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LEVERAGING BLOCKCHAIN FOR COMMUNICATION SERVICE PROVIDERS (CSP) TO COMBAT FRAUD AND ENHANCE REVENUE

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ABSTRACT

Blockchain as an emerging technology is being adopted by multiple sectors, including Telecom. This article explores how Telecom sector can deploy this technology to improve the Communication Service Providers (CSP's) revenue growth and build trust among the subscribers by preventing the frauds. This article inspects how this technology will help to increase the throughput and the overall efficiency.

Blockchain technology is a shared digital ledger which helps to update all transactions that are happening. These records will be stored in a decentralized ledger where only concerned people can access it. This article will also talk about how deploying blockchain for International roaming services by having the shared ledger in a way so that CSP's and the subscribers both are benefited and fraud is prevented. This technology can also make the billing process simple. Eventually, all these will lead to increase the trust of the customers and subsequently the revenue growth will also increase.

Nowadays the Telecom sector is in a position where they cannot afford any risk of fraud in their internal operation because of the heavy competition and loss. This is the reason why telecom companies can completely rely on Blockchain technology.

Blockchain is one of the emerging and most talked about technologies so far. Many organizations are trying to implement this technology and started investing in it. Telecom is one of the major sectors. This article explores how bringing Blockchain in Telecom in the midst of large digital transformation will improve the Communication Service Providers (CSP's) revenue growth and how the trust among the subscribers is built by preventing the frauds. CSP's are one among the other organizations which handles the personal data actively like Financial Institutions do and it is the most trusted organization than any other. This article also inspects how this technology will help to increase the throughput and the overall efficiency.

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1. Introduction

More than ever, the Communication Service Provider has to believe and rely on the latest technologies like cloud, blockchain and system computing, etc. Because most CSPs are in the middle of a large digital transformation event in response to the disruption happening to them. With the help of blockchain to this equation that offers the potential to both CSP's current process as well as develops blockchain-based services in the telecom industry. The importance of Blockchain is expected to grow because the demand for transparency and trust continues to increase which enables new business models for revenue generation in the telecom industry.

The main attributes of blockchain are the shared ledger that helps to provide trust, security and participant's information across different CSPs. Even the transactions done through CSPs can be secured using Cryptography like Vignere Cipher or Playfair Algorithm or Diffie-Hellman Key Exchange. In simple words, Cryptography ensures that the transactions are reliable, verifiable and authenticated.

Trust is the new cornerstone of any type of business transaction. Data is the new resource of our digital economy. Here CSPs are in between data and trust and recognizing the importance of data integrity so Blockchain helps to improve efficiency by earning trust and transparency during any transactions. Also, blockchain creates a direction between the customer and the CSPs that disables the inter-operations and helps in reducing the costs for CSPs and customer benefiting higher profits. Companies like IBM, Microsoft have started to monetize this technology by giving the service to their respective clients.

Objectives:

1. To reduce fraud and cybercrime by improving security.
2. To reduce the transaction cost with clear transparency
3. To simplify and automate billing processes.
4. To improve Transaction reliability by increasing trust.

2. Literature Review:

The Telecom industry lives in a technologically complex and competitive environment with few leakages in the business model. Now, the on-going pandemic crisis (COVID-19) has burdened many industries in terms of the credit crunch. But, according to Global news wire [1] , the revenue of Communication Service Provider (CSP) in India is expected to remain steady amidst COVID-19 Pandemic, which means there might not be a huge increase in revenue loss. Not many have done quality research on blockchain in the telecom industry. In the year, 2018, IBM released one paper based on How can we reimagined the telecommunication with blockchain [2]. The same paper dealt with how concepts can evolve into reality. And in the same year, Rajat Kochhar, Barjinder Kochar, Jatinder Singh, Varun Juyal (2018) wrote how blockchain would impact on telecommunication startups and how they can leverage blockchain. Deloitte has also released how blockchain will impact in the telecom industry with relevance to the C-suite in the year 2016 [3]

More than 600 million users have become internet users in the last six years and another 600 million users are expected to come online over the next six years. As the world steadily increases the number of connecting people to the internet which only set to grow in the coming years. To find a new source of revenue model and to build a secure system for this complex data, Blockchain has the potential to provide opportunities for reducing costs through efficiency gains. And in the highly competitive digital world, the infrastructure light over the top players (OTT) demands high bandwidth. Telecom couldn't handle and lost millions of dollars because of it [4]. To increase the revenue model, instead of increasing the pricing of OTT content and others but to prevent frauds and enhance the transaction visibility which subsequently increases the revenue model of the business. In the year 2016, the cybersecurity risks were 30% compared with regulatory and other risks [5]. It is important to develop an infrastructure and defense against vulnerability to fraud. Fraud monitoring and tracking of customer's activity can be done to cellular operators, OTT players where it decreases the revenue of the operator by increasing the operating costs, E-wallets and other value-added services, etc. that will also improve the scope of further advancements as the technology grows [6]. Risk can be interpreted as the probability of damage, negative in nature. But fraud can be understood as a criminal deed having an intention to steal the personal data for financial gains. Telecom fraud can be categorized into Revenue Fraud or Non-Revenue Fraud, to mask the criminal activities by experiencing the product or service with an intent to avoid payment. Unauthorized operation on customer accounts is said to be Subscription Fraud and Call forwarding fraud is known as Usage Fraud. The reduction in leakages from billing level and product and service level to network downtime level that can marginally increase the

revenue to the Communication Server Provider (CSP). Few use cases will help to understand the potential of blockchain. By implementing blockchain for data and value exchange within networks, that will reduce fraud and subsequently will reduce the cost of fraud detection and reduce the data losses so that it improves the trust of the CSPs. Using blockchain if we provide eSIM solutions based on cryptographic identities like the Vignere Cipher or Playfair algorithm we can decrease the cost of implementing the Identity Management System which will be an additional revenue system. The information is stored in the block that can be customized as per the participants to access relevant information. So, it could be the best comprehensive way to combat all these frauds using ledger technology and enhance the revenue model for Communication Service Providers.

3. Blockchain and its Types:

Blockchain is the new evolving technology which is originally devised for Bitcoin, but it could be the best way to prevent fraud. The best thing about the blockchain is that it has a decentralized ledger where the integrity of the transactional data can be maintained by providing the consensus protocol at the same time [6]. Decentralization is nothing but having access to data at the same time by everyone who has an invitation to access the data. The data that is stored will be in blocks using cryptographic tools like Playfair algorithm or Vignere Cipher or Diffie – Hellman Key Exchange where only network participants can verify to prevent potential corruption. If data is not synced for everyone who is participating in the network then the information would be corrupted. Smart contracts is a digital agreement that can boost the business model substantially in a higher value. It is a computer pre-programmed code that can execute by itself by acting as an agreement [7]. Basically it removes the intervention of the middle man and helps to track the ownership in a unique value with the help of an asymmetric algorithm that decrypts the information using a private key that is encrypted by the public key. For telecom companies, the regulators can also be part of the blockchain network so that they can have the visibility of the transaction and a better understanding of delivering services without middleman interventions. It will also help to validate the subscriber registering to which operator in their network.

3.1. Public Blockchain:

When the network is decentralized then public blockchain is preferred over a private chain because it gives the full transparency of the ledger to everyone who set it up as a node with the computer and the internet connection [8]. A public blockchain is extremely secure and it is continuously synced with an entire history of blockchain. It can be preferred over a traditional accounting system which can delay the actual process and providing at a higher cost. A public chain can provide the same at a faster pace and at a lower cost.

3.2. Private Blockchain:

Unlike the public chain, the node here allows the middleman to a certain extent that can be validated by the organization or the other node. Here, the efficiency will be more than the public chain because the transactions are written, verified, and maintained by the organization. It is similar to traditional businesses and governance models that can choose the admittance to read the transactions [9].

3.3. Consortium Blockchain:

The consortium chain is the amalgamation of the public and private chains. The consortium has the pre-determined selected nodes that have access to read and verify the blockchain ledger. It acts as a bridge between the lowest trusted characteristics of the public chain and the most trusted characteristics of the private chain.

3.4. Consensus:

Consensus is nothing but general agreement – Here all the nodes in the network ensures and agrees upon which block should get validated and added to the chain [10]. This makes the blockchain so powerful and robust where various algorithms and protocols are used with merits and demerits which is described more in the Table 1.

Table 1: Types of Consensus Algorithms.

Algorithm	Description	Merits	Demerits
1. **Proof of Work (PoW)**	Famous Consensus algorithm – Transactions are verified by the participants in the network so the trust is established within the network continuously. Nodes must solve the complex cryptographic blocks to get the reward [10].	• Highly Scalable • Famous Algorithm • Attractive	Needs High Computational Power.
2. **Proof of Stake (PoS)**	If a block is discovered, it would get validated by placing bet on the block and the validators gets a reward by validating it [10].	• Fast and Efficient • No Complex Puzzles	Little Vulnerable because no complex puzzles needs to be solved.

3. Proof of Activity (PoA)	The Amalgamation of both PoW and PoS where mining's are done by PoW and the mined block will have only the address	Having both the features makes the best algorithm	Needs more energy and Computational Power.
4. Proof of Burn (PoB)	To mine a new block, nodes will send to an irretrievable address so that large number of coins are allowed to mine a new block.	No complex puzzles needs to be solved	Loss of coins because burning coins is expensive.
5. Proof of Capacity	The ones who have large hard disk space are more likely to mine the next block and will earn the reward.	Decentralized and no hardware needed	Needs more hard disk space
6. Proof of Elapsed Time	Nodes with a shorter duration will keep on mining the coming blocks	Highly Energy Efficient	Rely on third party and need of specialized hardware.

4. Scope of Blockchain in Telecom Industry:

4.1. Identity Management:

Current Scenario: Now, all the person have to sign up to use the third party services and they have to prove the identity and their credentials using some kinds of digital documents. And signing up online creates username and password for yourself but most of the information would not be required to all the vendors. They only need a subset of it. Here, CSP can play a vital role because they possess a substantial amount of subscriber data that can be used to generate more revenue for the industry by also verifying personal documents like driving licenses, passport, and educational degrees.

Opportunity for Blockchain: The revenue can be increased by providing an identity as a service to numerous partners and utility services by the communication service providers. The identity transactions can be saved in the shared ledger as a record in the blockchain. For instance, when a subscriber is opening an account in any of the CSP's, the information and all the data can be stored in the e-sim where the same identity can be used for any third part services say e-commerce, airplane tickets and so forth.

The virtual identity is created while opening an account with CSP in the ledger, so the subscriber doesn't need to open a separate account for e-commerce, Facebook, or smart vehicles. The same copy of the ledger is sent to a third-party vendor for accessing the site by the subscriber. To confirm the virtual identity belongs to the subscriber, the third-party vendor takes the public key from the virtual identity encrypts them and sends them back so that it decrypts them and ensures the subscribers own the virtual identity. To access the same website, the same mechanism is used by the subscriber. The ledger holds all the transaction data and the subscriber preferences so that it can be used as a recommendation engine where e-commerce kind of sites will be benefitted. The information that goes to the third party partners will be relevant for that particular services and it is only based on the sign up that CSP is doing with that partner service provider. More people likely to use different services when it is not necessary to open an account from scratch all the services they use. In fact, the United States has already started experimenting with identity as a service on a project called ID2020 [11]. It aims to provide an identity of around 1.1 billion people who don't have an officially recognized identity. Here, Blockchain can find relevance to solve this problem. By incorporating this technology, additional revenues can be added to the telecom industry.

Benefits:

1. New Revenue Stream.
2. Cost saving compared to traditional IDM.
3. Ease of use of different services by the subscriber.

4.2. Fraud Management:

The roaming facility will be the major loss of revenues for telcos. Roaming is nothing but utilizing the service network by the subscriber even away from their network area by retrieving through other network providers. The Communication Service Provider goes through an increasing number of International Revenue Share Fraud (IRSF) on a regular basis. According to the Communication Fraud Association (CFCA), the telecom industry lost nearly $4billion to revenue share fraud cases [12]. Telecom operators have not found out any way to resolve fraud cases where 70% of total fraud losses in the telecom industry account to International roaming [13].

Current Scenario: When the subscriber is not in the home network area and the call or an event is initiated, the Visited Public Mobile Network (VPMN) queries to the Home Location Register (HLR) of Host Public Mobile Network (HPMN) about which services the roaming user has subscribed. The query will be validated by sending all the information related to Call Detail Record (CDR) to the billing system of VPMN and to HPMN as a Transfer Account Procedure (TAP) file so that the accounts between HPMN and VPMN is settled.

But the main challenge is that it takes a longer detecting time that subscriber is not in the HPMN so the exchange of data between HPMN and VPMN is not efficient. To respond to this fraud it will a long time than the fraud had occurred which is depicted in the figure 1.

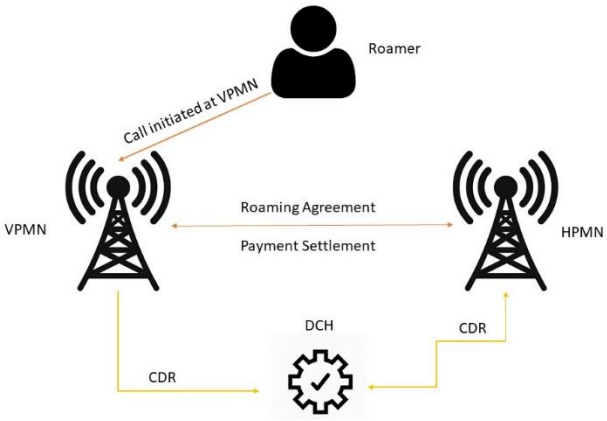

Figure 1 – Current Scenario

Blockchain-based solutions: When permission blockchain is implemented between all the pairs of the telecom operators which could help to replace the conventional ways of sending CDR. Here, both the operators act as miners so that they will have access to view all the transaction between the operators and data invasion is not possible. Here, smart contracts help to make the roaming agreement between the HPMN and VPMN. When the transaction contains CDR data gets established in the blockchain network, it triggers the smart contracts between HPMN and VPMN so that terms of agreement gets executed smoothly. In the current scenario, most of the telcos outsource to the Data Clearing House (DCH) the CDR transaction and to the billing conversion which is simply explained in the figure 2.

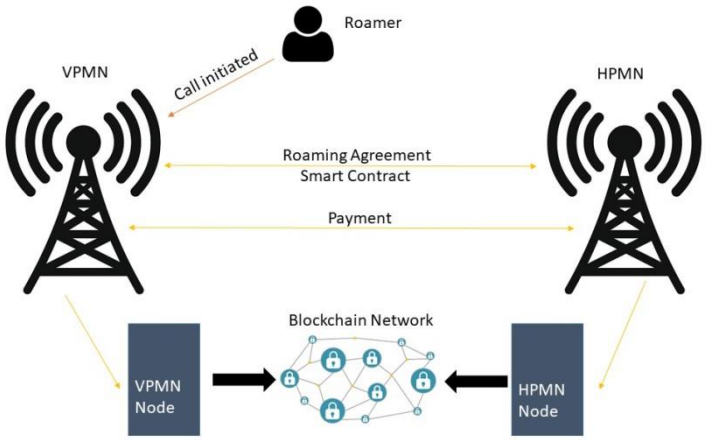

Figure 2 – Blockchain based solutions

Note: Figure 1 and Figure 2 is referred from Catering the Telecom Conundrum of Revenue Leakage: Blockchain- A Business Paradigm by Charishma Idamakanti, Kislay Bhardwaj (2017).

But here, Blockchain completely makes the role of DCH irrelevant which helps to the revenue streams of the telecom industry. The transaction and the payment between the HPMN and VPMN happens in the runtime, so there will not be any fraud and saving costs by eliminating the intermediaries(DCH).

Benefits:

1. New Revenue Stream
2. Eliminating the intermediaries
3. Automatic initiation of Roaming Agreement.

4.3. Billing:

Telecom offers four services that are Voice, data, SMS, and MMS. Billing for all four services is to gather and collect information of users in the respective offerings and then create an invoice for this to give it to the customer. The next would be the acknowledgment part, after the customer settles the bill. The subscribers are classified into pre-paid customers and post-paid customers. For Post-Paid subscribers, the invoice will be generated either on a monthly basis or once in three months. It's completely based on the subscription plan by the subscribers. So there will not be more leakage in the revenue because there is a lot of time for the telcos to bill the post-paid customers and not in the run time. For Pre-paid customers, the case is different. The billing will be in run time because every time when the subscribers utilize any of the services from Service Delivery Network (SDN) that enables all the digital services over the network.

Current Scenario: Some subscribers don't need to use some services offered by the operator. So they give request to BSS and HLR but because of improper integration of network elements, BSS get the request but HLR failed to get the request. Therefore, Subscribers still enjoy services without paying for a particular service. This could be the biggest leakage in the revenue streams in the telecom industry.

Blockchain Opportunity: For billing purposes, permission blockchain can be implemented along with switches and registers. The switches and registers will always be in sync and whenever the consumer wants to subscribe or unsubscribe, the information will get added to the blockchain network, and switches will get in sync with the network through their nodes. The information will be in run time so if BSS gets a request to unsubscribe to any of the services, blockchain ensures that even HLR unsubscribe that particular consumer for that services and vice-versa. As soon as BSS gets the request, the switches get updated where BSS acts as a third node here along with switches and registers. This basically improves the customer experience by solving a major revenue leakage problem.

Benefits:

1. Billing for all the services for which subscribers are utilizing.
2. Revenue Leakage is solved.

5. Conclusion:

Blockchain is the one good technology that can be compared to the internet in the late nineties that could solve day to day business problems in many industries but mainly in Telcos. We can mitigate most of the problems caused by fraud and revenue leakage in the industry. There are few startups like Dent

Wireless [14] and Airfox Wireless [15] could potentially disrupt the industry that utilized the unique opportunity of Blockchain to provide innovative solutions. As compared to any other new technology, Blockchain is being developed and implemented at faster rates. While having all the historic data being saved in the blockchain network, the data gets huge and unsustainable. To resolve this problem, the data must be explored to archive by various blockchain ecosystems. Within the next few years, Blockchain would predominantly in use and became the norm services like Identity Management, Billing, and Roaming Fraud. It's not too early to talk but inquisitive to know that within a few years, telecom will overcome all the challenges which are being difficult to tackle now

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