Kosmosis: Crypto Rug Pull Detection and Prevention

by Fusing On- and Off-Chain Data in a Knowledge Graph

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Agenda

Osthayerische
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Conclusion

Motivation

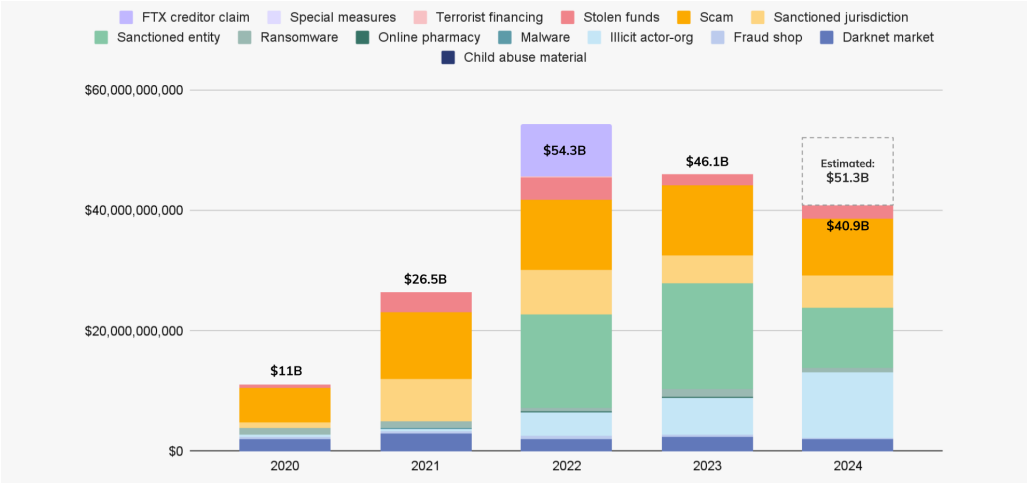


Figure 1: Total cryptocurrency value received by illicit addresses 2020 – 2024 [1]

Crypto Assets

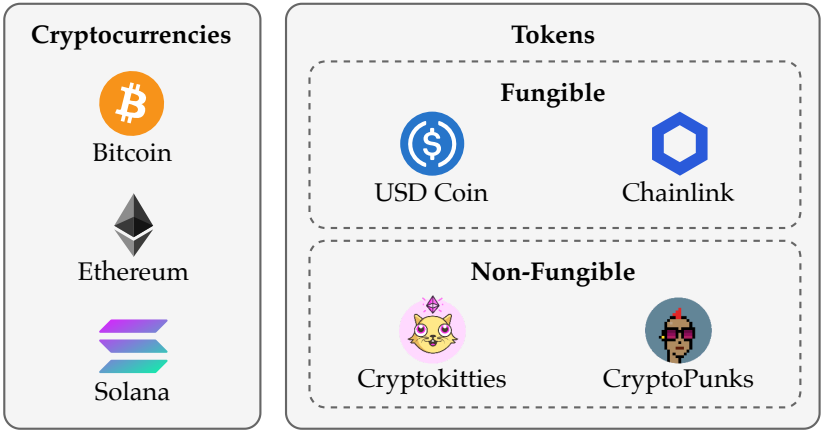


Figure 2: Overview of crypto asset categories

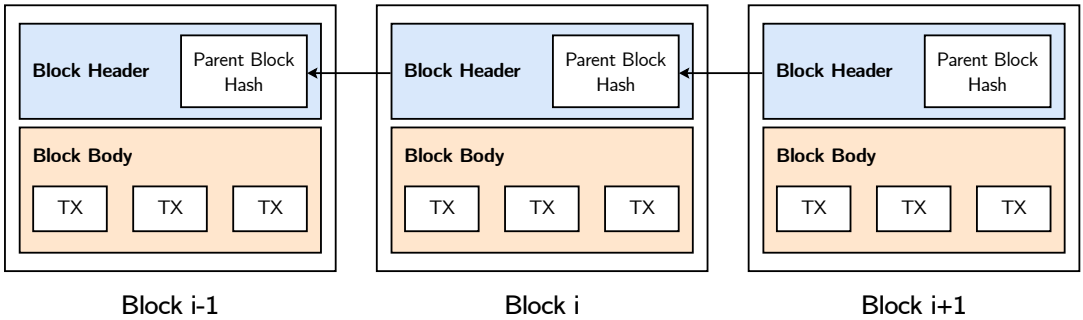


Figure 3: Blockchain data structure. Adapted from Zheng *et al.* [2]

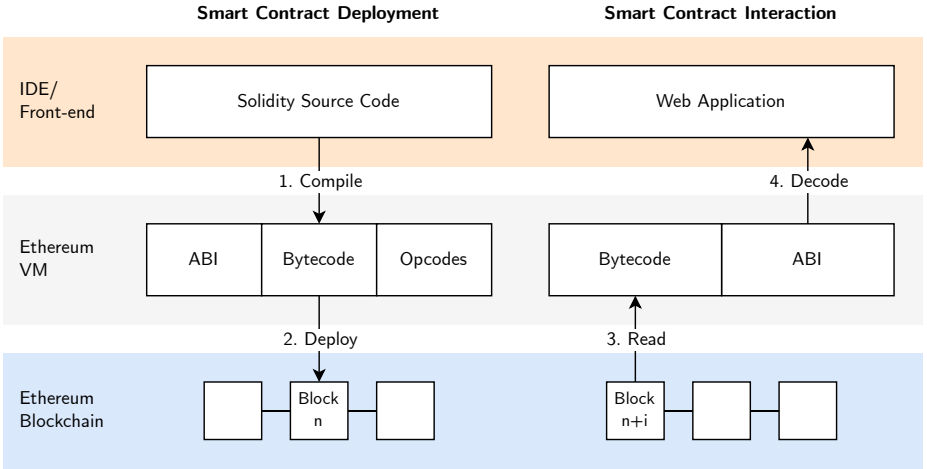


Figure 4: Smart Contracts on the Ethereum Blockchain. Adapted from Takeuchi [3]

Related Work

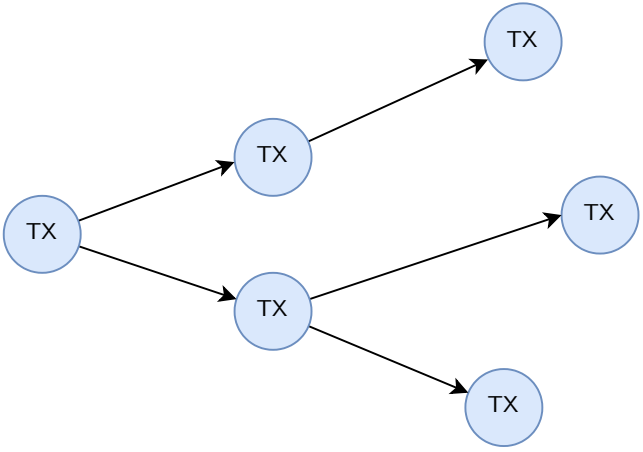


Figure 5: Money Flow Transaction Graph

Related Work

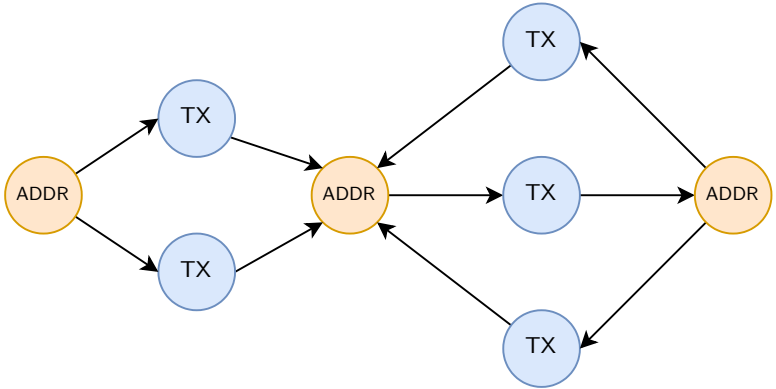


Figure 6: Address-Transaction Graph

Related Work

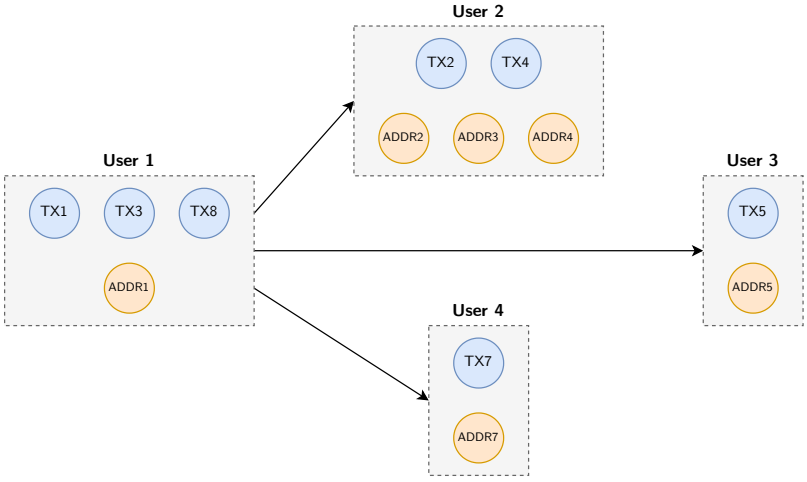


Figure 7: User-Entity Graph

Related Work

- Blockchain Address Deanonymization
  1. Clustering heuristics for blockchain addresses
  2. Connecting social media to blockchain data
- Recognition of common transaction patterns
  1. Visualization Software
  2. Frameworks (e.g., Tokeer)
- Detection of illicit activities
  1. Graph Convolutional Network
  2. DeepWalk
  3. Node2Vec

Rug Pull Use Case: Homer_eth

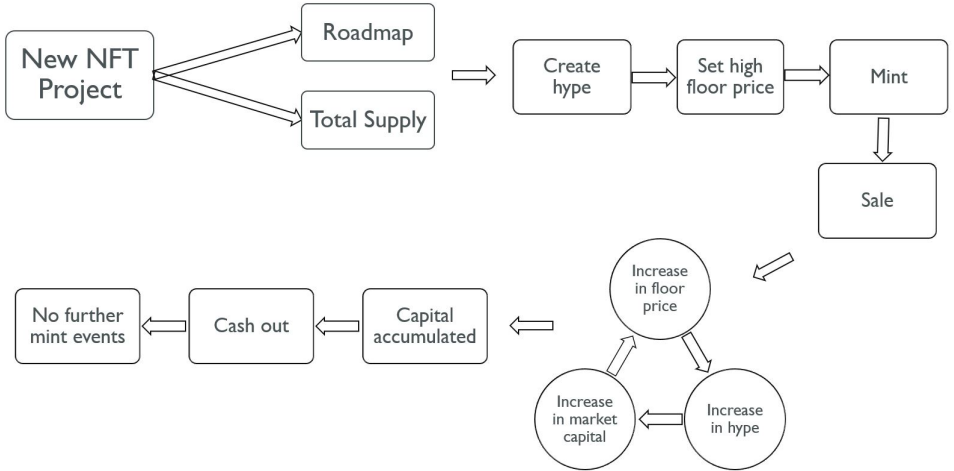
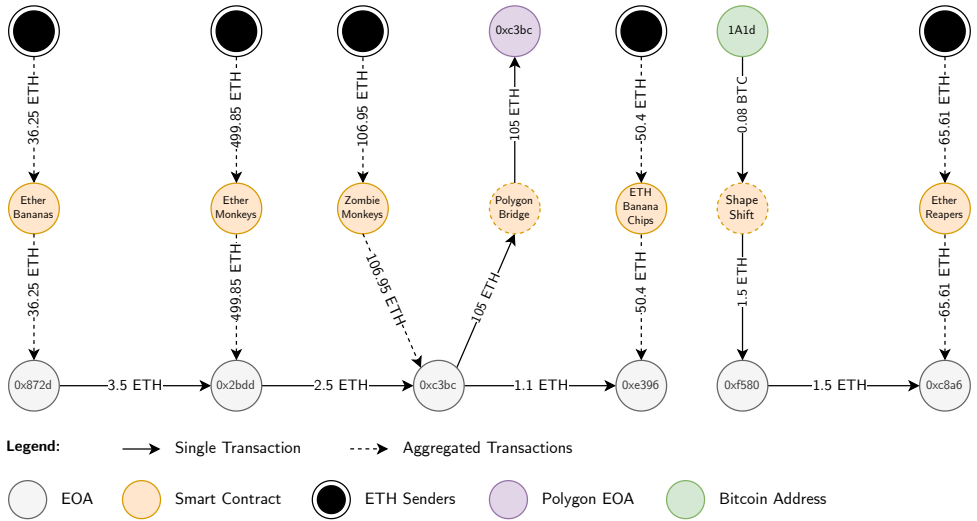
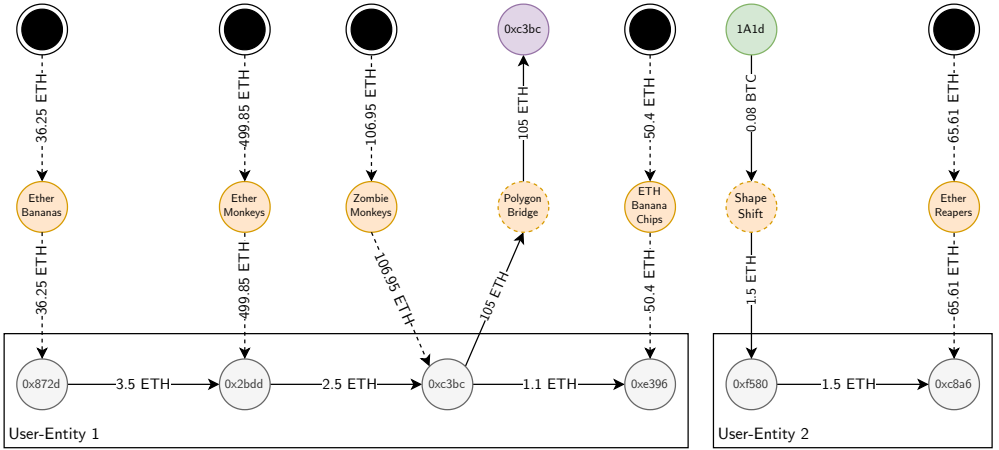


Figure 8: Rug pull flow. Adopted from Sharma *et al.* [4]

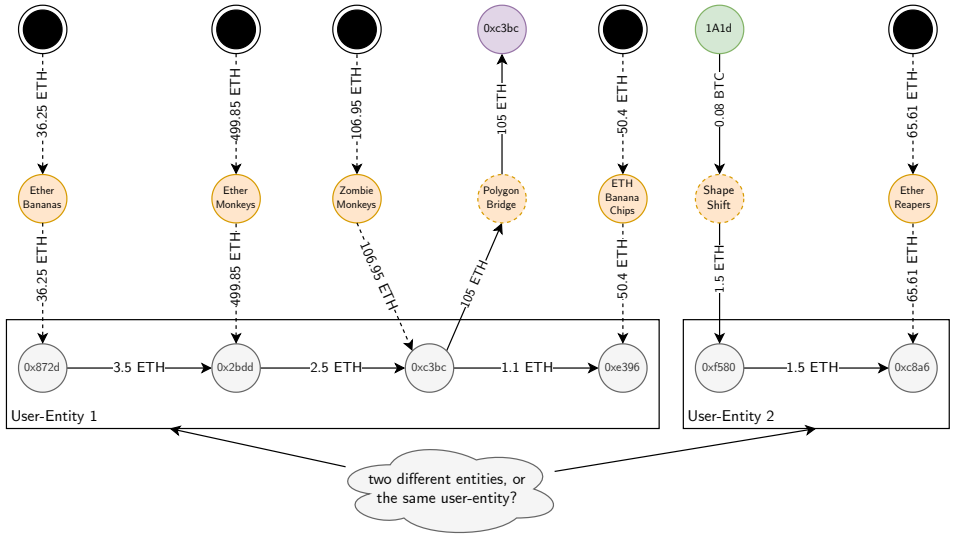
Rug Pull Transaction Graph



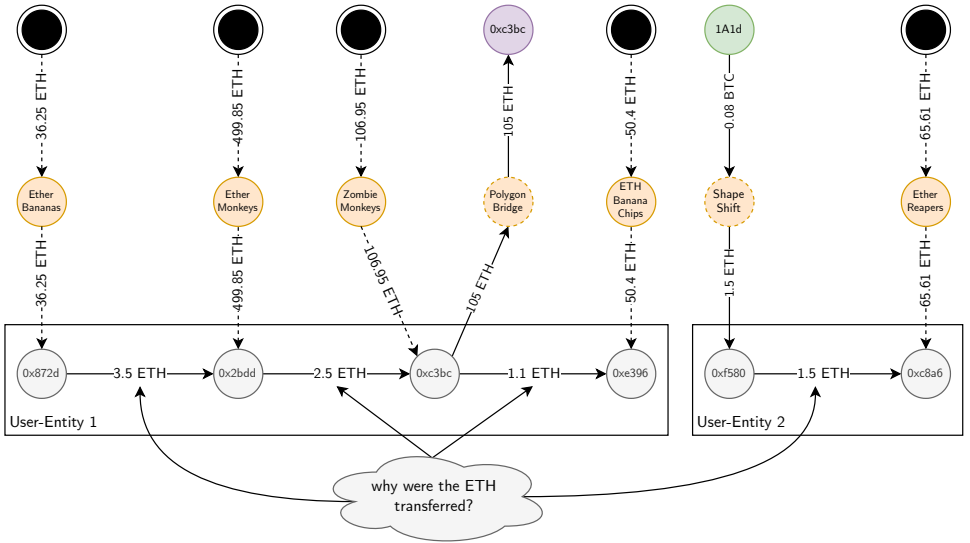
Rug Pull User Entity Graph



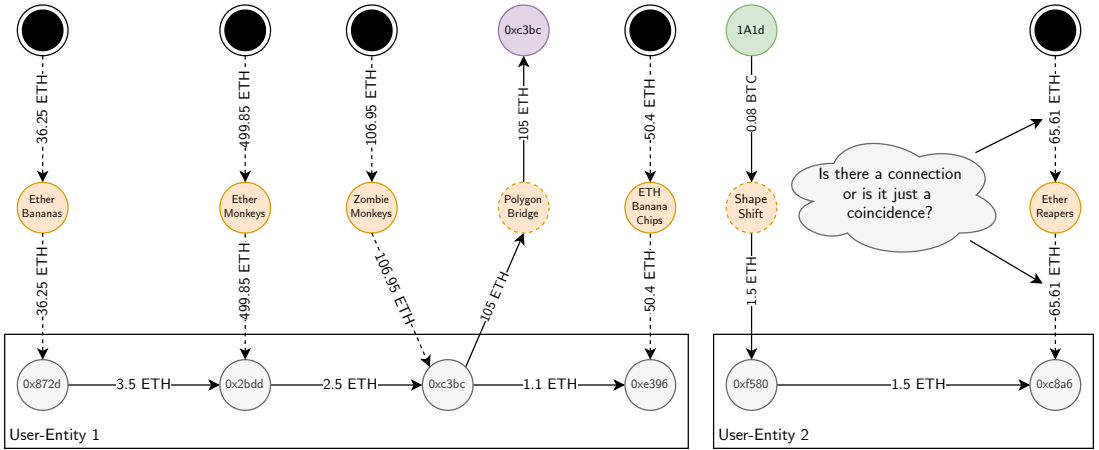
Rug Pull User Entity Graph



Rug Pull User Entity Graph



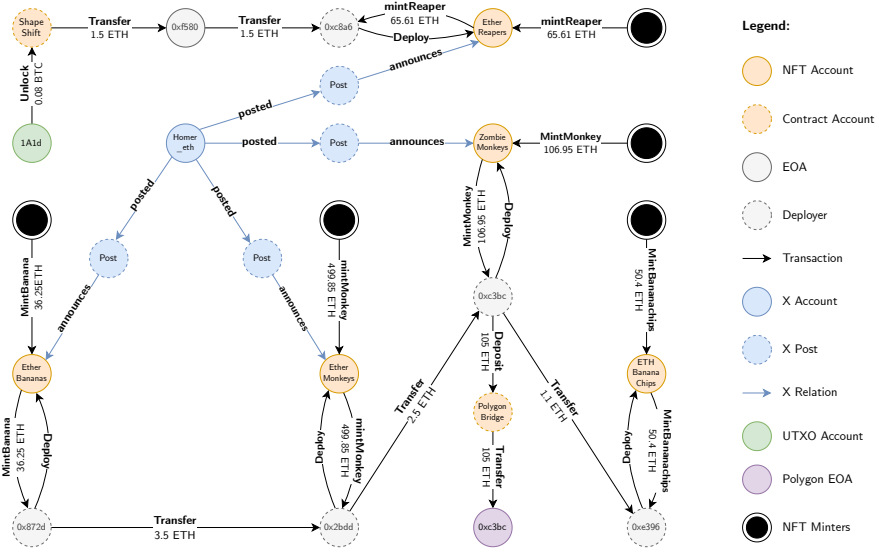
Rug Pull User Entity Graph



Kosmosis Objectives

1. Extracting the semantics contained in blockchain transactions.
2. Incrementally constructing a knowledge graph from on- and off-chain data.
3. Identifying and alerting users of rug pulls.

Kosmosis Knowledge Graph



Kosmosis Knowledge Graph

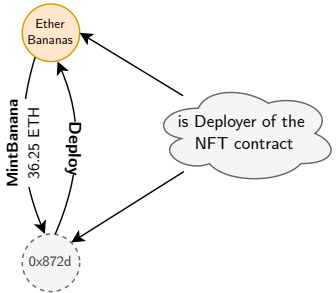


Figure 12: Contract-Deployer Relationship

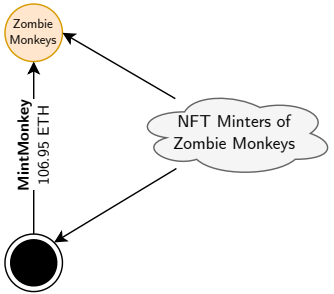


Figure 13: NFT-Minter Relationship

Kosmosis Knowledge Graph

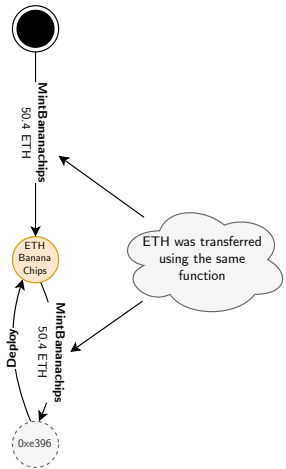


Figure 14: Semantics in Transactions

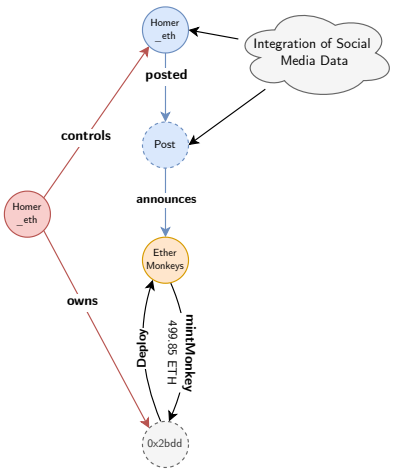
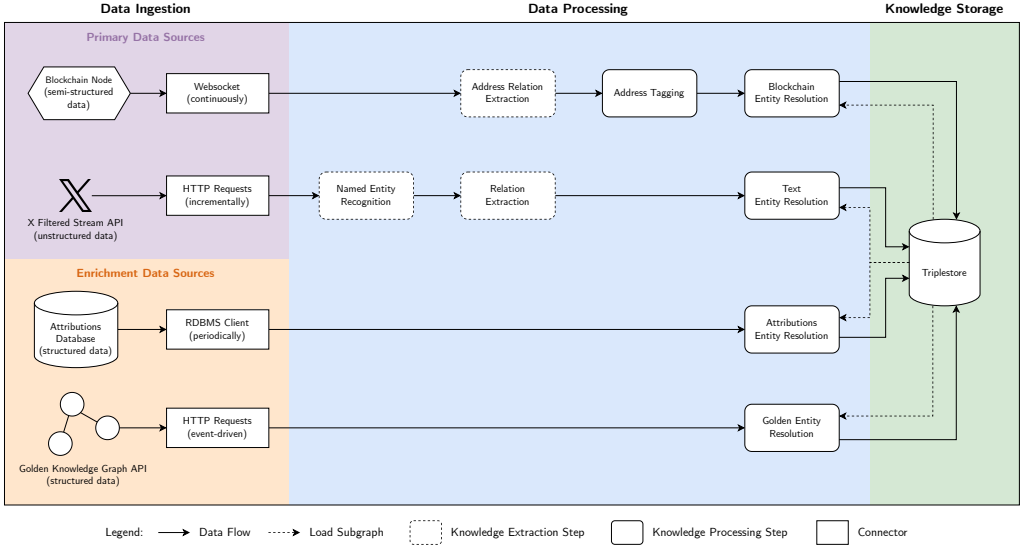


Figure 15: Real-World Entity

Incremental Knowledge Graph Construction Pipeline



Conclusion

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Kosmosis advances User Entity Graphs through semantics and off-chain data.

1. Extracting the semantics contained in blockchain transactions
   - To understand "why" and "how" crypto assets were transferred
   - Decoding smart contract interactions using their application binary interface
2. Incrementally constructing a knowledge graph from on- and off-chain data
   - Data from the blockchain, social media (X), and external knowledge bases
   - Data is processed in Data-Processing-Workflows and stored in a Triplestore
   - Knowledge graph grows as new knowledge becomes available
3. Identifying and alerting users of rug pulls
   - Browser extension that queries the graph when user wishes to execute a transaction
   - Knowledge graph queries enable new methods for rug pull detection

References

[1] K. Grauer, E. Jardine, E. Leosz, and H. Updegrave, "The 2025 Crypto Crime Report," Chainalysis, Annual Report, 2025.

[2] Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, "An overview of blockchain technology: Architecture, consensus, and future trends," in *2017 IEEE international congress on big data (BigData congress)*, IEEE, 2017, pp. 557–564.

[3] E. Takeuchi, "Explaining Ethereum Contract ABI & EVM Bytecode," (Jul. 16, 2019), [Online]. Available: https://medium.com/@eiki1212/explaining-ethereum-contract-abi-evm-bytecode-6afa6e917c3b (visited on 12/07/2023).

[4] T. Sharma, R. Agarwal, and S. K. Shukla, "Understanding Rug Pulls: An In-depth Behavioral Analysis of Fraudulent NFT Creators," *ACM Transactions on the Web*, vol. 18, no. 1, pp. 1–39, Feb. 29, 2024, ISSN: 1559-1131. DOI: 10.1145/3623376.