THE OPERATIONAL RESEARCH SOCIETY

Supply Chain Modelling As A Transversal Tool: Port Activity Scenario Model

Erwan Simon
Research Engineer, CATIE

15 of September 2020

Summary

1. **Context**
   - Small Ports
   - PIXEL Platform
2. **Approach**
   - Port Activity Scenario
   - Outcome Modules
3. **Uses**
   - Energy Consumptions
   - Pollutant Emissions
4. **Perspectives**

Erwan SIMON

CATIE

Context

Context: Small Ports Constraints & Needs

Need a tool to reach a “data-driven” state : gather data and valorize it

1. **Constraints:** Large variability (inside a port and between ports)
   - Data :
     - sources (IoT, data-base, manually edited)
     - types (expected vs realized, historical vs real-time vs predictive)
     - availability (does not / exist / unknown / will be)
   - Preferences (precision vs simplicity)
   - Involved goods, process and stockholders
   - Significant context evolution (and poor historical data)

- **Objectives**: Adaptable (for each port’s context)
  - Data heterogeneity-proof
  - Multiple use (assessment, monitoring, forecast and exploring)
  - Various purpose (energy, pollutants, efficiency…)
  - Scaling precision (adapt outputs to inputs)

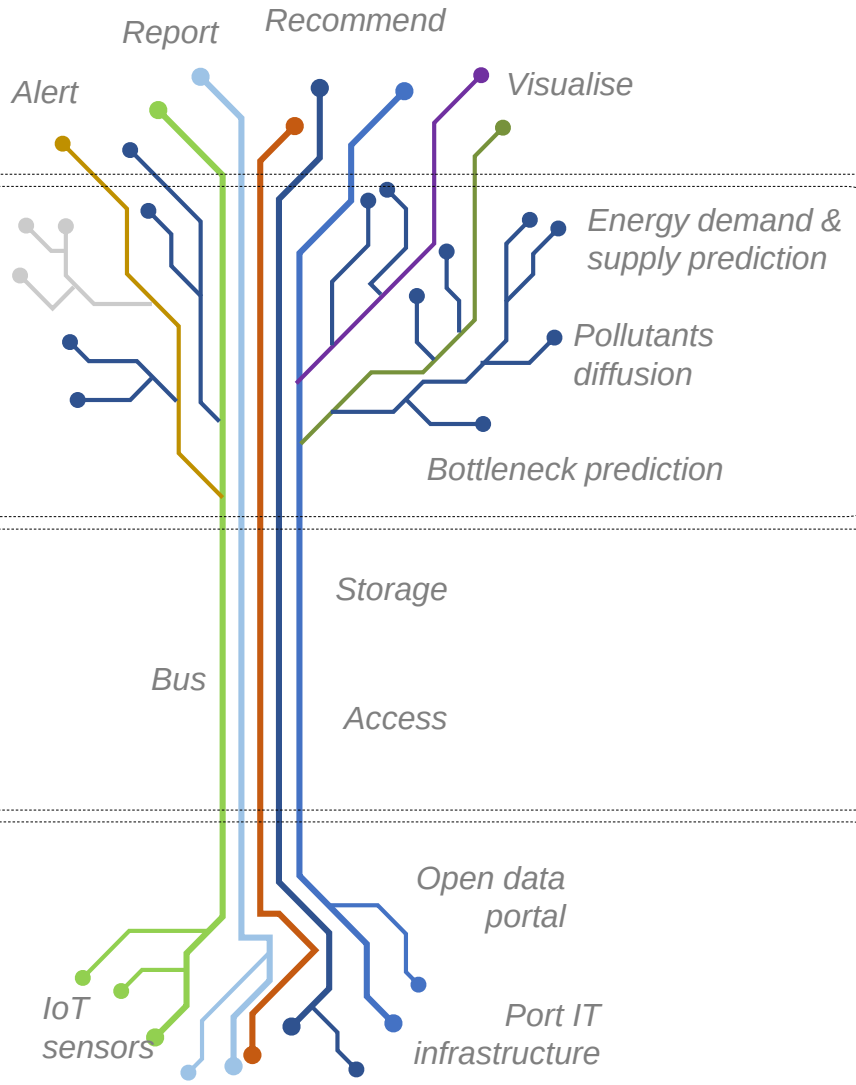
Context: PIXEL Platform

Diffusion
Bring the relevant information to the subscriber through the relevant channel

Monitoring & Modelling
Convert raw data to useful information about today and model port activities to predict future impact

Management
Support data processing through an open, robust and modular platform

Acquisition
Collect heterogeneous data from multiple sources through live data stream connectors

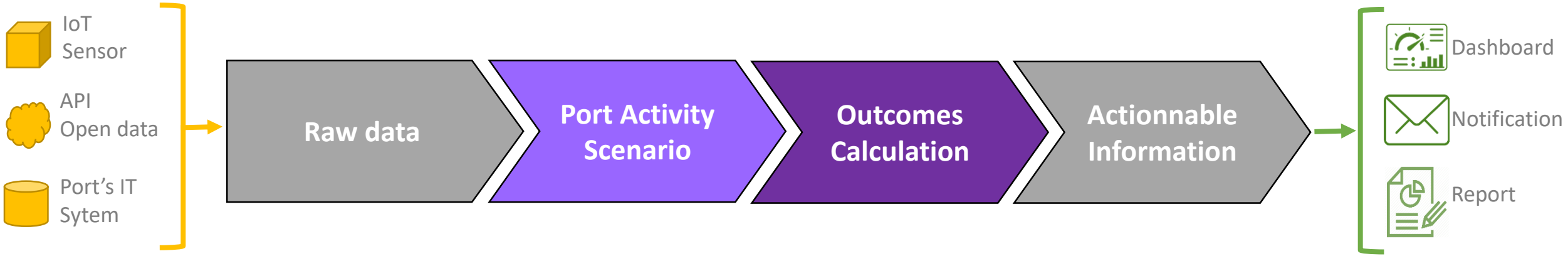


PIXEL

Approach

Approach: Port Activity Scenario

Convert raw data into actionable knowledge through chained elementary transformations.



Build the PAS

- For the considered set of hypothesis, list every port's atomic operations and project them across the time dimension to build Port Activity Scenario.

Calculate the outcome

- For every activity of the PAS, determine the resources use and externalities.

Approach: Port Activity Scenario

Boat Planning

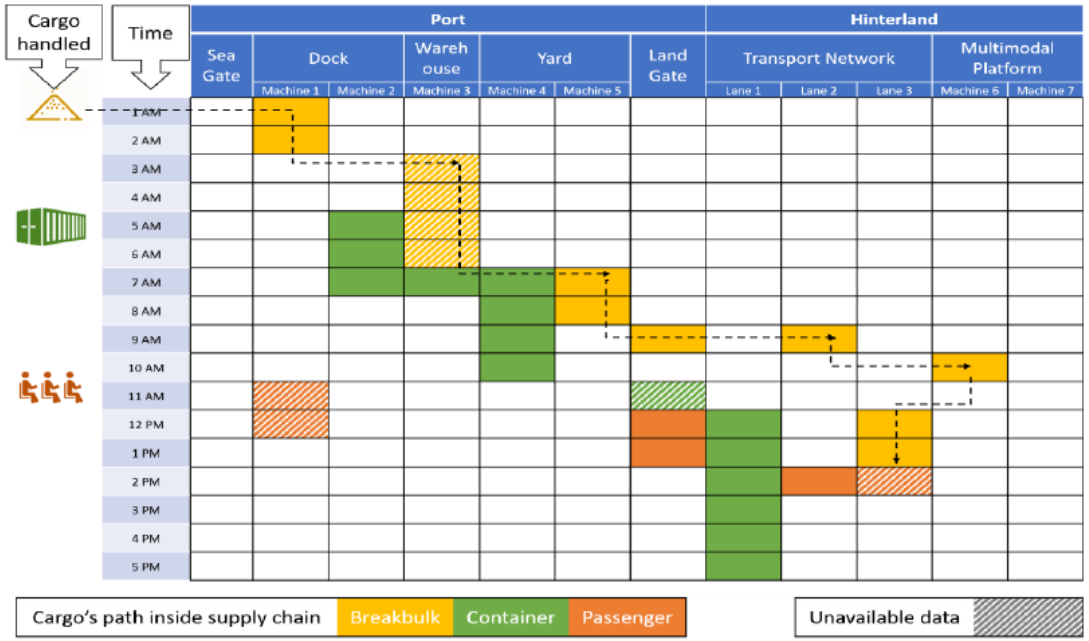
Start	Type	Tonnage
16/05/18 12:15	Cereal	6502
25/05/18 23:06	Sol.Bulk	15284
29/05/18 16:32	Sol.Bulk	
02/06/18 05:57	Liq.Bulk	
...	...	

Supply Chain

Dock	Sequence
452	{Crane1 > Conv.Belt3 >> ...}
421	{Pump4 > ...}
421	{Pump2 > ...}
310	{Hopper >>
...	

Machine Specification

Energy	Cons.	Debit	Status
Electric	4.5 (kW)	52 (cont./h)	Ok
Fuel B405	15 (L)	32 (T/h)	Ok
Fuel H56	28 (L)	125 (m^3/h)	HS [dates]
Electric	31 (kW)	32 (T/h)	Ok
...	...	...	...



Approach: Port Activity Scenario

Flexibility:

1. Modelized perimeter (see side, warehouse, hinterland side) is inherited from inputs perimeter.
2. Through inputs of different orientations, the model allows to address different use cases.

Minimalist	Rich setup
Live stream	Monitoring
Consolidated historical	Assessment
Estimated future	Forecast
« What if » scenario	Explore

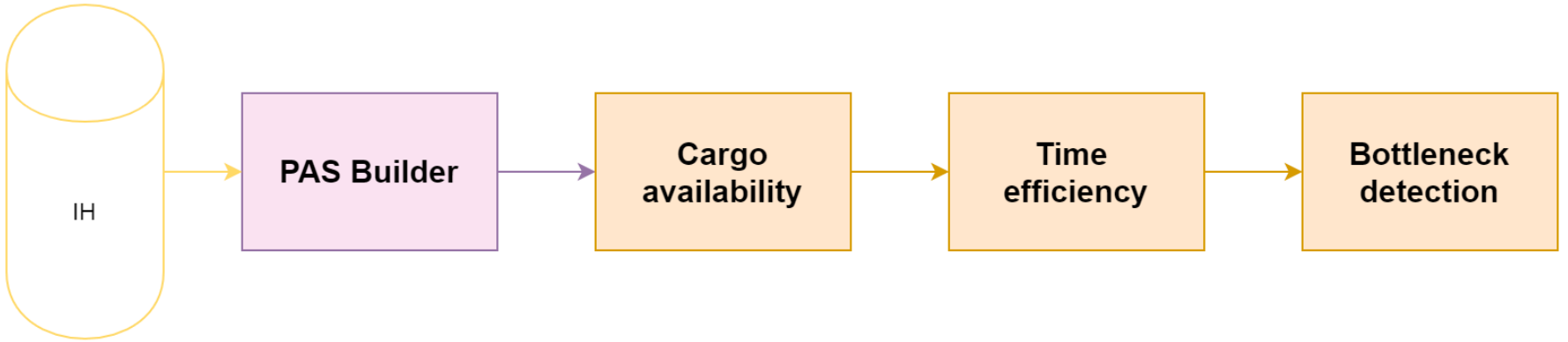
Approach: Port Activity Scenario

Plasticity:

1. Model's output accuracy & precision scales with inputs.
2. User can freely choose his optimal balance in the simplicity vs precision trade-off.

Minimalist	Rich setup
Vessels call (FAL form)	Billing data (dock, effective amount & arrival time…)
Supply-chain described as a whole (only one step)	Meticulous dissection (unit operations)
Basic machine specifications (no dependency to the context)	Specification dependency to context (throuput and consumption for each suitable cargo type)
	IoT/Sensor (weather station, PV production, road congestion…)
	Optional parameters (priority, uptime)

Approach: Outcome Modules



Purpose:

- Specialized calculations downstream of PAS builder
- Add information in PAS
- Convert & export PAS data

I/O:

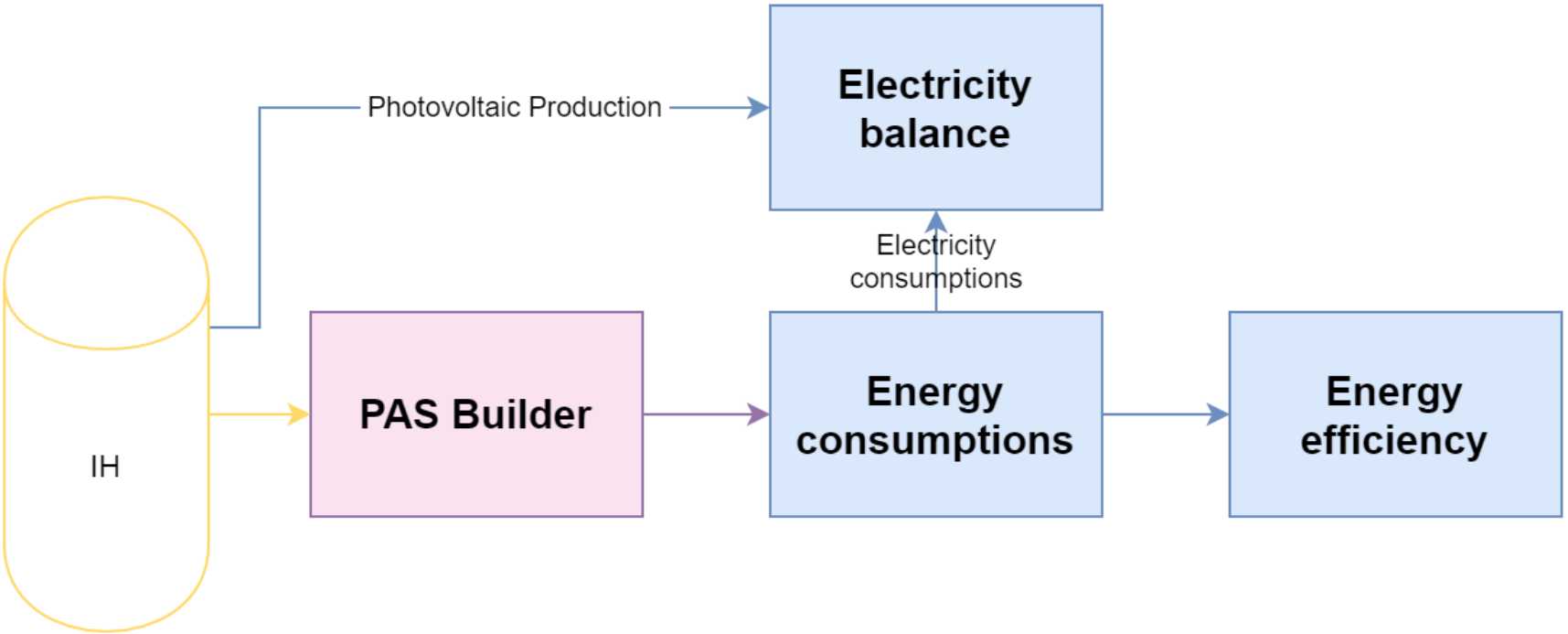
- Input: previous state of the PAS (+ data taken from Information Hub)
- Output: new state of the PAS (+ data added to Information Hub)

Modularity:

- Preset sequence of modules adapted to needs (and data available)

Uses

Uses: Energy consumptions

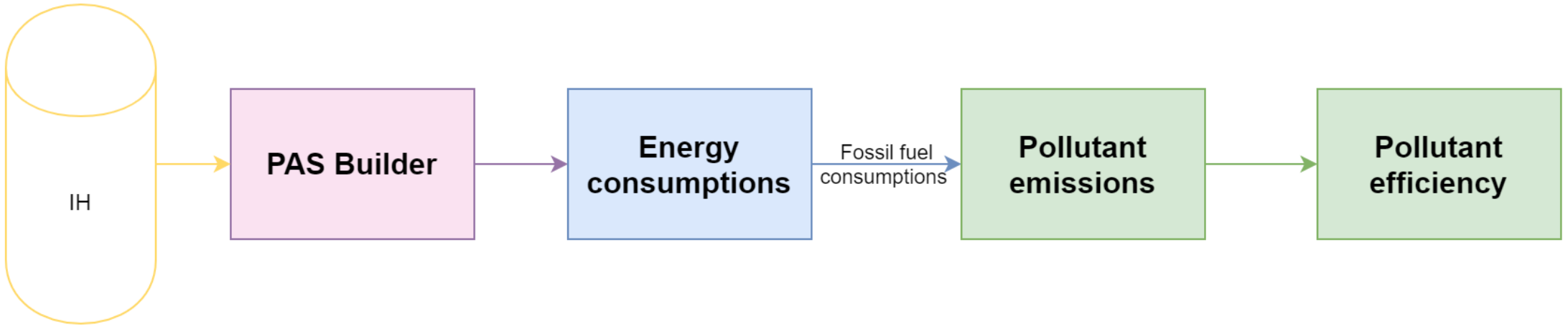


Forecast:

1. Probable electricity consumption annual peak with those vessel calls
   - Trigger notification (email)

2. Compare photovoltaic plant's electrical production versus consumption
   - Alert local grid manager for incoming production

Uses: Pollutant Emissions



Assessment:

1. From consolidated historic data, quantify GHG emissions for each cargoes
   - Creates automatic report

2. Send port's emissions to atmospheric transport model
   - Evaluates risk for the neighboring city

Perspectives

Perspectives:

1. **Work in progress**
   - Most of the development is done, currently deploying on pilot for test phase

2. **Disseminate PIXEL to the port community:**
   - Not only to port's authority, but to all stakeholders
   - Create a user community (sharing setup and good practices)

3. **PAS builder improvement**
   - Extend PAS builder scope to warehouse & hinterland side

4. **Outcome modules management**
   - Extend outcome modules list
   - Create a user-friendly "market place"

Thank you

1. **Website & News letter** https://pixel-ports.eu/
2. **Twitter** PIXEL-ports
3. **Project Coordinator** Prof. Carlos Palau, UPV, Spain
   coordinator-pixel-ports-eu@pixel-ports.eu
4. **Innovation Manager** Joao Costa, XLAB, Slovenia
   innovation-pixel-ports-eu@pixel-ports.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769355