

## Study on Blockchain Visualization

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**Abstract**— Blockchain is a distributed ledger system which provide underlying technology behind Bitcoin. Blockchain paradigm can be extended to provide a generalized framework for implementing decentralized computing resources. Some attempts has been made to visualize Blockchain transaction flow. This research aims to assess those attempts through systematic review.

**Keywords**—Blockchain, Visualization.

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### I. INTRODUCTION

Blockchain initially developed as a distributed ledger system to support Bitcoin. Bitcoin itself, initially conceived as a peer-to-peer electronic cash system.[1] Bitcoin is starting to come into its own as a digital currency, but the blockchain technology behind it could prove to be much more significant.[2]. The distributed ledger technology has been expanded beyond blockchain.[3] When more Blockchain solutions are taken in use with larger numbers of users, it will also have an impact on the research done on technical limitations and challenges. In the future, increased sizes and user bases in various Blockchain will trigger the need to conduct more research on the challenges and limitations in topics related to scalability [4]

### II. BLOCKCHAIN

Blockchain is a distributed ledger system that enable third party that don't fully trusted each other to do transaction. [5] It was transparent, so that other parties could rely on it and developers can take advantage from its transparency, including visualizing the transactions happened in real-time.

#### A. Introduction

The blockchain technology which endorse mutualism, open collaborations, and exchange network may imply economy of abundance and have a significant social impact. [6] Even though the technology may have business and technical challenges [7], such as acceptance of Bitcoin, its implementation in many other fields, for example Internet of Things, may have a greater significance. [8] However we rely on its implementation in currency that has been studied extensively. [9]-[13]

The idea of currencies flows in networks is not new. With Bitcoin we finally have a currency that not only links people (or: nodes) together in financial transactions, but the network is transparent. But experts argue that the currency is just one of many applications that can be built on the Blockchain algorithm and database powering Bitcoin. This way of linking nodes can be used to weave authentication layers in all sorts of networked applications.

With combination of open and transparent data available through various interfaces or APIs in combination with a networked data structure should be a valuable resource for data visualizers and information designers. Many of the visualization approach in this study use blockchain APIs which is open for developers.

### III. RESEARCH METHODOLOGY

The study was conducted through systematic mapping process. [14]. As a methodology, systematic review generally selects relevant primary studies and uses methods of synthesis. [15].The data was gathered through internet-based data collection.

### IV. RESULTS AND DISCUSSION

#### A. Data Visualization

We are examining 8 visualizations attempts of Blockchain: 1. Bit bonkers, 2. Bitcoin City, 3. Binodes, 4. Block seer, 5. Daily blockchain, 6. Elliptic, 7. Interact, and 8. Live globe. These are some results obtained from those visualization approaches:

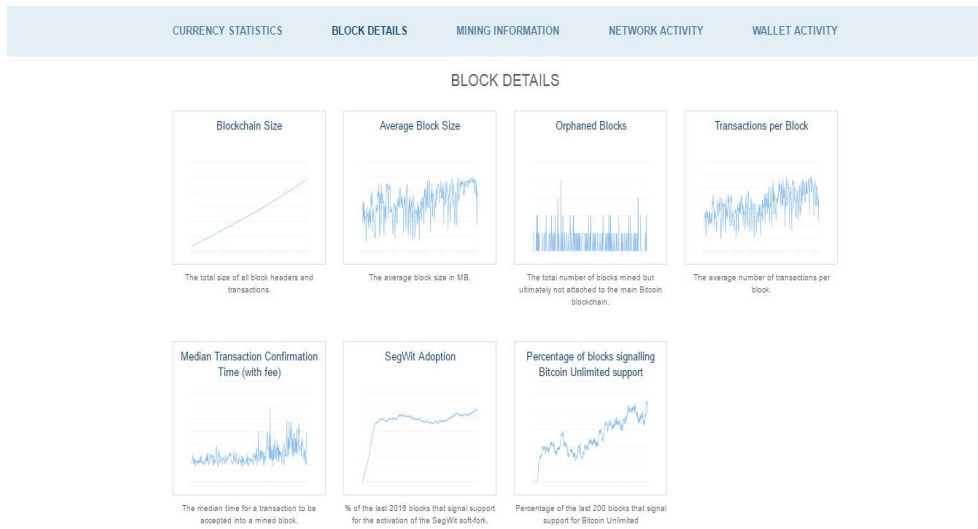


Fig. 1. An example of blockchain.info page which include documentation of Blockchain API

### 1. Bitbonkers

Bitbonkers is a visualisation of live bitcoin transactions from the blockchain. Every time a bitcoin transaction is made it is shown here as coloured ball dropping on the plate, we can click on the transactions to find out exactly how much they are worth in btc. The cubes represent the last block from the blockchain which are mined on average

every 10 minutes, the size of the block is determined by its size in kilobytes.

The cubes keep falling off the plate so that the browser doesn't crash. It was made using using three.js and oimo.js JavaScript libraries, and live streaming bitcoin transaction data from blockchain.info.

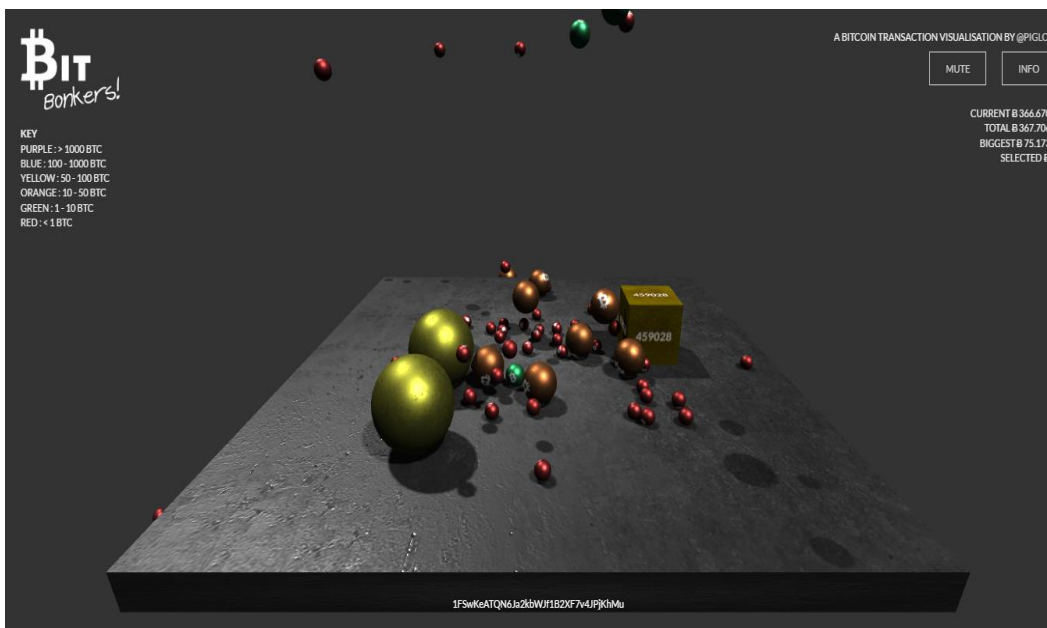


Fig. 2. An example of Bitbonkers visualization of blockchain.

### 2. Bitnodes

Bitnodes shows the distribution of Bitcoin nodes across the globe. It uses a Bitcoin crawler implemented in Python (Figure 3).

This visualization by the same author of all the Bitcoin nodes and the node density. Although the network structure is not clearly visible, it really suggests that there is a new “universe” evolving in finance (Figure 4).

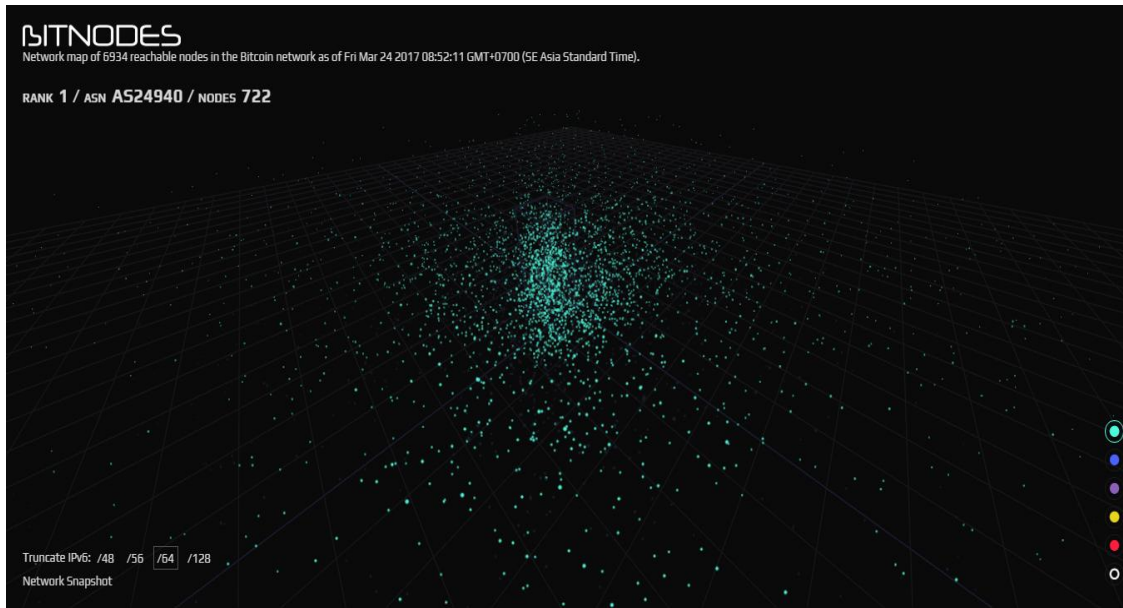


Fig. 3. An example of Bitnodes visualization of blockchain.

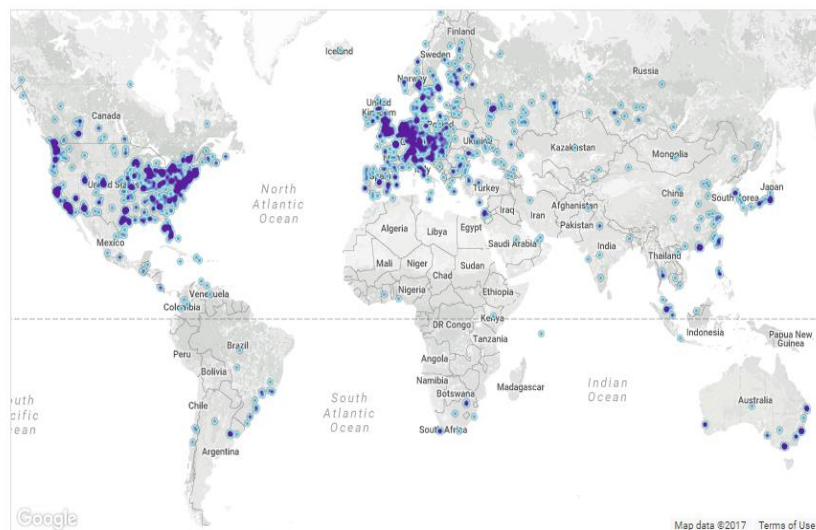
**GLOBAL BITCOIN NODES DISTRIBUTION**  
 Reachable nodes as of Tue Mar 28 2017 07:19:33 GMT+0700 (SE Asia Standard Time).

**6861 NODES**

24-hour charts »  
 Top 10 countries with their respective number of reachable nodes are as follow.

RANK	COUNTRY	NODES
1	United States	1967 (28.67%)
2	Germany	1300 (18.95%)
3	France	438 (6.38%)
4	Netherlands	390 (5.68%)
5	Canada	290 (4.23%)
6	United Kingdom	277 (4.04%)
7	n/a	255 (3.72%)
8	China	218 (3.18%)
9	Russian Federation	186 (2.71%)
10	Switzerland	99 (1.44%)

More (91) »



Map shows concentration of reachable Bitcoin nodes found in countries around the world.

Fig. 4. An example of Bitnodes visualization of global bitcoin nodes.

### 3. BitcoinCity

BitcoinCity idea was to graphically represent bitcoin transactions. The city in the visualization is a bitcoin transaction, on the road to the blockchain. Bitcoin City uses Blockchain.info web socket API as source of data and Isomer as JavaScript graphics library.

It receives information on the latest bitcoin transactions, mostly still unconfirmed, and draws a little city based on the transaction info. It tries to display as much information as possible about the transaction, with a touch of randomness to make each city as unique as possible.



Fig.5. An example of BitcoinCity visualization of blockchain.

#### 4. Blockseer

With Blockseer, we can visualize transactions and blocks in a detailed tree diagram is more of a visual research tool than a creative visualization of the Bitcoin universe (Figure 6).

#### 5. DailyBlockchain

The following visualization uses the open source vivagraph.js library to display the networked nature of Bitcoin. You can see Bitcoin transaction happening in real-time and the evolving hubs of the Bitcoin network.

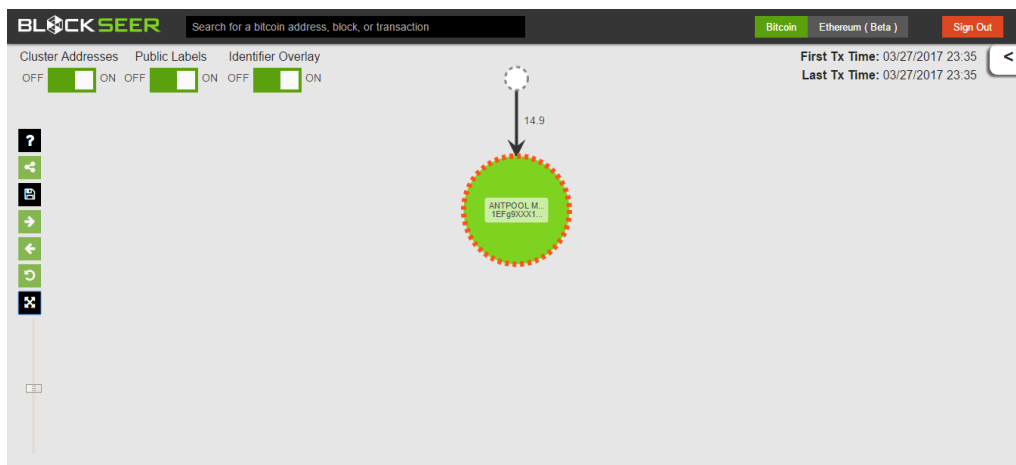


Fig. 6. An example of Blockseer visualization of blockchain.

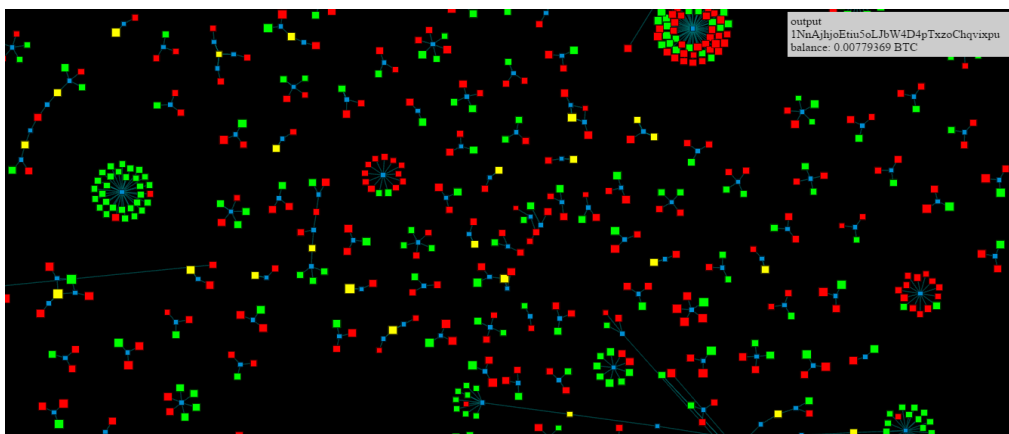


Fig. 7. An example of DailyBlockchain visualization of blockchain.

### 6. Elliptic

This visualization “The Bitcoin Big Bang” by Elliptic is one of the most beautiful visualizations of Bitcoin history at the moment.

### 7. Interaqt

Interaqt attempt to visualize live Bitcoin transaction. Here the size of the nodes represents the volume of the transaction. Every node also carries a link to all information on the transaction on bitcoin.info.

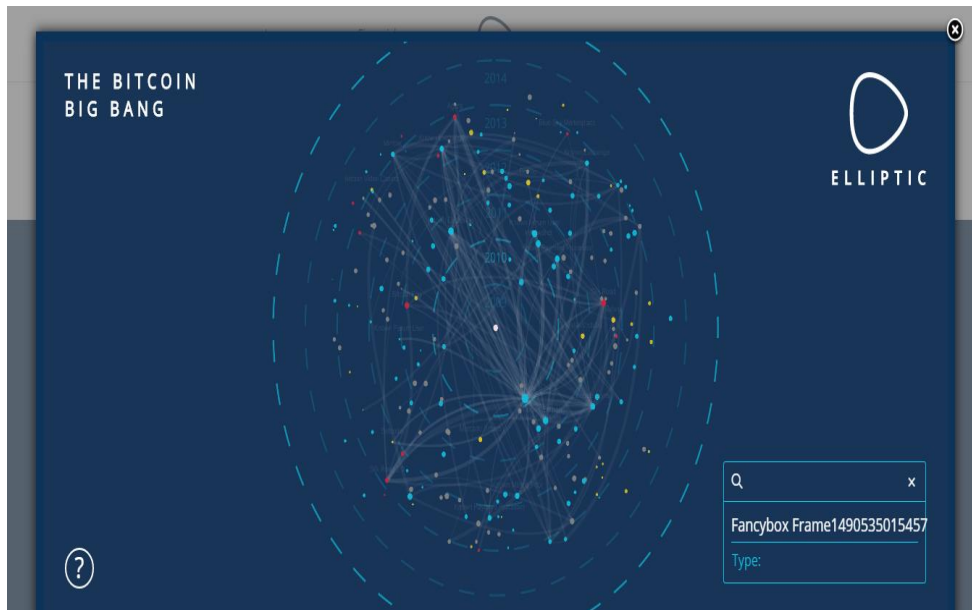


Fig. 8. An example of Elliptic visualization of blockchain.

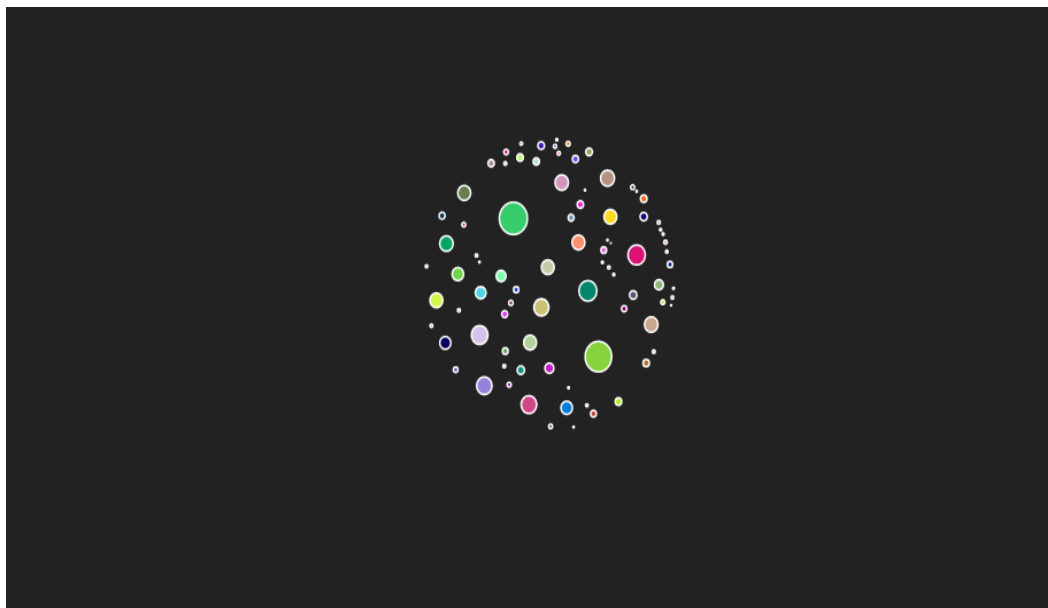


Fig. 9. An example of Interaqt visualization of blockchain.

### 8. Live Globe

To show the global nature of Bitcoin, the following live-map by Wizbit not only displays the transactions but also the latest discovered Bitcoin blocks. The WebGL globe visualization is also available on Github.

### B. Approach and Development Method

The approach and development method from each blockchain visualization can be summarized as the table below:

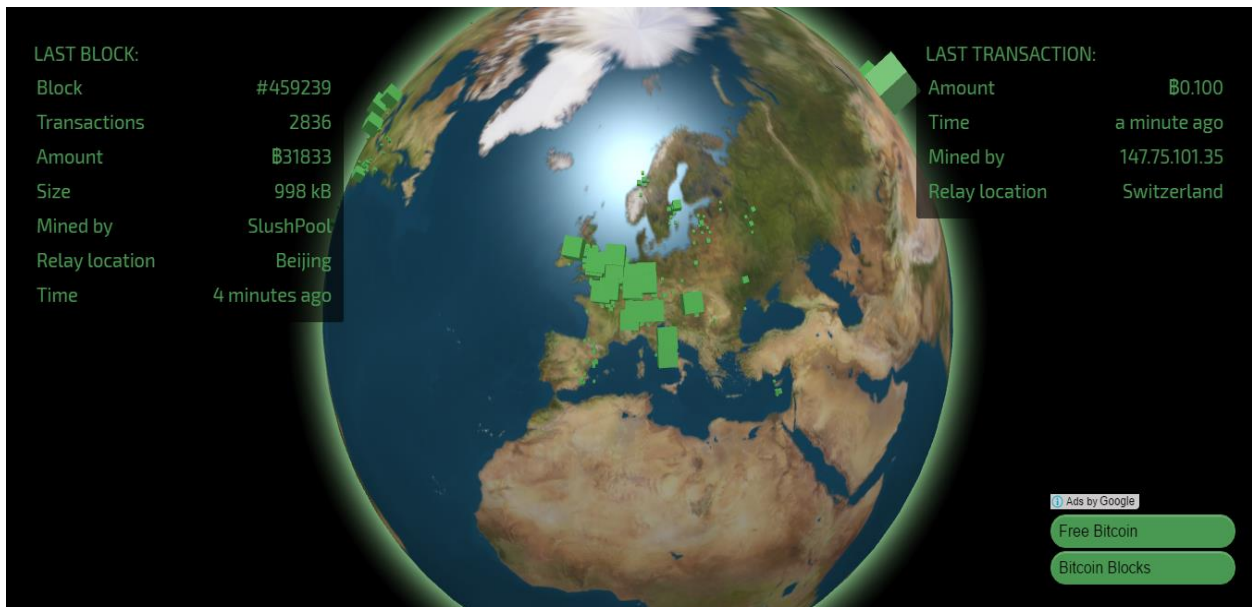


Fig. 10. An example of Liveglobe visualization of blockchain.

TABLE I  
BLOCKCHAIN VISUALIZATION METHODOLOGY

Name	Visualization Method		
	Approach	Visualization	Programming / Library
Bitbonkers	Network structure is not clearly visible	Cube → Last block from blockchain.  The size in kilobytes → The size of the block its	Three.js, Oimo.js
Bitnodes	Distribution of nodes around the globe	Bitcoin node	Python
BitcoinCity	City as Bitcoin transaction	City as transaction, road as blockchain	Isomer.js
Blockseer	Node as link to transaction	Detailed tree diagram	-
DailyBlockchain	Network of Blockchain, Realtime transaction, evolving hubs.	Evolving Hub	Vivagraph.js
Elliptic	History of Blockchain since the beginning of creation	Node → transaction	-
Interaqt	Live Bitcoin transaction	Size of the node → Volume of transaction Node → Link to transaction	-
LiveGlobe	Transaction and latest discovery	Latest discovered Blockchain blocks	WebGL

## V. CONCLUSIONS

Through the study, we found that blockchain visualization has been used to display transaction. The visualization was made with tree diagram, hub, and nodes, among others. The programming language or libraries has been used to build the blockchain visualization includes Python, WebGL, and Javascript libraries among others.

There are many any other attempts that could be explored to create a visualization with the public Blockchain APIs in which many different steps of accessing, analysing and interpreting Blockchain data are possible.

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