

A Summary on Comparing Software Quality Metrics of Traditional vs Blockchain-oriented Software: An Empirical Study

Paper review on software metrics

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BlockChain is growing list of records called by collective self-interests. Such a design blocks that are linked using cryptography. [1] Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a Merkle tree). A blockchain is a decentralized, distributed and public digital ledger that is used to record transactions across many computers so that any involved record cannot be altered retroactively, without the alteration of all subsequent blocks. This allows the participants to verify and audit transactions independently and relatively inexpensively. A blockchain database is managed autonomously using a peer-to-peer network and a distributed timestamping server. They are authenticated by mass collaboration powered facilitates robust workflow where participants' uncertainty regarding data security is marginal. The use of a blockchain removes the characteristic of infinite reproducibility from a digital asset. It confirms that each unit of value was transferred only once, solving the long-standing problem of double spending. A blockchain has been described as a value-exchange protocol. A blockchain can maintain title rights because, when properly set up to detail the exchange agreement, it provides a record that compels offer and acceptance. [2]

BOSE(BlockChain Oriented Software Engineering) may benefit from the introduction of specific metrics. To this purpose, it could be useful to refer to the Goal/Question/Metric (GQM) method that was originally intended for establishing measurement activities but it can also be used to guide analysis and improvement of software processes. Due to the distributed nature of the Blockchain, specific metrics are required to measure complexity, communication capability, resource consumption (e.g. the so-called gas in the Ethereum system), and overall performance of BOS systems. [3]

Motivation behind the work is lack of enough knowledge on software metrics of a BlockChain Oriented System. Using software metrics it can be measured the complexity of a software. There exist enough research on traditional software systems. By comparing the software metrics between two software it is possible to compare complexity between the software. This study shows the metrics analysis could successfully identify differences in programming practices. This project conducted to identify the differences between BlockChain Oriented System and traditional software system quality. [4]

This Work was done by experimenting five projects from C++/go BlockChain software

and five traditional Java project, a total of ten projects. The five BlockChain projects are: [4]

- Bitcoin-core
- Ehtreum-go
- Monero
- Dodgecoi
- Ripple

The five traditional software are:

- Apache Cassandra
- Apache Hadoop
- Pentaho Platform
- Jookeeper
- Tomcat

They selected nine software metrics to analyse the difference between BlockChain and Traditional software system. These nine are:

- Number of base classes
- Number of Declared Instance Methods
- Number of Declared Instance Variables
- Number of Local Methods
- Number of Lines of Codes
- Number of Lines of Comments
- Number of Statements
- Average Cyclomatic Complexity(AC)
- Ratio of Code to Comment(RCC)

The used empirical cumulative distribution function(ECDEF) for ten systems and feet the Log-normal and double Pareto distribution to check statistical differences among metrics. For statistical analysis they used MATLAB and R. In their analysis they focused on Average Cyclomatic Complexity (AC), Ratio Comment to Code (RCC) and number of statements (NOS). As a first step,

They used a best fitting procedure on the metric distribution using the douple Pareto and the log-normal distribution functions. They used the goodness of fit parameter provided by Kolmogorov-Smirnov statistic: KV. They have systematically computed KV for each system. The closer to zero the goodness of fit coefficient is, the better. [4]

The KV coefficient is interpreted as follows:

- close to 0, the fit is considered to be very good.
- larger than 0.6, the fit is considered fairly statistically good.
- values greater than 0.6 provide a worse fit.

The best fitting parameters values of the ten analysed projects statistically represent the metrics values for every system considered in the study. The parameters are μ and σ for the log-normal distribution, and α and β for double Pareto distribution. They confronted the two sets of parameters to find out statistically differences between the Traditional projects and Blockchain projects.

Now we discuss about **Findings of the research**. However, three metrics showed that differences between Blockchain and Traditional projects could be detected: [4]

- the Average Cyclomatic (AC), Average cyclomatic complexity for all nested functions or methods (AC);
- the Number of declarative statements (NOS);
- the Ratio of Comment lines to Code lines (RCC);

The AC Empirical Cumulative Distribution Function(ECDF) shows that the Log-normal fits for both software but better for Traditional Software as indicated by goodness of feet coefficient KS. The value of

KS for BlockChain and Traditional software are 0.236 and 0.190 respectively. Rank Sum and Kruskal-Wallis statistical test was performed on the values of μ and σ to verify that two categories show the statistical differences. However, tests showed a positive answer for Log-normal distribution.

For **NOS**, the fitting was better for traditional software. The coefficient KV was close to zero for double pareto distribution. The Log-normal distribution provide better fitting for the NOS metric CCDF then the pareto, being the coefficient was below 0.19 for traditional software.

The obtained results are similar to those obtained with the log-normal, concerning the coefficient of determination. However, the results are not useful for distinguishing between Blockchain and Traditional projects. Finally, RCC CCDF show more significant differences between Blockchain and Traditional projects than RCC CCDF. The average value for the coefficient of determination is very high for both sets of projects. The log-normal location parameters are dissimilar: the average value for Blockchain systems is around 0.364, while for Traditional is approximately 1.14. [4]

	μ	σ	KV
BlockChain	0.656	0.952	0.366
Traditional	0.611	1.373	0.401

Now discuss about **the Future direction of the research**. Although, in general, the statistical distribution for Traditional software and Blockchain software show similarities, the distribution of Average cyclomatic and Ratio Comment to Code metrics reveal significant differences in their queue, whereas the number of statements metric shows meaningful differences on the

double Pareto distribution. Traditional software projects with different domain are compared with blockchain project oriented toward a specific domain. This report claims that although this consideration may be bias, the blockchain ecosystem consists of several areas of interest such as distributed computing, web application, networking etc. Blockchain in the future will revolutionize business processes in many industries, but its adoption requires time and efforts. Nevertheless, in the near future, we can expect that governments will finally accept blockchain benefits and begin to use it for improving financial and public services.

References

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