Performance measurement in a world of targets and trade-offs

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Performance measurement in a world of targets and trade-offs

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Overview

- Performance measurement
  - some key challenges
  - SESAR 2020 Scientific Committee (TF3)
- KPAs, KPIs and metrics
- Targets and the future of the European ATM system
- Further exploration of trade-offs
- Questions for discussion
• Performance measurement
  – some key challenges
  – SESAR 2020 Scientific Committee (TF3)
High-level summary of challenges

- Spatial scope
  - G2G -> D2D context; intermodality – disruptive change?

- Better stakeholder alignment
  - pax- & cost-centricity; Performance Scheme opportunities

- Trade-offs
  - perennial topic; inter- & intra-KPA; where next?

- Oversight v. insight
  - typically NW level; complementarity (classical & complexity)

- Standardisation v. adaptability
  - comparative validity v. context-sensitivity (pax, ANSPs; global)

- Data and modelling context
Spatial scope

• Flightpath 2050 *(ACARE, 2011)*
  – “highly ambitious goals” *(x5)*
  – “90% of travellers within Europe are able to complete their journey, door-to-door within 4 hours”

• Flight-centric → pax-centric metrics
  – pax delay, driving costs & behaviour
  – 1.6 – 1.7 (US); 1.3 – 1.9 (Europe)
  – can’t always detect changes with flight-centric metrics alone

• How measure progress without the right metrics? (Current G2G?)
• Where are the key compressibilities to move towards 4H D2D?
• What new metrics do we need? (DG MOVE Aviation Strategy for Europe)
  - several new, challenging trade-offs are immediately apparent!
• What are the potential (integration) impacts on ATM?
  - e.g. for Essential Operational Changes, such as UDPP
  - e.g. for ATM Technology Changes, such as A-CDM
• Pax need? Impact on supply, of social norms (EC: speed paradigm)
Spatial scope

01 access and equity
02 capacity
03 cost effectiveness
04 efficiency
05 environment
06 flexibility
07 interoperability
08 participation & collaboration
09 predictability
10 safety
11 security

wrt baselines (current, 2035, 2050)
- APT access/egress modes used
- with/without bags
- min. ‘necessary’ waits (e.g. gate)
- buffers (elective wait; pax / a/c)
- MCTs
- terminal / taxi configs
- available route / ~ GCD / FR
- ATFM

- phase c.f. transition
- ‘unproductive’ time
Better stakeholder alignment

• Pax-centricity
  – more mature metric development in US (data-enabled)
  – future alignment with demand and utilities (VoT)

• Cost-centricity (detection c.f. flight-centric)
  – cost of delay supra-linear c.f. delay duration
  – cost of cancellation
  – cost of predictability (c.f. average delay)
  – (cost of) resilience
  – co-assessment with non-monetised metrics

• Performance Scheme opportunities (re. RP3, i.e. 2020-4)
  – better mapping of targets with SESAR deployment (e.g. Common Projects)
  – wider stakeholder inclusion (e.g. AUs and airports)
Trade-offs

- several projects, past and present (APACHE & Vista); CW ‘Challenges’

- various methods (e.g. influence diagrams, multi-criteria optimisation)

- demand for a multi-stakeholder tool
Trade-offs

2016 traffic at pre-economic crisis level of 2008

2016: third consecutive year that punctuality has fallen

PRR 2016 (draft)

Share of arrivals within 15 min of scheduled time

80.5% of arrival were punctual (-1.6% pt vs 2015)

Source: CODA
Increase in en-route ATFM delays (20.9% increase 2016 re. 2015)
Average delay = **0.86** mins/flt; RP2 target = **0.50** (2015-19)
Capacity/staffing issues remain by far the main driver
Trade-offs

Target: 1.0 mins/flt (summer e/r)
Actual: 1.9 mins/flt (summer e/r)
Cost: €1.6-1.7 bn (total ATFM)

ATFM slots, actual distribution, 2008. (NB. 88% IFR flights no ATFM delay; 92% in 2016.)
## Trade-offs

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Many different 90% 4H D2D curves exist, depending on:
- policy / regulation
- technology (c.f. ATFM / UDPP mechanisms)
- intermodality
- etc.
Oversight v. insight

Metric landscape

future requirements, improved contexts:
- market research (utilities etc.)
- wider economics (cost of delay, supply-demand, subsidy, etc.)

e.g. delay propagation mechanisms

average delay
Oversight v. insight

Complexity science

- Multidisciplinary; system of systems – usually a network
  - multiple components, non-linear dynamics
  - system properties cannot be predicted as a sum of the parts
  - non-analytical models, e.g. agent-based
  - usually need to take uncertainty into account
- Emergent behaviour, e.g. delay propagation
- ATM = complex socio-technical system
- How can complexity science contribute?
  - user-defined nodes/links in topological networks
  - existing metrics such as centralities (causality)
  - existing methods such as community detection, percolation theory and network vulnerability (analysis and treatment of nodes)

(JS Mill, 1872)
3.3.1 En-route ATFM delays

Please note that software release 20.0 of the Network Manager on 04 April 2016 introduced a change to improve the accuracy of the ATFM delay calculation for operational purposes which resulted in an estimated overall reduction of 11.8% of delay compared to the old methodology. More information on the change is available online at www.ansperformance.eu.

- Cost of delay (reg^N)
- Passenger demand (speed paradigm) and utility
- [...]
Data and modelling context

• Data
  – literature demonstrates many sampling and data constraints
  – how much of a network is ‘enough’? (non-saturation of metrics)
  – top 34 airports (Europe & US) => ≈2% error (thus care)
  – similar issues with data cleaning
  – accessibility in Europe improving (but: manuals, awareness, confidentiality)
  – big data: diversity / open architectures, integrity – dynamic metrics?
  – originally-filed flight plans (IFPS archives)

• Standardisation and comparability
  – EU-US harmonised KPI reporting, in coordination with ICAO
  – collaborations between China and US, China and EUROCONTROL
  – ATFM delay established as a proven leading indicator
  – standard (clean) datasets, c.f. other disciplines
S2020 Scientific Committee (TF3)

- Performance measurement in European air transport
  - key challenges and potential solutions
- Objectives
  - establishing key definitions
  - summarise state of the art, including European regulatory context
  - compare and contrast different indicators used (e.g. across stakeholders; across international schemes) and review critically
  - summarise current and recent research initiatives
  - identify key emerging challenges and key-trade-off analysis methods
  - propose initial solutions to (some of) emerging challenges (later!)
- Potential collaborations
  - PRU, ICAO, ART members (?)