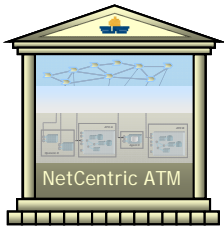


# Information management for interoperability in European air traffic control



The European air traffic control center, EuroControl, has established an architectural framework based on enterprise architecture inspired by DODAF/MODAF/NAF as a basis for the future development of networked European air traffic controls. The talk will present the information management and service architecture approach to cross - European interoperability for this. The architecture is being developed further in the ongoing SESAR project, with partners from the different European countries involved.

Ulf Larsson, Enterprise Architect, National air traffic center  
(Luftfartsverket), Sweden



# Single European Sky ATM Research, SESAR



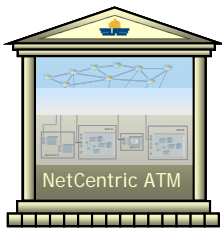
- Why started European Commission SESAR?

Reduction of Cost, automation and rationalisation of ATM!

- Budget 22 billion Euros (2 billion used within the DP-phase - 2006 to 2008)
- A new approach SESAR addresses the entire ATM? airports, ANSPs, Air Space Users (airlines), MIL, others
- A common joint development - SESAR Joint Undertaking (SJU)
  - 2009 till 2013 IP1
  - 2013 till 2017 IP2
  - 2017 till 2020 IP3

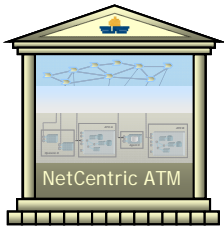
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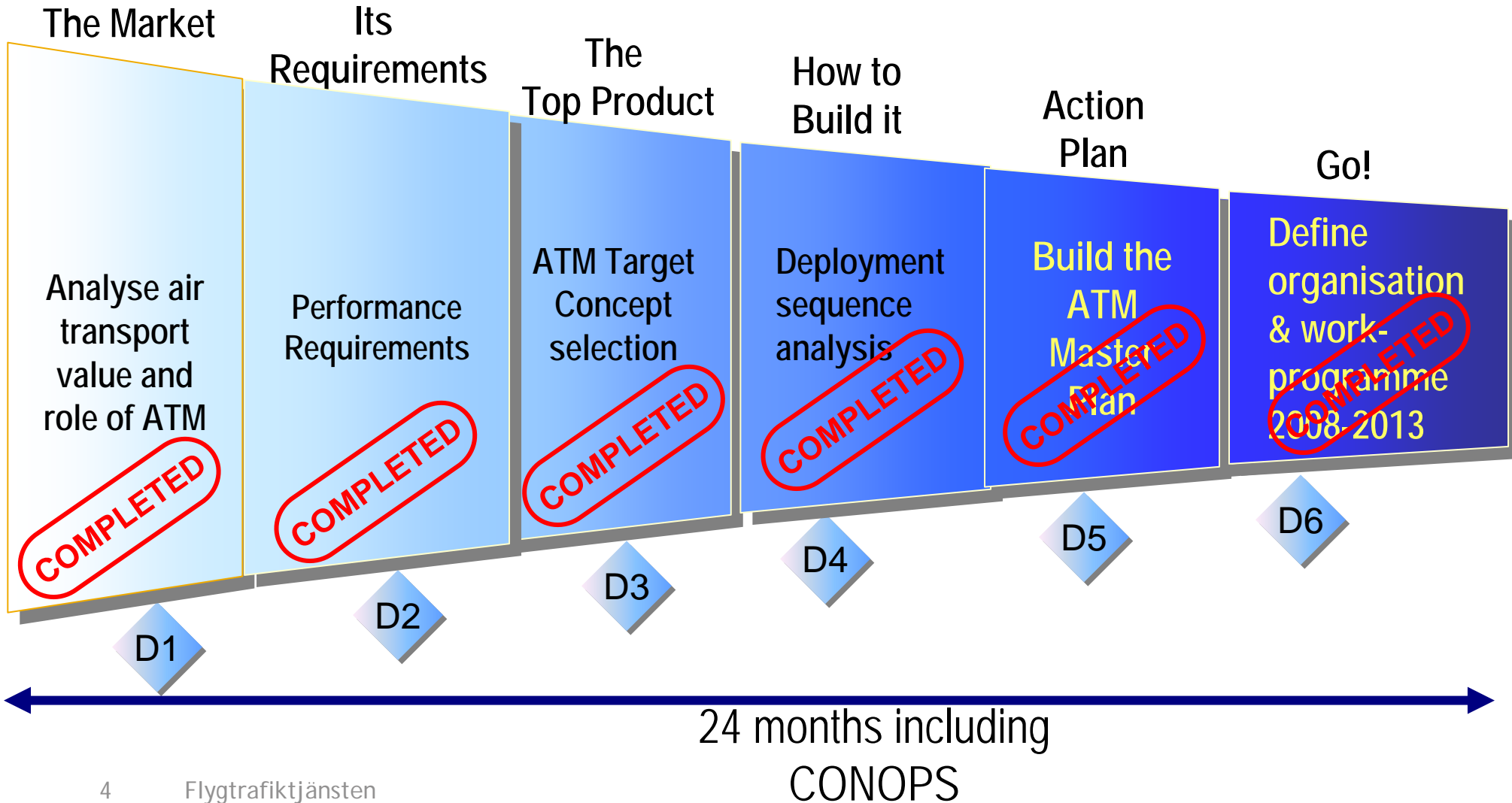


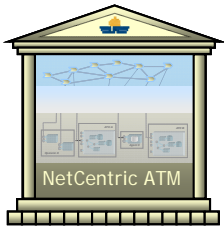
# Some participants in SESAR





# SESAR Definition Phase (start 2006 end mars 2008)

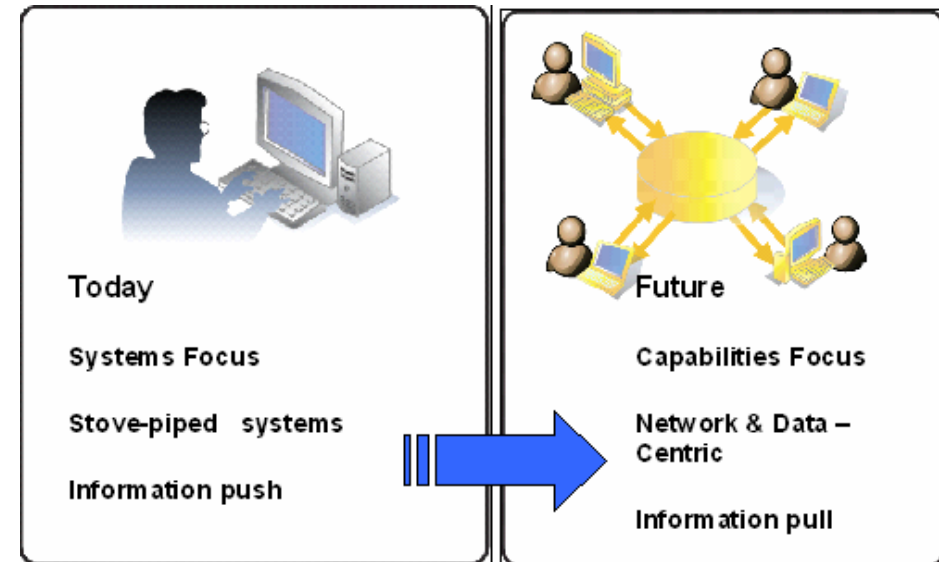


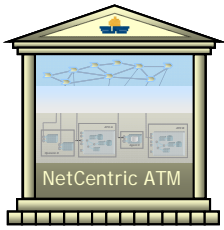


# Main Gaps!



- Missing the Enterprise level of Architecture
  - Formal Business Process models
  - Formal Information Models
  - Formal Operational Goals
  - Formal Service Model
  - Framework
- The Development is not driven from Business Perspective
- Missing Service Oriented mindset, too much focus on Systems

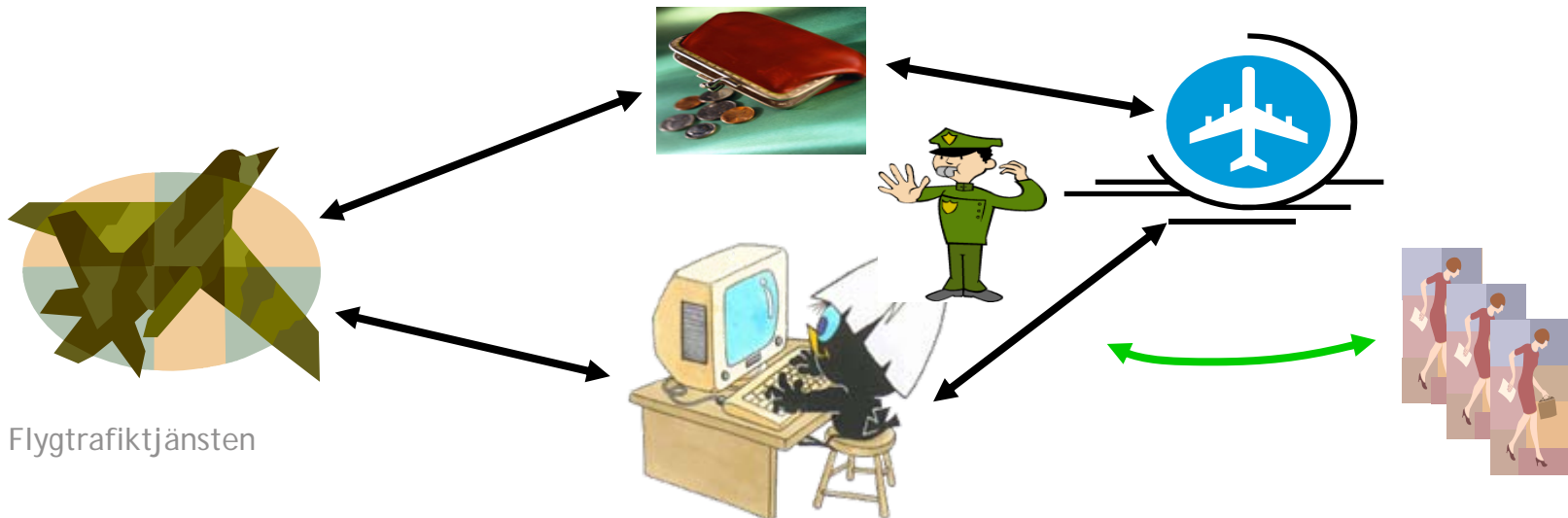


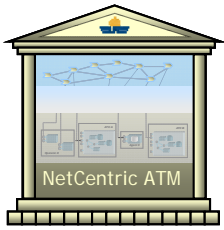


# What is the goal/objectives more than reducing the costs?



- It is about building seamless and interoperable distributed information systems within ATM;
  - Reuse of information and components (soft-ware components),
  - Share on-line operational information e.g. concerning flights and information that may affect a flight etcetera
  - In a flexible way make new demand/requirements possible (opposed to system flexibility)
  - The development requires new methods, tools, architecture (description) frameworks and formal description languages



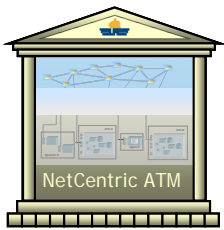


# The outcome of SESAR DP !



- SESAR DP documented;
  - Performance Based Approach, 11 KPAs are described to guide decision makers in order to reach the Vision (Cost / Effectiveness, Capacity, Interoperability etc.)
  - EAEA perspectives
  - SOA vs Service-Oriented (SoS, FoS)
  - Enterprise Architecture Framework
  - MDA (Modelling Driven Architecture)
  - NetCentric ("Intranet of ATM")
  - The development should follow a "top-down approach"

ATM Europe has started changing the suit and it is a comprehensive paradigm shift which affect all levels within ATM ("requires a change in mind set").



# Logical Architecture 2020

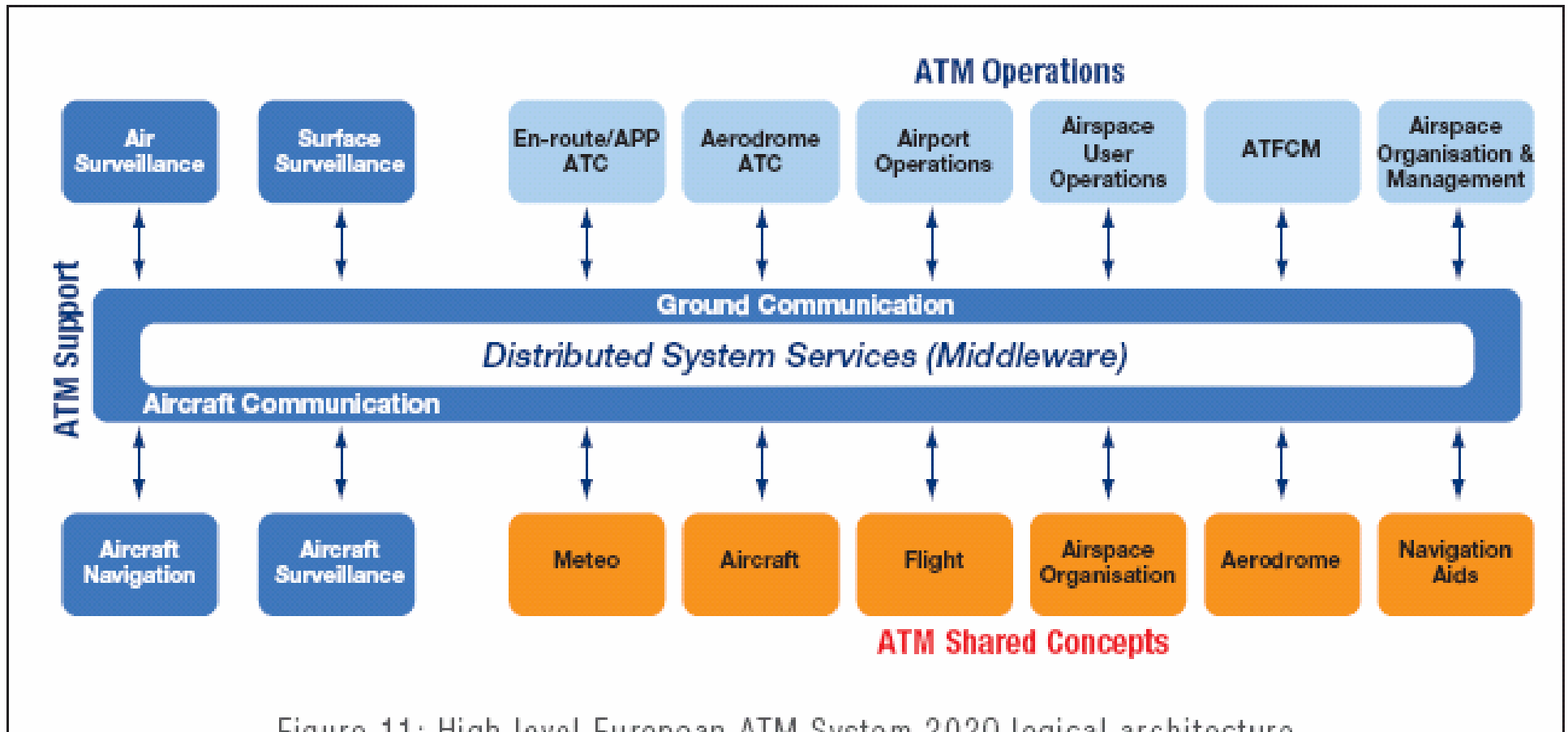
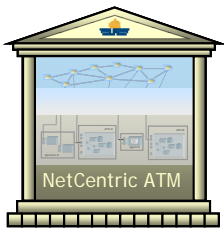


Figure 11: High level European ATM System 2020 logical architecture





# Business Trajectory a new Capability!

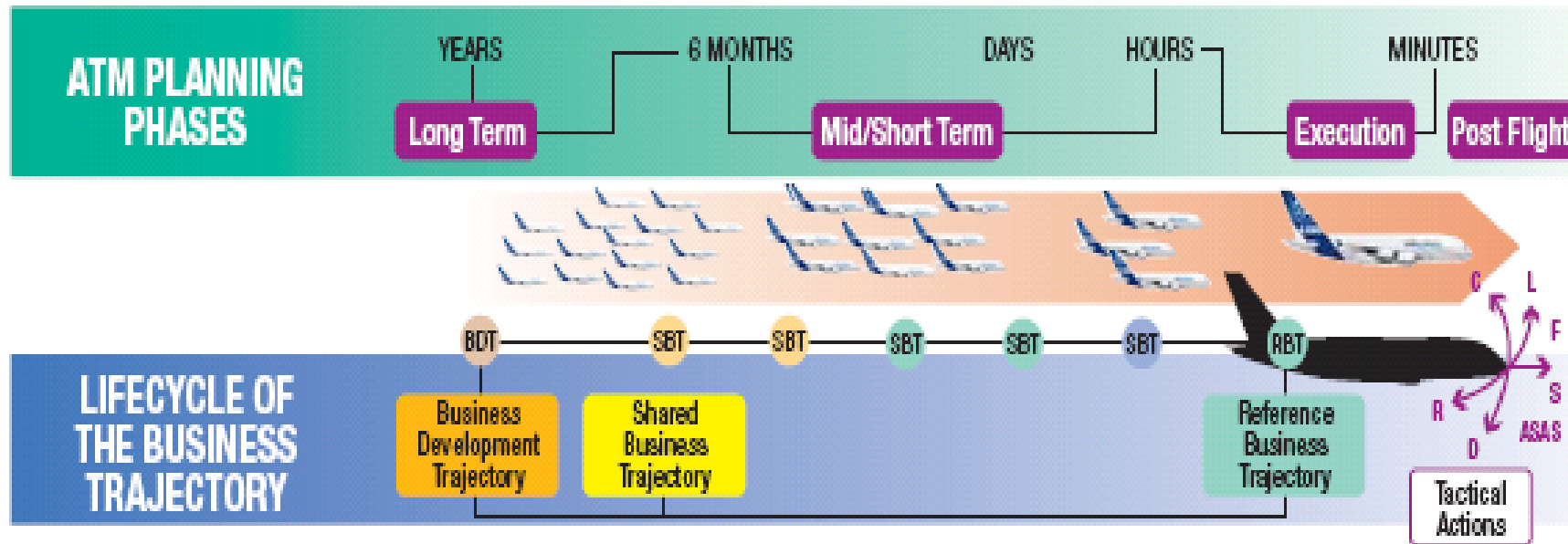
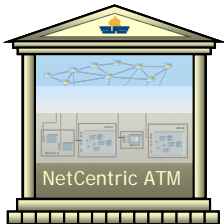
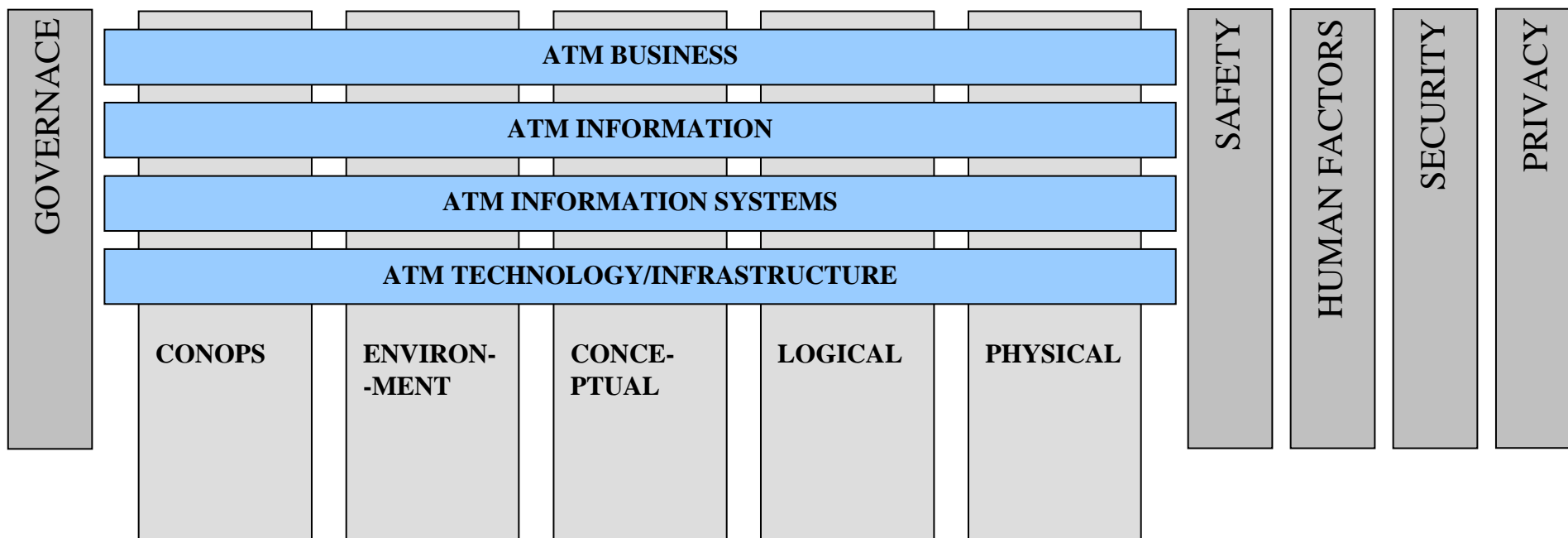
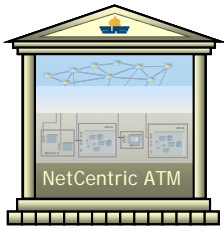


Figure 4: The Business Trajectory lifecycle



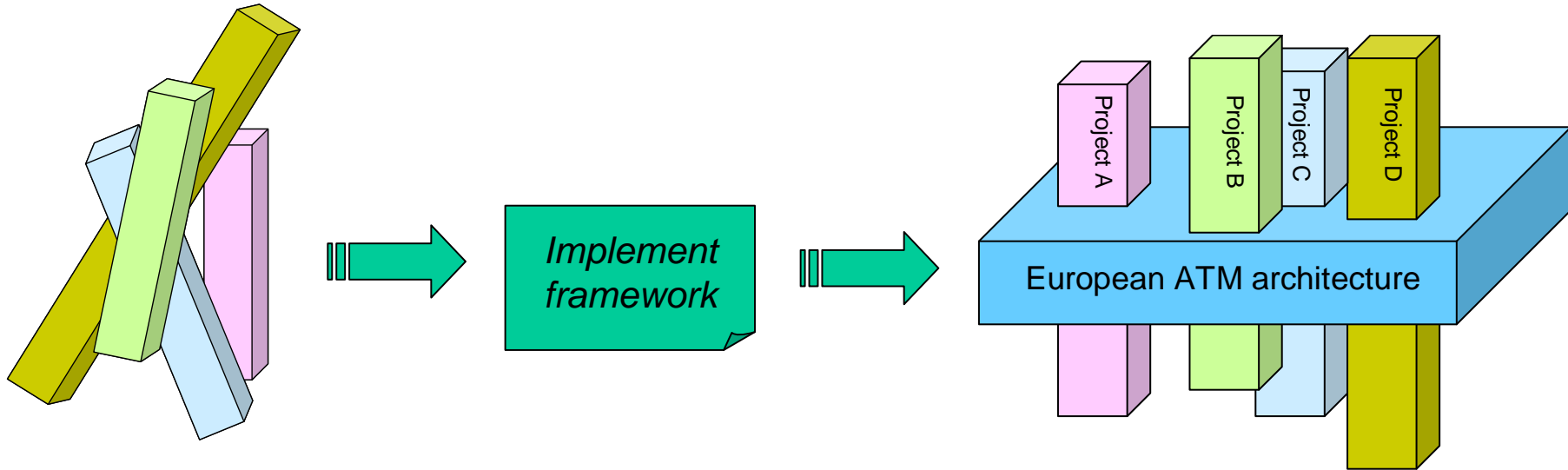
# EA-perspective





# Concept Description

## Enterprise Architecture Framework

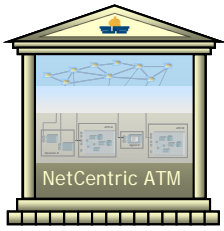


### Fragmentation

- Existing systems
- Development projects
- Interoperability
- Operational usage

### Alignment

- Commonality
- Consistency
- Coherence
- Interchange
- Standardisation
- Increased cost/benefit



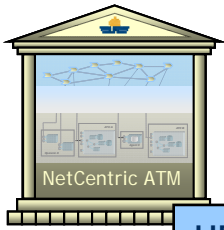
# Concept Description

## Enterprise Architecture Framework

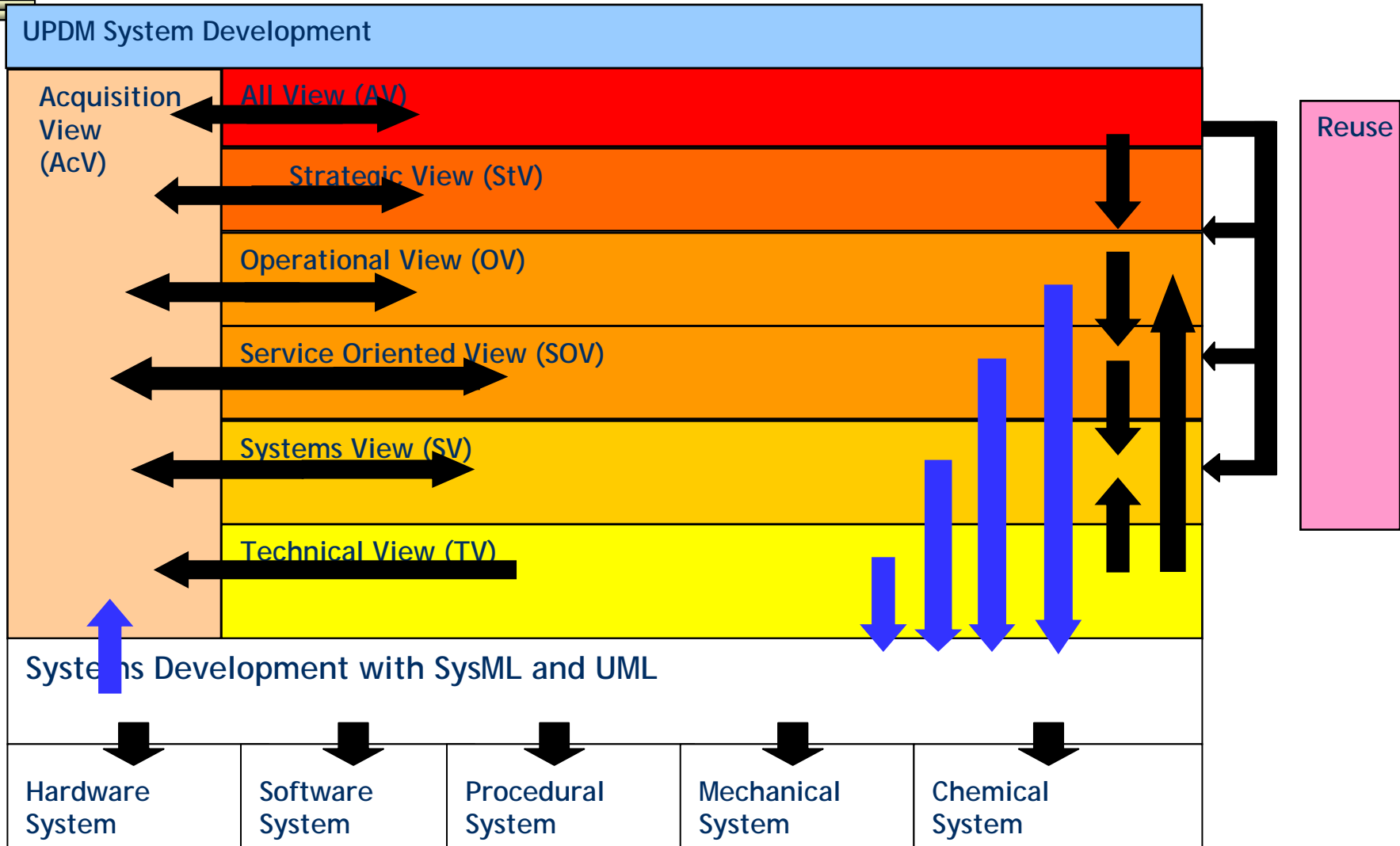


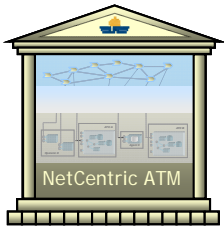
NAF, NATO Architectural Framework and MoDAF 1.2 (and OMG UPDM)

- Each View represents a specific Perspective of the Architecture
- Each View contains subviews



# OMG UPDM (UML Profile and Metamodel for DODAF, MODAF and NAF)





# Enterprise Architecture

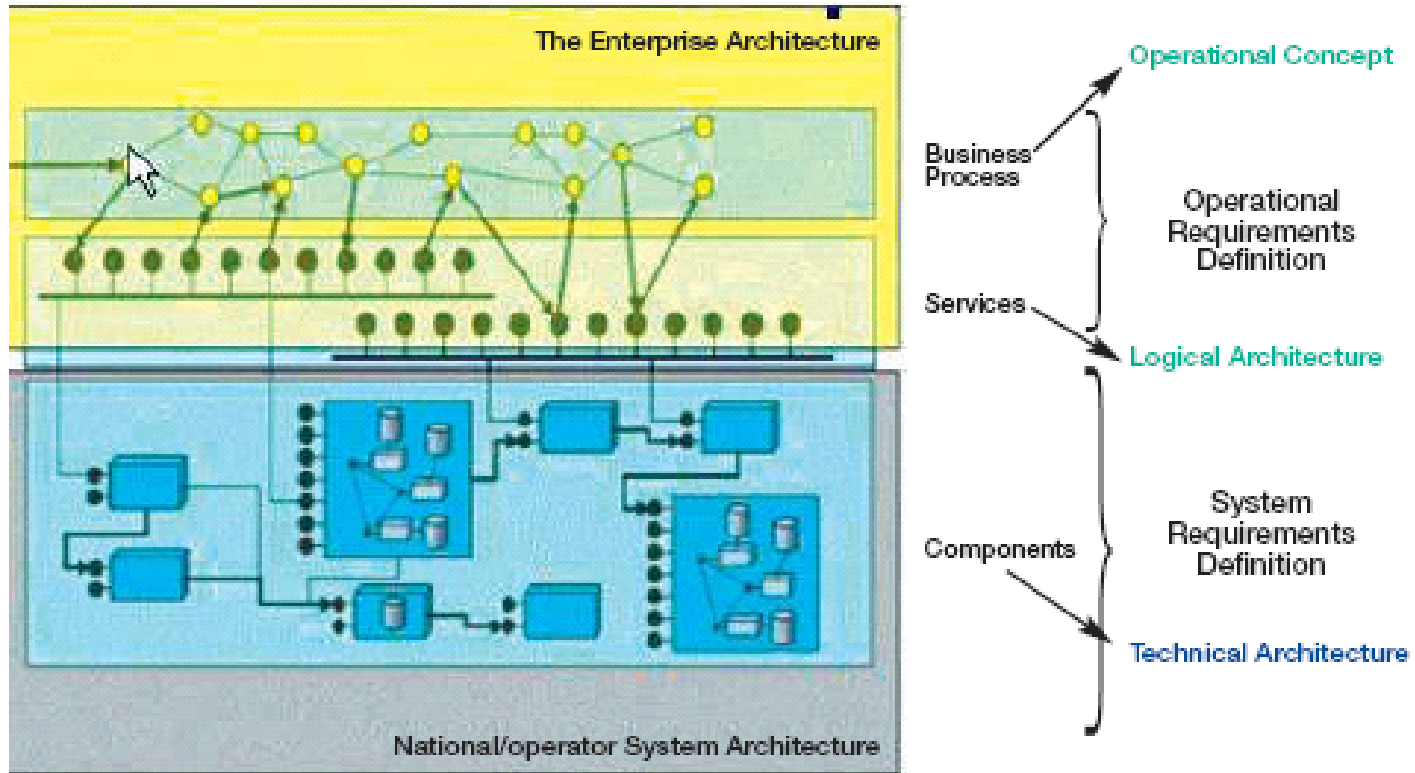
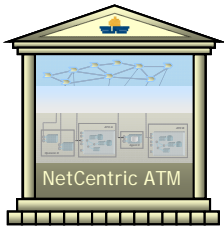


Figure 22: Boundary between operational requirements and implementation

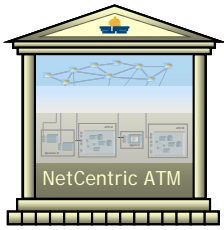


# Information as a strategic resource within ATM - the history!

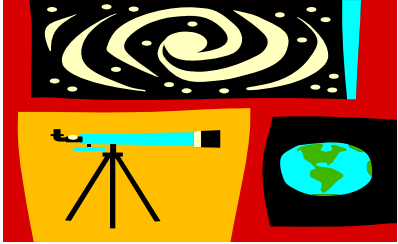


- ICAO started 1997 (SICIM ISO 10303-11)
- Eurocontrol AICM (a logical data model)
- SESAR (EC) discovered the needs for a Conceptual Information Model year 2006-2007
- LFV (NORACON) is responsible for the Information Management within SESAR Joint Undertaking
  - Information Management
  - Information Service





Where is ATM in this IM context?

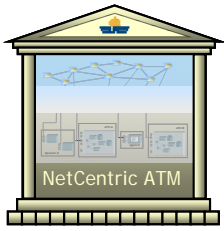


## **Service-Oriented Architecture the way forward within ATM**

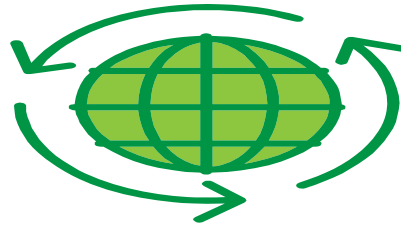
- The only possible way forward
- Requires a change in mindset
- Interoperable and Interchangeable Services (business and IT aligned)
- The Business must lead however it is not always in that way
- Top-down approach – Governance, reusability is key within SOA
- How to use the Service Bus and how to avoid a new “looked in position from an ANSP position” is a critical issue







# What is needed within ATM concerning Information Management?



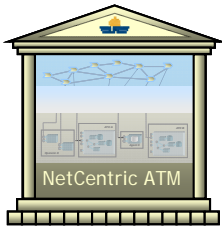
**See what we have –  
analyses, cleanup and  
import to ATM ONTOLOGY**



## **Concerning Information Models**

- **One ATM Conceptual Information Model**
- **a number of Logical Data Models**
- **Service Models**





## IM within ATM covers more....



**CONTENT** (meaning of shared concepts)

**DISTRIBUTION** (information about the distributor and options to obtain a resource)

**QUALITY** (quality measures, completeness, accuracy, integrity...)

**MAINTENANCE & UPDATING** (e.g. update frequency)

**DESCRIPTION & DISCOVERY** (e.g. descriptive information about a resource)

**EXCHANGE & ACCESS** (e.g. application schema of a resource and the exchange pattern)

**USER ID & PROFILE** (privileges within various user context)

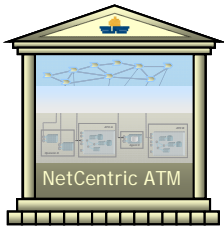
**SECURITY & AUTHENTICATION** (security and authentication aspects related to a resource)

**NOTIFICATION** (aspects of the event architecture)

**DIGITAL DATA RIGHTS** (legal rights related to the use)

**CHARGES** (charges related to the use of information)





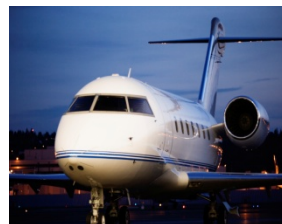
# SWIM Infrastructure ...

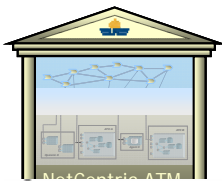


**Information Management addresses both Air-Ground and Ground-Ground Data and ATM Service Exchange**  
**Information Management is supported by a set of architectural elements (the SWIM infrastructure) underpinned by a communication Network – opposed to closely coupled interfaces**

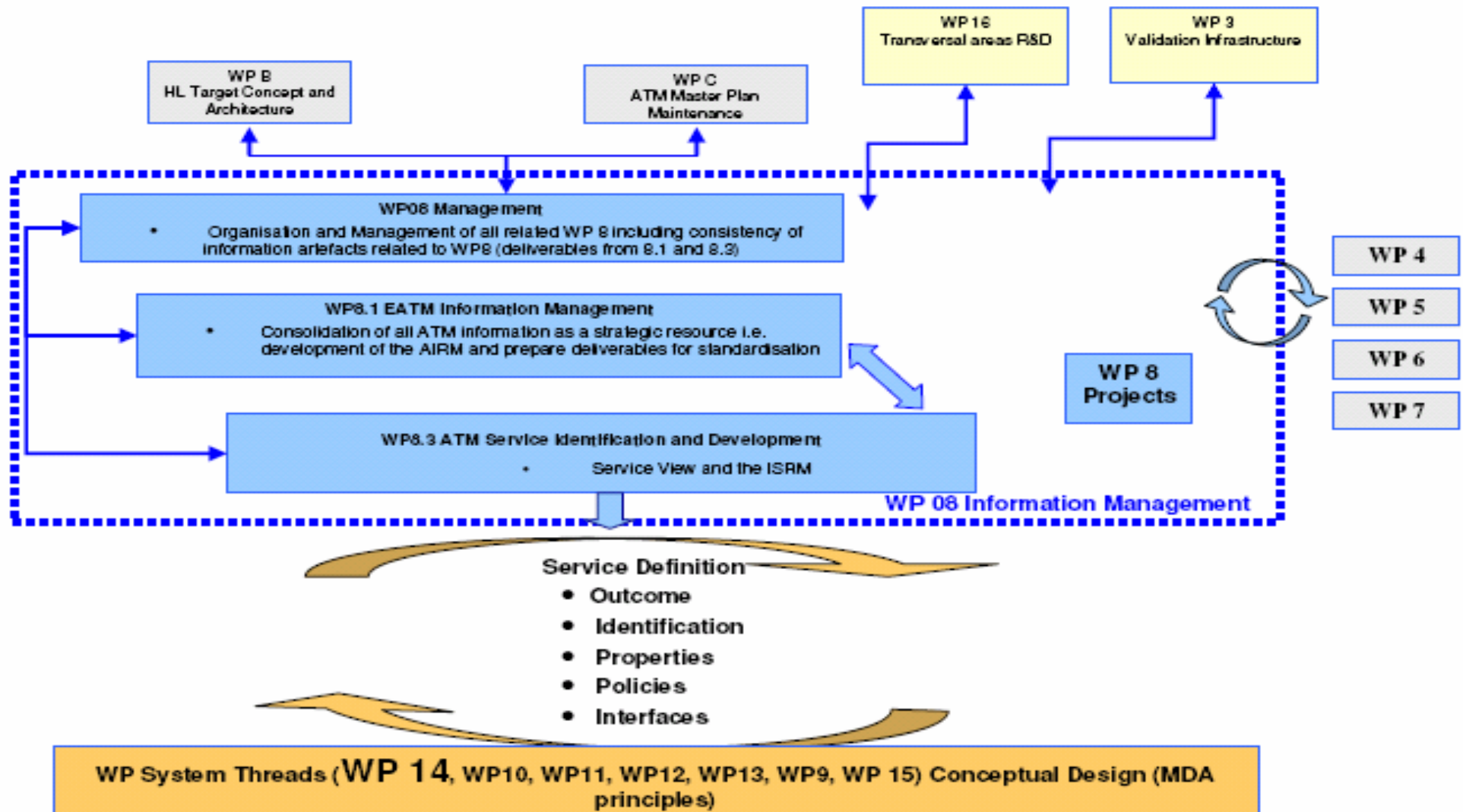


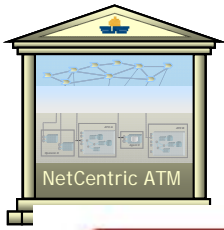
European ATM Enterprise



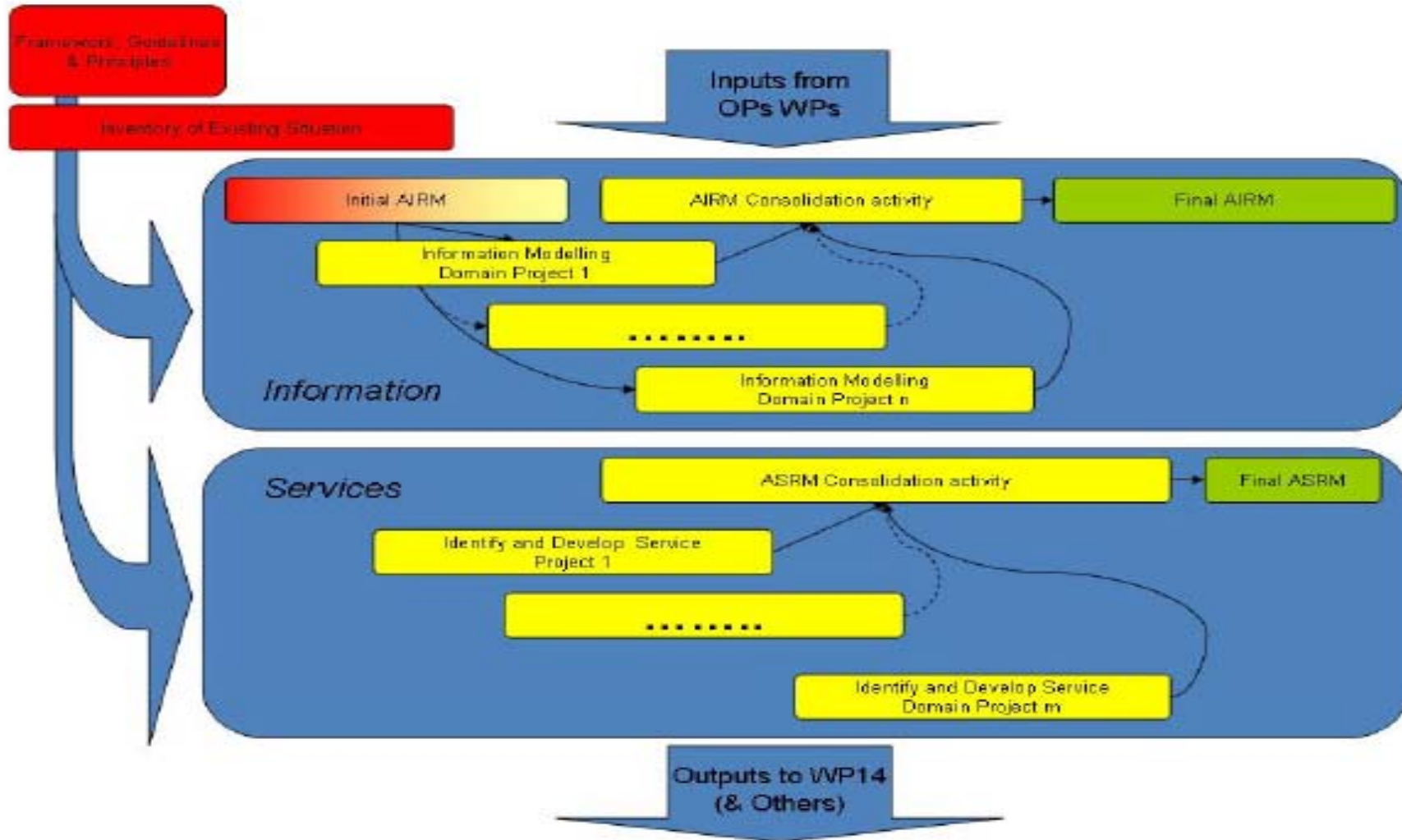


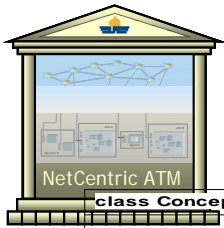
# Information Management (WP8) Overview





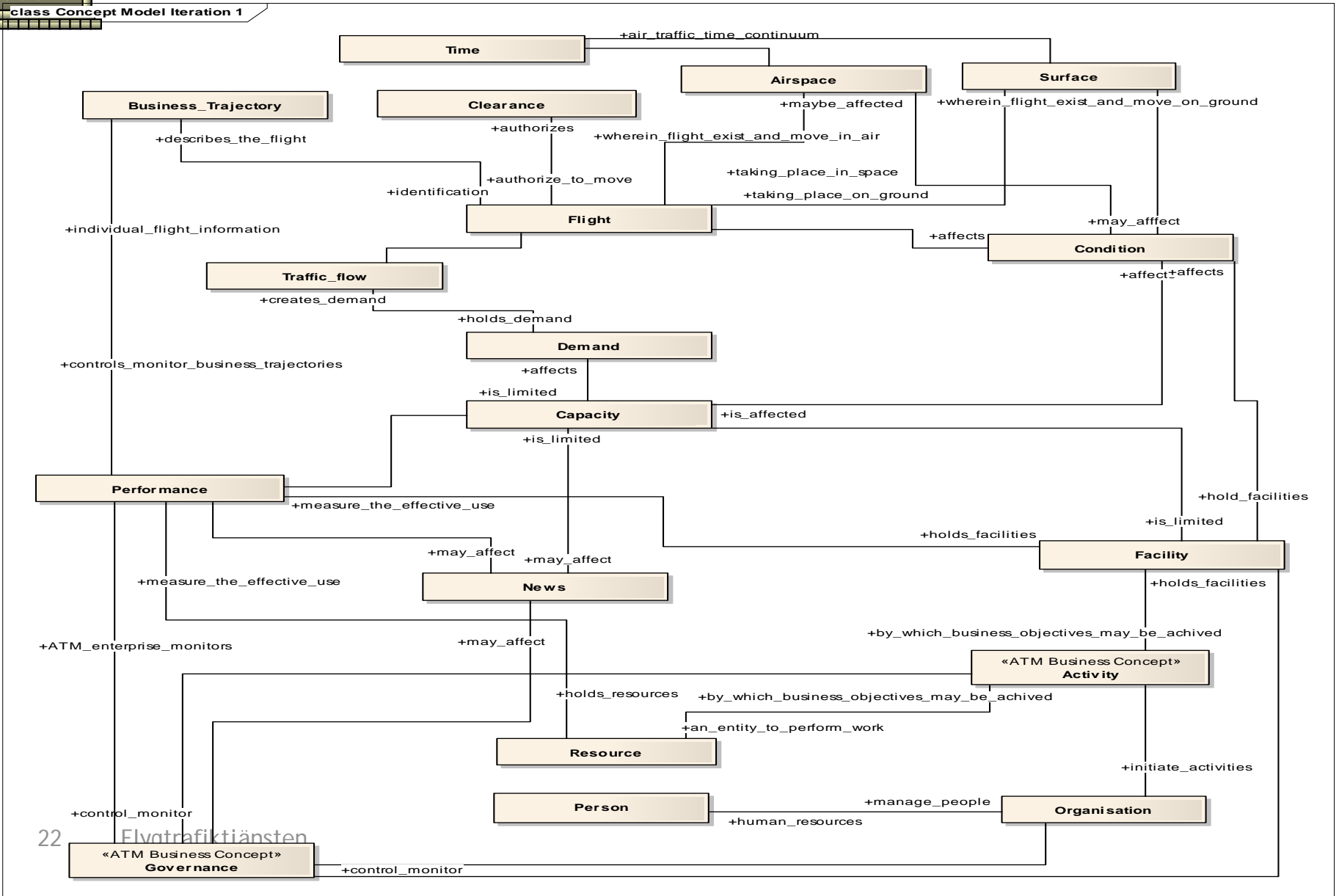
# Working arrangements Information Management (WP8)

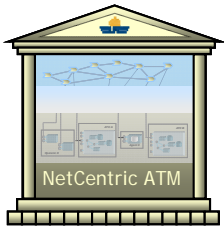




Class Concept Model Iteration 1

# In the frame of IM and EA TRS- Concept Model!



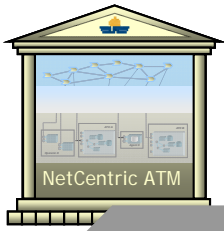


# In the frame of IM and EA TRS- Entity Framework!



## class Concept Model Iteration 1





# Clouds - everything as a service

