



HYPERLEDGER
GLOBAL  **FORUM**

PHOENIX, AZ | MARCH 3-6, 2020





Hyperledger Sawtooth

A Step by Step Guide to Advanced Smart-Contract Development



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NAMASTE PHOENIX
Greetings!

AGENDA

Recap

What is Blockchain?

Demystifying the **Hyperledger Sawtooth** – Essentials

Heading Towards Sawtooth 2.0

Sawtooth Smart Contracts

Design Patterns – Doing it the right way!

On-chain Smart Contracts – Sabre

Batch Injection

Hands On!

Build and Deploy your own “Smart Contract”



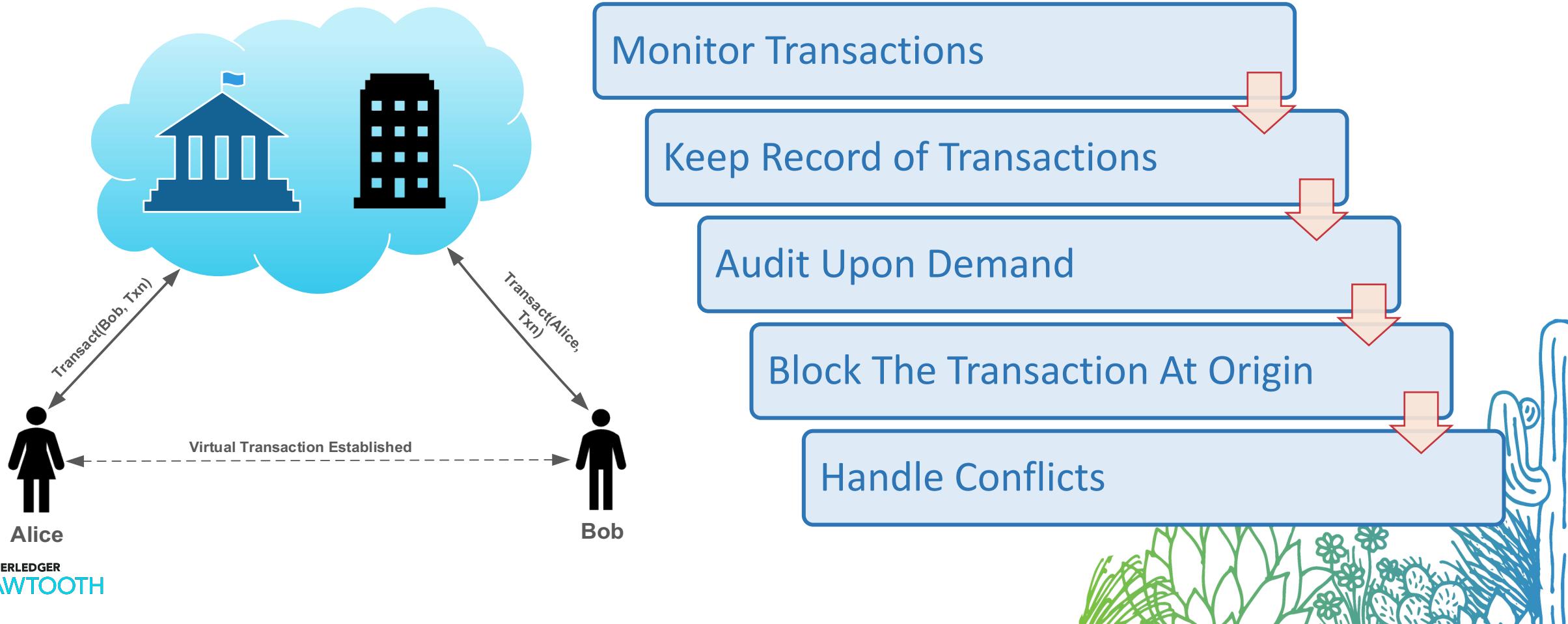


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Blockchain Recap



Transaction in Presence of Trusted Third Party

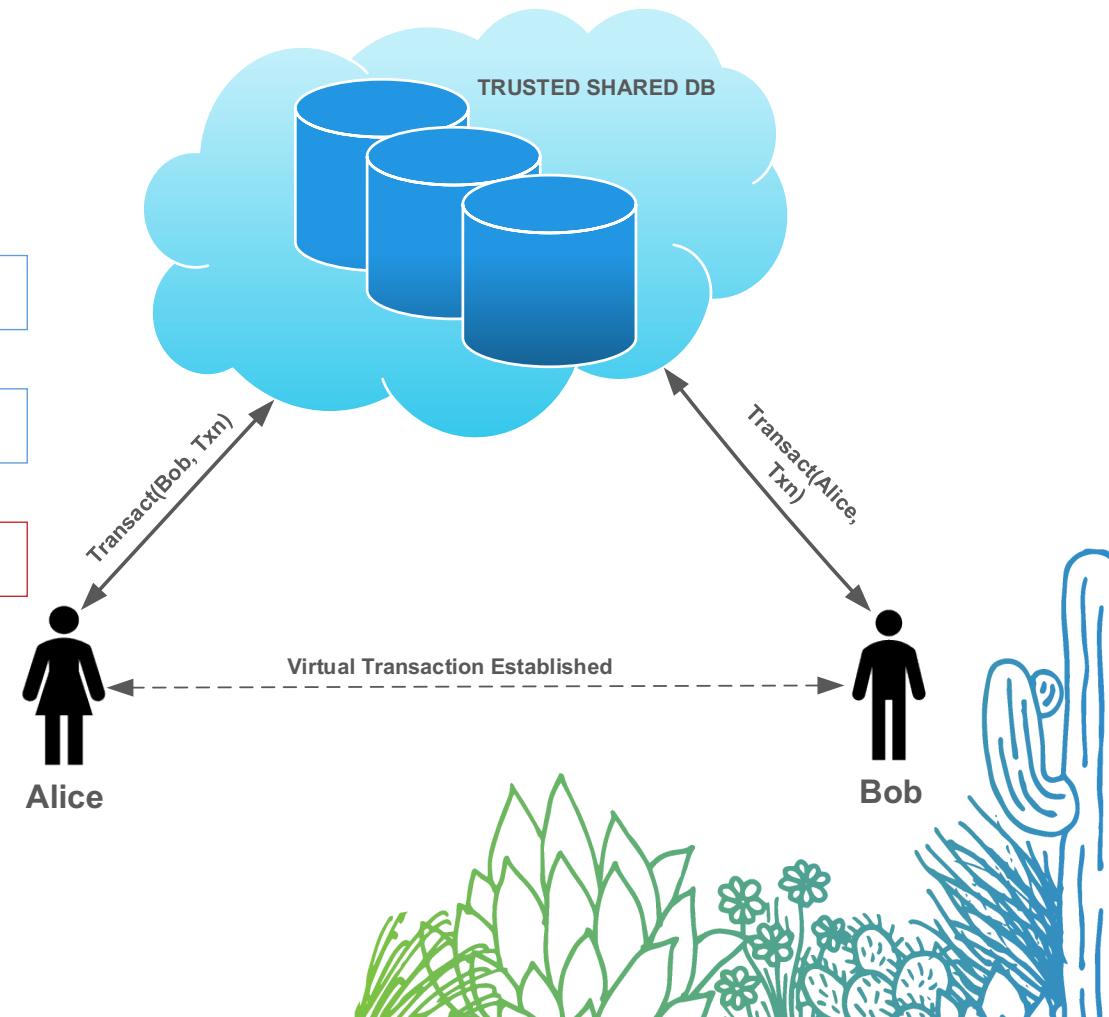


Transaction in Presence of Trusted Third Party

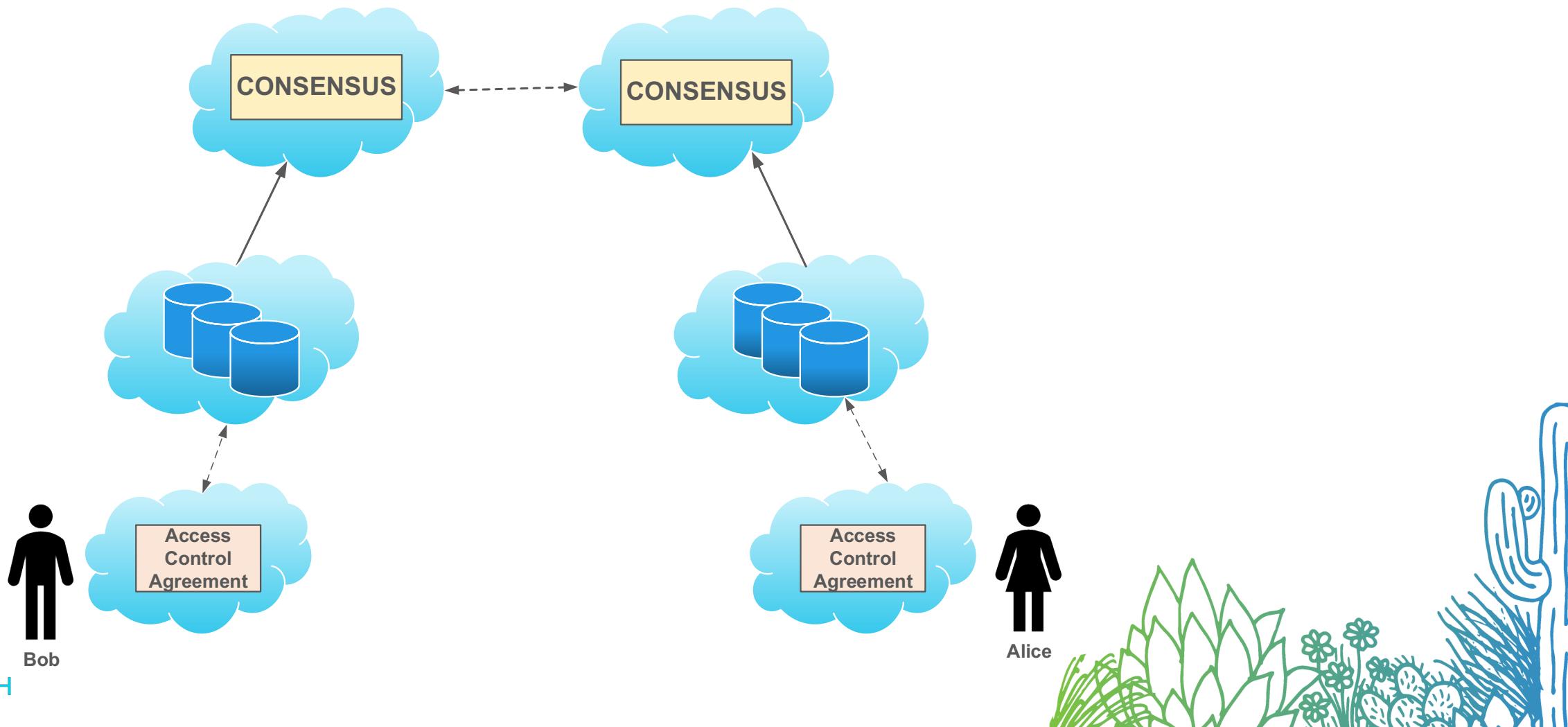
Both Parties Agree to Use Common Database

Access to Database is Restricted Through a Software

Question: Who Maintains? What Happens if Compromised?



Distributed and Decentralized Approach to the Trust



What is Blockchain?

NETWORK

replicates a database (ledger) of transactions to all the participants with their consent

DISTRIBUTED

DECENTRALIZED

IMMUTABLE

SECURE ACCESS



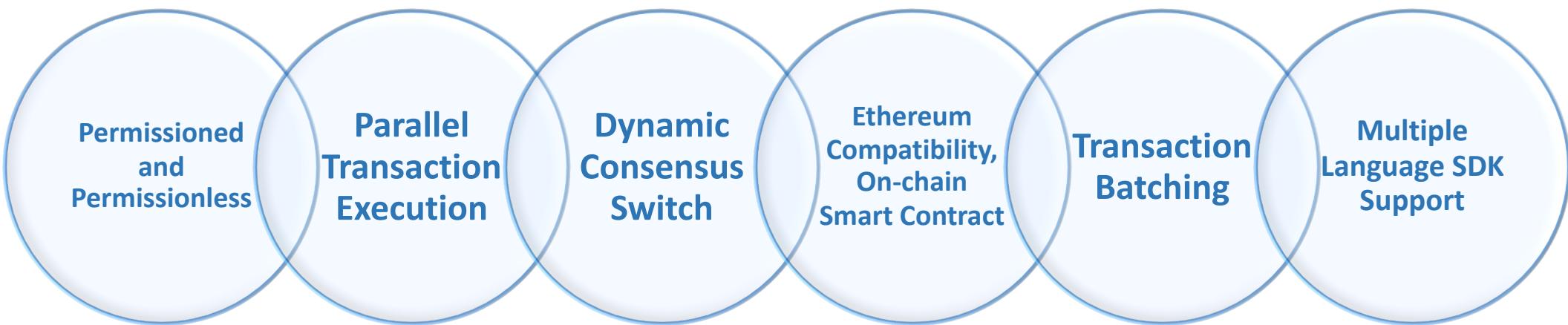


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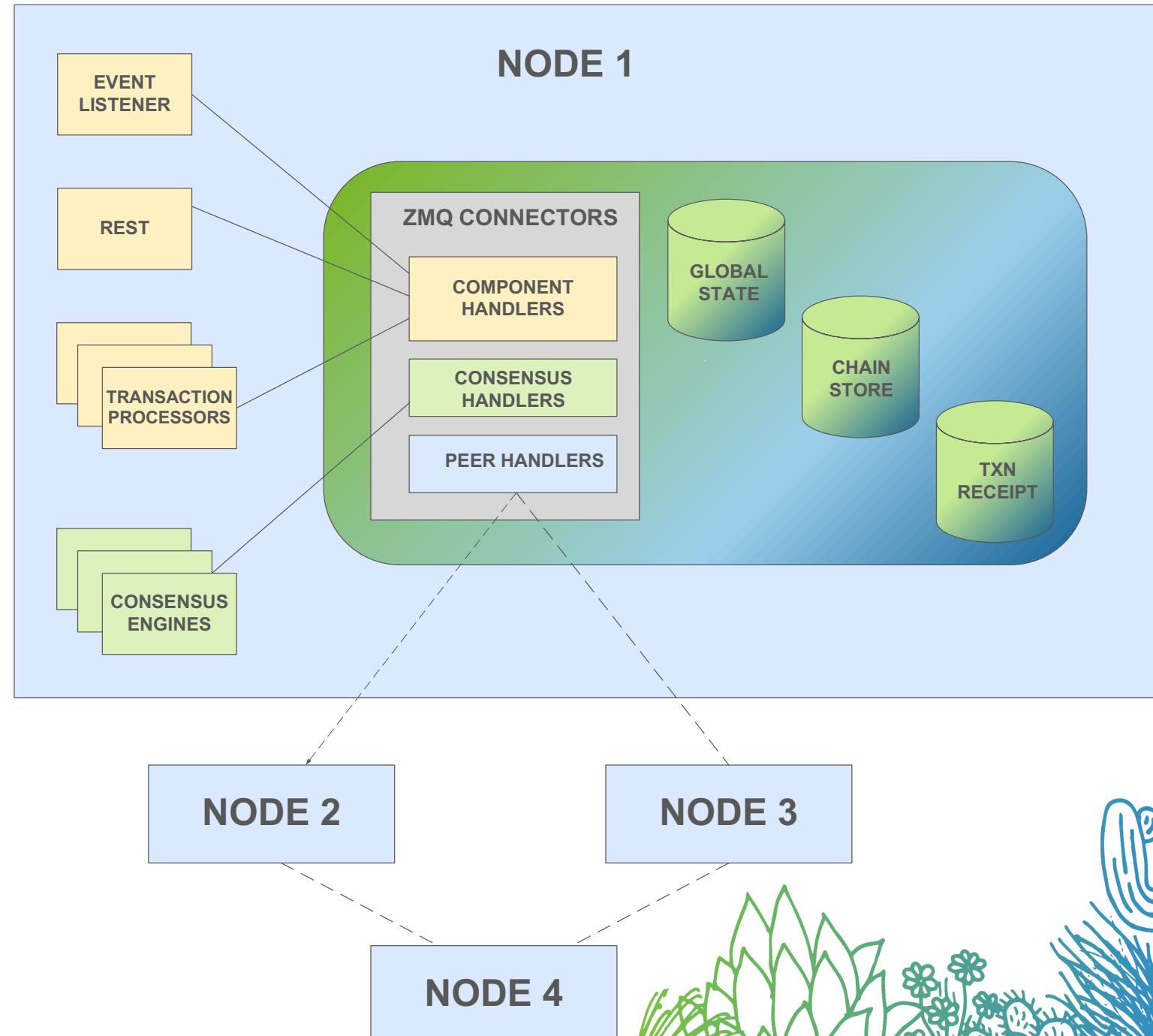
Hyperledger Sawtooth



Highly Modular Enterprise Blockchain Platform

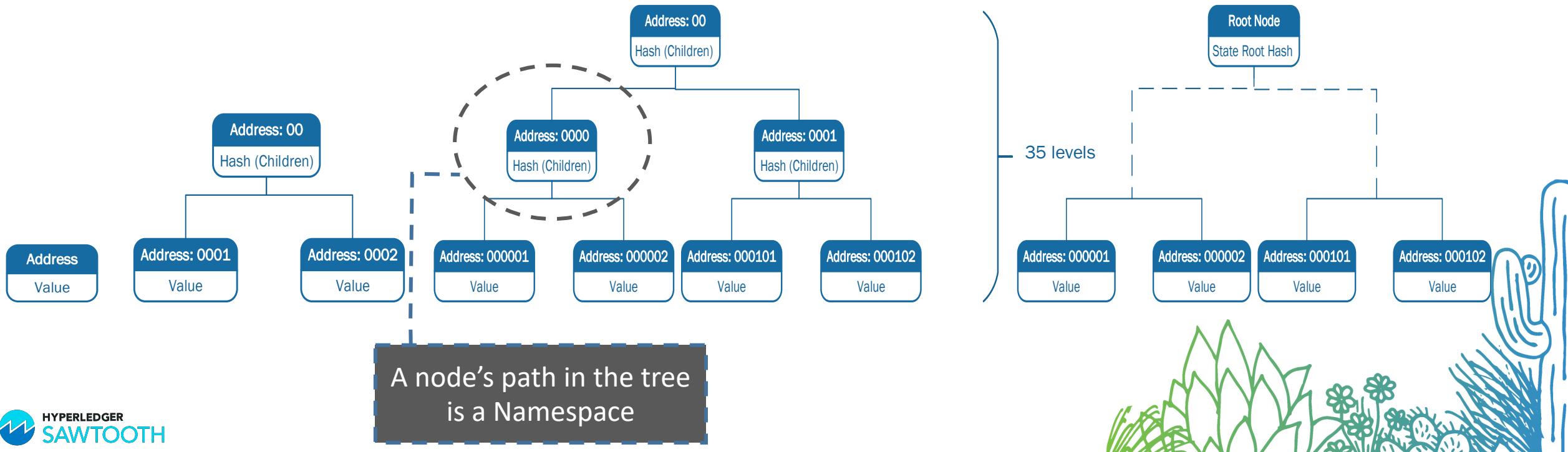


Component Architecture

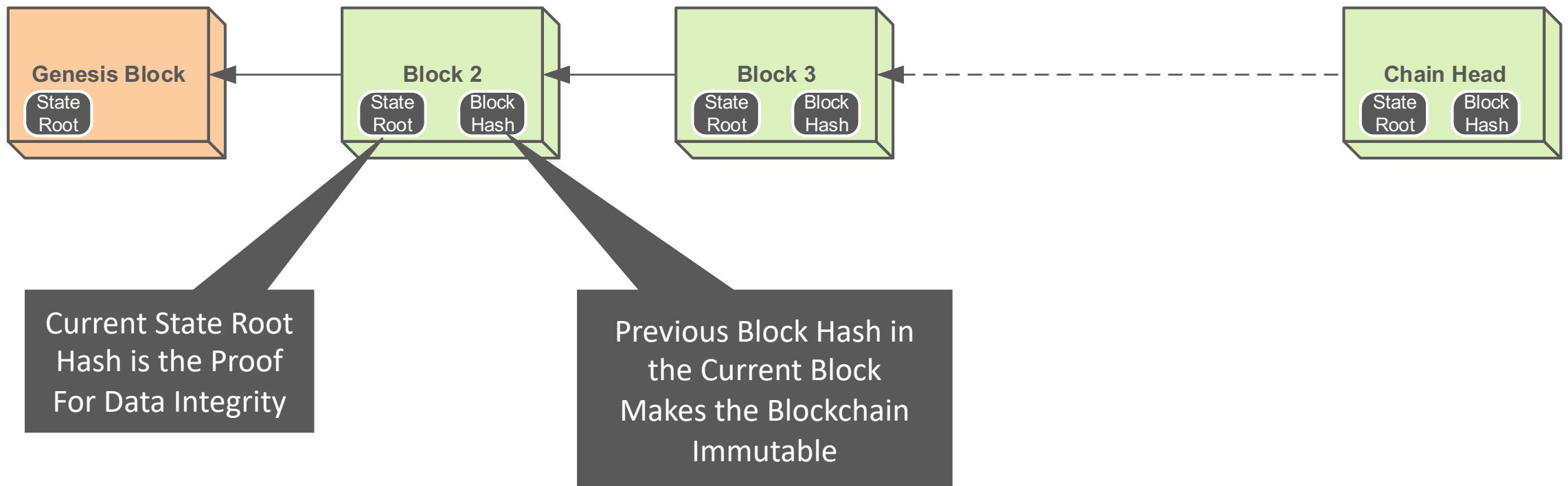


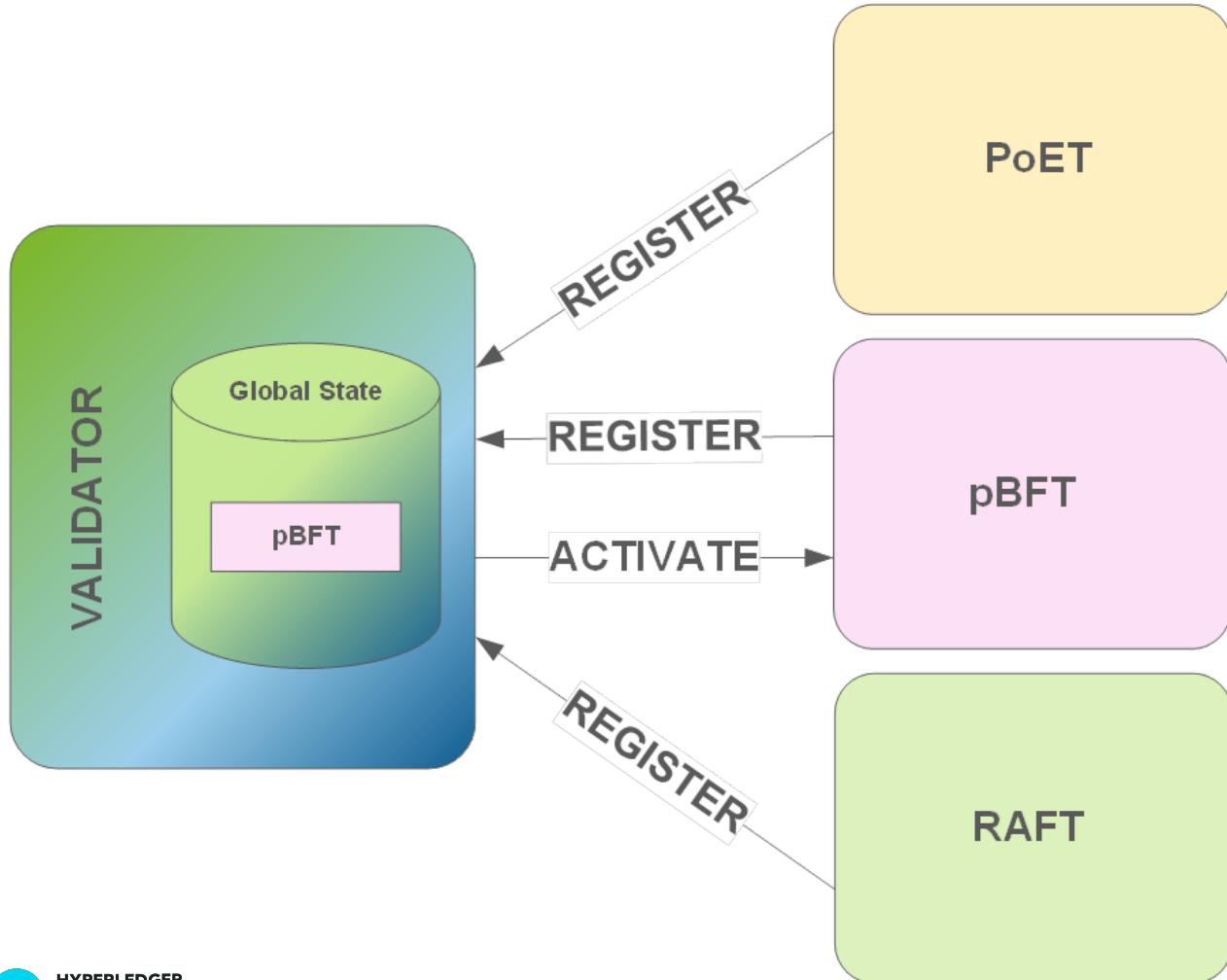
Global State and Addressing

Data For All The Transaction Families Are Stored In
A Single Instance Of **Merkle-Radix** Trie



State and the Block



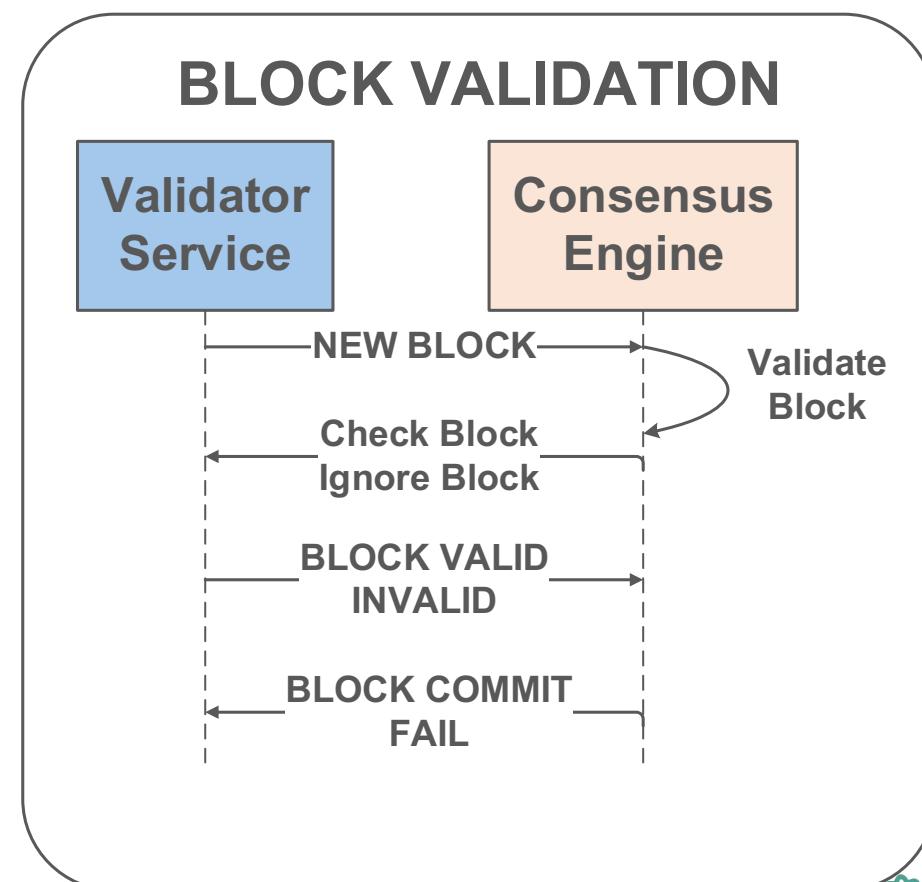
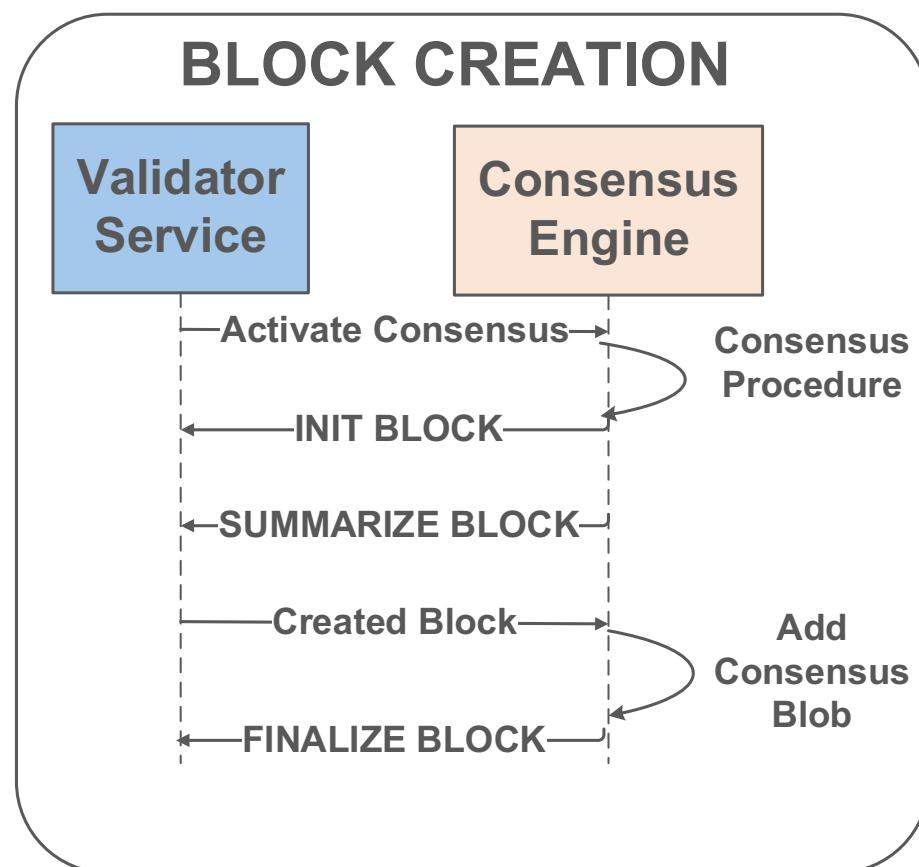


Consensus Engine

Mechanism By Which Blockchain
Nodes Agree Upon State

CFT	BFT
PoET SIM, RAFT	PBFT, PoET SGX
Forking	Fast Finality
PoET SIM, PoET SGX, Devmode	RAFT, PBFT

Consensus Engine Interaction

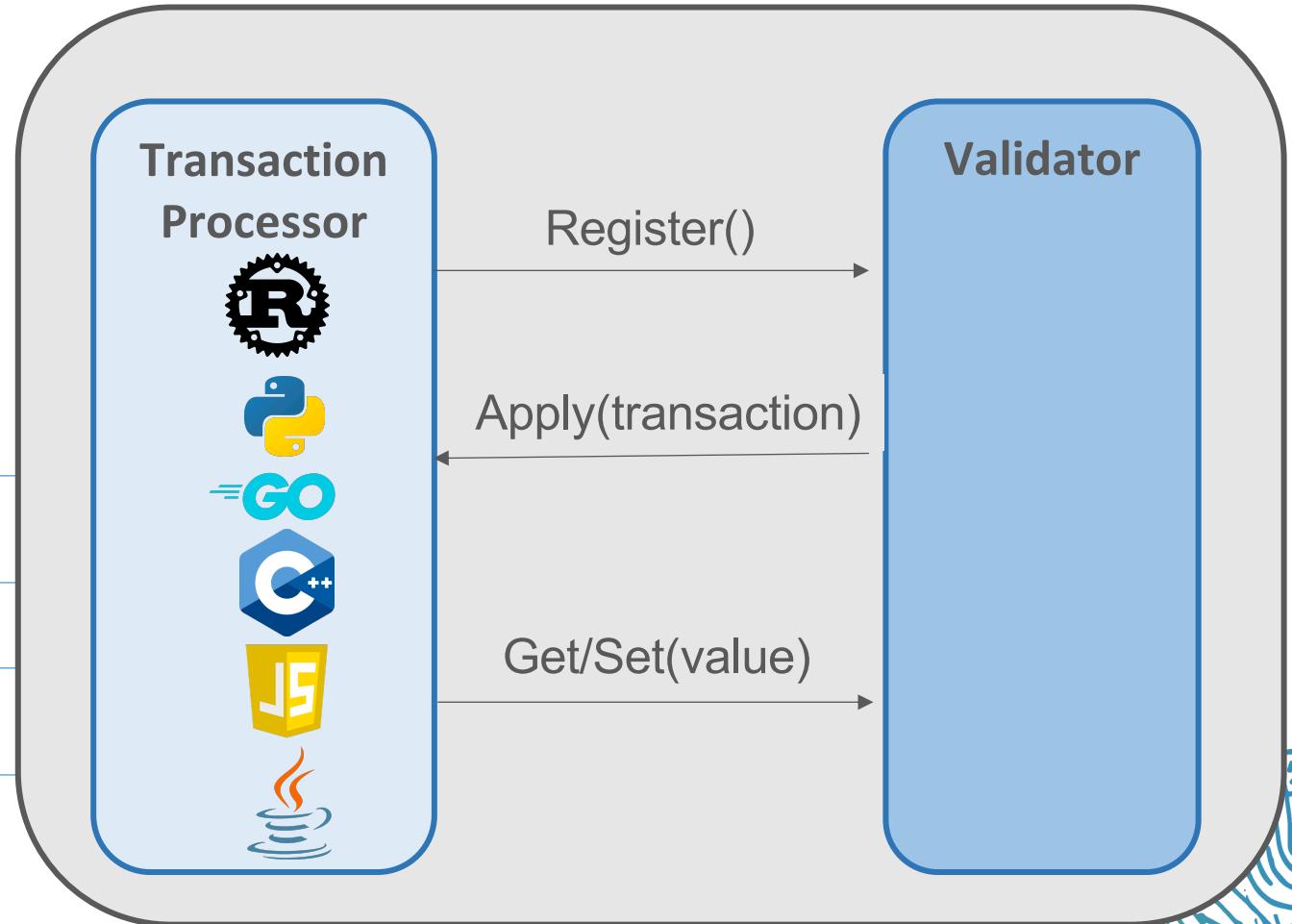


Transaction Processor

An **Engine** that Executes Application Business Logic

Accepts the Context From the Validator

Read/Write the State As Per Contract

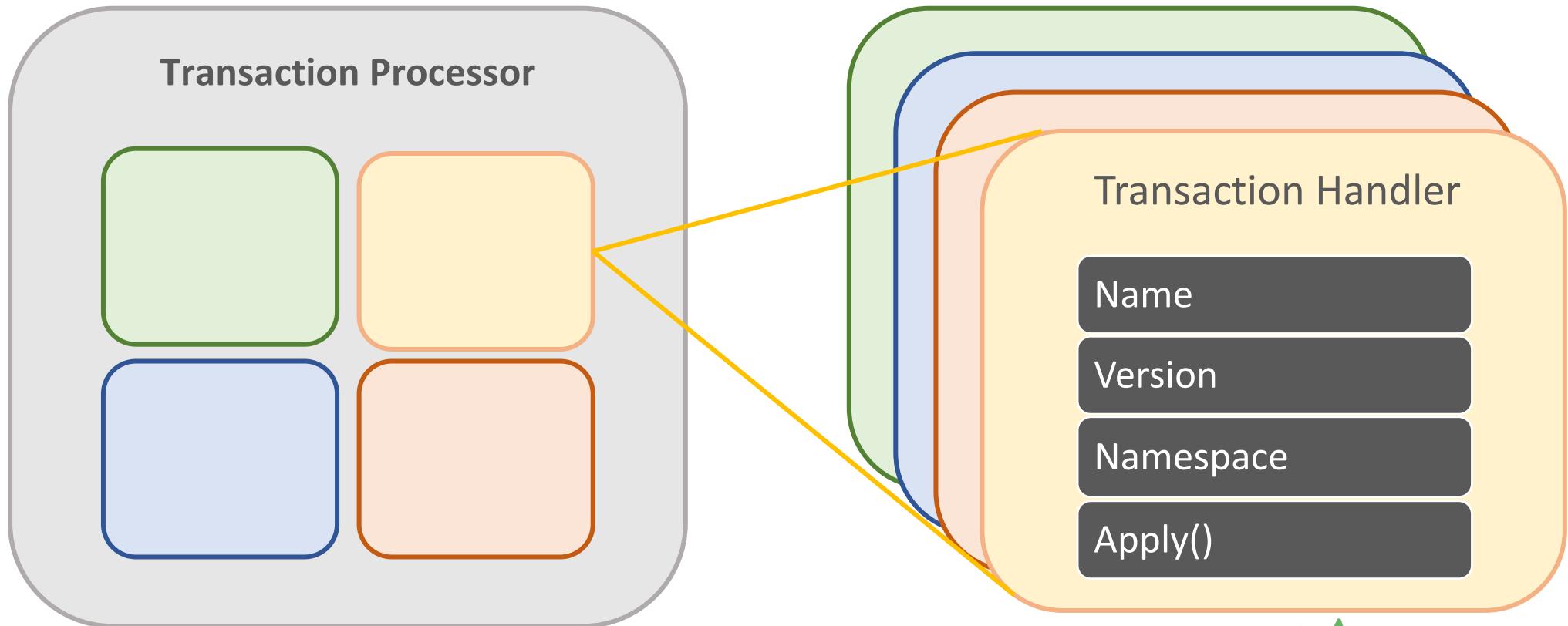




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Transaction Families

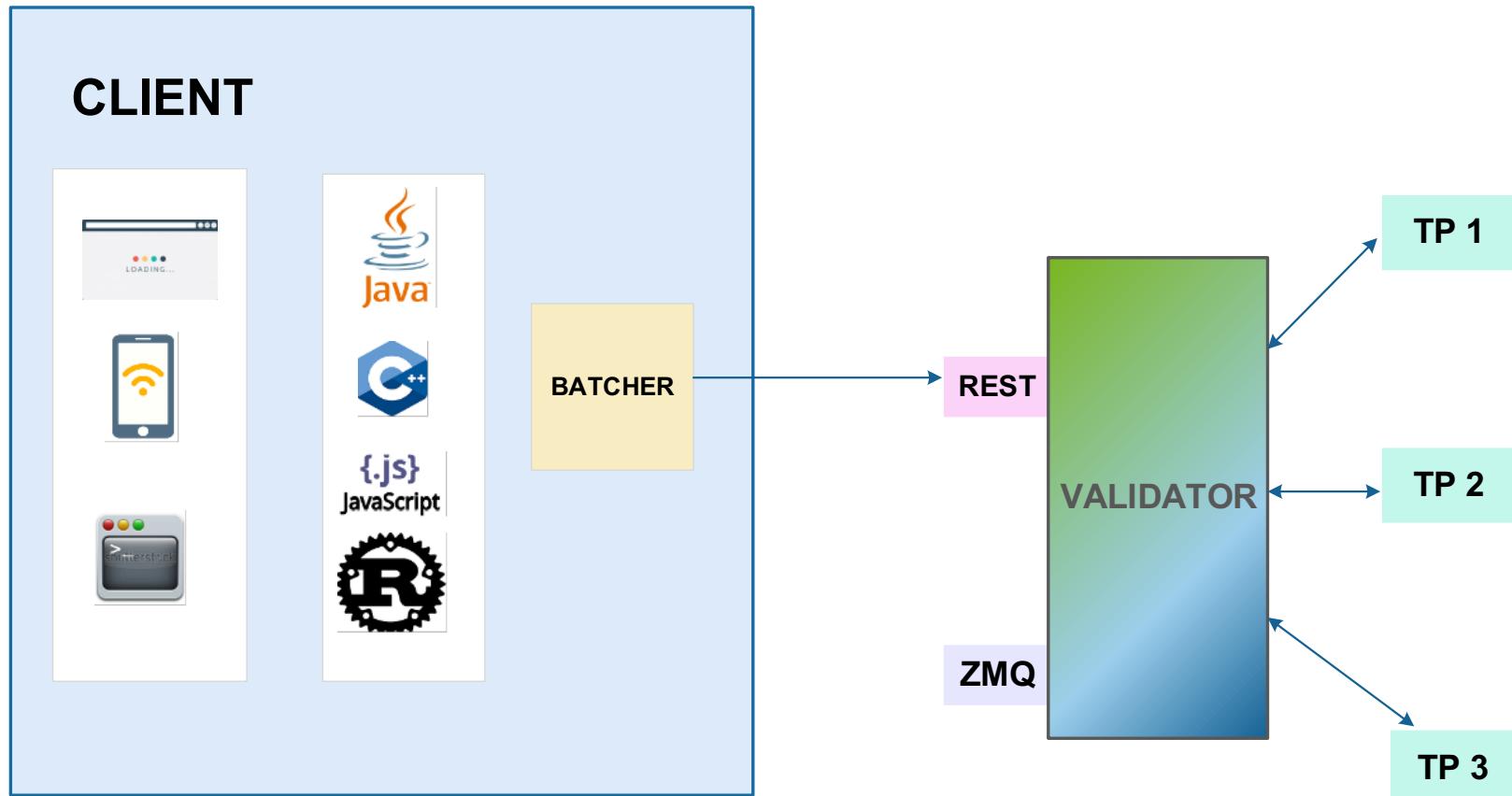




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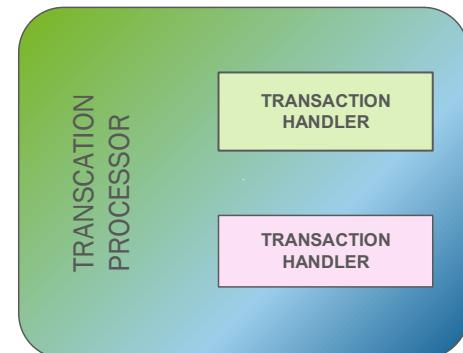
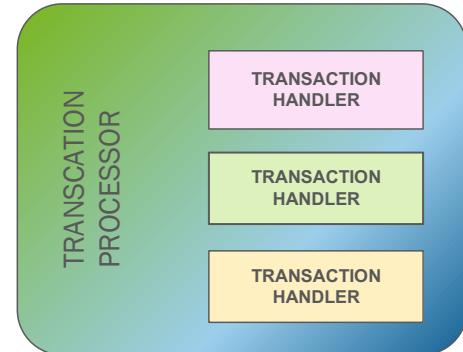
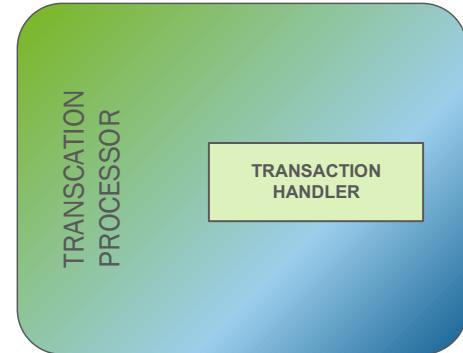
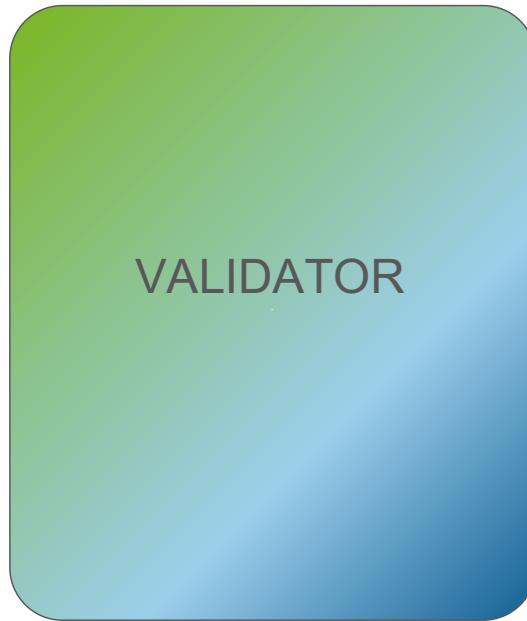
Client



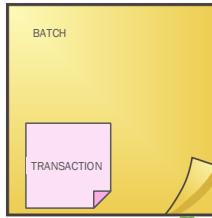
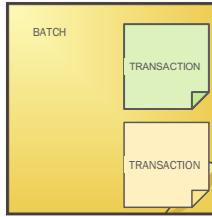
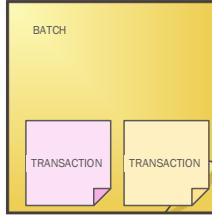
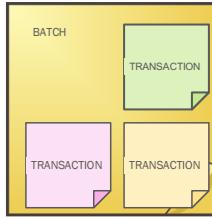


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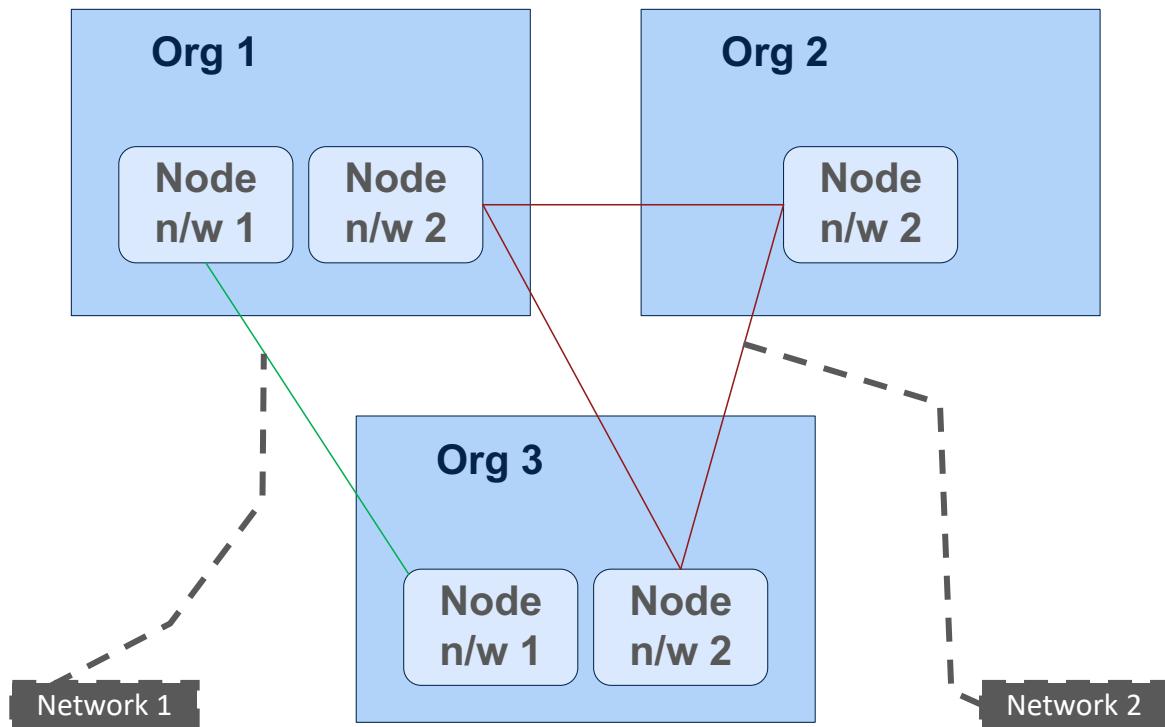
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Batches and Transactions



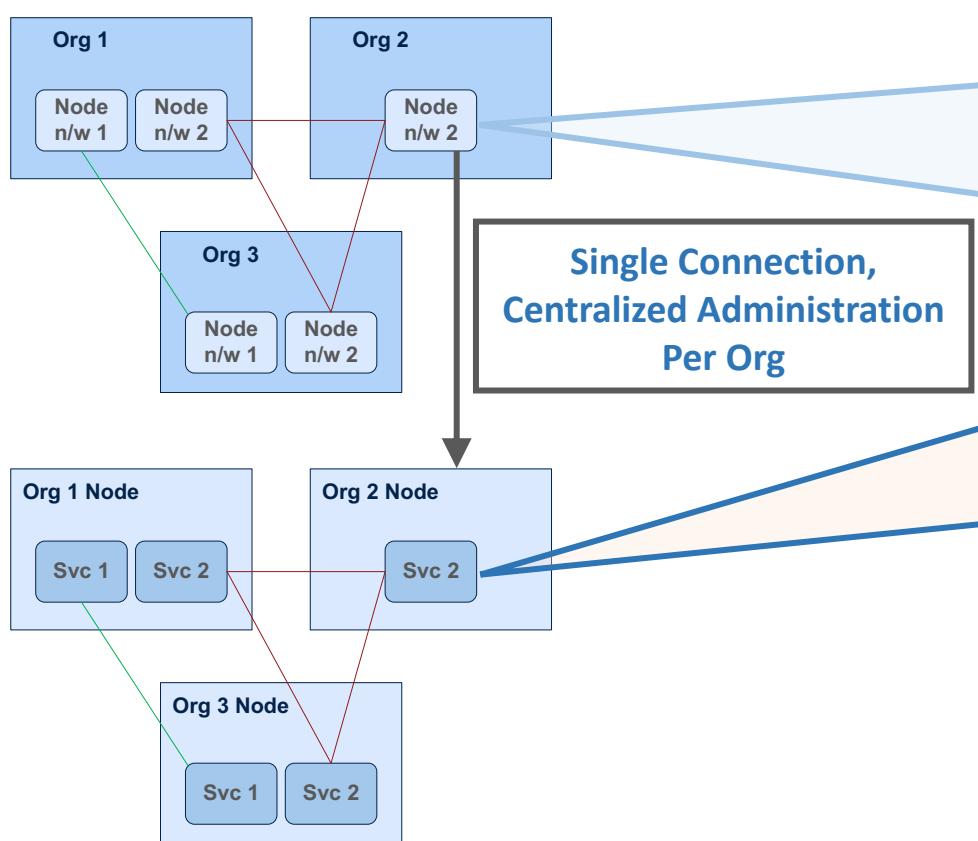
Privacy in Sawtooth



Permissioned Network, Known Participants Are Part of the Network

Read Protection Through A REST Proxy

Heading Towards Hyperledger Sawtooth 2.0



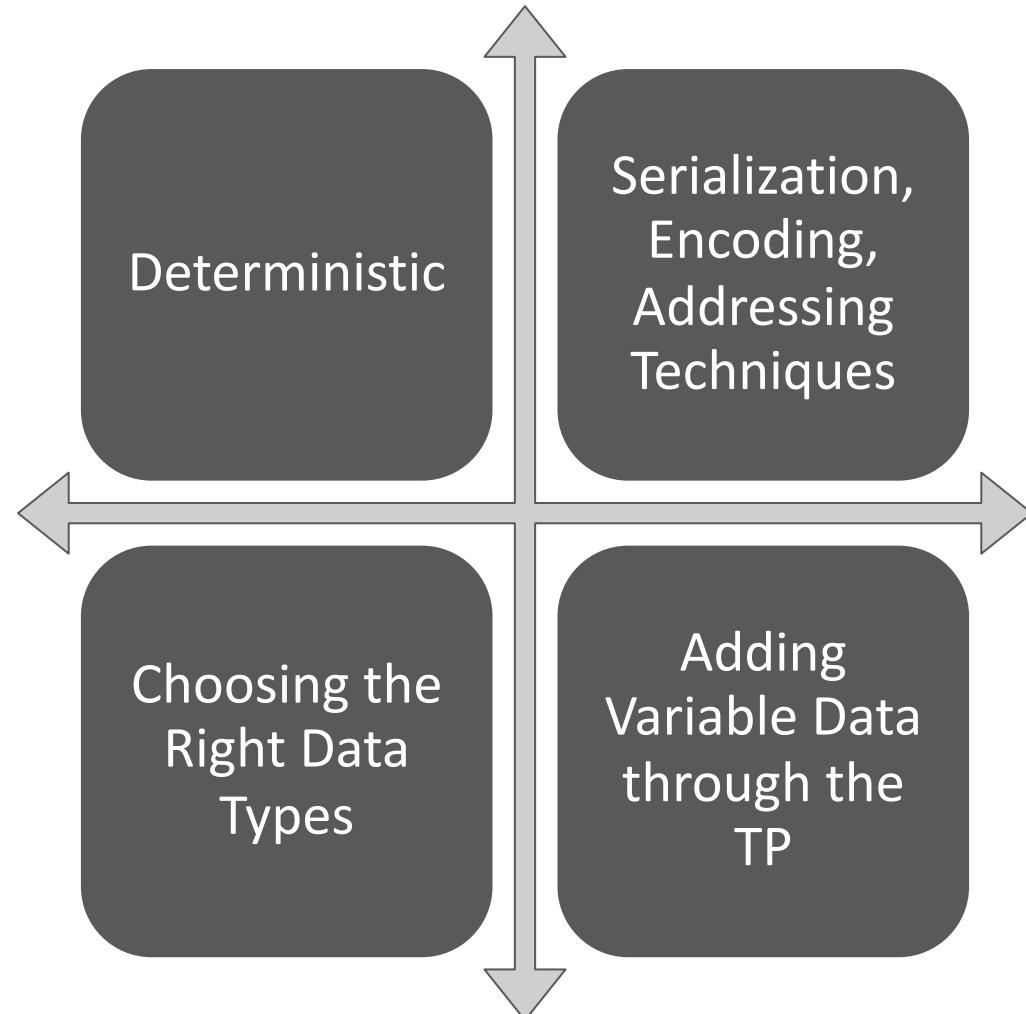


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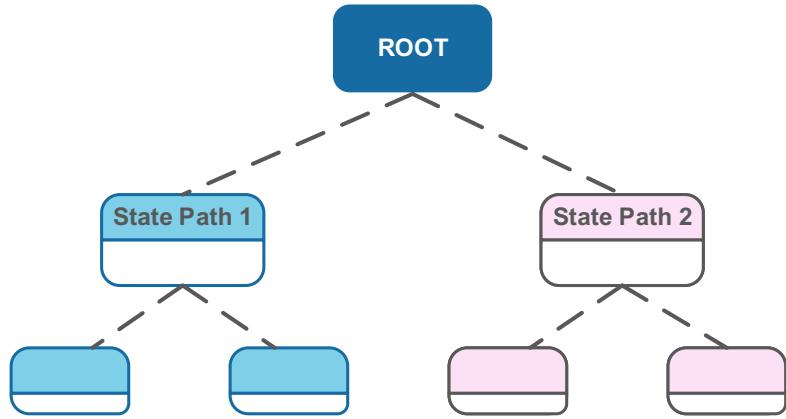
Design Patterns Doing It the Right Way Make the Most Use Of Platform Capabilities



Design Considerations

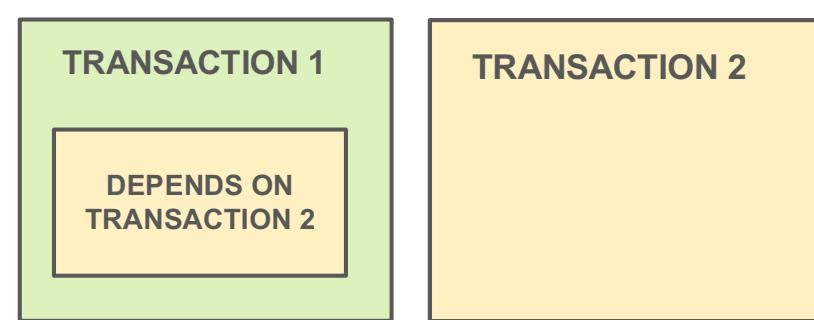


Parallel Execution

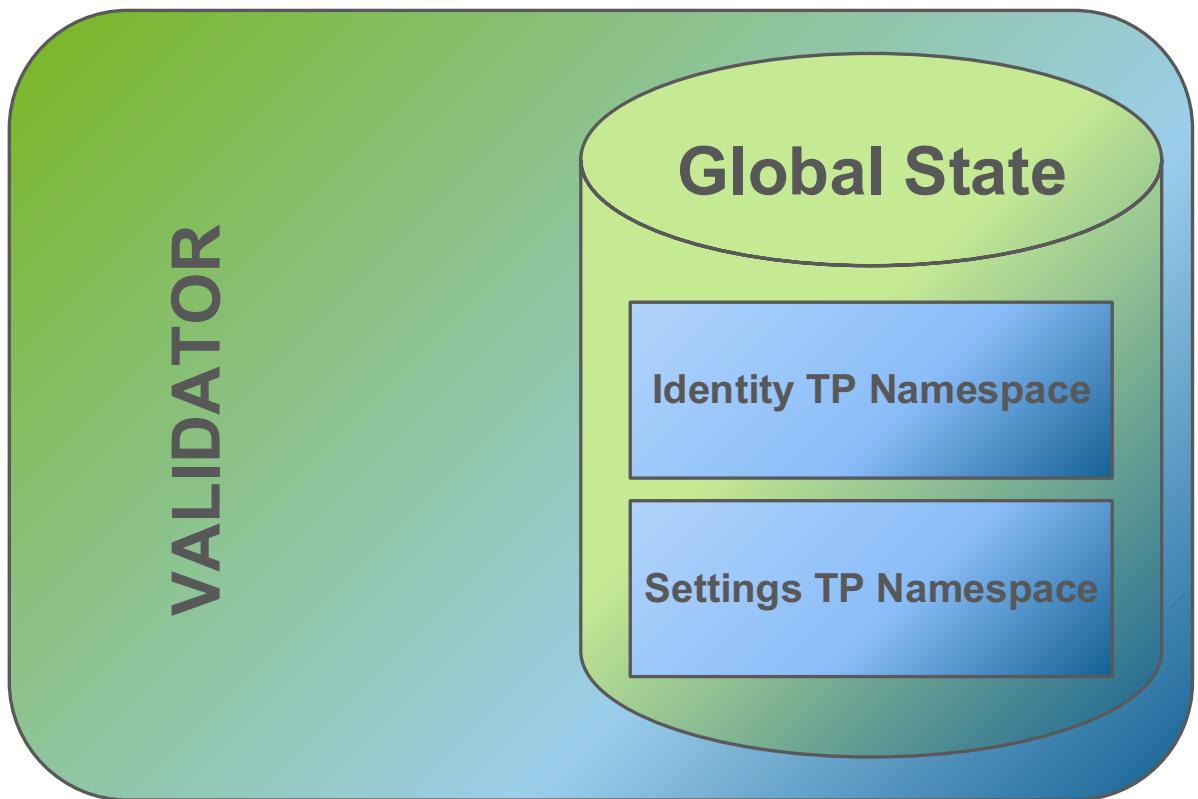


If transactions have overly broad input and output addresses,
it impacts on performance of parallelism

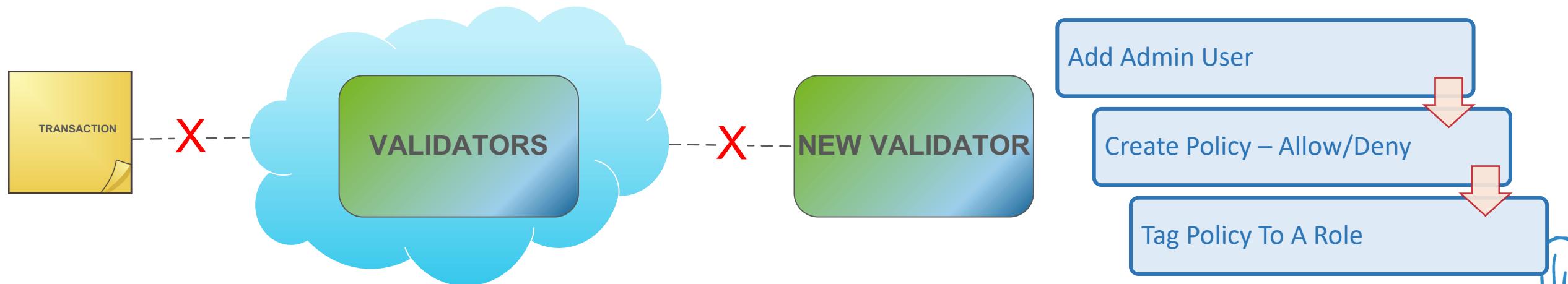
All predecessor transactions in batch must be executed before
executing the transaction for which it's a predecessor



Identity and Access Management



Transactor and Validator Permissioning





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Transactor and Validator Permissioning

HANDS ON – <https://github.com/arsulegai/hgf2020>

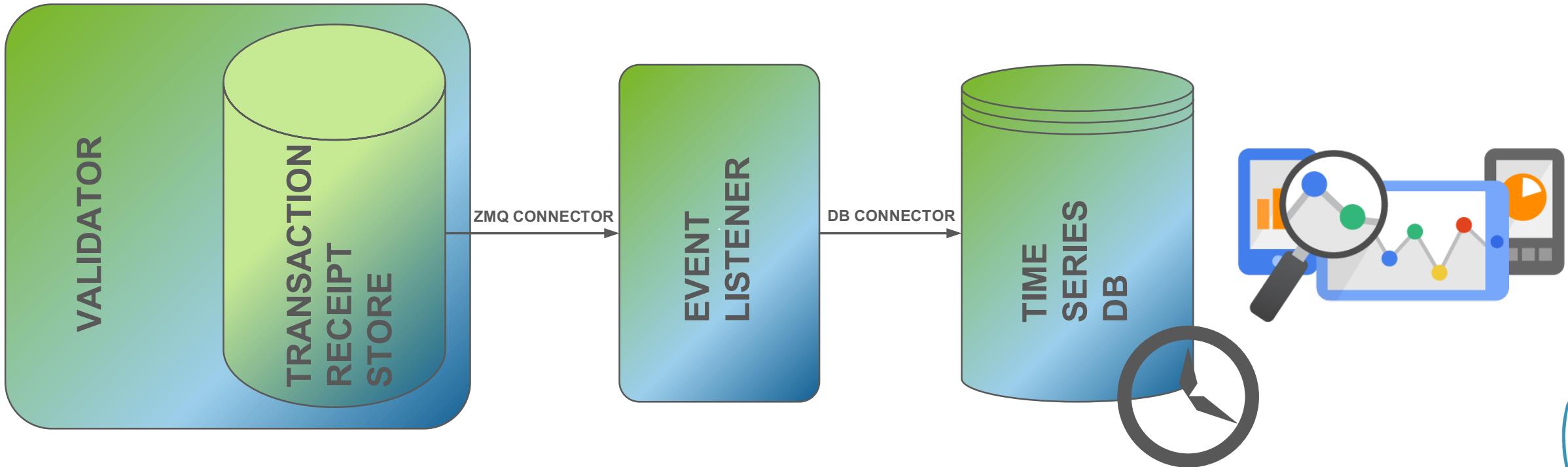




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Auditing Historic Transactions





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Event Handling

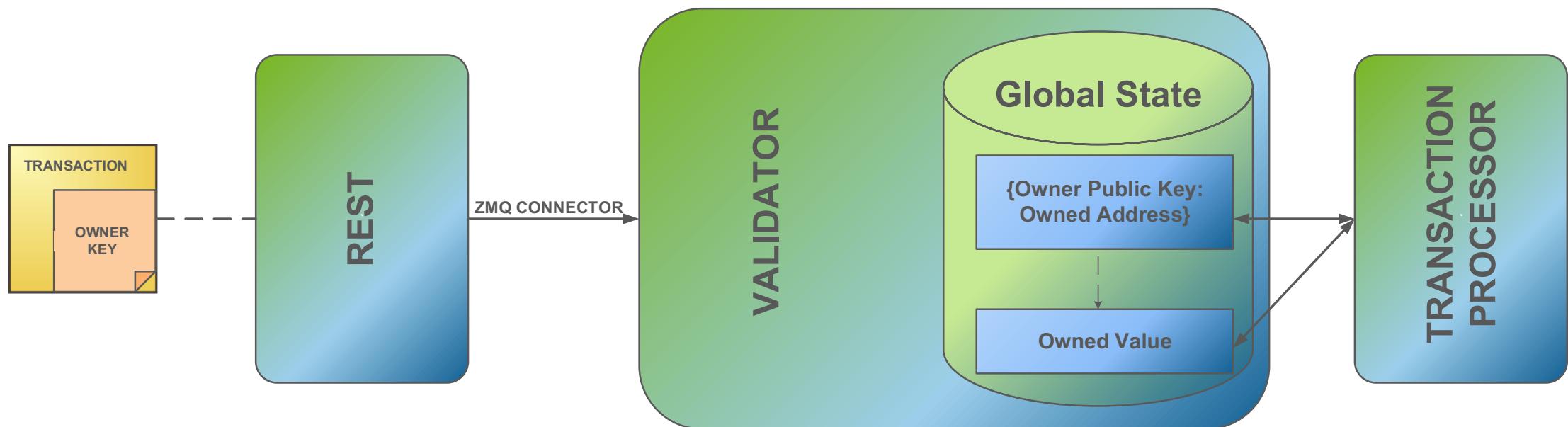
HANDS ON – <https://github.com/arsulegai/hgf2020>



Set Interval For Transaction Acceptance

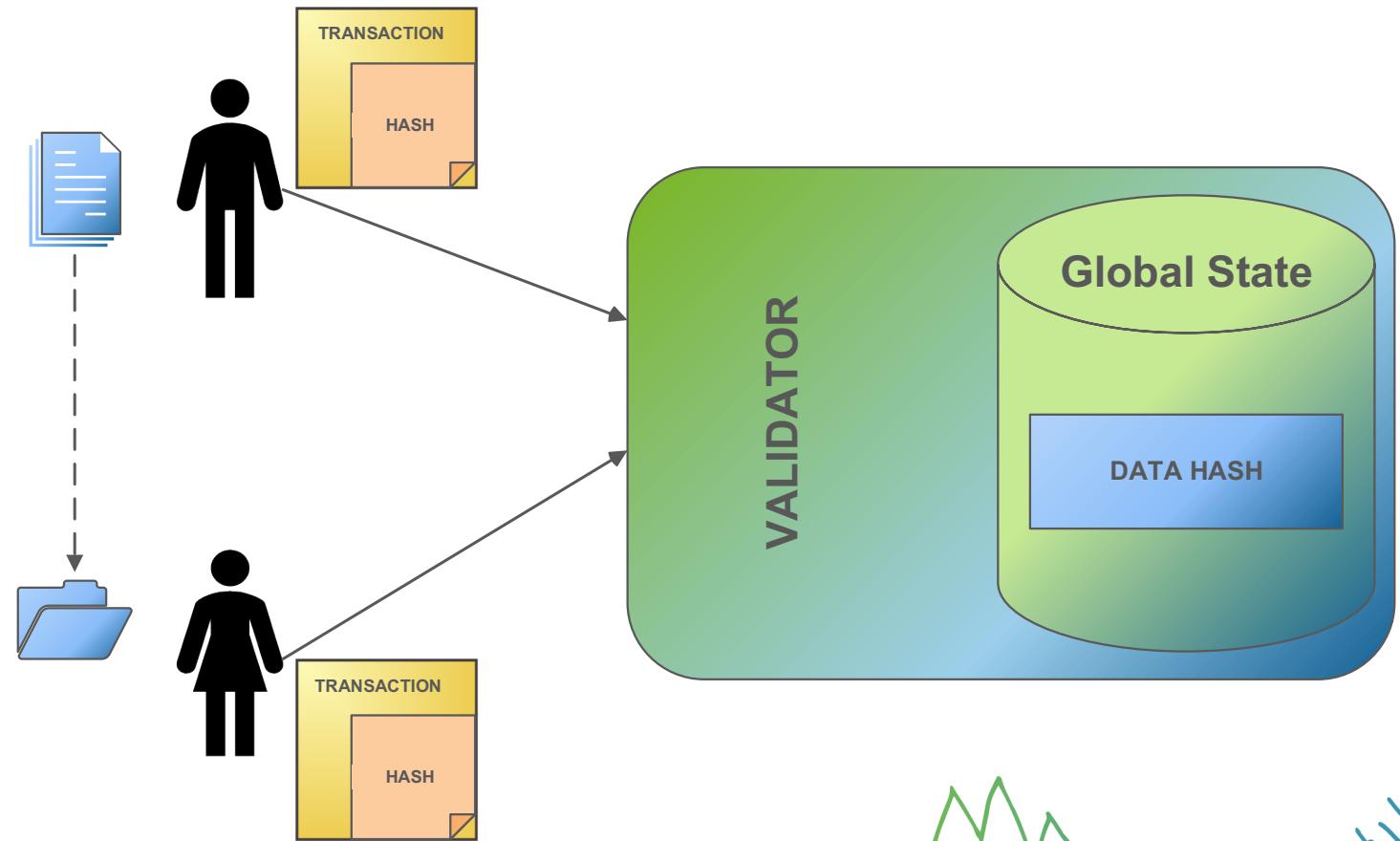


Ownership Pattern

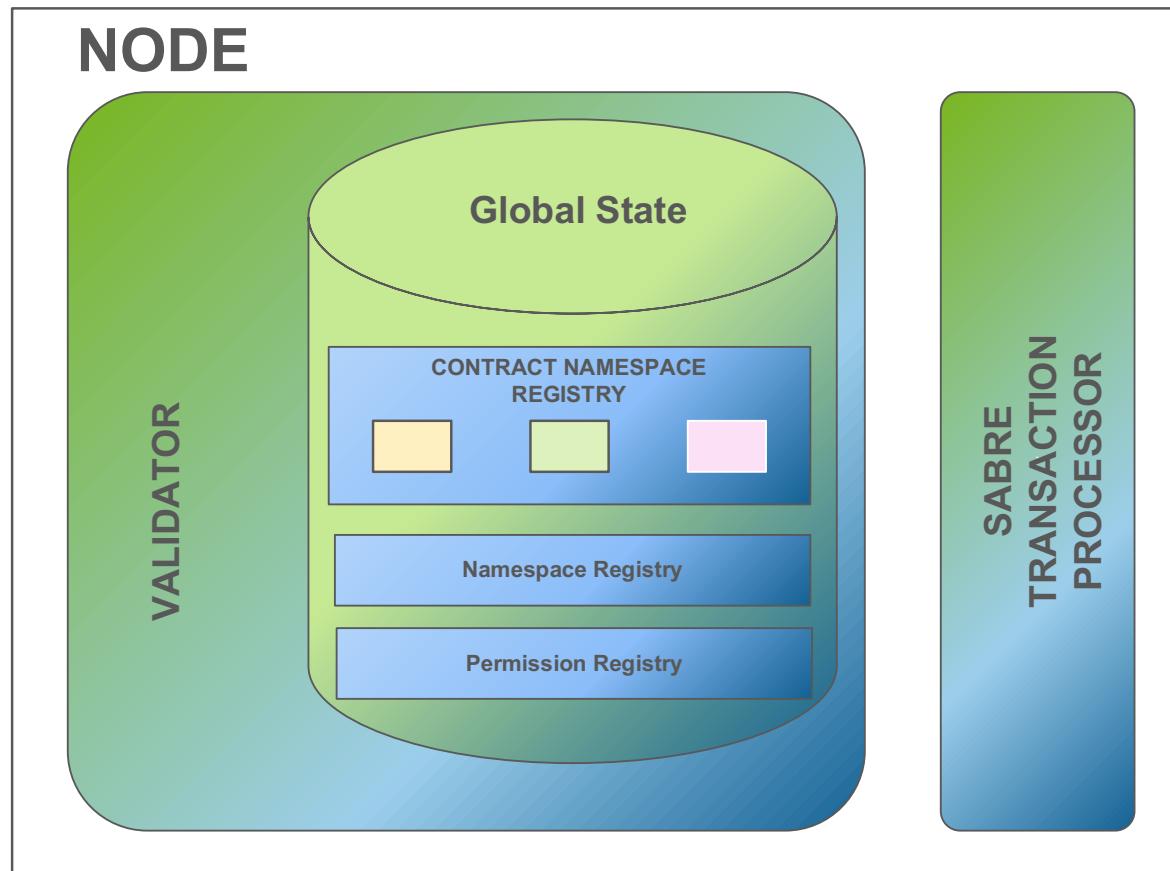


Securing Digital Asset

Off-Chain Transfer,
But On-Chain Integrity
Check



On-Chain Smart Contract Execution



CONTRACT 1

CONTRACT 2

CONTRACT 3

Sabre-Smart Contracts
are like stored procedure
in database but more
powerful

WASM
Stack Based Virtual Machine
Lightweight



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Converting to Sabre Smart Contract

HANDS ON – <https://github.com/arsulegai/hgf2020>



Testing Smart Contracts

Test Network

- A network setup to test Transaction Processor
- Useful for long running test setup

Simulated Network Setup

- Python tests can make use of `sawtooth_processor_test`





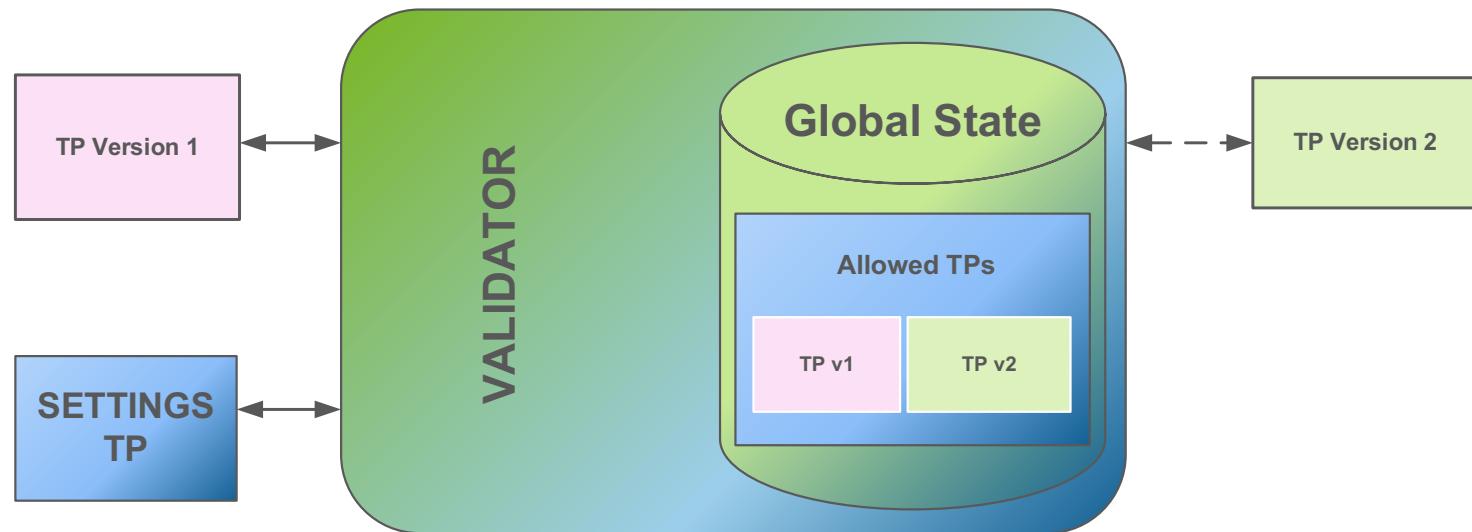
Transaction Processor Upgrade

Archive Current TP

Attach A New Version of TP

Allow Newly Attached TP

Inform Clients To Send
Transactions To Newer Version





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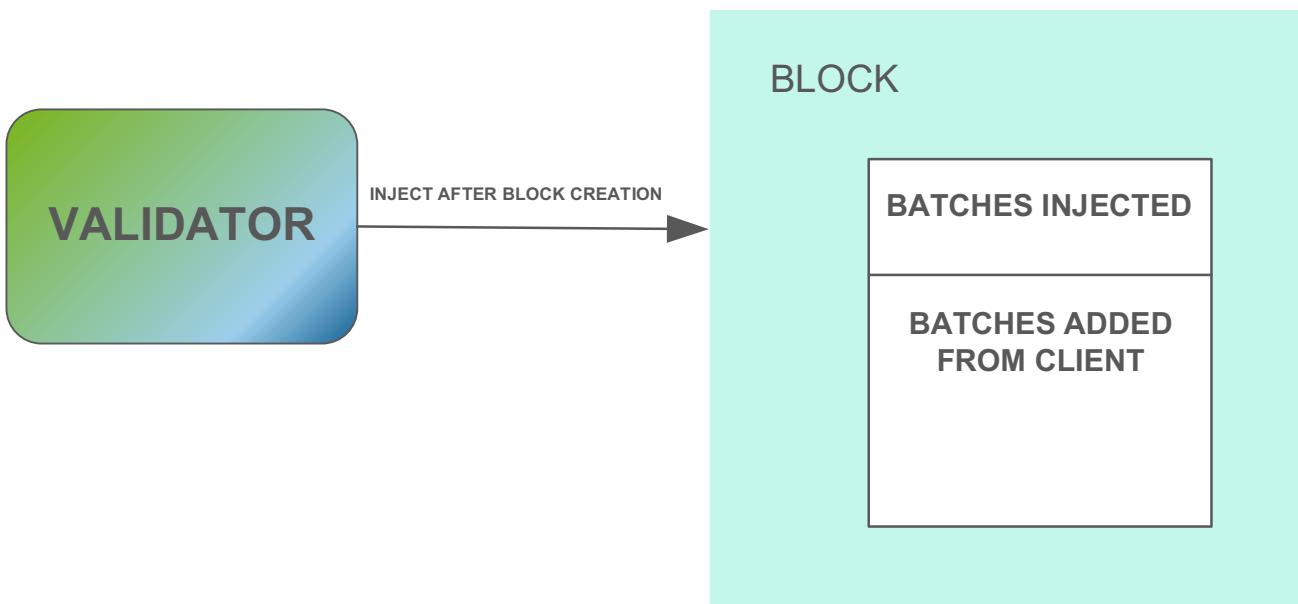
Transaction Processor Upgrade

HANDS ON – <https://github.com/arsulegai/hgf2020>



Batch Injection

Feature of Injecting Transactions Directly Into The Block



Use Cases

- Useful information for TPs, which cannot be set through Client transactions
 - Block Number
 - Timestamp
- Automatic transaction submission in response to a state



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BlockInfo Injector – Out of the Box

HANDS ON – <https://github.com/arsulegai/hgf2020>





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Write Your Own Smart Contract

Template Available – <https://github.com/arsulegai/hgf2020>





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Thank You