

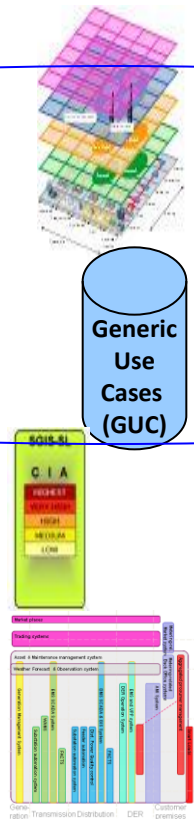
# Smart Grid Co-ordination Group WG Methodology



# Smart Grid Coordination Group (SG-CG) of CEN, CENELEC and ETSI

## Phase 1

- From 6/2011 until 12/2012
- Reference Architecture -> SGAM, conceptual model
- Sustainable processes -> Use Cases
- Smart Grid Information security (SGIS) – SGIS Toolbox
- First of standards
  - Prioritisation, work programme
  - First set of standards
- Framework for new standardization process for complex systems



## Phase 2

- currently under development until end of 2014
- Methodology (Use Cases, reference architecture, SGAM, conceptual model, market and flexibility, new applications)
- SGIS
- Set of Standards (Update)
- Interoperability (recommendations, Excel tool)

All reports of phase 1 are available under

<http://www.cencenelec.eu/standards/Sectors/SustainableEnergy/Management/SmartGrids/Pages/default.aspx>

# Methodology and New Applications Work Group

## Rationale for the creation of the WG

- The Reference Architecture WG and Sustainable Processes WG have largely advanced the definition of the methodology for Smart Grids
  - The Reference Architecture WG has defined architecture viewpoints and the SGAM methodology.
  - The Sustainable Processes WG has defined methods and tools for use case management.
- During M/490 Phase 1, interrelations between both WGs have been identified and partially addressed.
- The existing work needs to be further harmonized, consolidated and further explained (if necessary).

# Report ToC: Main section

|          |  |
|----------|--|
|          | <b>Foreword</b>  |
| <b>1</b> | <b>Scope</b>   |
| <b>2</b> | <b>References</b>  |
| <b>3</b> | <b>Terms and definitions</b>                                       |
| <b>4</b> | <b>Symbols and abbreviations</b>                                   |
| <b>5</b> | <b>Executive Summary</b>   |
| <br>     |  |
| <b>6</b> | <b>Concepts, Elements and Tools for the Smart Grid Methodology</b> |
| 6.1      | Smart Grid Actors and Roles  |
| 6.2      | Smart Grid Conceptual Model  |
| 6.3      | Smart Grid Use Cases   |
| 6.4      | Smart Grid Architecture Model (SGAM)                               |
| 6.5      | Smart Grid Architecture Model (SGAM)                               |
| 6.6.     | Standards Gaps, Prioritization, Work Program                       |
| 6.7.     | Security   |
| 6.8.     | Interoperability   |
| <br>     |  |
| <b>7</b> | <b>Processes and Management for the Smart Grid Methodology</b>     |
| 7.1      | Overall Process  |
| 7.2      | Introduction into Standardization Organizations                    |

# Report ToC: Annexes

## **Annex A Concepts, Elements, Tools for the Smart Grid Standardization Methodology**

### A.1 Meta-Models

### A.2 SGAM

#### A.2.1 Introduction

#### A.2.2 SGAM Smart Grid Plane

#### A.2.3 SGAM Interoperability Layers

#### A.2.4 SGAM Framework

#### A.2.5 SGAM Levels of Abstraction

#### A.2.6 Use Case Analysis with SGAM

#### A.2.7 Example

### A.3 Basics for Market Models

### A.4 Examples

## **Annex B New Business Model Framework for Smart Grid / Smart Energy**

### B.1 Traffic Light Concept

### B.2 Flexibility Concept

## **Annex C Detailed example(s)**

### C.1 Introduction

### C.2 Proposed Use Cases to be studied in 2013

### C.3 Primary Use Case Description

### C.4 Consideration of the WGSP 2136 use case against the SGAM

### C.5 Implication for the SGAM

### C.6 Conclusions for the WP4 work to date

# Use Cases – Interrelation between Domain and IT Experts

Template as  
form or check list

1 Description of Use Case

1.1 General

Give some general background related to the Use Case, for example about the project where the Use Case was developed for.

1.2 Name of Use Case

| Use Case ID | Name of Use Case                                       | Level of Detail                    |
|-------------|--|------------------------------------|
| UC-001      | UC-001: "Determine energy balance on substation level" | UC-001: UC-001: The UC-001 Annex A |

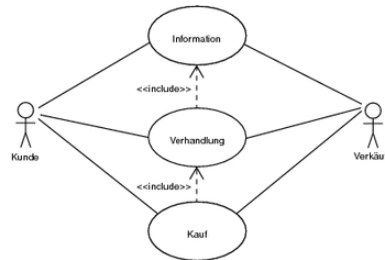
© will be filled later by the system or the administrator.

1.3 Version Management

| Version | Author        | Author's Address | Author's E-mail | Author's Phone | Author's Fax | Author's Mobile | Author's Other |
|---------|---------------|------------------|-----------------|----------------|--------------|-----------------|----------------|
| 1.0     | Author's Name | Author's Address | Author's E-mail | Author's Phone | Author's Fax | Author's Mobile | Author's Other |

Approval status will be used with the standardization organizations, more some first ideas are provided. A process suggestion for use cases in standardization will follow later.

UML-Graphics



To identify functional and  
technical  
requirements for standards  
-> Standards Gap Analysis



Domain Expert

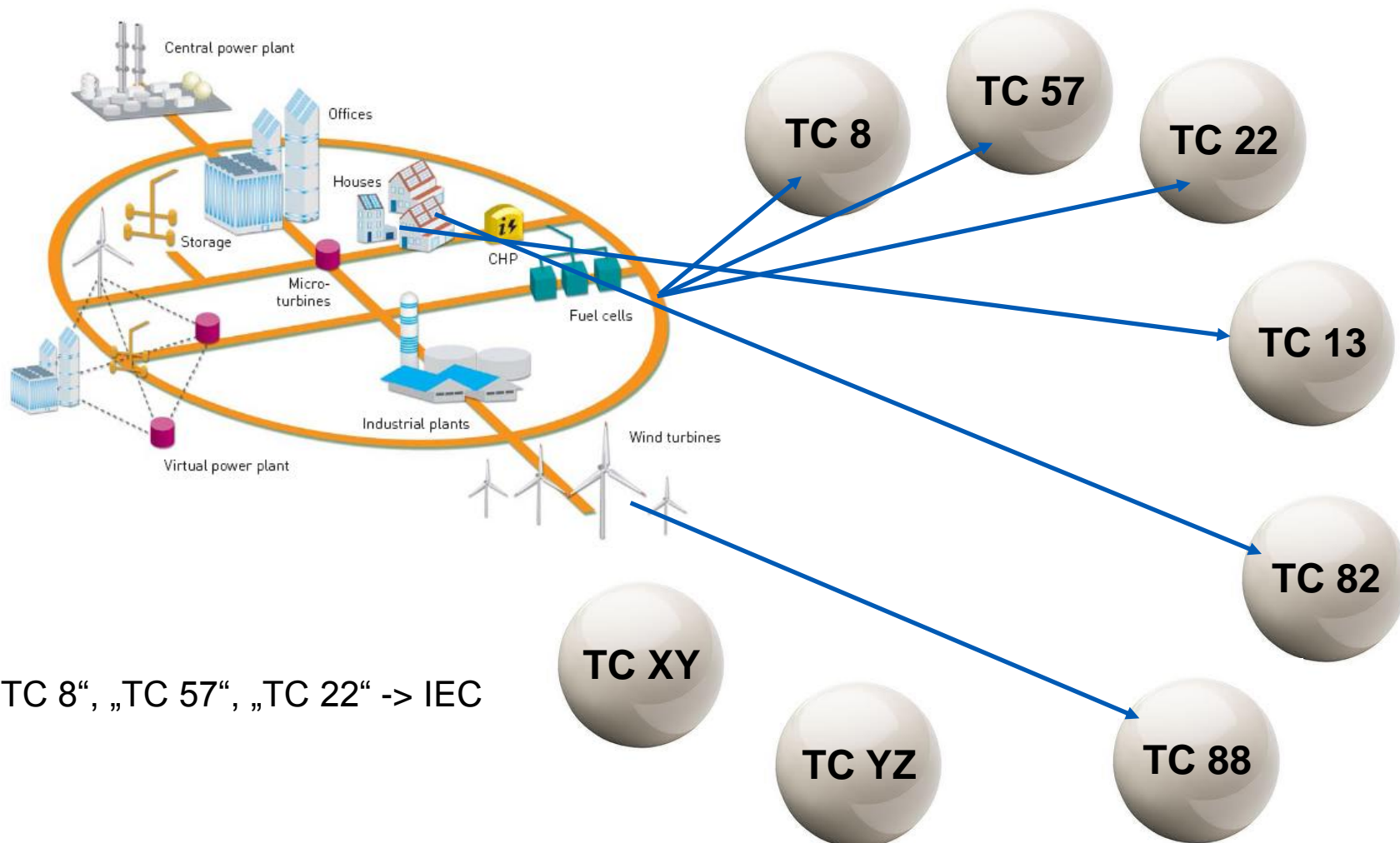


IT Expert  
System Engineer

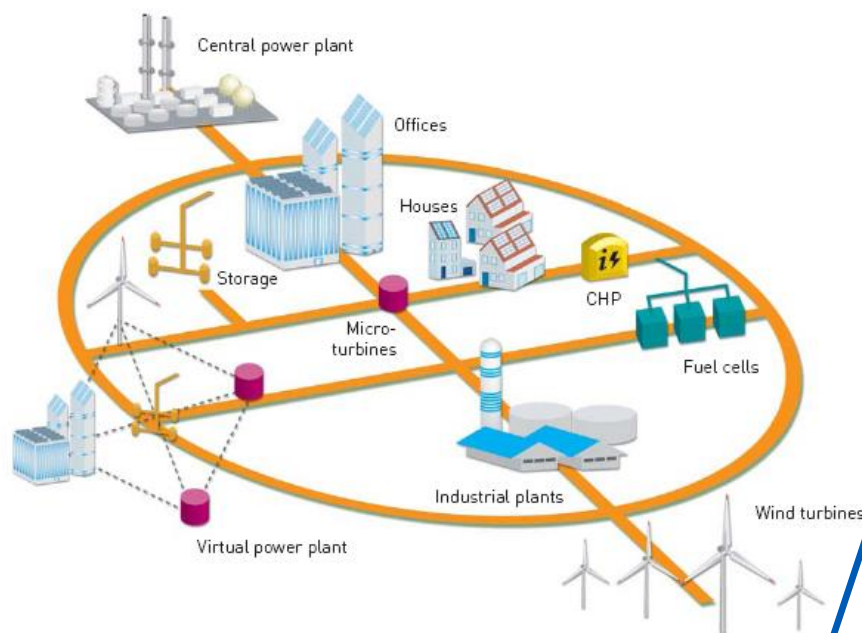
UML Unified Modeling Language  
for the technology neutral  
description of interactions  
and actors



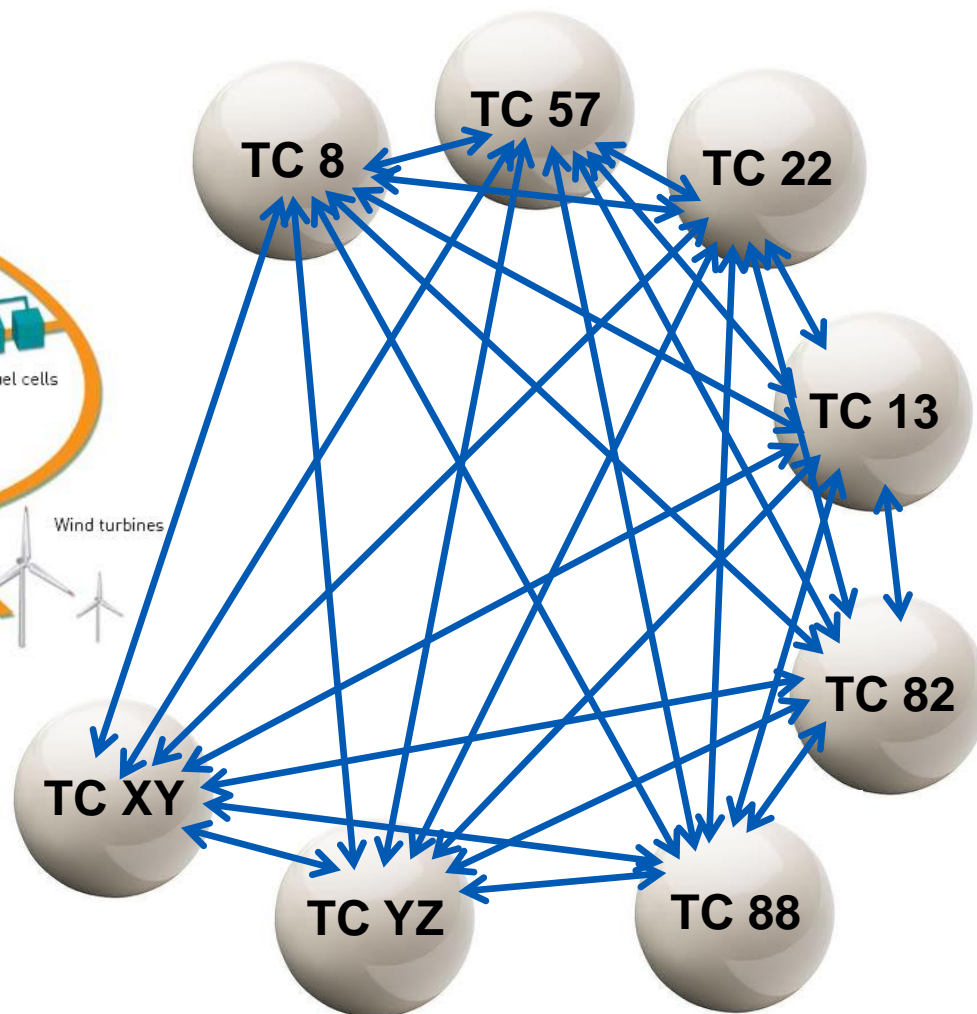
# Why is standardization interested in the use case approach?



# Smart Grid – Collaboration of Technical Committees

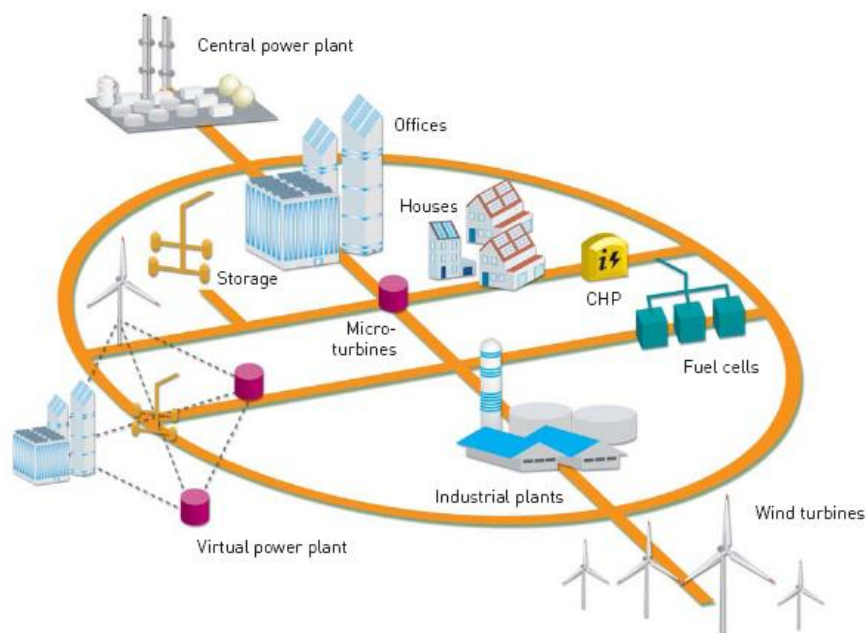


**today: Liaisons**



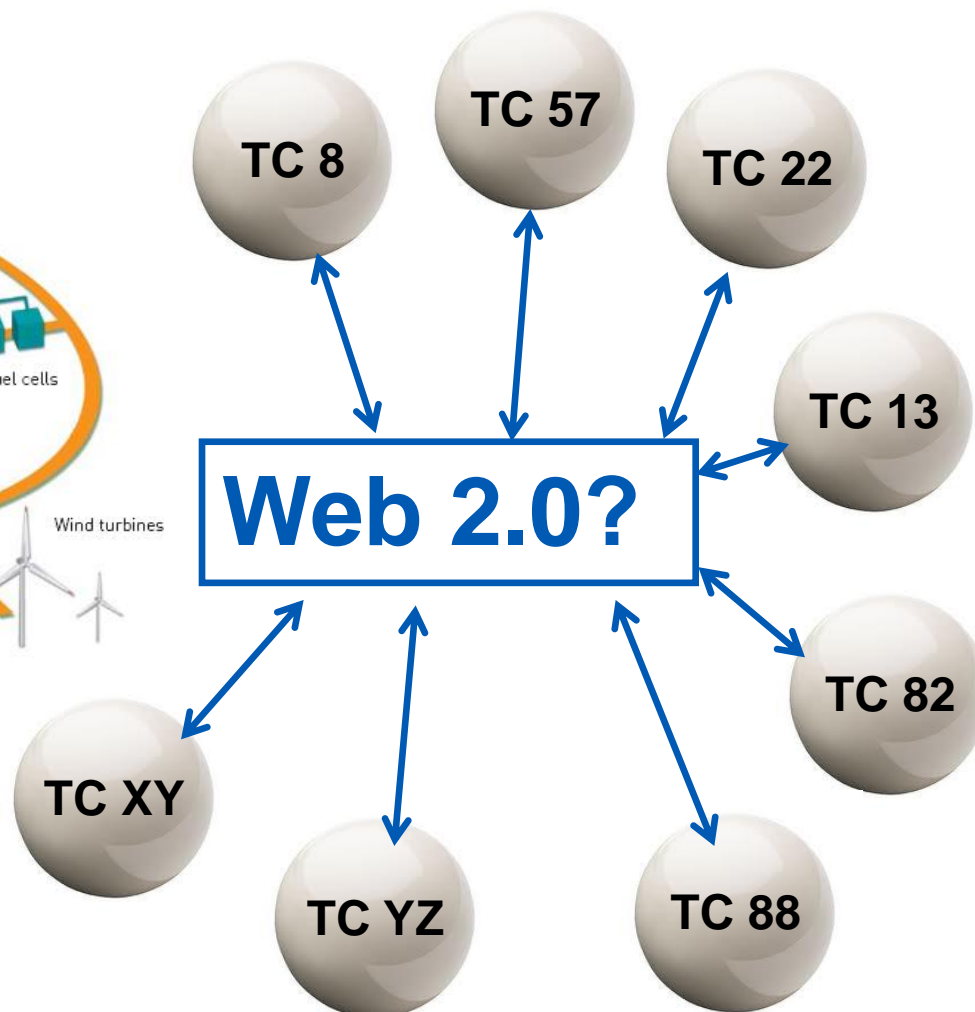


# Smart Grid – Collaboration of Technical Committees



**New processes for  
complex, cross cutting  
systems?**

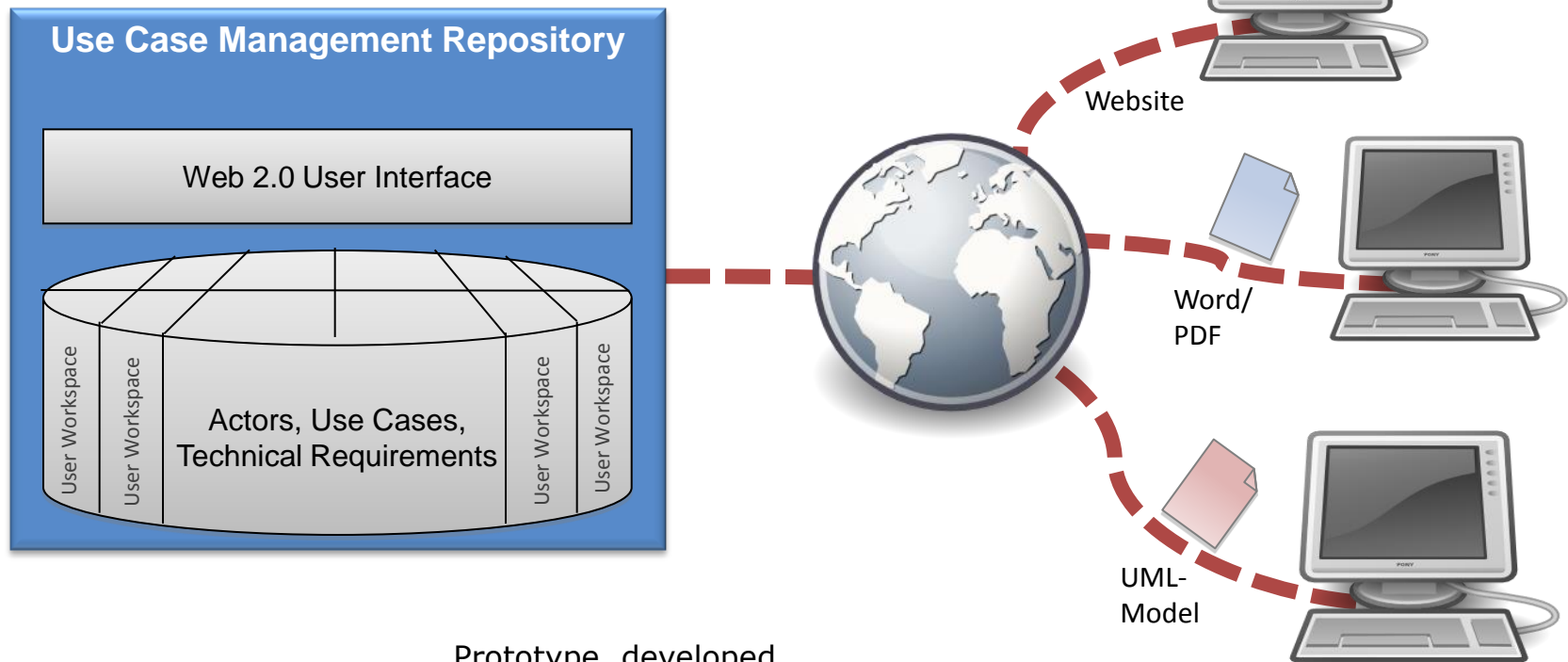
**e.g. collaborative  
description of use cases**



# Use Cases Received

- More than **450 Use Cases** received  
-> **Thanks to all contributing stakeholders**
- Main stakeholder groups had been: Smart Grid R&D projects, Technical Committees (TC), National Committees (NC), individual companies, associations
- Over 80% used the distributed templates (mainly short form)  
Others used very similar formats
- Level of detail was very different

# Use Case Management Repository (UCMR) - Overview



Prototype, developed  
2010 for the SG-CG

source: Offis / DKE

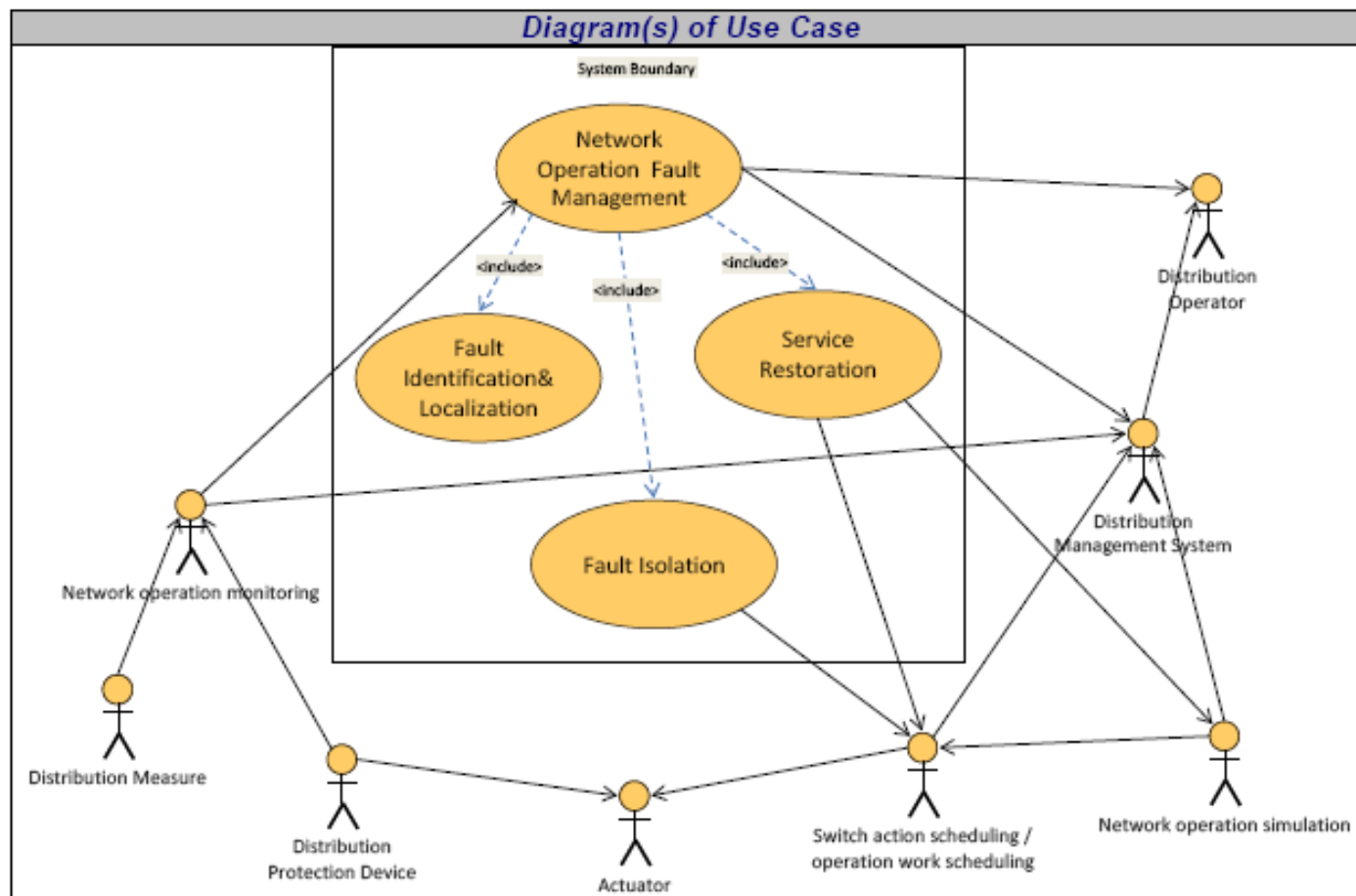
# Example: FLISR

## 2 Use case overview table of the use case "Locate and isolate fault and restore system (FLISR Fault location, isolation, system restoration)"

| <i>Name of Use Case</i>  | <i>Short description</i>  | <i>Actors</i>   | <i>General remarks</i> |
|--|---|---|------------------------|
| Locate and isolate fault and restore system (Fault location, isolation and system restoration (FLISR)) | <p>The FLISR use case is divided into four sequences:</p> <ol style="list-style-type: none"> <li>1. Fault detection and clearance – The protection devices in the grid are detecting the fault and issuing suitable breaker tripping.</li> <li>2. Fault localization – Identify the physical location of the fault by analysing the telemetered alarms received from protection devices in the grid</li> <li>3. Fault isolation – Determine switching actions which will isolate the faulty equipment(s) from the rest of the grid</li> <li>4. System restoration – Resupply those healthy parts of the grid, which are de-energized during the fault clearing.</li> </ol> <p>The execution within these s is typically highly automated, while the continuation with the next sequence typically requires a control room operator interaction.</p> | <p>Switch action scheduling / operation work scheduling, Network operation monitoring Network Operations Simulation, Distribution Management System (DMS), Distribution Operator, Network Operations Fault Management, Actuator, Distribution Measure, Distribution Protection Device</p> |                        |
| Next use case  |   |   |                        |
| Next use case  |   |   |                        |

# Example: FLISR

## 2 Diagrams of Use Case



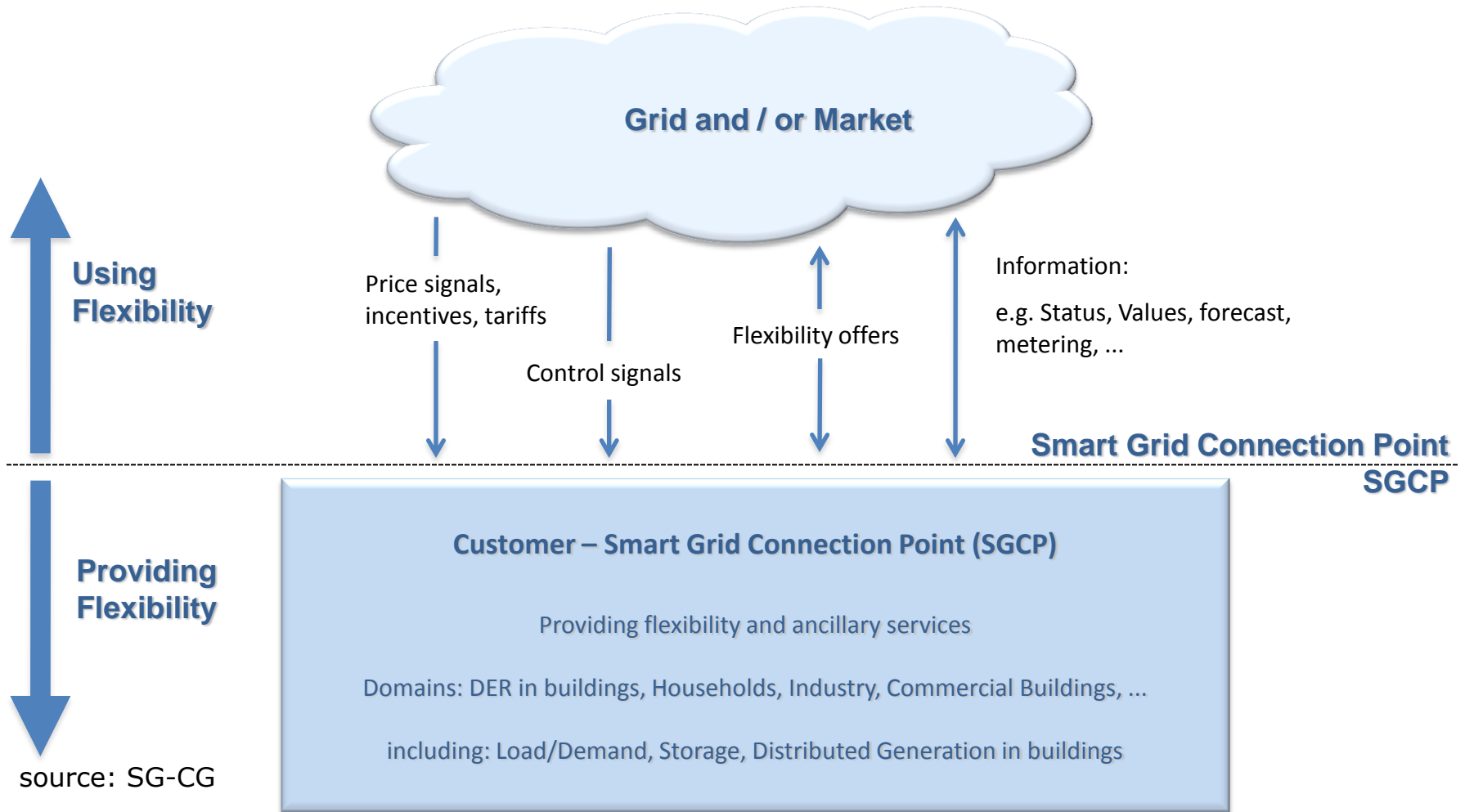
# Example: FLISR

## 4.2 Scenarios

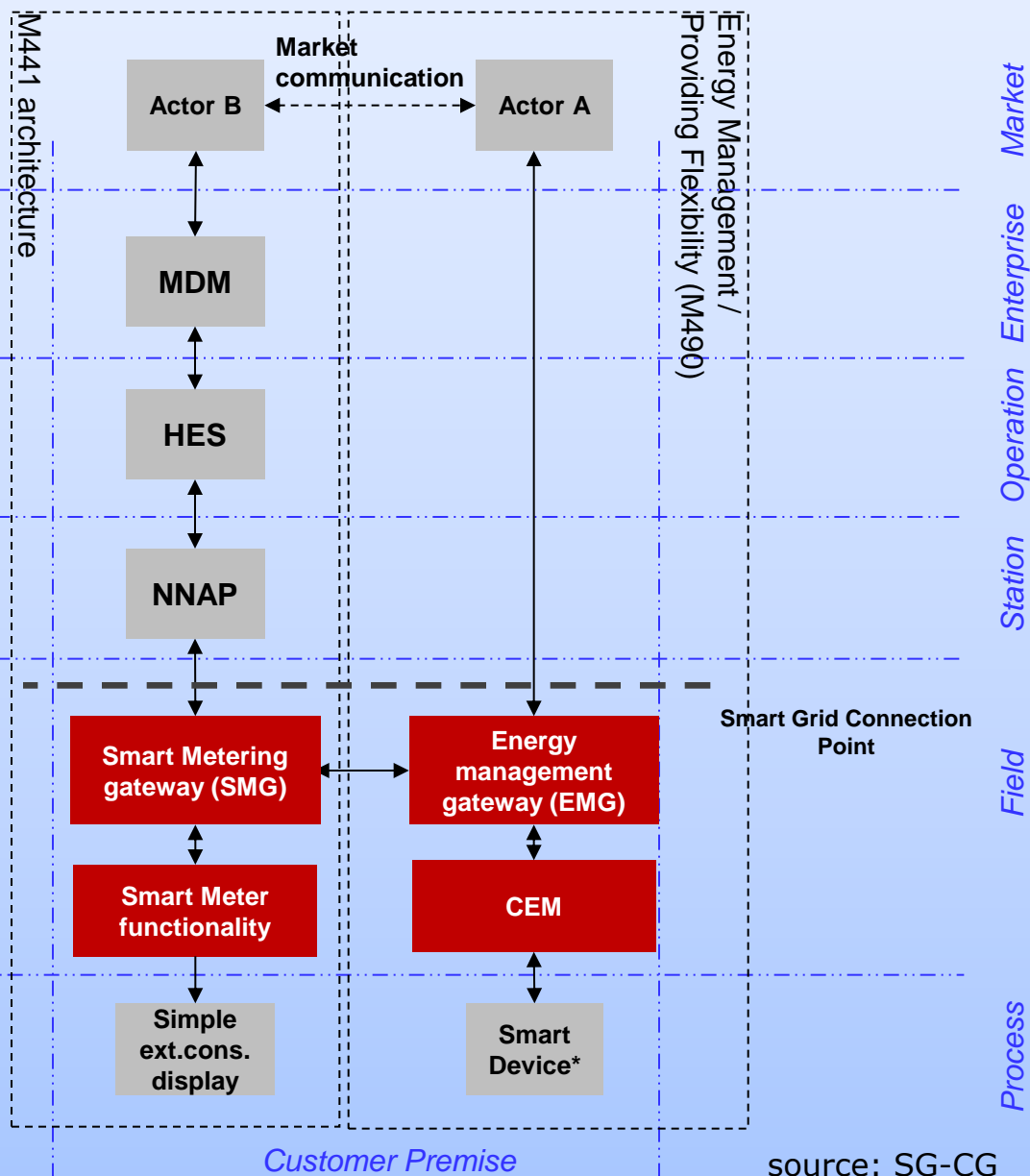
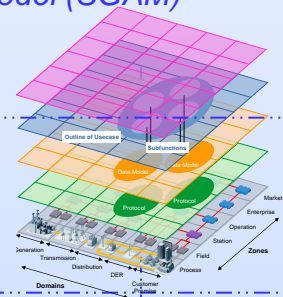
| Scenario Name : |                             | No. 1 - Fault occurs      |  |         |                                     |                                     |                                     |                   |
|-----------------|-----------------------------|---------------------------|--|---------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------|
| Step No.        | Event                       | Name of Process/ Activity | Description of Process/ Activity   | Service | Information Producer (Actor)        | Information Receiver (Actor)        | Information Exchanged               | Requirements R-ID |
| 1               | Fault occurs in the grid    | Tripping                  | Substation Protection Device detects a fault on the protected asset and trips to eliminate the current fault. It de facto de-energizes the protected asset e.g. the part of the radial operated network where the fault occurred | EXECUTE | Distribution Protection Device      | Actuator (Breaker)                  | Trip command                        | QoS-1             |
| 2               | Fault occurs in the grid    | Fault notification        | Substation Protection Device sends signal to the Network operation monitoring  | CREATE  | Distribution Protection Device      | Network operation monitoring        | Network Fault                       | IS-1              |
| 3               | Breaker trip alarm          | Information collection    | Network Operations Monitoring collects all incoming information provided by the network operation monitoring which is related to the occurred fault  | REPORT  | Network operation monitoring        | Network Operations Fault Management | Various fault and status informaion | IS-1              |
| 4               | Fault data collection ready | Fault localisation        | The Network Operations Fault Management application analyses the collected fault data and identifies the faulty equipment (see next scenario)  | CREATE  | Network Operations Fault Management | DMS                                 | Faulty Equipment                    | QoS-2             |



# Flexibility Concept SG-CG/SP



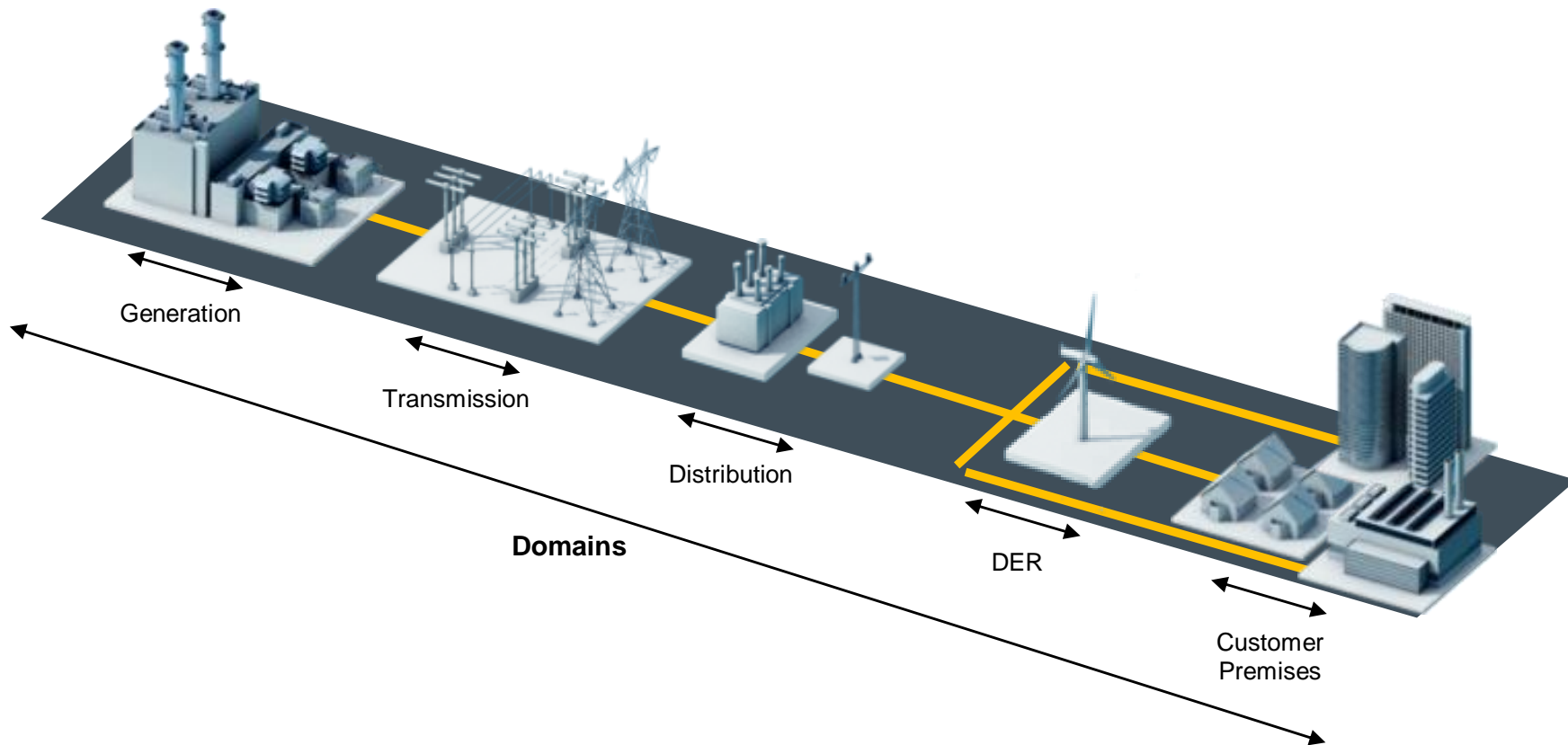
## Smart Grid Architecture Model (SGAM)



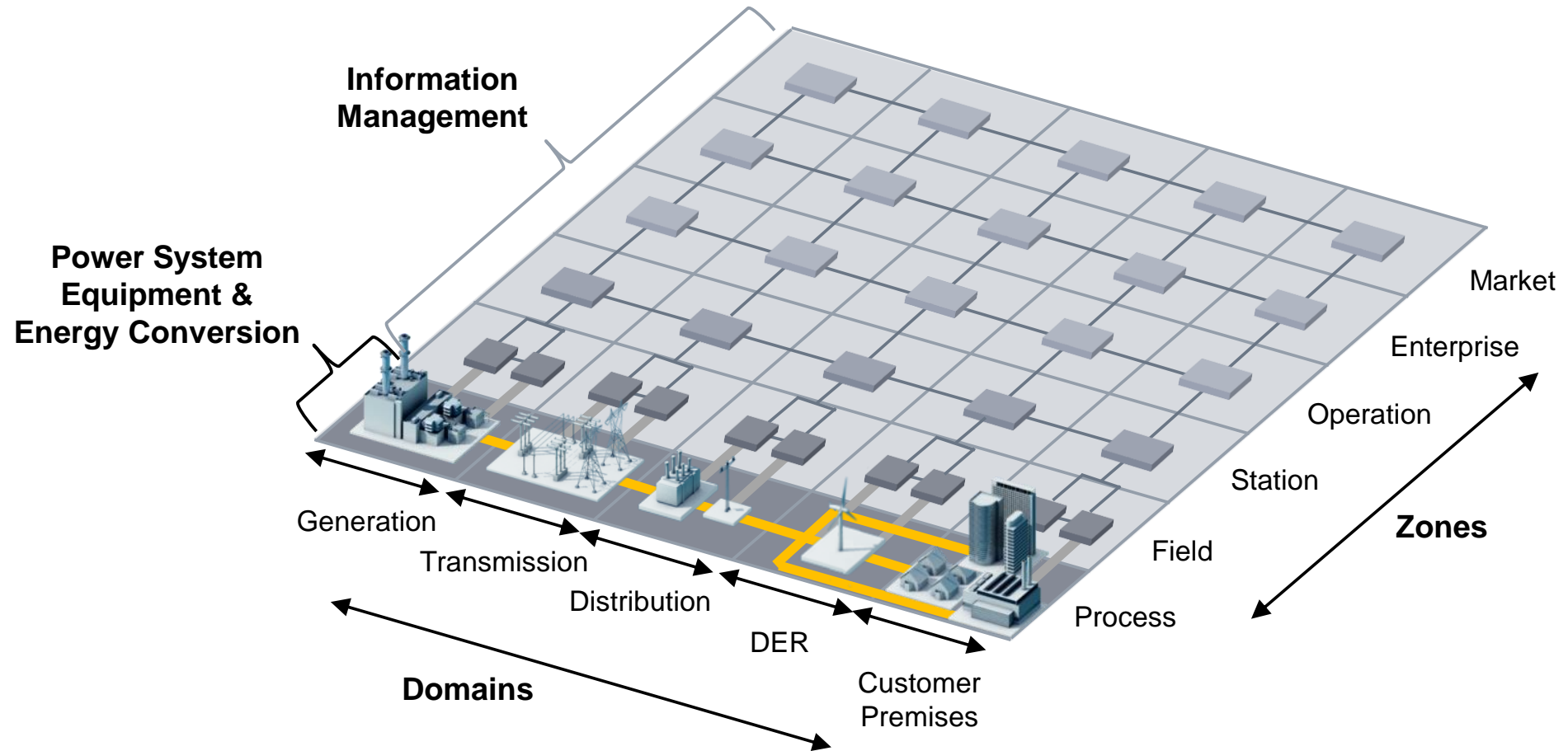
\* e.g. HBES device, smart appliances, storage, generator, domestic charger for EV, complex display

source: SG-CG

# SGAM Domains

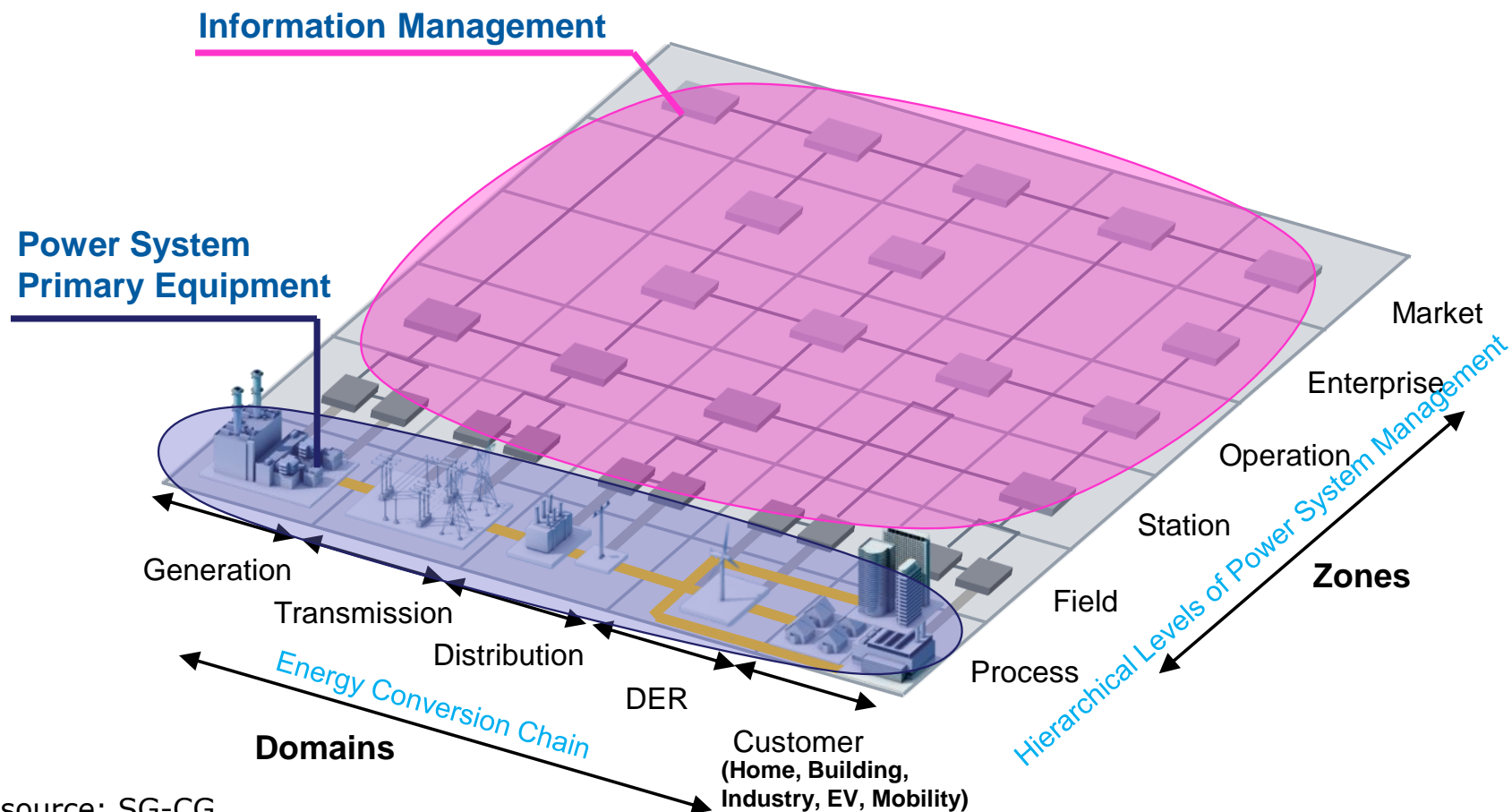


# SGAM Smart Grid Plane



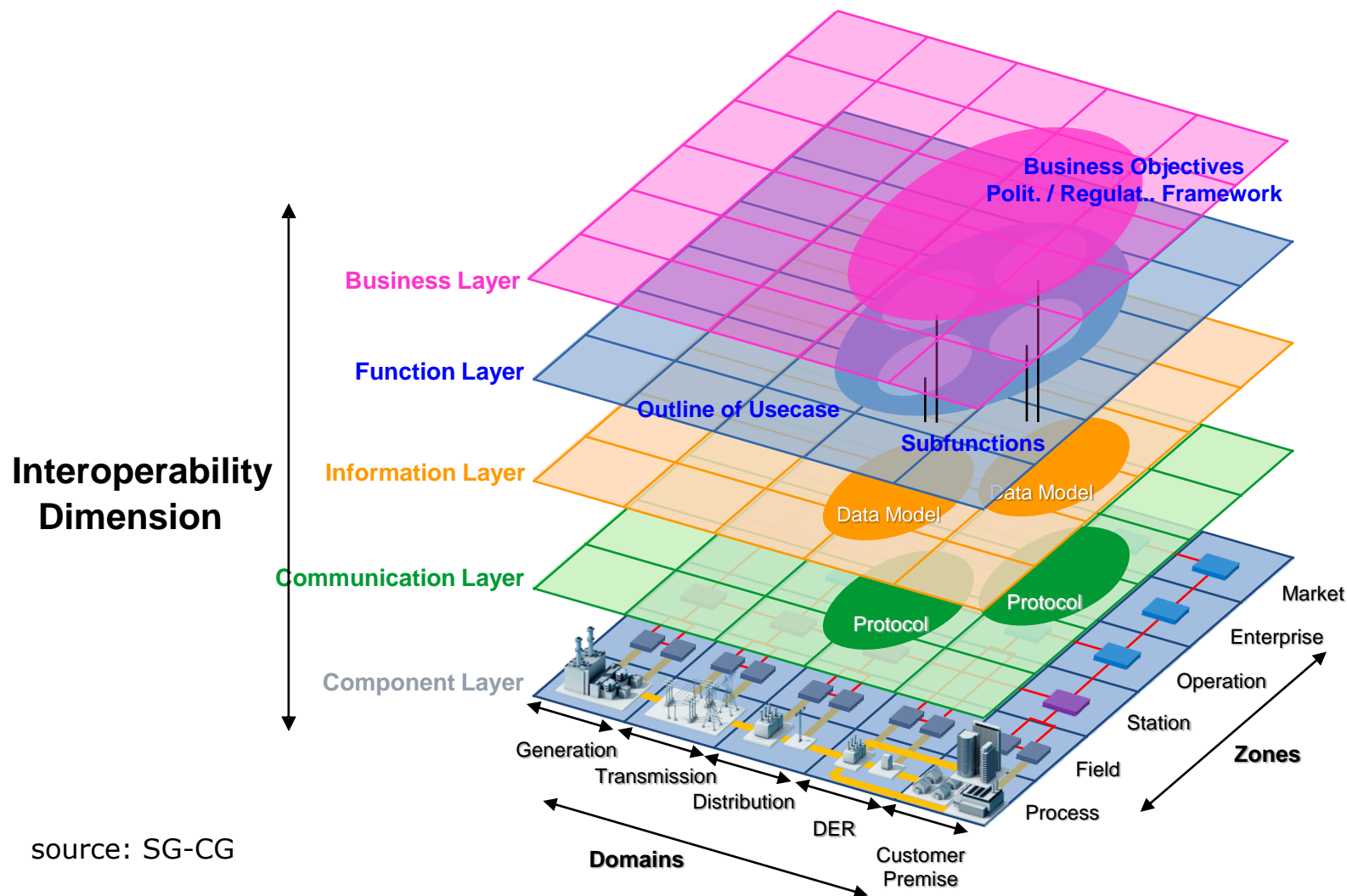
# Smart Grid Architecture Model (SGAM)

## The Smart Grid Plane



source: SG-CG

# SGAM Layers





# Example: Monitoring of the distribution grid (SG-CG WGSP-0600)

## Business Layer

- Different roles involved: DSO, aggregator, customer, ..

## Function Layer

- Several ways how monitoring information can be collected (sec. substations, AMI, CEMS, ..)

## Information Layer

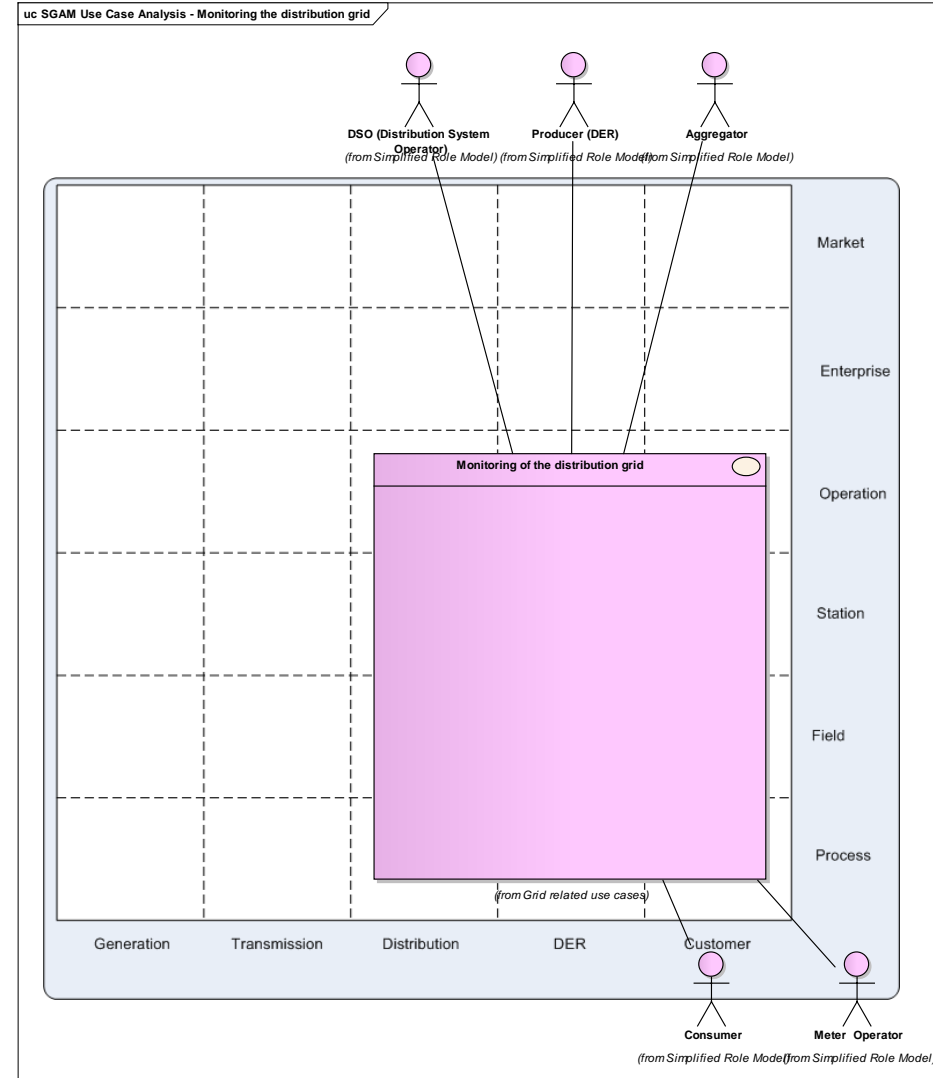
- power quality data, power flow, protection
- surveillance of substation
- Data from DERs, customers and meters

## Communication Layer

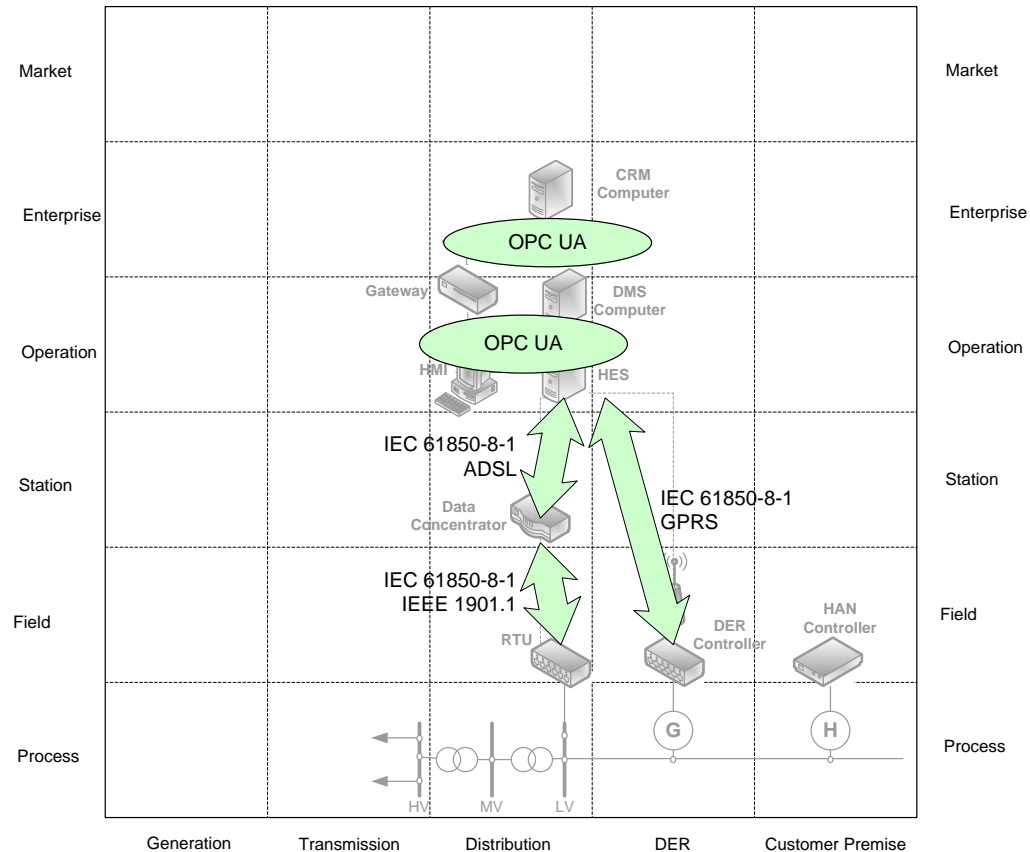
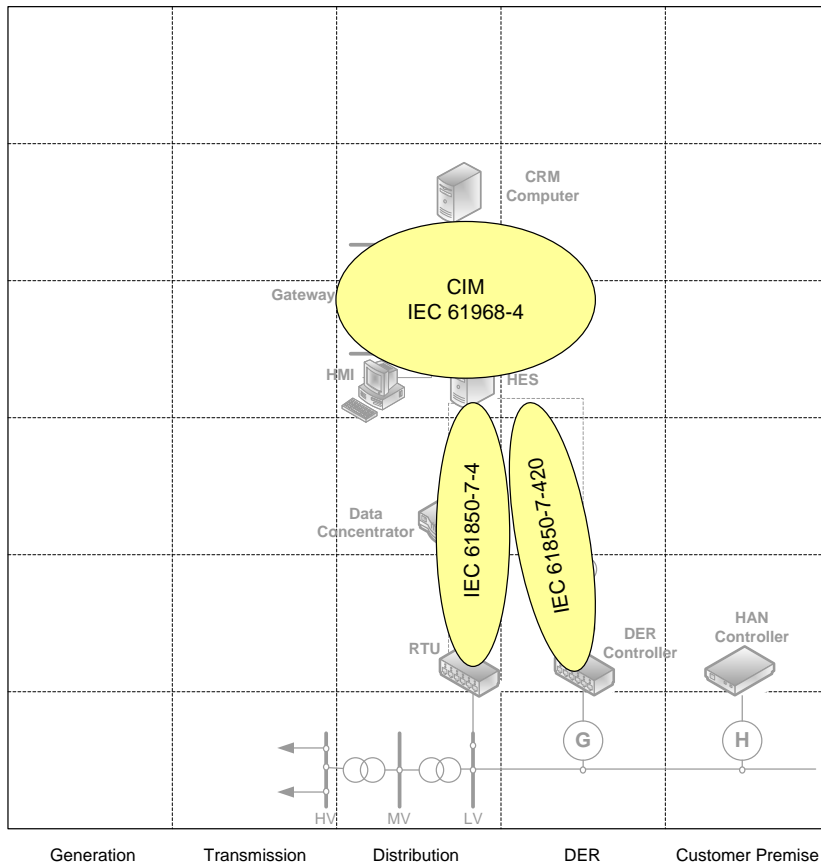
- Connectivity

## Component Layer

- Sensors & actors at lower voltage levels

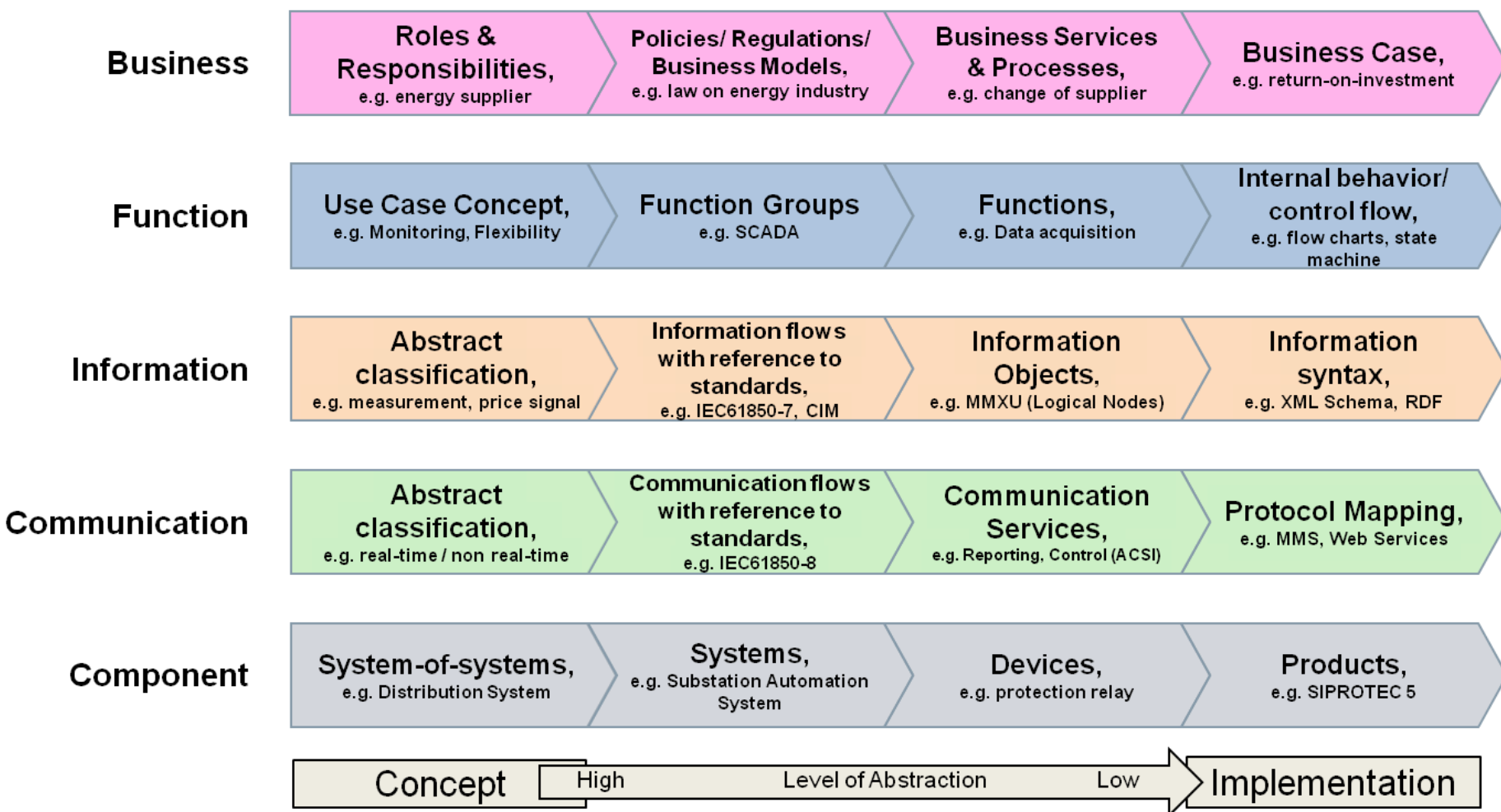


# Information / Communication Layer

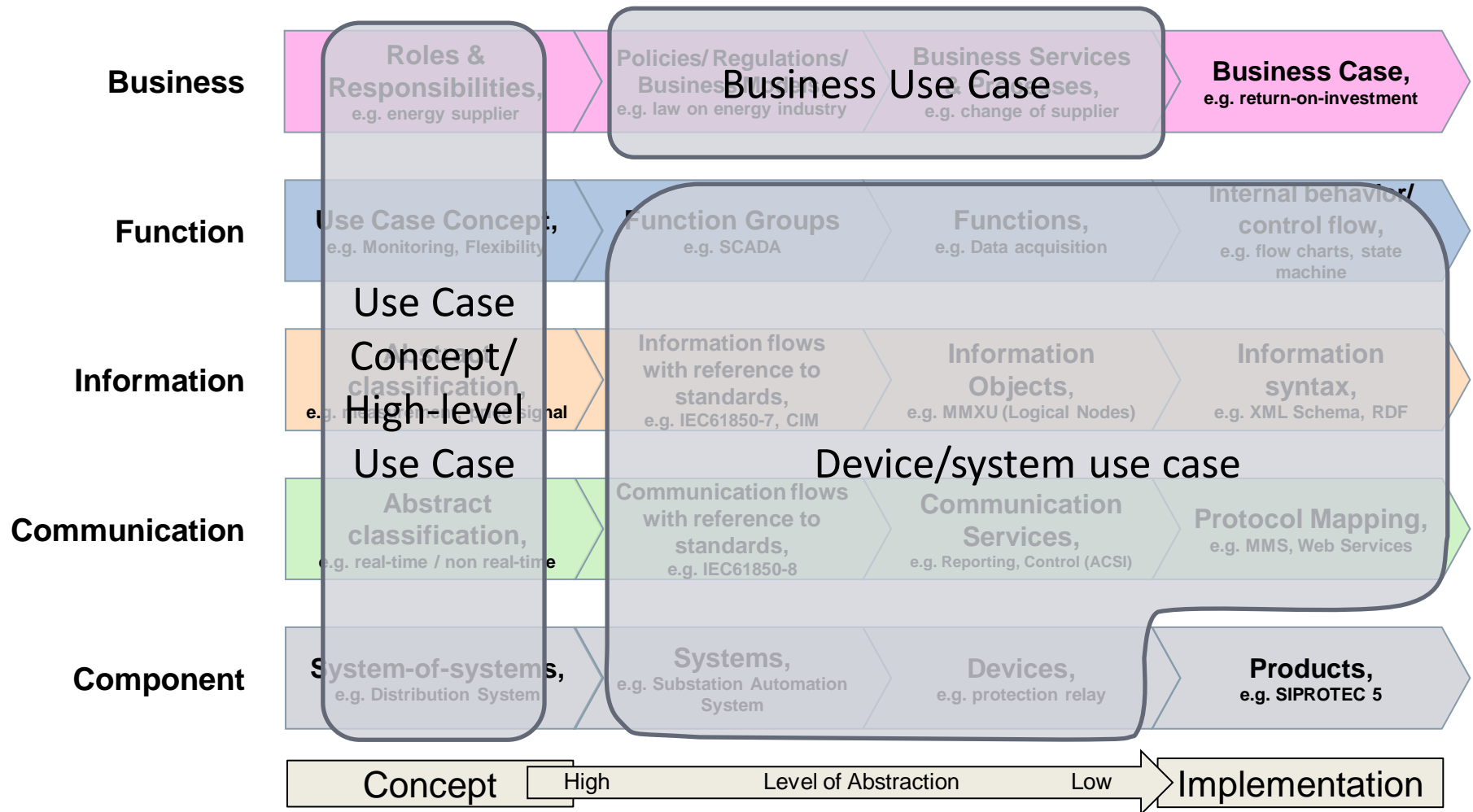


source: SG-CG

# SGAM Analysis Pattern



# Use Case Analysis with SGAM



# Example: Monitoring the Distribution Grid

## Use Case Concept

1

## 2 Business Use Case

- General: "Monitoring inside the distribution grid" - Business View (Section 5.7.2)
- Detailed: "Monitor system interruptions and report to regulator" (Section 5.7.5)

- Business goals:
  - Ensure safe and secure operation
  - Efficient use of equipment
  - ...
- Policies & regulation
  - ...

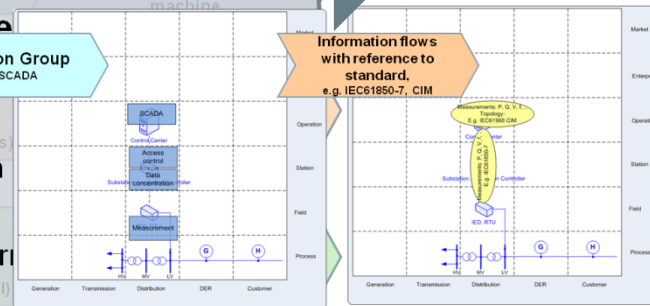
3

## Technical Use Case

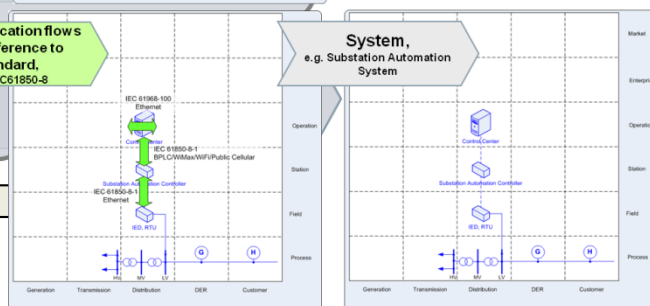
### Device/system use

- General: "Monitoring inside the distribution grid" - Technical View (Section 5.7.3)
- General: Detailing the function "Control" (Section 5.7.4)
- Detailed: "Monitor system interruptions and report to regulator" (Section 5.7.5)

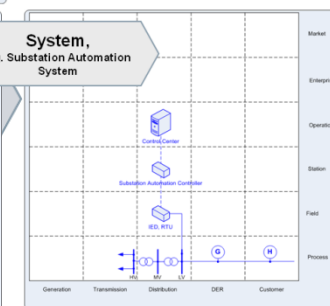
Function Group  
e.g. SCADA



Communication flows  
with reference to  
standard,  
e.g. IEC61850-8

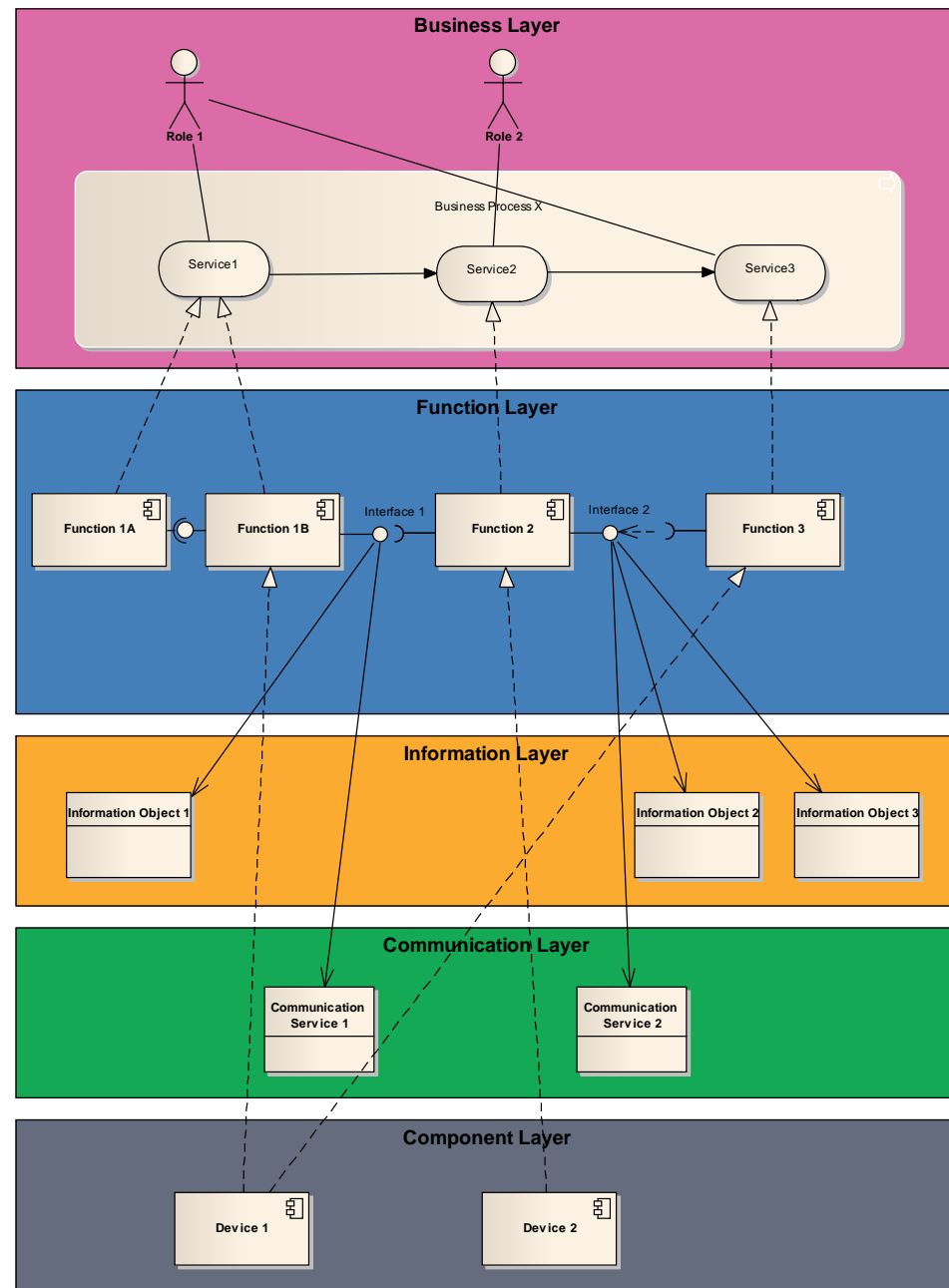


System,  
e.g. Substation Automation  
System



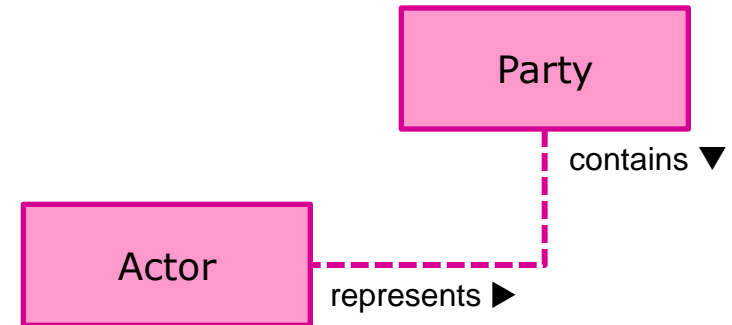
- Roles: DSO, ..
- Domains: Distribution, ..
- Zones: Field  $\leftrightarrow$  Operation
- ...

# Interrelation of SGAM layers





# Parties and Actors



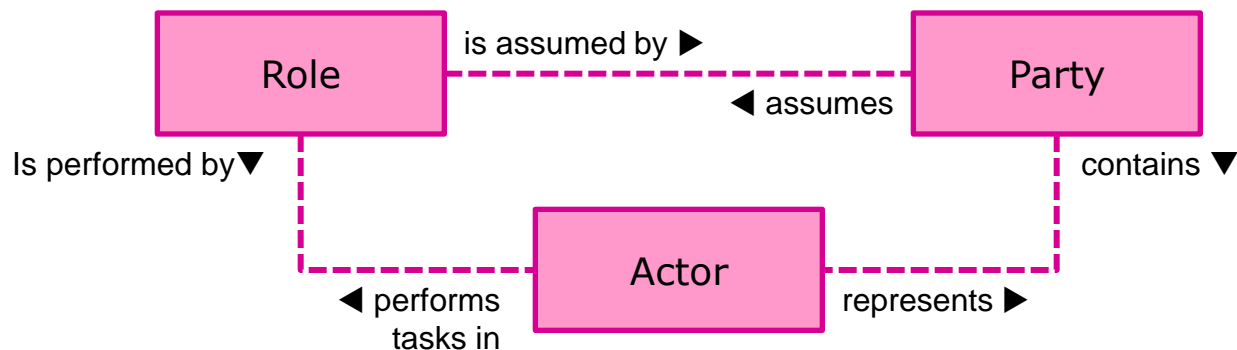
A **Party** is a legal entity, i.e. either a natural person or judicial person (organization)

- *Examples: Dong Energy, Liander, APX Group*

An **Actor** represents a *party* that participates in a business transaction

- *Examples: Employee, Customer, Electrical vehicle, Demand-response system.*

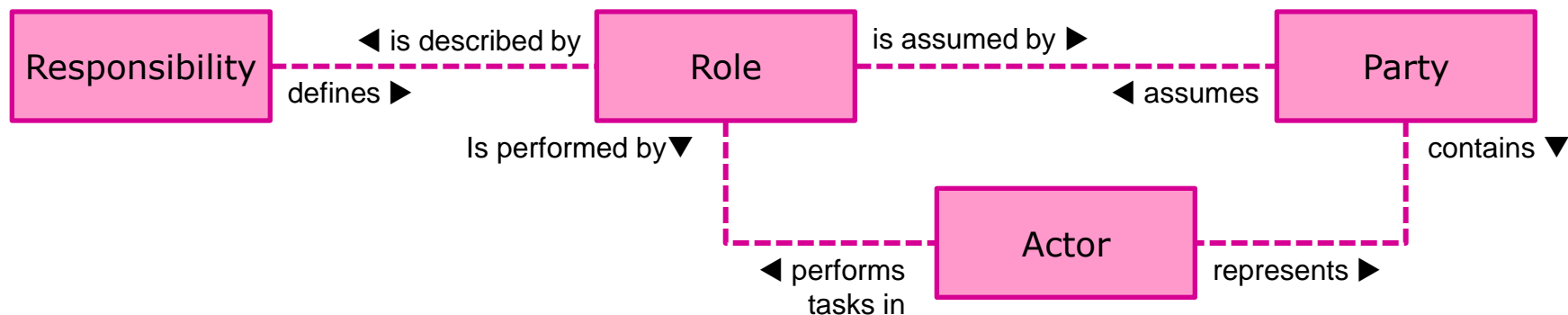
# Roles and Responsibilities (1)



A **Role** represents the intended external behavior (i.e. responsibility) of a *party*. *Parties* cannot share a *role*. *Roles* describe external business interactions with other *parties* in relation to the goal of a given business transaction.

- *Examples*: Balance Responsible Party, Grid Operator, Market Operator.

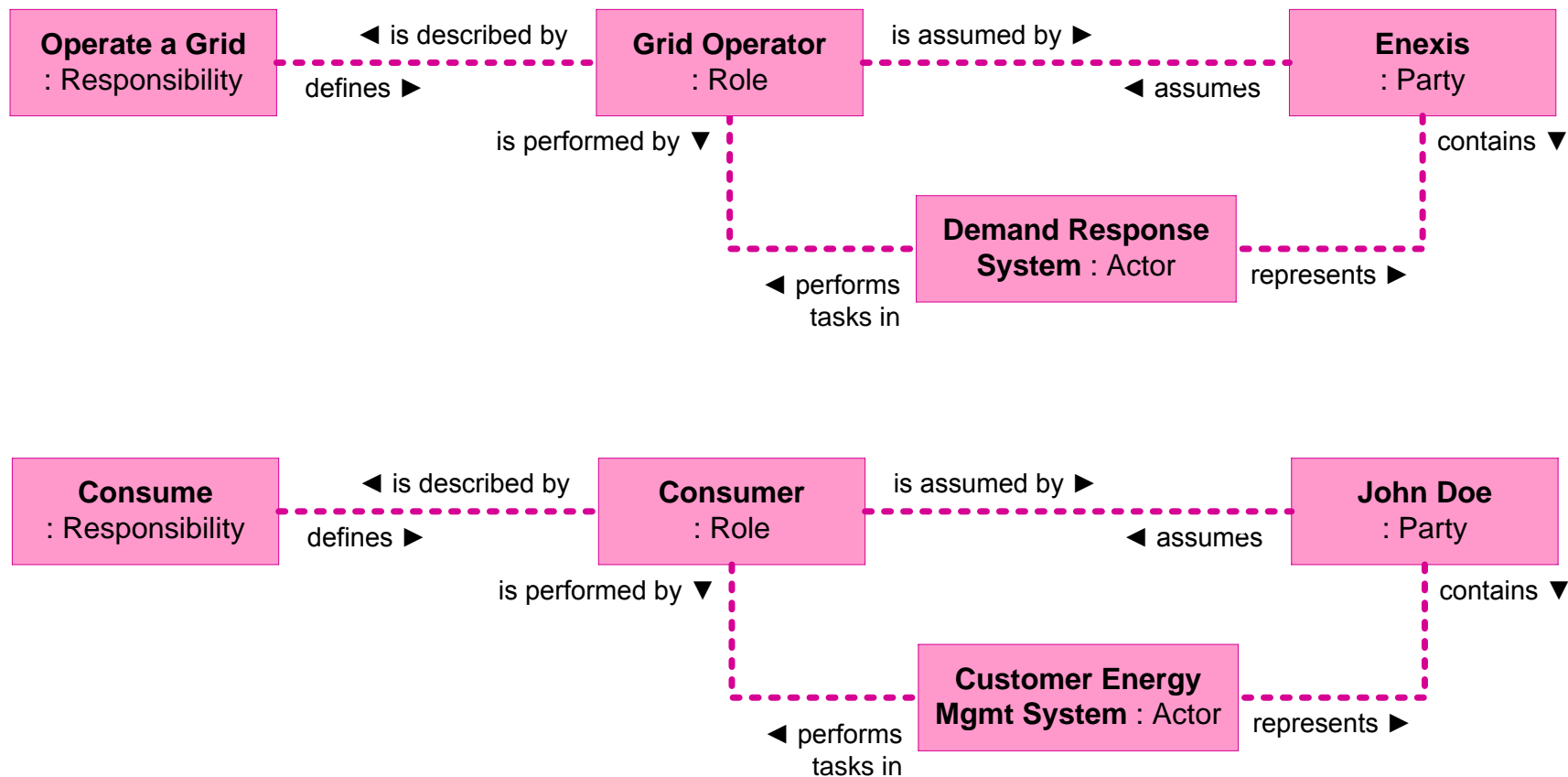
# Roles and Responsibilities (2)



**Responsibility** defines the external behavior to be performed by a *party* through its *role*.

- *Examples: Nominate Energy, Operate a grid, Determine the market energy price after applying technical constraints*

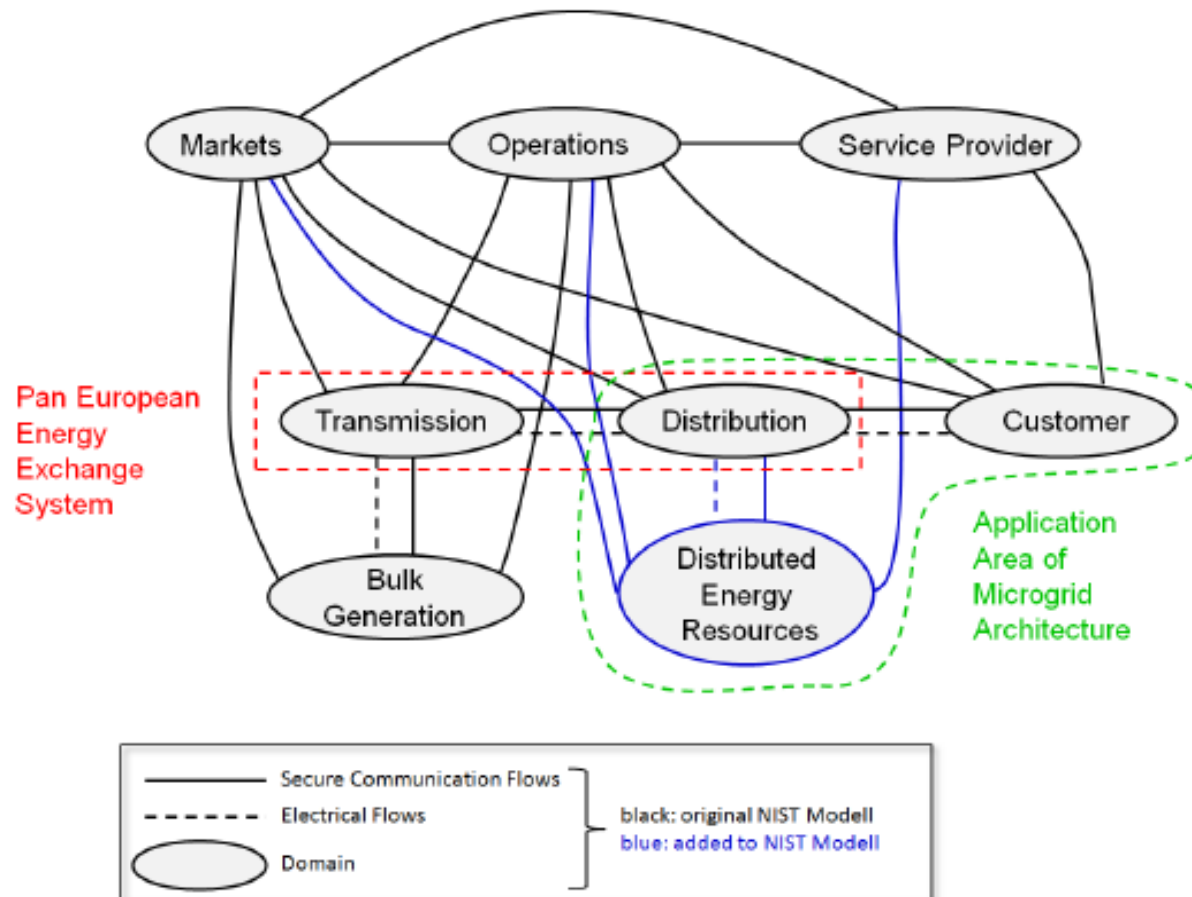
# Roles etc. Example



[illegible]

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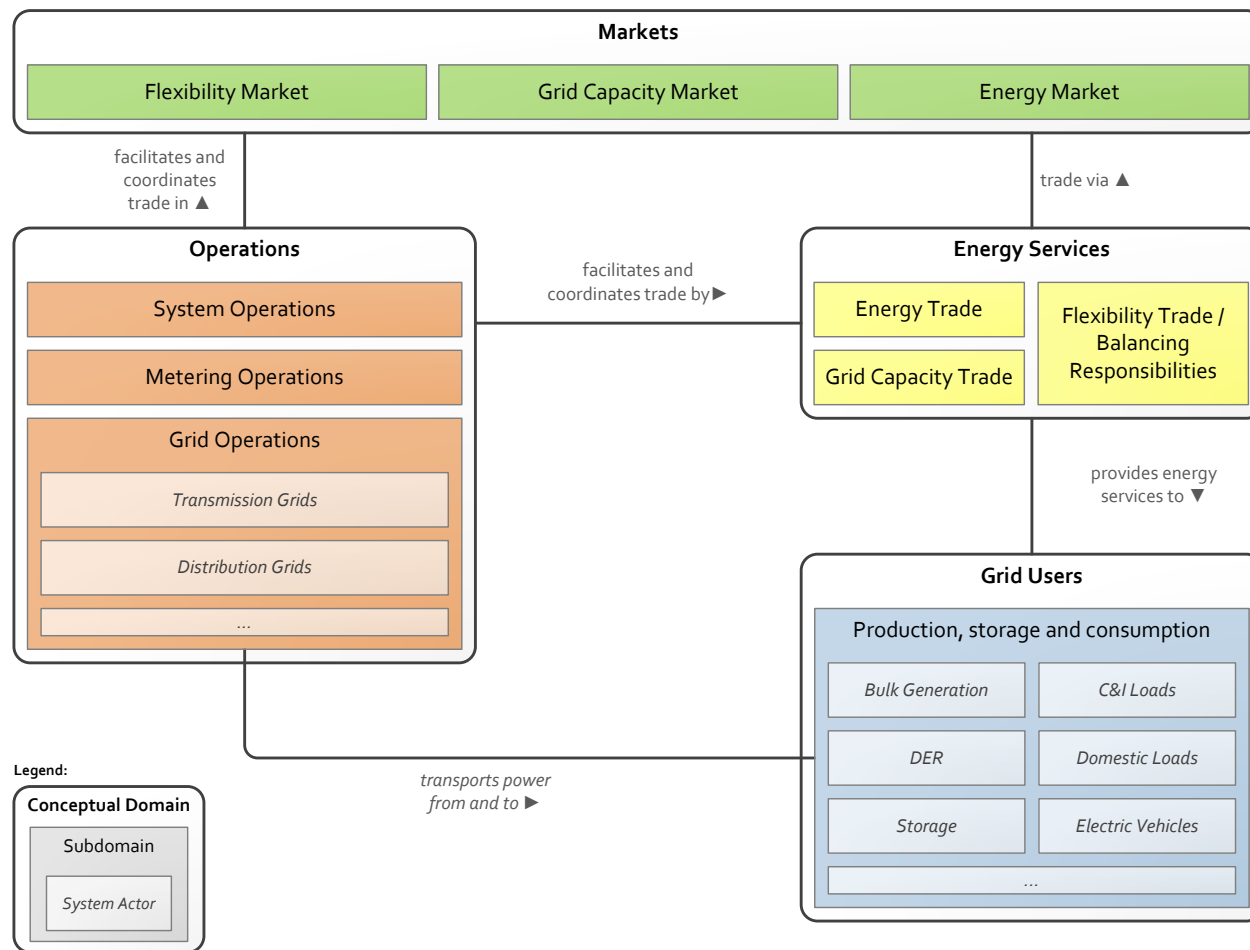
# Conceptual Model



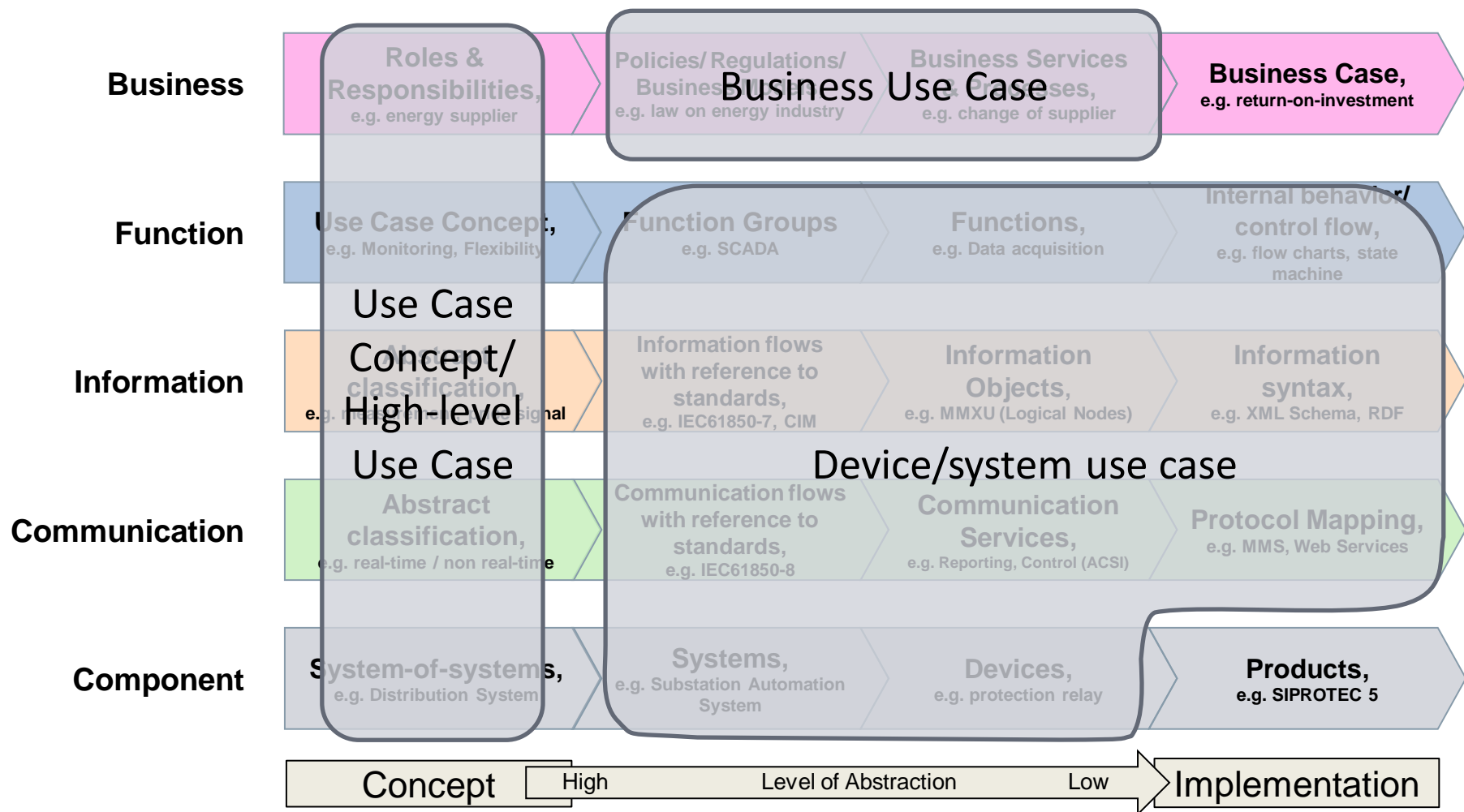
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based on NIST



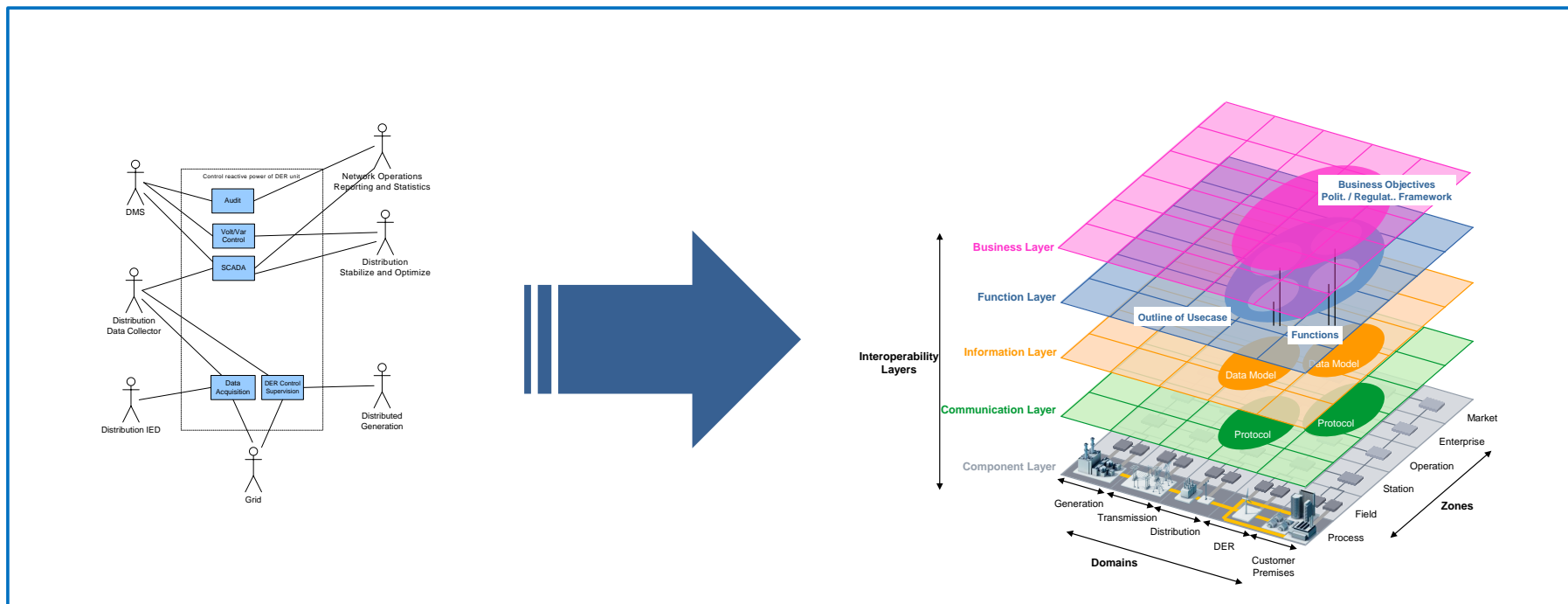
# Conceptual Model



# Use Case Analysis with SGAM



# Use Case Analysis with SGAM



Use Case Description

Business Layer  
Analysis

Function Layer  
Analysis

Component  
Layer Analysis

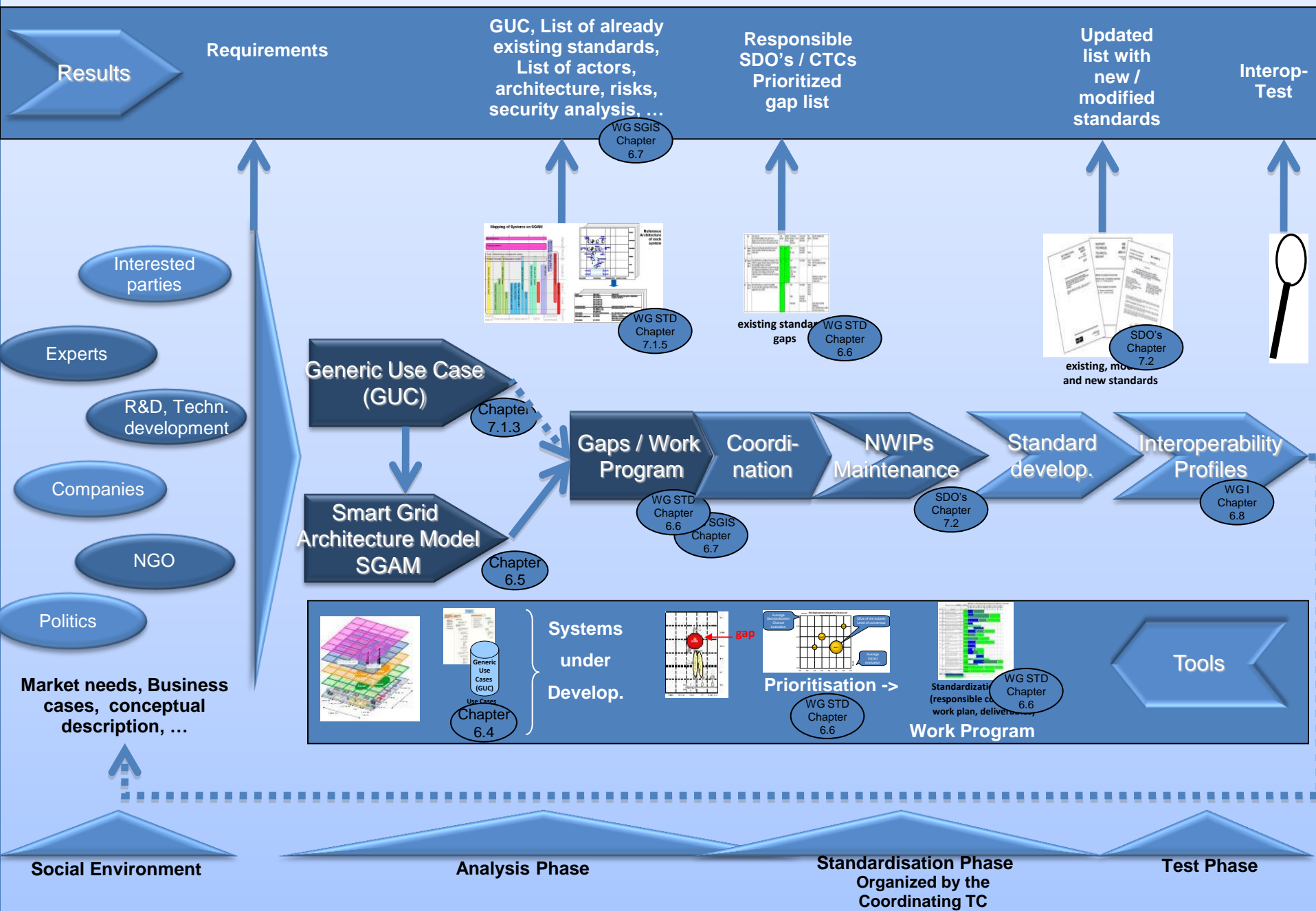
Information  
Layer Analysis

Communication  
Layer Analysis

## Remark

- The following process describes a work flow based on the tools and models explained before.
- This workflow is a suggestion. It might be adopted according to the needs of the user and the relevant project.

Time



# Thank you for your attention

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