Detection and Analysis of Cross-Chain Arbitrages Between Ethereum and Polygon

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Outline

About me

Murad Muradli

Personal Profile

Informatics (Master of Science)

Relevant Coursework

SoSe 23'
Blockchain-based Systems Engineering
Prof. Dr. Florian Matthes , Burak Öz , Felix Hoops

WiSe 2023/24
Seba Lab Course
Prof. Dr. Florian Matthes, Felix Hoops

Advanced Seminar Blockchain Technologies (IN2107, IN4909)
Jeeta Ann Chacko

Background & Motivation

Single-Network Arbitrage: The Hardware Store Example

Market A

Hardware

Bob

Market B

Hardware

- Located in the western part of town.
- Price of hammers: **$10**
- Lower demand, leading to lower prices.

- Located in the eastern part of town.
- Price of hammers: **$15**
- Higher demand, leading to higher prices.
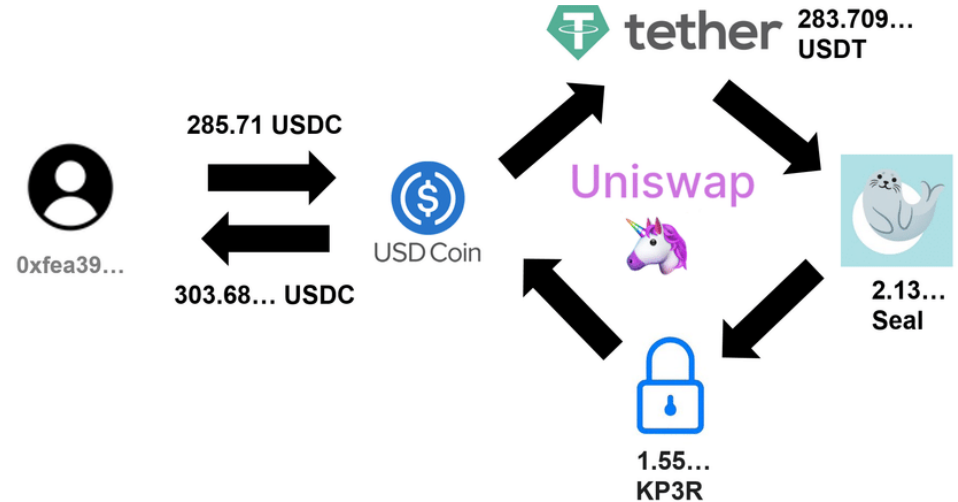
DEX: Decentralized exchange
- Peer-to-peer trading without intermediaries.
- Users control their own funds.

Arbitrage Opportunities:
- Price discrepancies between DEXes
- Buy low on one DEX, sell high on another.

Impact on Market:
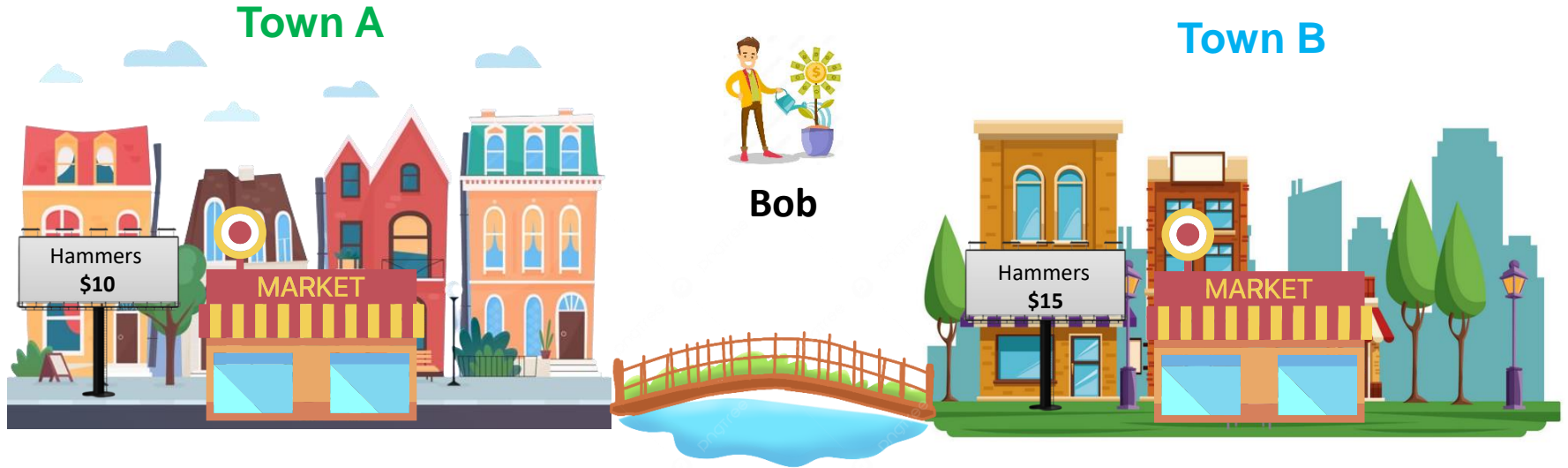- Promotes price consistency across DEXes.
- Generally seen as beneficial.

[Researchgate] *Cylic Arbitrage in Decentralized Exchange Markets*

[Blocknative] *The Fundamentals of Cross-Chain MEV*

Cross-Network Arbitrage

Town A

Bob

Town B

Hammers
$10

MARKET

Hammers
$15

MARKET

Bob sees that hammers are cheaper in Town A than in B. He plans to buy hammers in **Town A** and sell them in **Town B** for profit. **However, he needs a bridge to access the Market in town B.**

Challenges associated with the bridge**:**
- *Time delay:* Transport time can affect profits.
- *Transportation cost:* Fees for using the bridge reduce profits.

Polygon PoS:
- A Layer 2 scaling solution (side-chain) for Ethereum.
- Compatible with the Ethereum Virtual Machine (EVM)
- Support for a wide variety of DeFi apps:
  - Aave, SushiSwap, QuickSwap, Uniswap etc.

Key Features:
- High Throughput: Thousands of TXs per second (TXs)
- Low Fees: Much lower costs than Ethereum
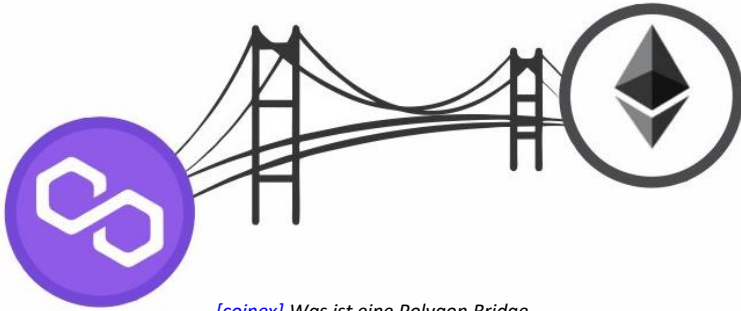- Checkpointing: Periodic batching of TXs to Ethereum

Use Cases:
- DeFi: better performance for decentralized finance
- NFTs: efficient minting and trading
- Gaming: scalable transactions for blockchain games

polygon
Polygon PoS

Background & Motivation
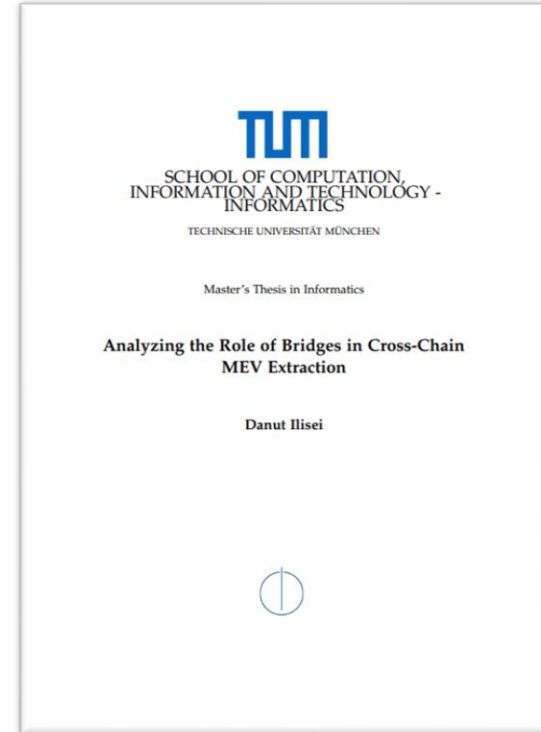Ethereum-Polygon

[coinex] *Was ist eine Polygon Bridge*

[Master's Thesis Danut Ilisei]

Key takeaways:
- Cyclic arbitrages do happen, though not very frequent.
- Lesser-known tokens used due to high-volatility of popular tokens.

Open questions:
- Improve heuristics to increase coverage.
- How can we identify the revenue-fee rate of arbitrages?

Research Questions

RQ 01 — What is the state-of-art literature on cross-domain profiting strategies in the context of blockchains?

RQ 02 — How can we develop a methodology to detect cyclic arbitrages between Ethereum and Polygon PoS using the Polygon bridge?
- *How can we devise heuristics to identify both successful and unsuccessful arbitrages?*

RQ 03 — How often do cyclic arbitrages occur between Ethereum and Polygon and how profitable are they?
- *Which tokens are used for profiting and how long are the bridging times?*
- *Is the Ethereum leg of the arbitrage submitted to the public mempool?*

RQ 04 — How do our obtained results compare to other profit-making strategies observed on blockchains?
- *Number of occurrence and profitability compared to strategies such as atomic arbitrages, non-atomic Centralized Exchange - Decentralized Exchange arbitrages, and sandwich attacks.*

Literature Review

- Study cross-chain MEV extraction.
- Research Polygon PoS.
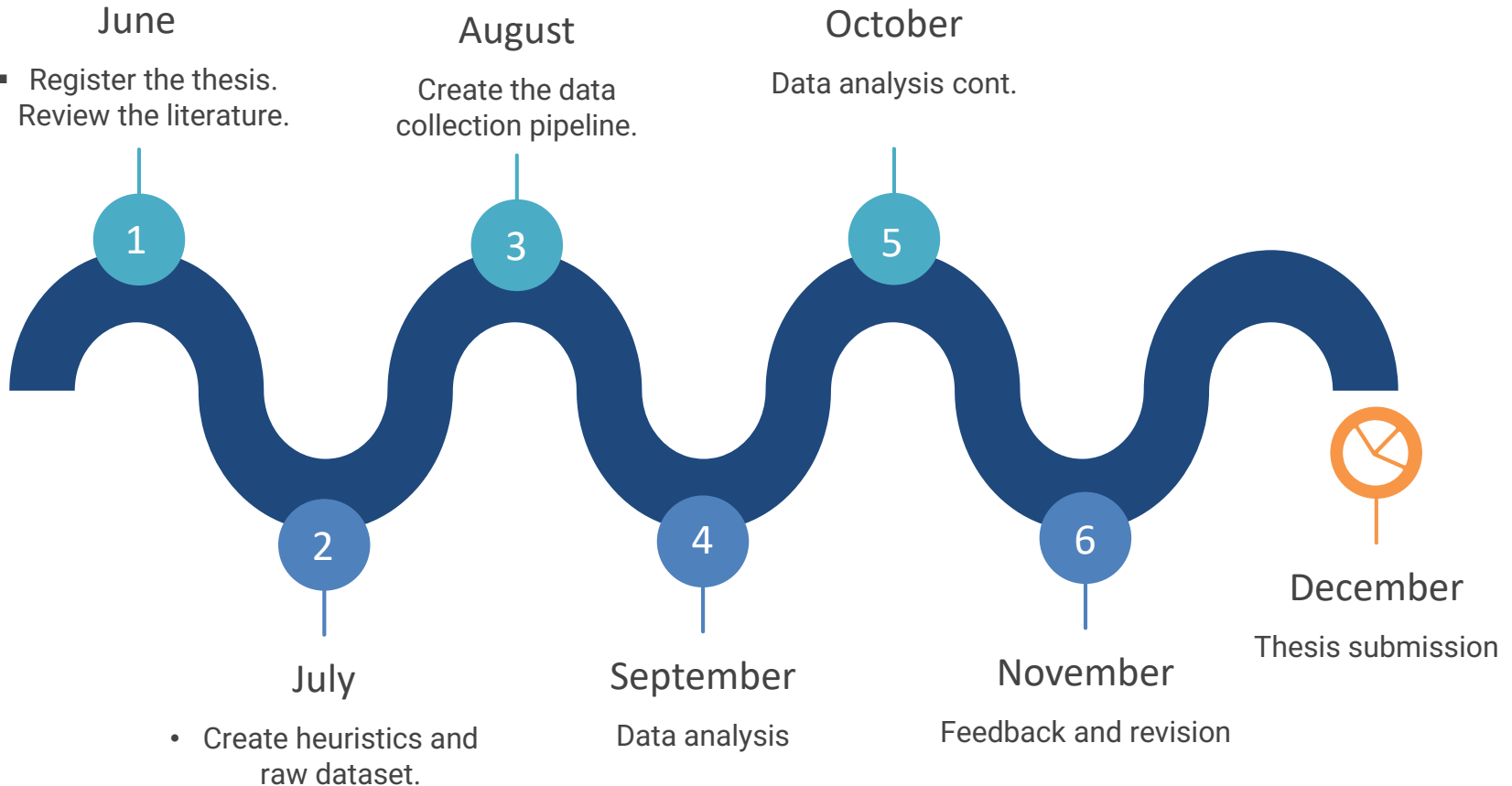
Heuristic Development

- Develop heuristics to detect both successful and failed arbitrages.

Data Collection

- Create a data collection pipeline which fetches transaction and mempool data from Ethereum and Polygon, following the predefined heuristics.

Timeline

June
- Register the thesis.
- Review the literature.

August
Create the data collection pipeline.

October
Data analysis cont.

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July
- Create heuristics and raw dataset.

September
Data analysis

November
Feedback and revision

December
Thesis submission

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