PiTrust – A blockchain based trust network

CS6675 Advanced Internet Systems – Course Project

05 May 2022

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PiTrust – A blockchain based trust network

- Use case
- Why blockchain?
- System description
- Preparation for Live Demo
- Guidance for Live Demo

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PiTrust – Use Case

- Imagine being new in a company or at a location
- You need to know something about a particular topic
- Whom could you ask for assistance?

=> Database of people to find a knowledgeable person

PiTrust – Why blockcain?

- Central database may be well-suited for a network of people trusting each other, but not for larger scale
  - Lack of transparency
  - Prone to manipulation
  - Scalability
- Blockchain solves these issues as it is publicly verifiable, non-revokable and highly scalable

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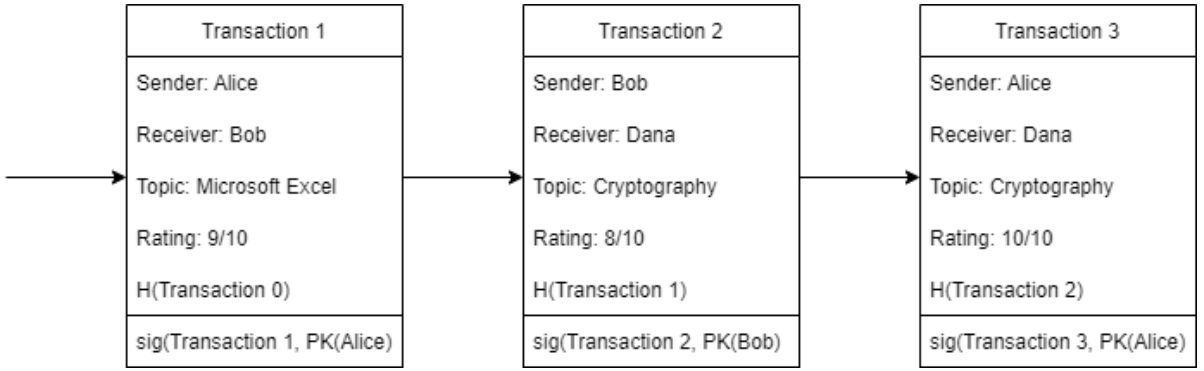
System Description - General

- Transaction (rating) information will be stored on the Polygon blockchain
  - Polygon is compatible to the very well-known Ethereum blockchain, but comes with much lower transaction fees (~$0.10 compared to ~$30 on Ethereum)
- Each transaction will store information about the actual rating (on a scale between 1 and 10), topic and also who has rated whom:

  T = (Sender, Receiver, Topic, Rating)



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System Description –Rating calculation

- Each transaction stores the most recent rating (for evidence) as well as the recalculated overall rating of a person's expertise based on all former and the most recent rating:

$$r_{new} = \frac{(r_{old} \times n) + r}{n + 1}$$

- The above-mentioned formula does not take into account that expert's ratings shall be weighted higher than novice's ones leading to a refined formla:

$$R_A = \frac{1}{11(n+1)} \sum_B R_A^B (R_B + 1)$$

with R_i being the (current) rating of person *i* and R_A^B being the (current) rating of person A for person B

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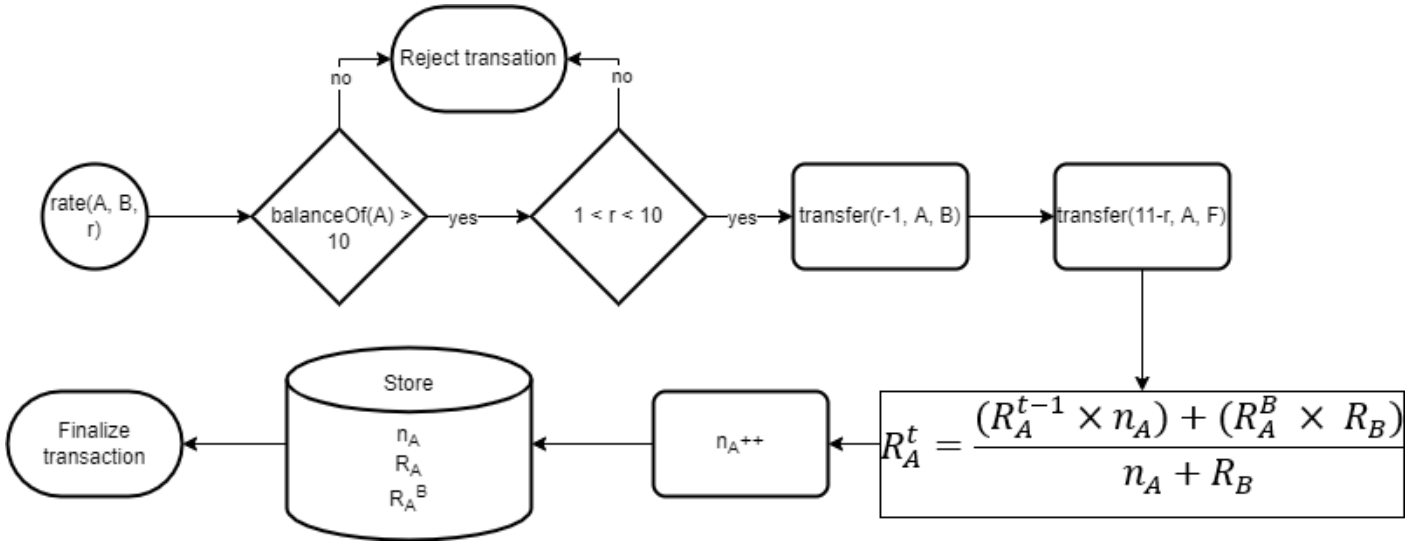
System Description – Tokenomics (1)

- The implementation the system as proposed would work, but also be prone to manipulation by creating large counts of fake-reviews, being positive or negative
- This may be mitigated by introducing a cryptocurrency token, which has a small, but real-world value as it can be exchanged against other cryptocurrencies such as Bitcoin and finally fiat money as well.
- Tokens can also be used as incentive for positive behavior (i.e., receiving, but also providing valuable feedback)

System Description – Tokenomics (2)

- Basic idea: Fixed supply with ability to buy tokens on (decentralized and/or centralized) exchanges
- Each rating costs 10 tokens, whereof *r-1* tokens will be transferred to the rated person and the rest being sent (back) to the contract wallet
  - Burning the tokens, i.e., sending them to an unusable address, was also considered



System Description – Tokenomics, additional thoughts

- *Spending* tokens for ratings currently does not provide any benefit for the users
  - Incentivation could be implemented by increasing voting power (social benefit) and/or provide some kind of interest on performed votings, comparable to *staking* tokens/coins
- Hoarding tokens for investment purposes does not fit its purpose
  - Rather high inflation (e.g. creating 20% additional tokens per year, currently implemented) or controlled burn of unmoved tokens (e.g. 10% per month) could mitigate that

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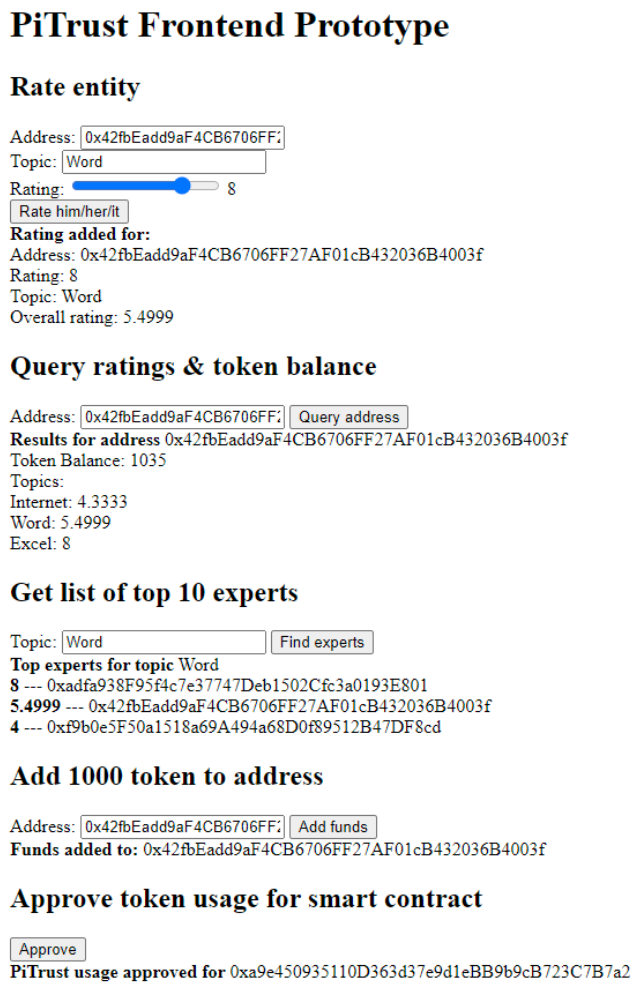
System Description – Frontend (1)

- Ethereum/Polygon smart contract alone is not usable by even technically versed people without prior knowledge of and tools for blockchain development
- Frontend could be developed as a “classic” executable application, but modern Web (3.0) applications rather make use of general-purpose web servers using HTML & JavaScript
  - More sophisticated frameworks such as React add even more value to the usability but have not been evaluated in-depth or used for the prototype
- Main interface between the frontend and the smart contract is provided by Metamask (or any other Web3 crypto wallet)

System Description – Frontend (2)

- Frontend was tested purely local, but will be provided on a publicly accessible webserver for the live demo
- Consists of 5 actions:
  - Rate an entity/person (i.e. a wallet address)
  - Query ratings & balance of one address
  - Get a list of experts for a given topic
  - Add 1000 token to an address (admin only)
  - Approve token usage (prerequisite for any action)



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Preparation for Live Demo (1) - Prerequisites

- Browser capable to use Metamask extension (Chrome, Brave, Firefox, Edge)
  - Mobile browsers & other Web3 wallets (e.g. Wallet Connect) shall also work but are not covered by the project's scope
- Installation of Metamask extension
- Configuration of Metamask for Polygon Mumbai testnet
- Import of (test-)wallet

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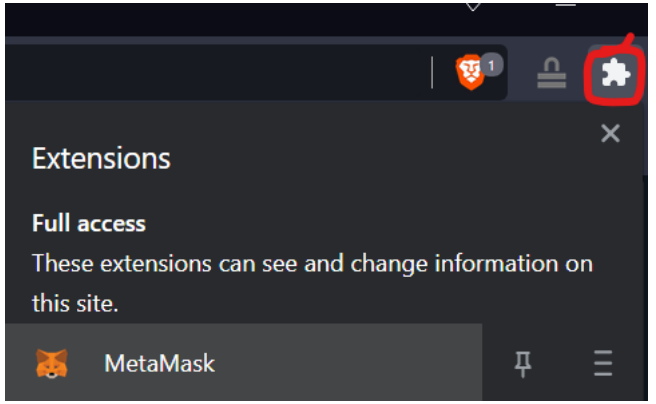
Preparation for Live Demo (1) – Metamask installation

- Go to https://metamask.io/download/
- Click on “Install Metamask for <your browser>
- Install from the Chrome (or other browser’s) web store
- After installation, you will find the MetaMask icon (a fox) after clicking on the puzzle tile in the upper right corner
- After clicking on the Metamask symbol click on Get Started



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Preparation for Live Demo (2) – Metamask configuration

- Click on “Create a wallet”
- Then “I agree”
- Chose a password you like and accept the terms of use
- Click on “Next” and “Remind me later”
  - You won’t use the wallet you created at all, but Metamask does not allow to start with importing a private key, which we will use (next slide)

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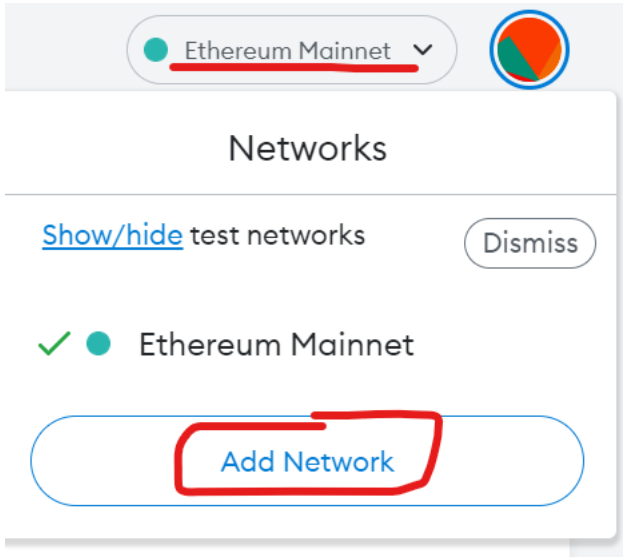
Preparation for Live Demo (3) – Adding Polygon Testnet

- Next, we will add the Polygon (Mumbai) testnet to Metamask (which is by default only configured for Ethereum Mainnet)
- Click on “Ethereum Mainnet” at the top of the Metamask site, then on “Add Network”
- Enter following network data:
  - Network Name: Polygon Testnet (does not matter)
  - New RPC URL: *https://rpc-mumbai.maticvigil.com*
  - Chain ID: 80001
  - Currency symbol: MATIC
  - Block explorer URL: *https://polygonscan.com/*



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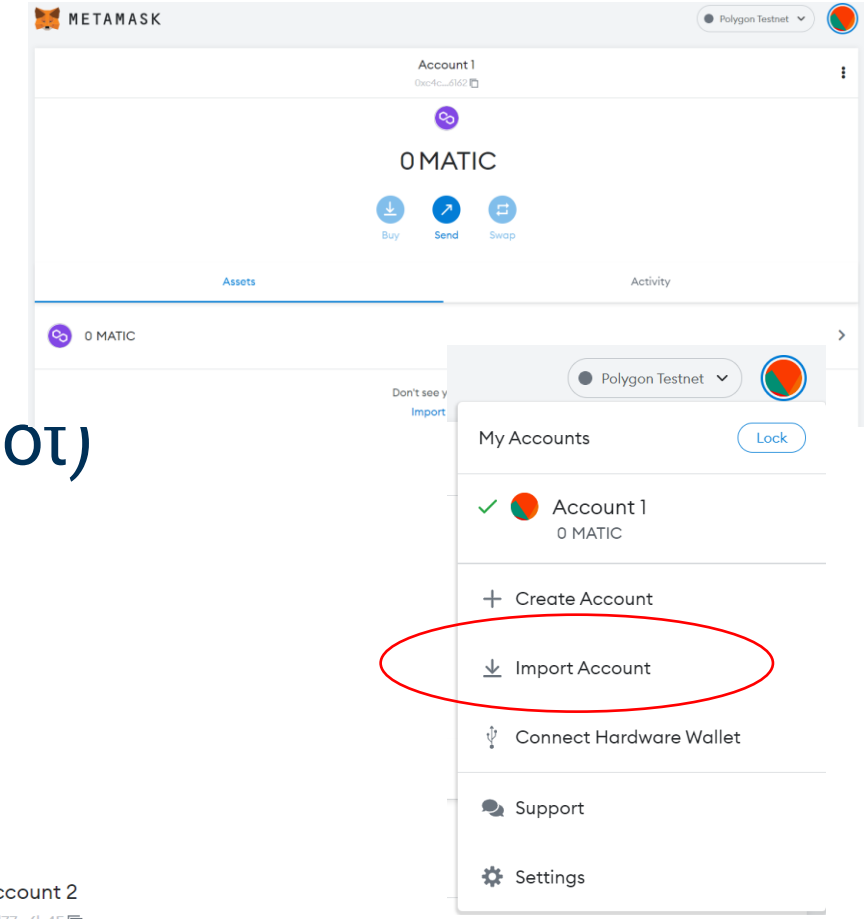
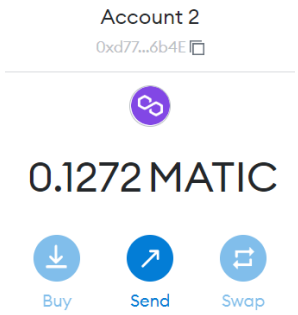
Preparation for Live Demo (4) – Adding Test account

- The screen shall now look like this:
- Next, we will add a “public” test account to Metamask.
- Click on the colorful “ball” in the top-right corner (colors may differ from the screenshot)
- Then click on “Import Account”
- Enter the (not-so-) private key string:
  7790309415a34c7019b60fa9cb4e03e027acb6174067b8901cf7e144f54612f1
- *And click on “Import”*
- *Now you shall see a (small) amount of MATIC available*





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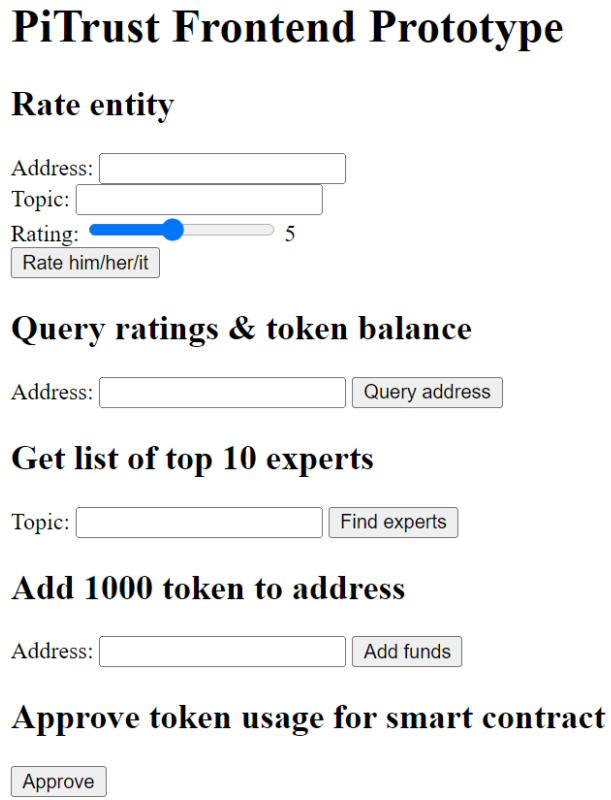
Live Demo

- After setting up Metamask, you are ready to interact with the smart contract
- Call http://pitrust.pidabbelju.de
- No need to “approve” token usage (was already done by me)
- Adding tokens to addresses will not work (admin only), but if you need some for additional addresses please just drop a message in the Ed Discussion forum



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Live Demo

- You can create ratings for arbitrary Polygon addresses and topics
  - Some exemplary addresses:
    0xc4ca55d47915A8f19F5e153bc2606739CEF36162 (your wallet)
    0xd77Ba78904Cf1cDa9D243C33E844317B95d46b4E (admin wallet)
    0xD5D02341C1163957a3a5f85c84cE27a7ee12C3F4 (contract address)
- You can search for already rated addresse, for example the above-mentioned ones or any other
- You can search for “experts”; at the time of writing, only the topic “Word” was used

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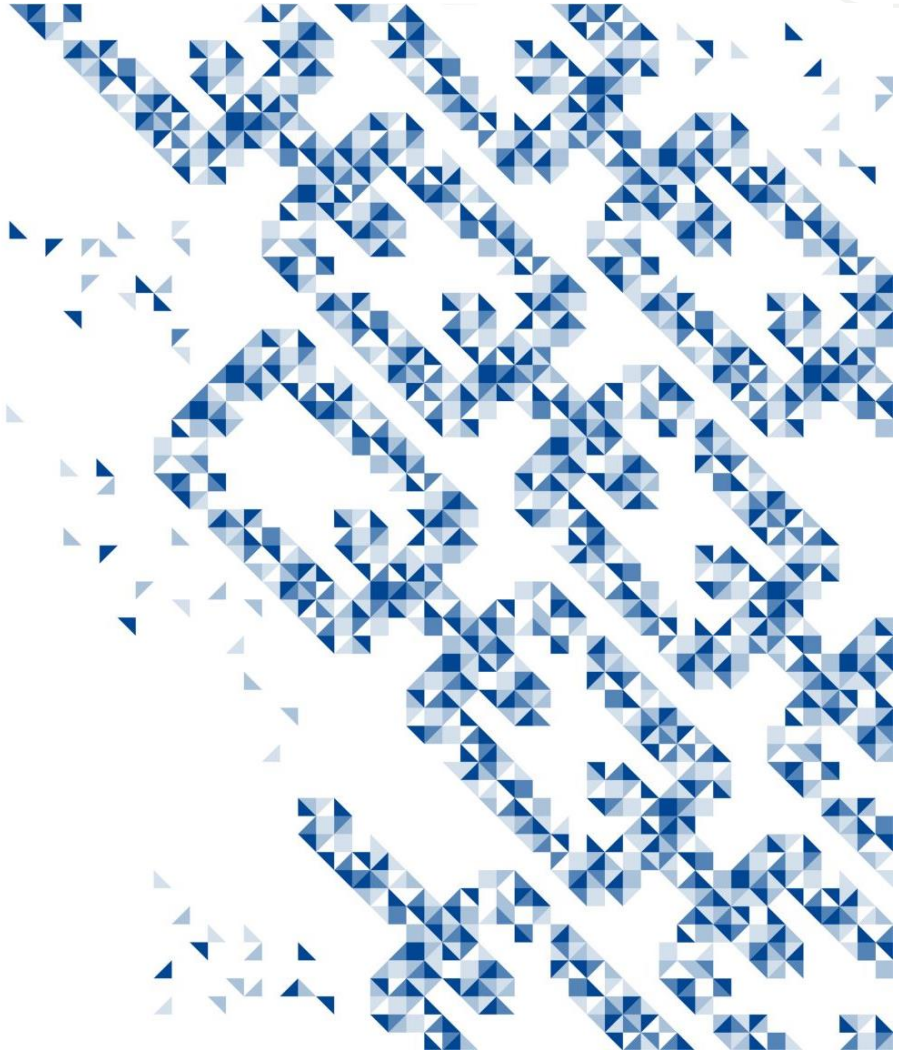
Thanks for clicking through this presentation!

Any comments, questions, recommendations and discussions are heavily appreciated!

Please just post in the dedicated Ed discussion thread – or via mail at

pwissmann3@gatech.edu



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