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New Technology Adoption Framework for Telecom Operators - with focus on Block chain

***Rahul Darmwal*[1]**

[1]Sr. Consultant, Ericsson,
Mumbai, India

Abstract: ***Adopting new technology in existing business is one of the toughest decisions that CXO's needto take. Till a technology becomes main stream, there are no clear strategies that can be used to defineadoption roadmaps. Blockchain poses such a problem for senior executives as it is one of the mostpromising disruptive technologies, but is still in its infancy. To help decision makers, this paper proposesa new technology adoption framework. The adoption framework will help Executives create testing andadoption strategies for new technologies. To clearly explain framework, an adoption scenario forTelecom operator wanting to use block chains has also been documented.***

Keywords: adoption, framework, technology, operators, blockchain

1. INTRODUCTION

In today's disruptive market, technology is evolving at breakneck speed. Shelf life of products has been on decline and we see more and more CXO's mulling over the next fundamental technology shifts and its impact on their Business. First mover's advantage is imperative for long term success of today's Technology focused companies. One of the most talked about technology disruptors is Blockchain and its use in various domains. This paper will try to introduce basic concepts of blockchain and propose an adoption model for Telecom operators that can be used to create adoption strategy.

In year 2008, Satoshi Nakamoto published a paper, "Bitcoin: A peer to peer Electronic Cash system" which describes a trust less transaction system based on blockchains[3]. Soon afterwards, work started on building Bitcoin mining and exchange system which today has become a hugely successful proof of concept for use of blockchains in everyday life. Success of Bitcoin made a lot of industries take notice of blockchain concept[7] and how it could be used to solve problems in their domains. Telecom sector is no exception and we see a lot of literature[4,5] being produced for use of blockchain in Telecom environment.

What is of significance is the fact that Blockchain is still a nascent technology with very few concrete implementations. This makes it very difficult for CXO's to determine the best approach for testing and assimilating this technology to existing business services. This paper tries to propose a Technology adoption model for emerging technologies and illustrate its use through a sample scenario of Telecom Operator trying to adopt blockchain technology.

2. WHAT IS BLOCK CHAIN?

Given below is Blockchain definition as mentioned in Wikipedia[8]

> A blockchain – originally block chain – is a distributed database that is used to maintain a continuously growing list of records, called blocks. Each block contains a timestamp and a

So, Blockchain is just a chain of data blocks, with linkages to previous blocks. Each data blocks are shared with all participants on the network. An algorithm is capable of creating trust between participants to make transactions meaningful and enforceable.

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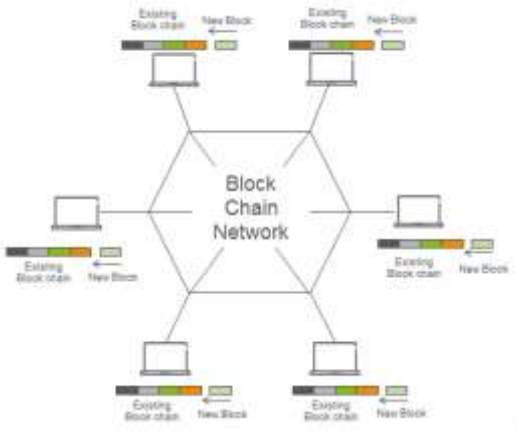

Figure 1: Concept diagram showing new block getting added to Distributed ledger

People familiar with ways of storing data (in a distributed ledger) will point out that this is a fundamental shift in the way data is stored and transactions executed. It is due to this change that, blockchains are revolutionizing existing use cases across industries.

Following is a simple analogy to explain how block chain works:

Let's assume some transactions need to be added to a block chain. Also assume existing block chain (sequence of blocks containing previous transactions).

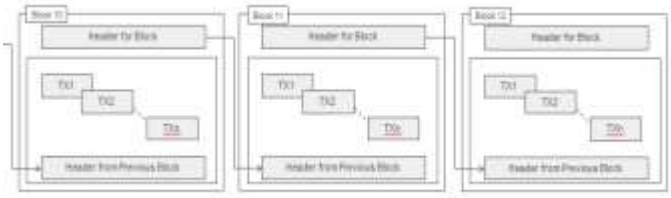

Figure 2: Concept diagram showing linkages between blocks in block chain

1. New transactions need to be added to existing blockchain. For this, Block 11 is being created by participant and this will get added to the chain.
2. The various transactions are ordered sequentially in the block
3. Header from previous block(Block 10) is added to current block(Block 11)
4. Using encryption algorithms, a header is created for new block (Block 11). The encryption algorithm considered transaction data in block along with Header from previous block (Block10). The headers are generally created using hashing algorithms, which are commonly used in cryptography. The block is then signed using participant's digital key.
5. The newly created block is now broadcasted to all participants of the block chain
6. The participants verify the block using headers included into blocks and digital signature of participants. The header contains link to previous block. The header is decoded to verify this linkage. The digital signature of the sender is also verified electronically. If all checks are cleared, the participant adds the block to its chain. As this is being done by all participants of block chain, it is almost impossible to get fraudulent transaction into the block chain without raising suspicion amongst the participants.

From above example, it would be clear that there exists a linkage between current block and its previous block. This linkage makes each block permanent and irreversible as blocks cannot be changed without impacting previous blocks. The headers for blocks are generally created by using hashing algorithms which are commonly used in cryptography.

Additionally, block chains can also be used to execute smart contracts[9]. These are small if-then codes that run on block chains. Based on transactions taking place, the smart contracts get executed and results can impact participants of contract, e.g. if delivery receipt of order is received on block chain, payment can then be release through block chain transactions.

3. TECHNOLOGY ADOPTION FRAMEWORK

To aid in decision making, there are a lot of models and frameworks available e.g. Impact-effort matrix[10], Opportunity Matrix[11], and such others. However, all these do not cater specifically to new emerging technologies. To cover the gap, this paper proposes a Model, which

can be used by Telecom Industry to specifically focus on new emerging technologies like Block chain and create a roadmap for adoption. An example for how Telecom Operators can use this model to determine adoption strategy for block chains has also been illustrated.

The framework builds on logical life cycle for any new technology/solution adoption. It proposes 4 distinct stages for adoption of new technology for existing business functions. To use this model, potential use cases which can benefit from new technology should be plotted on model framework based on the Business Complexity and Business Impact expected. The use cases can be plotted by defining rating criteria's for Complexity and Impact axis. Depending upon the rating criteria's, use case will fall in one of four stages. It is proposed that firms move sequentially from use cases in Stage 1 to use cases in Stage 4 to enable gradual adoption of emerging technologies.

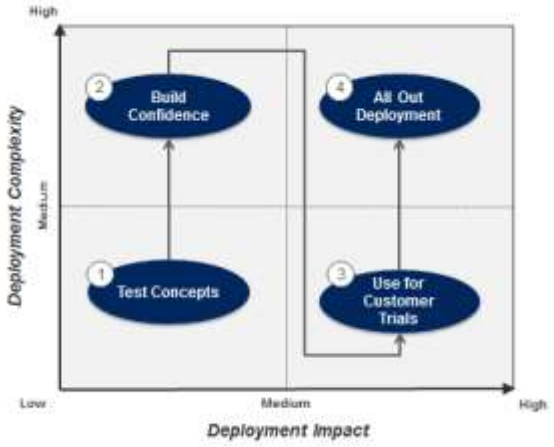

Figure 3: Proposed Technology Adoption Framework

The four stages of adoption are explained below:

Stage 1: Test Concepts –Business functions/use case that can be easily deployed using new technology, and do not have major impact on firms business, falls in this stage. This being the first stage, key concepts of new technology should be evaluated and tested by integrating them into Business functions/use cases falling in this stage.

Stage 2: Build Confidence - Business functions/use case that are complex to deploy, but do not have major impact on firms business fall in this stage. These functions/use cases should be used to gain expertise in new technology and should enable firm to understand exact capabilities of technology, and how it can be used in existing businesses.

Stage 3 – Customer Trials - Business functions/use cases that are simple to deploy, but are critical to firms business fall in this stage. These functions/use cases should be first ones to be used for customer trials. Being simple deployment, issues can be easily solved, at the same time; these deployments will give confidence to organization about their capabilities to deploy new technologies for critical functions.

Stage 4: All out deployment - Business functions/use cases that are complex to deploy, and are critical to firms business fall in this stage. These functions/use cases would be the most critical for functioning of firms business. The experience gained from Stage 1 through Stage 3 would give confidence to firm to being able to deploy mission critical solutions using new technology.

When use cases are plotted to adoption model, the model will provide strategic direction on which use cases should enterprise start with, how should adoption roadmap be and the various stages that they need to go through in terms of building competence, testing and launching critical services using new technologies.

4. EXAMPLE FOR USE OF ADOPTION MODEL

To highlight use of this model, let's consider a scenario where a Telecom operator wants to create an adoption roadmap for blockchain. Operator has identified 5 use cases where he feels blockhains can make a difference. These use cases are:

Postpaid subscriber billing:
In this use case, network elements share call data records directly with billing system on blockchains. By using Smart contracts, complex billing and rating logic can also be developed. This helps operator save costs as there is no need to invest in expensive database and billing systems.

Interconnect billing:

It is proposed that Telco's create private block chain and share roaming call data records on this block chain. The roaming network can put CDR's on block chain in real time and home network can process CDR's as soon as they are received as part of block. This will eliminate need of clearing house as all CDR's will be available on blockchain. As CDR's are available on blockchain, disputes related to billing and payments would become negligible. At same time, Operators will save costs by not subscribing to services provided by clearing house.

Public Private Key for Customer Authentication:

Public private keys are de-facto standards for authenticating transactions on the Internet. Blochchain also uses public private keys to determine participants and authenticate transactions. As private keys are never exposed to network, the level of security is much high as compared to existing challenge response authentication methods used by Telecom operators. Hence, the proposal to use public private keys for customer authentication within Telco.

Integrated O&M:

By creating private blockchain for network elements within operator, it is possible to share logs and status change messages over this block chain. All network elements connected to blockchain will be able to receive logs, alerts, etc. These logs are timestamped and stored as permanent records on distributed ledger and can be used to create detailed RCA's. This is of great help in multi-vendor environment.

Customer Purchase Management:

By creating blockchain between subscriber and operator, it will be possible to share every customer purchase transaction with customer and operator. As Customer also has copy of blockchain, he will be able to get exact logs of his purchases and same is valid for operator. As same blockchain is referred by operator and customer, there should be no mismatch between the purchased services and what is activated on system, thus reducing customer disputes.

A rating framework was created specifically to cater to Telecom operators wanting to explore Block chains. Though, the rating framework is focused towards Telecom Operators and Block chains, it can be easily modified for use of different industries and for other emerging technologies. The rating framework has been shown below. The values for parameters are based on authors experience and can be modified as per best understanding of user.

Figure 4: Sample rating framework for Telecom Blockchain

By using this rating framework, we are able to plot five use cases to the Adoption Model.

Figure 5: Mapping of Telecom use case on Adoption Framework

As is evident from this example, by using the rating criteria and model, following would be the strategy/roadmap for Telecom Operators to adopt Block chains:

- "Integrated O & M" should be the first function that Operator should develop using Block chains.

  Explanation: O&M, being an internal function, there would not be any service disruptions during testing of this use case. This use case will help build competences within Operator on Block chains and help in development of future complex solutions.

- "Interconnect Billing" use case can be considered as ideal candidate to gain expertise on block chains.

Explanation: Interconnect billing is an off line operation which does not impact core services. At the same time, to develop this capability, Operators would need to have block chain based charging solutions and this would expose them to detailed working of block chain, smart contracts, large scale deployments, integration with other operators, etc.

- For Customer trails, model suggests "Customer Purchase Management" use case.

Explanation: This use case will expose block chain based services to subscribers. The use of block chains in purchase functions will fundamentally change existing solutions and will be good testing ground for Telecom Operators readiness to deploy Block chains for core customer services.

- After above mentioned use cases have been successfully deployed, model suggests deployment of Core Telecom Network use cases such as "Subscriber Billing" and "Subscriber Authentication".

Explanation: As these functions are critical for Telecom operators, model proposed that these be executed in last stage after sufficient time and effort have been spent to really understand and develop block chain based solutions.

5. Conclusion

The adoption framework is expected to be a valuable tool for CXO's to strategies on adoption of new technologies. With its focus on Complexity and Impact, the model is generic enough to be used across any industry and for any new emerging areas. The output produced by model will give enough strategic direction to enable creation of detailed roadmap for new technology adoption.

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Author Profile

Rahul is a Senior Consultant working with Ericsson Global Services India Ltd. He has 14+ years of Industry experiences and has worked with Operators and Telecom Vendors. His areas of interest include Business and Operations Consulting. Rahul has an Engineering degree with specialization in Telecommunication from Mumbai University.