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## Comparing transaction speeds per unit of energy consumed of Traditional Financial Systems and Blockchain Systems

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**Abstract—** Transactions or exchange of value between parties engaged in various relationships be it business or personal use are the backbone of the economy. Transaction efficiency in terms of resources consumed when transferring money from one party to another is an important factor which can have massive impacts on the overall growth of the economy. We require a resource efficient - I.e. money transaction systems which are capable of providing transaction services at low cost, high speed & with minimal energy consumption. Here, in this paper, I compare the transaction speeds of Legacy Financial Institutions & Blockchain systems per unit of energy consumed. We came to a conclusion that at the moment Legacy Financial Institutes comes out as clear winner in terms of transaction speed per unit of energy consumed.

**Keywords—** *blockchain, VisaNet, transaction, energy, digital ledger*

### I. INTRODUCTION

#### A. Legacy Financial Institutions

Many traditional financial transactions platform have been present in the modern era, most importantly- Banks. They are a organization (essentially a for profit business) which disperses debt to customers in exchange of interest percentage of the principal loaned plus the loan amount itself which is to be paid by the customer, who took loan, over a period of time. Banks do fund these loans from another set of customers who want a safe place for there cash & for reliable payments system. Many other institutions are also present which are financial services corporations including Visa Inc. which facilitates electronics fund transfers throughout the world, most commonly through Visa branded credit cards, debit cards & prepaid cards.

VisaNet is an electronic payment processing system that is used to operate with e-commerce transactions. On average a transaction using VisaNet will take less than a second.

The merchant and consumer's banks must be members of Visa for the system to process a transaction. When a transaction takes place, the merchant's bank keeps and stores the transaction details and contacts the consumer's bank through VisaNet. The consumer's bank will either accept or decline this transaction. Once it has been accepted, VisaNet will transport a code securely to the merchant's bank where it is stored in a file and awaits settlement. VisaNet is currently the largest system that does this.

VisaNet can support debit, prepaid credit, credit, mobile payments and transfers as well as running risk management applications in real time when processing a transaction. The system provides telecommunication and payment data processing on a global scale. VisaNet can provide a distinct service catered to the country that the organisation, consumer or government is in using multiple currency and language processing services.

VisaNet is owned by Visa Corporate and was one of the first companies to have electronic card authorisation systems.

#### B. Blockchain Systems

A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain. Each block in the chain contains a number of transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participant's ledger. The

decentralised database managed by multiple participants is known as Distributed Ledger Technology (DLT).

Blockchain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash.

This means if one block in one chain was changed, it would be immediately apparent it had been tampered with. If hackers wanted to corrupt a blockchain system, they would have to change every block in the chain, across all of the distributed versions of the chain.

Blockchains such as Bitcoin and Ethereum are constantly and continually growing as blocks are being added to the chain, which significantly adds to the security of the ledger.

Different Blockchain systems include Bitcoin, Ethereum, Solana, Polkadot, Ripple, etc. These variety is due to the need for greater transactional efficiency using Blockchain infrastructure. Constantly new products are launched in this space which have improved features & facilities.

## II. RESEARCH METHODOLOGY

All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

### A. Hybrid Model

A model may include both descriptive and analytical components. A descriptive model's logical relationship can be examined, and conclusions can be drawn to reason about the system. Nonetheless, logical analysis yields quite different conclusions than a quantitative chemical investigation of system properties.

We collected data from different sources having transaction speeds and the energy consumed by each transaction of Legacy Financial Institutions and Blockchain Systems.

We will compare the transaction speed per unit of energy consumed by these two systems and aim to know which one is more efficient.

### B. Hypothesis Testing

Hypothesis testing is a sort of statistical reasoning that includes analysing data from a sample to derive inferences about a population parameter or probability distribution. First, a hypothesis is created regarding the parameter or distribution. This is known as the null hypothesis, abbreviated as  $H_0$ . After that, an alternative hypothesis (denoted  $H_a$ ) is defined, which is the polar opposite of the null hypothesis. Using sample data, the hypothesis-testing technique determines whether or not  $H_0$  may be rejected. The statistical conclusion is that the alternative hypothesis  $H_a$  is true if  $H_0$  is rejected. For this paper, Null hypothesis ( $H_0$ ): Blockchain systems have greater speed of transaction per unit of energy than legacy financial institutions.

Alternative hypothesis ( $H_a$ ): Legacy financial institutions have greater speed of transaction per unit of energy than blockchain systems.

### TEST (STATISTICS)

There are 3 tests available to determine if the null hypothesis is to be rejected or not.

They are:

1. Chi-squared test
2. T-student test (T-test)
3. Fisher's Z test.

For this paper, we will be using a 2 tailed T-student test.

A t-test is an inferential statistic that determines if there is a significant difference in the means of two groups that are related in some manner.

□

### Level of significance

The chance of rejecting the null hypothesis when it is true is the significance level (also known as alpha or  $\alpha$ ). A significance level of 0.05, for example, means there's a 5% probability of discovering a difference when there isn't one. Lower significance levels indicate that more evidence is required to reject the null hypothesis.

### Level of confidence

The confidence level indicates the probability that the location of a statistical parameter (such as the arithmetic mean) measured in a sample survey is also true for the entire population.

Sr No.	Data
1	650
2	4
3	150
4	100
5	30
6	170
7	193
8	84
9	57
Mean(x)	68.6111111
Standard Deviation(s)	16.20250324

Level of

significance = 0.05 i.e. 5%

Level of confidence = 95%

A t-score (t-value) is the number of standard deviations away from the t-mean. distribution's.

The formula to find t-score is:

$$t = (x - \mu) / (s / \sqrt{n})$$

where  $x$  is the sample mean,  
 $\mu$  is the hypothesized mean,  
 $s$  is the sample standard deviation,  
and  $n$  is the sample size.

The p-value, also known as the probability value, indicates how probable your data is to have happened under the null hypothesis.

Once we know the value of  $t$ , we can find the corresponding  $p$ -value. If the  $p$ -value is less than some alpha level (common choices are .01, .05, and .10) then we can reject the null hypothesis and conclude that Legacy financial institutions have greater speed of transaction per unit of energy than blockchain systems.

Calculating  $t$ -value:

Step 1: Determine what the null and alternative hypotheses are.

Null hypothesis ( $H_0$ ): Blockchain systems have greater speed of transaction per unit of energy than legacy financial institutions.

Alternative hypothesis ( $H_a$ ): Legacy financial institutions have greater speed of transaction per unit of energy than blockchain systems.

Step 2: Find the test statistic.

In this case, the hypothesized mean value is considered 0.

$$t = (x - \mu) / (s / \sqrt{n}) = (68.61 - 0) / (16.202 / \sqrt{9}) = 12.704$$

$t$ -value = 12.704

Calculating  $p$ -value:

Step 3: Calculate the test statistic's  $p$ -value. The  $t$ -Distribution table with  $n-1$  degrees of freedom is used to calculate the  $p$ -value. In this paper, the sample size is  $n = 9$ , so  $n-1 = 8$ . By plugging the observed value in the calculator, it returns a  $p$ -value. In this case, the  $p$ -value returned is less than 0.00001. Since this  $p$ -value is less than our chosen alpha level of 0.05, we can reject the null hypothesis. Thus, we have sufficient evidence to say that Legacy financial institutions have greater speed of transaction per unit of energy than blockchain systems.

### III. FINDINGS

Since legacy financial institutes have greater experience & research-development in regards to financial transactions technology, they clearly have an upper hand in comparison to Block chain systems. Block Chain systems though promise immense transaction speeds consume way more energy and thus are not feasible when compared to Traditional Financial institutions.

### IV. CONCLUSIONS

Legacy Financial institutions have greater transaction speed per unit of energy consumed than Blockchain systems. However new Blockchain systems with greater energy efficiency are being researched constantly and maybe in the future they might overtake legacy financial institutes.

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