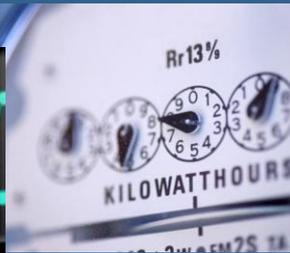


Smart Grids

From the Machine to Machine Perspective



[D. Boswarthick \(ETSI\)](#)
[O. Elloumi, JM Ballot \(ALU\)](#),
[ETSI Board Smart Grid Champions Team](#)

Smart Grids: an opportunity for the ICT industry

❑ Whatever the definition:

- **EC Smart Grids Task Force** (<http://www.smartgridtoday.com/public/939.cfm>)

The commission defines a smart grid as an electricity network that can intelligently integrate the actions of all users connected to it, including generators, consumers and those that do both in order to efficiently deliver sustainable, economic and secure electricity supplies.

- **IEC** (www.iec.ch)

Electric power network that utilizes two-way communication and control-technologies, distributed computing and associated sensors, including equipment installed on the premises of network users.

A smarter grid makes this transformation possible by bringing the philosophies, concepts and technologies that enabled the Internet to the utility and the electric grid”, US Dept. of Energy report on Exploring the imperative of revitalizing America’s electric infrastructure

❑ ... Smart Grids are an opportunity for the ICT industry

- **Smart Grids are about power**
- **but also: billing, e-Commerce, subscription management, OAM functions, data models, connectivity and routing, access technologies, data storage, virtualization, cyber-security, ...**

Smart Grid main issues

- ❑ **Modernization of the electrical network**
 - **Renewable energies: The power grid was not equipped to handle new power sources like wind or solar (focus on wholesale markets)**
 - **Outages due to e.g. inadequacy between demand and production**
 - **Little integration of operational data with asset management**

- ❑ **New application opportunities**
 - **Demand response: control electricity usage on the demand side**
 - **Home automation: control electrical appliances**
 - **Electrical vehicles: allow flexible charging mechanisms**

Where Smart Grids meet Telco know how

Service plane

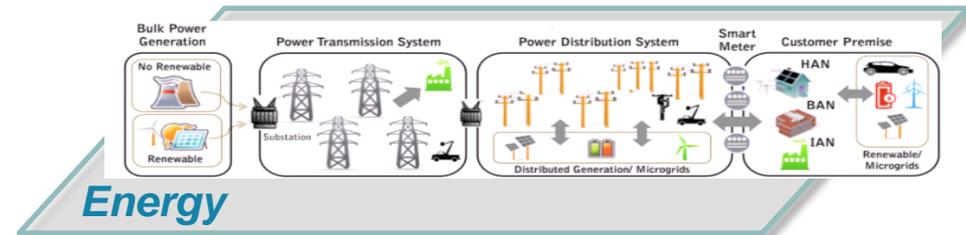
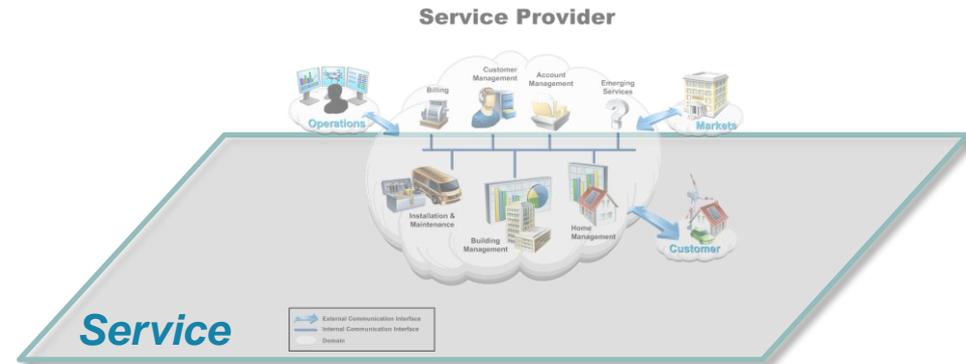
- Billing
- e-Commerce
- Data models
- Subscription management & activation
- Security
- Business processes

Connectivity & control plane

- Connectivity plane functions
 - OAM type functions
 - Traffic engineering, protection restoration virtualization and routing
 - Access technologies
- Energy control plane functions
 - Substation automation, condition monitoring & diagnosis, supervision & protection
 - Time synchronization
 - Metering

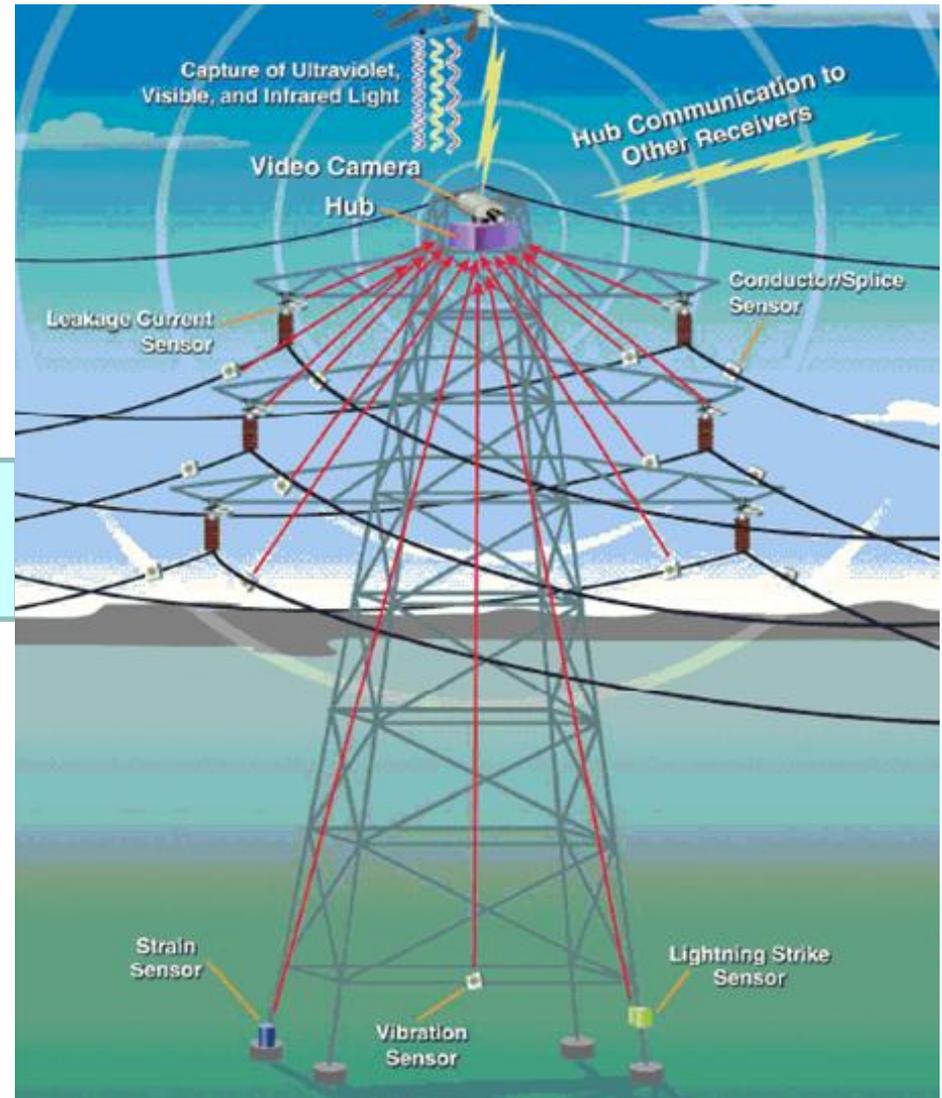
Energy Plane

- Sensors
- Electric storage and interconnection
- Transmission and Distribution Power Systems, etc.



Where Smart Grids meet M2M

- Smart Metering, an M2M application, is an important building block of the Smart Grid
- Smart Grid involves a large amount of sensor data: an integral part of the M2M architecture:
 - Data collection and aggregation
 - Communication mediation (wake-up time, etc)
 - Sensor lifecycle management
 - Event management
- M2M is now building capabilities for transaction management and compensation, etc.



The ETSI M2M Challenge

- M2M technical solutions are highly fragmented and usually dedicated to a single application (e.g. fleet management, meter reading)**
- Multitude of technical solutions and dispersed standardization activities result in the slow development of the M2M market**
- Standardization is a key enabler to remove the technical barriers and ensure interoperable M2M services and networks**

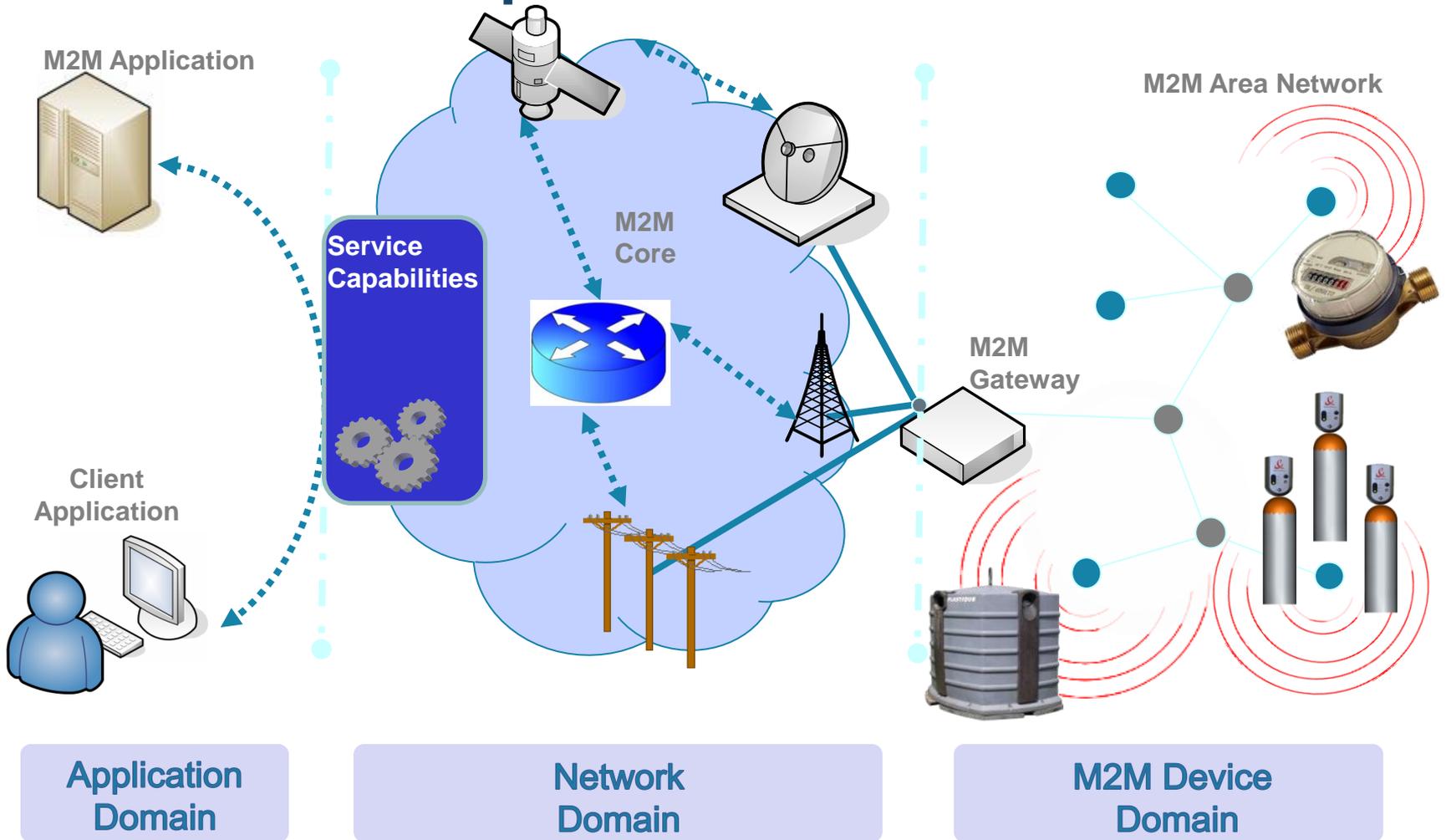
M/411 Smart Metering Mandate

- **EC Mandate issued in March 2009 by DG TREN and sent to the 3 ESO's : CEN, CENELEC and ETSI**
- **Main objective: to build standards for European smart meters, allowing interoperability and Consumer actual consumption awareness.**
- **Time schedule :**



- **March 2009 + 9 months : state of the art of existing standards, gap analysis, and first Workprogram**
- **March 2009 + 30 months : Develop new smart metering standards**

Simple M2M Architecture



Status of ETSI M2M Standards

Requirements document

- Stable content wise, remaining some editorial work

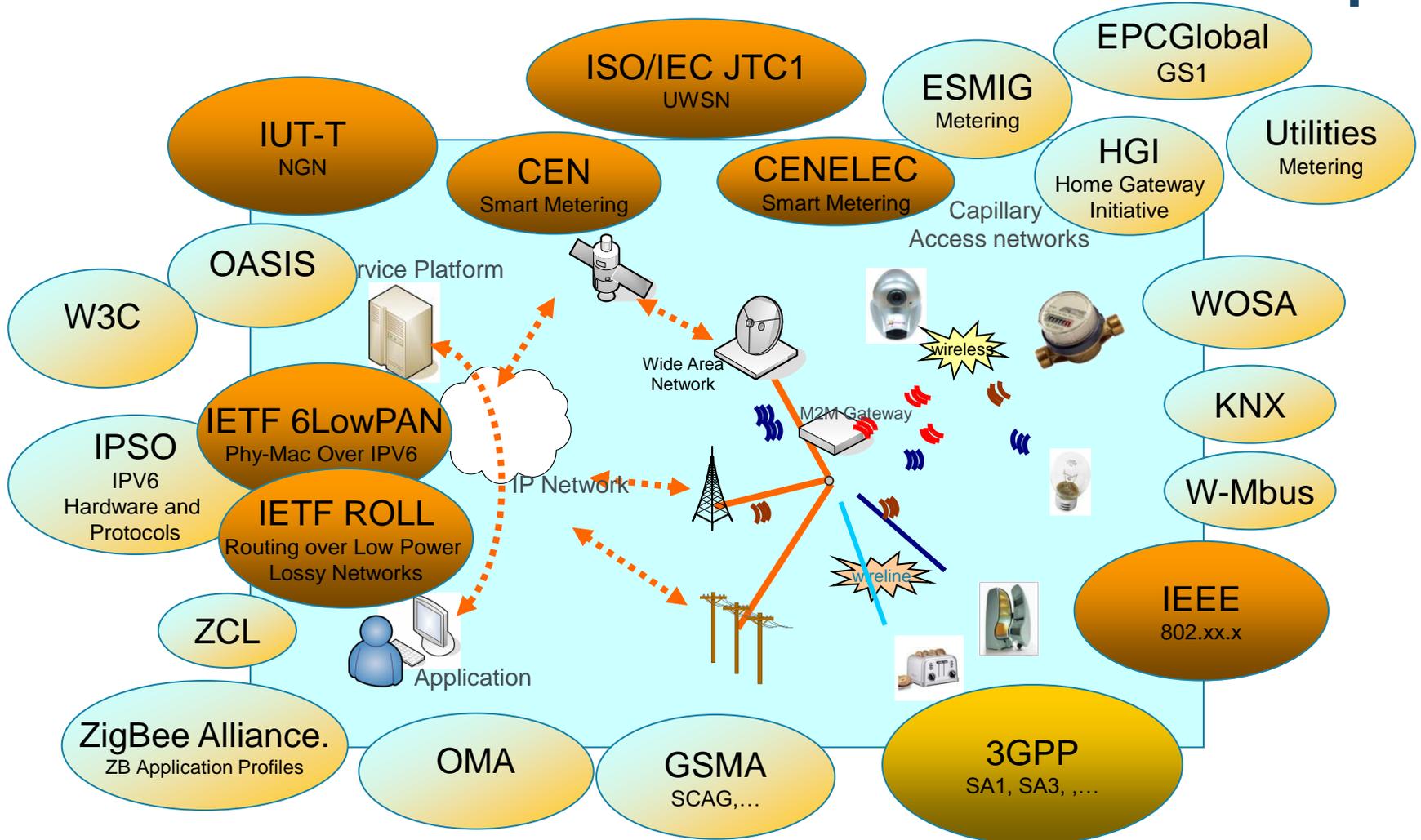
Architecture:

- Key capability identified
- Message flows documented
- Identified key interfaces for release 1 stage 3 work
- Target date for finalizing the architecture is: July 2010

Protocols:

- New WI agreed to the last meeting to progress stage 3 work for main interfaces: mld, dla and mla

M2M links with other SDOs and Industrial Groups



Summary

Smart Grid is more than an ICT overlay

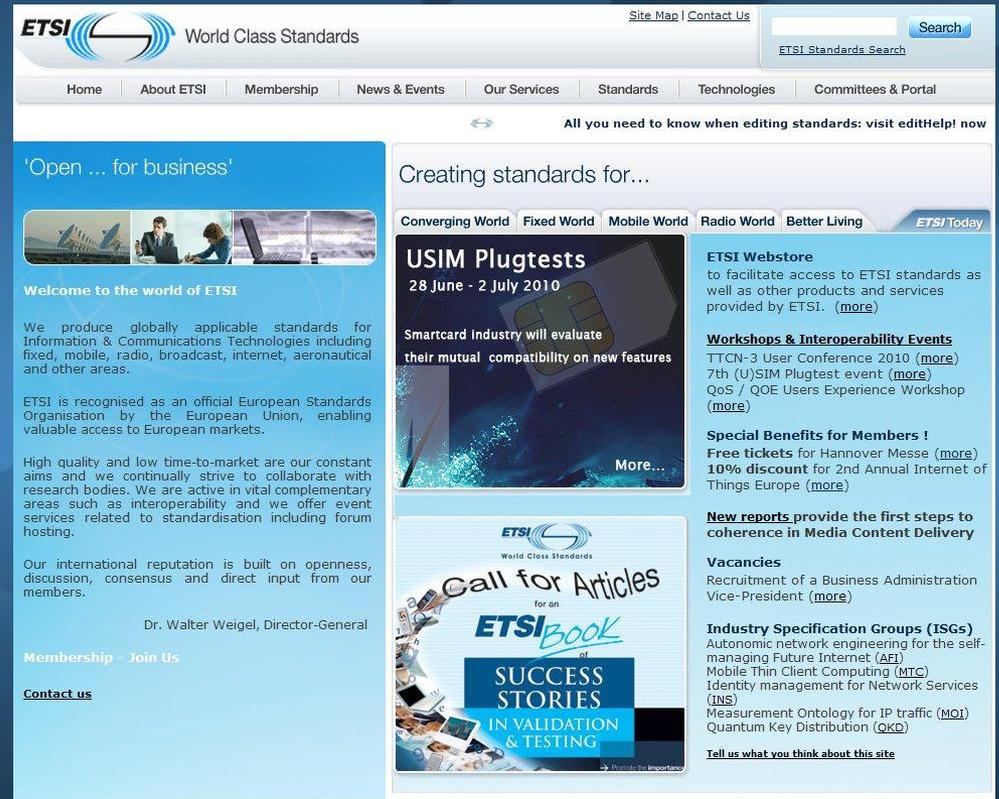
M2M is one foundation of Smart Grid

Global standards are essential for long term growth

ETSI has the lead on M2M standards

Thank you
for your attention

Any Questions?



The screenshot shows the ETSI website homepage with the following content:

- Header:** ETSI World Class Standards, Site Map | Contact Us, Search bar.
- Navigation:** Home, About ETSI, Membership, News & Events, Our Services, Standards, Technologies, Committees & Portal.
- Main Content:**
 - 'Open ... for business'**: Welcome to the world of ETSI. We produce globally applicable standards for Information & Communications Technologies including fixed, mobile, radio, broadcast, internet, aeronautical and other areas. ETSI is recognised as an official European Standards Organisation by the European Union, enabling valuable access to European markets. High quality and low time-to-market are our constant aims and we continually strive to collaborate with research bodies. We are active in vital complementary areas such as interoperability and we offer event services related to standardisation including forum hosting. Our international reputation is built on openness, discussion, consensus and direct input from our members. Dr. Walter Weigel, Director-General.
 - Membership - Join Us** and **Contact us** links.
 - Creating standards for...**:
 - Converging World**: USIM Plugtests (28 June - 2 July 2010). Smartcard industry will evaluate their mutual compatibility on new features.
 - Fixed World**
 - Mobile World**
 - Radio World**
 - Better Living**
 - ETSI Today**
 - ETSI Webstore**: to facilitate access to ETSI standards as well as other products and services provided by ETSI.
 - Workshops & Interoperability Events**: TTCN-3 User Conference 2010, 7th (U)SIM Plugtest event, QoS / QOE Users Experience Workshop.
 - Special Benefits for Members!**: Free tickets for Hannover Messe, 10% discount for 2nd Annual Internet of Things Europe.
 - New reports provide the first steps to coherence in Media Content Delivery**.
 - Vacancies**: Recruitment of a Business Administration Vice-President.
 - Industry Specification Groups (ISGs)**: Autonomic network engineering for the self-managing Future Internet (AEI), Mobile Thin Client Computing (MTC), Identity management for Network Services (INS), Measurement Ontology for IP traffic (MOI), Quantum Key Distribution (QKD).
- Call for Articles**: for an ETSI Book of SUCCESS STORIES IN VALIDATION & TESTING.

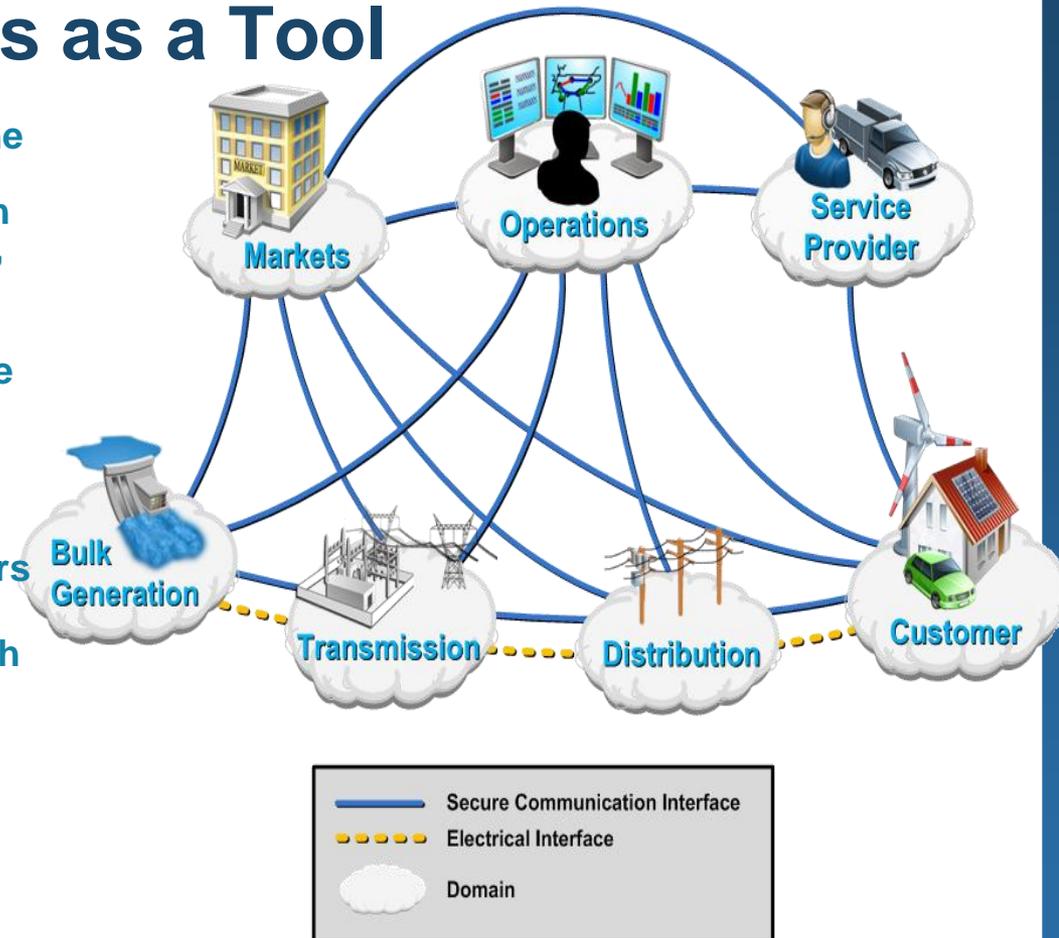
www.etsi.org

Extra Slides

**Smart Grids
Back-up material**

NIST Conceptual Model – Views as a Tool

- **Customer:** The end users of electricity. May also generate, store, and manage the use of energy. Traditionally, three customer types are discussed, each with its own domain: residential, commercial, and industrial
- **Markets:** The markets are where grid assets are bought and sold. Actors in the Markets domain exchange price and balance supply and demand within the power system
- **Service Providers:** The organizations providing services to electrical customers and utilities
- **Operations:** Actors involved in the smooth operation of the power system
- **Bulk generation:** The generators of electricity in bulk quantities. May also store energy for later distribution
- **Transmission:** The carriers of bulk electricity over long distances. May also store and generate electricity
- **Distribution:** The distributors of electricity to and from customers. May also store and generate electricity.



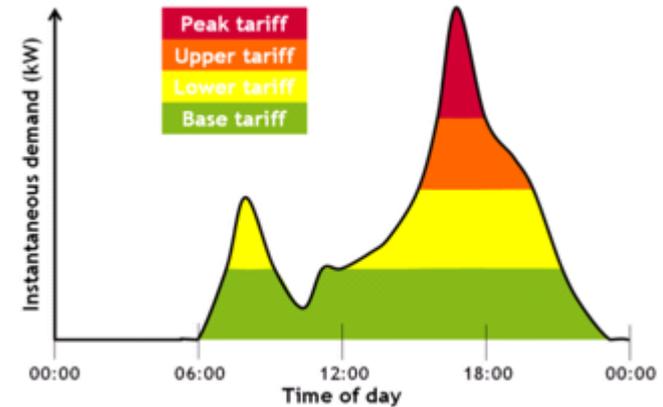
From M2M to Smart Metering to Smart Grids

Smart Metering: flexible demand management

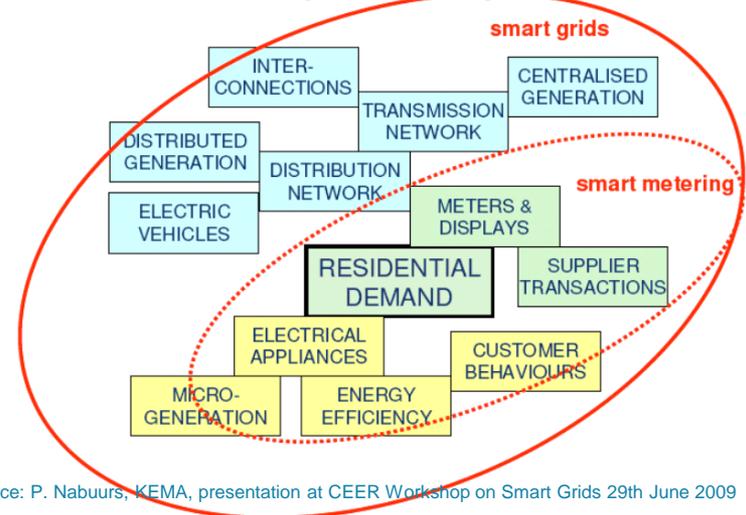
- Use smart metering to persuade customers to be more energy conscious:
 - Show customers their energy consumption patterns
 - Use flexible tariffs to motivate users to spread their non-essential load
- Use smart metering to control customers' non-essential load:
 - Control the non-essential load to fit the overall generation profile
 - Turn appliances on/off/up/down
 - Use smart metering intelligence to
 - Control directly from the meter
 - Allow intelligent, pre-arranged decisions by communicating tariff changes
- An application of M2M

Smart Grids: flexible power management

- Addresses the whole power value-chain



The Electric Elements



Source: P. Nabuurs, KEMA, presentation at CEER Workshop on Smart Grids 29th June 2009

Smart Grid standards ecosystem

	Standards Bodies	Influential Bodies	Policy & Regulation
Vision & Framework	IEEE P2030, ITU-T, IEC Smart Grid Strategy Group	NIST, EPRI, SG-ETP SEA, INCITS, OpenADR	IERN, ICER US: FERC, EU: ER-GEG / ACER, CEER China: SERC France: CRE UK: OFGEM Etc.
Service plane	ANSI C12, IETF, Zigbee, ETSI IEC 60870, 61868-70, Cenelec	DLMS, OpenADR, OPC-UA,	
Control & connectivity plane	ANSI C12, IETF, Cenelec, IEEE 1686, 1588, IEC 61850, 62351, Zigbee, ETSI	DLMS	
Energy plane	IEEE PES, 1547, C37, IEC, NERC	DNP, NEMA	

Simplified picture, the full eco-system needs a presentation on its own

Role of key bodies in the Smart Grid Standards ecosystem

- **NIST (National Institute of Standards and Technologies):** is not a standards body per se, but has been mandated by the US government to “project manage” the delivery of the set of standards for the US smart grid
- **EPRI (Electric Power Research Institute):** engage Smart Grid stakeholders to provide technical assistance in assessing standards needs and developing a draft interim standards roadmap, under contract awarded by NIST
- **IEEE P2030:** is an IEEE project developing a Draft Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS), and End-Use Applications and Loads
- **ANSI C12 suite:** Open and mature set of standards pertaining to smart metering for the US market
- **DLMS (Device Language Message Specification):** is the suite of standards developed and maintained by the DLMS User Association and has been co-opted by the IEC TC13 WG14 into the IEC 62056 series of standards. COSEM or Companion Specification for Energy Metering, includes a set of specifications that defines the Transport and Application Layers of the DLMS protocol

Role of key bodies in the Smart Grid Standards ecosystem (cntd.)

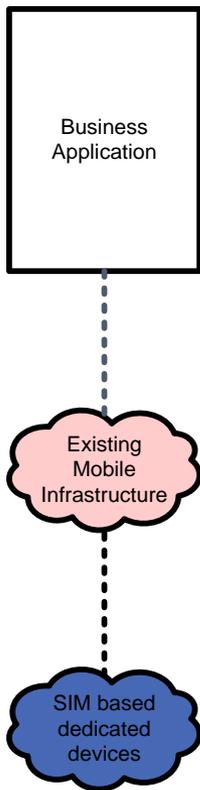
- **ETSI M2M:** develops an horizontal architecture for M2M applications including Smart Metering. ETSI is one of the three ESOs to have received the EC Smart Metering mandate and may be involved in the upcoming Smart Grid mandate?
- **IEC Smart Grid Strategy Group:** The IEC is a natural focal point for the electrical industry. It is currently aiming at providing a “one-stop shop” for the large number of Smart Grid projects that are being launched around the world. It has developed a framework for IEC Standardization that includes protocols and model standards to achieve interoperability of Smart Grid devices and systems
- **IETF:** created a set of activities pertaining to sensor technologies at large: 6Lowpan, roll. The objective is to bring IP all the way to low CPU, battery operated sensor devices. The IETF work is moving up the layers to introduce an HTTP equivalent for sensor devices (CoAP protocol). Recently the IETF created the smart grid directorate and the “core” working group

Extra Slides

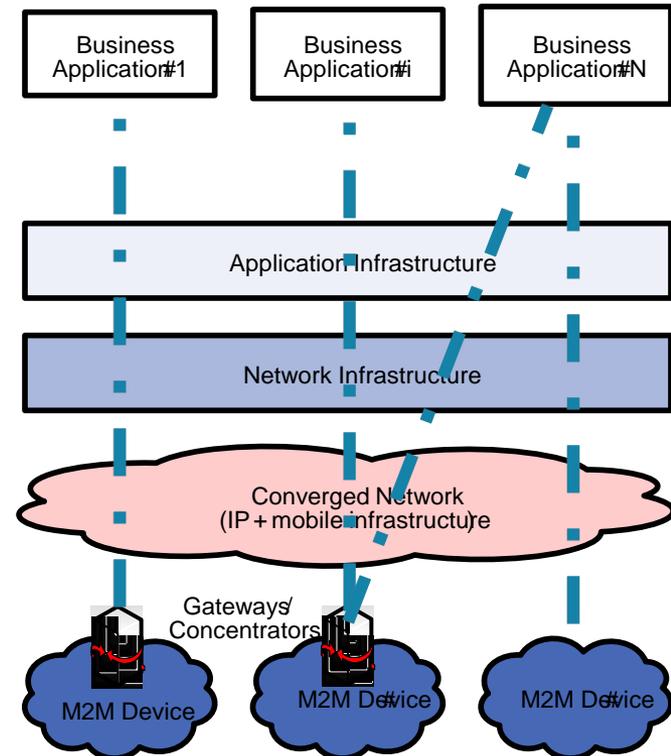
M2M
Back-up material

Inverting the pipes

existing proprietary vertical applications...



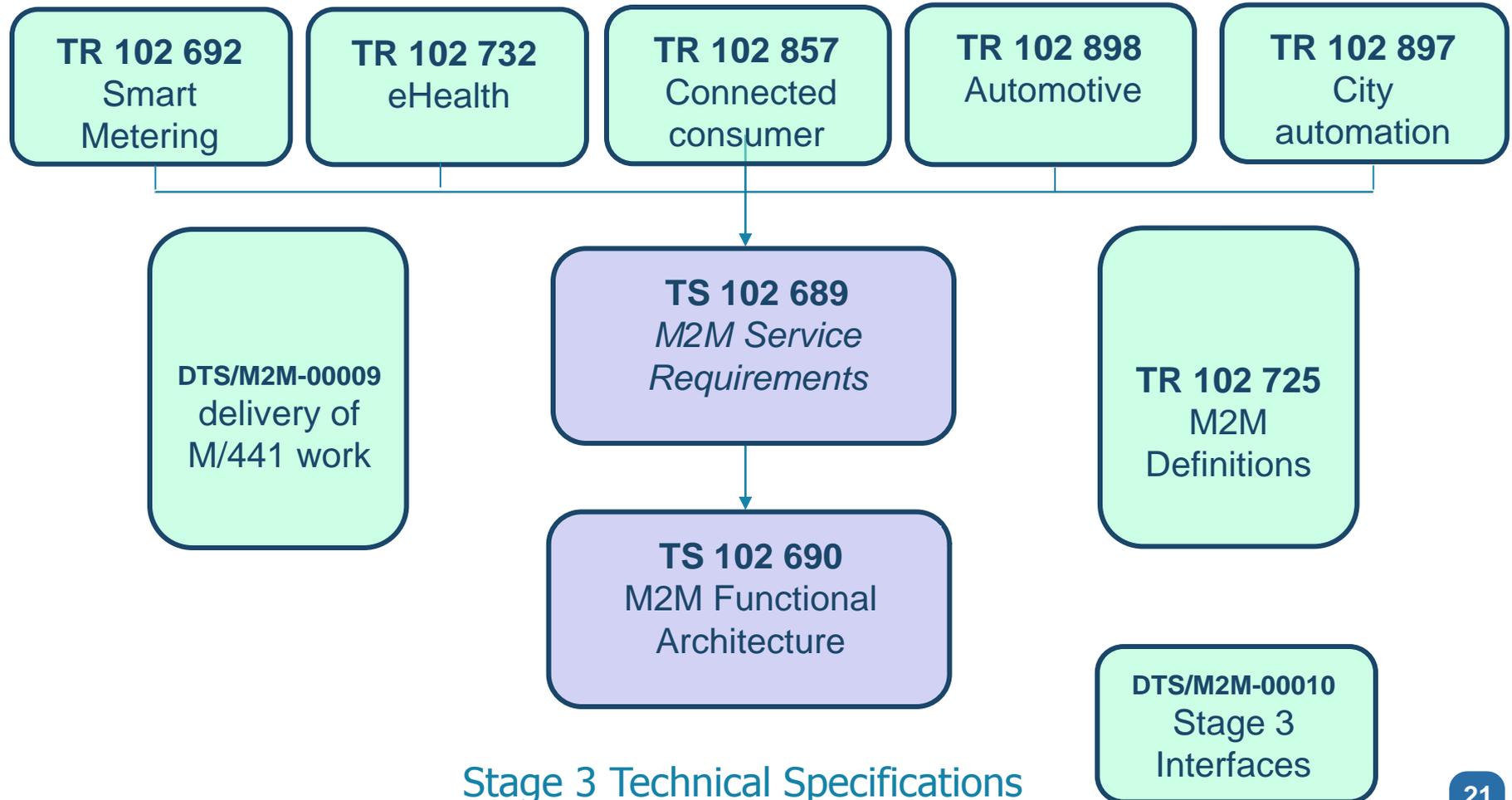
applications share common infrastructure, environments and network elements



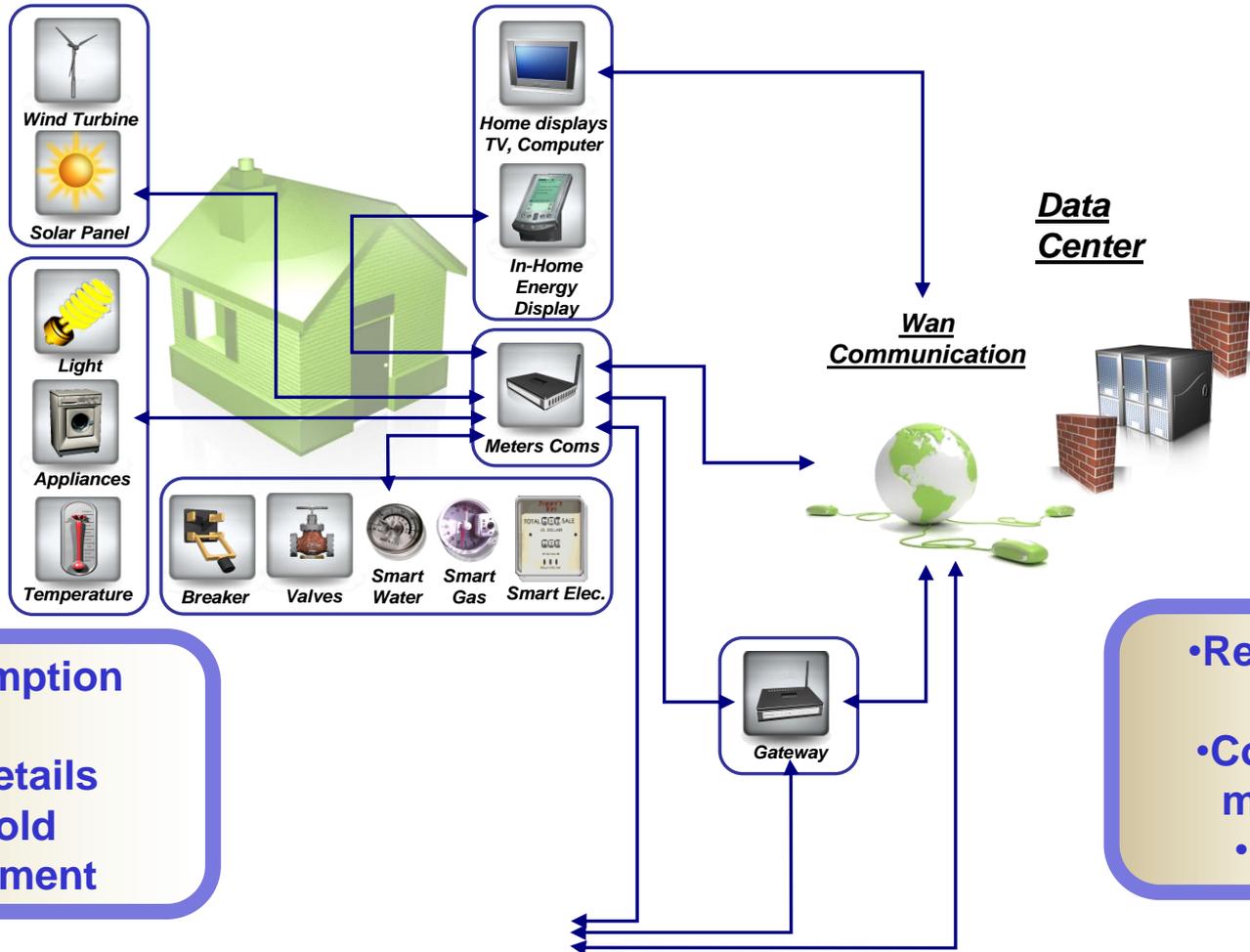
With permission of HP

Work Methodology, a stepwise approach

Use Case Technical Reports



M2M Application #1 Smart metering



- Consumption info
- Fault details
- Threshold management

- Remote Meter reading
- Consumption management
- Pricing info

Current M2M standards landscape

M2M Applications



API

M2M Platform



SP networks
(access, core)



Gateway Layer



I E T F

M2M area Network

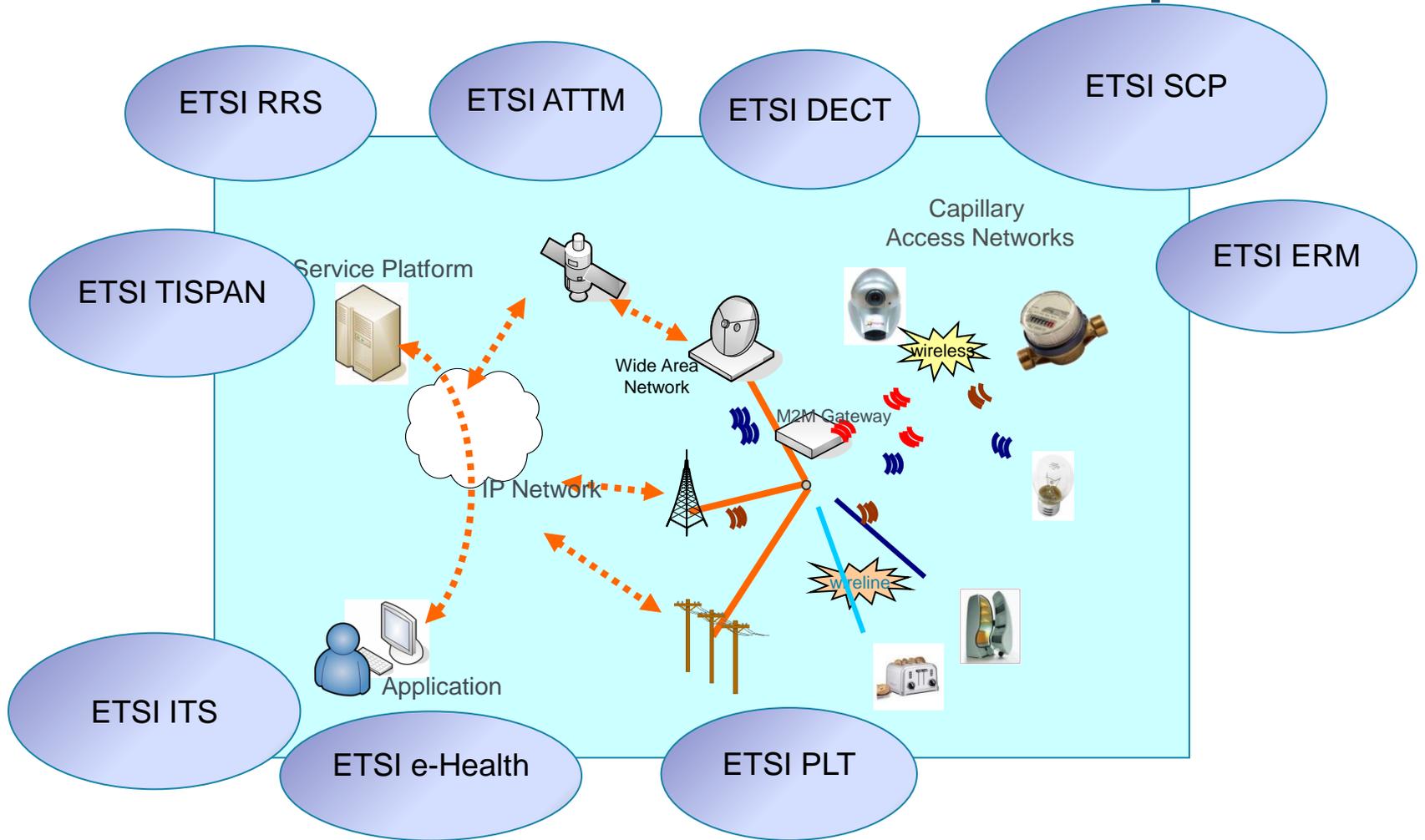


M2M Device



Example for metering applications

M2M Links with other ETSI Groups



Extra Slides

**Smart Grids
Acronyms**

Acronyms

- **IEC, International Electrotechnical Commission:** publishes International Standards for all electrical, electronic and related technologies
- **NIST, National Institute of Standards and Technology**
- **EPRI, Electric Power Research Institute**
- **SG-ETP, SmartGrids - Electricity Networks of the Future:**
<http://www.smartgrids.eu/>
- **SEA, Smart Energy Alliance:** <http://www.smart-energy-alliance.com>
- **INCITS, InterNational Committee for Information Technology Standards,**
<http://www.incits.org/>
- **OpenADR, Open Automated Demand Response,**
<http://www.openadrcollaborative.org/>
- **ANSI C12, ANSI Smart Meter standards suite**
- **Cenelec, European Committee for Electrotechnical Standardization**
- **IEEE PES, IEEE Power and Energy Society,** <http://www.ieee-pes.org/>
- **IEEE 1547, Standard for Interconnecting Distributed Resources with Electric Power Systems,** http://grouper.ieee.org/groups/scc21/1547/1547_index.html
- **IEEE C37, Series of standards for Low and High voltage equipment**

Acronyms (continued)

- **NERC**, North American Electric Reliability Corporation, <http://www.nerc.com/>
- **DLMS**, Device Language Message Specification, Smart meter standards group <http://www.dlms.com>
- **DNP**, Distributed Network Protocol, <http://www.dnp.org/>
- **NEMA**, US National Electrical Manufacturers Association, <http://www.nema.org/>
- **IERN**, International Energy Regulation Network, <http://www.iern.net/>
- **ICER**, International Confederation of Energy Regulators
- **FERC**, Federal Energy Regulatory Commission, <http://www.ferc.gov/>
- **ER-GEG**, European Regulators' Group for Electricity and Gas
- **SERC**, State Electricity Regulatory Commission (China)
- **CRE**, Commission de Regulation de l'Electricité (France)
- **OFGEM**, Office of the Gas and Electricity Markets (UK)

Extra Slides

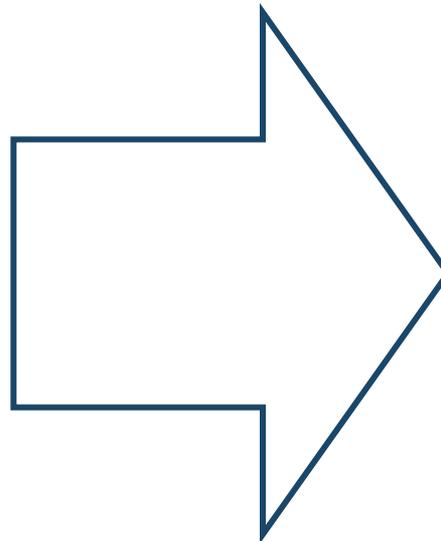
ETSI Overview

Why Standards?

**Standards
imply**

**Interworking
Equipments**

**Interoperable
Solutions**



**Visible
Benefits**

**Reduction of
development costs**

**Reduction of
deployment costs**

**Market
Expansion**

ETSI in a nutshell

- ICT standards organization**
- Global membership (740 Members from 62 countries)**
- Direct participation**
- 2 Partnership projects, 40 Technical bodies, 90+ working groups, 6000 industry experts/year**
- Globally applicable specifications and European Norms (EU recognition)**
- Enabler of a series of worldwide industrial success stories**
- Global web of alliances e.g.**
 - **Founding partner & service provider for 3GPP**
- Major focus on Interoperability**

The three dimensions of ETSI activities



Standards in support
of EU regulation



Standards for
global ICT markets



Service provision