



REDUCED ORDER MODELS as WEB Application for ENERGY MANAGEMENT Barriers and Challenges

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Overview

1. Megatrends
2. Building Simulation, overview of a mature field;
3. Web based simulation;
4. Options for web-based simulation
5. The BEM-SERVER H2G approach;
6. ModSCO Architecture;
7. Barrier and Challenges: Open Questions



Megatrends

Ageing of Population
RES Tech. and Feasibility
IoE - DDD

Megatrends are reshaping the business world,
breaking down walls, and powering convergence and collaboration.



Decentralized

70% of new capacity additions
will be renewables by 2040



Decarbonized

93% of CEOs see sustainability
as important to future success



Digitized

50 billion devices will
be connected by 2020

Source: <https://perspectives.se.com/blog/3-megatrends-shaping-the-new-world-of-energy>



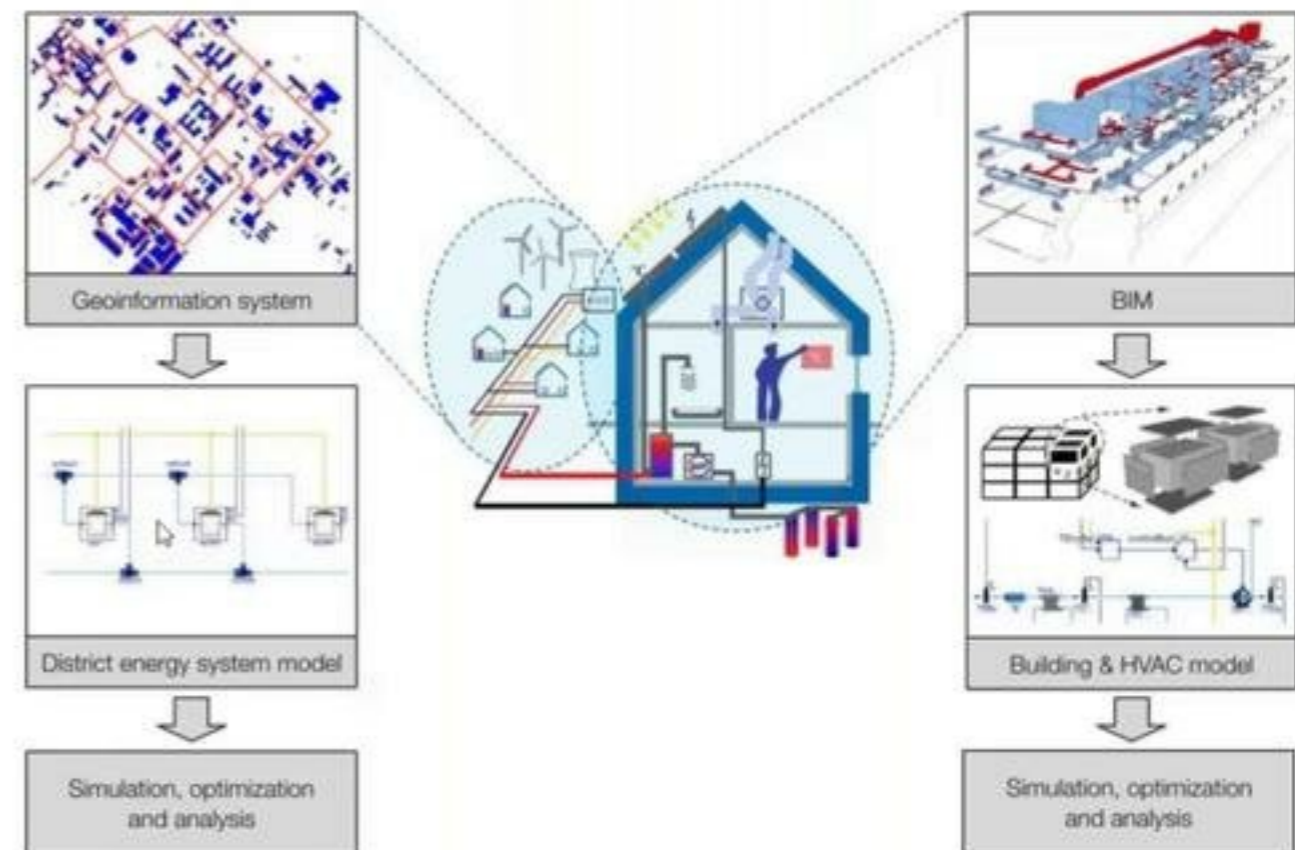


IBPSA – Maturity of a Field



<https://bs2021.org/ibpsa-world/>

The development, evaluation, use in practice, and **standardization**, of the models and programs is therefore of growing importance. For building Design, Construction, Operation, Maintenance and Management activities, there is also an urgent need for the integration of '**generally applicable**' and '**generally accepted**' methods and tools, for various applications, each having various levels of complexity and/or various types of end-users. Also important is the technology transfer issue within the building modeling field.



<https://ibpsa.github.io/project1/>
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H2020 and HIT2Gap

What are the problems?

- Data interoperability issues between the different type of equipment and applications, due to the heterogeneous and linked nature of the collected data
- Limited integration of advanced data management applications [12],
- Erroneous collected data,
- No integration of data related to building occupants,
- Lack of extensibility to adapt to new building conditions and requirements (i.e., adding new equipment, extending the management applications functionalities, etc.).

Sources:

<https://doi.org/10.1080/19401493.2015.1007699>

<https://doi.org/10.1016/j.egypro.2017.07.399>





H2020 and HIT2Gap Requirements Engineering

Requirements	Description
Field Interoperability	Ensures the integration among diverse installed systems/devices that are developed by different manufacturers and communicate via different communication protocols
Management Interoperability	Integrates different type of building-oriented applications and facilitates data exchange between them
Middleware Interoperability	Ensures seamless communication between the installed equipment and management level applications
Modularity	Allows different modules or components to be added/replaced without affecting the rest of the system
Genericity	Adapts to different environments and type of building
Evolutionary	Evolves to meet new requirements when it is necessary (e.g., adding new services or equipment)
Advanced processing	Embeds advanced techniques to process the collected building data and acquire valuable information

Sources:

<https://doi.org/10.1080/19401493.2015.1007699>

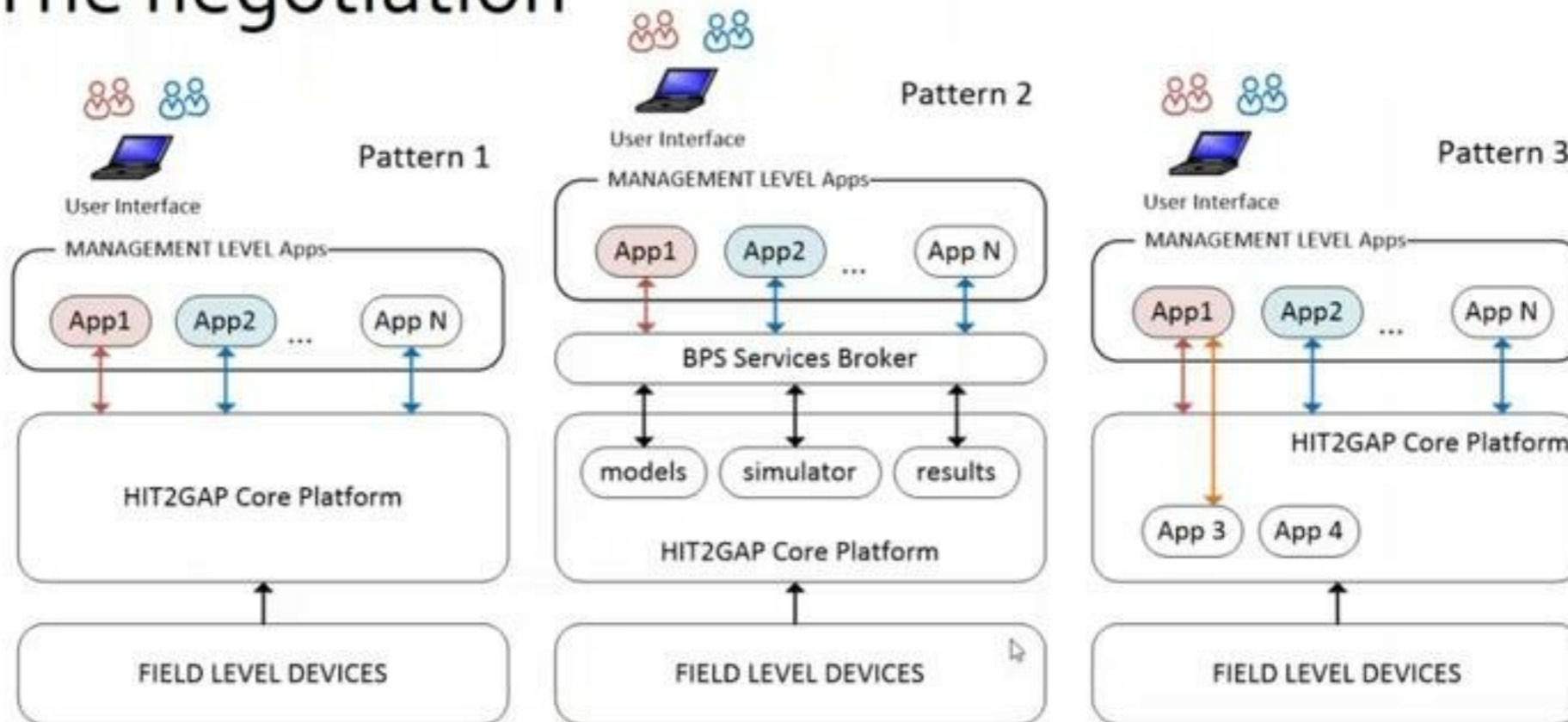
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Architecture choices for BPS integration

The negotiation

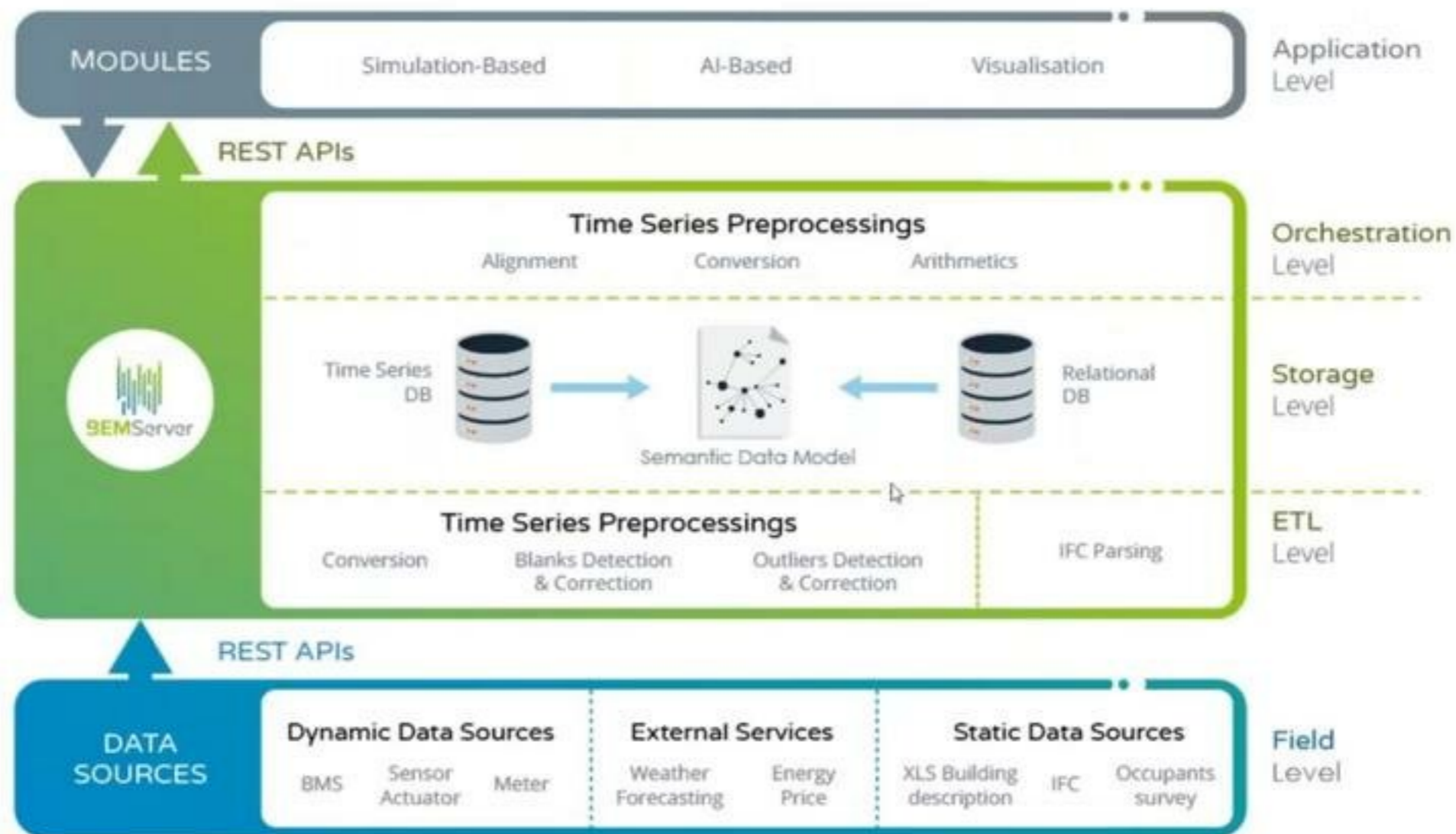


Legend:

- App to H2G CORE flow
- App to App flow
- App to H2G CORE integrated App flow
- H2G CORE to BPS Service Broker flow / H2G CORE to Field Level flow



HIT2GAP Project - The final solution



<https://github.com/HIT2GAP-EU-PROJECT/BEMServer>

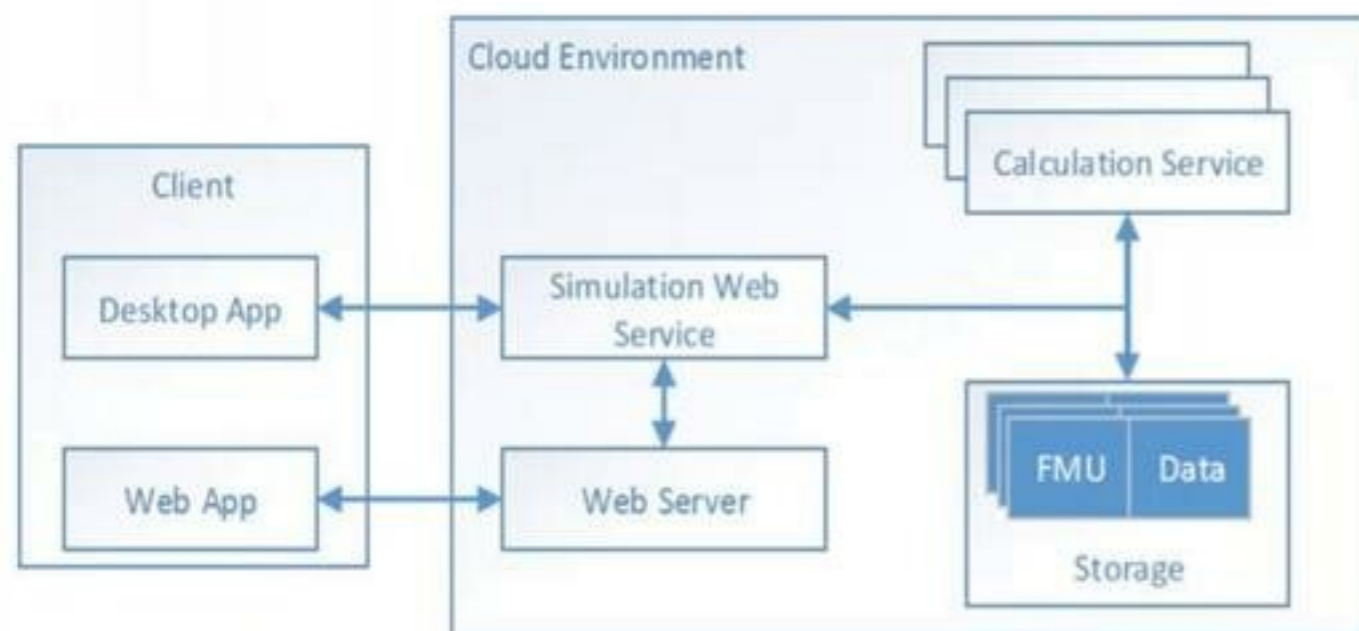




Architecture choices for BPS integration

OPTION 3

Distributed simulation services using cloud based solutions and FMI standard

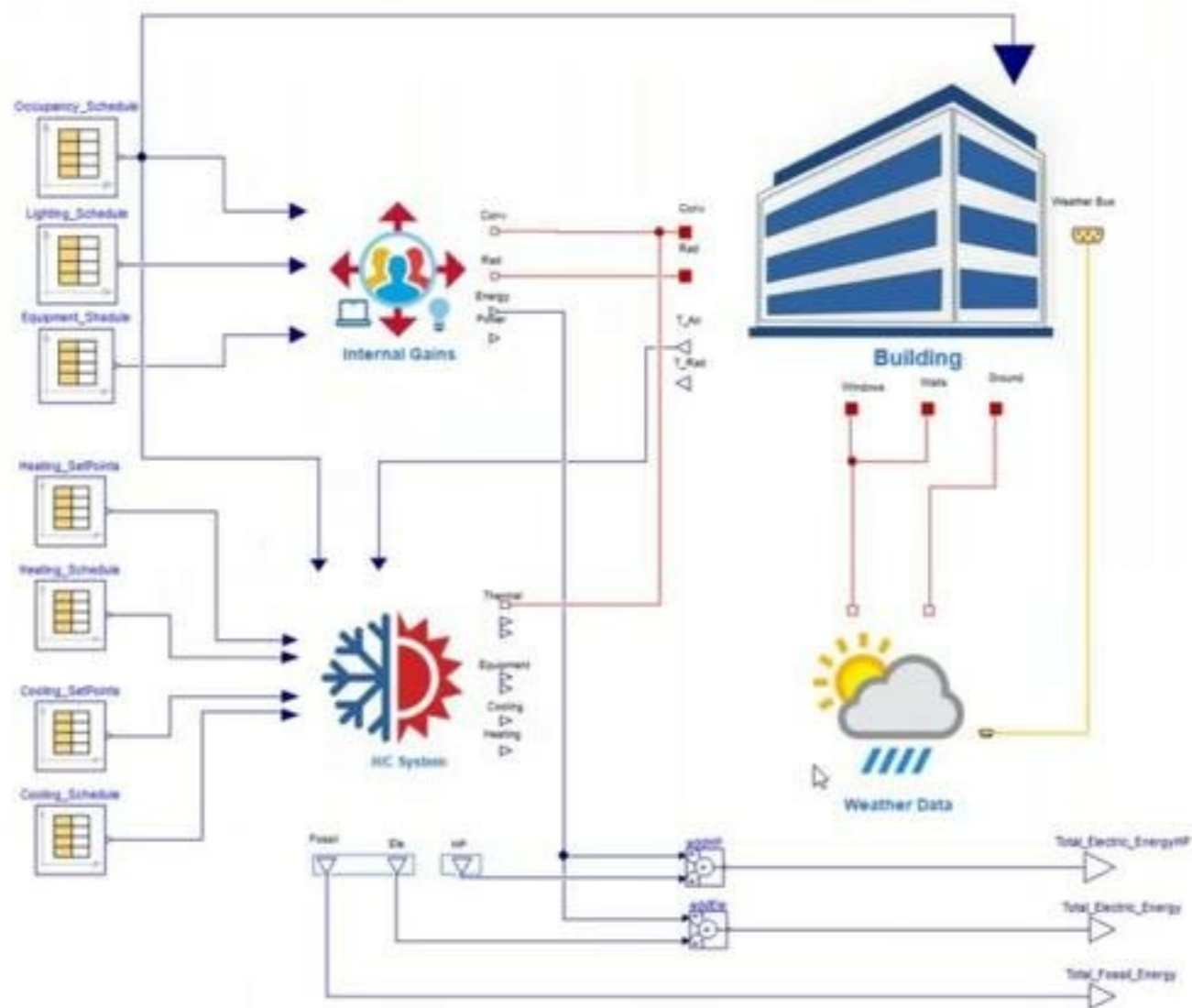


Overview of the cloud based simulation web service using FMI standard models.
Source: Bittner et al. (2015)





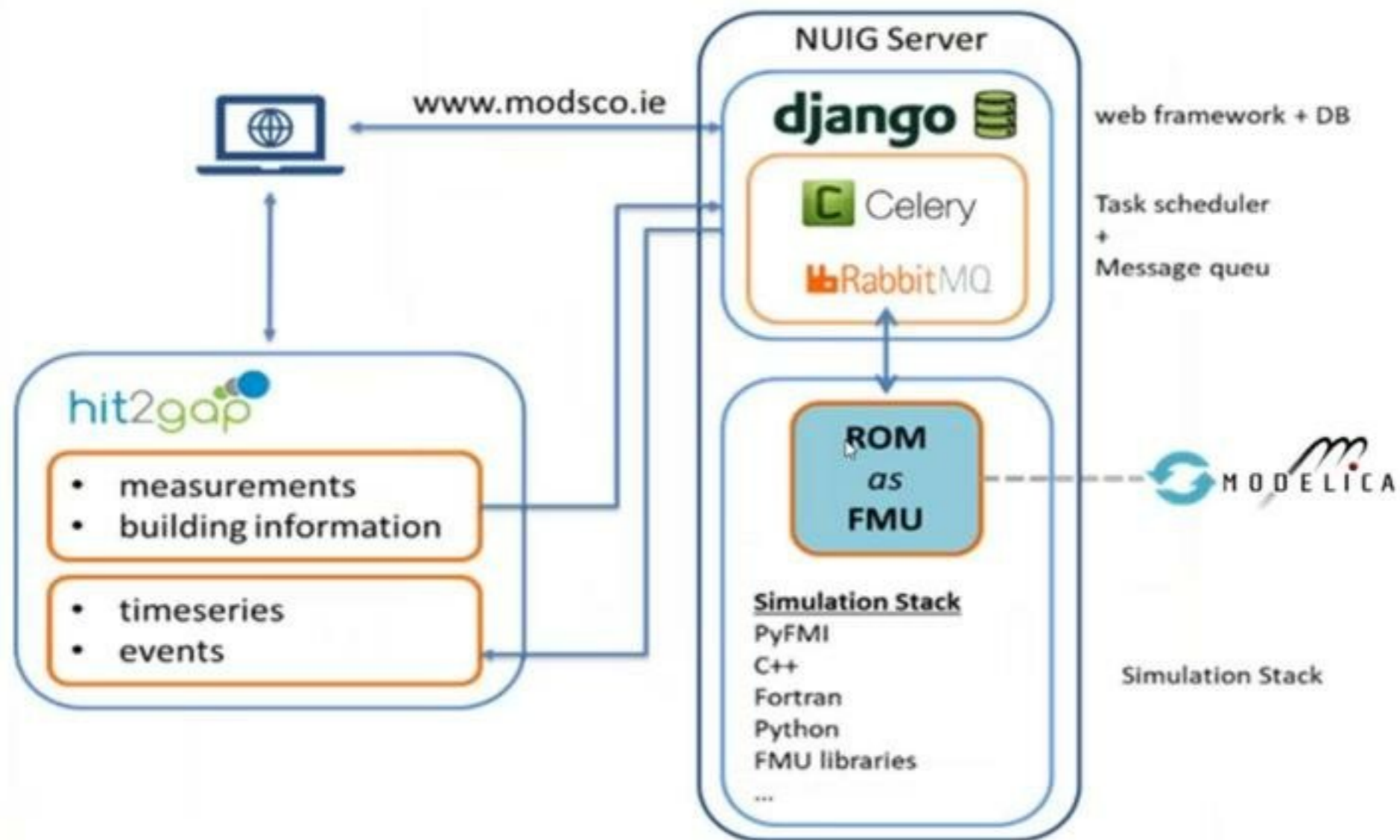
Reduced Order Models



Source: ModSCO. Online Reduced Order Models (ROM) to Address the Performance Gap †Alessandro Piccinini 1,2,* , Luis M. Blanes 1,2, Federico Seri 1,2, Letizia D'Angelo 1,2 and Marcus M. Keane 1,2 in MDPI Proceedings.



ModSCO v.1.0 - Architecture





www.modsco.ie





Barriers & Challenges

- USERS, who are they?
- GUIs – UX → Interface between human & systems
- Role of BPS in the BLC – ASHRAE 209 standard
- Credibility of BPS results
- Training and Education
- Platforms, good idea, but a business idea?
- Could we learn from other environments (Smart Manufacturing, Automotive, Aerospace ? In the Built Environment

