

# Process book

## Overview

In this process book we discuss our choice to implement visualisation for cryptocurrencies and exchanges between them. We also describe the intermediate steps before implementing the final visualisation.

We start by describing the data that we will use for the visualisation. Later we continue describing the difficulties we faced while implementing our initial idea. Next we discuss our final visualisation and discuss further improvements.

## Motivation

The cryptocurrency market is growing exponentially and is attracting more and more people. Some websites (e.g. [coinmarketcap.com](https://coinmarketcap.com)) already provide some really useful data for analysts but don't necessarily display them in the most effective way. For example, the exchange volume between any fiat, coins or tokens is shown as an exhaustive list that doesn't fully take into account our sensorial capabilities. From this observation, we concluded that some nice interactive visualization could make a difference. In order to improve the existing visualisation we will provide an interactive visualization that displays exchange volumes between cryptocurrencies in form of a graph where the nodes will represent cryptocurrencies and will be connected accordingly to the volume of the exchanges between them.



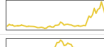







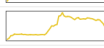


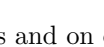
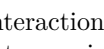
## Target audience

The exchange volume of cryptocurrencies pairs is an important indicator in technical analysis as it is used to measure the relative worth of a market move. If the markets make a strong price movement, then the strength of that movement depends on the volume for that period. The higher the volume during the price move, the more significant is the move. For this reason, our visualization aims to provide a quick way to analyze a particular aspect of the cryptocurrency market because the exchange volume is a fundamental metric in market understanding and analysis. We will thus provide a more practical tool to people who want to understand and see the evolution of the cryptocurrency market. (<https://www.investopedia.com/terms/v/volume.asp#ixzz4yLZS0MKD>)

## Related work and inspiration

The website <https://coinmarketcap.com/> provides detailed informations about cryptocurrencies and the exchange volume on different markets. The website is

in traditional excel form (see Figure 1)

2	⬆️ Ethereum	\$65,145,079,716	\$675.11	\$3,932,990,000	96,495,075 ETH	-22.01%	
3	🟡 Bitcoin Cash	\$41,821,280,676	\$2,479.13	\$3,122,190,000	16,869,338 BCH	-31.72%	
4	🔵 Ripple	\$39,953,617,038	\$1.03	\$3,724,700,000	38,739,144,847 XRP *	3.24%	
5	🟢 Litecoin	\$13,601,995,945	\$249.96	\$1,922,460,000	54,416,908 LTC	-24.31%	
6	⚙️ Cardano	\$10,264,527,226	\$0.395900	\$133,876,000	25,927,070,538 ADA *	-19.99%	
7	🟡 IOTA	\$9,584,153,959	\$3.45	\$466,806,000	2,779,530,283 MIOTA *	-33.77%	
8	⚡ Dash	\$8,363,670,007	\$1,076.68	\$392,295,000	7,768,018 DASH	-28.93%	
9	🌈 NEM	\$7,429,904,999	\$0.825545	\$129,758,000	8,999,999,999 XEM *	-16.25%	
10	🟡 Bitcoin Gold	\$5,421,170,723	\$324.22	\$339,332,000	16,720,449 BTG	-26.68%	
11	🟡 Monero	\$5,058,785,243	\$326.26	\$348,045,000	15,505,285 XMR	-28.97%	
12	🔥 EOS	\$4,706,855,216	\$8.48	\$478,729,000	554,960,751 EOS *	-25.55%	
13	🌌 Stellar	\$4,049,572,407	\$0.226755	\$214,247,000	17,858,800,940 XLM *	-14.14%	
14	🔵 Qtum	\$3,595,754,896	\$48.76	\$864,490,000	73,751,208 QTUM *	-25.52%	
15	🌱 NEO	\$3,580,291,000	\$55.08	\$264,219,000	65,000,000 NEO *	-26.43%	
16	🟢 Ethereum Classic	\$2,950,972,667	\$29.94	\$601,640,000	98,552,348 ETC	-35.09%	

In order to compare exchanges between different coins and on different markets one needs to switch tabs constantly. This makes the interaction complicated. As mentioned before, our goal is to use the same data, but organize it differently in order to make it easier to analyse and not just share information.

## Dataset

### Cryptonator

The first api that we tried to use for our visualisation provides a large list of cryptocurrencies (<https://www.cryptonator.com/api/>), the actual volumeweighted price, total 24h volume, rate change as well as prices and volumes across all connected exchanges. It contains also the markets information. The issue we had with this library was the limitations to make all the necessary requests in 30 seconds.

### Coin market cap

Scraping data from <https://www.coinmarketcap.com> was faster and fewer request were needed. All the necessary data was present on the website. The only problem was that it required more code in order to scrape the data from the website and there is the risk that the layout of the page can chage so we need to be atentive

if we want to keep our visualisation working for a long period of time. Despite this drawback we decided to work with the data from this website.

### **Preprocessing, analysis and insights on the data**

In order to gain intuition about the best visualisation we analyzed the number of coins (i.e. nodes) that we get, the number of transactions in total, the number of unique transactions between the nodes and the number of markets that are documented from our datasource.

From our datasource we have access to 100 top coins and 283 unique links between currencies (i.e. transaction on at least one market).

### **Visualisation**

The main idea for the visualisation was to create a way to present the value of the crypto currencies in USD and to visualise the volume of transactions between two currencies in the last 24h. Part of our goal was to keep interesting currencies/transactions in order to compare them easily with other currencies/transactions. We also wanted to give the possibility to visualise the connectivity of the “chosen” currencies i.e. the ones that the user would like to analyse, instead of visualizing all of them. Because of that we proceeded on providing the mode custom network in our visualisation.

Our first idea was to represent the crypto currencies like nodes and bind them together with their exchange volumes. At first we would take care of the current values and in a second time have a time line to come back and see the differences. In this way we could analyze the evolution between crypto currencies.

We also planned to have a selection box. With this box, a user will select the elements to be represented so as not to have too much data. Next to it, there would be other box in which we could select various markets in order to select only the currencies of certain markets.

In the following sections we describe the process from our initial idea to the final visualisation. We talk about the difficulties and surprises we had, as well as about implementation details.

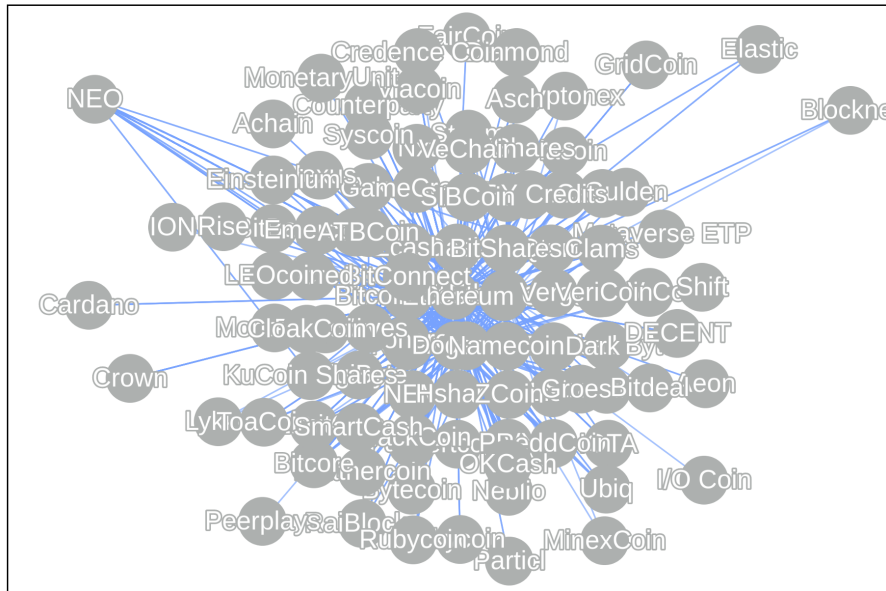
### **Work flow and difficulties**

The main difficulty with our initial idea was the fact that the visualisation was very uniform and uninteresting even though all the information was there.

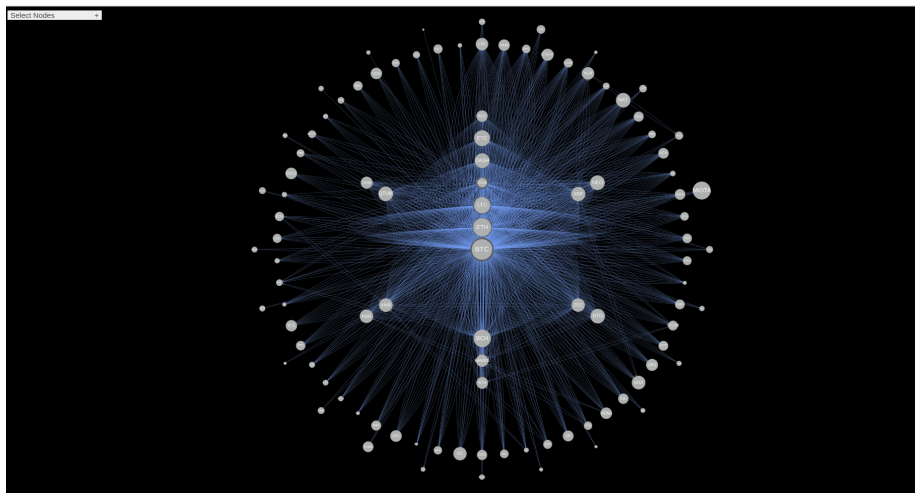
We had uniform layout of nodes which contained the id of the coin and when positioning the mouse on the node we were able to see the value in USD of the node. There were multiple edges between two nodes which presented the

transactions between the two nodes on different markets. By positioning the mouse on the edge we were able to see the volume of the transaction on a specific market between the two nodes, in the last 24 hours.

This is a figure of the initial visualisation.



With this visualisation we realized that there are too many links in the graph and the user experience wouldn't be great even if we make the graph sparse, as shown on the next image.

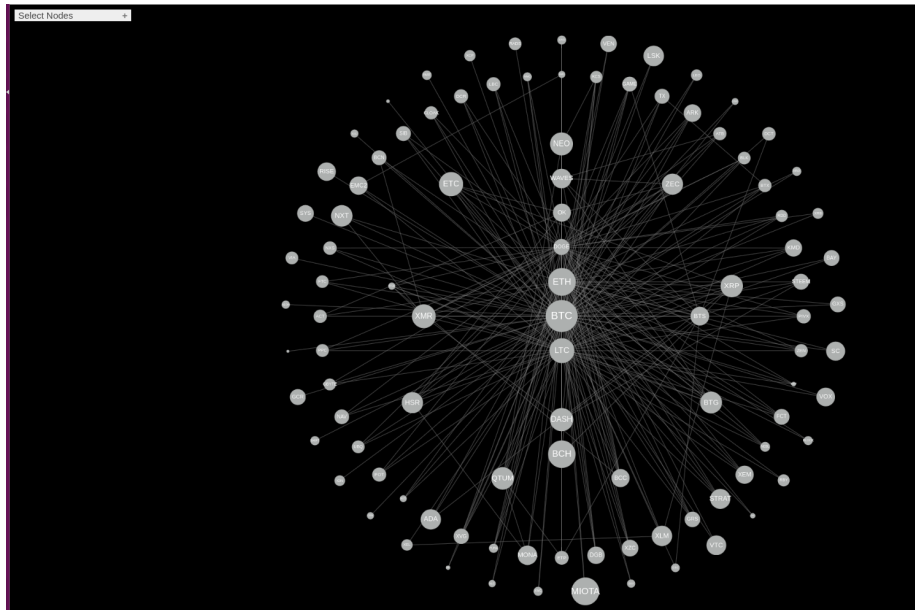


For this visualisation we also tried to vary the size of the nodes depending on their value in USD. It makes the graph more informative at first sight but

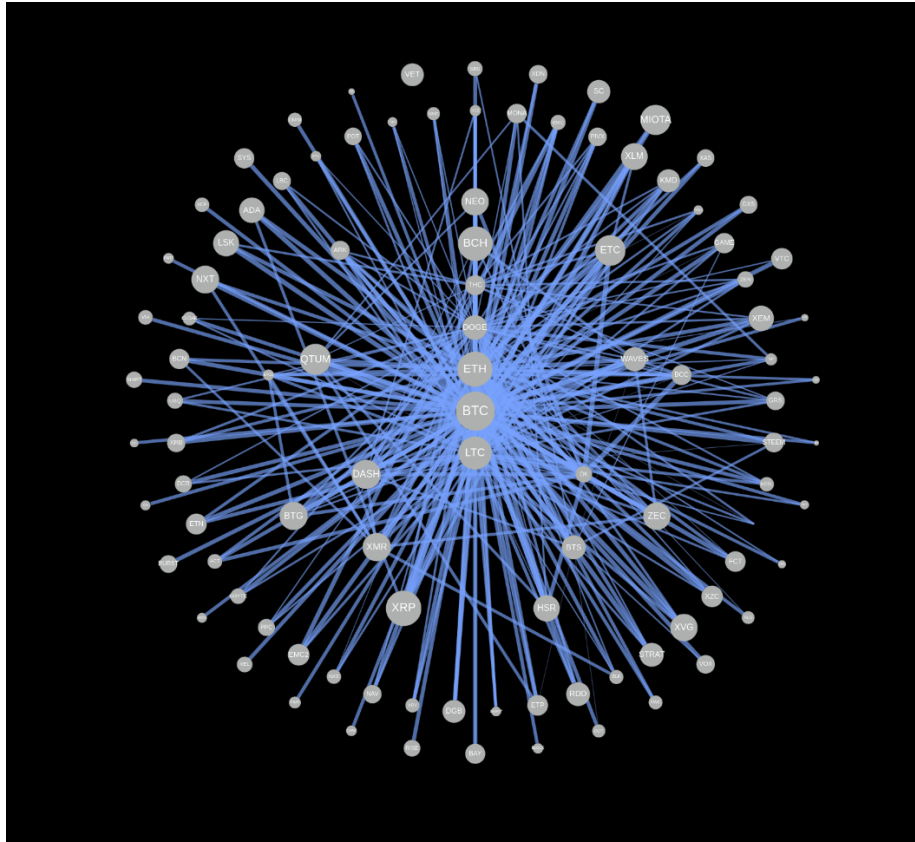
impossible to interact and analyze the transactions between two currencies.

We then decided to compromise with a small loss of information and merge the transactions between two different nodes on different markets in one edge between the nodes.

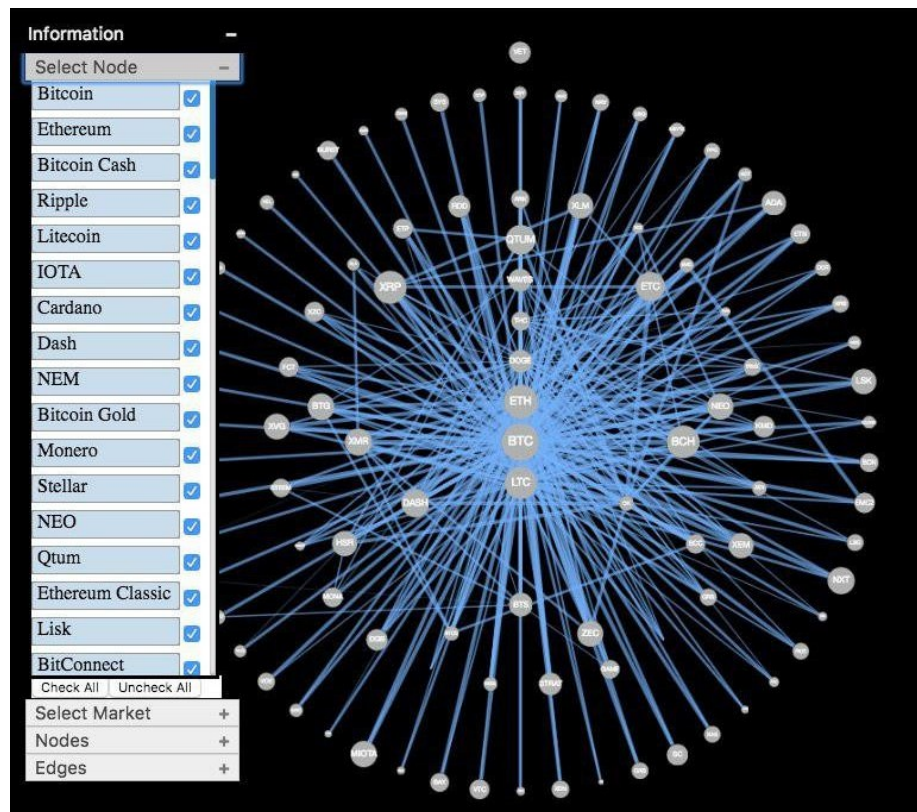
The next figure is the visualisation with the currencies and only one link for multiple transactions between nodes.



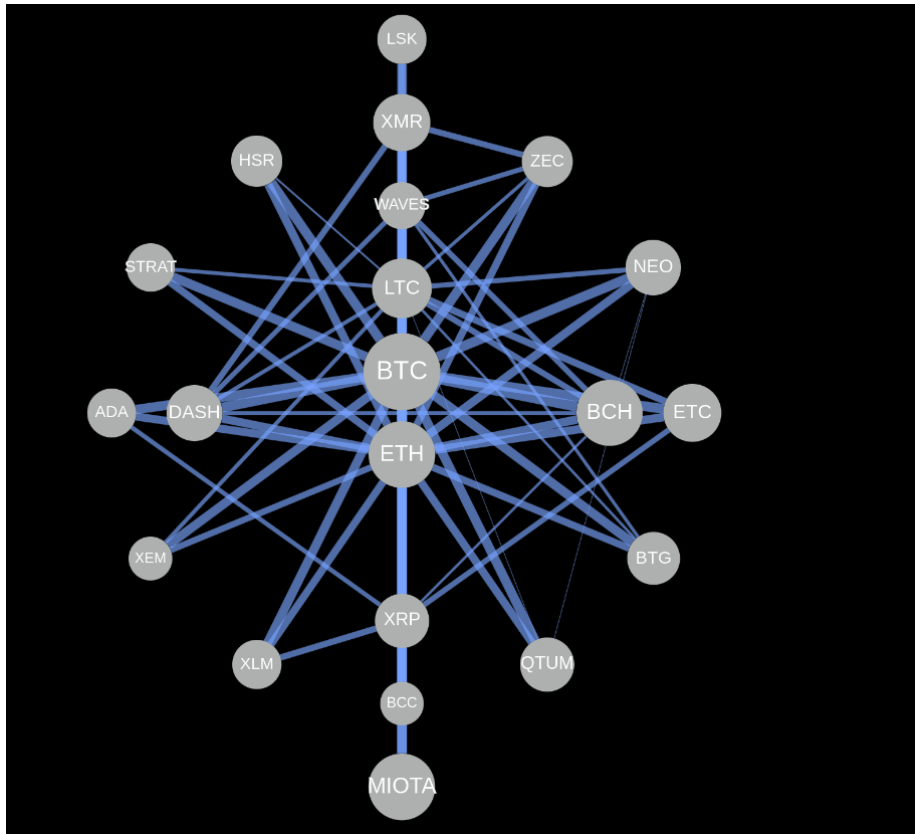
At this point it is still a lot of information on the graph but it is getting better. We also decided to give weight to edges in order to represent the total volume of transaction between two nodes in the last 24 hours (image below).



With this visualisation we also added possibility to remove/add nodes with expandable list generated in d3. Finally we decided to regenerate this list without d3 since finally the list remains the same during all interactions. Here is an example of this element:

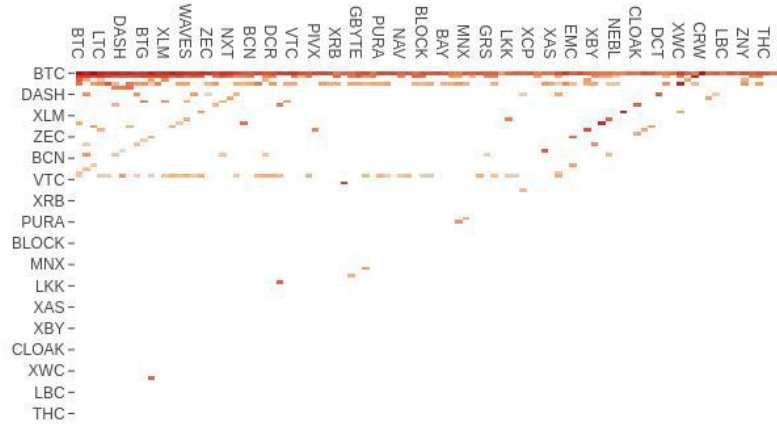


We also tested the same visualisation with less nodes i.e. customized network and it gave us a graph with which it was simpler and informative to interact. Presented on the next image.



Still being far away from our initial goal for interactive and comprehensive representation of the cryptocurrencies and the transactions between them we decided to completely change our initial idea and proceed with a heatmap where on each axis we'll have the same coins and the color of the intersection between two coins would represent the total volume of transactions between them. The resulting heatmap is presented on the figure below.



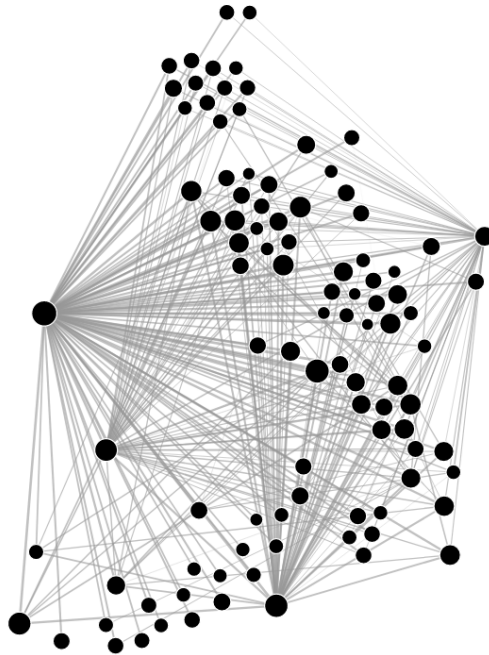


This visualisation looks much more cleaner but now it looks like that we present what is happening with 2-3 important nodes and it was not our initial goal.

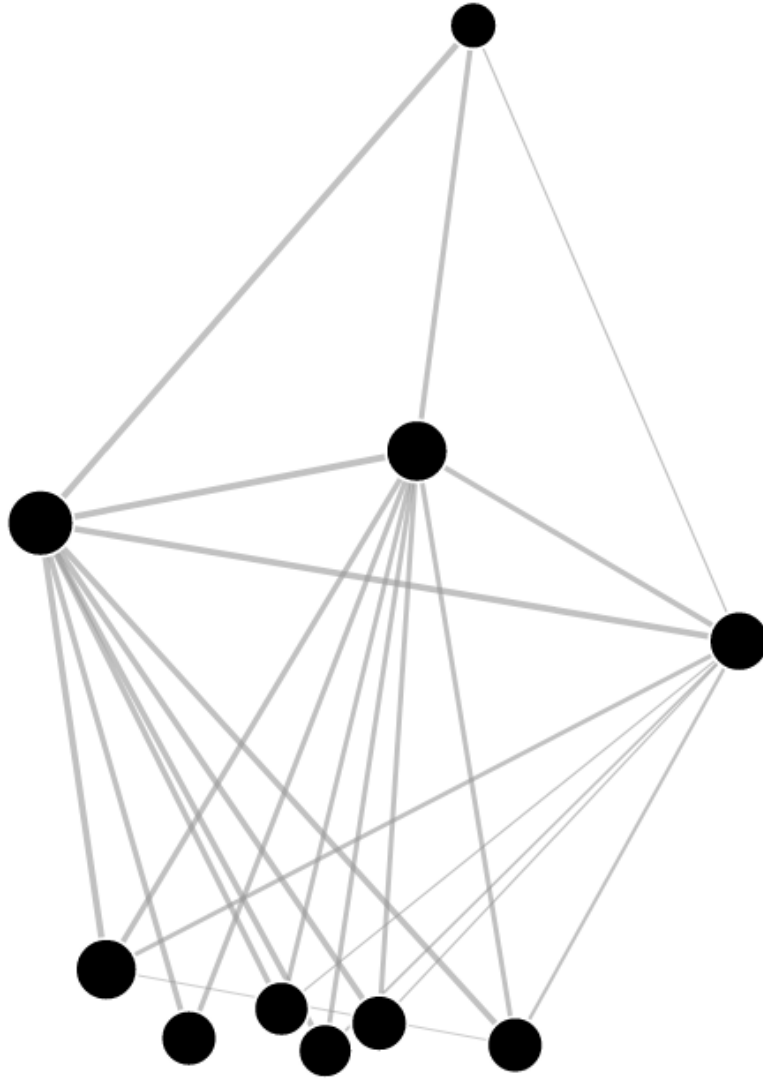
All of the previous graphs were generated using the library cytoscape. The heatmap was generated using the library plotly.

## Final visualisation

After simplifying the visualisation with a heatmap we realised that our information is dense for some coins but very sparse for others. Because of this reason we decided to continue with the graph, but this time directly using the library d3. We generated a force directed graph that regrouped nodes based on the the links in other nodes. In other words, coins that have transactions with same or almost the same coins were regrouped together. This is shown on the image below.



The size of the nodes denotes the volume of the specific coin in USD (on logarithmic scale because of the big difference between some coins), and the strength of the edges represents as initially stated, the total volume of the transactions between the two nodes on different markets. This visualisation is easy to understand on a custom network, as shown on the following image.



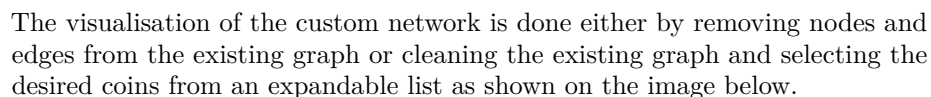
### Backend service

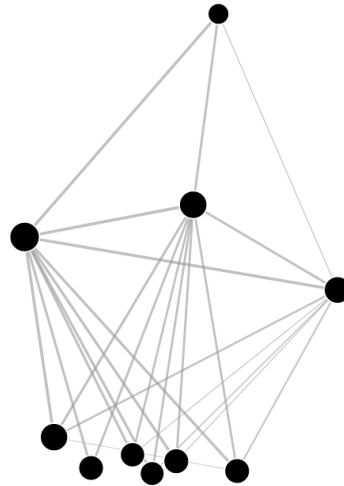
Implementing a backend service was necessary for both development and deployment of the app. Indeed, as markets are characterized by time series, we needed to fetch the data regularly in order to display the most up-to-date data. However, using our data source, scraping all the information we needed would take around 1 minute. Relying on a simple client-only architecture for our app would thus have been impractical. We would have needed to wait 1

Our server is written in python and uses the framework Flask as our interface between the server and the client. We also use the library Flask-Assets to easily manage the files required on the client side. During the server's initialization, we spawn two threads. The first one fetches the data from our data source every 5 minutes using the libraries Requests to fetch the HTML pages and Beautiful Soup to parse it. The second thread serves the request made by the clients using the decorator provided by Flask. Communications between those two threads happen through special lists created by a Manager object. The official python documentation describes the Manager class as follow: "Managers provide a way to create data which can be shared between different processes".

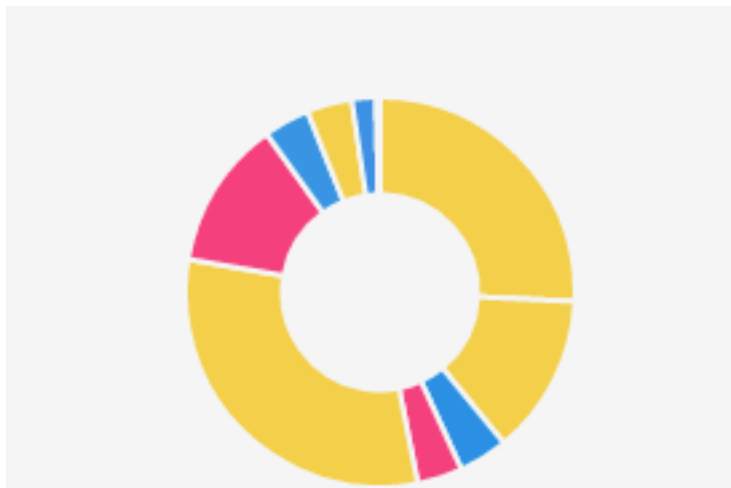
After settling on the visualisation of the cryptocurrencies we continued working on the interactive part of the visualisation. Having access to all this information we wanted to offer:

- For the comparison between coins or transactions, we implemented the possibility to simply click on the node/edge and the coin volume/transaction volume will be displayed on a bar chart. The analysis can be reinitialized together with the network. The bar char for transaction comparisons is shown on the image below.





By clicking on an edge other than adding the transaction on the barchart for transactions comparison it also shows a donought representing the market on wich every part of the transaction happened. Example of market visualisation is shown on the next image.



Finally, for the first time users we added a tour of the website possibility:

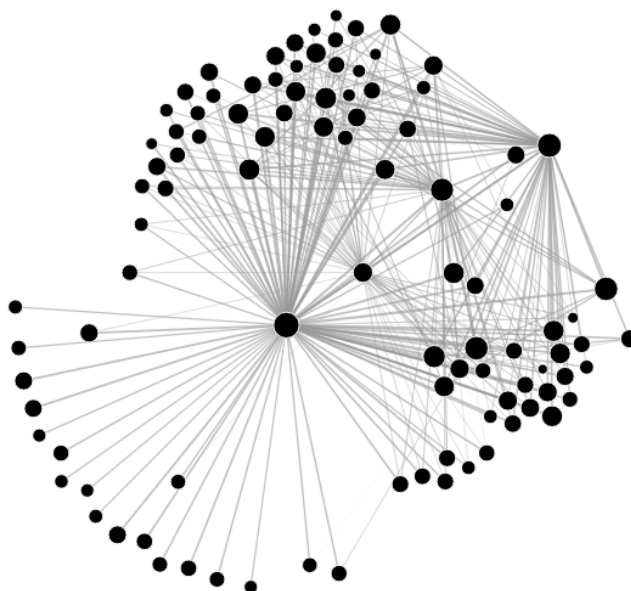


## Evaluation

The current visualisations offers different view on crypto currencies. As initially planned. it allows people to costumize and compare different attributes of their network. On one side this visualisation can help to understand some trends such as which currencies behave the same way i.e. make transactions with exactly the same currencies. Also helps to visually understand the connection between different currencis. However the interaction with edges remains complicated and on a large network of currencies, it is hard to notice the difference the strength of two different nodes. This is also one of the reasonos why we implemented the customized network mode.

## Things we learned for the data

By working on cryptocurrencies, we were exposed on big number of coins and realized that there are a fair number of transactions happening in 24h. As we can see on the heatmap we showed earlier, there are coins that are very “popular” which is expected and visible in our visualization. Also we learned that there are a good number of coins that make transactions only with the Bitcoin. On our visualisation those are the single link nodes:



Please note that Bitcoin is the big node in the middle.

### **Further improvement of the visualisation**

Visualizing complicated network such as transactions between crypto currencies is complicated and the visualization that we offer is no sense perfect. Regrouping nodes that have same exchanges in one bigger node that expands on request can be cleaner.

For exemple in our visualisation, the nodes that have transactions only with bitcoin will appear in one node and would be expanded in multiple nodes on request.

Also the d3 force simulation graph gives us freedom to experiment with forces in order to expand the graph and regroup nodes but it is hard to control the forces in a way that the graph is completely visible and the clusters of nodes are correctly formed. Finding way to fix this would improve the visualisation significantly.

For the moment that can be fixed by dragging nodes around such that similar nodes can regroup easily.

### **Peer assesment**

We all agreed to work on the idea of one team member : the cryptocurrencies. Even if it was easy to agree about the dataset that we will use for our project, it was a little bit more complicated to agree on what kind of visualisation we will be offering.

We had different understandings of the dataset and on the requirements of the class. After few discussions and brainstorming sessions we converged to the same idea.

Due to very different schedules, we find it easier to use online communication such as Telegram and Slack in order to work on this project. We used these chatting platforms in order to discuss our different ideas, to share our progress on the project or discuss technical issues. All of us worked on the project to the best of our abilities.

All team members respected each others opinion and we were always able to discuss difficulties and differences in understanding.