

European
Utility Week



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Amsterdam,
The Netherlands



SmartNet

Smart TSO-DSO interaction schemes, market architectures and ICT
Solutions for the integration of ancillary services from demand side
management and distributed generation

Data exchanges and ICT requirements for TSO-DSO
coordination to implement ancillary services from
distribution networks and for RT markets coupling

Gianluigi Migliavacca (RSE)



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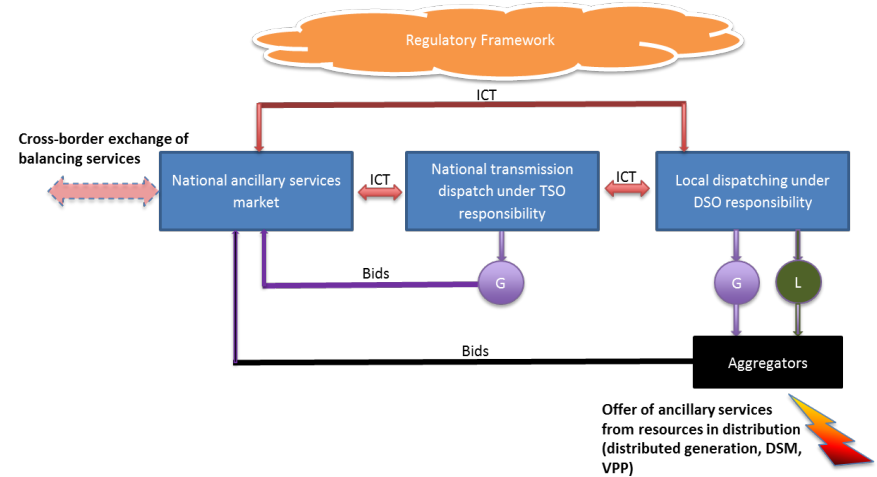
- **Overview of the SmartNet project**
- **Five TSO-DSO coordination schemes**
- **Analysis of information flows for each CS**
- **ICT requirements: a SGAM analysis framework**
- **Interoperability needs for future coupling of EU real time markets**

The SmartNet project

<http://SmartNet-Project.eu>

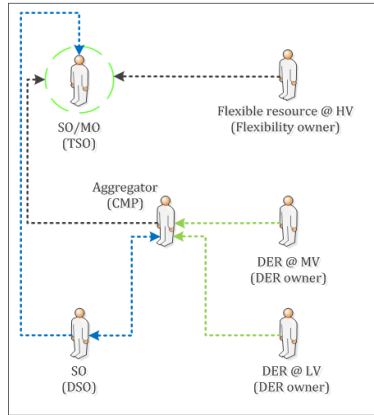


- **architectures for optimized interaction between TSOs and DSOs** in managing the purchase of ancillary services from subjects located in distribution.
- **three national cases** (Italy, Denmark, Spain);
- **ad hoc simulation platform** (physical network, market and ICT)
- **CBA** to assess which TSO-DSO coordination scheme is optimal for the three countries.
- use of **full replica lab** to test performance of real controller devices.
- **three physical pilots** to demonstrate capability to monitoring and control distribution by the TSO and flexibility services that can be offered by distribution (thermal inertia of indoor swimming pools, distributed storage of radio-base stations).



Five TSO-DSO coordination schemes

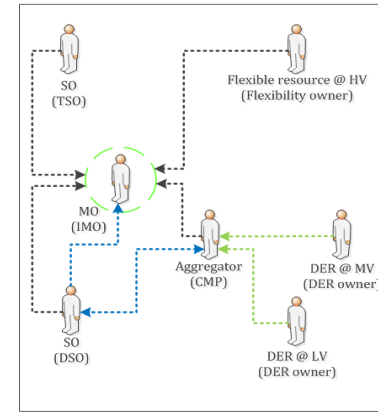
Centralized AS market model



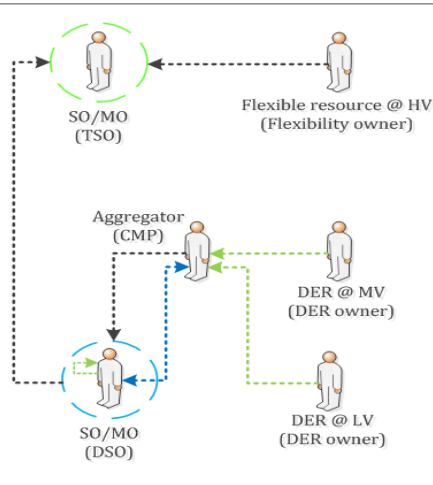
5 possible coordination schemes TSOs & DSOs for AS by distributed flexibility resources

- Centralized AS market model
- Local AS market model
- Shared balancing responsibility model
- Common TSO-DSO AS market model
- Integrated flexibility market model

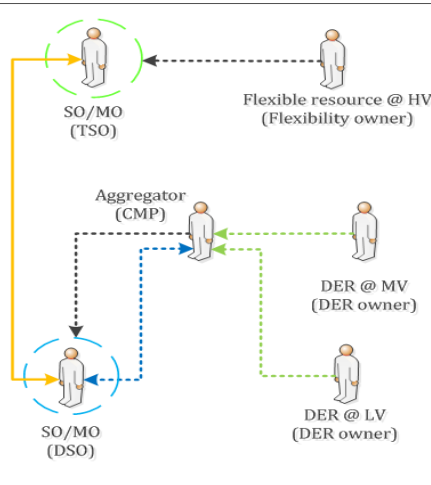
Integrated flexibility market model



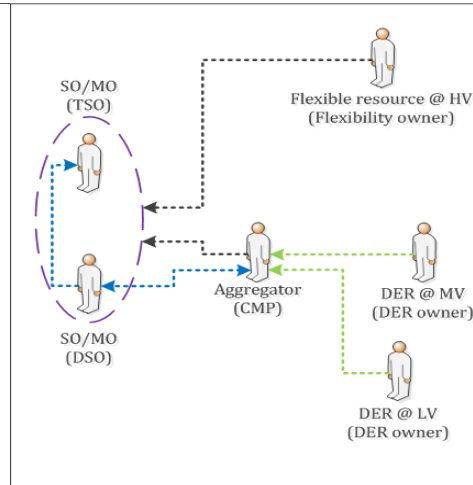
Local AS market model



Shared balancing responsibility model



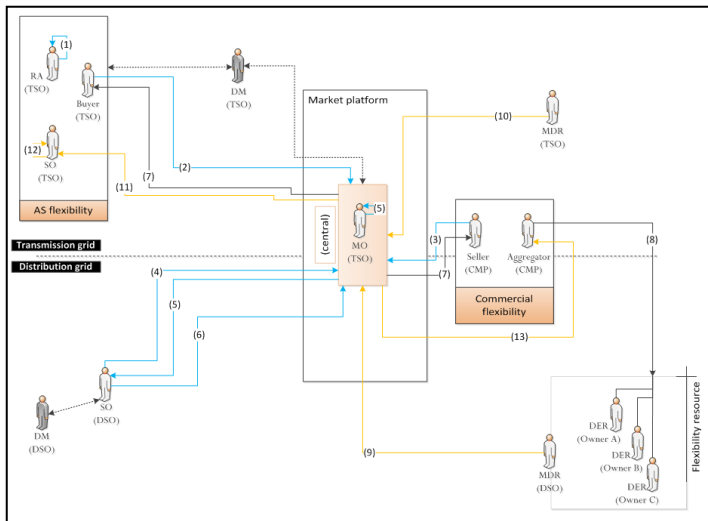
Common TSO-DSO AS market model



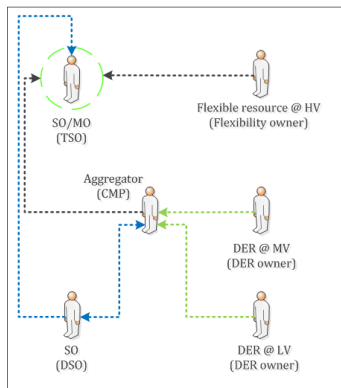
Legend

Role (Actor)	
Centralized market	
Local market	
Coordinated market	
Pre-defined profile exchange	
Aggregation	
Market bids	
Pre-qualification	

Analysis of information flows for each CS

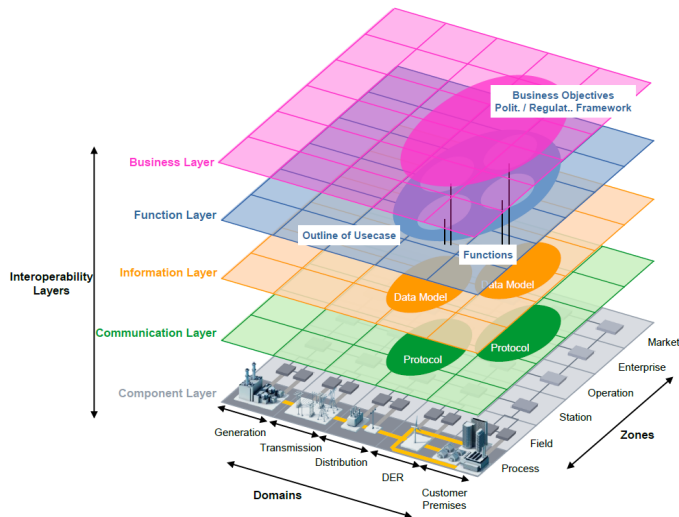


Centralized AS market model

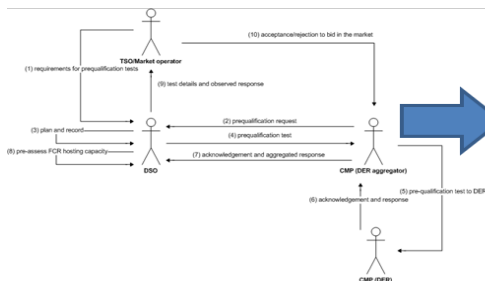


	Steps (#)	Origin	Action	Recipient
Procurement	1	RA (TSO)	Determines volumes to be procured	
	2	Buyer (TSO)	Communicates volumes to	MO (TSO)
	3	Seller (CMP)	Sends aggregated bids (from transmission and distribution) to	MO (TSO)
	4	SO (DSO) (*)	Communicates distribution grid constraints to	MO (TSO)
	5	MO (TSO)	Clears market and communicates results to	SO (DSO)
	6	SO (DSO) (**)	Checks if local constraints allow for activation requested by TSO and blocks if needed – communication to MO and step 5 will be repeated	MO (TSO)
Activation	7	MO/FD (TSO)	Communicates results to (activation is simultaneous if no capacity is procured)	Buyer (TSO) Seller (CMP)
	8	Aggregator/FD (CMP)	Activates units based on the selected bids	DER
Settlement	9	MDR (DSO)	Communicates measurements to	MO (TSO)
	10	MDR (TSO)	Communicates measurements to	MO (TSO)
	11	MO (TSO)	Communicates measurements to	SO (TSO)
	12	SO (TSO)	Corrects perimeter of BRPs affected by activation	
	13	MO (TSO)	Performs financial settlement of flexibility activation for resources connected at distribution and transmission grid	Aggregator (CMP)

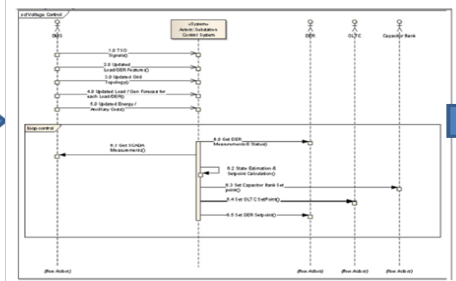
ICT requirements: a SGAM analysis framework



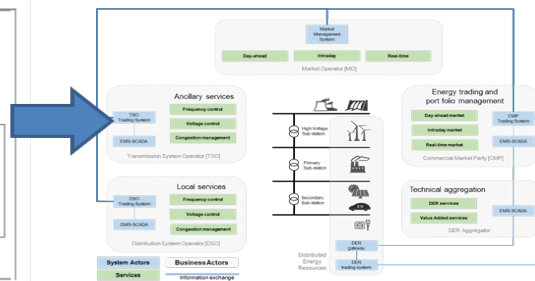
- **Use Case Analysis:** to create an initial use case description.
- **Business Layer Design:** business processes, services, and organizations linked to the use case
- **Function Layer Design:** functions, derived from the initial use case description.
- **Component Layer Design:** components needed for use cases, assigned to domain and zone. Subsequently, to a corresponding hardware.
- **Information Layer Design:** information exchanged between functions, services, and components identified, by analysing the data exchanged between actors
- **Communication Layer Design:** suitable communication protocols and ICT techniques



Business and function layers



Information layer



Communication and component layers

ICT needs and challenges for RT-markets coupling

The ENTSO-E NCEB provides for a phased approach to foster cooperation amongst TSOs in various areas of Balancing. The key concept of **Coordinated Balancing Areas**. As time passes, the level of cooperation within a Coordinated Balancing Area and between neighboring ones will increase; neighboring Coordinated Balancing Areas will merge; and finally all Coordinated Balancing Areas will merge to reach the **final target of a single pan-European Common Merit Order list**.



The e-BADGE project identified a few requirements of ICT technology suited for RT-coupling:

- **integrated among all the actors** participating in the trans-national market (TSOs, DSOs, market operators, aggregators, retailers, final users), each with his role → **interoperability** is key, the HW stretching from large central servers up to smart meters of residential users.
- Able to ensure **computability** in a limited amount of time. This may put strong limitations both to algorithms and to the SW/HW requirements
- Conceived in a **modular** way that ensures **scalability** with a ever-increasing huge number of connected players, asynchronous distributed transactions, etc (relatively low performance requirements but with high distributed data storage capability)
- Able to **reconfigure** themselves fast to respond to requests in real time
- Algorithms **robust** whatever are the market conditions; **reliability** of components, also by means of components redundancy
- **Secure** and protected against cyber-attacks (use of dedicated network, firewalls allowing only communications between enabled subjects).



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Thank You

Gianluigi Migliavacca

Contact Information

Affiliation: RSE S.p.A.
Phone: +39 02 3992 5489
Email: gianluigi.migliavacca@rse-web.it

