Machine Communication Platforms for Smart Home Applications

Tom Pfeifer | Next Generation Networks | ANGA COM 2013
Paradigm shift in Pervasive / Ubiquitous Computing

◆ euphoric phase:
  ▪ instrument everything
  ▪ massive wireless sensor networks, smart dust / paint

◆ reality shock:
  ▪ manageability
  ▪ energy supply
  ▪ acceptance

◆ revised approach:
  ▪ fewer devices
  ▪ wired / wireless based on requirements
  ▪ more intelligence per device
  ▪ more sophisticated algorithms
  ▪ scalability: down
    (miniaturisation -> resource constraints)
  ▪ scalability: up
    (large scale deployments -> interoperability of heterogeneous domains)
M2M Segments
The Smart Environment Nervous System: M2M Communication Platforms

Internet of Things

generates these things:
1. communicate
2. interconnect
3. need brain

M2M platforms can play the role of a nervous system for Smart Environments
Efficiency of connections needs optimisation
Traffic patterns are quite different from Human-2-Human or Human-2-Machine communication.

Mobile data traffic increase is parallel to the increase in number of devices.

The device capabilities are spanning:
- from: simple sensor nodes
- to: high definition video cameras

The communication requirements are spanning:
- from: a “four byte” fire alarm
- to: continuous real-time HD video streaming
To become Smart means to give sense to the raw data
Stop the Silo Mindset - Horizontal Approach for M2M

Existing Proprietary Vertical Solutions
- Application
- Network Domain
- Device

Solutions have common Horizontal Layers
- Application
- Application
- Application
- Service Capabilities
- Network Infrastructure
- Converged Network Domain
- Device
- Device
- Device
- Gateway
- Device
Decoupling Networks from Infrastructure

- Management of virtual networks
  - Independent, isolated VNs, running different protocols, packet formats, management tools, etc.

- Provisioning of virtual networks
  - Collection of virtual resources, aggregated to build virtual networks

- Virtualisation of resources

- Infrastructure made of virtualizable network resources

Source: EURESCOM Project P1956
Communication Elements of the Smart Network

Connected Devices

- Physical Vicinity
- Sensor Actuator
- (Sensor) Gateway

Operator Networks

- 3G
- Operator Network
- Open mtc
- Telecom Network

Operator Core Network

- QoS & Charging
- Seamless Mobility
- Security

Mash-Up Service Platform

- M2M resources
- M2M session support
- Device and connectivity mgmt.
- M2M data handling

Business Front-end

- Delivery to multimedia warning device

Telecom Network

- Application mash-up
Open M2M platform

- TU Berlin (AV)
- Fraunhofer FOKUS (NGNI)

Standard-compliant reference implementation:
- ETSI TC M2M
- 3GPP (3rd Generation Partnership Project)
- OMA (Open Mobile Alliance)
OpenMTC implements most of the features of ETSI TS 102.921 and 102.690 including a

- Network Service Capability Layer (NSCL)
- Gateway Service Capability Layer (GSCL)
Integration and Interworking on all layers
Supporting Interoperability

Heterogeneous Application Integration
Heterogeneous System / Platform Integration
Heterogeneous Device Integration
OpenMTC Architecture
OpenMTC Features

- OpenMTC implements most of the features of ETSI TS 102.921 and 102.690 including a
  - Network Service Capability Layer (NSCL)
  - Gateway Service Capability Layer (GSCL)
- Both layers implement service capabilities:
  - Communication (LTE, 3G, WiFi, fixed)
  - Application Enablement (network, device and gateway applications)
  - Data storage (devices, applications, sensor measurements)
  - Security & Device Management
- OpenMTC allows interworking with
  - OpenEPC (integration with the core network, QoS, access network selection)
  - OpenIMS (IP Multimedia Subsystem)
  - Various sensors and actuators (e.g. ZigBee, FS20 devices)
OpenMTC Application Enablement

- Exposes functionalities implemented in the service layers (N/GSCL) via the reference points
  - mla
  - dla
- Single contact point for
  - Network Applications (NA)
  - Gateway Applications (GA)
  - Device Applications (DA)
- Performs routing between applications and capabilities in the N/GSCL
- Routing is defined as the mechanism by which a specific request is sent to a particular capability
OpenMTC Communication Features

- Applications can store and receive data
- RESTful communication paradigm
- HTTP transport
- Applications can execute remote actions
- Single point of contact for communication with other SCLs
- Reports transmission errors
- Relays messages towards other SCLs
- Can inspect traffic generated by a particular M2M Device or M2M Gateway
- Verify if traffic is matching a given traffic pattern
  - e.g. number of connections/traffic per day
  - more than 20% of the monthly average traffic is generated in one day, etc.
- Other policies reg. traffic inspection possible
- Transport session establishment and teardown along with security key negotiation
OpenMTC Communication Features

- Integration with OpenEPC
- Device and/or network triggered policy-based access network selection using the 3GPP ANDSF (e.g. if clients dispose of 3G, WiFi, LTE connectivity)
- Policy-based QoS on mld interface using the 3GPP PCRF (e.g. guaranteed bandwidth)
- NTOE capability connecting to the 3GPP MTC-IWF to execute device triggering (e.g. to wake up devices that are not attached to the 3G network)
OpenMTC Reachability, Addressing and Repository

- Implements the ETSI defined resource tree
- Store N/G/DA and D/G/NSCL related registration information
- Subscriptions Management
- Event notifications
- Store application and SCL data
- Provide data upon
  - requests
  - subscriptions
  - access rights and permissions
- Manage group of M2M devices or gateways
- Provides mapping between name of M2M Device, Gateway, or group and a set of information:
  - Reachability status of M2M Device or Gateway
  - Scheduling information pertaining to reachability of M2M Device or Gateway
OpenMTC Device Management

- Implements OMA DM
- Supports the ETSI defined Management Objects (MO) that map to
  - OMA DM (ETSI TS 103.092)
  - BBF TR-069 (ETSI TS 103.093)
- M2M device management
- Configuration Management
- Software and firmware upgrade of M2M Device or M2M Gateways
- M2M Area Network management
OpenMTC Device Interworking

- GIP capability provides interworking between non-ETSI compliant devices and the GSCL
- OpenMTC implements the following GIPs
  - ZigBee GIP
  - FS20 GIP
  - HTML 5, sensor API GIP
- GIPs provide the mapping from various devices to the respective ETSI defined resources inside the GSCL
- This allows for interoperability across various sensor network / M2M area network technologies
The New Value Chain

- Building on horizontal M2M middleware and associated SDKs, M2M infrastructure operators can cover large parts of the M2M value chain.

- Strong strategic partnerships will still be essential:
  - to cover system domain specific integration & application development
  - to cover domains with specific hardware requirements.
... danke

Further information:

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