SMART GREEN TECHNOLOGY

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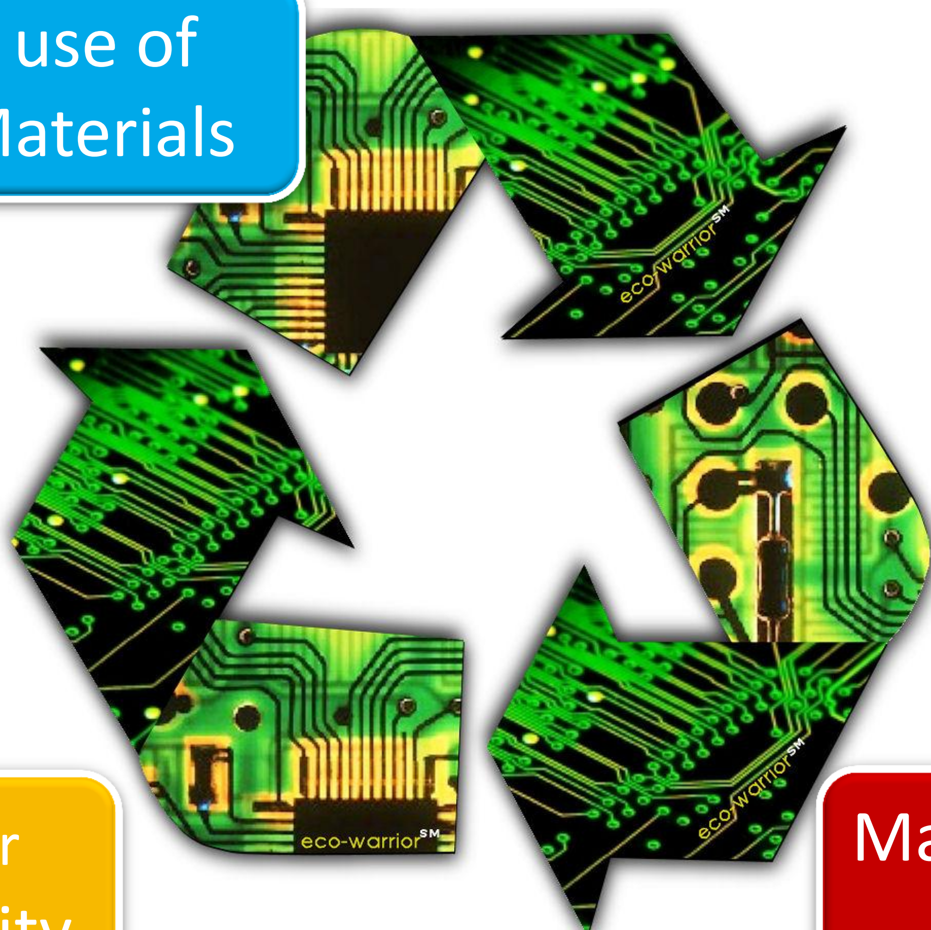
OutLine

- Green Electronic
- IoT
- Smart Grid
- Smart City

Green Electronic

Reduce the use of Hazardous Materials



Recyclability or Biodegradability

Maximize Energy Efficiency

RoHS

(Restriction of Use
of Hazardous Substances)

The restriction in electrical and electronic equipment, was adopted in February 2003 by EU.

1. Lead (Pb) → < 0.1%
2. Mercury (Hg) → 100 ppm (parts per million)
3. Cadmium (Cd) → 0.01%
4. Hexavalent chromium (Cr^{6+}) → < 0.01%
5. Polybrominated biphenyls (PBB) → < 0.1%
6. Polybrominated diphenyl ether (PBDE) → < 0.1%

The Directive Applies to Categories

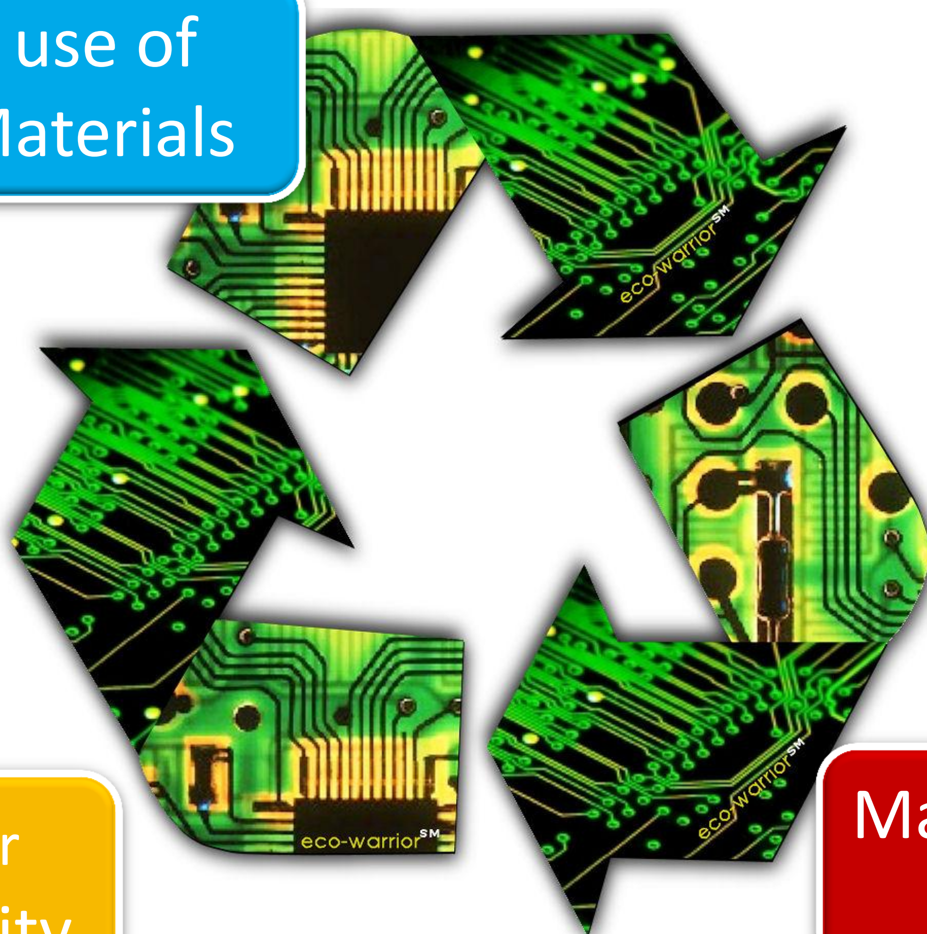
- Large household appliances.
- Small household appliances.
- IT & Telecommunications equipment (although infrastructure equipment is exempt in some countries)
- Consumer equipment.
- Lighting equipment—including light bulbs.
- Electronic and electrical tools.
- Toys, leisure, and sports equipment.
- Medical devices (exemption removed in July 2011)
- Monitoring and control instruments (exemption removed in July 2011)
- Automatic dispensers.
- Semiconductor devices

Restriction Exemptions

- Copper alloy containing up to 4% lead by weight.
- High melting temperature type solders (i.e. lead based solder alloys containing 85% by weight or more lead).
- Servers, switches, routers, cell sites and other telecommunication equipment that constitute the global Internet and phone systems are exempt from lead content restrictions.
- Solar panels - Cadmium telluride (CdTe) thin-film PV modules in photovoltaic panels are explicitly allowed by RoHS to contain unlimited cadmium.
- Limited amounts of mercury in fluorescent and other light bulbs where it is essential to their functioning

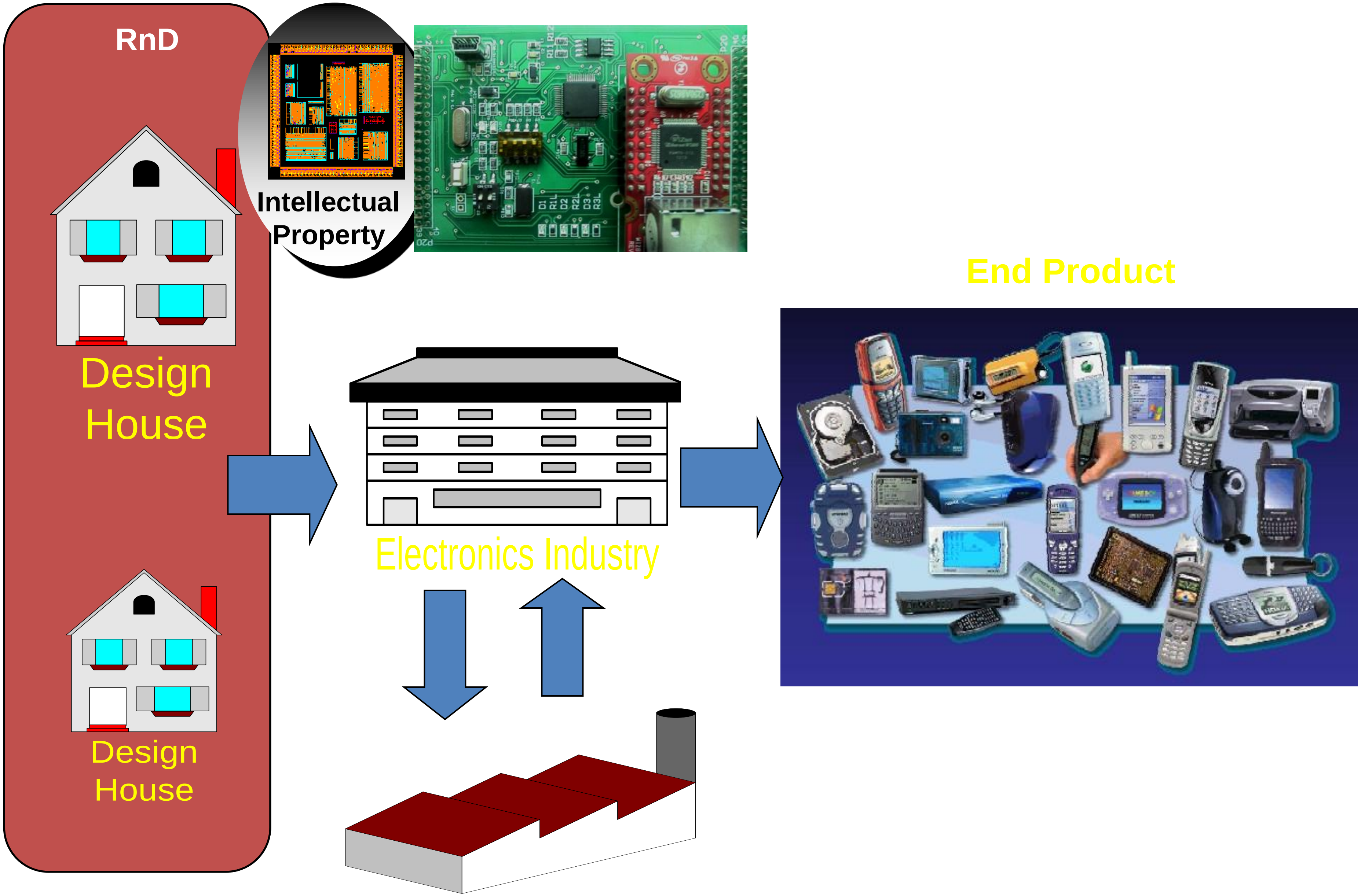
Green Electronic

Reduce the use of Hazardous Materials

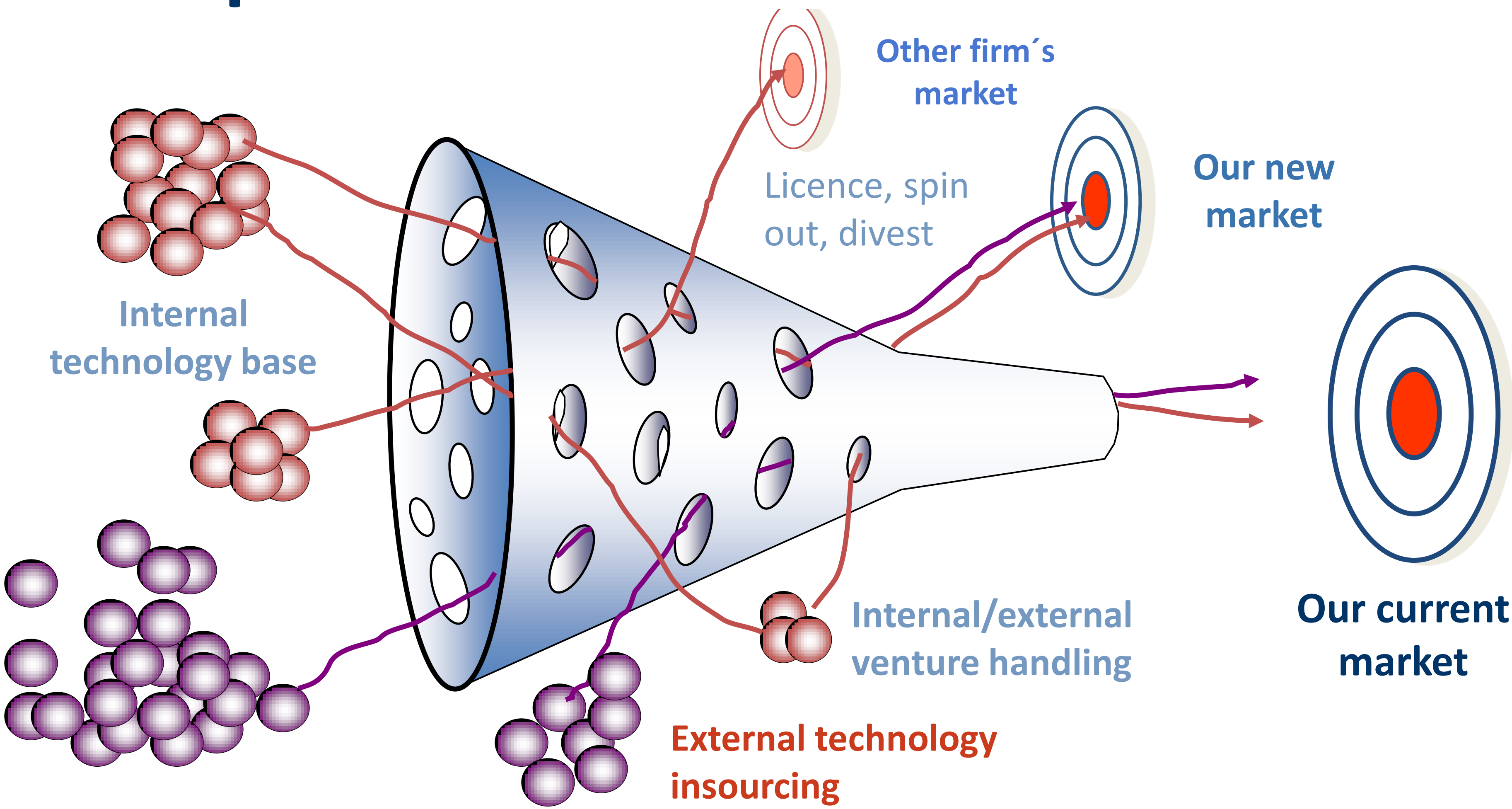


Recyclability or Biodegradability

Maximize Energy Efficiency

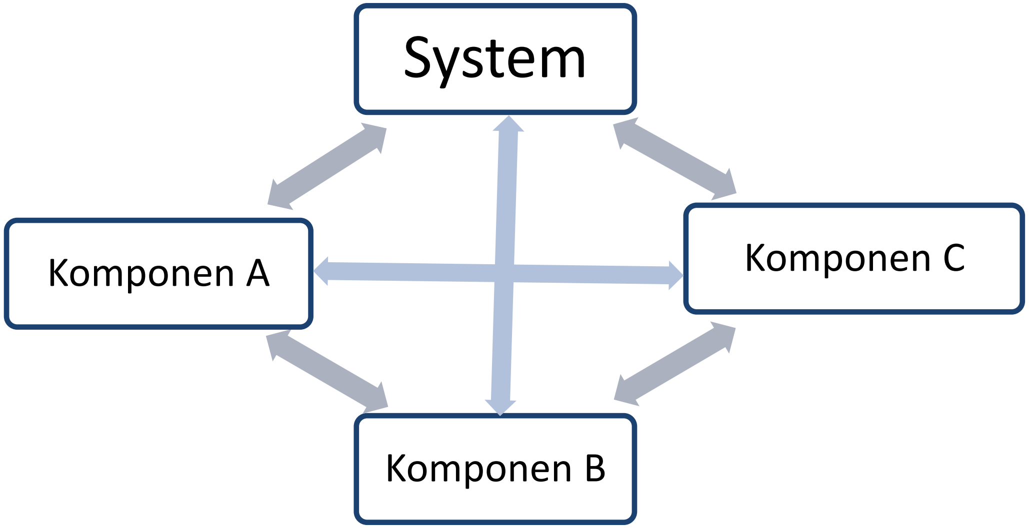

RnD
Intellectual Property
Design House
Design House
Electronics Industry
End Product

Open innovation



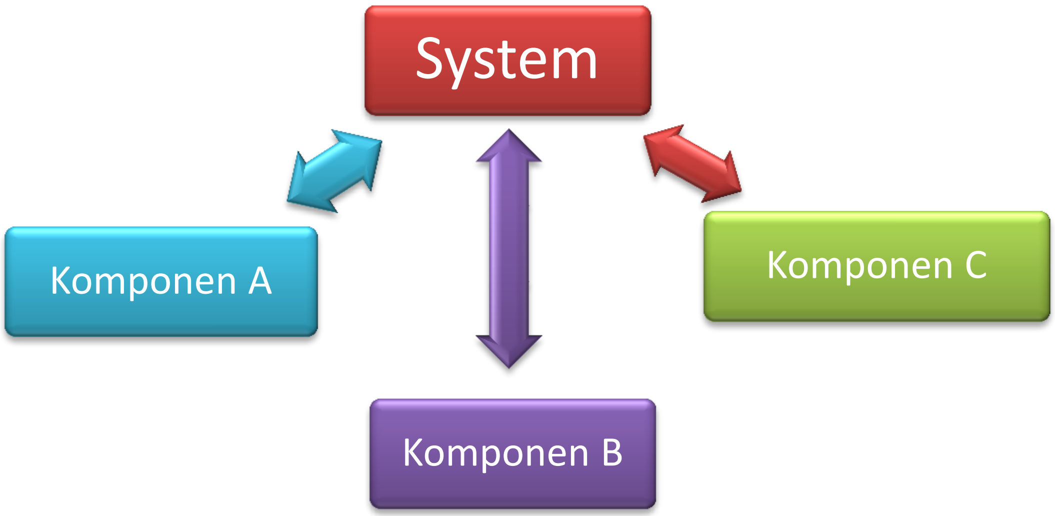
Prof Henry Chesbrough UC Berkeley, Open Innovation: Renewing Growth from Industrial R&D, 10th Annual Innovation Convergence, Minneapolis Sept 27, 2004

Setting and Advancing the Architecture with Internal R&D



- Semua komponen ingin dominan dlm system
- Hubungan komponen menjadi komplek
- Perlu expert utk memahami sistem keseluruhan
- Satu dirubah, yang lain harus berubah

Setting and Advancing the Architecture with Internal R&D



- Plug and Play
- Setiap Komponen dapat diteliti terpisah
- Pihak lain dapat ikut mengembangkan tiap komponen
- Terdapat opsi komponen dengan teknologi terbaik

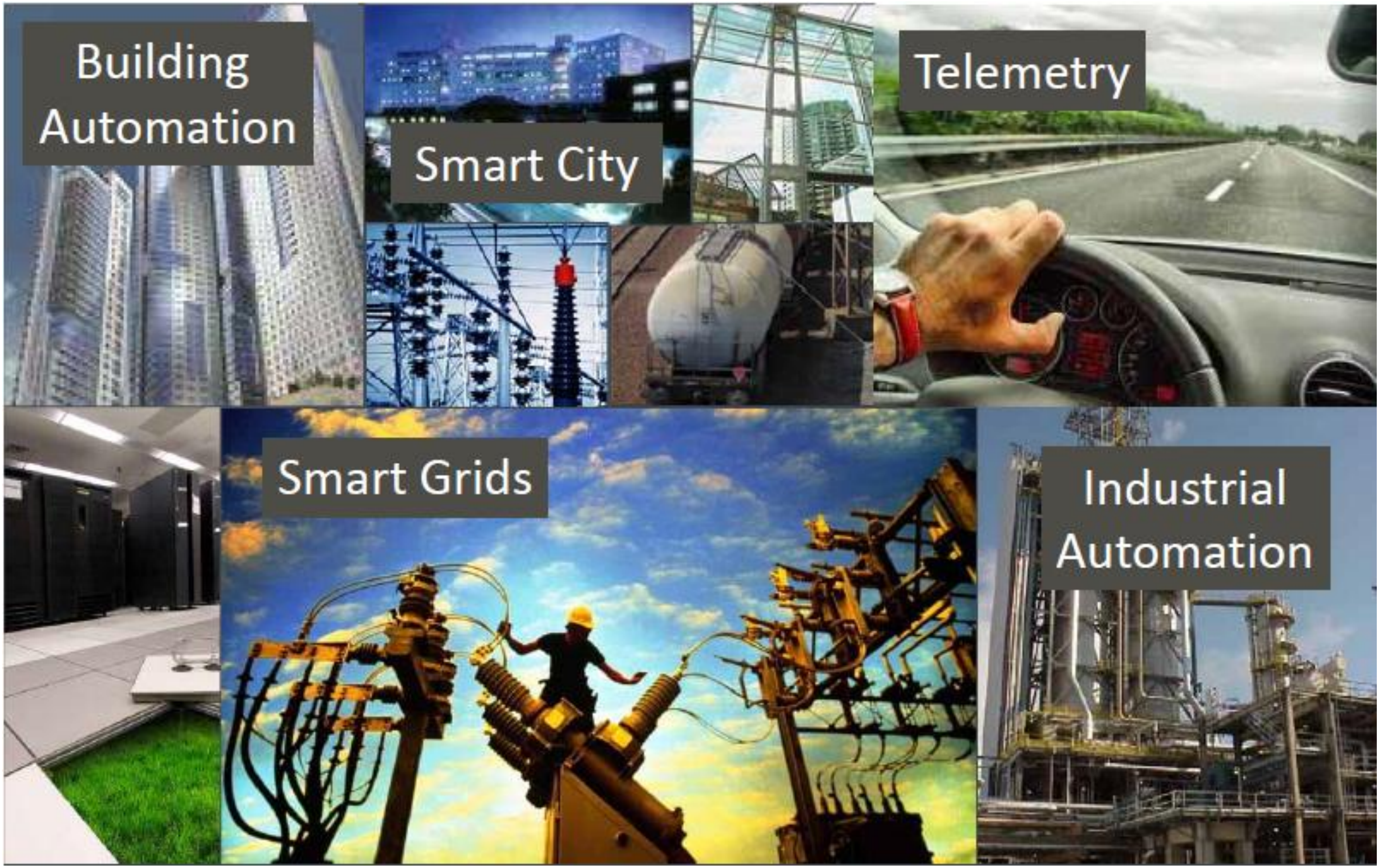

My Data
My Mobile
My Computer
Me (User)
My Tablet
My Consumer Identity
My Home Entertainment
My Friends
INTERNET OF THINGS

Internet of Things

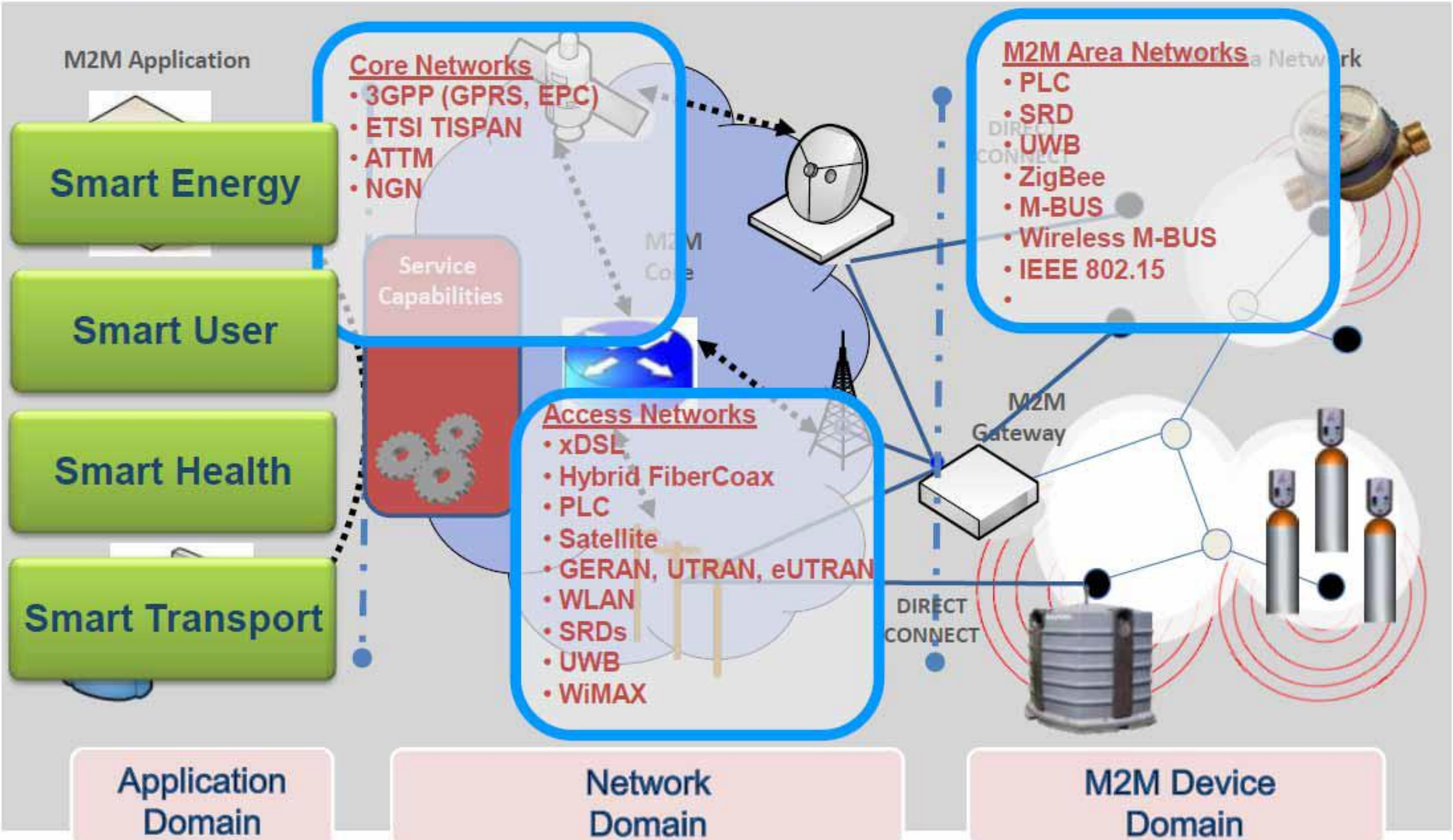
- The term Internet of Things was first used by Kevin Ashton in 1999.
- The concept of the Internet of Things first became popular through the Auto-ID Center and related market analysts publications.
- The Internet of Things refers to uniquely **identifiable objects** and their virtual representations in an Internet-like structure.

AUTO-ID Labs at MIT
The Internet of Things

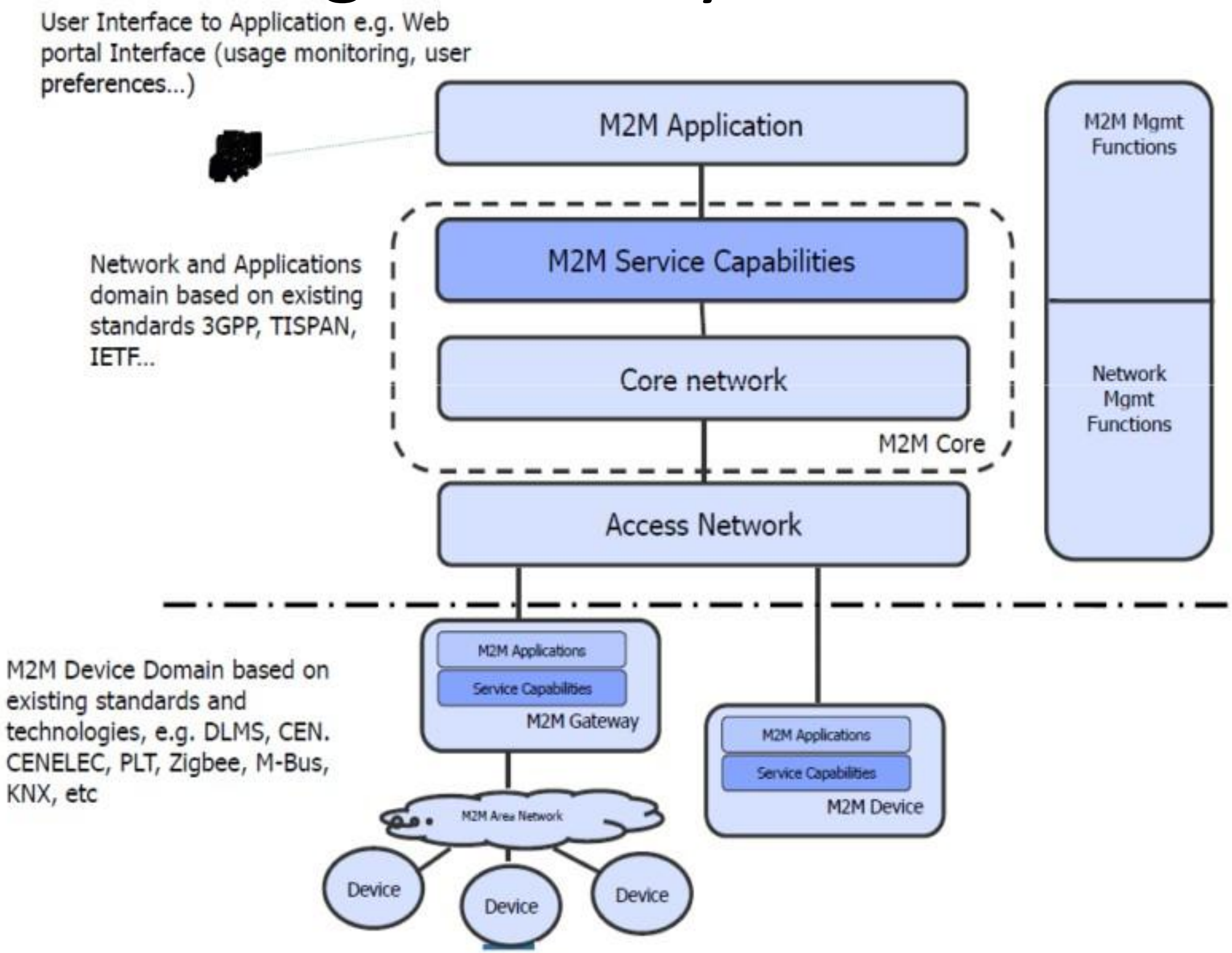
Applications

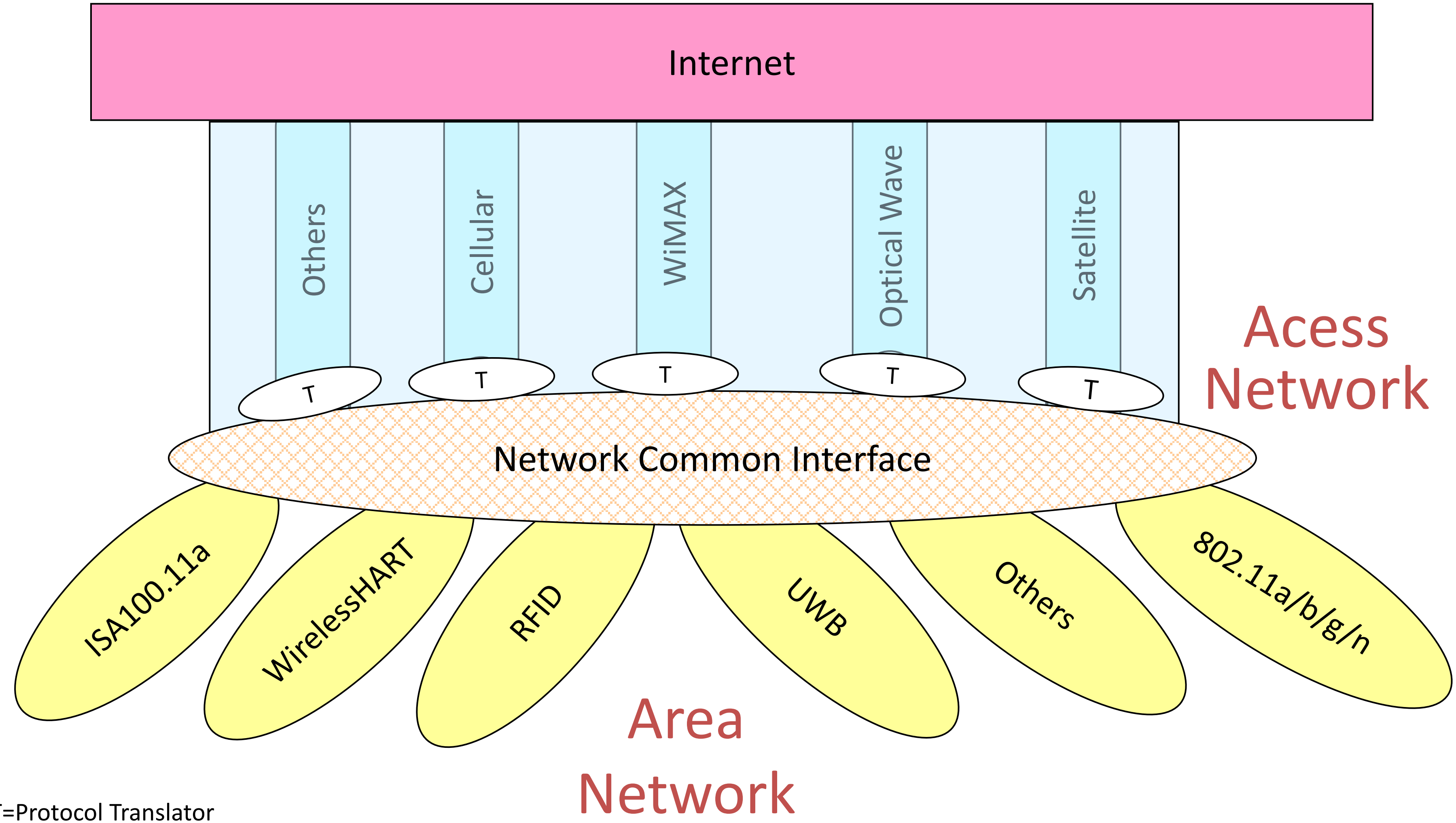


M2M Communication



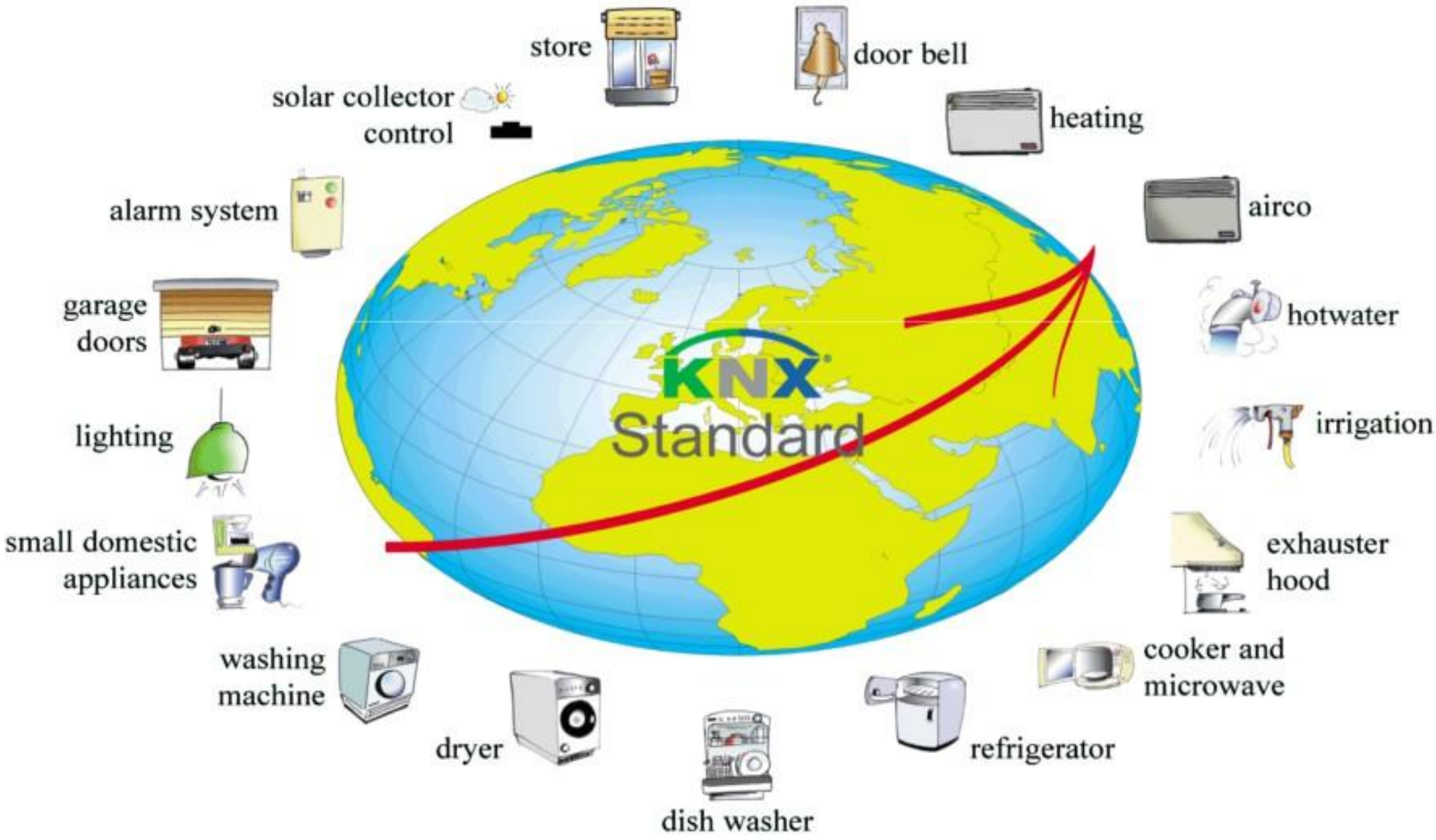
M2M High Level System Overview





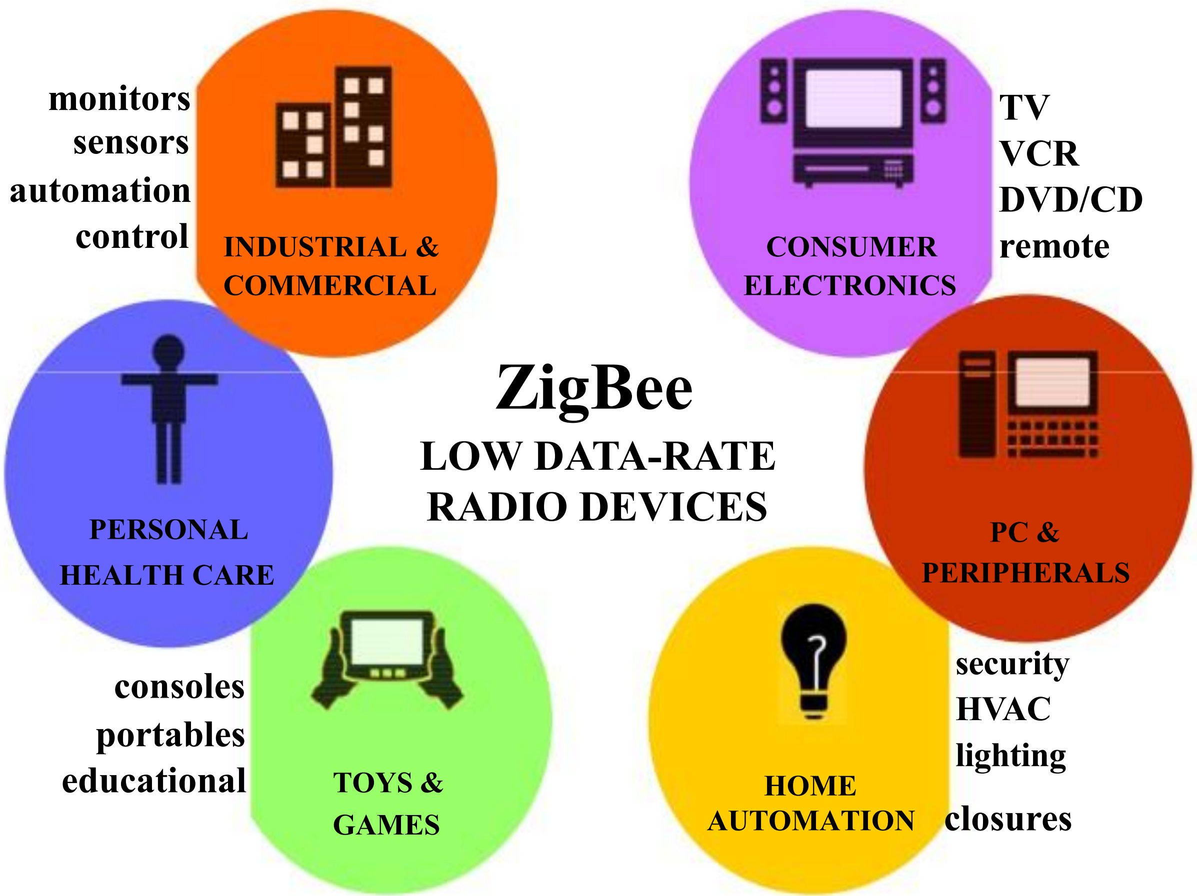
T=Protocol Translator

KNX : technology integrates Home and Building applications in one approved standard



ZigBee®
Control your world

Application Sectors



Heating, Ventilation and Air Conditioning systems(HVAC)

ZigBee General Characteristics

- ZigBee is a technological standard, based on IEEE 802.15.4 which was created specifically for control and sensor networks.
- Small packet devices
- Low data rate
- Low Power Usage consumption
- 3 Frequencies bands with 27 channels
- Data rates : 250Kbps for 2.45GHz, 40 Kbps 915Mhz and 20Kbps for 868Mhz band.

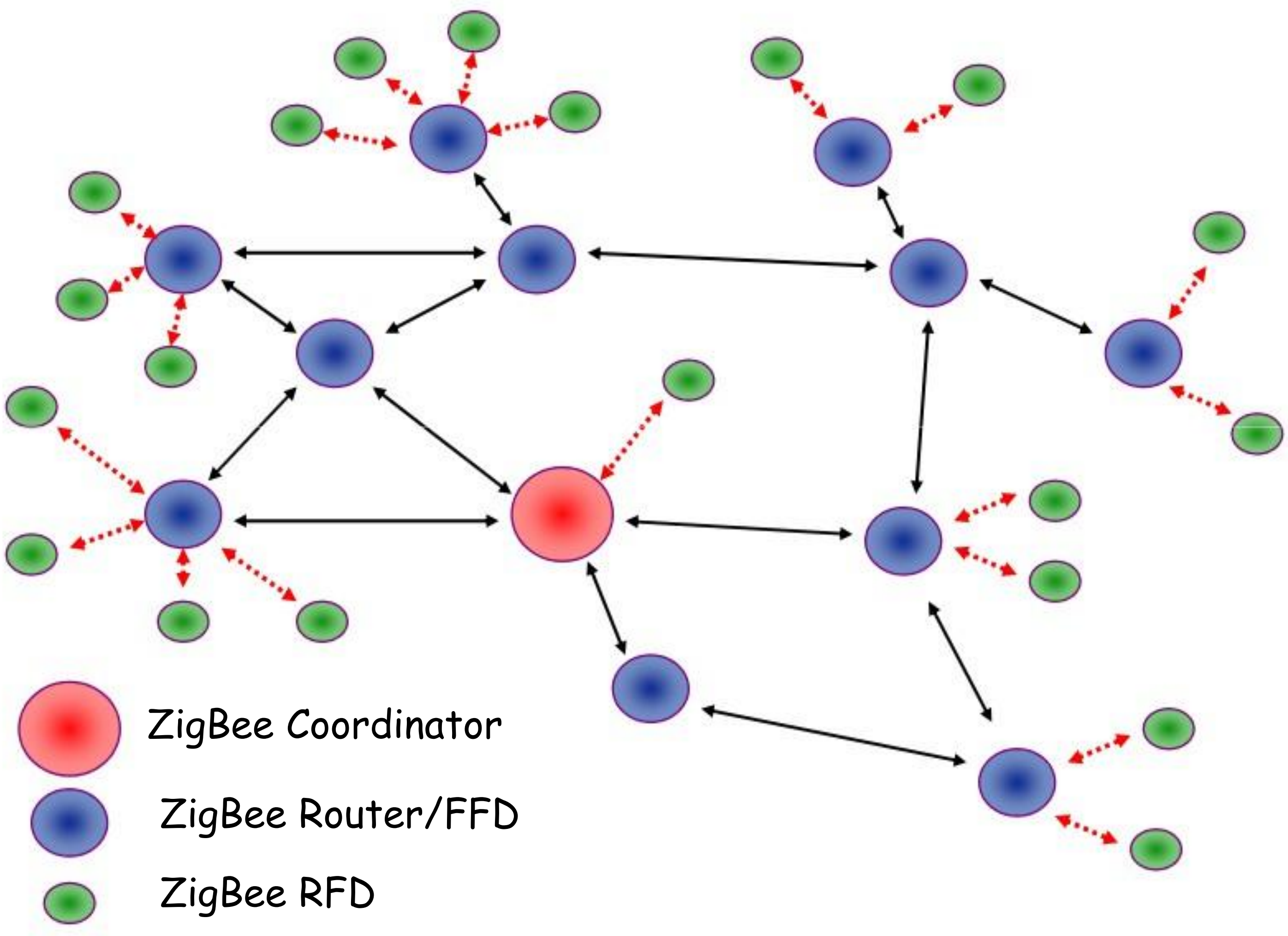
ZigBee®
Control your world

Why NOT 802.11 ?

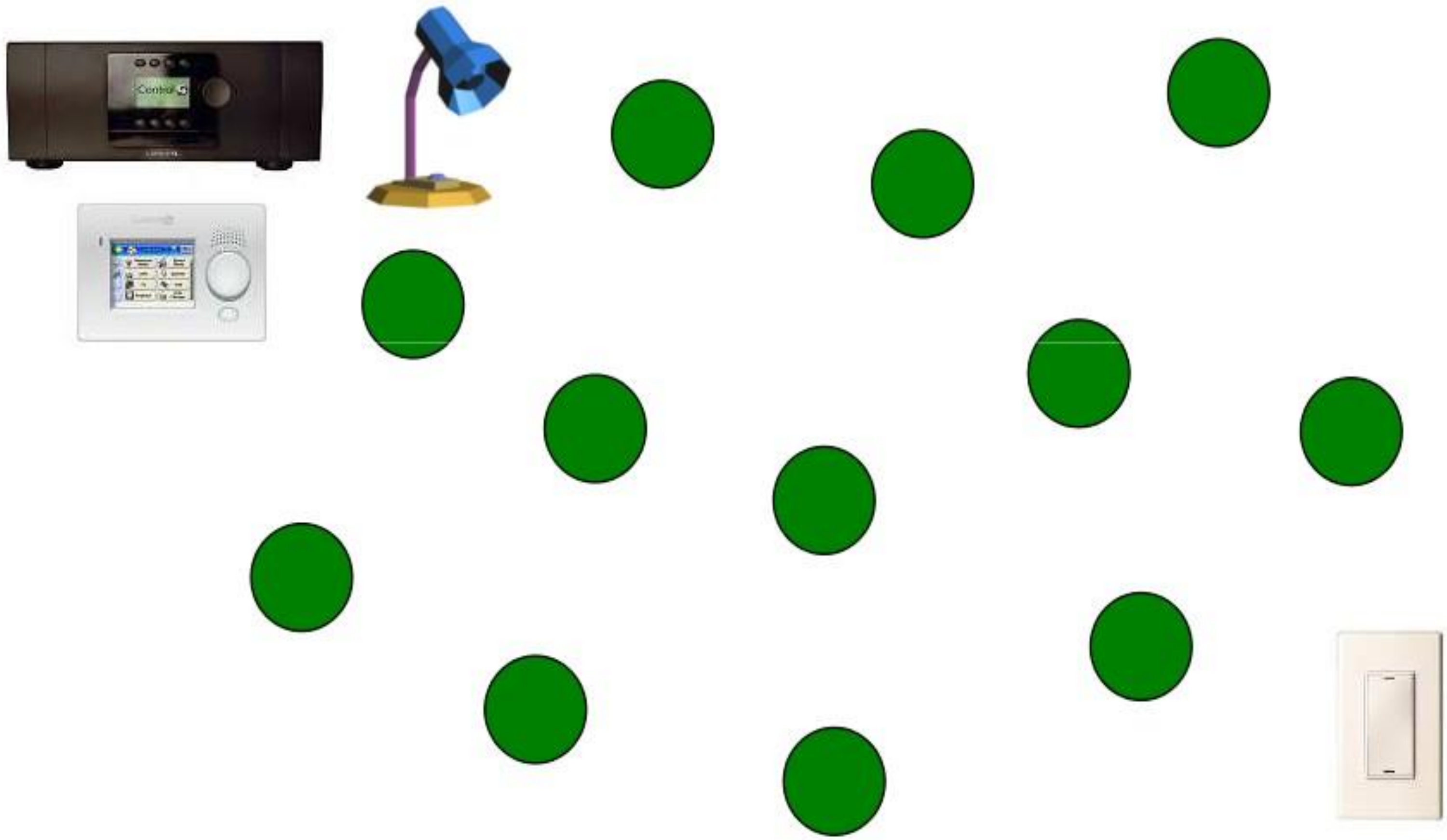
The Cost of Throughput

- High data rates
  - up to 11Mbps for b and
  - up to 54Mbps for g and a)
- Distance up to 300 feet, or more with special antennas
- High power consumption
  - Sources about 1800mA when transceiver is operational.

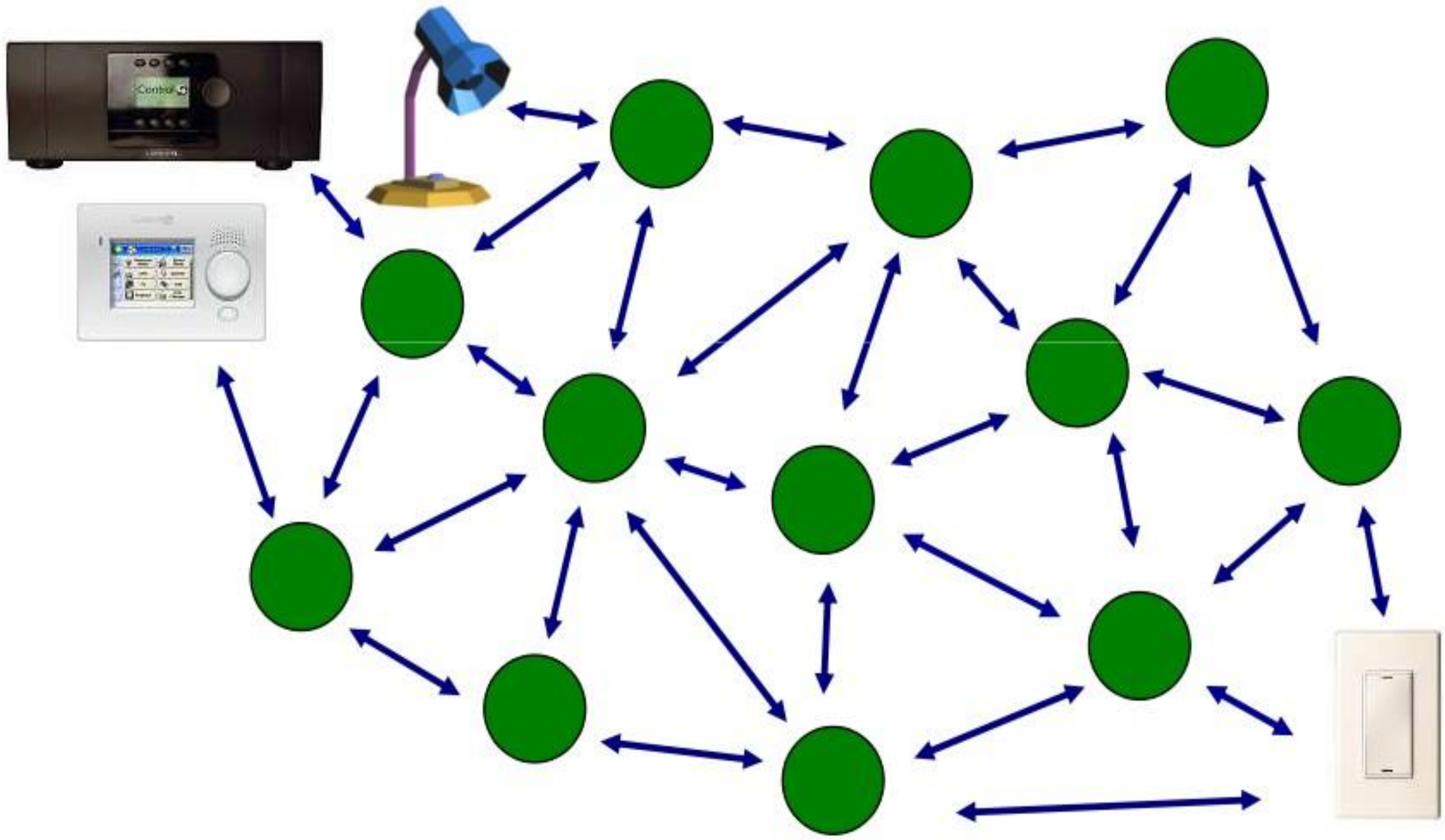
ZigBee as Mesh Networking



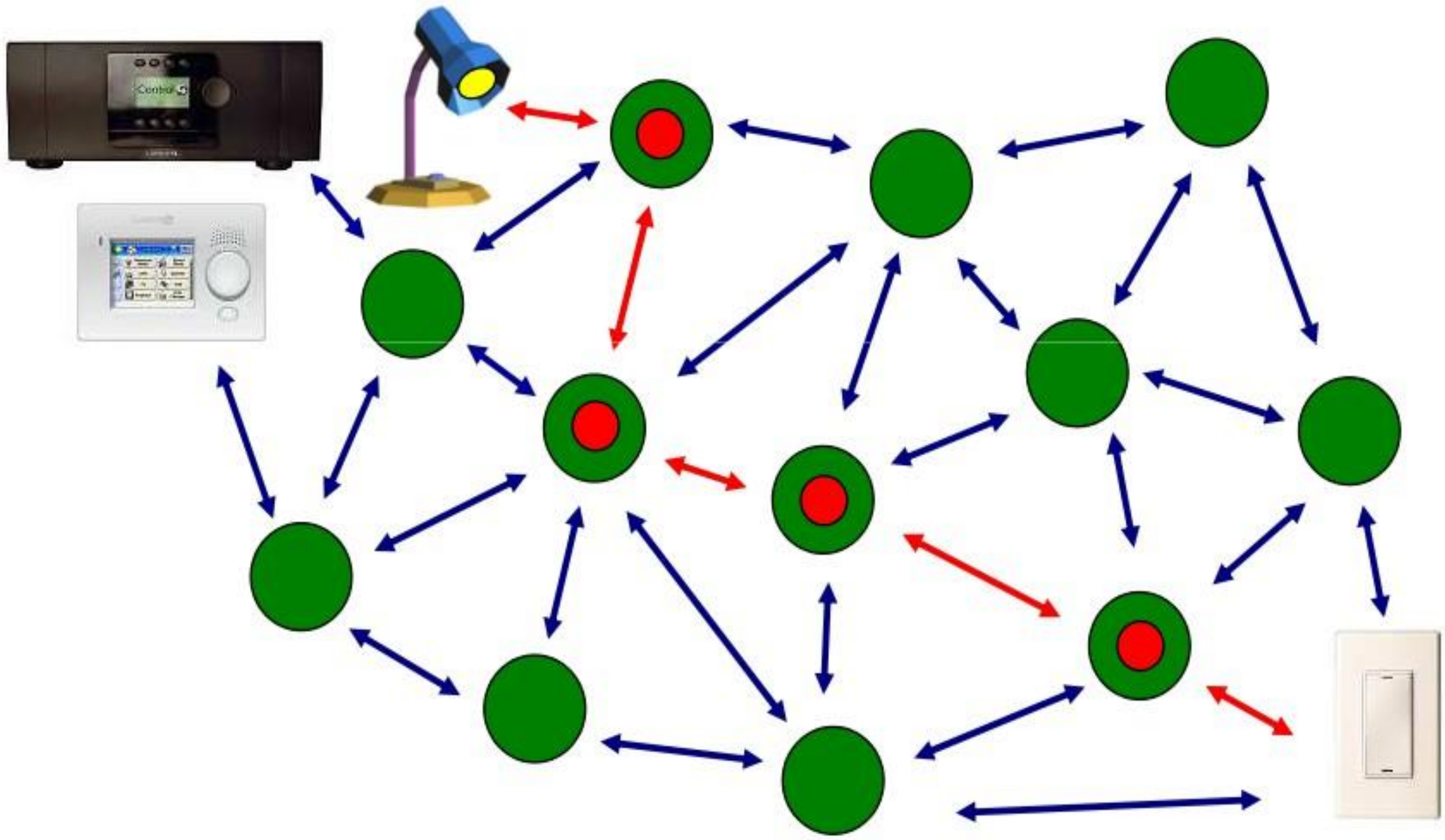
ZigBee Mesh Networking



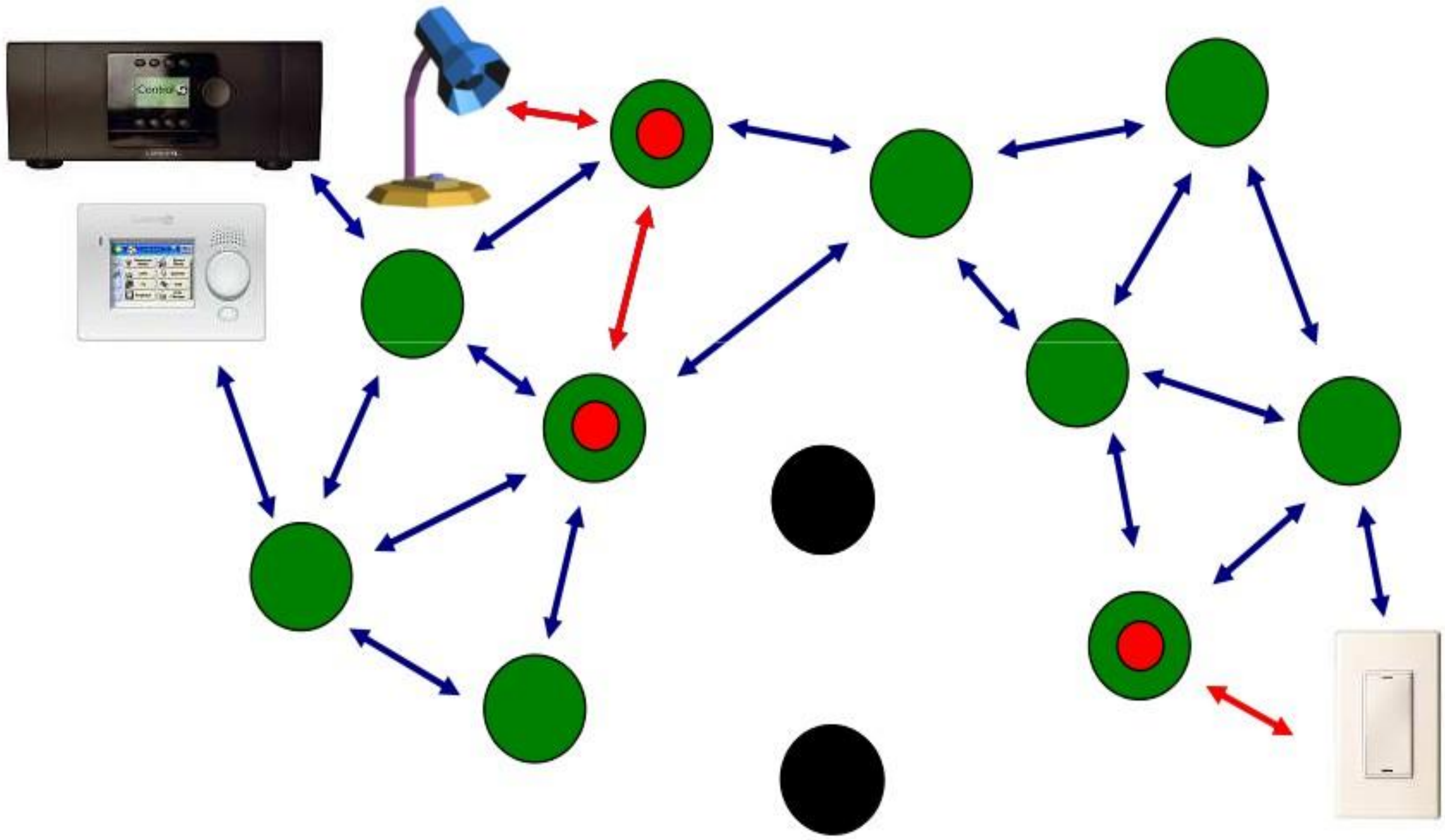
ZigBee Mesh Networking



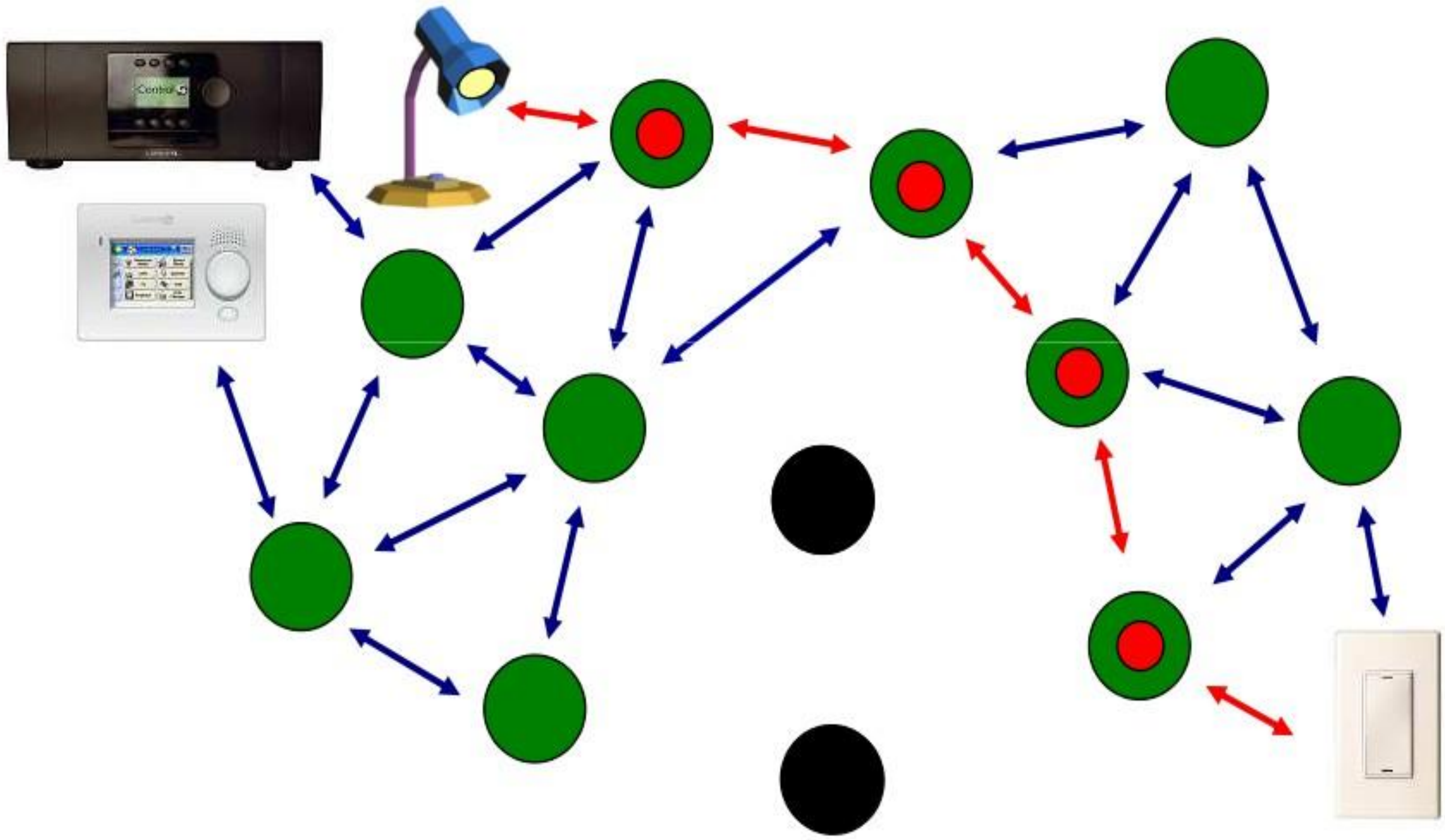
ZigBee Mesh Networking

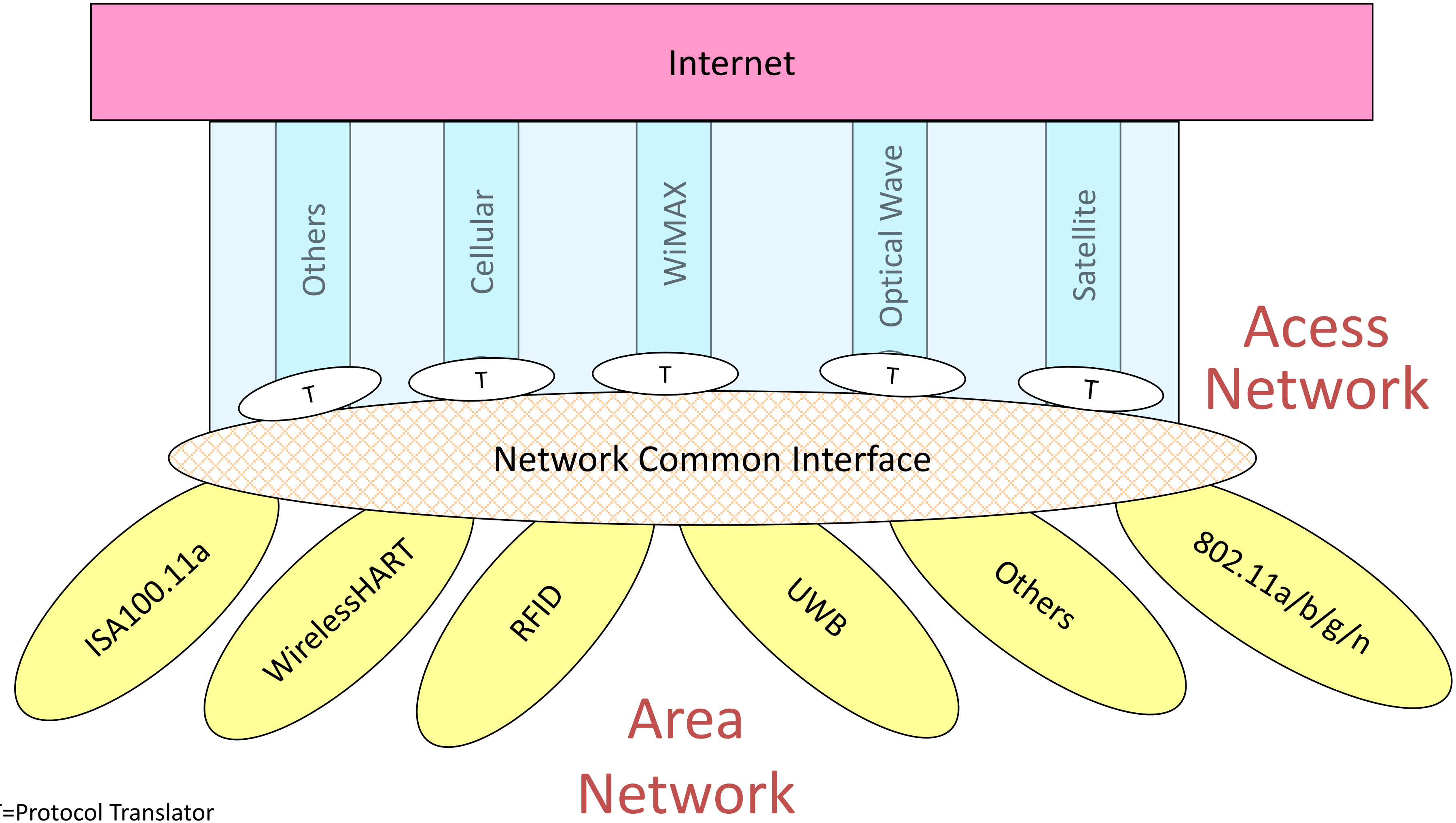


ZigBee Mesh Networking



ZigBee Mesh Networking

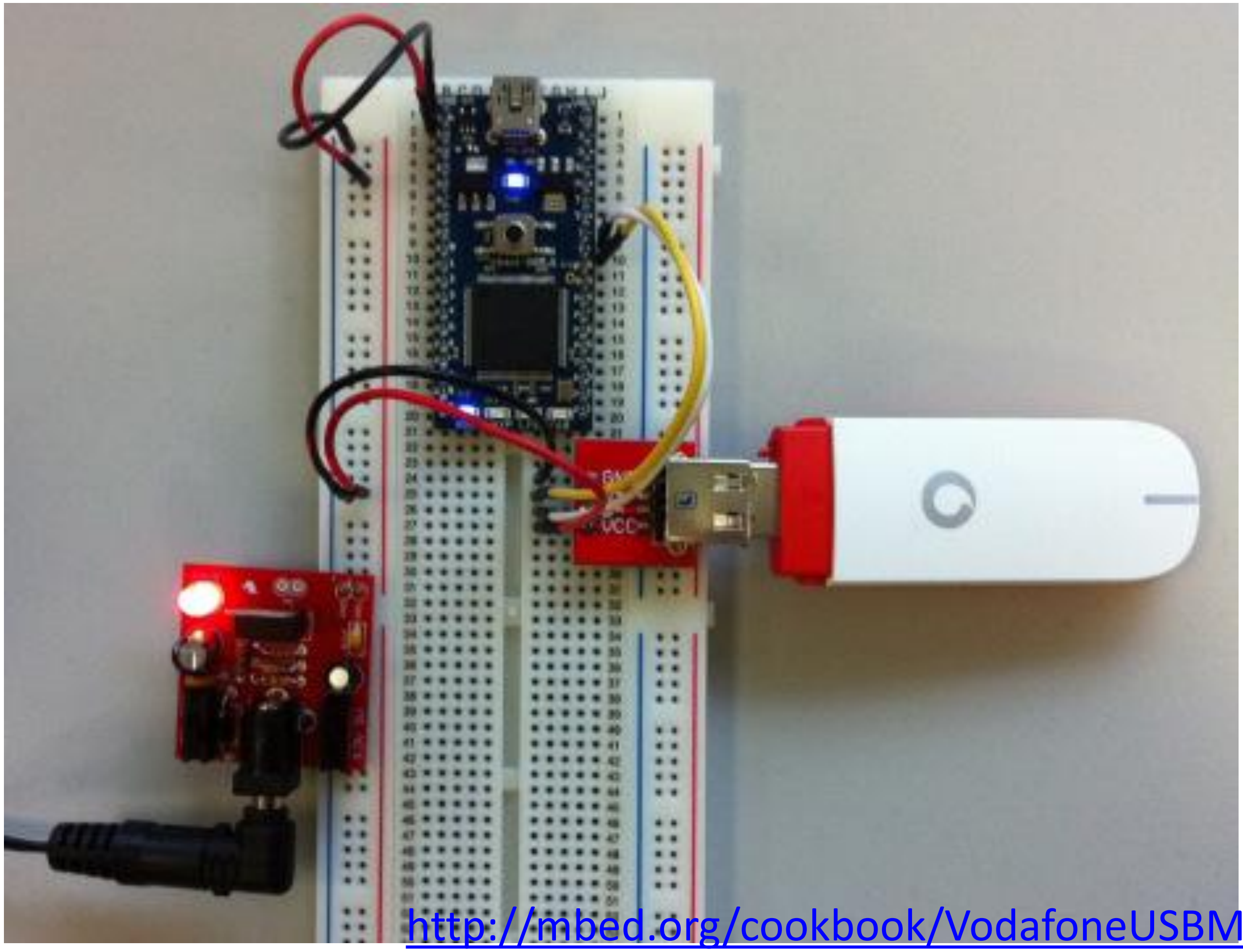




T=Protocol Translator

Libelium

Vodafone USB 3G modem driver from mbed

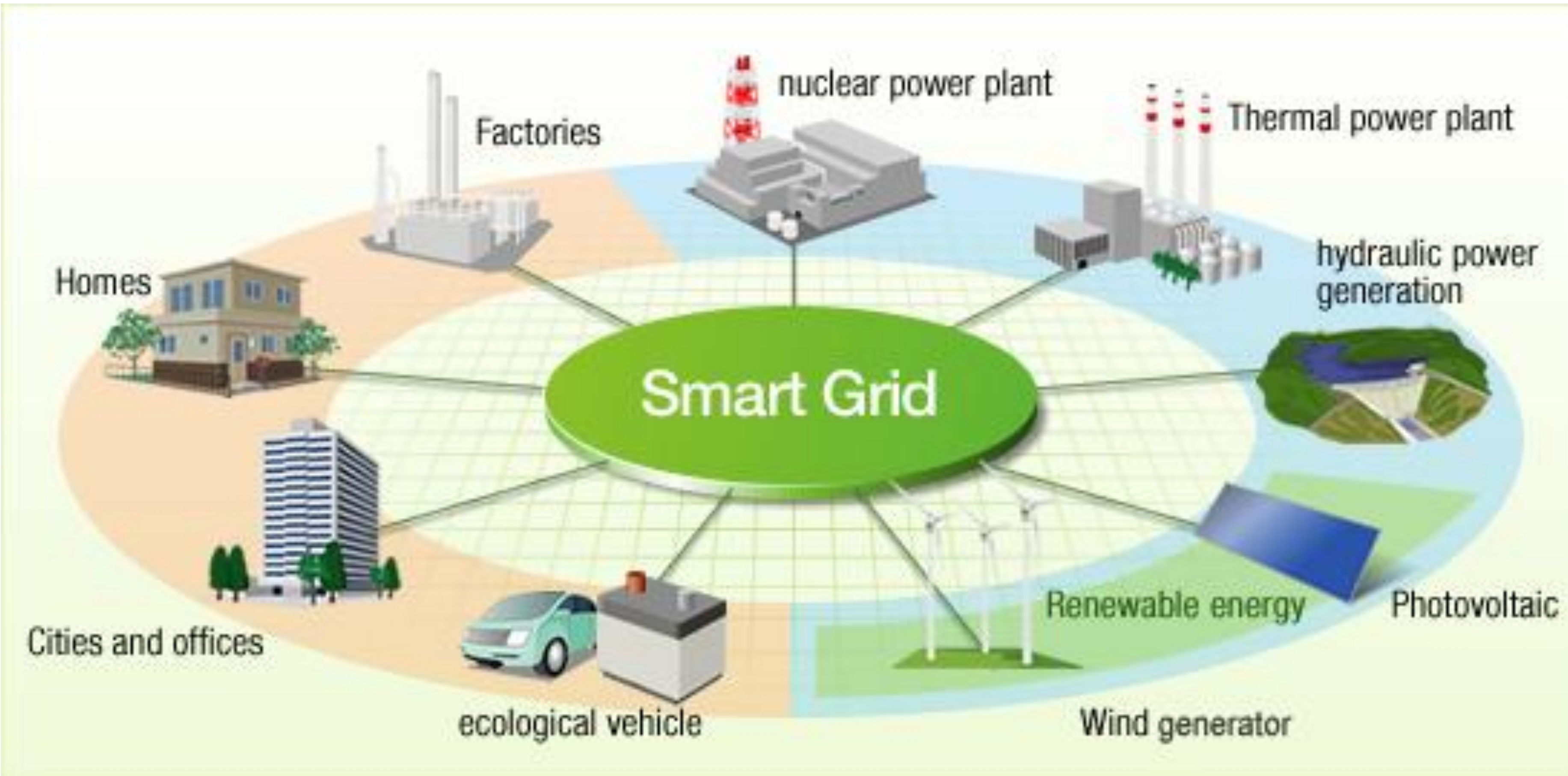


http://mbed.org/cookbook/VodafoneUSBModem

Applications

- Smart Grid
- Electric Vehicle Charging
- Smart City

The Internet of Things: Key Applications and Protocols
By Olivier Hersent, David Boswarthick, Omar Elloumi
John Wiley and Sons Ltd, January 2012

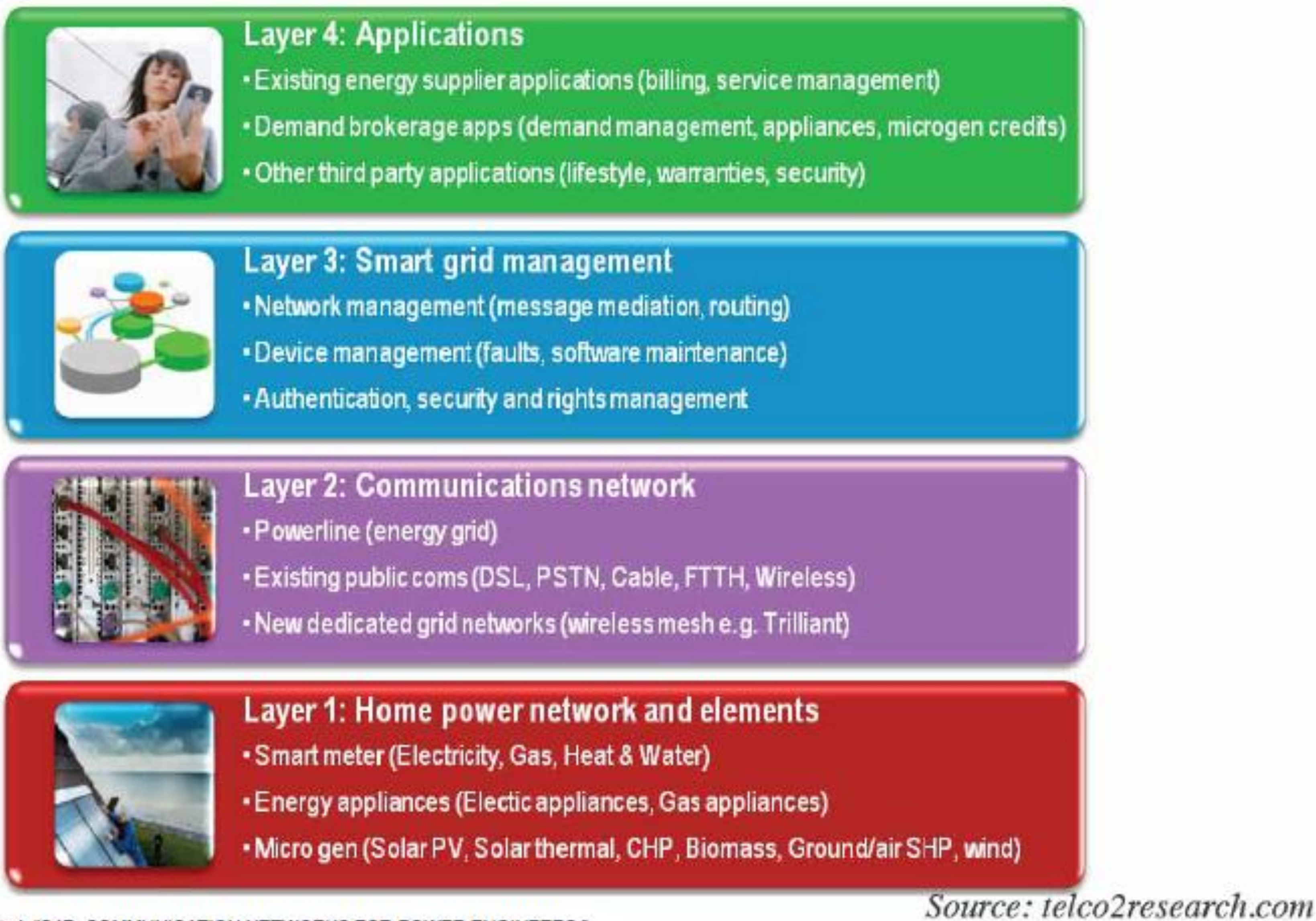

nuclear power plant
Factories
Thermal power plant
Homes
hydraulic power generation
Smart Grid
Renewable energy
Photovoltaic
Cities and offices
ecological vehicle
Wind generator

Jawa Bali Grid

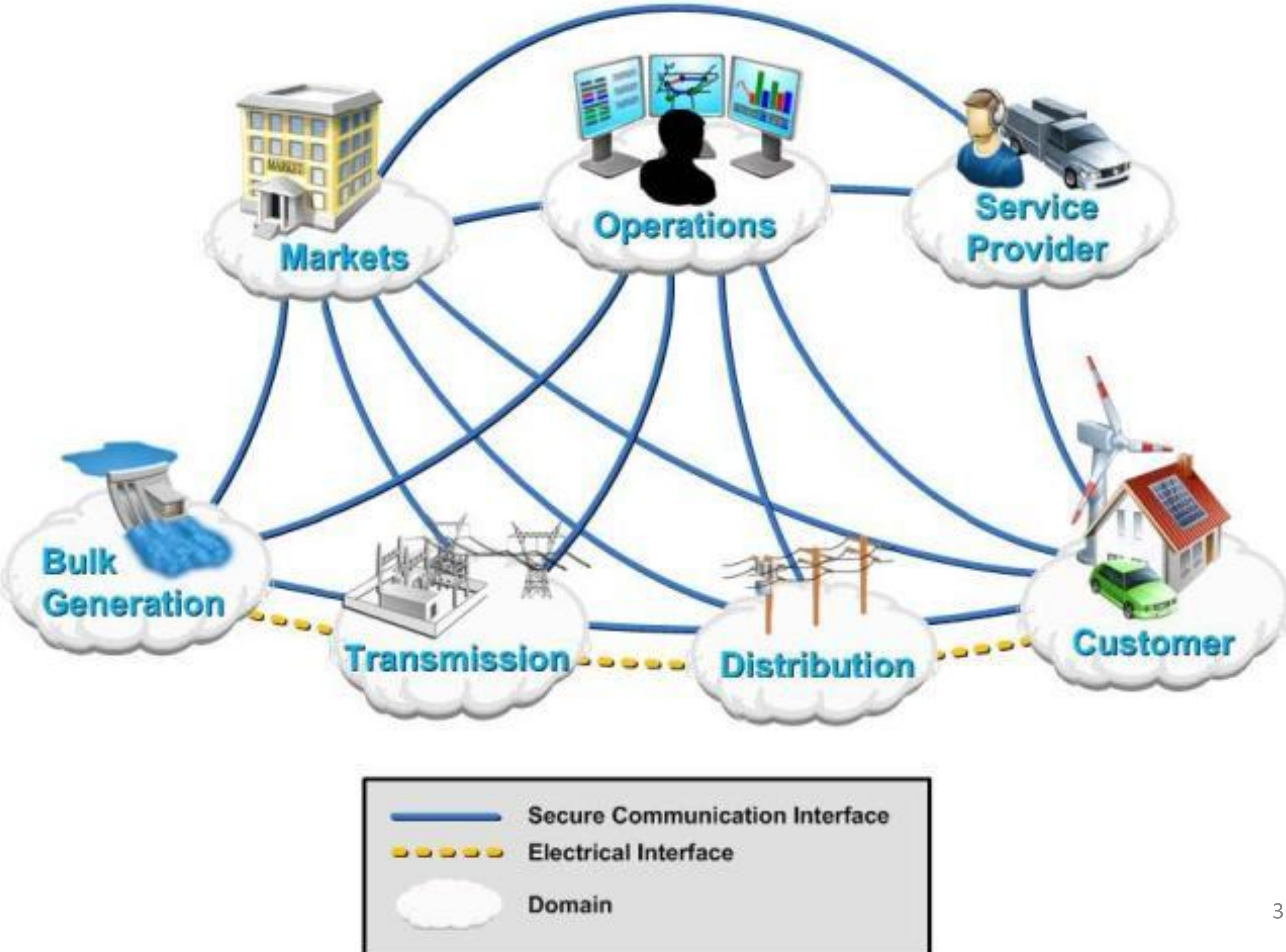
Mission of ICT in Smart Grids

- enable energy efficiency
- keep bills at both ends low
- minimize greenhouse gas emissions
- automatically detect problems and route power around localized outages
- accommodate all types and volumes of energy, including alternative
- make the energy system more resilient to all types of failures

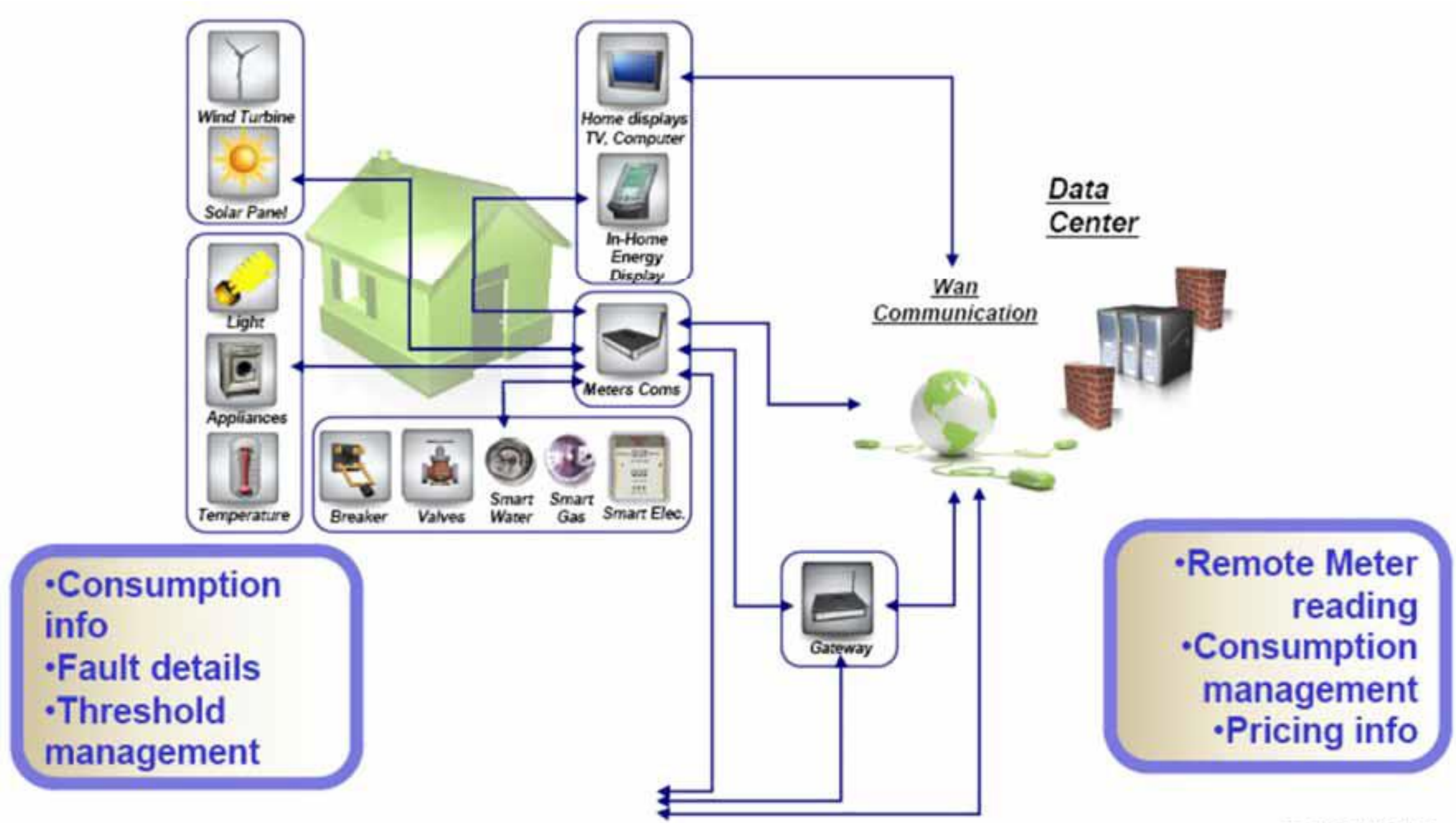
Taxonomy



[© Fabrizio Granelli, et al. "C4P: COMMUNICATION NETWORKS FOR POWER ENGINEERS," Tutorial at SmartGridComms 2011, Brussels, Belgium.]


Markets
Operations
Service
Provider
Bulk
Generation
Transmission
Distribution
Customer
Secure Communication Interface
Electrical Interface
Domain

ETSI M2M Smart Grid Concept



Features of the Smart Grid

1. **Reliability :** **fault detection** and allow **self-healing** of the network without the intervention of technicians

2. **Flexibility in network topology :** **bidirection** energy flows, allowing for distributed generation

Features of the Smart Grid

3. Efficiency :

- including **demand-side management**, for example turning off air conditioners during short-term spikes in electricity price.
- The overall effect is **less redundancy** in transmission and distribution lines, and **greater utilisation** of generators, leading to lower power prices

Features of the Smart Grid

4. Load adjustment

- Using mathematical **prediction** algorithms it is possible to predict how many standby generators need to be used**, to reach a certain failure rate**.
- In the traditional grid, the failure rate can only be reduced at the cost of more standby generators.
- In a smart grid, the **load reduction by even a small portion** of the clients may eliminate the problem.

Features of the Smart Grid

5. Peak curtailment/leveling and time of use pricing

- To reduce demand during the high cost peak usage periods, communications and metering technologies inform smart devices in the home and business when energy demand is high and track how much electricity is used and when it is used.
- It also gives **utility companies the ability to reduce consumption by communicating to devices directly in order to prevent system overloads.**

Features of the Smart Grid

6. Demand response support : allows generators and loads to interact in an automated fashion in real time, coordinating demand to flatten spikes.

7. Platform for advanced services : such as fire monitoring and alarms that can shut off power, make phone calls to emergency services, etc.

Electric Vehicle Charging

Top selling highway-capable electric cars and light utility vehicles produced since 2008 through April 2013			
Model	Market launch	Global sales	Sales through
Nissan Leaf	Dec 2010	> 62,000	Apr 2013
Mitsubishi i MiEV	Jul 2009	~ 25,500	Mar 2013
Tesla Model S	Jun 2012	~ 9,650	Apr 2013
Renault Kangoo Z.E.	Oct 2011	8,760	Apr 2013
Chery QQ3 EV	Mar 2010	5,758	Jan 2013
JAC J3 EV	2010	4,068	Dec 2012
Mitsubishi Minicab MiEV	Dec 2011	3,953	Mar 2013
Renault Fluence Z.E.	2011	3,487	Apr 2013
Renault Zoe	Dec 2012	2,530	Apr 2013
Tesla Roadster	Mar 2008	~ 2,500	Dec 2012
Smart electric drive	2009	> 2,200	Dec 2012
Bolloré Bluecar	Dec 2011	2,151	Apr 2013
BYD e6	May 2010	2,124	Dec 2012

By Country

- **Japan : 28,000, (July 2009-Dec2012)**

Nissan Leaf operating as a taxi in Japan

- **United States : 27,000 (2008-Dec 2012)**

The Tesla Model S in the second best selling all-electric car in the U.S.

By Country

- **China :** 27,800

QQ3 EV city car, with 5,305 units sold, followed by the JAC J3 EV

- **France :** 14,600 (Jan 2010 – Dec 2013)

Toyota Prius PHV with 413 registrations and the Opel Ampera with 190

By Country

- Noway : 10,005

Norway has the largest electric car ownership per capita in the world. Shown a Tesla Roadster, a REVAi and aTh!nk City at a free parking and charging station in Oslo.

By Country

- **Germany :** 7,497 (Jan 2010 - Dec 2012)

The Opel Ampera extended-range electric car was the top selling electric-drive car in Germany in 2012.

- **Netherlands :** 6,275

Two Car2Go Smart electric drives charging at the Herengrachtin Amsterdam.

Needs :

Charging station

Electric Vehicle Charging Station

- Dec 2012 : 50,000 non-residential slow charging points and 2,000 fast charges in the U.S., Europe, Japan and China.

- United States = 5,678 public charging stations across the country with 16,256 public charging points (March 2013)
- Europe: 15,000 charging stations (Nov 2012)
- Norway = 4,029 charging points and 127 quick charging stations (March 2013)
- Japan = 1,381 public quick-charge stations and only around 300 slow chargers (Dec 2012)
- China = 800 public slow charging points, and no fast charging station (Dec 2012)

Charging

Charging time	Power supply	Voltage	Max current
6–8 hours	Single phase - 3,3 kW	230 VAC	16 A
2–3 hours	Three phase - 10 kW	400 VAC	16 A
3–4 hours	Single phase - 7 kW	230 VAC	32 A
1–2 hours	Three phase - 24 kW	400 VAC	32 A
20–30 minutes	Three phase - 43 kW	400 VAC	63 A
20–30 minutes	Direct current - 50 kW	400 - 500 VDC	100-125 A

SMART GRID COMMUNICATION

- Recharging a large battery pack presents a high load on the electrical grid
- can be scheduled for periods of reduced load or reduced electricity costs
- **Vehicle battery can supply** energy to the grid at periods of peak demand
- requires **additional communication** between the grid, charging station, and vehicle electronics

SMART GRID COMMUNICATION

- SAE J2847/1 "**Communication between Plug-in Vehicles and the Utility Grid**". (by Society of Automobile Engineers)
- ISO and IEC are also developing a similar series of standards known as ISO/IEC 15118

J2847: The New “Recommended Practice” for High-Level Communication ZigBee Smart Energy

Smart Charger

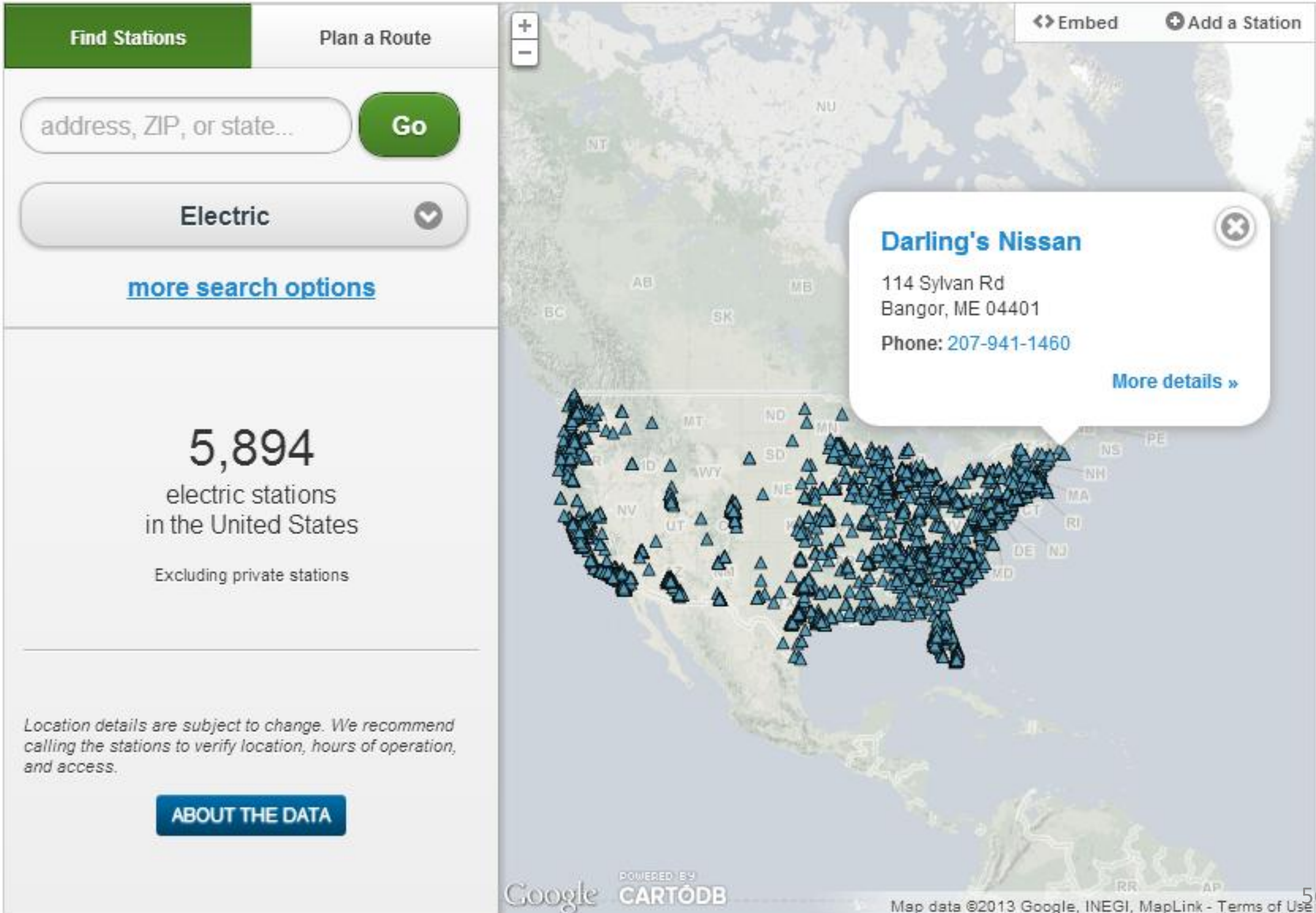
Functionality

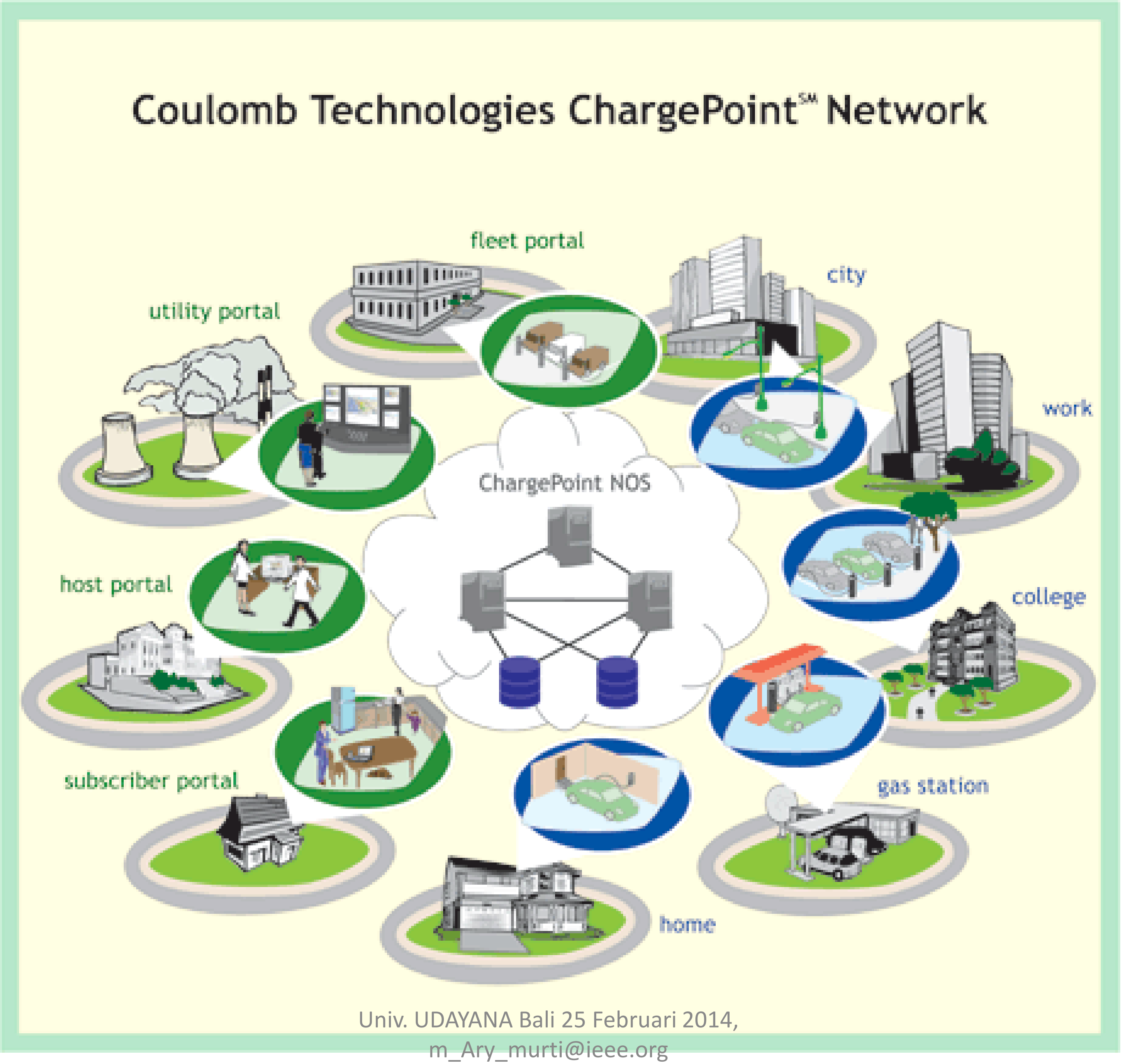
- **Price-Based Charging Strategy:**
  optimal-cost start/stop, time of use, critical peak pricing and real-time pricing
- **Regulation Services:**
  detects grid stress and adjusts charging rate.
- **Grid Events:**
  monitor and stop charging if a "grid event" occurs.
- **Grid Services:**
  utility directed reduction or increase in allowable charge rates.
- **Charge Now:**
  override all other charging methods.

Communication Strategy

- **Premises/Charging Station:**
  Supported: ZigBee and RS-232;
  Optional: USB,Ethernet, 802.11
- **Battery Charger:**
  Supported: CAN-bus; Optional: USB, RS-232, RS-485, Ethernet, 802.11 and PWM.
- **Battery Management System:**
  Supported: CAN-bus; Optional: USB, RS-232, RS-485, Ethernet and 802.11.
- **Display / Operator Interface:**
  I^2C, SPI, RS-485, CAN-bus, ZigBee.

Electric Vehicle Charging Station Locations




Coulomb Technologies ChargePoint℠ Network
fleet portal
city
utility portal
work
ChargePoint NOS
host portal
college
subscriber portal
gas station
home

Electric Vehicle Charging - IoT

Habit

- Route
- Drive
- Time

Vahicle info

- Type
- SoD/C
- Location
- Driver : ID, CC

- Charging Scheduled
- Time
- Location
- Power Demand

Smart City

Smart Port

Speed Up Traffic with M2M

Improving logistics in the **Port of Hamburg**

- **second largest port in Europe**, the size of 7,000 soccer fields and welcomes up to **40,000 trucks** a day, each carrying six or twelve containers.
- **Physical expansion was not an option**, since the city of Hamburg surrounds the port.
- The port's road infrastructure – over 80 miles (130 kilometers) – is restricted, and offers very limited ability to expand.
- What was **needed was an efficient traffic management system**.

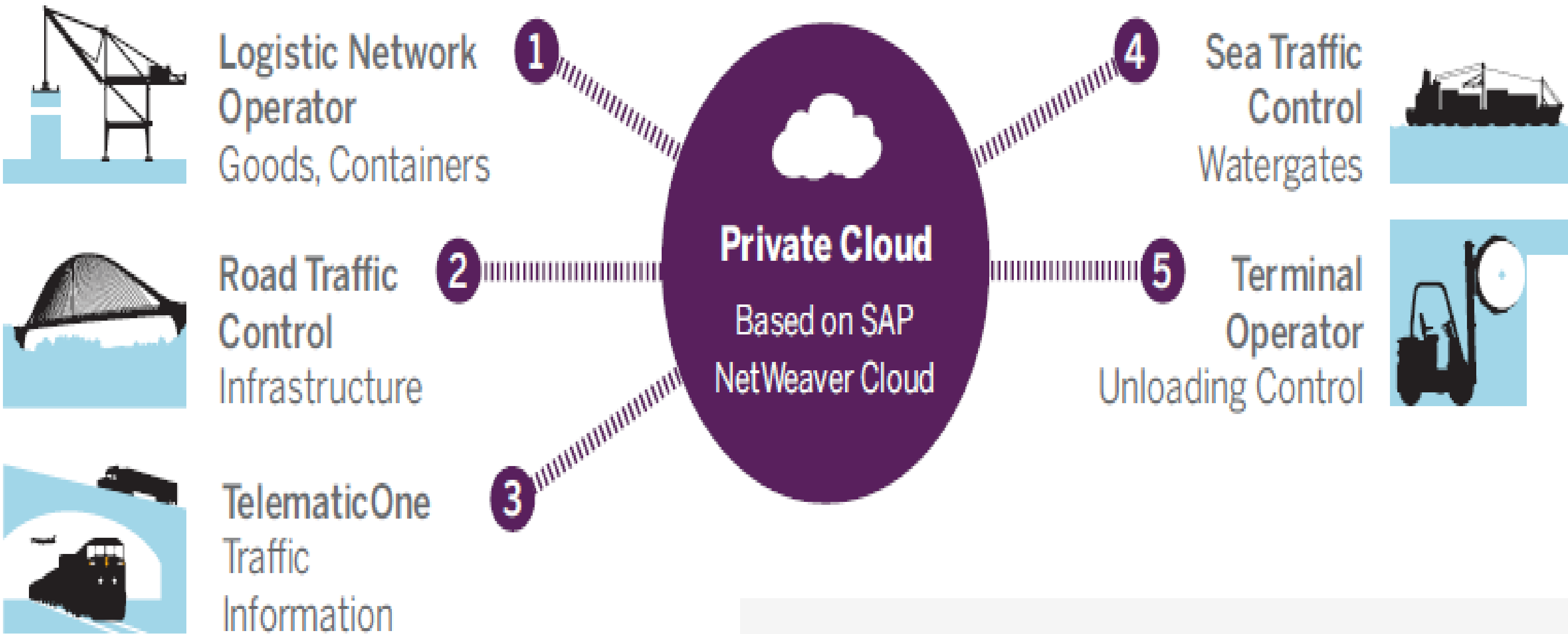
Speed Up Traffic with M2M

Improving logistics in the Port of Hamburg

- partnered with **SAP and Deutsche Telekom** in its **Smart Port Logistics pilot project**. During an initial three-month trial, **30 trucks** were fitted with tablets connected to the prototype Smart Port Logistics System.
- The system receives and integrates three sources of information in real time:

1. **traffic information**;
2. **infrastructure information**, including parking and the status of tunnels and moving bridges;
3. **location of participating trucks** approaching or within the Port of Hamburg.

Smart Port Logistics



1 Container status: order assignment, packaging rate, assigned staffnal

2 Infrastructure information: disruptions in operating procedure, weather impacts, security

3 Location data: freight vehicle location, velocity, standstill time

4 Access control: incoming ships, delays, permission to dock

5 Unloading surveillance: docking, shipment date and location

Drivers receive automated, personalized text-based messages with relevant traffic information and details about available parking, allowing them **to take optimal routes and avoid long waits**. As an **added benefit**, participating freight forwarding companies are also **able to track** their transport orders in real time.

Waiting times for trucks will **decrease**, and there will be **fewer traffic jams** within the port area and on the approach roads.

IEEE INDONESIA SECTION

IEEE COMMUNICATIONS SOCIETY Indonesia Chapter

Terimakasih

Telkom University