Waterways serving urban areas thanks to data-driven decision making

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IW-Net objectives

- **Fostering adoption of innovative technologies in Inland Waterway Transport sector:**
  - data-driven cargo management along the multimodal supply chain
  - sustainable waterways infrastructures management
  - innovative vessels with high degree of automation

- **Through the implementation of a multimodal optimization process across the EU transport system:**
  - paving the way of smooth multimodal flows serving urban areas
  - increasing the modal share of inland waterway transportation
  - and then cut transport's carbon footprint

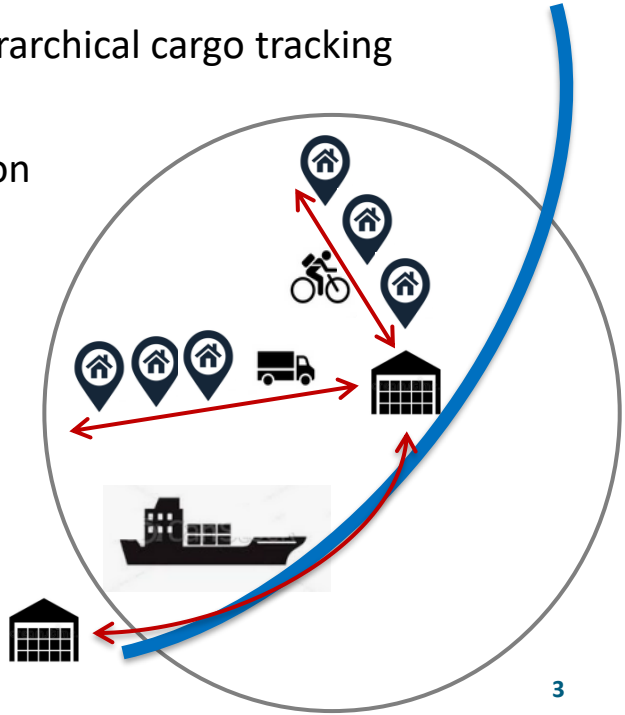
AS1a scenario: transportation of goods into dense urban areas

⇨ Increasing IWT efficiency thanks to reactive data-driven decision making

- based on real-time tracking data availability:
  - with embedded IoT sensors for an end-to-end real-time hierarchical cargo tracking
- enabling to choose the optimal multimodal route
  - at different levels of decision : tactical, operational, execution
  - optimal planning & allocation of residual capacities
- for uses-cases such as
  - late delivery, damage to goods
  - suspicion of a break in the cold chain
  - data-driven update of a transport order

⇨ Applying revenue management optimization

⇨ Benefiting by novel blockchain paradigm introduction



AS1a scenario stakeholders

⇨ Technical partners implementing IW-Net solutions:

- Revenue management optimization & data analytics : UPHF & ICCS
- Hierarchical tracking (EPCIS – IoT): IT-Optics, NGS & Multitel
- Block Chain : Inlecom, ICCS

⇨ Logistics partners testing IW-Net solutions:

- Sogestran & Blue Line Logistics with :
  - Zulu and its on board crane (small barge dedicated to pallets transportation)
  - FlexiMalle, a terrestrial container dedicated to urban logistics
- Ports of Brussels
  - with its Brussels Consolidation Construction Centre (BCCC),

  a multimodal urban hub located at the water edge

AS1a scenario pilot tests

⇨ Areas and topics for implementation :

→ **Flanders – Wallonia** : waterway shuttle management :

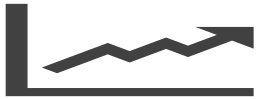
⇨ Resource planning ⇨ Demand booking ⇨ Planning execution

→ **Rouen – Paris** : hierarchical multileg tracking of returnable transports items (terrestrial container “FlexiMalle”), based on IoT devices

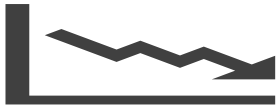
→ **Brussels area** : supervision of last mile delivery in urban zones, based on IoT devices for tracking small urban containers.

Revenue Management (RM) principles

- Since the fixed cost of a barge service is very large relative to variable costs per container, **the unit price per container** cannot be determined based on total cost, but based on total **demand**.



The more the demand increases

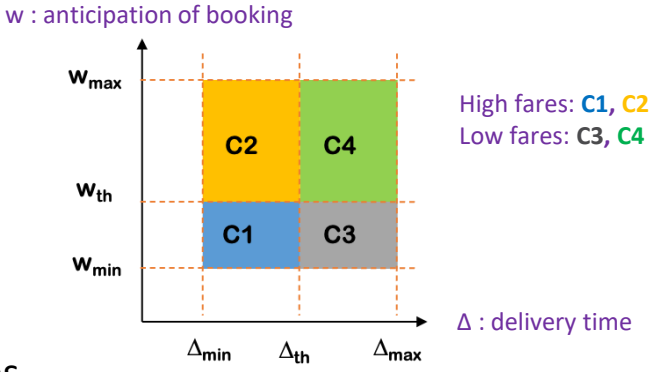


The more the fixed cost can be broken down

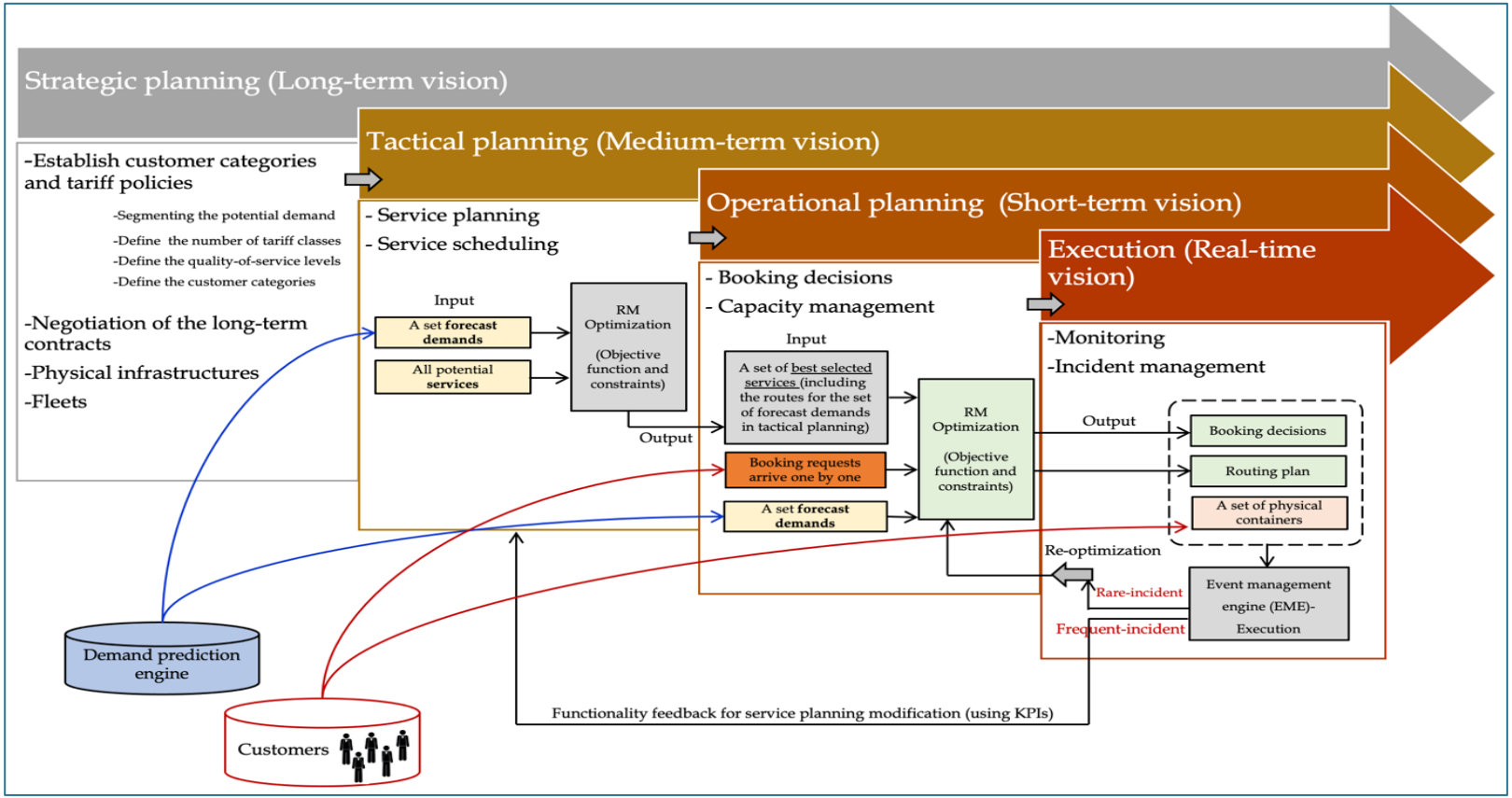
- Market segmentation allows offering transportation at
  - different prices, called fares**,** for different demand types (*standard, express, booking early/late*)
  - different purchase conditions for different customer categories (*regular, spot*).
- Given a **set of fare classes** and information/forecasts about demands to come, RM enables to
  - dynamically determine the capacities to be offered at each particular **moment**, for each particular **fare** and for each particular **customer category**
  - compute **demand optimal routing** solutions
  - update **residual capacities** of vessels along the network

Revenue management optimization

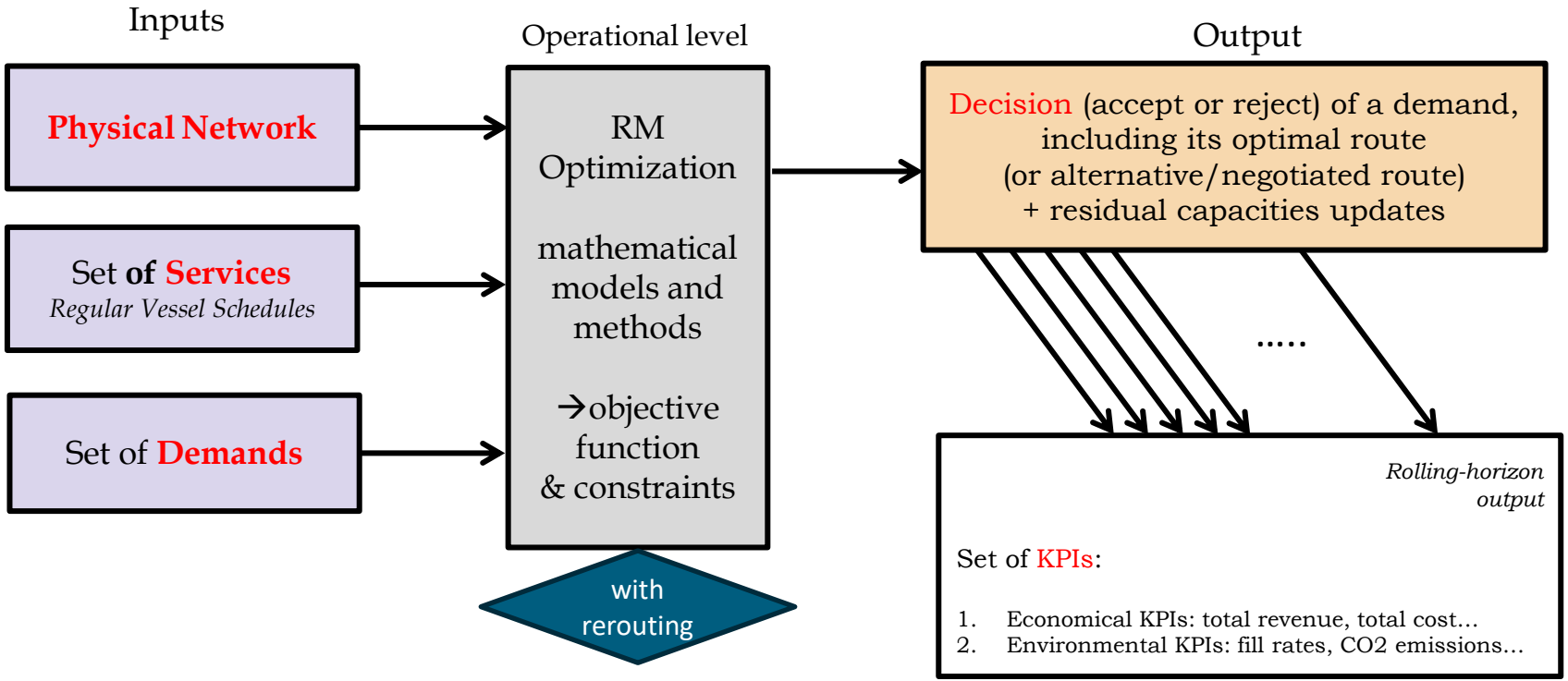
- **Revenue Management based modeling and optimization techniques enable to make informed decisions, through mathematical and computational efforts:**
  - inland waterway network and resources representation in *time* and *space*
  - *mathematical models* formulation
  - *solution techniques* implementation
  - at different levels of decision :
    - » tactical
    - » operational
    - » execution
  - optimal planning & allocation of vessels' capacities
  - rerouting mechanisms and re-optimization in case of incidents
  - data availability and data accuracy being **critical factors**



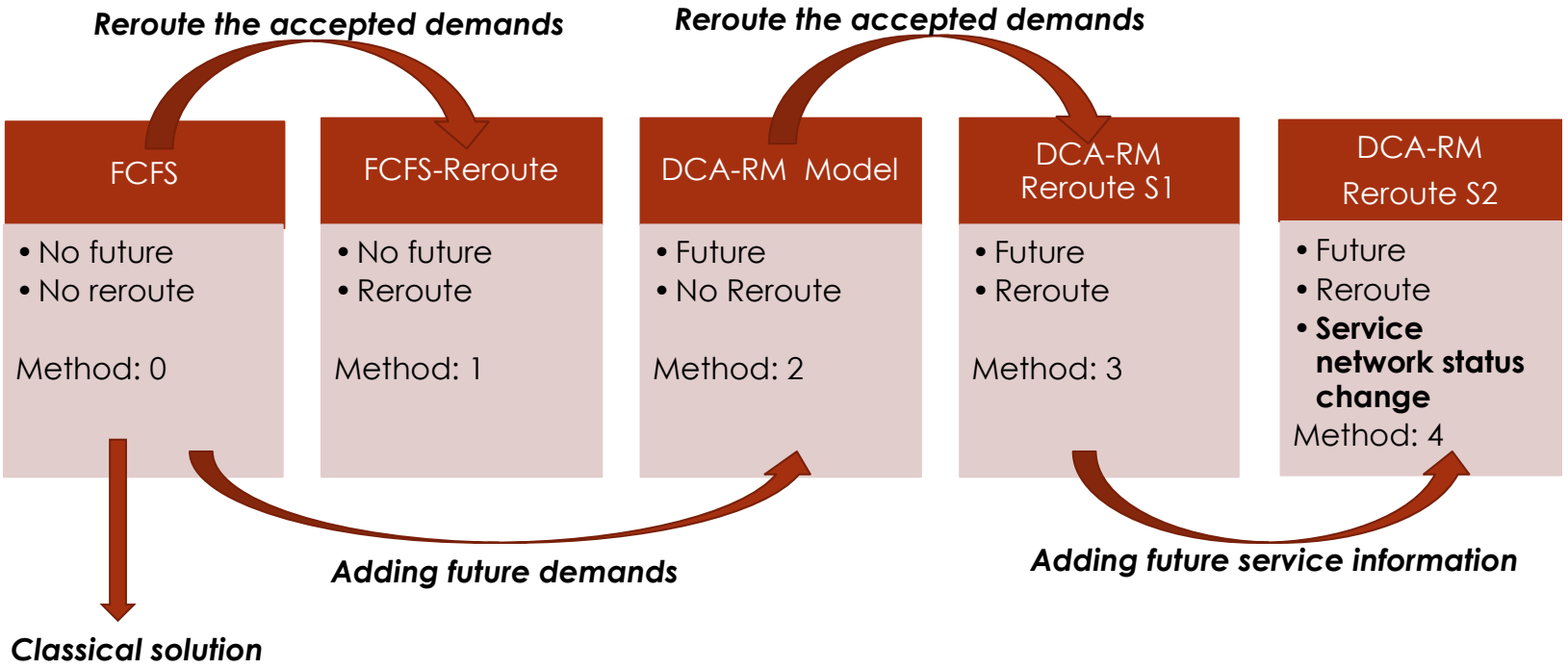
A hierarchical decision-making framework



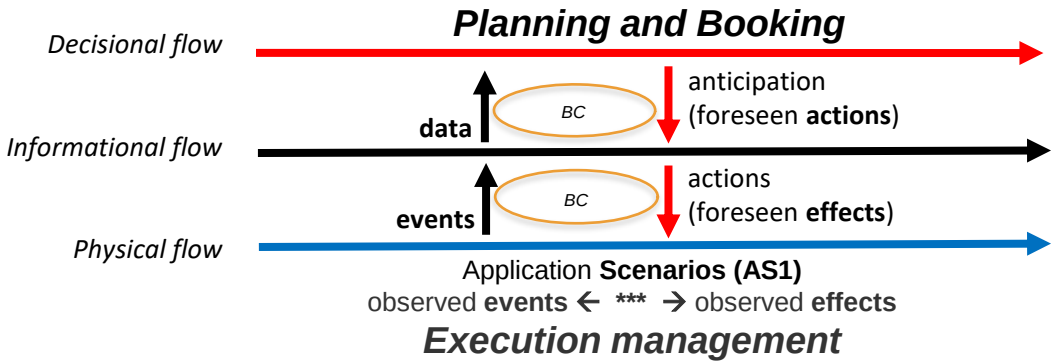
Zoom on the operational planning level



Zoom on rerouting mechanisms, execution and re-optimisation



Synchromodality based IWT Planning, Booking and Execution



RM and decision aid methods: make decisions in a **structured** manner

- *encourage* some decisions, *discourage* some other decisions
- *hierarchical* decision levels
- *consolidate effects* of decisions *between* different levels

Offers a broad perspective of the decisional process

The decisional flow integrates:

- **regular & scheduled** services
- **synchromodality** of operations

- demand/orders **booking system**
- **forecasts** and analytics
- freight/loads **consolidation**

- enhancement of **contractual terms** (**negotiation**, **re**-optimisation)

- **availability** of **data**/information
- **generating new data**/information

- **diversity** of application scenarios

Thank you for your attention!

Any Questions?