

# What UDPP hopes to deliver to AUs

## The importance of designing the right mechanism and understanding the drivers of the user

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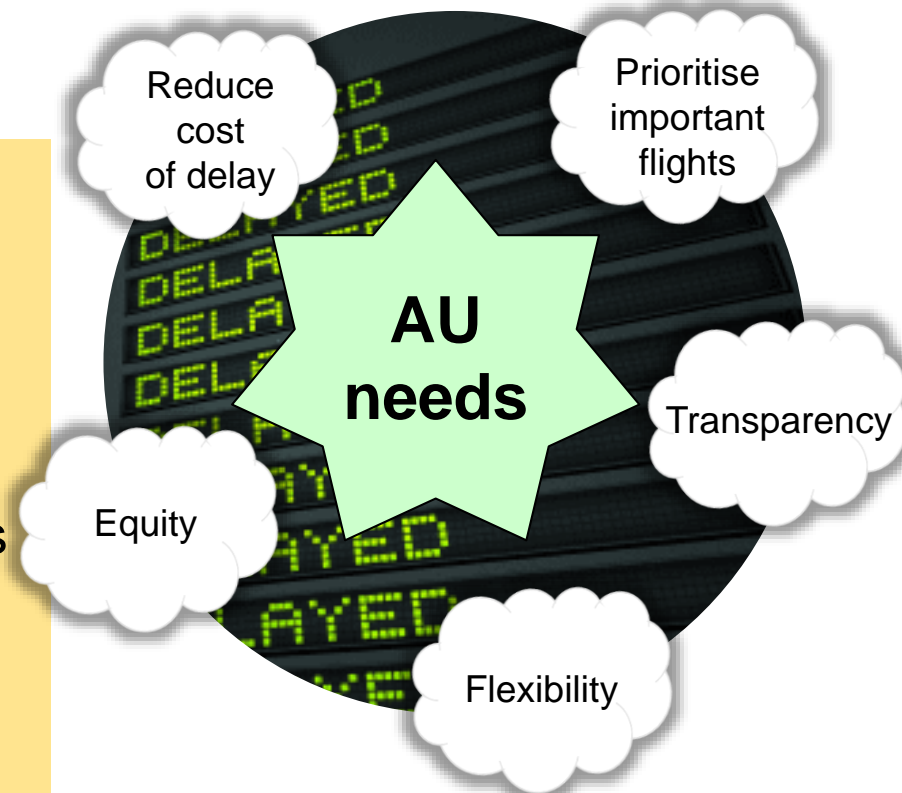
# UNDERSTANDING THE DRIVERS OF THE AIRSPACE USERS

## AU's “irrationality” in ATM

In order to maintain safety, the **European** Network ATFM Function at Airports or En-Route impose delays or other measures on certain flights before departure

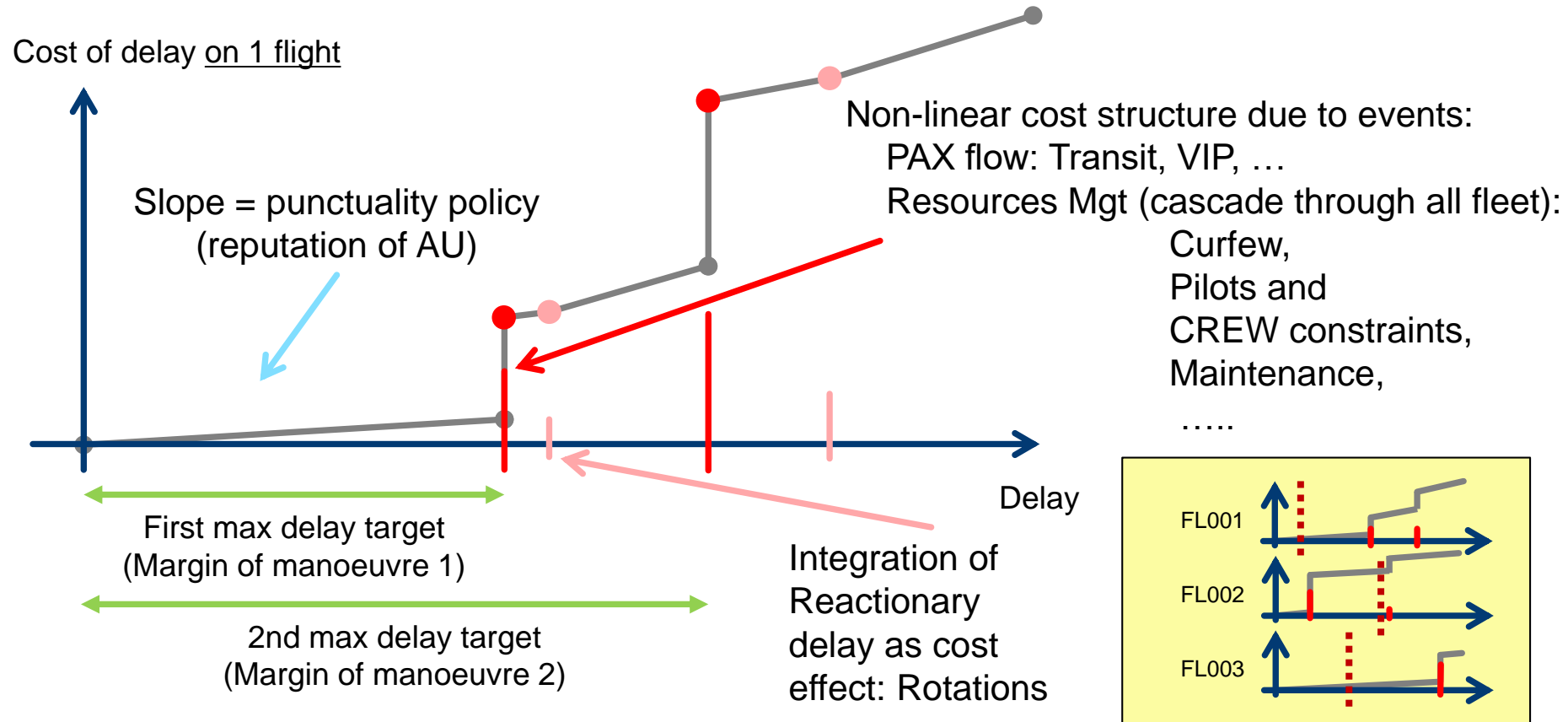
→ Large impact on AUs operations

- For ATFM, all flights are equal
- For AUs, every flight is unique:
  - Passenger experience
  - Airport/Crew/Aircraft Limitations and constraints
  - Schedule Integrity
  - ...



# Operational Cost of delay for Airspace Users ?

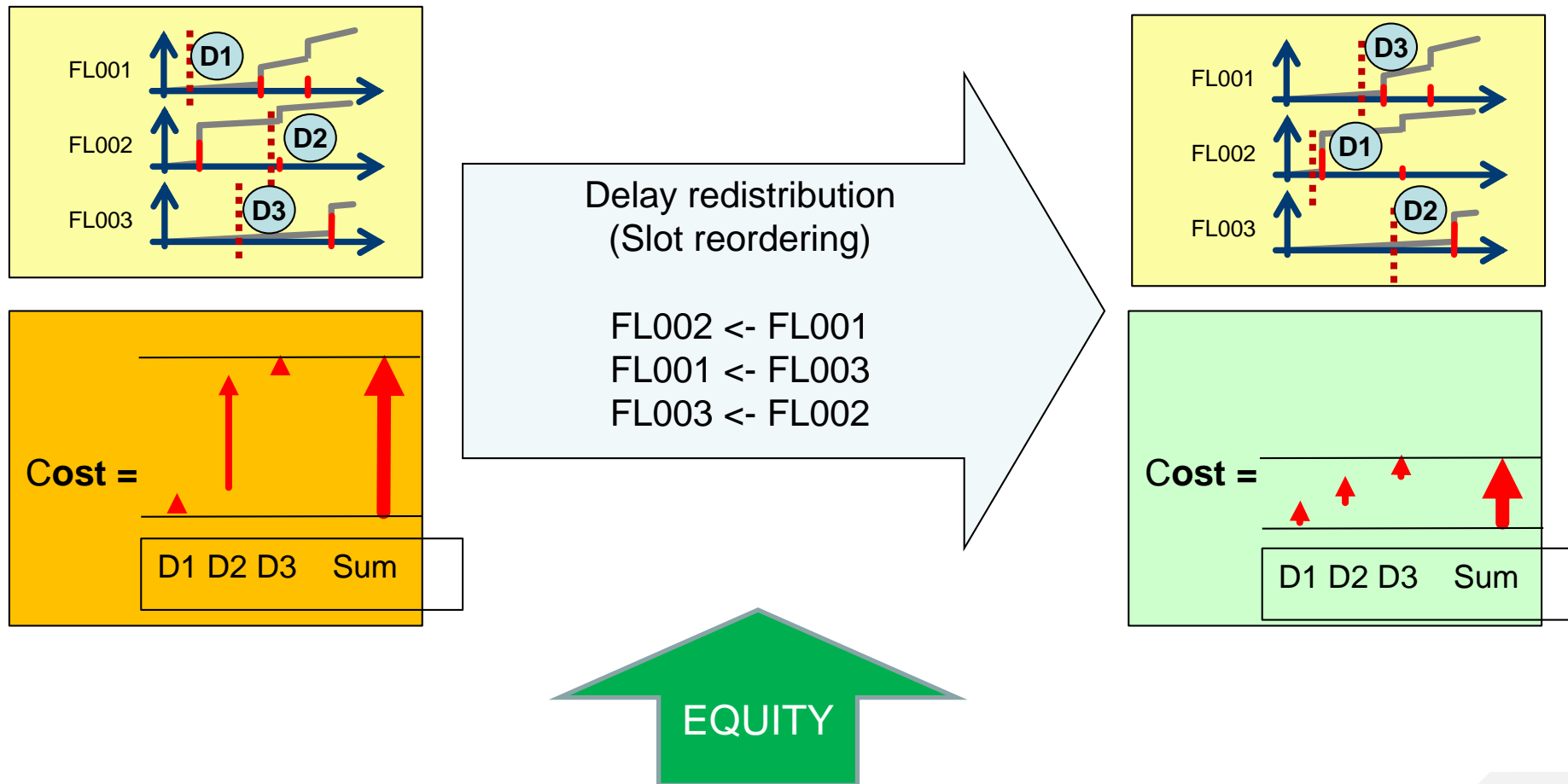
AU: Impossible to Act on delay → Act on Operational Cost of the delay



Each flight has its own particular complex cost structure including fleet rotation impacts: usually only known by the AU

# Operational Cost of delay for Airspace Users: manage the impact

AU: reorder Flight according to Operational Cost of the Delay



# UDPP progressive design

current

- *Level 0 : ATFM Slot Swapping (NM since 1996)*
- Level 1 : current Enhanced Slot Swapping (NM+SESAR1)
  - AUs swap flight 1 by 1 in ATFM Regulations coordinated with NM, not coordinated with STAM
- Level 2 : UDPP (SESAR2020)
  - AUs reorder several flights in a constraint, taking in account the Network impact and Airport constraints (What-If + API) – no impact on other AUs
- Level 3 : Flexible Credits for LVUC (Exploratory Research)
  - Taking into account Network impact and Airport constraints, AUs could accept impact from others to gain more flexibility for all AUs incl. Low Volume Users in a Constraint (LVUC) –which they are most of their time-.

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## UDPP features: FDR, SFP, Margins

- **FDR: Fleet Delay Reordering**
  - value (from 1 to xxx) to reorder AU's flights
  - B (to keep the Baseline delay)
  - S (to UDPP-Suspend a flight = put it last in Constraint)
- **SFP: Selective Flight Protection**
  - **Protect** Flights
- **MARGIN : Margins of Manoeuvre**
  - **Time Margins** reflect AU operational constraints : time\_not\_before / time\_not\_after
  - **Priority on Margin reflect Margins impact**
  - The system automatically optimises the flights reordering

All based on Equity Rules

Equity  
Checked

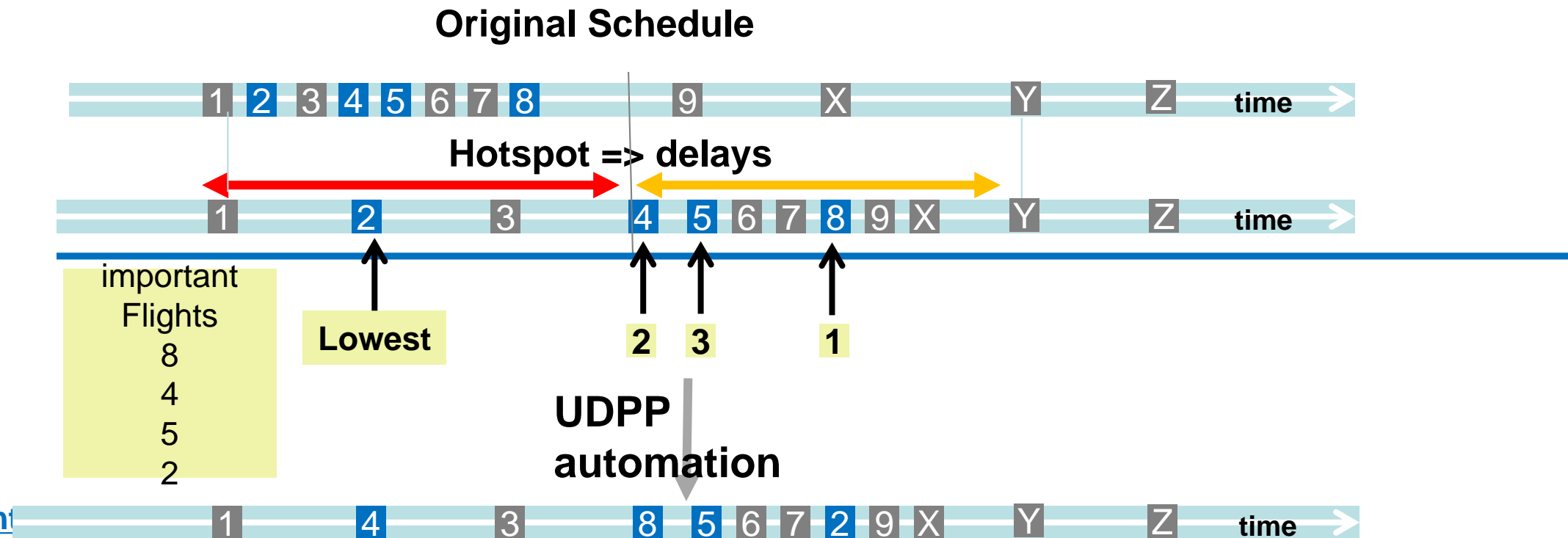
3 features: FDR, SFP, Margins

BLUE AIRLINE  
slots:

BLUE AIRLINE  
new slots:

BLUE AIRLINE  
PRIO:

BLUE AIRLINE  
Reordered flight  
in slots



Other AU : - Neutral impact for all flights



BLUE AIRLINE  
slots:

BLUE AIRLINE  
new slots:

BLUE AIRLINE  
PRIO:

BLUE AIRLINE  
Reordered flights  
in slots

### Original Schedule



Hotspot => delays



important Flight  
=  
8

8

UDPP  
automation

Protect

1 - Swap 8 with 2



2 - put 8 at the first slot at schedule



Improvement for 3 and 4, 8 on-time

Other AU : - Neutral impact for all flights after Schedule 8 and before Baseline 2  
- Positive impact for flights between Baseline 2 and Schedule 8

Validation results, assuming DCB Full Delegation mode

# WHAT UDPP HOPES TO DELIVER TO AUS

# “UDPP on Arrivals at one constrained airport” - Validation set-up

Technique : Human-In-The-Loop simulation of up to 7 AUs flights prioritization of arrivals at one airport:

- AUs typology re. nb flights and passengers in the airport arrival constraint :
  - HUB : airline at base airport and passengers' connections matter
  - Medium Volume : many flights (15+) but pax connections don't matter
  - Low Volume (LVUC) : up to 6 flights
- in coordination with Airport Operations Centre (APOC);
- in planning i.e. from Day-1 to up to 30 mn (actually 4 hrs) before departure-;
- in case of Fog, Thunderstorm, Loss of Runway and Snow, in morning, midday or afternoon

3 exercises with Airlines (Swiss, AF, HOP, Air Baltic, Transavia, ELAL) and Airports participants (Schiphol, LHR, Munich)

Objectives :

- **feasibility** of integrating UDPP with APOC processes using NM services,
- impact of UDPP on **airport** performance, focusing on Gate management
- **performance** of UDPP for AUs in terms of Equity and Cost efficiency:
  - Flexibility
  - Equity: Total ATM delay per airspace user (participating or non-participating) is not negatively impacted compared to the reference scenario
  - Cost efficiency, in terms of **cost** and missed **passenger** connections:
    - Overall direct operating costs (as calculated by the cost model) for airspace users reduces when compared to reference scenario
    - Number of missed passengers connections (as calculated by the passenger flow model) is reduced for UDPP users compared to the reference scenario

# Few results from one run

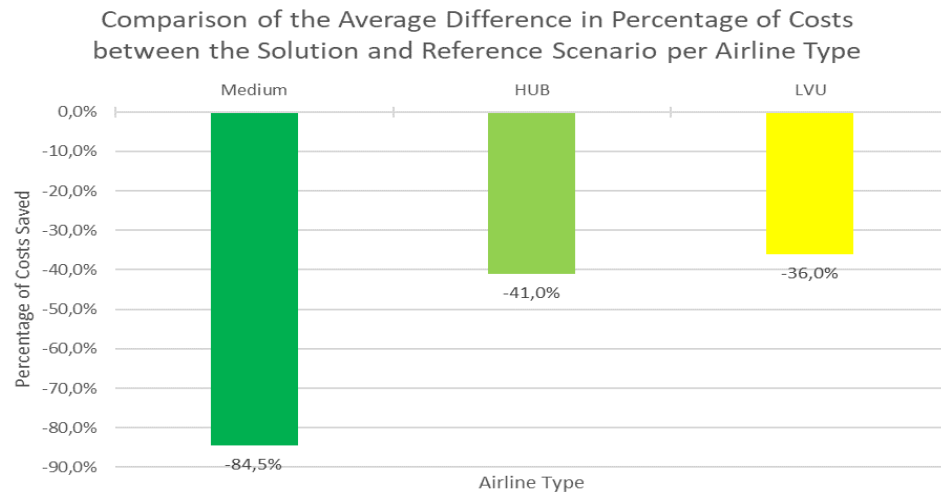
- The scenario was about using UDPP at 10:30 for a 42% reduction rate at arrival airport between 14:00 and 18:00
- **203** flights in the measure. **91** HUB flights eligible for and participating in UDPP, **16** LCC flights participating in UDPP.

| HUB  |  |        |
|--|--|--------|
| Avg Cost Diff                                    | -€ 106.133,00                              | -13,5% |
| Avg Number of Priorities given                   | 30 (automated margins), manual is around 5 |        |
| Avg Number of Flights moving from Baseline Slot  | 57   |        |
| Avg Number of Flights Touched per Priority Given | 4  |        |
|  |  |        |
| LCC (point to point)                             |  |        |
| Avg Cost Diff                                    | -€ 68.704,25                               | -65,8% |
| Avg Number of Priorities given                   | 10   |        |
| Avg Number of Flights moving from Baseline Slot  | 13   |        |
| Avg Number of Flights Touched per Priority Given | 2  |        |

|         | Total Number of Connecting Pax | Difference in TOTAL MISSED_CONNECTIONS | Difference in TOTAL OVERNIGHT PAX |
|---------|--------------------------------|--|-----------------------------------|
| AVERAGE | 4169                           | -1,39%                                 | -1,39%                            |

Partial results

# AU Cost efficiency and passengers connections improved



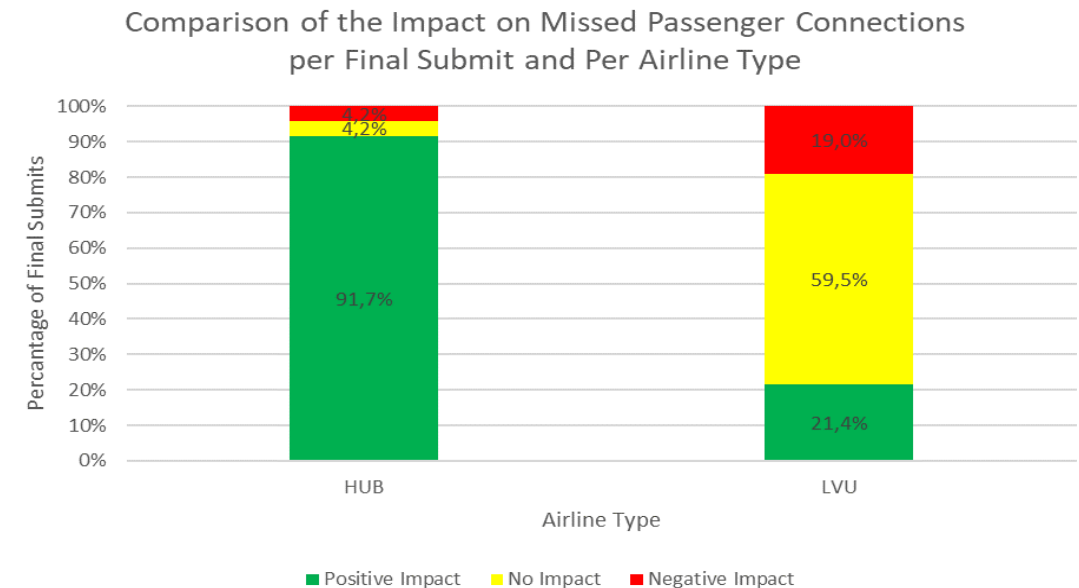
During all scenario events, by all airlines and all UDPP Functions, the airspace users were able to reduce the cost of delay considerably (with the exception of LVUC during the Thunderstorm scenario in which they were not able to utilise UDPP).

Using Margins during Heavy fog, the Medium User type was able to reduce the costs back to the standard cost and even a little bit further.

The Hub User's passenger connections were improved by an average **2.1%** (approximately **96** more passengers made their connections).

The number of passengers successfully reaching their final destination improved by **1.7%** (approximately **80** more passengers, reached their destination on the day but on the original flight),

Note that this doesn't reflect the number of pax for which saving the curfew avoided an overnight.



# UDPP reduce cost of delay & improve passengers' connections

- **Flexibility** is increased
- **Equity** is maintained
- **Cost-Efficiency** is increased - simulations at one airport with up to 7 AUs showed **58%** average reduction (**80K€**) on additional operating costs due to delays (results based on research cost model)
- Number of missed **passenger connections** is decreased

For Airport APOC:

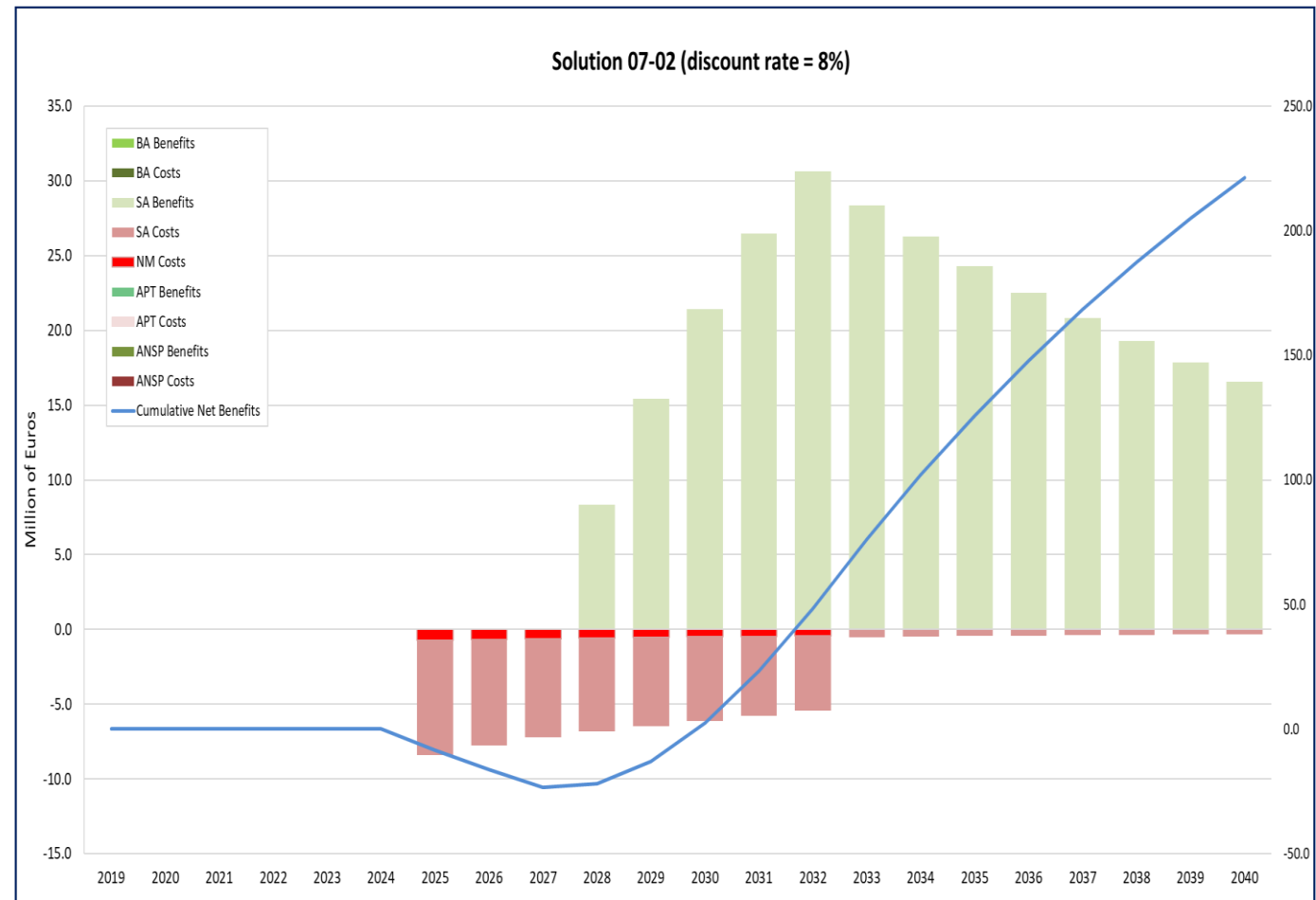
- UDPP improves the **pro-active** participation of **AUs in CDM** at airport.
- **Delay** is slightly **reduced** generally (when not it is to improve departure punctuality)
- Impact on **stand allocation planning** is less than actual planning fluctuations from current network disruptions
- **Better client service** is provided to AUs and passengers : this is good for the airport

# Extrapolation at ECAC level

## Conservative assumptions used:

- 120 regulations per year where UDPP is used
- 15 hub airports
- 1 AU prioritising per airport
- 40% average reduction of delay cost per AU and regulation (50K€ average cost reduction)

The Business Case is positive  
 Net Present Value 192 M€



# UDPP CHALLENGES IN ATM

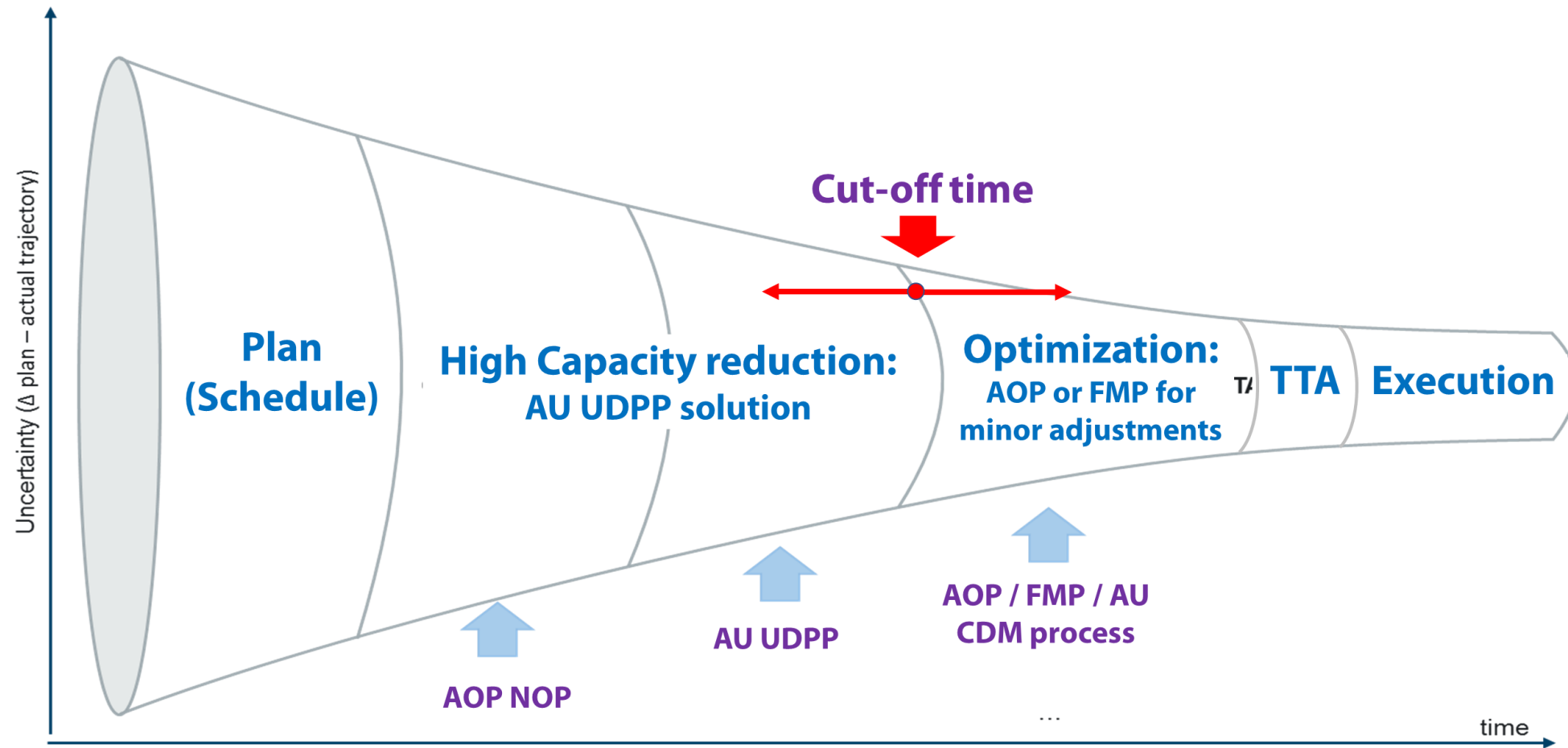


## Maturity reached...

- 3 exercises with Airlines (IATA Swiss, AF, HOP, Air Baltic, ELAL) and Airports participants (Schiphol, LHR, Munich) in 2019
- Average 58% reduction of cost of delay and improvement of passenger connections
- Shadow mode trial support to Swiss and Skyguide: rapid integration in a realistic environment
- The AU methods of prioritization (combining SFP, FDR & Margins) stabilized
- Aim for **integration in DCB Collaborative Framework** at few airports by end 2022 (IR Wave2)

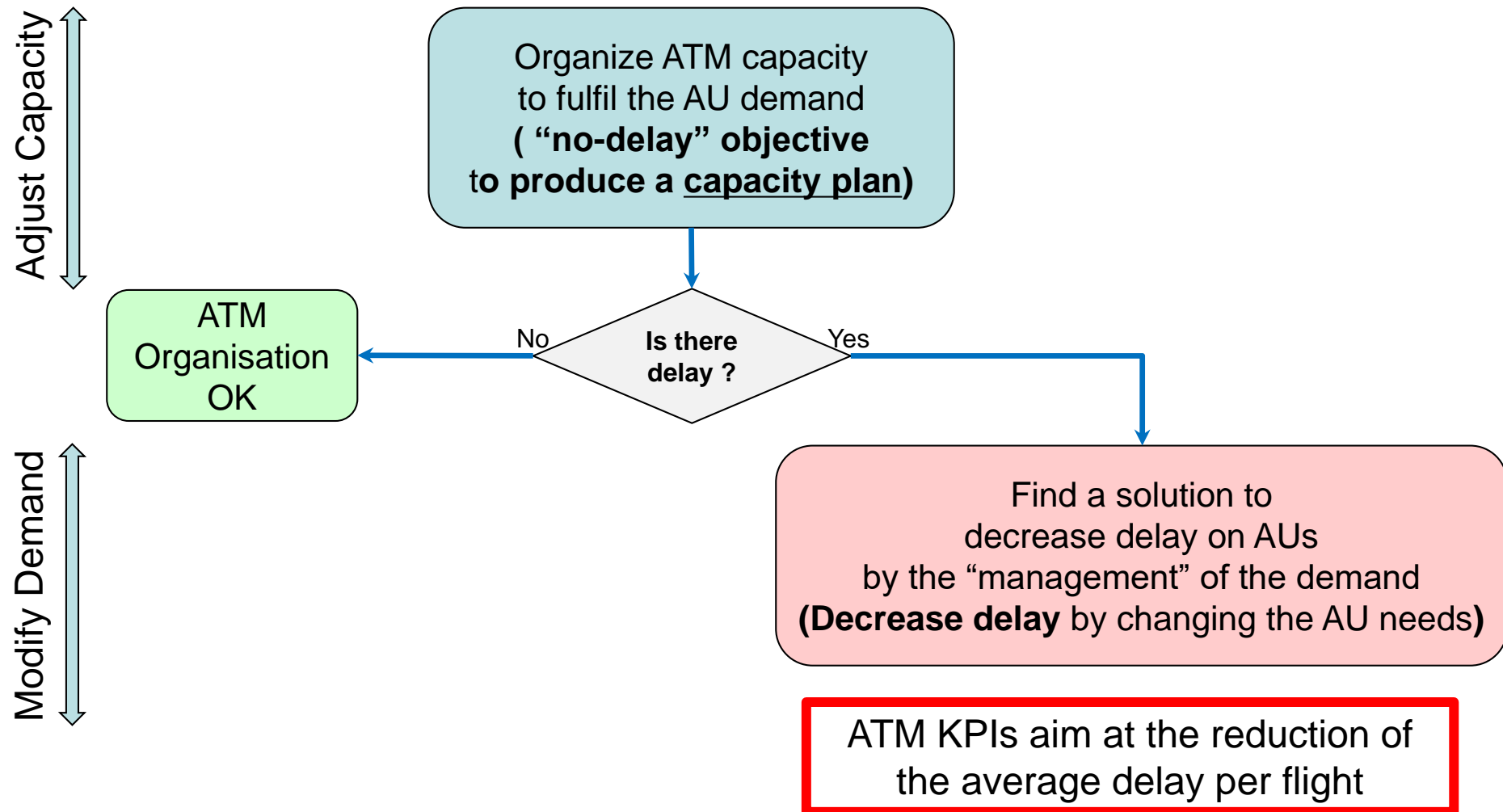
## ... challenges ahead

# UDPP, an AU input to ATM Collaborative framework



# ATM organisation today

Currently ATM organisation is based on a “No-Delay paradigm”

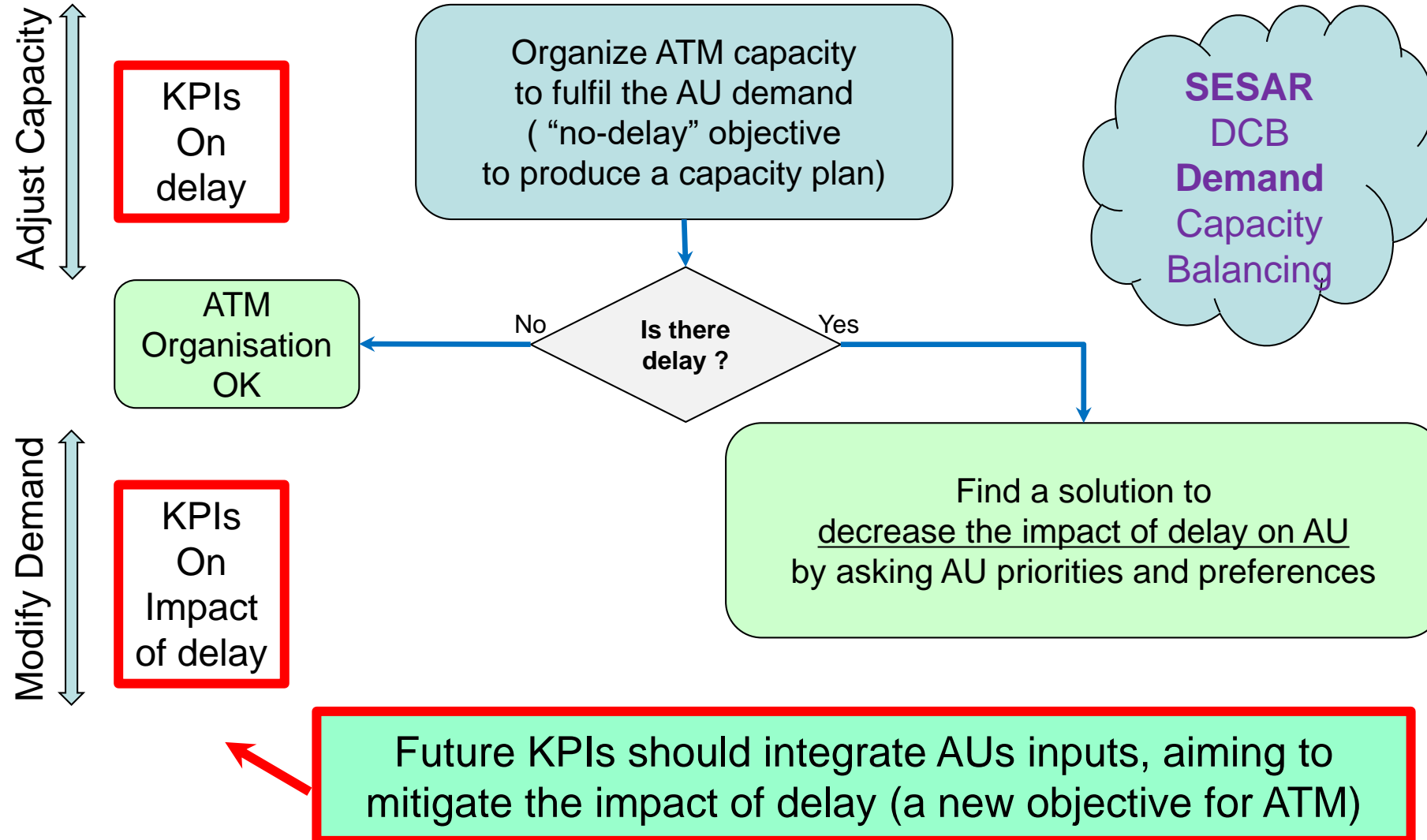


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This organisation is no more valid face to STAM measures and when solutions are given by AUs.

# Evolution of ATM paradigm integrating AUs need

ATM organisation is based on **Impact delay management paradigm**



# Inter-airlines and over-time flexibility needed ?

- HUB airlines not (much) interested : they have enough volume for UDPP flexibility – they want to exploit it first => deploy UDPP
  - Extra flexibility would be for cases when no good solution can be found within the delayed slots of the HUB AU
  - Would imply higher level of organisational complexity (beyond the OCC)
  - Business case to be found
- MEDIUM airlines also have benefits with UDPP but less
- LVUC have no other choice...

## Acceptability in ATM ?

- Impact on Network stability