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Komunikacijski sistemi za merilnike - 8. del: Prilagodilna plast

Communication systems for meters - Part 8: Adaptation layer

Kommunikationssysteme für Zähler - Teil 8: Anpassungsschicht

Systèmes de communication pour compteurs - Partie 8 : Couche adaptation

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Communication systems for meters - Part 8: Adaptation layer

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Kommunikationssysteme für Zähler - Teil 8: Anpassungsschicht

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 13757-8:2021) has been prepared by Technical Committee CEN/TC 294 “Communication systems for meters”, the secretariat of which is held by DIN.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Introduction

This document belongs to the EN 13757 series, which covers communication systems for meters. EN 13757-1 contains generic descriptions and a communication protocol. EN 13757-2 contains a physical and a Link Layer for twisted pair based Meter-Bus (M-Bus). EN 13757-3 contains detailed description of the application protocols especially the M-Bus Protocol. EN 13757-4 describes wireless communication (often called wireless M-Bus or wM-Bus). EN 13757-5 describes the wireless network used for repeating, relaying and routing for the different modes of EN 13757-4. EN 13757-6 describes a twisted pair local bus for short distance (Lo-Bus). EN 13757-7 describes transport mechanism and security methods for data. The Technical Report CEN/TR 17167 contains informative annexes from EN 13757-2, EN 13757-3 and EN 13757-7.

The M-Bus protocol upper layers (Transport and Application) can be used with various lower layers (Network, Data Link and Physical) as described in EN 13757-1. Systems based on the M-Bus protocol stack are well established in the metering market in Europe. In parallel, other wireless communication networks so called LPWAN (Low Power Wide Area Networks) have been widely deployedand targeting metering applications as well. The OSI reference model enables the transport of M-Bus upper layers on top of LPWANs lower layers. To ensure a seamless transition of the legacy systems based on Wireless M-Bus to LPWAN, an M-Bus Adaptation Layer (MBAL), needs to provide the necessary services and information, via an adequate interface, to the upper layers to minimize the impact on their existing implementations.

1 Scope

This document describes the functionalities and specifies the requirements of an Adaptation Layer to be applied when transporting M-Bus upper layers using a wireless communication protocol other than Wireless M-Bus. These alternative radio technologies developed outside CEN/TC 294 could be based on Internet Protocol or not and operate either in licensed or unlicensed frequency bands.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definition apply:

3.1
end device
communication end node like a radio adapter or a meter or other similar device

3.2
gateway
intermediate node in a data communication network, connected to two or more logical networks, where the protocols or modes used on the logical networks are different

3.3
head end system
system responsible for the management, reading and data collection of end devices applications

3.4
downlink
transmission in the direction from a gateway or a head end system to the end device

3.5
core network
a set of logical and physical entities providing the communication services between the HES and the end devices

3.6
uplink
transmission in the direction from an end device to the gateway or head end system

3.7
frame
unit of transmission at the Data Link Layer

3.8
low power wide area network
wireless technologies with characteristics such as large coverage areas, low bandwidth, possibly very small packet and application-layer data sizes, and long battery life operation

3.9
L(n)
refers to layer level (n) in the OSI model

4 Abbreviations and symbols

4.1 Abbreviations

AES – Advanced Encryption System

AFL – Authentication and Fragmentation Layer

APL – Application Layer

CI – Control Information (field)

CIoT – Cellular IoT

CN – Core Network

CSGN – CIoT Serving Gateway Node

DLL – Data Link Layer

DMZ – Demilitarized Zone

DoNAS – Data over NAS

ECM – EPS Connectivity Management

ED – End Device

eDRX – extended Discontinuous Reception

ELL – Extended Link Layer

eDRX – (LTE) Extended Discontinuous Reception

eNB – Evolved Node B

EPC – Evolved Packet Core

EPS – Evolved packet System

E-UTRAN – Evolved UMTS Terrestrial Radio Access Network

FUOTA – Firmware Update Over The Air

GPRS – General Packet Radio Service

GTP-U – GPRS Tunnelling Protocol – User Plane

HARQ – Hybrid Automatic Repeat Request

HES – Head End System

HTTP – Hyper Text Transfer Protocol

IoT – Internet of Things

IP – Internet Protocol

LLC – Logical Link Control

LPWAN – Low Power Wide Area Network

LTE – Long Term Evolution

MAC – Medium Access Control

MBAL – M-Bus Adaptation Layer

MCL – Maximum Coupling Loss

MME – Mobility Management Entity

MNO – Mobile Network Operator

NAS – Non-Access Stratum

NIDD – Non-IP Data Delivery

NWL – Network Layer

PCI – Protocol Control Information

PDCP – Packet Data Convergence Protocol

PDN – Packet Data Network

PGW – PDN Gateway

PDU – Protocol Data Unit

PHY – Physical Layer

PSM – Power Saving Mode

PTW – Paging Transmission Window

RAN – Radio Access Network

REST - Representational State Transfer

RLC – Radio Link Control

RRC – Radio Resources Control

S1AP – S1 Application Protocol

SCTP – Stream Control Transmission Protocol

SDU – Service Data Unit

SGW– Serving Gateway

RF – Radio Frequency

RFU – Reserved for Future Use

TAU – Tracking Area Update

TCP – Transmission Control Protocol

TPL – Transport Layer

UE – User Equipment

UDP – User Datagram Protocol

4.2 Symbols

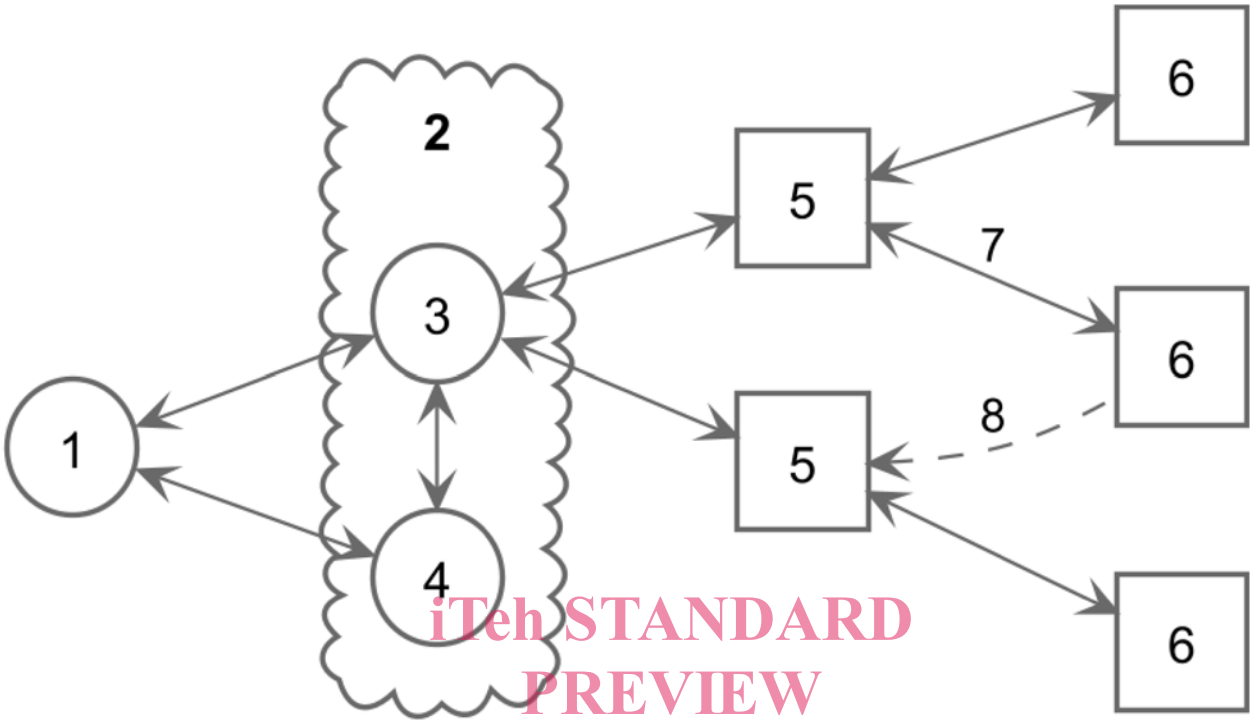
Hexadecimal numbers are designated by a following “h”.

Binary numbers are designated by a following “b”.

Decimal numbers have no suffix.

5 Network architecture

5.1 Overview



Key

1 Head End System
2 Core Network
3 Network Manager
4 Security Server
5 Gateway
6 End Device
7 Active Link
8 Spare Link

Figure 1 — LPWAN Network Architecture Overview

5.2 General description of network entities

5.2.1 Head End System

The HES is deployed and managed by the metering service or application provider. HES, and its related components are responsible for handling TPL/AFL / APL layers. It could be built of several components each of them is dealing with a given set or subset of functionalities or services typically fragmentation.

The HES is connected to the Core Network via dedicated interfaces and protocols and uses its services to exchange data messages with the end devices. It could also be connected to security server to manage the communication security requirements.

5.2.2 Core Network

5.2.2.1 Network Manager

The Network Manager is responsible for managing communication links and infrastructure using Network, DLL, and MAC services according to the protocol specifications. It allocates the necessary resources to establish a communication between the HES and the end device. These services enable the configuration and setting of different communication parameters to optimize network and end devices resources usage and enforce wireless communication rules.

The network manager communicates with the end devices through the gateways. Both elements are under the control of the network manager. In order to secure the communication link, the network manager could be connected to the security server to retrieve the adequate security material.

5.2.2.2 Security Server

The security server is responsible for managing the security services. It holds the necessary cryptographic keys and credentials of the end devices and distribute them to the network and the HES, via dedicated and secure interfaces, to achieve the required level of data confidentiality, integrity and authentication. These security materials are conveyed and stored in the security server in a way compliant with standard security policies.

5.2.3 Gateway

The gateway is a network element responsible for the transfer of RF frames between the network manager and the end device. Any frame transmitted by the network manager to the end device via the gateway is called downlink frame. Reciprocally, any frame transmitted by the end device to network manager via the gateway is called uplink frame. One uplink frame could be received on several gateways while a downlink is transmitted by a single gateway (see element 7 and 8 in Figure 1).

A gateway is potentially capable of operating on different frequency bands and/or channels and transmitting or receiving multiple frames at the same time.

5.2.4 End Device

The end device is responsible for managing all layers. It communicates with the gateway on the LPWAN layers and with the HES on the upper layers (APL/TPL/AFL). An end device is potentially capable of running several applications using one or multiple LPWAN. The necessary security material is either stored in the end device's memory or conveyed from the security server by the network manager.

Each end device has an LPWAN unique identifier equivalent to MAC address. The upper layers use the application address, contained in the TPL, to identify the end device when communicating with the HES.

Attention should be paid to the cases where multiple meters or sensors are served by a single end device acting as a radio adapter. In that case, the long header format of the TPL shall be used in each application message in both directions (ED <-> HES) while the end device uses its unique LPWAN ID at the lower layers.

To announce the relationship between the unique LPWAN ID and the application address, the latter shall be transmitted at least during the initialisation phase.

If there is a 1:1 relation between the unique LPWAN ID and application address, then the transmission of the application address may be skipped in any later message transfers. Otherwise, the application address needs to be provided at any time.