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Implication of 3GPP Link Characteristics on Lightweight IP Design
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Abstract

In 3GPP Release 12, the work item Machine Type Communication (MTC) is specifying low cost terminals for Machine to Machine communications. Since IETF has already developed a suite of protocols for device communication, it is useful to analyze the limitation of 3GPP MTC and the impact on the implementation of IETF protocol suite. This document analyzes the feature of 3GPP MTC and the impact on light weight protocol implementation for the MTC terminals.

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1. Introduction

As the Internet of Things are booming, it is important for cellular networks to support the Machine to Machine communication. In 3GPP one work item is set up since Release 10 to deal with the so called Machine Type Communication (MTC) in cellular network.

At the same time, IETF has developed a suite of Internet protocols suitable for small devices, including 6LowPAN [RFC6282], 6LowPAN-ND [RFC6775], RPL[RFC6550], COAP[I-D.ietf-core-coap].

This document tries to summarize the feature of 3GPP MTC and the impact on implementation of the IETF light-weight protocols suite in each layer. Link characteristic implications on upper layer protocols are also analyzed in [I-D.hex-lwig-energy-efficient].

1.1. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL","SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119]

1.2. Terminology

The terminologies used in this document can be referred to [I-D.ietf-lwig-terminology].

2. 3GPP MTC features

In 3GPP the scenarios for MTC and the features of the MTC is analyzed. Following are the features which is considered specific for MTC.[TS22.368]

1. Low Mobility: It is intended for use with MTC Devices that do not move, move infrequently, or move only within a certain region.

2. Time Controlled: It is intended for use with MTC Applications that can tolerate to send or receive data only during defined time intervals and avoid unnecessary signalling outside these defined time intervals.

3. Small Data Transmissions: It is intended for use with MTC Devices that send or receive small amounts of data. The observed size of many of the instances of data exchanges is on the order of 1K (1024) octets.

4. Infrequent Mobile Terminated: It is intended for use with MTC Devices that mainly utilize mobile originated communications.

5. MTC Monitoring: It is intended for monitoring MTC Device related events.

6. Secure Connection: It is intended for use with MTC Devices that require a secure connection between the MTC Device and MTC Server /MTC Application Server.

7. Group Based MTC Features: It is a MTC Feature that applies to a MTC Group. Generally the system shall be optimized to handle MTC Groups. The system shall provide a mechanism to associate an MTC Device to a single MTC Group. There are two sub features for Group based MTC features.

    a. Group Based Policing is intended for use with a MTC Group for which the network operator wants to enforce a combined QoS policy.

    b. Group Based Addressing is intended for use with a MTC Group for which the network operator wants to optimize the message volume when many MTC Devices need to receive the same message.

On the other hand, IETF has developed multiple protocols to enable end-to-end IP communication between constrained nodes and fully capable nodes. These works have witnessed the evolution of the traditional Interent protocol stack to the light-weight Internet protocol stack. As show in the below , IETF has developed CoAP as the application layer, and 6LowPAN as the adaption layer to run IPv6 on IEEE 802.15.4 and Bluetooth Low-Energy, with the support of routing from RPL and efficient neighbor discovery from 6LowPAN-ND.

However according to the features of 3GPP MTC, not all IETF protocol suites are necessary to be implemented for cellular MTC devices. In this document the impact of the MTC features on IETF protocol suites are analysed.

3. Impact on light weight implementation

3.1. Network layer

IPv6 is mandatory for 3GPP terminals. The consideration to implement IPv6 for 3GPP terminal is specified in [RFC3316]. As specified in RFC3316, standard IPv6 protocol stack is used. The MTC device does not need to support 6lowpan, 6lowpan-ND, or RPL for the communication between MTC device and MTC server or application in the cellular network.

However in cellular network deployment scenario, the MTC device is sometimes used as gateway device to bridge other resource constrained nodes to the cellular network. So the MTC device needs to implement 6lowpan-ND or RPL if other resource constrained nodes is connected through 802.15.4 or other wireless technologies.

3.2. Transport Layer

For MTC device, the assumed use case and scenario is about small data transmission. And the reliability is not required. Therefore the UDP based transport is suitable for MTC and should be mandatory for all cellular terminals.

3GPP MTC needs to support secure connection between MTC device and MTC server/ MTC Application Server. In this case the light-weight secure transport protocol such as DTLS should be supported by 3GPP MTC device.

3.3. Application Layer

CoAP [I-D.ietf-core-coap]was designed as a restful application protocol, connecting the smart devices application and service to the world-wide-web. It provides basic communication services such as service discovery and GET/POST/PUT/DELETE methods with a binary header. It is assumed to work over IPv6 in the network layer.

Although IPv6 is made mandatory for 3GPP terminals, IPv4 is still considered a default protocol for 3GPP MTC [TS23.888]. IPv4 based communication is used for communicaton between MTC device and MTC server. Many CoAP features are based on IPv6 assumption. For example, auto-configuration, resource discovery, etc. Therefore if CoAP is used for cellular network, it is necessary to consider how to support IPv4 for the mentioned CoAP features.

4. IANA Considerations

This document has no IANA requests.

5. Security Considerations

The security implementation should follow both 3GPP and IETF specifications.

6. References

6.1. Normative References

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