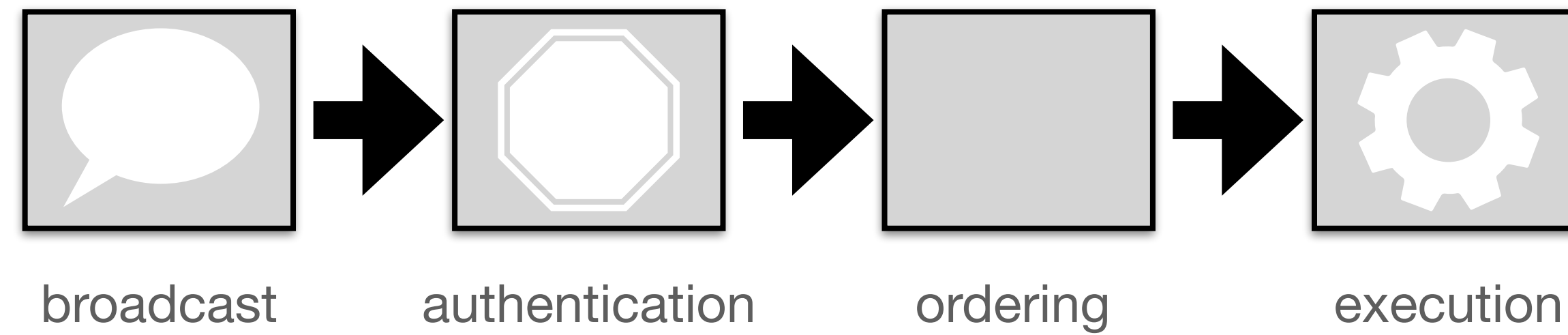


Hyperledger Fabric

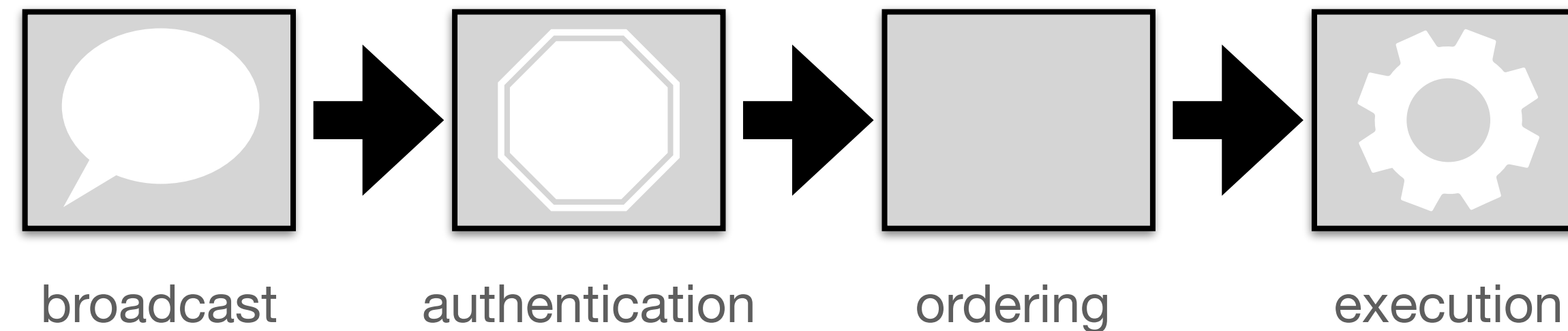
Execute-Order pipeline

Leander Jehl

Transaction processing pipeline

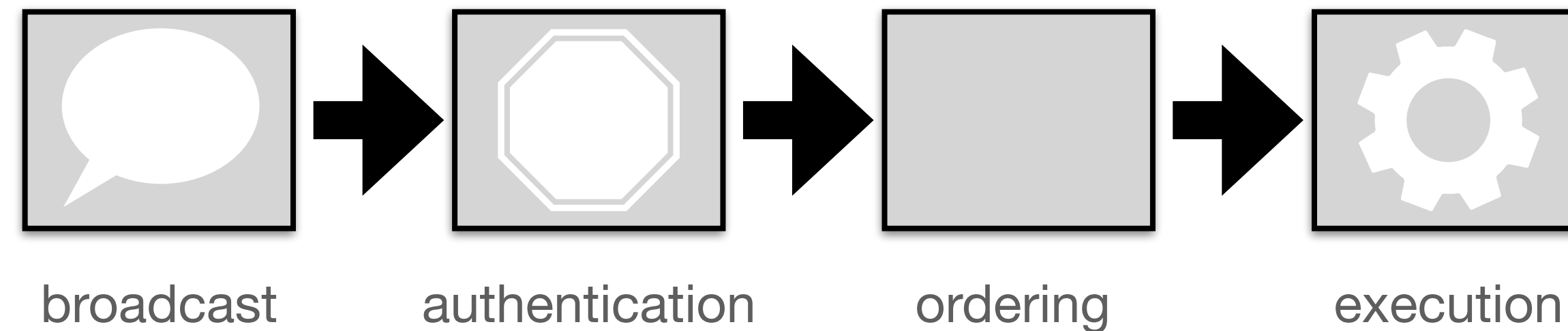


Transaction processing pipeline



- broadcast: send out transaction requires network resources
- validation: requires state
- ordering: requires coordination
- execution: requires state, must be deterministic.

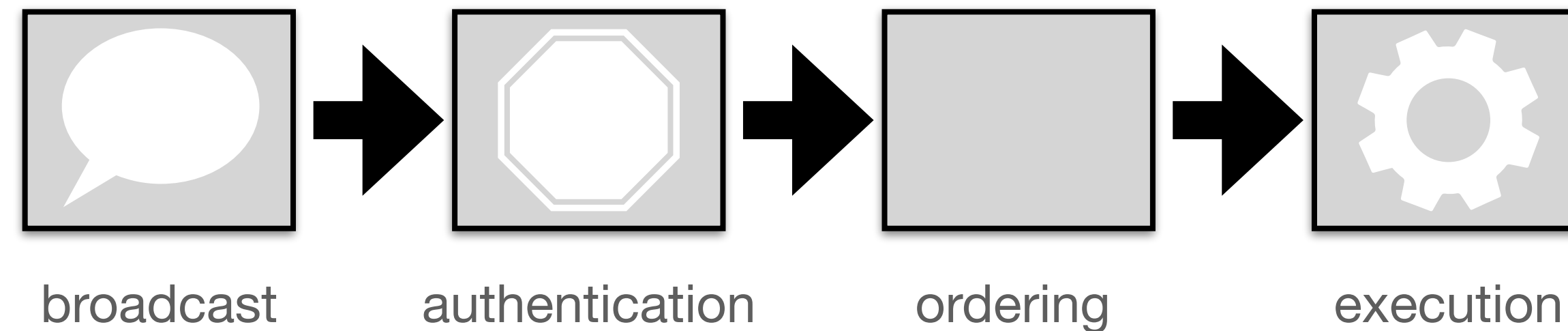
Transaction processing pipeline



- broadcast: send out transaction requires network resources
- validation: access rights
- ordering: requires coordination
- execution: requires state, must be deterministic.

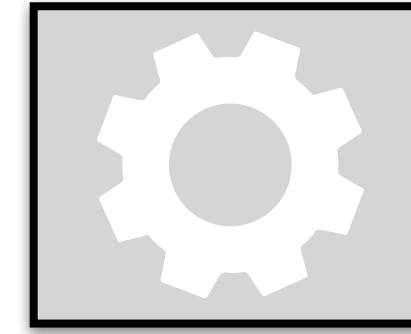
What is the bottleneck?

Transaction processing pipeline



- For complex workloads, and small scale BFT systems, execution is the bottleneck.
 - Single threaded execution to be deterministic
 - Can be complex workloads
 - Execution has privacy concerns (need access to data)

Transaction execution

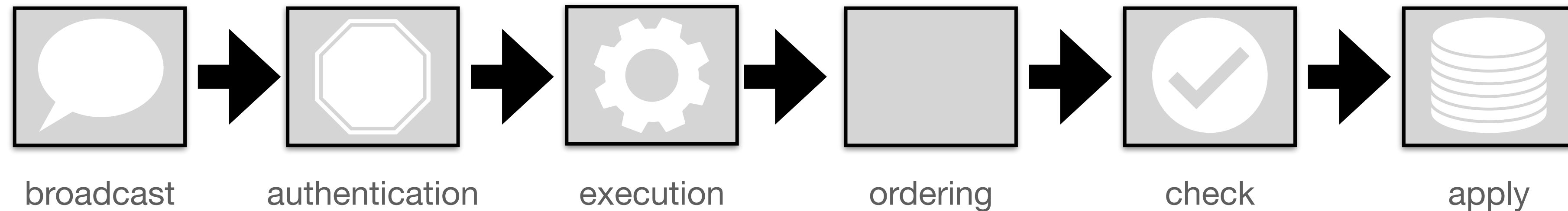


execution

Two approaches exist for crash fault tolerant systems:

- **Deterministic processing:** Each replica can process transaction and arrive at the same result.
- **Applying state change:** One replica executes transaction. Records state change Δ . All replicas apply Δ .

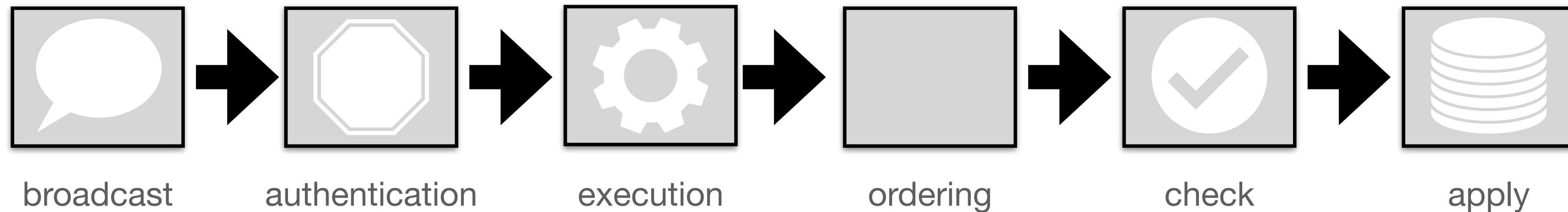
Transaction processing in Hyperledger fabric



- Execution happens on before ordering.
- Execution policies, i.e. require n nodes to get the same result.
- Changes are submitted to ordering with signature from n nodes.
- During check, possibly inconsistent transactions are removed (aborted).

Transaction processing in Hyperledger fabric

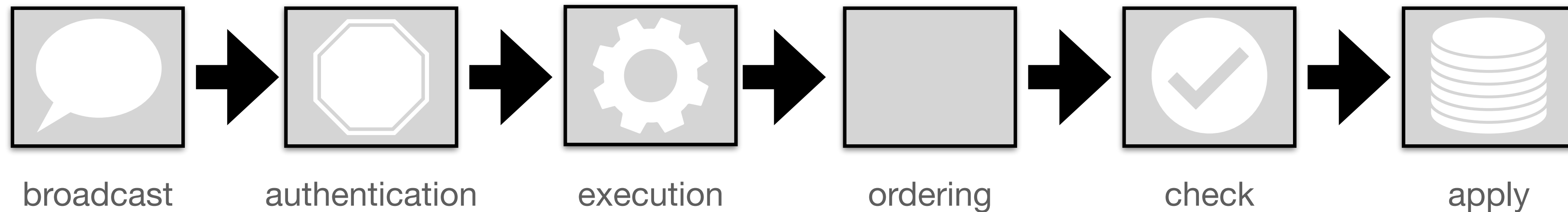
State



- State is organized as (key, value) pairs.
- Execution result records, new values for certain keys and which keys have been read.
- Based on read and write keys, *check* can remove inconsistent transactions

Transaction processing in Hyperledger fabric

State



- State is organized as (key, value) pairs.
- Execution result records, new values for certain keys and which keys have been read.
- Based on read and write keys, *check* can remove inconsistent transactions

For all stages but execution,
values can be encrypted.

Use cases and problems

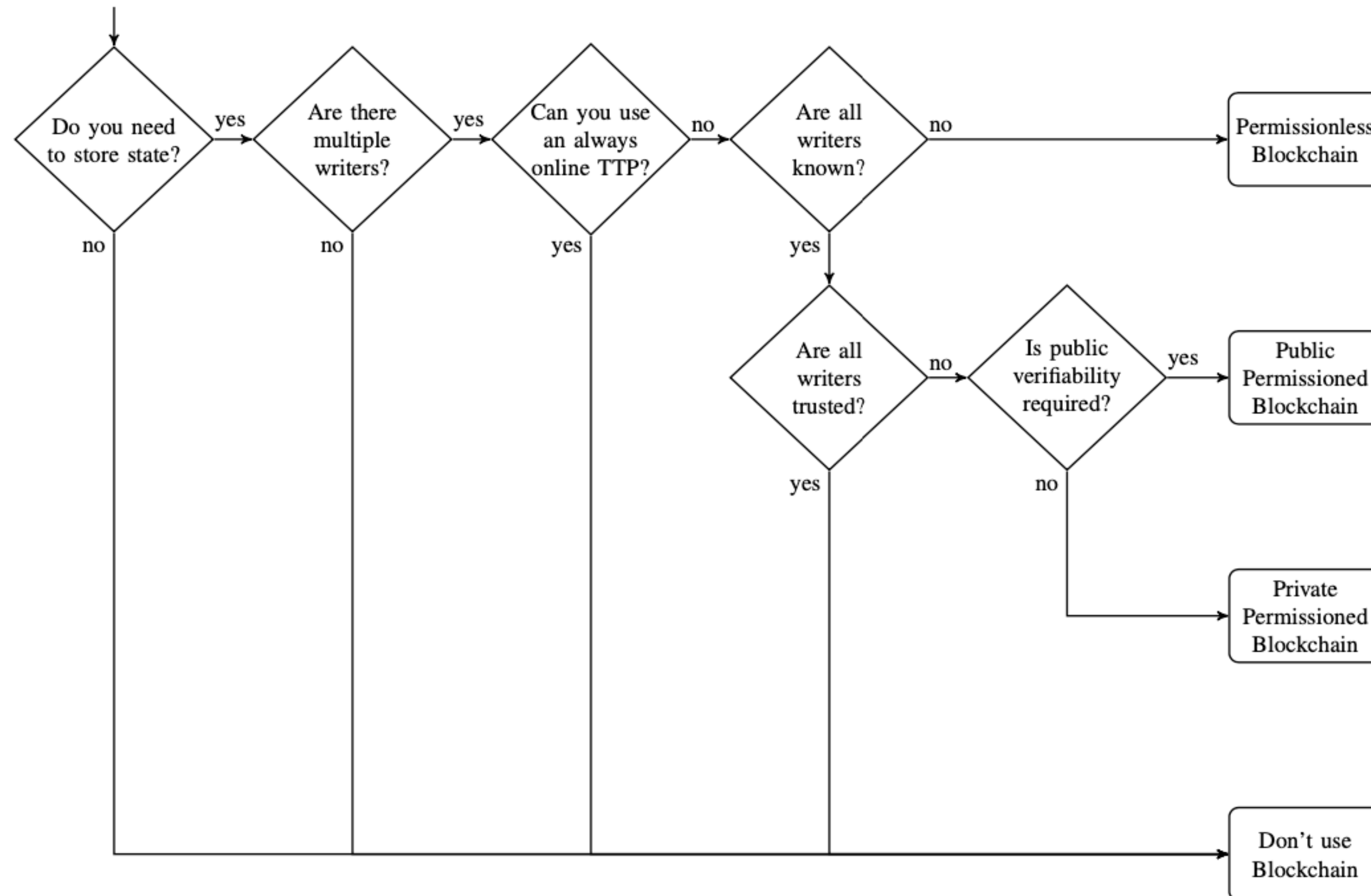
Use cases

Blockchain

- Financial
- Accountability
- Digital assets

Use cases

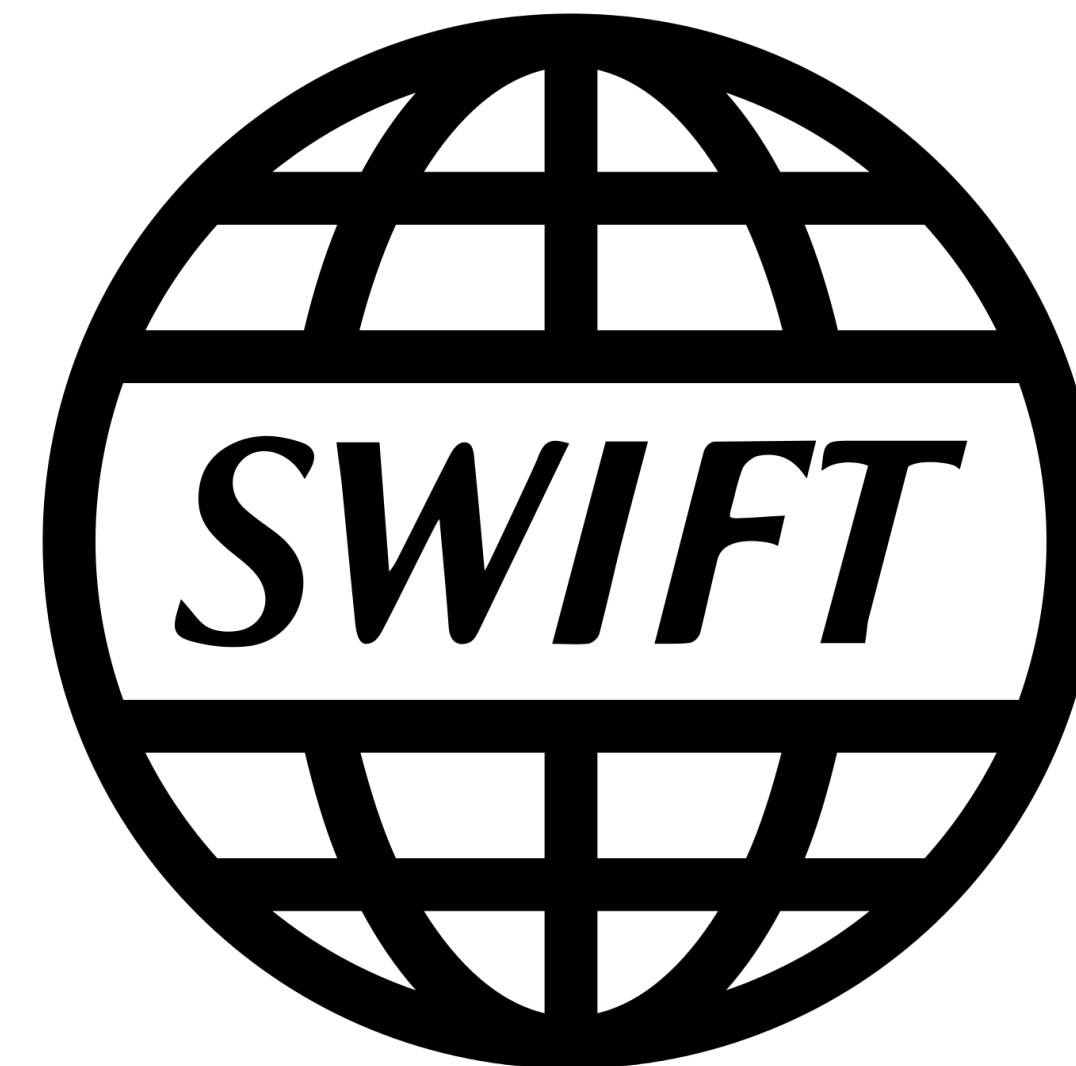
Do you need a blockchain?



Use cases

Blockchain

- Financial
 - International bank payments
 - Banking the unbanked



Use cases

Blockchain

- Digital assets
 - Buy and sell digital goods
 - What goods?

Use cases

Blockchain

- Accountability
 - Blockchain datastructure is used as log.
 - E.g. record data access
 - E.g. record decisions (autonomous vehicles)

Use cases

Blockchain

- Supply chain
 - Idea: Record each step in manufacturing on the chain.
 - Can trace faulty components
 - Can prevent fraud
 - Verify manufacturing conditions
 - Problem: Is my wine the wine certified on blockchain?

Use cases

Blockchain

- Proof of intellectual property
- E-Voting
- IoT