



A Blockchain Case Study for Urban Air Mobility Operational Intent

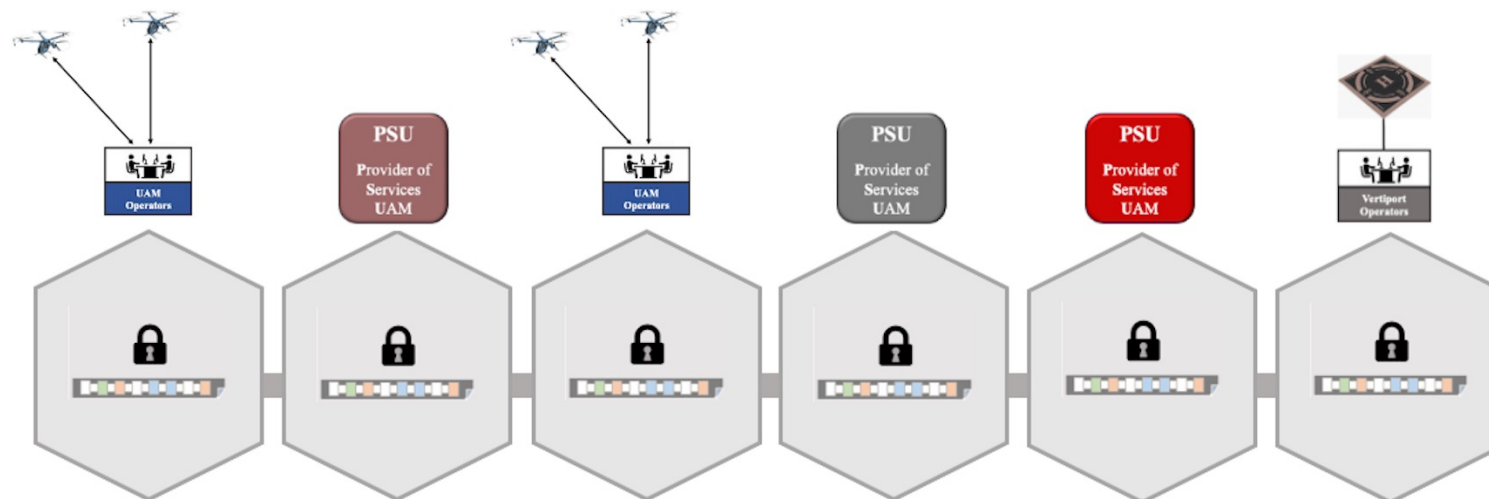
Kenneth Freeman, Norbert Gillem, Aidan Jones
NASA Ames Research Center

Nishant Sharma
Intrinsyx Technologies Corporation



What is Blockchain?

Blockchain is not cryptocurrency



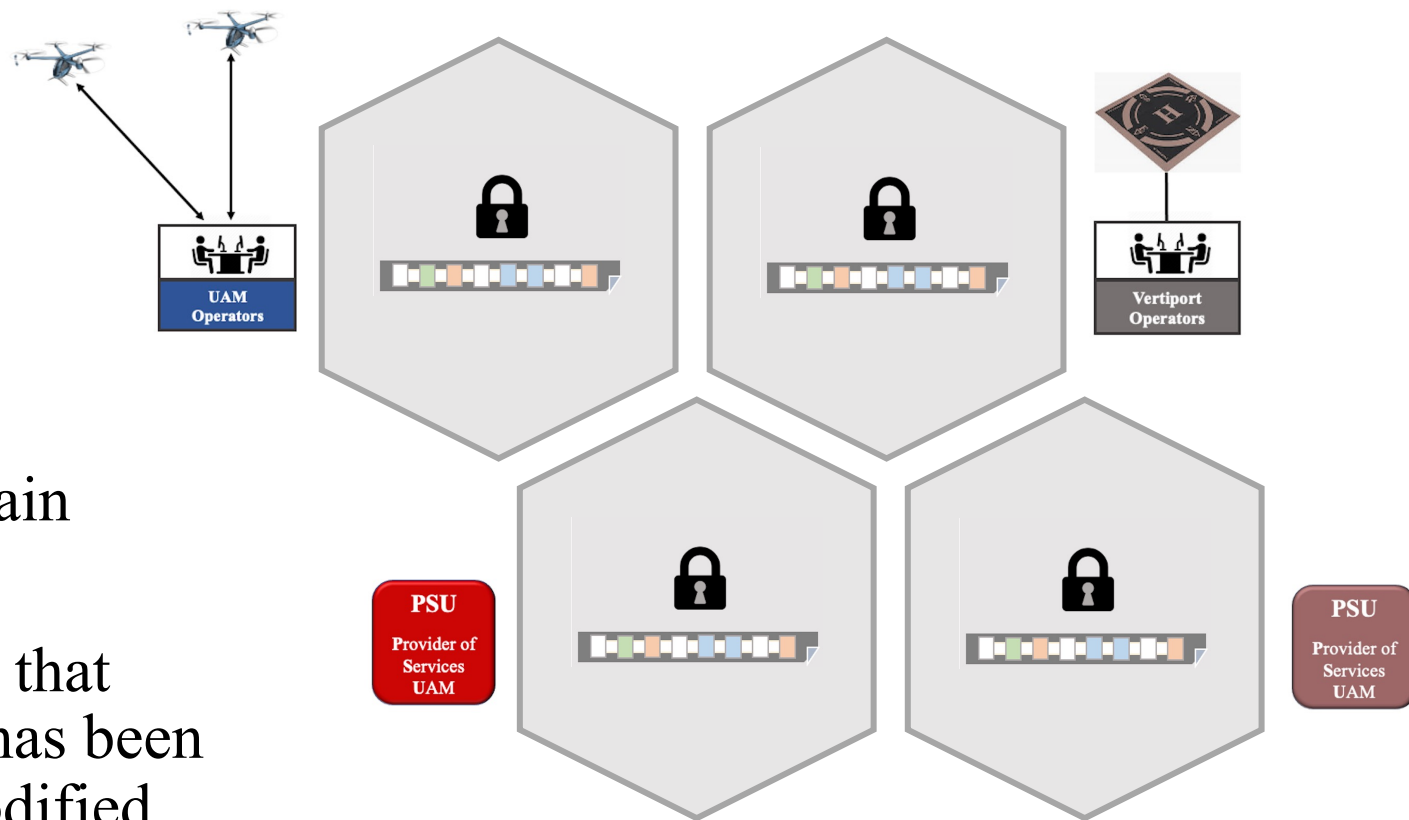
- Blockchain is the technology behind cryptocurrencies like Bitcoin
- Blockchain provides an immutable distributed ledger made up of blocks
- Blockchain technology provides is a method of maintaining security of transactions without the presence of a central authority



Why Use Blockchain?



- A blockchain is a distributed ledger that records all the transactions that take place on the network
- A blockchain ledger decentralized
 - It is replicated across many network participants
 - Each participant collaborates in the blockchain maintenance
- The information recorded to a blockchain is append-only
 - A cryptographic techniques is used that guarantees that once a transaction has been added to the ledger it cannot be modified.



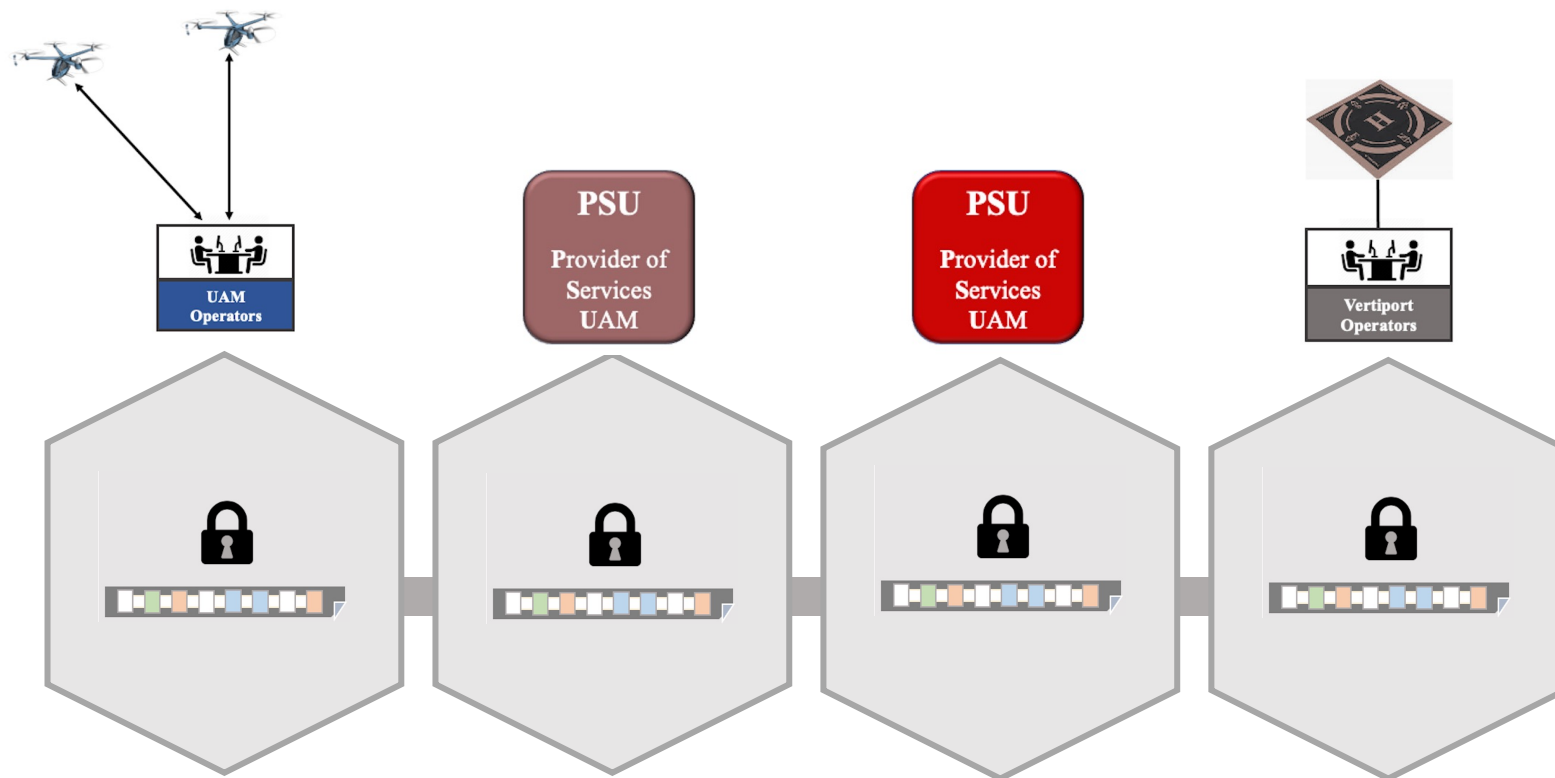


Why Use Blockchain?



A definition for immutability: *the state of not changing, or being unable to be changed*

- Immutability ensures that the no one can alter the state of the blockchain data
- Immutability also ensures that no one can intrude on the system



- UAM is a concept that proposes to develop short-range, point-to-point transportation systems in metropolitan areas using vertical takeoff and landing (VTOL) aircraft to overcome increasing surface congestion.
- The growth in the development of UAM systems, and the associated data exchange and service interactions will be at risk due to numerous types of cybersecurity attacks.

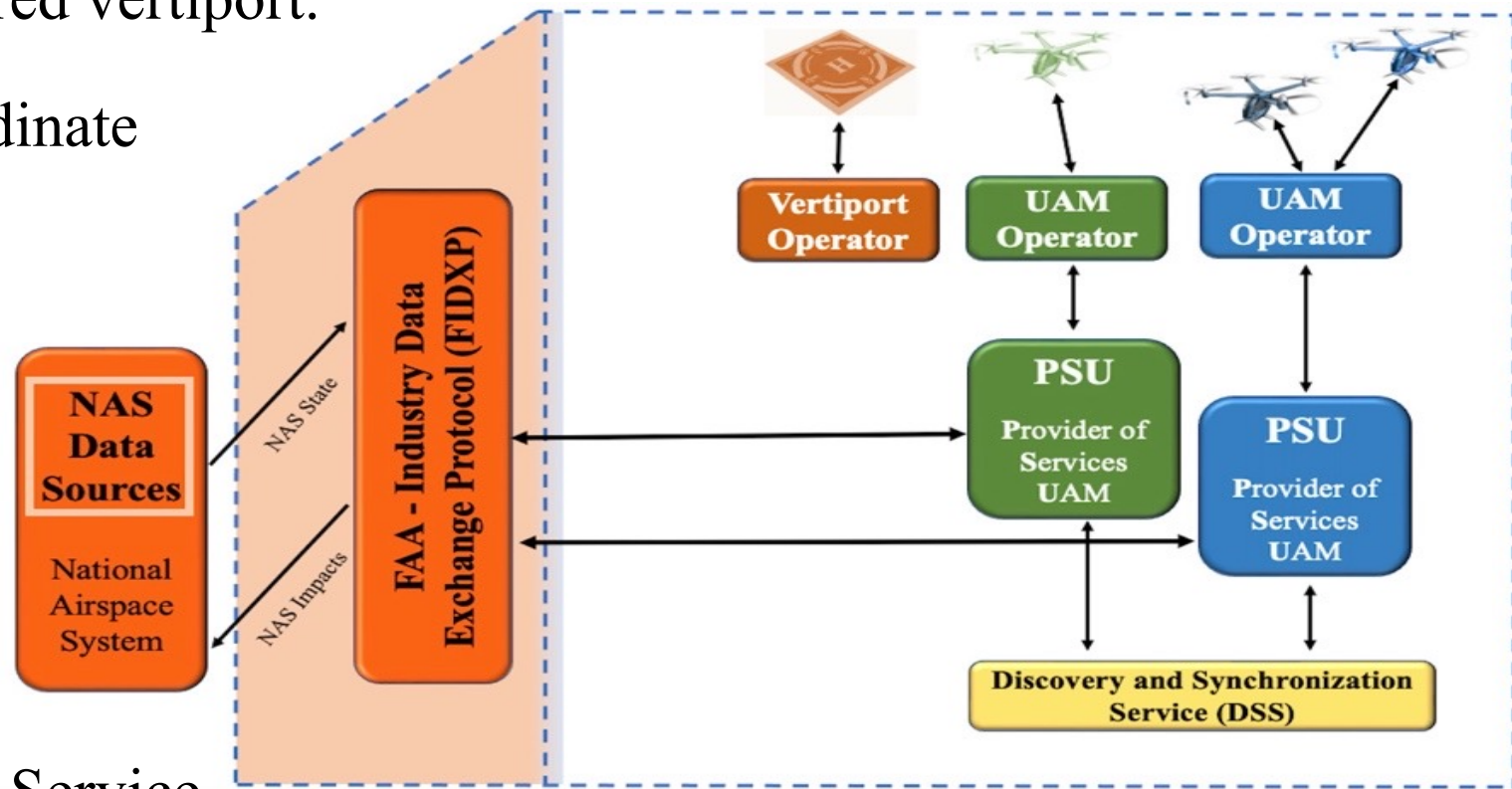




Case Study – Operational Intent



- In this case study, two vehicle operators are operating in the same airspace. Their intent is to fly vehicles that land at a shared vertiport.
- Each vehicle operator will coordinate its flight intent through a PSU.
- A PSU is an entity that provides services to the UAM Operator to help them meet UAM operational requirements that enable safe, efficient, and secure use of the airspace
- The Discovery Synchronization Service (DSS) enables PSUs to identify other PSUs with active operations around the area of interest during the noted planned flight times.

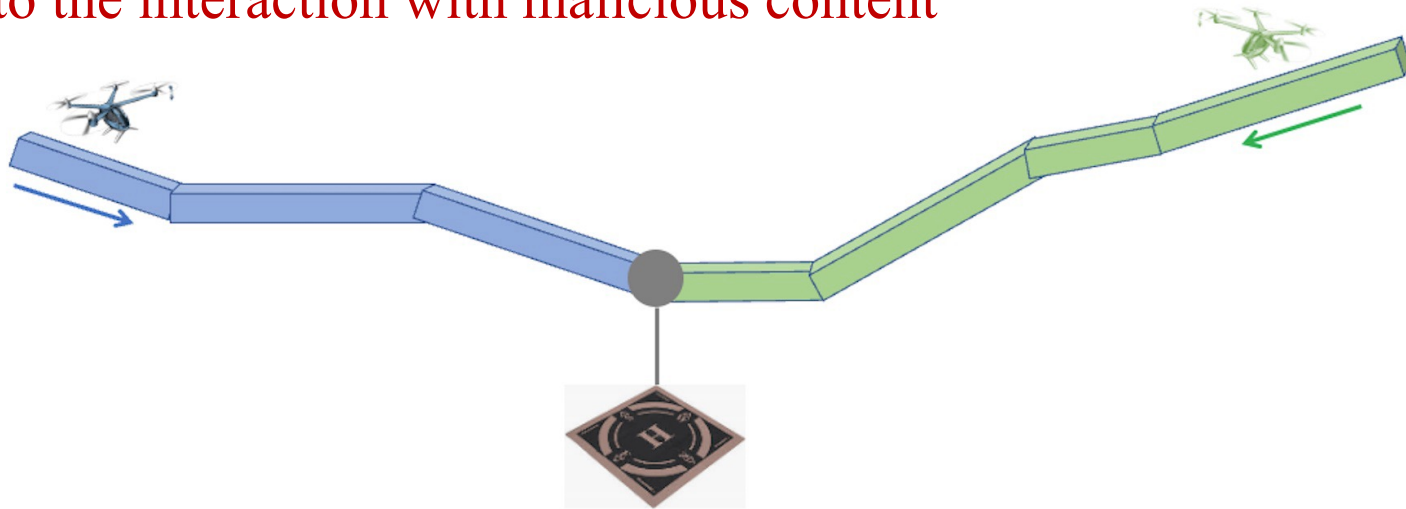




Selected Threats to UAM Environments

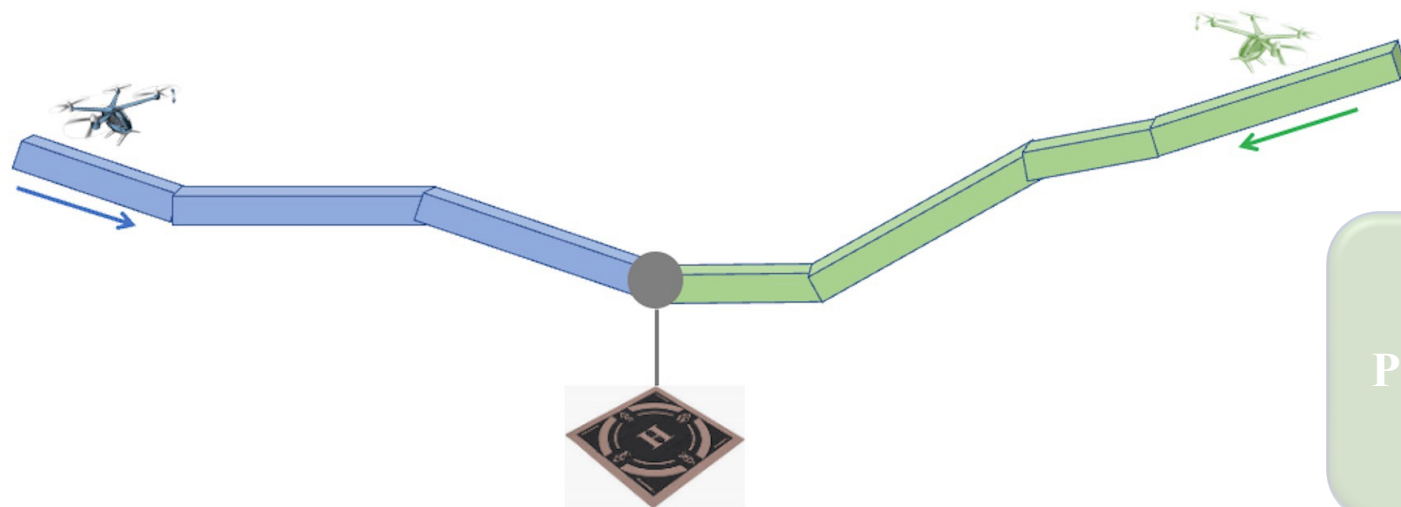


- The decentralized community of UAM operators, PSU operators and SDSPs will likely operate their services on local or cloud environments that require security.
- The intent of this work is to leverage a permissioned blockchain to simulate secure data exchange and storage, and to mitigate the following four cybersecurity threats that may impact a UAM environment:
 - Man-in-the-middle attacks, leading to data manipulation
 - Victims of spear phishing, leading to the interaction with malicious content
 - Exploitation of valid accounts, leading to the loss of credentials and system access
 - Exploitation of public facing application, leading to corruption of data





Case Study – Operational Intent



- Blockchain embraces a peer-to-peer decentralized design that eliminates central authority (replaced by consortium authority)
- Blockchain distributed ledger technology provides independently verifiable ledger copies



- With a solution, based on blockchain technology, the UAM operators can use a consensus mechanism to agree on a synchronized flight plan without relying on a central authority.
- Similarly, two UAM operators can communicate with the DSS to deconflict any planned flight plans, that may merge.
- The blockchain consensus mechanism ensures that all parties involved in the communication agree on the same data or message, or in this case, the operational intent of the two UAM operators.

