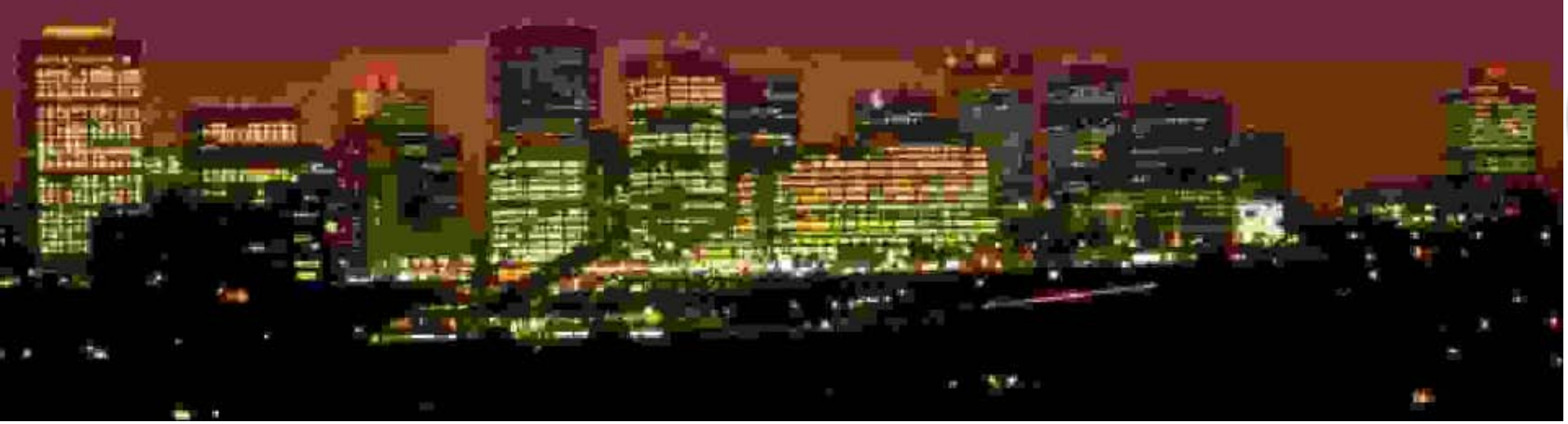

Smart Grid

Smart Grid Strategic Group (SG3)

(Egyptian Group)

Eng. Mohamed El-Safty

International Electrotechnical Commission

Standardization roadmap

Smart Grid Strategic Group (SG3)

June 2010

International Electrotechnical Commission

Agenda

- What is Smart Grid?
- What is available today?
- What projects are municipal utilities considering?
- What is required for Smart Grid development?
- Open for q/a.

OVERVIEW ABOUT STANDARDIZATION ROADMAP IN EGYPT

Smart Grid in Power Sector

- Transmission
  - •Asset Management
  - •HVDC and UHVAC etc.
- Distribution
  - •Advance Metering Infrastructures
  - •Asset Management etc.
- System Operations
  - •Self Healing Grids
  - •WAMS
  - •Adaptive Islanding etc.

Smart Grid Definitions

- "Smart Grid" is today used as marketing term, rather than a technical definition. For this reason there is no well defined and commonly accepted scope of what "smart" is and what it is not.
- However smart technologies improve the observability and/or the controllability of the power system.
- Thereby Smart Grid technologies help to convert the power grid from a static infrastructure to be operated as designed, to a flexible, "living" infrastructure operated proactively.
- SG3 defines Smart Grids as the concept of modernizing the electric grid.
- The Smart Grid is integrating the electrical and information technologies in between any point of generation and any point of consumption.

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Identifying standardization Needs in the national prospect & Providing the guideline for Strategic Standardization Activities

- "Smart Grid" is one of the major trends and markets which involves the whole energy conversion chain from generation to consumer.

- The power flow will change from a unidirectional power flow (from centralized generation via the transmission grids and distribution grids to the customers) to a bidirectional power flow.

- Furthermore, the way a power system is operated changes from the hierarchical top-down approach to a distributed control.

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- One of the main points about Smart Grid is an increased level of observability and controllability of a complex power system. This can only be achieved by an increased level of information sharing between the individual components and sub-systems of the power system.

- Standardization plays a key role in providing the ability of information sharing which will be required to enable the development of new applications for a future power system.

Smart Grid deployment must include not only technology, market and commercial considerations, environmental impact, regulatory framework, standardization usage, ICT (Information & Communication Technology) and migration strategy but also societal requirements and governmental edicts.

- The IEC should acknowledge the work already done by National Institute of Standards and Technology (USA)- NIST and the participants of the NIST roadmap effort.

- The IEC should actively offer support in the identified prioritized action fields where the IEC is involved and offer consultation in some areas, whereas NIST focuses on local or regional standards Advanced Metering Infrastructure, Distributed Energy Resources (e.g. AMI, DER) (see Figure 1).

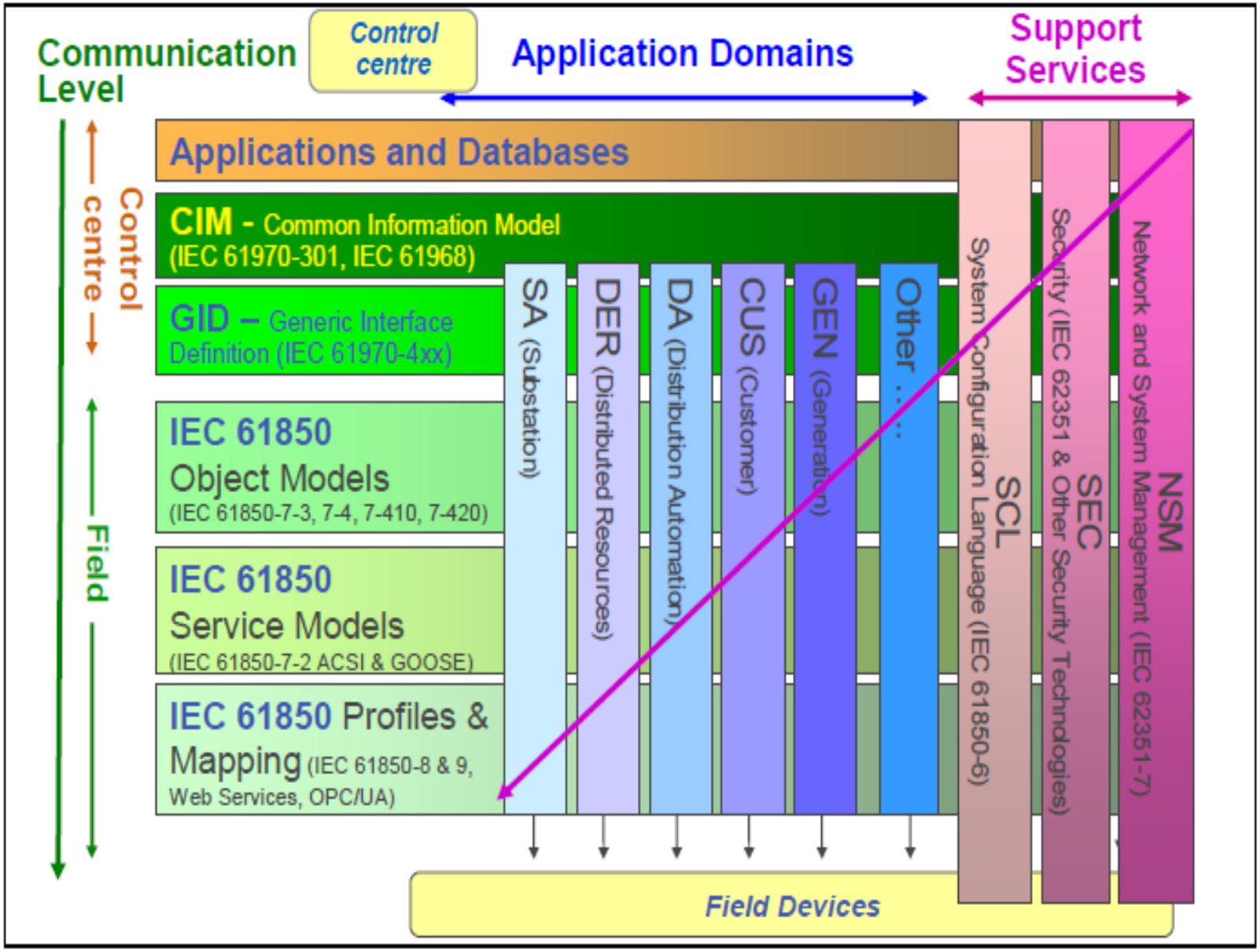
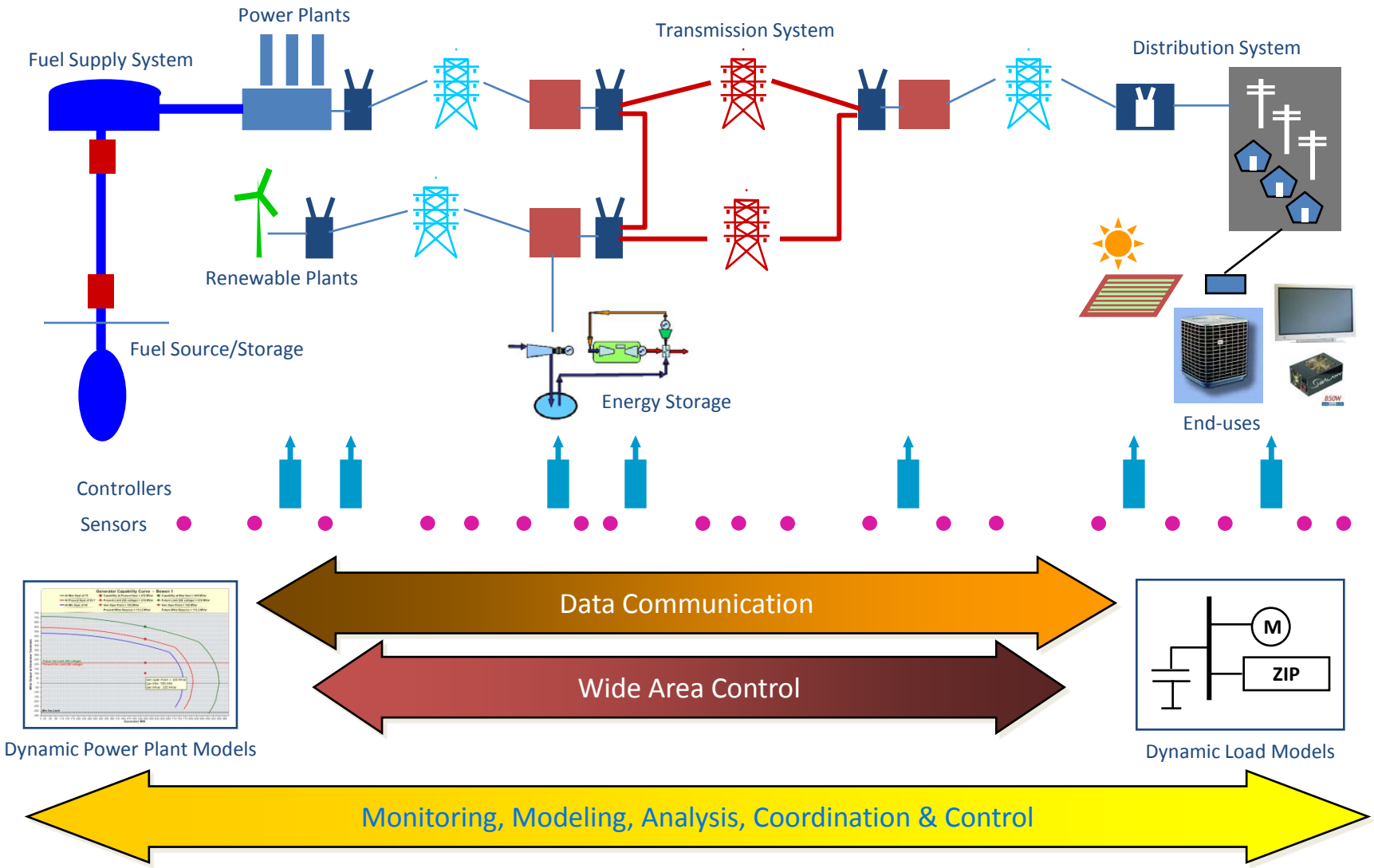


Figure 1 – IEC 61850 models and the Common Information Model (CIM)

Applications on:-

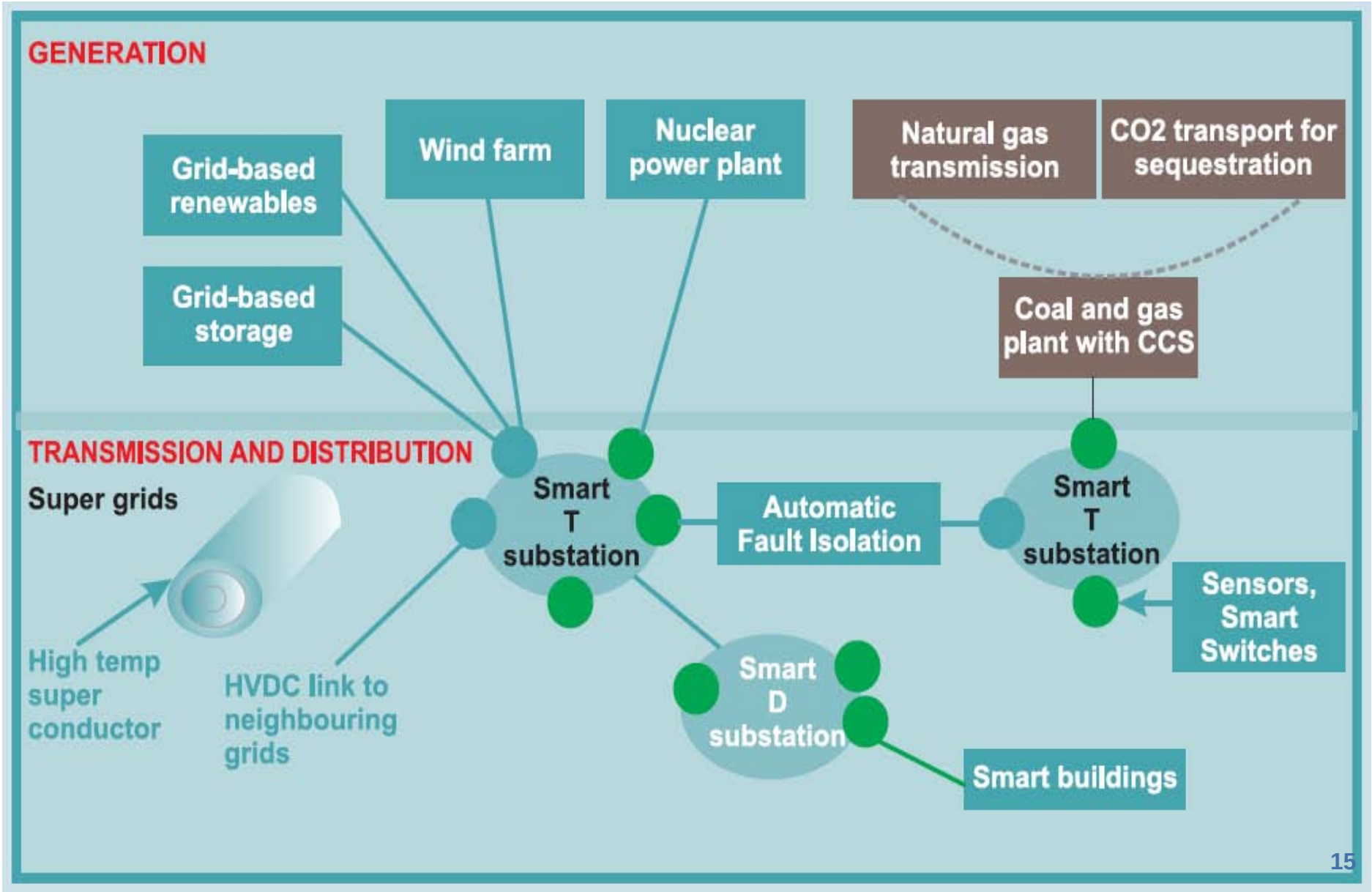
1. Generation
2. Distribution
3. Transmission


Power Plants
Fuel Supply System
Transmission System
Distribution System
Renewable Plants
Fuel Source/Storage
Energy Storage
End-uses
Controllers
Sensors
Data Communication
Wide Area Control
M
ZIP
Dynamic Power Plant Models
Dynamic Load Models
Monitoring, Modeling, Analysis, Coordination & Control

Applications on Generation systems

SMART GRID IN GENERATION

Overview of Smart Grid



The future vision embraces some new concepts in a four layer architecture not currently incorporated into the CIM and related standards architecture:

1.Information Layer – This layer includes the CIM but provides for the reality that there are other sources of information as well as the CIM that need to be taken into consideration when creating CIM-based information exchanges or repositories.

2. Contextual Layer – This layer formally recognizes that only a subset of the models in the Information Layer is needed for any particular interface or message definition. The Profile standards defined in this layer:

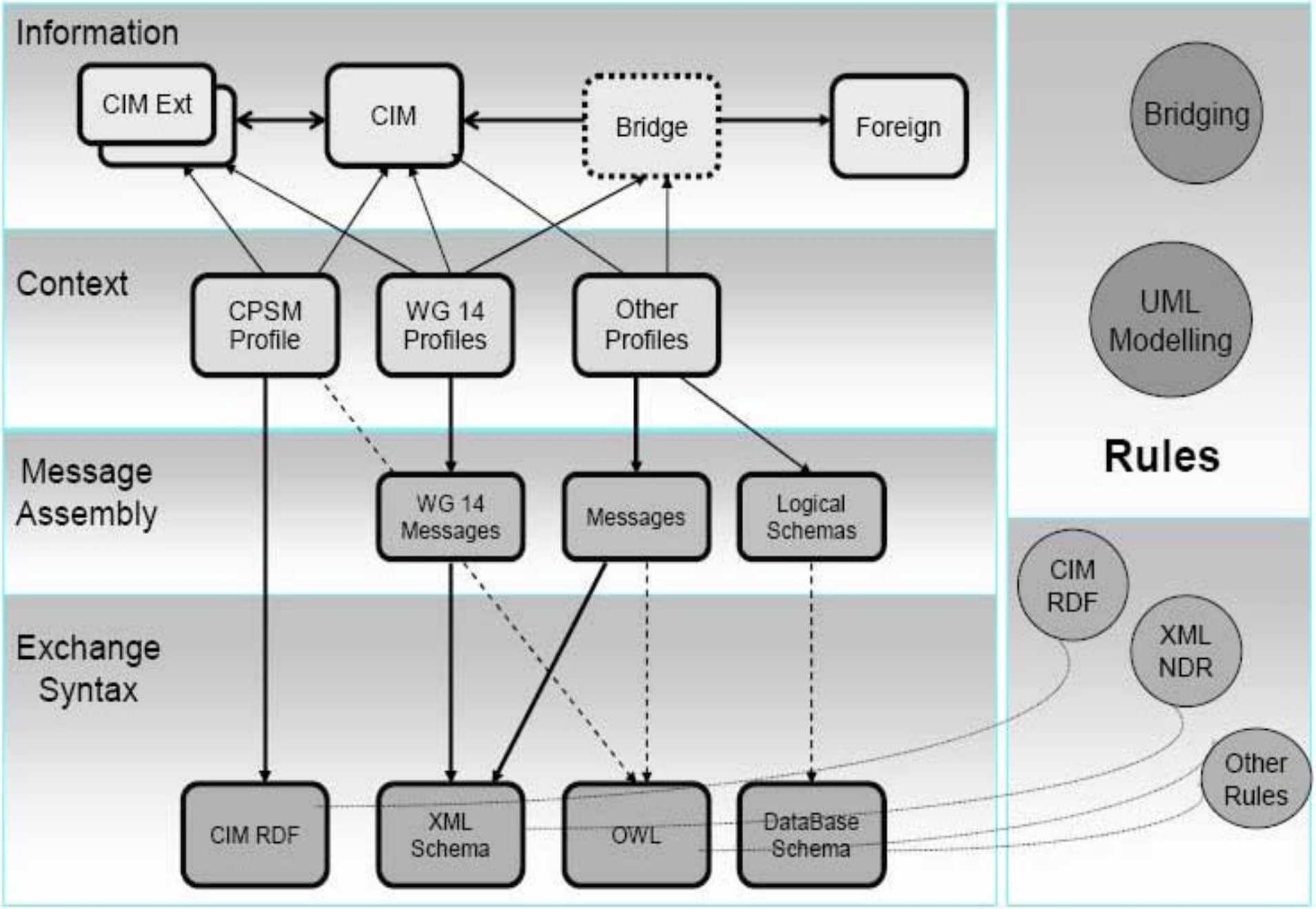
•define a subset of the models in the Information layer needed for a particular business purpose as well as constraining those model elements to address specific business needs, and

• provide a way to incorporate model elements from the different information sources in the Information layer in addition to the CIM.

3. Message Assembly Layer – This layer defines the structure of a Message that carries the Profile Information and what kind of operation should be performed with message payload.

4. Implementation Layer – or Message Syntax layer – provides for specific implementations of the Profiles defined in the Contextual layer.

As shown in Figure 9,



Next-generation CIM

Applications on Distribution systems

SMART GRID IN DISTRIBUTION

- **Smart Metering –**
  - **Automatic, Time of Use, Consumer Communication & Load Control**

- **Communications : Automated Metering Infrastructure (AMI) – LAN, WAN, HAN**

- **DRMS (Demand Response Management)**

- **In Home enabling technology**
  - **Demand in three category:**
    - **Immediate, Deferrable, Storable**
  - **Customer aggregation & De-aggregation required for Peak shifting**

- **Having**
  - **GIS (geo-spatial Information Systems),**
  - **AMI,**
  - **SAP (ERP),**
  - **OMS (Outage management System),**
  - **DMS (Distribution Management System),**
  - **EMS (Energy Management System),**
  - **DRMS (Demand Response management System).**

- **Model manager synchronizes GIS data with OMS, DMS & EMS.**

Smart Grid Application

- Distribution Substation SCADA
- Distributed Generation
- Geographic Information Systems (GIS_
- Outage Management Systems (OMS)
- Work Force Management
- Plug-In Electric Vehicls

Smart Grid Technologies Used for Distribution System Planning

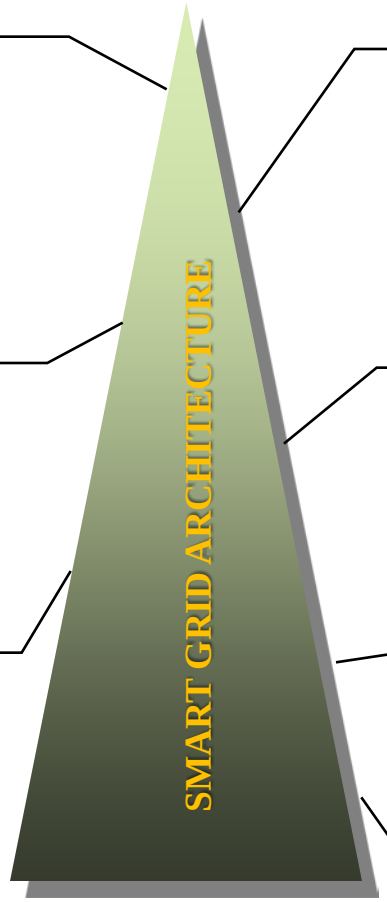
- ❑ Accurate and Real Time Load Modeling
- ❑ Accurate and Real Time Losses by Feeder
- ❑ Outage Cause Tracking
- ❑ Spatial Substation Locating
- ❑ Distributed Generation

Smart Grid Architecture

Distribution Applications
- GIS
- OMS
- MWM

Distribution Automation
- Station Automation
- Feeder Automation

Distributed Generation
- CDM Initiatives
- Net Metering
- peakSAVER DE
- Standard Offer Program



Control Centre
- DMS
- SCADA System

Metering
- Smart Meters
- Transformer Smart Meters

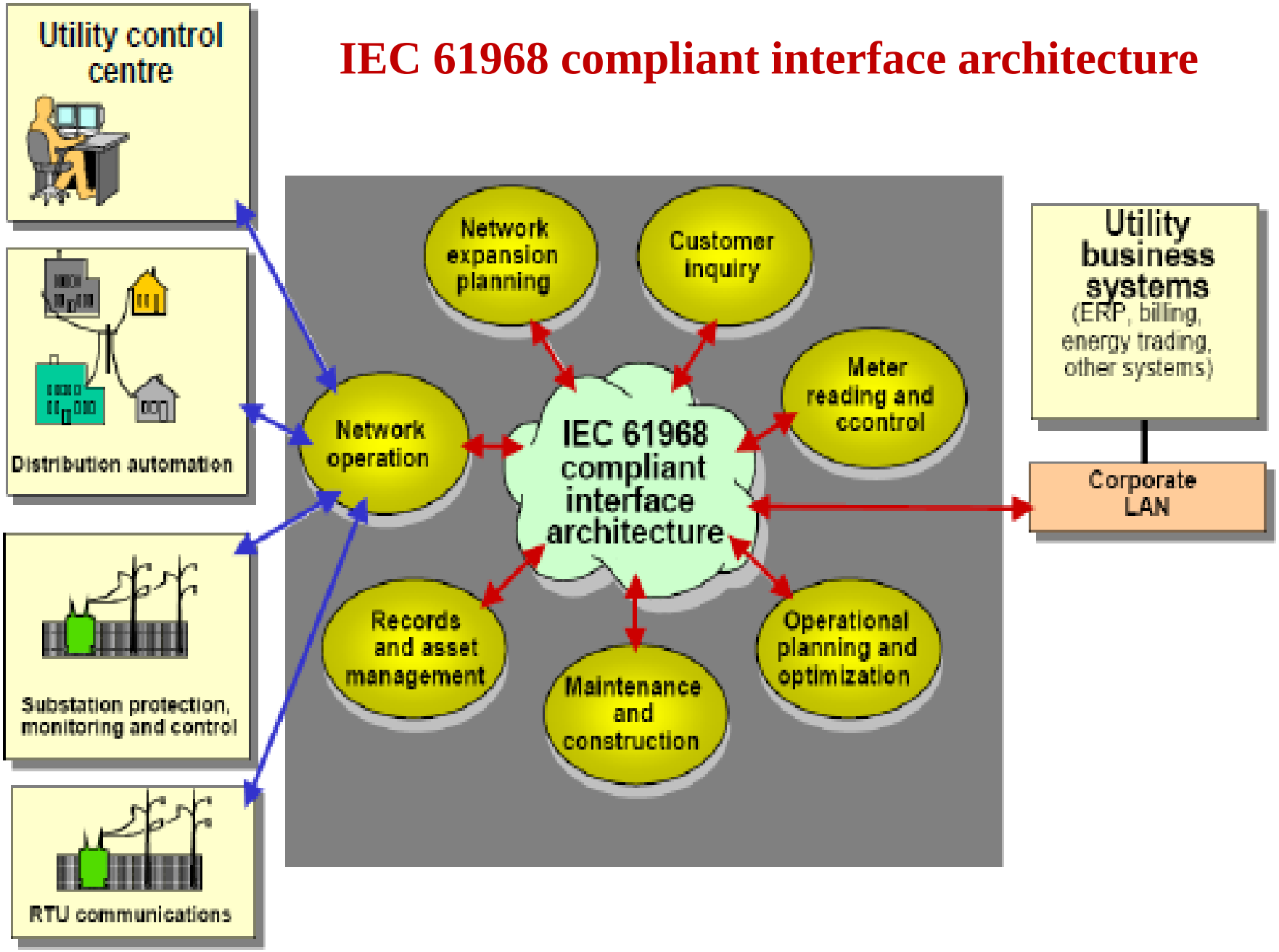
Load Control
- peakSAVER AC

Conservation

CUSTOMERS

The different parts of IEC 61968 include interfaces to grid operation, asset management, planning and optimizing grid operation, expansion and maintenance of the grid and metering , as shown in the following Figure.

IEC 61968 compliant interface architecture



Applications on Transmission systems

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SMART GRID IN TRANMISSION

Smart transmission systems, Transmission Level Applications

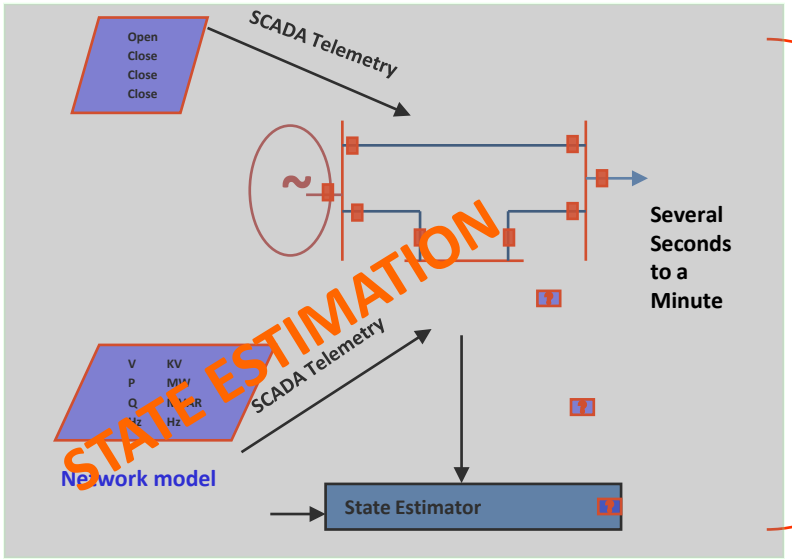
Description

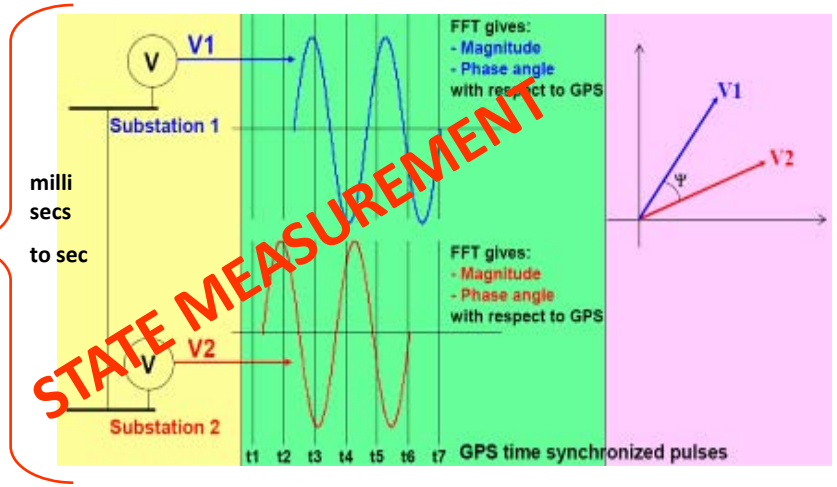
- Today's power transmission systems
  - transmitting power from point A to point B reliably, safely and efficiently.
  - No harmful to the environment.
- Typical transmission applications are
  - FACTS (Flexible AC Transmission Systems)
    - improve the performance of weak AC systems
    - to make long distance AC transmission feasible.
  - HVDC (High Voltage Direct Current).
    - (beyond approximately 600 km, considered as the break-even distance

Benefits of PMU

- Time synchronized sub-second data
- Dynamic behavior observing
- Directly provides the phase angles (State Estimation to State Measurement)
- Improve post disturbance assessment
- High data rates and low latency due to computation

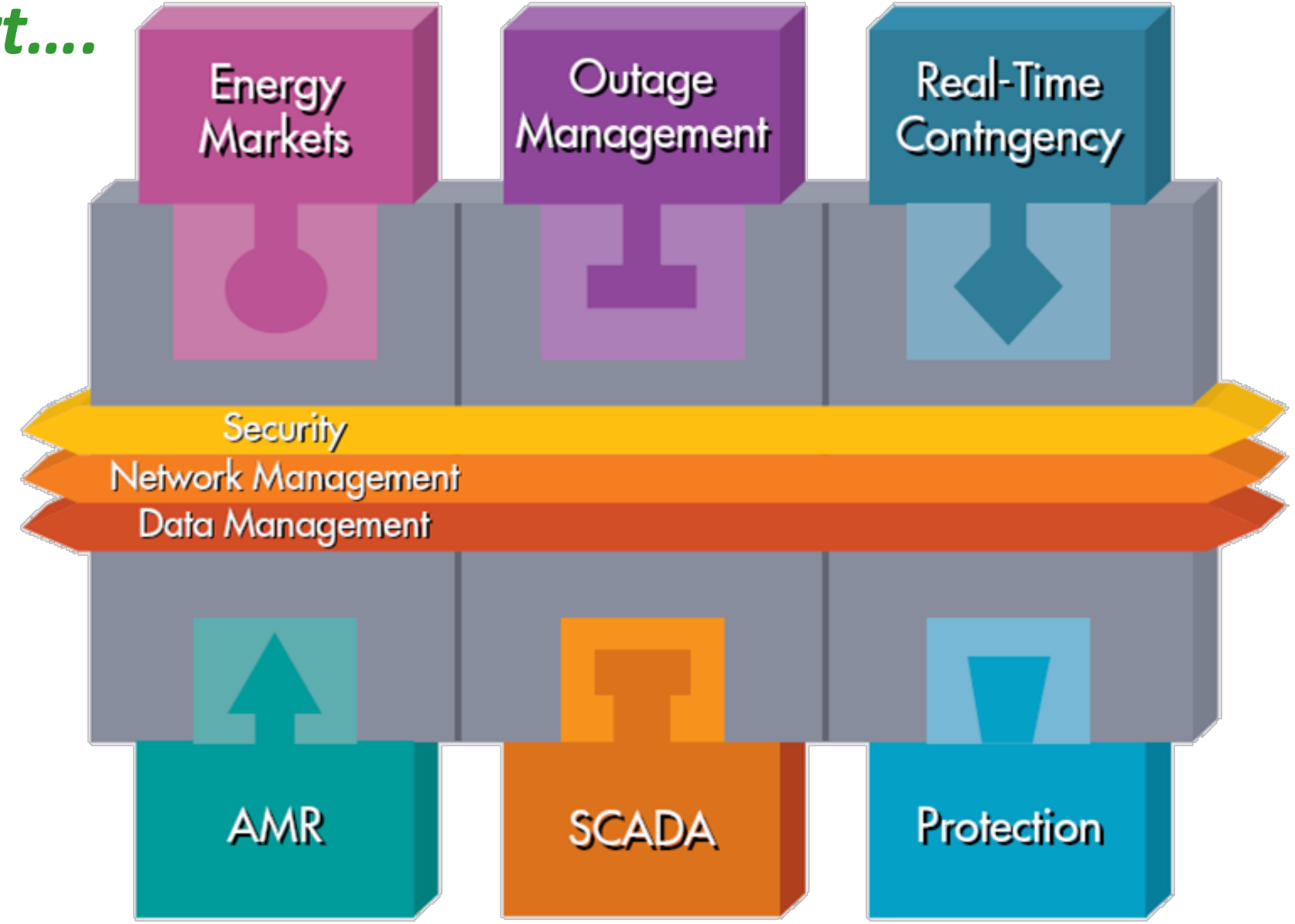
SCADA Vs PMU





- **Traditionally developed for accommodating old information technology regime (Slow communication, data without time stamp)**
- **Made possible for all round development in technologies**

Smart….



Interoperability using IEC 61850

Thank you for your attention!

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