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Partie 21-1: Services indépendants des supports

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IEEE Standard for Local and metropolitan area networks—

Part 21.1: Media Independent Services

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Abstract: Several use cases and services are defined, namely, handover between heterogeneous networks, home energy management system, software-defined radio access networks (SDRANs), radio resource management (RRM), and device-to-device (D2D) communication service that need to be implemented in conjunction with the media independent services (MIS) framework as specified in IEEE Std 802.21™-2017.

Keywords: home energy management system, IEEE 802®, IEEE 802.21™, IEEE 802.21.1™, media independent handover, media independent service, mobile node, mobility, network-assisted device-to-device communication, point of attachment, point of services, radio resource management, seamless, software-defined radio access network, use case

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Introduction

This introduction is not part of IEEE Std 802.21.1-2017, IEEE Standard for Local and metropolitan area networks—Part 21.1: Media Independent Services.

This standard defines several use cases and services, namely, handover between heterogeneous networks, home energy management system (HEMS), software-defined radio access networks (SDRANs), radio resource management (RRM), and device-to-device (D2D) communication service that need to be implemented in conjunction with the media independent services (MIS) framework as specified in IEEE Std 802.21-2017.

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IEEE Standard for
Local and metropolitan area networks—

Part 21.1: Media Independent Services

1. Overview

1.1 Scope

This standard defines several media independent services (MIS); handover, home energy management system (HEMS), software-defined radio access networks (SDRANs), radio resource management (RRM), and device-to-device (D2D) communication that shall be implemented in conjunction with the MIS framework as defined in IEEE Std 802.21™-2017 to optimize the performance of such services.

1.2 Purpose

The purpose of this standard is to describe the media independent use cases and services, and when implemented using the framework described in IEEE Std 802.21-2017, the user experience and management of mobile devices can be greatly improved. The services described in this specification are applicable for interworking between IEEE 802® networks and non IEEE 802 networks (e.g., cellular networks).

1.3 General

This standard describes the following use cases that can be independently implemented using the MIS framework (IEEE Std 802.21-2017), which improves the user experience of mobile devices and management of these devices by operators while mobile devices are either connected or interworking in a heterogeneous networking environment:

- Media independent handover service (Clause 5).
- Media independent service for software-defined radio access networks (SDRANs) (Clause 6).
- Media independent service for home energy management system (HEMS) (Clause 7).
- Media independent service for radio resource management (RRM) (Clause 8).
- Media independent service for device-to-device (D2D) communication (Clause 9).

The handover service use case provides link-layer intelligence and other related network information to upper layers to optimize handovers between heterogeneous networks. This includes media types specified by Third Generation (3G) Partnership Project (3GPP™), 3G Partnership Project 2 (3GPP2), both wired and wireless media in the IEEE 802 family of standards, and downlink-only (DO) media such as Digital Video

Broadcasting (DVB), Terrestrial Digital Multimedia Broadcasting (T-DMB), and Advanced Television Systems Committee—Mobile/Handheld (ATSC-M/H).[1] The use case addresses the support of handovers for both mobile and stationary users supporting both dual-radio and single-radio mode of operation. For mobile users, handovers can occur when wireless link conditions change due to the users' movement. For the stationary user, handovers become imminent when the surrounding network environment changes, making one network more attractive than another.

The SDRANs use case describes how the MIS framework is used to support the seamless handover in a software-defined radio access network (SDRAN) environment that includes both fronthaul and backhaul networks. The MIS framework enables operators to provide link-layer intelligence, allocate radio resources, and optimize handovers when a mobile device is switching between heterogeneous networks that are managed by a software-defined networking (SDN) controller.

The HEMS use case describes how MIS framework is used to control the devices in a home networking environment for energy management purpose. This use case leverages the media independent command service (MICS) framework and multicast group management capabilities as defined in IEEE Std 802.21-2017.

The RRM service use case describes how MIS framework is used to support resource management in heterogeneous networks. The MIS framework enables mobile node (MN) to monitor its link status (e.g., signal strength and data rate), communicate it to the network, and provide control to its physical layer and data link layers. Leveraging these capabilities, this use case describes how an operator controls and manages the radio resources (e.g., frequency and power) in a heterogeneous networking environment that uses various communication technologies and various frequency bands.

The D2D communication service use case describes how MIS framework is used to provide D2D communication service between MNs that are in close proximity. Using MIS framework, communication service providers and network operators help an MN to search for and connect to its peer when requested. The MN then discovers other MNs in close proximity and connects them using network assistance. Network operators save network resources by offloading data to D2D communication.

This standard also defines additional primitives and messages that are required to support the preceding use cases, which are not specified in IEEE Std 802.21-2017. The configuration and management parameters for all MIS are defined in a MIB, see Annex I of IEEE Std 802.21-2017.

1.4 Assumptions

The following assumptions apply during a single-radio handover for a device that has two or more radios:

a) In a single-radio scenario, the mobile device transmits on only one radio at a time. The target radio shall not transmit while the source radio is transmitting.

b) While the source radio is receiving, the target radio shall not transmit in a manner causing interference to the source radio receiver.

c) Prior to handover completion, only the source radio link is used to carry data.

1.5 Media independence

This standard, in conjunction with IEEE Std 802.21-2017, is intended to provide a generic interface between higher layer protocol stack and existing media-specific link layers, such as those specified by 3GPP, 3GPP2, the IEEE 802 family of standards, and downlink-only media.

[1] 3GPP is a trademark of The European Telecommunications Standards Institute (ETSI).

The handover use case uses service access points (SAPs) and primitives that provide generic link-layer intelligence. Individual media-specific technologies thereafter need to enhance their media-specific SAPs and primitives to satisfy the generic abstractions of this standard. Suitable adaptations are required to existing lower layer [medium access control (MAC) layer and physical (PHY) layer] standards of different media-specific technologies such as IEEE Std 802.3™-2015, IEEE Std 802.11™-2012, IEEE Std 802.16™-2012, 3GPP, 3GPP2, and DVB to satisfy the requirements of generic link-layer intelligence identified by this standard.[2]

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 802.1Q™-2014, IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks.[3, 4]

IEEE Std 802.3™-2015, IEEE Standard for Ethernet.

IEEE Std 802.11™-2012, IEEE Standard for Information Technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications.

IEEE Std 802.16™-2012, IEEE Standard for Air Interface for Broadband Wireless Access Systems.

IEEE Std 802.21™-2017, IEEE Standard for Standard for Local and metropolitan area networks—Part 21: Media Independent Services Framework.

IETF RFC 3748 (2004-06), Extensible Authentication Protocol (EAP).[5]

IETF RFC 4140 (2005-08), Hierarchical Mobile IPv6 Mobility Management (HMIPv6).

IETF RFC 4857 (2007-06), Mobile IPv4 Regional Registration.

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IETF RFC 5268 (2008-06), Mobile IPv6 Fast Handovers.

IETF RFC 5944 (2010-10), IP Mobility Support for IPv4, Revised.

IETF RFC 6275 (2011-07), Mobility Support in IPv6.

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