Ramachandran**, Member of the Board of Directors at **IOTA Foundation**
- **Adi Ben-Ari** is Founder and CEO at **Applied Blockchain**
- **Tyler Welmans** is the Blockchain Lead at **Deloitte UK**
- **Dr Pēteris Zilgalvis** is the Head of Unit for Digital Innovation and Blockchain in the Digital Single Market Directorate in DG CONNECT and Co-Chair of the **European Commission FinTech Task Force**
@appg_blockchain

Dr Luke Riley is the **Head of Innovation** at **Quant Network**. Luke Leads Quant's R&D group, which utilises cross-DLT standardisation to deploy DLT interoperability solutions such as cross-chain asset transfers, payment channel hubs, and atomic swaps. Previously at King's College London, where he developed their DLT online module and had a core role in EPSRC DLT funded projects for voting system and consensus protocol development.

Dr Navin Ramachandran, Member of the **Board of Directors** at **IOTA Foundation**. Navin is a Consultant Radiologist at University College London Hospital and an Honorary Senior Lecturer at the UCL Centre for Health Informatics and Multiprofessional Education. As a practising medical doctor and healthcare researcher, Navin took the lead of IOTA's eHealth-focused activities, publishing the use of the IOTA MAM protocol in healthcare. He also has a keen interest in information modelling, augmented reality and the impact of AI.

Adi Ben-Ari, Founder & **CEO Applied Blockchain**. Applied Blockchain is a fast-growing team of blockchain and cryptography experts based in London, and Porto, Portugal. They develop state of the art solutions for customers including Shell (also an investor in the company), KLM, United Nations, Vodafone, Lloyds Register, Toyota and over 60 blockchain startups and global corporates. Other accreditations include: (i) Keynote speaking at major industry conferences, presentation of blockchain to corporates (board C-level), advisory and development of real world

production solutions. Invited to present at UK Parliament and House of Lords, invited to lecture at University College London. (ii) Graduated Barclays Techstars technology accelerator programme with Tallysticks (blockchain based invoicing). (iii) 25+ years experience as solution / integration architect, designer, developer and development/project manager for blue chip companies and more recently start-ups. Extensive experience in Telecoms sector with Vodafone, T-Mobile, Carphone Warehouse, Nextel, Verizon, KPN, UPC, O2, and Amdocs. Financial services experience at Lloyd's Insurance Market and Lloyds Banking Group. (iv) Co-invented, designed, and registered a number of patents, including in blockchain, confidential computing and mobile payments. (v) Previous hands-on and architecture experience: privacy preserving technologies including multiparty computation, zero knowledge proofs, secure enclaves, blockchains and smart contracts, analytics, big data, machine learning, enterprise integration.

Tyler Welmans is the **Blockchain Lead** at **Deloitte UK**. Tyler spent ten years in the industry across legal, telco, media and FSI environments before joining Deloitte Digital in 2012, where he developed a focus on public sector consulting. Tyler is passionate about emerging and disruptive technology, particularly trends that can positively impact society, and is keenly interested in Digital Identity, the Internet of Things, and Blockchain technology. Tyler co-founded the Deloitte Blockchain Lab in 2015.

Dr Pēteris Zilgalvis is the **Head of Unit for Digital Innovation and Blockchain** in the Digital Single Market Directorate in DG CONNECT and is the Co-Chair of the **European Commission** FinTech Task Force. He was the Visiting EU Fellow at St. Antony's College, University of Oxford, for 2013-14. He has been a member of the California State Bar since 1991, completed his JD at the University of Southern California, his BA in Political Science, Cum Laude, at UCLA, and the High Potentials Leadership Program at Harvard Business School. An upcoming publication is "The Law and Political Economy of Decentralised Digital Ecosystems".

6. Contact details

APPG Blockchain Secretariat

Big Innovation Centre

4-16 Dowgate Hill
London EC2A 2BU
United Kingdom

info@biginnovationcentre.com

www.biginnovationcentre.com

