INDUSTRIAL RESEARCH

SESAR Solution 39 OSED-SPR-INTEROP for V3 - Part I

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PJ07-W2-39 OAUO

PJ07-W2 OAUO OPTIMISED AIRSPACE USERS OPERATIONS

This SESAR Solution PJ07-W2-39 OSED-SPR-INTEROP document is part of a project that has received funding from the SESAR Joint Undertaking under Grant Agreement No 874465 under European Union's Horizon 2020 research and innovation programme.

Abstract

PJ07-W2-39:Two Operational Improvements were addressed:

AUO-0109:

AUO-0110:

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1 Executive Summary

This document focuses on the definition of a collaborative framework for managing arrival constraints for Local DCB issues managed at FMP or Airport level, in collaboration with Network Function, and with the participation of Airspace Users (AUs).

This collaborative framework will enable the integration and necessary coordination of 4D constraints (limited to arrivals management) from various stakeholders (Airports, ANSPs, AUs and NM); it will ensure continuous stability and performance of the Network, and will give the opportunity to the Airspace Users to prioritize their most important flights (UDPP application), hence reducing the impact of ATM planning constraints on the costs of their operations.

In the definition of the operational framework, it is assumed that the UDPP process could be triggered to allow AUs to propose acceptable solutions for Local Demand Capacity Balancing issues through "What-If" scenario calculations using the information available to them. And, it is also assumed that the UDPP output will be used as an initial acceptable solution to the Local DCB processes.

The proposed solutions are expected to have a positive impact in the following areas:

- Increased flexibility by allowing the Airspace Users to recommend to the Network Management Function a preferred order for their flights in a measure
- Increased punctuality of individual flights, especially the ones for which delay causes a large impact on the AU fleet, thanks to the collaborative framework for managing arrival constraints
- Cost-efficiency of airspace users (reduced cost of the fleet operation due to the impact of delay).

2 Introduction

2.1 Purpose of the document

This document provides the requirements specification, covering functional, non-functional, and interface requirements related to SESAR Solution PJ07-W2-39.

The SESAR Solution Development Life Cycle aims to structure and perform the work at project level and progressively increase SESAR Solution maturity, with the final objective of delivering a SESAR Solution data pack for industrialisation and deployment. The SPR-INTEROP/OSED represents one of the key parts of this SESAR Solution data pack.

2.2 Scope

This document is the SPR-INTEROP/OSED for Solution 39 for V3 phase; it consolidates all the requirements characterizing the solution, following the validation activities performed and reported in the VALR of the solution.

These requirements will cover safety, performance and operational aspects as well as the interoperability aspects related to the concept.

2.3 Intended readership

This document is aimed at the following stakeholders:

- the SESAR2020 PJ07, PJ09, PJ04, PJ25 members, including Airspace Users
- the SJU and EUROCONTROL; and
- the transversal PJ19 project;

2.4 Background

In SESAR 1 and S2020 Wave 1, different approaches and Use Cases for the management of arrival constraints have been defined and validated using specific local tools:

SESAR 1 Solution #18 “CTOT and TTA” validated the concept of Target Time Management in the planning phase from a Network perspective for arrival traffic allowing provision for AU interactions. SESAR 1 Solutions #20 “Initial Collaborative Network Operations Plan (NOP)” and #21 “Airport operations plan (AOP) and its seamless integration with the network operations plan (NOP)”, validated the process for local DCB actors to collaborate with the Network in the TTA allocation process.

Wave 1 PJ24 VLD (Very Large Demonstration) Exercises at Barcelona, Palma de Majorca and Heathrow Airports addressed the hotspot resolution (Local DCB issues) based on TTAs (Target Times of Arrival) proposed for arriving flights (in pre-flight phase) by local DCB tools and applying local business/operational rules. The TTs were defined at local (Airport) level and shared with the Network Manager via the AOP connected to the NOP. Some limited provision was defined for AU integration, but an active AU participation as described within UDPP concept was not integrated in the local processes.

Wave 1 PJ25 shadow mode Exercise at Zurich Airport addressed the hotspot resolution through the local (FMP and AU) management of arrival regulations, for building an optimized sequence based on airlines' priorities. A limited part of UDPP was integrated in the local process.

These Exercises provided a very initial demonstration of how TTAs and AUs flights' prioritisation could be combined.

The collaborative framework builds on these past activities, and aims at:

- Reconciling and standardising local initiatives developed for managing arrival delay constraints;
- Providing AUs with a single harmonized entry point through NM to manage their priorities;
- Supporting further integration of Network/Airport processes;
- Addressing remaining issues and gaps identified by SESAR Wave 1 Projects.

2.5 Structure of the document

This OSED is structured as follows:

- Section 1: Executive Summary
- Section 2: Introduction
- Section 3: Operational Service and Environment Definition
- Section 4: Safety, Performance and Interoperability
- Section 5: Reference and Applicable Documents
- Appendix A: Description of the UDPP functionalities
- Appendix B: Cost and Benefit Mechanisms

2.6 Glossary of terms

Term	Definition	Source of the definition
Air Navigation Service Provider (ANSP)	Organisation responsible for the provision of traffic control and information services at airports and en-route. It includes control of air traffic at and around a controlled airport as well as local flow management.	
Airport Collaborative Decision Making (A-CDM)	Operational concept, which starts with information sharing, taking capacity related decisions in a collaborative manner on the day of operations (D-0). It aims at improving the overall efficiency of	

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	airport operations by optimising the use of resources, and improving the predictability of events. It focuses especially on aircraft turnaround and pre-departure sequencing processes by using A-CDM milestones.	
Airport Operations **Centre (APOC)**	A coordination arrangement at an airport, whereby operational stakeholders (actors) collaborate for the effective/efficient establishment and execution of an agreed operational plan, in a structured manner with agreed processes, either through physical or virtual interaction or a combination thereof. The APOC is the prime interface between the Airport and the Network Manager Operations Centre (NMOC) established in the States within, and adjacent to, the ECAC area.	
Arrival Optimisation period **UDPP flight Cut-off Time**	Arrival Optimisation period is the local Airport (the one creating the UDPP measure) arrival anticipation period, applicable on each flight of the UDPP measure used as part of the calculation of the UDPP flight cut-off time. The UDPP flight cut-off time specifies until when the AU can set priorities/Margins on their flight. Once the flight cut-off time has been reached, the last prioritisation submitted by the AU on this flight is taken as the “final UDPP prioritisation” to elaborate the UDPP solution. UDPP flight cut-off time = COBT – TRS@ADEP – TRS@ADES TRS@ADEP: Time To Remove a flight from Sequence <u>on departure airport</u> (already existing in NM). TRS@ADES: Time To Remove a flight from Sequence <u>on arrival airport</u> (doesn’t currently exist in NM). <u>The TRS@ADES represents the Arrival Optimisation Period.</u> The Arrival Optimisation period is defined when the “UDPP Measure” is initiated.	

Airspace User (AU)	Civilian airspace users include scheduled airlines, charter companies, cargo and air freight service providers, the business and leisure aviation sectors and all forms of non-military air travel.	
Baseline delay, Baseline Time	Represents the allocated delay to each flight in a constrained situation before or without the incorporation of AU constraints into the CCS resolution. It is used as a baseline of the equity in the CCS resolution and can be used to benchmark the concept to identify the concept's benefits.	
Capacity Constrained Situation (CCS)	A period of time in which the Capacity of an ATFM element (Airspace, Arrival Runway, Departure Runway …) has to be controlled in relation to the demand (reduction of capacity, overload situation …) . The Capacity Constrained Situation defines the capacity as a constraint to be respected and associated with a time window to apply it (or a group of time windows, in which case the capacity constraints define the sub-periods). Typically, the CCS includes also the recovery period where flights have delay to smooth the traffic during the transition from constrained to unconstrained state.	
Delay-Cost Curve	The function expressing the relationship between delay incurred on a flight and the cost penalty for the AU this delay represents. The delay-cost curve is unique for each flight, and it can encompass many aspects of the AU operation. Crucially, the delay-cost curve of a specific flight may be built in such way that it incorporates the costs of subsequent rotations of the same aircraft.	
Demand Capacity Balancing (DCB)	The process of comparing traffic demand and available capacity in a defined timeframe, determining bottlenecks and assessing mitigation measures in order to find the optimum result in terms of minimising delays and costs. Where used in this OSED to convey a role in the proposed process, the term 'DCB' is intended to be the aggregate group including Local DCB, Airport, and Network Manager.	

Fleet Delay Reordering (FDR)	The UDPP feature by which the AU can rearrange its own allocated baseline time by giving priority values on flights.	
Flow Management Position (FMP)	An operational position established in appropriate air traffic control units to monitor traffic load for defined sectors (at en-route or at airport level) to ensure that traffic is safely managed by Air Traffic Controllers. The established FMP can operate at a Regional, Sub-Regional or Local level and, when required, applies appropriate ATFCM measures in coordination with the NMOC.	
Knock-on delay or **Reactionary delay**	A side effect on subsequent flights due to delay given to an initial flight. The initial delays can be caused by various reasons, e.g. capacity constraints, ATC/Network constraints, airport constraints, but also airline constraints (crew, passengers …). The AU perspective on reactionary delay, in relation to the proposed concept, is to take into account all the AU fleet and aircraft rotations of the day to decrease the impact of the original delay. This is completely different from the Airport perspective where the typical approach to reactionary delay is to take into account only the impact on the local Airport platform.	
Margin of Manoeuvre	For an AU, it is the maximum delay a flight can take before incurring significant cost (i.e. disruption on the delay-cost curve according to delay). It is anticipated that the “significant cost” can be defined differently by each AU, but for the purposes of this example, the cost represents a “step” that is due to factors such as crew or pilot time-out constraints, a large number of passengers who miss a connection, an airport curfew infringement etc. Each time one of the factors is met; another step in cost is incurred, which represents the end of another Margin of Manoeuvre for the AU. The Margins are typically expressed via “Time Not After” and “Time Not Before” parameters (see definitions below).	

Network Manager Operations Centre (NMOC)	The Network Manager Operations Centre delivers core operational services across several domains: • Flow and Capacity Management • ATM Access Gateway and Flight Planning Operations • Information Management Domain • Crisis and Contingency Management • Post-operations analysis and reporting	
Network Operations Plan (NOP)	A rolling operational plan set up, maintained and shared by the Network Manager, containing expected and current traffic information, available sector capacities provided by the ANSPs and expected or actual delay information.	
Prioritisation	Actions made by the AUs (using the UDPP features SFP, FDR, Slot Swap, Margins) according to the importance of their flights impacted by a UDPP measure, based on their business needs (N.B. Slot Swap is not part of this document because it is already implemented).	
Protection/Protect a flight	UDPP Protection is part of the UDPP prioritisation. It is the highest priority given to a flight pushing its operation as close as possible to the planned (scheduled) off block time. To do this, UDPP applies the SFP algorithm for this flight.	
Scenario	An operational situation in which Use Cases are executed.	
Selective Flight Protection (SFP)	The UDPP feature by which an AU can obtain the minimum delay for a flight (Priority P) in exchange for more delay of another earlier own flight, even if the total delay for the given AU is increased.	
Suspension	ATFM suspension (FLS) is an ETFMS message sent, suspending a flight, which thereafter should not get take-off clearance. NB an ATFM Suspended flight is not visible in the NOP.	
Time Not After (TNA), Time Not Before (TNB)	These are the time components of the Margin of Manoeuvre. The components allow the definition of a closed (TNA and TNB together) or open-ended (TNA or TNB only) time window to be allocated by an AU to its own flight, as a constraint. This expression of AU constraint can be used to rearrange the AU sequence and/or to define a CCS resolution.	

Time to Remove from Sequence (TRS)	Time needed to remove a flight from departure sequence. Its purpose is to prevent last minute modifications of the CTOT. These values are kept updated by the relevant FMPs and TWRs. They may be adjusted at any time depending on the local aerodrome traffic situation and may vary during the day. The TRS prevents a change to a later CTOT, or the allocation of a CTOT, when the flight is already in the departure sequence.	
UDPP Suspended flight	UDPP Suspension is part of the UDPP prioritisation. It is the lowest priority given to a flight pushing its operation to the end of the CCS managed by UDPP (the UDPP measure). NB UDPP suspended flight is not an ATFM suspension, i.e. an FLS message.	
UDPP inputs	UDPP inputs is a collective term for Protection, Margins of Manoeuvre and UDPP Priority values (see definitions above and below) that an AU may set for their flights in the UDPP measure.	
UDPP max schedule anticipation	This CCS airport parameter (common to all AUs) gives the maximum early arrival delay buffer allowed by the airport to manage flights. (e.g. 5mn = 5minutes before reference flight arrival time is allowed). It's also used by the UDPP service to optimise the Arrival sequence maximising the arrival throughput.	
UDPP measure **UDPP NCP measure**	ATFCM measures that allows the AU participation through the articulation of AU constraints for the purpose of CCS resolution. Two principal types of UDPP measure are anticipated in the concept: - "UDPP measure" based on ATFM regulation; - "UDPP NCP measure" based on Network Cherry-Pick measure. Each type of UDPP measure has its own specificities that are largely inherent from the original measure that is currently used in operations.	
UDPP Priority value	A value given by the Airspace user on a flight (or a specified default value) used by the UDPP function to reorder the flights in the UDPP measure. Values can be: ***P*** for Protect, ***S*** for UDPP suspend, ***B*** for	

	"keep baseline", or a number from 1 (highest priority) to 999 (lowest priority). See UDPP feature definitions in Appendix A2.	

Table 1: Glossary of terms

2.7 List of Acronyms

Acronym	Definition
4D	Four Dimensional
ACP	Airport Cherry-Pick
AFUA	Advanced Flexible Use of Airspace
AMAN	Arrival Manager
ANM	ATFCM Notification Message
ANSP	Air Navigation Service Provider
AOC	Airline Operations Centre
AOP	Airport Operational Plan
API	Arrival Planning Information (message)
APOC	Airport Operations Centre
APT	Airport
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
AU	Airspace User
BDT	Business Development Trajectory
CASA	Computer-Assisted Slot Allocation (Network Manager slot allocation for regulations)
CCS	Capacity Constrained Situation
CDM	Collaborative Decision Making
CDM@CDG	Collaborative Decision Making at Charles De Gaulle Airport
CFMU	Central Flow Management Unit
CI	Confidence Index
CNS	Communication Navigation and Surveillance

CONOPS	Concept of Operations
CR	Change Request
CTOT	Calculated Take-Off Time
D0	Day ‘zero’, Day of Operation
D-1	Day ‘zero minus one’, Day before Operation
DCB	Demand Capacity Balancing
dDCB	Dynamic Demand Capacity Balancing
DFlex	Departure Flexibility
DMAN	Departure Manager
DOD	Detailed Operational Description
DPI	Departure Planning Information (message)
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
e-FPL	FF-ICE Flight Plan
EIBT	Estimated In Block Time
EOBT	Estimated Off Block Time
E-OCVM	European Operational Concept Validation Methodology
EXE	Exercise
F2F	Face-to-Face
FAB	Functional Airspace Block
FCL	Flexible Credits for Low Volume Users in Constraints (LVUCs)
FDA	Fleet Delay Apportionment
FDR	Fleet Delay Reordering
FIBT	Forecasted In Block Time
FIXM	Flight Information Exchange Model
FMP	Flow Management Position
FMS	Flight Management System
FOBT	Forecasted Off Block Time
FOC	Flight Operations Centre
FSFS / FPFS	First Scheduled First Served / First Planned First Served
HPAR	Human Performance Assessment Report
HSPT	Hot Spot
IBT	In-Block Time

ID	Identifier
INTEROP	Interoperability Requirements
IRS	Interface Requirements Specification
KPA	Key Performance Area
KPI	Key Performance Indicator
L-DCB	Local Demand Capacity Balancing
MCP	Mandatory Cherry-Pick
MPC	Most Penalising Constraint
NIMS	Prefix of Enablers linked to operational improvement defined in the European ATM master plan.
mn	Minute
MTT	Minimum Turnaround Time
NCP	Network Cherry-Pick
NM	Network Manager
NMF	Network Manager Function
NOP	Network Operational Plan
OBJ	Objective
OBT	Off-Block Time
OCD	Operational Concept Description
OI	Operational Improvement
OPAR	Operational Performance Assessment Report
OSED	Operational Service and Environment Definition
PAR	Performance Assessment Report
PDS	Pre-Departure Sequence
PIRM	Programme Information Reference Model
QoS	Quality of Service
RBT	Reference Business Trajectory
RMAN	Runways Manager (first Airport process to organise departure)
RTS	Real-Time Simulation
SAC	Safety Criteria
SAR	Safety Assessment Report
SBT	Shared Business Trajectory
SecAR	Security Assessment Report

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SESAR	Single European Sky ATM Research Programme
SFP	Selective Flight Protection
SIBT	Scheduled In Block Time (initial Airline schedule)
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SOBT	Scheduled Off Block Time (initial Airline schedule)
SPR	Safety and Performance Requirements
STAM	Short-Term ATFCM Measures
SWIM	System Wide Information Model
TAD	Technical Architecture Description
TMA	Terminal Manoeuvring Area
TRS	Time to Remove from Sequence.
TS	Technical Specification
TSAT	Target Start-Up Approval Time
TT	Target Time
TTA	Target Time of Arrival
TTOT	Target Take-Off Time
TW	Target Window
UC	Use Case
UDPP	User Driven Prioritisation Process
UIBT	User In Block Time (prioritisation given by User)
UOBT	User Off Block Time (prioritisation given by User)
VALP	Validation Plan
VALR	Validation Report
VALS	Validation Strategy
V-FOC	Virtual Flight Operation Centre (FOC)
VP	Verification Plan
VR	Verification Report
VS	Verification Strategy

Table 2: List of acronyms

3 Operational Service and Environment Definition

3.1 SESAR Solution 39 (PJ.07-W2-39): a summary

The Solution PJ.07-W2-39 develops a collaborative framework that will enable the integration and necessary coordination of constraints (limited to arrivals management) from various stakeholders (Airports, ANSPs, AUs and NM). This will ensure the continued stability and performance of the network and will give the opportunity to the Airspace Users to prioritize their flights, thereby reducing the impact of the delays generated by the ATFM planning constraints to limit the excess costs on their operations. In this case, AUs may contribute to a DCB solution such that their operational performance interests are best served.

The Solution's main objective is to define and validate a Collaborative framework for the coordination and collaboration between different ATFM processes (including the so-called User Driven Prioritisation Process - UDPP), dealing with delay constraints on arrivals (considered the most important contributor to capacity performance issues).

This Solution

- Addresses the need for harmonization at European level of arrival prioritisation processes (managed by Local DCB) in pre-flight phase, which aims to overcome the problem of AUs dealing with different interfaces to Network and local processes for the management of their priorities.
- Focuses on more integrated Network/Airport processes, beyond the current AOP/NOP integration that relies on simple data exchange.

For these reasons, it can be considered as a unique opportunity to close the gap for processes and tools, and to address the areas of improvement identified by AUs in the frame of S2020 Wave 1 activities.

Expected benefits include an improved coherency between the different processes, and an enhanced predictability by common usage of the most up-to-date flight data by all users.

In Wave 1, the integration with Local DCB processes has been addressed in limited scopes (VLDs at given Airports), thus a number of raised questions need to be further investigated. This Solution addresses a more complete integration in Wave 2, structured on the following approach:

- Arrival framework integrating UDPP with ATFM regulations managed by CASA and applying the FPFS principle

  The reconciliation of the arrival constraints resolution between the Network Management Function and the FMP/AUs local processes are addressed through the following:
    - Integration of ATFCM CASA regulations with UDPP for the calculation, updating and passing of arrival constraints to flights.

- NM validation and if necessary, application of Local DCB (FMP) management proposals during the pre-flight phase.

The approach will be addressed across validation exercises on different Airports.

The OI Step associated to this Solution is the following:

AUO-0110: Collaborative framework for managing arrival constraints at Local DCB level

In case of Target Times (Arrival) generated by Local DCB processes overlaying Network constraints in pre-flight phase, Collaborative recovery procedures and associated predictive and decision support tools are required, for ensuring reconciliation of local DCB measures with Airport CDM and Network Management process. These procedures may include the allocation of CASA regulations or arrival flights' management tools combined with the User Driven Prioritization Process (UDPP) into the overall reconciliation process, also in case of multiple constraints. Expected benefits would include coherency between the different processes, enhanced predictability from common usage of most up-to-date flight data by all users, and reduced impact of delays on Airspace Users operations

Rationale:

Need for new collaborative operational procedures between ANSP, AU, Airport, and Network to manage local DCB issues at arrival (in pre-flight phase), minimizing the risk of imposing multiple penalties to Airspace Users or increased workload for FMPs.

Better management of disruptions by increasing flexibility (integration of AU priorities via UDPP, and speeding up of the recovery to normal operations).

More automated tools and reduction of the 'Human-In-the-Loop' for the collaborative processes are also expected to evaluate the proposed UDPP solution, and its impact on the overall operational performance (AUs, Airports and Network effect).

The following table provides an overview of the Solution in terms of OI Steps and related Enablers, in line with the EATMA reference Dataset 21:

SESAR Solution ID	SESAR Solution Title	OI Steps ID ref. (coming from EATMA)	OI Steps Title (coming from EATMA)	OI Step Coverage
PJ.07-W2-39	Collaborative framework for managing arrival delay within an ATFM regulation	AUO-0110	Collaborative framework for managing arrival constraints at Local DCB level	Fully

Table 3: SESAR Solution 39 Scope and related OI steps

Enablers relative to OI: AUO-0110

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Local name	Project type	SESAR Program	OI Step Enabler Ownership	OI Step Enabler Compulsory
AOC-ATM-18_FOC adaptation to support UDPP	System Enabler	SESAR 2020 Wave 2	Develop	Required
NIMS-44_Evolution of NIMS to support management of UDPP, inclusion of user preferences and priority as part of SBT	System Enabler	SESAR 2020 Wave 1	Develop	Required
NIMS-46_Integrated local DCB working position	System Enabler	SESAR 2020 Wave 2	Use	Required
NIMS-46b_Interface to Integrated local DCB working position	System Enabler	SESAR 2020 Wave 1	Develop	Required
NIMS-48 will be unlinked from AUO-0110, subject to CR-07051 (at the time of publication of this report this CR was still pending.)	-	-	-	-

Table 4: OI Step AUO-0110 Enablers

It has to be noted that the OIs (and related Enablers) listed in table 3, 4, 5, are the integrated and re-scoped version of the initial OIs. These approved definitions, initiated by Change Requests to Dataset 19, and integrated in the EATMA Dataset 21, integrate the analysis performed on the initial four OIs, in collaboration with other Solutions.

The initial set of OI was AUO-0110 and DCB-0213; these two integrated into the "new" AUO-0110.

In order to fit this Solution properly within the High Level Concept of Operations, the CONOPS, the following table summarizes the High Level Operational Requirements applicable to PJ.07-W2-39:

	•	

Id	HL CONOPS Requirement Description	Op Env	Additional Background
S39-HLOR-01	Application of the collaborative framework on arrival shall allow for: • Integration and coordination of 4D constraints resulting from capacity issues on arrival from stakeholders at airport, ANSP, AU and NM level through: • Management of such constraints via the NOP using new rules and mechanisms, synchronisation and reconciliation of multiple measures per flight/flow – enhancing the current first planned/first served slot allocation principle; • Improved integration to streamline all prioritisation processes from all stakeholders concerned with arrivals, linking to pre-departure regulation at origin	Airport; ER-Very High Complexity; Network; Terminal Airspace;	AU Fleet Schedule (pre-flight phase) Air Transport subject to Demand and Capacity Balancing measures A-CDM Airports Hub Airports TMA & Extended TMA Degraded operational conditions
S39-HLOR-02	Application of a collaborative framework for delay constraints on arrival shall:	Airport; ER-Very	AU Fleet Schedule (pre-flight phase)

	• Increase the Airspace Users operational and flight cost efficiency • Increase the Airspace Users flexibility (plan and potential re-plan a flight) • Contribute to an optimised demand and capacity (DCB) management • Enable Airspace Users to optimise their flights integrating their fleet constraint and business needs by defining and implementing Trajectory Management processes from AU side that feed ATM (regional, sub-regional and local) DCB processes: • Integrate the trajectories calculated/planned by the Airspace User and their defined flights' priorities and preferences, together with the trajectories management process impact on execution phase • Allow the civil Airspace User to swap slots between eligible flights • Allow the Airspace User to contribute to revise the DCB measures	High Complexity; Network; Terminal Airspace;	Air Transport subject to Demand and Capacity Balancing measures A-CDM Airports Hub Airports TMA & Extended TMA Degraded operational conditions
S39-HLOR-03	The integration of UDPP processes shall be as efficient and effective as possible for the AU to: • Get an optimum trade-off between planning effort and flight operations benefit • Get a high degree of process automation on AU side reducing human workload & intervention • Facilitate operational cost efficiency during flight as a consequence of the planning of optimised trajectories	Airport; ER-Very High Complexity; Network; Terminal Airspace;	AU Fleet Schedule (pre-flight phase) Air Transport subject to DCB TMA & Extended TMA A-CDM & Hub Airports

Table 5: High Level CONOPS requirements related to SESAR Solution PJ.07-W2-39

3.1.1 Deviations with respect to the SESAR Solution(s) definition

No deviations

3.2 Detailed Operational Environment

The S39 tries to avoid being stuck in a too futuristic vision of the ATM environment.

The majority of the functionalities described in this document can be implemented in the current environment and in the SESAR2020 environment.

3.2.1 Operational Characteristics

The operational environment characteristics are based on the same environment as today. Network Management Functions and data provide the basis of the Solution environment. Majority of the functionalities used in the Solution are supported by the current ATFCM operation manual.

The Solution is defined also to progressively integrate functionalities not fully available today, e.g. the FF-ICE concept dealing with flights' priority. While FF-ICE is not within the PJ.07-W2-39 scope, it is foreseen that the predefined priority supported by FF-ICE Flight Plan (eFPL) definition can be used as an initial priority value for a UDPP measure and can be used to generate first delay accordingly See Reference document : [40].

AOP/NOP integration:

UDPP service can use AOP/NOP integrated data to provide AUs with a real-time vision of the current situation according to the status of the network and the airports. Runway, taxiing information etc. can be used to inform AUs on flights in-block times (IBT) on arrival as an estimation for flight ending time. An accurate IBT is important for airport to manage the landside operations of the airport, and for AUs to manage the flight rotations by integrating the Minimum Turnaround Time (MTTT)), crew rostering and crew hours, passengers (VIP, connecting passengers…), aircraft maintenance, etc.

AOP/NOP integration is under the responsibility of NM and airports exchanges, the Solution contributes to it through the proposed new operating method (see Section 3.3).

Sub-operational environments are defined to refine domain of application of requirements:

- NOP_Env: Regional ATFCM current environment
- FOC_Env: Airline Operation System environment
- DCB_Env: Local DCB environment
- APT_Env: Airport environment
- UDPP_Funct_Env: Regional ATFCM environment integrating UDPP functionalities
- Very large APT: Very Large Airport environment
- Large APT: Large Airport environment
- Medium APT: Medium Airport environment

3.2.2 Roles and Responsibilities

The objective of the Solution 39 is to integrate in the ATM environment the mitigation of a CCS (here an airport) by the AUs, and specifically the management of the arrival traffic at an airport. The rationale behind this is to decrease the impact of the problem for the AU.

This section describes the actors involved in the new Operational Process (es) / Service (s), their roles and their responsibilities.

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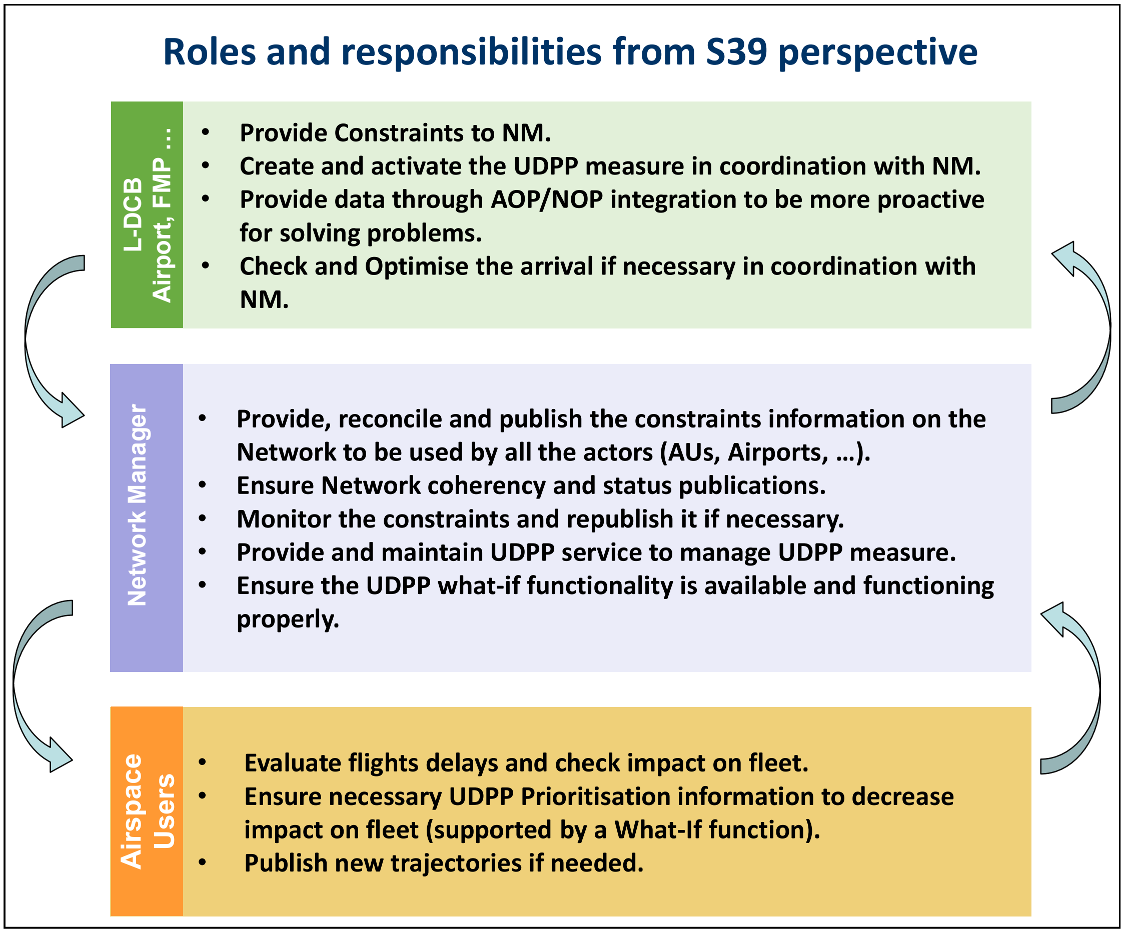

Figure 1: High level roles and responsibilities

The AU expectation is to have a unique, single entry point to manage their flights in case of delays (which is one of the objectives for S39). This unique point of contact is the Network Manager (called DCB or dDCB in the SESAR environment). Depending on the Airport/ANSP local organisation, the different functions are assumed by different real actors named: Local DCB, DCB-Net, Airport-ATC, Airport-DCB, FMP at Airport level, who make the link between airport and the NM system.

The most important element is that the different functions called Network Management Functions (NMF) used to managed delays on flights, are supported by one of these actors whatever the Airport organisation.

To identify the roles and responsibilities of the actors, four points of view have been defined (Collaborative background process, Initiate the UDPP Process, Implement UDPP solution, Coordinate Trajectory Solution). Their descriptions, including a short description of the relationship with the Trajectory Management processes, can be found in the following Table 6:

Actor	Collaborative background process	Initiate the UDPP Process	Implement UDPP solution	*Coordinate Trajectory Solution*
Network **NM** **DCB / dDCB**	Identify, evaluate and deliver imbalance to be managed (hotspot …) and open the possibility to AUs to address it (UDPP measure). Monitor the constraints, update and publish information as necessary. Maintain the NOP and the AOP/NOP integration.	Ensure UDPP service is available and functioning properly. Ensure UDPP environment is provided for all actors as necessary.	Ensure the UDPP what-if functionality is available and is functioning properly (impact assessment). Ensure Published UDPP solution available and effective. Maintain the UDPP solution to all actors	Provide updated information to AU that describes the current delay and sequence for flights based on UDPP prioritisation information.
Airspace User	Ensure FPL information has been sent to the Network to manage traffic properly. if e-FPL available send e-FPL information. Have the possibility to interact with the NM, especially to propose UDPP flight prioritisation for UDPP measures.	Ensure predefined prioritisation information has been put in the eFPL if needed and available (FF-ICE field: within fleet priority) if FF-ICE is available.	Evaluate the UDPP measure information and make UDPP prioritisation for flights within the constraint if needed.	Submit updated SBTs based on UDPP time calculated with prioritisation information.
Local DCB **Airport**	The L-DCB determines Airport capacity limitations and publishes the constraints characteristics (CCS) in coordination with NM. L-DCB assumes the coordination between Airport landside and airside. The L-DCB updates the airport organisation through the AOP and through Network (Runway used, taxiing …).	Publish and maintain Airport constraints when needed. Allow AU to mitigate the impact of delay with UDPP measure.	Evaluate and publish through AOP/NOP the impact of new time given by UDPP prioritisation through the Network. L-DCB can optimize UDPP output if needed in coordination with NM.	Update time information (Taxiing …) through API messages to NM when necessary. To be noted that taxi times can be overwritten by AU in eFPL if available.

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Actor	Collaborative background process	Initiate the UDPP Process	Implement UDPP solution	*Coordinate Trajectory Solution*
	Ensure good coordination with the Network especially with an appropriate AOP/NOP integration.			

Table 6: UDPP Actors Roles and Responsibilities

EATMA Role and responsibilities relative to Node:

Node	Responsibilities
Air Traffic Flow and Capacity Management	The ATFCM node is responsible for the demand and capacity balancing activities.
Airspace User Operations	Airspace User Operations represent all the activities undertaken by those organisations and individuals who have access to and operate in the airspace which is managed for ATM purposes in accordance with ICAO and national procedures. For the purpose of this document only those actors directly involved in ATM operations are described. The main types of civil Airspace User Operations are: · Scheduled Airline Operations / Organisation (A). The most extensive organization for Airspace User Operations is run by Airlines with a worldwide network. The daily operations of these Airlines, with up to thousands of flights per day all over the world, require a lot of flexibility. In order to give the best possible service to their passengers, maintaining punctuality and a high quality of service, Airlines have to run and to maintain a complex organization. This category regroups Cargo, Regional, Network, Charter and Low cost operators. · Business Aviation Operations / Organisation (BA). Another important segment of Airspace Users is Business Aviation, which concerns the operation or use of aircraft by companies for the carriage of passengers or goods as an aid to the conduct of their business. · Military Aviation Operations / (MA). Determined by strategic objectives dealing with National and International security and defence policies and commitments, the operation or use of military/State aircraft (combat aircraft, military air transport aircraft, tankers, AWACS, training aircraft, helicopters…) concern Air defence and policing flights, Search and rescue, instructional and training flights, combined air operations as part of complex scenarios and UAS operations for which special use of airspace may be needed. · General Aviation Operations / Organisation (GA), which operates civilian aircraft for purposes other than commercial

	passenger transport, including personal, business, and instructional flying, represents another type of Airspace Users. Depending on the size and organization of the Airspace User, the roles and tasks defined in this document may move from one actor to another, or may be consolidated into one actor, depending on the actually existing actors within the Airspace User organization. As an extreme example, the subset of General Aviation focused on personal transport does not normally have any organization except the pilot, so this actor will be responsible for all the tasks related to this/her individual flight. On the other hand General Aviation does not have to deal with many tasks which are important for the operations of other Airspace Users.

Table 7: EATMA: Node Roles and Responsibilities

EATMA Operational interaction per context:

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] Collaborative Arrival Management		Airport; En-Route; Network;
Node	Node instance	Node instance description
Air Traffic Flow and Capacity Management	Airport / Arrival FMP	Local DCB manages the arrival traffic on Airport and can set UDPP measure to manage it safely.
Airspace User Operations	AU	Airspace users can specify flights prioritisation on flights under a UDPP measure to decrease the impact of delay on their fleet.
Air Traffic Flow and Capacity Management	NM	NM manages and maintains the global picture of the traffic, the capacity and the constraints.

Table 8: EATMA: Operational interaction per context

3.2.3 CNS/ATS description:

The PJ.07-W2-39 scope falls in planning phase. Therefore, this section is not applicable.

3.2.4 Applicable standards and regulations

Current NM ATFCM standards and regulations are applicable for this solution.

3.3 Detailed Operating Method

3.3.1 Previous Operating Method

The current ATM environment based on static flight plans is evolving towards a trajectory-based environment to improve airports and ATM network performance. Airspace Users' (AU) decision processes and resulting business priorities differ from AU to AU and from flight to flight within one AU. The trajectory development and management processes in ATM currently do not allow each individual AU to incorporate specific aircraft/flight priorities into the requested trajectory, and they do not offer the opportunity to respect AU constraints in a way that best meets the AU business priorities.

Today the ATM system allows little flexibility to AUs: planning and sequencing are performed on a First-Planned-First-Served (FPFS) basis, delivered by the CASA algorithm, both under normal and abnormal conditions. In general, the current operating method, planning, sequencing, and flow management use only time-dimensional control to balance capacity and demand without AU interventions. Amongst the many available approaches, Network and Local Flow management are performed by means of regulations and slot-delay, as measures of last resort. All actions put in place to solve capacity problems are based on reducing the flight delay over the Network. This delay management paradigm does not however take into account the impact of the delay on the AUs:

- Impact of each flight and the rotational impact therein.
- Excess cost associated with this rotational impact over the day of operation for the AU (taking all fleet organisation of the day into account).
- Impact on passenger experience (transit passengers, VIP …).
- Impact to crew management (pilot flight time limitation, pilot flight duty limitation, pilot rest period …).
- Impact due to airport organisation (airport curfews, stand allocation …).
- Impact to the environment.

Full participation of AUs through their flight operations centres (FOC) into ATM collaborative processes, including flights' prioritisation with the full User-Driven Prioritisation Process (UDPP), is essential to minimise the impact of deteriorated operations on stakeholders, including AUs: a better recovery process that should offer more flexibility to accommodate AUs' changing business priorities and equity in the ATM system. The collaborative planning and flight execution processes shall be performed at 'level playing field', i.e. performance of all actors is taken into consideration. Rules must be implemented in case no collaborative planning is possible.

At the time of writing this document, the Network Manager (NM) and Local DCB actors (Airports APOC or ANSPs FMP) use different methods to solve demand-capacity imbalances (on arrival) in the context of the integration of the Airports into the ATM network, most of them providing some very limited flexibility for AUs to express their business needs through flights' priorities (ad-hoc, reactionary, or high-workload cases, or via the Proactive Flight Delay Criticality Indicator (P-FDCI) capability). These methods fall within the demand regulation category, and they consist of constraints imposed on traffic: real-time optimisation of capacity / demand across Europe, and delay management where aircraft are affected by an ATFM regulation in order to offer alternatives and minimise delay. Flights taking place on that day receive the benefit of ATFCM, which includes the allocation of individual aircraft departure times to avoid bottlenecks, and alternative flight profiles to maximise efficiency. Amongst others, the following measures (or methods) are of relevance for this document:

- ATFM regulations.
- Mandatory Cherry-Pick (MCP) (Network measure).

- Airport Cherry-Pick (ACP) (Local Measure).
- Slot Swapping.
- Local procedures for participating FMPs.
- Flight Criticality Indicator.

3.3.1.1 ATFM Regulations

To ensure that safety is not compromised whenever the traffic demand arriving at an aerodrome is forecast to exceed the available capacity, measures such as ATFM regulations are coordinated with the relevant FMP and applied by the NM staff to regulate the arriving traffic volumes accordingly.

The decision for implementation / cancellation and ownership of the ATFM regulation lies with the FMP, whereas the final decision on the regulation implementation is for NMOC to ensure global safety, following the FMP proposal.

All flights entering into a regulated traffic volume during the period of the regulation are subject to ATFM measures, except if:

- The flight belongs to a flow that is exempted from the regulation by the traffic volume definition.
- The flight departs from outside the ATFCM area.
- The flight is already airborne when the regulation is created.
- The flight is ATFM-exempted (STS ATFM exempted in the ICAO FPL).

During pre-flight operations, the NM team is responsible for the application of regulations.

All regulations shall have a reason to provide explanatory information on that regulation to external clients and post operations analysis.

3.3.1.2 Mandatory Cherry-Pick (Network Measure)

A Mandatory Cherry-Pick regulation (MCP) is used as a measure to solve short peaks (e.g. 1h or 1h 30min) of limited number of flights in congested areas. It consists of selecting flights creating complexity and applying ATFCM measures only to those flights. It may be used in combination with other measures (e.g. scenario) or other options available to the FMP.

The identification of the flights to be subject to the Network cherry-pick measure is carried out by the FMP and the delay for cherry-picked flights should not exceed 20 minutes. For predictability reasons, MCP is usually applied to flights close to the congested area, to minimize the lead time of the MCP regulation prior the start time of the hotspot.

The appropriate regulation reason is selected and the ANM remark shall contain the comment **'Network Cherry-Pick'.**

3.3.1.3 Airport Cherry-Pick (Local Cherry-Pick)

The aim of an Airport Cherry-Pick regulation (ACP) is to permit a degree of flexibility to the FMPs in order to solve short peaks of limited number of arriving traffic.

The main target of such improvements are short haul flights, therefore the procedure applies to flights operating entirely within the airspace of one ACC or between two adjacent ACCs. This procedure uses the same mechanisms of the MCP.

The identification of the flights to be subject to the ACP measure is carried out by the FMP and the delay for cherry-picked flights should not exceed 20 minutes. For predictability reasons, it is recommended to try to minimize the lead-time of the ACP regulation prior the start time of the congested period and the traffic selection must be at least 30 min before EOBT. FMPs shall ensure that the required arrival capacity (e.g. holding) will be available during the peak period.

The appropriate regulation reason is selected and the ANM remark shall contain the comment '**Local Cherry-Pick**'.

3.3.1.4 Flight Criticality Indicator (FCI)

From ATFCM OPERATIONS MANUAL [39]

Airspace users have the possibility to flag E-Helpdesk requests as critical for:

- Specific flight schedules which are key for airspace users' operations plans, or;
- Flights for which reducing ATFM delay is critical for their business.

Each airspace user can submit a critical request for a limited number of flights depending on the operational situation.

Critical requests are highlighted in the NOP flight list and E-Helpdesk queue to the NMOC staff for processing in magenta colour. Critical E-Helpdesk requests will not be subject to E-Helpdesk automatic processing rules (e.g. automatic rejection). This functionality is also available via the B2B communication channel.

Critical E-Helpdesk requests are subject to Network constraints depending on:

- The number of filed flight plans during the day of operations;
- The number of regulated flights in the system.

3.3.1.5 Slot Swapping

The slot swapping functionality is used to swap flights requested by AUs or FMPs. Additionally, it may be used to improve another flight if an aircraft operator requests a slot extension (i.e. instead of forcing the flight). AUs only request swaps concerning flights for which they are the responsible operator or where there is a formal agreement between both AUs to swap flights. The NM tactical team will neither check that these flights are from the same operators nor that a formal agreement exists.

FMPs may request swaps for two flights of the same AU or, during critical events at airports, also between any different AUs.

Conditions for the application of a slot swapping are the following:

- A request for a swap from an AO, TWR or FMP is received.
- For flights departing from A-CDM, the flight must not be pre-sequenced (not in 's' CDM status).

- The two concerned flights must be in slot-issued status.
- The two flights must be subject to the same most penalising regulation.
- One swap per flight shall be accepted, except critical events upon FMP request (probably updated to 3 swaps by flight end 2020).

3.3.1.6 Local procedures for participating FMPs

The following options, related to the new method described in Section 3.2, are available for those FMPs that have formal agreements to make use of them. The FMP tactical ATFCM measures reflect the NM Agreements where applicable.

In addition, there is a number of ATFCM local procedures agreed and published with the FMPs concerned.

3.3.1.6.1 Paris Charles de Gaulle (LFPG) diversion plan

This procedure is designed to prioritise flights that have diverted to re-position to their original destination: LFPG. The AU concerned for each diverted flight shall contact the unit responsible for collaborative decision making in LFPG (CDM@CDG).

The assumption is that an arrival regulation will be in force at LFPG. If not already applied, FMP requests NMOC to apply an arrival regulation. The rate is defined through coordination between CDM@CDG and Paris-FMP according to the number of diverted flights, to the CDG Arrival actual Capacity and to the Paris-ACC sectors demand / capacity balancing.

A priority flight list is established by the CDM@CDG in collaboration with the AUs. This list is communicated to Paris-FMP (by phone + email), who will then communicate the list to the relevant NMOC tactical position (by phone + email).

In all cases, flight plans must be updated to reflect the CDM process and the normal CTOT adherence rules apply.

3.3.1.6.2 Zurich (LSZH) departure priority window

Due to safety reasons, FMP will reduce the arrival capacity during certain periods in the hours of the morning peak in order to allow a higher number of departures.

Flights departing from out of area or any other flight in exempted status may not be captured by a regulation.

3.3.1.7 Network impact assessment of regulations

Using the Network Impact Assessment, it is possible to evaluate the potential on-load and off-load situation when a regulation is to be applied:

- Evaluate the impact on (active) traffic volumes and on-load / off-load areas.
- Evaluate the impact on Network delays.
- Visualise the regulations that are pushing traffic inside the revised / created regulation period and the regulations where the rectified / created regulation is pushing traffic.

3.3.2 New SESAR Operating Method

The new operating method is based on the integration of different processes used to manage the arrival traffic at an Airport.

The high-level objective, in addition to the previous operating method, is to decrease the impact of the delay for AUs caused by a CCS at arrival airport. In other words, the objective is to integrate the UDPP concept – either in full or partially - to the existing means for management of arrival traffic.

3.3.2.1 High level concept of collaborative framework for managing delay on arrivals

The new operating method builds on existing ones for resolving Capacity Constraint Situations (CCS) and incorporates additional features:

- Collaborative resolution of the CCS: all key stakeholders are involved in the resolution of DCB imbalance problem on arrivals to an ADES.
- Integration of UDPP into the CCS resolution process: the central part of resolving the DCB imbalance problem on arrivals at ADES is the inclusion and consideration of AU prioritisation in the process.

The UDPP mechanisms have been validated in SESAR2020 Wave 1, and as such they are part of the concept and new operating method defined in this OSED. The concept introduced herein covers the wider operational aspects of new or enhanced methods, enabled by the use of UDPP mechanisms or their components, for resolving DCB imbalance problems on arrivals. A detailed description of different UDPP mechanisms is provided in Appendix A (from SESAR 2020 Wave 1).

Fundamentally, the proposed concept acts on flights which are part of a DCB imbalance solution, and which are still in pre-flight stage (i.e. pre-off-block at ADEP). Thus, after creating a measure to solve an imbalance, each impacted flight has a different take-off time and the process has to manage the flights in different statuses according to anticipation to off-block time from ADEP.

The conceptual interactions diagram presented below shows the relationships and interactions between different ATM actors:

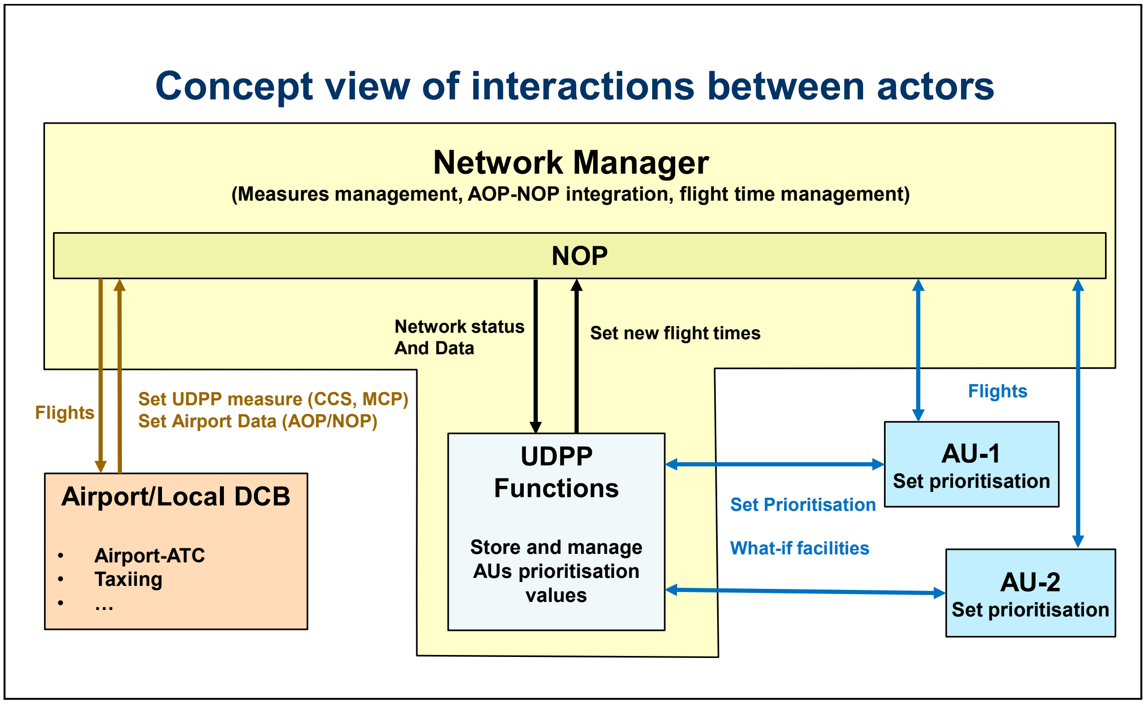

Figure 2: Concept view of interactions between ATM actors

The DCB imbalance detection at an Airport triggers the creation of a UDPP measure through the definition of the CCS in coordination with NM (General cases are described in Use Case 1: UC1).

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The central part of the framework is the NM system managing constraints and delay over the Network and maintaining a coherent and up-to-date situation for all the actors.

The UDPP service, part of the NM system, receives and processes the UDPP prioritisation inputs from AUs to produce a solution to the DCB imbalance problem while considering AUs' prioritisation.

UDPP service, envisaged as a part of the CASA function, uses NM data and AU prioritisation and continuously re-computes the slots based on the UDPP inputs received from the AUs at any given moment in time (asynchronous AU prioritisation).

On the AU side, in UDPP measure environment (UC1), a key interaction supported by a "What-if" facility available to the AUs offers the AUs the possibility to test a set of flight prioritisation for their flights, without formally submitting these inputs to NM service for publication. An AU can choose to run a What-if assessment on its flights with prioritisation and subsequently choose <u>not</u> to "Submit" this set of UDPP inputs. An AU becomes an "AU participating in the UDPP process" only if a formal Submit of UDPP inputs to the UDPP service is made by the AU, otherwise the AU is classed as a non-participating AU. It is expected that in practice any UDPP measure will involve a mix of participating and non-participating AUs (e.g. it can be assumed that some small airlines don't have and will not have a real-time cell with appropriate FOC infrastructure and/or staffing to set prioritisation to UDPP measures or to react to regulations as today).

It should be noted that the impact assessment given to AUs when prioritizing flights through the UDPP service, is supported by the NM system (based on the Network status) integrating AOP data through the AOP/NOP integration capability when available. The AOP/NOP integration is supported by the NM actor and it is developed in coordination with airports actors.

3.3.2.2 Collaborative framework for managing arrival constraints

The increasing need to optimise the traffic flow at airports, taking into account the different stakeholders requirements, produces a greater extent the implementation of local DCB measures adapted to specific circumstances. This section focuses on the integration or harmonisation of such arrival local DCB measures in Solution 39.

From SESAR Wave 1 we can identify three typical cases for arrival local DCB measures:

1. Arrival regulation using the CASA algorithm compatible with the UDPP process.
2. Local arrival DCB measures compatible with the UDPP process.
3. Local arrival DCB measures overlapping with the UDPP process.

As the UDPP process is related to the current NM flight management, it is proposed that UDPP becomes an NM service to optimise an existing DCB solution, considering the AUs prioritisation for their affected flights. In this case, the local DCB and the airport tools managing flights work in close relation with NM, using and updating the flight times in a coordinated manner. The flight times are always available and published by NM.

In SESAR Wave 1, the UDPP concept was successfully validated at maturity V2 level using the CASA algorithm (FPFS) as input for the UDPP process, which corresponds to the use case 1. The three cases above correspond to the VLDs or shadow mode trials run in SESAR Wave 1 (PJ24 and PJ25): case 1 corresponds to Zurich (shadow mode; no submit to NM), case 2 to Heathrow (VLD) and case 3 to Barcelona (VLD).

In terms of technical integration, the UDPP integration with local DCB also incorporates the current available API services and related B2B web services, taking into account the NM implementation details.

We assume that the local DCB measures to integrate with UDPP are accepted by NM as valid solutions, in particular:

- The local DCB shall comply with safety requirements.
- The Airport (APOC) or the FMP shall manage the local DCB solution following a CDM process involving all stakeholders.

3.3.2.3 Coordination and integration workflow

3.3.2.3.1 Principles

High level description:

1. The local DCB process is managed by the Airport or the local FMP.

2. The local DCB system is connected to the NOP through B2B services (SWIM compliant).
3. The Local DCB is expected to detect and set the adequate measure to manage an overload situation.
4. If a UDPP approach is decided to allow AUs to mitigate the impact of the solution (UDPP measure), the first step is to declare this measure to publish the L-DCB intention and to prepare to manage the organisation of the flights to decrease the overloaded situation and to open to the AUs the possibility to mitigate it.
5. During the process, the local DCB is expected to send Arrival Planning Information (API) containing Airport organization (runways used, taxiing …) as usual when the AOP is implemented. These information, if available, will be used by AU through UDPP information to optimize the block time of their flights accordingly. There is no impact on the UDPP mechanism if these planning information are not available in NM. Up to the L-DCB to give this service to the AU as it's not part of the PJ.07-W2-39.
6. During the UDPP prioritisation phase, only flights not reaching yet the UDPP flight cut-off time can be prioritised by the AU through the UDPP functions, and then flights may be assigned a new arrival time (updated), and the equivalent CTOT of the flight issued.
7. When the UDPP measure releases flights to optimization (after UDPP flight cut-off time), if needed the L-DCB (Airport or FMP) is allowed to use the NM eHelpdesk or to send Arrival Planning Information (API) containing TTAs on flights to the NOP for flights optimisation adjustment.
8. If a UDPP measure is chosen to manage the traffic overload (from a regulation measure), during the prioritisation phase, on each publish prioritisation action from AU, the AU prioritisation is used to calculate and to publish new times on flight on the Network.
9. NM assesses the network impact of the negotiation during the whole elaboration phase when information is submitted. NM provides the final time allocation depending on the network situation, i.e. depending on departure airports and other en-route constraints.
10. The negotiation result constitutes target times for the arrival airport stakeholders that the NOP will try to accommodate at its best effort.
11. NM, during the elaboration of the flight arrival time, always back calculates the CTOT and provides it to the flight’s departure aerodrome each time a solution is published.

The high-level coordination principles are the following:

1. The local DCB invokes the UDPP measure as a service, to elicit AUs’ input for prioritising their flights under situations of demand-capacity imbalance at an arrival airport.
2. Involving directly AUs in the prioritisation of their flights is considered of fundamental importance, since they are the users of the ATM system and are in the best place to define the order of arrivals that minimises the impact on their overall network schedule.
3. The collaborative process is based on 3 phases:
    a. **Phase 1**: UDPP measure creation and activation: identify the problem and create the adequate UDPP measure to allow AU prioritisation to face the imbalance.
    b. **Phase 2**: AU prioritisation & submission: allow AUs to evaluate and submit their prioritisation to the NM system. This phase depends on the type of UDPP measure set by the L-DCB.

c. **Phase 3**: Optimise arrival sequence and Network Impact Assessment: allow local DCB to optimize the result of the UDPP process. As current operations, requests for optimization are always possible, and this possibility will remain with UDPP operations. But for some local DCB, this step is not mandatory to ensure the safe and efficient resolution of the CCS (local DCB relies on the UDPP measure to resolve the CCS safely and efficiently as with CASA currently). NM always assesses the impact on the overall Network.

4. On the other hand, the local DCB is the stakeholder responsible to make sure that all the resources needed to accommodate the arrivals on the ground are available, in a safely manner. Therefore, the Airport needs to monitor/keep control of the final overall reordering process while trying to accommodate the AUs' needs as much as possible.
5. NM will manage the collaborative process outputs based on ATFM slots or TTAs and CTOT all along this process.

The following graphics define the general coordination workflow in 3 phases:

- **Phase 1**: UDPP measure creation and activation.
- **Phase 2**: AU prioritisation based on ATFCM regulation (UDPP measure: UC1).
- **Phase 3**: Optimise arrival sequence and Network Impact Assessment.

The 3 phases contain running activities across them, which are displayed by large arrows in the graphics. These running activities are described in the chapter 3.3.2.3.1.4 after the description of the 3 phases.

3.3.2.3.1.1 Phase 1: UDPP measure creation and activation

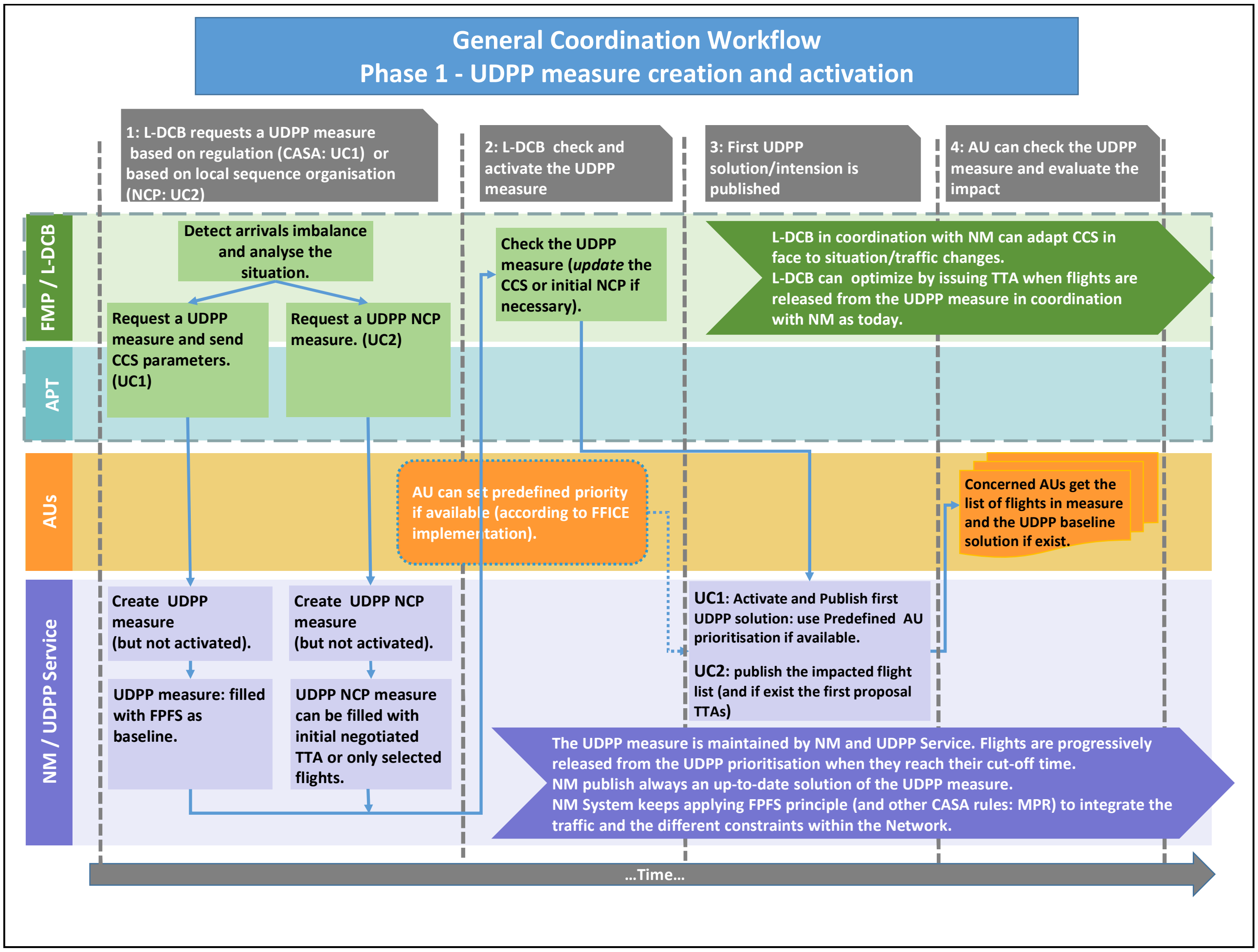

Figure 3: General coordination workflow - UDPP measure creation and activation

Description:

The overall scope of this phase is to identify the problem and create the UDPP measure to allow AU to mitigate the impact of the delay caused by the imbalance, by prioritizing their flights (as described in phase 2).

This phase is very similar to the current ATFM regulation measure creation. The step 1 and 2 depend a lot of the location and tools the L-DCB actor uses to manage ATFCM measures in coordination with NM.

In the current environment step 1 and step 2 is generally grouped and is business as usual for L-DCB to manage ATFCM measure, no extra workload and tool is needed.

Step1:

The local DCB (L-DCB) detects an imbalance according to the current NM/NOP status.

L-DCB decides, in coordination with NM, to involve the AU in the process for the mitigation of the delays.

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If the overload characteristics drive the L-DCB decision to apply UC1 approach, the initial state starts by a (safe) action to smooth the traffic, i.e. using the FPFS (CASA) rules, which guarantee an equitable solution for AUs. The FPFS approach is the most efficient one when the CCS generates medium to long measure durations and medium to high delays to flights (same applicability than current ATFCM regulation). It is also the most efficient for introducing and using the UDPP to mitigate these delays (by using AU input).

For more details please refer to the use case describes in section 3.3.2.5 .

NM creates the UDPP measure (UC1) or the UDPP NCP measure (UC2) according to L-DCB choices and generates the delay according to the FPFS principle (CASA algorithm) for the UDPP measure, or, potential impacted flights or a pre-filled sequence given by L-DCB for the UDPP NCP measure . NM will not activate the UDPP measure yet.

Step2:

This step is very depending of the L-DCB location, tools, and current implementation of the management of the ATFCM measures. In a current implementation this step can be completely embedded in step 1, or in future implementation, this step can enable a more open, flexible and coordinated with NM approach for L-DCB. In this case, L-DCB can check the impact generated by the NM UDPP measure creation.
L-DCB can adjust the UDPP measure if necessary, in coordination with NM.
When the UDPP measure impact is validated, L-DCB asks for its activation.

Step3:

NM activates and publishes the initial UDPP measure, the delays are allocated to flights concerned by the UDPP measure.
If pre-existing priorities are available for flights within the UDPP measure, the baseline delays are issued and according to this predefined prioritisation the set of time for a flight is issued (arrival time, departure time …). The UDPP Service is performed automatically.
Currently, this predefined prioritisation is supported by the eFPL implementation (FF-ICE field: fleet priority or any other mean setting priorities on flights). If eFPL prioritisation is not implemented or not active, the UDPP service will not use any predefined priority. In this case, the first delays generated on flights are identical to the delays generated today by a classic ATFM regulation measure.

Step4:

At this stage, AUs have all the necessary information to start using UDPP to mitigate the (impact of) delay on their flights in the measure.

3.3.2.3.1.2 Phase 2A: AU prioritisation based on ATFCM regulation (UDPP measure: UC1)

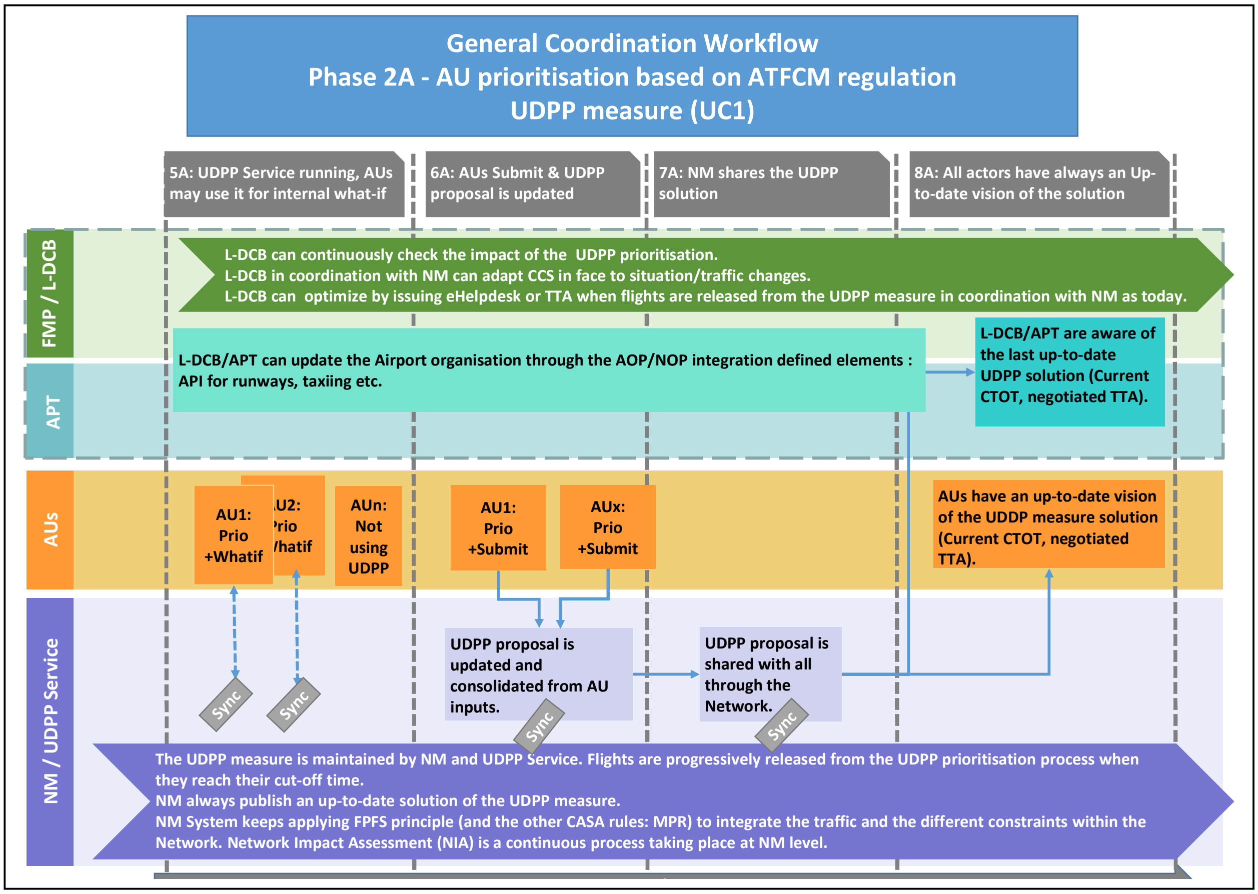

Figure 4: General coordination workflow - AU prioritisation What-if and Submit

Description:

This phase describes how AUs assign, test and submit their prioritisations to NM to mitigate the impact of the UDPP measure.

These steps apply to each AU separately. From a global perspective, it's a continuous process integrating AUs prioritisation via a Submit, when available. This phase finishes progressively when AU flight cut-off time occur.

Step5A:

Each AU can access the UDPP measure if concerned by it. AUs can assign and test their prioritisation on their own flights to check the new times, generated by the UDPP service, and to reduce the impact of the delay on their fleet. These new times will only be published after the Submit of the AU.

Each AU can use (or not) the UDPP Service to mitigate the impact of the delay; if an AU decides not to use UDPP Service, the baseline slot will be delivered as described in Step3. AU not using UDPP will not be negatively impacted by the other AUs (equity rules are automatically applied on slots generation).

Step6A:

In order to get their flights' prioritisations applied, the AU Submit them to the UDPP service. NM applies these prioritisations to the flights using the UDPP Service, and integrates all prioritisations from all AUs in the UDPP measure.

AU prioritisation:
AU prioritisation input consists of UDPP Protection (Priority "P"), Flights Margins ("Time Not After", "Time Not Before" and priority value on it) and only UDPP priority values (from 1 to 999) set by the AUs and applied on their own flights. AU prioritisation does not provide specific time values for flights, but inputs to be used by the UDPP algorithm to generate new times on flights, linked to the current situation of the Network and constraints. As time progresses, some variation may occur depending on the variability on flights and constraints in the ATM systems. Nevertheless, AU prioritisation is always taken as inputs and the best solution is always given to AU according to their prioritisation. For more information on UDPP see Appendix A.

Step7A:

Each time a new Submit (containing flight prioritisation) is sent by an AU to the NM, the UDPP Service re-calculates the new time associated and the CASA Most Penalising Regulation rules are applied if necessary. The new TTA and CTOT slots become active and public. Outside of the Submit instances, the UDPP service and CASA always integrate the current network situation, including other regulations, to generate times for the flights within the UDPP measure using the last UDPP inputs that had been previously provided by AUs and which are retained by the UDPP service for this purpose.

Step8A:

AUs, Airport and all the other actors always have the latest up-to-date view of the flights' times (CTOTs and TTAs) within the UDPP measure.

3.3.2.3.1.3 Phase 3: Optimise arrival sequence and Network Impact Assessment

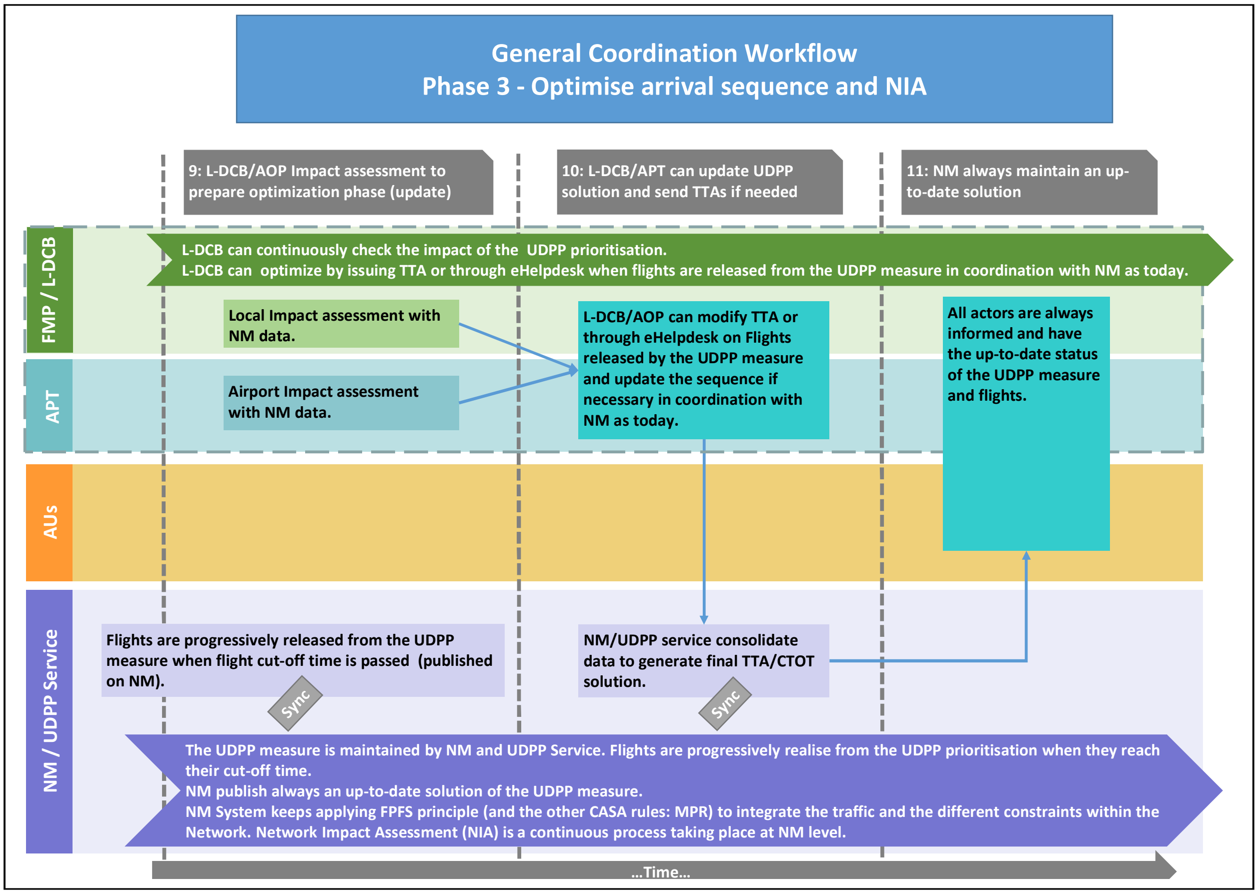

Figure 5: General coordination workflow – Optimise arrival sequence and Network Impact Assessment

Description:

The overall scope of this phase is to allow L-DCB and Airport to optimise the arrival if necessary. Some Airports have optimisation tools like Arrival Manager or Stand allocation tool. This local optimisation phase is the time window open to Local DCB to adjust current flight sequence in an optimum way, mainly by optimisation tool, but it's also possible to adjust the sequence by manual action coordinated with NM.

Note: this phase does not differ to the current operations, local-DCB can always request NM for some adjustment in case the measure has to be refined.

Step9:

L-DCB and Airport can assess the impact of the UDPP measure at any time after the creation of the UDPP measure, using NM up-to-date information; however, as today happens, doing it too long time in advance is counter-productive because of the uncertainty for the traffic and the available capacity to manage it.

Along the timeline, flights are progressively released from AU prioritisation (as they reach their respective UDPP cut-off times). During this same period of time, flights have less uncertainty and become more stable for accurate time operations on airport and close to arrival. When flights are passing the UDPP flight cut-off time, the flights' times are generally accurate enough to be part of an assessment of the impact at all levels, especially at arrival.

Step10:

L-DCB, in collaboration with Airport and NM, can change flights' times by assigning TTAs in case the sequence proposed by the UDPP measure is not manageable, or to make some adjustment to optimise it (as currently possible).

NM is always involved in this process, to maintain coherency and minimizing impact over the network. NM produces CTOTs accordingly.

Step11:

This step indicates the end of the process. The objective is to remind that all actors connected to the Network always have the up-to-date status of the flights, according to the different constraints, the flights' variability and the capacity status.

3.3.2.3.1.4 Running activities along phases

Running processes (dynamicity of the process):

NM

NM performs continuous monitoring of overall ATM situation from Step1 to Step11. This is a process as performed currently by the Network Management function via the NMOC.

NM supports UDPP measure creation, activation, and maintains and updates the data linked to the variability of the traffic and the resource associated to it.

NM always publishes an up-to-date situation including the UDPP solution with respect to variability. For a UDPP measure based on ATFCM regulation, AUs prioritisation are taken after AU prioritisation Submission, for a UDPP NCP measure, NM takes time constraint after L-DCB publishes new arrival time on flights. NM integrates the different network constraints to manage the flights. In case of multi-constraints occurring, NM will apply the Most Penalizing Regulation to set the required timestamps (CTOT, TTA).

After the publication of the UDPP measure, NM maintains it according to the traffic situation, and updates the measure in coordination with L-DCB if necessary.

If necessary, NM allows L-DCB to set TTAs on flights within UDPP measure after flights have reached their UDPP flight cut-off time which can be supported by a collaborative tool if existing at the local-DCB site.

As the UDPP Service is fully integrated with NM Systems, the flight cut-off time is based on existing data/service implemented by NM. The definition of the Cut-off time is based on the existing service called "targetTakeOffAPIRequest". See definition on chapter 3.3.2.3.2.1 - UDPP Cut-off time driven by optimisation period.

At any time NM can perform a network impact assessment on the current situation.

NM integrates the usual AOP/NOP coordination through API messages which specify Runway used, flight taxiing when available, etc.

L-DCB:

From the activation and publication of the UDPP measure (Phase 1, Step3), L-DCB has the possibility to adapt the measure in coordination with NM, in case of evolution of the situation. L-DCB can also update the Airport information (Runway, taxiing …) when available through the AOP/NOP link with NM.

When flights within the UDPP measure reach their respective UDPP flight cut-off time, AU can no longer reprioritise them. The L-DCB can, after this time, optimise them according to Airport constraints in coordination with NM like in today's operations.

L-DCB can always monitor the current situation by using the published data provided by NM.

3.3.2.3.1.5 CASA integrates the UDPP measure (UC1)

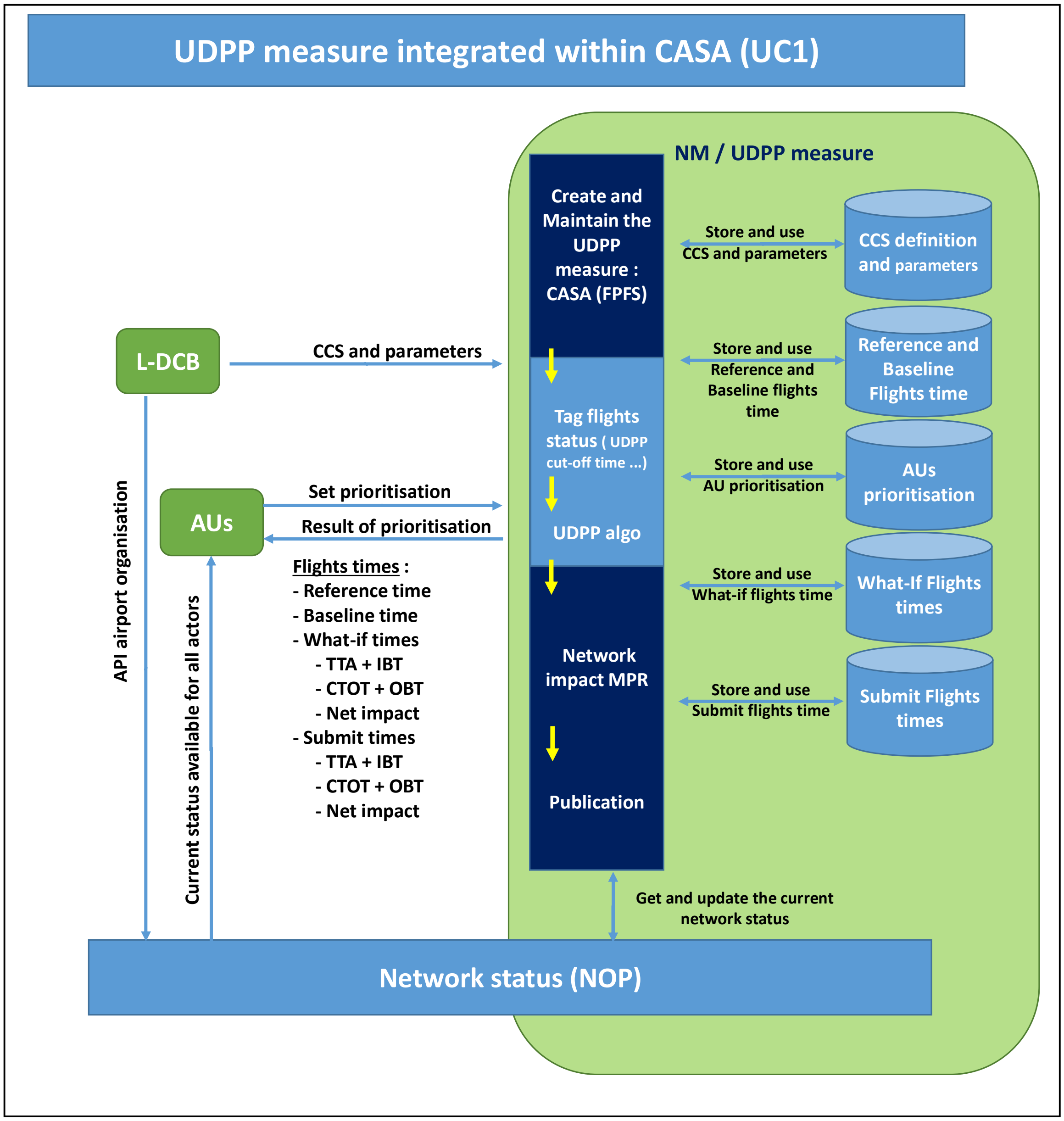

Figure 6: UDPP service integrated within CASA (UC1)

This high level description specifies the integration of the UDPP measure (from regulation) within NM based on CASA.

The UDPP service is considered as an intermediate step within the CASA Function, after the FPFS internal calculation.

In general, the CASA algorithm's FPFS principle uses the measure set by the L-DCB (CCS) to calculate the baseline times for flights within the measure.

The UDPP service integrates AUs prioritisation to reorganise the CASA FPFS output.
The first step of the UDPP service is to check flights to determine if they can be subject to prioritisation, and also to check whether a flight passed its UDPP cut-off time or not. If flights are passed the cut-off time, the previous Submit AU prioritisation - if it exists - is maintained as the final one, otherwise the initial baseline slots (generated by CASA FPFS) are maintained.
The UDPP service itself has no interaction with network constraints other than the arrival measure for which UDPP has been invoked for. The constraint interaction, supported by the CASA Most Penalizing Regulation rules, is applied internally on reordered flights after the UDPP service has integrated the UDPP inputs. The outcome of joint CASA + UDPP service processing is the solution that respects all necessary rules of both of these elements.
To apply UDPP prioritisation (automation based on rules integrating equity) and to enable AU to take decisions, a set of timestamp information has to be available and provided to the AUs who use the UDPP service:

- Reference and baseline time: the reference time is the one used if no constraint was applied. The baseline time is the one initially used (without prioritisation) to be assigned to AU flights by FPFS rules on arrival. The FPFS rule is known as equitable and well accepted by all airlines. This time corresponds to the landing time of the flight.
- The UDPP time corresponding to the new calculated time given after AU assigns a prioritisation: it's the output of the UDPP Service (algorithm) in what-if mode or in submit mode. It's based on the landing time given as baseline time.
    - This UDPP time has to be stored and used as What-if time if it's issued from a What-If request from AU.
    - This UDPP time has to be stored and used as Submit time if it's issued from a Submit request from AU.

Other times required and used by AUs to make decisions on prioritisation values to set for flights.
These times have to be provided to AU as reply to the prioritisation demand:

- The UDPP in-block time (U-IBT): it's the landing time given by the UDPP time calculation plus the taxi-in associated to the flight given by the AOP/NOP integration (API message). This time is very important for the AU to organise the aircraft and crew rotations, and passengers flow.
- The CTOT associated to the UDPP calculated time even if it's not in Submit mode. This value is important to the AU to organise the flight departure (UDPP time – Flight duration).
- The UDPP Off-block time (U-OBT) on the departure Airport: if the departure taxiing information is available = (UDPP time – Flight time – departure taxiing: taxi-out).

In Submit mode, all these time values are stored as Submit time values. They will be used by the AU as monitoring values to compare with the current time values from the NOP, enabling warnings for significant variations.

In What-If mode, all these time values are stored as What-If time values. They will be used by the AU to evaluate the impact of the prioritisation, and to decide whether to Submit or not.

All these times have to be calculated and sent to the AU at the end of each transaction: What-if times in What-if mode and Submit times in Submit mode.

Over the result of the prioritisation, the UDPP service/CASA has to save data, to be able to apply prioritisation and/or to enable AUs connection and re-connection (in case of connection failure).
The needed data are defined as follows:

- The CCS/measure definition:
  - The constraint characteristics: set of window and capacity constraint.
  - The Arrival Optimisation period used to calculate the UDPP cut-off time: it's an added duration before 'OBT-Time to Remove from Sequence', applied on each flight within the UDPP measure.
  - UDPP max schedule anticipation: This value gives the maximum 'negative delay' authorised on flight reference time (e.g. 10mn) to optimise the use of the resource object of the UDPP measure (e.g. 5mn = 5minutes before reference flight arrival time is allowed). It's also used by the UDPP service to optimise the Arrival sequence maximising the arrival throughput. This parameter also avoid having to much early flight arrival within a constraint area decreasing uncertainty.
  - Freezing flights input in UDPP measure (Late filer): Time to consider new flight plan as late filer. A UDPP measure follows the same rules than an ATFCM regulation: Late filers flights are pushed when capacity available and are not part of the FPFS measure calculation.

- The AU prioritisation and parameters
  - Default priority.
  - Max delay for protection.
  - The last submitted Prioritisation for each flight (Priority, Margins).

3.3.2.3.2 Planning horizon

The UDPP is conceived to work on large anticipation times (pre-tactical phase from D-1) as well as in tactical (pre-flight) phase. It addresses all situations where AUs can redefine the order of flights to reduce the impact of delays on their operations. It is specifically efficient in case of severe delays whose impact cannot be recovered by minor adjustments and where a large part of an AU's schedule has to be re-planned: the idea is to take the AUs' re-plan as a basis for ATFM and Airports.

The UDPP is not intended to produce the final time for the flights affected, but a strong indication of the preferred flights' organization when severe delays are foreseen.

The implementation of the final sequence to be flown by flights on the other hand remains the responsibility of the Local DCB (called optimization in this document) first and the ATS then, supported by the Arrival Manager (AMAN) system in charge of the fine optimization of the arrival traffic in real time (execution phase), i.e. indicatively several minutes to an hour (xStream concept) before the arrival.

To be noted that flights not subject to regulations (NM ATFCM manual Chap 6.2: Non ECAC flights, Airborne flights …) are part of the UDPP measure but with no delay applicable as defined today in ATFCM documents for a regulation. The Solution follows the same rules for managing flights in planning phase. Actions on airborne flights can only be done in ATC to adjust/optimise the sequence (AMAN) and is out of scope for Solution 39.

3.3.2.3.2.1 UDPP Cut-off time driven by optimisation periods (From ADEP and from ADES)

When a UDPP measure is applied on the arrival airport, the allocation of CTOT to flights generates departure time on flights assigned to the departure airports.

From departure airport and en-route perspective, but partially also from the arrival airport perspective, even if the anticipation period added by the flight duration is generally sufficient to manage the flight at arrival, a cut-off time for flight prioritisation must be defined to allow departure, en-route, and arrival to manage the flights effectively allowing optimisation.

The UDPP cut-off time effectively defines the end of the UDPP eligibility period of a flight, i.e. the period during which UDPP inputs for the given flight from the respective AU can be submitted to the UDPP service for processing. We assume that the cumulative time given for optimisation is sufficient for departure, en-route and arrival adjustments for optimisation.

If UDPP prioritisations have been submitted by a participating AU for a flight before its UDPP cut-off time, then the UDPP service will take into account this flight's prioritisation inputs. In case no UDPP inputs have been submitted by a participating AU before reaching the UDPP cut-off time of a flight, then the UDPP service will treat this flight with its baseline time value of the flight (as no UDPP input was send).

The UDPP service does not impose any limitations on the number of UDPP input submissions from a single AU. It is therefore possible for an AU to change or remove a previously submitted priority for a given flight by making a new UDPP prioritisation submission to the UDPP service, provided that the UDPP cut-off time for the given flight has not yet been reached.

Once the UDPP cut-off time of a flight has been reached, the last flight prioritisation submitted by the AU for this flight is locked from the UDPP measure perspective. AU prioritisation becomes not available for this flight. This flight is realised from the UDPP measure and becomes available for other actors (L-DCB/APT) for modification/optimisation if needed.

As UDPP Service is integrated with NM System, the flight cut-off time has the possibility to use variables/services already developed and supported by NM. In NM the most accurate variable dealing with last possible modification of a TTA is called "latestSubmissionTargetTakeOffAPI" and defined in the "targetTakeOffAPIRequest" service as attribute for the departure airport.

This "latestSubmissionTargetTakeOffAPI" attribute is set to OBT-TRS on departure (Time to Remove from Sequence) where TRS is airport and even Runway dependent. This attribute integrates the ADEP airport characteristics and can be used as a basis to elaboration the UDPP cut-off time.

This "latestSubmissionTargetTakeOffAPI" attribute contributes to the latest time that a TTA request can be submitted for a specific flight.

As the UDPP cut-off time represents the transition time for a flight when a flight goes from the AU prioritisation to the Airport Optimization, an extra duration from the "latestSubmissionTargetTakeOffAPI" time has to be defined to allow arrival Airport actions if needed.

Currently no equivalent existing variable/service is defined in NM for arrival airport, and a new attribute has to be created. To solve this, an intermediate solution has been put in place and the

"Arrival optimisation period" is created representing TRS at arrival. This variable will be implicitly initialised to 30mn, however the precise value will be subject of validation.

This extra negative duration "Arrival Optimisation period" produces the UDPP cut-off time as follows:

UDPP Cut-off time = OBT – TRS@ADEP – TRS@ADES.

Where:

OBT – TRS@ADEP = "latestSubmissionTargetTakeOffAPI" defined in NM

TRS@ADES = Arrival Optimisation period

By definition, UDPP cut-off time (and by consequence Arrival Optimisation period) affect the flight in the pre-flight phase.

Arrival Optimisation period (TRS@ADES):

The Arrival Optimisation period is a constant value assigned to the UDPP measure given by a parameter defined in the CCS. The Arrival Optimisation period is applied to all flights contained in the UDPP measure, regardless of their ADEP.

The Arrival Optimisation period value is given by the local DCB (e.g. Airport probably under the APOC coordination) according to the uncertainty of the situation and the characteristics of the different components influencing the final sequence.

The components influencing the value of the Arrival Optimisation period are linked to different optimisation tools used to optimise the airport:

- Starting time of the runway optimisation.
- Arrival manager (AMAN).
- Departure Manager (DMAN), Pre-departure sequence.
- A-CDM Airport.
- …

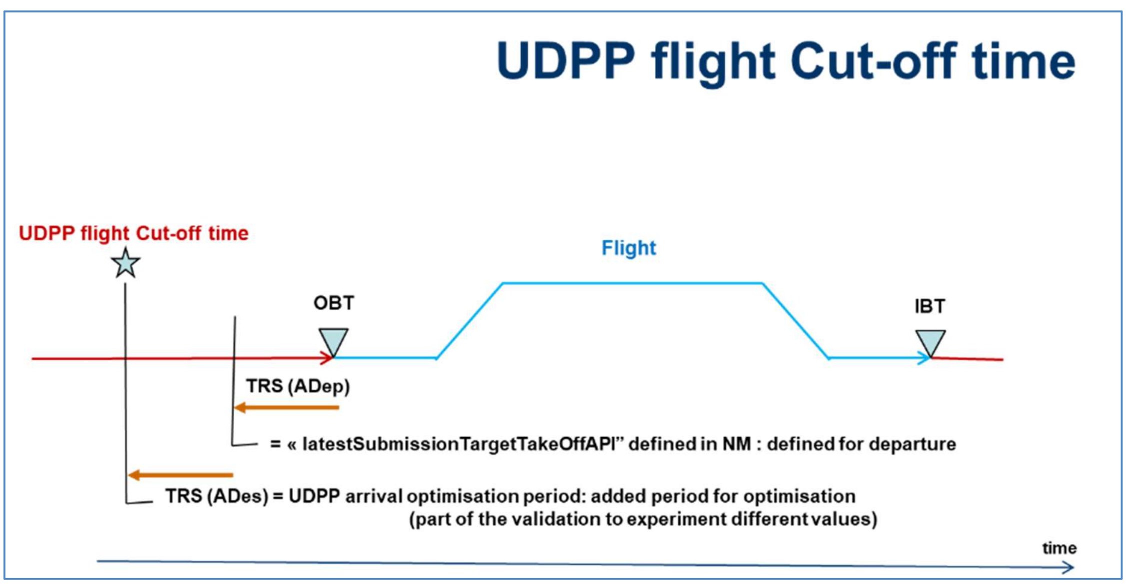

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Figure 7: UDPP flight Cut-off time

3.3.2.3.2.2 Freezing flights input in UDPP measure (late filer)

A UDPP measure can be published a long time in advance, and can use a part of the Airport flight schedules as the basis for the demand, waiting for real filed flight plans. If the Airport flights' schedule is not used, the progressive filed flight plans will increase the demand.

The time for freezing flights specifies when the UDPP function stops integrating new flight plans in the middle of the UDPP measure. After this time, new flight plans would be set in available slots if exist or generally at the end of the UDPP measure. In other words, late filers are managed by the UDPP algorithms as done by CASA, but according to the "Freezing flights input in UDPP measure" parameter. These late filers take the earliest slots available which are not yet "Allocated".

The time for freezing flights can be defined as today (by the NM function): 2 hours before the scheduled off-block time of a given flight.

3.3.2.3.2.3 UDPP max schedule anticipation

This is a local UDPP parameter defined for all the flights in the UDPP measure. This local UDPP parameter is applicable on all arriving flights, authorizing flights arriving within an earlier window than the flight reference time.

This value is decided and published by local DCB (airport), in coordination with the AUs when creating the UDPP measure through the CCS parameters.

This value gives the maximum 'negative delay' authorised on flight reference time (e.g. 10mn).

This parameter is useful for the UDPP algorithm to optimize the resource (Runway throughput) managed by the UDPP measure, avoiding possible hole in certain condition in the output sequence. But currently negative delay is not manageable by NM.

3.3.2.4 UDPP integration with P-FDCI

3.3.2.4.1 FDCI definition

FDCI is a parameter provided by the Airspace User to express Simple Preferences which consists on the provision of additional information released by the Airspace User to NMF to indicate the importance of some critical flights to progress on time. Hence, flow management should preferably assign no delay or limited ATFCM delay to those flights and adapt the measure to AU preference.

For critical flights, FDCI can be used by NMF for slot exemption, to reduce the allocated delay or to avoid providing STAM during the cherry picking selection to create a DCB measure.

This FDCI concept is related to the FDCI evolution defined in project PJ09.03. The FDCI can be viewed as an instantiation of the simple preference concept in short term implementation objective.

Two types of FDCI were identified:

- Proactive FDCI: issued for really critical flights before any DCB measure is allocated to the flight. The intention is that NMF consider this information before implementing any measure. This Proactive FDCI is not operational yet, but it has been validated in PJ07 S38.

- Reactive FDCI: issued through NM helpdesk when a DCB measure is already affecting the flight with the aim that NM and FMP can take any corrective action to reduce the impact.

The FDCI consists of three attributes:

- A first attribute reflecting the criticality.
- A second indicator containing the reason.
- A third one being the time tolerance (maximum acceptable delay) that will be used by NMF as a help to resolve the problem.

The time tolerance attribute is expressed via:

- Delay (maximum acceptable).

FDCI can support critical flights impacted either by En-route or airport DCB problems (or both).

3.3.2.4.2 UDPP and FDCI integration

According to the FDCI definition, in some situations UDPP and FDCI will cohabitate.

The figure below shows the time line for P-FDCI and R-FDCI:

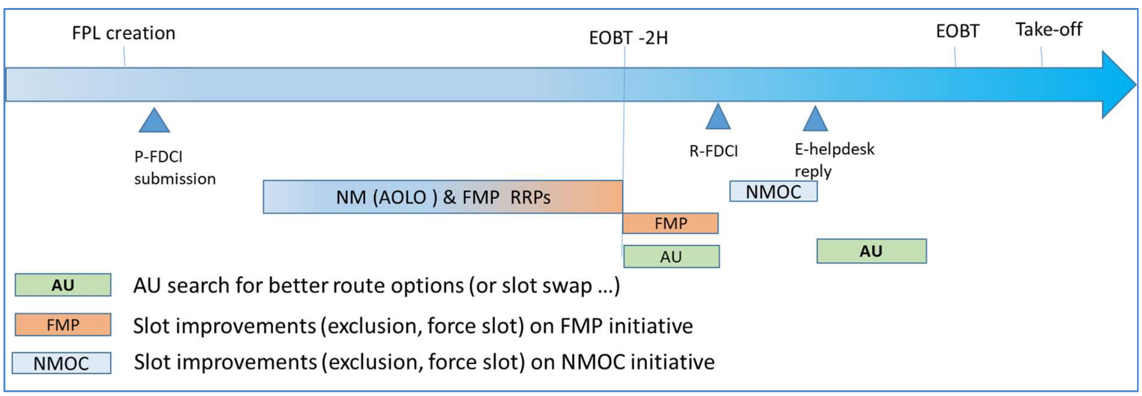

Figure 8: P-FDCI and R-FDCI on time line

A flight which declared P-FDCI and caught by a UDPP regulation will follow the process:

1. Until SIT1 (typically EOBT-2h) NM and FMP will try to avoid affecting that flight with DCB measures.
2. If the flight is affected by a UDPP regulation and the delay is greater than the P-FDCI tolerance, before declaring R-FDCI, the AU can benefit from UDPP following the AU preferred option:
   a. Follow the usual UDPP process in place as the rest of flights and declare the preferences.
   b. Automatically translate the P-FDCI time tolerance into UDPP margins ("Time Not After") and generate the UDPP preferences. As p-FDCI does not include an equivalent to "Time Not Before" it will be allocated to 0 in this particular option.

3. AU acceptance for UDPP solution.

4. If UDPP do not mitigate the delay, AU can declare R-FDCI through NM helpdesk.

In the above step 2, the option b have the advantage of reducing the AU workload by introducing the UDPP solution as part of the P-FDCI and UDPP potential automated actions.

P-FDCI can provide a simple mean for certain categories of AUs to be involved in UDPP.

As already mentioned, in case of UDPP regulation the transition between P-FDCI and R-FDCI will pass through the UDPP process before eventually need to declare R-FDCI.

In typical situations leading to UDPP there would be very few opportunities for NM helpdesk to find solutions for R-FDCI flights, then the transit from P-FDCI to UDPP could be one of the best opportunities to mitigate the delay for such flights.

3.3.2.5 Use Cases

The Use Cases (UCs) defined hereinafter further detail the generic process defined in previous sections within chapter 3.3.2 of this document.

The Use cases are defined based on the initial phase of resolving the DCB issue under Phase 1/Step 1 of the process in the new operating method. The means of initial resolution of the DCB issue is considered as the main distinguishing factor in terms of the application of the generic process.

The two types of previous operating method used as initial DCB solutions in the new operating method are:

- ATFM regulation.

This main DCB resolution is commonly used in operations, but it is fundamentally different in terms of his implication on interaction between ATM actors, as well as technical and operational details.

In the framework of this Solution defining strong common awareness and collaboration between actors, NM proposes not to use the ACP possibility considered too local to perform a general solution over the network. Use cases are defined UDPP measures to replace ATFCM regulation measure enhanced by AU prioritisation.

Due to the nature and scope of the Solution, the applicability of the UCs presented here (and thus of the generic process) is limited to CCS on arrivals i.e. non-nominal situations.

UCs presented below are envisaged to be usable for a wide range of DCB issues leading to capacity-constrained situations on arrivals. Any DCB issue can be described through a set of parameters such as length of notice ahead of the DCB issue when the DCB issue is identified, severity of the DCB issue, duration of the DCB issue, nature or source of the DCB issue and DCB issue dynamicity and predictability. These parameters will be used as variables when UCs are used as basis for validation scenarios.

3.3.2.5.1 Use Case 1: UDPP measure based on ATFM regulation.

In the previous operating methods, the arrival DCB issue was solved through an ATFM regulation.

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The UC1 is founded on the use of ATFM regulation for the initial solution of the DCB issue on arrivals: The initial delay given to flights within the measure are calculated by the FPFS algorithm of CASA.

As a result, one of the key features of this UC is the guarantee of equity in the initial solution that would be ensured through CASA algorithm and the UDPP algorithms.

Additionally, this kind of UDPP measure, starting by smoothing the traffic done by the FPFS CASA function, is typically used for more severe and/or longer duration of DCB issues, which in turn typically means a larger number of flights affected by the measure than a NCP measure, only limited to 20 mn delay and 1 hour or 1 hour and half constraint duration. Consequently, this kind of UDPP measure and the associated ATFM slot list is the most efficient environment suitable for the integration of UDPP mechanisms into the global arrival process.

This Use Case (UC1) has been successfully validated, as planned by the S39 roadmap, during the Zurich validation exercise run from Oct 4th 2021 to Oct 15th 2021 for detailed information see the Validation plan[42] and Validation report of S2020 solution 39 [43].

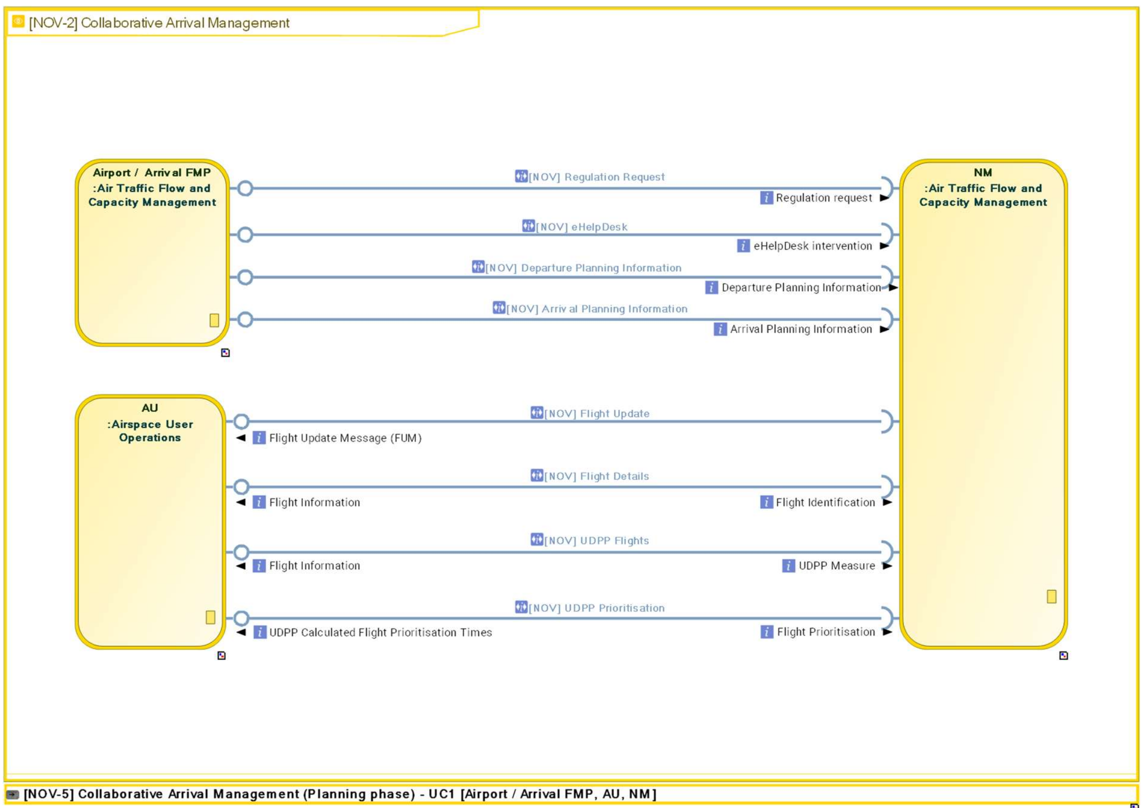
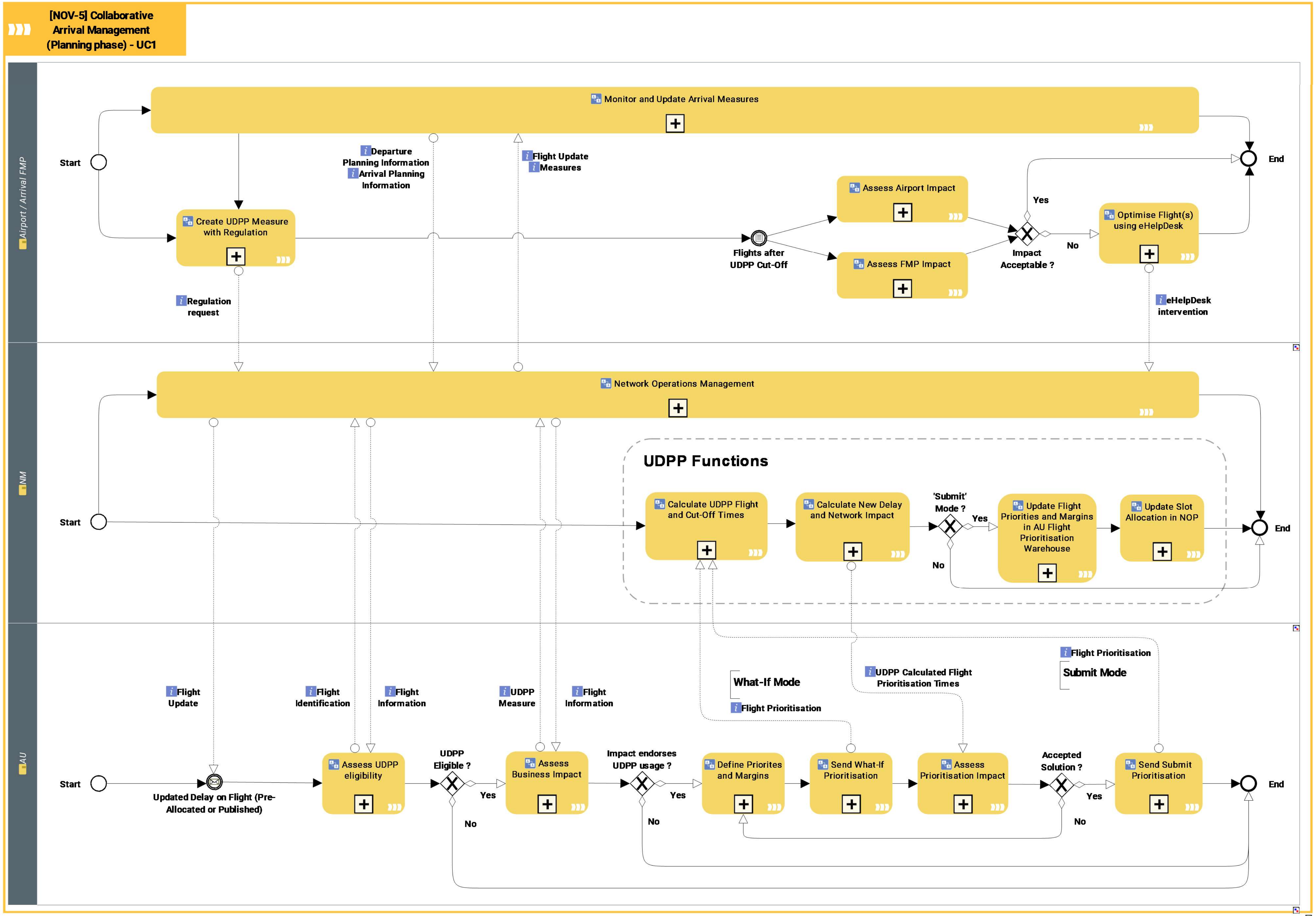


Figure 9: EATMA [NOV2] interaction model between nodes for UC1

1



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Activity	Description
Assess Airport Impact	Local DCB (as Airport representative) can assesses the UDPP arrival times, given by the Submission of the new prioritisation from AUs, by using the NOP and the AOP. If what-if functions exist, they can support the flight optimisation through TTA after flights cut-off times.
Assess Business Impact	The AU can assess if the flights concerning a UDPP measure has to be prioritized to decrease the impact of the delay on its feet.
Assess FMP Impact	Local DCB (as Network representative) can assesses the UDPP arrival times, given by the Submission of the new prioritisation from AUs, by using the NOP. If what-if functions exist, they can support the flight optimisation through TTA after flights cut-off times.
Assess Prioritisation Impact	AU can assess the impact of new times given by the UDPP functions on its fleet.
Assess UDPP eligibility	The AU can check if UDPP measures are touching its flights.
Calculate New Delay and Network Impact	Convert AUs prioritisation to new times according to all AUs prioritisation values and equity rules using reference times and baseline times. This activity implements the UDPP algorithms. Runs a network assessment and update the time on flight if necessary.
Calculate UDPP Flight and Cut-Off Times	This UDPP central function, calculates baseline time, cut-off time on flights according to the current status of each flight within the UDPP measure.
Create UDPP Measure with Regulation	If necessary, the local DCB actor, through a NM Function, can initiate UDPP measures to manage the arrival traffic, enabling AUs to mitigate the delay on their flights. The Initial delays, given to AUs flights, are based on ATFCM regulation to allow an equitable solution for AUs.
Define Priorites and Margins	AU can set prioritisation on flights concerned by a UDPP measure.
Monitor and Update Arrival Measures	The local DCB actor, through a NM Function, monitors the arrival traffic according to the APT resource availability: runways, gates... L-DCB can update a previously defined UDPP measures according to the evolution of the traffic, the resources, and the constraints.
Network Operations Management	The centralized NM NOP integrates all data information relative to flights including AUs prioritisations and allow actors to use it and communicate. NOP checks and publishes a global coherent view of the traffic and constraints and allow AUs prioritisations on their flights in a safe manner, avoiding publication of sensitive information to other AUs.
Optimise Flight(s) using eHelpDesk	Local DCB can optimize the UDPP measure after flight cut-off time through the NMOC eHelpDesk if needed.
Send Submit Prioritisation	When AU are OK with the prioritisation he has defined, AU can submit it to the Network. New times on flights are implemented and be visible through the NOP.
Send What-If Prioritisation	AU can run What-if to evaluate the result of a prioritisation on its flights.
Update Flight Priorities and Margins in AU Flight Prioritisation Warehouse	Priorities and Margins from AUs have to be stored to update the UDPP measure when CCS or flights are updated if necessary.

Update Slot Allocation in NOP	Update the Slot of each flights affected by the new prioritisation, if modified.

Table 9: EATMA activities description

Issuer	Info Flow	Addressee	Info Element	Info Entity
NM	Network Operations Management o--> Monitor and Update Arrival Measures	Airport / Arrival FMP	Measures	
NM	Network Operations Management o--> Monitor and Update Arrival Measures	Airport / Arrival FMP	Flight Update	FlightUpdateMessage
Airport / Arrival FMP	Monitor and Update Arrival Measures o--> Network Operations Management	NM	Departure Planning Information	
Airport / Arrival FMP	Monitor and Update Arrival Measures o--> Network Operations Management	NM	Arrival Planning Information	
NM	Network Operations Management o--> Assess Business Impact	AU	Flight Information	Flight
AU	Send Submit Prioritisation o--> Calculate UDPP Flight and Cut-Off Times	NM	Flight Prioritisation	FlightPriority
AU	Send Submit Prioritisation o--> Calculate UDPP Flight and Cut-Off Times	NM	Flight Prioritisation	AircraftOperator
Airport / Arrival FMP	Optimise Flight(s) using eHelpDesk o--> Network Operations Management	NM	eHelpDesk intervention	AIRM_OutOfScope

Issuer	Info Flow	Addressee	Info Element	Info Entity
Airport / Arrival FMP	Optimise Flight(s) using eHelpDesk o--> Network Operations Management	NM	eHelpDesk intervention	EhelpDeskTicket
NM	Network Operations Management o--> Updated Delay on Flight (Pre-Allocated or Published)	AU	Flight Update	FlightUpdateMessage
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	FlightPriority
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	EstimatedLandingTime
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	EstimatedOffBlockTime
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	EstimatedTakeOffTime
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	AircraftOperator
Airport / Arrival FMP	Create UDPP Measure with Regulation o--> Network Operations Management	NM	Regulation request	ATFMMeasure

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Issuer	Info Flow	Addressee	Info Element	Info Entity
AU	Assess UDPP eligibility o--> Network Operations Management	NM	Flight Identification	Flight
NM	Network Operations Management o--> Assess UDPP eligibility	AU	Flight Information	Flight
AU	Send What-If Prioritisation o--> Calculate UDPP Flight and Cut-Off Times	NM	Flight Prioritisation	FlightPriority
AU	Send What-If Prioritisation o--> Calculate UDPP Flight and Cut-Off Times	NM	Flight Prioritisation	AircraftOperator
AU	Assess Business Impact o--> Network Operations Management	NM	UDPP Measure	

3.3.3 Activity models are effectively described in the principles in section 3.3.2.3.1Differences between new and previous Operating Methods

This table is extracted form EATMA model. All data has already inserted in EATMA.

OI Step code – title (OI Step CR)		
AUO-0110 - Collaborative framework for managing arrival constraints at Local DCB level (CR 07051 Update AUO-0110 (PJ.07-W2-39))		
Activity	Impact	Change
Assess Business Impact	Update	
Assess Prioritisation Impact	Introduce	Add the possibility to assess the impact of a new UDPP prioritisation flights to decrease impact of delay.
Assess UDPP eligibility	Introduce	Automatic function Appling UDPP algorithms to calculate new delay on flights.

Calculate New Delay and Network Impact	Introduce	Automatic function Appling UDPP algorithms to calculate new delay on flights.
Calculate UDPP Flight and Cut-Off Times	Introduce	Automatic function Applied on flights under a UDPP measure to enable of stop UDPP prioritisation according to lights status.
Create UDPP Measure with Regulation	Update	L_DCB can create a UDPP measure on a CCS instead of a standard ATFCM regulation.
Define Priorities and Margins	Introduce	AUs can define UDPP flights prioritisation to decrease the impact of delay on its flights.
Send Submit Prioritisation	Introduce	AUs can Submit to the network its UDPP flights prioritisation.
Send What-If Prioritisation	Introduce	AUs can check the new delay and the impact on Network of its UDPP flight.
Update Flight Priorities and Margins in AU Flight Prioritisation Warehouse	Introduce	NM memorizes UDPP flights prioritisation to be apply in the traffic maintenance.
Update Slot Allocation in NOP	Update	NM update the slot of the flights.

Table 10: Differences between new and previous Operating Method

4 Safety, Performance and Interoperability Requirements (SPR-INTEROP)

4.1 Operational requirements

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.001
Title	Local DCB monitor the arrival traffic in Airport
Requirement	Local DCB shall monitor the arrival traffic prediction in Airport, and shall have the possibility to set a UDPP measure.
Status	<Validated>
Rationale	In order to manage safely the arrival flights, the local DCB actor has to monitor - through a NM Function - the arrival traffic according to the APT resource availability: runway and gates …
Category	<Operational> <safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Monitor and Update Arrival Measures
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.002
Title	Local DCB creates/requests to create a UDPP measure to manage the arrival traffic

Requirement	Local DCB shall have the possibility to create or to request the creation of a UDPP measure to manage the arrival traffic at Airport in coordination with NM.
Status	<Validated>
Rationale	In order to manage safely the arrival flights, the local DCB actor can create or request the creation of - through a NM Function if available and/or in coordination with NM - an UDPP measure to manage the traffic arriving at local airport.
Category	<Operational>

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19 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Monitor and Update Arrival Measures
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

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21 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.003
Title	Local DCB updates/requests to update a UDPP measure to manage the arrival traffic in case of constraint change
Requirement	Local DCB shall have the possibility to update or request to update a UDPP measure to manage the change of the constraint on arrival traffic at Airport in coordination with NM.
Status	<Validated>
Rationale	In order to manage safely the arrival flights, the local DCB actor can update or request to update - through a NM Function if available and/or in coordination with NM - an UDPP measure to manage the change of the constraint to the traffic arriving at local airport.
Category	<Operational> <safety>

22

23 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Monitor and Update Arrival Measures
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

24

25 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.004
Title	Local DCB decides to create/to request to create an arrival UDPP measure based on ATFM regulation
Requirement	Local DCB shall have to possibility to create or to request to create an arrival UDPP measure based on ATFCM regulation to manage arrival Capacity Constraint Situation in coordination with NM, allowing AUs to mitigate it through UDPP functions in an equitable way.
Status	<Validated>
Rationale	In order to decrease the impact of a Capacity Constraint Situation on arriving flights, local DCB - through NM Functions if available and/or in coordination with NM - can allow AU to mitigate the situation with UDPP, based on ATFCM regulation to allow an equitable solution for AUs.
Category	<Operational>

26

27 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Create UDPP measure with Regulation
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB

<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.005
Title	Local Airport checks the impact of flights arrival time according to current situation
Requirement	Airport shall evaluate the impact of current flights arrival times on Airport organisation: gates, security issues ...
Status	<Validated>
Rationale	Local Airport needs to evaluate the impact of the new arrival organisation time given by the AU prioritisation to face to the Capacity Constraint Situation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Assess Airport impact
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.006
Title	Local Airport-FMP checks the impact of flight arrival time according to current situation

Requirement	Local FMP shall evaluate the impact of current flights arrival on Airport ATC part: runways, taxiing ...
Status	<Validated>
Rationale	Local DCB needs to evaluate the impact of the new arrival organisation time given by the AU prioritisation to face the Capacity Constraint Situation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Assess FMP impact
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-LDCB.007
Title	Local DCB can optimise new arrival flights organisation
Requirement	DCB shall have the possibility to optimize the new arrival time of flights by adjusting TTAs.
Status	<Validated>
Rationale	Local DCB must have the possibility to optimize the final arrival sequence.
Category	<Operational> <safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39

<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Optimise Flight(s) using eHelpDesk
<ALLOCATED_TO>	<Allocate To>	PJ.04-W2-28.3
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMOP.001
Title	UDPP functions are available
Requirement	A UDPP Centralized functions shall be in operation to manage hotspot.
Status	<Validated>
Rationale	The UDPP functions are in operation to manage hotspot while allowing AUs to manage their fleet in a UDPP measure.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMOP.002
Title	The NM NOP is running and give up-to-date status of the traffic and constraints

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Requirement	The NM NOP shall integrate and maintain all flight data information in the NOP including AUs prioritisations.
Status	<Validated>
Rationale	The centralized NM NOP integrates all data information relative to flights including AUs prioritisations and allow actors to use it and communicate it.
Category	<Operational>

46

47 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	NOP
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

48

49 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMOP.003
Title	The NM NOP checks and integrates all flights time modifications from Actors and AUs prioritisations
Requirement	The NM NOP shall integrate and maintain all flight data information in the NOP including AUs prioritisations output.
Status	<Validated>
Rationale	The centralized NM NOP integrates all data information relative to flights and airspace, and checks and publishes a global coherent view of the traffic and constraints.
Category	<Operational>

50

51 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39

<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	NOP
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

52

53 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMOP.004
Title	A UDPP communication link is available to each AU when needed
Requirement	A private UDPP communication link shall be available to AUs to perform UDPP prioritisations privately.
Status	<Validated>
Rationale	a UDPP link shall be available to AUs to prioritise their flights in a safe manner, avoiding publication of sensitive information to other AUs. AUs Priorities and Margins must stay private.
Category	<Operational>

54

55 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	NOP
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

56

57 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMOP.005
Title	A NM NOP repository stores the AUs submitted prioritisation to be used to update and maintain times on flights on a UPDD measure

Requirement	A private NM NOP repository shall store the AUs submitted prioritisation to be used to update and maintain times on flights on a UPDD measure
Status	<Validated>
Rationale	When AU submit a prioritisation, this prioritisation shall be stored in a private NM NOP repository to be used to update and to maintain times on flights on a UPDD measure if flights status or CCS is modified.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	NOP
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.001
Title	A set of UDPP function is accessible to AU implementing UDPP
Requirement	NM shall propose and support a link to access the UDPP mechanisms from AUs.
Status	<Validated>
Rationale	UDPP mechanisms have to be accessible to AUs through a NM link.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions

<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

64

65 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.002
Title	NM implements UDPP prioritisation rules and equity
Requirement	NM shall implement UDPP mechanisms integrating UDPP rules and equity to support AUs prioritisations.
Status	<Validated>
Rationale	The UDPP mechanisms have to be developed in NM.
Category	<Operational>

66

67 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

68

69 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.003
Title	NM internal functions manage reference time, baseline times and cut-off time of each flights in the UDPP measure
Requirement	NM internal function shall manage the reference time, calculate the baseline time and cut-off time on each flight according to the current status of the flight, enabling AU prioritisation and the flight transition to Local DCB optimisation.
Status	<Validated>

Rationale	On each flight in the UDPP measure, to enable the AUs prioritisations, the AUs need to know the reference time on its flights (schedule), the baseline delays (what will be the delay of the flights if no prioritisation), all along the prioritisation process to assess and act accordingly. Local DCB must have enough time in order to react to the AUs prioritisations changes to optimise the operations at the arrival and departure airport and through the airborne phase. In a UDPP measure, a flight can be (re-)prioritized only if it's not already in the optimisation phase for the Local DCB: before the UDPP flight Cut-off time.
Category	<Operational> <safety>

70

71 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Calculate UDPP flight and Cut-off Times
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

72

73 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.004
Title	A UDPP function implements the initial delay on flights Impacted by the CCS
Requirement	NM shall set the initial delay on flights according to Local DCB decided initialisation mode: regulation or predefined TTAs.
Status	<Validated>
Rationale	In order to set the initial delay to flights in the UDPP measure, NM has to produce un initial solution based on ATFM regulation or list of TTA sending by local DCB.
Category	<Operational>

74

75 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39

<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Calculate UDPP flight and Cut-off Times
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.005
Title	A UDPP function calculates UDPP times for all flights in the measure (including non UDPP participating AUs)
Requirement	A UDPP function shall calculate new set of times: block times, departure time, arrival time ... according to the AUs prioritisation values and the current Network data.
Status	<Validated>
Rationale	A UDPP function must manage the flight prioritisations coming from all the AUs in a UDPP measure and produces a new sequence of flight with new times accordingly, taking into account AU prioritisation and flights status. Whatever the UDPP prioritisation given by an AU, other AUs who not participate in UDPP must not be impacted negatively by another AU prioritisation (Equity).
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Calculate new Delay and Network impact
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.006

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Title	The UDPP functions creates and maintains the UDPP environment for AUs
Requirement	The UDPP functions shall create and maintain the AU UDPP environment to allow AUs prioritisation according to the possible variability of the Network.
Status	<Validated>
Rationale	A UDPP set of functions shall be available and maintained to allow AU to operationally make flight prioritisation according to the current Network situation. All modifications in the network has to be integrated with the current already submitted prioritisation to recalculate and publish new flights times.
Category	<Operational> <safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.007
Title	A UDPP function allows What-If on AUs flights prioritisation
Requirement	A UDPP function shall allow the AUs to assess the impact of a prepared new prioritisation through a what-If function
Status	<Validated>
Rationale	In order to avoid possible instability and to be proactive in the solution to stabilize the fleet and ATFM organisation, a UDPP what-if function is available to show the impact of the AU prioritisation before Submit it to the Network.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Calculate new Delay and Network impact
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

88

89 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.008
Title	A UDPP function allows the AUs to Submit flights prioritisation to the network
Requirement	A UDPP function shall allow an AU to Submit his prioritisation to the Network.
Status	<Validated>
Rationale	A UDDP function has to be defined to allow AUs to Submit flights prioritisation to the Network.
Category	<Operational>

90

91 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Calculate new Delay and Network impact
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

92

93 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.009
Title	A UDPP internal function allows the integration of the result of UDPP times calculation in the current NM plan
Requirement	A UDPP internal function shall integrate the result of UDPP time calculation in the current NM plan in a global and coherent NM solution.

Status	<Validated>
Rationale	In order to take into account AUs prioritisations needs to mitigate delays, NM integrates the output of the UDPP prioritisation in the operational NOP, as an operational mitigation from AUs to manage the UDPP measure.
Category	<Operational>

94

95 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Update Slot allocation in NOP
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

96

97 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.010
Title	A UDPP function save AU's flights prioritisations to be used to maintain the current Network situation
Requirement	A UDPP function shall save AU's flights prioritisations to be used to maintain the current Network situation during Network variability.
Status	<Validated>
Rationale	According to the Network variability, the AUs submitted prioritisations has to be saved to be reused to maintain the current Network status.
Category	<Operational>

98

99 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Update Flight Priorities and Margins in AU Flight Prioritisation Warehouse

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<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-NMUD.011
Title	A UDPP function assesses the new times impacts on the network and give feedback to the AUs
Requirement	The UDPP function shall assess the impact of the new flight times issued from the new calculation of delay based on AU prioritisation and give feedback to the Aus.
Status	<Validated>
Rationale	UDPP function must transmit to AUs the Network impact of a new sequence generated by AU prioritisation including set of times associated to each flights.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Calculate new Delay and Network impact
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	UDPP_Funct_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.001
Title	AU can check if there are UDPP measures concerning its flights
Requirement	The AUs shall have the possibility to check the existence of UDPP measures associated to its flights.
Status	<Validated>

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Rationale	AUs have to know if an existing UDPP measures touch its flights allowing the possibility to use UDPP to mitigate delay.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Assess UDPP eligibility
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.002
Title	AU can get from the NOP all its impacted flights concerned by a UDPP measure
Requirement	The AUs shall have the possibility to get all its flights concerning a UDPP measure.
Status	<Validated>
Rationale	In order to make UDPP prioritisation, NM send to the AU, the list of flights associated to the UDPP measure.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Assess UDPP eligibility
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

113 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.003
Title	AU assesses the impact of delay on their fleet
Requirement	The AUs shall have the possibility to check the impact of delays on their all fleet of the day and possibly the day after in case of curfew problem.
Status	<Validated>
Rationale	In order to decrease the impact of delay on AU fleet, the AU must have the possibility to evaluate the impact of delay for flights in UDPP measure over its whole fleet, including the knock-on delay (or reactionary delay) that could affect also some flights the day after.
Category	<Operational>

114

115 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Assess Business impact
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

116

117 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.004
Title	AU set priorities and/or Margins on flights
Requirement	The AUs shall have the possibility to allocate Priorities and/or Margins on its flights if needed.
Status	<Validated>
Rationale	AU shall have a tool to allocate priorities and/or margins on flights within a UDPP measure.
Category	<Operational>

118

119 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Define Priorities and/or Margins
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

120

121 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.005
Title	AU can send what-if with flights prioritisation to NM to check new times generated by the UDPP rules
Requirement	The AU shall have the possibility to send what-ifs through to NM to evaluate the result of a UDPP prioritisation on its fleet.
Status	<Validated>
Rationale	To evaluate the impact of a new prioritisations the AU shall have the possibility to send a What-If through a NM link.
Category	<Operational>

122

123 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Send "What-If" Prioritisation
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

124

125 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.006

Title	AU assesses the flights new block time on their fleet
Requirement	The AU shall have the possibility to assess the result of a prioritisation over its fleet.
Status	<Validated>
Rationale	To evaluate the impact of a new prioritisation the AU shall have the possibility to check the result of a UDPP what-if function through the new block times analysis.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Assess Prioritisation impact
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-OAUF.007
Title	AU can Submit its flights prioritisation to Network
Requirement	The AU shall have the possibility to Submit its flights prioritisation to the Network to be implemented as AU mitigation proposal.
Status	<Validated>
Rationale	AU shall have the possibility to submit the prioritisation values given to its flights in a UDPP measure.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39

<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Send "Submit" Prioritisation
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

4.2 Safety and Performance requirements

The following performance requirements define the need in term of:

1. Safety: SAFT
2. Capacity: CAPA
3. Punctuality: PUN1
4. Cost effectiveness: COST
5. Flexibility: FLEX
6. Human Performance: HUMP
7. Equity: EQUI

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SAFT.P01
Title	Safety of the collaborative framework
Requirement	The S39 collaborative framework shall maintain the current Safety level
Status	<Validated>
Rationale	The defined collaborative framework must not compromise the safety: the safety levels have to be the same or better than with the current modus operandi.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

148

149 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-CAPA.P01
Title	Airport Runway throughput
Requirement	The S39 collaborative framework shall keep the current runway throughput
Status	<Validated>
Rationale	AU prioritisation must not negatively impact the runway throughput of the airport when the UDPP measure is put in place.
Category	<Performance>

150

151 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

152

153 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-PUN1.P01
Title	Punctuality on Airport
Requirement	UDPP measure shall increase the punctuality on airport by: [P70-MAX]: 0.06-0.22mn
Status	<Validated>
Rationale	Punctuality improvement on airport is defined differently according to the size of the airport : - Very large= Impact level 3 [P70-MAX]: 0.06 - 0.22 minutes. - Large=Impact level 3 [P70-MAX]: 0.06 - 0.22 minutes.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-COST.P01
Title	Cost efficiency of the UDPP solution
Requirement	UDPP Prioritisation shall decrease the cost of the delay for the AU
Status	<Validated>
Rationale	The UDPP solution shall decrease the impact of a capacity constraint (CCS), through the UDPP measure put in place, generating delay on flights. Managing impact of delay shall decrease the total cost of the delay for an AU, taking into account the whole fleet organisation of the day to propose flights prioritisation.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-FLEX.P01
Title	Flexibility for AU to prioritize flights
Requirement	The S39 collaborative framework shall give the AU a higher degree of flexibility
Status	<Validated>
Rationale	UDPP functions and interface have to give to the AU the possibility to rearrange their fleet according to their needs.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT

<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-HUMP.P01
Title	What-if response time
Requirement	The UDPP functions shall provide the response to What -if within limited time (10 sec)
Status	<Validated>
Rationale	AU must be able to evaluate the impact on their fleet via what- if function in due time.
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-HUMP.P02
Title	Submit response time
Requirement	The UDPP functions shall provide the response to Submit within limited time (10 sec)
Status	<Validated>

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Rationale	AU must be able to evaluate the impact on their fleet via Submit function in due time.
Category	<Human Performance>

170

171 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

172

173 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-HUMP.P03
Title	Usability of operating method
Requirement	The collaborative framework shall be usable for AU operator and FMP
Status	<Validated>
Rationale	The operating methods of the S39 collaborative process have to be usable by the human interacting with the system.
Category	<Human Performance>

174

175 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39

<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-EQUI.P01
Title	Equity among AUs
Requirement	The UDPP function shall generate an equitable solution between AUs
Status	<Validated>
Rationale	Equity is a Key factor for UDPP AU acceptability. The UDPP function must preserve equity between AUs. If the UDPP baseline solution is equitable (starting from FPFS solution), the final solution must be fully equitable. If the UDPP baseline solution is proposed through a non-equitable method, the UDPP algorithms must still applying equity between AUs but from this non-equitable initial solution; in this case the final solution is not equitable.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Very large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Large APT
<ALLOCATED_TO>	<Sub-Operating Environment>	Medium APT

4.3 Security requirements

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SECU.S01
Title	Security compliance of the collaborative framework
Requirement	The S39 solution shall respect the current applicable Security rules.
Status	<Validated>
Rationale	The S39 solution shall respect the current Security applicable rules defined for the NM environment for using and exchanging information between actors: NM, ANSP, Airport and AUs.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SECU.S02
Title	AU prioritisation information confidentiality against other AU
Requirement	The AU prioritisation shall be private and not visible by other AUs.
Status	<Validated>
Rationale	The confidentiality of AU information needs to be ensured.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

190

191 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SECU.S03
Title	Access credentials management on AU prioritisation
Requirement	The AU prioritisation shall be used only by NM or local DCB who are known, accepted by the AU and plotted.
Status	<Validated>
Rationale	The confidentiality of the information needs to be ensured even by L-DCB and NM.
Category	<Security>

192

193 [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

194

195 [REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SECU.S04
Title	Network Manager ensures AU prioritisation information assets integrity

Requirement	The AU prioritisation integrity shall be checked and ensured by the Network Manager.
Status	<Validated>
Rationale	The information provided by the Network Manager has to be trustable and maintain the original level of quality.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	UDPP functions
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	NOP_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SECU.S05
Title	AU ensure information assets integrity
Requirement	The AU prioritisation integrity shall be ensured by the AU.
Status	<Validated>
Rationale	The information kept by the AU has to be trustable and maintain the original level of quality.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Send "Submit" Prioritisation

<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	AU
<ALLOCATED_TO>	<Sub-Operating Environment>	FOC_Env

[REQ]

[REQ]Identifier	REQ-07-W2-39-SPRINTEROP-SECU.S06
Title	L-DCB ensure information assets integrity
Requirement	The AU prioritisation integrity shall be ensured by the L-DCB.
Status	<Validated>
Rationale	The information kept by the L-DCB has to be trustable and maintain the original level of quality.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.07-W2-39
<SATISFIES>	<High Level Operational Requirement>	S39-HLOR-01
<ALLOCATED_TO>	<Activity>	Monitor and Update Arrival Measures
<ALLOCATED_TO>	<Allocate To>	PJ.07-W2-39
<ALLOCATED_TO>	<role>	Local DCB
<ALLOCATED_TO>	<Sub-Operating Environment>	DCB_Env

4.4 Interop

Information exchanged between activities are already describe in EATMA model. The output of the EATMA model is as follows:

Issuer	Info Exchange	Addressee	Info Element	Info Entity
NM	Network Operations Management o--> Monitor and Update Arrival Measures	Airport / Arrival FMP	Measures	
NM	Network Operations Management o--> Monitor and Update Arrival Measures	Airport / Arrival FMP	Flight Update	FlightUpdateMessage
Airport / Arrival FMP	Monitor and Update Arrival Measures o--> Network Operations Management	NM	Departure Planning Information	
Airport / Arrival FMP	Monitor and Update Arrival Measures o--> Network Operations Management	NM	Arrival Planning Information	
NM	Network Operations Management o--> Assess Business Impact	AU	Flight Information	Flight
AU	Send Submit Prioritisation o--> Calculate UDPP Flight and Cut-Off Times	NM	Flight Prioritisation	FlightPriority
AU	Send Submit Prioritisation o--> Calculate UDPP Flight and Cut-Off Times	NM	Flight Prioritisation	AircraftOperator
Airport / Arrival FMP	Optimise Flight(s) using eHelpDesk o--> Network Operations Management	NM	eHelpDesk intervention	AIRM_OutOfScope
Airport / Arrival FMP	Optimise Flight(s) using eHelpDesk o--> Network Operations Management	NM	eHelpDesk intervention	EhelpDeskTicket
NM	Network Operations Management o--> Updated Delay on Flight (Pre-Allocated or Published)	AU	Flight Update	FlightUpdateMessage

Issuer	Info Exchange	Addressee	Info Element	Info Entity
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	FlightPriority
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	EstimatedLandingTime
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	EstimatedOffBlockTime
NM	Calculate New Delay and Network Impact o--> Assess Prioritisation Impact	AU	UDPP Calculated Flight Prioritisation Times	EstimatedTakeOffTime

212 **Table 11: EATMA interaction between activities**

213

214 IER definitions

Identifier	Name	Issuer	Intended Addressees	Information Element
IER-07-W2-39-SPRINTEROP-NM.001	ATFCM Measure	NM	Airport / Arrival FMP	Measures
IER-07-W2-39-SPRINTEROP-NM.002	Flight Update	NM	Airport / Arrival FMP	Flight Update
IER-07-W2-39-SPRINTEROP-APT.001	Departure Planning Information	Airport / Arrival FMP	NM	Departure Planning Information
IER-07-W2-39-SPRINTEROP-APT.002	Arrival Planning Information	Airport / Arrival FMP	NM	Arrival Planning Information
IER-07-W2-39-SPRINTEROP-NM.003	Flight Information	NM	AU	Flight Information
IER-07-W2-39-SPRINTEROP-AU.001	Flight Prioritisation	AU	NM	Flight Prioritisation
IER-07-W2-39-SPRINTEROP-AU.002	Flight Prioritisation	AU	NM	Flight Prioritisation
IER-07-W2-39-SPRINTEROP-APT.003	eHelpDesk intervention	Airport / Arrival FMP	NM	eHelpDesk intervention
IER-07-W2-39-SPRINTEROP-APT.004	eHelpDesk intervention	Airport / Arrival FMP	NM	eHelpDesk intervention
IER-07-W2-39-SPRINTEROP-NM.004	Flight Update	NM	AU	Flight Update
IER-07-W2-39-SPRINTEROP-NM.005	UDPP Calculated Flight	NM	AU	UDPP Calculated Flight Prioritisation Times

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	Prioritisation Times			
IER-07-W2-39-SPRINTEROP-NM.006	UDPP Calculated Flight Prioritisation Times	NM	AU	UDPP Calculated Flight Prioritisation Times
IER-07-W2-39-SPRINTEROP-NM.007	UDPP Calculated Flight Prioritisation Times	NM	AU	UDPP Calculated Flight Prioritisation Times
IER-07-W2-39-SPRINTEROP-NM.008	UDPP Calculated Flight Prioritisation Times	NM	AU	UDPP Calculated Flight Prioritisation Times

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5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

[1] B.04.01 D138 EATMA Guidance Material

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

[4] B4.2 D106 Transition Concept of Operations SESAR 2020

System and Service Development

[5] 08.01.01 D52: SWIM Foundation v2

[6] 08.01.01 D49: SWIM Compliance Criteria

[7] 08.01.03 D47: AIRM v4.1.0

[8] 08.03.10 D45: ISRM Foundation v00.08.00

[9] B.04.03 D102 SESAR Working Method on Services

[10] B.04.03 D128 ADD SESAR1

[11] B.04.05 Common Service Foundation Method

Performance Management

[12] B.04.01 D108 SESAR 2020 Transition Performance Framework

[13] B.04.01 D42 SESAR2020 Transition Validation

[14] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.

[15] 16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model

[16] 16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA

[17] Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)

[18] ATM Cost Breakdown Structure_ed02_2014

[19] Standard Inputs for EUROCONTROL Cost Benefit Analyses

[20] 16.06.06_D26-08 ATM CBA Quality Checklist

[21]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[22]03.00 D16 WP3 Engineering methodology

[23]Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects

[24]European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

System Engineering

[25]SESAR Requirements and V&V guidelines

Safety

[26]SESAR, Safety Reference Material, Edition 4.0, April 2016

[27]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[28]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[29]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[30]16.06.05 D 27 HP Reference Material D27

[31]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[32]SESAR, Environment Reference Material, alias, “Environmental impact assessment as part of the global SESAR validation”, Project 16.06.03, Deliverable D26, 2014.

[33]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

Security

[34]16.06.02 D103 SESAR Security Ref Material Level

[35]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[36]16.06.02 D131 Security Database Application (CTRL_S)

5.2 Reference Documents

[37] ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[1]

[38] SESAR2020 wave1 UDPP OSED PJ07-OAUO-WP3-D3.1.010

[39] ATFCM OPERATIONS MANUAL – Network Manager EUROCONTROL – 27 April 2021 ED: 25.0

[40] ICAO, Manual on Flight and Flow Information for a Collaborative Environment, Doc 9965, AN/483

[41] PJ.19 High Level Requirements 2020: High Level Operational Requirements for Wave 2 Solutions (CONOPS)

[42]SESAR 2020 Solution 39 VALP

[43]SESAR 2020 Solution 39 VALR

Appendix A User Driven Prioritisation Process (UDPP)

General principles

The UDPP concept is the component to be integrated in the collaborative framework to manage arrival flight at Airport allowing AUs to propose their prioritisation.

The UDPP concept is based on decreasing the impact of delay to AU by asking them to give a prioritisation on their flights entering a managed constraint area.

The constraints given to the implementation of UDPP are as follows:

- Equity has to be respected: an AU prioritisation cannot have a negative impact on another AU's flight(s)
- The best result for reordering flight according to all AU prioritisation inputs is always given without human intervention

To measure the impact of delay, the notion of AU cost of delay is used to evaluate different solutions.

AU Cost of delay

According to the different tools available on the different FOC of the different airlines, evaluating possible solutions face to delay could be a difficult task that only experienced dispatchers can handle. Comparing different options and scenarios to decrease the impact of delay is driven by the operational cost impact off the delay on the fleet (sometime integrating operational changes until D+2). Cost is the common denominator of the impact to evaluate different kind of solutions. The cost is not always quantifiable to allow comparisons or easy decision making when faced with complex situations and AU reputational value is not easy to judge. However, as cost approach is proposed, integrating all the relevant elements to calculate a cost value for delay. The cost approach is proposed but not mandatory to use UDPP.

Operational cost of delay, including punctuality reputation, is one of the most efficient ways to compare solutions, but as it is not mandatory to use UDPP, a conventional approach is of course allows. Whilst no mandatory method is applied to UDPP, UDPP priority values are always used to give the best solution. No mandatory method to be applied to the UDPP prioritisation is foreseen because priority management is an internal airspace user business. However, UDPP priority values are always used to give the best solution according to the priority values given.

In some OCC, we cannot speak directly about Cost management or operational cost. The dispatcher does not have this info, and only uses his operational knowledge and experience about his network and fleet. His main goal is just to reduce big delay on particular flights to avoid disruptive situation (curfew, crew time and maintenance are the main reasons). However, these impacts are de facto linked to the cost.

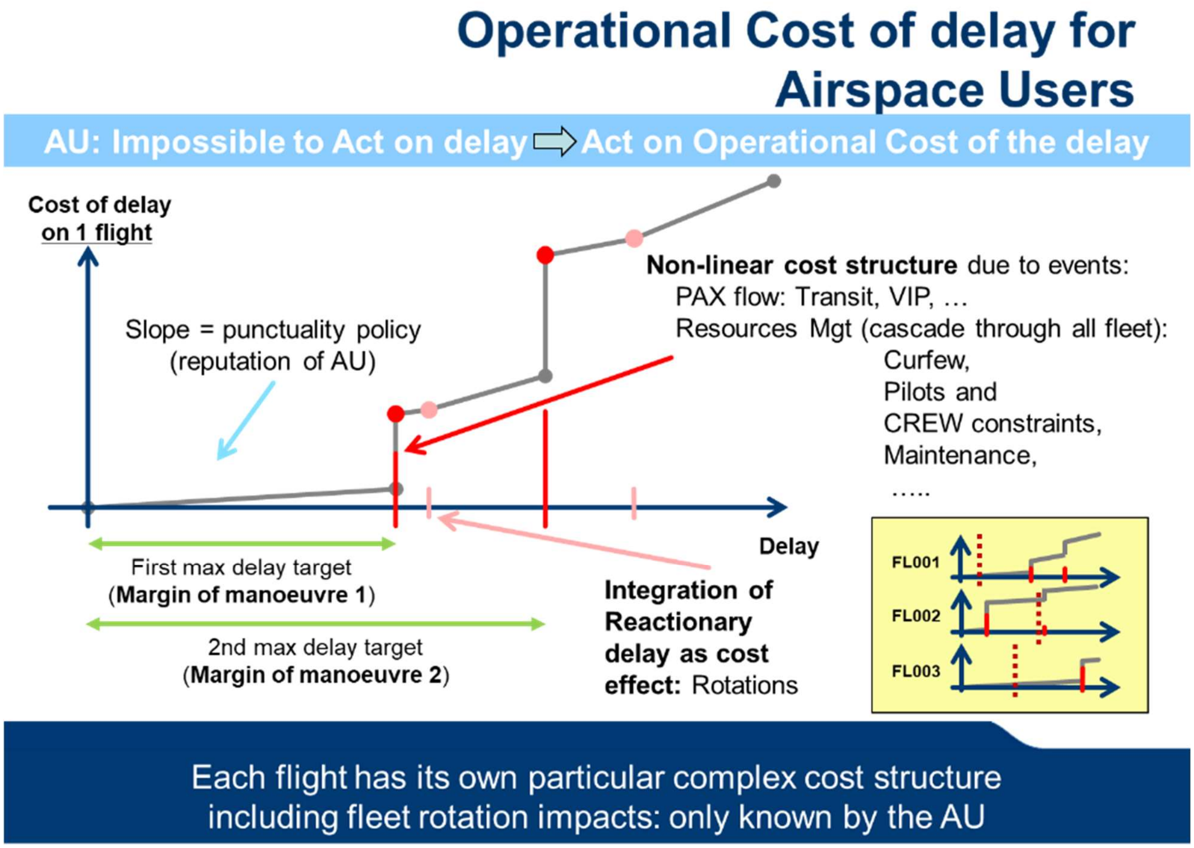


Figure 11: Operational cost of delay for AUs

A very simple example is given above to illustrate that reordering flights can decrease the impact of delay.

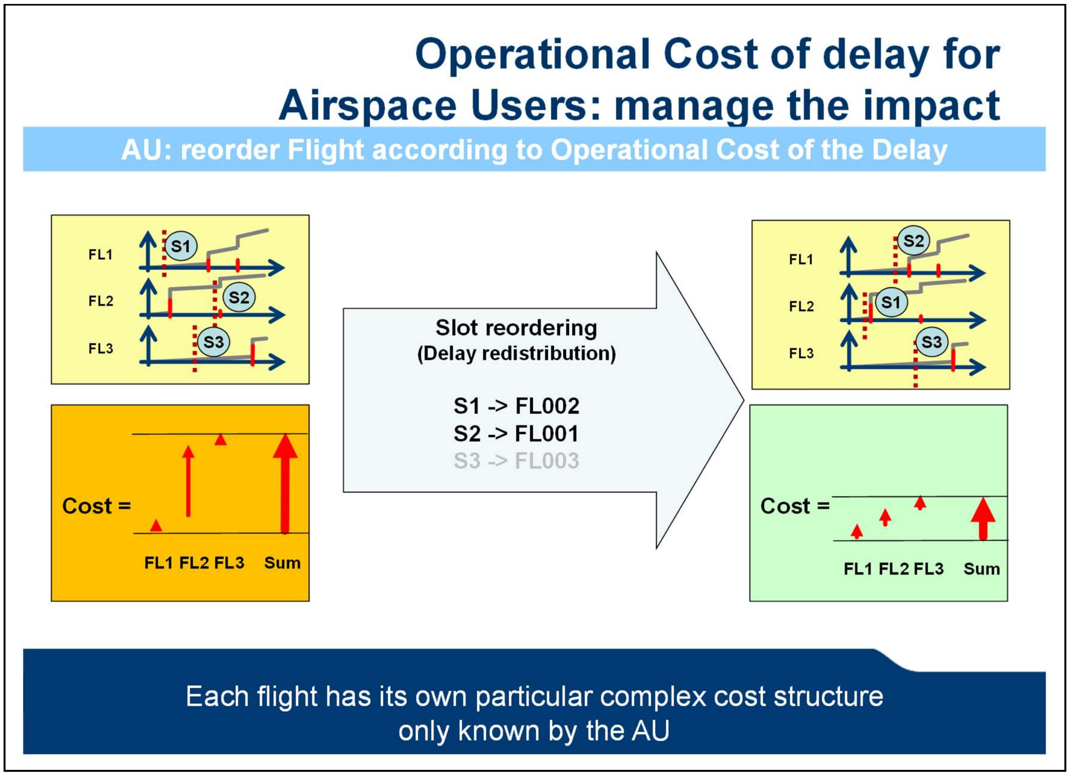


Figure 12: Operational Cost of delay reordered

UDPP prioritization

The UDPP concept is based on minimising the impact of delay to AUs.

The main objective for an AU is to mitigate and reduce the impact of delay on their operational fleet.

The AU can use independently any UDPP feature to manage its flights. All the AU prioritisation values and parameters are not public to other AUs. Only UDPP service store and manage the AU prioritisation to calculate the new time to be assign to AU flights.

Equity in UDPP

Today the FPFS method used by CASA is widely accepted by AU to be fair and equitable as it preserves the original sequence of flights and then the attribution of delays on each flight.

The notion of equity is fully integrated in the UDPP service and is part of the algorithms. All AUs claim to have an equitable solution to the problem of delay, there is no way to avoid equity in UDPP.

Equity in UDPP is implemented in a way that one AU’s prioritisation does not negatively impact others AUs, meaning that any flights from other AUs cannot have more delay than the original baseline delay based on FPFS. In other words, an AU cannot take a slot time if it does not give to others one at or before (SFP) the slot time they want to take.

UDPP features

The UDPP features can be used, by each AU that has more than one planned flight to enter into the published UDPP measure.

The common aim of the UDDP algorithm is that, regardless of any prioritisation actions performed by the AUs, the equity aspect is maintained and the best possible solution is produced according to the different AUs prioritisation inputs. There is no need of human intervention to produce the new time on flights.

UDPP concept is based on three features that can be used by AU to make its prioritisation (to decrease the impact of delay):

- **Fleet Delay Reordering (FDR)**: a prioritisation feature using baseline times associate to the AU flights within the measure, to reposition the AU flights according to priority value.
- **Selective Flight Protection (SFP)**: a specific prioritisation feature to force the protected flight (Pflight) to be into a time window even if there is no direct AU baseline time allocated to its flights.
- **Margins**: a feature to manage time windows that AU associated to its flights.

UDPP FDR feature

The FDR feature is based on reordering the AU list of flights in measure but only on the baseline time given on its own flights by the FPFS output.

For this, the AU can put a priority value on its flights to be reordered.

FDR priority values can be set to:

- A priority number from 1 (highest priority) to 999 (lowest priority) to give flights a relative ranking number (up to the AU to choose the range of priority to apply. This range can be decided according to the way and the AU internal tool used to manage the UDPP measure. E.g.: this priority value could be a ranking value over all the AU flights within the UDPP measure).
- "L" Lowest priority flight: specifies the AU's lowest priority flight(s) whatever the value given to its other flights (could be seen as the 1000 priority value)
- "B" Baseline priority: specifies to keep the baseline delay of the flight as the target delay.
- "S" to UDPP suspended flight: specifies that the flight will no longer be in the middle of the UDPP measure, up to the AU to take a decision concerning this flight (cancellation, diversion, rerouting …). It becomes the least important flights of the UDPP measure, and the flight will be allocated after the last not UDPP suspended flights of the UDPP measure.

Note: The specific UDPP suspended priority value (S) allows the AU to take advantage of this action to create a better situation for him, for its other flights. At the same time, because a suspended flight is allocated to an available slot after the last flight of the UDPP measure, it can be considered that the UDPP Measure is decreased and all of the AUs will benefit from this action.

The AU can avoid giving a priority values to all its flights, the AU can set a default priority value to be taken if no priority is given to a flight.

During the validation exercises, AU uses two priority values as default values (but nothing is blocked or mandatory):

- The “B” value is given as an default value if the AU wants to limit the number of changes of flights, in this case the reordering is apply only on flights with have a priority value.
- The value 5 is given as a default value, if the AU has decided to use a priority range from 1 to 9 only (or 50 for using priority range from 1 to 99). This default value allows flights with no priority to be part of the reordering as middle priority flight.
- Other values are allowed according to each AU’s specific way of managing priorities on flights.

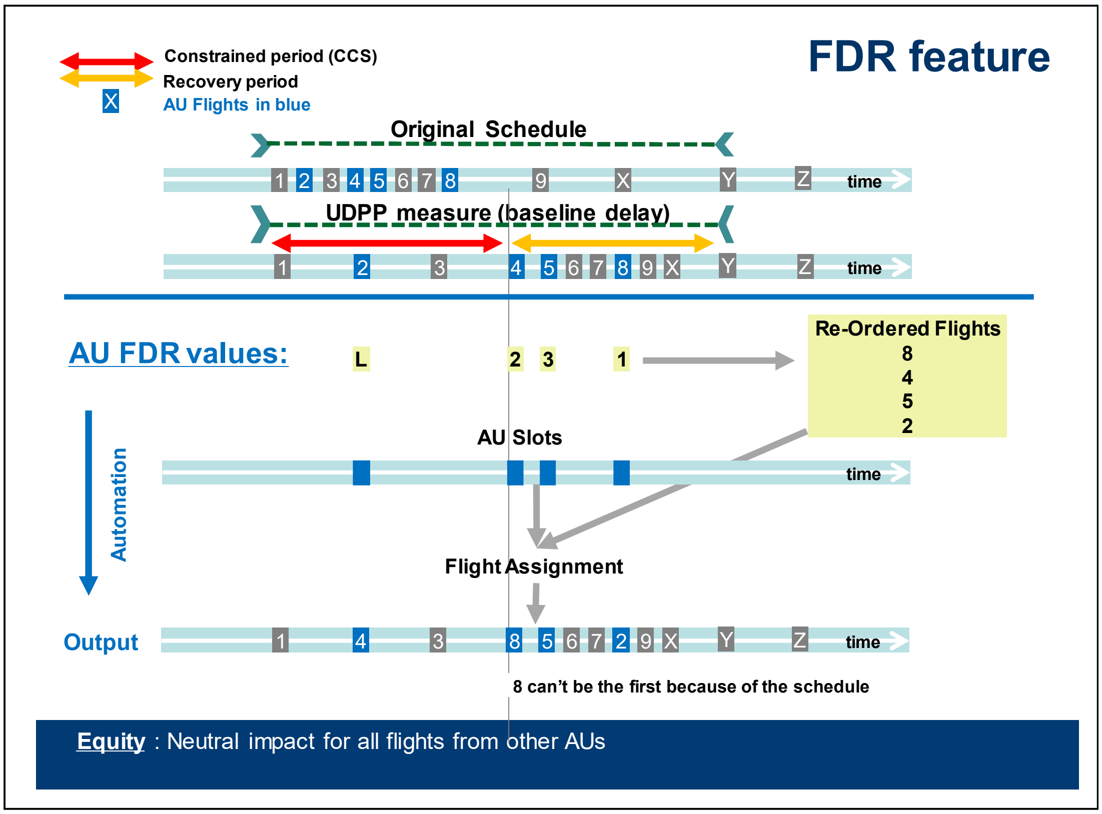


Figure 13: example of FDR

UDPP SFP feature

The SFP feature is defined by the specific priority value “P” (for protect) to give to the AU the possibility to protect a flight (Pflight) even if there is no direct AU flight time allocated to the AU flights.

To do so the AU must have, a minimum of one slot time at or before the original schedule of the protected flight (within a window: called the Pobjective) to not negatively impact other AUs.

If an AU places a P on a flight (Pflight), the UDPP algorithm, first tried to find an AU baseline time within the Pobjective time window of the Pflight. If it exists the Pflight is put on it. Note: this is equivalent to a highest priority flight in FDR feature.

If no baseline time is available in the Pobjective time window, the algorithm finds the first available AU baseline time earlier then the flight's origin time. When an AU target baseline time is found, this baseline time is lost by the AU (not usable by this AU) and the Pflight is allocated to the global baseline time (slot) on or just after its reference time.

Note that if no slot is available within the Pobjective, no negative impact is generated to the other AUs but positive impact may be experienced.

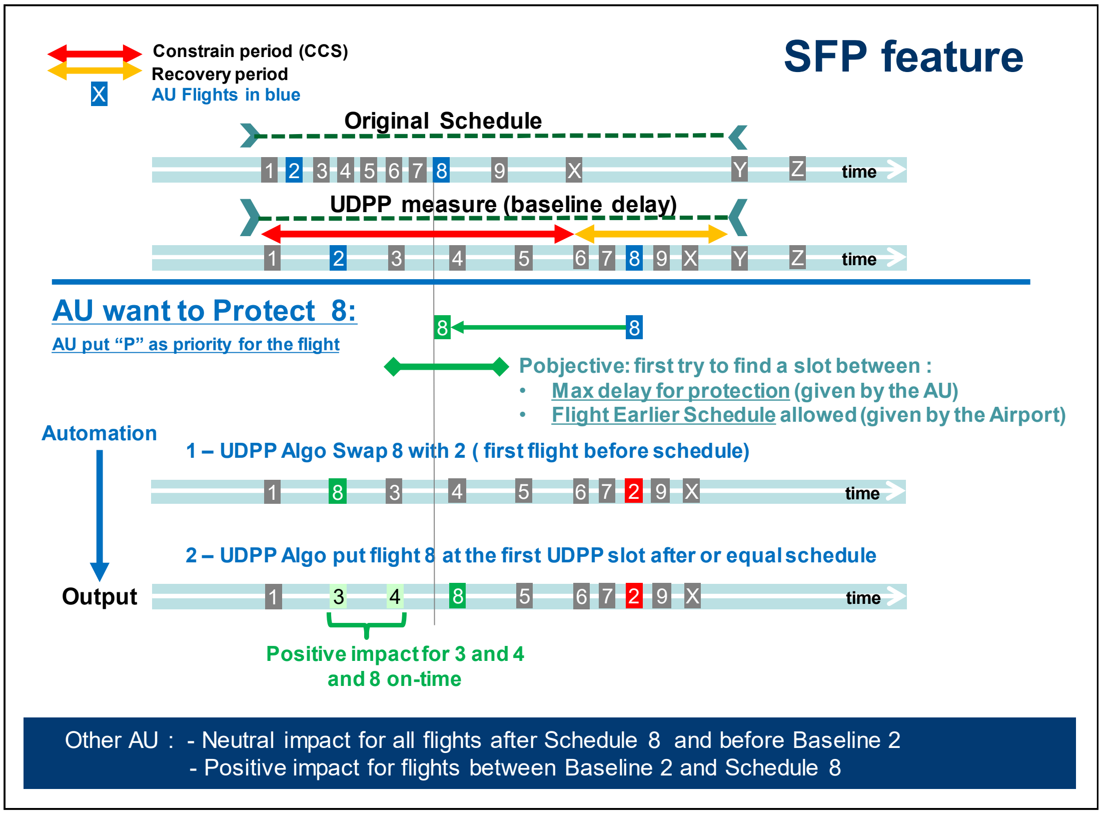


Figure 14: example of SFP

The Pobjective of a Pflight is given by two parameters:

- The MaxDelayProtection: this AU parameter gives the maximum delay acceptable for a Pflight according to its schedule time: (e.g. 5mn or 10mn). This parameter, defined by the AU, and applicable to all its Pflights, can be changed dynamically to adjust AU objectives on Pflights.
- The UDPP max schedule anticipation: this airport parameter (common to all AUs) gives the maximum early arrival delay buffer allowed by the airport to manage flights. (e.g. 5mn = 5 minutes before reference flight arrival time is allowed)

Note that, if margins are specified for a Pflight, Margins are taken in place (overwrite) of these two Pobjective parameters (above) if they are compatible.

UDPP Margins feature

Margins on flights provide the AU with the possibility to express time constraints on certain flights with time values, as per below.

The Margin feature allows the AU to decrease the impact on the variability of the Network (including constraints modification) on their own operations by specifying their own time constraints to solve. The UDPP margin is always taken as input when something change in the Network. Whatever the Margins and the NM situational awareness, the UDPP service always provides the best possible solution to solve it.

Currently, a specific algorithm has been developed named “Margin” to allow the possibility of such feature.

Margins on flights can be given by two values:

- “Time Not After”: specifies a time by which the flight is requested not to be later than the value indicated.
- “Time Not Before”: specifies a time by which the flight is requested not to be earlier than the value indicated.

The objective of the algorithm is to rearrange flights automatically according to these time constraints using the AU’s own baseline time (similar to FDR, but not based on priority values, but based on time values).

A priority value can be allocated on flights with Margin. This priority value can then be used in tandem with the time values indicated the importance of the Margin to be implemented first, in this case the highest priority Margin (Prio = 1) is manage first etc.… Another way to see this priority value is to allow it according to the importance of the cost or lack of resource generated by going over this “Time Not After” margin.

For example a flight with a “Time Not After” with a priority=1 will be managed first, and then, have its “Time Not After” objective realized. Then a flight with a “Time Not After” with priority=6 will be managed after and its “Time Not After” objective will not be necessarily realized if the available AU slot cannot give it.

Providing input Margins is not mandatory on flights, if no Margin value is given on a flight, the flight is managed as an FDR flight (using only the priority value or the default one if priority is also not given for this flight).

Margins on Protected flights

The protection of a flight does not necessarily mean that the flight will be on time (even with a Pobjective given by a small window representing the On-time Objective).

The AU can, if required, protect a flight within a time window by defining Margins.

If margins are defined for a specific Pflight, the Margins replace the time value of the Pobjective:

- If a “Time Not After” is given to a protected flight, this time replaces the upper Pobjective time (normally set by Schedule + MaxDelayProtection).

- If a “Time Not Before” is given to a protected flight, this time replaces the lower Pobjective time (normally set by: Schedule – UDPP max schedule anticipation).

Only one of the two Margins could be given.

The algorithm checks that:

- The “Time Not After” could not be earlier then the schedule.
- The “Time Not Before” could not be earlier then the Schedule - UDPP max schedule anticipation.
- The “Time Not After” >= “Time Not Before”

FDR, SFP and Margin mixed in the same (prioritisation) approach

All the UDPP features are managed through a single algorithm, allowing the AU to use a mix of the different possibilities to organize his fleet.

The algorithm manages the flights in the following order:

1) Manage Protected flights (flight with a “P” as priority value)
2) Manage Margin flights (flight with a “Time Not After” value without a “P” as priority)
3) Manage default Baseline flights (flight with No Margins values, no priority value, and when the defaults priority is “B”)
4) Manage flights with priority value (flights with a priority value 1 to 999 or “L” (= to 1000) with no “Time Not After”)
5) Manage UDPP Suspended flights (flights with a “S” as priority value)

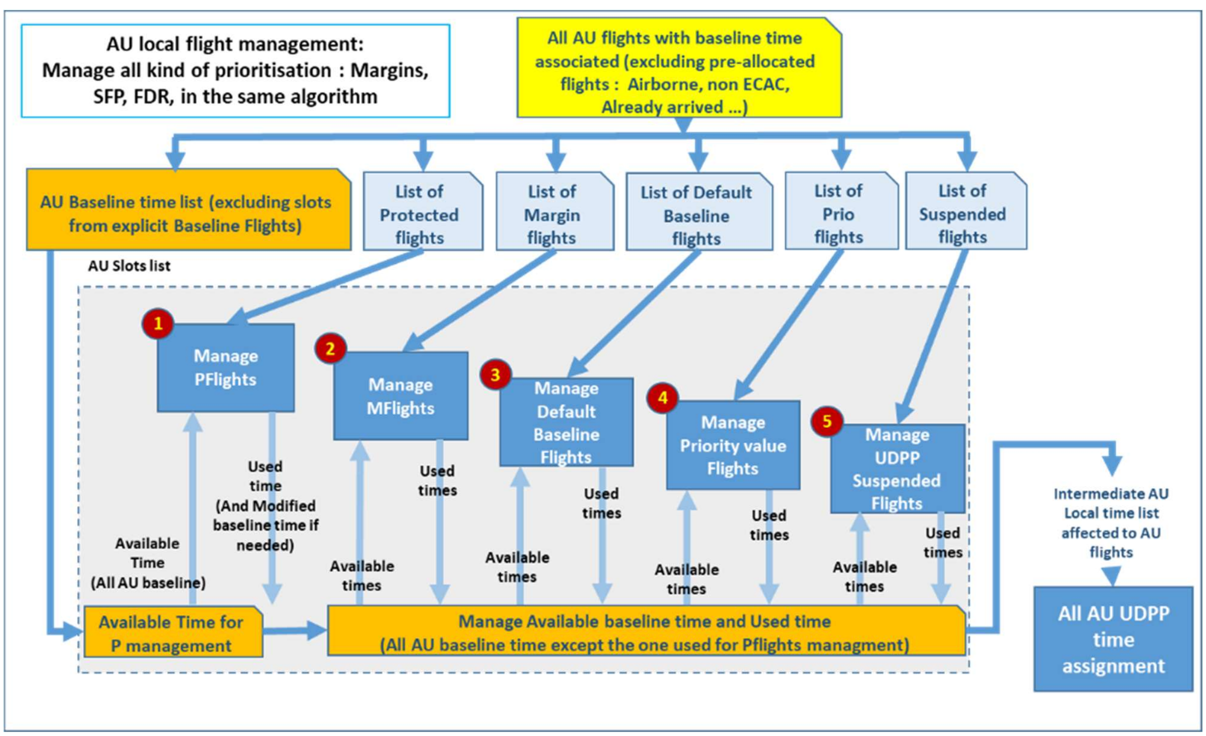


Figure 15: Flights prioritisation management

AU prioritisation inputs: different ways of thinking

AUs have a number of different options when mitigating the impact of delay on their fleet.

No specific features is mandatory, the objective is to allow AUs a large possibility to interact with the UDPP algorithm according to their own capability, configuration, model and tools.

Whilst the use of the different UDPP techniques / solutions is not mandatory, the objective is to allow AUs the possibility to interact with the UDPP algorithm through the use of these techniques in order to reduce the impact of delay.

Some example are defined here.

- Usage of default value: the default value is apply when no priority is given to a flight:

  This default value can be set by AU to “B”: in this case, only flights with a priority value are part of the re-ordering. This way of setting priorities limits the number of changes for the AU flights, but also limits the number of possibilities to find a solution.

  If the default value is set to a number (e.g. 5), all flights in the UDPP measure are rearranged and the delay is distributed over all the AU flights.

  N.B.: “B” can be specifically set to a flight if the AU wants to exclude the flight from the reordering: keep Baseline as a solution.

- Usage of the “Protect” priority:

  Generally, “P” is used for important flights to allow them to be “on time” even if no slot is available for the AU. This can cause extra overall delay by pushing lowest priority flights later in the sequence. To be noted that starting by using priority 1 for this flight could be helpful for rearranging the sequence without impacting the overall delay.

  On the other hand, using 'P' with margins, could increase the possibility of finding a solution.

- Usage of UDPP Suspend “S” or Lowest “L” priority:

  “S” is foreseen to be used only when the impact of pushing a flight completely outside of the UDPP measure is beneficial to the AU. Otherwise, use “L” for lowest priority flights. The flights will be assigned at the last slot of the AU.

Appendix B Benefit Impact Mechanisms

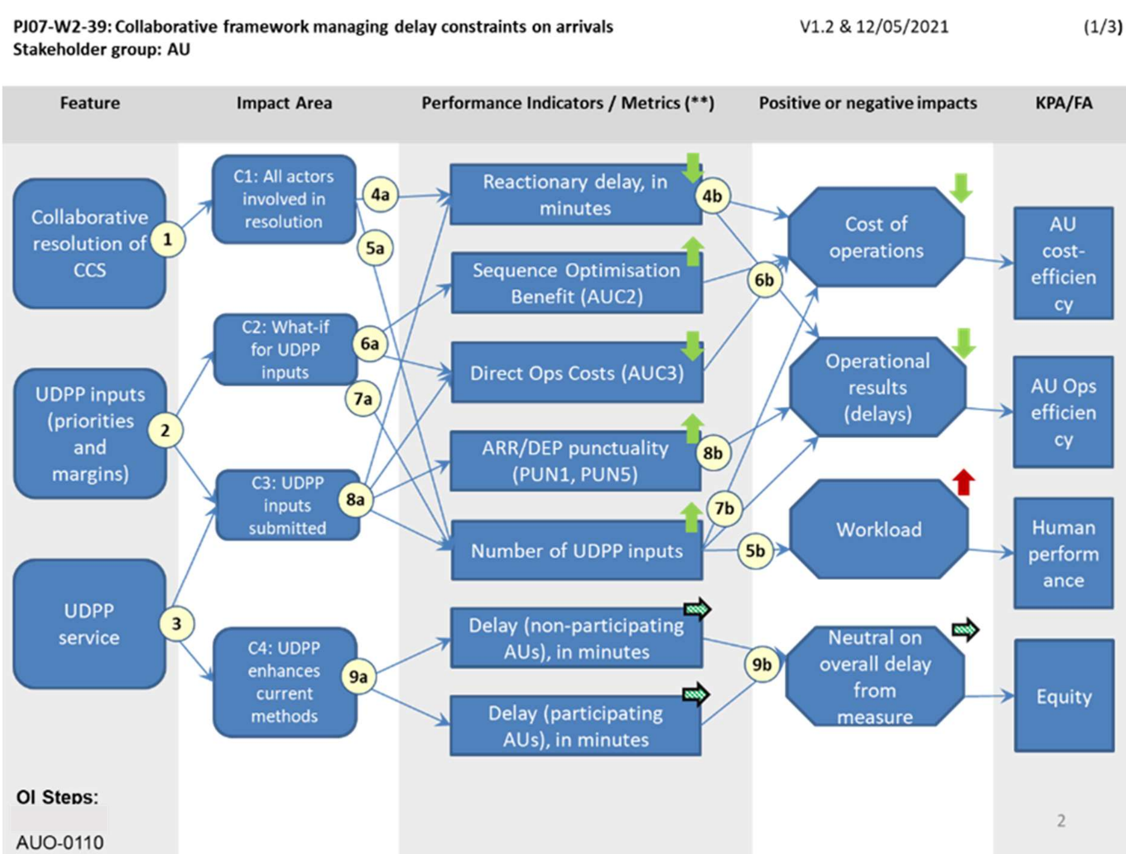
B.1 Stakeholders identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
Airlines (Airspace users)	Act on flight on UDPP measure.	Reduce the Impact on Fleet when ATFCM delay occur.
FMP + NM	Facilitate and Support UDPP measure.	Support AU prioritisation and maintain SAFETY over the network.
Airport	Assess new UDPP sequence and implement it.	Integrate new sequence from UDPP measure in Airport management and optimise resources.

Table 12: Stakeholder's expectations

B.2 Benefits mechanisms AUO-0110

<u>Stakeholder group:</u> Airspace Users



Feature description:

(1) A Capacity Constrained Situation (CCS) on arrivals is resolved by involving all key stakeholders in the process (C1). AUs are allowed to provide UDPP inputs to optimise their operations by managing the impact of delay. NM function provides the UDPP service. Both the FMP and the APT have the acceptance/rejection right for the UDPP service outputs, and they have the possibility to intervene in the Optimisation phase (phase 3) of the framework in case the UDPP solution is not acceptable to them. The outcome of the collaborative CCS resolution process resolves the demand-capacity problem (DCB) problem.

(2) UDPP inputs at AUs' disposal are Priorities and Margins. Priorities and margins for individual flights are solely within the remit of the AU.

The initial CCS solution is based on an ATFM regulation (Use Case 1), the UDPP inputs serve as the central element of three basic UDPP mechanisms: Selective Flight Protection, Fleet Delay Reordering and Margins. The UDPP mechanisms are housed by the UDPP service. An AU participating in the UDPP-enabled CCS resolution may use one or more of these mechanisms to optimise its operations through the AU's What-if facility that allows them to find an optimal solution (C2). Once an acceptable solution (from the AU perspective) for UDPP inputs has been found using the What-if facility, the UDPP inputs are submitted by the participating AU to the UDPP service for processing (C3).

(3) UDPP service receives the UDPP inputs from participating AUs and incorporates them into the CCS resolution (C3), thus enhancing the current set of DCB imbalance resolution methods (C4). The UDPP service does not guarantee that it will be possible to incorporate all of AUs' UDPP inputs at all times. The UDPP service is a feature that ensures the CCS resolution outcome respects fairness and equity principles wherever applicable. In particular, the UDPP service builds on the first-planned-first-served (FPFS) principle that CASA uses in case of UDPP measure being based on an ATFM regulation

Mechanism description:

(4a) Involvement of AUs in the resolution of the CCS through the use of UDPP mechanisms or through expression of AU constraints will help reduce the number of reactionary delay minutes in the sequence of AU's aircraft rotations, and thus reduce the cost impact of the delay.

(4b) The reduction of overall number of reactionary delay minutes will have a positive economic and operational impact on the AU, leading to improved AU cost-efficiency and operational efficiency.

(5a) The involvement of AU in the process is expressed through the number of UDPP inputs submitted to the UDPP service.

(5b) The production of the UDPP inputs, and potential coordination with other actors, may increase the workload of the AU actors, specifically in the Flight Operations/Planning section, and thus may have a negative effect on human performance aspects.

(6a) The AU what-if facility is the pre-requisite to allow the realisation of overall direct operational cost benefit for the airlines (AUC3 metric, i.e. the avoidance of excess costs associated with delayed operations) and to the increase in the sequence optimisation benefit (AUC2 metric, i.e. the benefit stemming from the AU's ability to intervene on the arrival sequence in the planning phase). It does this by identifying the optimal UDPP inputs.

(6b) The avoidance of excess operating costs on days when the AU's flight sequence and rotations are affected by ATFM delays is eventually expressed as reduction of direct operating costs; this positively affect the cost of operations for the AU and this positively affect AU cost-efficiency.

(7a) The availability of the what-if facility for UDPP inputs allows the AU to select the type and number of UDPP inputs submitted to the UDPP service, depending on the AU's optimisation strategy (e.g. maximising the AUC3 benefit, optimising the amount of AUC3 benefit per UDPP input etc.)

(7b) The number of UDPP inputs submitted by the AU is the essential determining factor in the reduction of operating costs, as well as in the reduction of in-block delays and thus improved punctuality. The relationship between the number of UDPP inputs and the degree of improvement in economic and operational performance of a given AU varies depending on AU-specific factors and operational circumstances.

(8a) The UDPP inputs submitted by the AU to the UDPP service lead to the improvement of the reactionary delay (reduction of minutes of delay), as well as the improvement of AUC2 and AUC3 metrics for the given participating AU. The submission of UDPP inputs also potentially leads to the improvement of punctuality of some of AU's flights through reduced reactionary delays in subsequent aircraft rotations.

(8b) Improved punctuality has an overall improvement effect on AU's operational efficiency.

(9a) The UDPP service manages and uses the UDPP inputs from participating AUs whilst respecting the presence of non-participating AUs in the measure. UDPP service only manages participating AUs' flights within the slots from the initial solution, meaning that the overall ATFM delay remains the same.

(9b) The overall delay from measure remains unchanged and equity is preserved.

Stakeholder group: FMP + NM

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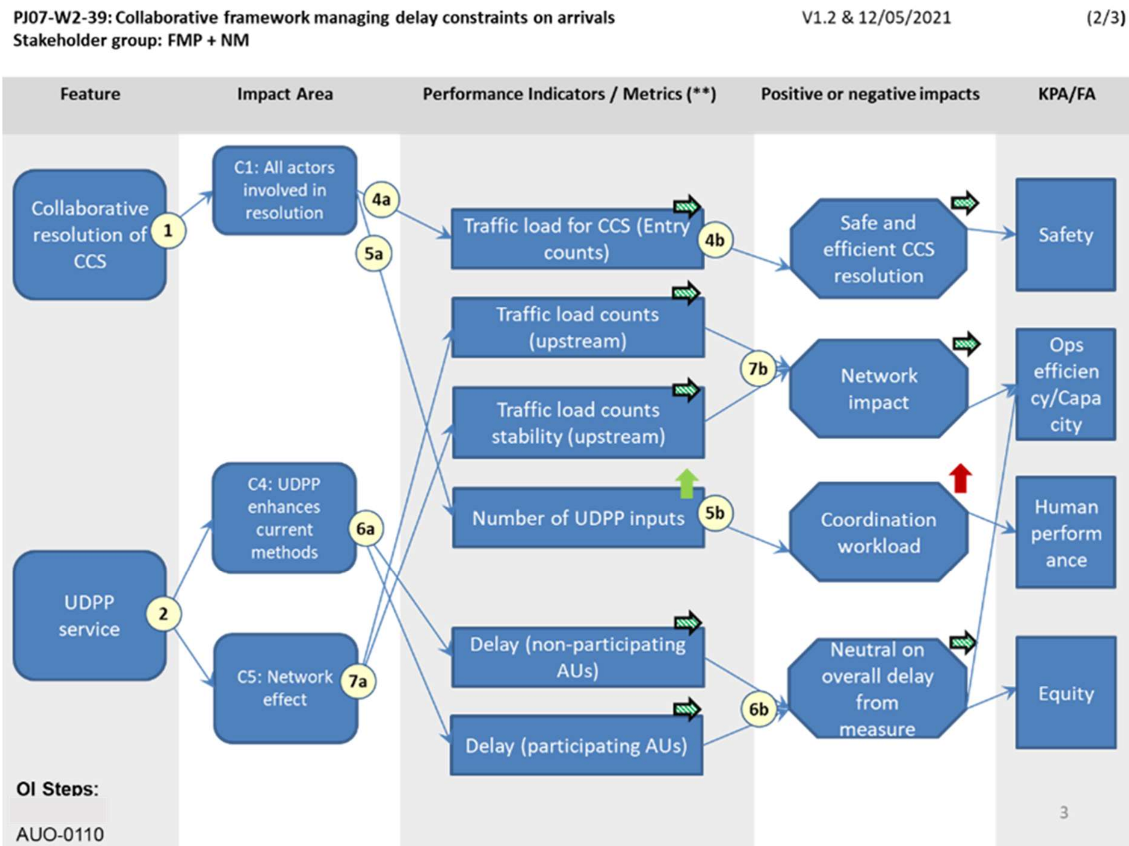


FMP and NM stakeholders are merged into a single BIM diagram because of the multiple overlaps in the respective separate diagrams. For instance:

- The metrics regarding traffic load counts in upstream sectors/traffic volumes are both a concern for the FMP(s) responsible for the given areas, however at the same time these metrics, when considered in an aggregated fashion, express the impact in the Network, which is an important aspect for NM.
- ATFM delay from the ATFM regulation is the outcome of FMP's solution of the DCB problem and it is an important metric for the respective ANSP. Similarly, the total delay at the Network level is important from the NM perspective.
- The key pre-requisite for AUs' ability to realise the benefits of the collaborative framework for managing constraints on arrivals is the opportunity to express AUs' constraints regarding flights and delay (i.e. UDPP inputs) in the planning phase. This opportunity is granted by the FMP's and/or NM's choice to use the said collaborative process, and secondly by the provision of the UDPP service, managed and provided by NM, that supplies the technological means to support AU's flexibility and objectives.

Feature description:

(1) A Capacity Constrained Situation (CCS) on arrivals is resolved by involving all key stakeholders in the process (C1). AUs are allowed to provide UDPP inputs to optimise their operations by managing the impact of delay. NM function provides the UDPP service. Both the FMP and the

APT have the acceptance/rejection right for the UDPP service outputs, and they have the possibility to intervene in the Optimisation phase (phase 3) of the framework in case the UDPP solution is not acceptable to them. The outcome of the collaborative CCS resolution process resolves the demand-capacity problem (DCB) problem.

(2) UDPP service is embedded in the NM function. The UDPP service receives UDPP inputs from participating AUs and incorporates them into the CCS resolution, thus enhancing the current set of DCB imbalance resolution methods (C4). The UDPP service always maintains an accurate and up-to-date UDPP solution by considering the traffic and constraint situation in the Network. In parallel, the UDPP solution produced by UDPP service affects the traffic and constraint picture within the Network (C5). The UDPP service is a feature that ensures the CCS resolution outcome respects fairness and equity principles wherever applicable. In particular, the UDPP service builds on the first-planned-first-served (FPFS) principle that CASA uses in case of a UDPP measure being based on an ATFM regulation.

Mechanism description:

(4a) The involvement of all actors shall not change the resolution of the CCS. The CCS (hotspot) traffic load resulting from the collaborative framework's measure remains the same as with an equivalent, non-UDPP measure currently available.

(4b) No impact on traffic loads within the CCS preserves the safe and efficient CCS resolution, and thus has no impact on safety.

(5a) AUs actively participate in the CCS resolution by submitting UDPP inputs to optimise their operations.

(5b) FMP and NM perform their respective impact assessments on the outputs of the UDPP service, and in case interventions are needed this may increase the coordination workload for these actors. This may therefore have an impact on human performance aspects.

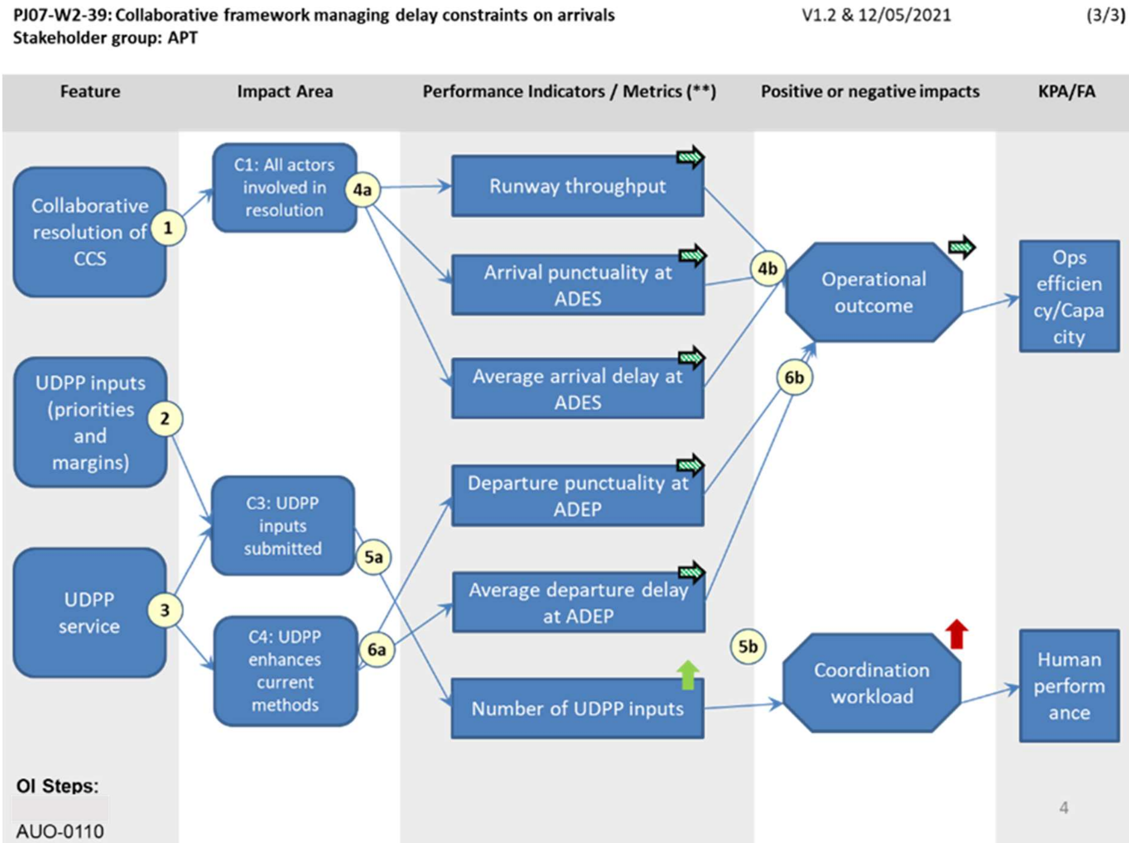
(6a) The UDPP service manages the UDPP inputs from participating AUs whilst respecting the presence of non-participating AUs in the measure. UDPP service only manages participating AUs' flights within the slots from the initial solution, meaning that the ATFM delay remains the same.

(6b) The overall delay from measure remains unchanged and equity is preserved. From the NM and FMP perspective, this means that the delay from the measure is constant and does not negatively impact the performance metrics of the ANSP or NM.

(7a) The UDPP service reflects on participating AUs' UDPP inputs (where possible). As a result, take-off and arrival times, as well as 'times over' in ENR sectors change for individual flights. Such changes may have an impact on the traffic load in the parts of Network that these flights cross but which are outside the target arrival CCS area the measure is resolving. Thus, traffic load counts and traffic count stability in upstream airspace may be affected.

(7b) Volatility as well as saturations in upstream sectors are not negatively affected (in comparison to the situation when the collaborative process is not used), and thus there is no Network impact and subsequently no impact on operational efficiency or capacity.

Stakeholder group: Airport



Feature description:

(1) A Capacity Constrained Situation (CCS) on arrivals is resolved by involving all key stakeholders in the process (C1). AUs are allowed to provide UDPP inputs to optimise their operations by managing the impact of delay. NM function provides the UDPP service. Both the FMP and the APT have the acceptance/rejection right for the UDPP service outputs, and they have the possibility to intervene in the Optimisation phase (phase 3) of the framework in case the UDPP solution is not acceptable to them. The outcome of the collaborative CCS resolution process resolves the demand-capacity problem (DCB) problem.

(2) UDPP inputs at AUs' disposal are Priorities and Margins. Priorities and margins for individual flights are solely within the remit of the AU.

- In case the initial CCS solution is based on an ATFM regulation (Use Case 1), the UDPP inputs serve as the central element of three basic UDPP mechanisms: Selective Flight Protection, Fleet Delay Reordering and Margins. The UDPP mechanisms are housed by the UDPP service. An AU participating in the UDPP-enabled CCS resolution may use one or more of these mechanisms to optimise its operations through the AU's What-if facility that allows them to find an optimal solution (C2). Once an acceptable solution (from the AU perspective) for UDPP inputs has been found using the What-if facility, the UDPP inputs are submitted by the participating AU to the UDPP service for processing (C3).

(3) UDPP service receives the UDPP inputs from participating AUs and incorporates them into the CCS resolution (C3), thus enhancing the current set of DCB imbalance resolution methods (C4). The UDPP service does not guarantee that it will be possible to incorporate all of AUs' UDPP inputs at all times. The UDPP service is a feature that ensures the CCS resolution outcome respects fairness and equity principles wherever applicable. In particular, the UDPP service builds on the first-planned-first-served (FPFS) principle that CASA uses in case of UDPP measure being based on an ATFM regulation.

Mechanism description:

(4a) The involvement of all actors shall not change the resolution of the arrival CCS. This CCS (hotspot) resolution does not have an impact on runway throughput (both within and outside of the CCS), and similarly it does not have a negative impact on the overall arrival punctuality at the destination airport, due to constant but differently distributed in-block delay at ADES.

(4b) No impact on key operational outcomes at the destination airport (i.e. the airport with which the arrival CCS is associated) from the new collaborative framework means that there is no impact on airport's capacity and operational efficiency.

(5a) AUs actively participate in the CCS resolution by submitting UDPP inputs to optimise their operations.

(5b) The ADES APT actor runs the airport impact assessment on the outputs of the UDPP service, and in case interventions are needed this may increase the coordination workload for these actors. This may therefore have an impact on human performance aspects.

(6a) The UDPP service manages the UDPP inputs from participating AUs whilst respecting the presence of non-participating AUs in the measure. UDPP service only manages participating AUs' flights within the slots from the initial solution., meaning that the ATFM delay remains the same. The use of UDPP mechanisms does not have an impact on the overall departure punctuality at the outstations for the flights impacted by the CCS and UDPP measure.

(6b) There is no operational impact at the outstations (ADEPs) for the concerned flights. Conversely to the ADES where the impact is concentrated at a single airport (due to the CCS for given airport's arrivals), the impact at the ADEPs is distributed and the volume of flights being subject to UDPP changes is limited at the respective ADEPs. Therefore, there is no operational efficiency or capacity impact at ADEP.

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Appendix C Operational concept for AUO-0109

This appendix describes the operational concept for AUO-0109 Collaborative framework for managing arrival constraints at Airport.

This part of the concept is still in V2 according to the E-OCVM methodology. This is the reason why it is not included in the main text of the OSED which is in V3 and then included in this separate appendix. For the Use Cases related to this AUO-0109 no dedicated EATMA model was developed, but dedicated diagrams are presented to illustrate the workflow and activities.

The approach for this concept is an arrival framework integrating UDPP with Airport driven Local DCB process for reconciliation with NM and AU. The reconciliation of the arrival constraints resolution between the Network Management Function and the Airport/AUs is addressed through the following:

- Detection, analysis and coordination of the local Demand/Capacity imbalances during the pre-flight phase: APOC and AUs coordinate a resolution process supported by integrated tools.
- NM Network assessment and application of Local DCB (APOC) management proposals during the pre-flight phase (pre-tactical and tactical from ATFM perspective). The progressive integration of AOP and NOP between NM and Airport, will be used when available in NM data.
- Integrating actively to the current mechanism of providing Target Times of Arrival (TTAs) by ATM/Airport stakeholders, the AUs flights constraint through UDPP flights prioritisations.

The approach will be addressed across validation exercises on different Airports.

<u>The OI Step associated is the following:</u>

AUO-0109: Collaborative framework for managing arrival constraints at Airport

Collaborative recovery procedures and associated predictive and decision support tools are put in place to support Airports, Airspace Users, Network and ANSPs stakeholders to anticipate, understand and manage arrivals related disruptive events at Airports' level in planning phase, aiming at reducing impact and knock-on effects, optimizing solutions whilst ensuring that users' end-to-end processes are managed. These procedures may include the allocation of Target Times for arrival flights combined with the User Driven Prioritization Process (TTA/UDPP) into the overall reconciliation process, also in case of multiple constraints.

Rationale:

Need for new collaborative operational procedures between ANSP, AU, Airport, and Network to manage (network) local DCB issues at arrival (in pre-flight phase), minimizing the risk of imposing multiple penalties to Airspace Users or increased workload for APOC.

Better management of disruptions by increasing flexibility (integration of AU priorities via UDPP, and speeding up of the recovery to normal operations).

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More automated tools and reduction of the 'Human-In-the-Loop' for the collaborative processes are also expected to evaluate the proposed UDPP solution, and its impact on the overall operational performance (AUs, Airports and Network effect).

The following table provides an overview of the Solution in terms of OI Steps and related Enablers, in line with the EATMA reference Dataset 21:

SESAR Solution ID	SESAR Solution Title	OI Steps ID ref. (coming from EATMA)	OI Steps Title (coming from EATMA)	OI Step Coverage
PJ.07-W2-39	Collaborative framework for managing arrival delay within an ATFM regulation	**AUO-0109**	**Collaborative framework for managing arrival constraints at Airport**	**Fully**

Enablers relative to OI: AUO-0109

Local name	Project type	SESAR Program	OI Step Enabler Ownership	OI Step Enabler Compulsory
AIRPORT-48_Advanced Airport UDPP integrated with AOP Monitoring	System Enabler	SESAR 2020 Wave 2	Develop	Required
AOC-ATM-18_FOC adaptation to support UDPP	System Enabler	SESAR 2020 Wave 2	Develop	Required
NIMS-44_Evolution of NIMS to support management of UDPP, inclusion of user preferences and priority as part of SBT	System Enabler	SESAR 2020 Wave 1	Develop	Required
NIMS-46_Integrated local DCB working position	System Enabler	SESAR 2020 Wave 2	Use	Required

OI Step AUO-0109 Enablers

Deviations with respect to the SESAR Solution(s) definition

No deviations

Operational Characteristics

Same as in chapter 3.2.1

Roles and Responsibilities

Same as in chapter 3.2.2

C.1 New SESAR operating method

In some cases, when the DCB imbalance has low impact on traffic, the Airport can trigger a UDPP Network Cherry-Pick measure to involve AUs, through the UDPP prioritisation. The creation of this UDPP NCP measure allows to integrate AU flights constraint (prioritisation) given by AUs, on local solution (described in Use case 2: UC2).

In Network Cherry-Pick measure (UC2) no automatic update and calculation is done by NM and the local DCB actor is responsible of maintaining the measure and its content.

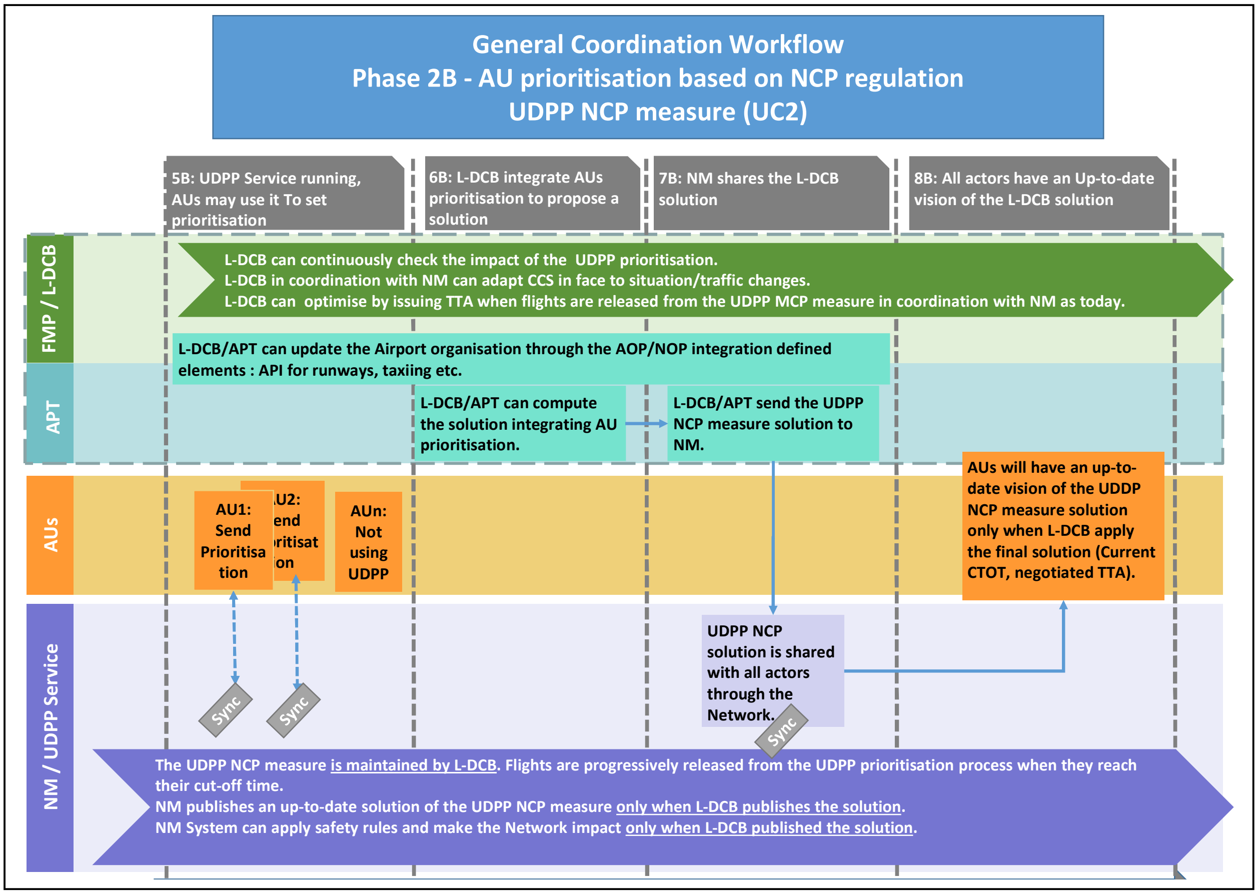
If a UDPP NCP measure is chosen to manage the traffic overload, the solution is based on TTA and this TTA solution is based on the result of the negotiation among the involved stakeholders (including APOC, ATC, FMP and AUs), assuming that the AU needs are taken first into account to face the overload situation, but no centralized automation is implemented to generate a solution. Up to L-DCB to produce and publish the solution integrating AU prioritisation.

The L-DCB apply the UC2 approach to manage the imbalance. This possibility is given by the existing NCP measure (an ACP measures is not validated by NM) which is restricted in duration and severity by NM: 1h or 1h30 with less than 20 min delay, and dedicated to solve short traffic peaks. This kind of measure, not implementing initial solution by a FPFS function, is not considered equitable by AUs, but it may still be useful for the L-DCB to pre-organise the arrival sequence according to light operational constraints to manage (e.g. in case the restriction is applicable only on a part of the CCS).

Workflow

In UC2, NM publishes the UDPP NCP measure with the current impacted flight list, and the initial negotiated TTA on flights if exist.

AU prioritisation based on NCP regulation (UDPP NCP measure: UC2):



General coordination workflow - AU prioritisation based on UDPP NCP measure

Description:

This phase describes how AUs assign their prioritisations to NM to mitigate the impact of the UDPP NCP measure and how L-DCB takes it into account to propose a solution.

These steps apply to each AU separately. From a global perspective, it's a continuous process integrating AUs prioritisation to L-DCB through NM. This phase finishes progressively when AU flight cut-off time occur and when L-DCB/APT publish UDPP NCP solution to NM.

Step5B:

Each AUs can access the UDPP NCP measure if concerned by it. AUs can assign their prioritisation on their own flights under the form of Margins (minimum "Time Not After" with priority value). AUs don't have necessarily a baseline delay to elaborate Margins but have a global view of the UDPP NCP measure. AUs can NOT test their prioritisation by "What-if" but send their wish to the L-DCB, through NM, to be taken into account to produce the solution. No new time or slot allocation is publish at this stage. AUs prioritisations are stored in NM and is available to L-DCB to elaborate the UDPP NCP solution.

Step6B:

In order to get AU flights' prioritisations applied, the L-DCB in collaboration with the Airport, can compute AUs prioritisation (Margins with priorities) to elaborate the UDPP NCP measure solution integrating local constrains and local business rules. At this time no publication through NM is done, only local impact is evaluated. There is no NM automatic UDPP algorithm apply on AU prioritisation, only local tool integrate AUs prioritisation to produce UDPP NCP solution.

AU prioritisation:
AU prioritisation input consists of UDPP Margins ("Time Not After", optional "Time Not Before" and relative priority values).

Step7B:

After UDPP cut-off time and when L-DCB has produce a UDPP NCP solution, this solution is sent to NM for publication through TTAs. The NM Service re-calculates the new time associated and the CASA Most Penalising Regulation rules are applied if necessary. The new TTA and CTOT slots become active and public. The NM always integrate the current network situation, including other regulations, to generate times for the flights within the UDPP NCP measure using the last input from the L-DCB.

Step8B:

AUs, Airport and all the other actors have the latest up-to-date view of the flights' times (CTOTs and TTAs) within the UDPP NCP measure but only after the L_DCB publication of the target time of flight under the UDPP NCP measure.

Use Case 2: UDPP measure based on ATFM NCP measure (TTAs allocation)

This use case is a basically the same as the use case 1 but proposing a different option to implement a couple of the activities.

This UC is based on the use of Target Time of Arrival (TTA). This UC is fully aligned with the NMOC Target Time concept actually defined by NM.

This UC is based on the creation of the proposed NCP solution with an initial proposed flight time solution (based on proposed TTA) or only by the creation of the list of flight possibly impacted by the solution. After an AU flight prioritisation phase, the L-DCB issues the solution and send it to NM through TTA.

Because the initial solution, if defined (by local DCB), is not based on FPFS solution to smooth the traffic, the proposed TTA solution is not considered as equitable for AU as defined by UDPP. In this case the final UC2 solution would not be considered as equitable either.

The typical scenario under which a TTA solution would be used, instead of FPFS CASA function, is a less severe DCB issue where the resolution can be achieved through changing the arrival time for a few flights. Because of the relatively small number of flights typically contained within a NCP measure, in comparison to an ATFM regulation, this UDPP NCP measure based on TTAs' negotiation may be less likely to be used by the AUs for UDPP interventions.

The content of the TTA solution is produced by the local DCB. The local solution can be achieved through an automated mechanism using a specific local algorithm, or through a manual flight time modification processes by a human operator.

This Use Case (UC2) was validated, as planned by the S39 roadmap, during the Alicante (ALC) validation exercise in coordination with WP04 solution S28.3 and the Charles de Gaulle (CDG) exercise. For detailed information see the Validation plan [42] and Validation report of S2020 solution 39 [43].

No new EATMA model is needed for this use case 2 because it is the same as the use case 1, the activities are the same for both use cases. The difference resides in the way that some activities are implemented in detail in each use case.

To illustrate this, just take as example the activity “Create UDPP Measure with Regulation”. For each use case the detailed creation of UDPP Measure with regulation will be:

- User case 1: Regulation implemented with a rate equal to the traffic volume capacity.
- Use Case 2: Regulation implemented as Network Cherry picking regulation (NCP)
- Use case 2 bis (see next chapter): Regulation implemented with a rate above the traffic volume capacity with the intention to get 0 minutes delay to the affected flights.

Even if the activities are the same, the detailed way they are implemented could change completely the operational situation. That is the reason why we need to define this new use case to validate different implementing options.

Having said that, this chapter only describes the activities in use case 2 that are implemented differently than in use case 1.

Description of activities that are implemented differently than in use case 1:

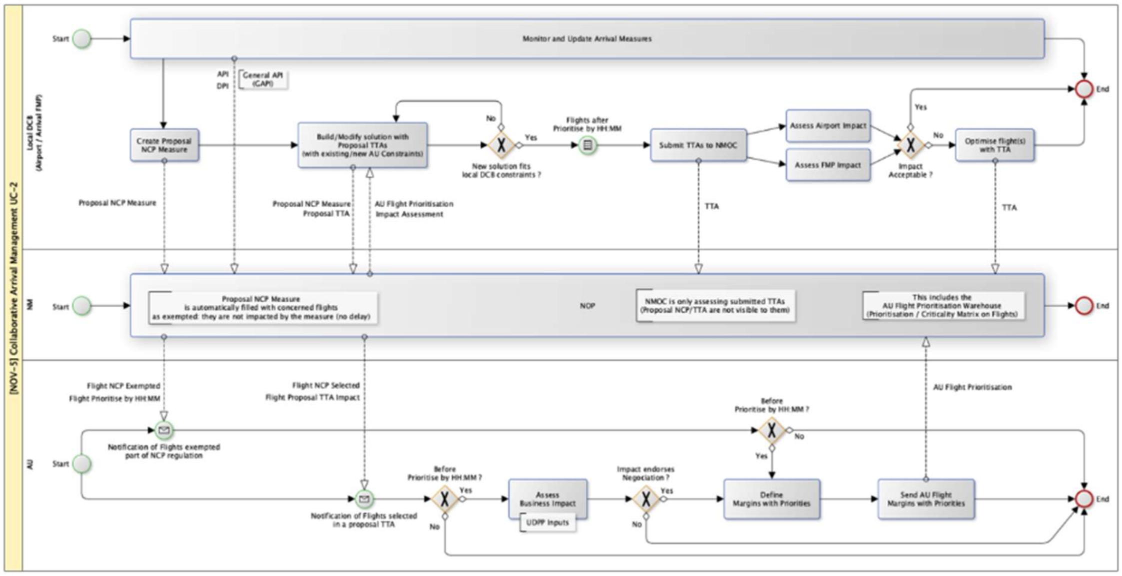
- Activity: “Create UDPP Measure with Regulation”

  If necessary, the local DCB actor, through a NM Function, can initiate a Proposal NCP Measure to manage the arrival traffic, enabling AUs to mitigate the delay on their flights by sending Margins and priorities to NM to be taken as part of the decision for L-DCB.

- Activity: “Calculate New Delay and Network Impact”

  Convert AUs prioritisation to new times according to all AUs prioritisation values and rules using reference times and baseline times. This activity implements the local DCB solution by sending the corresponding TTAs from local DCB manager to NM.

  NM assesses submitted TTAs and generate new time on flights integrating safety issues if occur (e.g. other MPR).



Activities model for UC2

Activity	Description
Monitor and Update Arrival	The local DCB actor, through a NM Function, monitors the arrival traffic according to the APT resource availability: runways, gates etc. L-DCB can update a previously defined UDPP measures according to the evolution of the traffic, the resources, and the constraints.
Create Proposal NCP Measure	If necessary, the local DCB actor, through a NM Function, can initiate a Proposal NCP Measure to manage the arrival traffic, enabling AUs to mitigate the delay on their flights by sending Margins and priorities to NM to be taken as part of the decision for L-DCB.
Build/Modify solution with Proposal TTAs	Local DCB builds or modifies the Proposal TTA solution integrating AU prioritisation by using its own algorithm to fulfil its local constraints
Submit TTA to NMOC	After the UDPP flight cut-off time, the Local DCB sends flights TTA to NM to publish the TTA result of the coordinated UDPP NCP measure solution.
Assess Airport Impact	Local DCB (as Airport representative) can assesses the UDPP arrival times, given by the Submission of the new prioritisation from AUs, by using the NOP and the AOP. If Airport DCB what-if functions exist, they can support the flight optimisation through TTA or e-Helpdesk after flights' UDPP cut-off times.
Assess FMP Impact	Local DCB (as Network representative) can assess the UDPP arrival times, given by the Submission of the new prioritisation from AUs, by

	using the NOP. If local DCB what-if functions exist, they can support the flight optimisation through TTA or e-Helpdesk after flights cut-off times.
Optimise Flight(s) using TTA	Local DCB can optimize the UDPP measure after flight's UDPP cut-off time through the TTA update mechanism if needed.
Receive notification of flight exempted part of NCP measure	AUs can receive a notification from NM of flights part of a UDPP NCP regulation
Assess Business Impact	The AU can assess if the flights concerning a UDPP measure have to be prioritized to decrease the impact of the delay on its fleet.
Define Priorities and Margins	AU can set prioritisation on flights concerned by a UDPP measure. For a NCP measure, only Margins with priority is taken by L-DCB to produce a solution.
Send AU flights Margin with Priorities	When AU determines acceptable prioritisation based on Margins with priorities, it can formally send it to the Network. The values will be taken by L-DCB to process the solution.
Network Operations Management	The centralized NM NOP integrates all data information relative to flights including AUs prioritisations and allow actors to use it and communicate. NOP checks and publishes a global coherent view of the traffic and constraints and allow AUs prioritisations on their flights in a safe manner, avoiding publication of sensitive information to other AUs.
NM assesses and implement TTAs coming from L-DCB	NM assesses submitted TTAs coming from L_DCB and generated new time on flights integrating Safety issues if occur (MPR).
NM AU flights prioritisation warehouse	NM stores AU flight prioritisation and can send the last value to the L-DCB actor on demand.

Activities description

Use Case 2 bis: UDPP measure based on ATFM regulation and TTAs allocation

This use case is a refinement of the use case 2 to investigate potential advantage of current features available in the NM system.

This UC is based on the use of Target Time of Arrival (TTA). This UC is fully aligned with the NMOC Target Time concept actually defined by NM.

This UC is a blend of UC1 and UC2. It is based on ATFM regulation but with high initial rate which ideally automatically allocate slots with 0 minutes of delay to the concerned flights. After an AU flight prioritisation phase for the flights inside the regulation, L-DCB can issue the proposal solution and send it to NM through TTAs.

Because the initial solution, if defined (by local DCB), is not based on FPFS solution to smooth the traffic, the proposed TTA solution is not considered as equitable for AU as defined by UDPP. In this case the final UC2 solution would not be considered as equitable either.

If the situation degrades and L-DCB solution is no longer valid, L-DCB manager reduces the regulation rate and launches the UDPP measure with the automated UDPP algorithm following the Use Case 1 process.

The content of the TTA solution is produced by the local DCB. The local solution can be achieved through an automated mechanism using a specific local algorithm, or through a manual flight time modification processes by a human operator.

This Use Case (UC2 bis) will be validated, as planned by the S39 roadmap, during the Charles de Gaulle (CDG) exercise. For detailed information see the Validation plan [42] and Validation result of S2020 solution 39 [43].

As already explained in use case 2, here are described only the two activities that are implemented differently than in the use case 1 as no new EATMA model is needed for this use case 2 bis.

Description of activities that are implemented differently than in use case 1:

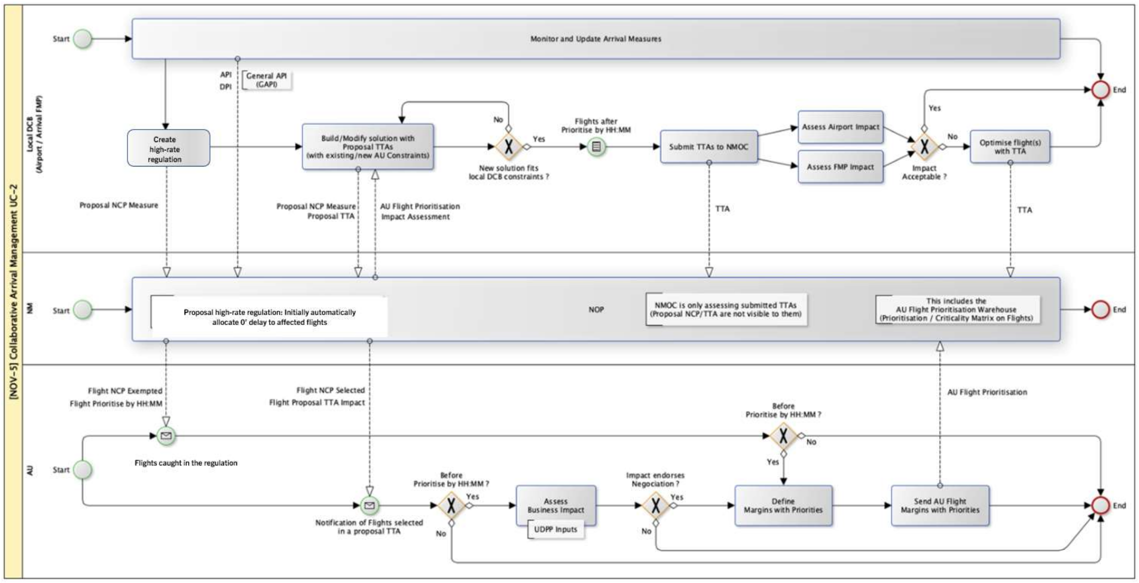
- Activity: “Create UDPP Measure with Regulation”

  If necessary, the local DCB actor, through a NM Function, can create a “high rate” regulation for the arrival traffic, and enable AUs to mitigate the potential delay on their flights by sending Margins and priorities to NM. This action will allocate 0 minutes of delay to most of the affected flights, as the regulation rate is much higher than the demand.

- Activity: “Calculate New Delay and Network Impact”

  Convert AUs prioritisation to new times according to all AUs prioritisation values and rules using reference times and baseline times. This activity implements the local DCB solution by sending the corresponding TTAs from local DCB manager to NM.

  NM assesses submitted TTAs and generate new time on flights integrating safety issues if occur (e.g. other MPR).



Activities model for UC2 bis

Activity	Description
Monitor and Update Arrival	The local DCB actor, through a NM Function, monitors the arrival traffic according to the APT resource availability: runways, gates etc. L-DCB can update a previously defined UDPP measures according to the evolution of the traffic, the resources, and the constraints.
Create high rate regulation	If necessary, the local DCB actor, through a NM Function, can create a high rate regulation to manage the arrival traffic, and enable AUs to mitigate the potential delay on their flights by sending Margins and priorities to NM to be taken as part of the decision for L-DCB.
Build/Modify solution with Proposal TTAs	Local DCB builds or modifies the Proposal TTA solution integrating AU prioritisation by using its own algorithm to fulfil its local constraints
Submit TTA to NMOC	After the UDPP flight cut-off time, the Local DCB sends flights TTA to NM to publish the TTA result of the coordinated UDPP NCP measure solution.
Assess Airport Impact	Local DCB (as Airport representative) can assesses the UDPP arrival times, given by the Submission of the new prioritisation from AUs, by using the NOP and the AOP. If Airport DCB what-if functions exist, they can support the flight optimisation through TTA or e-Helpdesk after flights' UDPP cut-off times.
Assess FMP Impact	Local DCB (as Network representative) can assess the UDPP arrival times, given by the Submission of the new prioritisation from AUs, by using the NOP. If local DCB what-if functions exist, they can support

	the flight optimisation through TTA or e-Helpdesk after flights cut-off times.
Optimise Flight(s) using TTA	Local DCB can optimize the UDPP measure after flight's UDPP cut-off time through the TTA update mechanism if needed.
Flights caught in the regulation	AUs will receive a SAM with the regulation ID and the allocated delay/CTOT. Initially the delay would be 0 minutes.
Assess Business Impact	The AU can assess if the flights concerning a UDPP measure have to be prioritized to decrease the impact of the delay on its fleet.
Define Priorities and Margins	AU can set prioritisation on flights concerned by a UDPP measure. For a high rate regulation measure, only Margins with priority is taken by L-DCB to produce a solution.
Send AU flights Margin with Priorities	When AU determines acceptable prioritisation based on Margins with priorities, it can formally send it to the Network. The values will be taken by L-DCB to process the solution.
Network Operations Management	The centralized NM NOP integrates all data information relative to flights including AUs prioritisations and allow actors to use it and communicate. NOP checks and publishes a global coherent view of the traffic and constraints and allow AUs prioritisations on their flights in a safe manner, avoiding publication of sensitive information to other AUs.
NM assesses and implement TTAs coming from L-DCB	NM assesses submitted TTAs coming from L_DCB and generated new time on flights integrating Safety issues if occur (MPR).
NM AU flights prioritisation warehouse	NM stores AU flight prioritisation and can send the last value to the L-DCB actor on demand.

Activities description

Differences between new and previous Operating Methods

OI Step code – title (OI Step CR)		
AUO-0109 - Collaborative framework for managing arrival constraints at Airport (CR 03605 Update AUO-0109 (PJ.07-39))		
Activity	**Impact**	**Change**
Assess Business Impact	Update	Business as usual, but with the added possibility to use UDPP, the method and decision to decrease the impact of delay can be different.
Assess Prioritisation Impact	Introduce	Add the possibility to assess the impact of a new UDPP prioritisation flights to decrease impact of delay.
Assess UDPP eligibility	Introduce	AU can check if the UDPP measure is ongoing on flights.

Calculate New Delay and Network Impact	Introduce	Automatic function Appling UDPP algorithms to calculate new delay on flights.
Calculate UDPP Flight and Cut-Off Times	Introduce	Automatic function Applied on flights under a UDPP measure to enable of stop UDPP prioritisation according to lights status.
Create UDPP Measure with Regulation	Update	L_DCB can create a UDPP measure on a CCS instead of a standard ATFCM regulation.
Define Priorities and Margins	Introduce	AUs can define UDPP flights prioritisation to decrease the impact of delay on its flights.
Send Submit Prioritisation	Introduce	AUs can Submit to the network its UDPP flights prioritisation.
Send What-If Prioritisation	Introduce	AUs can check the new delay and the impact on Network of its UDPP flight.
Update Flight Priorities and Margins in NOP	Introduce	NM memorizes UDPP flights prioritisation to be apply in the traffic maintenance.
Update Slot Allocation in NOP	Update	Business as usual: NM update the slot of the flights.

C.2 Benefit Impact Mechanisms AUO-0109

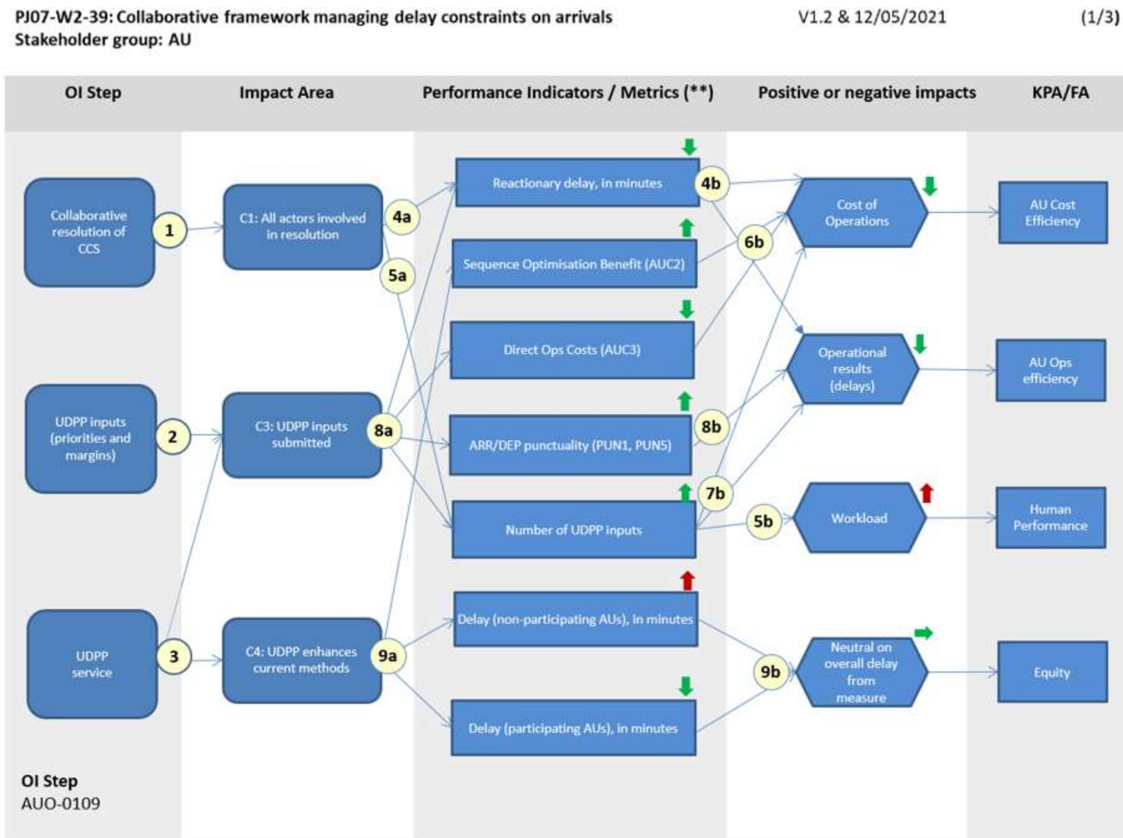
C.2.1 Stakeholder identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
Airlines (Airspace users)	Act on flight on UDPP measure.	Reduce the Impact on Fleet when ATFCM delay occur.
FMP + NM	Facilitate and Support UDPP measure.	Support AU prioritisation and maintain SAFETY over the network.
Airport	Assess new UDPP sequence and implement it.	Integrate new sequence from UDPP measure in Airport management and optimise resources.

Stakeholder's expectations

C.2.2 Benefits mechanisms AUO-0109

<u>**Stakeholder group:**</u> **Airspace Users**



Feature description:

(1) A Capacity Constrained Situation (CCS) on arrivals is resolved by involving all key stakeholders in the process (C1). AUs are allowed to provide UDPP inputs to optimise their operations by managing the impact of delay. NM function provides the UDPP service. Both the FMP and the APT have the acceptance/rejection right for the UDPP service outputs, and they have the possibility to intervene in the Optimisation phase (phase 3) of the framework in case the UDPP solution is not acceptable to them. The outcome of the collaborative CCS resolution process resolves the demand-capacity problem (DCB) problem.

(2) UDPP inputs at AUs' disposal are Priorities and Margins. Priorities and margins for individual flights are solely within the remit of the AU. The initial CCS solution is based on a Network Cherry Picking (NCP) measure with Target Time of Arrival (TTA) managed by the Local DCB actor (either the FMP or Airport actor), the UDPP inputs are utilised as an expression of AU constraints to be taken into consideration by the Local DCB when building or refining the CCS solution.

(3) UDPP service receives the UDPP inputs from participating AUs and incorporates them into the CCS resolution (C3), thus enhancing the current set of DCB imbalance resolution methods (C4). The UDPP service does not guarantee that it will be possible to incorporate all of AUs' UDPP inputs at all times. the solution is an NCP measure based on TTAs

Mechanism description:

(4a) Involvement of AUs in the resolution of the CCS through the use of UDPP mechanisms or through expression of AU constraints will help reduce the number of reactionary delay minutes in the sequence of AU's aircraft rotations, and thus reduce the cost impact of the delay.

(4b) The reduction of overall number of reactionary delay minutes will have a positive economic and operational impact on the AU, leading to improved AU cost-efficiency and operational efficiency.

(5a) The involvement of AU in the process is expressed through the number of UDPP inputs submitted to the UDPP service.

(5b) The production of the UDPP inputs, and potential coordination with other actors, may increase the workload of the AU actors, specifically in the Flight Operations/Planning section, and thus may have a negative effect on human performance aspects.

(6b) The avoidance of excess operating costs on days when the AU's flight sequence and rotations are affected by ATFM delays is eventually expressed as reduction of direct operating costs; this positively affect the cost of operations for the AU and this positively affect AU cost-efficiency.

(7b) The number of UDPP inputs submitted by the AU is the essential determining factor in the reduction of operating costs, as well as in the reduction of in-block delays and thus improved punctuality. The relationship between the number of UDPP inputs and the degree of improvement in economic and operational performance of a given AU varies depending on AU-specific factors and operational circumstances.

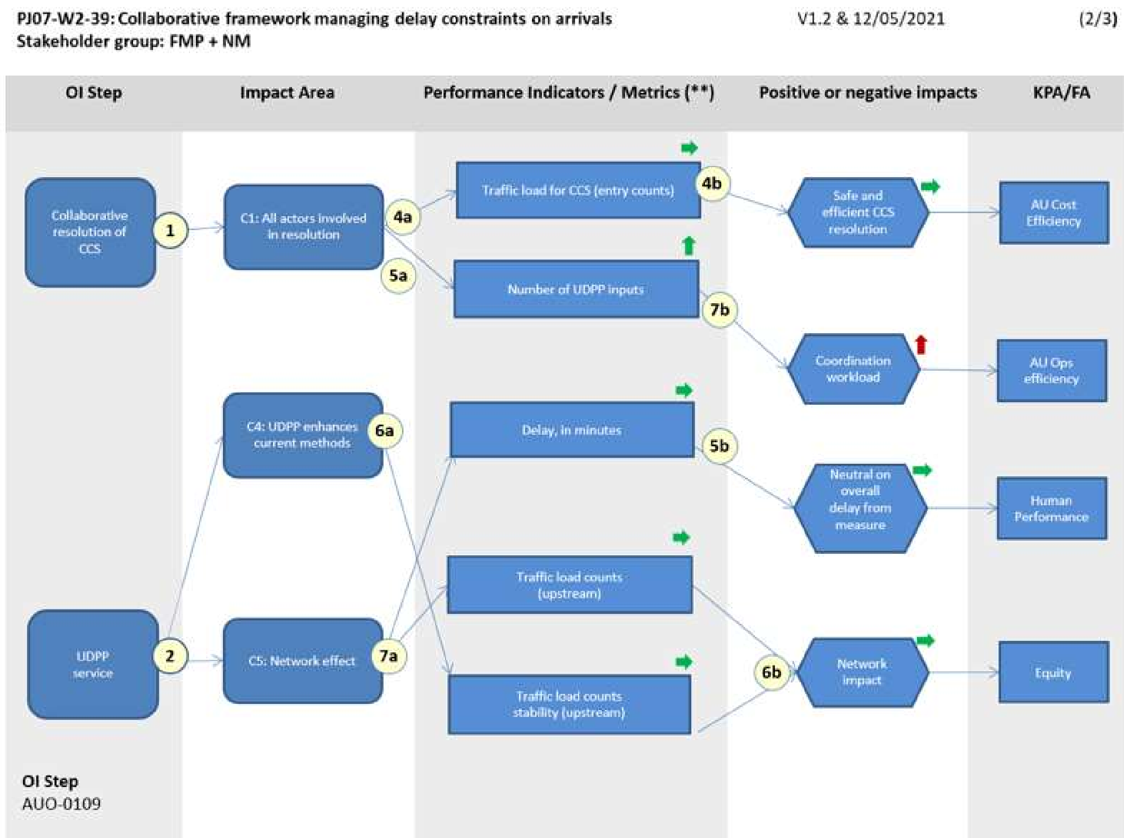
(8a) The UDPP inputs submitted by the AU to the UDPP service lead to the improvement of the reactionary delay (reduction of minutes of delay), as well as the improvement of AUC2 and AUC3 metrics for the given participating AU. The submission of UDPP inputs also potentially leads to the improvement of punctuality of some of AU's flights through reduced reactionary delays in subsequent aircraft rotations.

(8b) Improved punctuality has an overall improvement effect on AU's operational efficiency.

(9a) The UDPP service manages and uses the UDPP inputs from participating AUs. The non-participating AUs will have more chance to be selected in the NCP measure. UDPP service only manages participating AUs' UDPP inputs to optimise the sequence. The selected flights in the NCP measure will be different but the overall ATFM delay remains the same.

(9b) The overall delay from measure remains unchanged.

Stakeholder group: FMP + NM



FMP and NM stakeholders are merged into a single BIM diagram because of the multiple overlaps in the respective separate diagrams. For instance:

- The metrics regarding traffic load counts in upstream sectors/traffic volumes are both a concern for the FMP(s) responsible for the given areas, however at the same time these metrics, when considered in an aggregated fashion, express the impact in the Network, which is an important aspect for NM.
- ATFM delay from the ATFM regulation is the outcome of FMP's solution of the DCB problem and it is an important metric for the respective ANSP. Similarly, the total delay at the Network level is important from the NM perspective.
- The key pre-requisite for AUs' ability to realise the benefits of the collaborative framework for managing constraints on arrivals is the opportunity to express AUs' constraints regarding flights and delay (i.e. UDPP inputs) in the planning phase. This opportunity is granted by the FMP's and/or NM's choice to use the said collaborative process, and secondly by the provision of the UDPP service, managed and provided by NM, that supplies the technological means to support AU's flexibility and objectives.

Feature description:

(1) A Capacity Constrained Situation (CCS) on arrivals is resolved by involving all key stakeholders in the process (C1). AUs are allowed to provide UDPP inputs to optimise their operations by managing the impact of delay. NM function provides the UDPP service. Both the FMP and the

APT have the acceptance/rejection right for the UDPP service outputs, and they have the possibility to intervene in the Optimisation phase (phase 3) of the framework in case the UDPP solution is not acceptable to them. The outcome of the collaborative CCS resolution process resolves the demand-capacity problem (DCB) problem.

(2) UDPP service is embedded in the NM function. The UDPP service receives UDPP inputs from participating AUs and incorporates them into the CCS resolution, thus enhancing the current set of DCB imbalance resolution methods (C4). The UDPP service always maintains an accurate and up-to-date UDPP solution by considering the traffic and constraint situation in the Network. In parallel, the UDPP solution produced by UDPP service affects the traffic and constraint picture within the Network (C5). The UDPP service is a feature that ensures the CCS resolution outcome respects fairness and equity principles wherever applicable. The solution is an NCP measure with TTAs, the UDPP service provides the AU inputs to build the local DCB solution.

Mechanism description:

(4a) The involvement of all actors shall not change the resolution of the CCS. The CCS (hotspot) traffic load resulting from the collaborative framework's measure remains the same as with an equivalent, non-UDPP measure currently available.

(4b) No impact on traffic loads within the CCS preserves the safe and efficient CCS resolution, and thus has no impact on safety.

(5a) AUs actively participate in the CCS resolution by submitting UDPP inputs to optimise their operations.

(5b) FMP and NM perform their respective impact assessments on the outputs of the UDPP service, and in case interventions are needed this may increase the coordination workload for these actors. This may therefore have an impact on human performance aspects.

(6a) The UDPP service manages the UDPP inputs from participating AUs in the measure. The solution is an NCP solution managed by the local DCB (FMP or Airport actor), the TTAs defining the solution will be allocated taking into account the AU UDPP inputs and then the non-participant AUs will have more chance to be selected in the NCP measure.

(6b) The overall delay from measure remains unchanged and equity is preserved. From the NM and FMP perspective, this means that the delay from the measure is constant and does not negatively impact the performance metrics of the ANSP or NM.

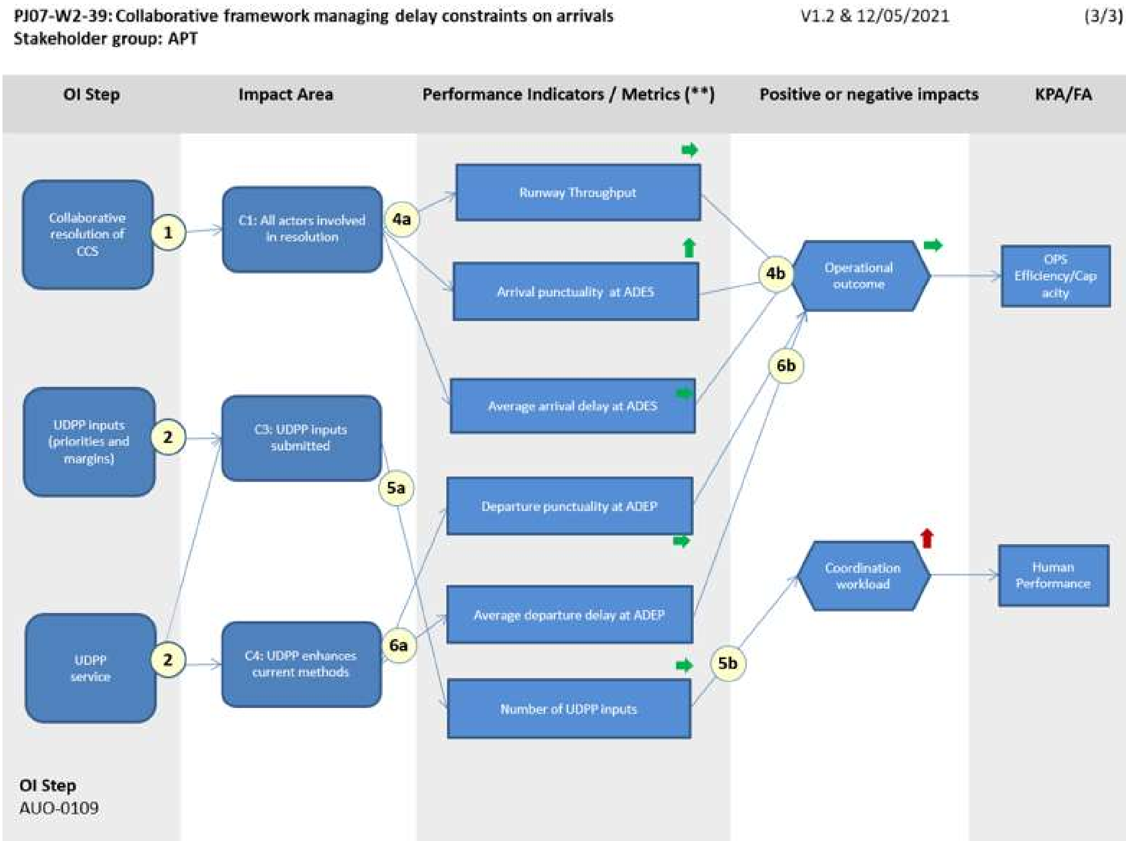
(7a) The UDPP service reflects on participating AUs' UDPP inputs (where possible). As a result, take-off and arrival times, as well as 'times over' in ENR sectors change for individual flights. Such changes may have an impact on the traffic load in the parts of Network that these flights cross but which are outside the target arrival CCS area the measure is resolving. Thus, traffic load counts and traffic count stability in upstream airspace may be affected.

(7b) Volatility as well as saturations in upstream sectors are not negatively affected (in comparison to the situation when the collaborative process is not used), and thus there is no Network impact and subsequently no impact on operational efficiency or capacity.

Stakeholder group: Airport

EUROPEAN PARTNERSHIP

Co-funded by the European Union



Feature description:

(1) A Capacity Constrained Situation (CCS) on arrivals is resolved by involving all key stakeholders in the process (C1). AUs are allowed to provide UDPP inputs to optimise their operations by managing the impact of delay. NM function provides the UDPP service. Both the FMP and the APT have the acceptance/rejection right for the UDPP service outputs, and they have the possibility to intervene in the Optimisation phase (phase 3) of the framework in case the UDPP solution is not acceptable to them. The outcome of the collaborative CCS resolution process resolves the demand-capacity problem (DCB) problem.

(2) UDPP inputs at AUs' disposal are Priorities and Margins. Priorities and margins for individual flights are solely within the remit of the AU. The initial CCS solution is based on a Network Cherry Picking (NCP) measure with Target Time of Arrival (TTA) managed by the Local DCB actor (either the FMP or Airport actor), the UDPP inputs are utilised as an expression of AU constraints to be taken into consideration by the Local DCB when building or refining the CCS solution.

(3) UDPP service receives the UDPP inputs from participating AUs and incorporates them into the CCS resolution (C3), thus enhancing the current set of DCB imbalance resolution methods (C4). The UDPP service does not guarantee that it will be possible to incorporate all of AUs' UDPP inputs at all times. The UDPP service is a feature that ensures the CCS resolution outcome

respects fairness and equity principles wherever applicable. The solution is an NCP measure based on TTAs, the UDPP service provides the AU inputs to build the local DCB solution.

Mechanism description:

(4a) The involvement of all actors shall not change the resolution of the arrival CCS. This CCS (hotspot) resolution does not have an impact on runway throughput (both within and outside of the CCS), and similarly it does not have a negative impact on the overall arrival punctuality at the destination airport, due to constant but differently distributed in-block delay at ADES.

(4b) No impact on key operational outcomes at the destination airport (i.e. the airport with which the arrival CCS is associated) from the new collaborative framework means that there is no impact on airport's capacity and operational efficiency.

(5a) AUs actively participate in the CCS resolution by submitting UDPP inputs to optimise their operations.

(5b) The ADES APT actor runs the airport impact assessment on the outputs of the UDPP service, and in case interventions are needed this may increase the coordination workload for these actors. This may therefore have an impact on human performance aspects.

(6a) The UDPP service manages the UDPP inputs from participating AUs. The solution is a MCP solution, the UDPP service will again manage the TTAs for the participating AUs taking into account their UDPP inputs. The use of UDPP mechanisms does not have an impact on the overall departure punctuality at the outstations for the flights impacted by the CCS and UDPP measure.

(6b) There is no operational impact at the outstations (ADEPs) for the concerned flights. Conversely to the ADES where the impact is concentrated at a single airport (due to the CCS for given airport's arrivals), the impact at the ADEPs is distributed and the volume of flights being subject to UDPP changes is limited at the respective ADEPs. Therefore, there is no operational efficiency or capacity impact at ADEP.