

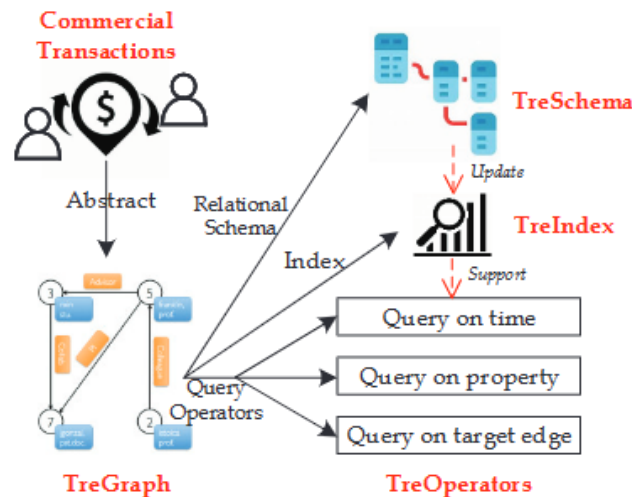
# Introducing On-chain Graph Data to Consortium Blockchain for Commercial Transactions

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# Problems & Ideas

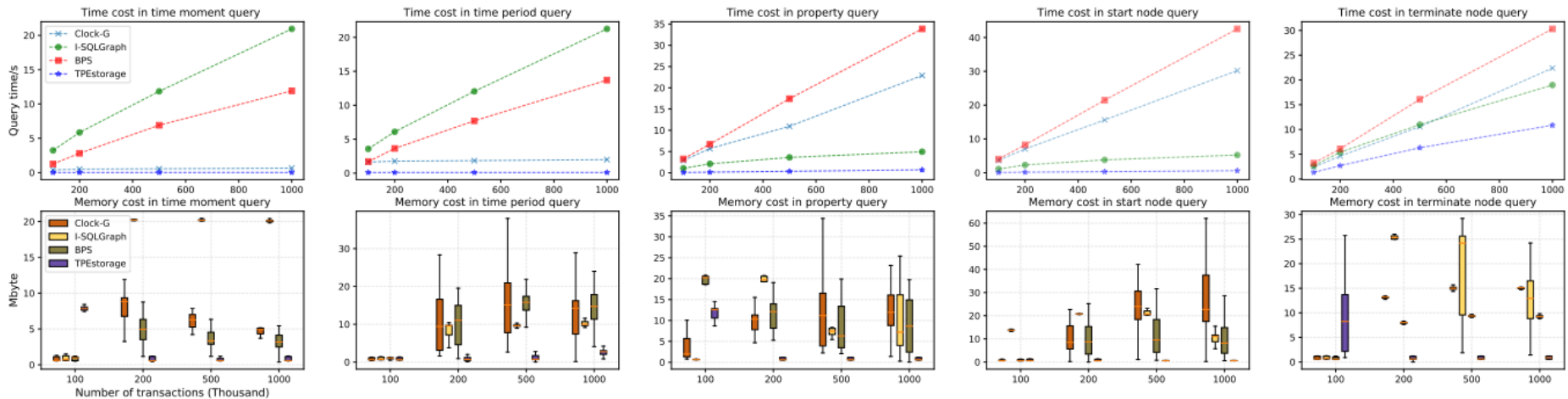
- Problems of introducing on-chain graph data into blockchain:
  - Off-chain graph data cannot support the real-time, security and credibility of blockchain.
  - Replacing the databases into graph databases is very challenging due to the security, data consistency, and decentralization of blockchains
- Ideas: Abstracting transactions into graph without changing the databases, and storing and querying the graph in an efficient approach.



The solution contains four parts: 1) a description of commercial transactions and a definition of TreGraph as the abstracted transaction graph, 2) a relational schema for TreGraph in the local database of each node, called TreSchema, stored in the relational database, 3) a tree-structured in-memory index for TreSchema, called as TreIndex, and 4) a group of graph operators on the TreGraph, called TreOperators and implemented through TreIndex and TreSchema.

# Main Contributions

- Contributions:
  - A novel graph structure of blockchain transactions, which offers a new perspective to present the blockchain transactions;
  - An efficient storage schema in the relational storage for storing graph in the blockchain without changing existing blockchain databases;
  - A novel index and five query operators for the storage schema to make efficient graph queries in the blockchain;



Query performance of competitors and our solution. The result shows that our solution has the best performance in most queries.