An IP perspective on Blockchain: beyond the realm of cryptocurrencies

Executive Summary

" **Blockchain is a foundational technology that has the potential to profoundly change our social and economic infrastructure.** Although its used interchangeably with Bitcoin, they are not the same thing; Bitcoin is a digital cryptocurrency which is completely unregulated, but blockchain is the underlying technology that maintains the Bitcoin transaction ledger.

There are fundamental principles common to all blockchain. In essence, blockchain is a record of transactions commonly referred to as a ledger. Copies of the ledger are distributed amongst the peers in the network which is why it is sometimes called a 'distributed ledger'. However, because there is no central authority, network participants must reach a "consensus" on the validity of transactions before they can be recorded. This provides blockchain with two characteristics: transparency and decentralization.

Our research indicates that blockchain is experiencing a period of hyper-growth- as evidenced by patent flings, equity investment and announcement of blockchain initiatives by traditional institutions. This would suggest that innovation remains surprisingly resilient as companies adjust to growing geo-political and economic uncertainties, including the imposition of tougher sanctions, in the US in particular. At first glance, the regulator appeared to be taking a hands-off approach, but R&D players should be wary that there will be increased scrutiny in years ahead that may delay product development. And it is in light of this ambiguity, that we will see companies tap into more favorable markets conditions in regions like Europe. If companies are to ensure return of investment on distributed ledger-enabled projects, early adoption will be key.

Although the potential benefits of blockchain are known, there remains some key challenges that need to be addressed. Because much of blockchain is open-source, this has prompted a culture of "open innovation"; enterprise incumbents are choosing to participate in open-ledger projects aimed at realizing the value of blockchain. On the other hand, there are still incentives to obtain a patent on a new and non-obvious blockchain improvement, for example, by using a patent as a bargaining chip in cross-licensing negotiations or a route to obtaining tax credits.

At present, the regulator has been keeping a close eye on developments, wary of stifling innovation through premature imposition of regulation. However, there have been calls for a framework to deal with pertinent risks like money laundering, terrorism and legal certainty. It is also submitted in this report that there is a strong justification to reject one of the fundamental principles of blockchain technology- absolute immutability- in favor of an 'editable' blockchain to address legal and regulatory requirements, sensitive information and human error. From R&D to Legal Departments, companies using or planning to deploy distributed ledger technology should take steps to ensure they are not in breach of relevant data protection laws, particularly those obligations under the EU General Data Protection Regulation, which will take effect in May 2018.

Start-ups were the first movers in blockchain innovation, shortly followed by a fleet of financial institutions and tech giants. But as the technology reaches maturation, we will see more non-tech entrants attempt to penetrate the market.

Blockchain 2.0 is the idea of blockchain as a programmable distributed trust infrastructure, which will create opportunities and potential use cases for sector-specific problems from healthcare to intellectual property rights.

Litigation involving non-patenting entities is likely to be prolific, but to mitigate IP disputes across different sectors, organizations are developing industry-led defensive patent strategies.

In future, we will see decentralized structures become ubiquitous and the injection of artificial intelligence into DLT.
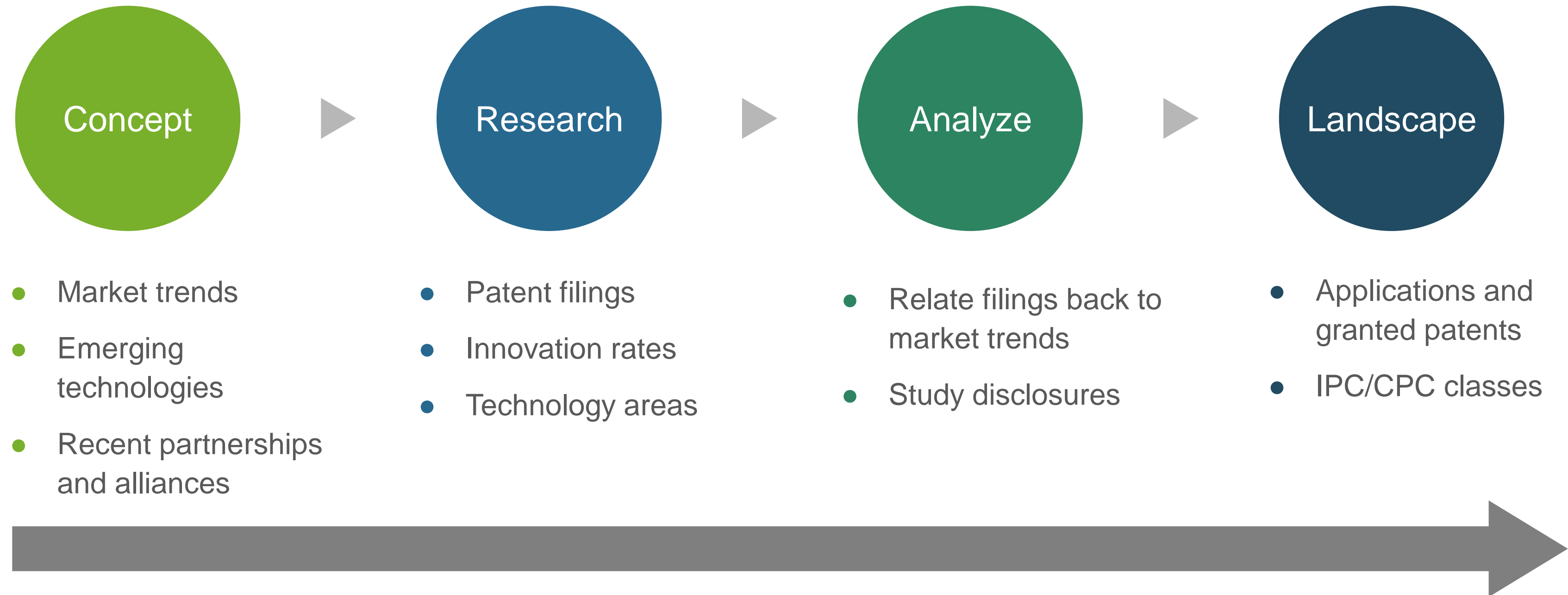
Contents

- Market Insights

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- Competitive Landscape

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Our methodology

How we analysed the landscape

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Concept ▶ **Research** ▶ **Analyze** ▶ **Landscape**

- Market trends
- Emerging technologies
- Recent partnerships and alliances

- Patent filings
- Innovation rates
- Technology areas

- Relate filings back to market trends
- Study disclosures

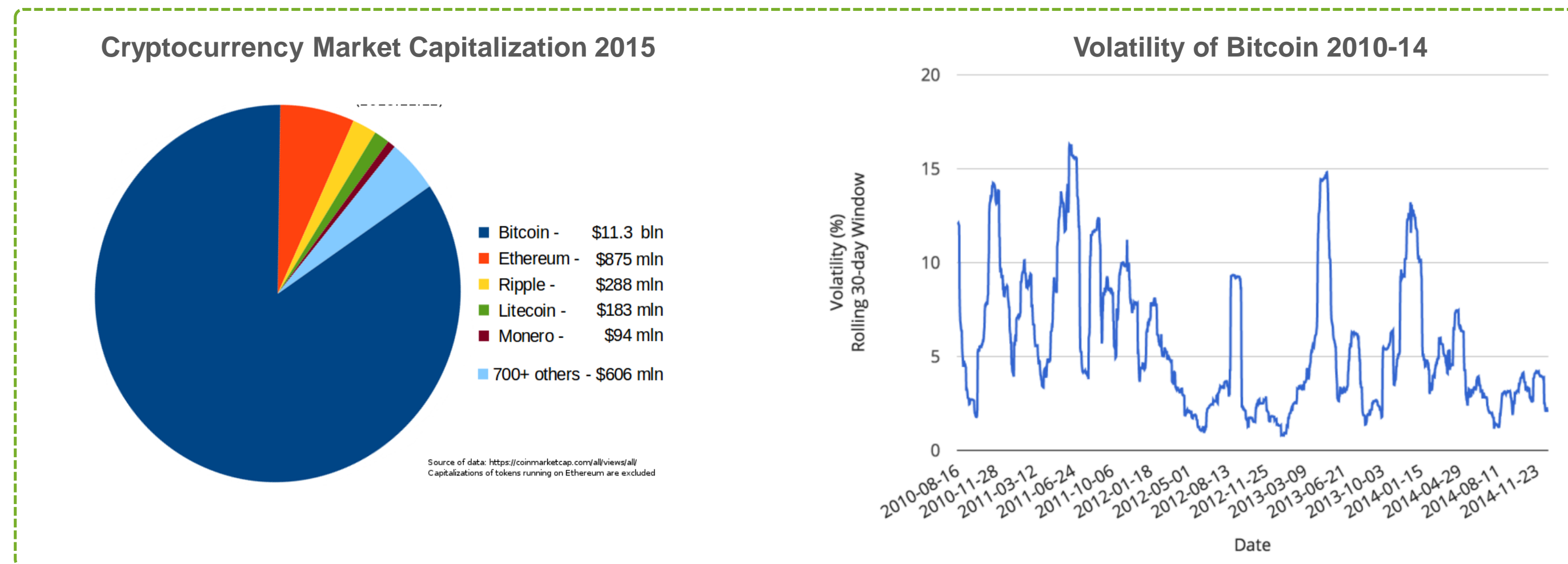- Applications and granted patents
- IPC/CPC classes

Market Insights

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Cryptocurrencies: what are they?

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A truly peer-to-peer electronic cash system

Before taking a look at blockchain, it is important to bear in mind that Bitcoin and blockchain are not the same thing- although you would be forgiven for thinking so, because they are closely related.

To provide a brief disambiguation, Bitcoin is a digital "cryptocurrency" that is not regulated by a centralized authority like a bank or government. Blockchain, on the other hand, is the underlying technology that maintains the Bitcoin transaction ledger. When the first Bitcoin was created, in 2009, by Satoshi Nakamoto, it was the first application of distributed ledger technology (DLT), but somehow this lead to "Bitcoin" being used as a synonym for blockchain. Unfortunately this situation has acted as a deterrent; a lot of non-tech R&D companies have been distracted by the volatility associated with cryptocurrency markets, at the expense of realizing the value of blockchain in their organization.

Cryptocurrency Market Capitalization 2015

- Bitcoin - $11.3 bln
- Ethereum - $875 mln
- Ripple - $288 mln
- Litecoin - $183 mln
- Monero - $94 mln

- 700+ others - $606 mln

Source of data: https://coinmarketcap.com/all/views/all/
Capitalizations of tokens running on Ethereum are excluded

Volatility of Bitcoin 2010-14

Volatility (%) Rolling 30-day Window

Date

Although Bitcoin leads the market, in terms of market capitalization, user base and popularity. However, there are various types of other currencies inspired by Bitcoin which are collectively called altcoin. Examples of these alternative currencies include Litecoin (LTC), Ethereum (ETH), and Ripple (XRP).

How blockchain works

Basic principles underlying blockchain

Blockchain may seem complex (and it is), but it can also be distilled into some readily understandable principles that can be used to appreciate the value of the technology :

1. A distributed database
In its simplest form, a blockchain is a database or record of transactions, commonly referred to as a ledger. The transactions on this database could involve any type of property, intangible or tangible: it could be a currency, goods or even information. Copies of the ledger are distributed amongst the peers in the network which is why it is sometimes called a 'distributed ledger'. And a blockchain needs to do two things: gather data into fixed structures called blocks and then chain them together using cryptography- this forms a blockchain.

2. Transparency
Let's start with a simple transaction where A transfers Bitcoin to B. How would this work, exactly? It begins like most digital transactions, where A requests a sum of money from B, with the transaction being broadcasted to other computers in the network. However, because there is no central authority, network participants must agree on the validity of transactions before they can be recorded. This agreement is known as a "consensus", which is achieved through a process known as "mining".

3. Security and computational logic
Miners are like book-keepers of the ledger that engage in complex, resource-intense equations to verify the legitimacy of the transaction. To be more specific, the key to blockchain security is hash. A hash function transforms each block of information associated with a transaction into something different by applying a cryptographic algorithm to create hash- a unique string of characters. Through this process of mining, a "proof of work" that meets certain requirements is created. One of the safeguards that makes the system difficult (although not impossible) to hack, is the fact that this process is so costly and time consuming. In real-world terms, that means a lot of processing power. Anyone attempting to hack the Bitcoin network would have to compete against the whole network.

4. Immutability
For a transaction to be validated, an individual record must therefore have a proof of work to show the consensus was achieved. When a miner solves the problem, the discovery is announced to the rest of the network and a block is added to the chain. Since all the participants have a copy of the entire blockchain, they can detect when the hashes do not match up across the chain. Inherently, this means that records cannot be tampered with after they have been added to the blockchain. Adding a new block to the chain means updating the ledger that is held by all users. It creates a permanent public record. It can not be removed. Here the system is provided with transparency rather than relying on governments and traditional banking systems.

How secure is the protocol?

A blockchain facilitates secure online transactions

Differences between public and private blockchains

To understand blockchain's security risks, it is important to distinguish between public and private blockchain. Bitcoin uses a "permissionless" blockchain. Anyone can read or write transactions, provided they put in enough effort to solve the cryptographic puzzle. This has attracted business interest, so the network is used for market trading. By deduction, this makes a private blockchain one that has restricted or required permission for those to read and write transactions.

Source:<http://binarybills.com/2017/03/30/how-safe-are-blockchains-it-depends/>

Because there is no centralized authority, public blockchains typically require vehicles to arbitrate disputes among participants in the network. With Bitcoin, for instance, new transactions can only be added to the blockchain after a participant on the network (known as a "miner") solves a complex mathematical problem, known as a proof of work.

When a miner 'solves' the problem, they are usually rewarded with Bitcoin- this incentives the work. And the effort the miners have to expend on finding a 'node' that solves the problem, is a sign the transactions are valid.

This is how Bitcoin and other cryptocurrencies secure their blockchain by requiring new entries to include a proof of work. While cryptocurrencies experience rock fluctuations in value, so far this technology has managed to fend-off cyber attacks for more than 8 years.

Why your business should care

Reasons to invest in blockchain technology

- **It's a "foundational technology".** While some third parties may mistake the volatility of Bitcoin for blockchain, they are not the same thing. The truth is that blockchain is not a "disruptive" technology, which threatens traditional businesses with a lower-cost solution. According to the *Harvard Business Review* (2017), blockchain is a "*foundational* technology: It has the potential to create new foundations for our economic and social systems".

- **Growth of DLT is unprecedented.** The global blockchain technology market is expected to reach 7.74 billion USD by 2024 (Grand View Research, 2016). Even though most this growth has been driven by the financial services industry, companies are pursuing a myriad of use cases from healthcare to public transport.

- **Gain a competitive-edge.** Failure to adopt new technologies is often the difference between a strong organization and a sustainable one. If we assume that bitcoin is like an early email then yes, blockchain may be decades away from reaching its full potential. Enterprise incumbents like Microsoft, IBM and PWC have already made their move. However, in order to co-ordinate business transformation companies need engage in the dialogue now, to ensure adoption in the near future. Deloitte's Survey reports that 60% of big company executives are knowledgeable about blockchain. Even if you do not have the resources to be a first-mover in blockchain related innovation, know-how and infrastructure-readiness will be crucial factors in surviving the profound change that blockchain will bring about.

- **Increase productivity and reduce costings.** There is a great incentive to applying blockchain to business processes: It allows the defining structures in our organizations- contracts, transactions and records- to be secure and transparent. Companies are already realizing the value of blockchain by tracking items in complex supply systems.

The rise of blockchain

A brief history of blockchain innovation

Blockchain adoption and its impact on innovation
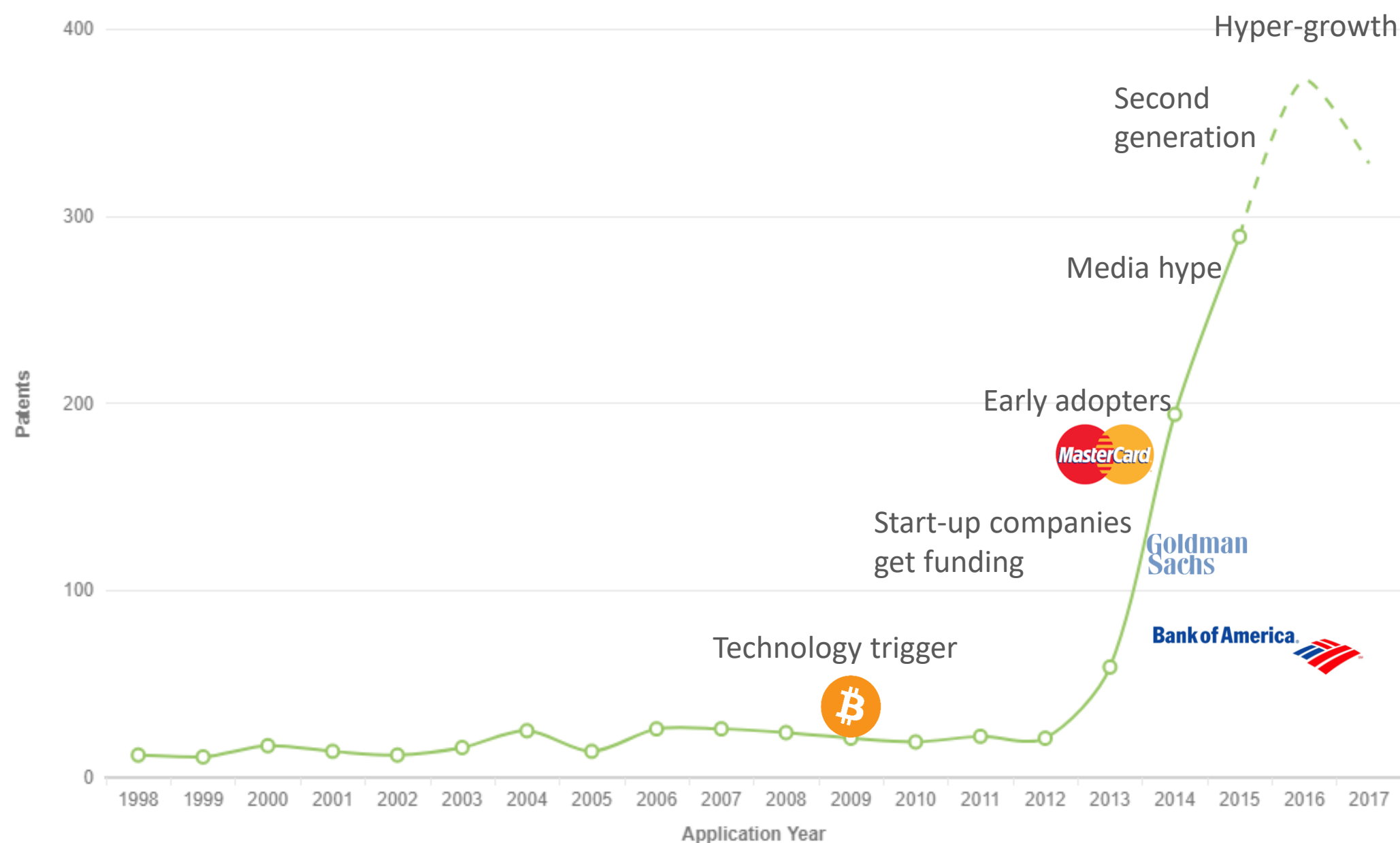
Blockchain is a foundational innovation

The world first caught on to blockchain technology when, during the 2008, financial crisis, an anonymously authored white paper was published. The white paper set out what was termed "*a truly peer-to-peer version of electronic cash*" with the goal of enabling parties to transact without the need for a financial institution to act as a trusted intermediary.

At first glance, companies have been slow to commercialize distributed ledger technology until 2012, based on looking at published applications and granted patents. This was probably due to the lasting impression of Bitcoin as a volatile cryptocurrency.

With much of the software provided under open-source licenses, Bitcoin development proceeded without system ownership or governmental oversight. Many of the leading public blockchain implementations, such as Ethereumm are also open-source. Against this background, Bitcoin took off in 2013, and the price surged, hitting a record of around $1108 per Bitcoin- this was the trigger for many non-financial entrants. At least in its early stages, there was a strong correlation between the stability of cryptocurrency prices and blockchain related patents.

First-movers were from the financial sector; for instance, Bank of America has actively been seeking patents since 2013; it was amongst the first institution to openly claim that cryptocurrencies had "clear potential for growth". Then in 2014, Goldman Sachs filed for a patent related to a "cryptographic currency". More recently, growth has re-emerged from specialized start-ups who have discovered novel use cases for blockchain like insurance, for example.

Even if blockchain is a force to be reckoned with, it has been noted by the *Harvard Business Review* that it will take decades for blockchain to seep into our socio-economic infrastructure.
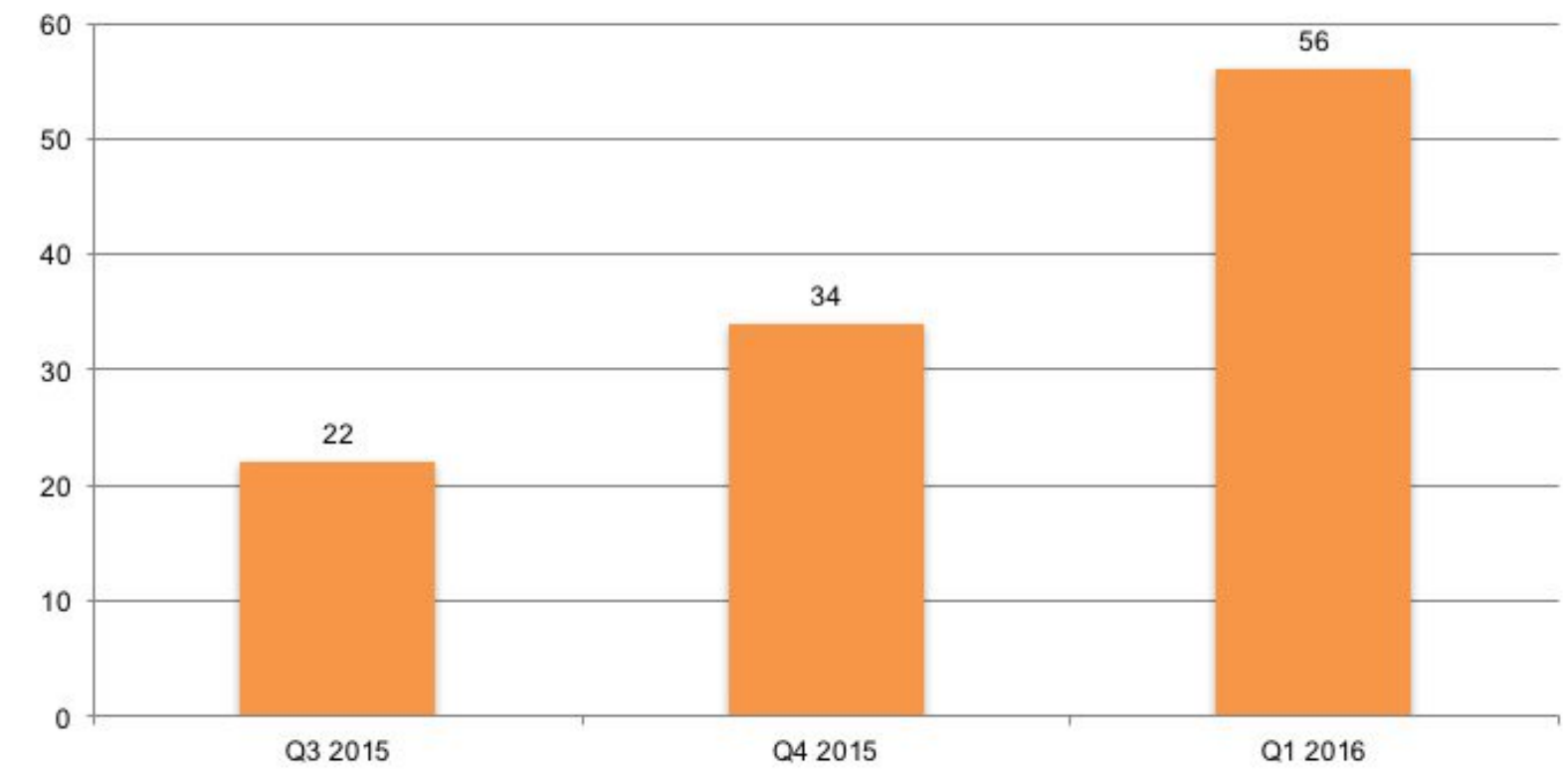
The race to patent blockchain

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VC-backed start-ups and early-adoption by traditional institutions

Predicted filing trends, 2016-2019
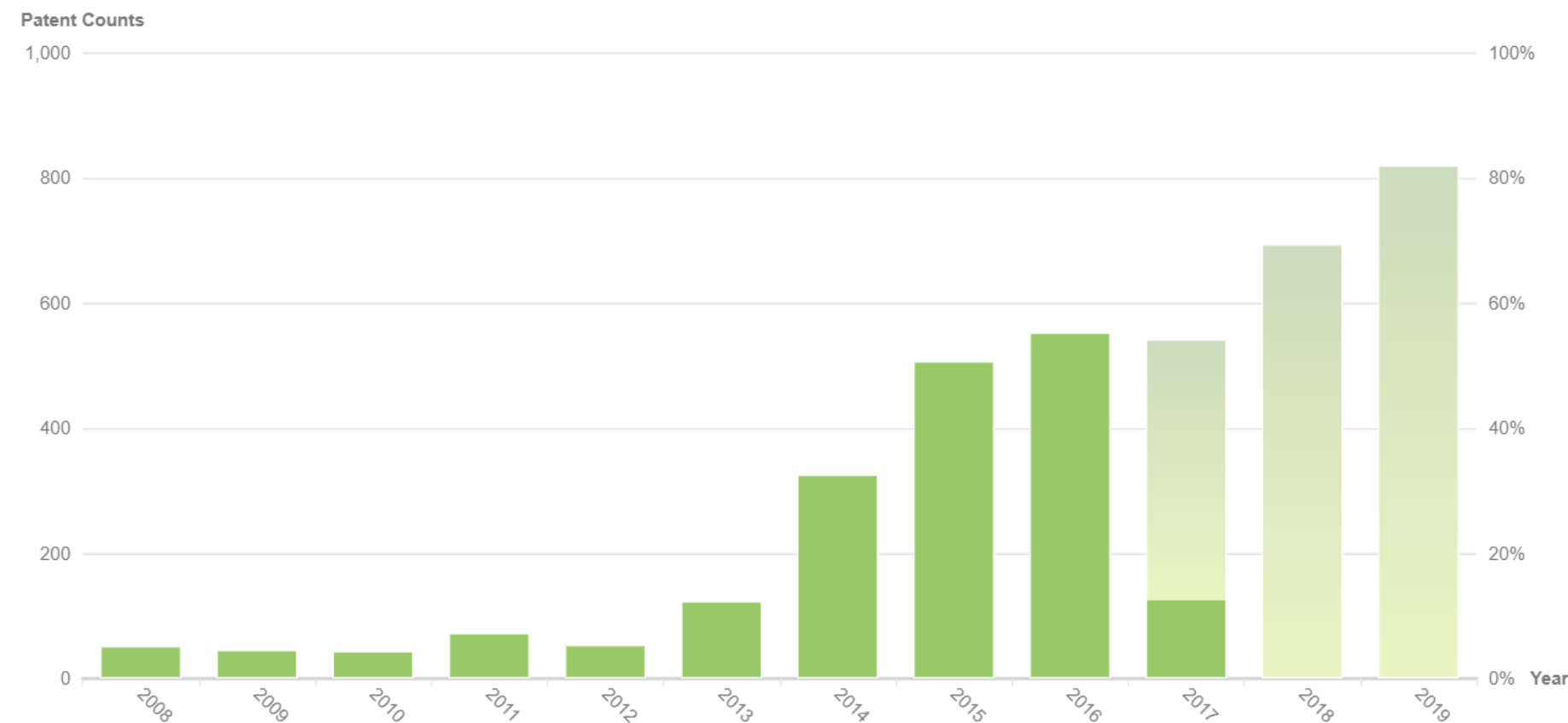
Number of Blockchain Announcements by Traditional Institutions

Source: CoinDesk

How has the rate of innovation and advancement of this technology evolved over time?

Between 2013-2014 there was an 89.7% increase in the number of global published patent applications** related to blockchain technologies. The number of assignees filing for patents on blockchain-related technology is increasing year on year. Using our trend prediction methodology and market intelligence, we anticipate an exponential increase 47% in the number of published applications between 2015 and 2019, when the blockchain market will hit hyper –growth.

If we look at Q1 2016 as an example, equity investment in bitcoin and blockchain start-ups, by venture capitalists has now exceeded $1.1bn and according to CoinDesk, there has also been an increase in the number of traditional institutions (i.e. governments, central banks, financial institutions and other large firms) that have announced some form of blockchain initiative.

** Due to the "grace period" between applying for a patent and publication of that application by the relevant patent office, data collected from 2015 is inconclusive

Regional trends

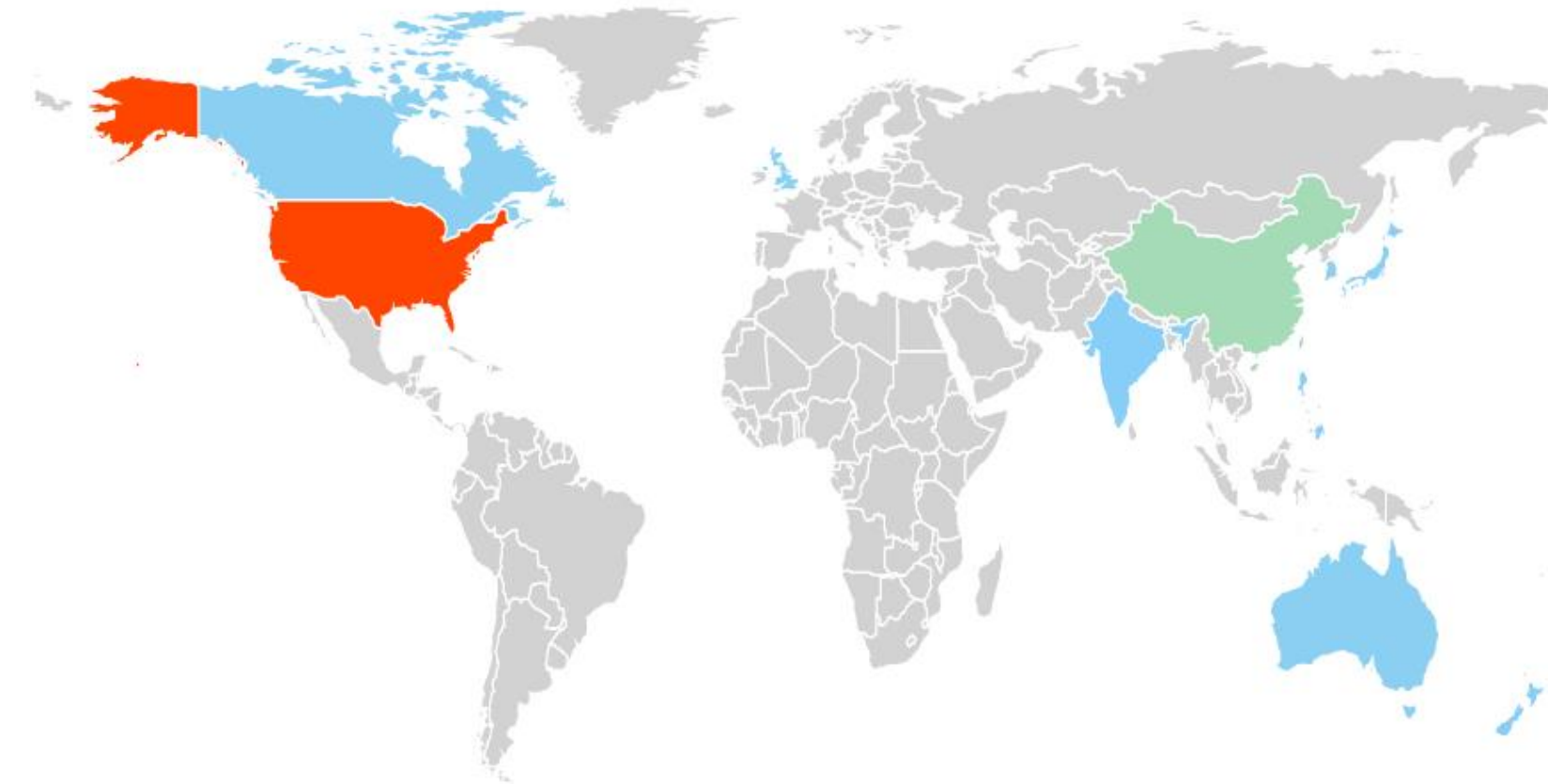## Western Europe grows as the US drops back

Which countries are most interested in blockchain?
As expected, the US is leading patenting activity related to blockchain, with a majority share of 62.7%, followed by PCT applications. Innovation remains surprisingly robust as companies adjust to growing geo-political and economic uncertainties, including the imposition of tougher sanctions, in the US in particular. According to our data, most activity has been coming from the State of California, where Silicon Valley start-ups have bolstered overall regional trends.
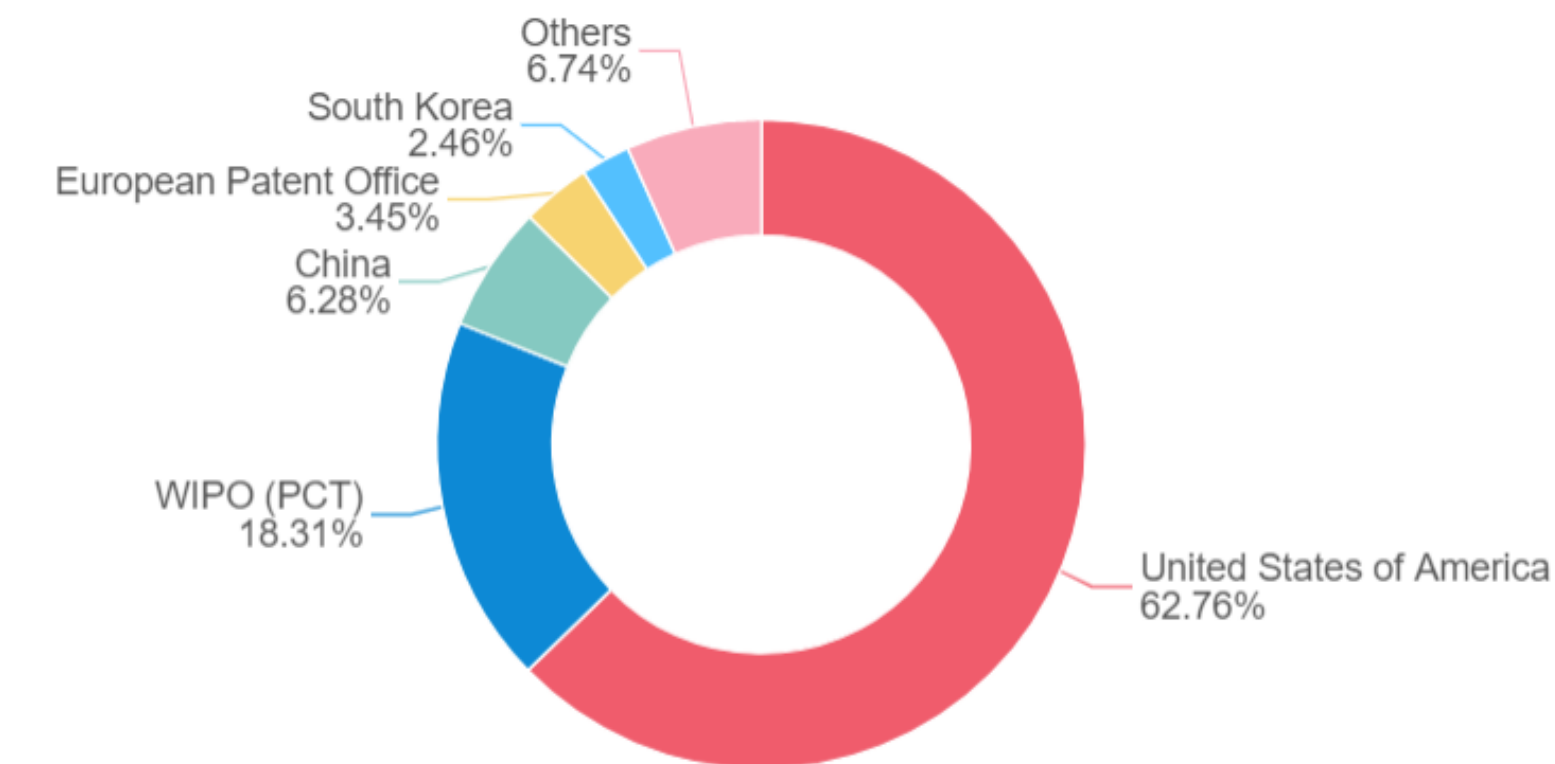
Globally, the regulator has taken a hands-off approach to blockchain. However, in future, the US will become the "reference jurisdiction", as many localities look to the States for guidance on regulating cryptocurrencies and their respective legal status. Although, in future this impact the success rate of filings, it is unlikely to be a deterrent.

In July 2017, the US said that the offering of digital tokens "are subject to the requirements of the federal securities law". This means that virtual transactions will not be exempt from existing regulatory frameworks that are designed to protect markets. The SEC's approach ends a period of doubt, but is strong evidence to suggest other countries attempt to fit cryptocurrencies within their existing regulatory framework.

Elsewhere, Europe continues to be a major player in blockchain innovation, particularly countries like Estonia, Denmark, and Sweden, which are up-and-coming playgrounds for high-revenue, VC-backed companies. Certainly that is how it is seen by the European Commission, who is already pledged to grow its "support" for DLT-enabled projects. Although whether Europe will go beyond the "proof of concept" phase, to take the next step of divesting funds in pan-European blockchain business is yet to be seen.

Geographic territory map of patent filings related to blockchain

Others 6.74%
South Korea 2.46%
European Patent Office 3.45%
China 6.28%
WIPO (PCT) 18.31%
United States of America 62.76%

Competitor Insights

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Key players

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Which big players are filing applications related to blockchain?

Key players

Hardware manufacturers are leading the way, followed by Fintech

Top blockchain innovators, based on published and granted patents
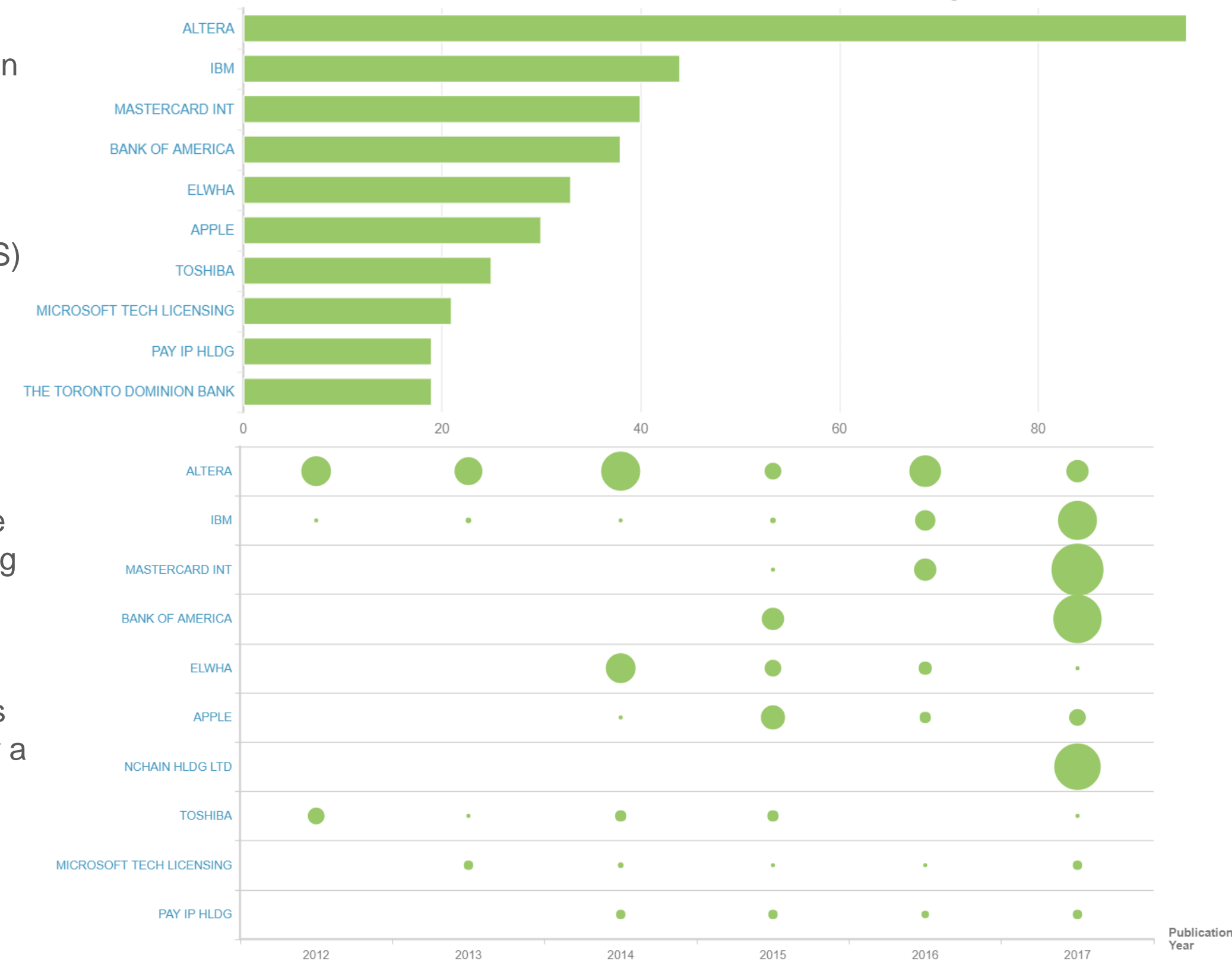
Filing trends

As expected, top filing companies are more likely to invest in cryptocurrencies, than developing their own proprietary code or focusing on novel use cases. The only exception to this rule appears to be IBM who have the most diverse blockchain portfolio of any of the entrants. They have filed patents on everything from DLR-enabled personal identification to smart contracts, supporting their objective of helping business to build blockchain solutions. This Blockchain-as-a-service (BaaS) model has led to collaborations with the likes of Nestle, Unilever and Walmart to tackle food safety, even though this has not resulted in co-ownership of their IP assets.

Interestingly, the top filer overall, Altera, is not a notorious tech-giant, but a manufacturer producing hardware and development boards that can be used to program mining algorithms. In some ways this is a microcosm for blockchain, if the biggest innovator is a specialized, high-tech company that is focused on generating the sheer processing power to support the cryptocurrency market.

MasterCard and Bank of America have exponentially increased DLT-related filings over the course of 2017. They were also some of the first filing financial institutions back in 2013-14, so this recent spurt in activity may suggest they are preparing for a high consumer demand, as well as seeing results from early "proof of concept" initiatives.
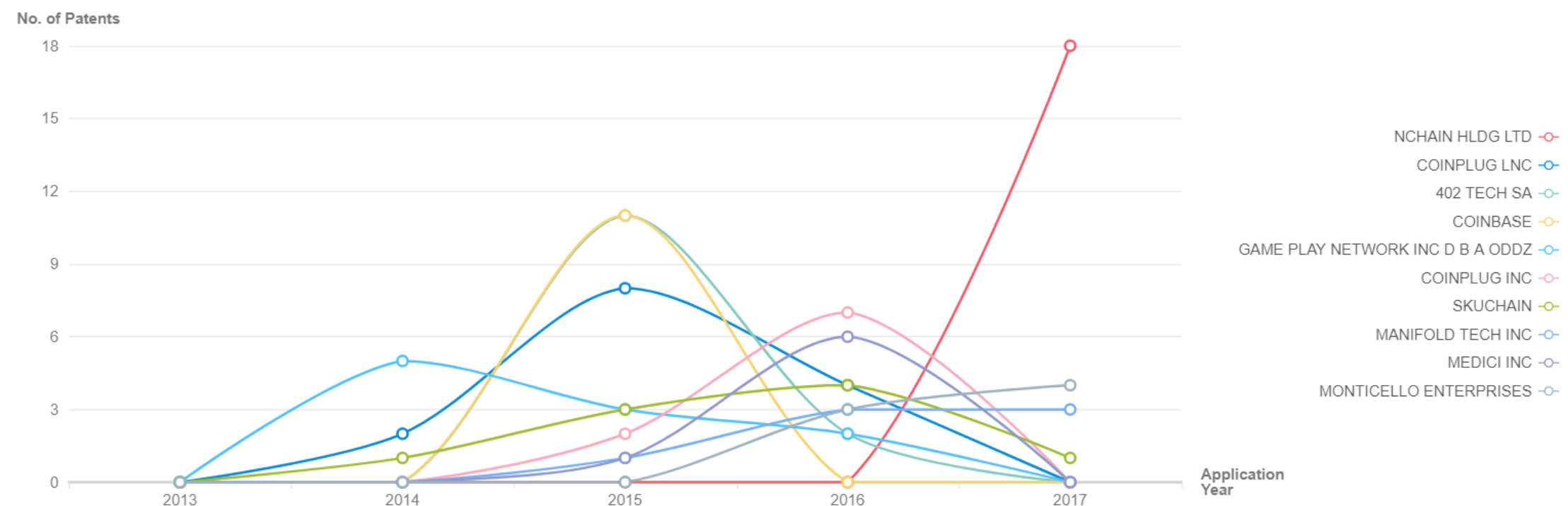
Finally, we can see Microsoft has a relatively modest degree of patenting activity; although, this report has revealed, they seem to be more focused on licensing technology to and from other assignees rather than innovating aggressively in this domain.

Emerging Innovators

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6 Blockchain and bitcoin start-ups you need to know about

No. of Patents

Legend:
- NCHAIN HLDG LTD
- COINPLUG LNC
- 402 TECH SA
- COINBASE
- GAME PLAY NETWORK INC D B A ODDZ
- COINPLUG INC
- SKUCHAIN
- MANIFOLD TECH INC
- MEDICI INC
- MONTICELLO ENTERPRISES

Application Year

It is possible to locate new and emerging companies by looking at assignees have filed patent applications exclusively over the last five years.

Here are the top filers:

1. nChain. this London-based company is focused on blockchain R&D and has recently been acquired by PI High Tech Private Equity Fund in April 2017.

2. CoinPlug. Founded in 2013, Coinplug provides bitcoin exchange, wallet, okBitcard and ATM payment processing targeted at Korea.

3. Coinbase. Golden-state-based Coinbase has received a total of $217.2M in total equity funding for their digital currency wallet service and have acquired high-tech start-ups blockr and Kippt, both in 2014.

4. Skuchain. This company is applying the cryptographic principles developed in the Bitcoin network to supply chains- they are focused on building Smart IoT Contract.

5. Medici Ventures. An investor in blochain.

6. Manifold Technology. The tech company's patented platform was revealed at the blockchain for Wall Street Conference in 2016, in NYC.

The patent landscape

Enterprise incumbents move on blockchain

Methodology

The landscape is plotted according to keyword and international patent classification (IPC) similarity. In order to better understand how some of the key players and concepts relate to the most recent publications they have been highlighted to indicate potential filing strategies.

Determining competitor direction

Enterprise incumbents have been making a move on the blockchain landscape but each player has a slightly different emphasis. IBM having been working on developing an enterprise offering, IBM blockchain, which is completely independent to their Hyperledger Project Contribution. For example, one of their recent applications related to a transactional database management system. This can be contrasted with a company like Apple, who are using the power of blockchain to fortify future and existing devices within their portfolio; they have filed approximately 30 patent applications related to validating access to devices and secure payments generally.
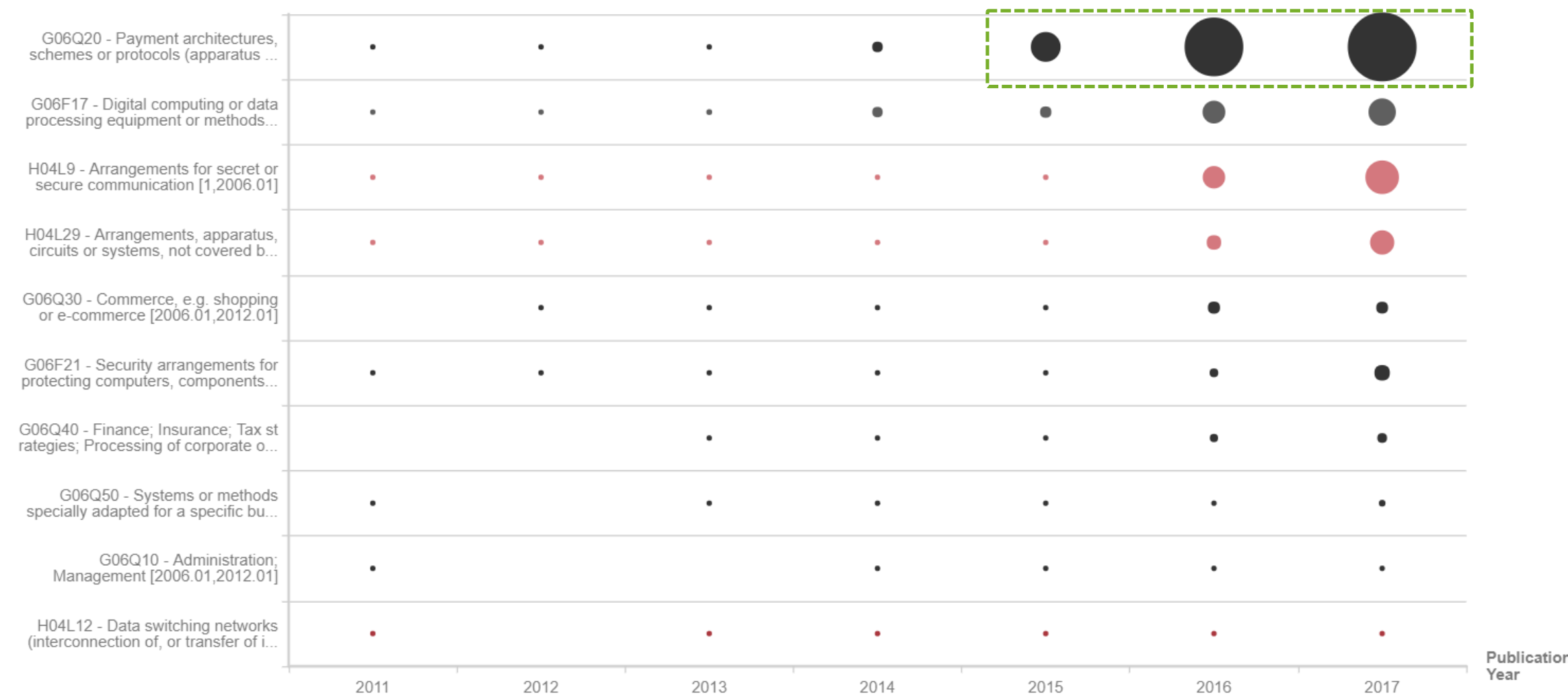
Some players have adopted an altogether different approach to blockchain innovation, focused on commercializing the technology. Microsoft is working on Project Bletchley an open, modular Blockchain-as-a-service (BaaS) fabric provided by Azure. However, they are involved in 13 instances of licensing on the patent landscape. Their most frequent partners seem to be VirnetX Inc. and Science Applications International Corporation (SAIC).Taking a deeper dive, VirnetX is a US-based company that specialises in internet security software; they are likely developing solutions to securely register domain names. On the other hand, SAIC is more focused on solving issues of national and global importance in the areas of defence, intelligence and homeland security- it is likely they are working with the US Government to provide blockchain services.
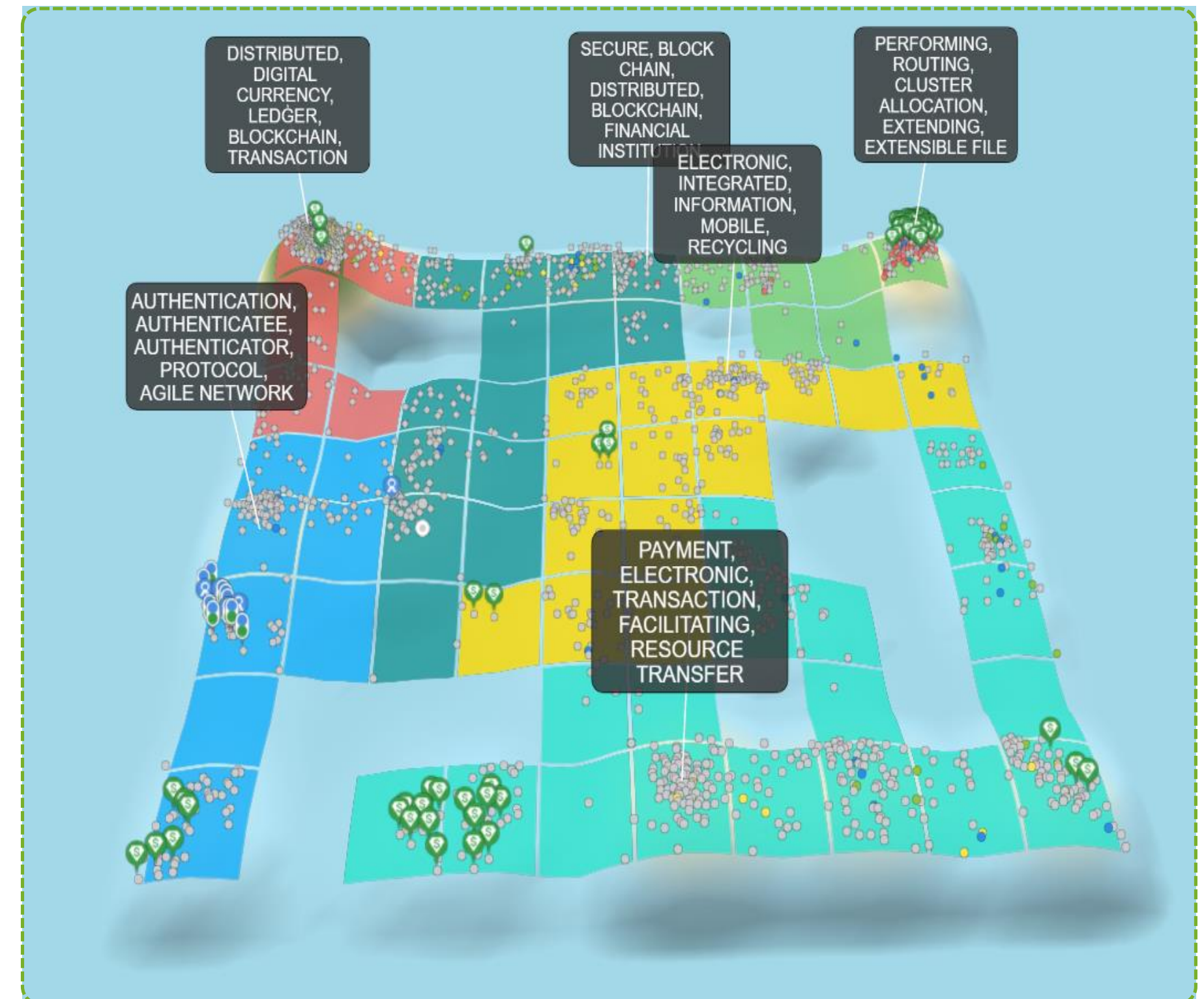
Technology Focus

Payments remain the focus but use cases like cyber-tech are increasing

Published applications and granted patents related to blockchain

	2011	2012	2013	2014	2015	2016	2017
G06Q20 - Payment architectures, schemes or protocols (apparatus ...	·	·	·	•	●	●	●
G06F17 - Digital computing or data processing equipment or methods...	·	·	·	•	•	•	•
H04L9 - Arrangements for secret or secure communication [1,2006.01]	·	·	·	·	·	●	●
H04L29 - Arrangements, apparatus, circuits or systems, not covered b...	·	·	·	·	·	•	●
G06Q30 - Commerce, e.g. shopping or e-commerce [2006.01,2012.01]		·	·	·	·	•	•
G06F21 - Security arrangements for protecting computers, components...		·	·	·	·	•	●
G06Q40 - Finance; Insurance; Tax strategies; Processing of corporate o...			·	·	·	·	·
G06Q50 - Systems or methods specially adapted for a specific bu...	·		·	·	·	·	·
G06Q10 - Administration; Management [2006.01,2012.01]	·		·	·	·	·	·
H04L12 - Data switching networks (interconnection of, or transfer of i...	·		·	·	·	·	·

Publication Year

Which areas of blockchain are companies focusing on?
Using patents as a proxy for innovation, it is possible to determine the technology focus of companies penetrating the blockchain market.

Technology segmentation can be determined using the international patent classification (IPC) and co-operative patent classification (CPC) codes that are applied to patent documents by the World Intellectual Property Organization (WIPO) and the examiners of the respective patent offices like the EPO and USPTO.

At a top level "payment architectures, schemes a protocols"- G06Q10- remains surprisingly resilient, despite the emergence of blockchain use cases outside the financial sector. This classification would appear to cover data processing in relation to payment protocols like Bitcoin as well as any transaction where the procedure includes verification and authentication of all parties involved. Although it is likely that this is more of a symptom of how assignees are patenting blockchain rather than market consolidation.

Hot topics gaining traction in 2016-17 include "security arrangements for protecting computers" which has seen a modest increase in the number of patent applications. To some proponents it has been a long time coming but, companies are discovering ways that blockchain can be used to revolutionize cybersecurity.

Key Challenges

Will blockchain be open-source? patsnap

Collaboration will enable companies to realize value of DLT offerings

Alternatives approaches to innovation

Traditionally, financial institutions have opted for a "own-what-we-develop" approach when it comes to software. Even despite the number of patent applications already filed, however, patent protection has become bit of a taboo in the world of distributed ledgers. Much like the founders of Bitcoin, these companies are trading-off market monopoly for more collaborative open-source models and increasingly actors are realizing that this technology will have to be shared for stakeholders to gain value. Perhaps its no longer a question of asking the question "could I obtain a patent?" but rather, "should I obtain a patent?"

On the one hand, we have the Hyperledger project ("HLP"). In December 2015, the Linux Foundation announced the creation of project to enhance cross-industry collaboration by developing open-source blockchains, focusing on improving the security of these systems. According to the HLP Charter, the mission of the project is to allow "…members [to] build and run robust, industry-specific applications, platforms and hardware systems to support business transactions". And if we look at the project's member organization, it reflects a community-wide effort; the founding members include top tier companies like Cisco, Fujitsu, Hitachi, Intel J.P Morgan, and Samsung. Already, in July 2017, the project has announced its production-ready Hyperledger Fabric, originally contributed by IBM and Digital Asset, that will provide a modular architecture for the execution of smart contracts.

On the other side of the fence, some companies have chosen to hedge their bets. The most controversial example is a recent innovation developed by professional services company Accenture- who is also a top-tier partner of HLP. They, alongside co-developer Giuseppe Ateniese, have filed patent applications in the US and Europe related to a feature which allows a designated administrator to 'edit' a "permissionless" blockchain system.

The incentive to patent

Some would say this represents a paradigmatic shift in how companies are thinking about blockchain innovation. But the question remains: why patent? Its clear that those that do pursue patent protection can obtain significant benefits. For example, patents may be used defensively. In this manner, they may provide a party with a bargaining chip in potential cross-licensing negotiations prior to, or during, infringement litigation. For smaller organizations, a patent may provide evidence that innovation is taking place, which may be the key to securing investments or providing an avenue to obtain tax credits (Krasprowicz and Macek, 2017).

Overall it seems blockchain innovation will be driven by both open source initiatives as well as by proprietary code. Whether code will be made available through licensing agreements is yet to be seen.

Legal implications

If you are considering DLR, beware of data privacy laws

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Personal Data and the blockchain

By design the blockchain databases allows- at least in theory- transactions between parties without them having to disclose their identity to the other party; this is a mischief which data protection law attempts to correct. In principle, if a transaction cannot be traced back to individuals, their anonymity is not affected. And a such companies are legally permitted to use and process data, being outside the scope of European data protection law. But the case is not so clear cut. Paradoxically, if we take a transaction involving, Bitcoin, for example, A's transfer of money to B will be made available to the public and the record will be tamper-proof. It is true that names, addresses, and telephone numbers are not discoverable. However, it may still be possible to peel back the anonymity of the users in the network. In one study on Bitcoin, it was possible to trace back the IP address of a service user to a specific internet connection or internet owner (Biryukov et al., 2014).

The EU General Data Protection Regulation (GDPR)

The EU has introduced a new data protection framework in the form of Regulation 2016/679- the General Data Protection Regulation ("GDPR"). The GDPR will replace the current Directive in Member States and will take effect in May 2018. Here's what you need to know:
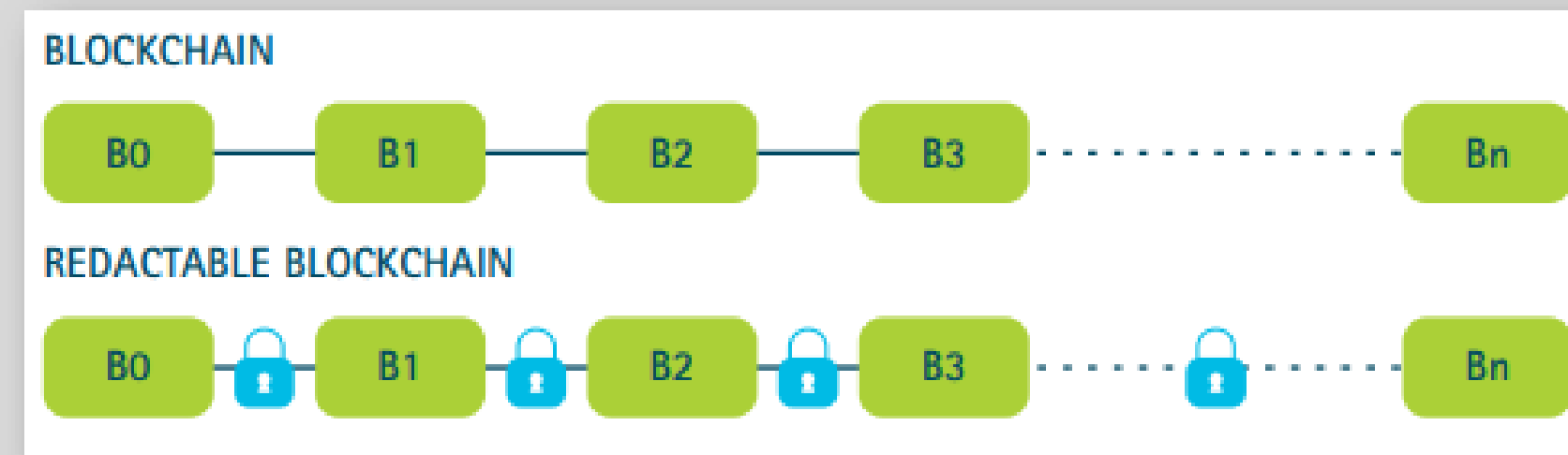
- GDPR has expanded the territorial reach of data protection; it catches data controllers and processors outside the EU "offering goods or services" to EU citizens. In practice, a company outside the EU which is targeting customers in the EU will be impacted by the new rules.
- In its ruling in 2014, the European Court of Justice explicitly recognized the "right to be forgotten" so the EU citizen are entitled to remove any content retrievable from an index of search results, providing the information was not in the public interest. Now this right is strengthened and clarified in Article 17 GDPR. Will services providers be obligated to delete or correct data entries? As we have seen with the Accenture prototype, it may be possible to introduce editability into the blockchain. However, in order to maintain authenticity it will require nomination of trustworthy administrators according to strict rules of governance;
- GDPR also requires "data portability" whereby companies must give customers a copy of their personal data to take them on request- this will have a huge impact on banks, in particular.

In many ways blockchain technology will help discharge companies obligations. But one of the fundamental principles of blockchain- its un-eraseability- is also a potential threat to the individual rights of data protection and privacy held by an EU citizen. It is clear that R&D and legal teams will have to work together to deal with the relevant data protection law.

Is immutability really workable?

A case for 'editable' blockchain

Accenture's invention enables blockchain editing by using a variation of the "chameleon" hash function, which can create a matching algorithm through the use of secure private keys. After a change has been made, the original blockchain remains intact but a key can be used to unlock a padlock to the block that must be changed and its successor. This means that, when necessary, designated administrators acting on agreed rules of governance can edit, rewrite or even remove blocks without breaking the continuity in the chain.

BLOCKCHAIN

B0 — B1 — B2 — B3 - - - - - - - Bn

REDACTABLE BLOCKCHAIN

B0 🔒 B1 🔒 B2 🔒 B3 - - - 🔒 - - - Bn

Source:<https://newsroom.accenture.com/content/1101/files/Cross-FSBC.pdf?

Immutability is one of the key principles of blockchain technology- and there are many proponents that believe this is what makes the new technology innovative. The idea of that a centralized authority can make changes to a decentralized ledger is, of course, a direct contravention of the corruption that Nakamoto sought to put right.

Accenture relied on two primary justifications for developing their prototype, both interlinked. First, they make a conceptual point; if blockchain is to become a reality, we need to rethink absolute immutability. In their patent application, they preserve this virtue by making it possible to identify blocks that have been changed with an un-tamperable "scar" that cannot be removed, even by trusted parties. Second, they come to a logical conclusion that people make mistakes. What happens when there is a bug or weakness in the smart contract code? We also have to address sensitive information and accommodate for legal and regulatory requirements. It is this last notion, that of legal and regulatory requirements, that still remains a great unknown. The World Economic Forum recently noted that success in this area will require "deep collaboration between incumbents, innovators and regulators".

Threats and opportunities

Blockchain 2.0

It's inevitable- blockchain will create new revenue pools in almost every sector

Bitcoin is the most well known application of blockchain. But blockchain has many more existing and potential applications, besides being used as a cryptocurrency. Even Satoshi Nakamoto, the creator of the blockchain, envisaged that "*the [blockchain design supports a tremendous variety of possible transaction types that I designed years ago. Escrow transactions, bonded contracts, third party arbitration, multiparty signatures, etc. If Bitcoin catches on in a big way, these are things that we'll want to explore in future…*"

The term blockchain 2.0 is different from Bitcoin; rather than an asset, it is the idea of blockchain as programable distributed trust infrastructure. Instead of annexing blockchain to payments and currency, blockchain 2.0 expands the scope of the technology to (i) enable the decentralization of markets more generally; (ii) involve other types of assets, for example, land, cars and even IP rights and; (iii) support other types of technology.

As the ecosystem builds, the likelihood that blockchain will significantly shake-up a diverse range of business structures will increase. In February 2017, the *Harvard Business Review* suggested that blockchain was a foundational technology "…with the potential to become the backbone of recording transactions and will create new economic value by dramatically lowering the cost of transactions".

Those organizations that adopt a 'wait-and-see' approach to the world of decentralized ledgers are at risk of not developing the expertise, infrastructure, or experience to integrate the technology effectively. If anything, blockchain will create niche opportunities and potential solutions to sector-specific problems.

What elements are common to all blockchains?

- Decentralized network;
- Distributed ledger;
- Digital signatures and cryptography;
- Programable logic;
- Blockchain uses encryption and digital signatures to prove identity in an anonymized way.

What are the use cases for blockchain? patsnap

Value propositions for blockchain 2.0 by sector

| Sector	Potential applications
Economics and markets	▪ Smart contracts ▪ FinTech ▪ Insurance ▪ Securities trading ▪ Shared economy and crowdfunding
Government and legal	▪ Company incorporation, transfer of equity or ownership ▪ Voting ▪ Decentralized storage ▪ Notarization and document registry ▪ Smart contracts
Internet of Things	▪ Security ▪ Shared ownership of connected devices like autonomous vehicles, land and smartphones.
Consumer Goods	▪ Proof of personal identity ▪ Supply chain tracking ▪ Custodian service for e-commerce
Healthcare and pharmaceuticals	▪ Anti-counterfeiting ▪ Billing and claims adjudication ▪ e-Health record ▪ Pharmaceutical supply chain ▪ Clinical trials

Smart Contracts

Building blocks for digital markets

What is a smart contract?

The basic premise of a standard contract is universal: two or more parties enter into an agreement enforceable by law. And there are certain ingredients that have to be present for the obligation to be enforceable; in particular, a contract generally requires an offer, acceptance, something of adequate value to be exchanged (i.e. consideration) and intention to create legal relations. Smart contracts, on the other hand, are computer protocols that have embedded the terms and conditions of a contract. If I state in code that "If X occurs then do Y", then this is definitely not a new concept; in fact, a standing order or direct debit could fall within such a definition. The phrase smart contract" was actually coined around 1993 by Nick Szabo, a legal scholar and cryptographer, with the aim of bringing "highly evolved" practices of contract law and related business practices to the design of electronic commerce protocols between strangers on the internet. What makes smart contracts different is the idea of combining the same coding with blockchain to product, what some proponents believe is a, partially, or full-executing, contract.

How it works

Taking this idea, a blockchain-enabled contract can be used to exchange any type of asset, and bi-pass the need for an intermediary like a lawyer. To exemplify this, we can take an analogy from Szabo himself. Let's say A wants to get a snack from a vending machine, supplied by B. Ordinarily, A may have to go to lawyer for notary, pay a fee, and wait for the document to be verified. With smart contract, A could just drop a Bitcoin into the machine and receive a finite item, in this case a soft drink. Here A has a legally binding contract with B in the traditional sense, and those obligations have been executed (almost) automatically.

Source:<http://www.blockchaintechnologies.com/blockchain-smart-contracts?
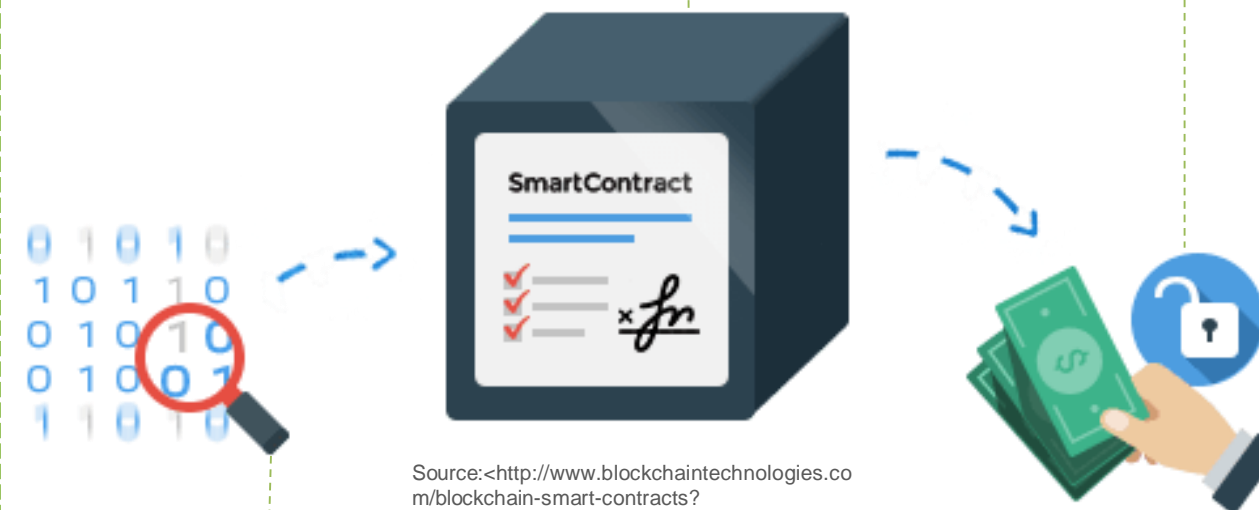
The benefits of making contracts "smart"

There benefits that flow from using a sting of code to recognize the fulfillment of conditions:

- Makes contractual relations with unknown third parties safe and secure. Think PayPal; the transaction is un-erasable. If the terms of the contract are easier to enforce then the parties to the contract can also be held to account;

- Multiple third parties can sign the contract at a relatively low cost. And funds are only spend, for example, only when a required percentage of people agree (and there is *consensus ad idem* or mutual agreement.

Verifying IP with blockchain

Save costs and make enforcement easier

Verifying intellectual property rights (IPRs)

It is one thing to apply for a patent related to blockchain technology, but what about the idea of using blockchain to verify intellectual property rights themselves. If, in principle, blockchain can be used to transfer money then why could we not apply DLT to record and transfer our intangible assets?

And the weight of evidence seems to suggest there is a good reason for doing so. Most arguments advocating blockchain tend to focus on the idea that a centralized system is only as trustworthy as the entity controlling it. But, for the most part, this is not the "pain" when it comes to intellectual property rights. Here we can distinguish between IP protection that arises automatically and rights that have to be registered in order to be enforceable, like a patent. Either way, it can sometimes be difficult for someone to prove ownership of these rights and correspondingly, for third parties to determine their infringement risk or know when it is necessary to seek permission from the creator/inventor.

Take the law of copyright in the UK, for example. Copyright protection is automatic, so long as the work meets certain qualifying criteria (e.g. it's the author's own 'intellectual creation'). However, unlike other registered forms of IPRs, there is no adequate means for authors to catalogue works. Although it is still a proof of concept, some companies are using blockchain to demonstrate ownership of a document without revealing the sensitive information it contains, to provide proof that it was authored at a particular time.

How it works

Let's suppose an inventor has created an original literary work. The inventor anonymously uploads his journal article to a blockchain network, pays a fee to a provider, and in exchange has cryptographic proof that the document was created at a particular point in time. The actual file is not stored online- so a hacker cannot compromise the server- but a time-stamp will make it possible to verify authorship should it arise at a later date, "Basically, by inserting the cryptographic hash of the document in a transaction, when the transaction is mined into a block, the block timestamp becomes a document's timestamp", Manuel Aráoz, a developer who built Proof of Existence explains.

More and more companies are catching on. Spotify, for example, has recently acqui-hired Mediachain, presumably to verify rights in musical works. And, of course, this technology can bed used to harness any type of information, given its ability to prove a document or piece of code was verified at a point in time; confidential information, NDAs, and even independent verification of the "first-to-file" a patent application. For companies, it means never having to pay notarization fees and stronger enforcement of IPRs.

In practice

It's clear that registering works on a blockchain is tamper-proof evidence, so don't be put off by the fact this technology is in its early stages. Evidence produced by blockchain-based records and signatures is admissible in most courts. In the EU, for instance, the current eIDAS regulation prohibits courts from denying the legal admissibly of timestamps.

Verifying IP with blockchain

Law firms and start-ups backing DLT

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New legal service models

Typically, a qualified lawyer will notarize a document and you will have to pay a fee. But blockchain innovation seem to put this idea on its head and what we are seeing emerge in 2017, is the "servitization" of the legal sector; law firms are tapping into the software-as-a-service market as a potential revenue stream, and this is particularly evident in relation to blockchain technology.

For example, P&TS, Swiss law firm, has teamed up with Bernstein Technologies GmbH to offer notarization services for invention announcements based on blockchain technology for example. Increasingly, we will start to see more partnerships between law firms and start-ups that attempt to tackle the end-to-end innovation lifecycle. If development continues at its current rate, it will be commonplace for organizations to buy an 'enterprise' package of notarization services and perhaps companies will even start building out these capabilities in-house.

Even if the applications are obvious, this a relatively new development so not many companies have chose to patent this particular use case. However, notarization start-up Stampery has applied for a patent related to methods for certifying and verifying "data units".

Verifying IP with blockchain

Stampery teams-up with Microsoft Office

SYSTEMS AND METHODS FOR CERTIFICATION OF DATA UNITS
AND/OR CERTIFICATION VERIFICATION

Application Number
US15/594364
May 12, 2017

Publication Number
US20170250815A1
Aug 31, 2017

Value(USD) ⓘ
Unavailable

Assignee Name
STAMPERY INC.

Inventor Name
CUENDE, LUIS IVAN, SANCHEZ DE PEDRO CRESPO, ADAN

IPC Classification
IPC(8): H04L9/32 , G06Q20/06

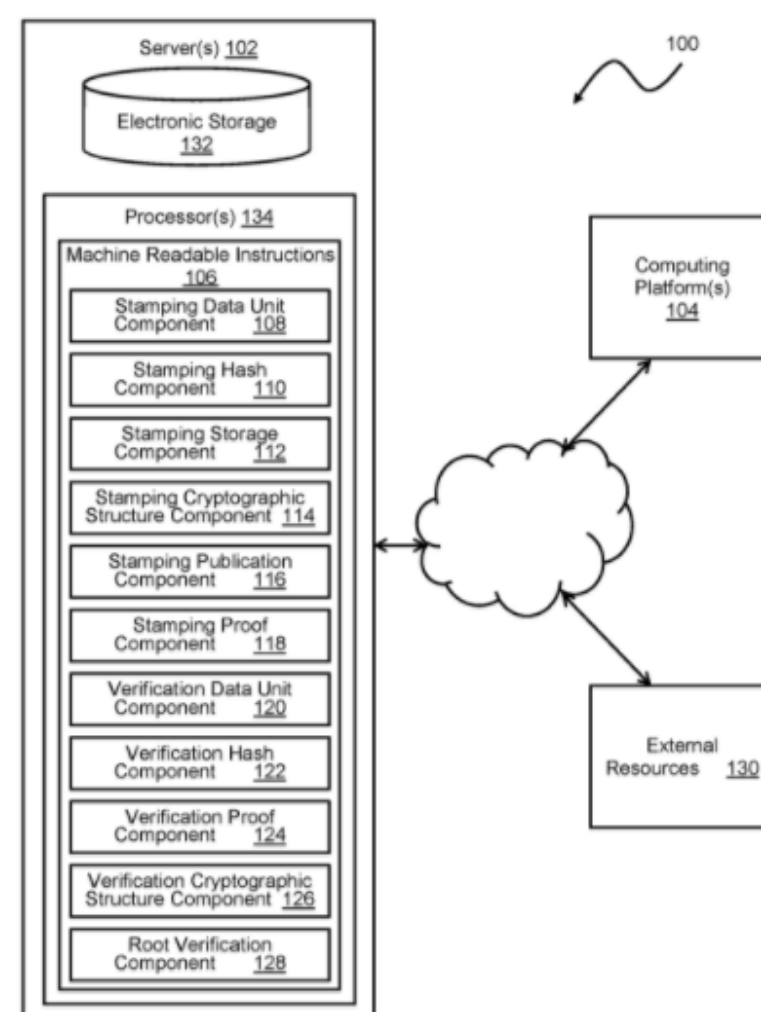**Certification of "data units"**
Even if applying blockchain to IP is a logical step, it is still a relatively new use case. As a result, there are very few companies who have ventured into the arena, by trying to obtain a patent on such technology.

Notarization start-up Stampery, on the other hand, is an early mover. Stampery offers a verification and certification platform that generates legal proofs for all its customer's sensitive documents using both Bitcoin and Ethereum Classic blockchains. Recently in April 2017, they have teamed-up with Microsoft Office to produce an add-in for the Stampery API.

Stampery has applied for a patent related to a method for obtaining a proof on a publication which can be used for certifying a document.

If this patent is granted by the patent office, it will be extremely broad in scope.

Revolutionizing cybersecurity

Blockchain-enabled cybersecurity is gaining traction

BLOCKCHAIN-SUPPORTED, NODE ID-AUGMENTED DIGITAL RECORD SIGNATURE METHOD
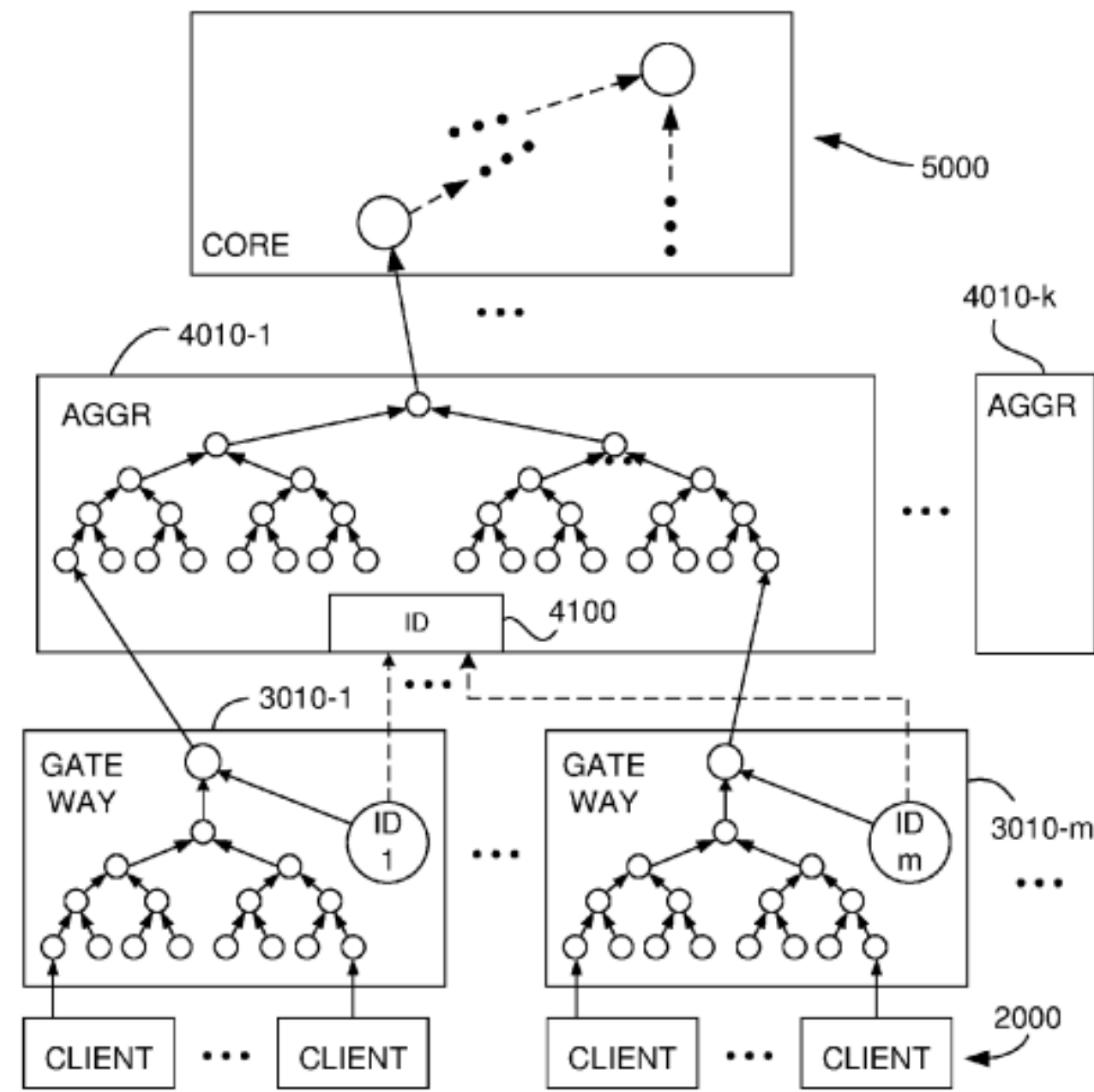
US administration backs start-ups for "grid's edge"
This report has identified consolidation in the area of cybersecurity. Realizing that most of blockchain is open-source, companies are taking to making new and non-obvious improvements to the security of blockchain systems.

If we can capture the power of DLT, it can be used to detect and mitigate against cyberattacks- at least that was the logic of one Estonian start-up. Guardtime has used blockchain-enabled technology to create a data ID.

Instead of using the more traditional Public Key Infrastructure (PKI), Guardtime has applied for a patent, published in February 2017, related to a keyless Signature Infrastructure (KSI).

Recently, the Department of Energy (DoE) has selected Guardtime and the Pacific Northwest National Labatory (PNNL) to "develop blockchain security technology to help secure distributed energy resources at the grid's edge".

The multimillion-dollar award is part of a program launched by the Obama administration to "enhance the reliability and resilience of the nation's energy critical infrastructure."

Preventing illegal activity

FICO files patent to monitor blockchain

Behavioral Misalignment Detection Within Entity Hard Segmentation Utilizing Archetype-Clustering
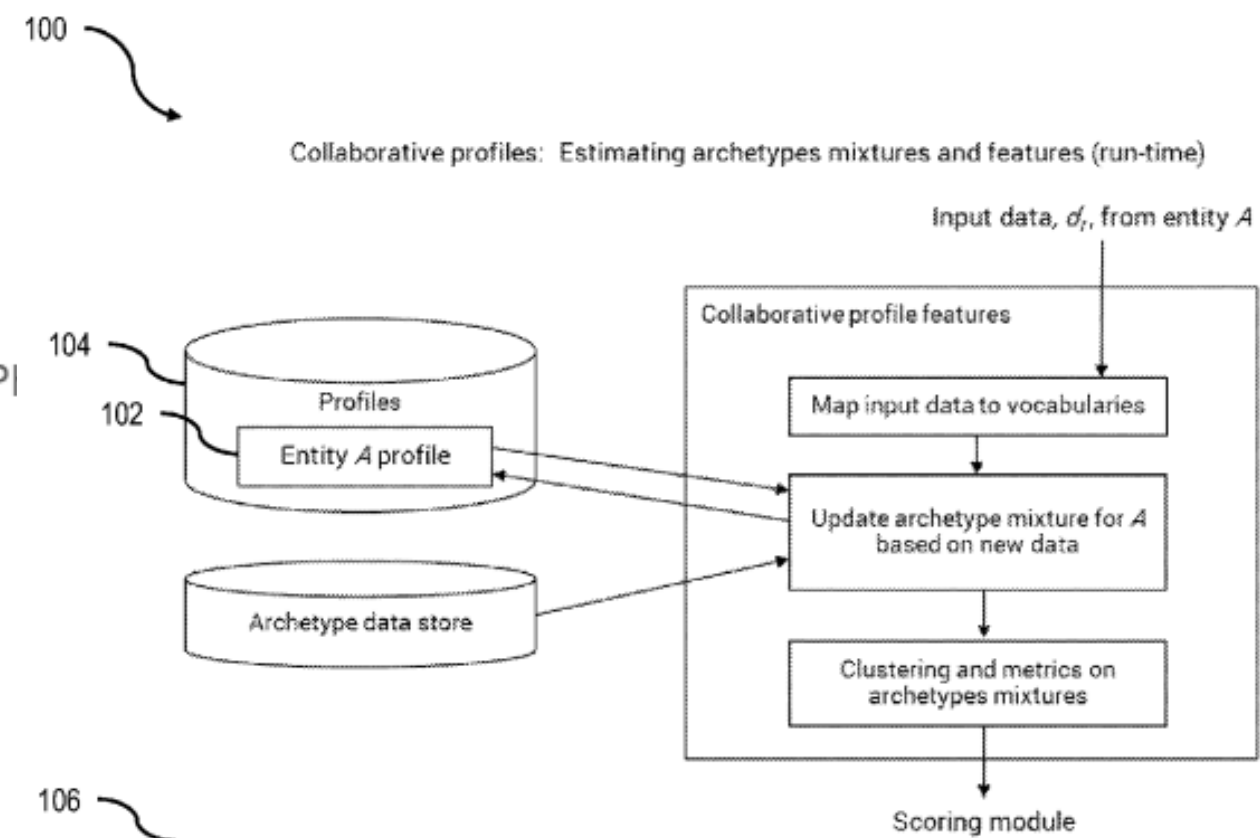
Application Number
US15/074856
Mar 18, 2016

Publication Number
US20170270428A1
Sep 21, 2017

Value(USD) ⓘ
Unavailable

Assignee Name
FAIR ISAAC CORPORATION

Inventor Name
ZOLDI, SCOTT MICHAEL, MURRAY, JOSEPH

IPC Classification
IPC(8): G06N99/00 , G06N7/00

Preventing money laundering
Fair Isacc Corporation offers a portfolio of cloud-based solutions to enhance business performance, but they are probably better known as the company behind the FICO scoring system.

FCIO has applied for a patent, published in September 2017, that discloses a system for detecting changes in behavior, indicative of potentially illicit transactions.

The application teaches that that "because emerging payment systems such as mobile and cryptocurrencies may have limited interaction with traditional financial institutions, there are more limited opportunities to detect laundering which involves. To improve detection, a cloud based data store integrates information from multiple sources, including:. a) entities associated with legal and illicit bitcoin exchanges [and] b) entities associated with mobile payment and remittance networks".

The proposed system works by assigning transactions a anti-money laundering "threat score", which could be used by banks

This illustration suggests some companies are trying to centralize the legal and administrative exchanges that take place on the network.
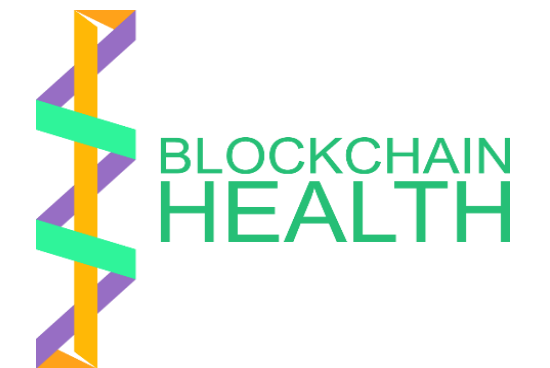
Healthcare-Pharma Market Map

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Supply chain management

Health Data

CHRONICLED

BLOCKVERIFY

skuchain

·TECH·TRANSPARENCY·TRUST· PROVENANCE.ORG

everledger

BLOCKPHARMA

Gem

FILAMENT

CARGOCHAIN

guardtime

pokitdok

MEDREC
Blockchain for EMRs
pubpub.org/pub/medrec

patientory

BLOCKCHAIN HEALTH

BRON.TECH

DNA.Bits

Electronic Heath Records (e-HRs)

Pharmaceuticals

patsnap

Block-tech could solve the counterfeit drug conundrum

According to industry experts, over 100,000 lives are lost due to drugs that do not contain the active ingredients they are supposed to and consequently harm patients. In fact, worldwide, over 100,000 lives are lost due to counterfeit drugs. They account for over $200bn loss each fiscal year in the pharma industry.

The Drug Supply Chain Security Act (DSCSA)
The DSCSA attempted to fight the counter-fit drug problem and when it was enacted in the US in 2013, companies were obliged to put in place systems and methods to gather and produce "transaction information" (TI) for each transaction going back to the manufacturer by 2030 (s.582(6)(1)(D)). Pharma supply chains are complex; they involve multiple stakeholders, no trusted intermediary and drugs frequently change ownership from manufactures to distributors- leading to high risk factors for consumers.

Open-source initiatives
So, how can companies demonstrate DSCSA-compliance? Enter blockchain. Chronicled Inc and LinkLab LLC have announced the MediLedger Project, a joint venture that aims to build an "interoperable system" for registering and verifying drugs using this technology.

Golden state start-up Chronicled has even applied for a patent (*US20160358184A1*) related to a open registry for identifying, and authenticating a product using wireless tamperproof tags. Based on this disclosure, a supply chain solution could work as follows: a digital ID tag would be added to medicinal products, allowing ownership to be transferred via smart contracts.

Pfizer, Roche and Genetech are among the companies involved in the project's implementation, which is likely to they will forego developing any of these capabilities in-house, in favor of collaboration with a specialized company. Other pharma companies are likely to follow this strategy.

Source:<https://www.pymnts.com/news/b2b-payments/2017/ibm-blockchain-supply-chain-finance-management-pharmaceutical-industry-china/>

Healthcare

Xerox envisages making our hospitals smarter with e-records

SECURE REVISIONING AUDITING SYSTEM FOR ELECTRONIC DOCUMENT FILES

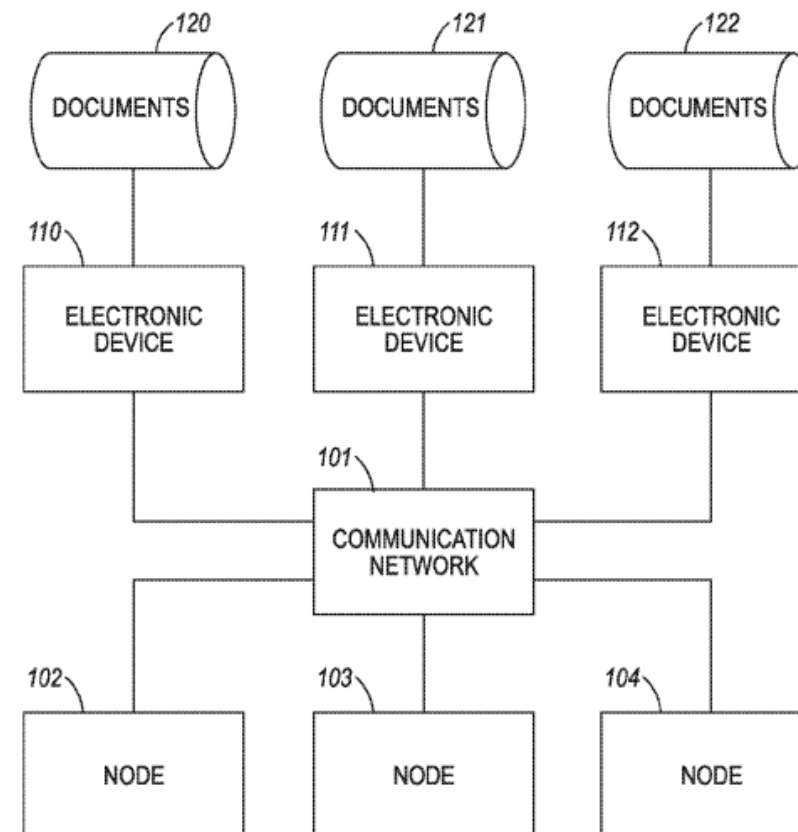| Application Number	Publication Number
US15/044574	US20170237569A1
Feb 16, 2016	Aug 17, 2017

Value(USD) ⓘ
Unavailable

Assignee Name
XEROX CORPORATION

Inventor Name
VANDERVORT, DAVID R.

IPC Classification
IPC(8): H04L9/32 , H04L29/06

Blockchain for electronic health records
Xerox Corporation has filed a patent in the US, related to a way to securely revise electronic documents using blockchain.

As for who they envisage licensing the technology to, Xerox suggests the disclosed system might be used for "regional hospital systems or multinational corporations".

Taking a closer look at one of the embodiments taught in the application:

"..*the auditing system uses an encryption process, such as public key cryptography, to sign all record changes in an electronic document (with the public half of the key pair). This is important in ensuring the security of record changes before they are fixed in the blockchain. The security of the disclosed system and method may improve as the system becomes larger*."

It is possible that the healthcare sector could adopt such a decentralized system to manage electronic health records using blockchain-enabled technology.

What next for blockchain?

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New blockchain offerings

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Everything from business to banking will become decentralized

Fast-forward to 2030. Banks have seen the benefits of early adoption, and have been greeted with regulatory guidance and legal certainty. And adoption has become (almost) mainstream and integral to capital markets. What then? What new structures will emerge from blockchain related innovation? Here are 3 new and emerging market tech-trends driven by blockchain:

Decentralized autonomous organizations ("DAOs").
From a legal perspective, it is possible to view an organization a complex network of contractual relationships between the separate corporate personality that is, the business, and various stakeholders including the directors, shareholders and employees. If one were to replace this traditional structure with a series of smart contracts or pre-programmed rules then this is the conceptual essence of a decentralized autonomous organization (DAO). A DAO's financial transaction record and program rules are maintained on the blockchain. The most famous example of a DAO was called "The DAO", a project launched in 2016 but failed within a matter of months. The idea was that participants receive DAO tokens, then vote for which projects to fund. These smart contracts could be programmed to carry out a range of task, not just related to money. It could work almost like a venture capitalist so that funds could be dispersed when a certain percentage of voters agree to fund a project. Arguably, it is not difficult to conceive a future involving DAOs, or even the next logical step- a decentralized conglomerate ("DC"). In fact, OpenLedger has announced its Global Enterprise 3.0 program, the first shared DC

Decentralized applications ("daaps")
It's like a "decentralized appstore" where anyone can publish their unstoppable apps (daaps), and do not require a intermediary to manage the user's information.

Artificial intelligence (AI) integration
Big data has clearly transformed AI. However, blockchain is likely to play a role too. What could be achieved if we integrated AI with blockchain-enabled technologies? The short answer is: "we don't know, yet purely because we can comprehend it". On the other hand, there are some more obvious applications such as data modelling, testing and training for predictions. There could even be a possibility of combining AI with the DAO or DC business model. This would probably be something akin to a an organization that accumulates its own wealth. Imagine a company that automatically generates and sells its own assets to produce a profit.

Dealing with disputes

Patent trolls will be relentless; a defensive approach will be crucial

Put simply, there is a sweet spot that exists somewhere between giving away open-source technology and filing patents for different ways that technology is being used. Against this background, non-patenting entities (NPEs) or patent trolls are likely to become prolific when it comes to stealing blockchain-related IP. However, companies should not be lured into a false sense of security by an "open innovation" approach; when it comes to litigation, it is probably better to be holding something to bargain with than nothing at all. To mitigate the potential risks represented by NPEs, organizations have attempted to build a defensive wall through a number of community-drive organizations:

The Cryptocurrency Defence Foundation (CCDF)
CCDF is an organization that acquires cryptocurrency related patents and licenses them to all those who agree not to enforce their patents against the other members of the community, in a kind of non-aggression pact. They stated that their goal is "to make the cost of supressing bitcoin with patents many times larger that the benefit of doing so". According to the Foundation there are four major areas of support:
- Open patent licensing
- Defensive publication
- Innovation support
- Litigation support

Blockchain Intellectual Property Council (BIPC)
Chamber of Digital Commerce (CDC) launched the Blockchain Intellectual Property Council (BIPC), an initiative to promote blockchain innovation in and distributed ledger technologies by addressing intellectual property issues. Perianne Boring, Founder and President of the CDC said "[d]eveloping and industry-led defensive patent strategy is paramount to help protect innovation and drive wide adoption of blockchain-enables technologies". More than 40 institutions have already committed to the council including IBM, Microsoft, Deloitte, Earnest & Young and Medici Ventures.

The Takeaway

Take steps to prepare your organization for a "trusted" technology revolution

- Blockchain has the potential to change fundamentally the way- businesses, governments, organizations and individuals- interact. In essence, blockchain provides a simple but secure way of transferring money, goods or information from one entity to another and across the globe.

- Blockchain and currencies like Bitcoin are not the same thing; Bitcoin volatility will continue like all tradable assets- but blockchain is here to stay.

- And based on the findings of this report, it's a transformation that had already begun.

- Organizations will need to be prepared as the technology enters a new frontier.

Appendix

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