Data Modeling for Digital NOTAM System

Federal Aviation Administration

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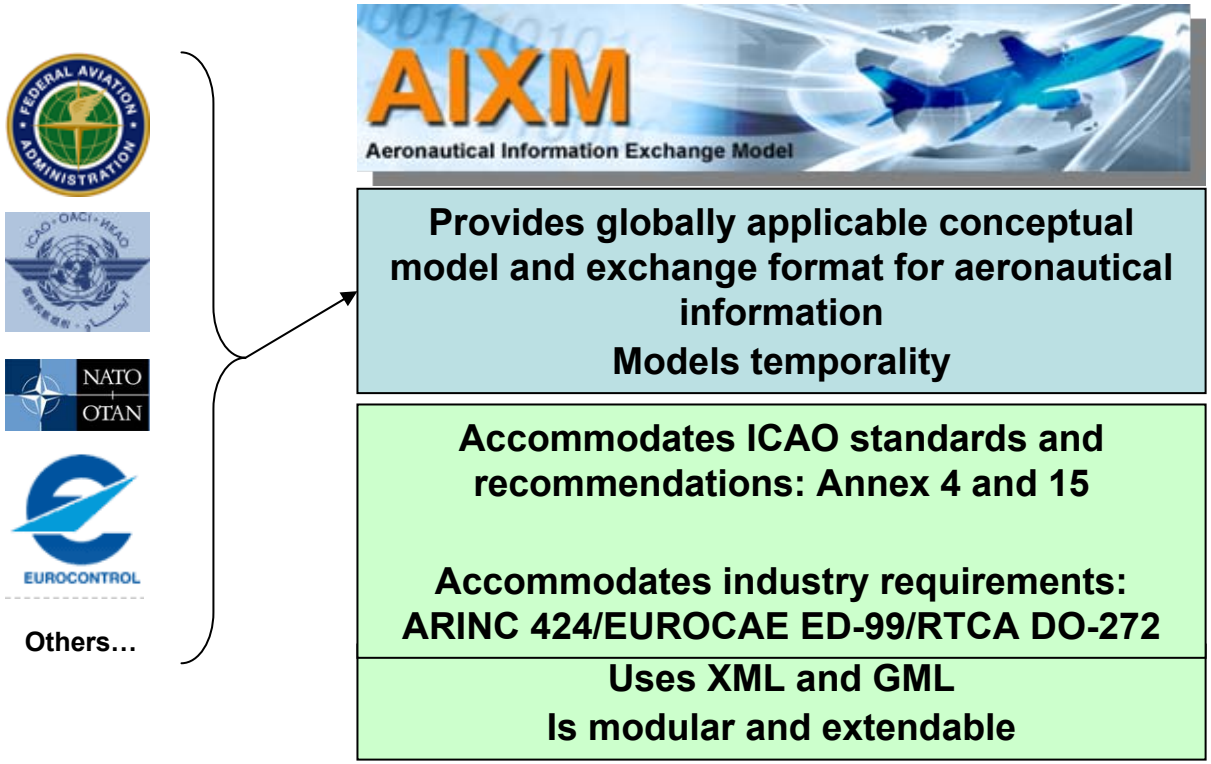
Data Modeling – Why?

- Science for representing a real world concept into a form that can be interpreted by an information system
- Data Model describes the structure of the data within a given domain (aeronautical data)
- Provides basis for formal contracts between interoperable systems

- Data driven application
- Eliminate free-form text
- Enables computer interpretation
- Foundation for interacting with multiple systems – *messaging*
- Enables providing data in multiple views

AIXM: Information Model



- **AIXM 5**
  - Model for aeronautical information
  - www.aixm.aero

AIXM: Information Model

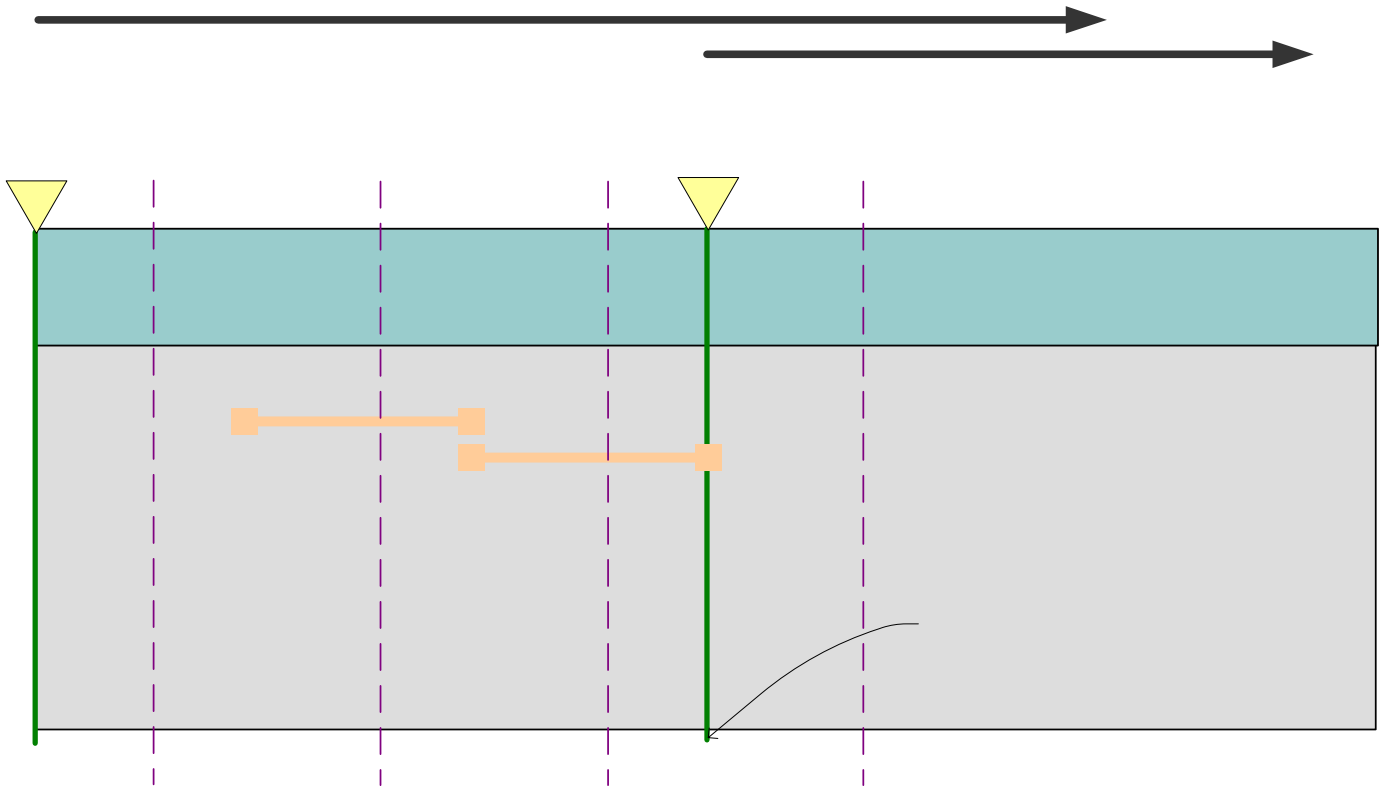
- **AIXM provides international standardization**
  - Content model: UML class definitions for features, attributes, data types, associations & business rules
  - Exchange format: XML/GML encoding

- **The AIXM evolution has demonstrated its capacity to adapt to increasingly demanding requirements**
  - ISO 19100
  - GML
  - Extensibility

Data Model Requirements

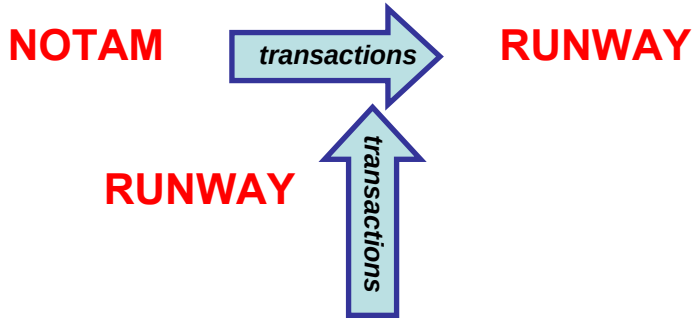
- **Enable digitizing NOTAMs**
- **AIXM 5 based**
  - Globally applicable
  - Application schema supporting NOTAM processing applications
  - Simplify mapping data for electronic distribution
- **Temporality Model**
  - Support permanent and temporary changes
  - Allow features to have life-span
- **Flexible**
  - Data content separate from product specification
  - Allows consolidation and elimination of stovepipe systems

Temporality Illustration

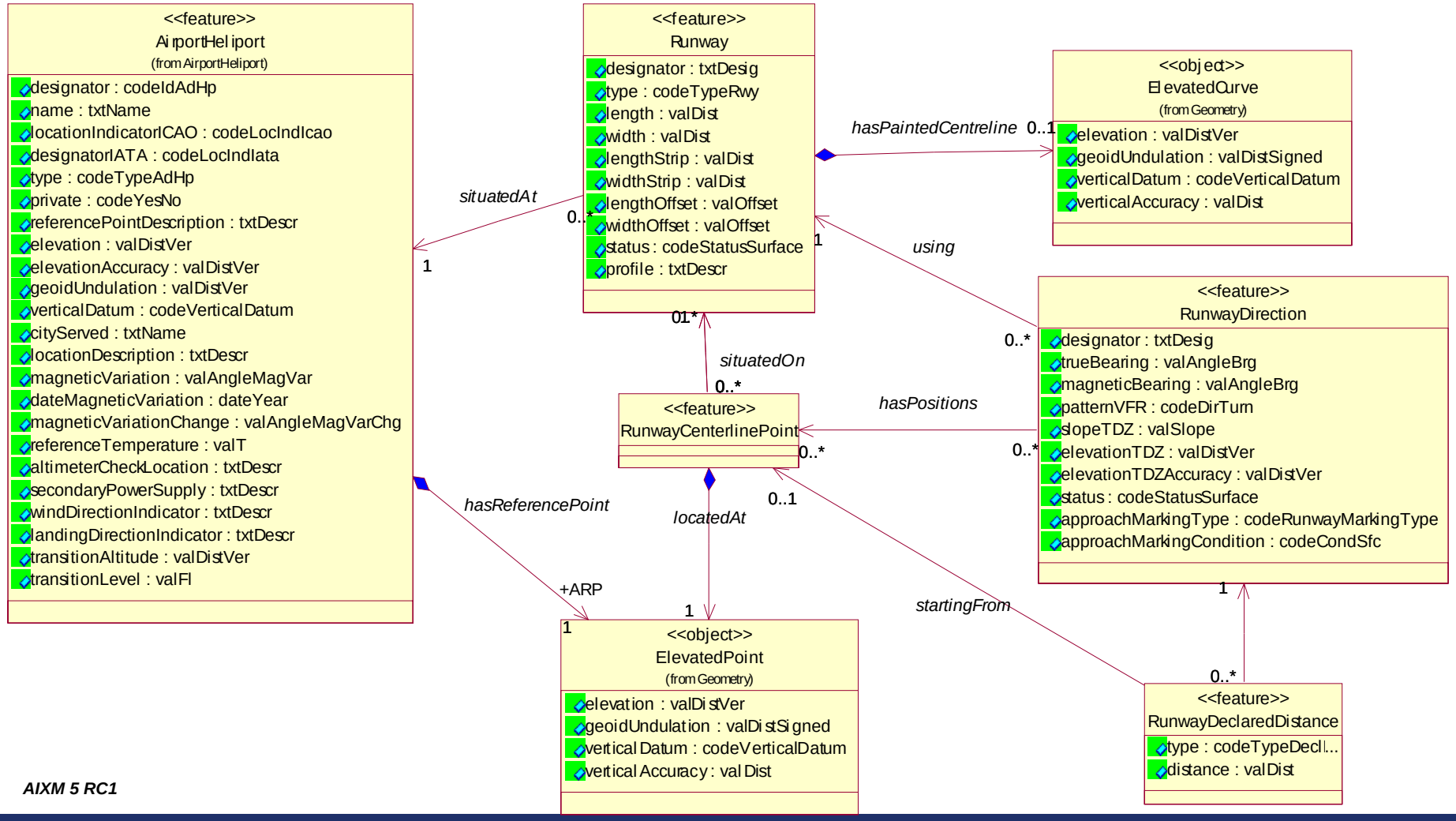


Concept of Transactions

- **Data model designed to capture changes as transactions**
  - Flexibility in identifying specific change
- **All transactions have a life-span**
  - Start of Life and End of Life
- **State of the system at a given moment of time (snapshot) obtained by combining all the effective and relevant transactions**
- **Design allows supporting multiple products requiring same data structure – Extensible!**
- **Flexibility to provide answers from both product and feature perspective**
  - **Product example:**
    - » **Find NOTAM Related Change:**
  - **Feature example**
    - » **State of RUNWAY @ Time1:**

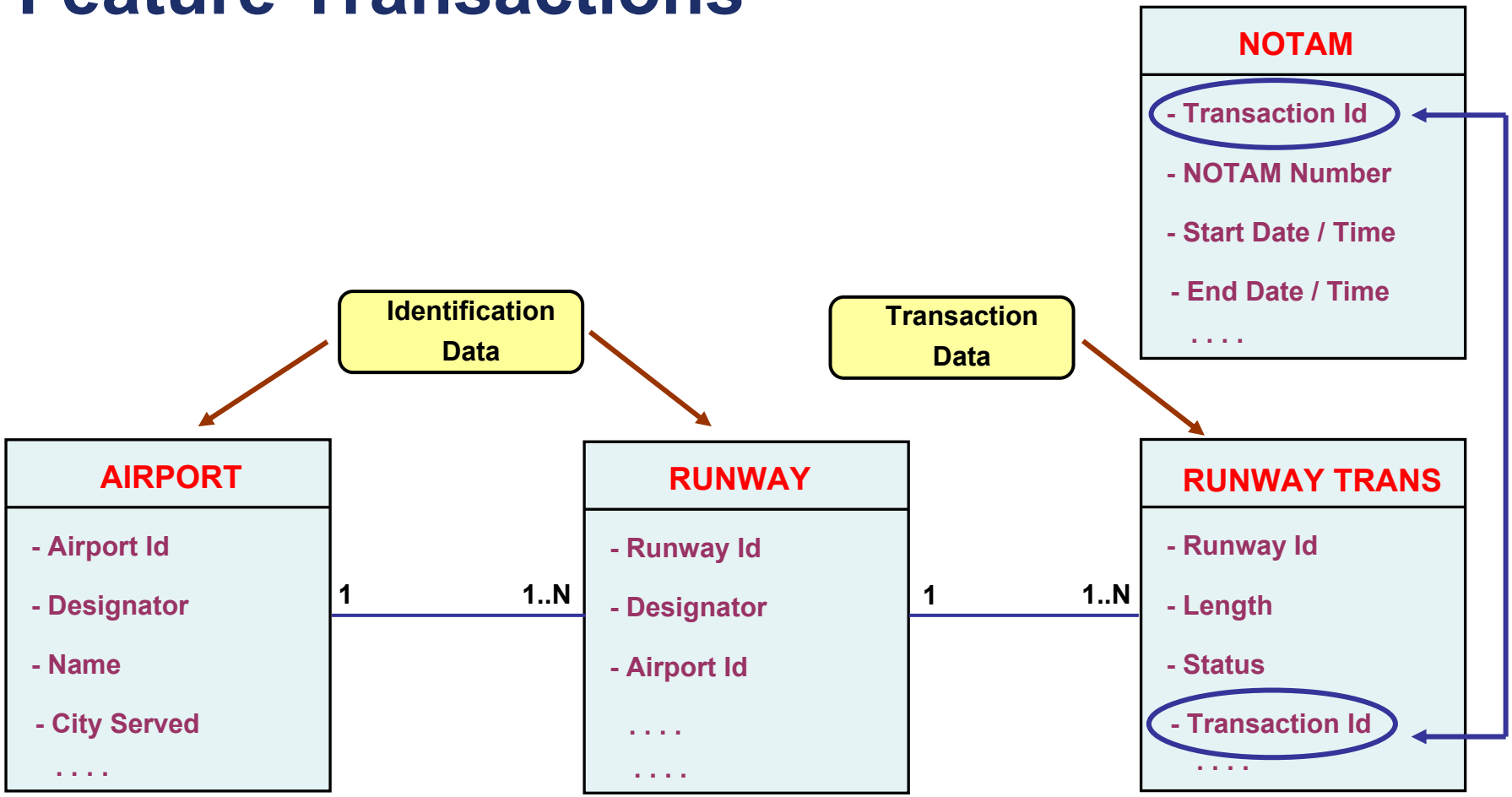


AIXM Conceptual Model - Runway



AIXM 5 RC1

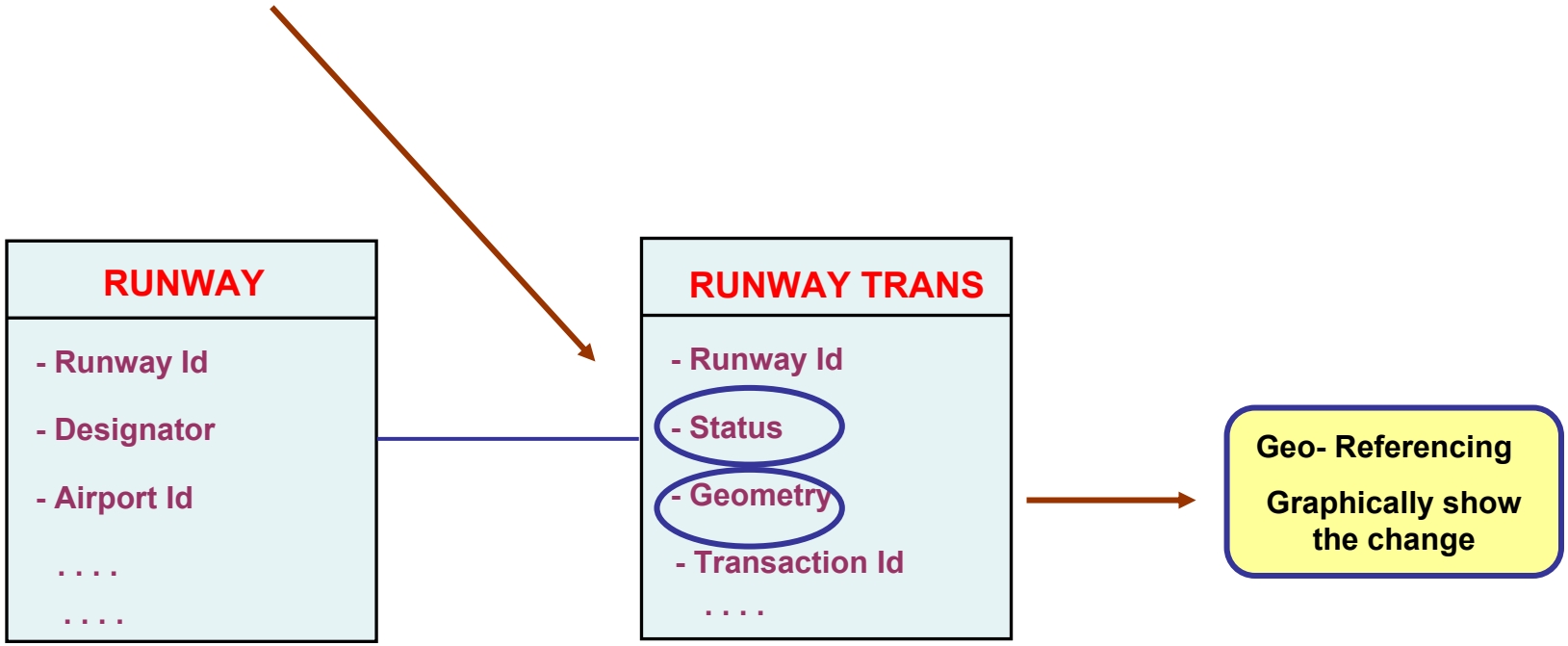
Feature Transactions



Runway NOTAM Example

Status Change

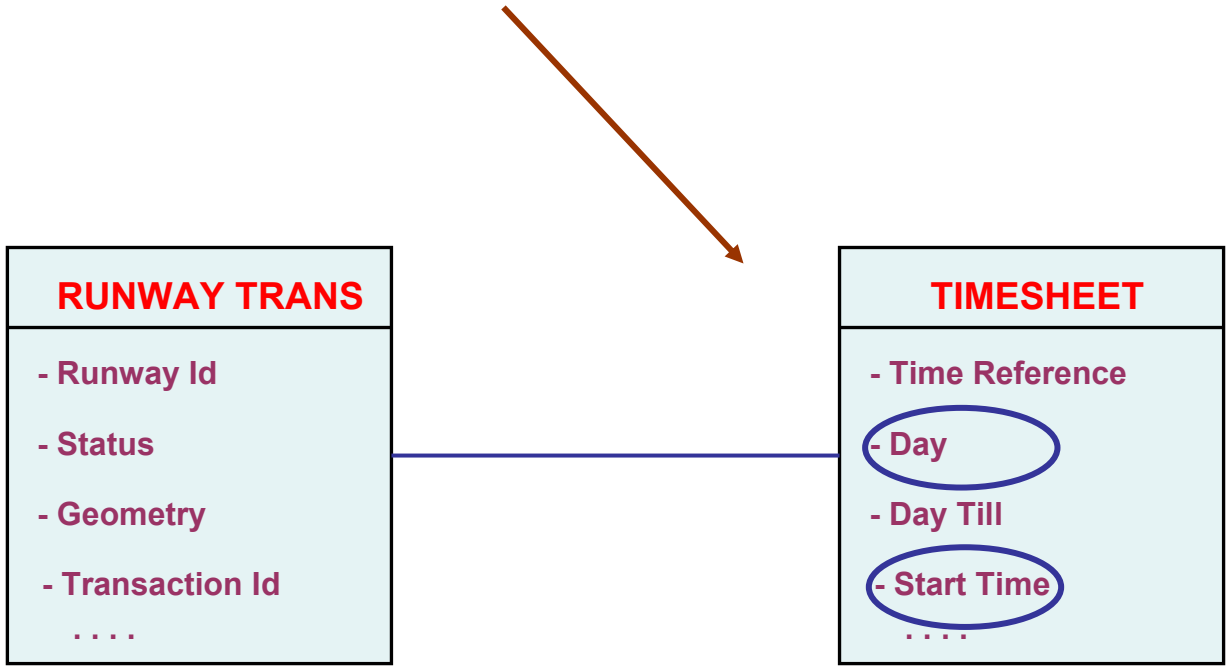
18R/36L CLSD WEF 0610101500-0610101700



Runway NOTAM Example

Status Change w/ Time

10L/28R CLSD 0900-1600 DLY WEF 0610110900-0610131600



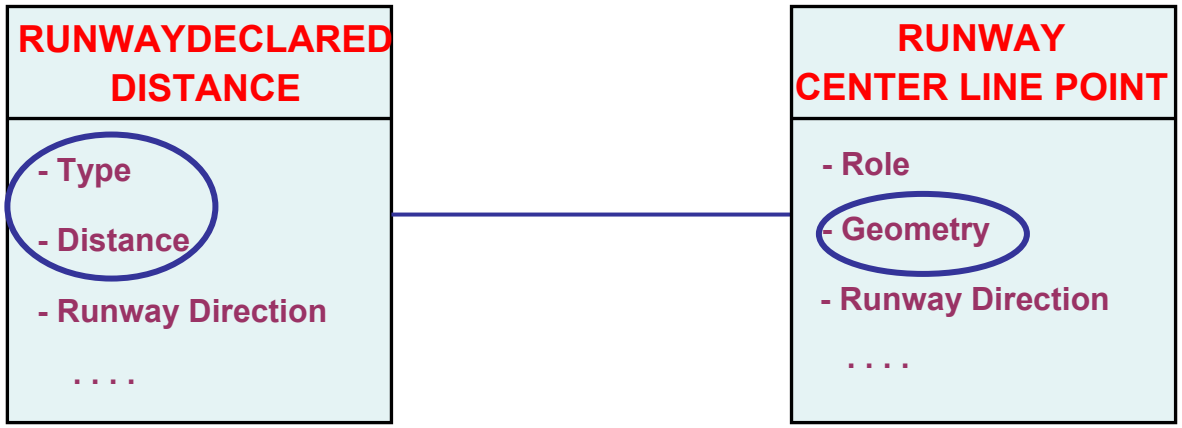
Runway NOTAM Example

Threshold Displacement

23 THR DSPLCD 590 LDA 5010 WEF 0703291500

Auto-Calculated!

Graphically show the change



Runway NOTAM Example

Partial Closure

26 W 2000 CLSD 1300-0200 WKDAYS WEF 0704091300

? 13/31 NW 600 CLSD

Auto-Calculated!

Graphically show the change

RUNWAYDECLARED DISTANCE

- Type
- Distance
- Runway Direction

. . . .

RUNWAY CENTER LINE POINT

- Role
- Geometry
- Runway Direction

. . . .

Ensures Consistency

Runway NOTAM Example

Limitations & Restrictions

18/36 CLSD JET

6/24 CLSD EXC 1 HR PPR 203−627−3001

USAGE LIMITATION

- Limitation Id
- Usage Limitation
- Timesheet Id

. . . .

. . . .

USAGE CONDITION

- Condition Id
- Prior Permission
- Limitation Id

. . . .

. . . .

AIRCRAFT CHARACTERISTICS

- Type
- Engine
- Max Wingspan
- Max Weight

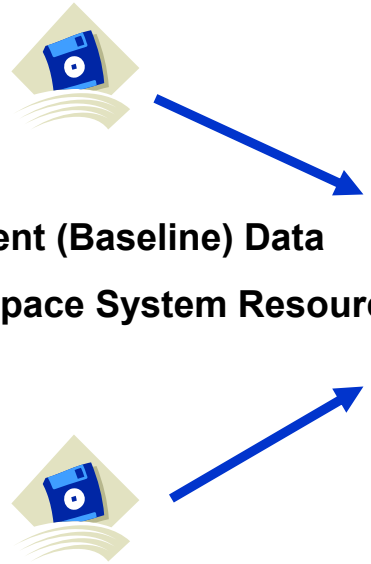
. . . .

FLIGHT CHARACTERISTICS

- Type
- Rule
- Status
- Military

. . . .

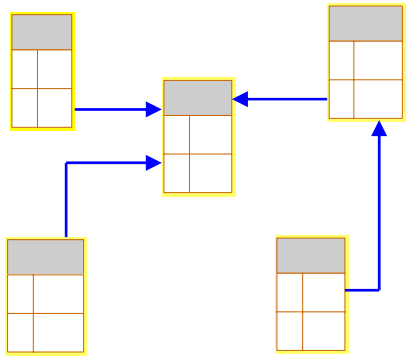
Data Content For Demonstration



Permanent (Baseline) Data

(National Airspace System Resource)

Temporary Update



AIXM Based Data Model

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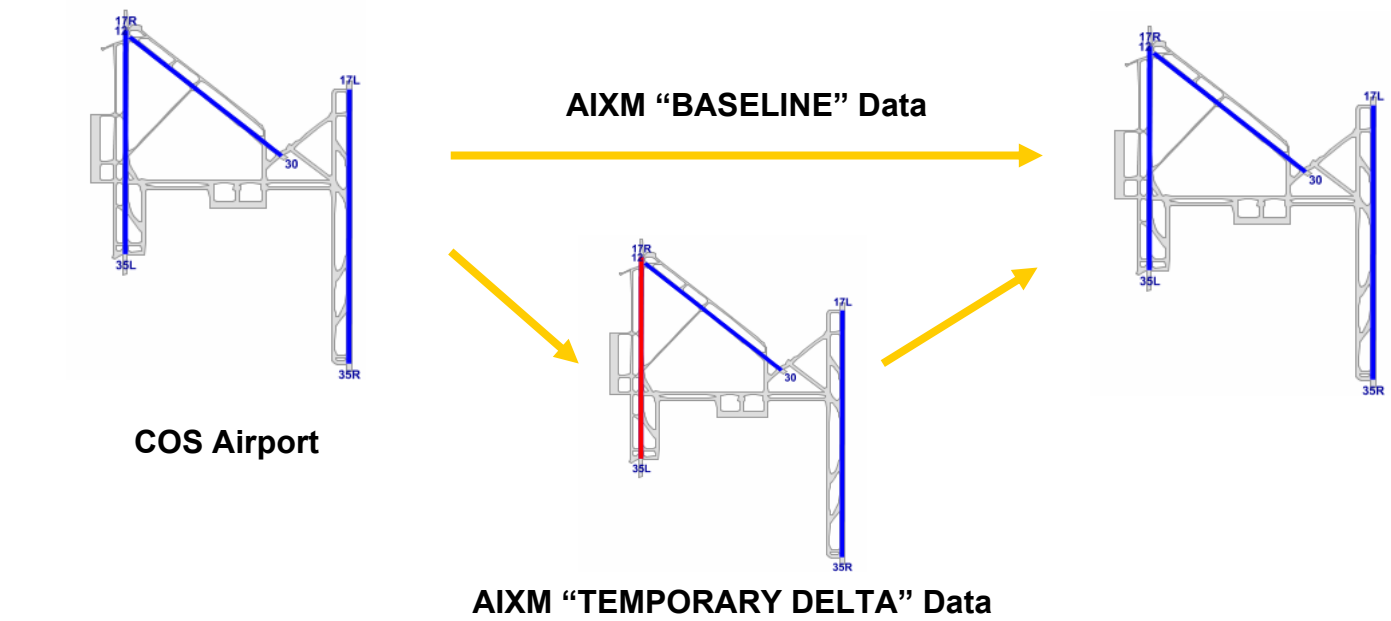
Integrates Permanent & Temporary Data

Summary

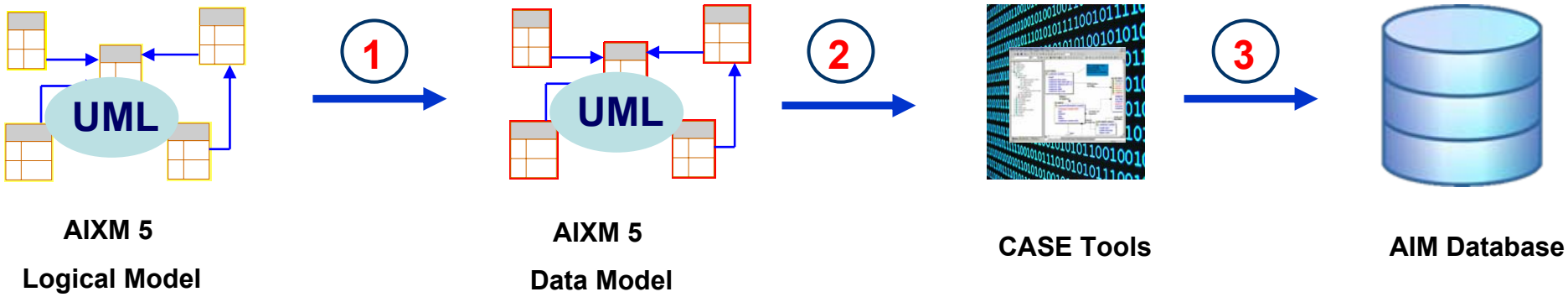
- **Designed with fully temporality model**
  - Permanent and temporary changes to aeronautical data
- **Cooperation with EUROCONTROL and Global Communities means US Digital NOTAM solution will be consistent worldwide.**

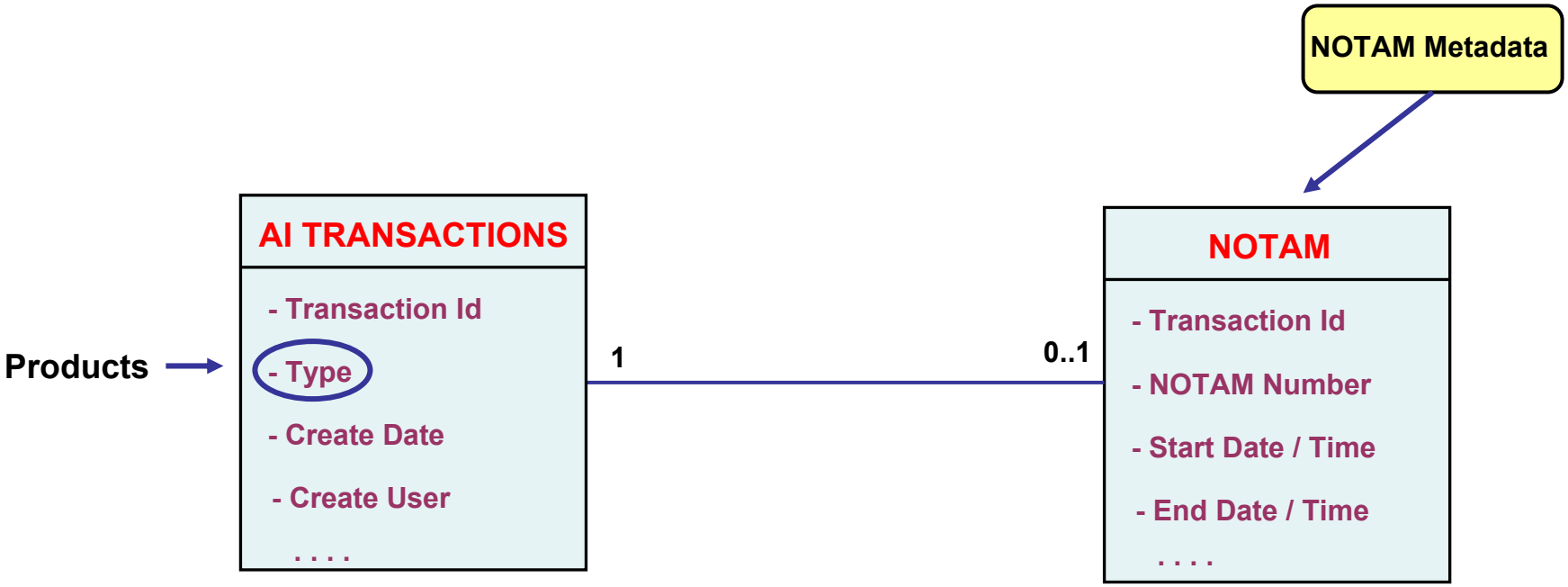


Questions
&
Discussion

Backup Slides

Implementation: Logical to Physical



1. Implementation Changes
2. Generate XMI (XML Metadata Interchange) file to be read by CASE Tools
3. Generate relational database objects using CASE Tools

Transactions - Illustration