wiseGrid

- Smart Grids & Modelling software
- Making Energy sector easier to understand

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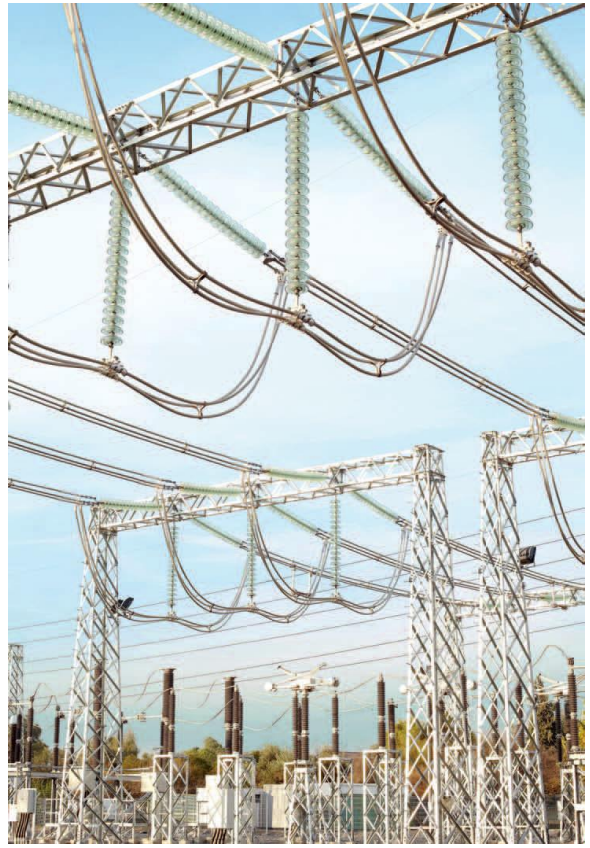
Utility Sector

Utilities is a category of companies that provide basic services to businesses and consumers

- Provision of electricity
- Transmission of electricity
- Distribution of electricity
- Natural gas delivery
- Water and sewage services
- Others

Electrical utilities are strongly regulated



HEDNO (ΔΕΔΔΗΕ) Hellenic Distribution Network Operator in brief

- HEDNO S.A. (ΔΕΔΔΗΕ) was established and launched its operation 2012. [previously: distribution department of PPC S.A (ΔΕΗ)]
- Main mission is the development and operation of the Electricity Distribution Network and the electricity systems of the non-interconnected island. Assurance of a transparent and impartial access to electricity by all consumers, producers and suppliers with transparency and objectivity
- Through the Medium and Low Voltage networks, HEDNO delivers electricity to 7.4 million customers, while the Company manages the High Voltage networks in Attiki and in the non-interconnected islands. In terms of number of consumers served, HEDNO is the fifth largest Distribution Company in EU.
- HEDNO is a modern European company with one of the lowest operating costs at European level and a very satisfactory quality of service.
- HEDNO is a DSO witch stands for Distribution System operator

HEDNOs mission

Our mission is to ensure proper operation, maintenance and development of the distribution network and management of the Non Interconnected Islands Electricity Systems.
Delivering uninterruptible electricity to 7.4 million consumers across the country
The company´s vision is to achieve the best possible combination of quality services and low cost **giving first priority to the environment**

Total Network Length: 236,000 km

Total install RES capacity: (MW): 4,000

Amount of RES installed in the Interconnected Network: 56,491

HEDNO Operating Systems

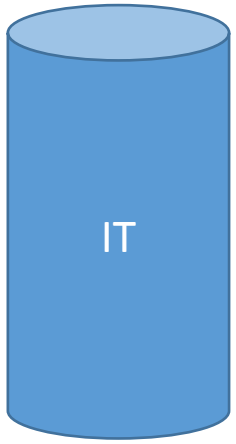
Operating systems or **Operation Technology (OT)** is mission critical for HEDNO. Operating systems monitor, protect and control hardware resources. They can identify possible failures to the distribution grid as short circuits, overloads, transmission line damages etc. They can also protect the distribution grid either automatically or through acknowledgement and appropriate decision making by the network operator

EXAMPLES

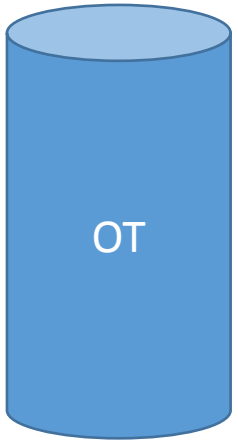
Operating Systems	Brief Description
SCADA	**Supervisory Control and Data Acquisition**. It's a real time automation software package positioned on top of hardware. SCADA systems are used to monitor and control the equipment in the industrial process witch include manufacturing, traffic lights control systems, water distribution, power generation, electricity transmission and distribution amongst others.
DMS	**Distribution management System**. Is a collection of software applications which act as a decision support system to assist the control room and field operating personnel. Works parallel with SCADA.
GIS	**Geographic Information Systems**. Store, manipulate, analyze, represent spatial or geographic data
OMS	**Outage management System**. Applications that identify the location upon failure, prioritize restoration failures, manages restoration resources (human or machinery). Calculates the number of customers impacted by the failure. This information is very crucial for the management of HEDNO
IVR	Interactive Voice Response. The system can predict and identify the locations of outage calls from customers. Works in combination mostly with OMS.

Disconnection: Separate IT and OT Silos of information

Information Technology
'Commercial oriented'



Operation Technology
'Production Oriented'



Technology Misalignment

- Due to its nature, real time controlling of sensors and equipment, Operation Technology was not designed to meet IT purposes. Ethernet and TCP/IP communications were not considered an option for OT

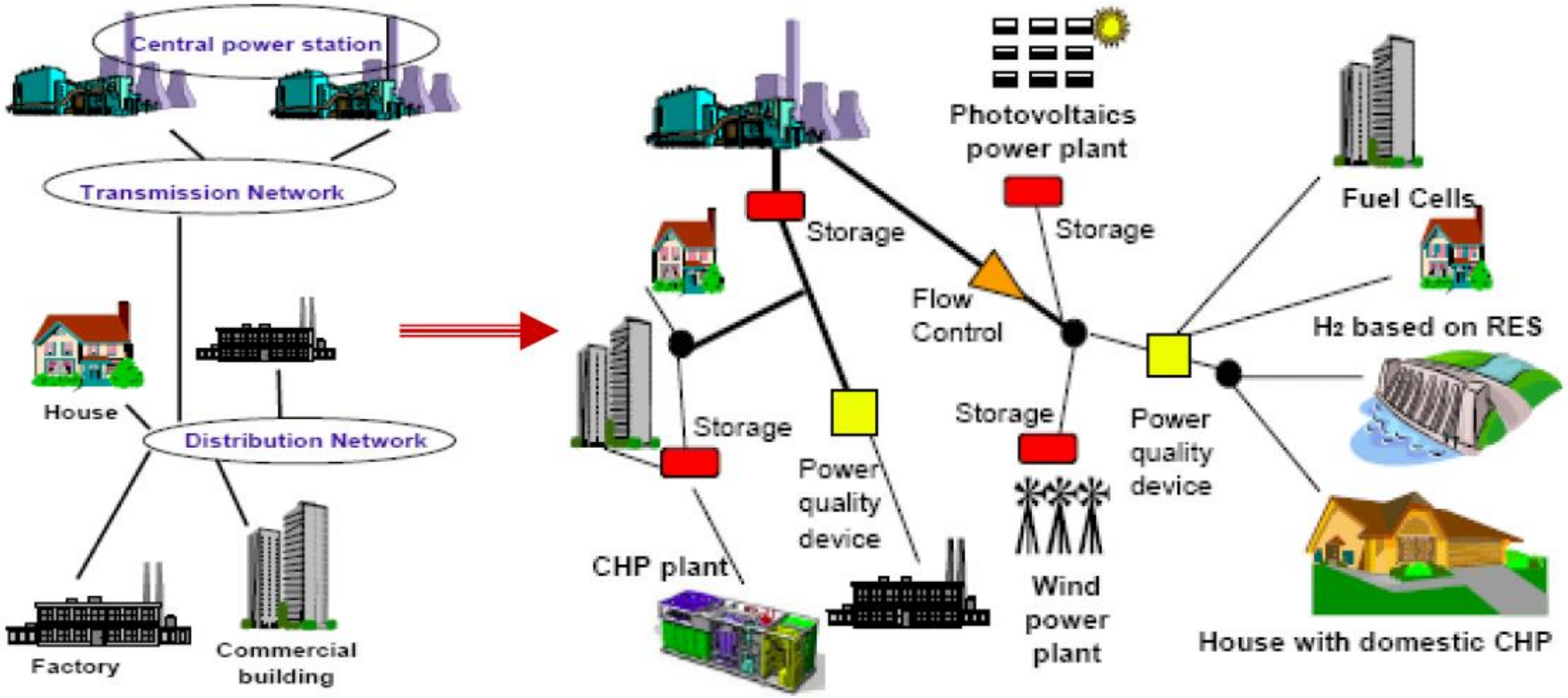
Ownership and Governance separation

- CIO (Chief Information Officer) vs COO (Chief Operation Officer). OT is normally 'owned' by production managers/field engineers and not by IT professionals. Therefore, there is often a lack of communication
- Separate system procurements

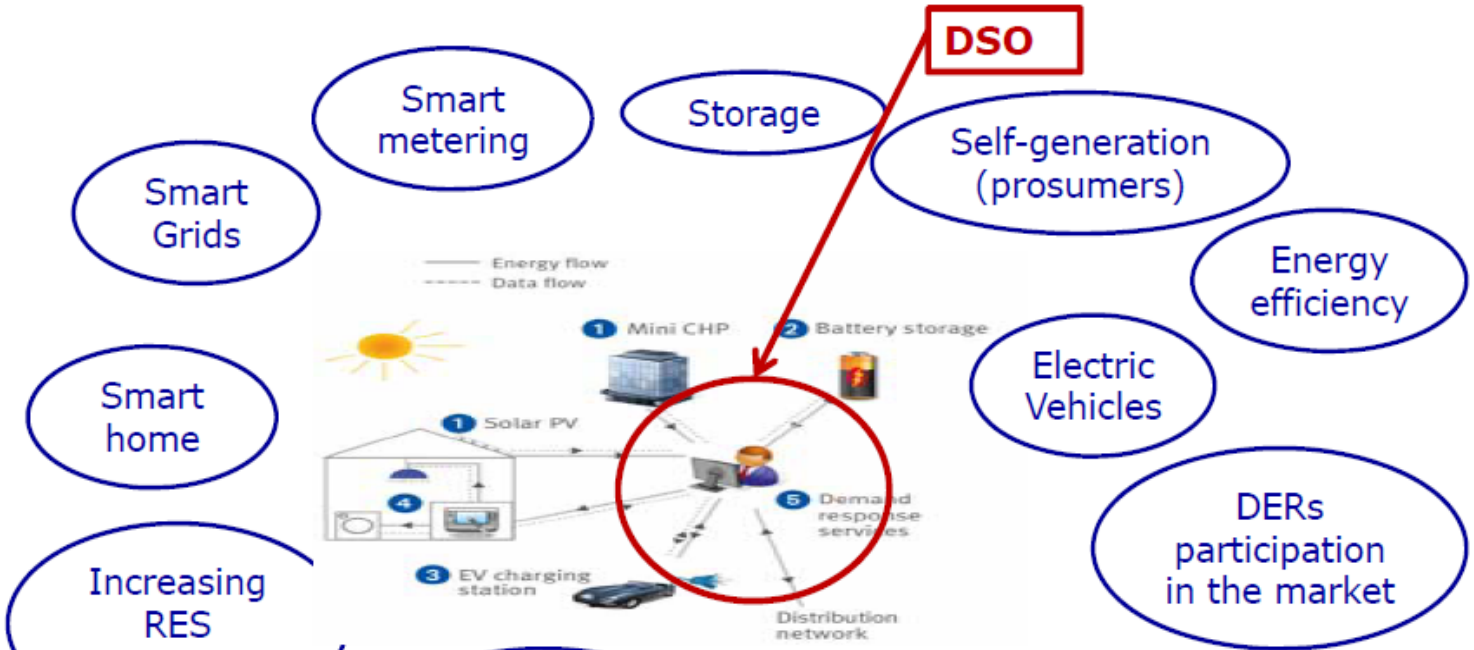
Separate IT and OT Silos problems

- Vendor lock-in. Costly contracts and maintenance support
- Data redundancy
- Discrepancies between systems referring to the same pool of information. Poor data quality
- Point to point integration efforts have been proved not affordable in terms of time and cost

New challenges:
Conventional Business → New Business towards Smart Grids



Smart Grids means many energy actors



Smart Grids & the role of DSO

DSO: Distribution System Operator

Smart adapt or die ?

WiseGRID identified 45 different energy actors … and counting

Actors = commonly accepted entities with different types (device, system/app, service, organization)

Some Examples:

Actor name	Description	Actor type
Aggregator	Accumulates flexibility from Prosumers and sells it to the Supplier, the DSO or the TSO.	Organization
DMS	*Distribution Management System*. A system that monitors, controls and analyzes in real-time or near real-time the electricity distribution system.	System
SCADA	Supervisory Control And Data Acquisition.	Device
Battery Operator	An entity responsible for operating a set of Storage Units connected to the electricity grid.	Organization
Building Management System	An automated system that monitors and controls the equipment of a building (ventilation, lighting, electricity infrastructure, etc.)	System
CHP	*Combined Heat and Power*. A system that simultaneously generates electricity and useful thermal energy in one process from a single source of energy.	Device
Consumer	An entity connected to the grid, that consumes energy, i.e. a Prosumer without any production capabilities.	Person
Data Provider	Independent entity responsible for undertaking and coordinating the information exchange and translation of the data of various sources into a common data model.	Organization
Distributed Energy Resource	Any type of generation units, storage units and load flexibility resources connected to the distribution network.	System
DMS	*Distribution Management System*. A system that monitors, controls and analyzes in real-time or near real-time the electricity distribution system.	System
DSO	*Distribution System Operator*. The entity responsible for: the distribution network planning and development; the safe and secure operation and management of the distribution system; for data management associated with the use of the distribution system; for procurement of flexibility services.	Organization
Electronic Meter	A physical device containing one or more registers.	Device
Energy Management System	A system that monitors, controls and optimizes the operation of the energy system under supervision.	System
ERP	*Enterprise Resource Planning*. A system that offers integrated management and automation of business processes. It is also used to refer to the Customer Relationship Management (CRM) system.	System

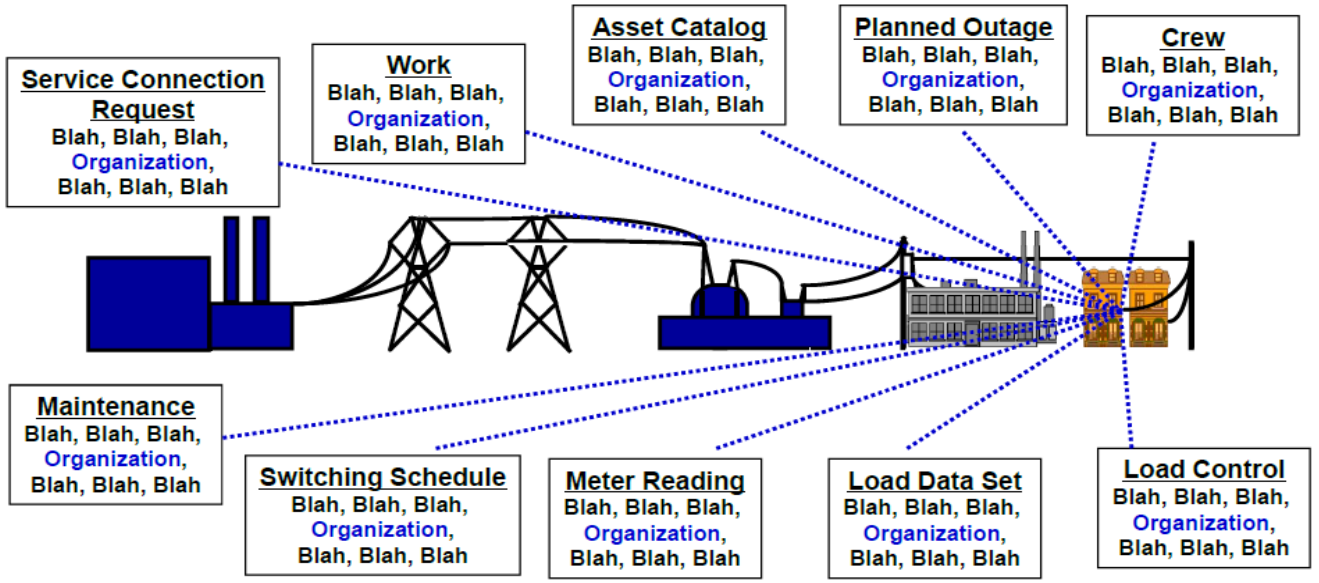
IT and OT convergence benefits. Urge for solution

- Cost reduction by applying same technology, standards and governance principles
- Risk reduction by jointly addressing security issues against outside intruders. Central security governance throughout the company
- Enhance performance. With the integration of IT and OT, time and costs will be saved by allowing the smooth adoption of newly-developed products into existing operations
- Operational visibility. IT/OT convergence can provide better operation transparency to top management reducing the time between events and decision making. IT technologies such as Big data, Analytics, Business Process management systems can contribute towards operational visibility

Common Information Model – Why?

The Energy Sector is very complex. Contains a large amount of equipment and services with different attributes and behavior.

The advent of both energy liberalization and Smart Grids with so many actors and additional services has aggravated the complexity



Need for common understanding both inside and outside the company. Harmonious information among systems.

Common Information Model – From point to point to semantic integration

…continued…

"CIM isn't the easiest way to do anything but it's the easiest way to do everything" (Britton, 2010)

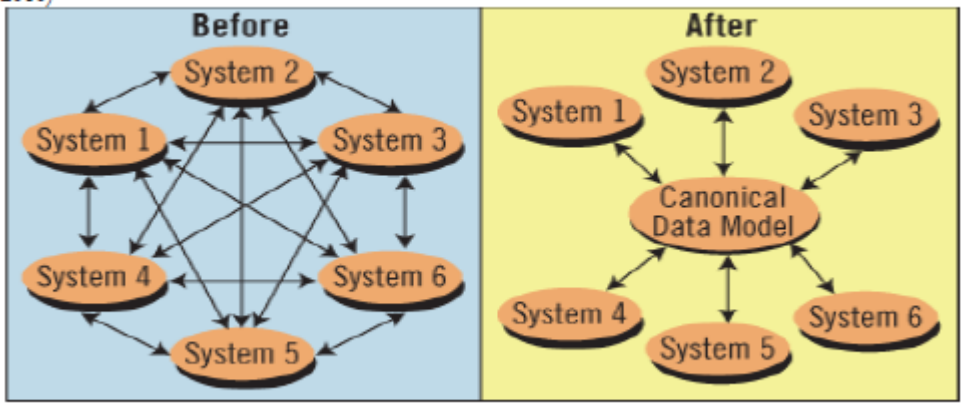
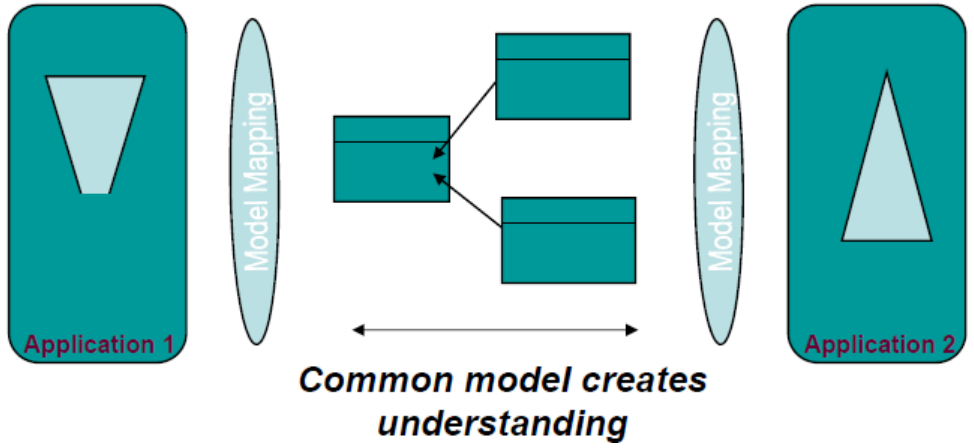


Figure 2, benefits of a Canonical Data Model (Britton, 2010)



The Common Language provides relevant information to a user regardless of the source, thus avoiding vendor lock-in and allowing small sized software integrators to provide solutions

Common Information Model – From point to point to semantic integration

Same as previous slide with real systems operated by a DSO

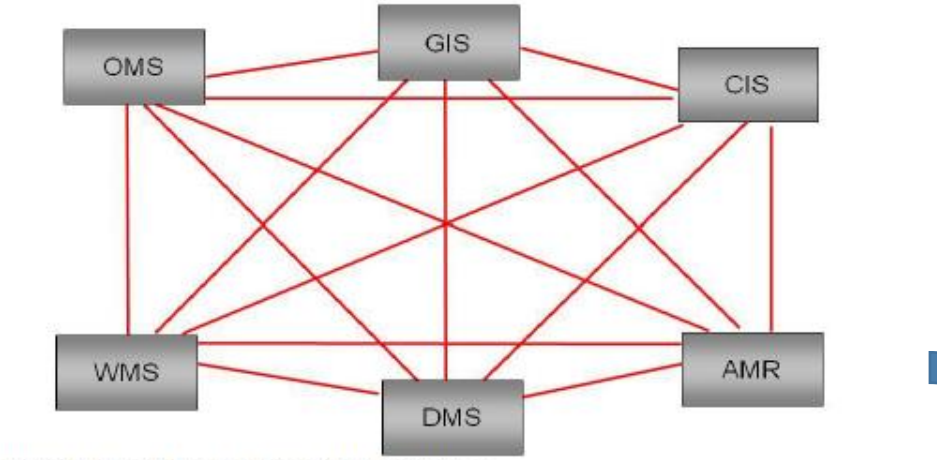


Figure 10, theoretical scenario before CIM implementation

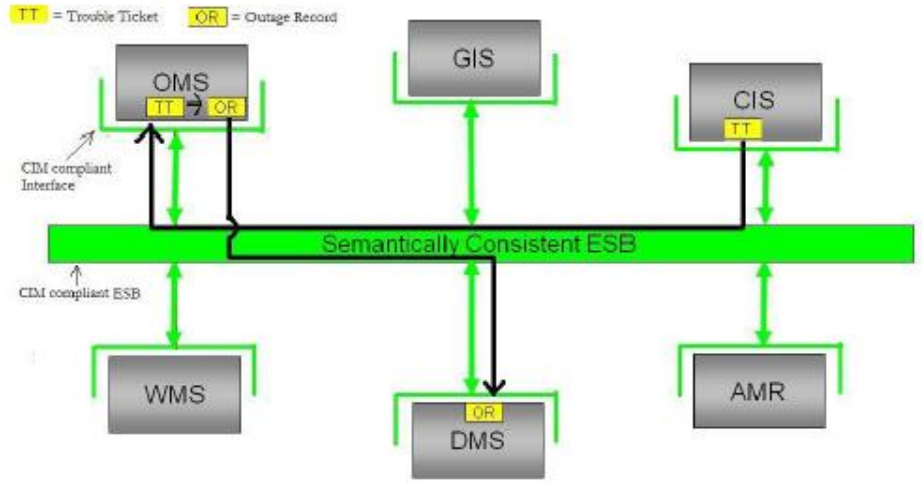


Figure 11, theoretical scenario after CIM implementation

Finding a solution to a Tower of Babel problem

HEDNO 13th Strategic Integration Project using CIM

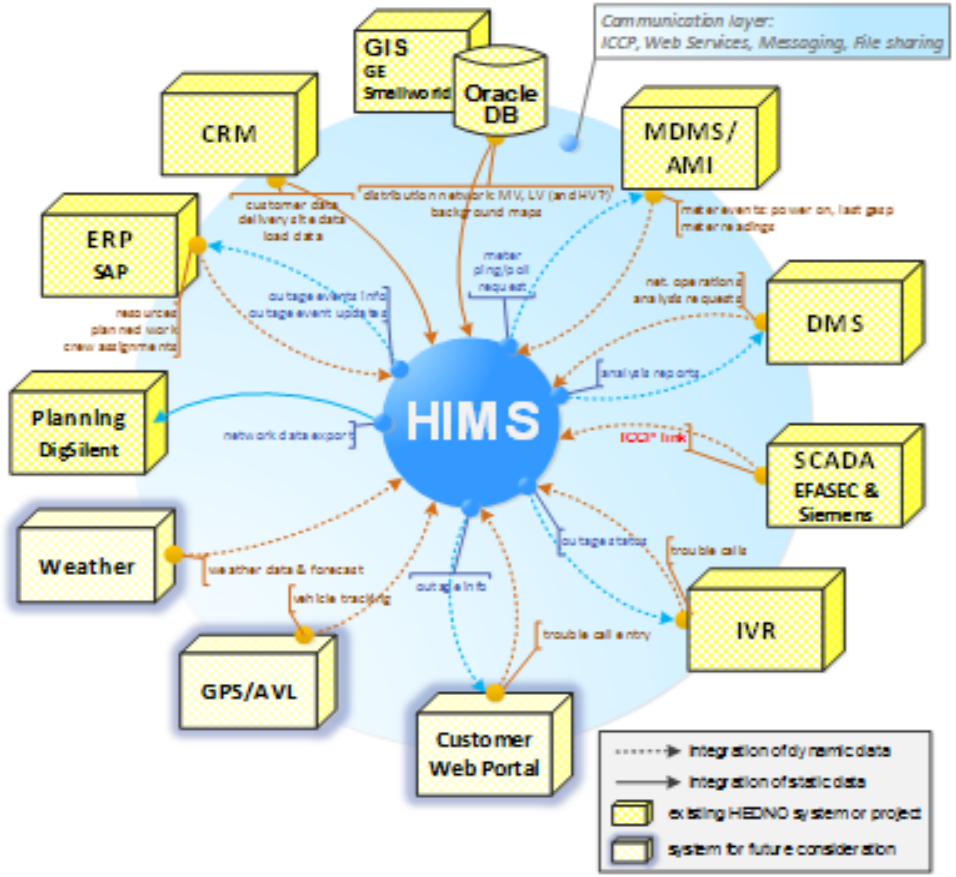


Figure 5-2 – Data flow between HIMS and other systems (including existing and future)

WiseGRID Technological Solutions

Pilot Sites


Electric cooperative Crevillent, Spain


RES cooperative Flanders, Belgium


Public DSO Terni, Italy


HEDNO National DSO Greece

CIM & HEDNO development involvement in WiseGRID – Data exchange

- The CIM set of standards is based on UML information model representing real-world objects and information entities exchanged within the value chain of the electric power industry. CIM is a kind of mandatory standard when we think about application integration-data exchange and new applications being implemented in the company. It is also mandatory within WiseGRID context.
  - Semantic/conceptual model maintained by IEC in Sparx Enterprise Architect modeling tools. Conceptual model is a vocabulary of basic terms, a precise specification of what those terms mean and how they relate to each other. Inheritance between parent and child is the main idea.

- Data Exchange using message broker
  According to Gartner most common reason for a DSO to implement CIM is to define message payloads for system integration project. This is what we are going to implement in WiseGRID to tackle data exchange between heterogeneous systems.

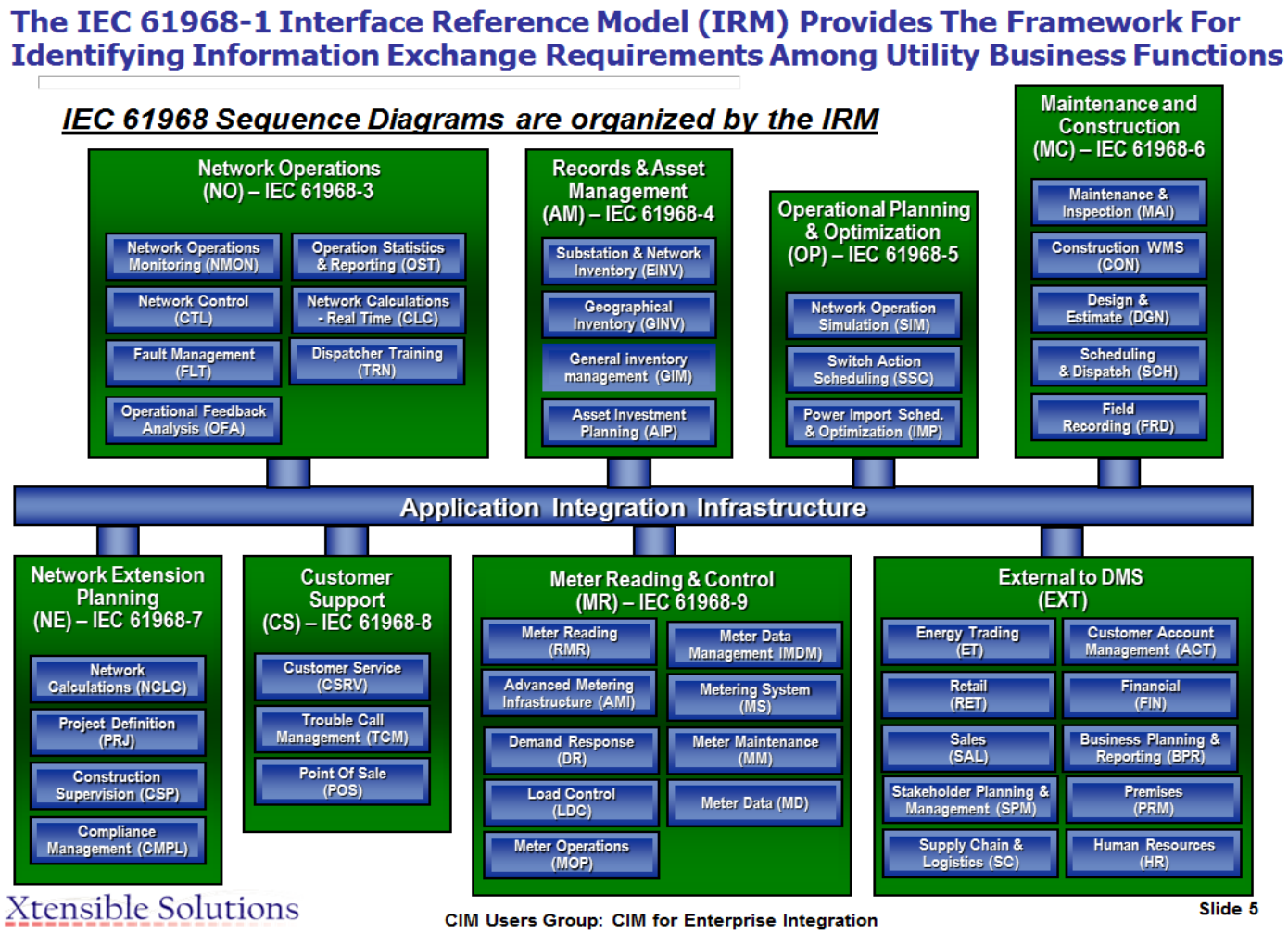
- CIM Payloads examples:
  - **MeterReadings**
  - **EndDeviceEvents**
  - **Meter Reading Request**
  - **Measurements** (current, voltage)

CIM: emphasize IEC 61968

CIM : The glue that holds everything together
Joint effort of large number of participants,
subject matter experts and organizations

IEC 61970
IEC 61968 (distribution),
IEC 62325
IEC 61850 etc

New extensions/updates every two years

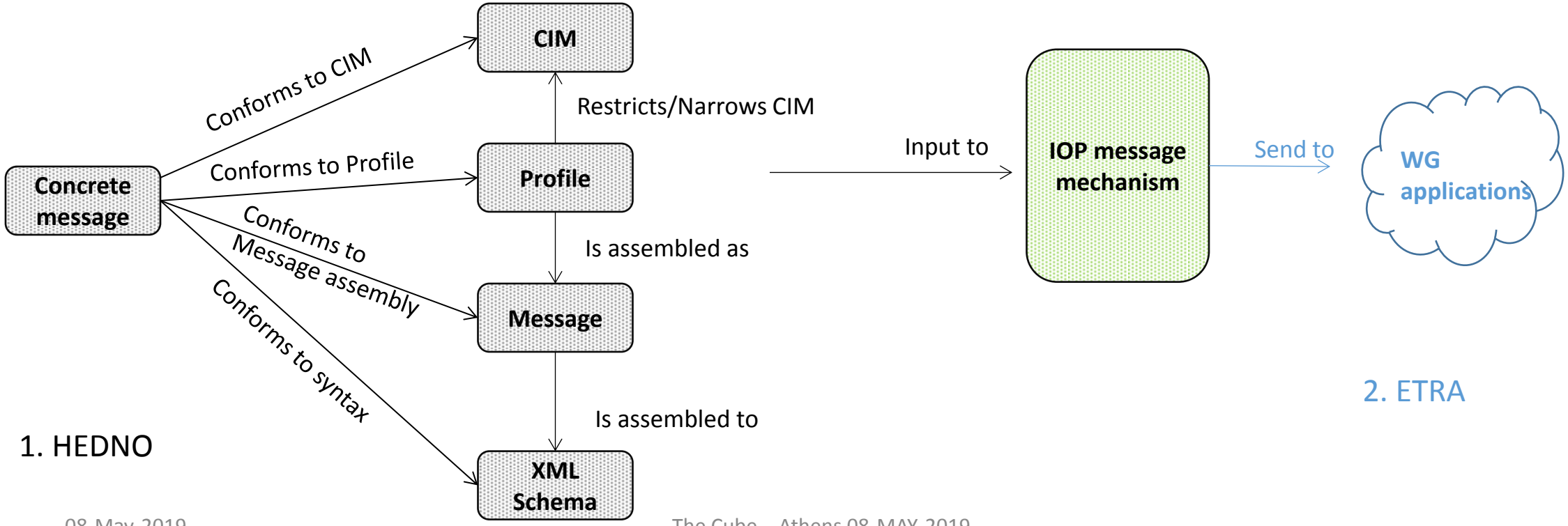


CIM & HEDNO development involvement in WiseGRID – Data exchange

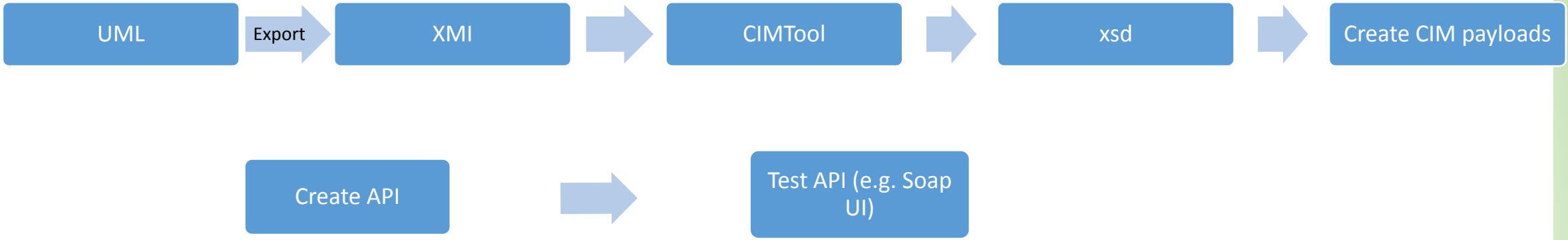
Basic work to be done for HEDNO:

In the end the key goal is to **get interoperable messages between systems**. This can be accomplished in two separate stages:

- Create a concrete CIM message as an XML file
- Create API or in other words a CIM adapter to transform source files to CIM Payloads



Implementation Roadmap: Simplified



Development skills: XML, RDF, some programming language like Java, Python …Mongo DB.. ERP…

Most important is a **willing mind** indispensable to learn and understand new business terminology and processes

Innovation Lab powered by HEDNO (ΔΕΔΔΗΕ) https://switchonlab.gr/

Questions ?

Thank you!

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