**Lecture 1 Notes**

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* Now let us start with the first topic of Unit 1, i.e. Blockchain Introduction:
* So, what is blockchain? Do Have any idea? How it works?
* The Bitcoin Network is the first successful implementation of blockchain technology.
* blockchain technology typically refers to the transparent, trustless, publicly accessible ledger that allows us to securely transfer the ownership of units of value using public key encryption and Consensus methods.
* The potential for blockchain technology is not limited to bitcoin.
* As such, it has gained a lot of attention in a variety of industries including: financial services, charities and nonprofits, the arts, and e-commerce.
* According to Marco and Lakhani
* A blockchain is an “Open, Distributed ledger that can record transactions between two parties Efficiently and in a Verifiable and Permanent way” they mentioned it in Harvard business review.
* If u c the definition carefully we can observe few keywords like
  + Open (Accessible to all)
  + Distributed or Decentralized (No single party control)
  + Verifiable (Everyone can the validity of the information)
  + Permanent (The information is persistent)
* So, these are very important keywords. Let us discuss one by one.
* The keyword open refers to the access control about the blockchain, it is accessible by all the users of blockchain network.
* Second keyword Distributed or decentralized refers to the Control of the data by the users,
* So, in blockchain no single user will be having central control over it.
* the data will be distributed among all the users of the blockchain.
* Next, Verifiable feature refers to the validity checking over the blockchain,
* every user of the blockchain can validate the transactions and blocks in the blockchain.
* Last keyword Permanent feature refers to the life span of information stored in blockchain, it is a persistent storage structure.
* Blockchain technology underlies cryptocurrency networks, and it may also be used in a wide variety of other applications as well.
* Blockchain networks combine private key technology, distributed networks and shared ledgers.
* Confirming and validating transactions is a crucial function of the blockchain for a cryptocurrency.
* Blockchain has the potential to grow to be a bedrock of the worldwide record-keeping systems,
* It was created by the Satoshi Nakamoto in the year 1991

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* For example, If we consider the traditional way of sharing the documents between two parties.
* It is a centralized one, each party cannot modify the data at a time.
* In this if the data in the centralized system is affected by any vulnerability or system failure.
* data will be not available to any of the party.
* So, there is more chances of data loss and integrity loss with this system.

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* Next, we consider the shared google document between 2 parties,
* In this system the users can modify the document at a time but it is also a centralized one.
* And if this centralized system is prone to vulnerabilities or any system crashes results in data loss.

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* For all these problems, here is the solution with blockchain.
* In blockchain every user can edit the data on their local copy of the document,
* the Internet will take care of Ensuring updating and consistency.

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* So, blockchain can also be called as internet database.
* It is a decentralized system, in which there is central unit who is taking care of all the data and transactions.

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* In blockchain Blocks are the core components.
* Which stores information about transactions like the date, time, and amount of your most recent purchase from purchase in the network.
* Blocks store information about who is participating in transactions and the identity of that block which distinguishes them from other blocks.
* Node which is part of the blockchain will collect the transaction information over a certain period and mine a block.
* This constructed block will be verified and validated by the validator nodes in the network.
* And based on the consensus mechanism the block will be added to blockchain.
* As I told that blockchain is a distribute system, in which a local copy of the global data will be maintained at every node.
* The system ensures the consistency among all the copies of data in the network.
* Each local copy will get update based on the global data.
* These local copies will be known as public ledger.

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* Now we will discuss an example of Public ledger from Banking Sectors and how it will get updated.
* Let us take one blockchain scenario in which there exist 4 parties Alice, Bob, Eve and Jane.
* Each party is having its own ledger.
* If alice is having 100 bitcoins, that information will update in all others local copies.
* If alice transfers 50 bitcoins to Bob, that transaction information will update in the ledger of others in the network.
* If bob sends 30 bitcoins to eve, this transaction get update in the others copy.
* If Alice again wants to send the 80 bitcoins to Jane. It will become an erroneous transaction.
* because Alice is having only 50 bitcoins but he is trying to transact 80 so this transaction will not validate by other validators in the network.

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* Next we are discussing about the working procedure of blockchain.
* Do u have any idea about how blockchain works?
* Okay, now will c,
* When miner collects transaction data and mine the block, it can add to blockchain.
* In between transaction initiation and addition of block to blockchain there exist several stages of validation.
* Once the transaction validated with all the stages, it can add to the block.
* Once the block is constructed, miner must do some task to get chance of adding his block to blockchain.
* When the miner finishes task he will broadcast his block in network, validators will validate the block and add it to existing blockchain.
* For a block to be added to the blockchain, four things must happen with it:
  + A transaction must occur
  + That transaction must be verified
  + That transaction must be stored in a block, and
  + That block must be given a hash (Hash is the unique value to represent the block)

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* The figure in the slide shows how does the blockchain work in a step by step view.
* Here we are discussing general procedure.
* Specifically with respect to particular development platform few steps may vary.
* Here in Step 1: a user request for a transaction i.e. transaction initialization.
* In Step 2: a block representing the transaction is created i.e. block mining
* Next in Step 3: a block is broadcasted to all the nodes in the network
* In Step 4: validators will validate the block and the transactions
* In Step 5: a Block will be added to the chain and
* In last Step 6: transaction gets verified and executed.
* So, this is the typical working procedure of the blockchain.

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* Next we are discussing about some statistics related to the usage, attitude and importance of bockchain technology.
* This statistics I have from the survey of Deloitte conducted from Feb 8 to Mar 4, 2019 as a primary research vehicle to gain greater insights into the overall attitudes and investments in the blockchain.
* Deloitte considered 1386 organizations for the 2019 survey, but in 2018 it has considered 1053 organizations.
* Graph shows the drastic change in the positive response of the respondants compared to 2018 survey.
* 53% of the respondants say the blockchain technology has become critical priority for their organizations in 2019.
* A 10 points rise in 2019 compared to 2018.

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* In this graph, shows the change in attitude of the respondants about the blockchain over a past one year.
* The level of agreement towards adopting blockchain for their organization requirements has increased and disagreement towards blockchain technology.
* According to this around 12 % of the respondants are planning to replace current system of record.
* It shows the general attitude towards the blockchain has been changing in a positive way.

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* Next this shows the adoption of blockchain technology by the various organization are of various domains to say few Technology Media and Telecommunication (TMT), Financial Services, Manufacturing, Energy and resources, Consumer products, etc..
* It is showing that not only financial transaction services, Technology Media and Telecommunication (TMT) has lifted more attention towards the blockchain technology around 26%.
* It is more compared to other organization resondants.

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* This graph shows the important contribution of blockchain technology in the security aspect.
* It also shows the level of security offered by the blockchain technology over the conventional IT services.
* According to survey 71% of the respondants believe that blockchain technology is more secure than traditional IT solutions.
* Only 1% of the respondants believe that blockchain technology is not secure.

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* As I told , before blockchain has wide range of real time applications, Few of them we are discussing here.
* Various application includes Bitcoin, Digital IDs, Real Estate, Voting, Payments and Transfers, Healthcare, Banking, Law Enforcement, Online Music, Education and Internet of Things.

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* Here we are discussing about the HealthCare application of blockchain technology,
* Blockchain has a wide range of applications and uses in healthcare.
* The ledger technology facilitates the secure transfer of patient medical records, manages the medicine supply chain and helps healthcare researchers unlock genetic code.
* Keeping our important medical data safe and secure is the most popular blockchain healthcare application at the moment, which isn't surprising.
* Security is a major issue in the healthcare industry. Between 2009 and 2017, [more than 176 million patient records](https://www.hipaajournal.com/healthcare-data-breach-statistics/) were exposed in data breaches.
* The perpetrators stole credit card and banking information, as well as health and genomic testing records.
* Blockchain's ability to keep an incorruptible, decentralized and transparent log of all patient data makes it a technology rife for security applications.
* Additionally, while blockchain is transparent it is also private, concealing the identity of any individual with complex and secure codes that can protect the sensitivity of medical data.
* The decentralized nature of the technology also allows patients, doctors and healthcare providers to share the same information quickly and safely.

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* Here we are discussing about the Education application of blockchain technology,
* Not only private but also many state educational institutions are either getting ready to implement blockchain-based tools,
* or they are conducting research which will enable the strengths and weaknesses of implementing blockchain technology in education to be identified.
* An incontestable advantage of blockchain technology most often discussed is that it will make the dematerialization of documents possible.
* It is also expected to aid in avoiding the risk of losing or falsifying paper documents.
* Paper-based higher education diplomas, school certificates and extra training course certificates get lost and the original can be lost over time.
* Once put in blockchain, the information about a student’s grades and the courses that have been undertaken will not get lost,
* and it is impossible to change or falsify the information.
* At the same time, one can easily access this information with the owner’s consent.

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* Here we are discussing about the Real Estate application of blockchain technology,
* The advent of blockchain technology has been set to revolutionize the real estate industry, and the potential changes are already taking its shape.
* the existing world of real estate is complicated with the lack of transparency in its transactions such as leasing, purchasing, and sales and fails to attain the level of confidentiality and authenticity of operational data.
* Several aspects of its operations such as property sale prices, sale history, lease rental rates, market valuation, and so on expect greater demand for transparency, data integrity, and security i.e. a trusted environment.
* Revamping the tedious, paper-based, time-consuming system of ownership and renting into a next-generation digitized system based on blockchain technology.

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* Here we are discussing about the IoT application of blockchain technology,
* Applications of the [Internet of Things (IoT)](https://www.aricent.com/solutions/enabling-software/iot) are growing fast, almost every device in the home, factories and agriculture sector is expected to be enabled with internet connectivity in the coming years.
* IoT requires a huge investment in infrastructure to manage the identity, security and availability of the devices to ensure the system runs smoothly.
* All the characteristics of a permissioned private blockchain network are well suited for the IoT ecosystem: it’s decentralized, [security](https://www.aricent.com/services/security-engineering) is assured, devices are identified and the record of transactions is immutability.
* IoT nodes directly communicate and verify the validity of transactions without requiring a centralized authority.
* The resolution time to validate a transaction is faster with a private blockchain as the user base is smaller compared to a public Bitcoin blockchain network, which typically requires about 10 minutes to mine and resolve a transaction.

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* There is a lot of development work being done for applying blockchain to IoT networks, specifically to address security issues.
* Few Application platforms we are going to discuss here are
* First lets discuss about Watson Iot, IBM has integrated this **Watson IoT** Platform with Blockchain to help companies create use cases using blockchain and IoT.
* Next we are discussing about Maru, Chain of Things (CoT) is developing **Maru**, an integrated blockchain and IoT hardware solution to solve issues with identity, security and interoperability of IoT networks.
* **And Another Tool is Telstra, it** has successfully verified real-time tamper detection testing with blockchain. As a result, the company has enabled blockchain with biometric security for its secure smart home offerings.