



USING DIGITAL TWIN FOR DECISION SUPPORT IN RAS FEEDING PROCESSES

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IOT

IOT ENGINEERING INTERNET OF THINGS (IOT) Artificial Intelligence

- Data platforms
- Predictive systems
- Decision-making apps



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(I2S) WG / ICT4Water cluster

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FIWARE TSC Member. Chair.
Digital Twins working group

French SME
South France

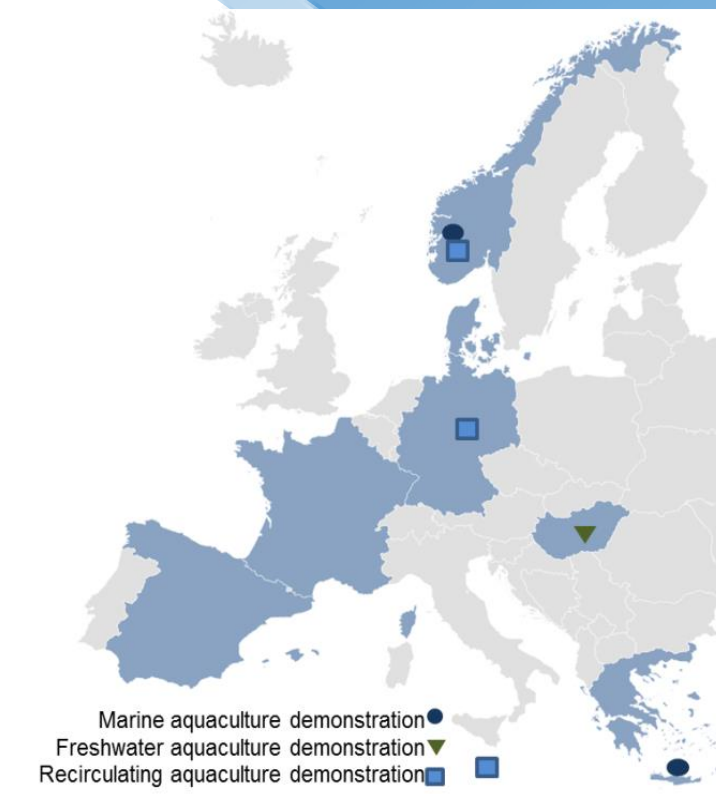
30+ FP/H2020 projects
since 2010

Public & private customers

www.egm.io

- 11 European companies (SMEs and larger companies)
- 5 Research & Innovation expert groups
- Integration of expertise & products along a circular value chain:
 - Feeding formulation and feed additives
 - In-cage monitoring, feeding technology and feed control
 - Deep-tech SMEs (biosensors, Internet of Things, Artificial Intelligence)
 - Biotechnology: By-product valorization and zero waste

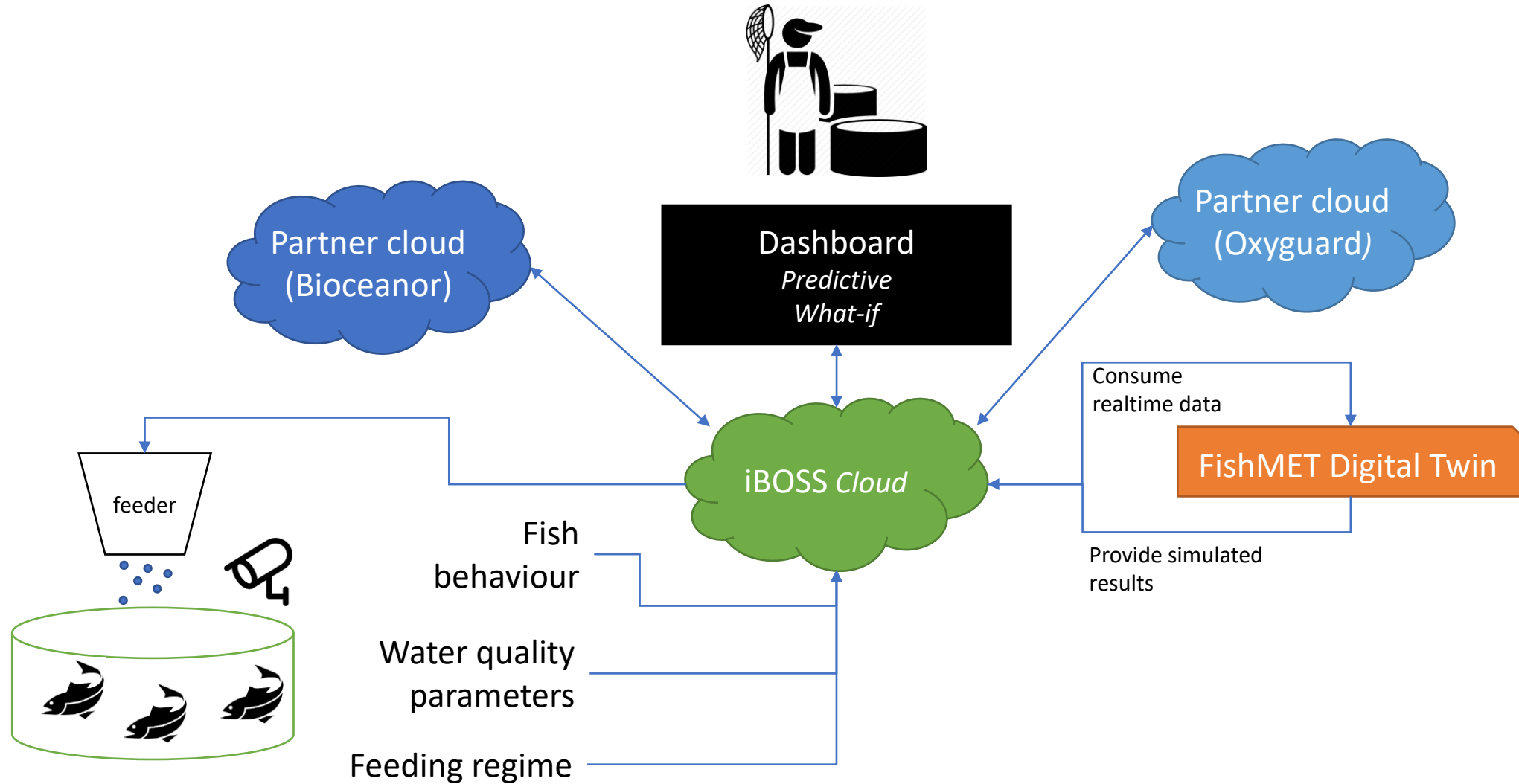
Nº	Participant organization name	Acronym	Country
1.	AQUABIOTECH GROUP	ABT	MALTA
2.	NORCE NORWEGIAN RESEARCH CENTRE AS	NORCE	NORWAY
3.	COVARTEC - DURAND DOMINIQUE, DENIS, FABRICE	COV	NORWAY
4.	OXYGUARD INTERNATIONAL AS	OXY	DENMARK
5.	SUSTAINABLE INNOVATIONS EUROPE SL	SIE	SPAIN
6.	HELLENIC CENTER OF MARINE RESEARCH	HCMR	GREECE
7.	SZENT ISTVAN UNIVERSITY	SZIU	HUNGARY
8.	TTZ BREMERHAVEN EV	TTZ	GERMANY
9.	LEITAT	LEI	SPAIN
10.	EASY GLOBAL MARKET SAS	EGM	FRANCE
11.	NCE SEAFOOD INNOVATION CLUSTER AS	NCE	NORWAY
12.	BIOCEANOR SA	BIO	FRANCE
13.	UNIVERSITET I BERGEN	UIB	NORWAY
14.	ALLER AQUA RESEARCH GMBH	AA	GERMANY
15.	VITAFORT Zrt.	VF	HUNGARY
16.	GYŐRI ELŐRE Fish Farm	GE	HUNGARY



Map 1 Countries in the consortium and demonstration sites in Europe.



Deployment principle



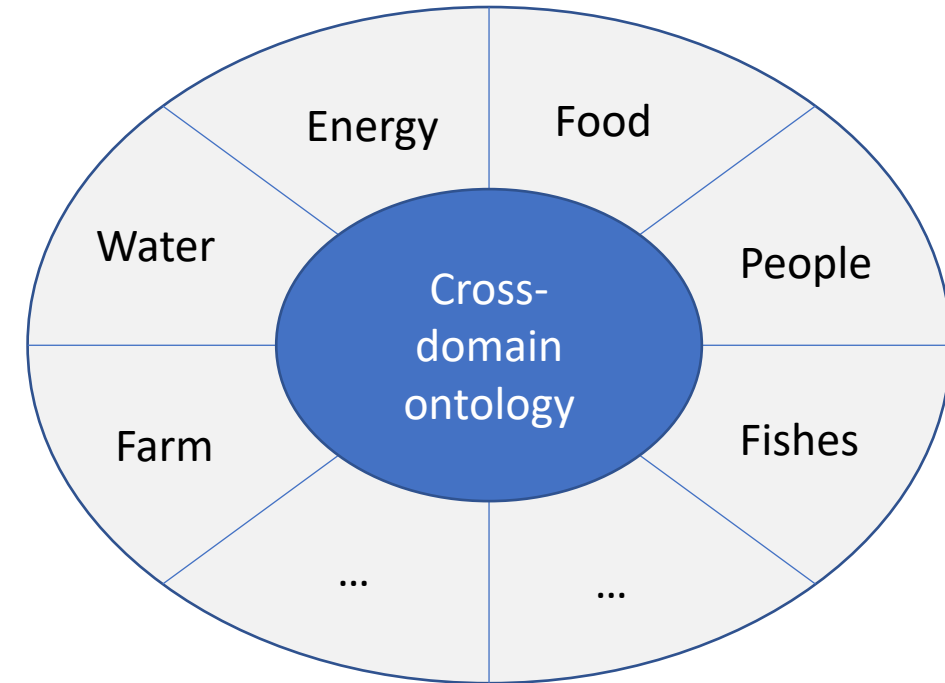
- **One interface to connect all components**

- Based on standardised data exchange interfaces
 - Restful API
- **Cross domain capabilities of the data model**

NGSI-LD



- **Open-source ecosystem**



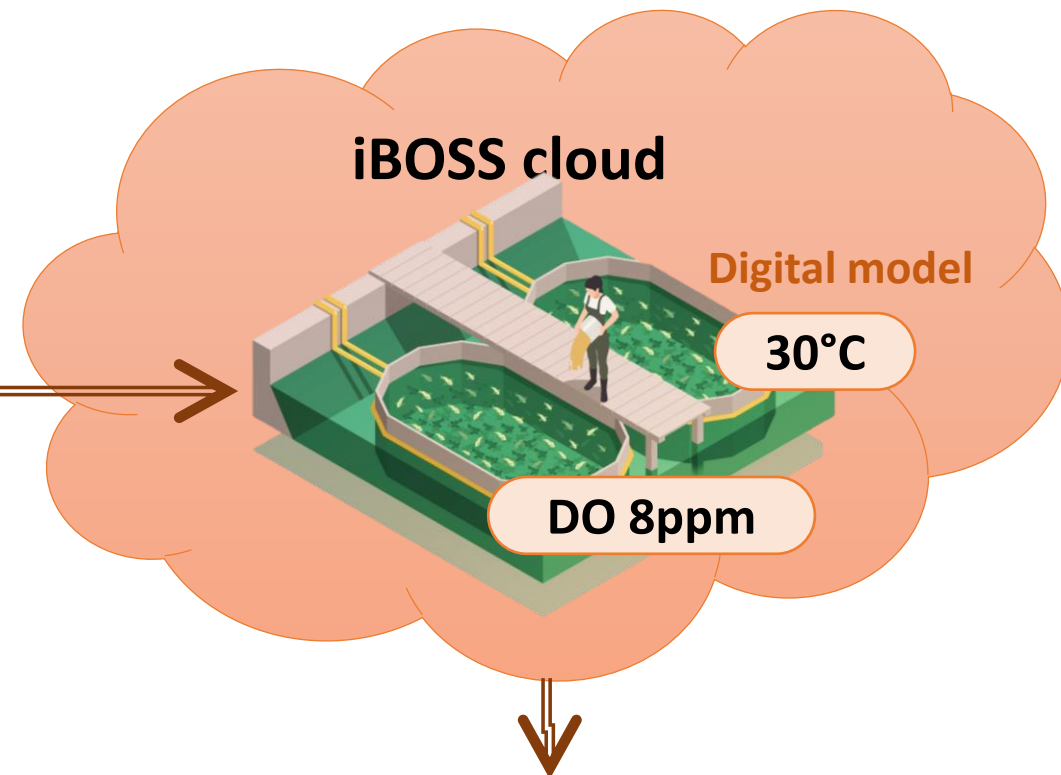
https://www.fiware.org/wp-content/uploads/FF_PositionPaper_FIWARE4DigitalTwins.pdf

Data twin representation

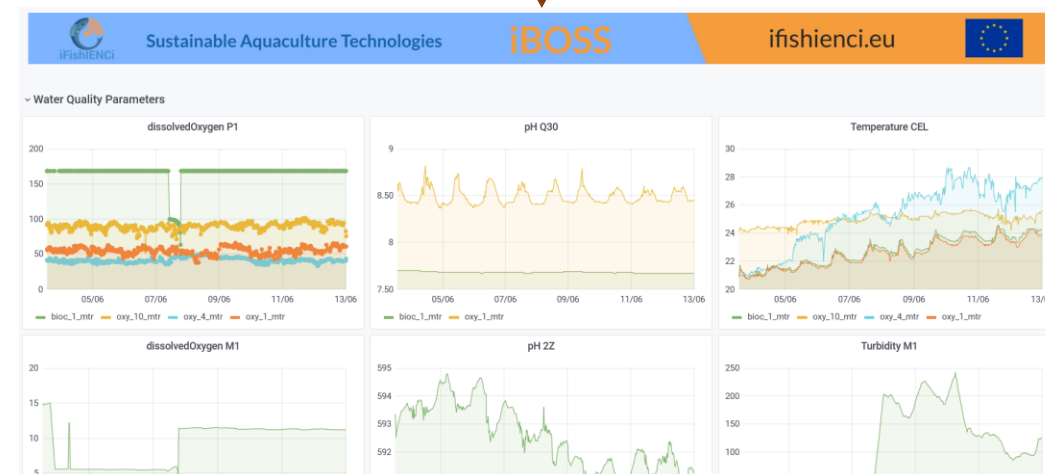
Physical domain



Sensors stream

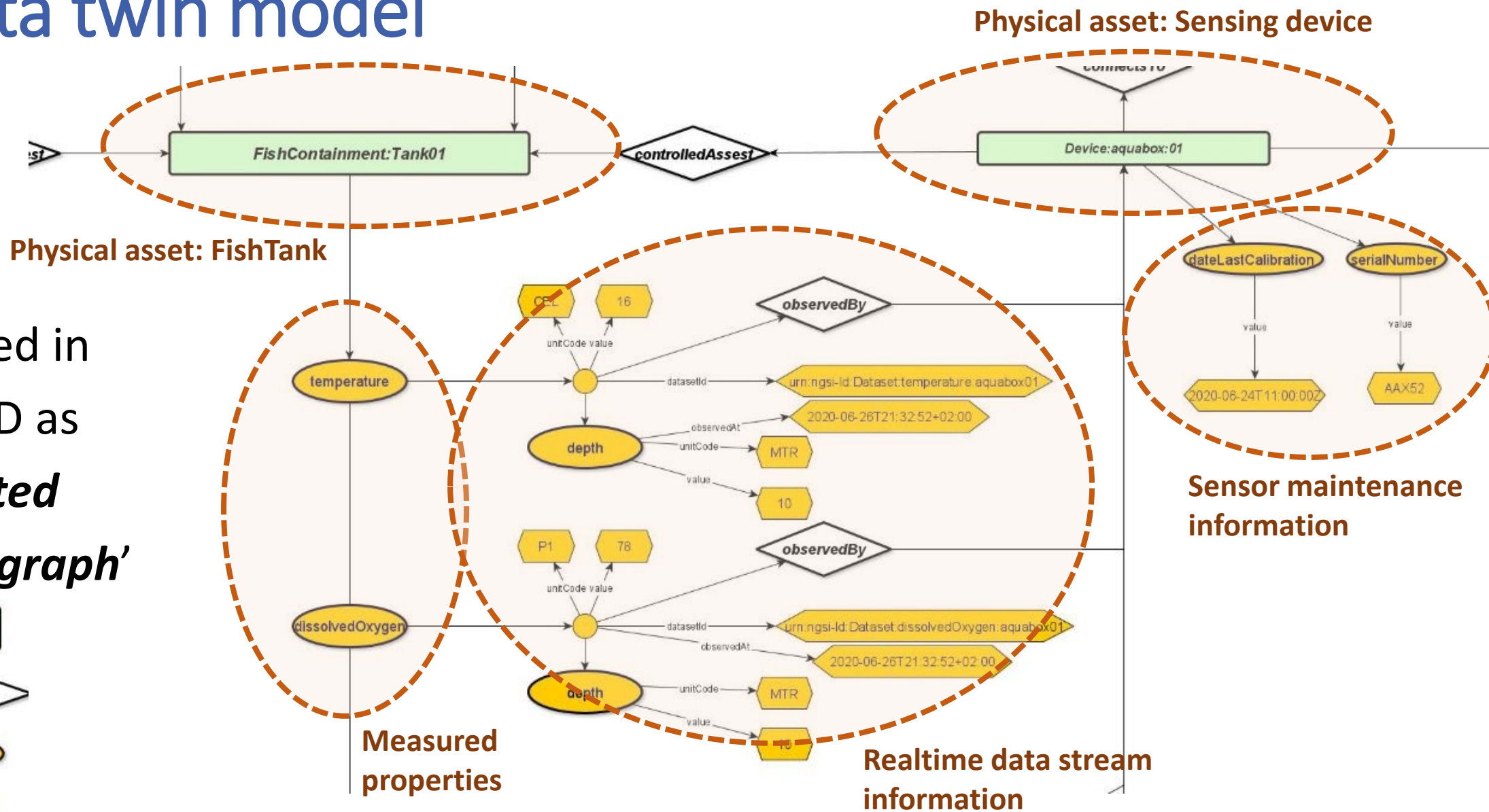
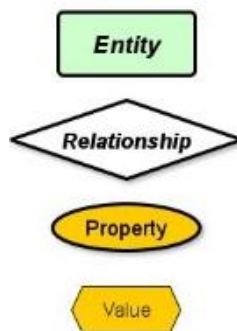


- Simplest form of a Digital Twin
- Realtime state representation through a digital artefact



Data twin model

Modelled in
NGSI-LD as
*'directed
property graph'*



Digital twin levels

● Data twin (descriptive twin)

- Realtime status of any parameter : water quality, process (feeding, ..)

● Predictive twin

- Predict future states and raise alerts
 - DO level to go beyond a low threshold within the coming hour
 - Biomass to reach a preset target in 2 weeks

● Design twin

- Use predictive twin to run scenario based analysis
 - « What » will be my biomass evolution change « If » I increase feeding by 10% ('what-if' analysis)

● Prescriptive twin

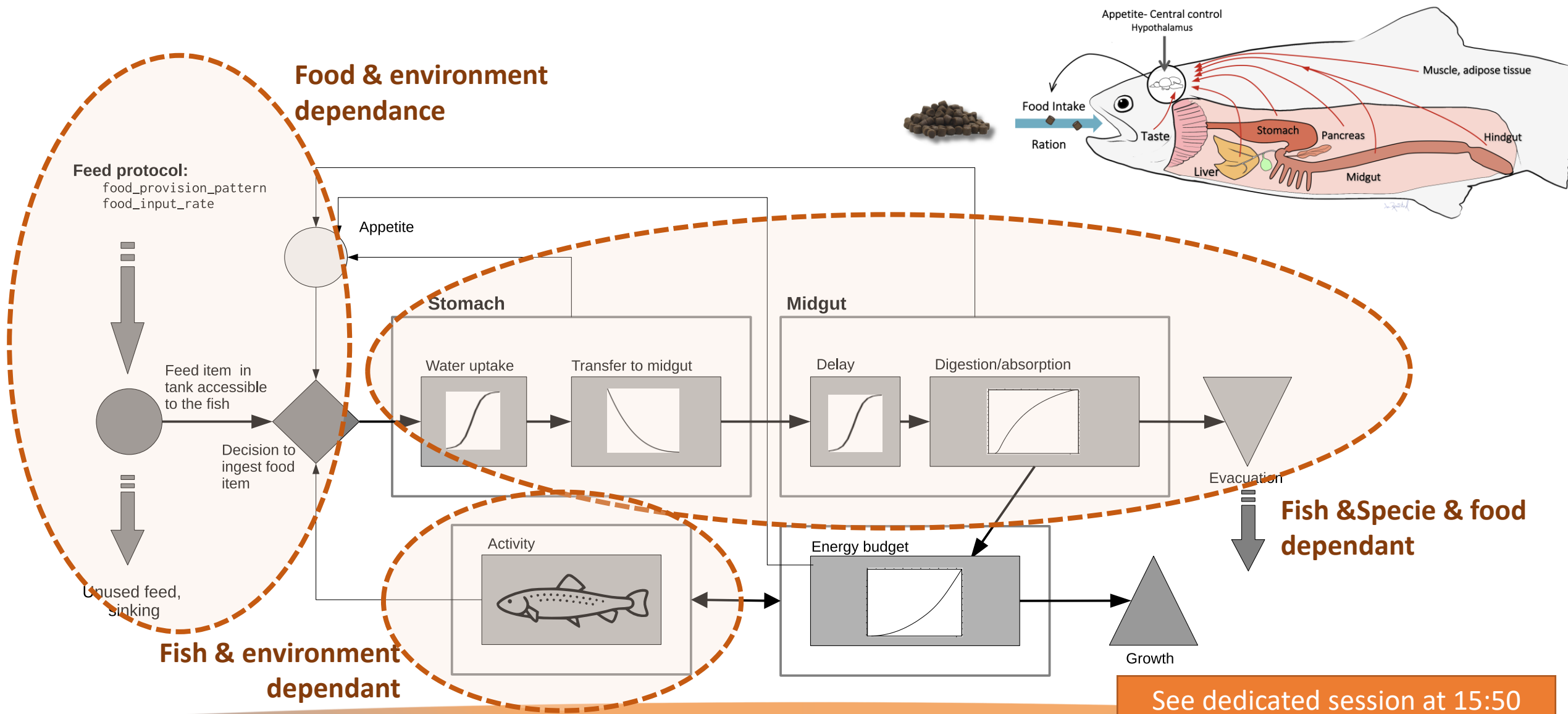
- Provide recommendations based on multi-criteria analysis

Need for a model of the physical asset

- Physical
- Behavioural
- Machine learning
-

+ Physical asset / Digital twin / user interaction model

Trout model for biomass estimation in RAS



See dedicated session at 15:50

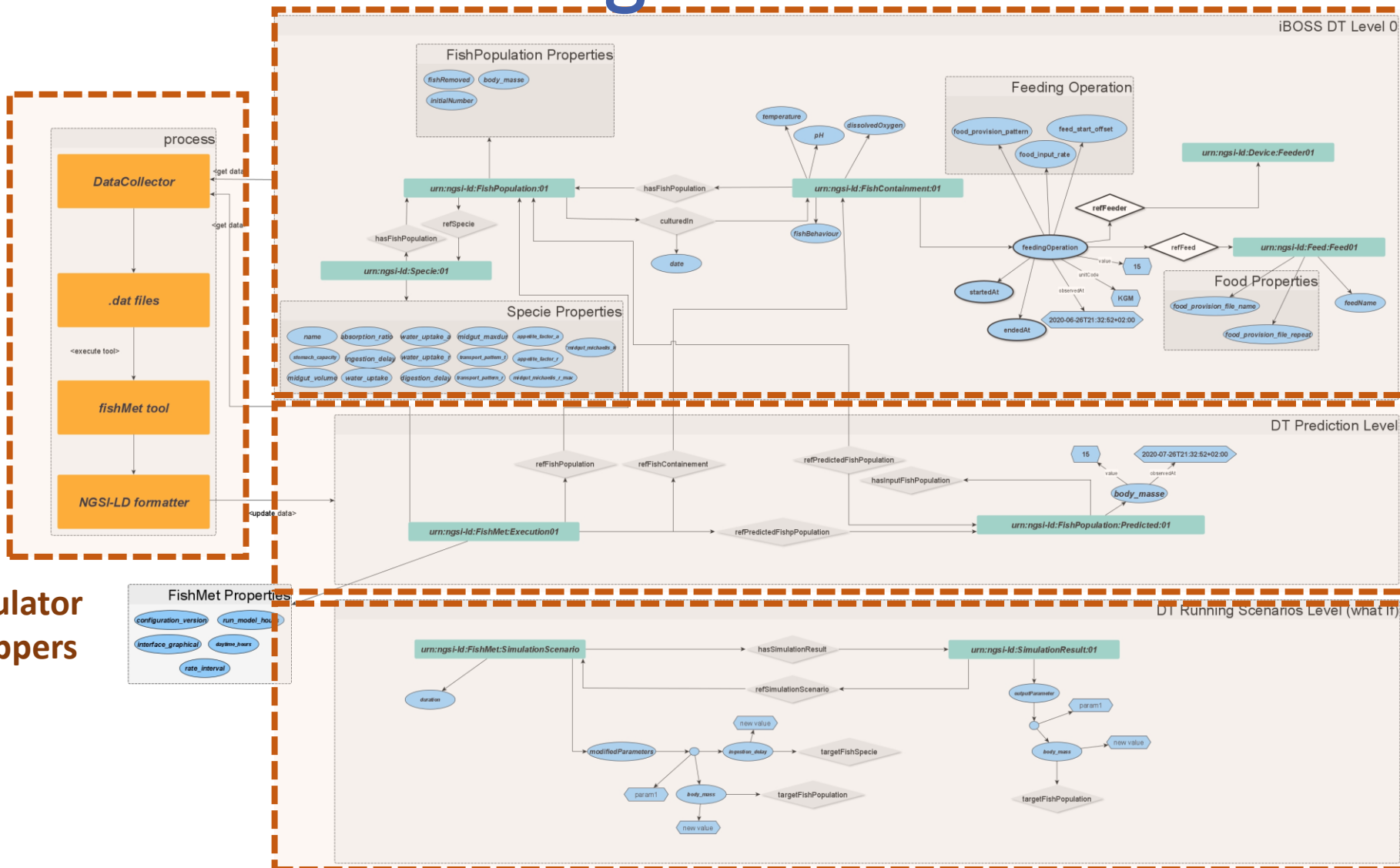
Trout model integration: overview

Descriptive twin model

Predictive twin

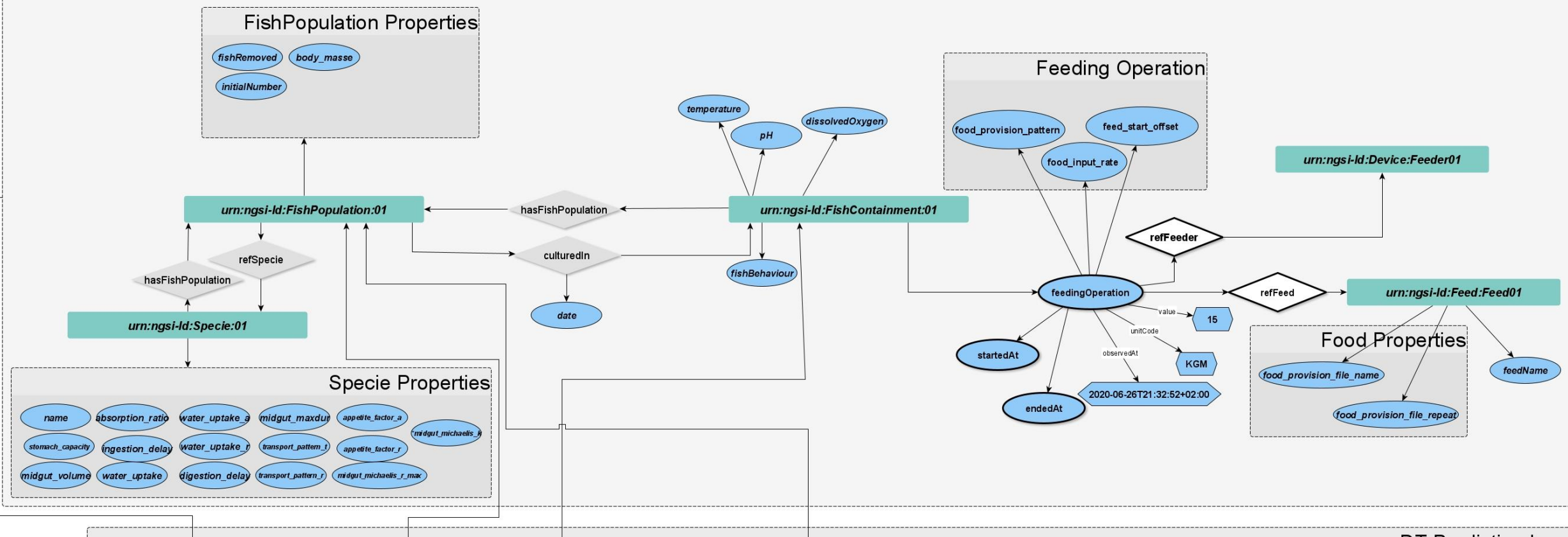
Design twin

Simulator
wrappers



Trout model integration: descriptive twin

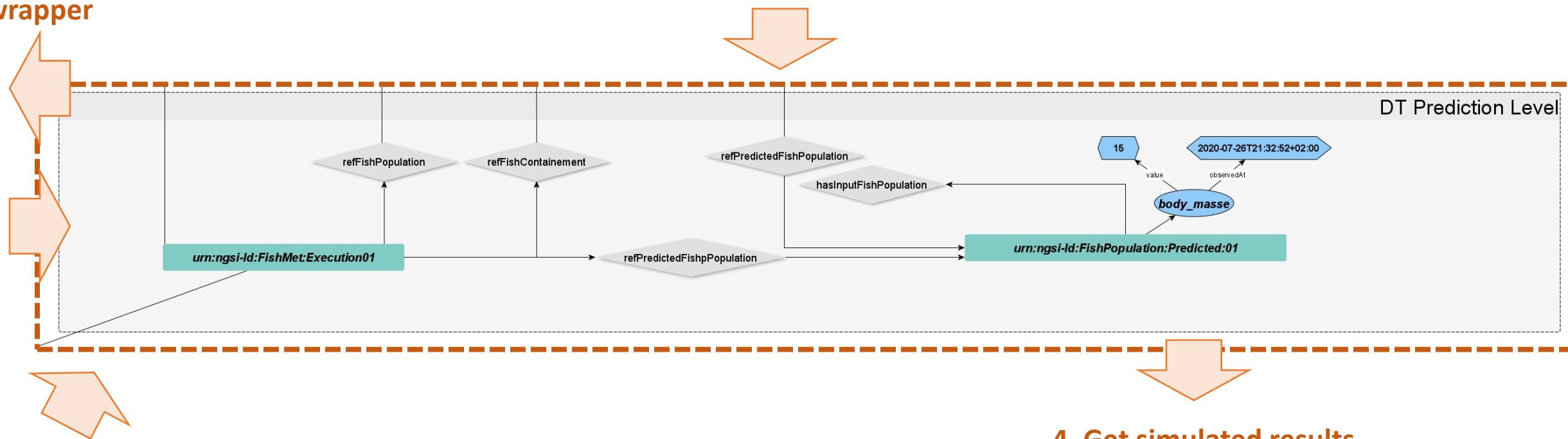
iBOSS DT Level 0



Trout model integration: predictive twin

3. Interact with simulator through wrapper

1. Get actual data from the prescriptive twin



2. Enter simulator configuration parameters

4. Get simulated results
(incl. timeseries with timestamps
in future)



4. Get simulated scenario results

Conclusion

- An **interoperable platform** based on **open standards** and **open-source components** has been demonstrated to handle **Digital Twins**
 - Basis for further data exchanges over the aquaculture value chain
- Several **levels of Digital Twins** have been defined and modelled
- Interaction mechanisms have been defined between system components
 - Generalisation potential to new applications
- Next steps will allow realtime comparison of model predictions with actual observation so to fine tune the model.



Thank you !

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