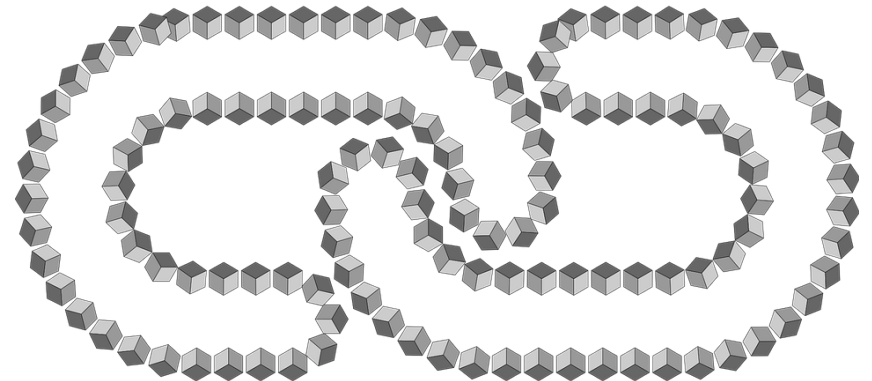
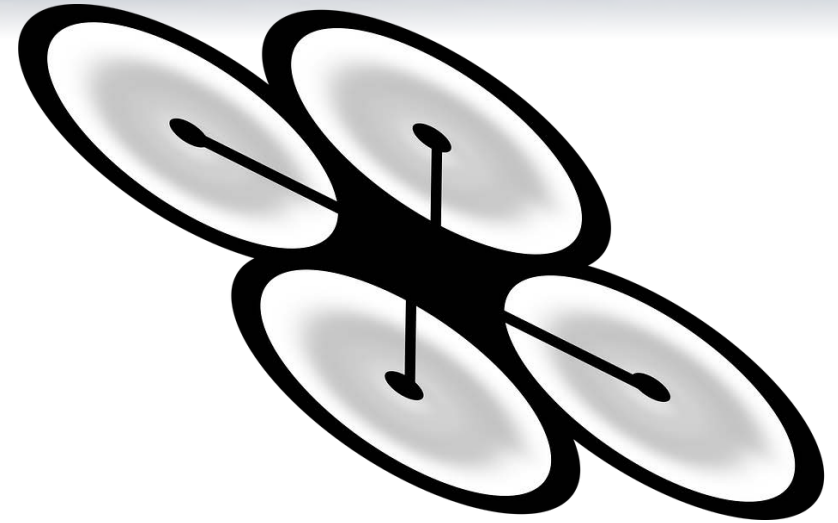




Blockchain in UAM: Secure Data Exchange and Storage

April 2024

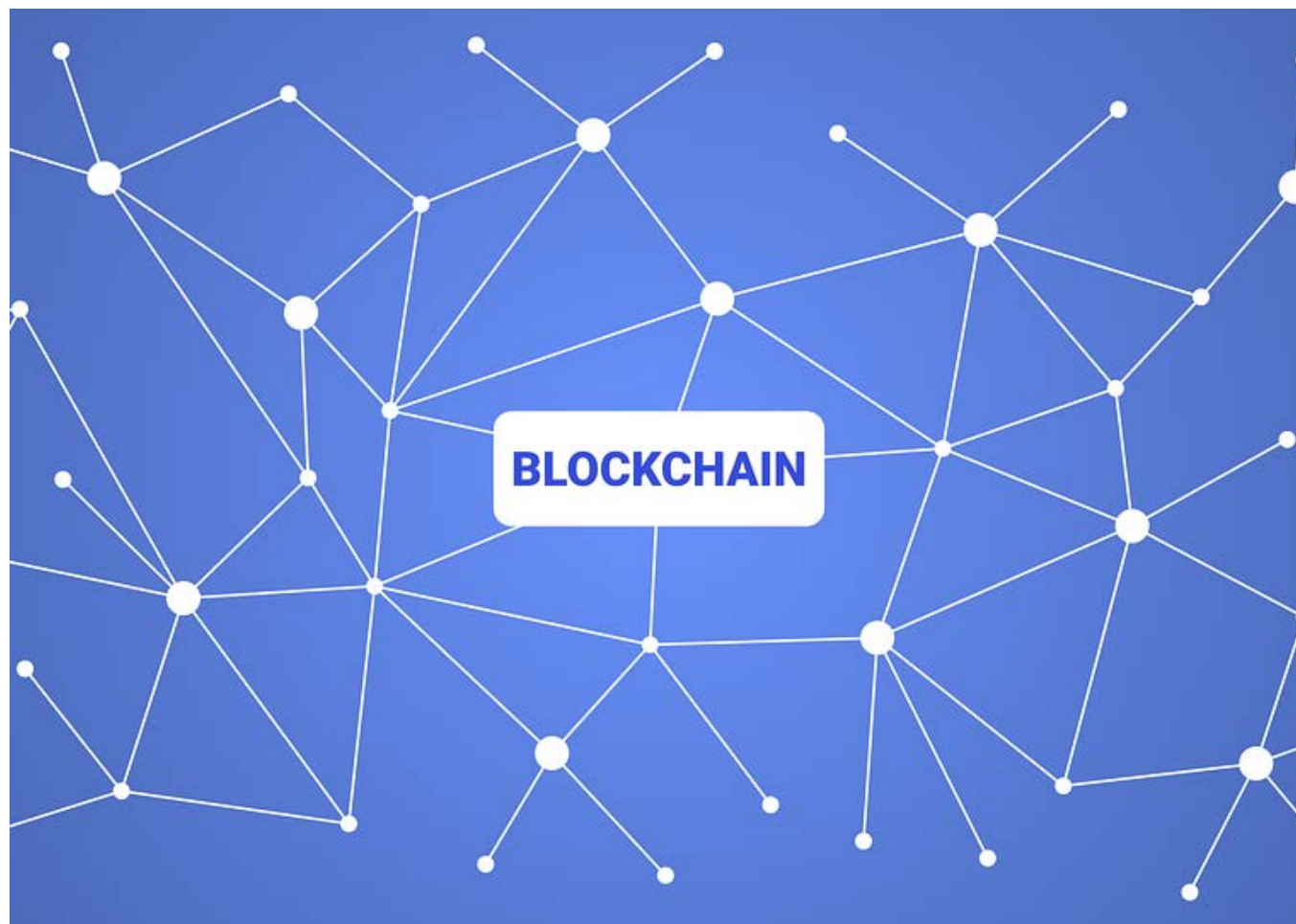




Contents



- Blockchain
- Hyperledger Fabric
- Urban Air Mobility
- Justification for Blockchain in UAM
- Blockchain Network
- UAM Simulation
- Takeaways, Concerns, and Ongoing Work



- Ledger / database
- Distributed
 - Data is replicated across participants
 - Any participant can add data
 - Participants converge on state using a consensus mechanism
- Immutable
 - Ledger is append-only
 - Maintains a record of modifications



HYPERLEDGER FABRIC

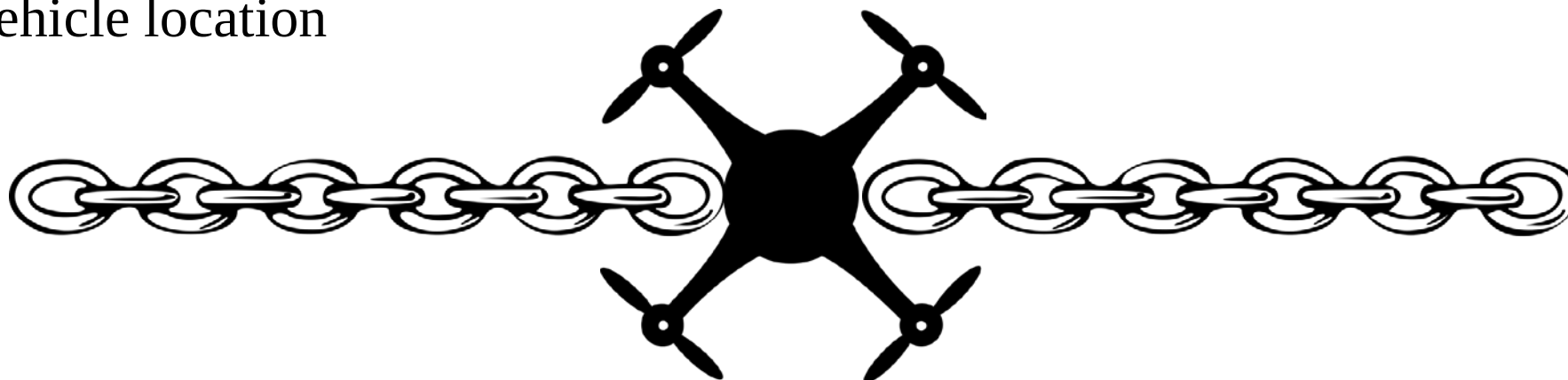
- Permissioned blockchain
 - Only allowed members can participate
- Consensus performed by centralized ordering service
 - Logically centralized, can be distributed in practice
 - Uses Raft by default, other algorithms can be used
- Centralized consensus allows for high throughput
- HLF supports multiple ledgers, called channels
 - Allows to partition data based on use case



- Managing vertical takeoff and Landing (VTOL) vehicles in an urban environment
 - How to determine if a flight plan is safe?
 - How to deconflict trajectories?
- In UAM, air traffic control is the responsibility of private entities
- Federated environment with many different actors
 - PSUs, fleet operators, vertiport operators, supplemental data/service providers
 - FAA, NASA
- Information of interest includes registration information, flight plans, constraints, and telemetry data

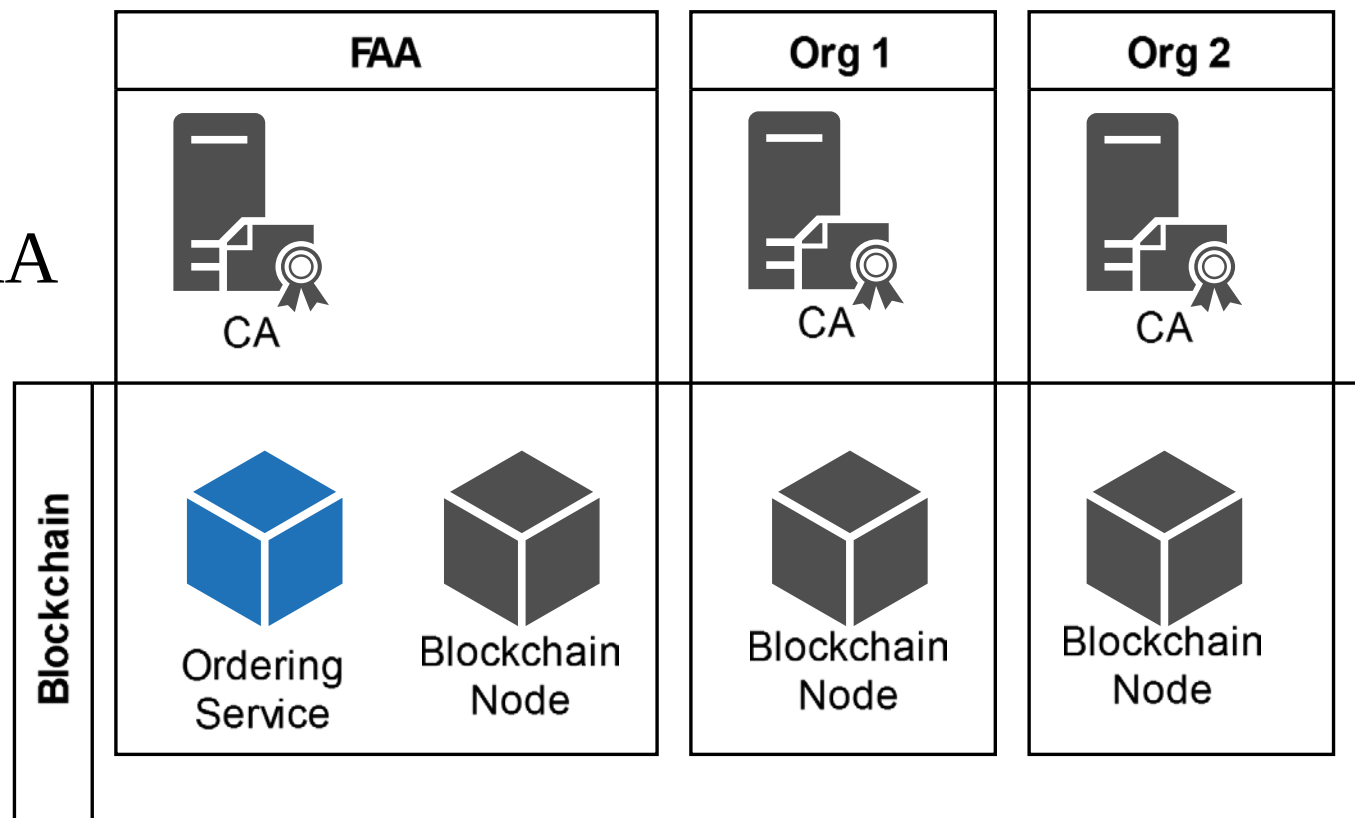


- Lots of independent entities, all want control over their data
- Transparency required between participants
- Security concerns
 - Authorized manipulation of records
- Immutable record provides clear record of events, good for audits
 - Proposed, modified, and accepted flight plans
 - Vehicle location



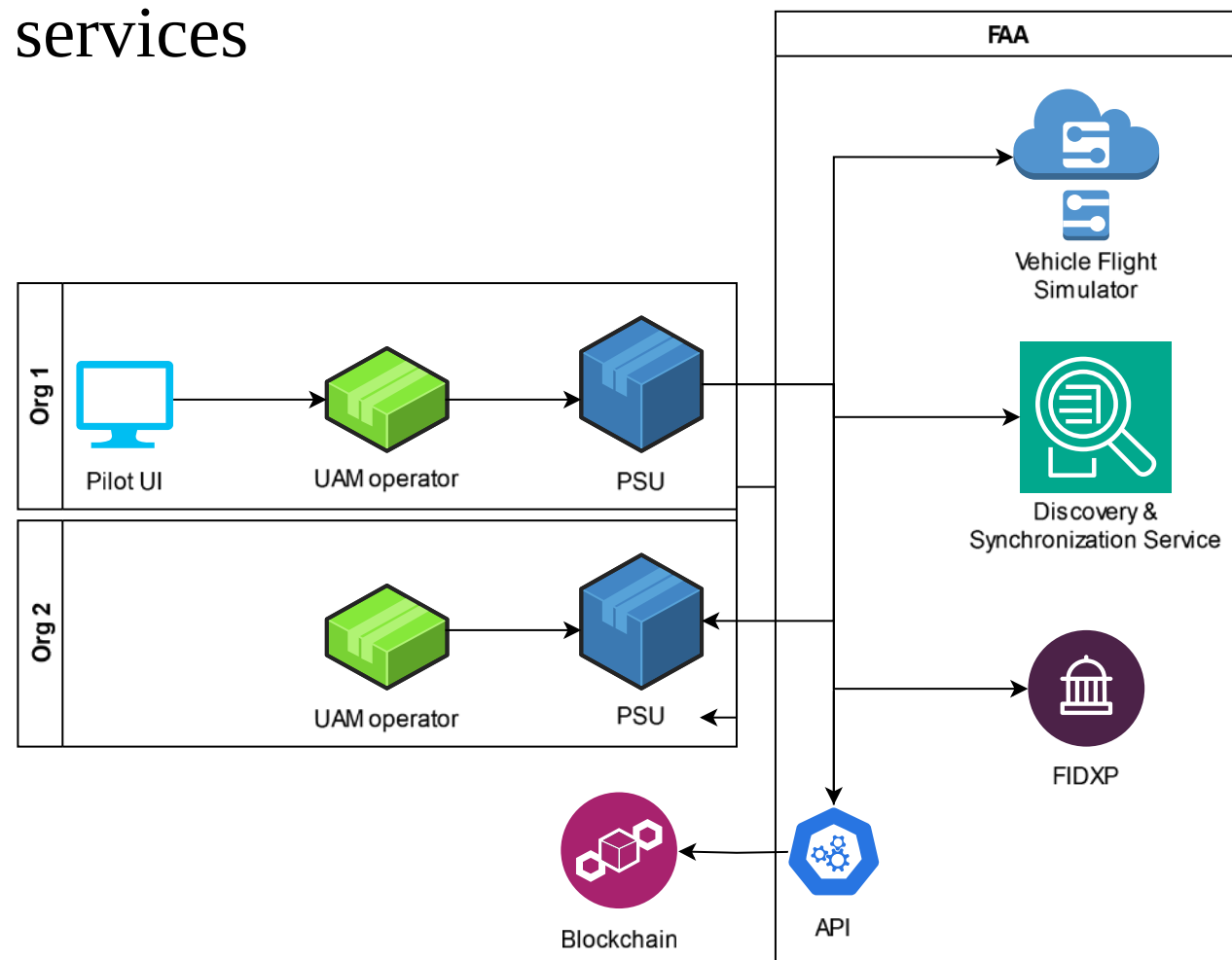


- Three organizations
 - 2 private organizations
 - FAA
- Each has a CA, peer node
- Ordering service belongs to FAA





- UAM services mocked as REST services
 - UAM operator
 - PSU
 - DSS
 - FIDXP
- API wrapper around blockchain





Takeaways, Concerns, and Ongoing Work



- Blockchain implementation succeeds in storing flight plans, telemetry
 - Different organizations can add, access information
 - Blockchain can handle real-time telemetry data
- Lingering concerns over acceptable volume of telemetry data
- Ongoing work
 - Improving simulation code
 - Robustness
 - Support wider range of simulations
 - Flight test
 - Record actual live telemetry data
 - Integrate that in with other simulation



Thank you!