Air Mobility Data & Reasoning Fabric

TACP/CAS D&R Fabric Team

MOBILITY CHALLENGE

- Throughout the world, especially in dense urban environments, the quality of life is being negatively impacted by ever growing commute time.
- Travel, beyond commuting, is increasingly driven by door-to-door challenges – not just gate-to-gate considerations.
- Air Mobility may be an approach to address these challenges, as it can effectively convert our 2D mobility system to a 3D mobility system, vastly increasing mobility options.

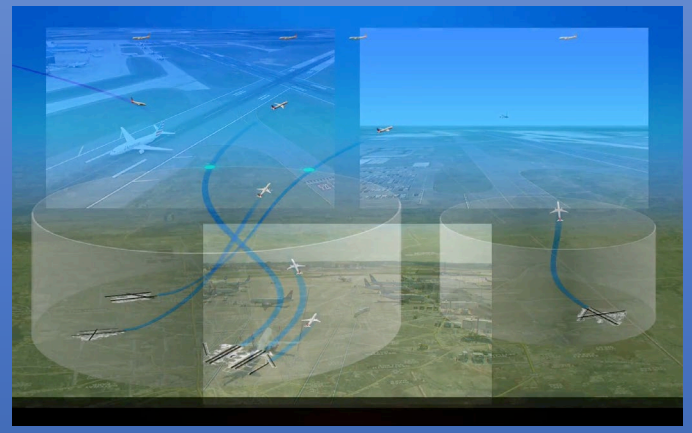
AIR MOBILITY CHALLENGES

- Moving from 2D to 3D mobility requires more complex decision, in very short amounts of time, and in safety critical situations.
- Many decisions will need to be made or augmented by machine intelligence.
- Decisions must be made based on accurate, reliable, and current data which must be available to humans, machines, or a combination.

Air Mobility Data Sources

Data will arise from Smart Vehicles operating in Smart Airspace systems, engaged with an instrumented Smart City.

SMART AIRSPACE



SMART VEHICLES

SMART CITIES

Air Mobility Data & Reasoning Fabric

Data & Reasoning Fabric needs to be an open architecture and a set of data and reasoning services with the following attributes:

Data (Available in-time from disparate sources) – Availability, Quality, Integrity, Correctness, and Authenticity will be driven by standardized requirements.

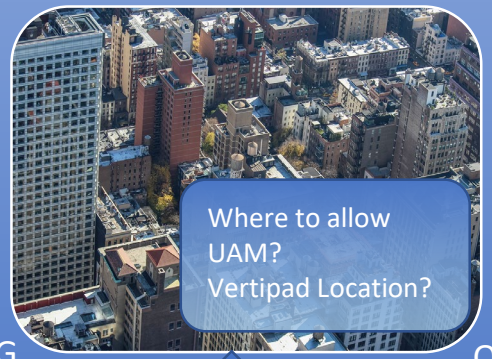
Fabric (Consistent capabilities available as connected nodes across cyber physical entities) – Brings together a choice of nodes across multiple cloud and edge resources that seamlessly work together to tie in data and the reasoning elements for real-time and non-real-time decision-making by *all* users (humans and machines) of the airspace.

Reasoning (Available as services) – At the minimum includes various analytics, AI techniques, Machine learning algorithms, uncertainty quantification methodologies, and a set of Physics engines.

OPPORTUNITY: Retain current levels of safety even with increased air travel density, complexity, and user communities.

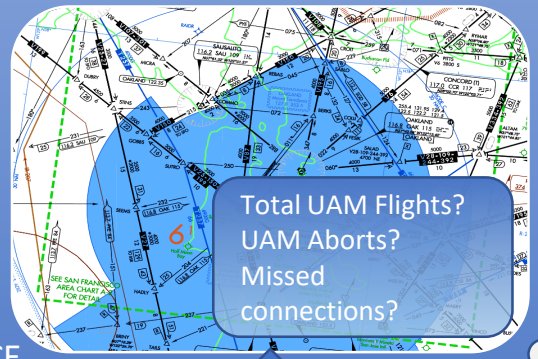
Air Mobility Planning, Operations, and Performance

APPLICATION ENGINES



PLANNING

OPERATIONS



PERFORMANCE

D&RF

REASONING FABRIC

Knowledge Base & AI Engine

Data Science

Analytics & Machine Learning Engines

DATA FABRIC

Cloud-scale data store

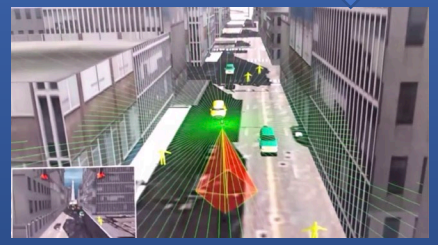
High-availability

Security & Governance

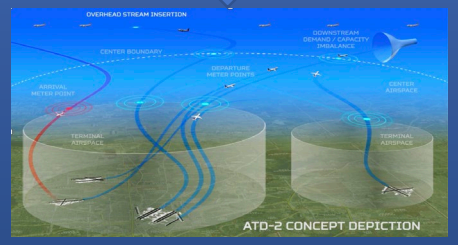
Multi-tenancy

Real time

DATA Producers & Consumers



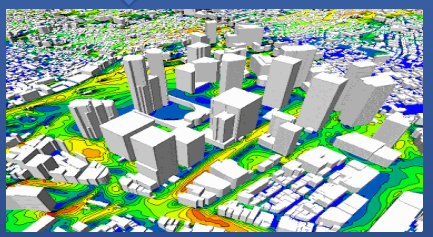
SMART VEHICLES



SMART AIRSPACES

SMART CITIES

FAA RULES



MICRO-WEATHER

Air Mobility Data & Reasoning Fabric

Questions:

1. Does an Air Mobility Data & Reasoning Fabric address the data & reasoning challenges that must be resolved to achieve the air mobility vision?

2. Can elements of the Fabric/Mesh/Big Data technology base being developed across the world be re-deployed as the technology base of an Air Mobility Data & Reasoning Fabric?

3. What role should NASA play?
   a) Prototype application of Fabric technologies to air mobility challenge?
   b) Identify missing standards/technologies and develop, then re-prototype?
   c) Other?

4. How do we assess this opportunity, realistically, given the complexity of the technical challenge and the extreme pace of Fabric technology development?

Backup

Data and Reasoning Fabric – The Market Vision

Who will use the fabric?

- The data and reasoning fabric is envisioned to serve multiple market segments.
- Each market segment has different utility functions (or key attributes that are important to that particular segment).
- Beyond the commercial use, the data and reasoning fabric will also serve as a contiguous medium to disseminate and enforce regulatory measures for airspace safety.

What will the fabric do for its users?

- Fabric will enable accessibility of data when it is needed where it is needed, which is critical for data-driven digital systems such as the autonomous vehicles.
- However, fabric is not just about data, rather it is going to embed reasoning inferred from the data to make real-time decision making fast and accurate.
- Users from different market segments will use the fabric to not only boost their internal productivity but also enhance the overall safety and efficacy of the shared airspace usage.

Image Bibliography

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