The SmartNet Project

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Agenda

- The context
- TSO-DSO interaction in the view of the European stakeholders
- Goals of SmartNet and added value for the system
- SmartNet and the other EU projects
- Three main reference architectures
- Overall project layout
- Work-packages and chronogram
- The consortium
- About the project coordinator

The context: some key "driving forces"

Need to balance G and L in real time (bulk storage is still insufficient)

An adequate level of reserve must stay available

Need for new patterns of TSO-DSO coordination

Possibility to provide advanced services for the system <u>if dispatchability is guaranteed</u>

Evolution of distribution systems:

- **Smart Grids**
- **VPP (storage + generation**
- **DSM**

Increased needs for system flexibility and reserve

Explosion of RES deployment in T&D system: network under stress

Drive to extend market coupling towards real time markets

Need to provide economic "signals" to allocate reserve in an efficient way

System unbundling: creation of electricity markets:

TSO-DSO interaction in Stakeholders' view

European Commission: *"The Commission will prepare an ambitious legislative proposal to redesign the electricity market and linking wholesale and retail. This will increase security of supply and ensure that the electricity market will be better adapted to the energy transition which will bring in a multitude of new producers, in particular of renewable energy sources, as well as enable full participation of consumers in the market notably through demand response … enabling the roll-out of new technologies smart grids and demand response for an efficient energy transition"*.
(From: *"A framework strategy for a resilient Energy Union with a forward-looking climate change policy"*, part of the Energy Union Package)

ACER: *"The remit of DSOs is perhaps changing faster than any other single actor in the energy sector. Some networks are beginning to require more active management as significant volumes of small-scale generation connect to distribution grids. The TSO-DSO interface therefore requires careful management, as does the need for efficient information exchange, coordinated congestion management and integrated planning (coordination requirements between TSOs and DSOs introduced, for example, by the Demand Connection Code provide a valuable starting point). NRAs and ACER will work with DSOs and TSOs to assist them in more clearly defining their respective roles and responsibilities so that DSOs may manage their evolving networks in a transparent and reliable way, whilst at the same time supplying system services to TSOs"*
(From: "European energy regulation. A bridge to 2025")

TSO-DSO interaction in Stakeholders' view

ENTSO-E: indicates, among other, the following three policy actions:

- *TSOs and DSOs need to provide consumers access to participate in all markets.*
- *TSOs should work with DSOs and regulators in determining requirements around observability and active power management of distributed generation (DG) and demand-side response (DSR)*
- *Many aspects of TSO-DSO interaction will be addressed by the Network Codes.*

The implementation, maintenance and amendment of Network Codes are a priority for TSO-DSO collaboration in the coming years.

(From: Towards smarter grids: Developing TSO and DSO roles and interactions for the benefit of Consumers)

CEDEC, EDSO4SmartGrids, ENTSO-E, Eurelectric, Geode: *To solve their respective challenges in a cost- and resource efficient way, both TSOs and DSOs will rely upon access to a common set of supply and demand side resources. Ensuring coordinated access between TSOs and DSOs to this limited pool of assets is essential for enabling TSOs and DSOs to fulfil their missions in a manner that minimises societal cost and maximises sustainability and security of supply of our power system.*

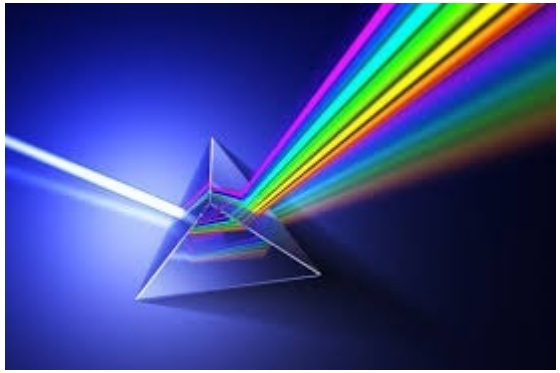
(From: General Guidelines For Reinforcing The Cooperation Between TSOs and DSOs)

SmartNet: goals

SmartNet analyses **architectures for optimized interaction between TSOs and DSOs** in managing the exchange of information for the acquisition of ancillary services (reserve and balancing, voltage regulation, congestion management) from subjects located in the distribution segment.
Different architectures are compared **on three simulated national cases** (Italy, Denmark, Spain).
The simulation platform is then implemented in a **full replica lab**, where the performance of real controller devices will be tested.

Physical network layer

Market layer



ICT layer

Three physical pilots developed to show:

- modalities to exchange monitoring signals between transmission and distribution networks
- study cases on services that can be offered by entities connected to distribution
  - thermal inertia of indoor swimming pools,
  - storage of radio-base stations for telecommunication).

SmartNet: added value for the system

The ambition of SmartNet is to tackle such questions as:

- **which ancillary services** could efficiently be provided from distribution to the whole system (via transmission)

- **which optimized modalities ("architectures")** could be adopted for managing the network at the TSO-DSO interface and what monitoring and control signals could be exchanged to carry out a coordinated action

- **what information has to be exchanged** and how (ICT) for the coordination on the distribution-transmission border, starting from monitoring aspects, to guarantee observability and control of distributed generation, flexible demand and storage systems

- **which regulatory implications** could the above issues have on the European system and on the on-going market coupling process.

SmartNet and the other EU projects

SEVENTH FRAMEWORK PROGRAMME

BADGE

Simulator of trans-national balancing market for the AIS zone

GRID4EU
INNOVATION FOR ENERGY NETWORKS

Analysis of Smart Grid technologies and costs-benefits

electra
Turn on the Grid of the Future

European Liaison on Electricity Committed Towards long-term Research Activity Integrated Research Programme

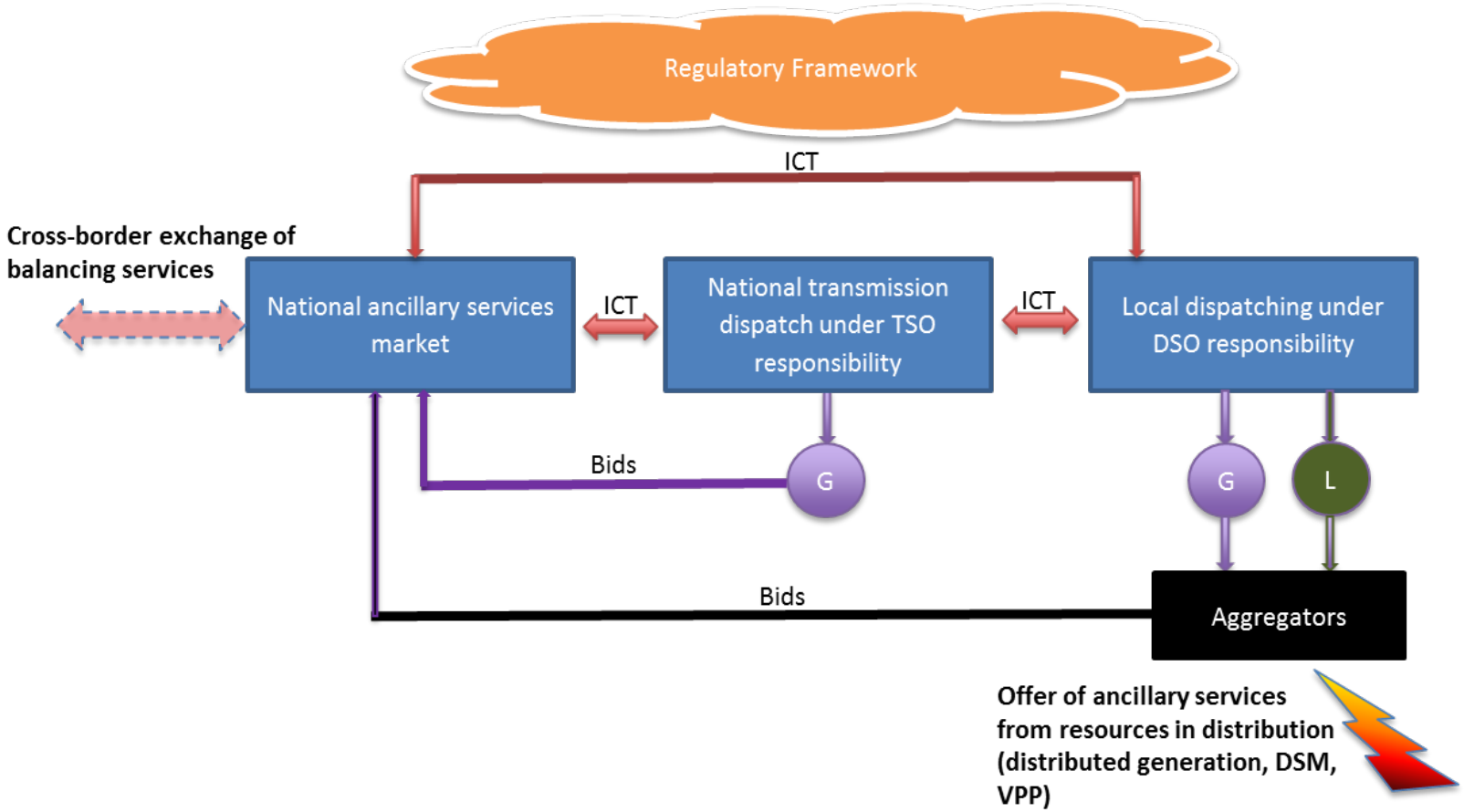
SmartNet

FutureFlow

"Designing eTrading Solutions for Electricity Balancing and Redispatching in Europe"

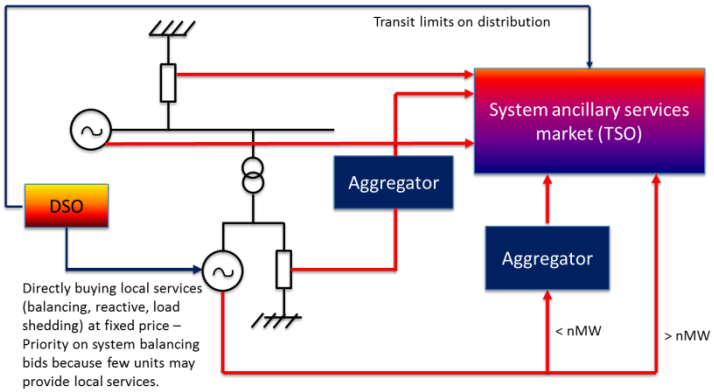
+ other LCE6-LCE10 projects

Relationship between main system actors

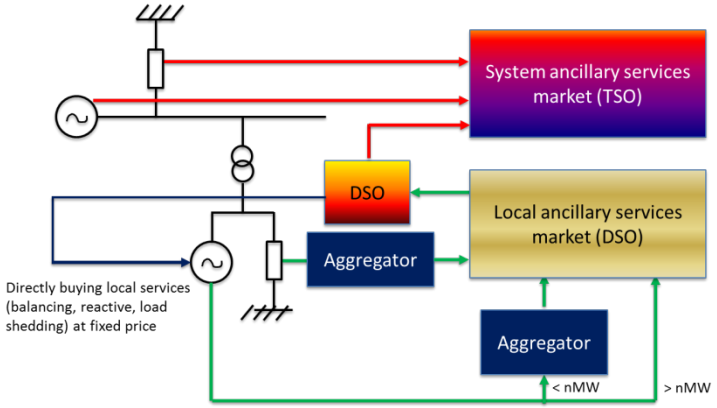


Three main reference architectures

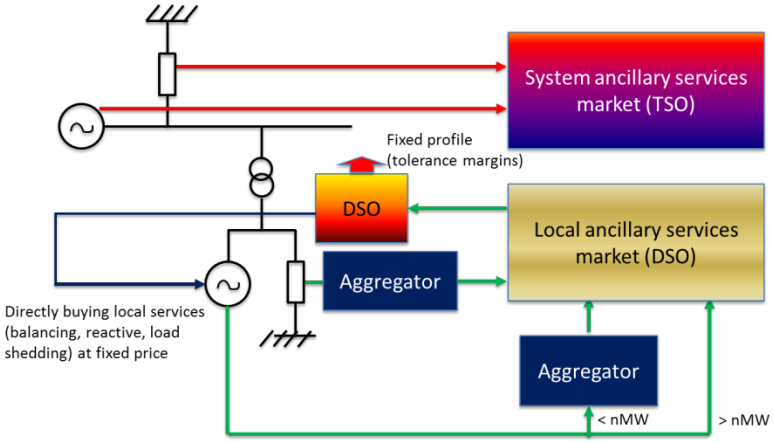
Extended central dispatching



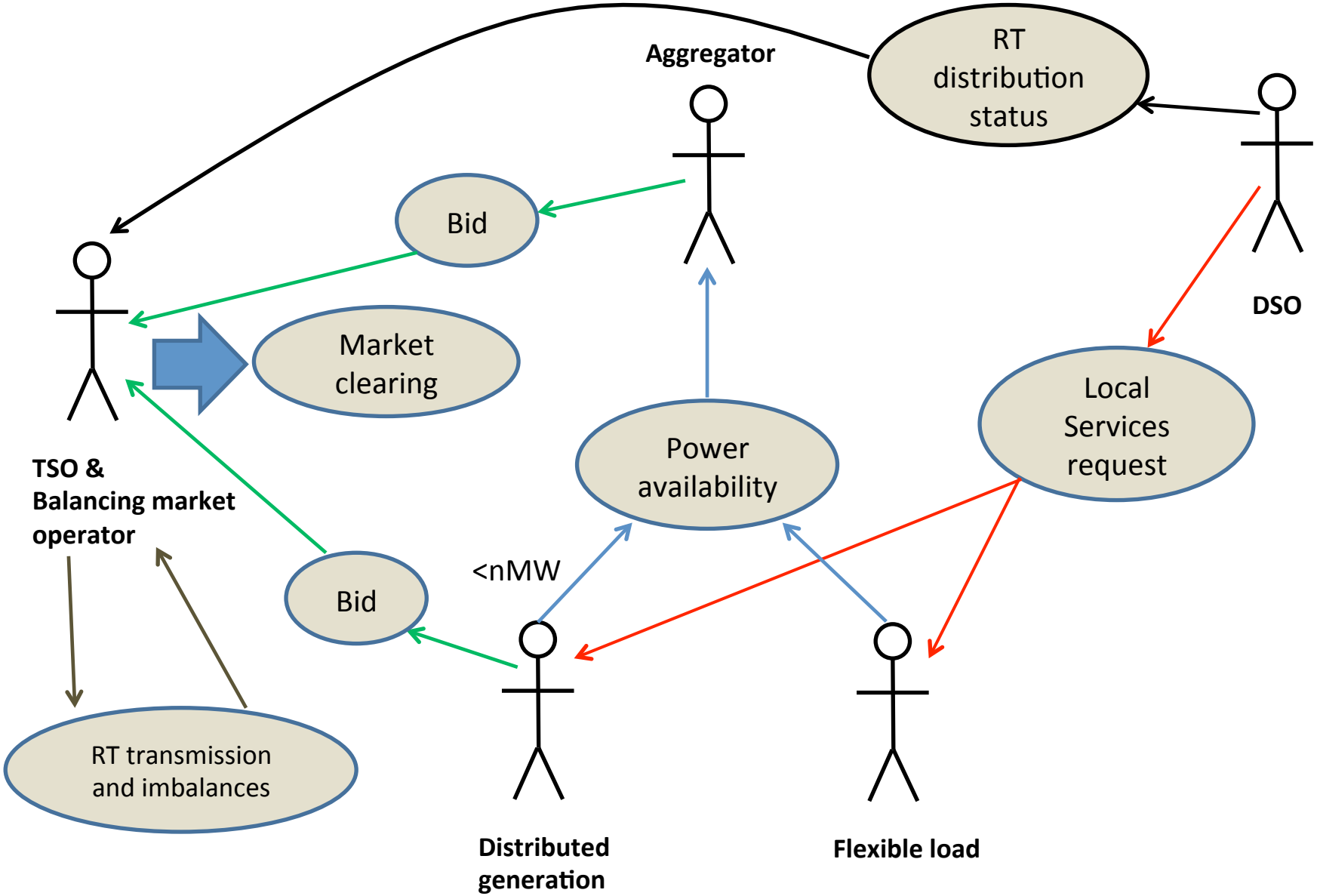
Local DSO dispatching



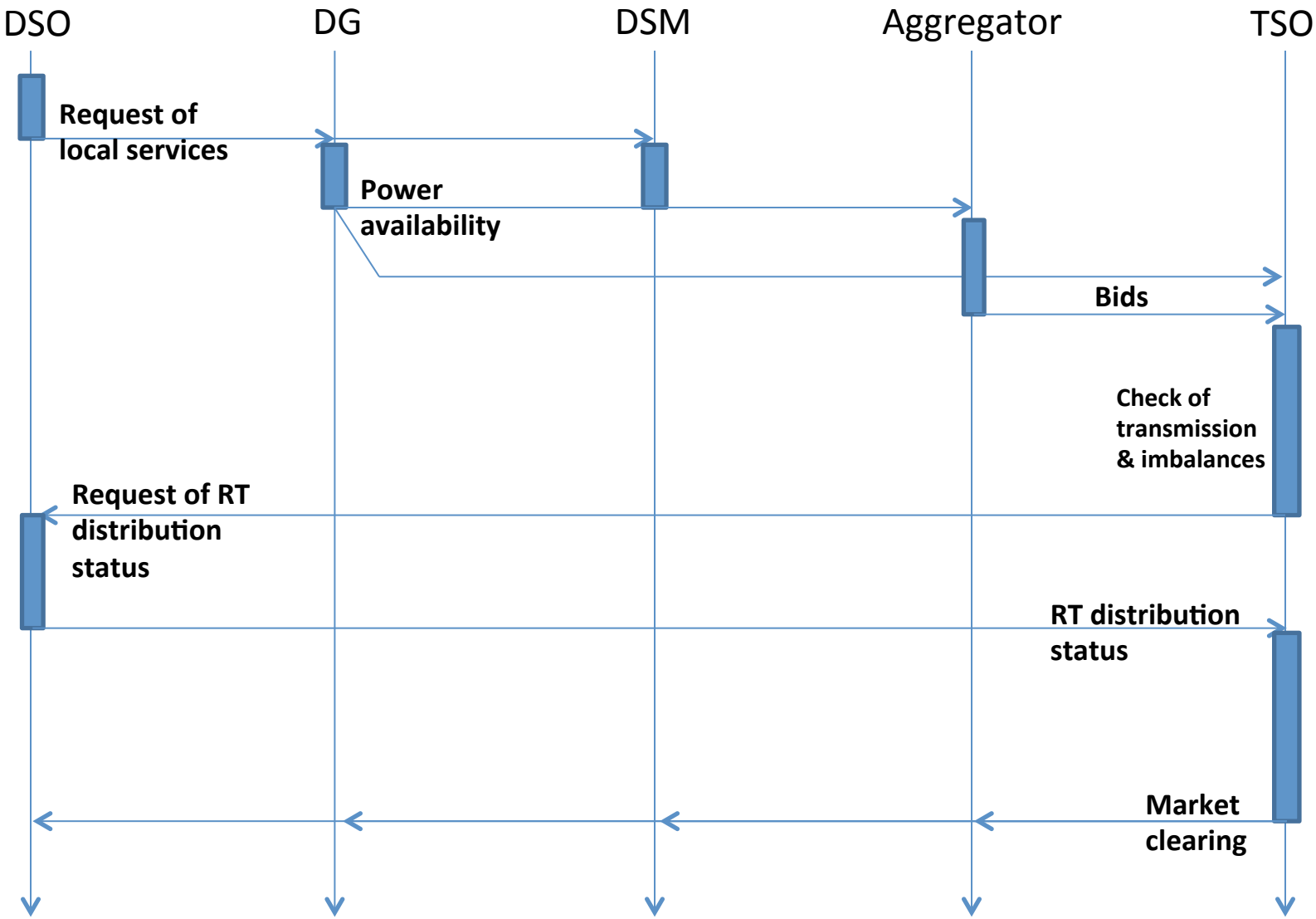
Programmed exchange at primary substations



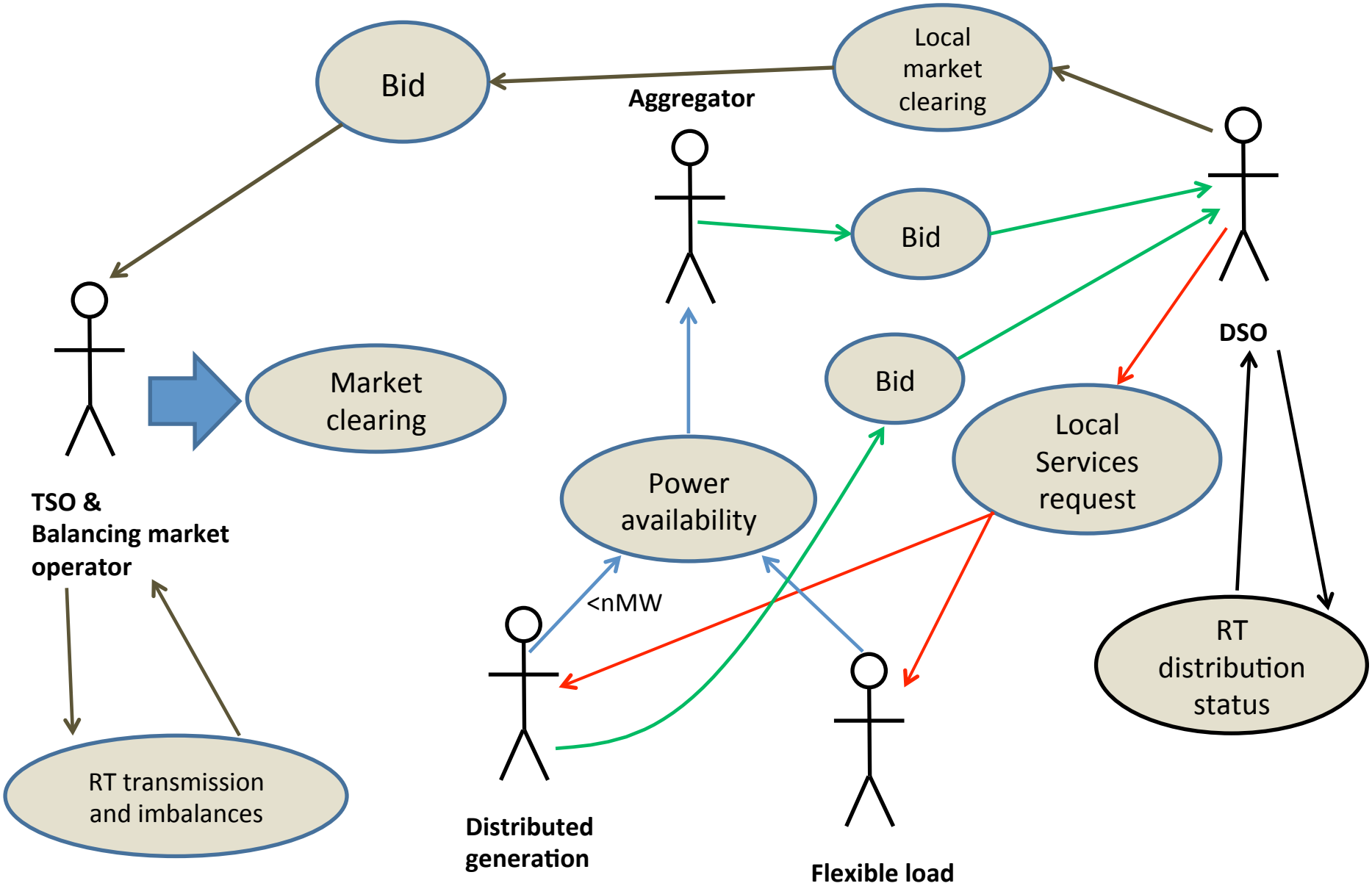
Architecture 1: use case diagram



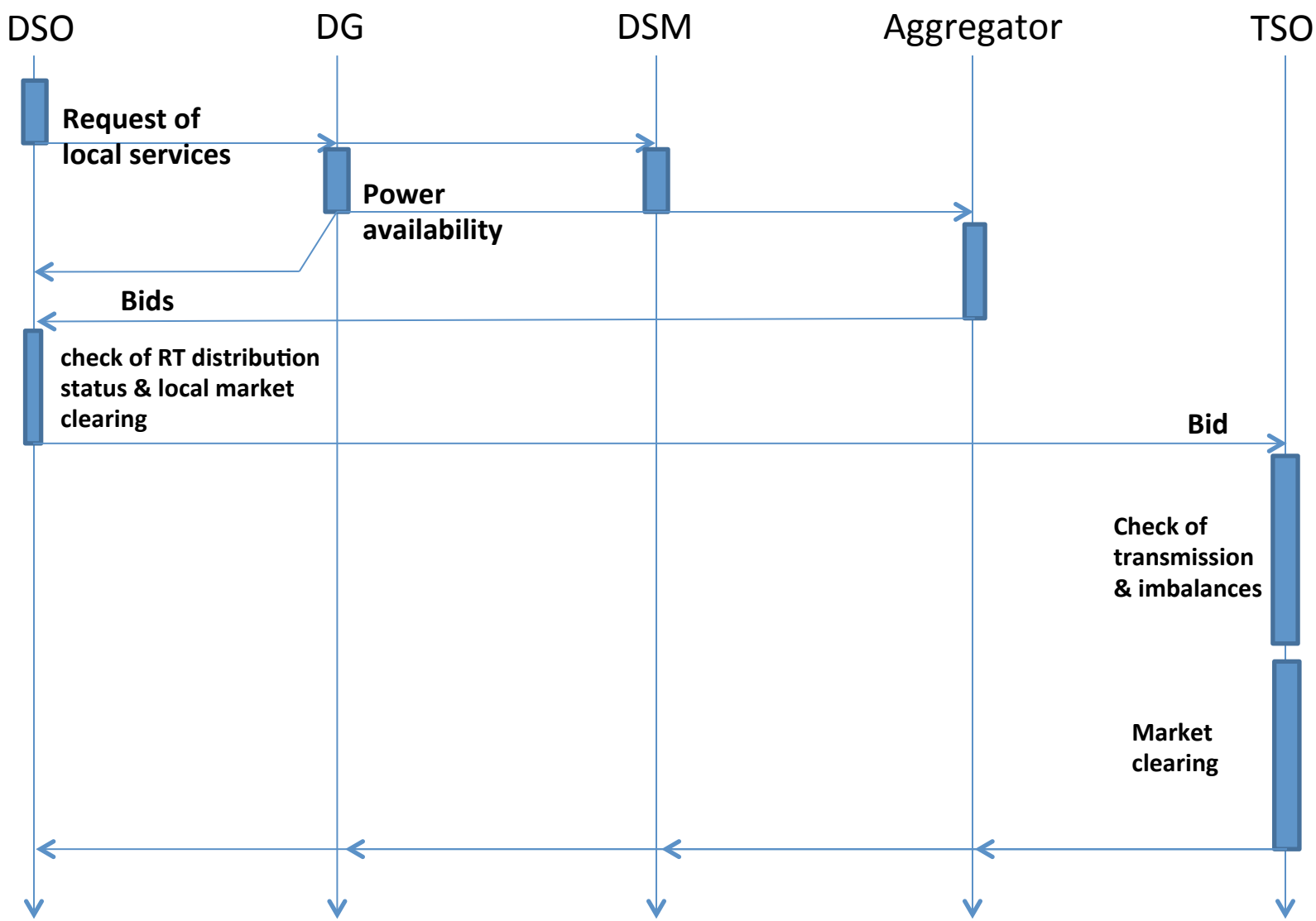
Architecture 1: sequence diagram



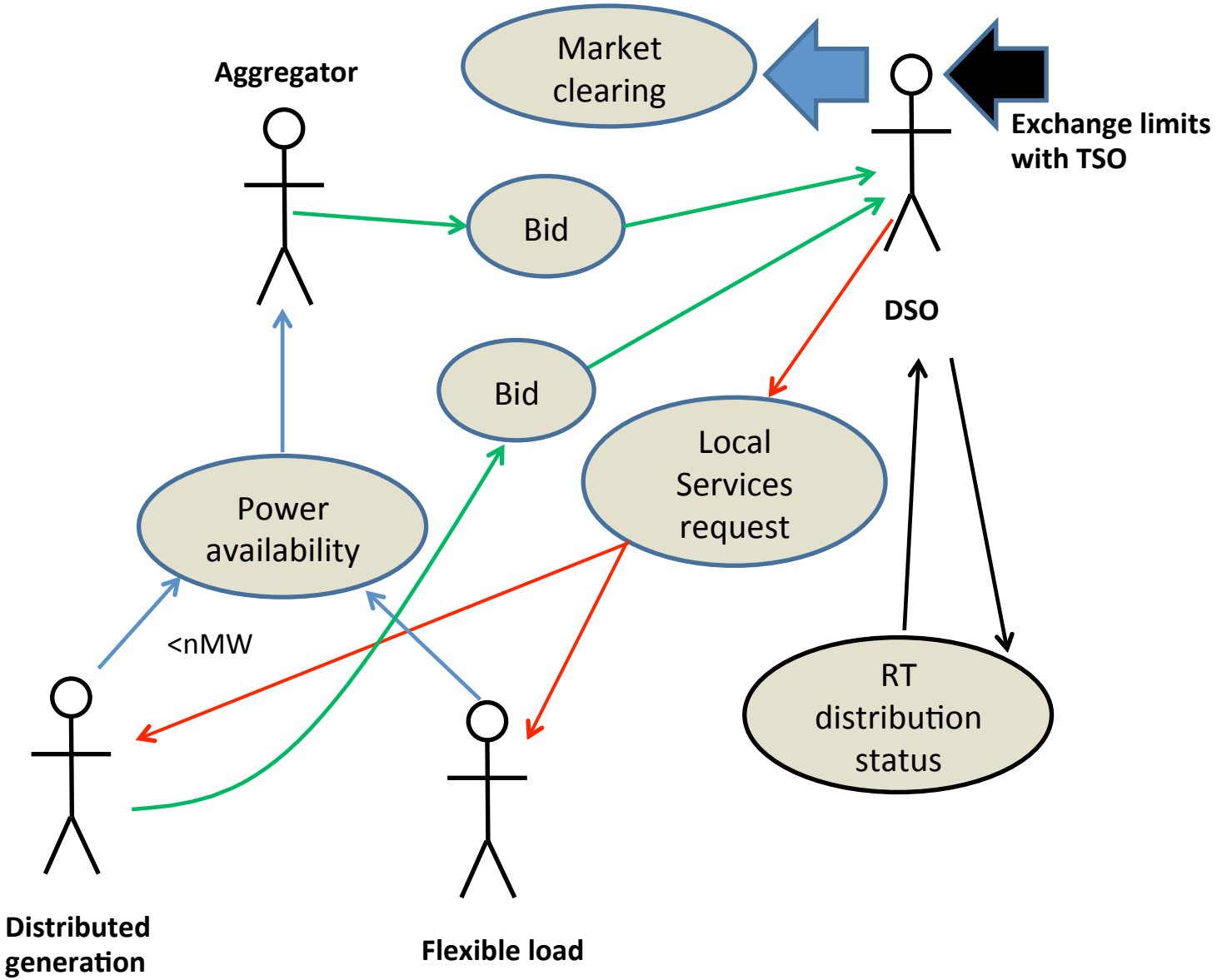
Architecture 2: use case diagram



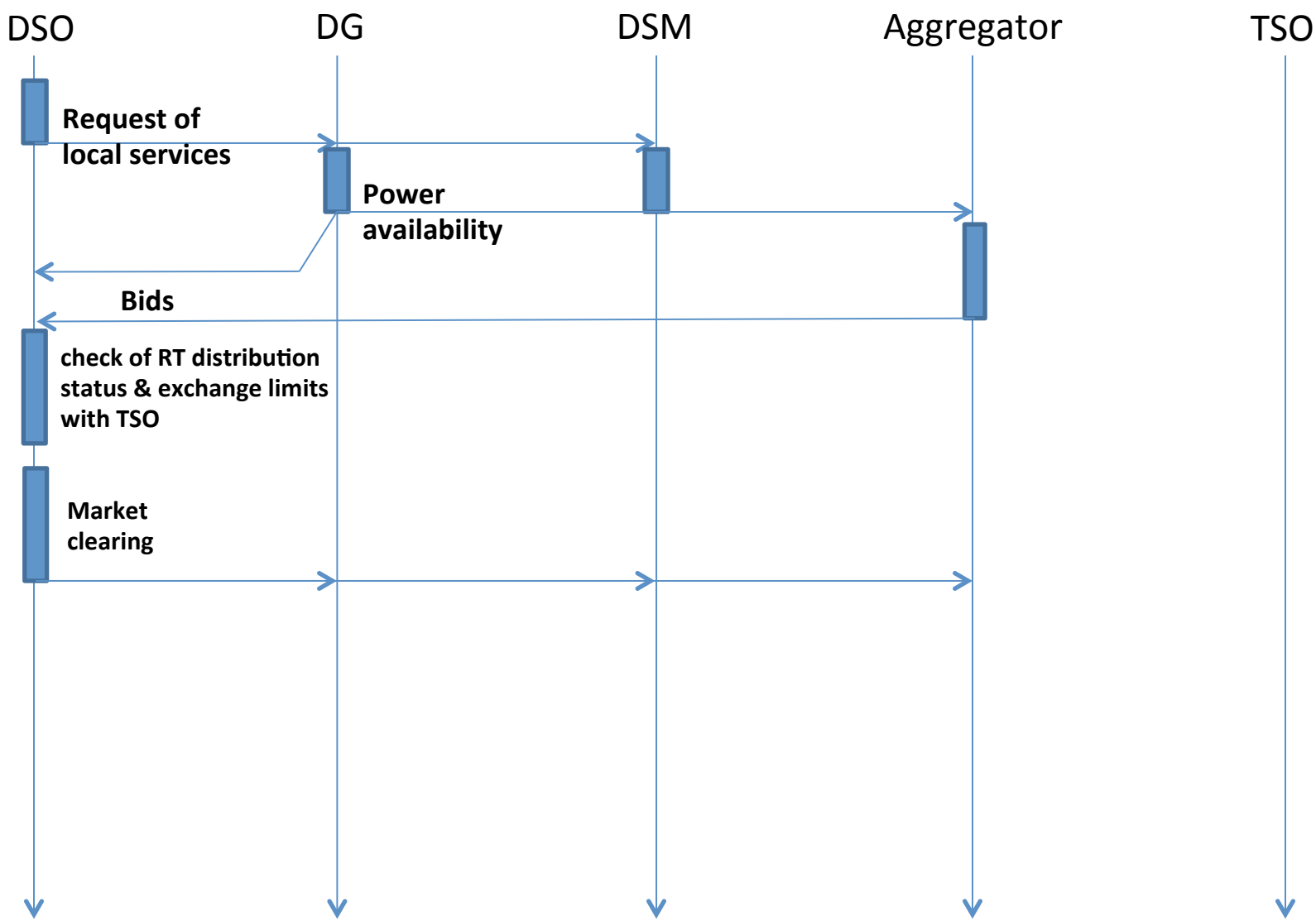
Architecture 2: sequence diagram



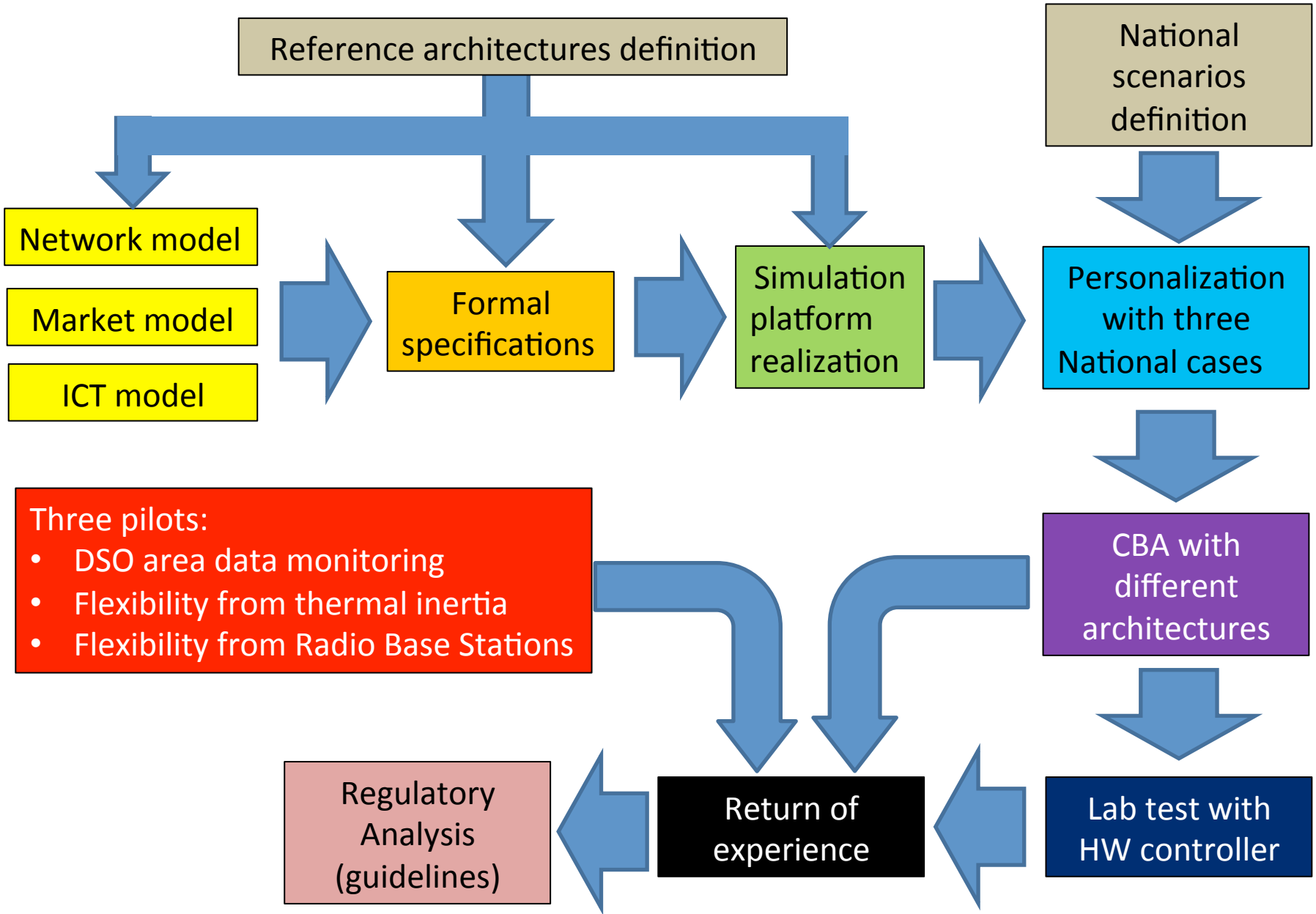
Architecture 3: use case diagram



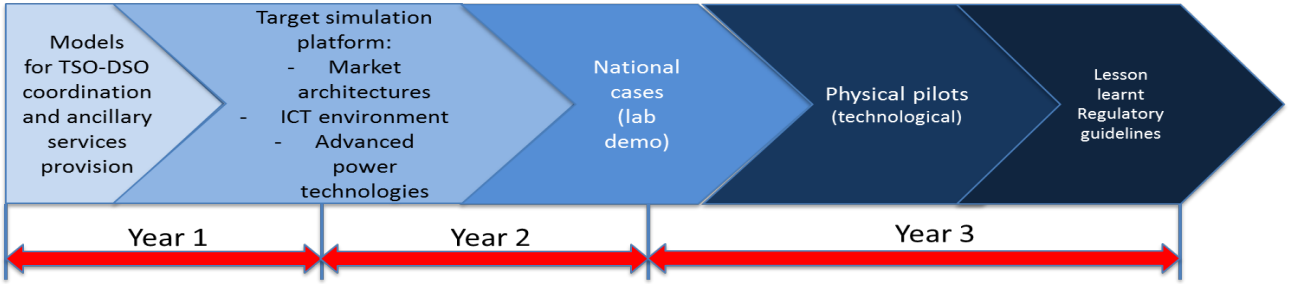
Architecture 3: sequence diagram

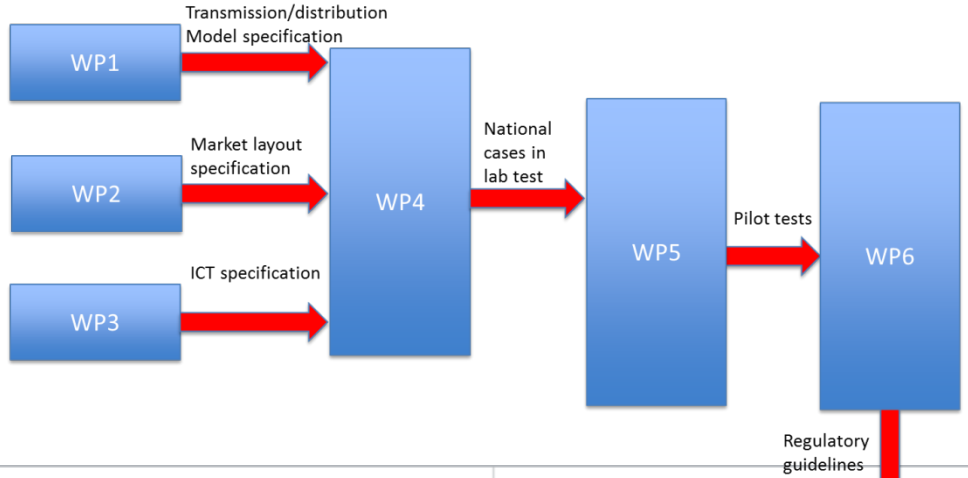


Overall project layout



Work packages and activities chronogram



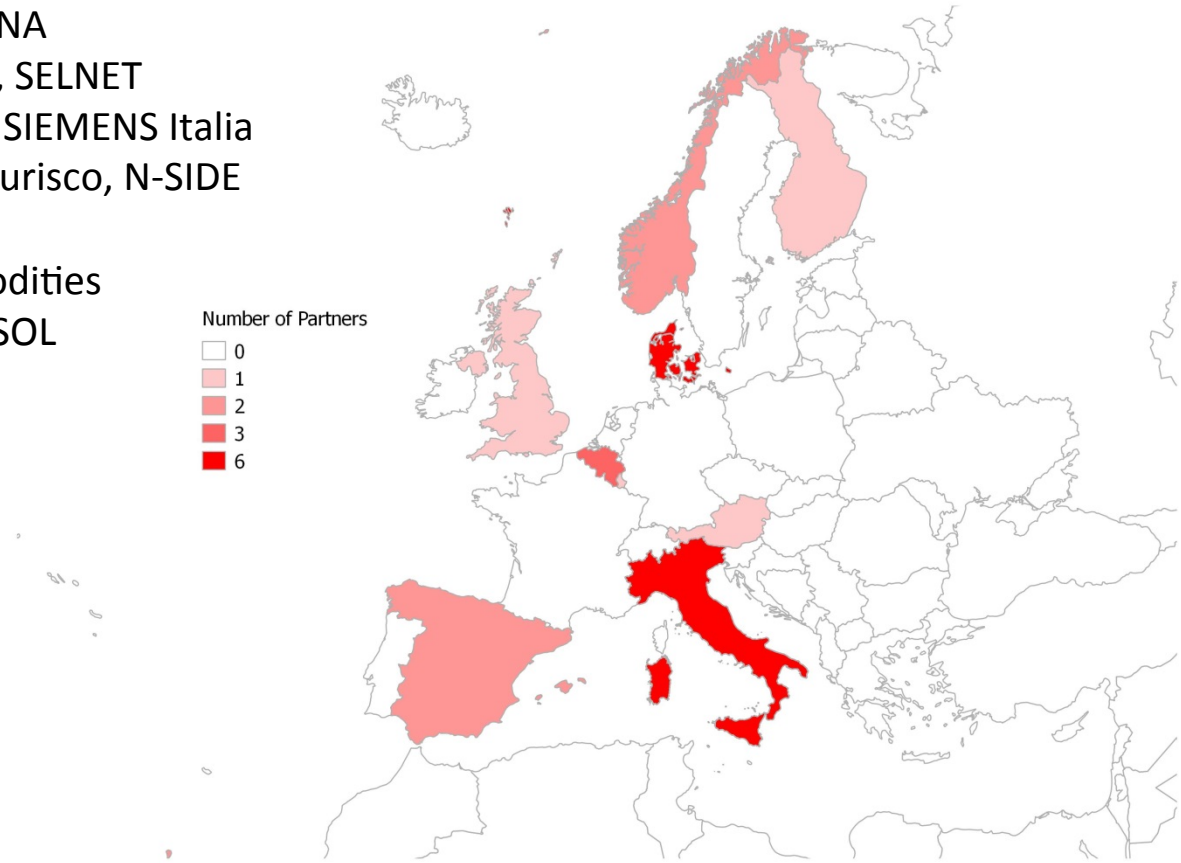


	Year 1				Year 2				Year 3			
	1	4	7	10	1	4	7	10	1	4	7	10
WP1	■	■	■	■	■							
WP2	■	■	■	■	■	■	■	■				
WP3	■	■	■	■								
WP4			■	■	■	■	■	■	■	■		
WP5	■	■	■	■	■	■	■	■	■	■	■	■
WP6									■	■	■	■
WP7	■	■	■	■	■	■	■	■	■	■	■	■
WP8	■	■	■	■	■	■	■	■	■	■	■	■

The SmartNet consortium

- **R&D partners**
  - Research Organizations: RSE, AIT, SINTEF, Tecnalia, VITO, VTT
  - Universities: DTU, Uni-Strathclyde, KU Leuven
  - Other: EUI/FSR

- **Industrial partners**
  - TSO: Energinet.dk, TERNA
  - DSO: ENDESA, NYFORS, SELNET
  - Manufacturers: SELTA, SIEMENS Italia
  - Software developers: Eurisco, N-SIDE
  - Telecom: VODAFONE
  - Trader: Danske Commodities
  - Vacation rental: NOVASOL



Experience of project coordinator

- It coordinated the project **REALISEGRID** (http://realisegrid.rse-web.it, 2008-2011), to develop a set of criteria, metrics, methods and tools to assess how the transmission infrastructure should be optimally developed to support the achievement of a reliable, competitive and sustainable electricity supply in the EU.
- It took part to **SUSPLAN** (http://www.susplan.eu, 2008-2011), developing strategies, recommendations, and benchmarks for the integration of renewable energy sources (RES) by 2030-2050 within an Europe-wide context.
- It was partner of **TWENTIES** (http://www.twenties-project.eu, 2010-2013) aimed at removing some barriers which prevent the electric system from taking advantage of more wind electricity.
- It was leader of two WPs in the IEE project **GridTech** (http://www.gridtech.eu, 2012-2015), assessing the impact of new technologies into the EU system till 2050.
- It leads one WP in the project **eBADGE** led by Telekom Solvenije (http://www.ebadge-fp7.eu, 2012-2015), studying potential benefits of a future trans-national balancing market including VPP participation.
- It takes part in the important project **eHIGHWAY2050** (http://www.e-highway2050.eu), 2012-2015), led by RTE and aimed at developing the foundations of a modular and robust expansion of the pan-European network from 2020 to 2050; RSE leads the WP on cost-benefit analysis.
- It was also member of a consortium that performed (2013-2014) a **study on behalf of MedGrid** on the impact of a massive import of energy from Africa along the “central” corridor.
- It **supports the Irish TSO EIRGRID** with tools and expertise. RSE provided tool support for the NSCOGI grid study. EIRGRID bought from RSE a permanent license of the tool ESPAUT.

Thank you for your attention…

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