



Blockchain patents unchained

A patent landscape on blockchain and digital currencies

Enric Escorsa, IALE Tecnología

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IALE Technology SL
Address: Milà i Fontanals 12 2^o6^a
08012 Barcelona, SPAIN
Tel. 00-34-93-4672556
www.ialetecnologia.com
contacto@ialetecnologia.com

IALE Technology SpA
Address: 1/2 831 East, office 407
Vina del Mar, Chile
Tel. 00-56-32-2887237
www.ialetecnologia.com
info@ialetecnologia.com

Is it worth it patenting on blockchain? Who is now doing it and why?

In this brief report we find out who is behind the development of new technologies enabling block chain. We look at patent data to identify companies/assignees claiming novel technologies and solutions and protecting them to get control of this promising market and positioning their block chain systems and platform implementations for different sectors.

Yes, you are reading yet another post about blockchain, the “hot” topic everyone (from speculators, to idealists) is talking about: there are already uncountable sources in the internet -news portals and blogs¹, social aggregators², chats, forums and active communities³- that are permanently updating on new cryptocurrencies, new [ICOs](#) (Initial Coin Offerings) being launched and new metrics for monitoring their highly volatile market capitalization⁴.

Is not all this information enough? what else can be said about blockchain?

We wonder whether checking a different source can bring an overview or, at least, some additional hints. **Patent documents** are in fact, a vast source of technical, formal information produced worldwide and registered in each national or regional IP office by whoever that has an strategic interest in protecting a new technology or a new process or a different way of doing something that was not been done before. Patents also provide valuable hints on the evolution of technologies.

So, patents can hopefully bring us some light on the current developments related to blockchain. This is our initial, simple hypothesis; let’s undertake some patent searches and see what we get.

¹ Coindesk (<https://www.coindesk.com>), cointelegraph (<http://www.cointelegraph.com>), newsbitcoin (<https://news.bitcoin.com>), cryptonewsbytes (<https://cryptonewsbytes.com>), Coinmania (<https://coinmania.online>), bitcoinist (<https://bitcoinist.com>) etc.

² Subreddits (/r/Bitcoin, /r/Ethereum, /r/ethtrader, /r/Ripple, /r/btc, /r/BitcoinCash,...), telegram groups, etc.

³ bitcointalk (<https://bitcointalk.org>), hackernoon (<https://hackernoon.com>), coincerunch (<https://coincerunch.io>), coinmarketcal (<https://coinmarketcal.com>), cryptorelease (<https://www.cryptorelease.org>), Blockchain Berkeley (<https://blockchainatberkeley.blog>), etc.

⁴ Coinmarketcap (<https://coinmarketcap.com>), Cryptocompare (<https://www.cryptocompare.com>), icogeeker (<https://www.icogeeker.com>), cryptopanic (<https://cryptopanic.com>), Coinlive (<https://coinlive.io>), Coinspector (<https://coinspector.com>), etc.

Searching for Blockchain patents

IFI CLAIMS[®] Patent database is an excellent place to search because all patent data is centralized, integrated and normalized, so we just have to trigger our patent searches in its search interface and get patent data containing all relevant patent data fields.

First of all, we must try to embrace all concepts related to block chain. Different terminology is used for closely related or equivalent technologies, so the first step is identifying this terminology. To start, an option is using the Pearl concept search service provided by WIPO (the World Intellectual Patent Office) where we can get a first idea of terminology that has been used in patents related to this field (figure 2).

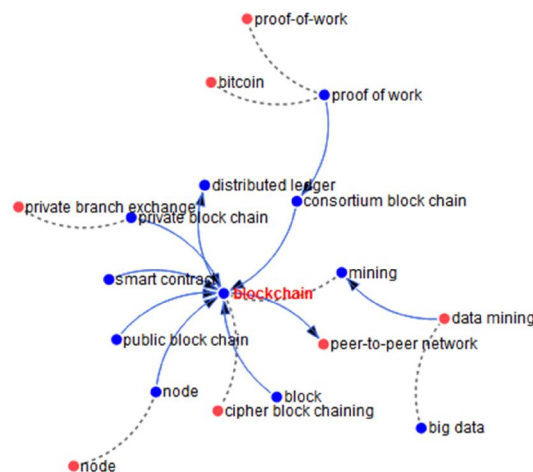


Figure 1: Terminology in patents associated to Blockchain. Source: WIPO Pearl

But we have to make sure that we include all other relevant synonyms defining blockchain based systems; our knowledge on the field or the advice from an external expert if necessary, may help; then we can write and combine these keywords down in the form of thorough, coherent search equations such as the following:

Blockchain OR (block AND chain) OR “distributed ledger” OR proof-of-work OR bitcoin OR (bit AND coin) OR ethereum OR litecoin OR ICO OR “Initial Coin Offering” OR “private branch exchange” OR “smart contract” OR “cipher block chaining” OR cryptocurrency OR (node AND token AND transaction) OR “digital currency” OR “Tokenized Equity” OR cryptocoin NOT “block polymer” NOT “block copolymer”

We are now ready to trigger these searches in selected patent data fields (in this case text fields: abstract and claims) to get all relevant patents. We do that in CLAIMS[®] Direct 2.1, the IFI CLAIMS[®] Patent database web service and user interface through which we are able to get, in just one go, all worldwide related patents. We can save reports, combine them and conveniently export all results in a tabular format (.csv) containing all patent fields and its metadata, plus normalized data (citations, homogenised assignee names, etc.) from IFIClaims.

After tidying and filtering non-relevant results in our retrieved data⁵, a set of 4447 **patent documents** is obtained, including 3800 patent applications, 307 granted patents, 298 applications of utility models and 48 granted utility models.

Evolution of blockchain patent filings

The volume of patents filed during the latest two years really stands out. The hype seems to be real.

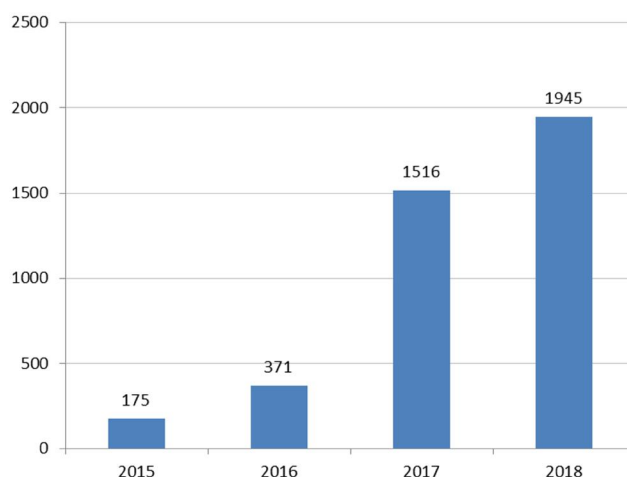


Figure 2: Evolution of the patentability of inventions related to Block Chain (up October 2018)

Source: IALE Tecnologia, data from IFI CLAIMS, visualization generated with [Matheo Software](#)

⁵ For example, for clarity and convenience, patents results specifically associated with telephone pbx and VoIP systems were filtered out. Moreover, some patents containing “block chains of polymers” were disambiguated from the unrelated chemical domain and also excluded.

Countries where blockchain is protected

Country code fields tell us where patents are protected, thus regions of strategic interest. Most of the patents are filed in China (49%). The US is the second chosen jurisdiction for filing blockchain patents (19%); a 12% of patents documents are worldwide applications that have gone via Patent Cooperation Treaty (PCT) through the World Intellectual Property Office (WIPO). Korea and Japan are also leading countries for blockchain patent filings; other key regions where protection is sought are Australia, Canada, Taiwan, India and Singapore. Great Britain is the first European country for blockchain patents, followed by Germany.

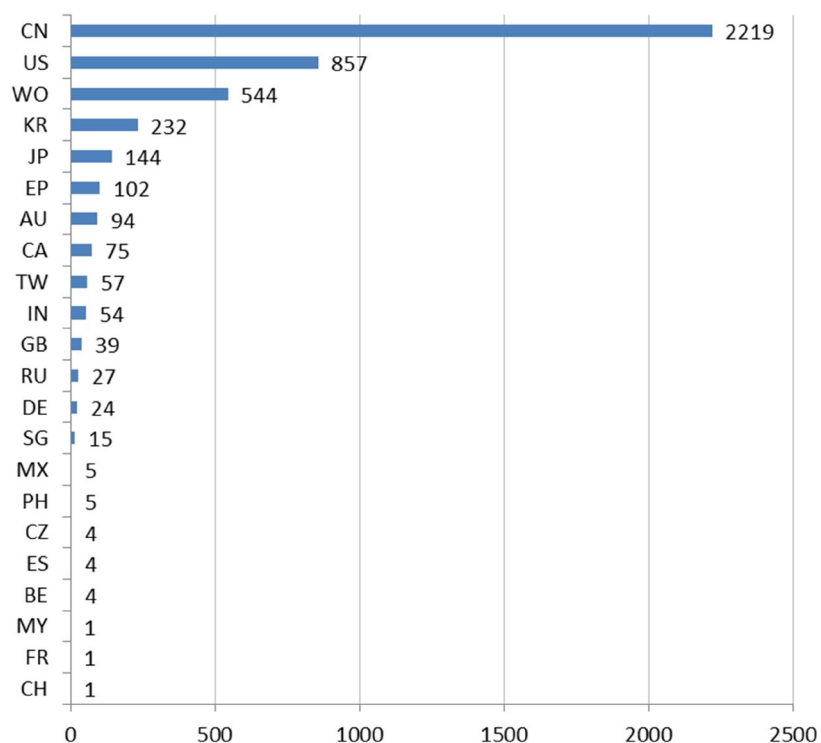


Figure 3: Country code of blockchain patents

Source: IALE Tecnologia, data from IFI CLAIMS

Who is patenting on blockchain

Top patent assignees are: South Korean fintech [Coinplug](#), pioneer bitcoin protocol creators [Nchain Holdings](#)⁶, finance services multinational [Mastercard](#), ecommerce giant [Alibaba](#), [Bank of America](#), [Accenture](#), phone operator [China Unicom](#) and tech firms such as [Intel Corporation](#) and [IBM](#).

Other relevant assignees are [Toronto-Dominio Bank](#) that is patenting a technology for a point-of-sales system and asset tracking⁷; [Black Gold Coin](#)⁸, patenting in USA and Australia methods for identity verification; [British Telecom](#)⁹, claiming cybersecurity measures for protecting blockchains; information provider [Thomson Reuters](#), also working on identity and data verification; online blockchain platform [Coinbase](#)¹⁰ owning granted patents for bitcoin transactions methods (US-9436935-B2) and chinese code review platform [Bubi Network](#)¹¹

We also find other big tech companies such as [Sony](#), that has filed inventions of electronic devices for maintaining a distributed ledger (Sony Entertainment was awarded a grant in 2010 for a patent -US7856102B2- on methods and apparatus for providing message authentication codes using a pipeline and involving cypher blocks); [Dell](#) and [Fujitsu](#), are also active in secure distribution transaction ledgers and secure data sharing systems and [Tyco](#) has granted patents on architectures for access management (US10055926B2).

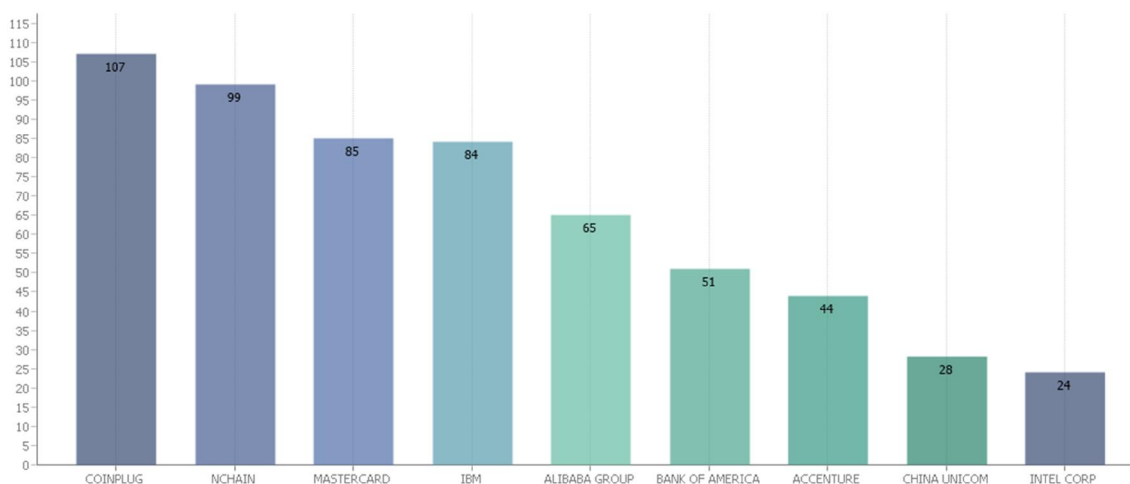


Figure 4: Main assignees/applicants patenting on Blockchain

Source: IALE Tecnologia, data from IFI CLAIMS, visualization generated with Matheo Software

⁶ <https://bitcoinpatentreport.com/2018/02/21/the-truth-about-the-patent-portfolio-of-dr-craig-wright/>

⁷ <https://www.ccn.com/canadas-td-bank-wants-us-patent-for-blockchain-point-of-sale-system/>

⁸ <https://www.businesswire.com/news/home/20150703005323/en/Pioneering-Aten-%E2%80%9DBlack-Gold%E2%80%9D-Coin-Offer-New>

⁹ <https://www.coindesk.com/british-telecommunications-receives-patent-for-blockchain-protection/>

¹⁰ <https://cryptovest.com/news/kipo-pushes-for-more-blockchain-patents-by-south-korea>

¹¹ <https://news.bitcoin.com/pr-bubi-launches-code-review-bounty-program/>

Some promising application fields

From a first sight, most of the disclosed inventions deal with transaction protocols mainly related to security and linked to financial services, but we also read some promising titles in other fields of application:

- ✓ **Accenture**, for example, has recently obtained a grant for a patent to secure 3D model sharing using distributed ledger (US10063529B2).
- ✓ **Intel**, has worked on blockchains for securing IoT devices, including vehicles and drones (US20170285633A1);
- ✓ **IBM** has applications of blockchain on radically different sectors ranging from mobile telecommunications (US-20180255130-A1) crowdvoting and peer-review processes (US-20180181979-A1, US20180176228A1), food shelf life management (US20180174094A1), detecting medical fraud (US-20180121620A1), gaming (US20180114403A1) contracts amongst enterprises (US20180089638A1) or reputation tracking (US20170140394A1), amongst many others.
- ✓ **Ericsson**, has patented trash collector systems using blockchain (US20170178125A1).
- ✓ **Walmart** has filed worldwide patent applications for apparatus and methods for collaborative shopping (WO2018111847A1), for managing a demand on an electrical grid using a publicly distributed transactions ledger (WO2018112043-A1), for controlling access to a locked space using cryptographic keys stored on a blockchain (WO2018112038A1) and also for obtaining a medical record stored on a blockchain from a wearable device (WO2018112035A1).

Top inventors

As for the **most prolific inventors**, korean technologist [Joonsun Uhr](#), founder of [Coinplug](#) (a startup providing Bitcoin exchange & wallet service, okBitcard bitcoin prepaid card, 2-way ATM and payment processor for the Asian Market) appears as the top inventor in our patent set with more than a hundred patents filed together with co-inventors Jai Hu Wong and Joo Han Song. They are followed by australian partners [Dr Stephane Savanah](#), Director of Scientific Research at Nchain, and [Craig Steven Wright](#), one of the pioneer creators of Bitcoin¹² (accounting each of them for more than 60 patents).

¹² He has claimed he is the identity behind the pseudonym [Satoshi Nakamoto](#) Source: Wikipedia

Colaboration amongst applicants

Co-patenting networks are identified between Hongkong based **Digi inc**, a company that offers block chain as a service and **Wifire Open Network Group** on electronic money managing methods (CN-106600401-A); also between **Accenture** and **GSC Secrypt LL**, a legal firm created by cryptography inventor experts from academia in Italy, USA and Brazil that had developed a distributed key secret to rewrite the content of block chains¹³ (US-20170374049A1); apparently, the system was based on previous IBM's Chamaleon Signature system. Finally, there is also collaboration between chinese institutions **Sate Grid Corporation** branches, the **University of Tsinghua** and **Beijing Huitong Jincai Info Tech Co Ltd**, in this case on block chain based distributed power generation quality evaluation methods (CN107301501A).

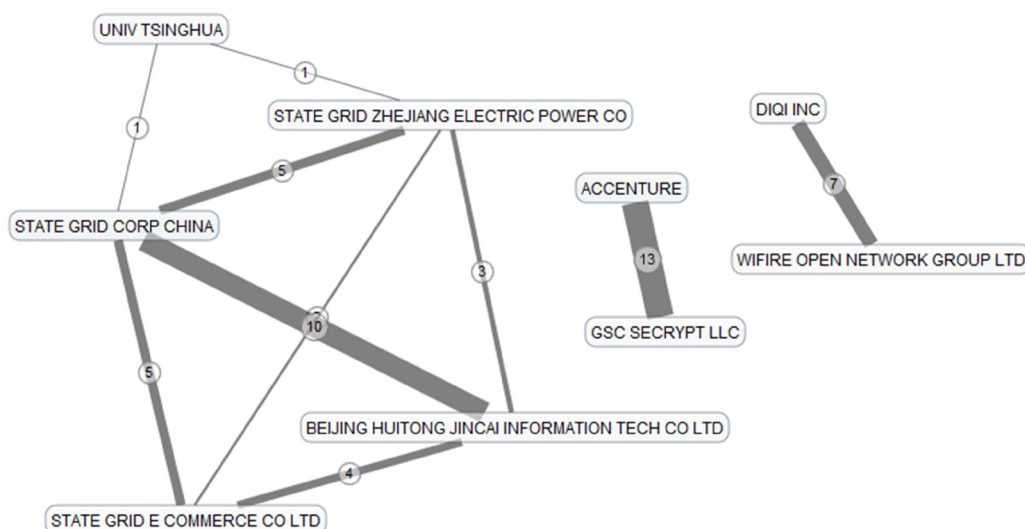


Figure 5: Main co-patenting networks in blockchain patents

Source: IALE Tecnologia, data from IFI CLAIMS, visualization generated with Matheo Software

Main topics and technologies

At this point, we process the textual content of all patents so as to model topics and identify disclosed processes and technologies. We used for that the R programming language and in particular the Natural Language Processing package *Tidytext*, developed by Julia Silge¹⁴. We created wordclouds and co-occurrence networks with the main terms of all patents and

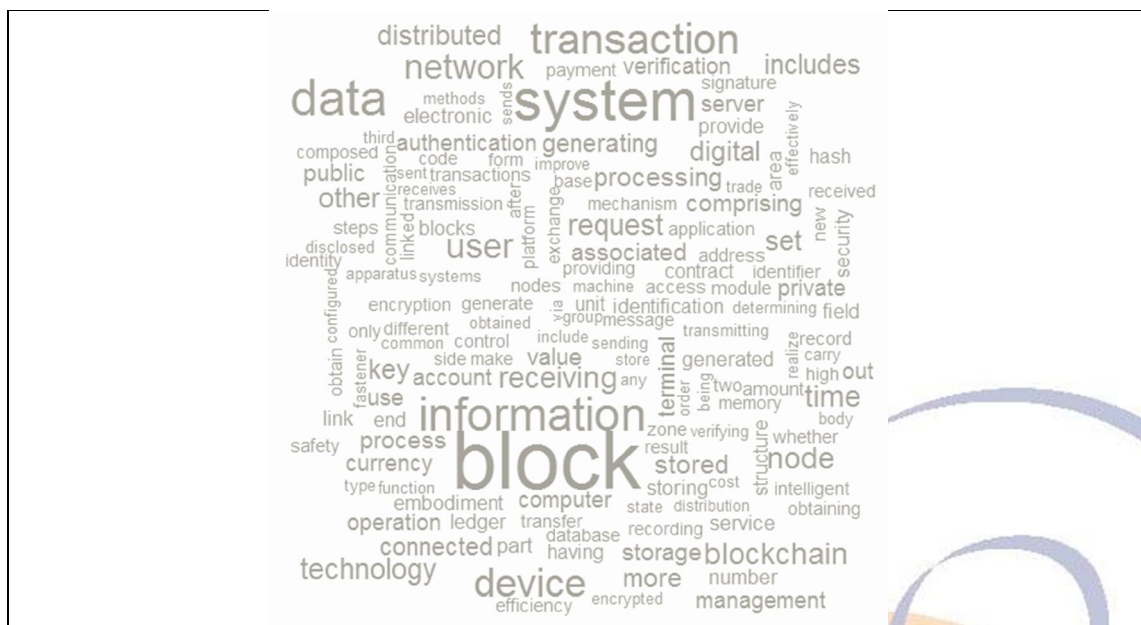
¹³ <https://www.cio.com/article/3122807/financial-it/why-accenture-broke-the-blockchain-with-ibms-help.html>

¹⁴ <https://cran.r-project.org/web/packages/tidytext/vignettes/tidytext.html>

also applied a clustering algorithm¹⁵ to deploy topic contents into significant groups. The results are shown in figure 6.

In terms of cryptocurrencies, *Bitcoin* is named in 102 patents, whereas *Ethereum* in 6.

- Applicants mentioning Bitcoin in their patents are: Nchain, Coinplug, Coinbase, 21 Inc, RFCO Llc, Ox Labs Inc, Jetstream Holdings Ltd, Intel, Valasca Ltd, Ericsson, Sendlater Inc, Shenzhen Fanxi Electronics Co Ltd, Nemoict, Nautilus Hyosung, Monegraph, Midea Group, Libra Services, Leetcoin, Kona I Co, IBM, Heliopay, Fujitsu, Ezetap Mobile Solutions PVT Ltd, Chain Holdings Ltd and Beijing Bitmain Tech Ltd
- Applicants mentioning Ethereum are: Hefei Weitian Yuntong Info Tech Co Ltd, Commw Scient Ind Res Org, Redenbacj Lee Lawyers Pty Ltd and Nat Ict Australia Ltd.



¹⁵ LDA https://en.wikipedia.org/wiki/Latent_Dirichlet_allocation

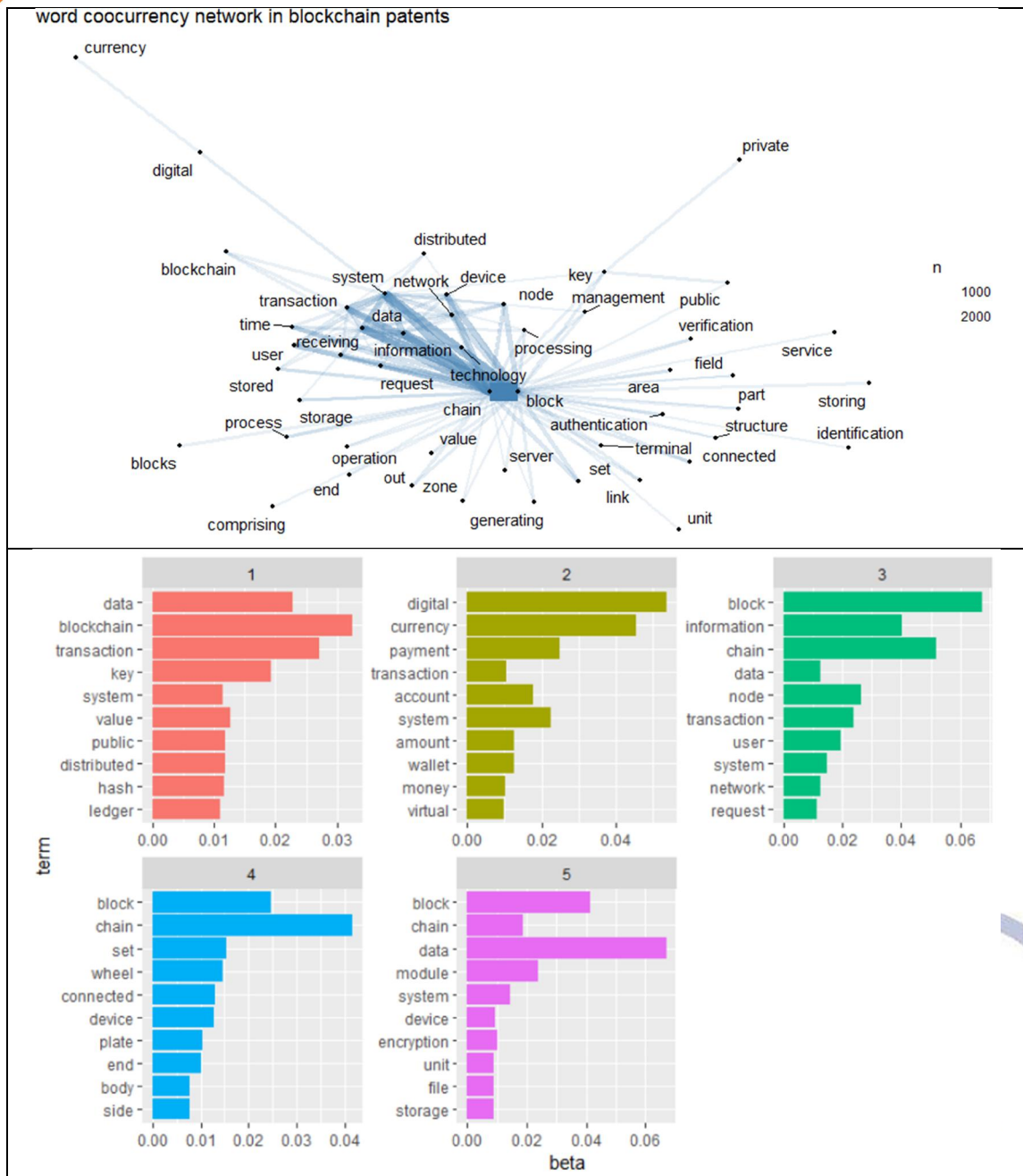


Figure 6: Main topics in Blockchain patents's abstracts: wordcloud and word frequency table (above); word cooccurrence network (middle) and topic clustering applying LDA to patent texts (below).

Source: IALE Tecnologia, data from IFI CLAIMS, visualization generated with R.

Interestingly enough, one of the resulting groups (cyan coloured) refers to *connected wheel devices*. In fact, blockchain technologies are already being tested, in the context of IoT, for communication and real-time information exchange amongst autonomous vehicles. Included in this group would be Intel's patent on Trusted vehicle telematics using blockchain data analytics (US20180091596A1).

Let's look now at Patent Classifications¹⁶ to derive main areas of current technological development. These include:

- **Payment architectures, schemes or protocols using E-Cash** (G06Q 20/065) → 492 patents.
- **Transmission of digital information, cryptographic mechanisms such as Chaining, e.g. hash chain or certificate chain** (H04L2209/38) → 467 patents.
- **Payment architectures, schemes or protocols involving key management** (G06Q 20/3829) → 434 patents.
- **Transmission of digital information, cryptographic mechanisms, involving digital signatures** (H04L 9/3247) → 433 patents.
- **Transmission of digital information, cryptographic mechanisms, such as Financial cryptography, e.g. electronic payment or e-cash** (H04L2209/56) → 413 patents.
- **Transmission of digital information, cryptographic mechanisms, Using cryptographic hash functions, involving keyed hash functions, e.g. message authentication codes [MACs], CBC-MAC or HMAC** (H04L 9/3236) → 350 patents.
- **Modes of operation, e.g. cipher block chaining [CBC], electronic codebook [ECB] or Galois/counter mode [GCM]** (H04L 9/0637) → 306 patents.
- **Data processing methods for Finance; Insurance; Tax strategies; Processing of corporate or income taxes Exchange, e.g. stocks, commodities, derivatives or currency exchange** (G06Q 40/04) → 267 patents.
- **Payment architectures, schemes or Transaction verification protocols** (G06Q 20/401) 237
- **Business processing using cryptography** (G06Q2220/00) → 230 patents.

Grouping 4 digit Classifications gives us an idea of main application areas (see left hand-side of figure 7).

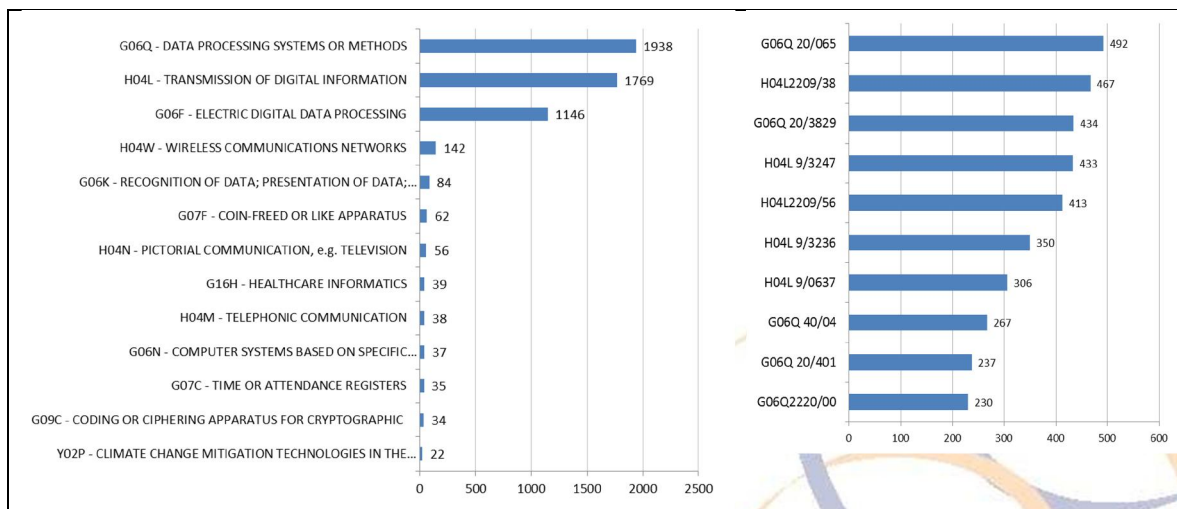


Figure 7: Main CPC 4 digits (left) and CPC full digits (right)

Source: IALE Tecnologia, data from IFI CLAIMS, visualization generated with Matheo Software

¹⁶ Cooperative Patent Classification (CPC) <https://worldwide.espacenet.com/classification>

Main specialization areas

Figure 8 (below) is an overall network graph representing in this case, the main applicants and their **areas of technological specialization** (derived from the CPC patent classification codes).

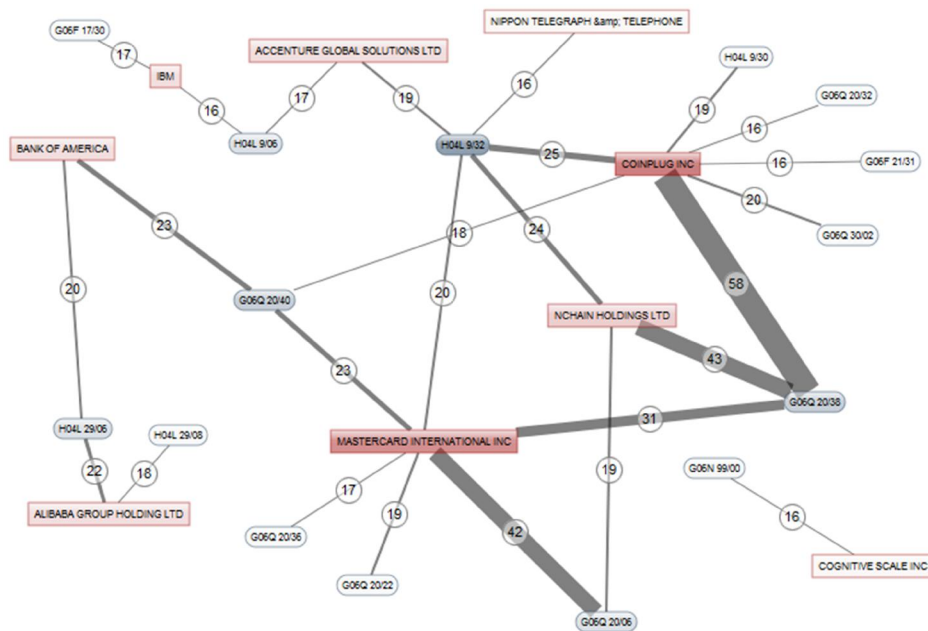


Figure 8: Network of main areas of specialization of companies developing block chain related technologies
Source: IALE Tecnologia, data from IFI CLAIMS, visualization generated with Matheo Software.

Main technology areas of specialization are *Payment architectures, schemes or protocols details* (G06Q 20/38), were **Coinplug** (58 patents) and **Nchain** (43) are focusing their development strategies; **Mastercard** is also in this area (31) but is specifically claiming inventions on *Private payment circuits, e.g. involving electronic currency used among participants of a common payment scheme* (G06Q 20/06).

IBM is leading developments in the field of *Digital computing or data processing equipment or methods, specially adapted for specific functions such as Information Retrieval* (G06f 17/30).



Cognitive Scale, a company based in Austin, Texas that develops software applying blockchain and AI to solve complex business problems for finance, healthcare, and ecommerce markets, has 16 patents on *Computer Learning systems* (G06N 99/00).

Alibaba and **Bank of America**'s core developments focus on *Arrangements, apparatus, circuits or systems characterized by a protocol* (H04L 29/06); Alibaba, for instance, has invented systems for filing service data processing requests into block chain (US20170140394A1).

Accenture is active in *encryption apparatus using shift registers or memories for block-wise or stream coding* (H04L 9/06) and *arrangements for secret or secure communication including means for verifying the identity or authority of a user of the system or for message authentication* (H04L 9/32), area in which **Nippon Telegraph** has also filed 16 patents.

Let's check out now, what has been invented and who is active in categories such as Y02P (Climate Change Mitigation Technologies) or in G16H (Healthcare Informatics):

Some companies patenting on blockchain and Climate Change Mitigation Technologies (Y02P) are:

- ✓ **Shenzhen Fanxi Electronics**, patenting on a distributed photovoltaic power transaction system (WO2018032369),
- ✓ Electric car charging stations company **eMotorWerks** (Enel Group); patenting on automated power generation based on user-specified rules (US20180015838A1).
- ✓ Power grid management company **Causam Energy**, patenting on blockchain platform for advanced energy settlements (US20170358041A1).

Australian company **Power Ledger** is disrupting in this niche by using Blockchain technology to enable consumers to manage the energy economy in a transparent, automated, and auditable manner.

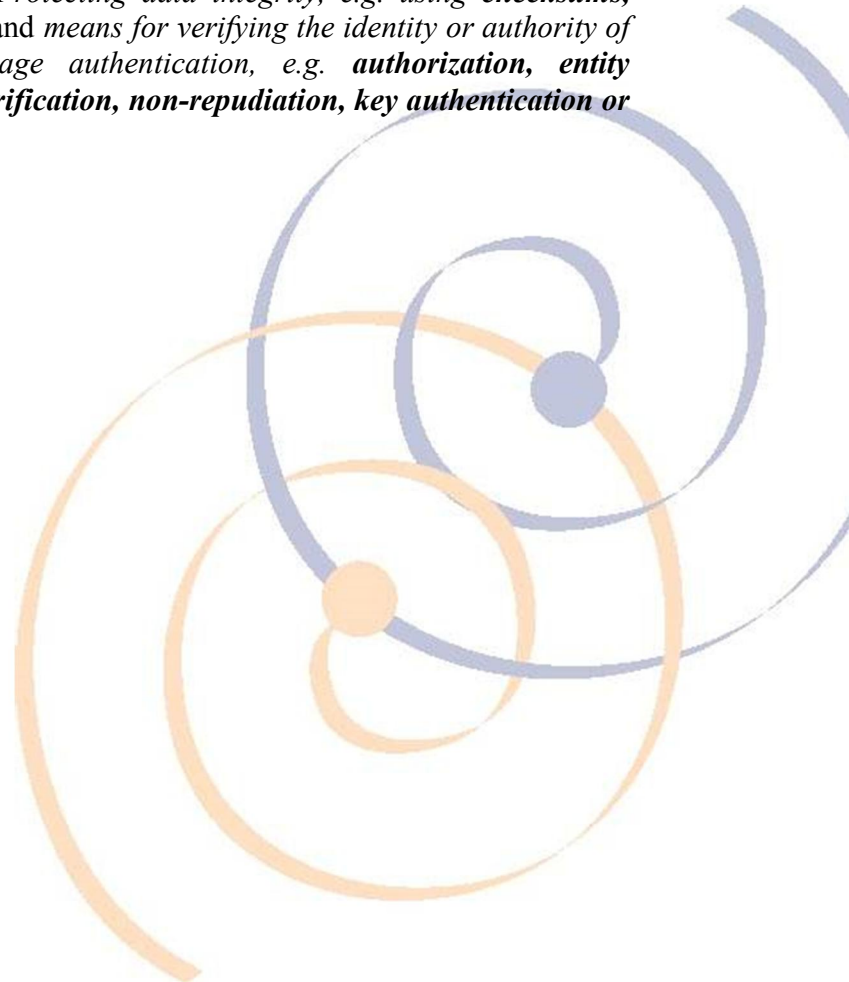
Some companies patenting on blockchain and Healthcare Informatics (G16H) are:

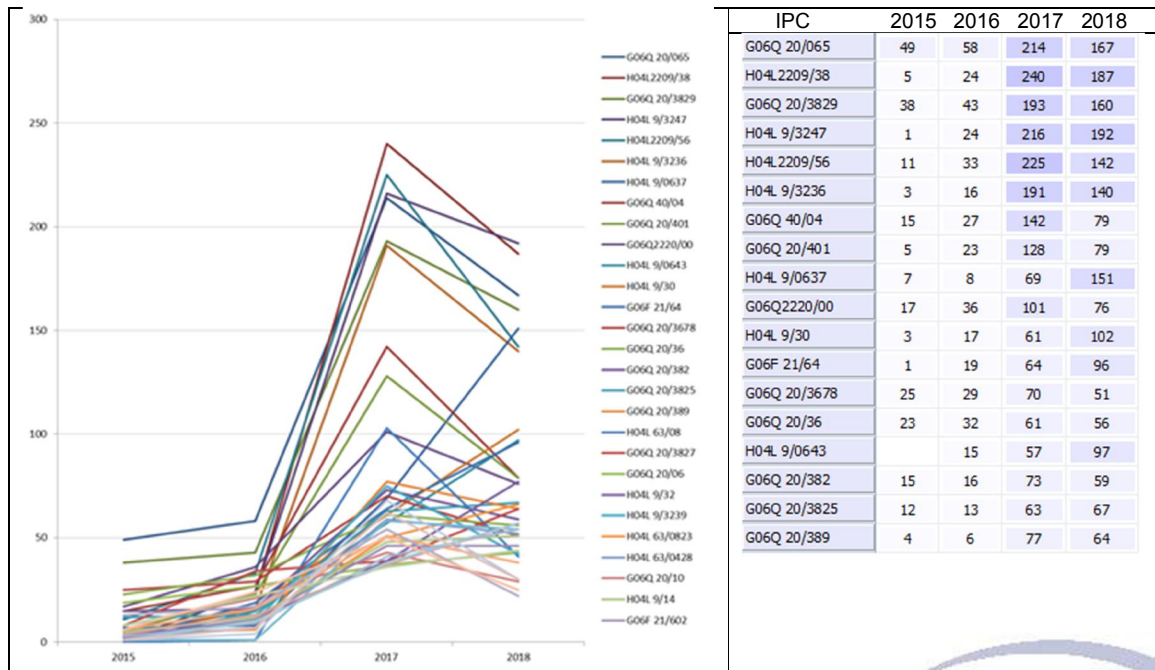
- ✓ **WalMart**, patenting on methods for obtaining a medical record stored on a blockchain from a wearable device (US-20180167200-A1)
- ✓ **NantWorks**, patenting worldwide on healthcare transaction validation mechanisms (WO2015175722A1)
- ✓ Global media company **BBM Health** (Börm Bruckmeier Publishing) (WO2018039312A1).

- ✓ [Netspective](#) consultancy, applying Natural Language Processing and blockchain to regulatory issues (US20170091397A1),
- ✓ Healthcare IT Platform [Pokitdok inc.](#), (WO2017223540A1)
- ✓ [Nokia](#), on methods for verifying user's health data (WO2017198891A1)
- ✓ [Openclinica](#), also on verification of clinical data (US-20180218779A1) , same as [Cognitive Scale](#) (US20180165416A1).
- ✓ [Irise](#), an hospital security system (WO-2017198891A1)
- ✓ Genomics company [Macrogen](#), awarded granted patent in Korea for bio-information data management and storing methods (KR-101880175B1)
- ✓ [Suggestic](#), a healthtech startup focusing on diet plans, claims inventions using Augmented Reality and Blockchain for decision methods using contextual filtering (US20180190375A1).

Technology trends and emerging areas

When looking at the evolution of all areas, we notice certain particular areas that seems to be gaining some relevance in the latest years: That is the case of *Block ciphers*, i.e. *encrypting groups of characters of a plain text message using fixed encryption transformation e.g. cipher block chaining [CBC], electronic codebook [ECB] or Galois/counter mode [GCM]* (H04L 9/0637); also *Cryptographic mechanisms such as Public key*, i.e. *encryption algorithm being computationally infeasible to invert or user's encryption keys not requiring secrecy* (H04L 9/30); ...*Hash functions*, e.g. *MD5, SHA, HMAC or f9 MAC* (H04L 9/0643); ...*Protecting data integrity*, e.g. using *checksums, certificates or signatures* (G06F 21/64) and *means for verifying the identity or authority of a user of the system or for message authentication*, e.g. *authorization, entity authentication, data integrity or data verification, non-repudiation, key authentication or verification of credentials* (H04L 9/32).





- H04L 9/00** {Cryptographic mechanisms or cryptographic} **arrangements for secret or secure communication** {(network architectures or network communication protocols for network security **H04L 63/00** or for wireless network security **H04W 12/00**; security arrangements for protecting computers or computer systems against unauthorized activity **G06F 21/00**)} D i
- H04L 9/06** • the encryption apparatus using shift registers or memories for block-wise {or stream} coding, e.g. DES systems {or RC4; Hash functions; Pseudorandom sequence generators} D
- H04L 9/0618** •• {Block ciphers, i.e. encrypting groups of characters of a plain text message using fixed encryption transformation} D
- H04L 9/0637** ••• {Modes of operation, e.g. cipher block chaining [CBC], electronic codebook [ECB] or Galois/counter mode [GCM]} D

Figure 9: Evolution of CPCs over the years (above) and Classification H04L 9/00 on cryptographic mechanisms and H04L 9/0637 subclass (below)

Source: Espacenet

Final remarks

Protected technologies related to Blockchain have been revised. Some other technologies, processes or novel distributed transaction mechanisms being essentially different than today's known block chain technologies are likely to be claimed and eventually gain momentum; some of these might have fallen out of the scope of this study and would therefore require a broader scope of search or further, deeper analysis over time.

Some references:

- Is Blockchain About to Become a Patent War Battleground?
<https://cointelegraph.com/news/is-blockchain-about-to-become-a-patent-war-battleground>
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https://www.alixpartners.com/media/3782/ap_the_race_to_patent_the_blockchain_sep_2016.pdf
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- As Blockchain Grows, Companies Look to Avert a Patent War
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- Walmart awarded patent for crypto powered energy consumption management system
<https://cointelegraph.com/news/walmart-awarded-patent-for-crypto-powered-energy-consumption-management-system>