



Tech Paper

The Tangram Network is a decentralized network composed by three kind of participants with different roles.



Tech Paper

01

Tangram network

Participants, The Tangram HUB, The Masternode, The Worker

pag 3-4

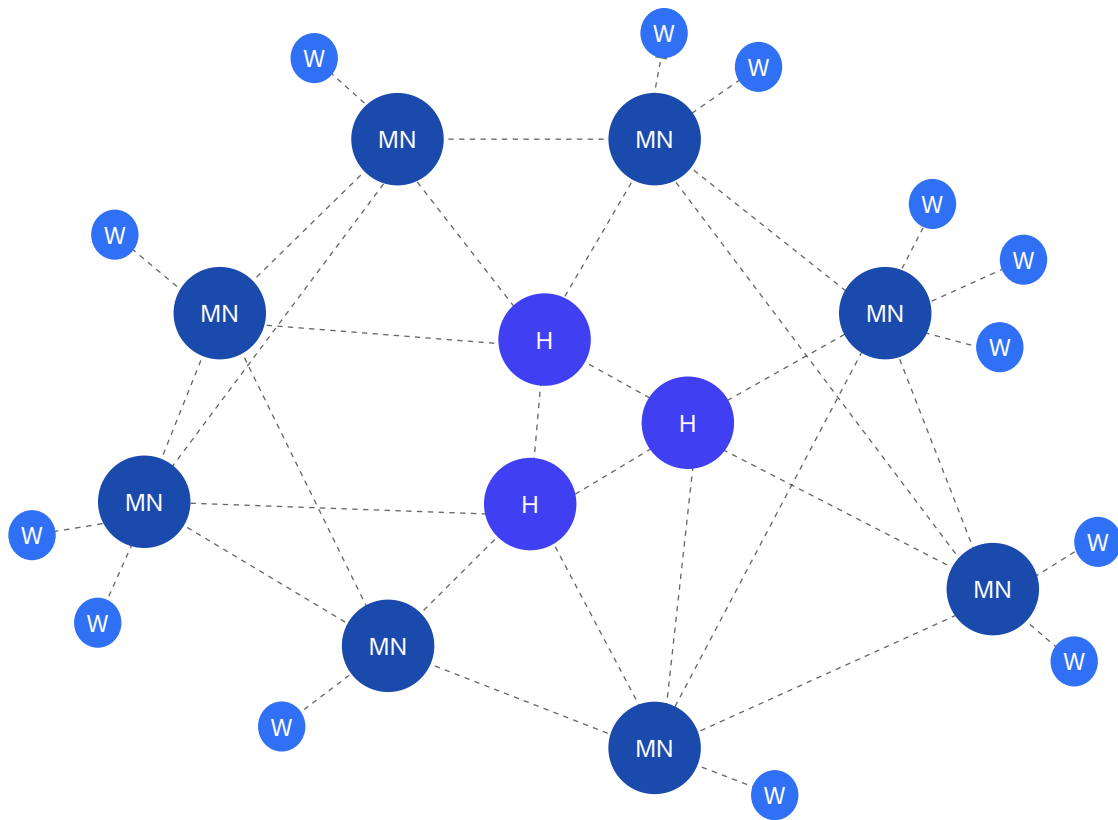
02

Proof of Transcoding & consensus

Club, Transcoding process

pag 5-8

Tangram network



MN: Masternode

W: Worker

H: Tangram Hub

Network topology

Participants

The Tangram Network is a decentralized network composed by three kind of participants with different roles.

The Tangram HUB

The Tangram HUB is a distributed cluster that works as a input door for transcoding requests. It accepts video files, transcoding specifics, JSON or XML files with input and output path specifics and for the automatization of the video transcoding process with third party cloud storages.

The Hub is pluggable with external storage services, like AWS or Google Cloud, and it interacts with them to retrieve video files and to put output files after the transcoding process.

The Hub:

- Is a scheduler for the definition and the primary distribution of jobs to Masternodes (see Masternodes);
- Has a distributed file system for the file managing;
- Has also a Masternode;
- In the first phase of the release, got a particular role in the Club (see Club), as it has power of veto on ballots and votes, and a vote weight of 30% in the Club for the reward process and the adding of new nodes.

In the first phase of the release the Hub will be entirely managed by the Tangram team and then gradually decentralized.

The Masternode

A Masternode is a public node of a distributed network. It manages the primary distribution of jobs, the verification of the transcoding process and the reward for the Worker nodes (see Worker).

The Masternode:

- Runs a Tangram Ethereum full node (see Tangram Ethereum);
- Receives messages from the Hub about new jobs, and it distributed them to the Workers;
- Reaches consensus with other Masternodes about the verification of the transcoding process and the reward (see Transcoding Consensus);
- Runs a primary service of APIs for the Worker nodes;
- Takes part of a club both on the public Ethereum network and on the Tangram Ethereum network and it has right to vote about the reward, the adding and the removing of Masternodes (see Club);
- Runs a secondary messaging system on the Tangram Network;
- Can be also a Worker node;
- Receives a reward for the consensus process;
- Can merge the chunks transcoded by the Worker nodes.

The Worker

The Worker runs on different operating systems.

Client released in the first phase:

CLI Client:

- Windows;
- Linux;
- macOS.

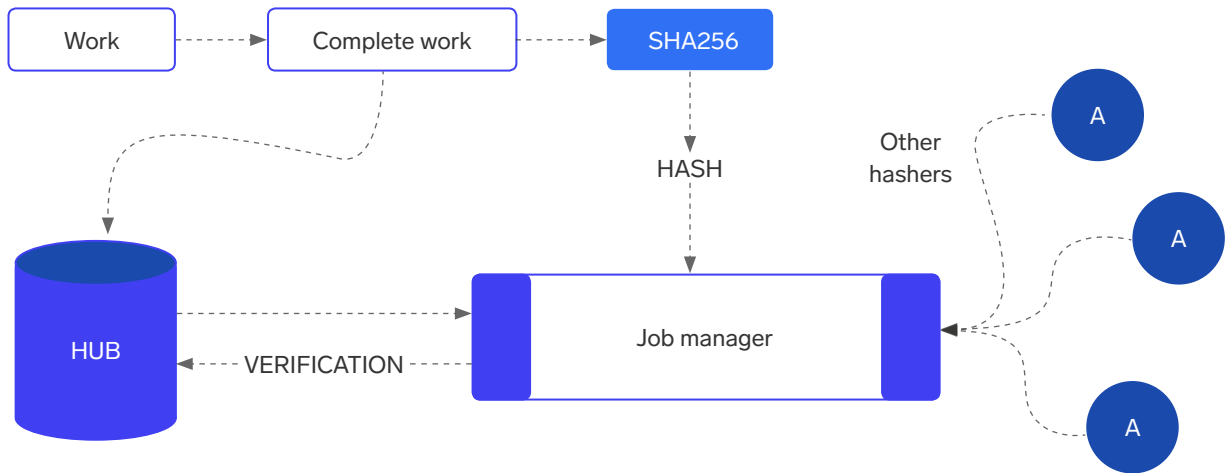
GUI Client:

- Windows;
- Linux;
- macOS;
- Android;
- iOS.

The Worker:

- Is an Ethereum wallet that interacts with the Tangram Ethereum network;
- Authenticates on the Tangram authentication system providing only its public key;
- Can transcode chunks of video released by a Masternode;
- Receives a reward in TNGRM after the completion of a job, and in competition with other Workers
- Is not in the club and it hasn't right to vote

Proof of Transcoding & consensus



Transcoding process. The Job Manager is a smart contract where all the job ids are stored and where all the Workers stores the obtained results. The Hub and the Masternodes interact with the job manager to verificate the transcoding process and to reach consensus on the validity of it with a vote in the club (not represented here).

The Proof of Transcoding is obtained thanks to:

- Competition between Workers with the same cpu architecture;
- Cryptography.

Each chunk of video is randomly distributed to multiple Workers. Before the distribution, the Hub creates on the Job Manager (a smart contract) a register to track the work on the chunk.

This table represent the structure of a register created by the Hub. The container has a bytes32 ID, specifically a sha256 of the job name, for example:

Job name: 1123.11

Hash of job name: 50F083BCA3D3EF0EFB8C6BE6A10A658BFFC2DD5CB937CBA7F5F2C621E28CC25B

In the table:

Container:
50F083BCA3D3EF0EFB8C6BE6A10A658BFFC2DD5CB937CBA7F5F2C621E28CC25B

The 3 slots are empty slots for the Workers.

When a Worker ends a job, interacts with the smart contract to :

- Check how many Workers executed the job faster, and if nobody did it;
- It executes an hashing of the encoded file and communicates to the contract the execution of the job, providing the obtained hash and delivering the file
- If somebody made the job faster, it executes an hashing of the encoded file and communicates to the contract the execution of the job, providing the obtained hash.

The Workers will write in the register as represented here

Container:
50F083BCA3D3EF0EFB8C6BE6A10A658BFFC2DD5CB937CBA7F5F2C621E28CC25B

Worker: 0xb53Ea26eB55984795bF73d426098609FD1F1a84B	128EDCB81E2ADF20F20EEDFCE8082368F2368D DFFE7F19ED6BC24BE598F65EAA
Worker: 0x7380f05998eB619d6a0E2F8acD19B2abe79E45DF	128EDCB81E2ADF20F20EEDFCE8082368F2368D DFFE7F19ED6BC24BE598F65EAA
Worker: 0x6DBC30b9D51E792F001Bd6A6Bd173F526f62E1A1	128EDCB81E2ADF20F20EEDFCE8082368F2368D DFFE7F19ED6BC24BE598F65EAA

The second column is the hash of the encoded file.

The Masternodes can now interrogate the Job Manager to verificate the correctness of the encoding process.

The Masternode:

- Compares the obtained hashes. The execution of the job by different Workers, if completed correctly, will output the same hash for each Worker. Any difference on the hash result will let to identify malicious Workers;
- After the verification, a reward request is sent from the club (see Club) to the Worker that completed the job first and for the Workers that validated the hash.

With this system, as the of chunk redundancy to Workers increases, the verification of the process becomes more reliable.

Managing a real time register, the bandwidth is saved, as a Worker that is not arrived first will not try to deliver the file. In the case of concurrent execution, the arriving order is going to be determined by the order of the transactions included in the block by the Masternode.

The Hub or the Masternode receiving the encoded result file will provide the Worker with a cryptographic receipt, also stored on the Job Manager, to assure the delivery of the output result.

This competition incentives the Workers to improve their hardware in order to obtain more probabilities of reward.

Club

The Club is a smart contract present on the Tangram Ethereum blockchain and on the public Ethereum blockchain. It's a register of all the Masternodes addresses inside the network and it accepts votes and the creation of votes by its members.

To be a member of the Club, a Masternode:

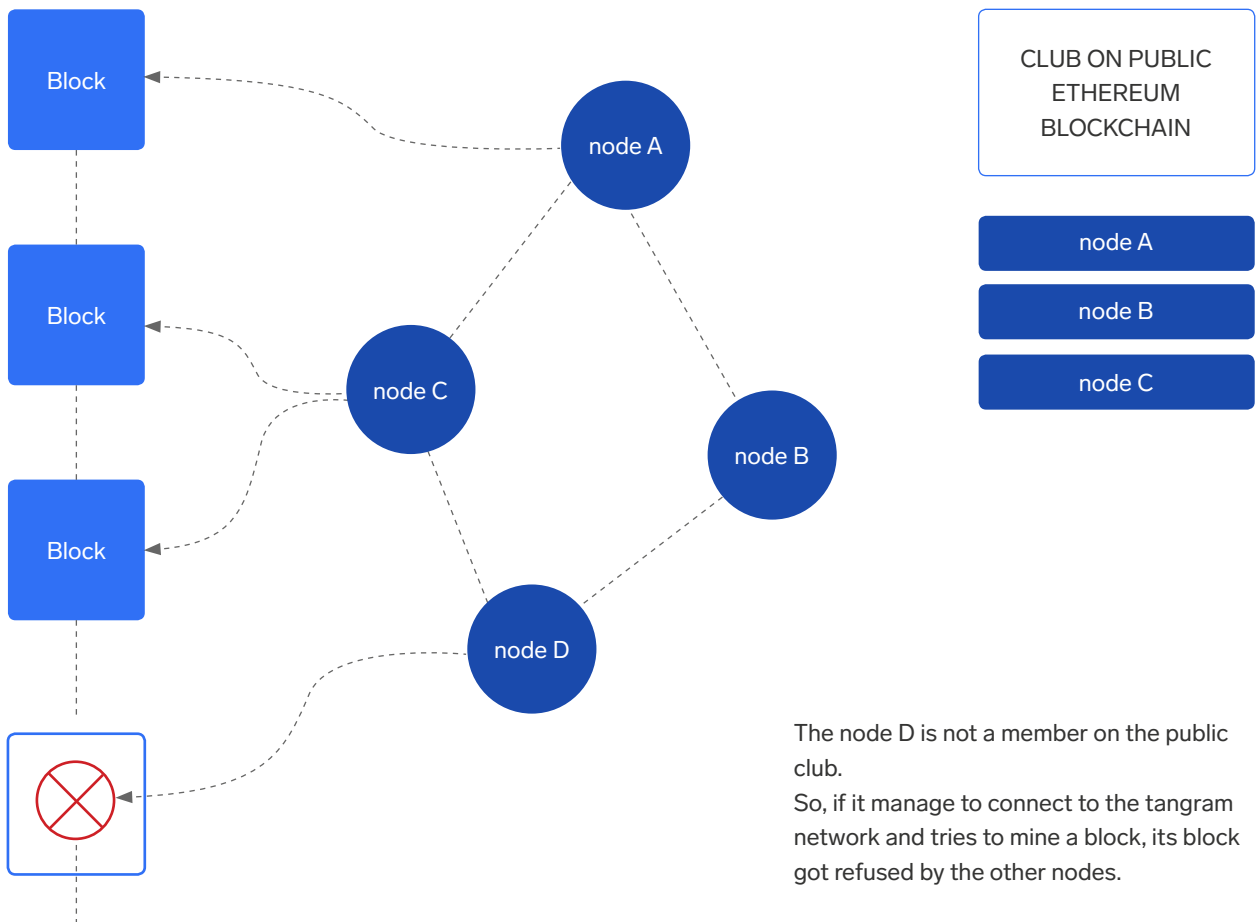
- Needs to stake TNGRM on a staking contract on the public Ethereum blockchain;
- Needs to receive a vote from at least the 70% of the existing Masternodes to join the club.

Being a member of the Club:

- Gives right to vote on the reward and on the transcoding process (70% quorum);
- Gives right to mine blocks on the Tangram Ethereum blockchain;
- Gives right to vote to add a new Masternode (70% quorum);
- Gives the right to vote to remove a Masternode with the release of the stake (70% quorum);
- Gives the right to vote to remove a Masternode with the loss of the stake (70% quorum).+

Only a node present in the Club can mine new blocks on the Tangram blockchain.

During the block validation process, each nodes check if the block miner is present on the club on the Ethereum public blockchain.



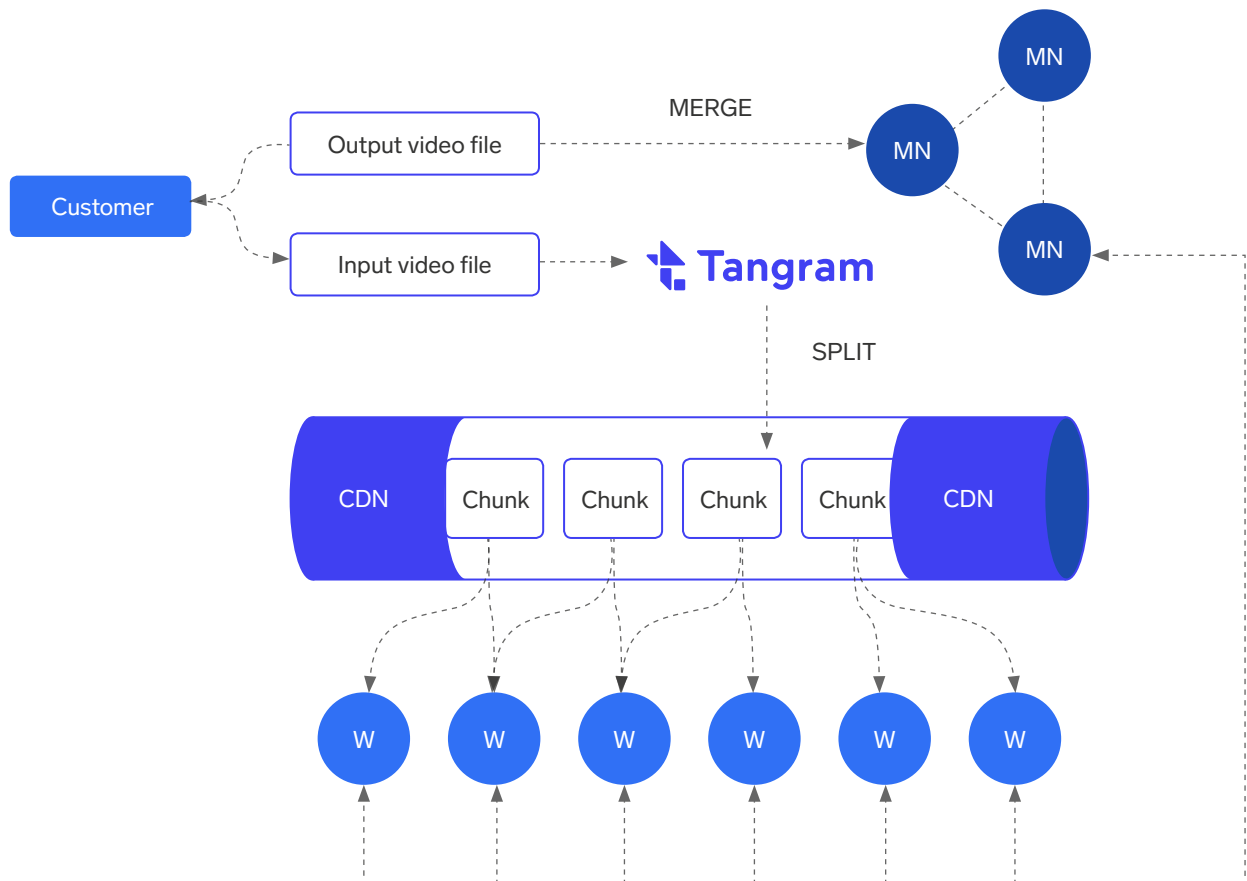
The node D is not a member on the public club. So, if it manage to connect to the tangram network and tries to mine a block, its block got refused by the other nodes.

Block mining on the Tangram blockchain

Transcoding process

The transcoding process follows these steps:

1. The customer submit and input file video to the Hub, or connects its AWS bucket to the Tangram Network;
2. The Hub retrieve the input file and splits it in chunks of videos (6 to 12 seconds chunks);
3. The Hub distributes job messages information to the Masternodes, based on the transcoding power available by each Masternode;
4. The Masternode distributes job messages to its available Workers;
5. The Workers pull the input chunk from the Masternode or from the CDN;
6. The Workers read all the transcoding specifics from the job message and start the transcoding process;
7. The Worker submits the transcoded file either to the Hub or the Masternode.
8. The Masternodes and the Hub can either merge the received chunks in a output video file to deliver to the customer or submit all the chunks back to the CDN, providing a manifest to the customer.



MN: Masternode

W: Worker

CDN: Content Delivery Network

