

Smart Grid Reference Architecture (SGAM)



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Content

Introduce SGAM as a conceptual framework
to allow different smart grid actors to jointly
discuss and design smart grid solutions

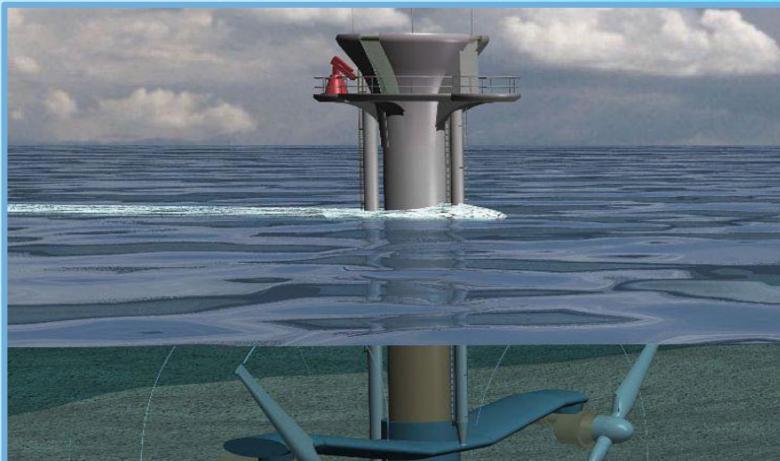
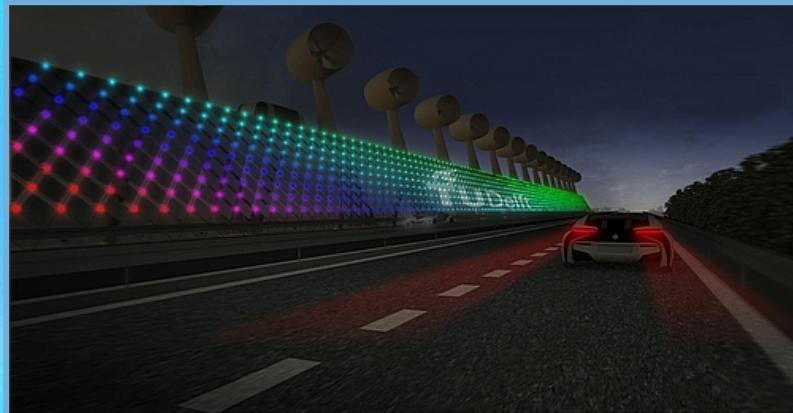




Integration

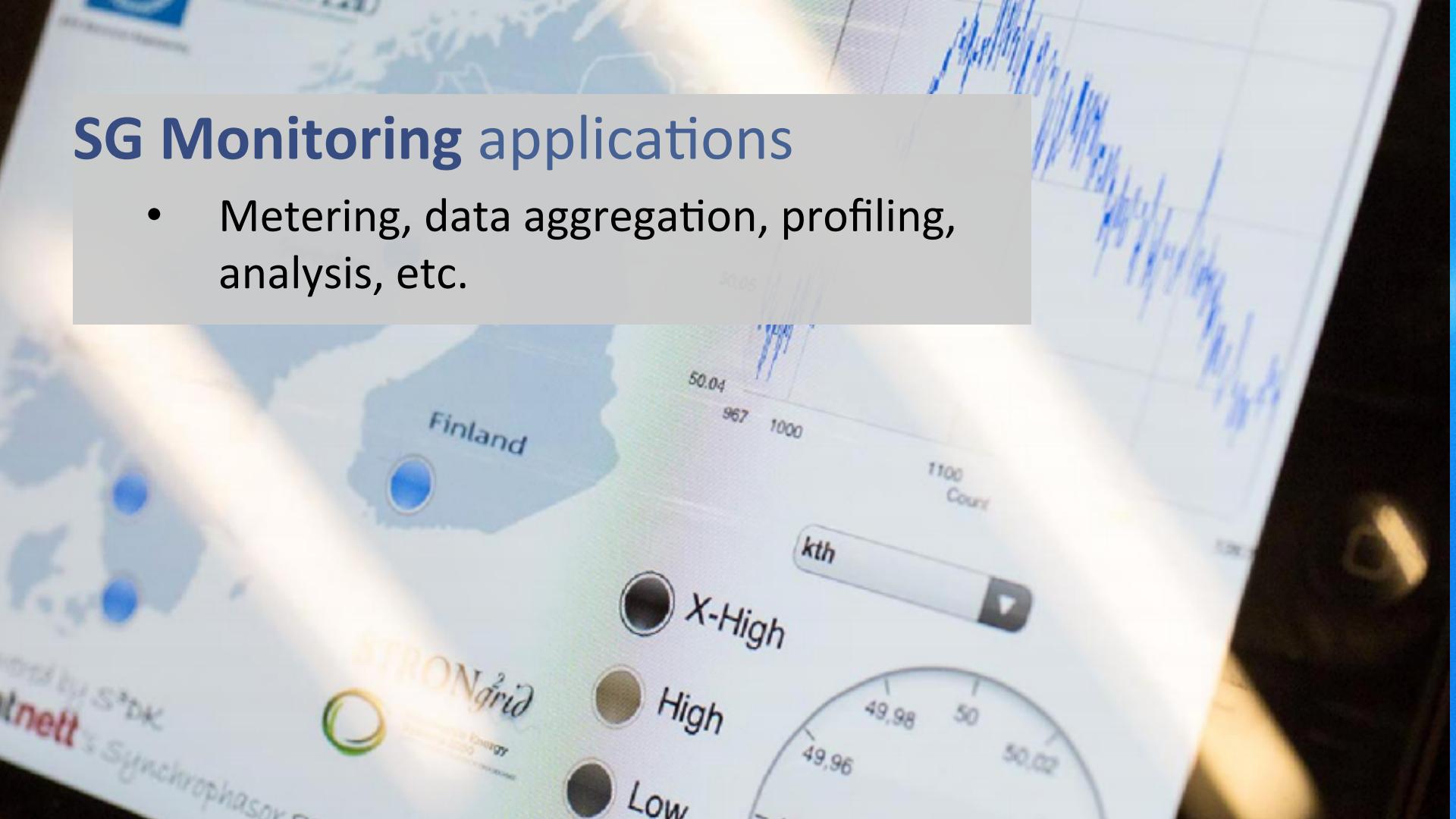


Integration of new energy sources



SG Monitoring applications

- Metering, data aggregation, profiling, analysis, etc.



SG: control applications

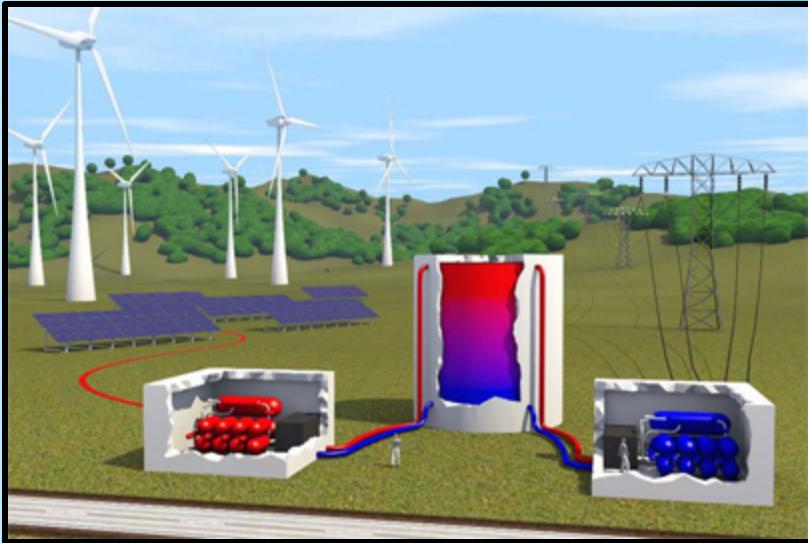
- Secondary control and tertiary control voltage settings
- Topology of the grid
- Protection
- Mitigating power quality problems



Control power generation depending on supply and demand



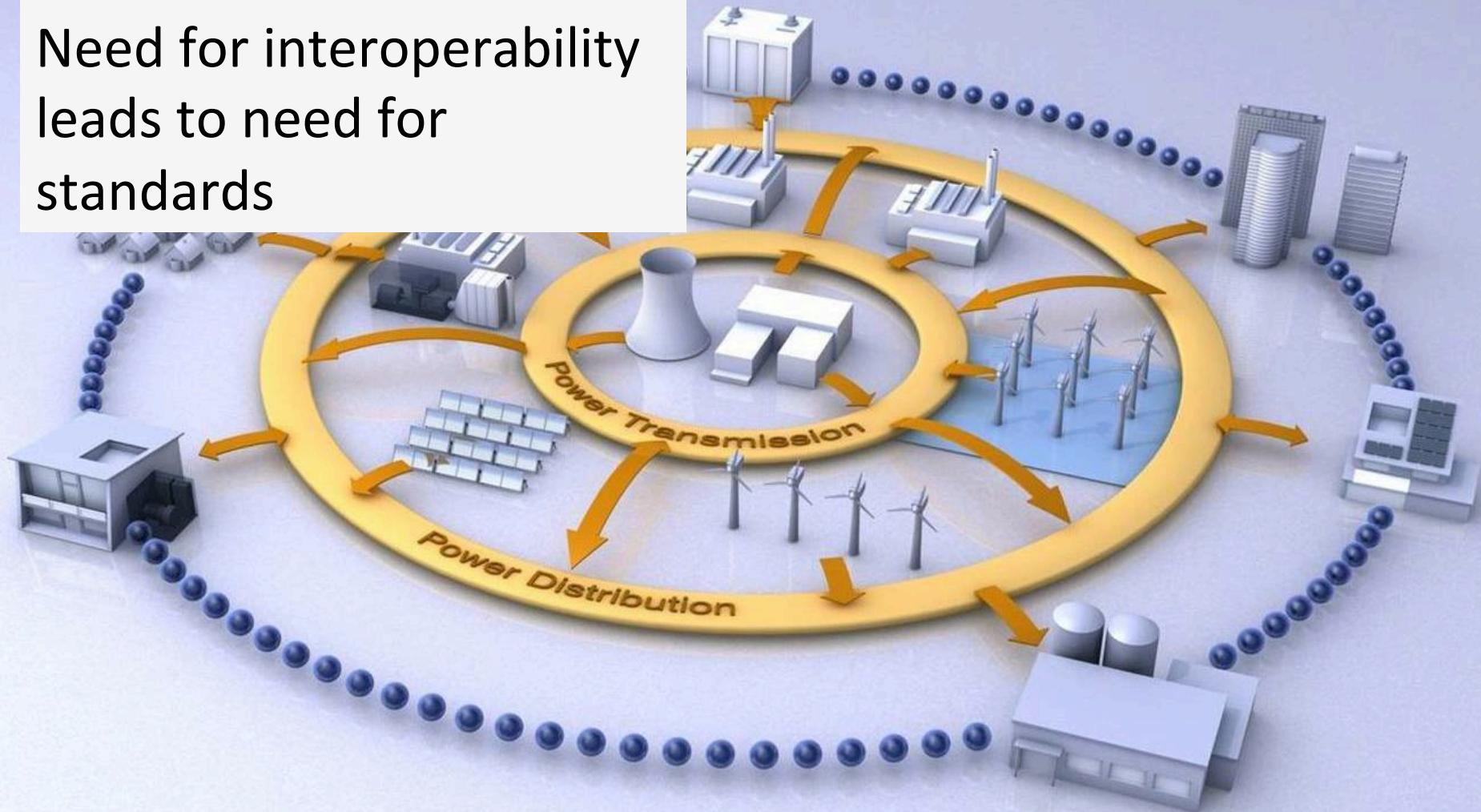
Control storage (surplus)



Need for Interoperability leads to need for SGAM

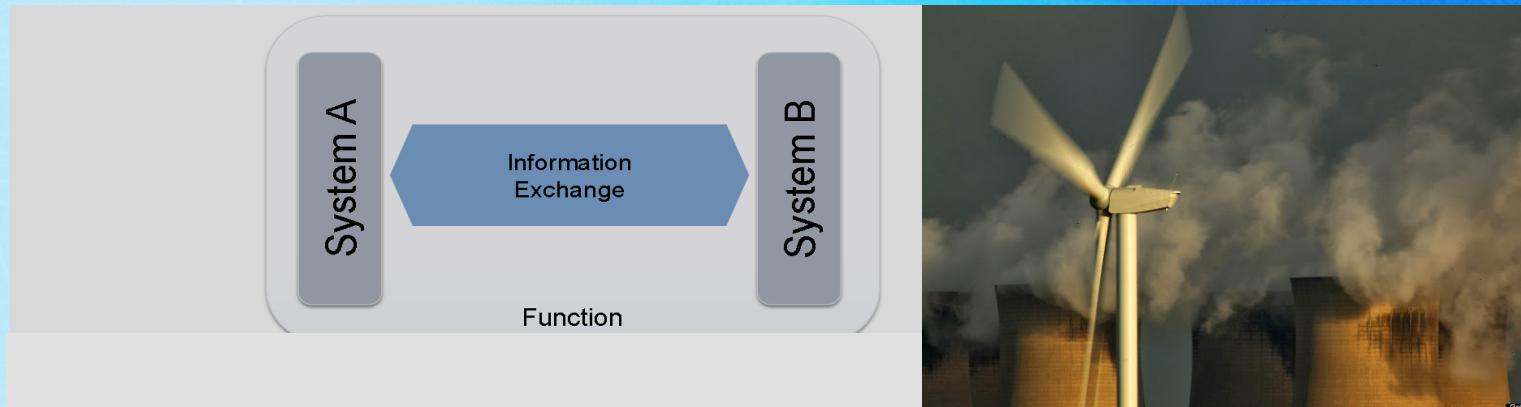


Need for interoperability
leads to need for
standards

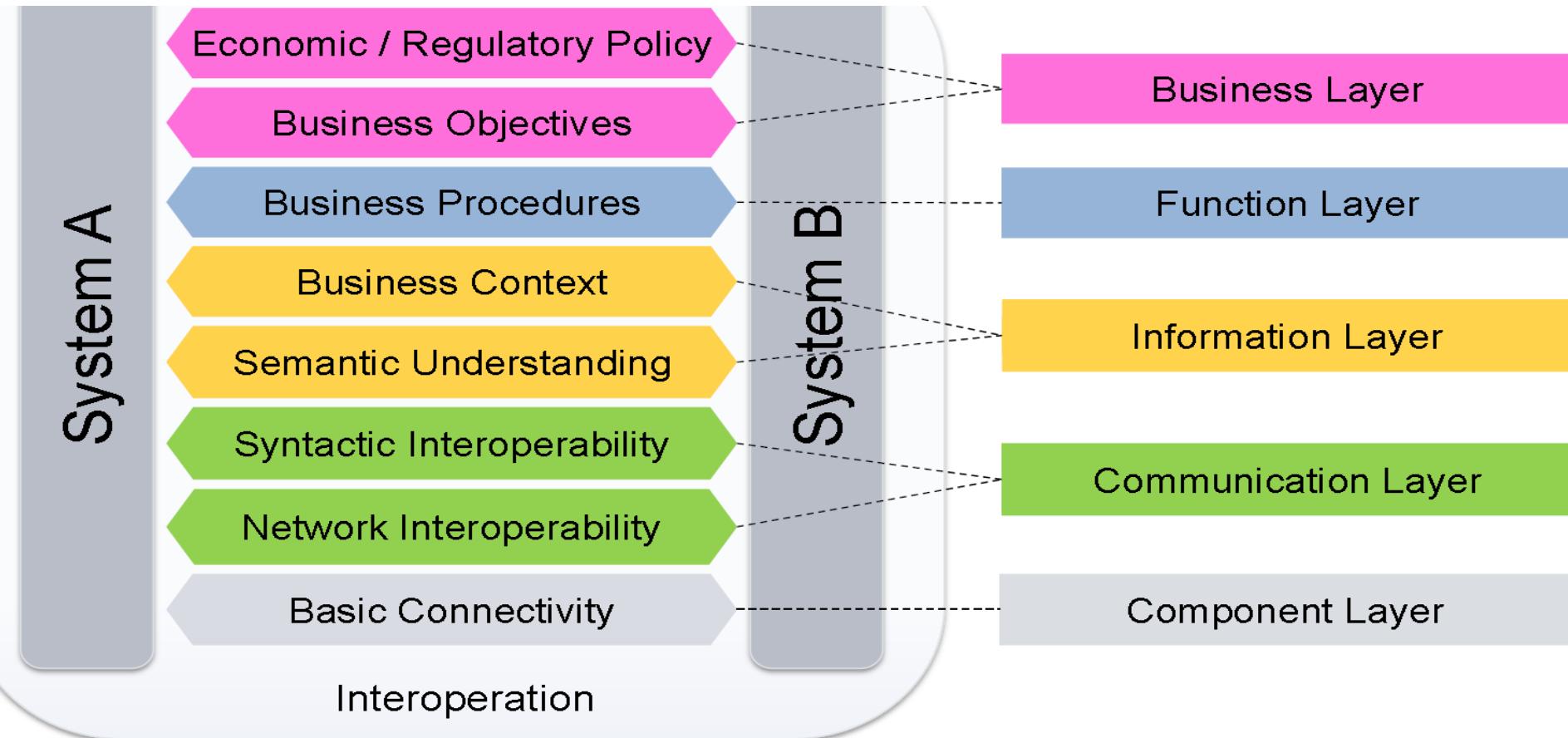


Interoperability

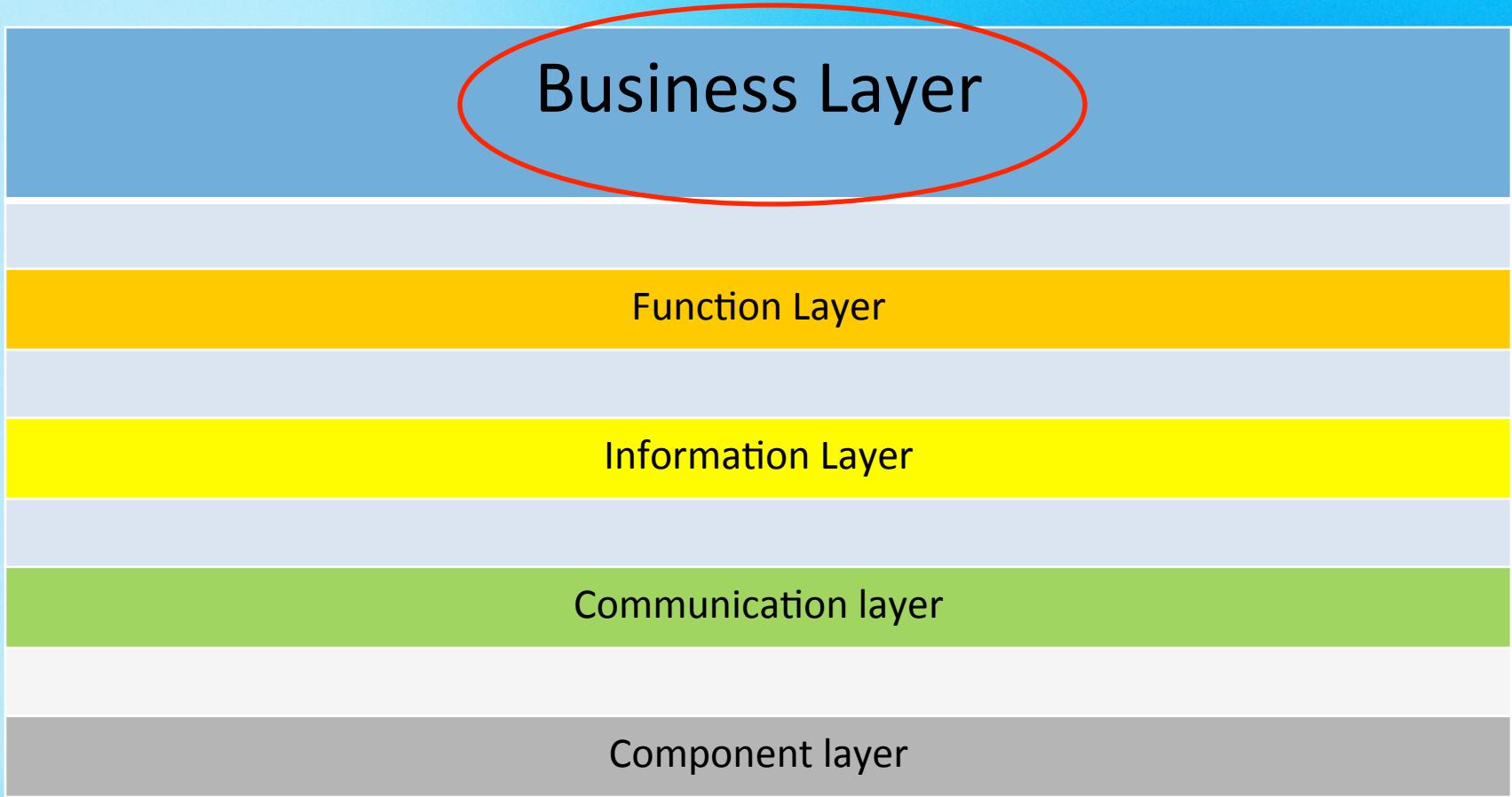
Ability of two or more devices to exchange information and to use that information for correct cooperation.



SGAM interoperability layers:



Architecture - Layers



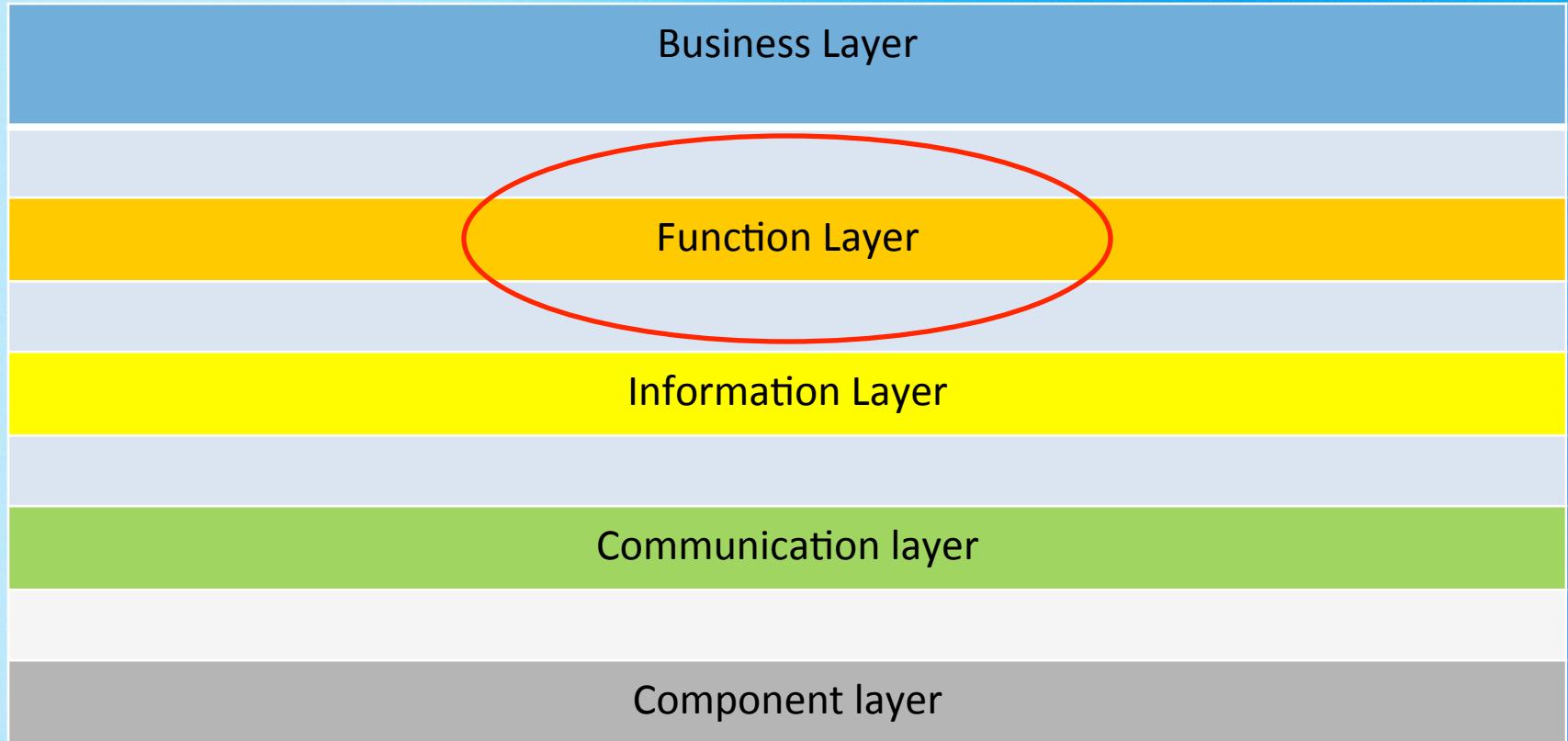
Business Layer SG

- **Business view on information exchange**
- **Map regulatory and economic (market) structures and policies, business models, business portfolios**
- **Map business capabilities and business processes**
- Supports **business executives** and **regulators** in decision making

Vermont Renewable Energy Tariffs 08-Feb-12				
	Years	€/kWh	1.29 CAD/kWh	1.267 USD/kWh
Wind Energy				
<100 kW	20	0.164	0.212	0.245
>100 kW <1.5 MW	20	0.089	0.115	0.113
Photovoltaics	25	0.189	0.244	0.271
Biomass	20	0.095	0.123	0.121
Landfill Methane	15	0.069	0.088	0.087
Farm Methane	20	0.107	0.138	0.136
Hydro	20	0.094	0.121	0.119

<http://vermontspeed.com/standard-offer-rates/>

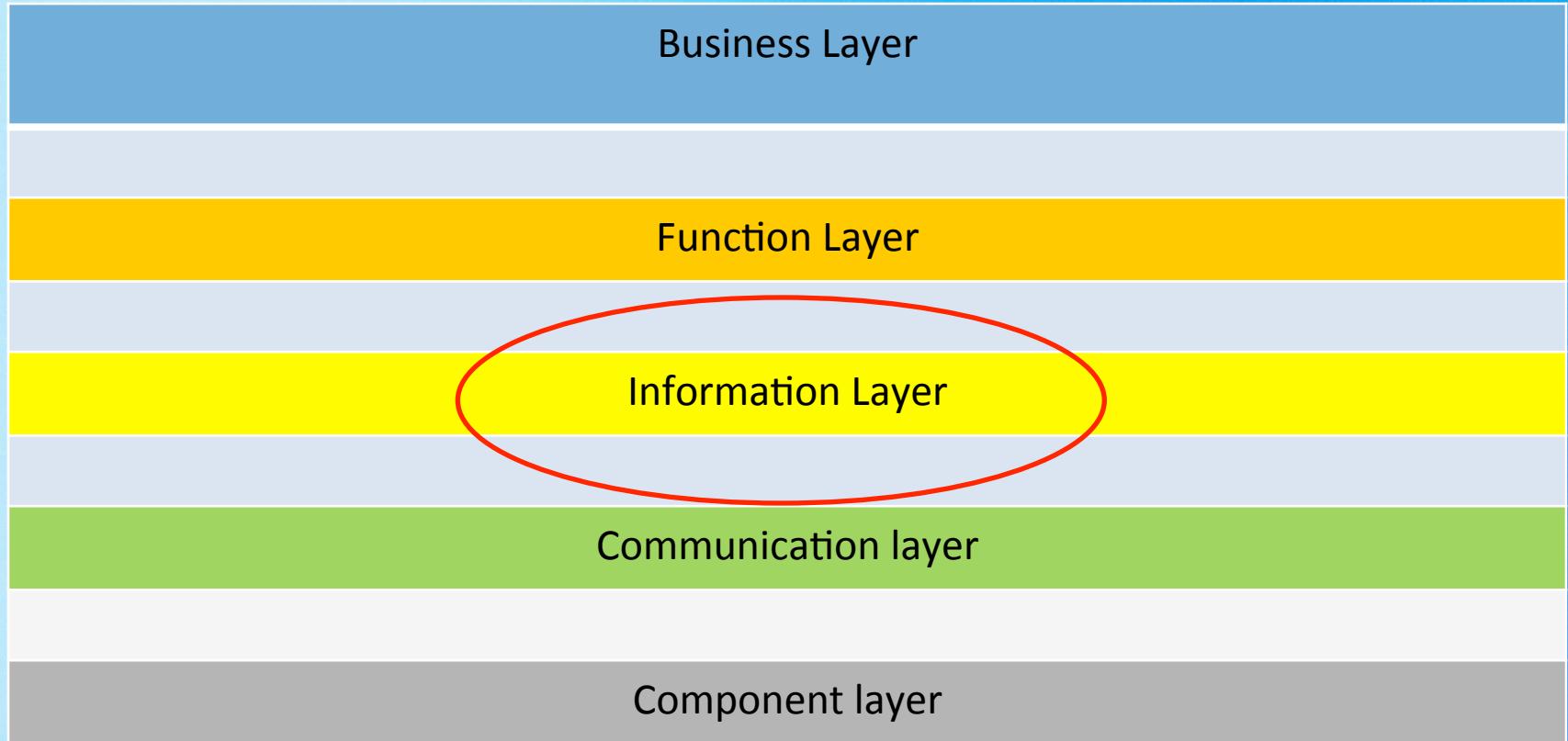
Architecture - Layers



Function Layer

- Function smart grid is energy (secure, etc.)
- In the function layer, you control for example the voltage of the network

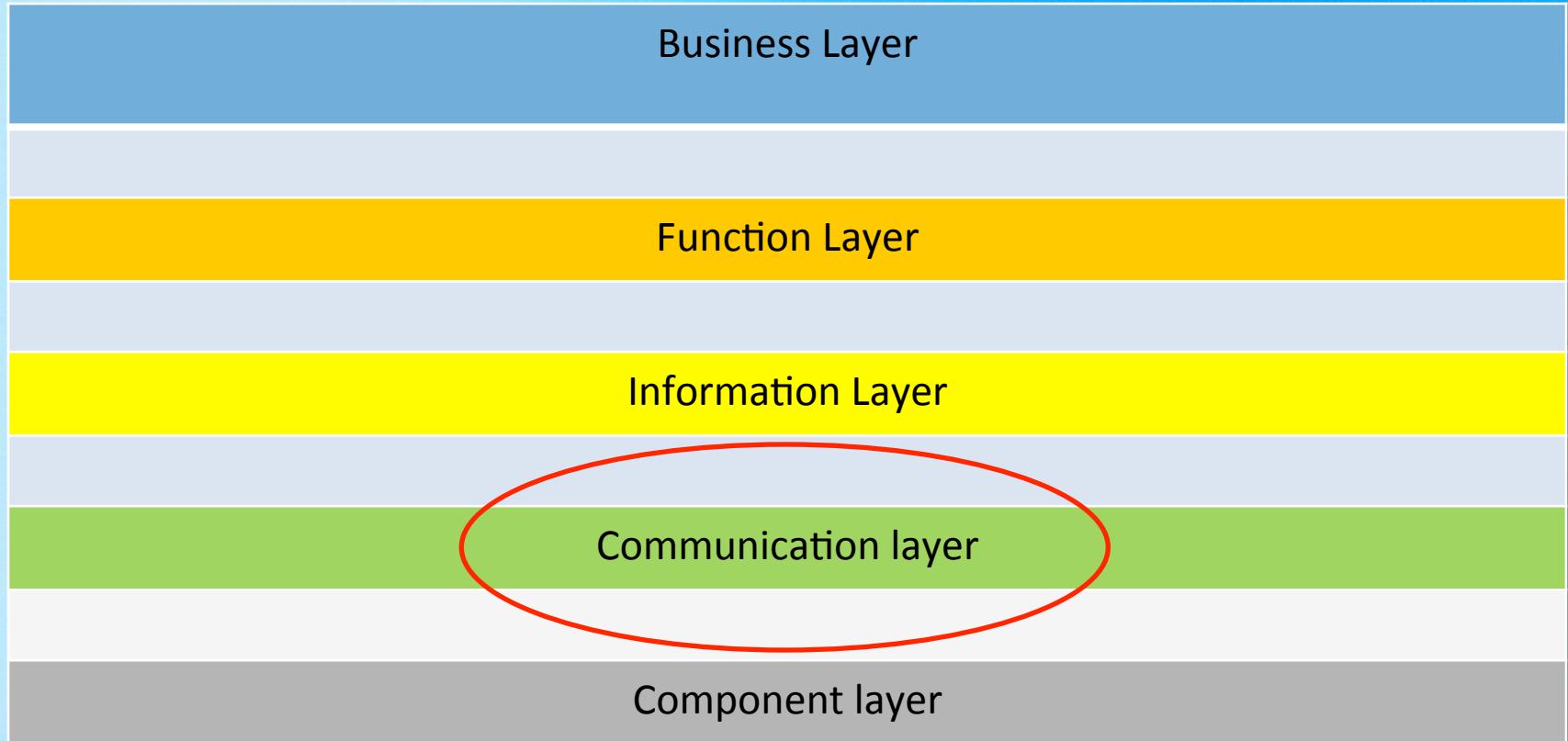
Architecture - Layers



Information Layer

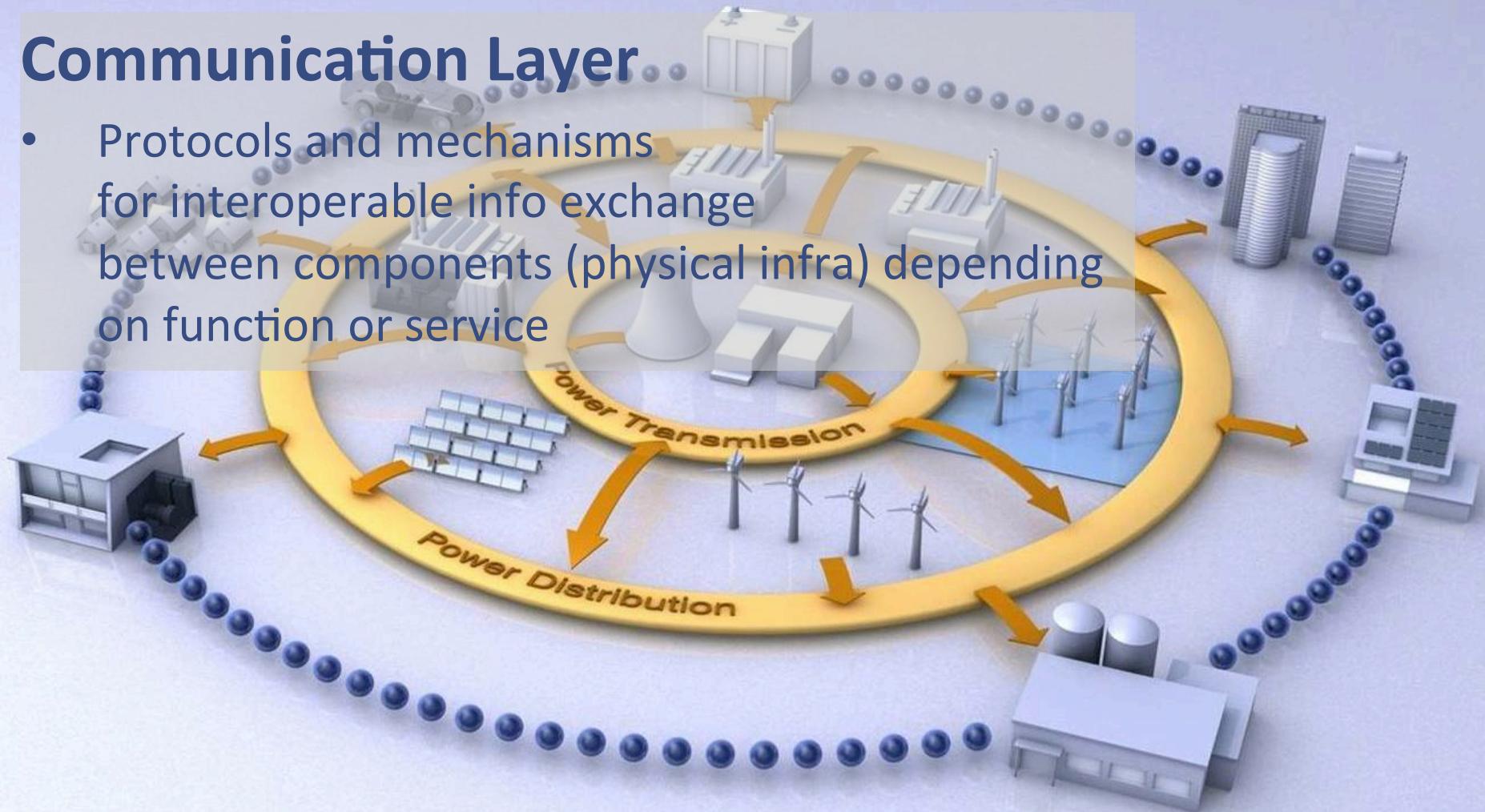
- Transforms data into useable information
- Describes how functions (energy) and services talk to each other
- Think about production, business, performance etc.

Architecture - Layers

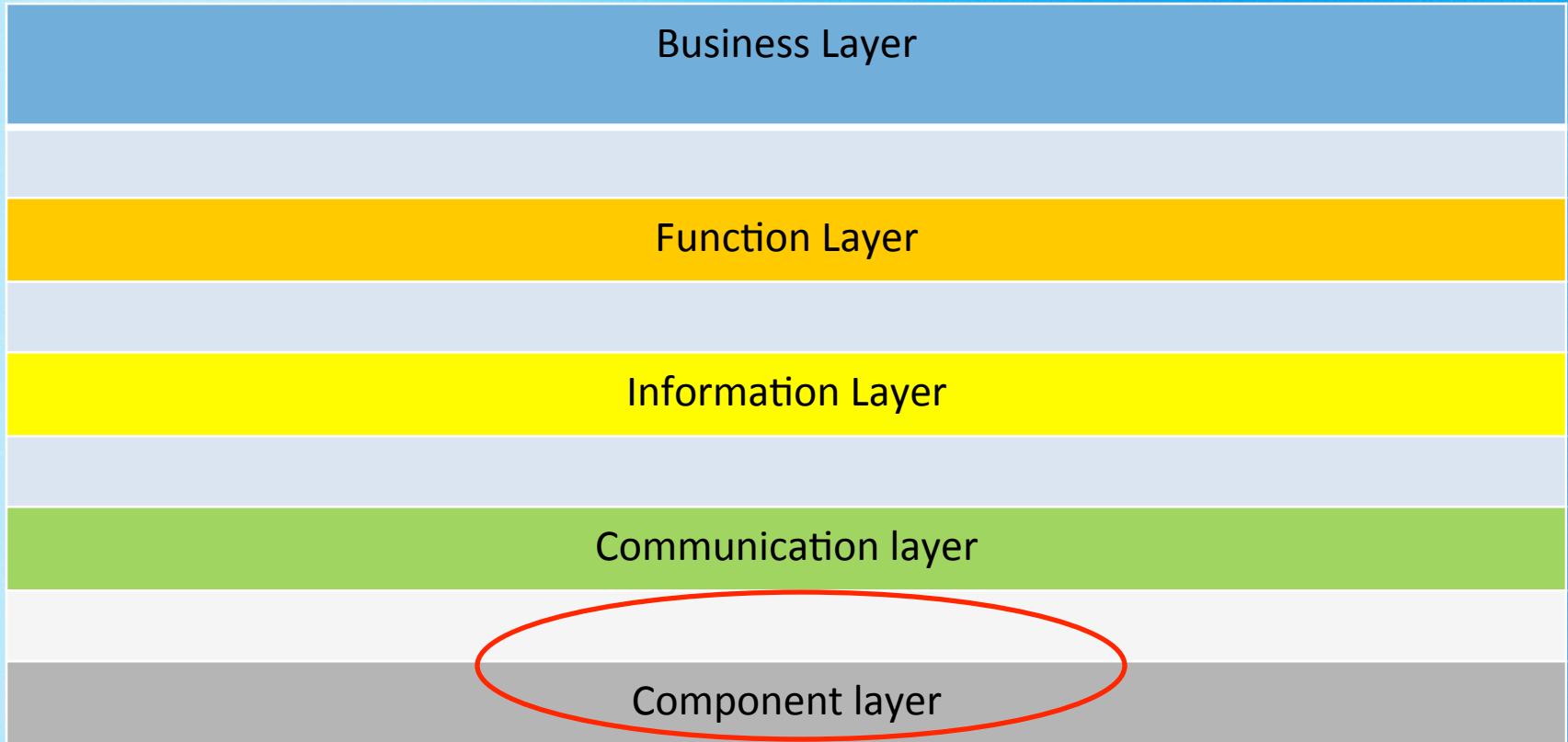


Communication Layer

- Protocols and mechanisms for interoperable info exchange between components (physical infra) depending on function or service

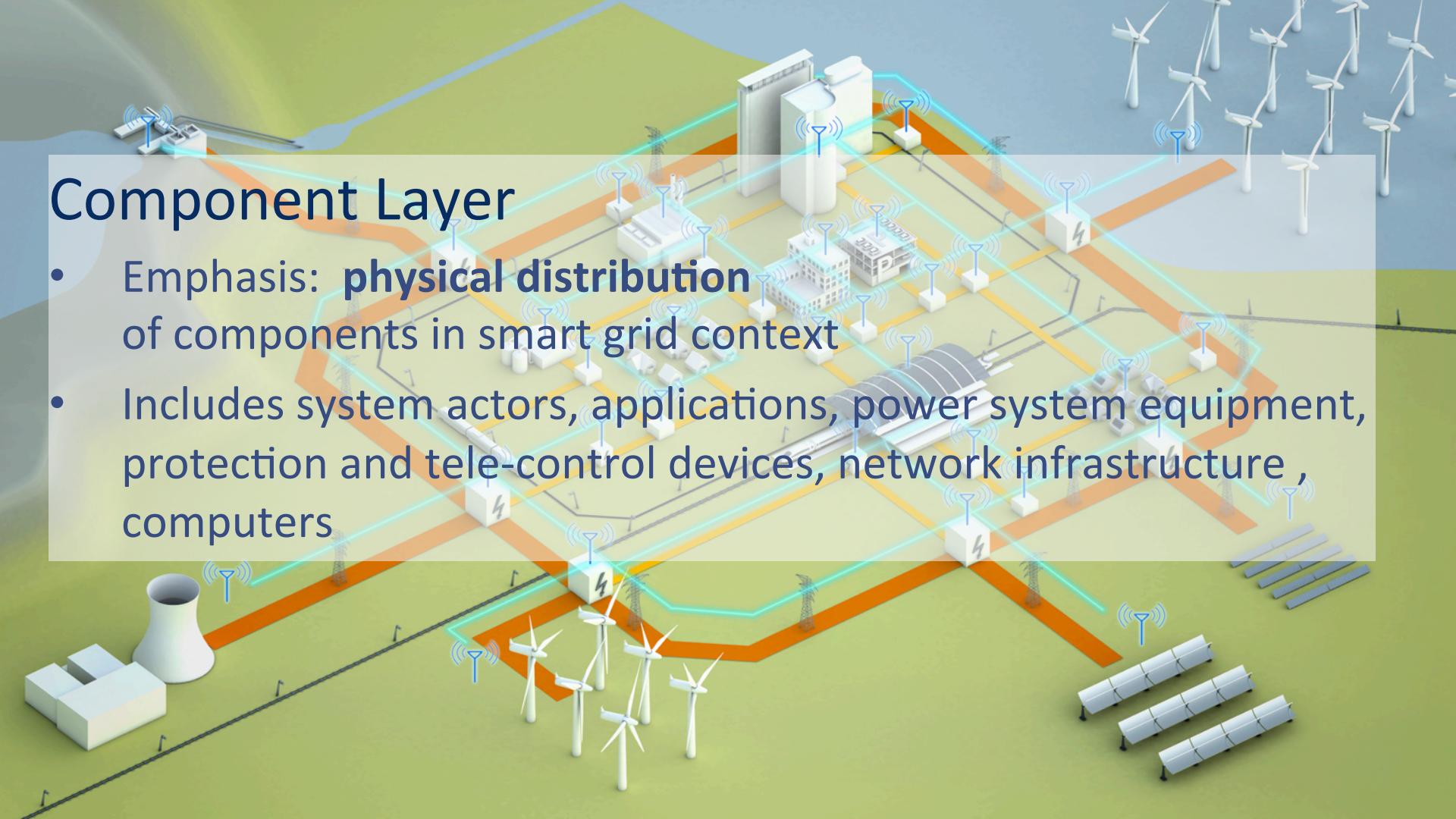


Architecture - Layers

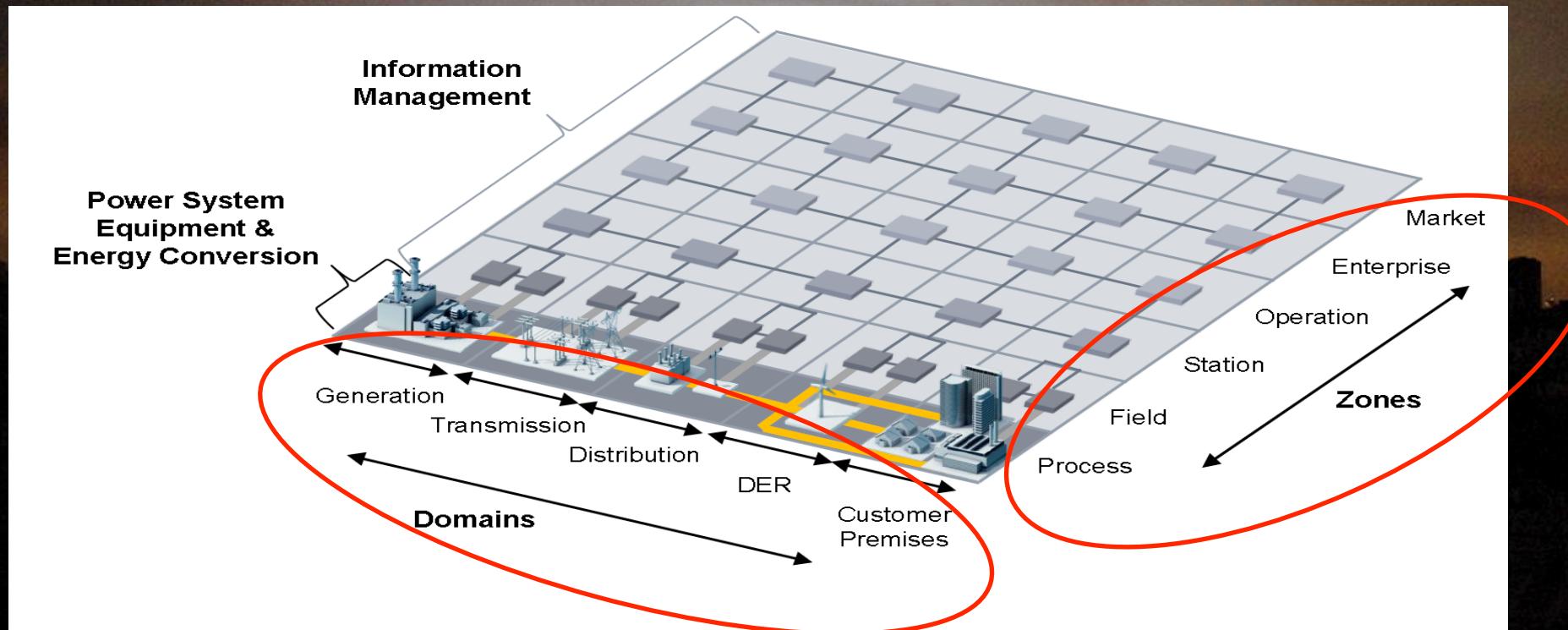


Component Layer

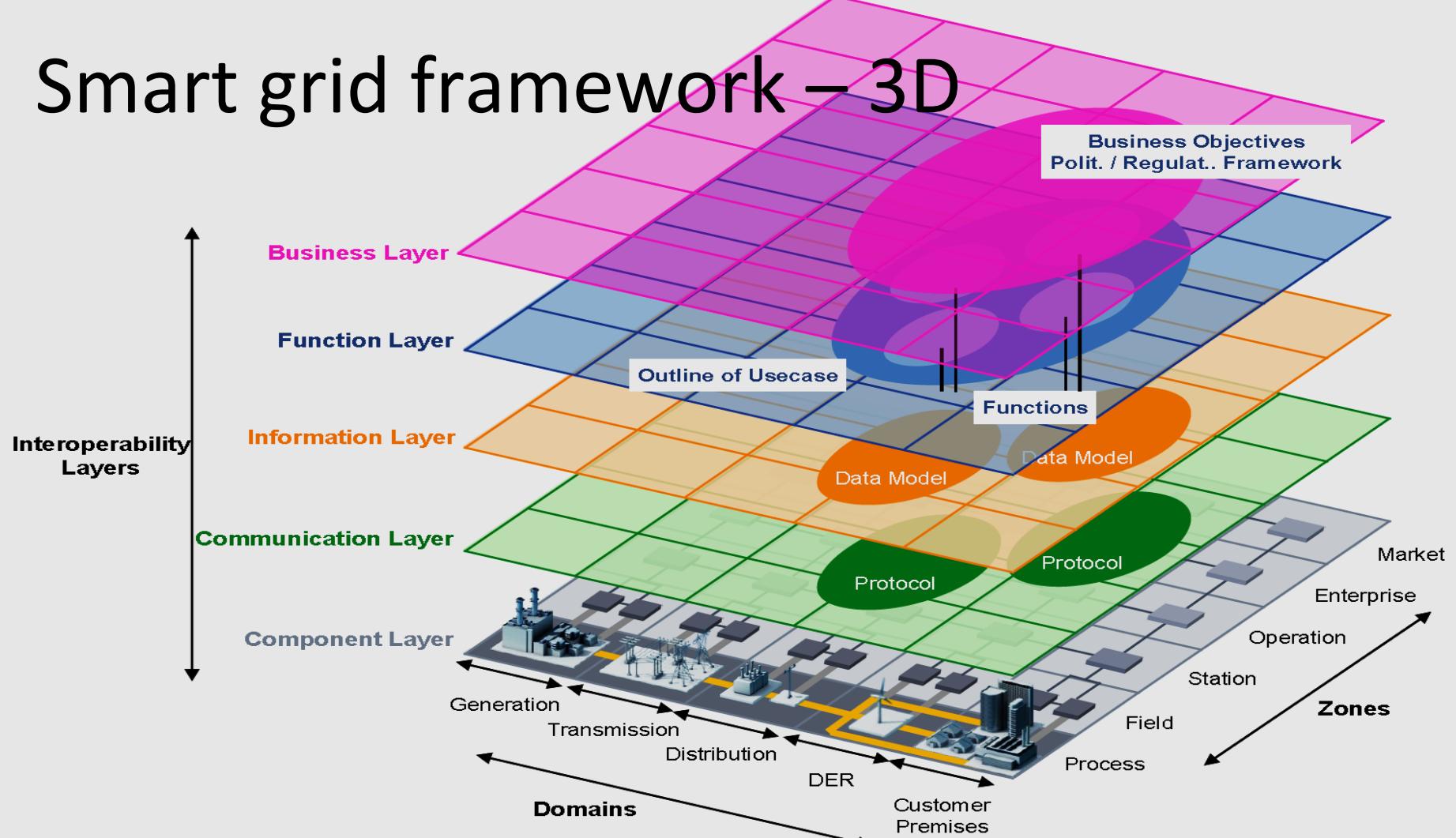
- Emphasis: **physical distribution** of components in smart grid context
- Includes system actors, applications, power system equipment, protection and tele-control devices, network infrastructure , computers



Smart grid plane: domains and zones



Smart grid framework – 3D



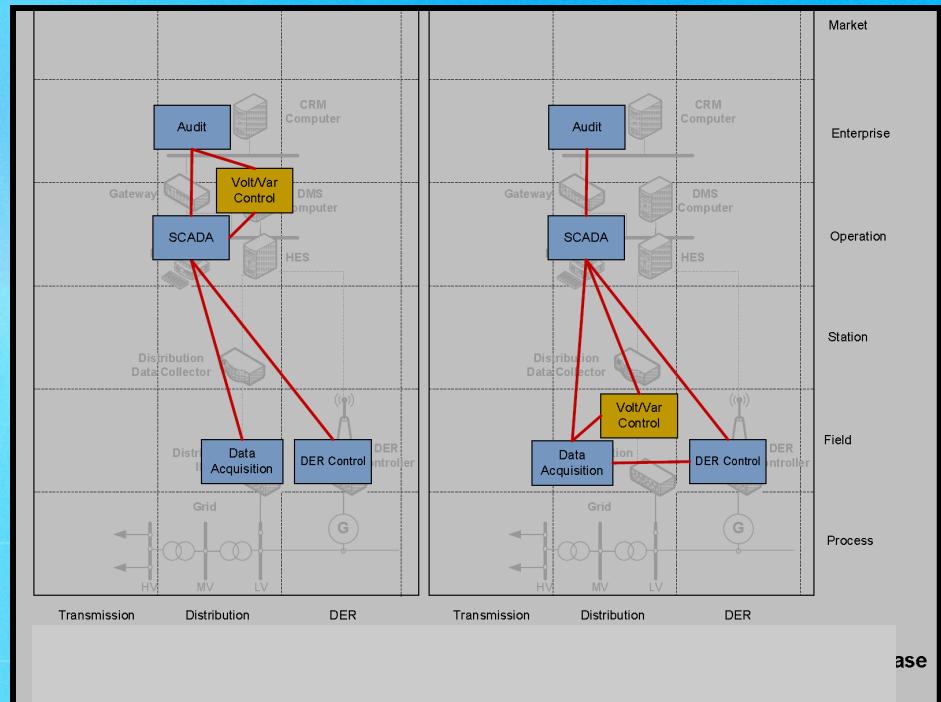
Example VVC Volt-VAR control



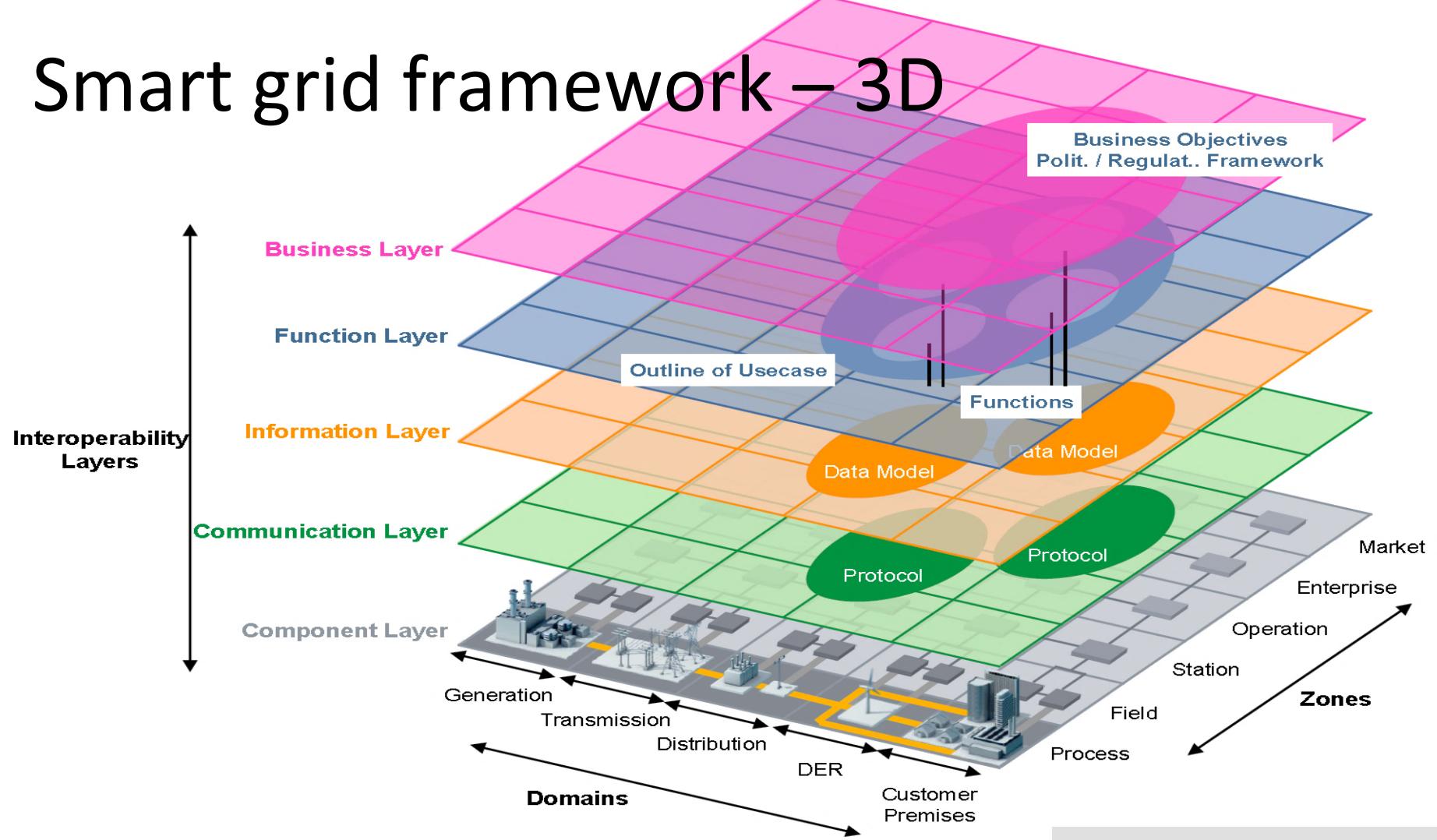
- VVC is fundamental operating requirement of all electric distribution systems
- Prime purpose of VVC is to maintain acceptable voltage at all points along the distribution feeder under all loading conditions

Example VVC Volt-VAR control

- Part of the function layer
- How to organize Supervisory Control and Data Acquisition (SCADA)?
- Choice central or de-central
- This is then reflected in the SGAM



Smart grid framework – 3D



Thank you for your attention!

Please post any questions you may have
on our discussion forum.