Addressing Unique M2M Challenges with Converged Gateways

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Where are we heading?
What are the challenges?

• Lots of M2M devices
  – We don’t want to congest the access and core networks with signaling to and from all these devices
  – We want to be able to identify and address all devices (both individually and in groups). Addressing schemes have to be able to support all these devices.

• These devices have varied characteristics (delay tolerance, duty cycle, RAT capability, etc) making it difficult to find a “one-size-fits-all” solution for access network and core network operation

• The devices should provide autonomous operation - maintenance and configuration should be “human” free

• Leveraging unreliable unlicensed bands and emerging spectrums (e.g. TVWS)

• Unique security considerations: physical attacks to unmanned devices, compromised (malicious or not) device behavior

• Some of these devices will be constrained in terms of power & storage – requiring targeted solutions for security, end-to-end reachability, etc.
Who’s doing what?

- Standards are being developed to address these challenges.

- M2M / Converged GW can solve many of the challenges and some.
M2M – ETSI Network Architecture

Intelligent Pipe provides the bridge, enables Operator to monetize using Service Platform and APIs

M2M Capillary Network
WLAN, WPAN (Zigbee, 6LoWPAN, Bluetooth), Wireline

M2M Gateway
Interconnects M2M Capillary NW to Operator’s Core NW
Proxy for Service Provider NW to interact with and manage M2M devices
Provides local services

RAN

Cellular Core Network

M2M Server
Service APIs to 3rd-Party M2M Applications

Operator’s M2M Service Platform, offering Service Capabilities to 3rd-Party Application Providers
Solutions Flow into Terminal and Network Components

**Terminals**
- User Interface
- Applications
- Connection Manager
- Media Mobility
- Advanced Compression
- M2M Services
- Terminal Mobility (MIH)
- Security
- Bandwidth Aggregation, Segregation
- IP Layer
- Cellular
- WLAN
- WPAN

**Networks**
- Smart Personal Networks
- Media Mobility
- Advanced Compression
- M2M Services
- Radio Resource Management
- Security
- Bandwidth Aggregation, Segregation
- Dynamic Spectrum Management
- IP Layer
- Cellular
- WLAN
- WPAN

**M2M Device, Laptop, Netbook, iPad, Smart Phone, TV**

**Femtocell, Access Point, M2M Gateway, Home Gateway, Set Top Box, Server, Routers**
Network of Networks Concept Platform in the Home/Enterprise

Middleware Platform enabling intelligent multimedia & services delivery over heterogeneous networks

Enabling new services via well-defined APIs

Multimedia content adaptation and delivery

Connectivity and bandwidth management over heterogeneous networks
The Converged Gateway, seen as an “ETSI M2M Gateway” provides:

- A tool that extends the reach of an M2M service provider – extend into capillary networks in a home/enterprise
- Hierarchical integration of M2M Service Capabilities, allowing the functionality to reside closer to the involved entities while at the same time enabling optimizations in both network signaling load and data storage
- Proxying for Network Service Capabilities and Network applications
- Potential advanced features
  - Bandwidth and Spectrum Management
  - Enhanced Security (e.g. Security scalability, Platform validation, and Trusted Environment)
  - Media Mobility
Benefits of a Converged Gateway – At Service Layer (2 of 4)

• Real Gains…
  – Reduced Access/Core Network Signaling Load
    • Device and network registration information needs to be stored in a repository, typically located in the M2M server/core. This information can be mirrored, shared, and/or coordinated with the gateway → alleviating network signaling load
  – Efficient Management of Underlying Devices
    • Management of M2M Area Network devices by a gateway allows:
      – More efficient scheduling of management of individual devices,
      – “Bulk” management of similar devices, reducing signaling in M2M area network and access/core networks
      – Protocol translation if M2M Area Network management protocol is different from management protocol on the network side
  – Legacy device support
    • Gateways will allow ETSI compliant service layer to interact with legacy devices through an interworking unit
• Real Gains…
  – Security
    • Gateway permits group authentication, authorization, and registration, of M2M Area Network devices
    • Provides first level of “filter”ing to prevent interaction with access and core network
  – Network Selection
    • Gateway will allow selection of the optimum access network for communication to a network application. Similarly gateway will allow selection of optimum M2M Area Network parameters for communication to M2M devices
• Real Gains…
  – Device History Tracking
    • Gateway is best located to store device history for potential tracking purposes. Information can also be used to monitor device compliance to agreed profiles and to generate fault management reports.
  – Service Provider - User Experience
    • Gateway allows efficient bulk transfer through multicast and broadcast
    • Gateway will cache M2M device data for potential querying by network application. Gateway can synchronize the availability of the cached data from multiple sources → removing burden from device
    • Gateway can manage inter-M2M Area Network communication reducing network traffic over access/core networks
    • Gateway can provide user plane protocol conversion to allow M2M service to extend to constrained devices
    • Network applications can be accessed locally, bypassing need to go through M2M Server/Core
Benefits of a Converged Gateway – What’s Next?

- Converged Gateway is in a unique position as the link between the “internal” home/enterprise capillary networks and the external access/core/transport networks.

- It has access to information that can be used to provide a number of advanced services.
  - Self Organization
    - Gateway can provide M2M devices with operating parameters (bandwidth, transmission parameters, etc) → plug-n-play
  - Bandwidth aggregation
    - Gateway can provide aggregation of traffic to M2M devices across multiple wireless networks, enabled by the use of cognitive radio techniques and innovative network protocols combined with deep packet inspection → increased reliability and per-device throughput
Benefits of a Converged Gateway – What’s Next?

• It has access to information that can be used to provide a number of advanced services.
  – Interference management
    • Gateway can make use of whitespace through interaction with the TVWS (TV white space) database
    • Gateway will assign operating channels to M2M Area Networks with a focus to reducing interference
      → increases reliability and system throughput
  – Enhanced Security Features
    • Secure and trusted environment: an environment which can be trusted to perform security sensitive operations
    • Platform validation: an ability for a device to measure it’s “own health” and report the results to the Gateway / Core Network
    • Delegation and load balancing of traditional network-based security and device management features by using network edge components such as the M2M or Converged Gateway
Thank You for your time!
Live M2M Demo after this Session in the lobby.
Enabling the Operator’s Intelligent Pipe for M2M Services

Cellular Network

1. Subscribe/Register for alert
2. Request meter reading
3. Wake up sleeping sensor nodes, request readings
4. Send meter readings
5. Send meter readings
6. Send alert
7. Adjust Thermostat

M2M Gateway

WPAN

WLAN

Detect Interference, switch WPAN channels
Threshold Exceeded

Cache, aggregate, schedule data

WPAN channels switched

Capabilities applicable to Smart Grid, Smart Metering, Security, Appliance Control, Asset Tracking....
1. User gets multimedia call (voice and video) on phone via cellular
2. User moves to location with weaker cellular signal/high interference
3. Video is now offloaded via WLAN to phone
4. Noticing proximity to TV, user moves the media session to TV
5. As TV location has marginal coverage on both Cellular & WLAN, system aggregates video across Cellular & WLAN
Bandwidth Management Solution Highlights

• IP layer solution to load balance traffic over multiple network connections
  – Networks of same access type, or across heterogeneous networks
  – Bandwidth allocation based on policies (operator, user) and/or network conditions

• Key features:
  – Packet inspection to determine application flow type, QoS requirements
  – Programmable policy engine
  – Bandwidth segregation: allocation of different application flows to different networks, based on policies and/or network performance
  – Bandwidth aggregation: simultaneous distribution of application flow over multiple network connections
  – Bandwidth mobility: seamless movement of application flows across network connections, based on network conditions
Bandwidth Management Solution – Key Benefits

- Bandwidth multiplying technology enabling richer, seamless multimedia experience
  - Access to increased bandwidth
  - Increased access options, flexibility in network selection
  - Allocation of right bandwidth to right application at right time
  - Operator-controllable offloading of traffic from licensed -> unlicensed spectrum
  - Load sharing, load balancing among multiple network connections
  - Reliable, interference-robust support of high data rate applications
Network architecture flattens

To the users, the network disappears

Media is network agnostic

Media moves seamlessly, between devices and over networks

Media is context-optimized for network bandwidth, device capability, power, cost, etc.