DRAFT

Radiocommunication Study Groups

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INPUT TOWARDS WORKING DOCUMENTS ON OBJECTIVES AND REQUIREMENTS FOR MOBILE WIRELESS ACCESS SYSTEMS FOR COMMUNICATIONS TO A LARGE NUMBER OF UBIQUITOUS SENSORS AND/ OR ACTUATORS SCATTERED OVER WIDE AREAS IN THE LAND MOBILE SERVICE

1 Introduction

IEEE 802.16 Working Group (WG) has reviewed with great interest the liaison 5A/TEMP/203 (dated 18 May 2010) received from ITU-R Working Party 5A containing two attachments regarding "Mobile Wireless access systems providing telecommunications for a large number of ubiquitous sensors and/or actuators scattered over wide areas in the land mobile service".

The IEEE would like to inform WP 5A about the P802.16p project on enhancements to the IEEE 802.16 radio interface to support machine-to-machine (M2M) communications[1]. Developing M2M capability in broadband wireless access networks will accelerate implementation of the "Internet of things" vision.

The P802.16p project followed an IEEE 802 tutorial of March 2010 on the challenges and potential technology opportunities in future 802.16 networks[2]. The tutorial identified M2M services and applications as a key area for development of new wireless services. This M2M project has the objective of identifying M2M usages and applications, M2M features that are common across multiple applications, M2M system architecture, and potential optimizations of the IEEE 802.16 radio interface[3].

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[1] IEEE Project Authorization Request (PAR) P802.16p, 30 September 2010.

[2] IEEE C802.16-10/0016r1, "Future 802.16 Networks: Challenges and Possibilities," IEEE 802 Call for Interest Tutorial, March 2010.

[3] IEEE 802.16ppc-10/0002r7, "Machine to Machine (M2M) Communication Study Report," May 2010.

The IEEE P802.16p project was formally authorized by the IEEE-SA Standards Board on 30 September 2010. Work has begun on drafting system requirements[4].

2 IEEE P802.16p Project

The objective of the P802.16p project is to enable a range of M2M applications that are automated rather than human-controlled and which require Wireless Metropolitan Area Network (WMAN) communication in licensed bands. These applications have network access requirements that are significantly different from those used to support standard cellular connections. Some of the M2M applications of interest include secured access and surveillance, tracking, tracing and recovery, public safety, vehicular telematics, healthcare monitoring of bio-sensors, remote maintenance and control, smart metering, automated services on consumer devices, and retail digital signage. The IEEE P802.16p project intends to enhance the current IEEE 802.16 standard by addressing the unique requirements posed by these usages, such as very low power consumption, large numbers of devices, short burst transmissions, robust device integrity, high reliability, staged access priority, time tolerant operation, time controlled operation, low/no mobility, extremely low latency, and others.

IEEE P802.16p will specify enhancements to the IEEE 802.16 medium access control (MAC) and minimal modifications to the IEEE 802.16 Physical Layer (PHY), which is based on orthogonal frequency division multiple access (OFDMA). Minimization of any PHY changes is essential to avoid hardware changes to currently IEEE 802.16 base station/device equipment that may otherwise prevent quick entry into the M2M market. In this first stage of M2M optimizations, the following features will be supported: low power consumption at the device, support of extremely large numbers of devices, efficient small burst transmissions, and improved device authentication. While these features are not all-encompassing to the M2M applications space, they are common to several key applications, such as smart metering, remote maintenance and control, etc.

Figure 1 shows the basic system architecture that is assumed for IEEE 802.16 based M2M communications. In this figure, the IEEE 802.16 M2M device is an IEEE 802.16 mobile station with M2M functionality. The M2M server is an entity that communicates to one or more IEEE 802.16 M2M devices. The M2M server also has an interface which can be accessed by an M2M service consumer. The M2M service consumer is a user of M2M services (e.g., a utility company). The M2M server may reside within or outside the Connectivity Service Network (CSN) and can provide M2M specific services for one or more M2M devices. An M2M application runs on the M2M device and the M2M server.

[4] IEEE 802.16ppc-10/0011r2, "IEEE 802.16p Machine to Machine (M2M) System Requirements Document (Initial Working document)," September 2010.

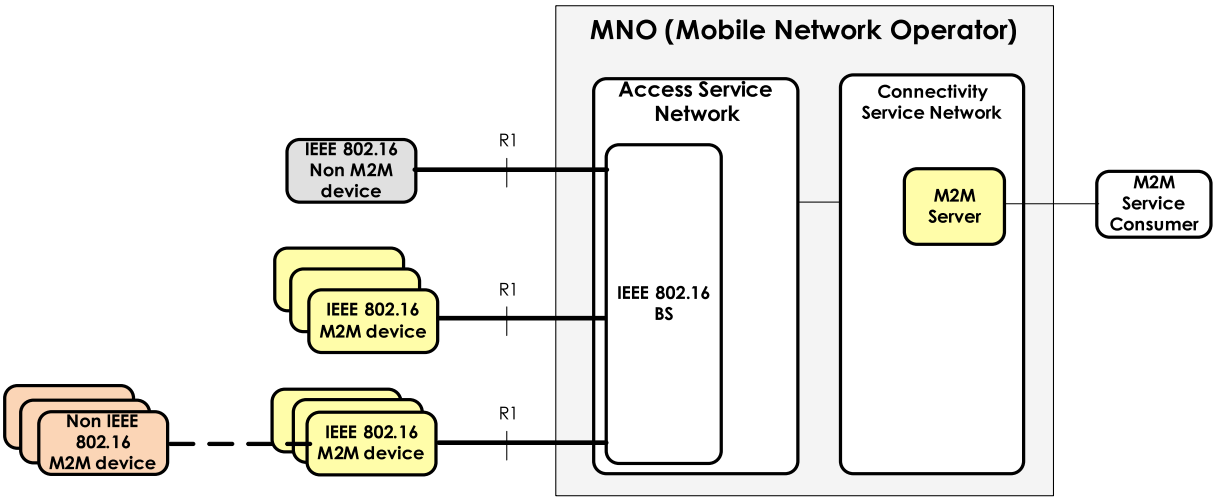

Figure 1. High-level M2M service system architecture

The M2M service system architecture in IEEE 802.16 supports two types of M2M communication: a) communication between one or more M2M devices and an M2M server, and b) point-to-multipoint communication between M2M devices and the BS. An IEEE 802.16 M2M device can act as an aggregation point for non-IEEE 802.16 M2M devices. The non-M2M devices typically comprise one or more sensors and a low power, low cost connectivity solution such as IEEE 802.11, IEEE 802.15, etc. The aggregation functionality will be critical to M2M deployments since not all devices will be able to support WMAN connectivity, and the aggregation device will provide an efficient and cost-effective means of supporting a large number of localized devices/sensors.

3 Discussion

In general, IEEE 802.16 is aligned with 5A/TEMP/203 on the wireless system features needed to enable M2M usages. There are, however, some items for which we have comments, and some that require further clarification:

- Long-term connectivity of the network interface: Longevity requirements -whether 5 to 10 years or several decades – need to be clarified. One of the implications of this requirement is that system may need to be designed with excess bandwidth.

- Communication range: The text calls for space diversity techniques to improve coverage. However, several other architectures and enabling technologies can be considered to improve coverage, such as femtocell networks, multi-RAT networks, relays, coordinated MIMO, and others.

- Accommodation capability: In our view, a video camera for surveillance applications may be regarded as a sensor. In this case, the data generated may be large and can potentially challenge the available system capacity. In our view, the system should be optimized for small data bursts but also accommodate large data transmissions.

- Suppression of interference: In addition to the techniques used for interference mitigation, smart resource scheduling (time/frequency resources) and/or MIMO techniques can also be extremely effective.

- New network topologies: These are required to provide the extra reliability required for some M2M applications.

- Security: Since the M2M device may be deployed remotely over long time periods, the network should provide support for the device to report any tampering or damage to the device. New security procedures are also necessary for new network topologies

- The wide area ubiquitous network (WAUN) application example provided in Attachment 2 seems hand tailored to low data rate and very long range. Given that devices are expected to stay in the field for many years without possibility of upgrade, we suggest further review of the usage model envisioned by the application regarding long term growth requirements

The IEEE is looking forward to continued cooperation with WP 5A on the development of the Report and Recommendation and on exchange of information on status and progress given our common goals.

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