Global approach to system of systems

CSDM 2021 - Beijing

T.Chevalier
Digital Design Manufacturing & Services roadmap lead
Head of DDMS Modeling & Simulation research

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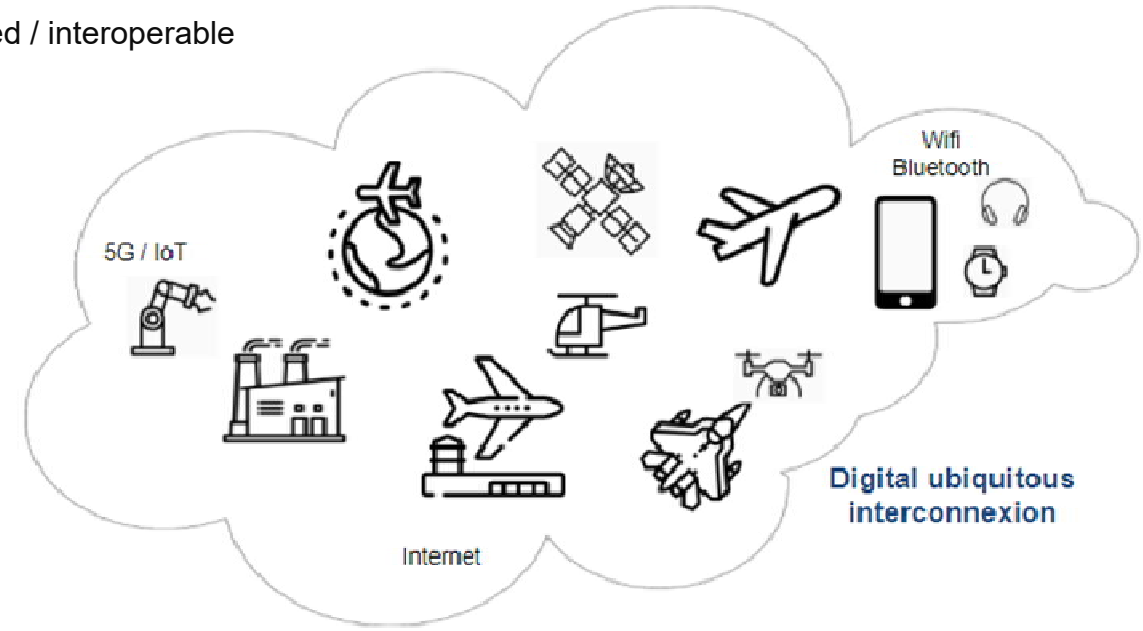
Digital part of ecosystems

Most ecosystems impacted by digital revolution

Digital part of most ecosystem moving to cloud / platform paradigm

⇨Core digital part of most ecosystems more & more integrated / interoperable
(digital integration from the top)



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IoT / 5G / Edge

Evolution of 5G and edgecloud technologies make smart assets actionable and connected

New smart devices pervade now most aspects of our daily lives

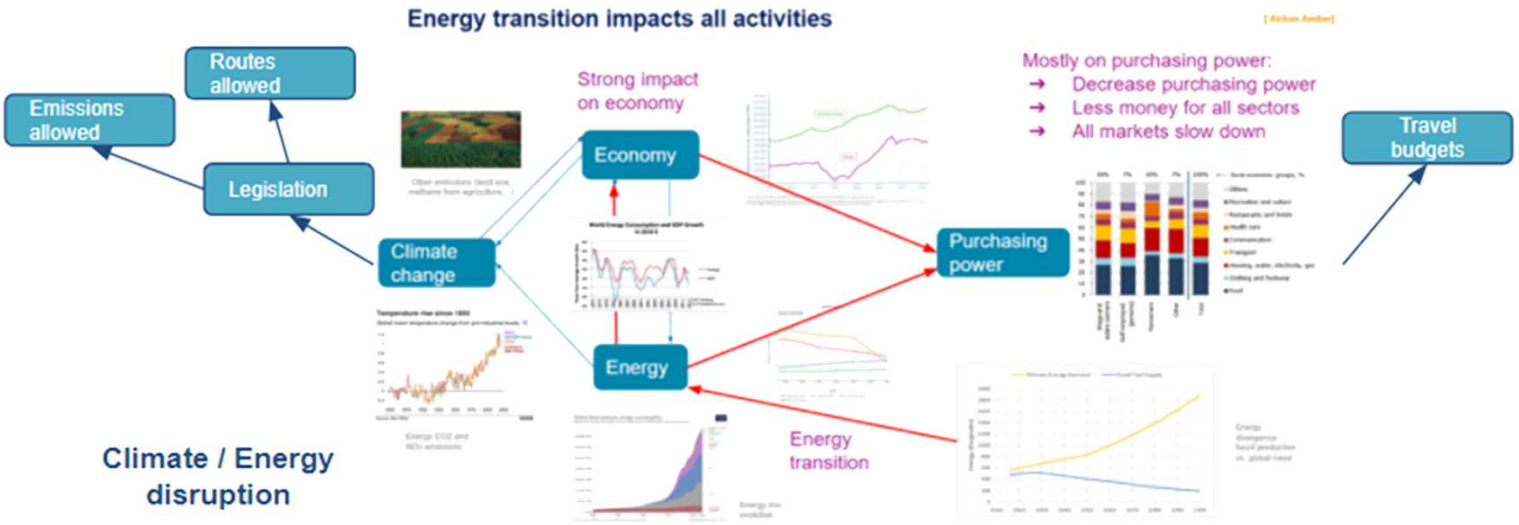
⇨Smart assets at the edge of most ecosystems are more & more integrated with ecosystem core digital system and at the same time more interoperable with other smart assets from the edge of other ecosystems (digital integration from the bottom)

Energy

Energy transition from fossil to renewable energies create at least temporary segmentation & competition for energy

Most ecosystems are addicted to abundant and cheap energy

⇨ De facto coupling of ecosystems through energy needs / availability



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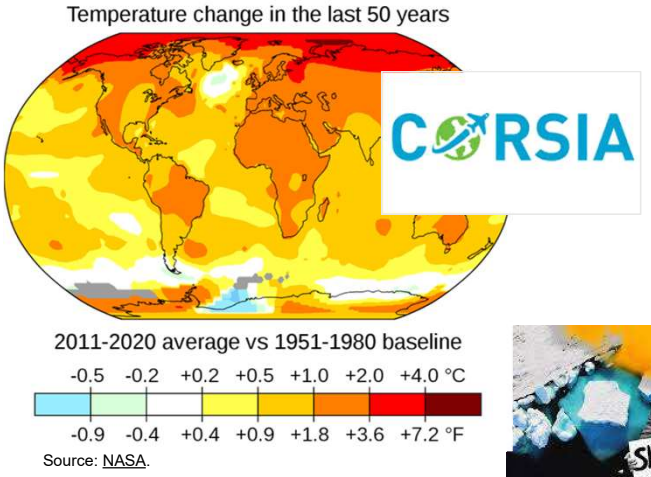
Climate change

Climate change generate natural phenomenon of great impact on our communities
(unusual droughts/floodings, storms, temperatures…)

Communities take steps trying to avoid/limit/revert climate change
(regulations, social pressure…)

⇨ Business exercise conditions can rapidly change due to steps taken by communities to alleviate climate change



Flights forbidden
when <2 train connexion
is available

Source : CBS News

13% less flights in 2019 in Sweden
due to Flight shaming

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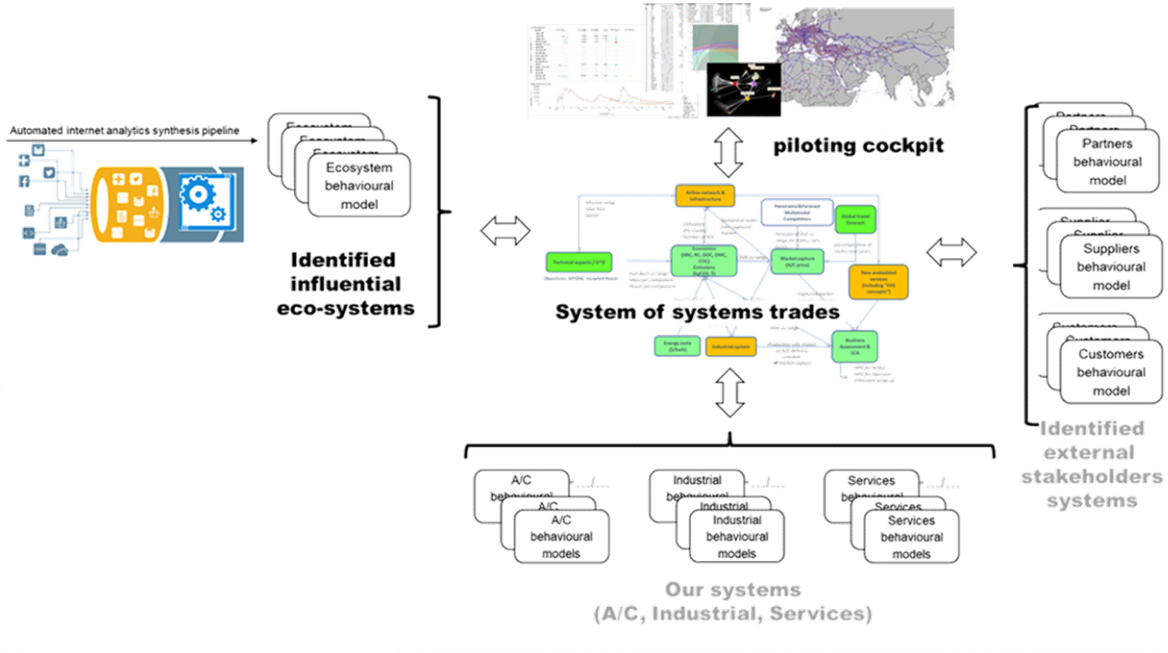
Airbus

Aerospace has long time to market and heavy upfront investments

Aircrafts produced during a few decades and operated also a few decades,
for an overall lifecycle order of magnitude of typically 50 years

⇨Need robust targets for a successful development,
need to simulate how our future systems will perform in system of systems / system of ecosystems



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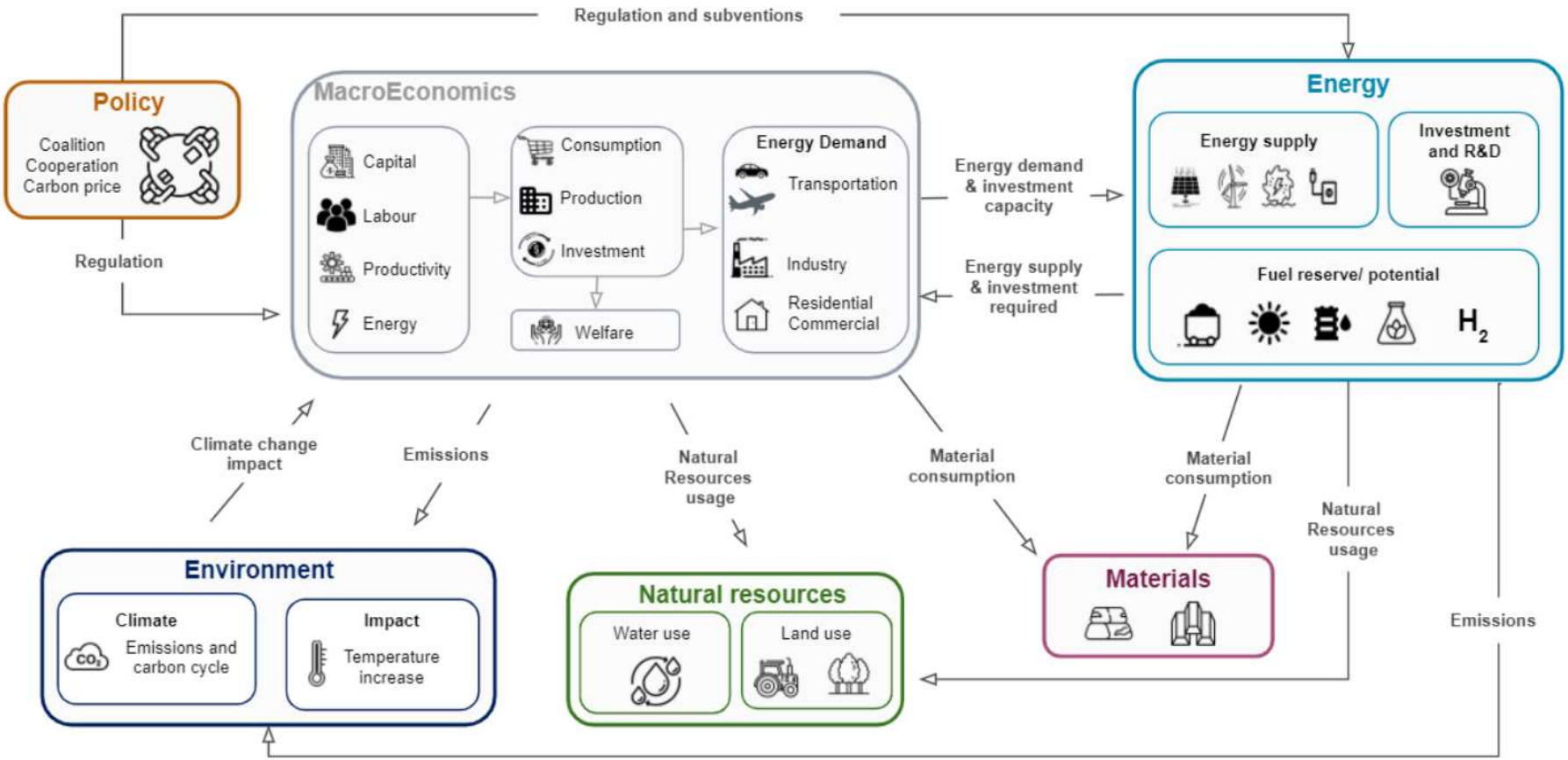
The need for a global approach



Airbus “WITNESS” model (**W**orld environmental **I**mpac**T** a**N**d **E**conomics **S**cenario**S**)

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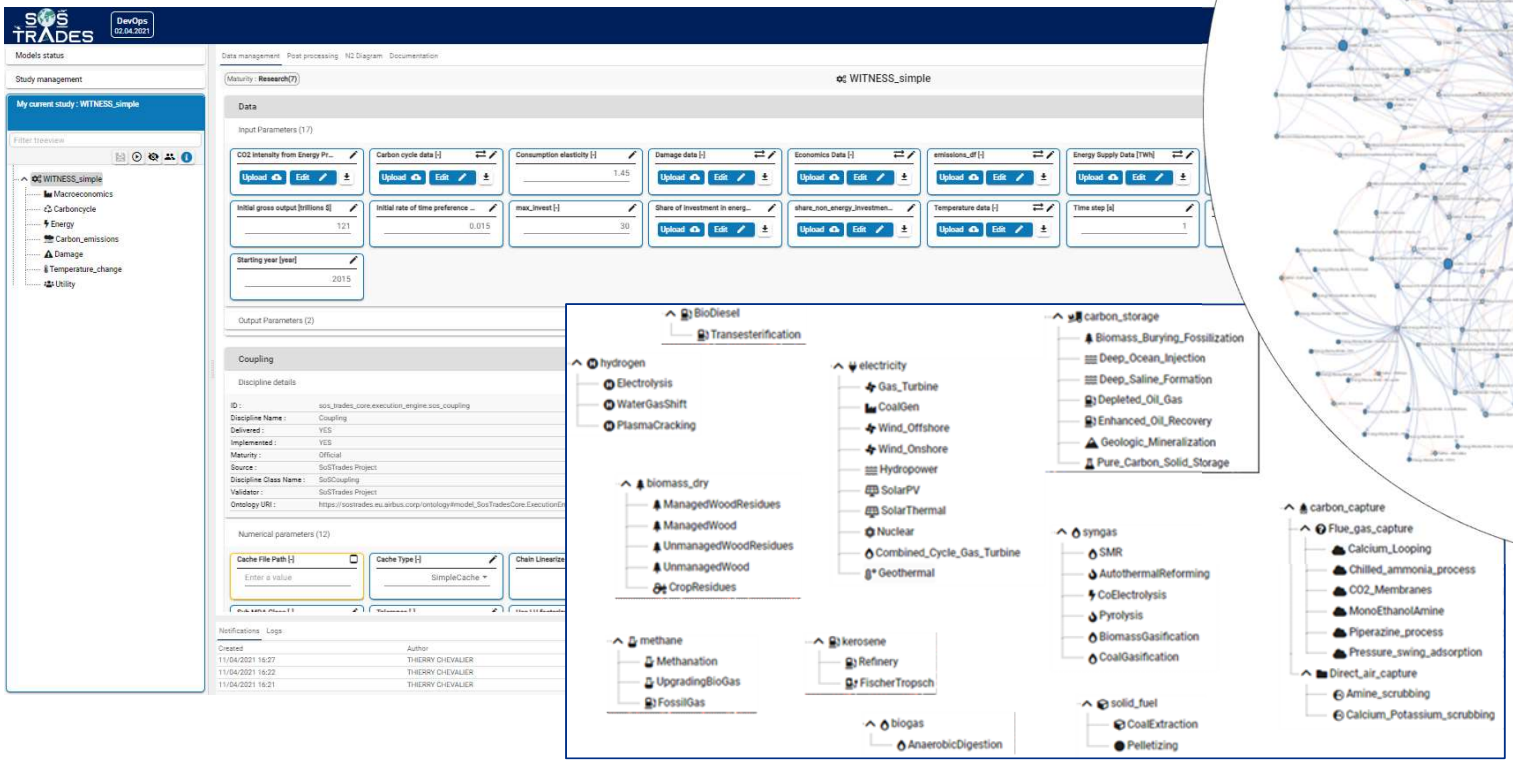
Associated simulation needs

- Thinking at System of Systems level, # of systems definition, scoping…
- Cooperative co-validation of inputs & co-analysis of outputs
- Coupling large # of model
- Handling volatility & update of ecosystems
- Systemic handling of accuracy, sensitivities, uncertainties & margins



Typical System of Systems simulation models interconnexion

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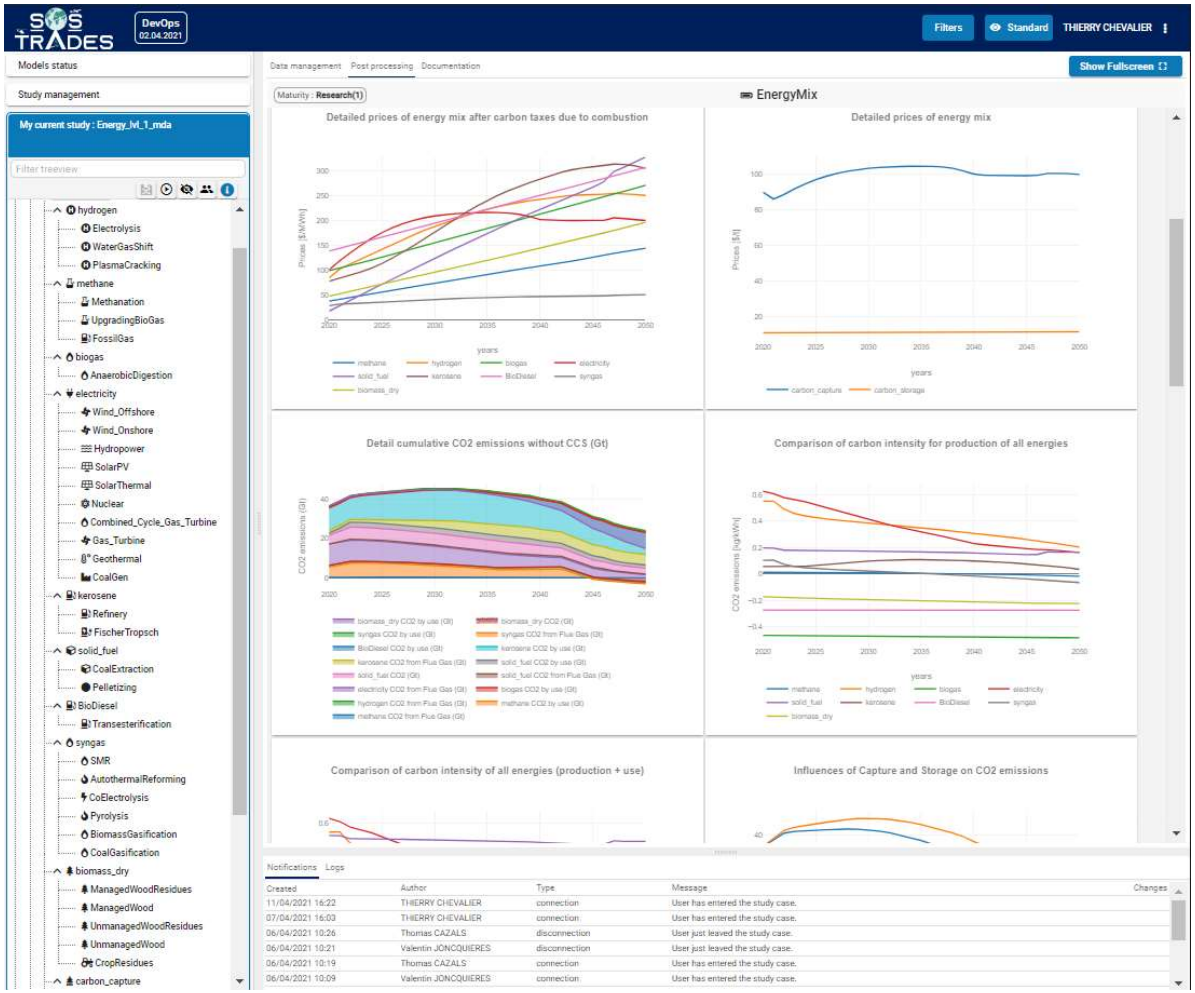
Hints to do it

- Using System Engineering approach to clarify scopes
- Using ontology to integrate large # of models from heterogeneous origin
- Using surrogates models to provide stable interfaces to simulations integrations
- Dynamically updating world ecosystem models through web harvesting pipeline
- Automating assembly of models to speed-up set-up & update of simulations
- Using Multi-Disciplinary Analysis & Optimization to converge scenarios
- Providing and using cooperative facilities & GUI to collectively gain confidence in inputs & outputs
- Dynamically allocating cloud computing resource (infrastructure as code)

…and cooperating between all actors
to get robust assumptions on energy transition !



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Thank you

Contributing to
pioneer sustainable aerospace for a safe and united world
by
leading transformation of the aerospace industry

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