**CHAPTER 1**

**INTRODUCTION**

6. What consensus method to be used with this Blockchain?

6.1 The environment may not be able to effort competitive and high resources consuming consensus like PoW and alike. At the same time, it is difficult to define value of coin/token in coin/token based consensus like PoS.

6.2 PBFT should do it.

6.3 Each participating node have 2 task to do per time, generate its own audit message and distribute to the network (which they supposed to do it even without Blockchain) and receive audit message from the network to validate and prove it to be added to the chain. This is where we need to determine about computational resources that require for these task. How much amount of resource should be limited for Blockchain to keep each computer operate its regular operation normally.

6.4 What about technical capability and limit of each consensus method?

5. What is this chosen environment? Maybe, a system that have at least 5 participating nodes and each node have different internal environment, i.e. Windows NT, Windows 10, Kali Linux, Ubuntu, CentOS, Macintosh, and Androids. That mean, participating node possibly included several computers from different unit in the same organization branches and different branches. Possibly be the main computers of each units or wards which normally used to operate regular operation and always active. This may also allow the network to be scalable depend on available computational resources in environment, included crossed-organization.

4. What component we needed for this scenario? A). a design of system that made to work well with healthcare operation and compatible with its unique characteristics. B). a design of Blockchain that compatible with the chosen environment. C). we need to combine these two designs together.

3. Who will be participating node? (Whomever) Organization that want their audit data to be immutable. In this case, we focus mainly on healthcare organization.

2. What the main purpose of Blockchain use? Make audit data become immutable.

1. What is the main purpose of this paper? Demonstrate how Blockchain can be used together with IHE implementation guided system to create immutable audit.

# Motivation/Background

Emerging cyber threats in healthcare domain

Incidents and damage

Major incidents came from social engineering on healthcare employees and poor security in healthcare enterprise.

* Data Breach
* Insider Threat
* Ransomware

Because of these kinds of threats, improved capability to track activity in healthcare information network will allow better mitigation and strategy against these emerging threats.

Patient’s personal information are high valuable for hacker

Shop for necessary information to hack something else

Healthcare info. Can be used to forge social engineering material.

We need more secured approach to protect patient’s info

If we can notice suspicious activity in healthcare network, we may be able to prevent cyber-incident, reduce its damage, or mitigate it more efficient. This is where audit is needed.

But Audit itself is also vulnerable.

This is where Blockchain is needed.

Healthcare information have its own unique characteristic. Most of healthcare employees need to work on the verge of live or dead of patients. That mean, healthcare employees may not be able to effort a duty to take care of healthcare information system. IHE (Integrating Healthcare Enterprise) is the organization who established to help IT employees and developer to create IT infrastructure and system that satisfy the requirement of operation in healthcare.

ATNA is a profile in IHE IT implementation guide. It’s built to work with unique healthcare environment. This allow fined-grain activity monitoring. What about not just ATNA?

What will happen, if we apply ATNA to Blockchain? Apply ATNA to Blockchain will help ensure integrity of audit related information in healthcare. Strengthen healthcare information security against emerging cyber-threats.

When we want to use Blockchain, we need to think about its component. These components are Participating node, Consensus, Block Structure, and Hash Chain. We may also need to think about its business value as it will power the Blockchain network. We may need to conduct some kind of experiment to determine for suitable consensus to be used along with the application of ATNA Blockchain.

Factors:

* Size and amount of transaction per time.
* Speed requirement
* Organization within the network.
* Environment of participating node.

# Problem statement

Why use Blockchain instead of distribute copies of data to several location? What advantage Blockchain give? > If these copies become different by any cause, how can we know which one is trustable? That’s where consensus and hash chain come in. Can we create Blockchain that can ensure integrity of audit data while provide necessary mechanism to make sure that every copies of these data are not tempered. So, how consensus and hash chain can help?

Consider scenario in term of cost and benefit

* Every node have the same set of data | Data backup: yes | Blockchain: yes
* Every node require space to store data | Data backup: yes | Blockchain: yes
* Consensus provided | Data backup: depend | Blockchain: yes
* Hash Chain implementation | Data backup: depend | Blockchain: yes
* Have goal to preserve integrity of data | Data backup: yes | Blockchain: yes
* Cost |
  + Data backup: spending on each backup node for single team that require small space for data
  + Blockchain: spending on single or several blockchain node for single or more than one team while require bigger space for data

If the final equation is: bitcoin blockchain ⊆ blockchain technology ⊆ distributed ledger technology ⊆ distributed databases

How Blockchain technology better/different/improved from distributed ledger technology?

How distributed ledger technology better/different/improved from distributed databases?

How distributed databases better/different/improved from centralized database?

# Objective

# 1.4.1 To study and analyze related standards and regulations for developing tele-presence robot

1.4.2 To implement the standards and regulations into research and development of the tele-presence robot

1.4.3 To improve our previous design on tele-presence robot for better reliability and comply to the standard and regulation

# 1.4 Scope of project

This project focuses to analyze international standard and regulations for tele-presence robots based on present availability before implements to the design of pre-prototype platform for DoctoSight robot.

# 1.5 Expected result

New design of pre-prototype platform for DoctoSight robot is comply with standards and regulations for tele-presence robots.

**1.6 Thesis Organization**

A thesis submitted in partial fulfillment the degree of bachelor of engineering of the requirements for Biomedical Engineering, Faculty of Engineering, Mahidol University.