2012 Annual IEEE CQR International Workshop

Huawei M2M Perspective and Activities

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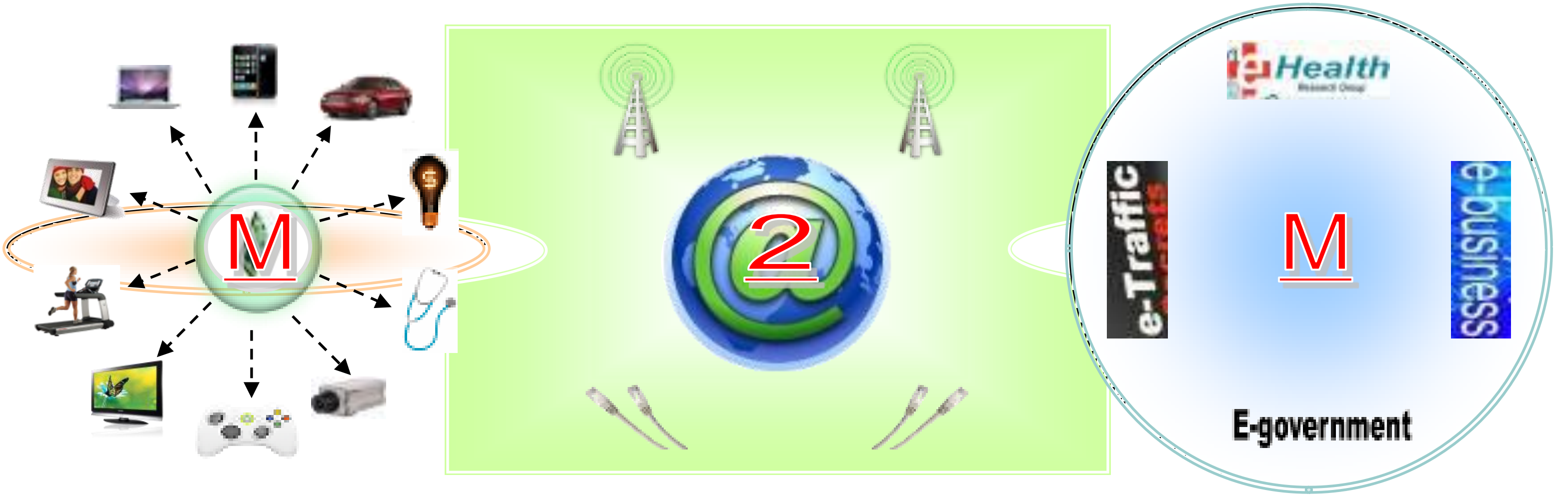
HUAWEI

M2M - connecting end devices to local network (home and business) and WAN (cloud) based applications



Terminal

Network

Application

Thorough perception and measurement

Ubiquitous access and interconnection

In-depth smart analysis **(data analytics)** and control

- Enable devices to be able to "think" and communicate with the outside

- Public communications network, M2M network, and the Internet ensure the ubiquitous connection between production materials and industrial applications

- Industrial smart application and control systems (computing, storage, and application)

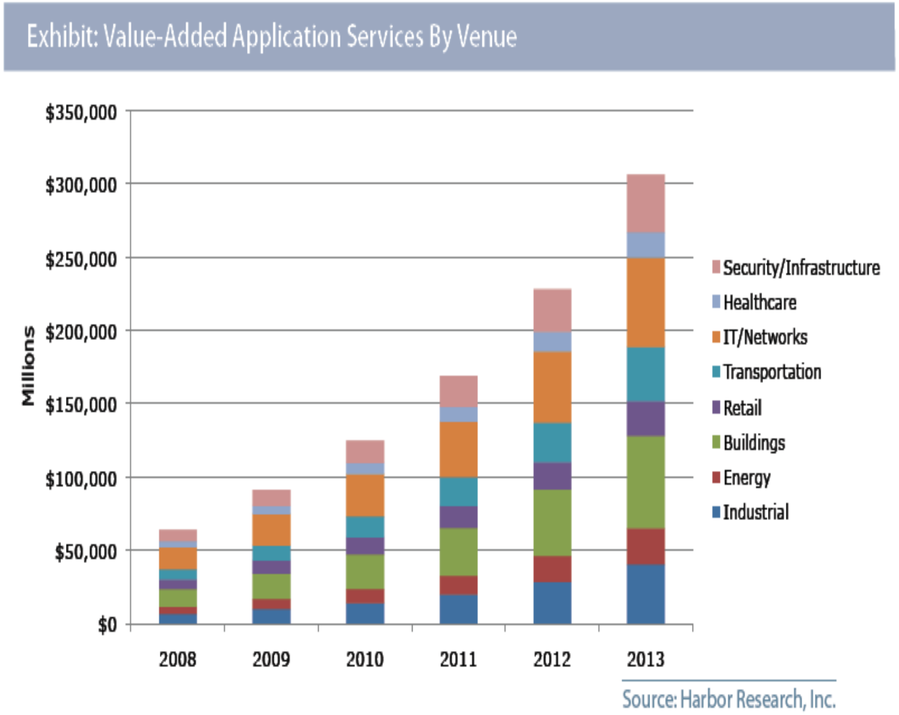
Huge Potential Market

By 2014, the revenue from M2M services will be ~$300B

By 2014, there will be +50B of Smart devices connected to the Internet

6B Mobile phones
+50B Smart devices

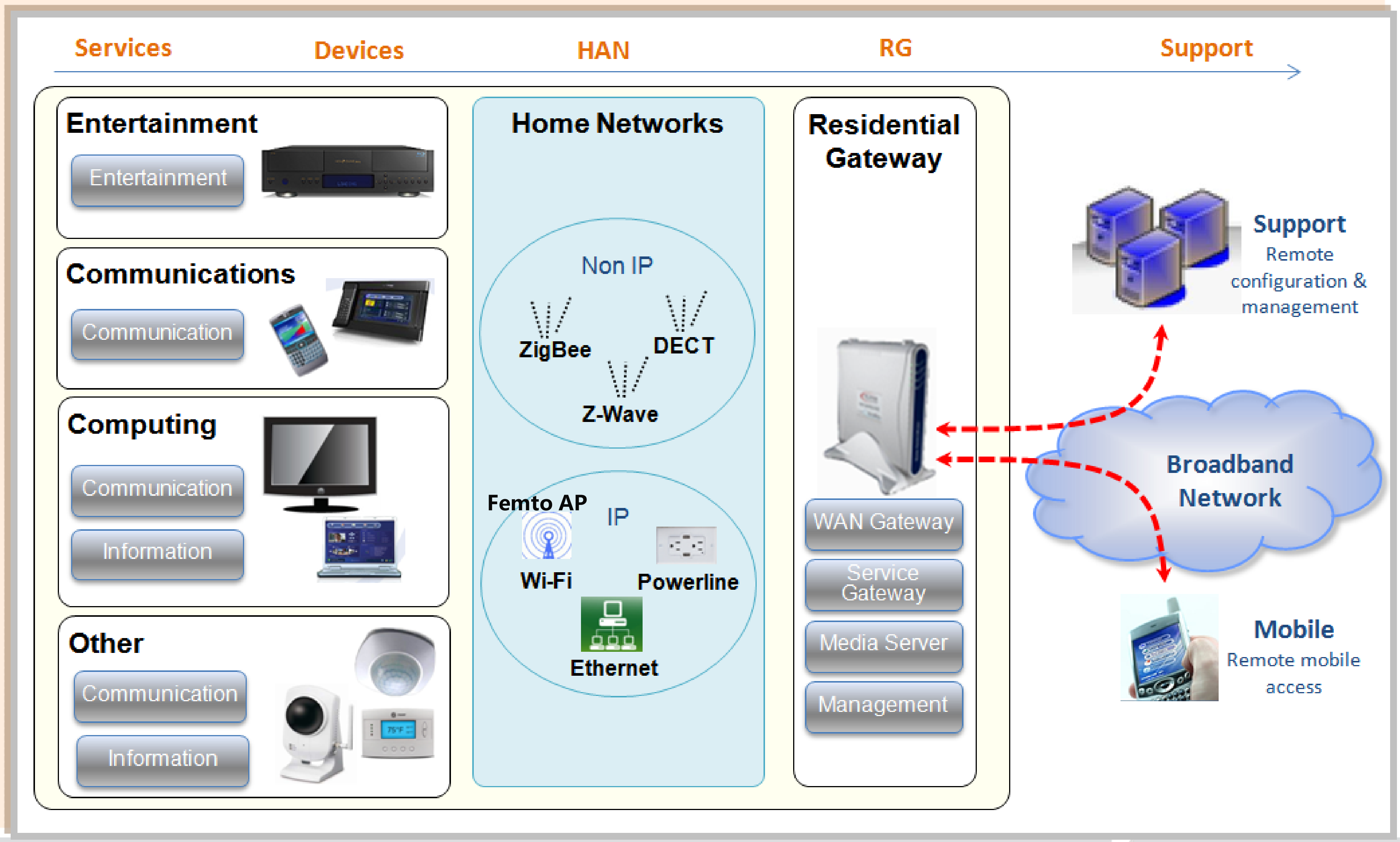
The market size of M2M services in various areas



Source: Harbor Research, Inc.

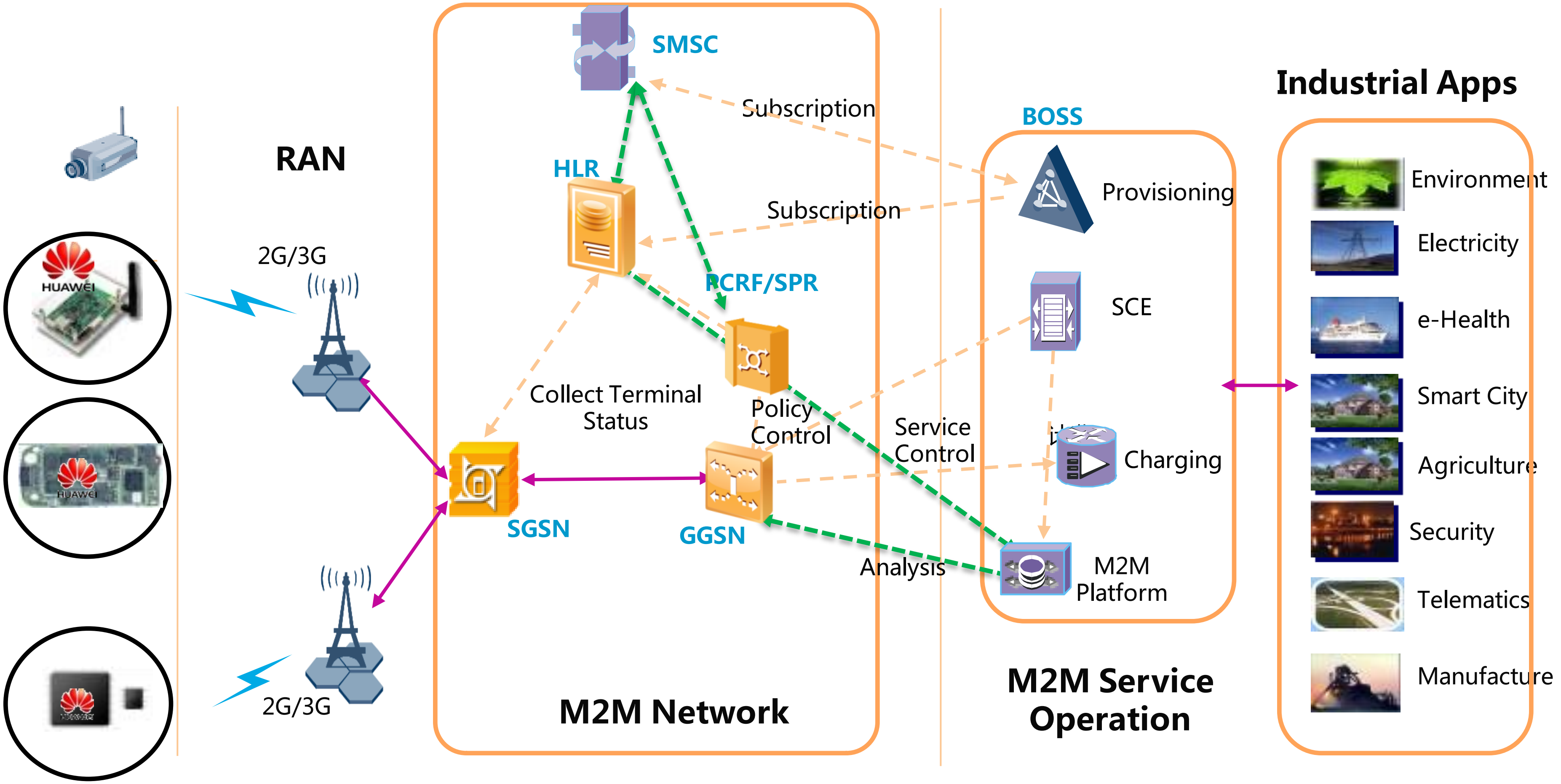
Digital Home – Service Provider View

(Broadband Forum source)



True E2E Solution: Wireless based example

(M2M needs a common framework for all services and devices to interoperate and scale with proper management/configuration regardless whether broadband network is fixed, wireless or cable.)



RAN

2G/3G

2G/3G

SMSC

HLR

PCRF/SPR

SGSN

GGSN

Subscription

Subscription

Collect Terminal Status

Policy Control

Service Control

Analysis

M2M Network

BOSS

Provisioning

SCE

Charging

M2M Platform

M2M Service Operation

Industrial Apps

Environment

Electricity

e-Health

Smart City

Agriculture

Security

Telematics

Manufacture

Device

Network

Software

Enterprise

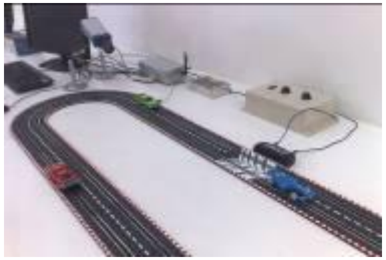
Challenges

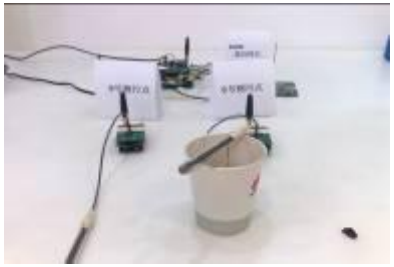
- **M2M has been developing differently in each region of world:**
  - USA
  - Europe
  - China
  - South Pacific
- **Lack of standard requirements: Piecing together an end-to-end network is huge effort**
- **Need for integration testing lab**

M2M Test and Certification Lab

HUAWEI
Testing & Certificating Lab
for M2M Terminals & Applications
物联网终端与应用测试认证实验室

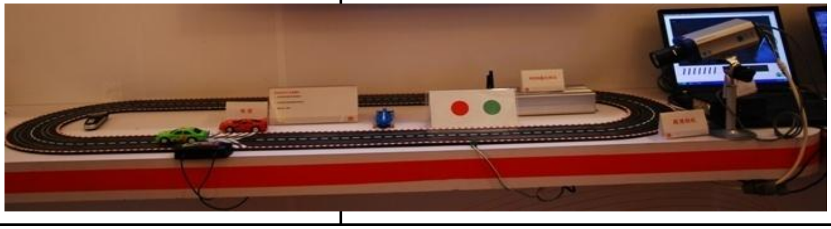
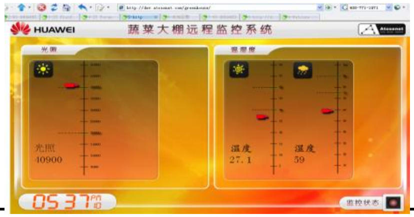
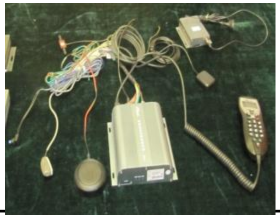
Photo of Huawei M2M lab



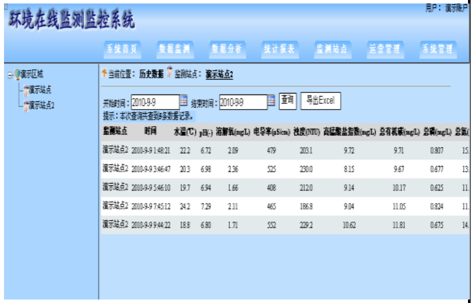


- M2M applications are numerous and complex. Wide number of trial and commercial deployments around world with regional differences, partial standardization, proprietary solutions, and there are also numerous vendors
- Created the Accreditation Centre to provide list of partners and list of industrial terminals and applications for the carriers.
- In 2010, there were already over 30 partners doing Accreditation Testing in Huawei lab.

Integration - Applications & Terminal (1)

	M2M service category	Function	Terminal Pic	Apps	Company
1	Automotive & Logistics	Motion Monitoring. 1) Wireless or Cable Data Transmission 2) Inboard Accurate License Plate Identification 3) Wide Use and Quick Deployment			
2	Environment Monitoring	Digital Environment Protection. 1) WSN with Water Quality and Water Pollution sensor 2) Digitization and Monitoring In Real Time 3) Alarm of Light/Sound/SMS		 HUAWEI 蔬菜大棚远程监控系统 光照 温湿度 光照 10900 温度 27.1 湿度 59 05 37 PM 监控状态	
3	Automotive & Logistics	Car Device. 1) Voice navigation 2) eCall/bCall/iCall 3) POI and Entertainment 4) Tracking and Position 5) Security Management			
4	Automotive & Logistics	Car Device. 1) Voice navigation 2) eCall/bCall/iCall 3) Tracking and Position 4) Security Management 5) Remote Control			

Integration - Applications & Terminal (2)

	M2M Service Category	Function	Terminal Picture	Apps Picture	Company
5	Security solutions	Intelligent Security Monitoring. 1) WSN with vibration/infrared sensors 2)Digitization and monitoring in real time3)Alarm of Light/Sound/SMS "			
6	Environment Monitoring; Smart Agriculture	Environment Sensor. 1)Temperature/Moisture/Light /Water quality/Air condition sensor 2) Real-time Monitoring 3) Alarm when abnormity PH, CO2 and other soil factors.			
7	Consumer Electronics	Wireless LED. 1) Instant information publication 2) Remote updating and controlling			

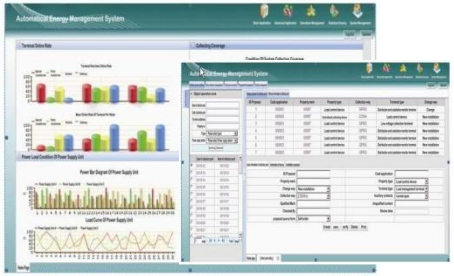
当前位置：历史数据 监测站点：演示站点2

开始时间：2010-9-9 结束时间：2010-9-9 查询 导出Excel

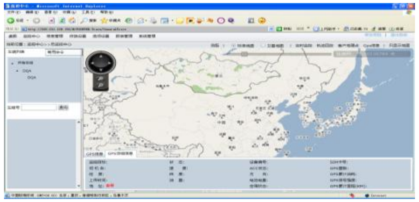
提示：本次查询共查到5条数据记录。

监测站点	时间	水温(℃)	pH(-)	溶解氧(mg/L)	电导率(μS/cm)	浊度(NTU)	高锰酸盐指数(mg/L)	总有机碳(mg/L)	总磷(mg/L)	总氮(
演示站点2	2010-9-9 1:48:21	22.2	6.72	2.09	479	203.1	9.72	9.71	0.807	15.
演示站点2	2010-9-9 3:46:47	20.3	6.98	2.36	525	230.0	8.15	9.67	0.677	13.
演示站点2	2010-9-9 5:46:10	19.7	6.94	1.66	408	212.0	9.14	10.17	0.625	11.
演示站点2	2010-9-9 7:45:12	24.2	7.29	2.11	465	186.8	9.04	11.05	0.824	11.
演示站点2	2010-9-9 9:44:22	18.8	6.80	1.71	552	229.2	10.62	11.81	0.675	14.

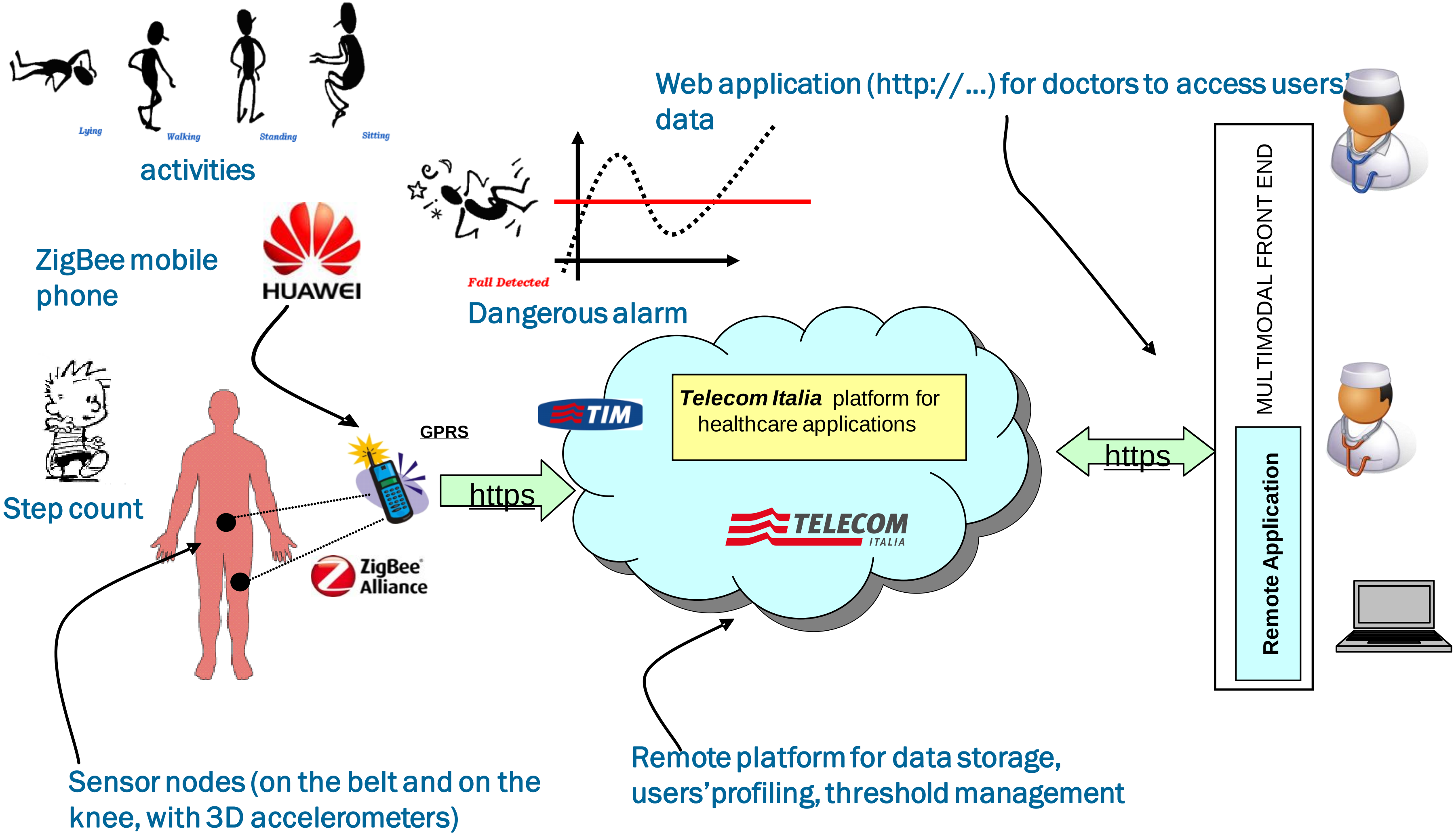
Integration - Applications & Terminal (3)

	M2M service category	Function	Terminal Picture	Apps Picture	Company
8	Security solutions	Intelligent Security Monitoring. 1) WSN with Infrared/Fire/Water/Temperature Sensors 2) Digitization and Monitoring in Real Time 3) Alarm of Light/Sound/SMS			
9	Automotive & Logistics	Car Device. 1) Bus station Report 2) eCall/bCall/iCall 3) Tracking and Position 4) Security Management 5) Remote Control			
10	Automotive & Logistics	Car Device. 1) Bus station Report 2)eCall/bCall/iCall 3) Tracking and Position 4) Security Management 5) Remote Control		 Automatical Energy Management System Terminal Online Rate Collecting Coverage Power Load Condition Of Power Supply Unit Power Bar Diagram Of Power Supply Unit Load Curve Of Power Supply Unit Picture 1	

Integration - Applications & Terminal (4)

No.	M2M Service Category	Function	Terminal Pic	Apps Pic	Company
11	Telemetry	AMR. 1) Automated meter reading/monitoring 2) Analysis of energy consumption"			
12	Consumer Electronics	GPS Personal Tracker. 1) GPS / CellID Positioning 2) SOS Key and Quick-dial Number when Emergency 3) Tracking Children, Pets, Disabled People, Car, Asset			
13	Automotive & Logistics	Car Device. 1) Security Management 2) eCall/bCall/iCall 3) Tracking and Position			
14	Healthcare	e-health testor 1) Blood pressure, heart rate, ECG collection 2) Setup profile automatically 3) Remote Diagnosis 4) One Key for Help and Position			
15	Mobile Commerce	Wireless POS. 1) Point of sales 2) Payment system			

Prototype system: e-Health



activities

ZigBee mobile phone

Dangerous alarm

Web application (http://...) for doctors to access users' data

Step count

https

Telecom Italia platform for healthcare applications

https

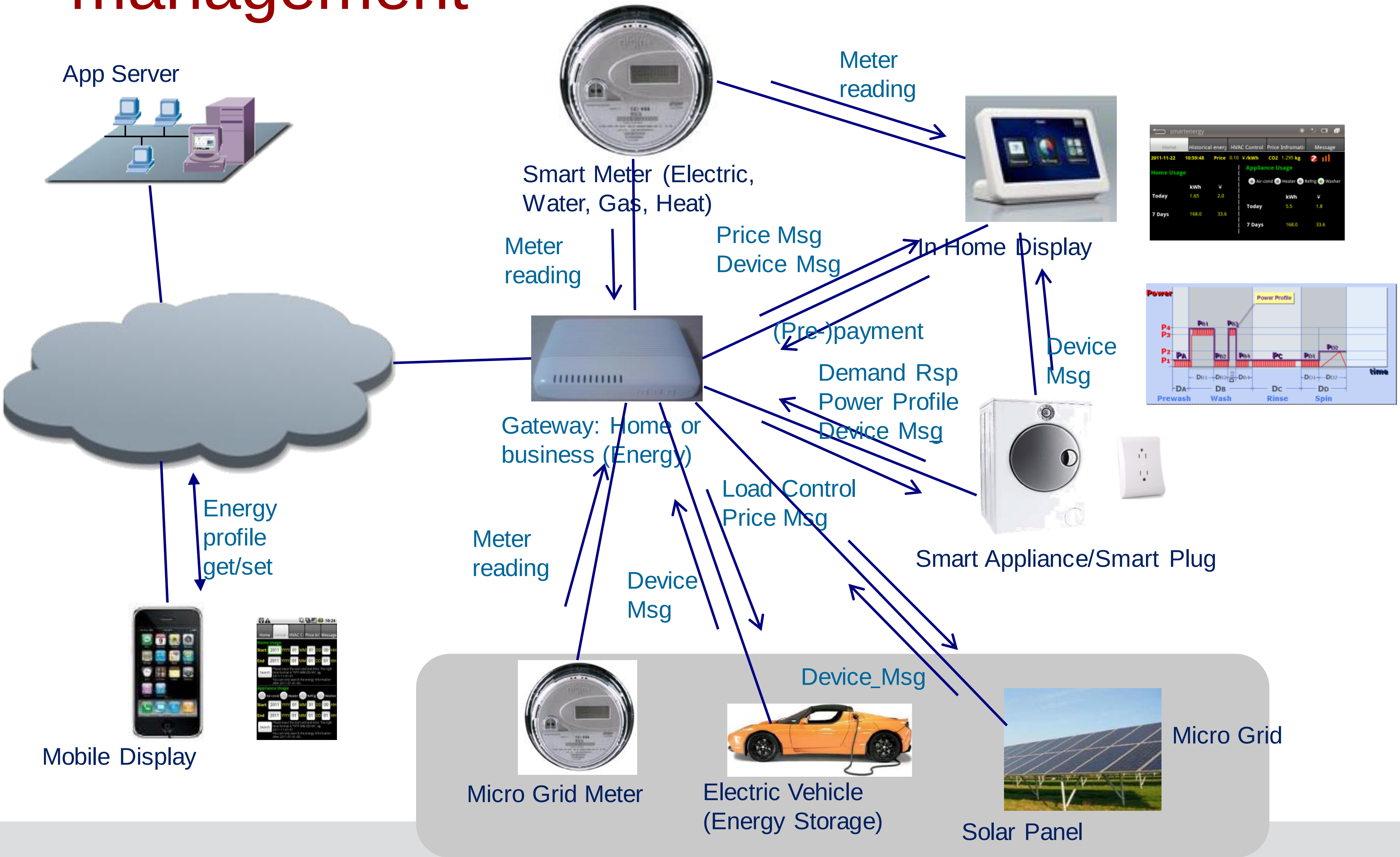
MULTIMODAL FRONT END

Remote Application

Sensor nodes (on the belt and on the knee, with 3D accelerometers)

Remote platform for data storage, users'profiling, threshold management

Prototype system: Home energy management



App Server

Smart Meter (Electric, Water, Gas, Heat)

Meter reading

In Home Display

Meter reading

Price Msg
Device Msg

(Pre-)payment

Device Msg

Gateway: Home or business (Energy)

Demand Rsp
Power Profile
Device Msg

Load Control
Price Msg

Smart Appliance/Smart Plug

Energy profile get/set

Meter reading

Device Msg

Device_Msg

Mobile Display

Micro Grid Meter

Electric Vehicle (Energy Storage)

Solar Panel

Micro Grid

smartenergy

Home | Historical energ | HVAC Control | Price Infromatic | Message

2011-11-22 10:59:48 Price 0.10 ¥/kWh CO2 1.295 kg

Home Usage

	kWh	¥
Today	1.65	2.0
7 Days	168.0	33.6

Appliance Usage

○ Air-cond ○ Heater ○ Refrig ● Washer

	kWh	¥
Today	5.5	1.8
7 Days	168.0	33.6

Standards in M2M

- Huawei active in Broadband Forum: Gateway and end device management & configuration components: See companion slides on Broadband Forum M2M Activities
    - Software/firmware module mgmt./upgrade, proxy mgmt., performance testing and monitoring, security mechanisms mgmt protocol and CPE, network security and reliability, data/object models coordinated across SDOs, Control Signaling and Data Abstraction – “Missing piece”
- M2M success requires a common framework for all services and devices to interoperate and scale with proper management & configuration regardless whether fixed, wireless or cable network.
    - Avoid market confusion; reduce standardization efforts & resources; avoid overlapping or orthogonal standards; enable App developers, Operators and vendors to focus on single standards thread
- “One M2M” => multi SDO consolidation: ARIB, ATIS, CCSA, ETSI, TIA, TTA, and TTC (the “SDOs”) recognize M2M services rely on telecommunication providers for connectivity to myriad of devices in field and the M2M application servers in common manner
    - Essential that “vertical” industry players participate in oneM2M

Summary

- Huawei M2M test lab growing, providing comprehensive cooperation and filling industry need
- M2M requires common framework for all services and devices to interoperate and scale with common management/configuration independent whether fixed, wireless or cable broadband network.
- Huawei participating in establishing global organization called “oneM2M “to piece together end-to-end standards and fill gaps.
  - Huawei also actively contributing to 3GPP, Broadband Forum, ETSI M2M and other national standards organization, IEEE 802, IETF, ITU, OMA, ZigBee Alliance, and others, providing elements needed for M2M
- Companion slides discuss Broadband Forum (BBF) activities on critical components for M2M defined by BBF

Thank you

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2012 Annual IEEE International Communications Quality and Reliability (CQR) Workshop

Broadband Forum Machine-to-Machine (M2M) Activities

(Companion Huawei M2M Perspective and Activities)

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broadband forum

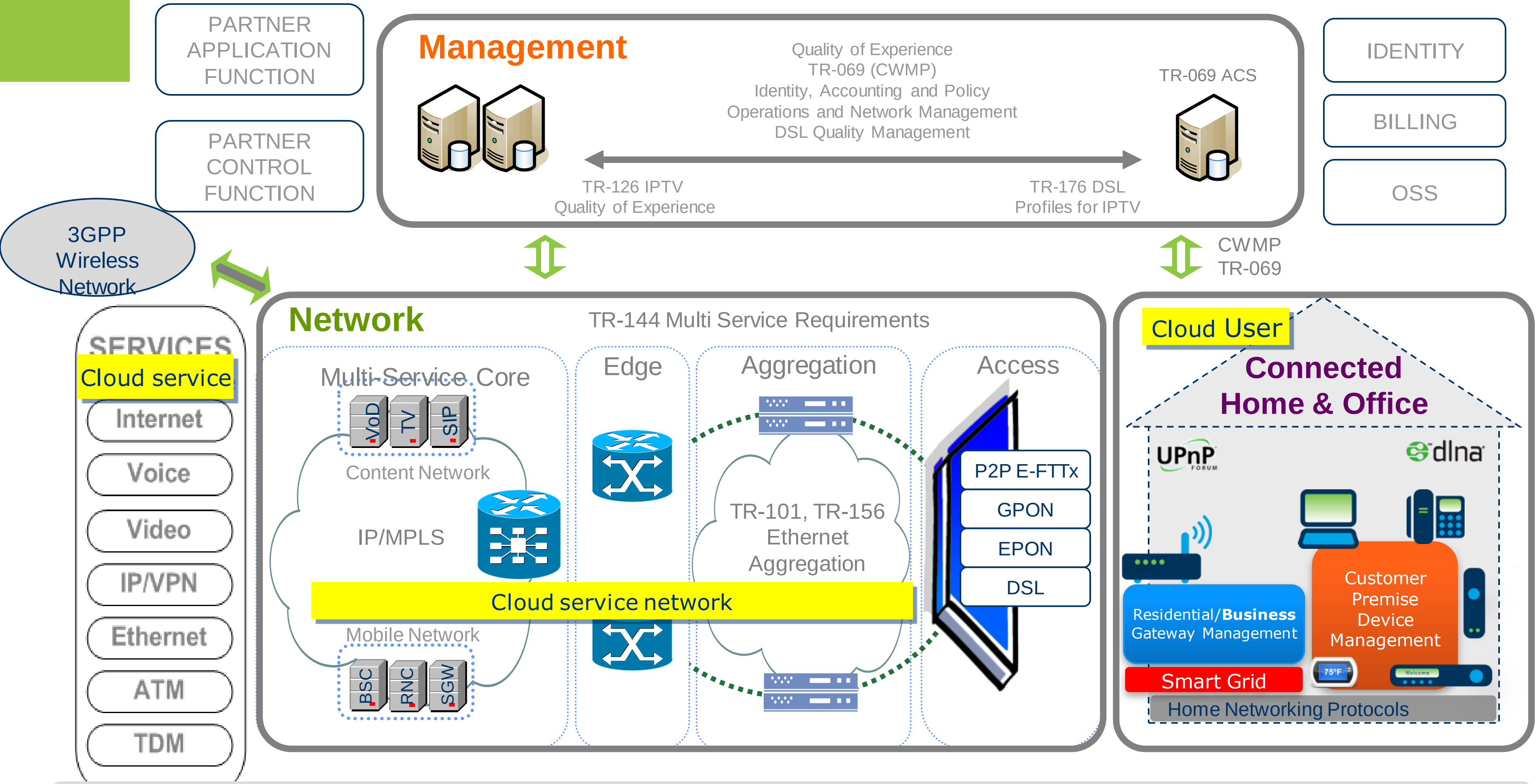
Broadband Forum

Engineering smarter & faster connections

- Architecting a connected lifestyle
  - Defining best practices for global networks
  - Enabling multi-service and content delivery
  - Establishing technology migration strategies
  - Engineering critical device & service management tools
  - Redefining Broadband
- Who are we?
  - Industry consortium made up of approximately 200 service providers, vendors, consultants, academia and test labs
  - Predominant broadband industry forum since **1994**
  - Engineer technology solutions to help service providers achieve standards based, economical and effective broadband deployments

broadband forum

Broadband Forum Scope



PARTNER APPLICATION FUNCTION

PARTNER CONTROL FUNCTION

3GPP Wireless Network

Management

Quality of Experience
TR-069 (CWMP)
Identity, Accounting and Policy
Operations and Network Management
DSL Quality Management

TR-069 ACS

TR-126 IPTV
Quality of Experience

TR-176 DSL
Profiles for IPTV

IDENTITY

BILLING

OSS

CWMP
TR-069

SERVICES

Cloud service

- Internet
- Voice
- Video
- IP/VPN
- Ethernet
- ATM
- TDM

Network

TR-144 Multi Service Requirements

Multi-Service Core

VoD TV SIP

Content Network

IP/MPLS

Mobile Network

BSC RNC SGW

Edge

Aggregation

TR-101, TR-156
Ethernet
Aggregation

Access

P2P E-FTTx

GPON

EPON

DSL

Cloud service network

Cloud User

Connected
Home & Office

UPnP FORUM

dlna

Residential/**Business** Gateway Management

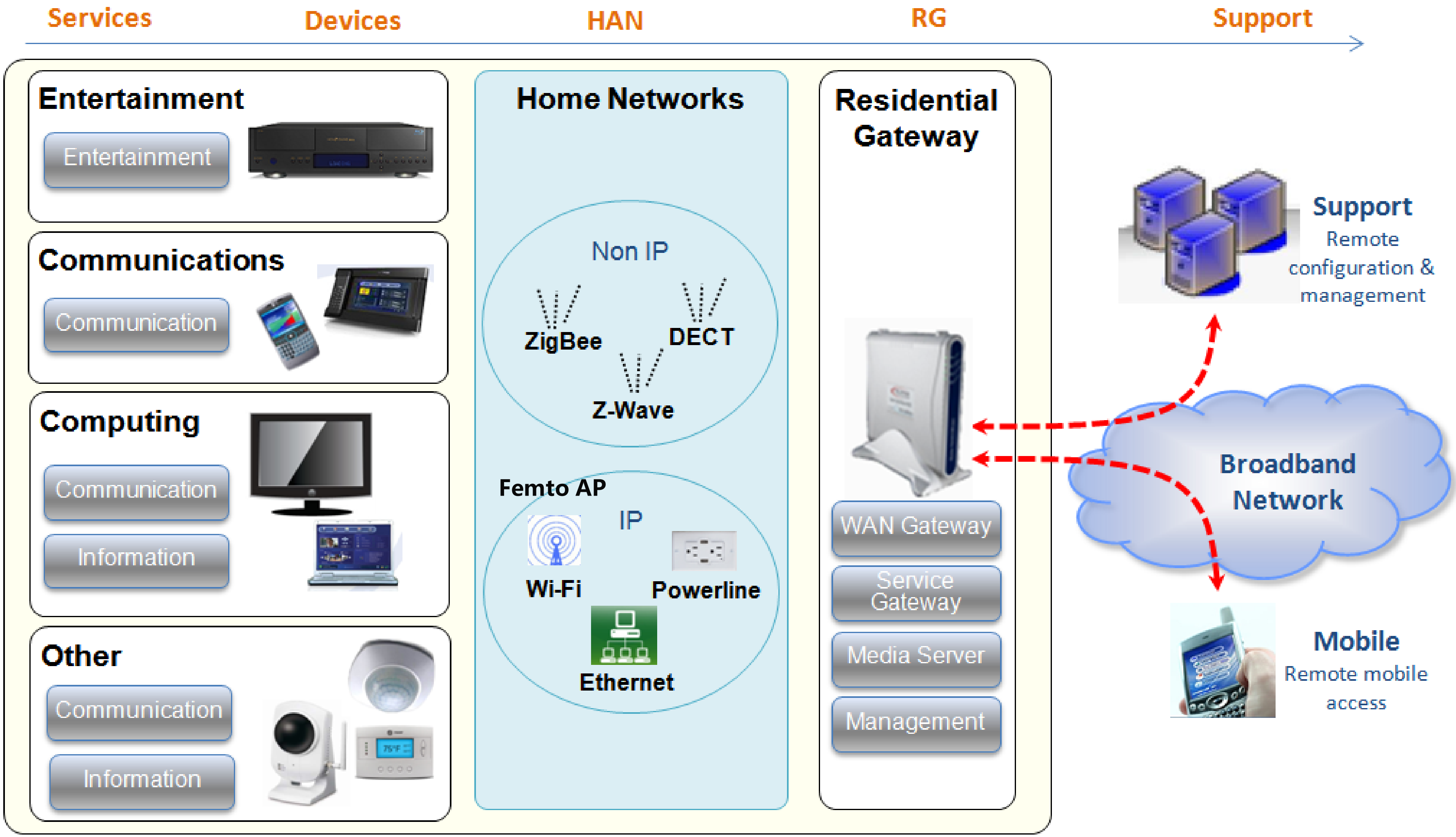
Customer Premise Device Management

Smart Grid

Home Networking Protocols

Multi Service Architecture & Requirements   Fixed Mobile Convergence (FMC)   Certification, Test and Interoperability

Digital Home – Service Provider View

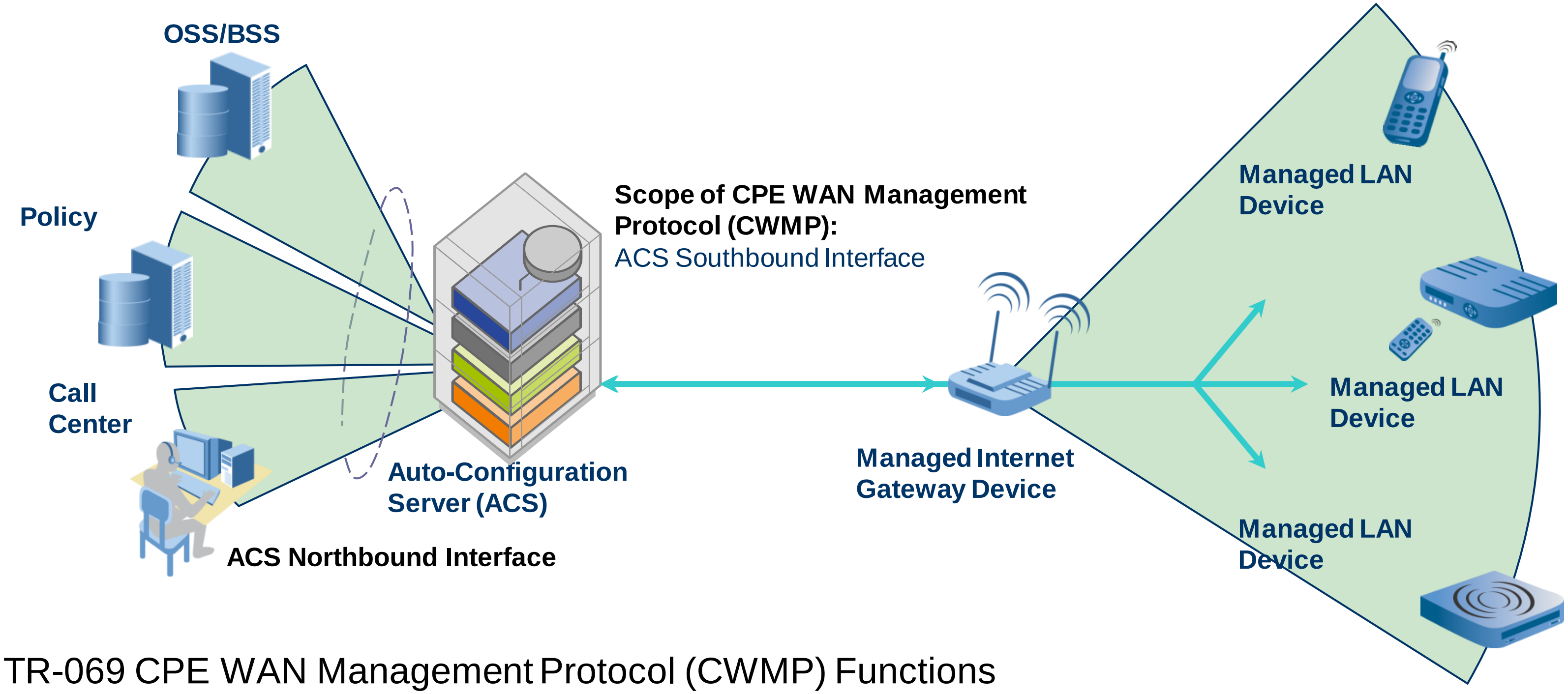


Broadband Home – Device Management

TR-069 – CPE WAN Management Protocol (CWMP)

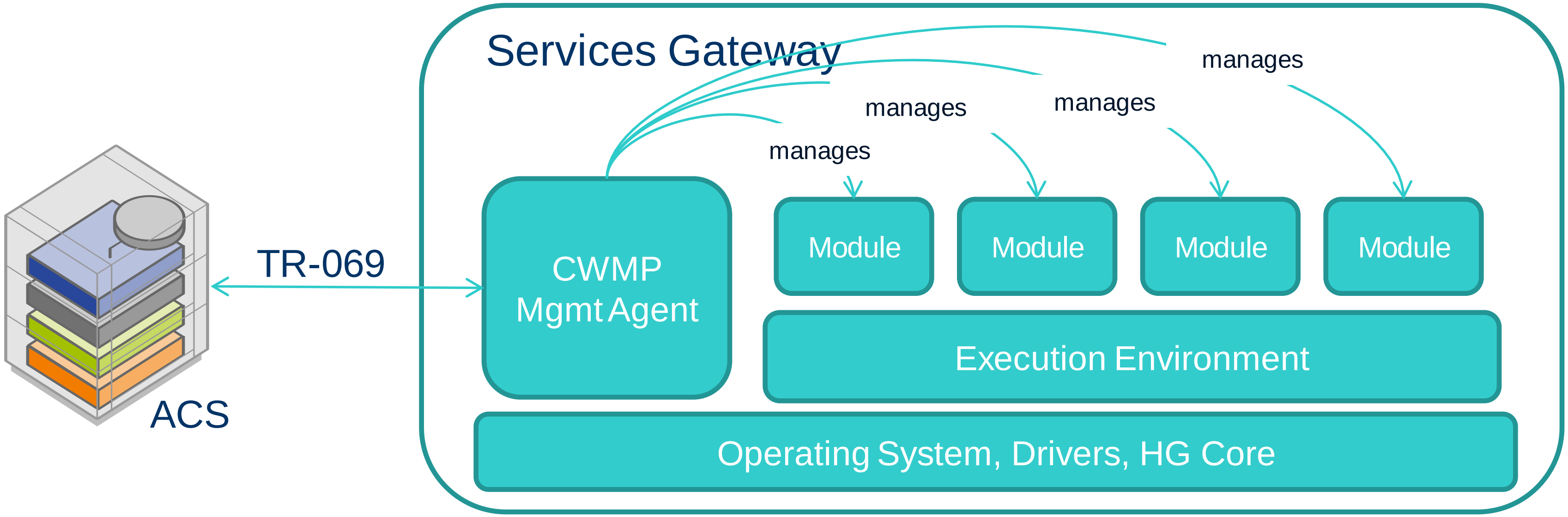
- Industry leading device management solution.
- Evolving TR-069 family of extensive and modular manageable ‘objects’ covering wide range of devices and functionality.
- Referenced by many industry bodies such as 3GPP, ATIS, CCSA, ETSI, HGI, ITU-T, others.
  - ❑ **Approved as a European standard in 2010 by ETSI.**
  - ❑ **Currently referenced in ETSI M2M architecture as the protocol for device management that runs over the “mld” reference point.**
  - ❑ **Ongoing work between the Broadband Forum and ETSI TC M2M to develop/extend Object model for M2M.**
- Ratified by DSL (now Broadband) Forum in May 2004, amended in 2006 and 2007, and recent M2M driven amendments: A3 and A4
- Key liaison relationships with other SDOs (OMA, 3GPP, ETSI, etc.)

TR-069 Management Architectural Framework



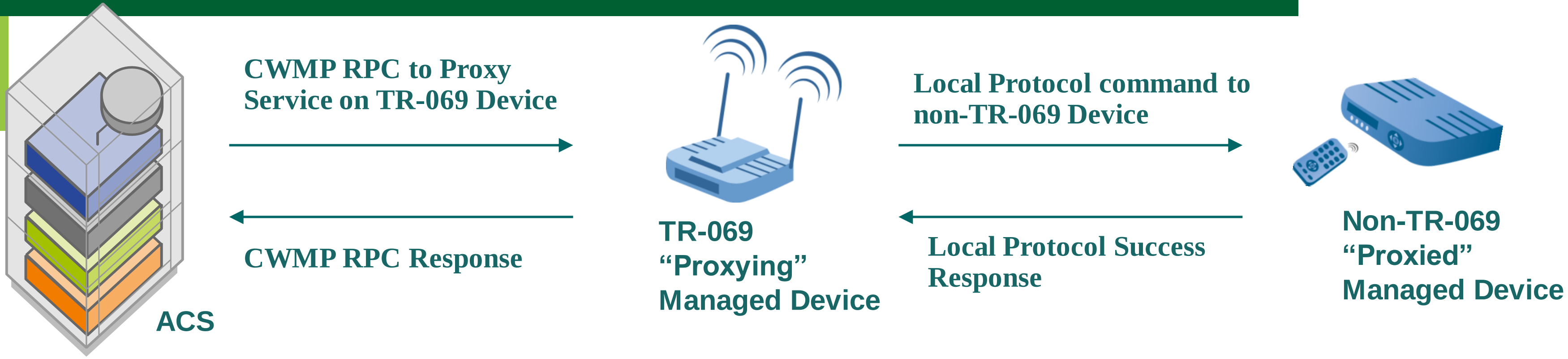
- TR-069 CPE WAN Management Protocol (CWMP) Functions
  - Bootstrap
  - Service Provisioning
  - Firmware and Software Module Management
  - Diagnostics
  - Fault and Performance Monitoring
  - Large and growing set of defined object models
  - Proxy management for non IP devices

Software Module Management
TR-069 Amendment 3



- Software Module Management to support embedded applications.
- Open design for mapping to multiple Execution environments (OSGi, OMA, etc.).
- New RPC and Software Module Data Model support required as needed.

Remote Management of non-TR-069 Devices TR-069 Amendment 4 (proxy)


CWMP RPC to Proxy Service on TR-069 Device
CWMP RPC Response
ACS
TR-069 "Proxying" Managed Device
Local Protocol command to non-TR-069 Device
Local Protocol Success Response
Non-TR-069 "Proxied" Managed Device

- Proxy management agnostic to the local protocol
  - UPnP DM/DLNA, Zwave, ZigBee etc.
  - Layer 2 protocols (e.g. HomePlug OAM, etc.)
  - Any proprietary local protocols known by the proxying device
- TR-069 accesses proxied devices through TR-069 embedded and virtual managed objects
  - ACS sends management commands to proxying device
  - TR-069 device converts TR-069 commands to local protocol
  - Once proxied device has successfully executed commands, TR-069 device sends CWMP messages to ACS

CPE Security

Security model is scalable - intended to allow basic security to accommodate less robust CPE implementations, while allowing greater security for those that can support more advanced security mechanisms. Security goals of CWMP:

- Prevent tampering with the management functions of a CPE or ACS, or the transactions that take place between a CPE and ACS.
- Provide confidentiality for the transactions that take place between a CPE and ACS.
- Allow appropriate authentication for each type of transaction.
- Prevent theft of service

- Note: Network Access Node also has requirements to prevent denial of service and other attacks.

CWMP Security Mechanisms

To prevent tampering with transactions between CPE and ACS, provide confidentiality for transactions, allow various levels of authentication:

- Use of TLS for communications transport between CPE and ACS providing transaction confidentiality, data integrity, and allows certificate-based authentication between CPE and ACS.
- The HTTP layer provides an alternative means of CPE and ACS authentication based on shared secrets. Note, the protocol does not specify how the shared secrets are learned by the CPE and ACS.
  - The CPE MUST support both HTTP basic and digest authentication. The ACS chooses the authentication scheme by virtue of providing a basic or digest authentication challenge.

Throughput Performance Tests and Statistical Monitoring

Performance and statistical monitoring capability supports both Network initiated diagnostics and CPE initiated diagnostics in ongoing or on-demand basis. Generic tools enable the validation of QoS objectives and Service Level Agreements(SLAs).

- – The UDP Echo Plus test is a UDP Echo with the addition of performance specific fields in the payload to allow for time-stamping and sequencing for packet loss and jitter.
  - Security considerations: In order to prevent a DOS (Denial of Service) attack on the CPE, the CPE will only respond to the UDP request from a Source address defined in SourceIPAddress, and will only service the port defined in UDPPort.
- – The CPE Upload and Download Diagnostic throughput test simulates the client behavior in the client/server paradigm performing an FTP or HTTP transaction to a corresponding remotely located FTP or HTTP test server.

- CPE must support Active Notification Parameter Definitions, and CPE may reject a request by an ACS

Network Security, QoS and Reliability

- Security requirements applied to BBF core and access network specs
  - Protect the aggregation network and BNGs from broadcast and multicast storms at user and network port levels
  - Protect against MAC address spoofing; MAC address flooding; filtering of reserved group MAC destination addresses for VLAN
  - DHCP processing; ARP Processing and IP Spoofing Prevention
  - Access Loop Identification and Characterization with RADIUS authentication and accounting
- Triple-play services Quality of Experience (QoE) requirements specified as end-to-end (not just access link), and can be translated into engineering measures at the network transport and application layers.
- Broadband Multi-Service Architecture & Framework Requirements
  - BW services and relative QoS, guaranteed QoS, and QoS on demand, Reliability and Network availability criteria
  - Network performance metrics
  - AAA functions include
    - network to authenticate a subscriber session
    - authenticate device attachment

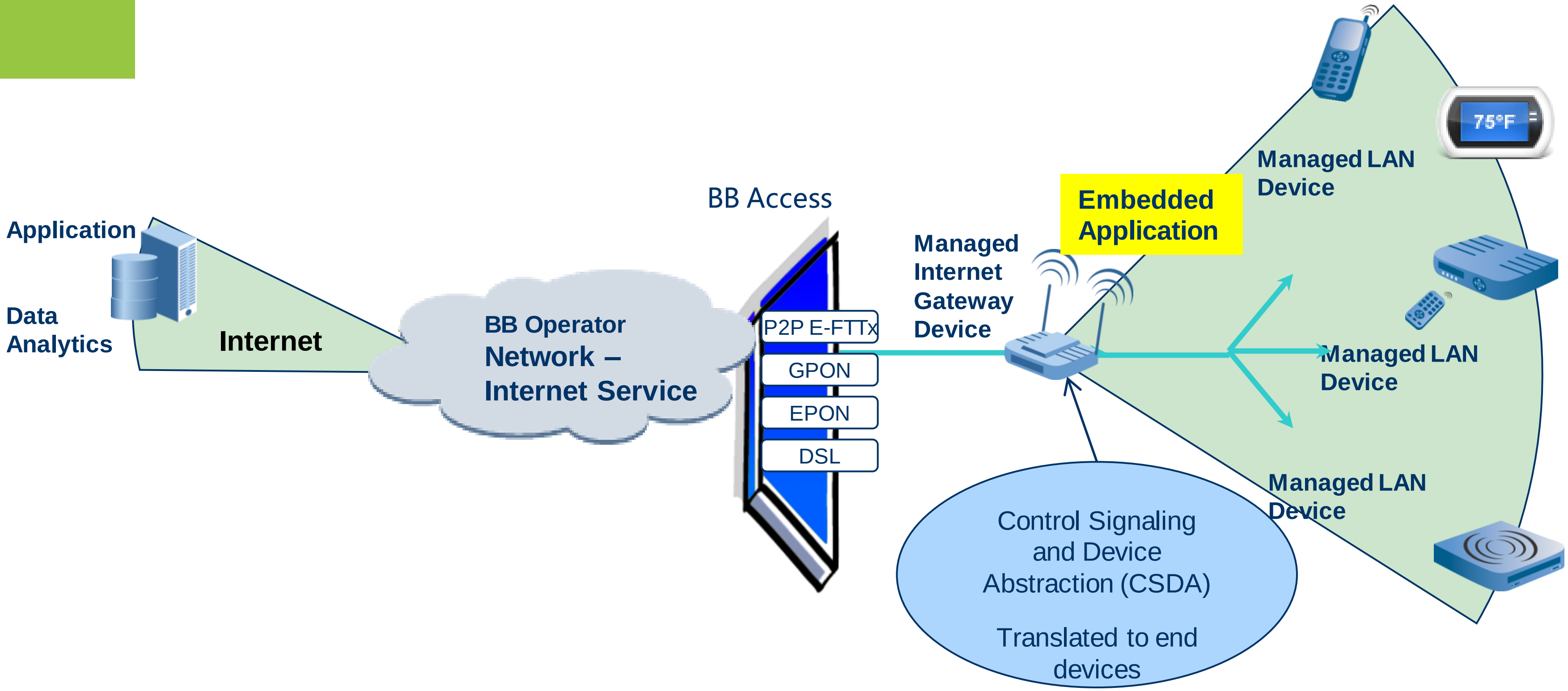
Broadband Policy Control Framework

- Information Model supporting IPv4 and IPv6 policy based management and control. Augments several other BBF multi-service architecture specs.
- Requirements on admission control, QoS and bandwidth management, security, AAA and charging.
  - Policy implementation involves distributed traffic conditioning and Policy Enforcement Points (PEPs) requiring authentication of devices that communicate policy information, protection of messaging, and more sophisticated charging to prevent Policy related fraud.
- Policy framework provides privacy (and security) mechanisms to ensure customer data cannot be misappropriated. Other privacy requirements on Service Providers are/will be regulatory defined.
- Relationship between BBF requirements to external Standard Development Organizations (SDOs) policy and NGN efforts is addressed, and integration of features to allow the broadband multiservice network to work with generic NGN architectures.
- BBF collaborating with 3GPP on policy for Fixed Mobile Convergence (FMC) in two steps:
  - Interworking between fixed and wireless (static policy provisioning)
  - Converged (dynamic) network solutions.

Broadband Forum M2M Ongoing Activities

- Management Plane
  - Incorporate ETSI M2M Data models
  - Potential BBF management specifications for a standard **North-Bound Interface** (NBI) for interfacing to new services and/or APP servers.
  - Continued exploration of M2M networks and paradigms
  - Current work defining set of M2M use cases to verify extended verticle scenarios impact to TR-069, identify new object models
  - Data modeling extensions & potential protocol extensions
- Control Signaling and Data Abstraction – "Missing piece"
  - Access to devices (and gateways) on existing network technologies without modification using common communication and common objects
  - Not management plane – "Instant / real time" command communications.
  - Provide technology agnostic access for embedded apps and cloud applications

Current Control Signaling & Device Abstraction Activity


Application
Data Analytics
Internet
BB Operator Network – Internet Service
BB Access
P2P E-FTTx
GPON
EPON
DSL
Managed Internet Gateway Device
Embedded Application
Managed LAN Device
75°F
Managed LAN Device
Managed LAN Device
Control Signaling and Device Abstraction (CSDA)
Translated to end devices

- BBF in early phase of defining "Missing piece" essential to Service Providers to provide common device abstraction and signaling for new M2M related services
- Scalable solution for all devices, both IP and Non-IP
  - Provides access to all devices using common communication and common objects
  - Provide technology agnostic access for embedded apps and cloud applications

oneM2M (multi SDO Consolidation)

ARIB, ATIS, CCSA, ETSI, TIA, TTA, and TTC (the "SDOs") recognize that M2M services often rely upon telecommunications providers for connectivity between the myriad of devices in the field and the M2M application servers.

- M2M needs a common framework for all services and devices to interoperate and scale with proper management/configuration regardless whether fixed, wireless or cable broadband networking.
- Need for a common efficient, easy and widely available M2M Service Layer, which can be readily embedded within various hardware and software.
  - Avoid market confusion; reduce standardization efforts/resources; avoid overlapping or orthogonal standards; enable app developers, Operators and vendors to focus on single standards thread
- Wide number of trial and commercial deployments around world with regional differences and based on proprietary solutions
- Essential that "vertical" industry players participate in oneM2M

Summary

- Broadband Forum defining some of the components critical in piecing together M2M networks involving the connected home
  - Defined proxy management for devices that do not support TR-069 so Service Providers can extend same provisioning and device management to Home Access Network (HAN) devices as available with TR-069. Is advantage SPs have versus OTP provider that does not have a management plane.
  - Improved network security, QoS and reliability
  - Defining protocol translation and implementation guidelines for UPnP-DM. Defining objects that model new HAN interfaces.
  - Started development of Control Signaling Device Abstraction (CSDA) layer, critical piece in providing "standardized architecture".
- BBF liaison and/or collaboration agreements with 20+ SDOs specific to M2M work
- Close communication with ETSI to provide CSDA "missing piece", TR-69 integration into ETSI M2M Architecture & leverage the ETSI M2M Release 1 security provisions

Thank You

For more information,
visit us at
http://www.broadband-forum.org

broadband forum