Digital twinning for the last mile under the PaaS framework

Dimitrios Rizopoulos, Harris Niavis, Maria Kampa, Aristea M. Zafeiropoulou, Rod Franklin, Antonis Mygiakis, Anastasios Kakouris, Andreas Alexopoulos and Ioanna Fergadiotou

13.6.2023

Session 1, Stream E, Urban Hubs and Consolidated Centres in Cities, IPIC Conference

Digital twinning for the last mile under the PaaS framework

Contents of the presentation:

- Main challenges in last-mile and PI-inspired interventions,

- Digital Twinning under the Platform as a Service paradigm,

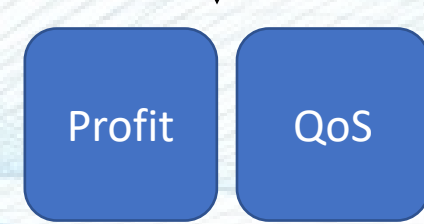- Modelling, AI and analytics tools,
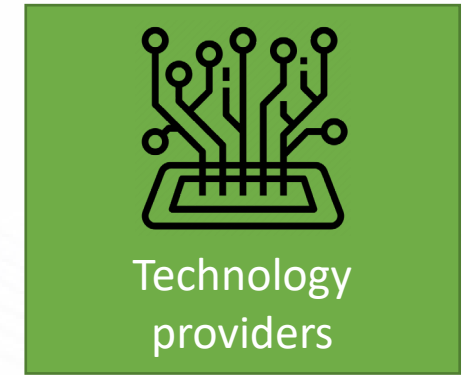
- Blockchain & supporting data sharing.

inleoom URBANE IPIC 2023

Challenges in the last-mile (1)

- Different needs & priorities for different stakeholders:

Drivers and couriers

Technology providers

Public authorities

End client

Logistics Service Providers

E-commerce

Manufacturer

Public welfare and local economy

Monitoring, Control & Safety

Noise levels

Emissions

Space management & land use

New services

Next day delivery

Scheduling & Rescheduling

Product returns

Fast delivery & QoS

Customer support

Profit

QoS

inlecom | URBANE | IPIC 2023

3

Challenges in the last-mile (2)

- Different needs & priorities can be satisfied by <u>interventions</u> in the last mile network:

  - Innovative green & automated vehicle technologies,

  - New types of facilities and network configurations,

  - Distribution methods and business models,

  - New technologies and technology-enabled methods of analysis.

Physical Internet-inspired interventions ..
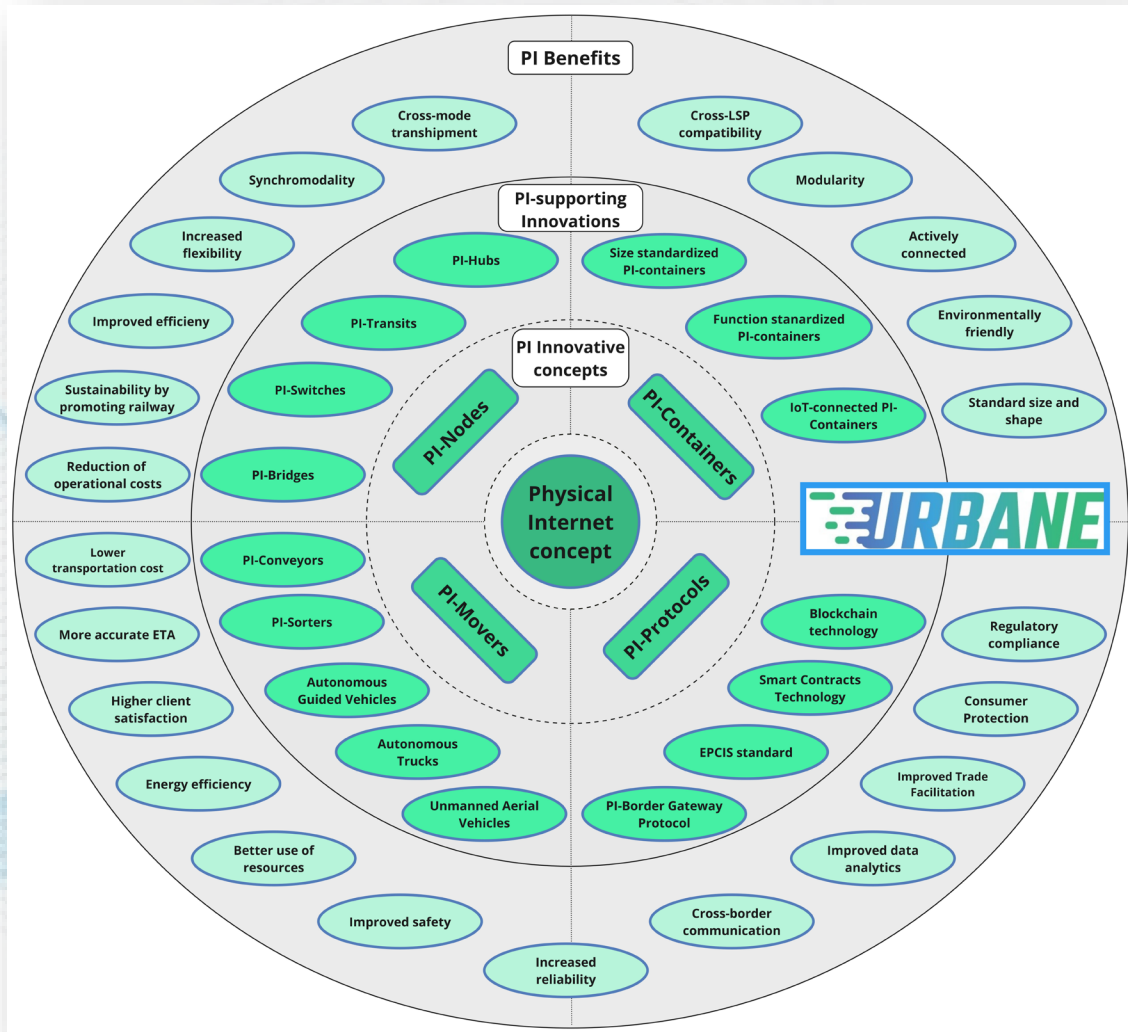
.. as an answer to several of the challenges:

- Standardized data exchange, communication & consensus,

- Standardized containers, handling & transshipment processes,

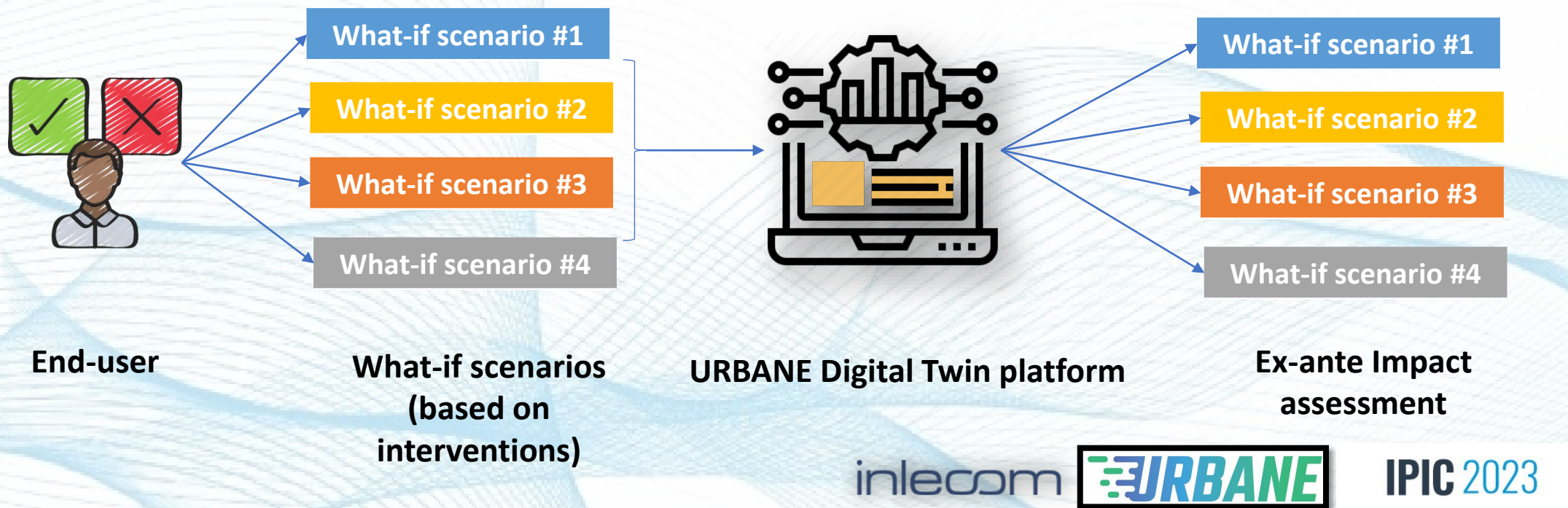- Promotion of green modes & synchro-modality.

Digital twinning for the last mile under the PaaS framework
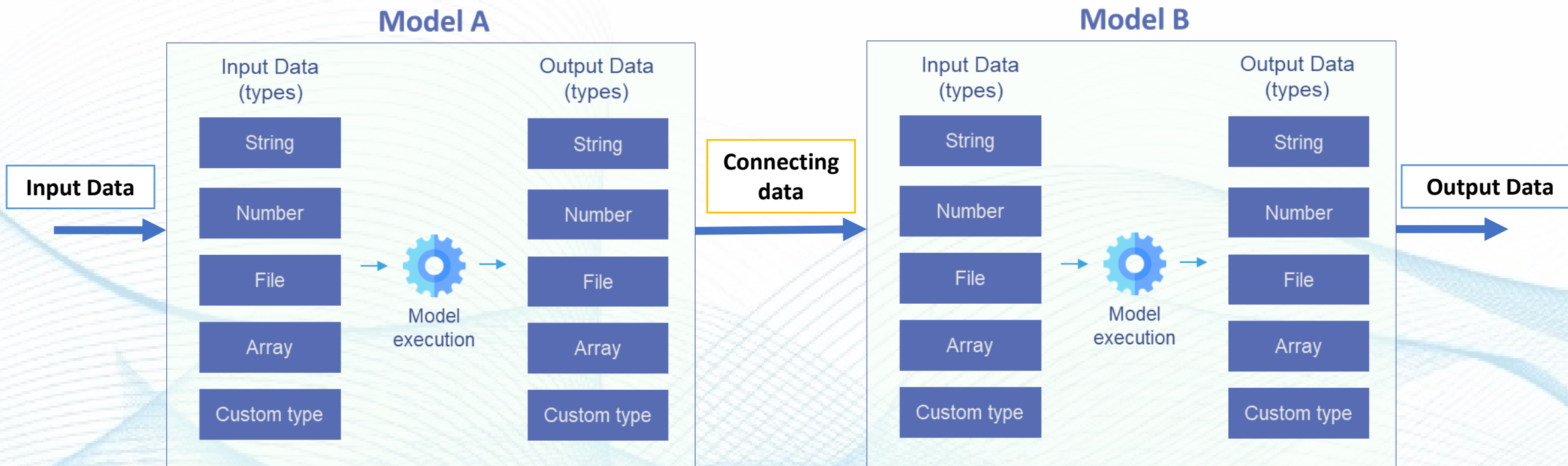
Contents of the presentation:

- Main challenges in last-mile and PI-inspired interventions,
- Digital Twinning under the Platform as a Service paradigm,
- Modelling, AI and analytics tools,
- Blockchain & supporting data sharing.

Digital Twinning under the PaaS framework (1)

- A decision maker (transportation or logistics professional) wants to examine specific PI-inspired interventions (i.e., "what-if" scenarios) to the last-mile logistics network of their company or area of responsibility (i.e., LSP, public authority), and estimate their impact on operations and the surrounding environment.

End-user

What-if scenario #1
What-if scenario #2
What-if scenario #3
What-if scenario #4

What-if scenarios (based on interventions)

URBANE Digital Twin platform

What-if scenario #1
What-if scenario #2
What-if scenario #3
What-if scenario #4

Ex-ante Impact assessment

inlecom URBANE IPIC 2023

Digital Twinning under the PaaS framework (2)

Digital Twinning under the PaaS framework (3)

Digital Twinning under the PaaS framework (4)

URBANE DT Platform Models Library
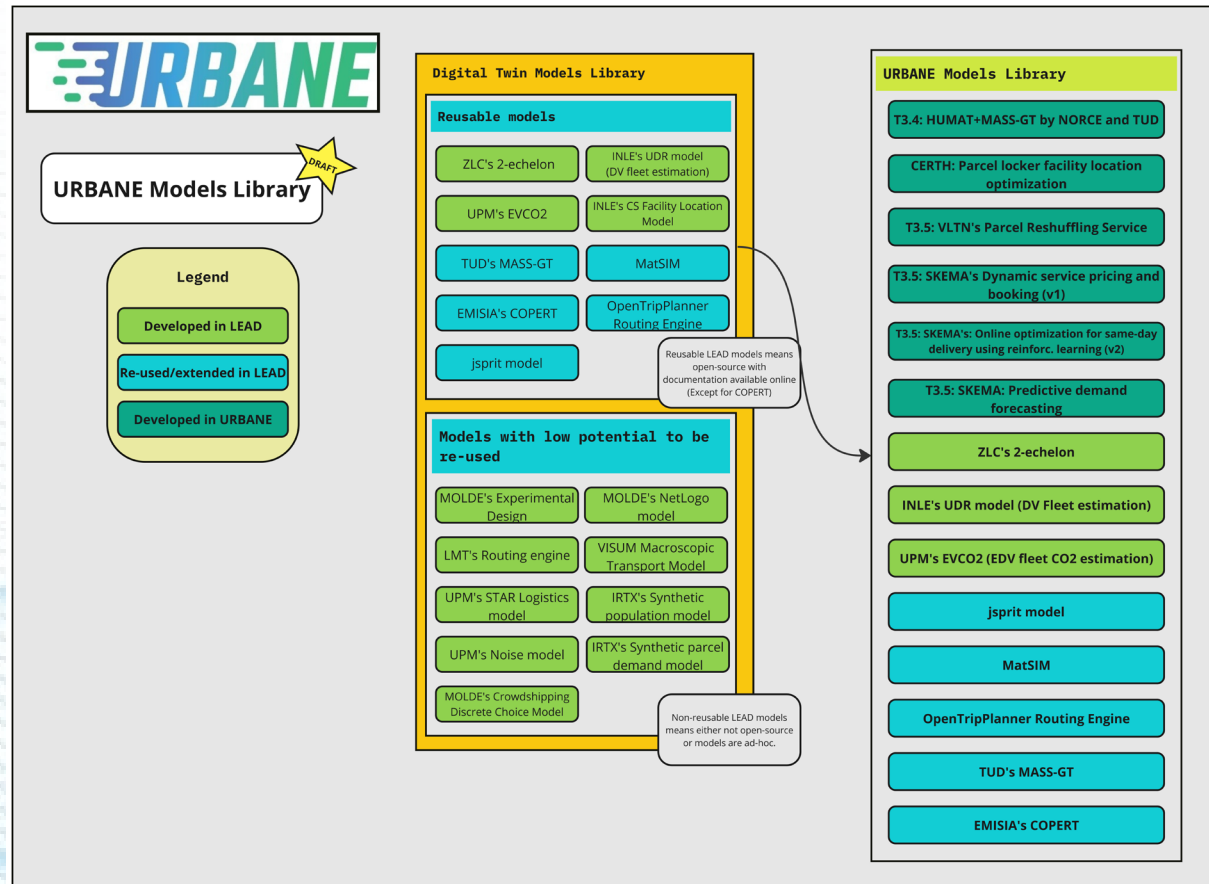
Digital twinning for the last mile under the PaaS framework

Contents of the presentation:

- Main challenges in last-mile and PI-inspired interventions,

- Digital Twinning under the Platform as a Service paradigm,

- Modelling, AI and analytics tools,

- Blockchain & supporting data sharing.

Decision support for LSPs

- In the Porto LL, INLECOM has supported SONAE MC (LSP) with the transition towards the electrification of their fleet.

- A digital model based on the Vehicle Routing Problem has been applied to answer the questions:
  - Should I establish a specific logistics service for <u>rescheduling or 'small' orders</u> out of 'depot X' based on a <u>specific type of EDV scooter</u> available on the market?
  - Based on <u>real-time data ingestion</u>, how many conventional trucks/EDVs do I need to cover demand in future 'demand window X' during 'day Y'?
  - Should I place chargers at all of my depots? Where should they be placed?

UDR model: Fleet size estimation
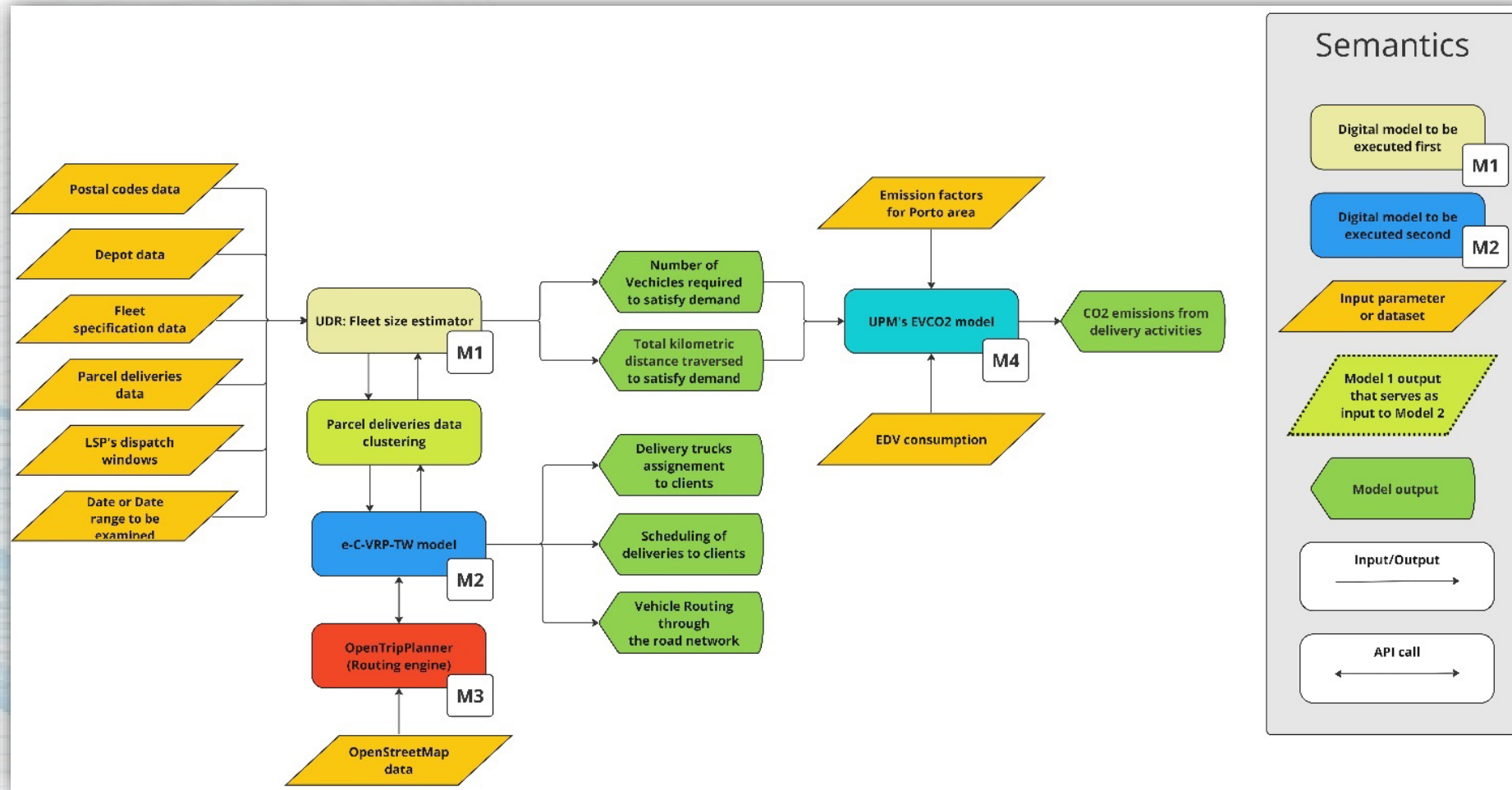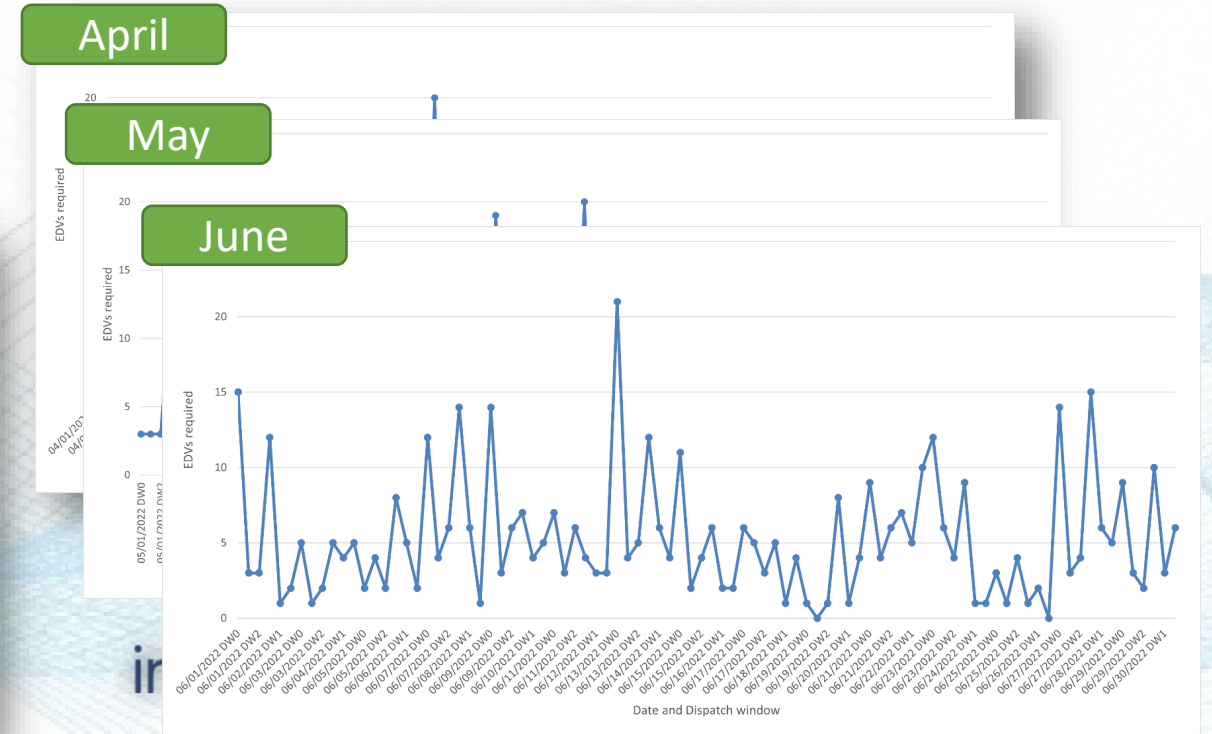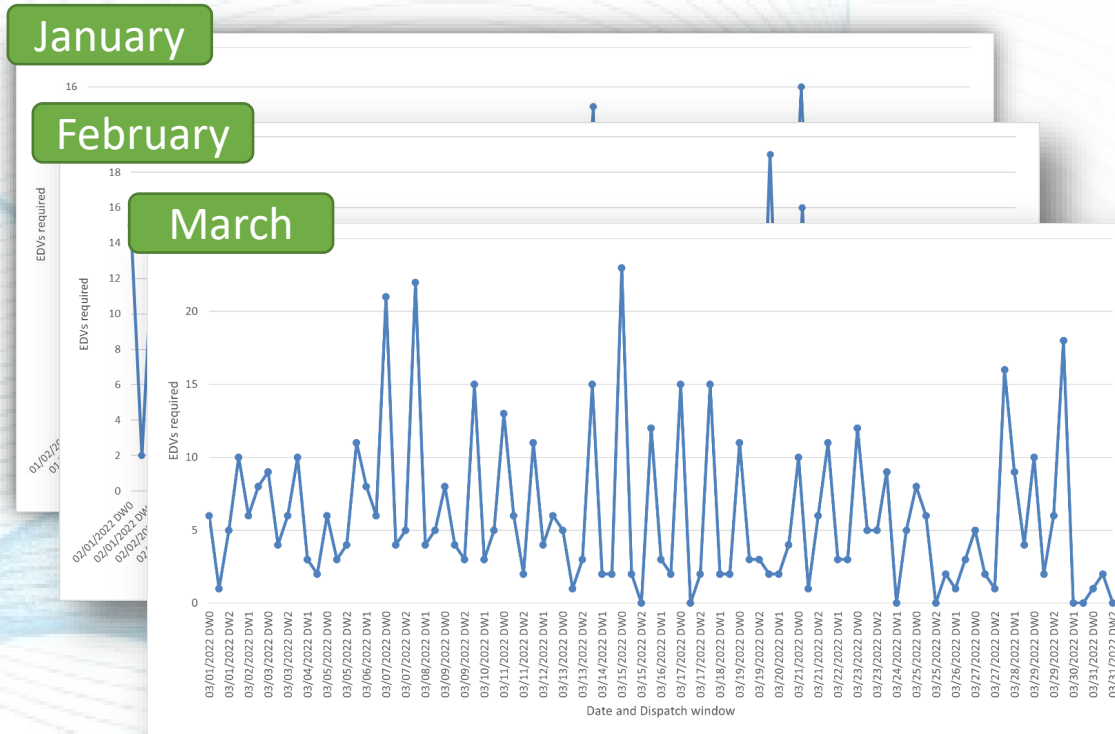
Results for the establishment of a small-orders services (1)

Based on dispatch window-based analysis of deliveries data for a 6-month period from January 2022 until June 2022:

EDVs required to cover demand for each month

18

Results for the establishment of a small-orders services (2)

Correlation between EDVs purchased and used and DW demand covered
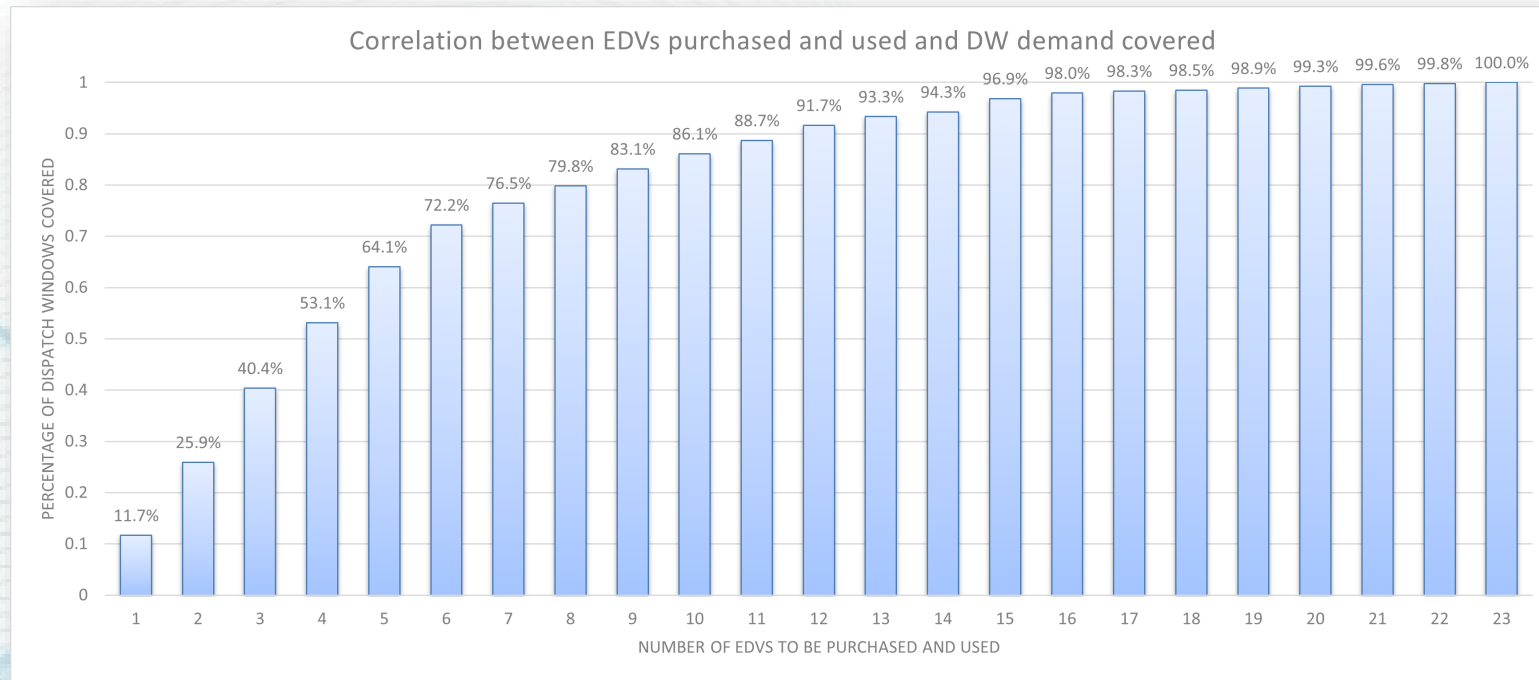
Different correlations between delivery fleet specification and demand coverage can be derived on different timeframes (historical data, real-time, future demand, etc.)

.. enabling the business planning of services and the informed placement of EV chargers on LSPs depots.

UDR model: Fleet size estimation
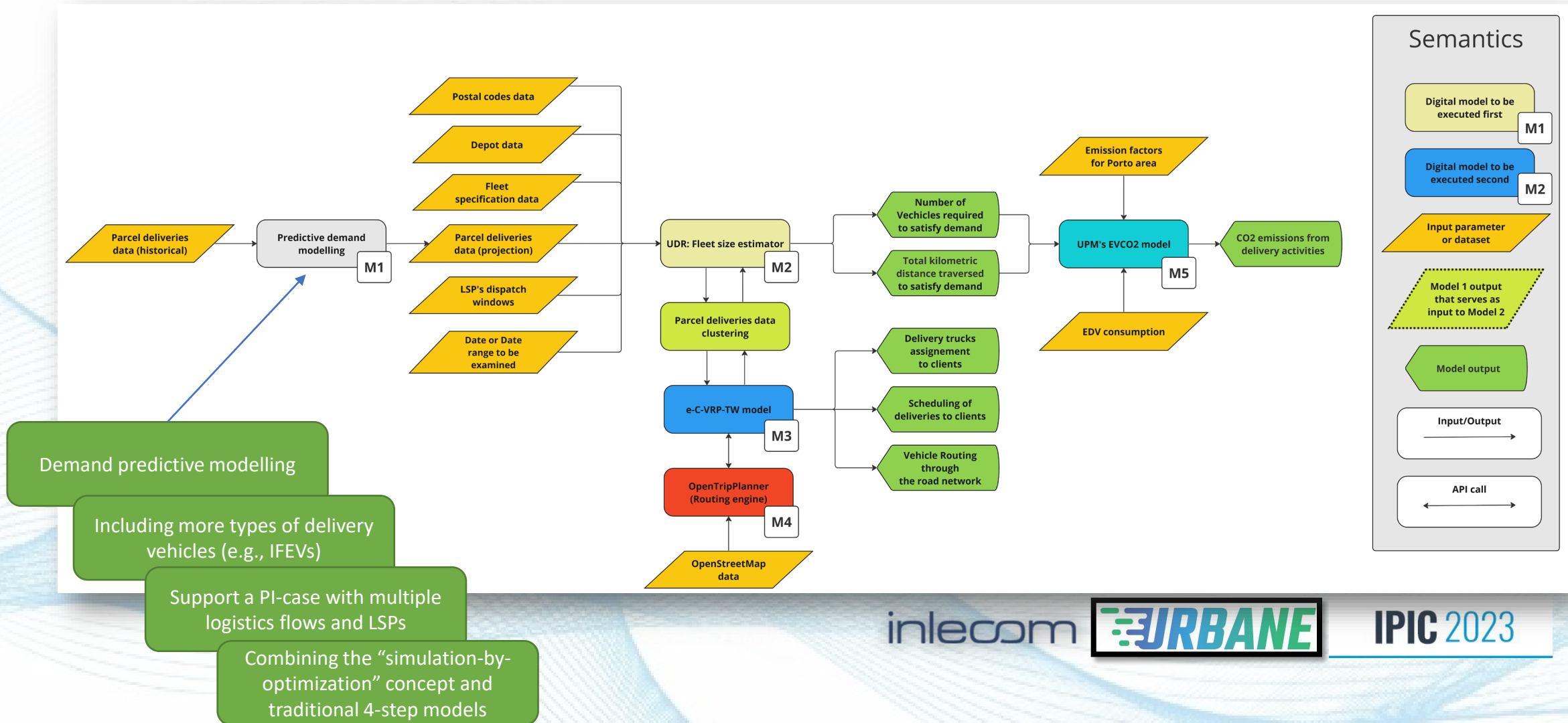
Digital twinning for the last mile under the PaaS framework

Contents of the presentation:

- Main challenges in last-mile and PI-inspired interventions,

- Digital Twinning under the Platform as a Service paradigm,

- Modelling and analytics tools,

- Blockchain & supporting data sharing.

Blockchain & supporting data sharing

One of the great roadblocks to PI adoption is data sharing across LSPs!

- Shipment tracking,
  - Transactions,
    - Proof of delivery,
      - Sensors' data,
        - Emissions data.

Blockchain Platform distributed over several nodes

- Data transparency and privacy based on predefined system architecture,
- New (shared) business opportunities based on smart contracts,
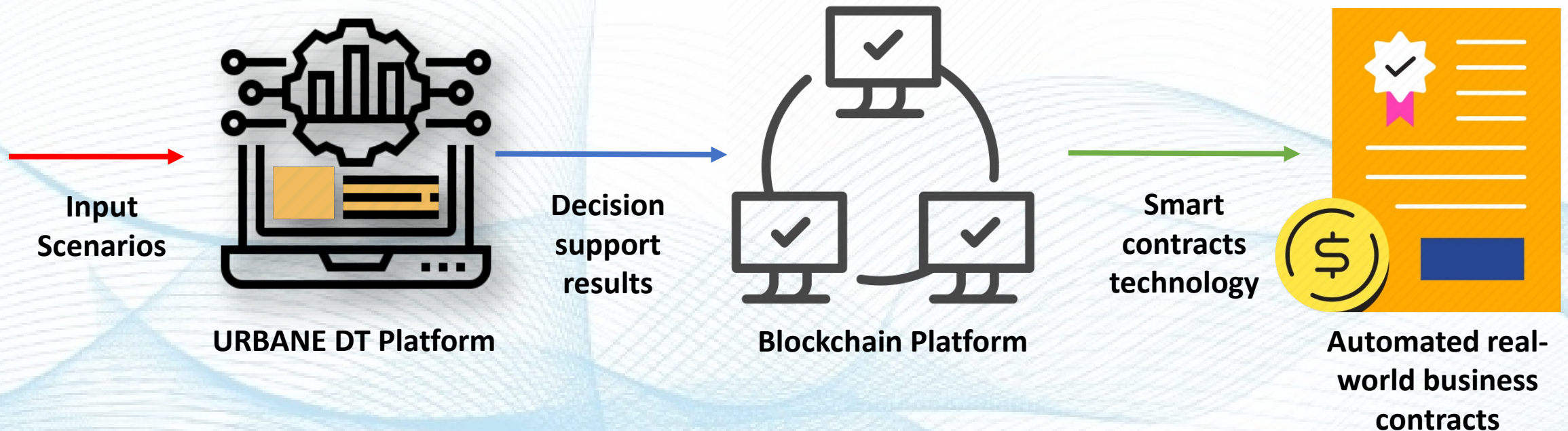- Dispute resolution based on immutable and auditable records of transactions.

Blockchain & supporting data sharing

One of the great roadblocks to PI adoption is data sharing across LSPs!

Input Scenarios → **URBANE DT Platform** → Decision support results → **Blockchain Platform** → Smart contracts technology → **Automated real-world business contracts**

Next steps

- <u>Long Long-term:</u> Offer a DT Platform under the PaaS paradigm for multiple stakeholders in the last mile, supported by the benefits of Blockchain.

- Mature integration of new models and models scenarios within the URBANE Models library,

- Include Real-Time UCs and operational-level planning scenarios,

- Successful re-application of models across URBANE Wave 1 LLs, Wave 2 LLs, and potentially follower cities (feasibility study),

- Further connect UCs between Digital Twinning and Blockchain platforms.

Thank you ..! Any questions?

Stay in contact with the KLU, INLE, KON URBANE teams:

Ioanna Fergadiotou	Rod Franklin
ioanna.fergadiotou@inlecomsystems.com	rod.franklin@the-klu.org
Antonis Mygiakis	Aristea Zafeiropoulou
antonis.mygiakis@konnecta.io	aristea.zafeiropoulou@konnecta.io
Harris Niavis	Maria Kampa
harris.niavis@inlecomsystems.com	maria.kampa@inlecomsystems.com
Tasos Kakouris	Andreas Alexopoulos
tasoskakouris@gmail.com	andreas.alexopoulos@konnecta.io

Dimitris Rizopoulos

dimitris.rizopoulos@inlecomsystems.com