# Hubs.jl : a Julia library for industrial symbiosis optimization using a networked hubs approach

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# Motivation

## 1. Targeted applications

- Optimal design and commitment of industrial systems
  - → energy and materials flows, multi-input and output processes
- Industrial symbiosis withing and between industrial sites
  - → extending the concept of energy hubs to industrial hubs
  - → hubs are connected to transport networks

# Motivation

## 2. Technical & scientific motivation

- Testing and developing new optimization algorithms

  → leveraging the power of JuMP

- Many optimization algorithms require repetitive solving

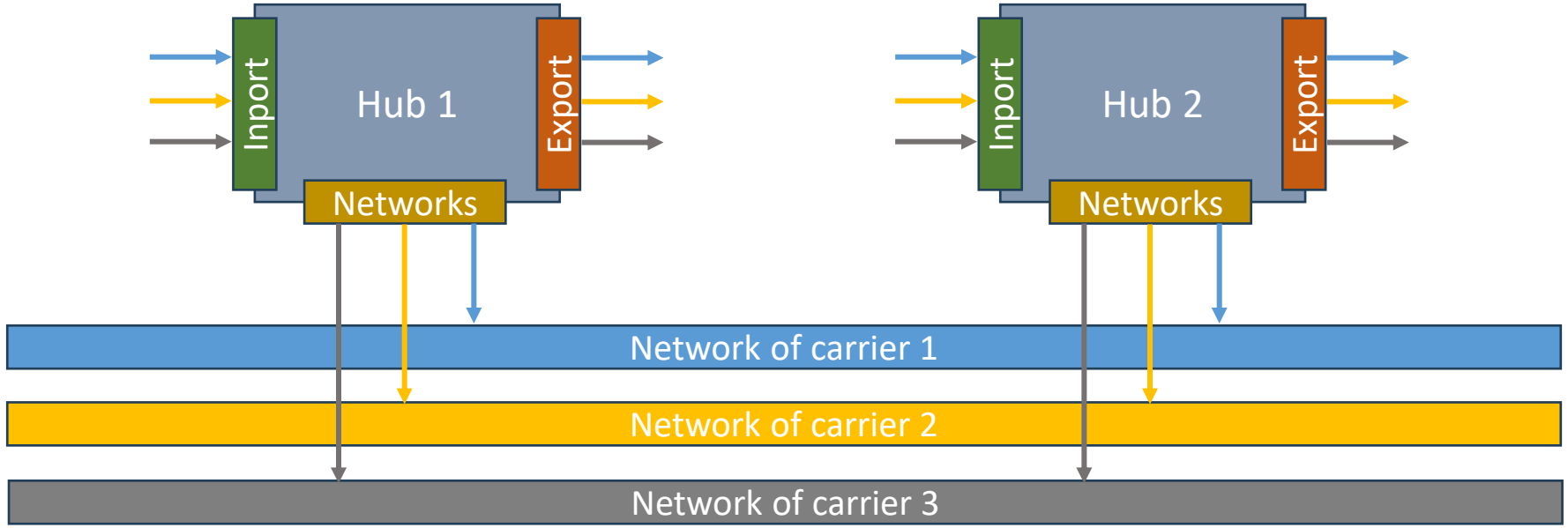
  (Rolling horizon, decompositions approaches, sequential relaxations, polynomials and SoS, etc..)

  → necessity for fast model generation and updating

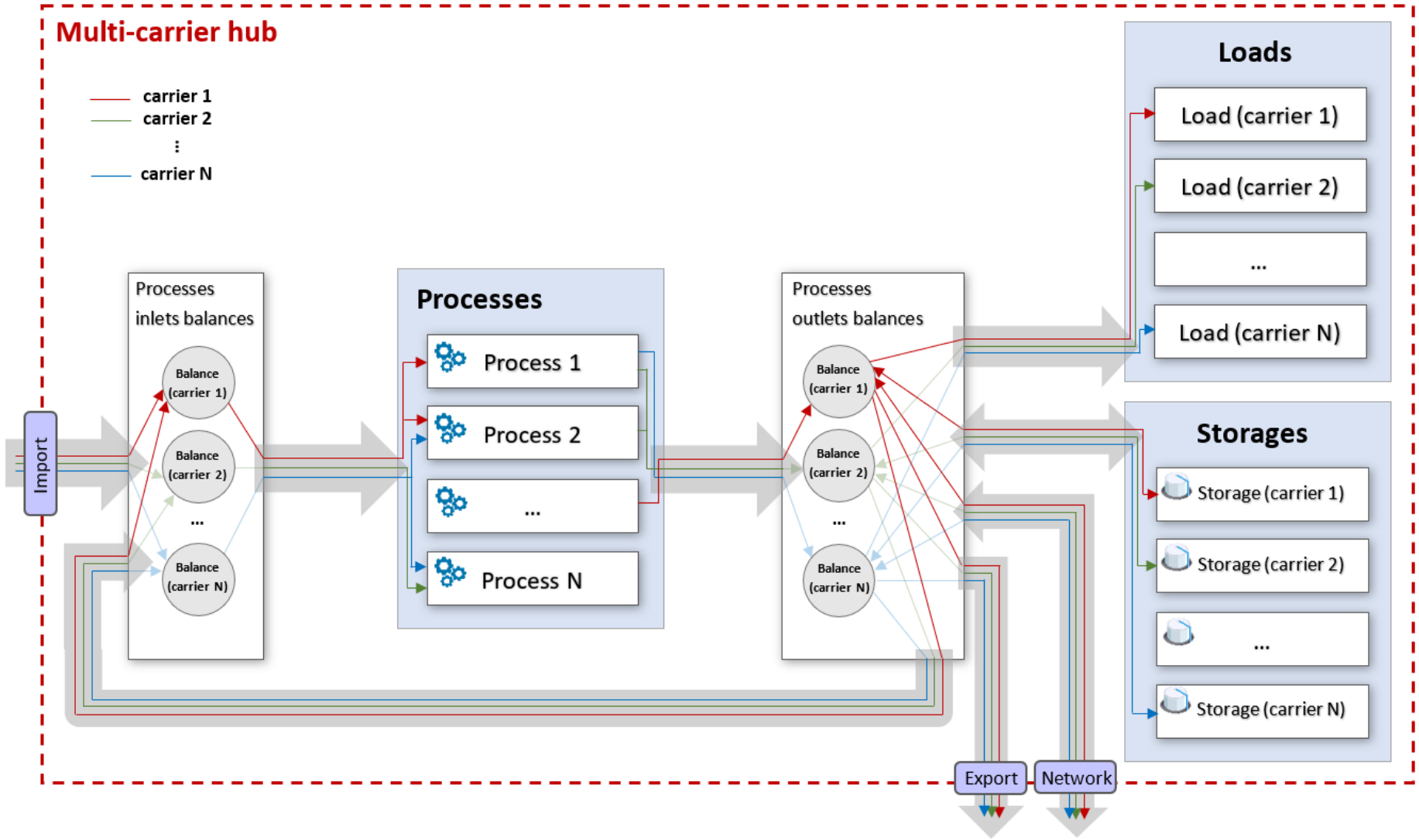
- Need for a platform to conduct research on new methods quickly and efficiently

  → genericity and easiness of use

# Networked hubs



# The multi-carrier hub concept



# Typical work flow

- Creating a multi carrier network an adding hubs

```
network = Hubs.MultiCarrierNetwork()
Hubs.addHubs(MCN, 5)
```

- Adding processes

```
Hubs.addProcess(network,
                hubs = 1,
                name = "CHP",
                inputs =  ["Gaz"],
                outputs =  ["Electricity", "Heat_90", "CO2"],
                nom_in = [1.0],
                nom_out = [0.35, 0.6, 0.24],
                CAPEX = 1100,
                OMEX = 50,
                maximum_size = 1100
)
```

# Typical work flow

- Adding storage capacities

```
Hubs.addStorage(network,
                hubs = 1,
                carrier = "Electricity",
                efficiency = 0.95,
                charging_efficiency = 0.85,
                discharging_efficiency = 0.8,
                CAPEX = 1100,
                OMEX = 50,
                maximum_size = 500
)
```

- Adding loads

```
Hubs.addLoad(network,
             hubs = 1,
             carrier = "Heat_60",
             load = Load_Hub1_Heat_60
)
```

# Typical work flow

- Adding storage port; import, export, recycling

```
Hubs.addPort(network,
             hubs = 1,
             carrier = "Electricity",
             type = :import,
             min = 0.0,
             max = Solar_Radiation_Hub1,
             cost = 0.0,
             maximum_size = PV_Hub1_Area,
             CAPEX = PV_CAPEX,
             OMEX = PV_OMEX)
```

- Constructing & solving the model

```
model   = Hubs.constructModel(network)
results = Hubs.solve(model)
```

# Thank you !

Available positions in energy systems optimization :

PhD, postDoc, engineer

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