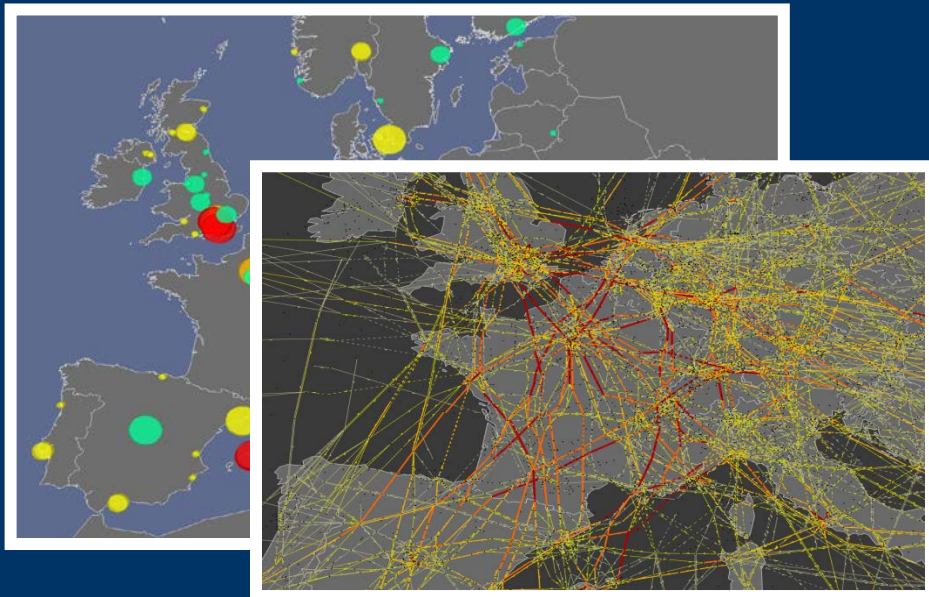


SESAR 2020 - PJ09 DCB

Advanced Demand & Capacity Balancing



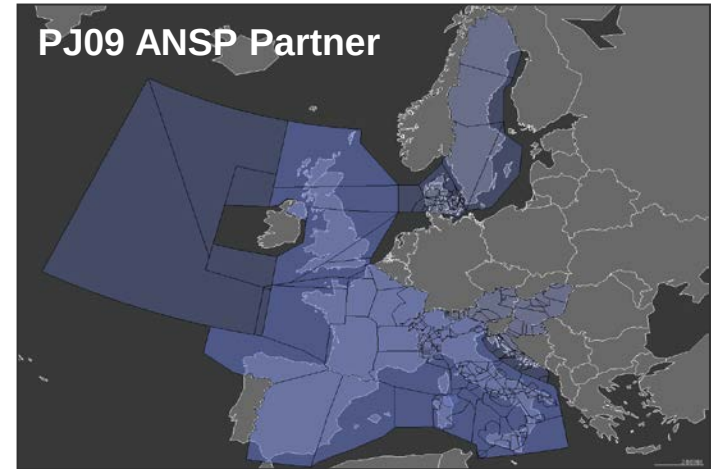
6th – 7th March 2018 (Madrid)

Hamid KADOUR

PJ09 - Partner Organisations

24 Partner Organisations

- EUROCONTROL Experimental Centre
- Network Manager
- 10 ANSPs
- 4 Ground Industry
- 4 Airports
- 2 R&D Labs



COOPANS: AustroControl, CroatiaControl, IAA, LfV, Naviair
 Frequentis SESAR Partners Consortium: Frequentis, Hungarocontrol, Steria, Bull



B4



PJ09: 6 Key Points for Improvement

- Traffic and Complexity Prediction
- Performance driven and Collaborative Decision Making
- Integrating Network ATC Planning (INAP)
- Target Time Management in Execution Phase
- A common knowledge base for Planning and Execution
- Reconciliation of conflicting measures



PJ09: The structure

PJ09

Project Lead:
EUROCONTROL

Solution PJ09-01

Network Prediction & Performance
Lead: EUROCONTROL

Improving Traffic & Workload Predictability

Traffic and Complexity Prediction
Performance Monitoring

Local

Transversal

Regional

Solution PJ09-02

Integrated Local DCB Processes
Lead: ENAIRE

Closing the Gap between ATFCM Planning & Execution

DCB / ASM Integration
Integrated DCB / ATC Processes
Target Time Mgt and DCB / AMAN

Solution PJ09-03

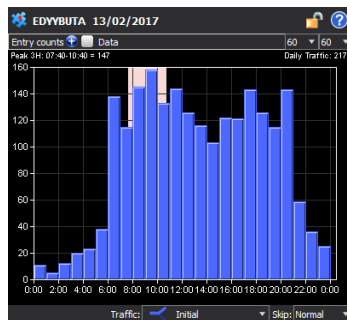
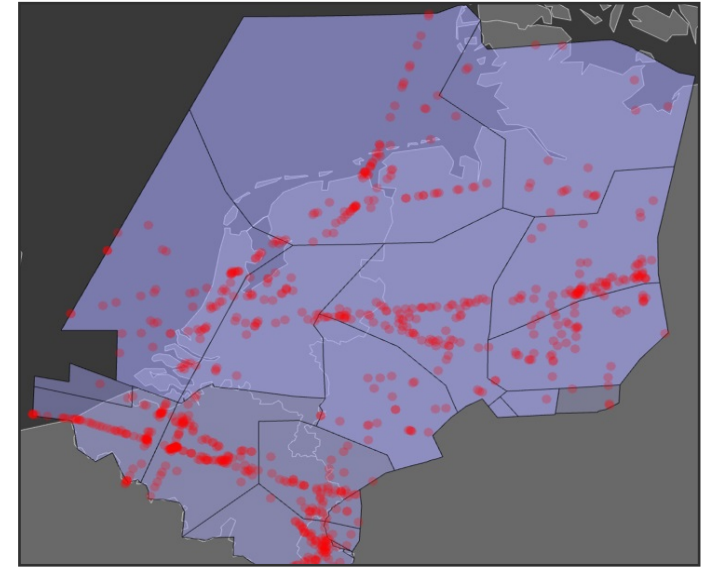
Collaborative Network Mgt Functions
Lead: EUROCONTROL

Regional Network Intelligence

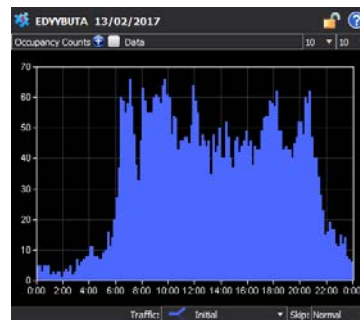
Rolling AOP/NOP
Supervision of the Network
Collaborative Constraint Management

PJ09.01: The ground to improve DCB

- To **Role of DCB** is to **keep the ATCOs workload in the safe area** (to prevent overload)
- Decisions are based on predicted incoming traffic demand
- SESAR 1 allowed the introduction of new methods (i.e. evaluation) with different validity/usability timeframe



Entry Counts



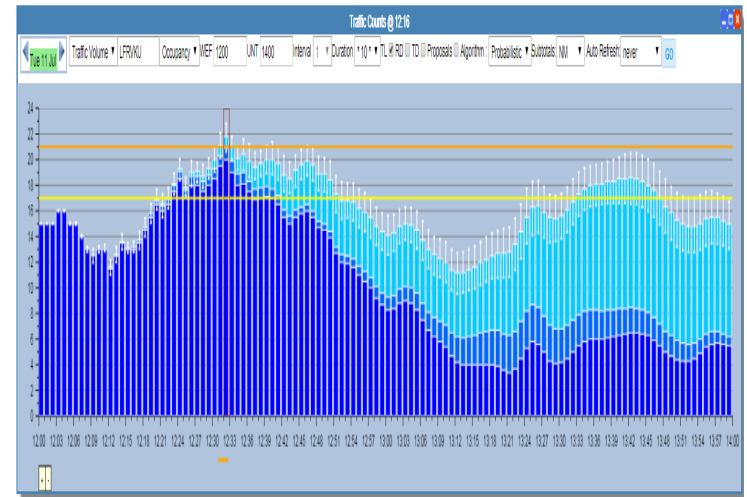
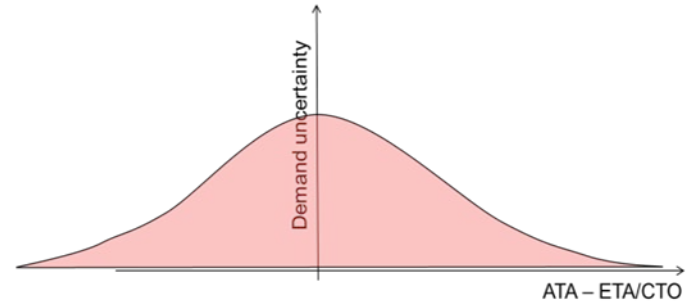
OCC Counts



Complexity

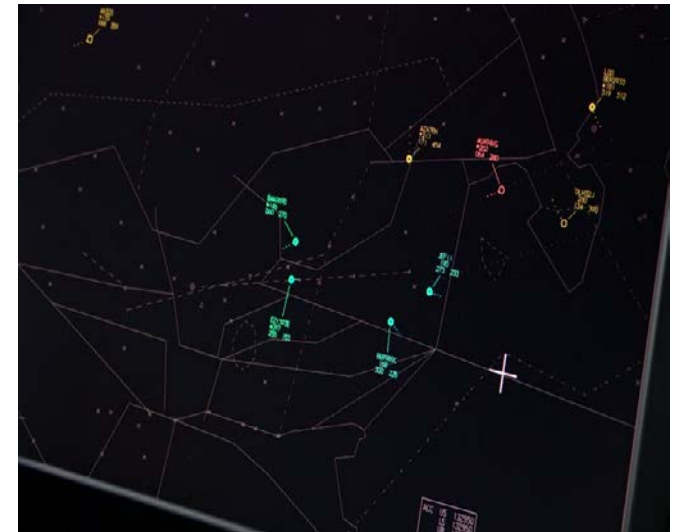
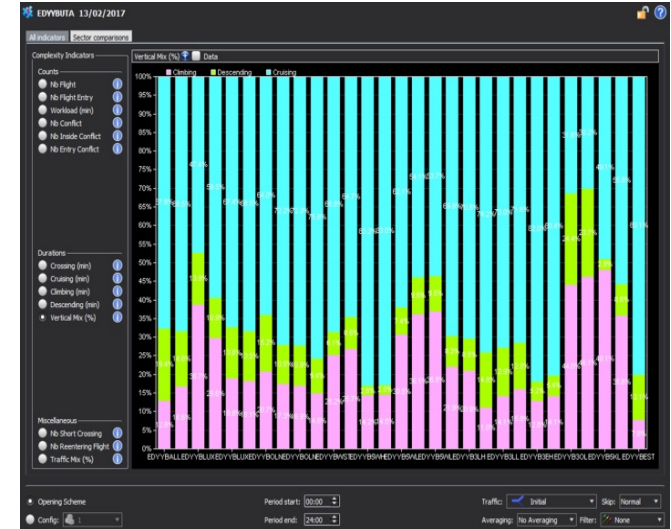
PJ09.01: Improving Predictability

- SESAR 1, an initial step
- **Many volatile factors** present in traffic demand forecast
- **Human correction** performed by operational actors (i.e. FMPs)
- **PJ09.01** research activities will bring the **Probabilistic Demand Forecast** and the associated tools to quantify the operational uncertainties.
 - Improved Traffic demand prediction.



PJ09.01: Complexity & Imbalance Prediction

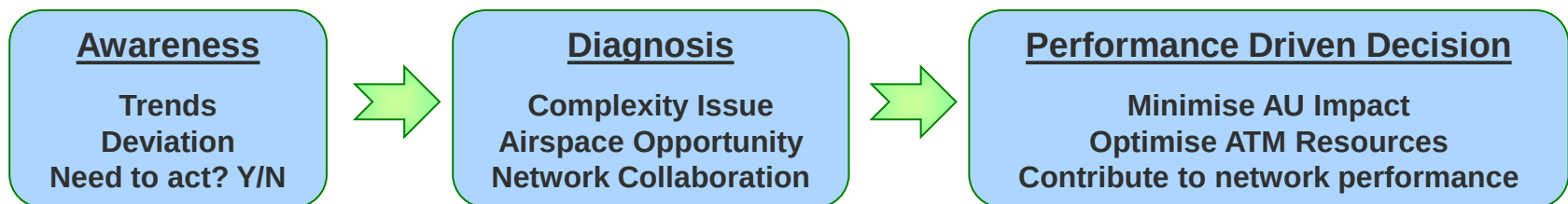
- New **local complexity** and **Workload Prediction Algorithms** will be assessed.
- Complexity **contributing factors analysis** method & tools
- Simplified Standard European Complexity Algorithm (for Imbalance Repository)
- Semi-Automated upload of local imbalances into NOP Imbalance Repository (*architecture study only*)



PJ09-01: Performance Driven

- **Monitoring of Performance**, a key element to support operational decision making
- Performance Indicators **not designed to help operators** in decision making
- Lack of awareness for network state
- PJ09.01 will investigate a generic Performance Analysis Framework dedicated to DCB
 - for Regional & Local-Level
 - for all stakeholders (AU, Airports, ANSPs, NM) to foster collaboration

Facilitating Decision Making:



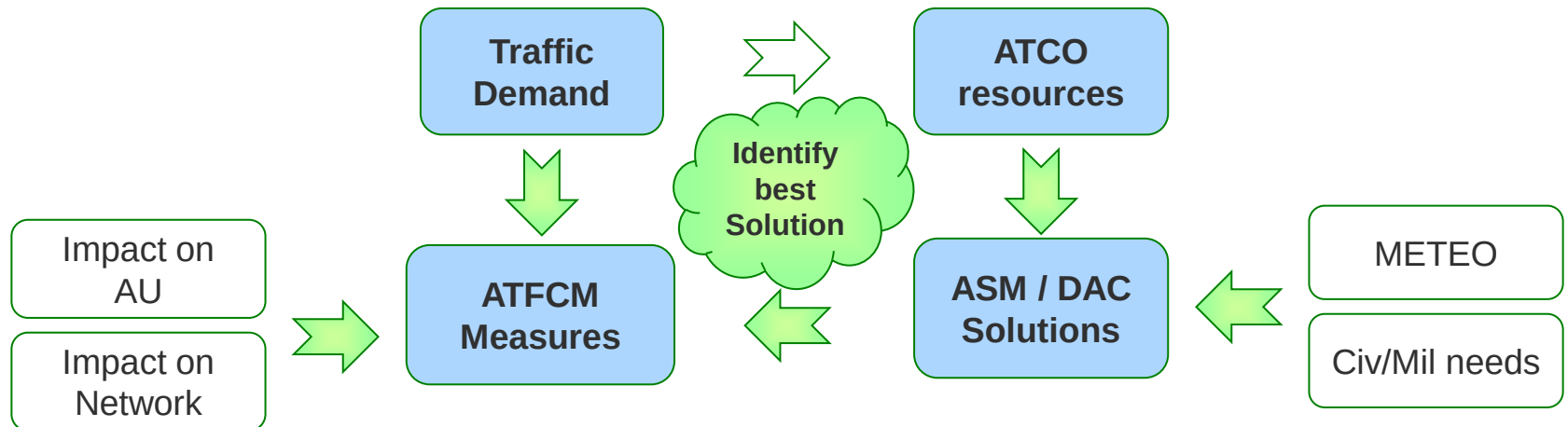
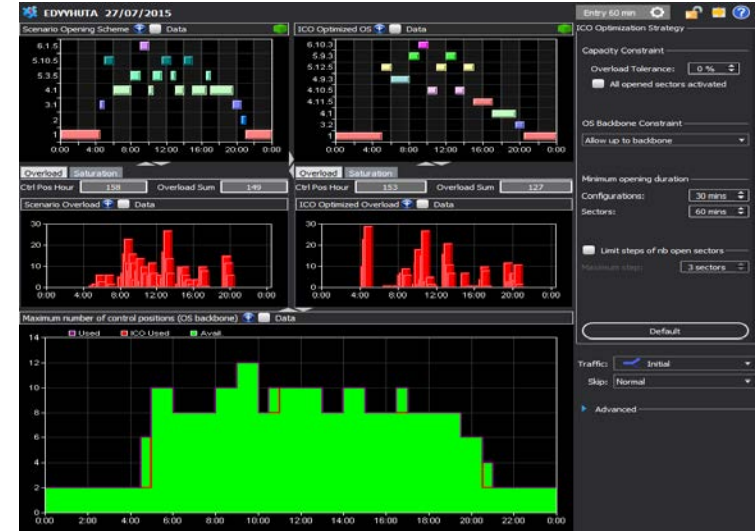
PJ09.01: Critical and Crisis State Mitigation

Balance Business Needs with the Needs of the whole System

Network State	Nominal Network State	Critical Network State	Network Crisis
Dominant Attitude	Individual and DCB-related interests	Anticipation of degraded/disrupted conditions	Recovery from degraded/ disrupted conditions
Performance Agenda	Nominal DCB-related PIs	Network-centric performance indication	Resilience PI: time to recover

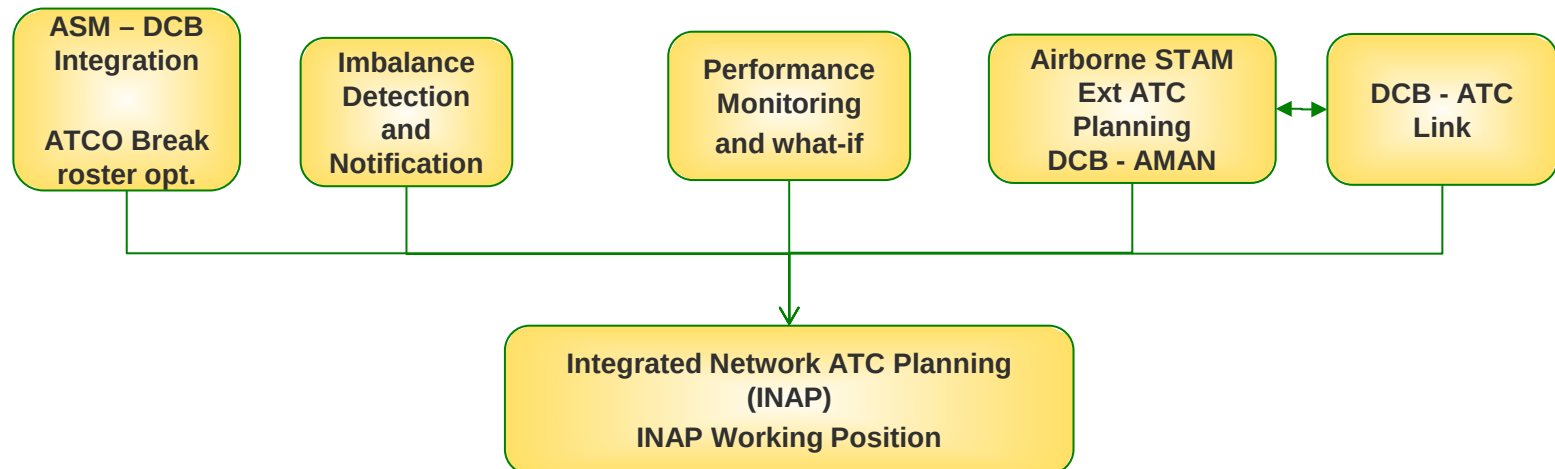
PJ09-02: Integrated Local DCB Processes

- Integration of **ASM** into DCB Processes
- Optimal Mix between ASM measures & STAM measures (including civil / military)
- Improved use of MET data for capacity planning



PJ09-02: Integrated Local DCB Processes

- **INAP Working Position**, Integrating DCB with Complexity Mgt / Extended ATC Planning
- **Airborne STAM**, Target Time Mgt in execution phase (**closing the gap with ATC**)
- Using the Performance Monitoring Cockpit with focus on tactical Ops KPIs, as developed by PJ09-01
- Improved coherency between Regional and Local-Level
- Information Flow, Roles and decision making FMP ⇔ ATC



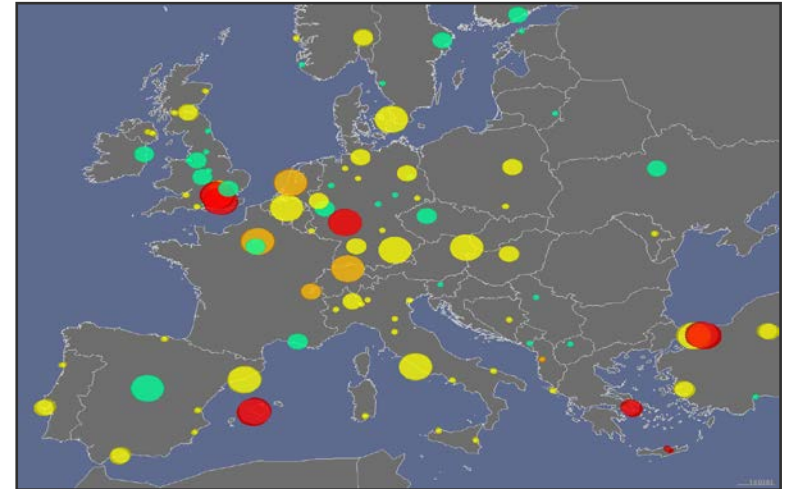
PJ09-03: Rolling and Collaborative NOP

Collaborative Network Management Functions

- **Flow and Flight planning Integration (support to FF-ICE)**
 - ✓ Enriched DCB information and congestion indicators for AUs to assess the network DCB impact on a flight or preliminary flight plan
 - ✓ What-if and What-else services for AUs to identify network constraints and find opportunities.
- **AOP / NOP Integration**
 - ✓ Focus on AOP information improving network demand predictions
- **AUs Priority and Preference Indicators**
 - ✓ Provided by AU and APT to be considered in DCB (local and NM)
- **Enhanced What-If capabilities**
 - ✓ For ANSP for imbalances prediction (entry, occupancy, complexity)
 - ✓ For AU in support to FF-ICE

PJ09-03: Supervision of the Network

- **Develop Network Supervision Tools** to support Arbitration and **Decision Making at Network Level**
 - ✓ Advanced monitoring and alert functions
 - ✓ What-if network impact assessment
 - ✓ Trade-off functionalities and identification of opportunities
- Integration of Performance Monitoring and trade-off functions (from PJ09-01) into Network Manager Operating Centre (NMOC)



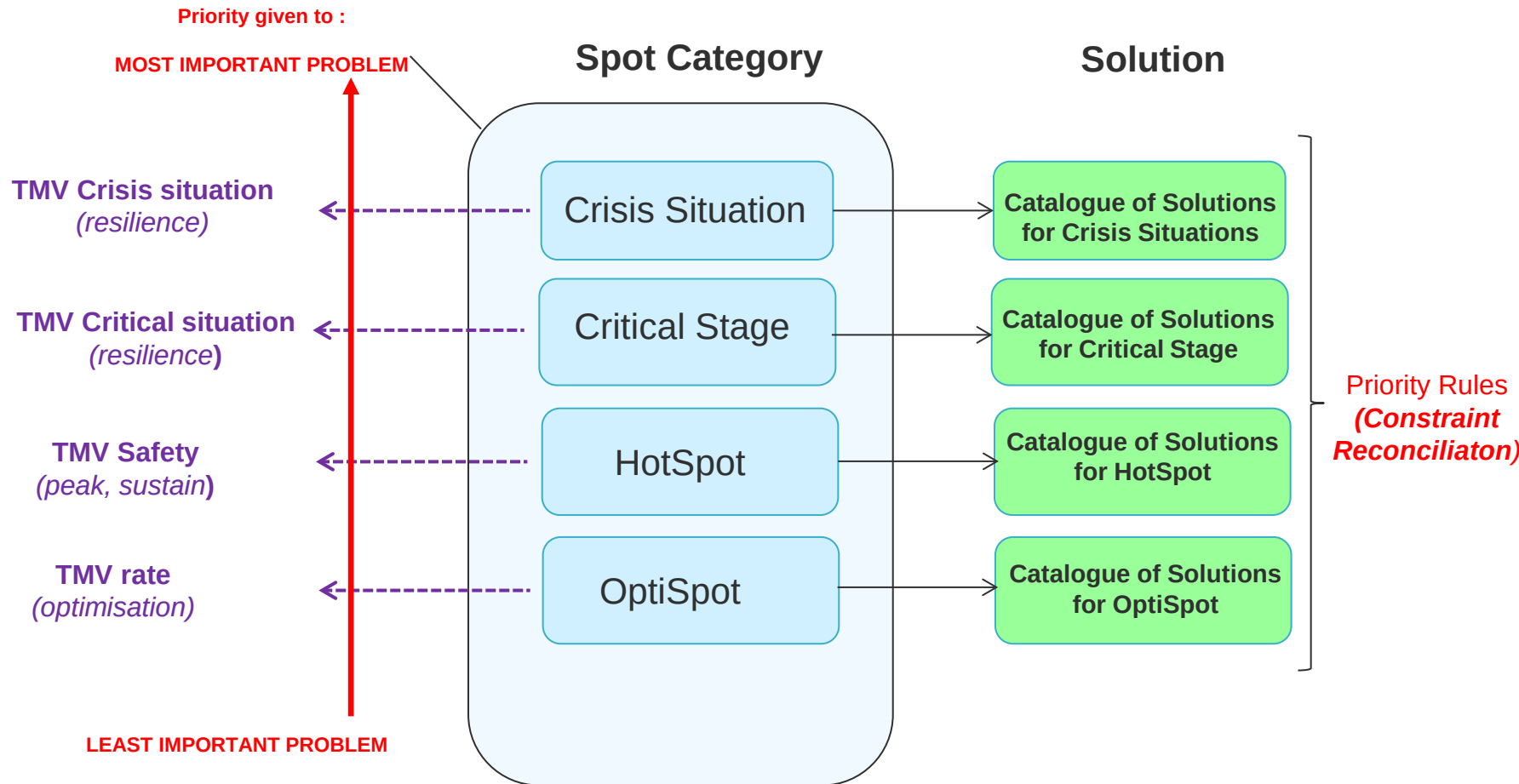
PJ09-03: Constraint Reconciliation

- An evolution towards more distributed environment, **multiplication of sources (i.e. origin) for DCB decisions**, mix of DCB measures of different nature from pure optimisation issues to safety-critical ...
- Taking into account of **stakeholders business needs**
 - Airport operations and Arrival Time Management
 - Airspace User Preferences and Priorities (UDPP)
- New emerging and conflicting traffic synchronisation needs (Extended AMAN, XMAN)

PJ09-03: Constraint Reconciliation

- Recognise the different DCB objectives
 - Pure optimisation like arrival sequence management
 - Complex & safety issues
 - Critical situation
 - Crisis management
- Need to categorize the problems by **Category** (Hotspot, Optispot, ...)
- To define the rules to be applied (Multiple Constraint Reconciliation) :
 - Within a Category ?
 - Between two **Categories** ?

PJ09-03: Category of Problems

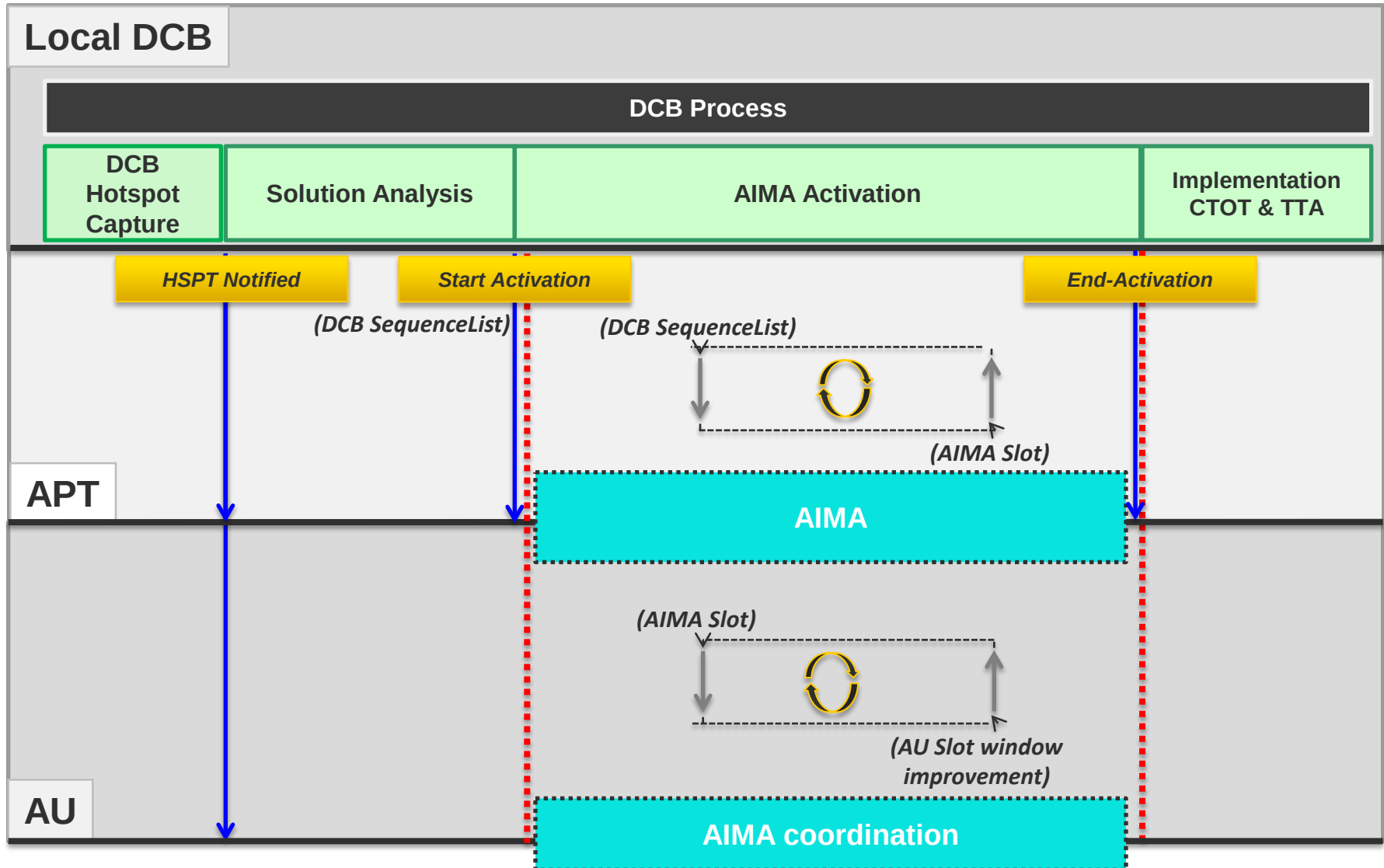


PJ09-03: A DCB Collaborative Framework

- Managing different DCB Problem categories implies different actors, roles and responsibilities, several modes of collaborations are defined to reflect them:
 - **Limited Delegation:** It concerns the limited transfer of responsibility and authority, during a determined timeframe.
 - **Full Delegation:** It concerns the full transfer of responsibility and authority, from the DCB solution design to the solution implementation.
 - **Full Autonomy:** it concerns the full responsibility and authority to manage from the DCB Spot identification, Solution design and implementation. CDM is still applicable to take collaborative decision with others actors (coordination mechanism)

PJ09-03: DCB Collaborative Framework

Delegation mode illustration



PJ09-03: Constraint Reconciliation

Key R&D topics

At network level, a mechanism shall ensure the management of these interfering constraints.

- To ensure the balance between Network Performance vs Local Performance targets
- To provide a Network View for Consolidated Constraints (NCC), based on:
 - The introduction of **priority rules** to manage conflicting DCB measures depending on the nature of the related DCB “Spot” (i.e. hotspot, optispot)
 - Seeking for an **optimal solution** based on stakeholders criteria (AU, APT, ANSP)
 - Wave 2: Machine Learning to identify “**Smart Regulation Scheme**” optimised for any forecast load pattern

