The blockchain technology was initially known as the technology on which the now famous Bitcoin cryptocurrency is based . However, every day new application ideas for this technology arise in various fields , ranging from the registration of property to the fight against counterfeiting.

But what is the blockchain technology and why is it awakening so much interest lately?
As part of the Bitcoin system, its functionality is basically that of providing a register or distributed accounting ledger in which the different transactions made with bitcoins are stored.

Applications of blockchain technology beyond bitcoin… Every 10 minutes approximately a block is generated with the information of the transactions that have been made during that period of time. The block is verified by the members of the Bitcoin community and, if there is consensus , it is stored in the blockchain or main block chain, just after the previous block of transfers.

- This chain of blocks is public and can be consulted at any time by anyone; In addition, there is no single copy of the chain, rather it is a decentralized system in which each node stores a copy This way, not only intermediaries disappear, reducing the cost of transactions, but the system is much safer, transparent and unalterable.
- In addition, the blockchain technology has another peculiarity and is that each user has a private cryptographic key associated with another public key. The private key is the one that contains all the information about the user and guarantees their identity, while the public key only shows what the user wants others to see.

To send money, the user needs to prove that he has in his possession the private key to prove that he is who he says he is and to sign the transaction with him, while to receive money it is enough to provide the public key. That provides a diverse degree of anonymity in transactions, something that has been criticized in the Bitcoin system for facilitating shady business transactions.

Applications of blockchain technology within the financial system. Its applications within the financial system beyond Bitcoin are many, hence it has aroused so much interest among banks and other financial institutions.

- According to the World Economic Forum, in the coming years we will witness an important transformation in which the blockchain will end up becoming the "heart" of the future global financial system.
- Recently, 80% of banks have acknowledged that they are already working on the development of products based on this technology.

Among its applications are:

- The possibility of streamlining payments and transfers and the sending of remittances, considerably reducing their cost: for example, the American startup Abra is developing a global digital asset management system, with functions of retail banking such as payments and savings and based on the bitcoin blockchain that already allows, among

other things, the almost instantaneous sending of remittances to other countries from the mobile and for around 0.25% of the current cost.
- Stock markets: for example, Nasdaq already uses blockchain technology in its private stock market , one of the largest in the world.
- Decentralized prediction markets: Augur is a decentralized prediction market that allows its users to buy and sell shares anticipating an event based on the probability that one or another outcome will occur.

Applications of blockchain technology in other areas

1. Distributed cloud storage
   - Instead of relying on centralized cloud storage services, such as Dropbox, Amazon or Google Drive, the blockchain technology offers the possibility of storing the data or files in a P2P network (peer-to-peer), that is, they are saved by multiple members of the network.
   - In current centralized systems all the information or files are stored in the same space, so it is much easier to be attacked by a hacker or to lose information due to a technical problem or natural catastrophe, such as fires or floods.
   - In the distributed storage, on the other hand, the files and information are stored in a similar way to the P2P systems used by programs such as Torrent or Emule, that is, an identical copy is stored in each node of the network.
   - Anyone on the Internet can store your information in exchange for a previously agreed price and, having multiple copies in different places of the network, the system is much safer .
   - Once encrypted, the information is sent to the network incorporating metadata that allows you to track each step that the file gives .
   - Storj, for example, has developed a system of this type in which users who have spare space on their disks can automatically rent the space without using other users who need it, while those who need space to store their files can pay to do it on the computers of other users.According to the company, its system will reduce data storage costs by up to 80% .In addition to Storj there are other systems such as Tahoe-LAFS, Datacoin or Factom.
   - Distributed cloud computing thanks to the blockchain

2. Identity management
   - Blockchain technology allows users to create their own digital identity tamper-proof . According to experts, this kind of ID based on blockchain will soon replace online user names and passwords .
   - We can use our blockchain identity to access applications and websites, sign digital documents, etc. There are already some companies that offer this type of services, such as: Onename, Keybase or ShoCard.

- There is also an initiative called "Blockchain Emergency ID", Bitnation, which basically provides an emergency digital ID to immigrants and refugees whose passports have been confiscated or lost in their way.
- To do this, it creates a network of trust in which the members of each family verify the identities of the other members.

3. Registration and verification of data
   - Just as bitcoin transactions can be stored unchanged in the blockchain , this technology can be used to store any other type of information, thus generating an unchanged distributed record , much safer than traditional databases, which must be managed by a third party.
   - Companies like Tierion, Proof of Existence or Factom already offer this type of services.

   - Its possibilities are enormous both in the business sector and the public . For example:

bc in small networks?

- In clinics and hospitals: to create a registry with the data and the medical history of the patients.
- In the property registry: to create a record that shows who owns each property or land, as well as all the transactions of sale made. In this way, any type of fraud or manipulation is avoided. For example, Factom is collaborating with the government of Honduras in the development of a blockchain- based program to manage land ownership registration; and the Republic of Georgia has partnered with Bitfury to develop property titles based on blockchain technology for the country's National Public Registry Agency. The government of Japan has also announced that it will unify all records in a single property and real estate register based on blockchain and in Europe,Sweden is already testing a system of this type .
- For vehicle registration .
- For the protection of intellectual property and the creation of creative digital products , such as music, photos, electronic books, etc .: If we have an original work of our own creation in digital format we can encrypt it and store it as a transaction in a blockchain designed for this purpose, in this way the authorship and the date in which it was registered will be registered. Some companies, such as Proof of existence, already offer this type of services.
- Records of births and deaths, marriages and divorces, etc. The government of Estonia, one of the most progressive in technology, is working with Bitnation to allow residents with digital identity to register their marriages and birth certificates in the blockchain Horizon. And Kim Jackson and Zach LeBeau got married on the blockchain in November 2015, although for the moment it's just something symbolic. An advantage of these systems in the future is that they will be a legal proof of marriage at the international level.
- You could even create an international criminal record.

    - Other examples at the private level: all the conversations of Slack of a company could be stored in a registry; track all orders of a company from the moment of purchase until the user receives the product at home; create a verifiable audit trail of insurance claims; etc.

4. Automatic execution of contracts
- Some blockchains as ethereum and hyperledger include the ability to create " intelligent contracts " (smart contracts) that, despite what appears by name, are not at all intelligent.
- These are mere software programs that collect the terms of a contract between the parties and are stored in the blockchain , with the peculiarity that they are self-executing when a series of conditions specified in the contract itself are met .
- In this way intermediaries are avoided, reducing costs and bureaucratic delays ; as well as any type of interference by a third party.
- The possibilities of this functionality combined with other new technologies such as the Internet of things and financial technologies are enormous. For example:
    - The information of a sales contract could be connected to a GPS so that the intelligent contract automatically issues the payment to the supplier and to the carrier as soon as the package arrives at its destination.
    - Or make an intelligent contract for the leasing of a vehicle that in case of non-payment of any of the receipts prevents the driver from starting the vehicle or accessing it. And in the future, in the case of being a self-contained vehicle, the car could even return alone to the company that owns the vehicle that offers the lease .
    - It could also transform the world of music . The British singer Imogen Heap intends to use blockchain technology so that musicians can grant licenses to use their music and receive the corresponding payment without the need of numerous lawyers, accountants and intermediaries in between. In this way, artists could receive more money for their jobs (all that intermediaries now take) and the sharing of benefits among all parties involved would be much more transparent and reliable.

Blockchain technology and smart contracts

5. Tracking the supply chain and proof of provenance
- Nowadays, it is usual for each part of a product to come from different places or companies. This establishes a whole supply chain until it reaches the company that assembles or produces and markets the final product.
- Sometimes the chain is so long that it is difficult to follow up the entire process.
- Companies like Provenance.Org, SkuChain or Everledger are already using blockchain technology to do this type of monitoring and guarantee the origin of different products:

from food ingredients or agricultural products, to diamonds, works of art and, practically, anything else that requires it.

- In this way, the blockchain offers a solution to counterfeiting and can facilitate the traceability of the products in order to obtain a certification (for example, of ecological product).

6. Notary services
   - Using the blockchain as a notary service is easy and cheap.
   - By allowing you to create immutable records and track a document or chain of events, the blockchain allows, for example, verify the authenticity of any document that has been registered in it, eliminating the need for a centralized or third-party certificate .
   - Stampery and Blockverify are two companies that are using the bitcoin blockchain to verify all kinds of things, from emails and documents to pharmaceutical products.
   - A document certification service attests to the authorship (who created it), its existence (at what specific moment it was created) and its integrity (which has not been manipulated) .
   - Since the blockchain is not manipulable and can be verified by independent third parties, these services are legally binding.

     Among its main advantages:
     - It is safer because, unlike a person who can corrupt, the blockchain can not be altered.
     - It is much cheaper , since the high fees of notaries are eliminated.
       Thanks to the possibility of registering anything in it anonymously, it guarantees the privacy of the registered document and of those who request notary service .
       Other companies that offer this type of service:
       - Ascribe: certify the authorship using the blockchain . It also offers a property transfer service while maintaining a mention of the original author.
       - Uproov: register the multimedia creations made with a smartphone almost immediately after its creation. This is especially interesting to show that an event or meeting has taken place at a specific date and time and that the documentation produced there has not been altered.

7. Automated security
   - The combination of digital identities based on the blockchain with smart contracts and the electronic locks of the Internet of things, will also allow the creation of automated security systems that guarantee or impede access to some specific people in a completely automatic way .
   - For example, a code can be stored in the blockchain so that a door of a car, a house or a room inside a company allows or denies access to it to the person who approaches depending on who the person is. is trying to access.

- This completely guarantees security, since no one has to keep the keys or there is no third party involved in the process that could be corrupted.

8. Rental of properties and collaborative economy
   - The previous system can be made even more complex by combining it with an intelligent rental contract. For example, if an owner of a flat or a vehicle wants to rent it, it would be enough to elaborate and store in the blockchain an intelligent contract in which the owner sets a price for the rent for a while.
   - At the moment when the user makes the payment with a transaction registered in the blockchain , the smart contract would be executed allowing the access to the property to that specific user for the stipulated time. A company that offers this type of service is Slock.
   - This type of systems could end up with companies like Airbnb or Uber , since it is no longer necessary for any intermediary to intervene.
   - Another example, in this case of collaborative economy, is La'Zooz, a car sharing application similar to BlaBlaCar but based on blockchain technology . La'Zooz rewards its users, developers and drivers with Zooz points.
     - Being based on the blockchain the identity of the users and the ratings assigned by them to other users are much more reliable, since they can not be manipulated.
     - In addition, the service becomes cheaper, as there is no central authority or company to act as an intermediary between the users, taking part of the money, as in the case of Uber or BlaBlaCar.
     - On the other hand, since there is no intermediary to go against, the service can not be blocked or closed by governments.

9. Vote online
   - The blockchain solves one of the great problems of Internet voting systems: the anonymity of the vote.
   - By its own structure and functioning, the blockchain can guarantee that a person can not vote more than once in the same election, while guaranteeing the privacy of their vote.
   - Furthermore, since there is no central authority to manage the vote, it is not possible to manipulate it .
   - Electronic voting would improve speed and would considerably lower the cost of elections and referendums, which would allow referendums more frequently and thus improve democracy.
   - This type of system can also be used for any type of voting, for example, an internal consultation in a company.
   - The first blockchain technology voting was carried out by the Danish political party Liberal Alliance in the spring of 2014, for an internal election.
   - Electronic voting with blockchain

10. Electricity market without intermediaries: a system in which houses can create their own electricity and sell the surplus

- Nowadays , it is usual for a central energy supplier to supply electricity to each house, company or public building in exchange for tariffs, often abusive.
- However, there are more and more houses or buildings that generate their own electricity with renewable energy systems.
- Some users are completely disconnected from the power grid, but others continue to be connected and basically use the power of the network when they do not generate enough energy with their renewables and contribute energy to the grid when they generate a lot and have surplus.
- For these cases, some countries have established a compensation system , between the watts supplied to the network and those consumed, to calculate the energy bill, but it is not easy to keep track of them.
- Using a blockchain , houses and buildings, connected to each other through a distributed network, could buy energy from the grid or sell their surpluses depending on their needs at any time, without the need for any intermediary to take control.
- All payments transactions and energy exchanges would be stored in the blockchain and verified by the members of the network.

11. Applications in the media sector

- One of the main applications in this sector is based on the capacity of the blockchain to facilitate low cost microtransactions .
- The current payment networks have a very high cost and require high fees. Hence, users can only purchase monthly or annual subscriptions, instead of being able to pay for a specific content.
- Using the blockchain , a website or digital newspaper may charge its readers per page or article , guaranteeing access to said content automatically as soon as the reader makes the corresponding payment registered through the blockchain .

12. Military applications

- Both the Defense Advanced Research Projects Agency (DARPA) of the US Department of Defense and NATO have launched projects related to the application of blockchain technology in the Army.
- For example, DARPA wants to take advantage of blockchain technology to create a secure messaging service .
- The proposal, entitled " Secure Messaging Platform " and registered as part of the SBIR Program (Small Business Innovation Research Program) aims to develop a messaging platform capable of transferring messages through a decentralized security protocol that is secure through multiple channels.
- For its part, the NATO Information and Communications Agency is evaluating the proposals sent to the 2016 Innovation Challenge . The request for proposals included a section entitled "Military applications of the blockchains".

- In addition to these initiatives, there are other more obvious applications, similar to some of those explained above, such as the automatic blocking or unlocking of weapons or military vehicles depending on who tries to handle them .

13. Decentralization of the Internet of Things (IoT)
    - The Internet of Things is increasingly popular and new connected devices are emerging every day, but most of today's IoT platforms are based on centralized models , in which a company or central authority controls the connections between different devices.
    - However, it has already been proven that this approach is not practical in many scenarios , in which the devices need to exchange data with each other autonomously.
    - Hence, the next step is the development of decentralized IoT platforms.
    - The blockchain technology allows the exchange of data in a safe and reliable way while it elaborates an immutable record of all the messages exchanged between the different connected intelligent devices.
    - IBM has already created a platform of this type in collaboration with Samsung. The platform, called ADEPT (Autonomous Decentralized Peer to Peer Telemetry), generates a distributed device network, using blockchain technology and three procolos: BitTorrent for file sharing. Ethereum, for smart contracts. And TeleHash for P2P messaging.
    - A startup called Filament has also created a software for a decentralized IoT that uses the Bitcoin blockchain to assign each device on the network a unique ID.

14. Applications in the insurance sector (Insurtech)
    - The combination of the blockchain with the smart contracts and the IoT could completely revolutionize the insurance sector and provide users with a more transparent, responsible and unquestionable demand management system.
    - It would be enough to register the contract conditions in an intelligent contract and store it in the blockchain , so that it is automatically executed when certain conditions previously established by both parties are met.
    - As homes, vehicles, etc .; are increasingly full of devices and sensors connected to the Internet of things, you can automatically detect any incident, assess the damage and make the corresponding payment to the affected in accordance with the terms of the signed insurance, even before the affected has been given what happened and without the need for it to be expressly requested.

15. Internet applications
    - Currently, DNS servers (Domain Name Servers) are under the control of governments and large companies, so they are vulnerable to an abuse of power whether it is censorship or espionage of the use we make of the Internet.
    - The use of blockchain technology in this sector would allow the DNS or Internet telephone directory to be kept decentralized , so that each user had the same DNS list on their computer.

- NameCoin is an alternative blockchain technology (with small variations), open source and experimental, used to implement a decentralized version of the DNS to test censorship or any other type of external control .
- The public key infrastructure (PKI), currently used for centralized management and distribution of digital certificates issued by a central authority, could also change and be replaced by a KSI (

There is no doubt that the applications of the blockchain are many and very diverse. In fact, it should be noted that in this article we have collected only a few examples. Your real possibilities are even greater. Just look at these examples and try to apply them to other sectors, such as the betting services so fashionable nowadays; or even the distribution of scholarships and grants granted by governments to students and non-profit organizations, in which both payment and follow-up could be fully automated. Of what there is no doubt, it is that the blockchain offers us the possibility of transforming a large part of our world and our daily life, giving control directly to people .