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Control your world

ZigBee Overview
Wireless Sensor Networking

May 18, 2011

Bob Heile, Chairman
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ZigBee Alliance
European ZigBee Developers´ Conference

5th European ZigBee Developers' Conference
May 18 - 19, 2011 Munich, Germany

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ZigBee Alliance Overview

- Organized as an independent, neutral, nonprofit corporation in 2002 for WSN Standards Development
- Open and global
  - Anyone can join and participate
  - Over 400 companies worldwide are members
  - Membership is global [approx. 40% Americas, 30% EMEA, 30% Asia]
- Activities include:
  - Open Standards for wireless sensor and control
  - Product Certification and compliance programs
  - Branding, market development and user education
- ZigBee is a key enabler for the Internet of Things

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ZigBee Application Areas

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Security
HVAC
AMR
Lighting Control
Access Control

BUILDING AUTOMATION

Demand Response
Net Metering
AMI, SCADA

ENERGY MGT. & EFFICIENCY

CONSUMER ELECTRONICS

TV
VCR
DVD/CD
Universal Remotes

Chronic disease
Elderly care
Fitness
Wellness

PERSONAL HEALTH CARE

PC & PERIPHERALS

Mouse
Keyboard
Joystick
Touchpad

TELECOM SERVICES

M-commerce
Local gaming
Local chatting
Info Services

Retail Store Mgmt
Shopping
Supply Chain
Environmental
Energy Mgmt

INDUSTRIAL CONTROL

HOME AUTOMATION

Security
Safety
HVAC
Lighting Control
Access Control
Irrigation

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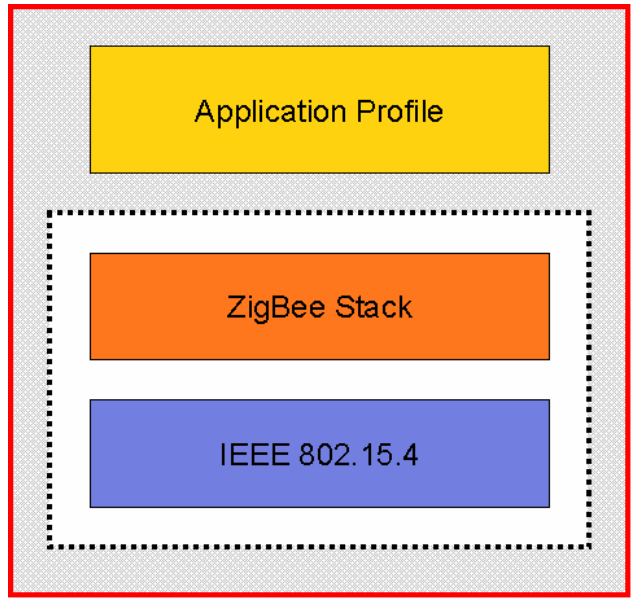
ZigBee Product Interoperability

ZigBee Certified Product



- Products with same application profiles interoperate End-to-End
- More than 100 certified products!

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ZigBee Certification Program

- Rigorous testing plans established to ensure conformance to the standard
- Three approved testing labs to afford competition and choice for vendors
- Golden-unit and test harness approach used to support real product interoperability
- Test houses adhere to internationally-accepted standards (IEC, etc.) to support global market adoption and conformance
- Process of change-control board allows for continuous improvement to test plan and specification integrity

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Check for the Certified ZigBee Logo!

Only certified ZigBee products feature the ZigBee certified logo either on the box and/or on the product!

Certified ZigBee Smart Energy product

Certified ZigBee Home Automation product

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ZigBee Technology-Performance

- **Excellent in-building coverage**
  - Inherently robust radio link
  - Mesh networking
  - Acknowledge oriented protocol
- **Coexistence**
  - Many multi-radio products
  - Multi-radio deployments
- **Tolerance to interference**
  - CES – ZigBee networks perform flawlessly
  - Large scale hospitality and hospital deployments
- **Proven scalability**
  - MGM City Center Aria Hotel with 85,000+ radios in 4200 separate ZigBee networks concurrently to 3 independent WiFi networks
  - University of Miami Hospital, 4.2 million square feet, 27 buildings, 121 floors with 16,000 assets

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ZigBee Green Power

A world with less batteries

- Energy consumption and battery operation are two of the most critical challenges for wireless sensor networking
- Combining energy harvesting and wireless communications allows for maintenance free control and monitoring
- There are huge market opportunities for batteryless, wireless solutions, in particular in the building/office/hotel segments

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ZigBee has become "Mainstream Technology"

"Our research with more than **600 companies** has found that the **ZigBee market has "crossed the chasm"** and is now a **mainstream technology**. This is further illustrated by several new ZigBee entrants such as BlueRadios, CEL, and SyChip (Murata), as well wireless sensor network pioneer Dust Networks. We have identified **over 350 companies that offer, or are developing, products** based on IEEE802.15.4 and ZigBee. These companies have combined annual **revenues of more than $1 trillion.** In fact, despite a challenging economy,15.4/ZigBee unit sales have increased at an average of 62% per year since 2007."

- Market Dynamics Report, electronics publications

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ZigBee Standards & Market Adoption

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Current ZigBee Applications

- ZigBee Home Automation (ZHA)
- ZigBee Smart Energy (ZSE)
- ZigBee Building Automation (CBA)
- ZigBee Telecom Services (ZTS)
- ZigBee Health Care (ZHC)
- ZigBee Remote Control (ZRC)
- ZigBee Input Device (ZID)
- ZigBee 3D Sync (Z3D)
- ZigBee Retail Services (ZRS)

+Future profiles proposed by member companies…

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Drivers for the Smart Grid

Achieving Changes in…

- Generation
  - Renewables
  - Variability
  - Storage
  - Distributed resources
- Load
  - Reduce peaking
  - Energy management
  - Plug in vehicles
- Reliability and security
  - Improved measurement and control
  - Risk-based methodology

Requires…

- Automated management, operation, control
- 2-way flow of power and information
- Interoperability at many levels
- Standards

Source: George Arnold, NIST

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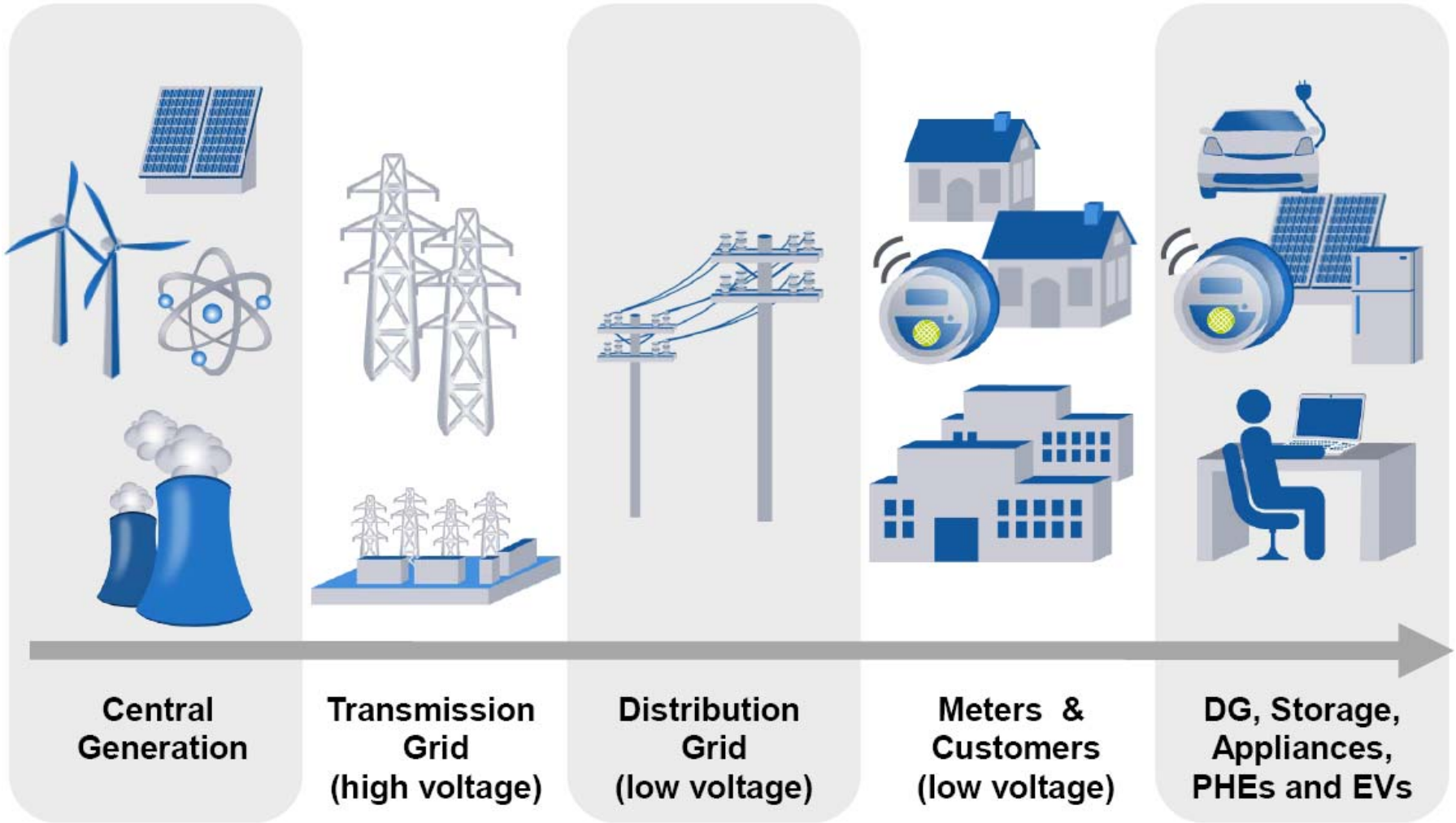
Smart Grid Infrastructure Ecosystem



Picture courtesy of Grid Net

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Broad Categories of Smart Grid Standardization

- Devices used in the Smart Grid
- Physical Interfaces

- Information and data structures
- Communications

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Some Groups engaged in Smart Grid Standards

- European Standards Organizations - CEN, CENELEC, ETSI
- Global Organizations- ITU, IEC, ISO/IEC JTC1
- MIIT, CAS in China
- METI, MIC, ARIB in Japan
- IEEE: P2030 Smartgrid Guide and IEEE802.15.4g Smart Utility Networks and a whole host of other activities
- IETF
- Society of Automotive Engineers (SAE) on plug-in vehicle communications and the Association of Home Appliance Manufacturers (AHAM) for White Goods
- UCA OpenSG
- Industry Alliances like ZigBee

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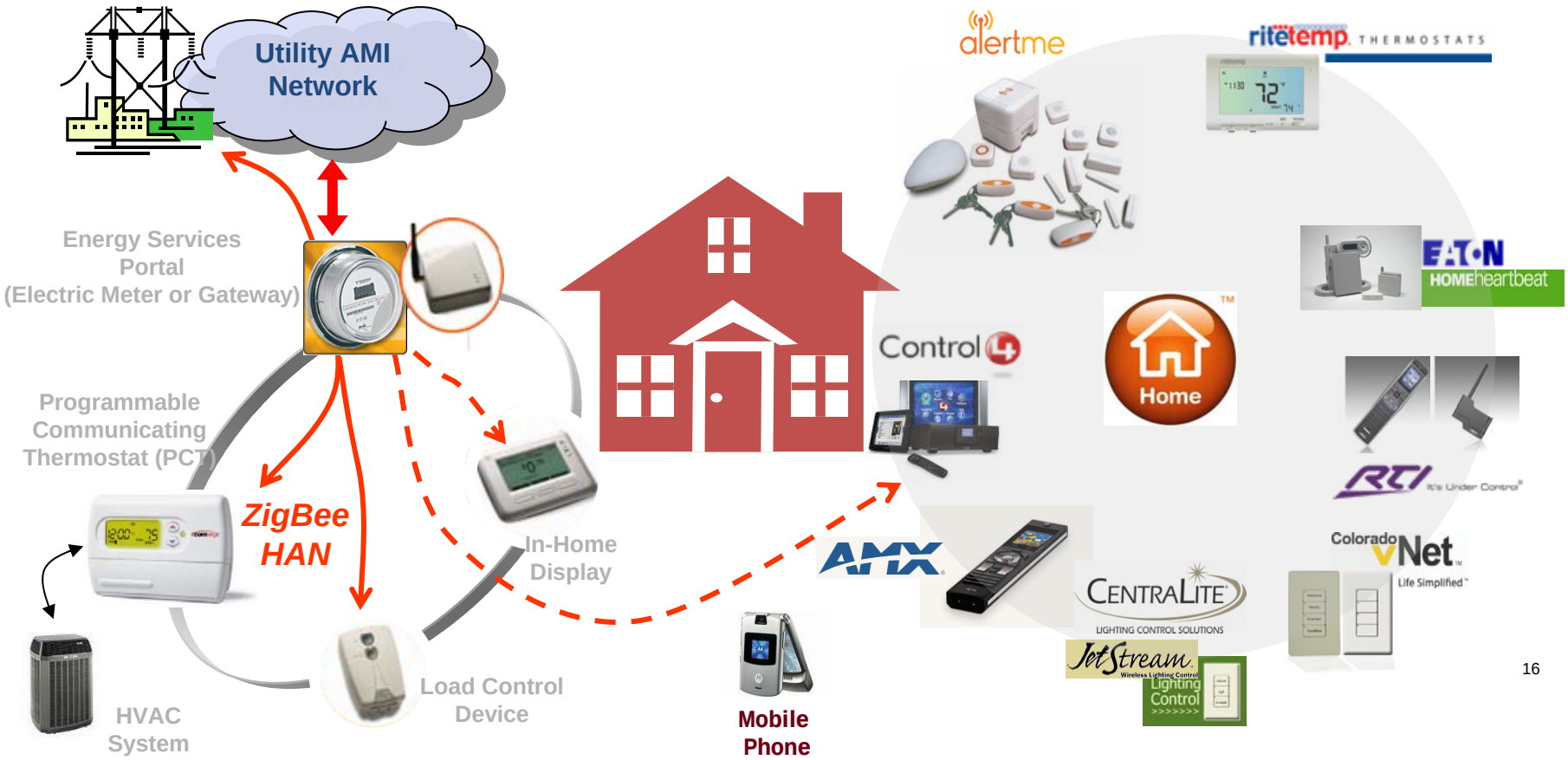
Smart Energy & Home Automation

Urgent demand for Smart Energy + compatibility with mainstream Home Automation systems enables customer choice



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ZigBee Smart Energy Standard

- Supported Features Include:
  - Basic metering [measurements, historical info, etc]
  - Demand Response (DR) and Load Control
  - Pricing [multiple units & currencies, price tiers, etc.]
  - Text messages
  - Device support for Programmable Communicating Thermostats (PCTs), Load Controllers, Energy Management Systems, In Home Displays (IHDs), etc.
  - Security to allow consumer only, utility only, or shared networks
  - Support for water and gas

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Goal is HAN Side Energy Management

- Optimize Energy Consumption
- Avoid load peaks

Through—

- Customer settings
- Time of Use pricing
- Green Energy availability

Extra Home Automation Services Enabled:

- Remote Control
- Remote Assistance
- Appliance customization
  - Cycle downloads
  - Configuration Upgrades

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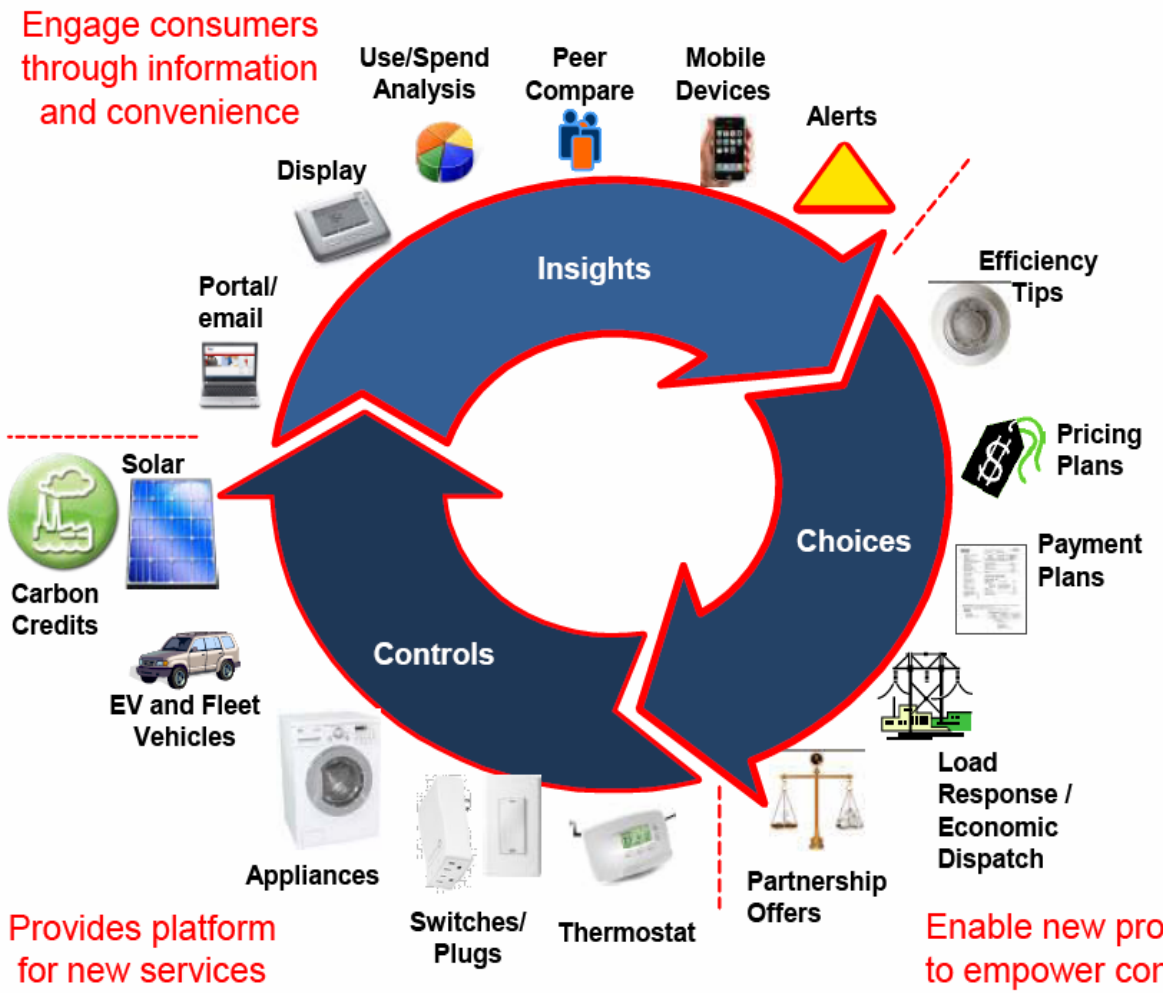
Achieving Consumer Participation is Key



Smart Energy enables a new experience that transforms the way customers use and value electricity

Source: Reliant Energy

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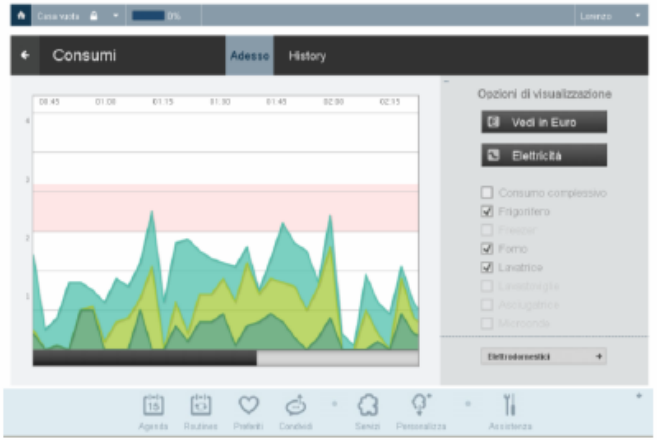
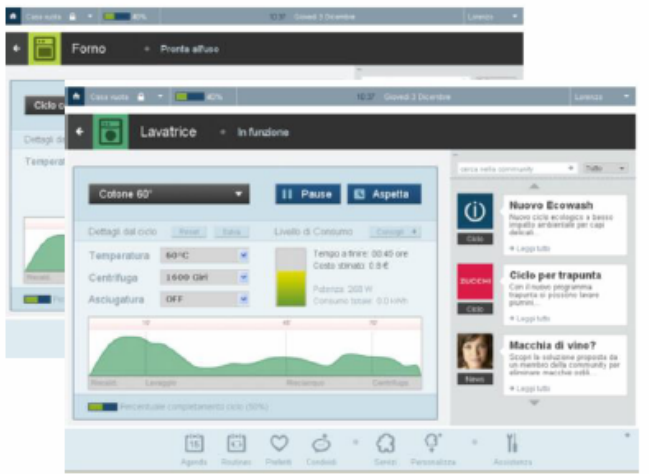
Energy Awareness Drives Behavior

Customer energy awareness alone could reduce up to 15% energy consumption
(Darby – Oxford university)





INDESIT company

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Major Deployments Underway

- Install of 40+ million meters in USA continues at full speed with additional pilots/tests being carried out all around the country
- Texas market hitting major milestones (millions of meters installed)
- State of Victoria in Australia upgrading all its meters with ~50% completed to date
- British Gas planning to use ZigBee Smart Energy for its multi-million meter roll-out in the UK

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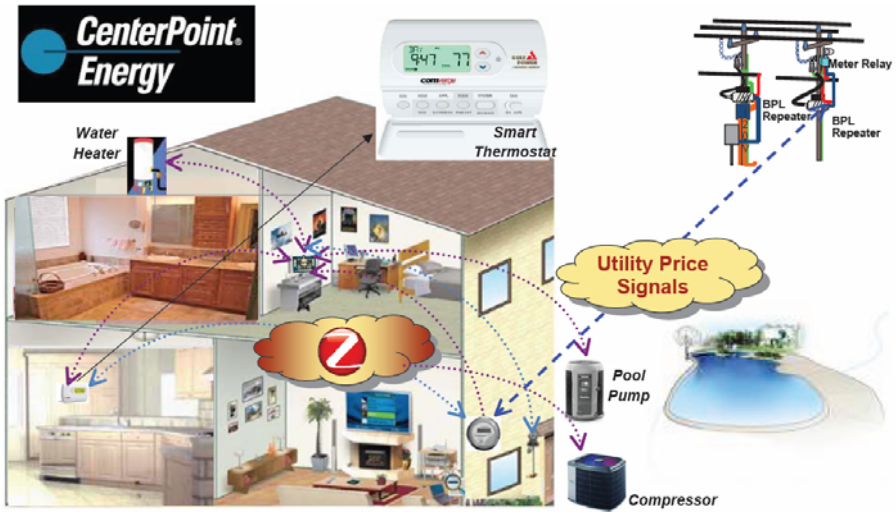
The Texas Environment

- Texas is a leading market in the rollout of Smart Metering with more than 6 million residents accessing information and interacting with the grid,
- Texas represents combination of utility, state portal, AMI providers, vendors and energy retailers



- Operational use cases being evaluated include commissioning, text messages, price events, etc. using ZigBee SE Certified HAN Devices containing actual production security certificates

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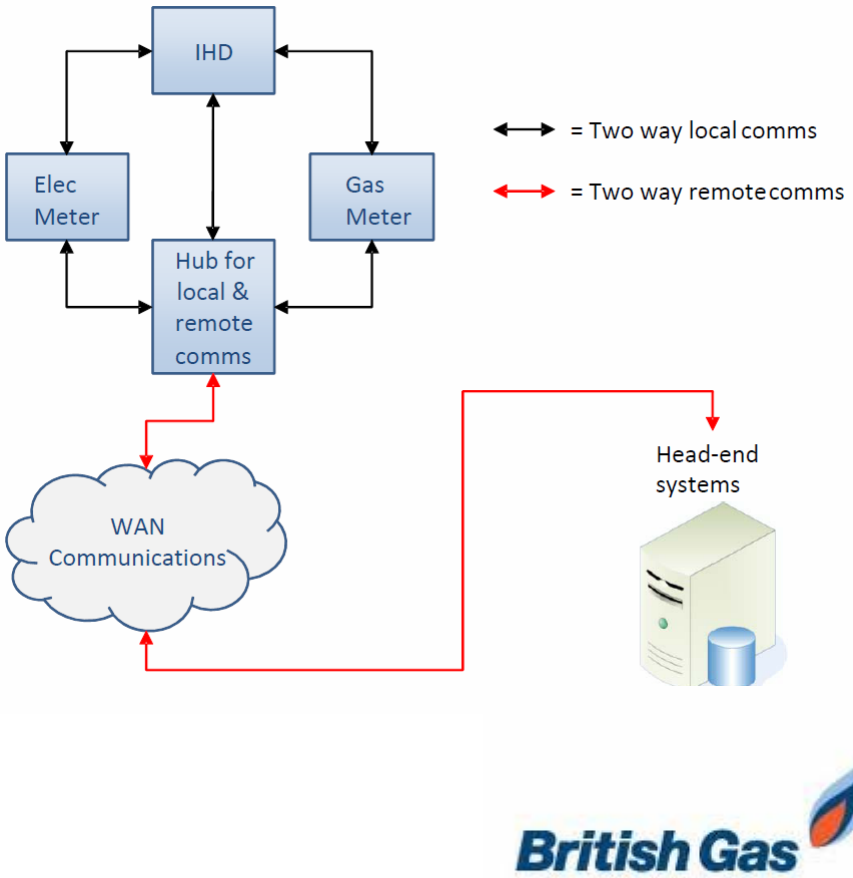
British Gas Deployment



- British Gas plans to install up to 2 million ZigBee Smart Energy equipped gas and electric smart meters
- The in-home system architecture has 4 main components:
  1. Gas Meter
  2. Electricity Meter
  3. Telecommunications Hub (comms hub)
  4. In home display unit (IHD)
- Business partners include: mobile operator Vodafone; billing systems SAP; software and communications firms, OSIsoft and Trilliant; and global smart meter manufacturer, Landis+Gyr

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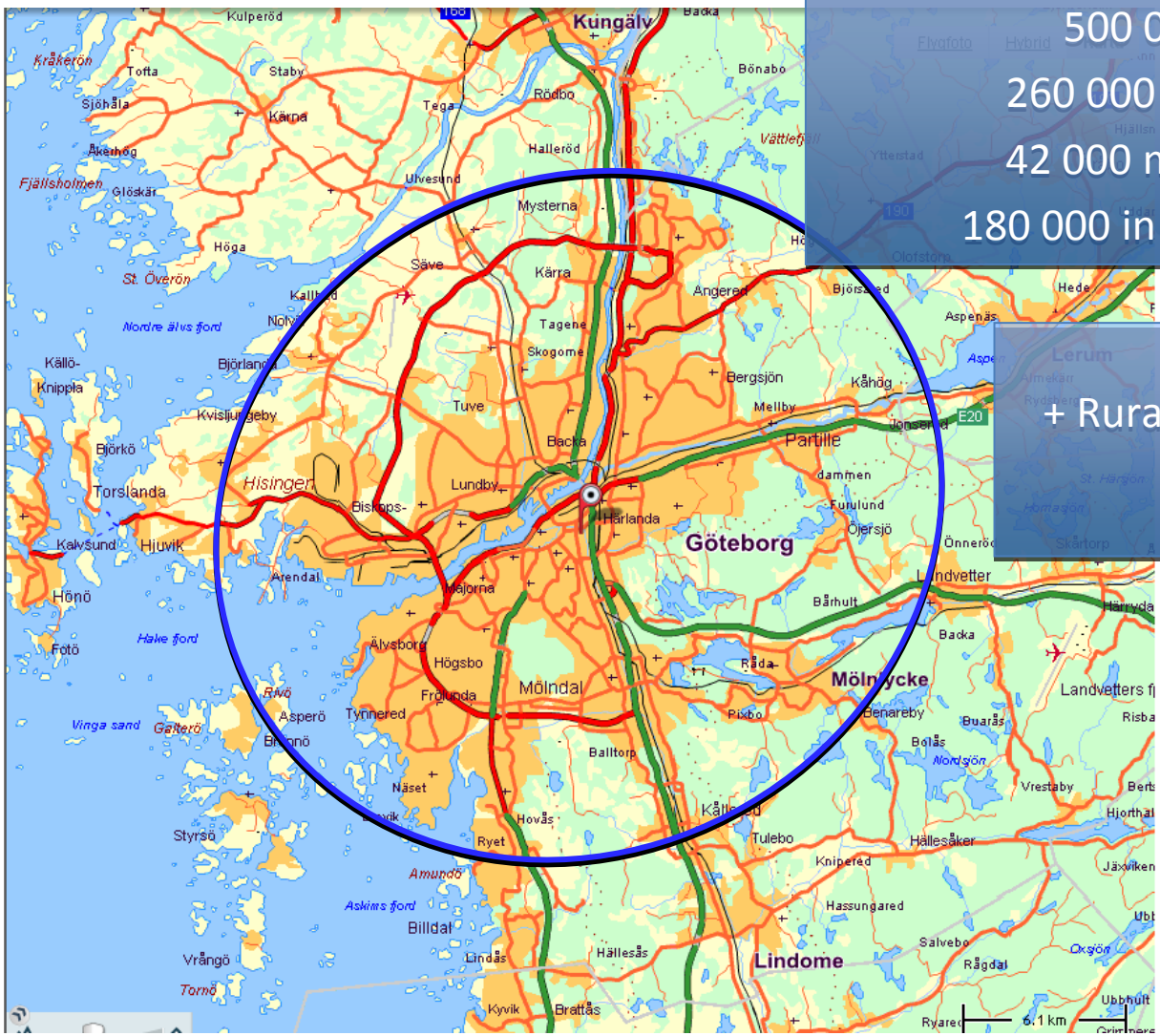
Göteborg: ”The ZigBee City”

500 000 Citizens
260 000 meters < 63 A
42 000 meters indoors
180 000 in metering-rooms

+ Rural area including 15 000 metering points



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- **Immediate Focus:**
  - Power Quality and Failure alarms
    - Smart Grid foundation
  - Multimetering – Gas, District Heating, Water
  - Advanced Meter Management - implementation of processes
- **New Services (among others)**
  - Individual metering (heat, water)
  - Security Alarm
  - ZigBee locks
  - Control of street lamps

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Recent ZSE Enhancements

- What's in the most recent update?
  - Standardized Over-the-Air Bootloader
  - Enhanced Price Cluster Support
    - Block tariffs, in which price changes are triggered by accumulated consumption, rather than time of day
    - Price acknowledgements, application-level messages acknowledging receipt of a price update by a device
  - Tunneling Support
    - Tunneling manufacturer-specific messages between back-office systems and in-home devices, delivered through an ESI
    - Tunneling other standards-based protocols, such as ANSI C12.18 or DLMS COSEM
  - Meter Swap-Out Support
    - Allow replacement of the Trust Center, which manages device provisioning
    - Allow devices on the HAN to provision to new Trust Center
  - Prepayment
    - Credit monitoring
    - Service connect/disconnect notification

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Future ZSE Enhancements

- **Enhanced Network/Communications options**
  - Integration with ZigBee IP stack
  - Support for multiple communications protocols

- **Added Support for EVs, Distributed Generation, etc.**
- **Input through partnerships with Global SDOs and Industry Groups**
- **Other Improvements based on continuing feedback and market needs**

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The Path to Smart Cars

- Society of Automotive Engineers (SAE) and ZigBee working to use ZigBee Smart Energy to define how EVs and the grid interact to provide:
  - Essential control functions necessary to safely manage the charging of PEVs while maintaining grid integrity
  - Location independence
  - Management of charging costs & utility incentives
  - Real-time information for control of transportation energy use

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ZigBee Alliance Partner Relations

We work with a number of SDOs, industry associations, groups, and initiatives…

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ZigBee Home Automation (ZHA)

- ZigBee provides a unprecedented level of value added functionalities to customers
  - Entertainment Solutions
  - Energy Management Solutions
  - Convenience Solutions
  - Security Solutions
  - Safety Solutions
  - Integration with ZigBee Smart Energy and other ZigBee based networks
  - Remote Access

- Expandability with devices from multiple vendors
- ZigBee Green Power allows for batteryless devices
- Large and growing eco-system with leading HA vendors (Control4, AMX, Crestron, etc.)

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ZigBee Health Care (ZHC)

Continua Health Alliance adopts ZigBee to address:

- **Independence for the Physically Challenged & Aging**
  - Remote monitoring
  - Provides real-time location capabilities
  - Maintains freedom of mobility
- **Chronic Disease Management**
  - Better self management
  - Multi device management for multiple chronic diseases
  - Improvement monitoring in professional settings
- **Health and Wellness**
  - Body-worn sensors for sports and fitness
  - High accuracy monitoring

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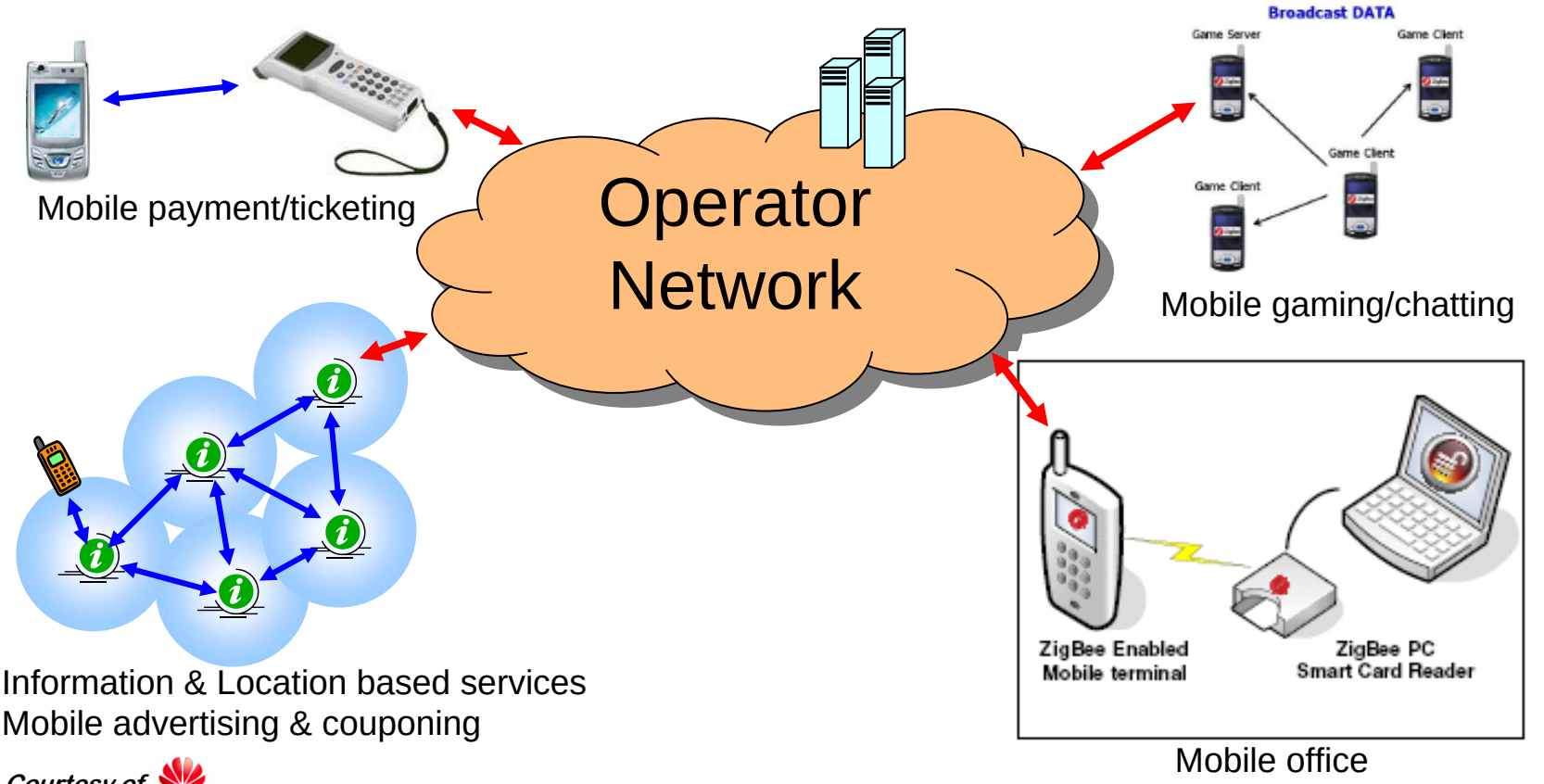
ZigBee Telecom Services(ZTS): M2M with your Mobile

- **Expanded communication services enrich daily life**
  - **Talk with people → Communicate with things**
  - **Public Networking → Personal (Grouping) networking**



Slide Courtesy of HUAWEI

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ZigBee Retail Services

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Retail

Work with other profiles

Telecom

Building

Home

Health

Energy

Shipping/Receiving

Consumer Devices

Video/Voice

Monitoring/Alerts

Scan/Shop

Proximity Marketing

Customer Services

Payment Services

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ZigBee RF4CE Entertainment Control

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ZigBee RF4CE

- Addresses interaction & communication with and between consumer electronic devices
- Greatly improved CE Experience
  - Resolves interference issues with Plasma high frequency inverter and LCD backlight with robust RF solution
  - Improves battery life by up to >10X while improving reliability and functionality
  - No line-of-sight restrictions (you can control from anywhere in the home)
  - Typical range ~25-35 meters @ 0dBm (10mW)
  - Standardized inter-CE device communication
- Supports extensive list of devices including digital TVs, DVD and Blu-ray players, set-top boxes, remotes, media centers, gaming consoles & more

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ZigBee RF4CE Application Profiles

- RF4CE Application Profiles are developed to deliver smarter functionality on top of the RF4CE standard
  - Defines pairing and discovery procedures
  - Standardizes commands
  - Ensures interoperability between devices from different vendors
- Three application profiles defined
  - Remote Controls: ZRC (completed)
  - Keyboards/mice: ZID (work in process)
  - 3D-glasses: Z3S (work in progress)
- Other application profiles under consideration

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ZigBee RF4CE Use Cases

- Interactive Remote Control
  - Does not require point-and-shoot
  - Displays messages
  - Can be woken up (“find-me” function)
- Media Center Control
  - Server/STB etc. in different room or closed cup-board
  - Controls content like streaming music, photos and movies
  - Remote navigation of content

- Internet TV
  - Usage of keyboard as Remote Control and for entering URL’s or data
  - Use of (air-)mouse for browser control on the TV
- 3D Television
  - Bring your own 3D glasses for watching movies

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The Home and Beyond from a Telecom perspective

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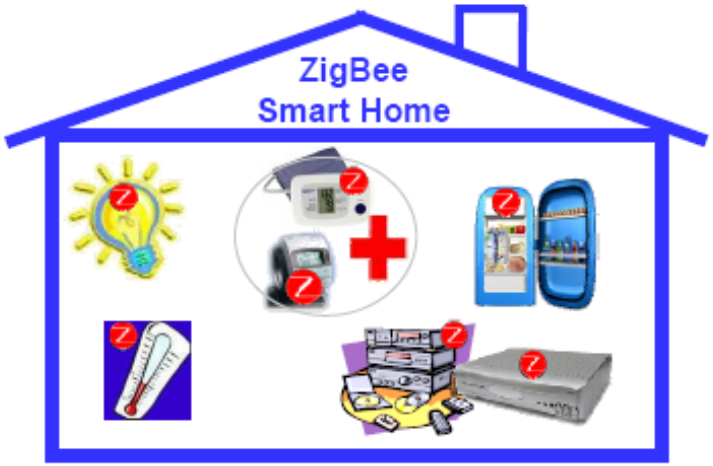
Telecom

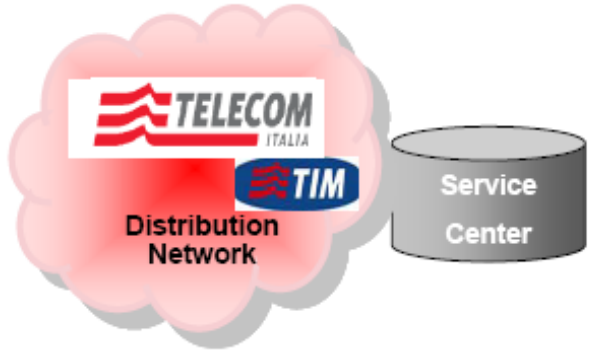
Handset is the hub of interaction with the Internet of Things

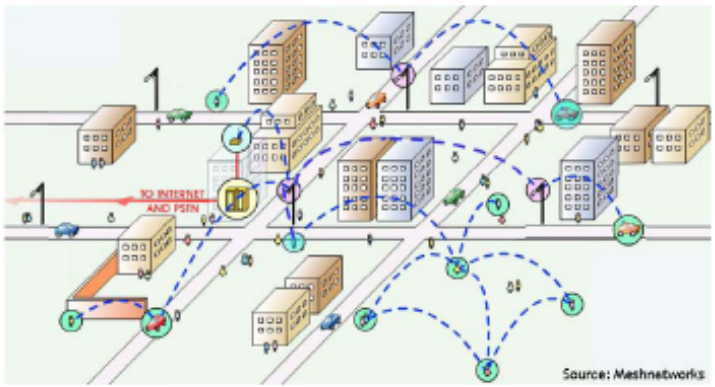


Home Automation&Control

- Lights, HVAC, Domestic appliances
- Entertainment (e.g. DTT)
- Healthcare, Tele-assistance
- Monitoring & Security (e.g. temperature, gas)

Mobile Terminal





Digital Smart City

- Access Control
- Parking payment system
- Infomobility services (e.g. traffic control)
- Environmental Monitoring
- Localization

M-Commerce Services

- m-payments (bar, shops, supermarkets)
- m-ticketing (cinema, train, bus)

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Thank-You!

For More Information:

www.zigbee.org

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