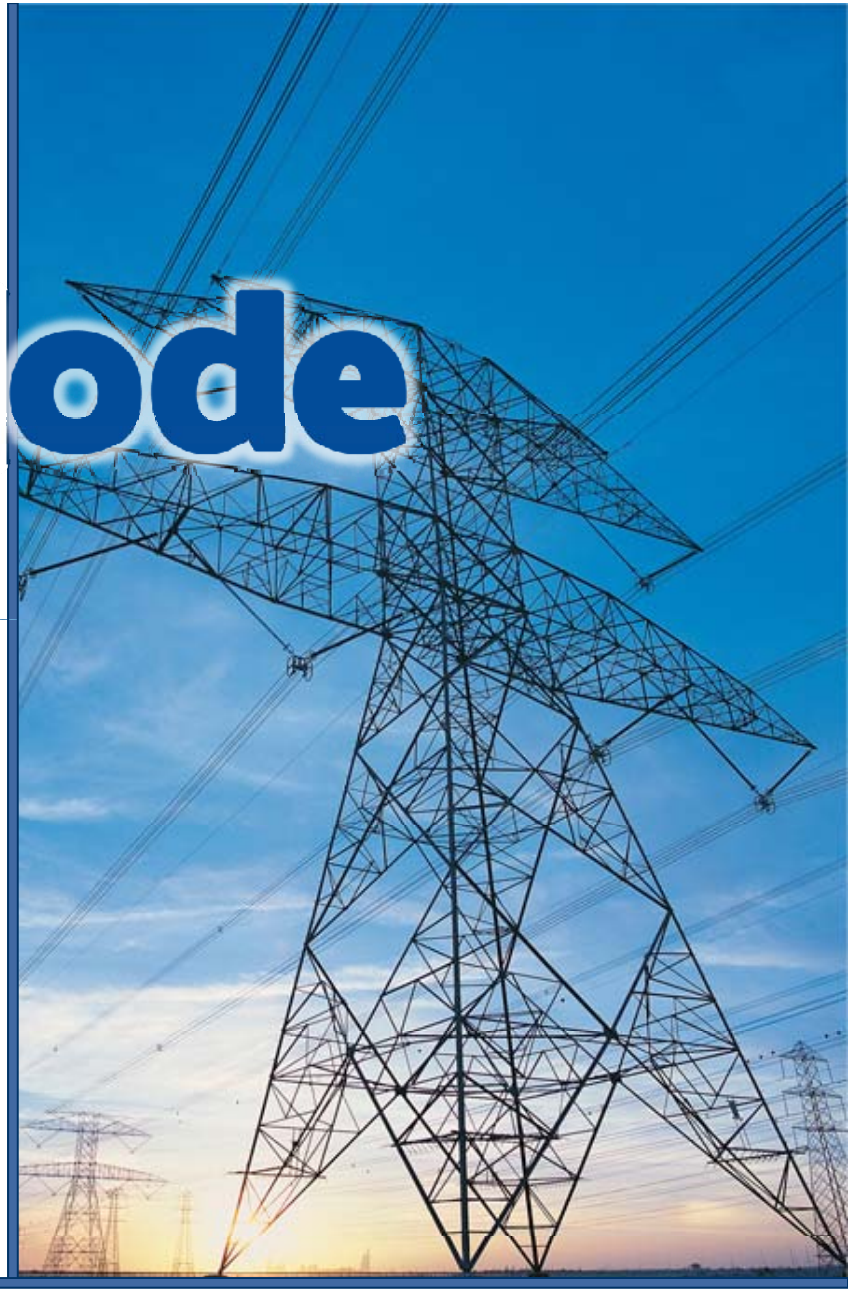
Open Architecture for Secondary Nodes of the Electricity SmartGrid



IEEE International SmartGridComm 2011

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Iberdrola

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Siemens AG

Brussels, October 17th, 2011

OpenNode

OpenNode is a project funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement Number 248119.

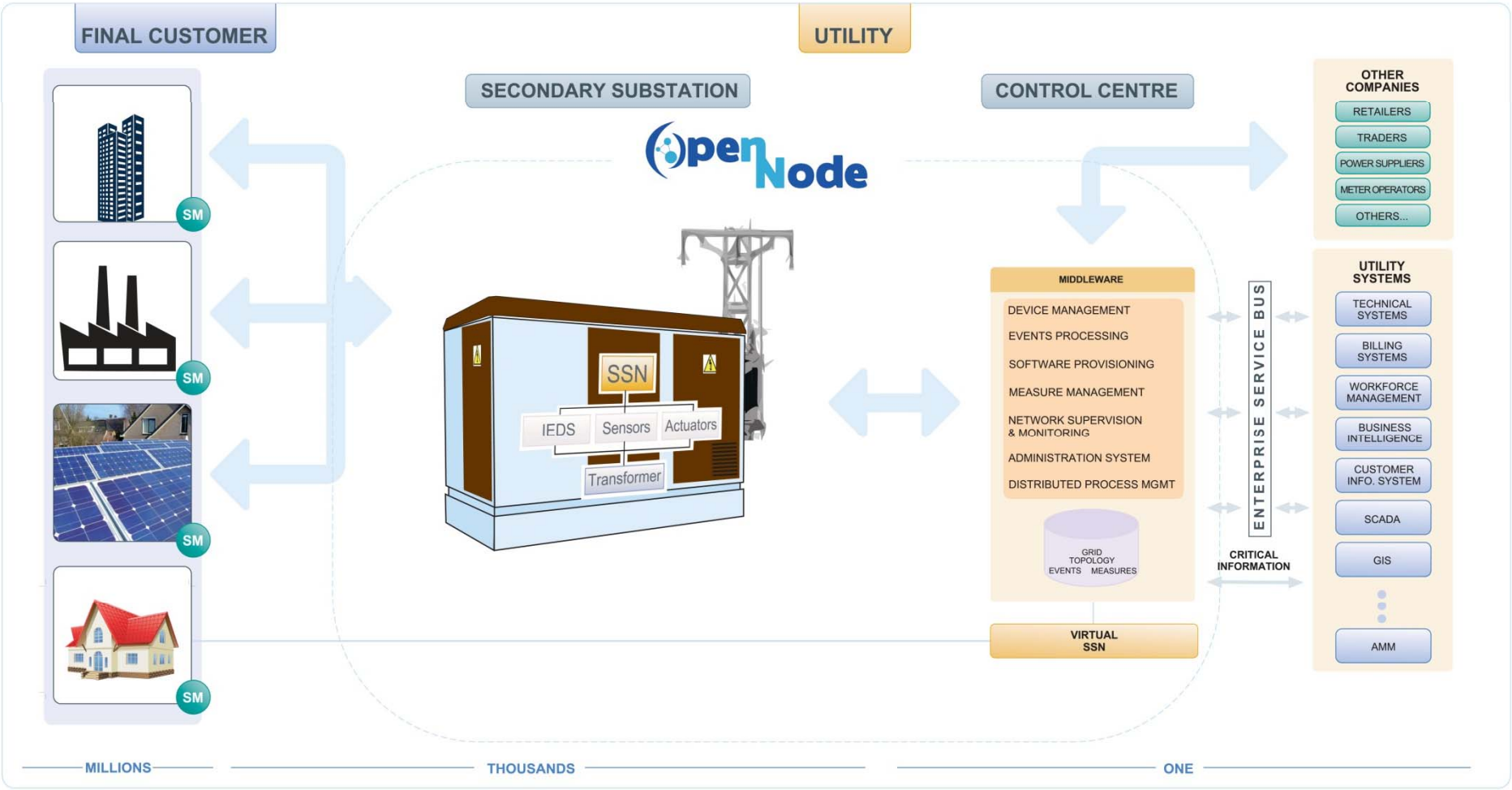
*It is focus on nowadays **challenges** within "smart distribution grids"*

*To **address the challenge**, a consortium of nine organisations from six European countries is working in the OpenNode project. The project started on January 2010 and has a duration of 30 months.*

Project objectives

- OpenNode project was born to face out those questions that arise from the new electrical distribution grid scenario. How can we:
  a. improve the distribution grid monitoring to cope with volatile states in the grid?
  b. control the distribution grid devices to ensure proper operation of the distribution network in both normal and abnormal situations?
  c. integrate the “smart” substation automation devices (e.g. Intelligent Electronic Devices and attached sensors and actuators) to increase the efficiency of the distribution grid?
  d. interoperate with the different roles e.g. operation of the smart meters, power and grid operation?

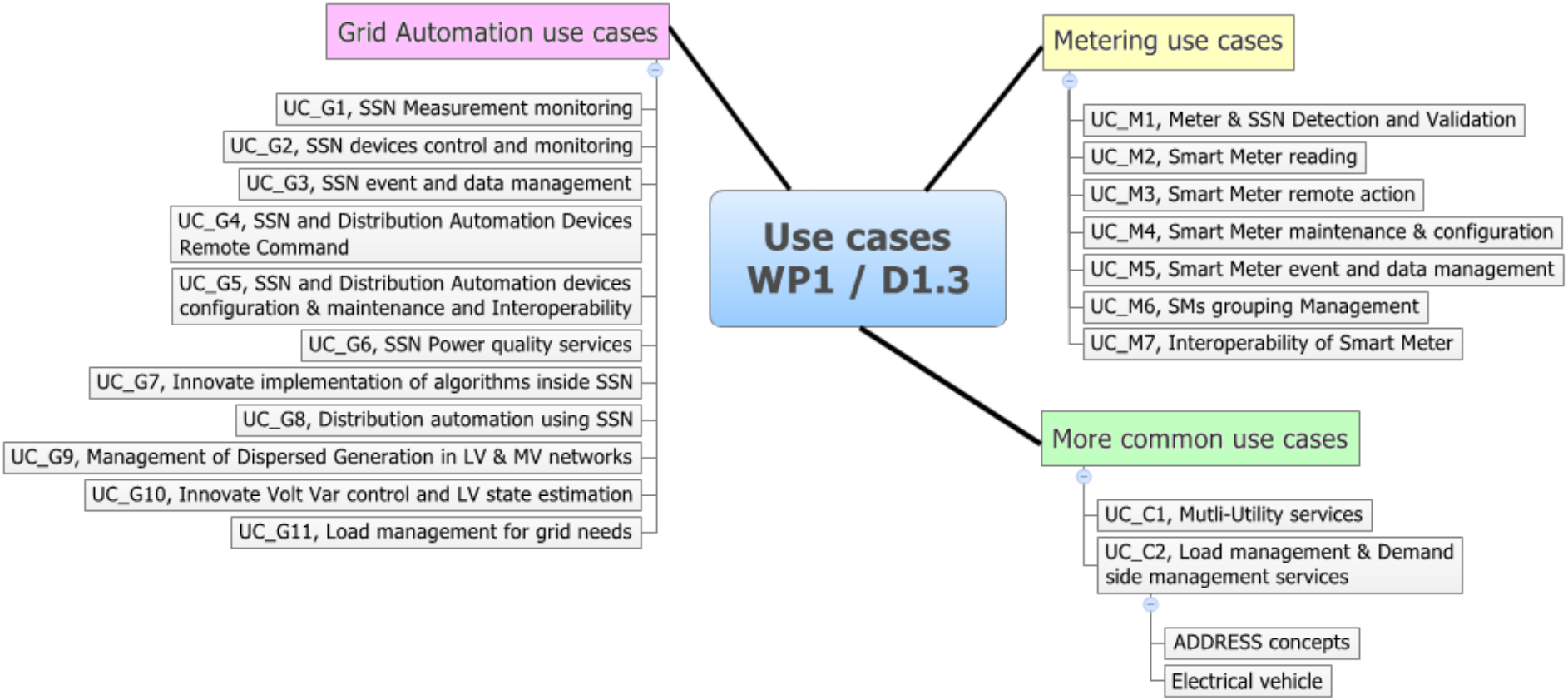
Overall System Architecture



Functional requirements and Use cases

OpenNode functionalities and Uses Cases

Complete list of of Uses Cases



Functional requirements and Use cases

OpenNode functionalities and Uses Cases

Main present Metering Functionalities and Uses Cases

Use case	Name and fucntions
UC_M1	**Meter & SSN Detection and Validation** BA01 - Meter Detection and Validation BA08 - SMs and SSNs Clock Synchronization BA10 - Alarms and Events Management BA13 - SSN Automatic Detection BA22 - Information Management
UC_M2	**Smart Meter reading** BA03: Electricity SMs reading (On demand) BA04: Electricity SMs reading (For billing) BA10: Alarms and Events Management BA14: Load Profile Management BA22: Information Management OP01: Other Remote Meter Readings OP03: Power Quality Management OP04: Prepayment Mode
UC_M3	**Smart Meter remote action** BA06 - SMs remote Disconnection and Reconnection BA10 - Alarms and Events Management BA11 - Illegal Manipulation Detection
UC_M4	**Smart Meter maintenance & configuration** BA02 - Remote Tariff Programming BA08 - SMs and SSNs Clock Synchronisation BA09 - SMs and SSNs Remote Firmware Update BA10 - Alarms and Events Management BA12 - Information Interruptions BA20 - Maintenance Management BA22 - Information Management AD03 - Meter Availability Control
UC_M5	**Smart Meter event and data management (storage & additional services offer by Middleware)** BA03 - Electricity SMs reading (On demand) BA04 - Electricity SMs Reading (For billing) BA09 - SMs and SSNs Remote Firmware Update BA14 - Load Profile Management BA22 - Information Management OP01 - Other Remote Meter Readings OP03 - Power Quality Management
UC_M6	**SMs grouping Management (including Public Lighting Management)** OP06 - Unplanned Load shedding OP08 - SM Grouping Management
UC_M7	**Interoperability of Smart Meter** All requirements coming from UCM1 to UC_M6, must be proved

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You may consider to add a complete list with all the funtional requirements.
Raúl Soriano, 10/3/2011

Functional requirements and Use cases

OpenNode functionalities and Uses Cases

Main present Grid Functionalities and Uses Cases

Use case	Name and fucntions
UC_G1	**SSN Measurement monitoring** BA10 - Alarms and Events Management BA15 - Quality Measurements and Metering Acquisitions BA18 - SS Monitoring Management BA22 - Information Management OP05 - Quality Measurements and Metering Acquisitions (internally by the SSN)
UC_G2	**SSN devices control and monitoring** BA10 - Alarms and Events Management BA18 - SS Monitoring Management BA19 - Fault Detection Management (through external BA22 - Information Management OP07 - SS Transformer Tap changer
UC_G3	**SSN event and data management (storage & additional services offer by Middleware)** BA05 - SS Energy Related Measurement Readings BA09 - SMs and SSNs Remote Firmware Update BA10 - Alarms and Events Management BA12 - Information Interruptions BA13 - SSN Automatic Detection BA15 - Quality Measurements and Metering Acquisitions BA17 - Remote Switching of MV Lines BA18 - SS Monitoring Management BA19 - Fault Detection Management BA20 - Maintenance Management BA21 - Power supply backup BA22 - Information Management OP05 - Quality Measurements and Metering Acquisitions OP07 - SS Transformer Tap changer OP10 - Automatic Power Restorations OP13 - Advanced Controller Devices OP18 - Fault Locator Management AD01 - Fraud Detection (Energy Balance) AD02 - Automatic Adaption to Grid Changes AD03 - Meter Availability Control AD05 - Islanding Operation AD06 - Var Control
UC_G4	**SSN and Distribution Automation Devices Remote Command** BA17 - Remote Switching of MV Lines OP13 - Advanced Controller Devices
UC_G5	**SSN and Distribution Automation devices (remote) configuration & maintenance and Interoperability** BA09 - SMs and SSNs Remote Firmware Update BA10 - Alarms and Events Management BA20 - Maintenance Management OP08 - SM Grouping Management OP12 - IEC 61850 Capabilities

Slide 7

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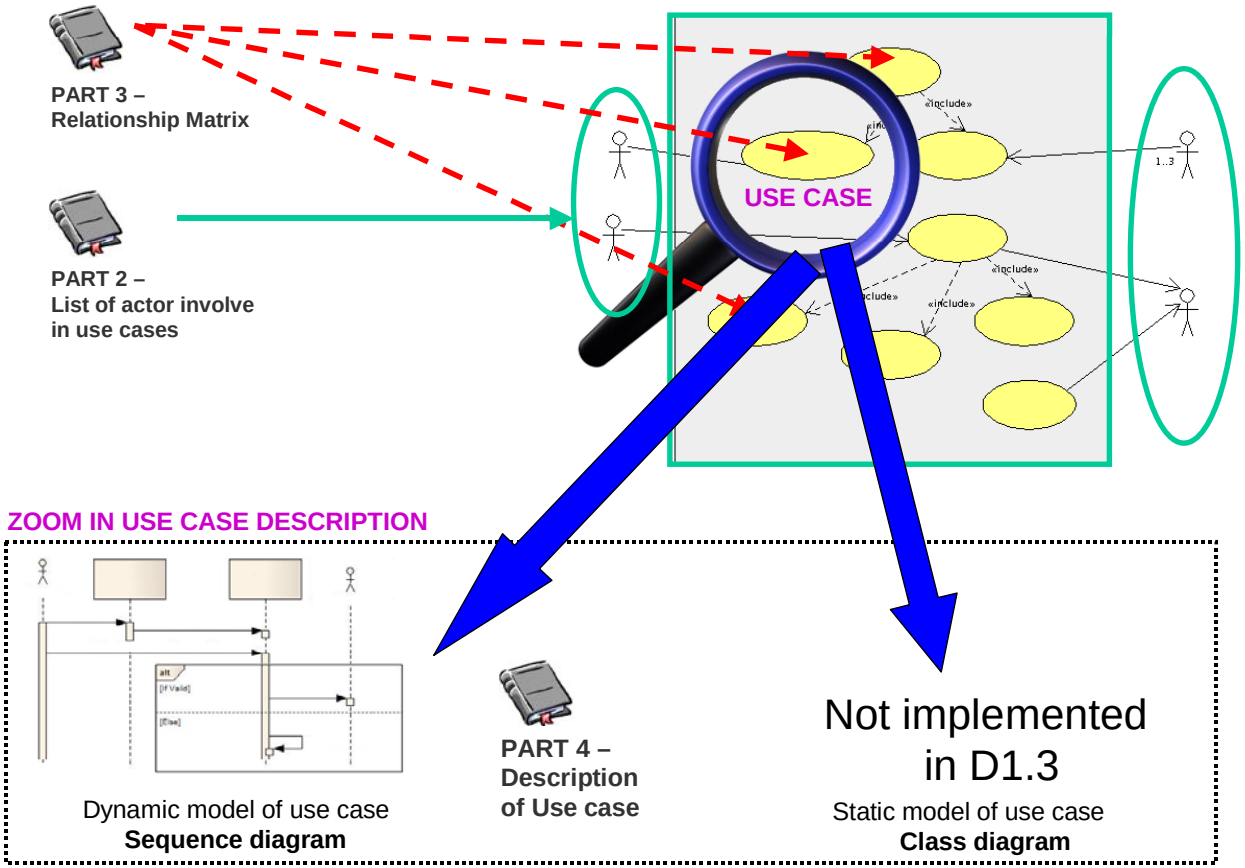
You may consider to add a complete list with all the funtional requirements.
Raúl Soriano, 10/3/2011

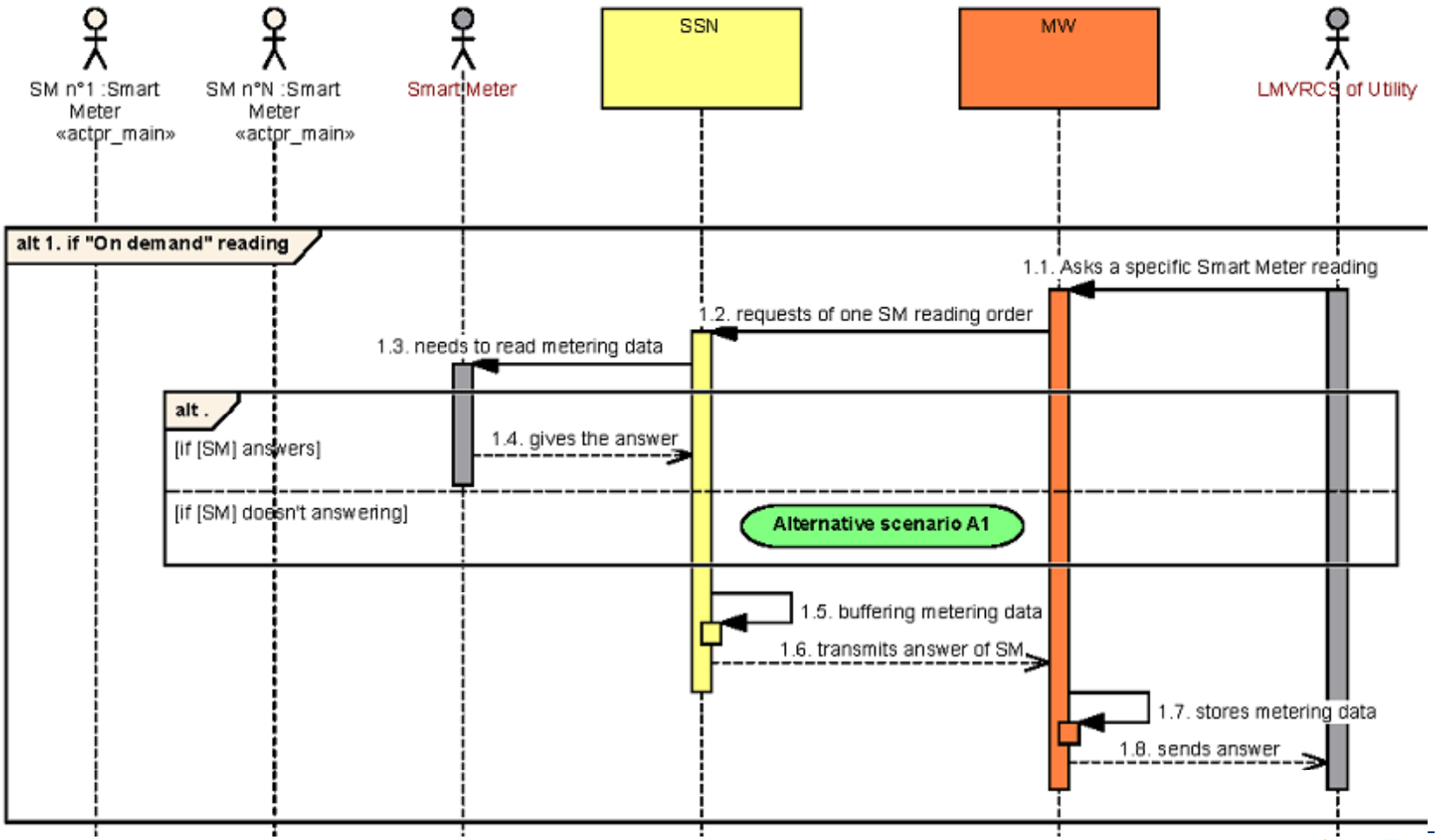
Functional requirements and Use cases

Uses Cases

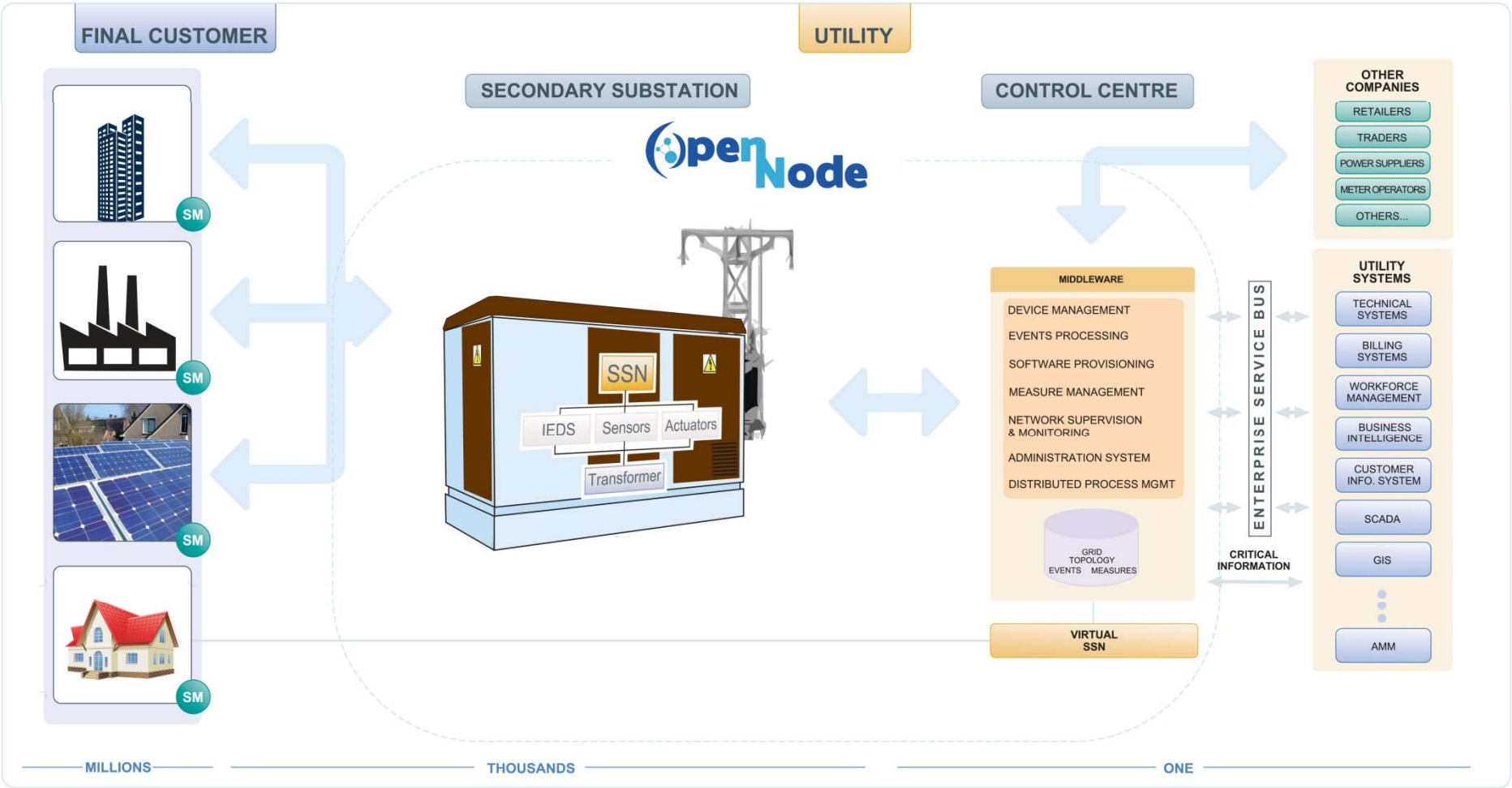


Functional requirements and Use cases

Uses Cases

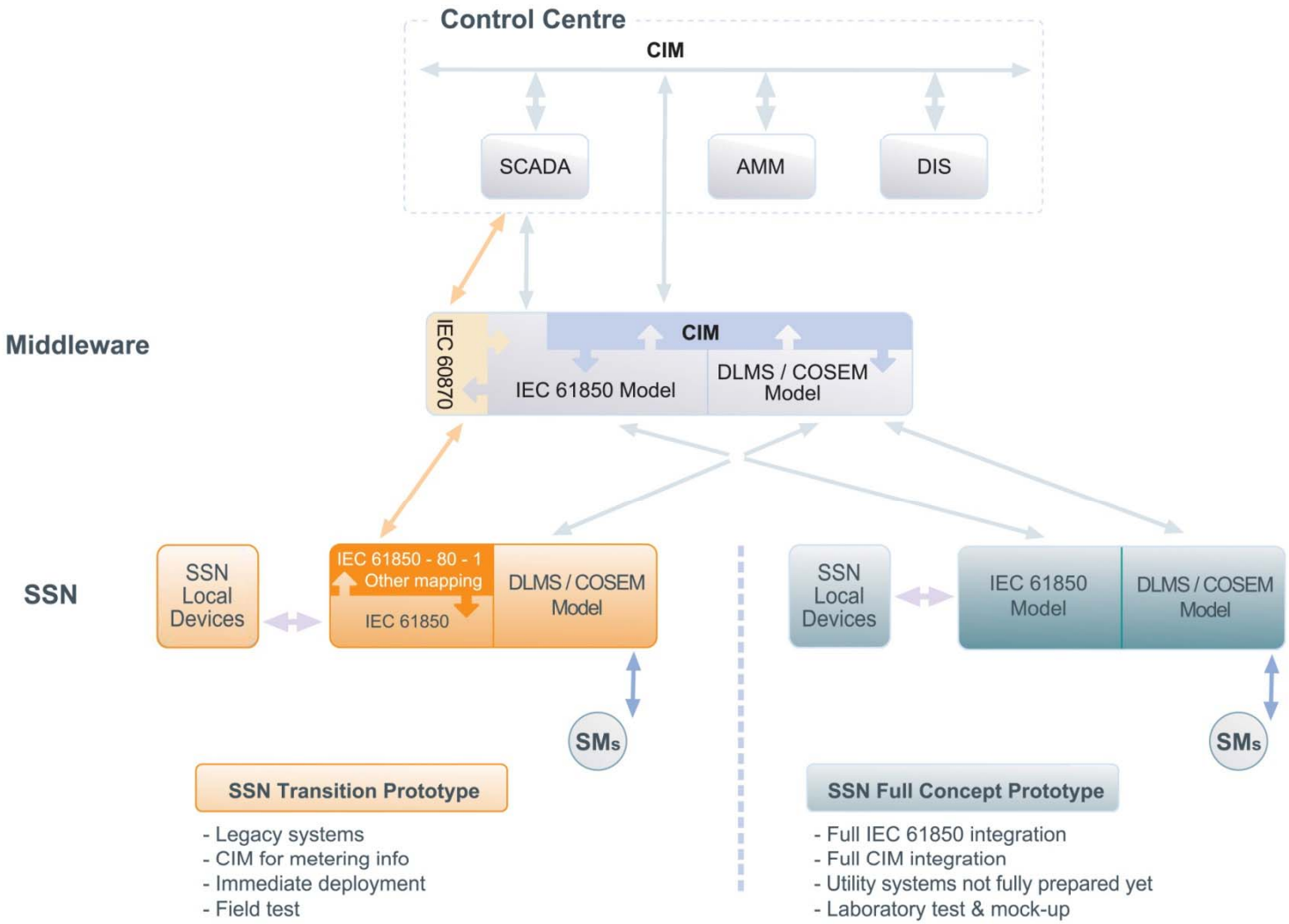


Overall System Architecture



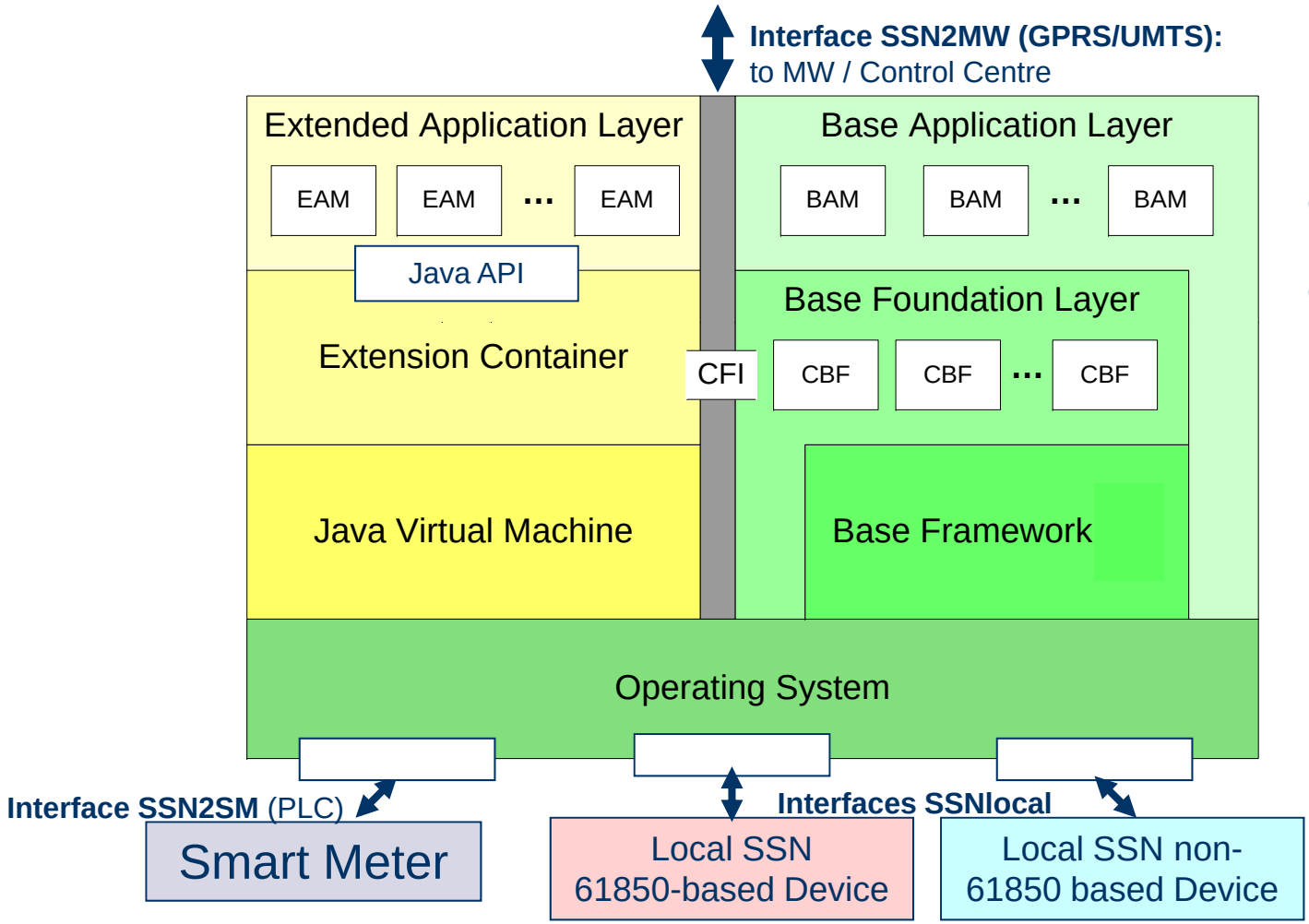
Smart node Technology Development

The Communication in the future Smart Grid



Smart node Technology Development

SSN Architecture



BAM: Base Application Module

EAM: Extended Application Module

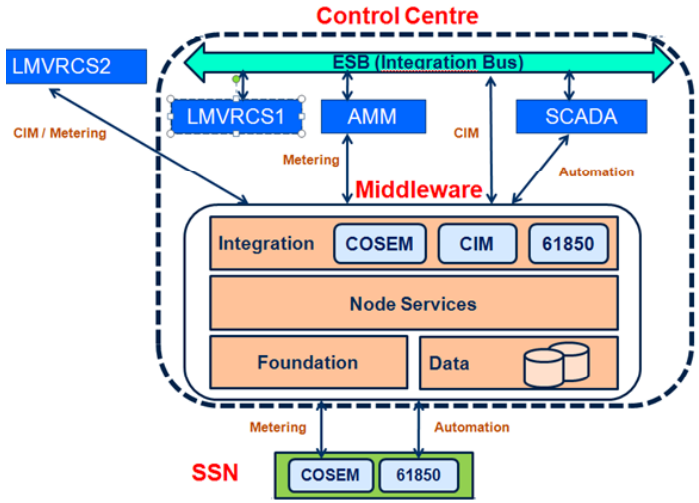
CFI: Container – foundation interface

CBF: Common Basic Function

Smart node Technology Development

The MW in the future Smart Grid

- The Middleware is a *central software* that runs in the Control Centre of the Utility operating the distribution power grid
- Is the *gate* of the SSNs to the Utility systems: *transferring* and *integrating* data in both ways
- Manages the *technical data and the storage* of events and readings of the assets from: SSN, SM and other devices
- The MW is in a *central position* to aggregate all essential grid information, to
  - *supervise the LV/MV* grid status based on the received data and events
  - perform some *autonomous actions*



Current Status

- OpenNode's *general requirements and use cases* are completed.
- Middleware, SSN and VSSN are in an advanced stage of developed. Actually, *interoperability test* are being performed right now.
- *Communication architecture* is defined including the evaluation and selection of standards.
- *First prototypes* of the SSNs and the Middleware reference implementation are expected to be completed *by the end of 2011*
- *Two main tests sites* have been defined, a laboratory (Clamart, EDF) and a part of a grid (Madrid, IBERDROLA).
- *Test procedures* are being defined.

Conclusions

OpenNode introduces the Smart Grid concept

from the edge of the Grid (i.e. smart metering) to the distribution grid (i.e. the SSN) by

a) developing an *open and smart SSN* complemented by

b) a *novel middleware concept* fulfilling the requirements of diversifying stakeholders and

c) taking a *broad landscape of use cases* in account and providing *migration strategies*

Consortium

1. Atos Origin Sociedad Anónima Española (ATOS ORIGIN) - Spain
2. IBERDROLA DISTRIBUCION ELECTRICA, S.A. (IBD) - Spain
3. EDP Inovação SA (EDP) - Portugal
4. ELECTRICITE DE FRANCE S.A. (EDF) - France
5. SIEMENS AG (SIEMENS) - Germany
6. Nucleo de Comunicaciones y Control, SL (NUCLEO) - Spain
7. KEMA NEDERLAND BV (KEMA) - Netherlands
8. Instituto de Tecnología Eléctrica (ITE) - Spain
9. SIEMENS AG Österreich (SIA) - Austria

Thank you for your attention

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