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STRATEGIC ALLOCATION OF TRAFFIC USING REDISTRIBUTION IN THE NETWORK

Better pricing for ATM?

SESAR Innovation Days

Madrid, 26 November 2014

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Background

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Background

- Major actions are needed to ensure that capacity meets expanding demand in the air and at the airports
- Provision of air navigation services is paid through route charges
- Central Route Charging Office (CRCO) operates the common system for billing and collection of route charges
- Unit rates are set to recover a-priori determined costs for a given reference period

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Background

- Today capacity demand imbalances tackled:
  - Strategic and tactical capacity side interventions
  - Tactical demand management (ATFM slots)
- Results in application of costly and likely inequitable measures
- Demand-capacity imbalances can be addressed through Demand management (DM) measures
- We explore the possibility of applying DM measures to be taken primarily at the strategic and pre-tactical level, with special emphasis on market-based mechanisms

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Objectives

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Objectives

- SATURN objective: propose and test realistic ways to use market-based demand-management mechanisms to redistribute air traffic in the European airspace, at the **strategic** level

- Objectives of this work:
  - Set the policy and pricing context
  - Examine current practice
  - Present two possible future scenarios
  - Present model implementation plan
  - Describe the consultation and validation processes

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Definitions

- **Operational environment** – an operational framework for ATM (including who controls the pricing), the system's objectives / policy goals (e.g. with respect to cost recovery and congestion), and the regulatory setting

- **Pricing** (framework) – type and modulation (if any) of the tariffs, how the prices are set strategically and collected tactically

- **Scenario** – combined context of the operational environment and pricing (usually refers to a future case)

- **Mechanism** – protocol (set of rules) for implementing a scenario (more than one mechanism may be effected within a given scenario)

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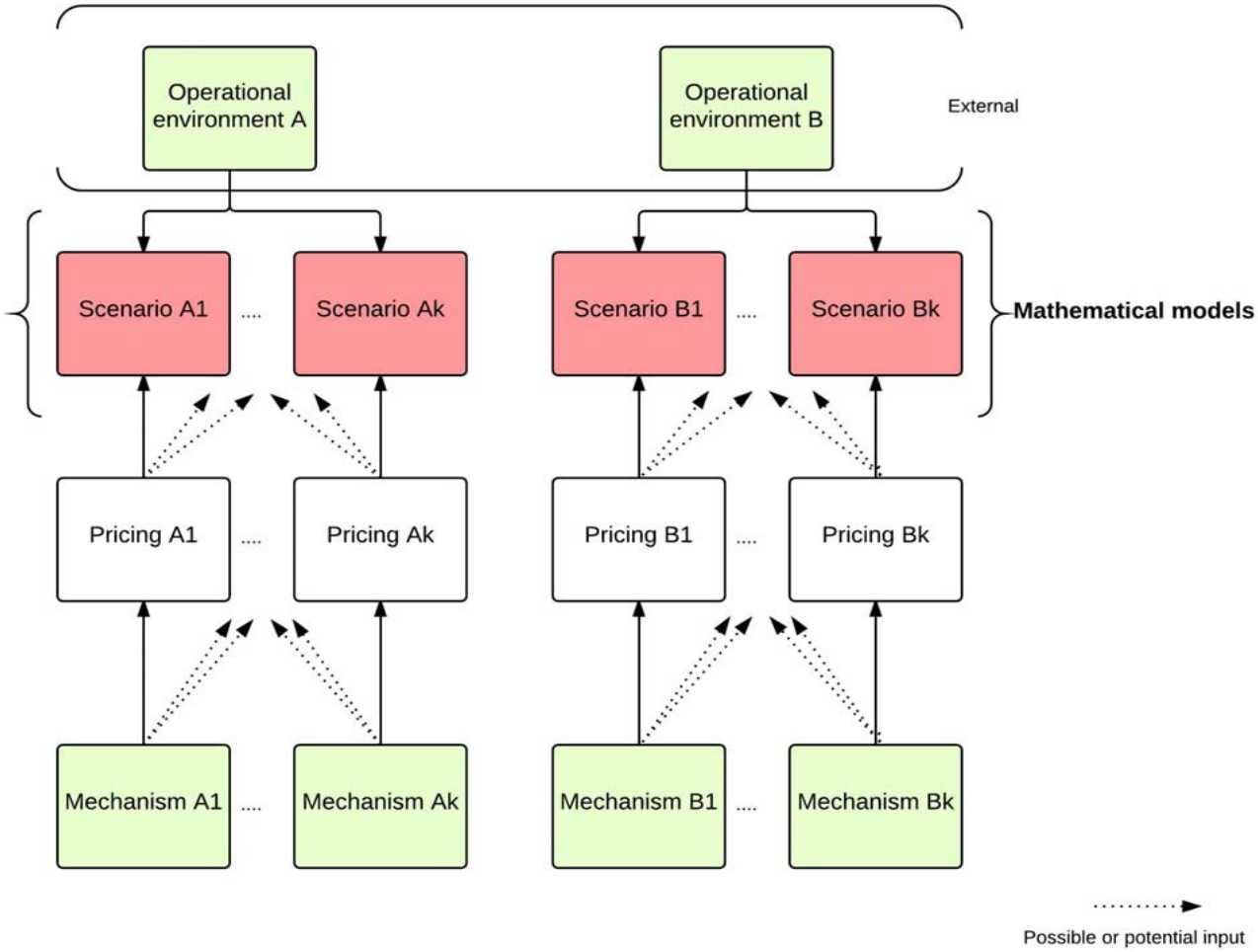
Relations between defined terms



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Policy and pricing context

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Classification criteria (I)

Operational environment-related criteria		
1. Control		
a. Fully centralised	b. Fully market-based	c. Market-based with a regulator
2. Pricing strategy objective		
a. Revenue/cost oriented	b. Resource consumption oriented	c. Both 2(a) and 2(b)

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Classification criteria (II)

Pricing-related criteria			
3. Type of tariff	a. Flat: a fixed fee gives unrestricted access to the network		
	b. First-best: based on exact marginal costs i.e., users pay proportionally to the load they impose to the network		
	c. Second-best: not based on exact marginal costs, i.e., average tariff for all users		
	d. Multi-part: any combination of 3(a)-(c)		
4. Modulation of the tariff	a. Time and space invariant: the network is tariffed in the same way all the time		
	b. Time-dependent, space invariant: prices can vary according to time		
	c. Time-invariant, space dependent: prices can vary according to location in the network		
	d. Time and space dependent: the network is tariffed according to location and time		
5. Users classification	a. No differentiation: all users are equal		
	b. Users are differentiated, e.g. by classes		
6. Price setting strategy	a. Customer-perceived value: willingness to pay determines the price		
	b. Resource-estimated value		
	c. Both 6(a) and 6(b)		
7. Payment	a. Monetary		
	b. Non-monetary: e.g. credits or permits		
	c. Hybrid monetary/non-monetary		
8. Quality of service	a.i. Best effort	a.ii. Guaranteed service	a.iii. Variable
	b. Capped service, e.g. capacity-constrained		
	c. Compensation for service denial		

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Current and future ATM operational environments

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Operational environments

- The operational environment is not something the SATURN project has a control of, but it is our choice of probable future operational environments

- It is a combination of two characteristics:
  - The **control figure** characteristic describes the entity or entities that control the pricing of ATM services
  - The **pricing strategy objective** characteristics describes the main goals of the pricing strategy

- SATURN will explore the following operational environments:
  - Current
  - Centralised
  - Decentralised

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Current operational environment

- Today. From an economic point of view, it is a monopolistic competition, where competitors (ANSPs) are differentiated on a location basis (country boundaries) and competitors' pricing policies are not taken into account

- Two main characteristics are:
  - **Decentralised control**: unit rates are *formally* set by the ANSPs and collected by CRCO. ANSPs provide an input in terms of their determined costs, and have hardly any other impact on the setting of unit rates. It is also to be noted that the SES performance scheme has compulsory cost-efficiency targets, which, in turn, drive unit rates
  - **Pricing strategy objective**: cost recovery – en-route charges are collected to recover operational costs of national ANSPs for ANS services. Linked to binding performance targets

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Centralised operational environment

- Prices are set and modulated, or only modulated, by a central authority whose objectives are cost recovery of ANS expenses and reduction of network congestion

- This operational environment has a central planner, ANSPs as operators and airlines as customers. This configuration is similar to that of rail transport in most European countries

- The two main characteristics are:
  - **Centralised control**: tariff setting and modulation, or only tariff modulation is set and applied by the central planner
  - **Pricing strategy objective**: cost recovery and congestion reduction

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Decentralised operational environment

- Each ANSP, or Functional Airspace Block (FAB), sets its own en-route tariffs and modulation, in order to recover costs and reduce congestion within its own airspace. ANSPs act independently

- The two main characteristics are:
  - **Decentralised control**: each ANSP is responsible for setting its own tariffs and tariff modulation, the regulator for granting cooperation among ANSPs
  - **Pricing strategy objective**: cost recovery and congestion reduction: each ANSP is responsible for its own airspace

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Future pricing options

- Modulation of charges presented
- More liberal options possible
  - Yield management - as the resource is consumed, prices change
  - Trajectory-based pricing
  - Hybrid mechanisms - permits distribution with the possibility of trade
- Equity
  - Equality of outcome - willingnes to pay and congestion damages
  - System with memory over time

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Model implementation overview

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Model implementation

- Scenarios are developed into mathematical models
- Rationale: route charges are adjusted based on time and location of service consumption (resource use), in order to reach desired network equilibrium conditions
- Key assumptions:
  - Fixed demand matrix
  - Capacity constraints are known in advance
  - A finite set of 4D trajectories is available for every flight
  - Users want to minimise their operational costs
  - Revenue neutrality (ANSP revenue)
  - Sector-period based tariffs
- Models tested on small to large scale instances
- Fully developed models to be tested on European wide network

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Consultation and assessment approach

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Assessment indicators

- Assessment indicators currently under consideration include
  - Performance Scheme (RP1 and RP2) indicators
  - SESAR Performance Targets
  - New SATURN-derived indicators
- Additional data may be needed, e.g., to measure punctuality

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Suitable quantitative indicators

Potential assessment indicator	Performance Scheme (RP1/RP2)	SESAR Performance Target	Included in SATURN?
Environmental: Horizontal flight efficiency	X		X
Cost efficiency: En-route service units	X		X
Cost efficiency: Direct ANS cost per flight		X	X
Capacity: En-route ATFM delay	X		X
Sector capacity utilisation			X
Distribution of charges across airlines			X
Cost of delay			X
Departure punctuality		X	X
Arrival punctuality		X	X
Reactionary delay: rotational		X	X
Reactionary delay: non-rotational		X	
Cancellations		X	
Variation in block-to-block times		X	X
Flight operation cost estimation			X

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Consultation

- Two-stage process
- First round of consultations completed:
  - In principle no opposition to modulation of charges. If the process is fair and transparent
  - Airlines willing to pay a premium charge in order to receive a premium service
- Second round next year
  - Consult on early results
  - Validate indicators and modelling rules

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Conclusions

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Conclusions

- Expectations: to provide clear understanding of the benefits and shortcomings, of the various pricing mechanisms available to be introduced at the strategic and pre-tactical level to smooth-out imbalances on the day of operations.

- New developments:

  – Several mathematical models defined

  – Computational experiments ongoing. Small (few hundred flights) to large scale (tens of thousand flights)

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Thank you! Questions?

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