Building Trust in Data Assets for Real-Time Aviation Analytics

DEFENCE AND SPACE

Heiko Udluft, Sept 2018

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AirSense
TRUSTED INSIGHTS FOR SMARTER DECISIONS

Airbus AirSense brings new, trusted, actionable insights combined with multi-source, real-time ADS-B data for improved end-to-end decision-making across aviation stakeholders.

BENEFITS

- **Improve situational awareness:**
- ✓ Surveillance beyond your infrastructure
- **Identify operational bottlenecks:**
- ✓ Spot anomalies and outline performance potential
- **Optimize resource utilization:**
- ✓ Increase capacity, decrease costs, maintain performance

PRODUCT OFFER

- **Trusted Live Data Services:**
- ✓ Global, real-time aircraf tracking fused from various sources
- ✓ Flight-related events in real-time providing input for decision making
- **Insightful Advanced Analytics:**
  Historic, live and predictive analytics though APIs and dashboards

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Product Categories

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Digital products create to measurable customer upside

VALUE ADDED SERVICES

Historic Big-Data Analytics

- Benchmark past performance
- Analyze asset history
- Flag unusual operations

Real-Time Analytics

- Provide situational awareness
- Generate alerts and warnings
- Analyze impact of operations
- Identify bottlenecks during operations

Predictive and Prescriptive Analytics

- Predict future system state
- Early warnings for disruptions
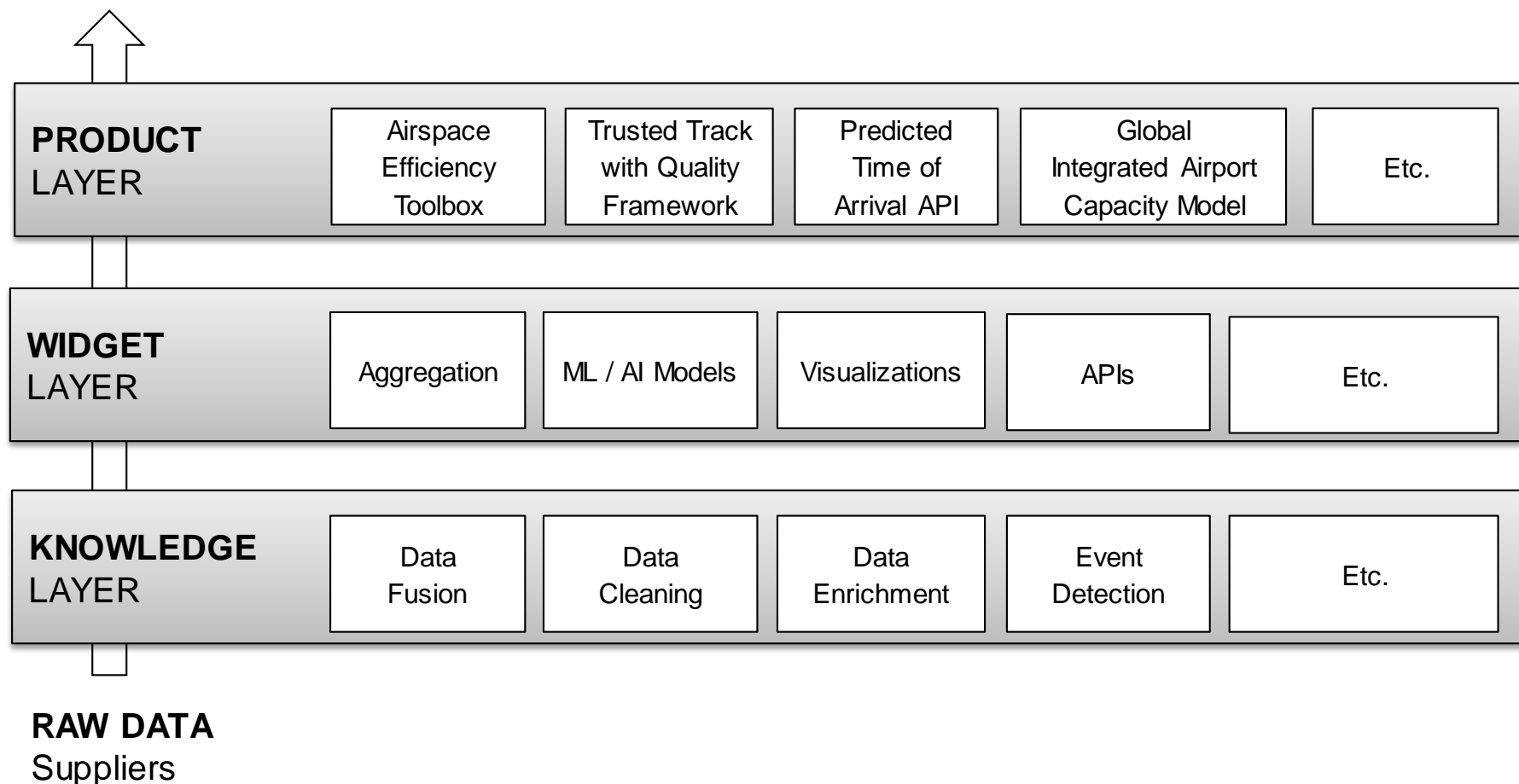- Suggest Actions to impove performance

FOUNDATION

Trusted Tracking Data Service

Track all aircraft, anywhere   Ensure true information   Merge complementary data

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Digital Product Structure

AirSense **Solution delivers real-time, reliable, cleaned and fused data and surveillance-based analytics using our cloud-based architecture to make information easy to consume and enable better decisions.**

PRODUCT LAYER	Airspace Efficiency Toolbox	Trusted Track with Quality Framework	Predicted Time of Arrival API	Global Integrated Airport Capacity Model	Etc.
WIDGET LAYER	Aggregation	ML / AI Models	Visualizations	APIs	Etc.
KNOWLEDGE LAYER	Data Fusion	Data Cleaning	Data Enrichment	Event Detection	Etc.

RAW DATA
Suppliers

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Aircraft positions are:

- Self reported (e.g. ADS-B)

  - Aircraft broadcasts its position

- Actively interrogated (e.g. Radar)

  - A signal is sent to the aircraft, reflected, and received

- Passively observed (e.g. MLAT, spotters)

  - A signal from the aircraft if received and analyzed

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What is ADS-B?

- Aircraft position data
- High update interval (2Hz)
- High precision (GPS ~few meters)
- "Simple" receiver equipment
- Explicit uncertainty
- Mandated for commercial aircraft
- Several stakeholders collect data
  - ANSPs
  - Companies
  - Private persons
  - Etc.

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- New view on operations of assets
  - Aircraft centric
  - Infrastructure centric (Airspace, Airports)
  - Passenger centric
- Large amount of data
 - Significant statistics
  - Machine learing
  - Global picture

So we can create actionable analytics!

- Data supplier specific infrstructure
- Data supplier specific format
- 2+ Billion messages sent per day
- 100+ GB per day, 3+ TB per month, 35+ TB per year
- Challenging to handle:
  - Storage
  - Processing
  - Analytics
- Varying data quality

2 Trajectores: Which one is wrong?

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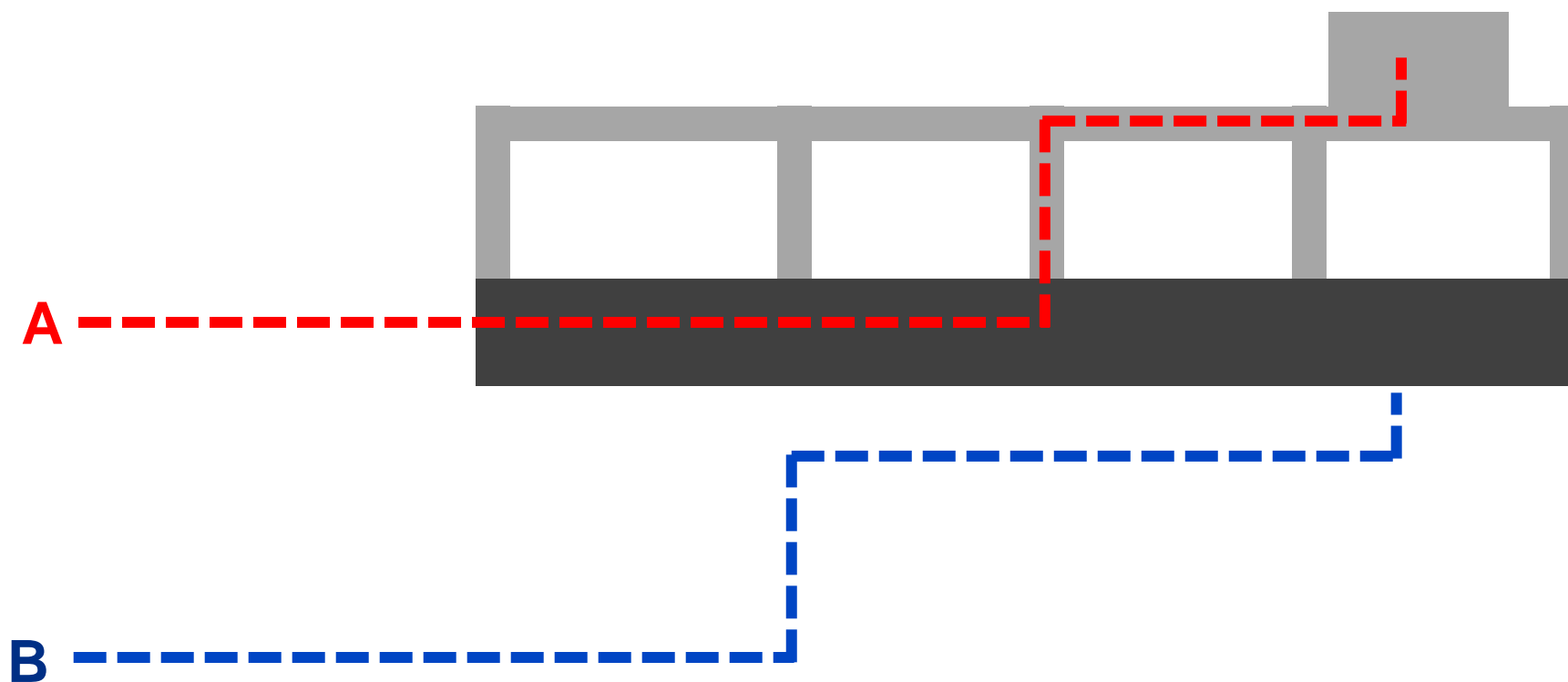
2 Trajectores: One has more uncertainty!

Data Quality issues: Ambiguous Meta Data
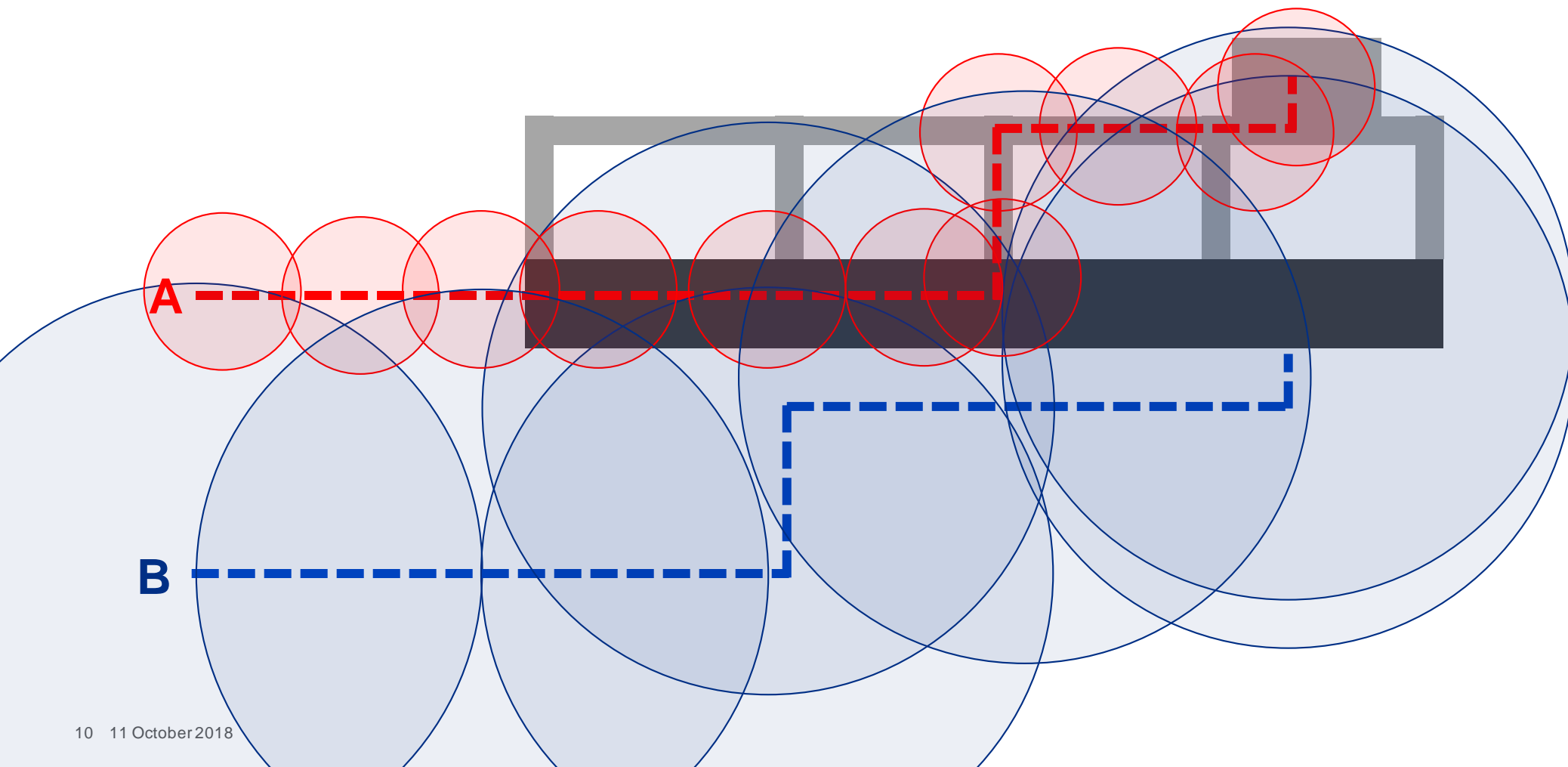
- ADS-B provides data, who is operating an aircraft
  - Specifically, we can identify an aircraft by it's ICAO and the airline by the Airline ID
- The ICAO field is a unique ADS-B transponder ID
  - This would likely only change when the transponder is serviced / replaced
- The Airline ID is generated from the first 3 characters of the ADS-B "callsign" field

How can there be more than one airline per ICAO?

Number of Airlines per ICAO

- 1
- 2
- 3
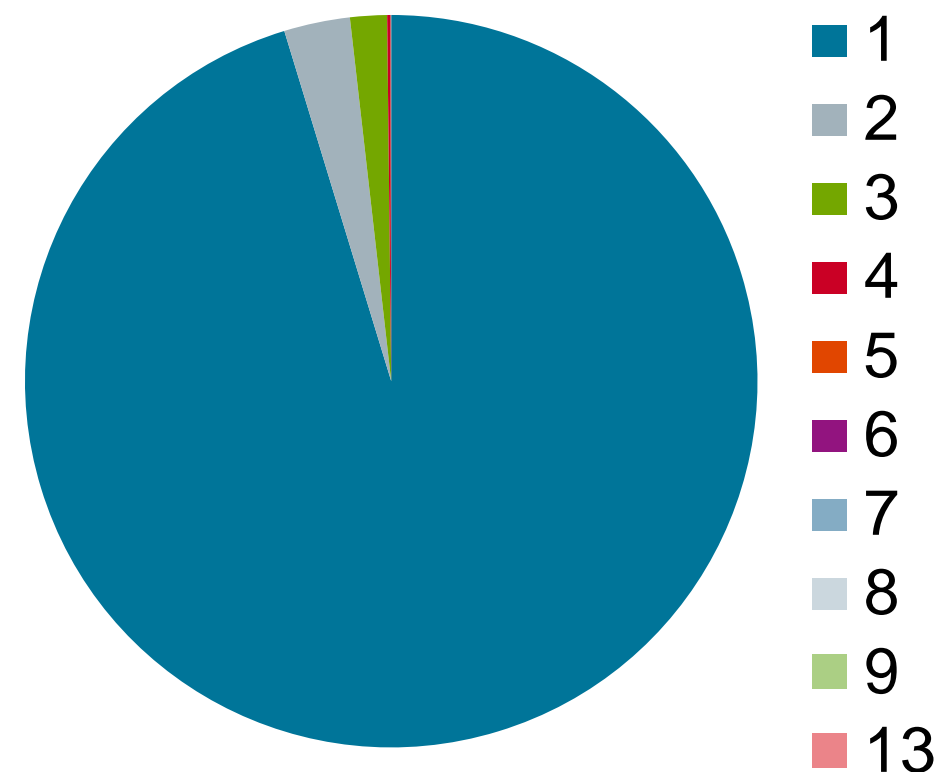- 4
- 5
- 6
- 7
- 8
- 9
- 13

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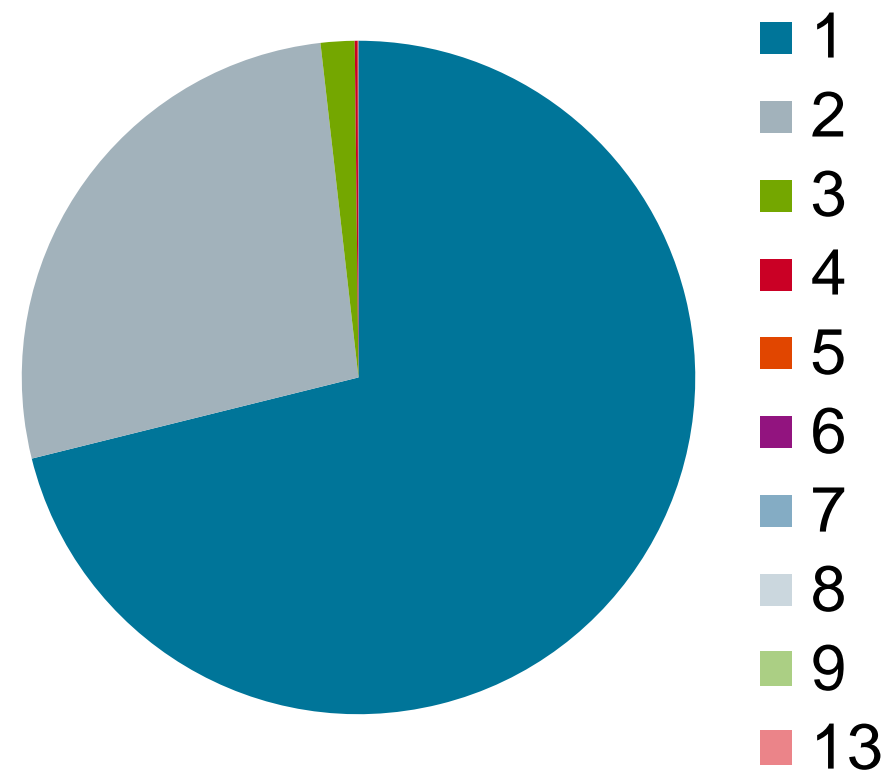
There can be more than one airline per ICAO if:

- We count "NULL" values
- An aircraft uses the registration as callsign
- Multiple Airlines share the same aircraft

Actionable information!

Number of Airlines per ICAO

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 13

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- Multiple data providers send information about aircraft positions at different times
- Positions get rounded to nearest decimal
- Timestamps have different accuracy

Provider A
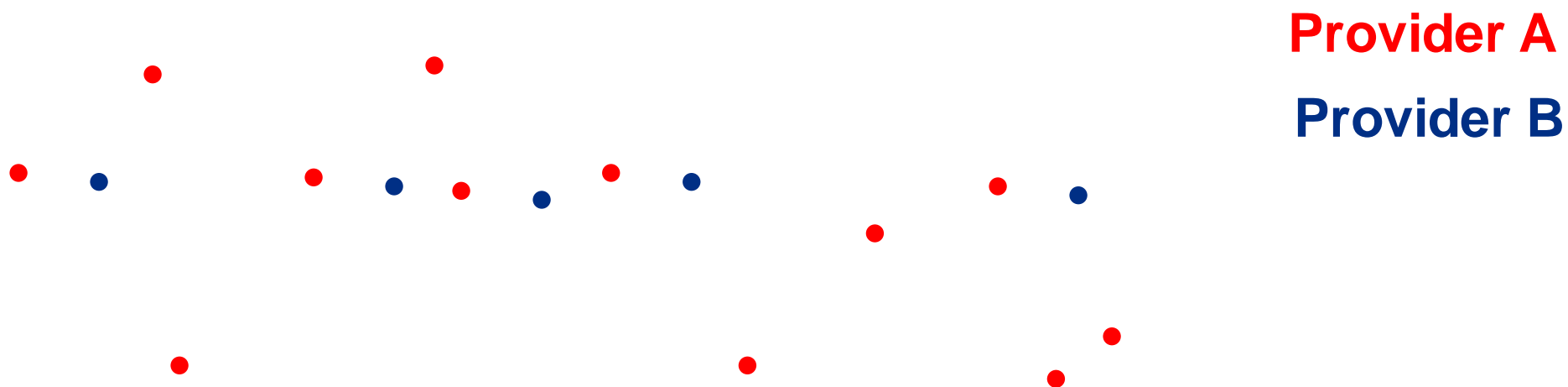
Provider B

- Understand data specific limitations
- Account for Provider specific parameters
- Fuse data into one "true" stream

Provider A

Provider B

Fused Stream
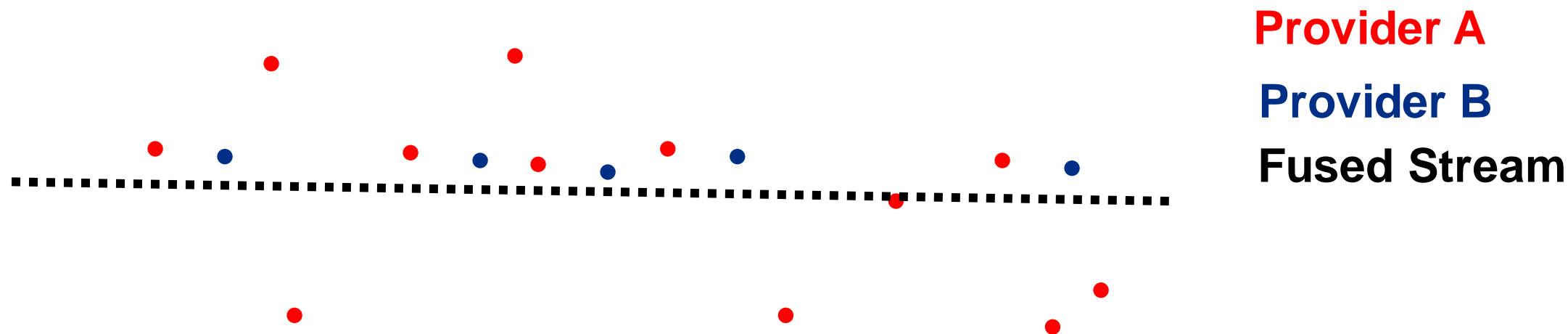
Provide best possibel truth of data:

- Ingest
- Fuse
- Clean
- Enrich
- Distribute

Make uncertainty explicit with every position

Share assumptions and code with analysts

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Aircraft Position Data Service

- 2 million messages per minute
- Kafka – easy message handling
- Kubernetes – resilient service provision
- Docker – flexible deployment

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600 Analysts working with this data

Open source inside the company:

• Shared code base

• Shared data base

• Shared compute resources

• User exchange (meetings / hackathons)

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Next Steps

Commercialize analytics architecture

• Database

• APIs

• Dashboards

Develop widgets

Deliver products

Dashboard

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Dashboard for Aircraft History

1. Filter aircraft by airline and equipment

Airline:
- ANY -

Equipment:
- ANY -

2. Select aircraft based on registration

Registration:

Show analysis for selected registration.

Selected Registration: DAIMM

Aircraft Utilization

Visualization

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