

Price-Setting Auctions for Airport Slot Allocation: a Multi-Airport Case Study

An Agent-Based Computational Economics
Approach to Strategic Slot Allocation

SESAR Innovation Days
Bologna, 2nd December 2015



	Airport slot allocation: a computational economics approach
	The ACCESS simulation platform
	Case study: primary slot auctioning
	Conclusions and future directions

- Continuous growth in air transport $\Rightarrow$ Pressure on airport capacity
- New airports/runways: long look-ahead time, often difficult or unfeasible (cost, environment, land availability, etc.)
- Need for demand management policies for airport capacity:
 - Administrative slot controls ('IATA-based' system)
 - Congestion-based (first-come first-served 'US-like' system)
 - Market mechanisms: congestion pricing, auctions, secondary trading...
 - Hybrid approaches

- Administrative slot allocation has been so far the dominant approach in Europe: Regulation 95/93, based on IATA WSG
 - Primary allocation: grandfather rights + ‘use-it-or-lose’ it rule
 - Secondary allocation: slot transfers under specific circumstances, slot exchanges on a one-for-one basis, slot trading not specifically regulated but accepted in practice
- Previous studies commissioned by the EC have identified several areas for improvement:
 - Transparency and independence of coordinators
 - Consistency between slots and flight plans
 - Economically efficient use of capacity
 - Competition

- Market mechanisms are expected to bring incentives so that scarce capacity is used by those airlines able to make best economic use of it
- However...
 - No agreement on the impact of the proposed changes: different views across stakeholders
 - Risks: impact on airline operating costs, uncertainty for long-term planning, market failures, negative externalities...
 - Many possible market designs: experience in other sectors shows that different market designs may lead to very different outcomes

- Airport slot allocation - challenges:
 - Multiplicity of dimensions and stakeholders
 - Complementary items: complexity of the combinatorial assignment problem
 - Bounded rationality, evolutionary behaviour, asymmetry of information, etc.
 - Uncertainty
- Classical approaches from economics and operations research face important limitations to address some of these issues
- Agent-based modelling provides an appealing framework to tackle these questions

- ACCESS: Application of Agent-Based Computational Economics to Strategic Slot Allocation (SESAR WPE, 2nd CfP)
- Evaluation of different slot allocation mechanisms, with particular focus on market mechanisms:
 - Impact on network performance
 - Distributional analysis
- Modelling and simulation framework based on auction theory and agent-based modelling
- Partners: Nommon, ALG, UVA-INSISOC, UNITS

The ACCESS Simulation Platform

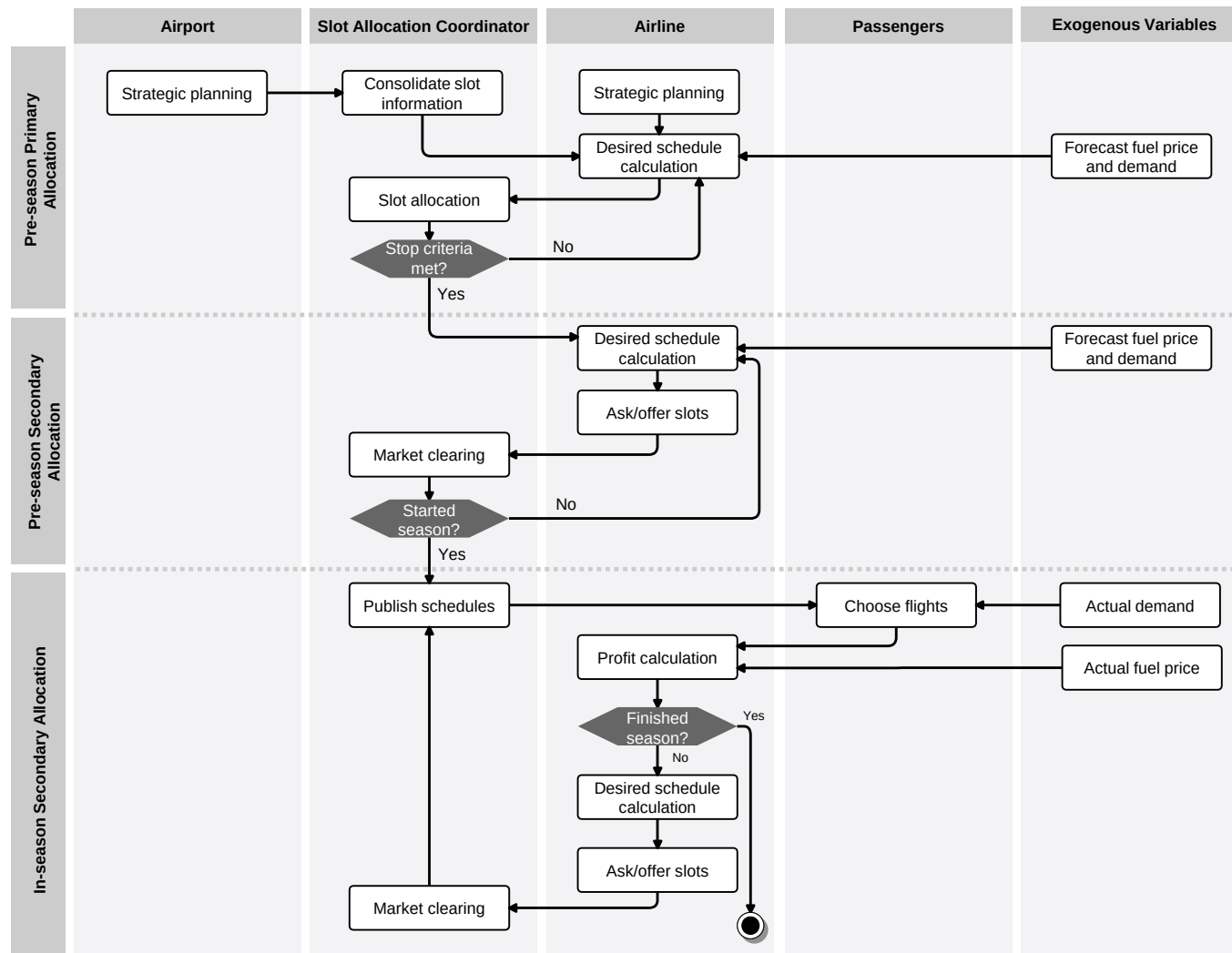
ACCESS simulation platform

- Inputs: primary + secondary slot allocation mechanisms (policies under testing)
- Exogenous variables: demand evolution, airline cost factors
- Agents (attributes + behavioural rules):
 - Airports
 - Airlines
 - Slot allocation coordinator
 - Passengers
- Outputs: KPIs influenced by the slot allocation system
 - Available slots, slot requests, slot prices, slot allocation, slot use
 - Utilities obtained by the airlines, the airports and the passengers

Slot allocation mechanisms

- Primary allocation mechanism:
 - Administrative slot allocation based on EU Regulation 95/93
 - Optimisation-based approach
 - Slot auctioning
- Secondary allocation mechanism:
 - Trading in a decentralised, over-the-counter market
 - Trading in a centralised, organised market

Agent-based model

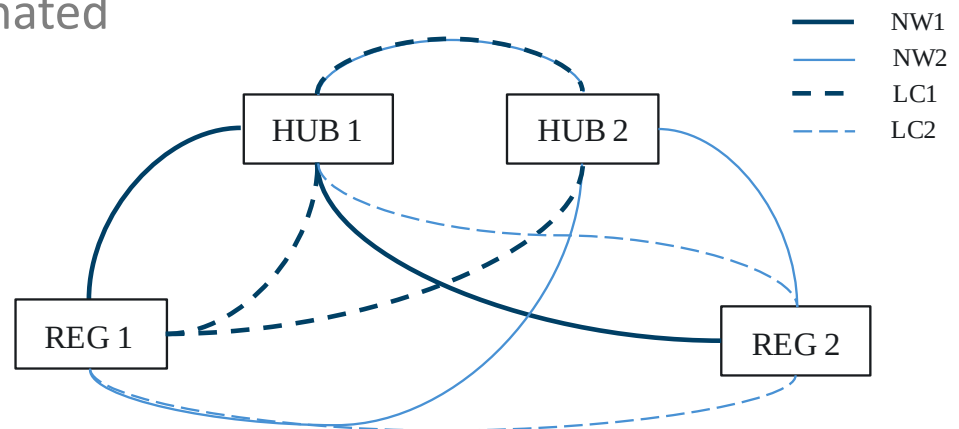


Case Study: Primary Slot Auctioning

Case study: primary auctioning

- Objective: evaluate and demonstrate the capabilities of the model by analysing the performance of the proposed auction in terms of its ability to match capacity and demand, as well as its impact on different types of airlines
- Primary allocation through combinatorial price-setting auction
- Simplified scenario: 4 airports, 4 airlines
- Simulation of a single season
- All available capacity is simultaneously auctioned for all the coordinated airports in the network

- 2 network carriers (NW1, NW2) + 2 low cost carriers (LC1, LC2)
 - Network carriers schedule their flights to/from their hub
 - Low cost operators operate a point-to-point network
- 1 hub for each network carrier (HUB1, HUB2) + 2 regional airports (REG1, REG2)
 - HUB1, HUB2, REG1: coordinated
 - REG2: non-coordinated



Auction type and motivation

Iterative Combinatorial Price-setting Auctions

- **Combinatorial:** allow airlines to bid for combinations of slots
- **Price-setting:** provide prices for slots
 - Different prices for arrival and departure slots
 - Same prices for slots in the same coordination interval
- **Iterative:** consecutive rounds improve the results

Decentralisation

- Split logic: the auctioneer and the bidders solve different problems
- Split complexity: each particular problem is simpler
- The auctioneer only modifies prices to balance supply and demand
- Information privacy (only slot prices and final allocation are public)

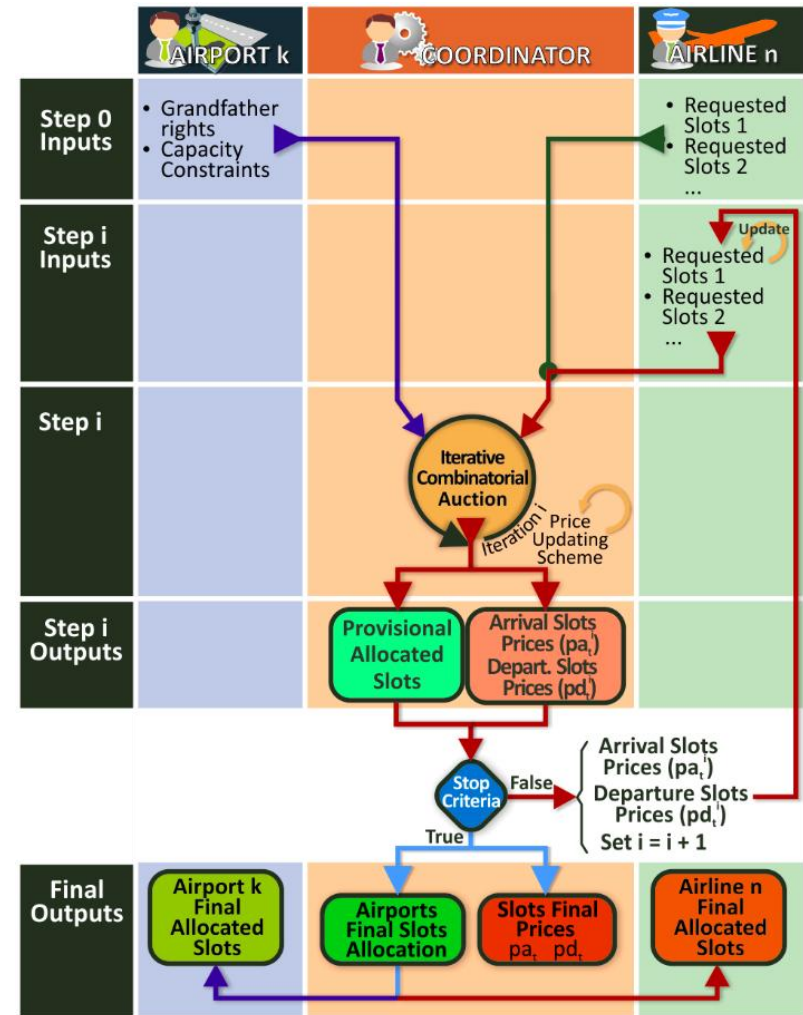
Auction mechanism

Iterative process:

1. Slot prices communicated (a/d)
2. Airlines request their preferred slots according to current prices
3. The coordinator:
 - aggregates the requests
 - compares them with available slots
 - checks stop criteria
 - modifies slot prices

+ Tie-breaking (if needed)

⇒ Final slot allocation and slot prices

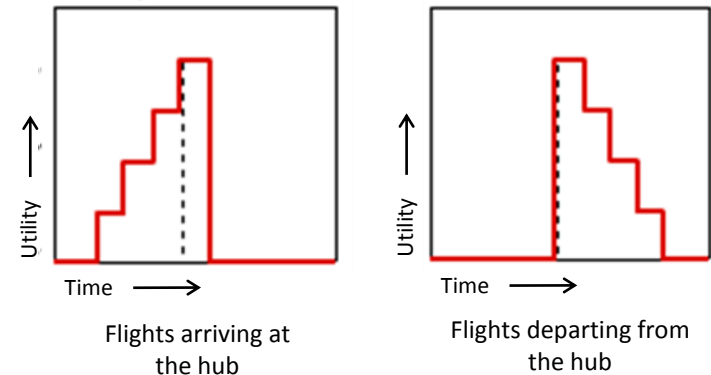


- Each airline intends to operate a pre-defined set of flights
- Each of these flights provides a utility that is a function of the time at which the flight is scheduled
 - If the price of all the slots is 0, airlines will request those slots allowing them to operate their preferred schedule
 - If, as a result of the auction, the prices of certain slots increase, airlines can shift the departure/arrival times of certain flights, so as to maximise the net utility, i.e., the utility obtained from the flight minus the cost of the slots required to operate such flight
 - Airlines may decide to cancel certain flights, if the net utility for all possible options is negative

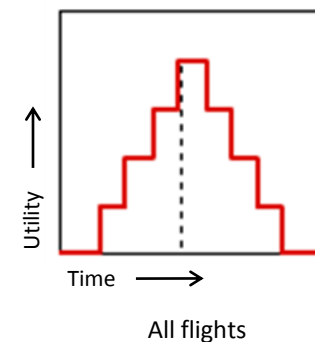
Airline behaviour

- Network carriers schedule their flights in the form of waves of arrivals and departures to/from their hub
- Low cost carriers operate according to a point-to-point network
- Peak utility is higher for network carriers
- Time sensitivity is higher for network carriers

Flight utility for network carriers



Flight utility for low cost carriers



Airlines preferred schedule

Flight ID	Airline	Departure Airport	Preferred TOD	Arrival Airport	Preferred TOA
1	NW1	REG2	7:20	HUB1	8:37
2	NW1	HUB1	10:00	REG2	11:17
3	NW1	REG2	12:10	HUB1	13:27
4	NW1	HUB1	15:55	REG2	17:12
5	NW1	REG2	18:35	HUB1	19:52
6	NW1	HUB1	20:30	REG2	21:47
7	NW1	REG1	7:55	HUB1	8:51
8	NW1	HUB1	10:55	REG1	11:51
9	NW1	REG1	12:55	HUB1	13:51
10	NW1	HUB1	15:45	REG1	16:41
11	NW1	REG1	18:05	HUB1	19:01
12	NW1	HUB1	20:00	REG1	20:56
13	NW1	REG1	21:40	HUB1	22:36
14	NW1	HUB1	22:40	REG1	23:36
15	NW2	REG1	7:25	HUB2	9:29
16	NW2	HUB1	7:15	HUB2	8:51
17	NW2	REG2	7:30	HUB2	8:36
18	NW2	REG2	8:45	HUB2	9:51
19	NW2	HUB1	8:25	HUB2	10:01
20	NW2	HUB2	10:00	HUB1	11:36
21	NW2	HUB2	10:15	REG2	11:21
22	NW2	HUB2	11:10	REG1	13:14
23	NW2	HUB2	11:00	HUB1	12:36
24	NW2	HUB2	12:00	REG2	13:06
25	NW2	REG2	13:05	HUB2	14:11
26	NW2	HUB1	12:50	HUB2	14:26
27	NW2	REG1	13:35	HUB2	15:39
28	NW2	HUB1	14:15	HUB2	15:51
29	NW2	REG2	14:20	HUB2	15:26
30	NW2	REG1	14:35	HUB2	16:39
31	NW2	REG2	15:20	HUB2	16:26
32	NW2	HUB2	16:00	HUB1	17:36
33	NW2	HUB2	16:10	REG2	17:16
34	NW2	HUB2	17:20	REG1	19:24
35	NW2	HUB2	17:00	HUB1	18:36
36	NW2	HUB2	17:15	REG2	18:21
37	NW2	HUB2	17:30	REG1	19:34
38	NW2	HUB2	18:00	HUB1	19:36
39	NW2	REG1	18:50	HUB2	20:54
40	NW2	HUB1	19:00	HUB2	20:36
41	NW2	REG2	19:40	HUB2	20:46
42	NW2	HUB1	20:15	HUB2	21:51
43	NW2	HUB2	21:00	REG2	22:06
44	NW2	HUB2	21:30	HUB1	23:06
45	NW2	HUB2	21:40	REG1	23:44
46	NW2	HUB2	21:50	REG2	22:56

Flight ID	Airline	Departure Airport	Preferred TOD	Arrival Airport	Preferred TOA
47	LC1	HUB2	6:35	REG1	8:39
48	LC1	HUB2	7:15	HUB1	8:51
49	LC1	REG1	7:50	HUB1	8:46
50	LC1	HUB1	9:30	HUB2	11:06
51	LC1	HUB1	9:55	REG1	10:51
52	LC1	REG1	13:00	HUB2	15:04
53	LC1	HUB2	14:05	HUB1	15:41
54	LC1	REG1	16:25	HUB1	17:21
55	LC1	HUB1	16:20	HUB2	17:56
56	LC1	HUB2	17:20	REG1	19:24
57	LC1	HUB1	18:00	REG1	18:56
58	LC1	HUB2	17:55	HUB1	19:31
59	LC1	REG1	19:50	HUB2	21:54
60	LC1	HUB1	20:15	HUB2	21:51
61	LC2	REG2	6:45	HUB1	8:02
62	LC2	HUB1	8:40	REG2	9:57
63	LC2	REG1	12:10	REG2	13:27
64	LC2	REG2	15:40	REG1	16:57
65	LC2	REG2	18:30	HUB1	19:47
66	LC2	HUB1	20:25	REG2	21:42

Airport capacity

HUB1	Coord time interval	
	10min	60min
ARR	1	4
DEP	1	4
TOTAL	1	6

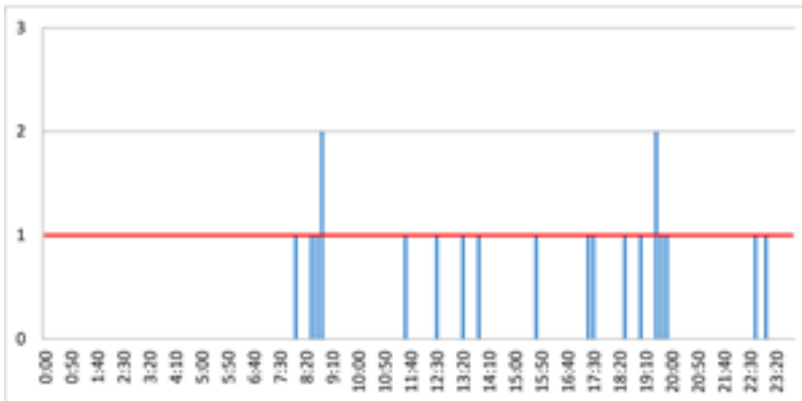
REG1	Coord time interval
	20min
ARR	3
DEP	3
TOTAL	4

HUB2	Coordination Time Interval					
	10 min			1 hour		
	ARR	DEP	TOTAL	ARR	DEP	TOTAL
0:00	0	0	1	2	2	3
1:00	0	0	1	1	2	3
2:00	0	0	1	1	1	2
3:00	0	0	1	1	1	2
4:00	0	0	1	1	1	2
5:00	0	0	1	2	2	3
6:00	1	0	1	2	2	5
7:00	1	1	1	3	4	7
8:00	1	1	1	4	4	7
9:00	1	1	1	4	4	7
10:00	1	1	1	4	4	8
11:00	1	1	1	4	4	7
12:00	1	1	1	3	4	7
13:00	1	1	1	3	4	7
14:00	1	1	1	4	4	7
15:00	1	1	1	3	4	7
16:00	1	1	1	3	4	7
17:00	1	1	1	4	4	7
18:00	1	1	1	4	4	7
19:00	1	1	1	4	4	7
20:00	1	1	1	3	4	7
21:00	1	1	1	3	3	6
22:00	1	1	1	3	2	5
23:00	0	1	1	2	2	4

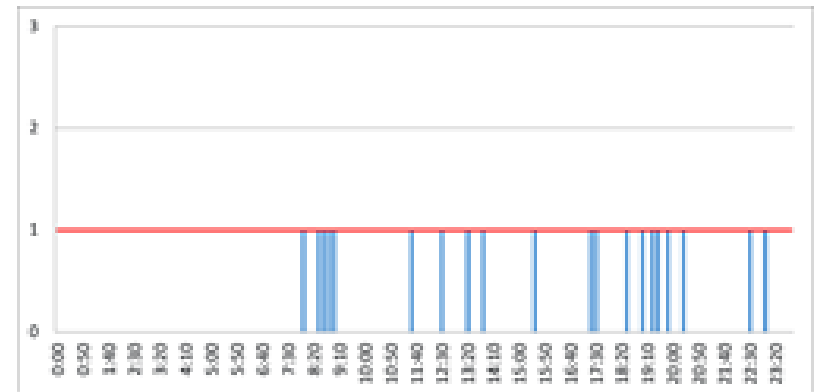
Results

Demand and capacity balancing

- Example: arrivals in HUB1 - capacity vs slot requests

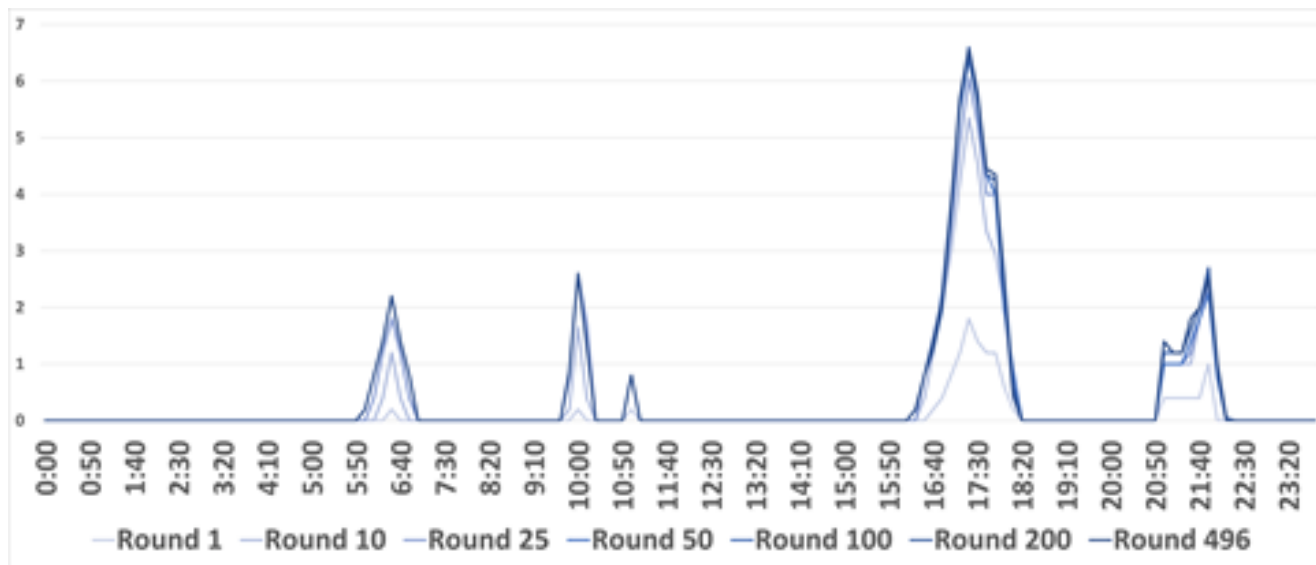


Initial slot requests



Final slot requests

- Example: evolution of HUB2 departure slot prices along the auction



Slot allocation

Flight ID	Airline	Departure Airport	Obtained Departure Slot	Arrival Airport	Obtained Arrival Slot	Net Flight Utility
1	NW1	REG2	-	HUB1	8:30	18.80
2	NW1	HUB1	10:00	REG2	-	20.00
3	NW1	REG2	-	HUB1	13:20	20.00
4	NW1	HUB1	15:50	REG2	-	20.00
5	NW1	REG2	-	HUB1	19:50	17.10
6	NW1	HUB1	20:30	REG2	-	17.60
7	NW1	REG1	7:40	HUB1	8:50	18.20
8	NW1	HUB1	10:50	REG1	11:40	20.00
9	NW1	REG1	12:40	HUB1	13:50	20.00
10	NW1	HUB1	15:40	REG1	16:40	19.20
11	NW1	REG1	18:00	HUB1	19:00	16.90
12	NW1	HUB1	20:00	REG1	20:40	15.80
13	NW1	REG1	21:40	HUB1	22:30	20.00
14	NW1	HUB1	22:40	REG1	23:20	20.00
15	NW2	REG1	7:20	HUB2	9:20	18.00
16	NW2	HUB1	7:10	HUB2	8:50	18.00
17	NW2	REG2	-	HUB2	8:30	18.00
18	NW2	REG2	-	HUB2	9:40	16.62
19	NW2	HUB1	8:10	HUB2	9:50	14.92
20	NW2	HUB2	10:00	HUB1	11:30	15.40
21	NW2	HUB2	10:10	REG2	-	16.70
22	NW2	HUB2	11:10	REG1	13:00	18.00
23	NW2	HUB2	11:00	HUB1	12:30	17.20
24	NW2	HUB2	12:00	REG2	-	18.00
25	NW2	REG2	-	HUB2	14:10	18.00
26	NW2	HUB1	12:50	HUB2	14:20	18.00
27	NW2	REG1	13:20	HUB2	15:30	17.20
28	NW2	HUB1	14:10	HUB2	15:50	17.20
29	NW2	REG2	-	HUB2	15:20	17.20
30	NW2	REG1	14:20	HUB2	16:30	17.20
31	NW2	REG2	-	HUB2	16:20	17.80
32	NW2	HUB2	16:00	HUB1	17:30	18.00
33	NW2	HUB2	16:10	REG2	-	18.00
34	NW2	HUB2	17:20	REG1	19:20	11.45
35	NW2	HUB2	17:00	HUB1	18:30	14.20
36	NW2	HUB2	17:10	REG2	-	12.30
37	NW2	HUB2	17:30	REG1	19:20	12.25
38	NW2	HUB2	18:00	HUB1	19:30	14.75
39	NW2	REG1	18:40	HUB2	20:50	17.65
40	NW2	HUB1	18:40	HUB2	20:10	15.03
41	NW2	REG2	-	HUB2	20:40	17.65
42	NW2	HUB1	20:10	HUB2	21:50	13.40
43	NW2	HUB2	21:00	REG2	-	16.60
44	NW2	HUB2	21:30	HUB1	23:00	16.20
45	NW2	HUB2	21:40	REG1	23:40	16.00
46	NW2	HUB2	22:00	REG2	-	15.62

Flight ID	Airline	Departure Airport	Obtained Departure Slot	Arrival Airport	Obtained Arrival Slot	Net Flight Utility
47	LC1	HUB2	7:00	REG1	9:00	13.91
48	LC1	HUB2	7:20	HUB1	9:00	14.75
49	LC1	REG1	7:40	HUB1	8:40	14.30
50	LC1	HUB1	9:20	HUB2	10:50	15.30
51	LC1	HUB1	9:50	REG1	10:40	16.00
52	LC1	REG1	12:40	HUB2	14:50	15.30
53	LC1	HUB2	13:50	HUB1	15:30	15.30
54	LC1	REG1	16:20	HUB1	17:20	16.00
55	LC1	HUB1	16:20	HUB2	17:50	15.35
56	LC1	HUB2	18:10	REG1	20:00	12.07
57	LC1	HUB1	18:00	REG1	18:40	16.00
58	LC1	HUB2	18:40	HUB1	20:20	11.37
59	LC1	REG1	20:00	HUB2	22:10	14.61
60	LC1	HUB1	20:40	HUB2	22:20	12.61
61	LC2	REG2	-	HUB1	8:00	13.60
62	LC2	HUB1	8:20	REG2	-	12.33
63	LC2	REG1	12:00	REG2	-	14.00
64	LC2	REG2	-	REG1	17:20	14.00
65	LC2	REG2	-	HUB1	19:20	12.58
66	LC2	HUB1	21:00	REG2	-	11.76

- Example – LC1:
 - Flight #57 scheduled on originally preferred time
 - Flight #58 shifted from HUB2 peak time so as to maximize net utility

Flight ID	Airline	Departure Airport	Preferred TOD	Arrival Airport	Preferred TOA
47	LC1	HUB2	6:35	REG1	8:39
48	LC1	HUB2	7:15	HUB1	8:51
49	LC1	REG1	7:50	HUB1	8:46
50	LC1	HUB1	9:30	HUB2	11:06
51	LC1	HUB1	9:55	REG1	10:51
52	LC1	REG1	13:00	HUB2	15:04
53	LC1	HUB2	14:05	HUB1	15:41
54	LC1	REG1	16:25	HUB1	17:21
55	LC1	HUB1	16:20	HUB2	17:56
56	LC1	HUB2	17:20	REG1	19:24
57	LC1	HUB1	18:00	REG1	18:56
58	LC1	HUB2	17:55	HUB1	19:31
59	LC1	REG1	19:50	HUB2	21:54
60	LC1	HUB1	20:15	HUB2	21:51

Initial schedule

Flight ID	Airline	Departure Airport	Obtained Departure Slot	Arrival Airport	Obtained Arrival Slot	Net Flight Utility
47	LC1	HUB2	7:00	REG1	9:00	13.91
48	LC1	HUB2	7:20	HUB1	9:00	14.75
49	LC1	REG1	7:40	HUB1	8:40	14.30
50	LC1	HUB1	9:20	HUB2	10:50	15.30
51	LC1	HUB1	9:50	REG1	10:40	16.00
52	LC1	REG1	12:40	HUB2	14:50	15.30
53	LC1	HUB2	13:50	HUB1	15:30	15.30
54	LC1	REG1	16:20	HUB1	17:20	16.00
55	LC1	HUB1	16:20	HUB2	17:50	15.35
56	LC1	HUB2	18:10	REG1	20:00	12.07
57	LC1	HUB1	18:00	REG1	18:40	16.00
58	LC1	HUB2	18:40	HUB1	20:20	11.37
59	LC1	REG1	20:00	HUB2	22:10	14.61
60	LC1	HUB1	20:40	HUB2	22:20	12.61

Final schedule

Impact per airline type

- NW1 and NW2 are willing to pay higher sums to get slots as close as possible to their preferences, while LC1 and LC2 prefer to get cheaper slots at the expense of more shifted flights

Airline		Average Price Paid per Slot (m.u.)	
Network carriers	NW1	1.15	1.35
	NW2	1.44	
Low cost carriers	LC1	0.41	0.35
	LC2	0.21	

Airline		Percentage of Total Flights Shifted from Preferred Schedule	
Network carriers	NW1	7.14%	13.04%
	NW2	15.63%	
Low cost carriers	LC1	62.29%	65%
	LC2	66.67%	

Distributional analysis

- Analysis of equity and distributional issues: distribution of benefits and costs among stakeholders
- Example: utility finally obtained by each airline

Airline		Maximum Utility (m.u.)		Final Utility (m.u.)		Difference
Network carriers	NW1	280	856	158.8	600.5	-30%
	NW2	576		441.7		
Low cost carriers	LC1	224	308	202.9	281.1	-9%
	LC2	84		78.3		

Conclusions and future directions

- Main results:
 - Simulation of the behaviour of a set of airlines competing over a congested airport network
 - Prediction of the resulting schedule and the utilities obtained by the airlines. Airlines are affected in different ways, depending on their business model
- The auction allows the balancing of capacity and demand in a decentralised manner, without the need for airlines to disclose sensitive information
- The available capacity is allocated to those airlines able to make best economic use of it, and the economic value of each slot emerges from the auction

- Model enhancements:
 - More complex/realistic behavioural models (e.g., learning capabilities)
 - Explore other behaviour (e.g., anticompetitive practices)
- Optimisation of auction design to minimise convergence time and analysis of scalability in more complex scenarios
- Comparison of auctions vs current administrative system
- Ability to yield an optimal solution according to different optimisation criteria (e.g., maximisation of social welfare)
- Combine primary and secondary slot allocation mechanisms along several seasons in more complex and realistic scenarios able to inform future policy developments
- Consider slot allocation in several markets (e.g., US and Europe)



NOMMON

www.access-sesar.eu

Ricardo Herranz

Nommon Solutions and Technologies

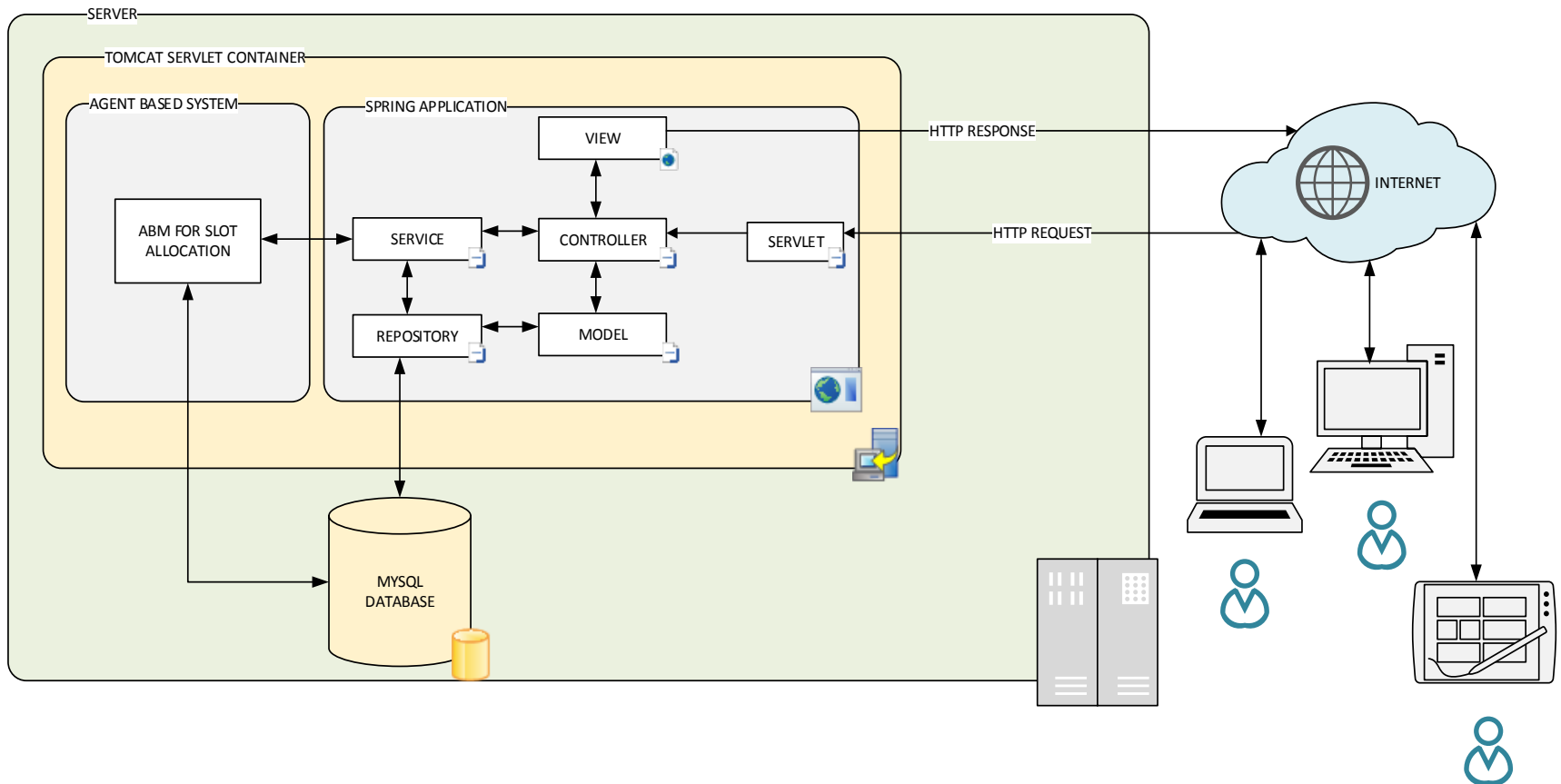
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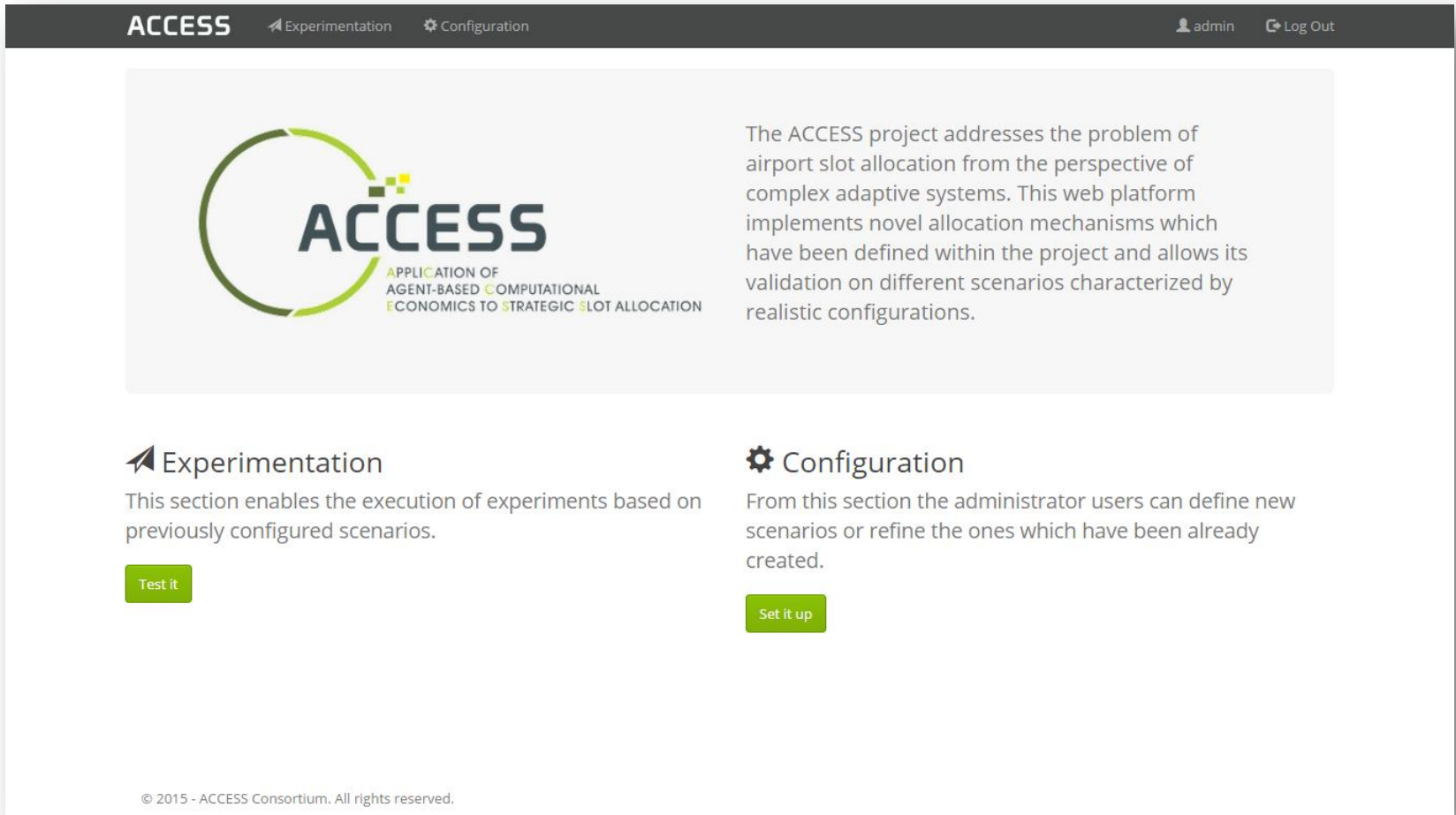
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Back-up slides:
ACCESS simulation platform

System architecture





The screenshot displays the user interface of the ACCESS web application. At the top, a dark navigation bar contains the 'ACCESS' logo, links for 'Experimentation' and 'Configuration', and user controls for 'admin' and 'Log Out'. The main content area features a large hero section with the ACCESS logo and a descriptive paragraph about the project's focus on airport slot allocation. Below this, two columns present the 'Experimentation' and 'Configuration' sections, each with a brief description and a prominent green button to initiate the respective function. The footer includes a copyright notice for the ACCESS Consortium.

ACCESS
APPLICATION OF
AGENT-BASED COMPUTATIONAL
ECONOMICS TO STRATEGIC SLOT ALLOCATION

The ACCESS project addresses the problem of airport slot allocation from the perspective of complex adaptive systems. This web platform implements novel allocation mechanisms which have been defined within the project and allows its validation on different scenarios characterized by realistic configurations.

Experimentation

This section enables the execution of experiments based on previously configured scenarios.

[Test it](#)

Configuration

From this section the administrator users can define new scenarios or refine the ones which have been already created.

[Set it up](#)

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ACCESS
Experimentation
Configuration
david
Log Out

Scenarios
Airlines
Alliances
Airports
Aircraft

Airlines

Create a new instance or select an existing one

Name

Identifier

General information

Business model

Alliance

Hubs
Hub 2 (HUB2)
Regional 1 (REG1)
Regional 2 (REG2)

Fleet

		ACR1	ACR2	ACR3
Aircrafts	units	2	2	0
Direct cost	€/km	1520	1126	0.00
Indirect cost	%	100	100	0

☐ Allow fleet modification

Turnaround times

Airport		ACR1	ACR2	ACR3
HUB1	minutes	50	60	0
HUB2	minutes	50	60	0
REG1	minutes	45	50	0
REG2	minutes	40	35	0

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ACCESS

Documentation Configuration

Save Logout

Scenarios

Airlines

Alliances

Airports

Aircraft

Scenarios

Create a new instance or select an existing one

Name

Scenario 1

Description

This scenario implements the hub airports and the network airline companies defined in D4.1, allowing to test it in a situation in which the fuel price experiences a high increase and the demand follows the reference profile.

Access level

☒ Private
 ☐ Public

Timeline

Time horizon

20 years

Simulation step

1 month

Airlines set

Airlines

Network 1 (N1)

Network 2 (N2)

Low Cost 1 (LC1)

Low Cost 2 (LC2)

☐ Allow modification of airline fleet

Airports set

Airports

Hub 1 (H1)

Hub 2 (H2)

Regional 1 (R1)

Regional 2 (R2)

☐ Allow expansion of airports capacity
☐ Allow modification of airports landing fees

Grandfather rights

Airport	Airline	0:00		0:10		0:20		0:30	
		Arrival	Departure	Arrival	Departure	Arrival	Departure	Arrival	Departure
HUB1	TOTAL	Operations	1	1	1	1	1	1	1
HUB1	N1	Operations	0	0	0	0	0	0	0
HUB1	N2	Operations	0	0	0	0	0	0	0
HUB2	TOTAL	Operations	1	1	1	1	1	1	1
HUB2	N1	Operations	0	0	0	0	0	0	0
HUB2	N2	Operations	0	0	0	0	0	0	0

Demand forecast

Origin	Destination	M1	M2	M3	M4	M5	M7	
HUB1	HUB2	passengers	34198	33056	41859	40912	42584	42553
HUB2	HUB1	passengers	33980	32838	41627	40808	42546	42258

Demand volatility

Medium

Fuel price forecast

Fuel price profile

Reference

Price volatility

Medium

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ACCESS
Experimentation
Configuration
david
Log Out

New experiment
Experiments results

New experiment

Name
Experiment A.1

Slot allocation mechanisms

Primary allocation mechanism
Combinational auction with a Walrasian non-adaptive regular Tâtonnement price update

Secondary allocation mechanism
None

Scenario configuration

Scenario
Scenario 1

This scenario implements the hub airports and the network airline companies defined in D4.1, allowing to test it in a situation in which the fuel price experiences a high increase and the demand follows the reference profile.

Time horizon
20 years

Simulation step
1 months

Frequency of Primary allocation
6 months

Auction configuration on Primary allocation

Initial prices
Zero

Alpha-up
0.20

Alpha-down
0.15

Stop criterion
Maximum number of rounds reached (C1)

Lambda
0

Delta
30

Gamma
0.25

Feasibility adaptation

Mechanism
Random

Simulation configuration

Number of replicas
100 replicas

Max processing time
12 hours

Execute
Clear

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New experiment
Experiments results

Experiments results

Id	Name	User	Date	Status	Actions
150	Experiment C.1	user	12 May 2015	Finished	Results
151	Experiment A.2	user	12 May 2015	Finished	Results
152	Experiment A.3	user	13 May 2015	Finished	Results
153	Experiment A.4	user	13 May 2015	Finished	Results
154	Experiment B.1	user	14 May 2015	Error	Error
155	Experiment B.2	user	18 May 2015	Finished	Results
156	Experiment B.3	user	18 May 2015	Processing	Wait
157	Experiment C.1	user	18 May 2015	Waiting	Wait
158	Experiment C.2	user	18 May 2015	Waiting	Wait
160	Experiment A.1	david	19 May 2015	Waiting	Wait

«
1
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