

IEEE Standard for Wireless Access in Vehicular Environments (WAVE)— Networking Services

IEEE Vehicular Technology Society

Sponsored by the
Intelligent Transportation Systems Committee

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Abstract: Wireless Access in Vehicular Environments (WAVE) Networking Services provides services to WAVE devices and systems. Layers 3 and 4 of the open system interconnect (OSI) model and the Internet Protocol (IP), User Datagram Protocol (UDP), and Transmission Control Protocol (TCP) elements of the Internet model are represented. Management and data services within WAVE devices are provided.

Keywords: Provider Service Identifier (PSID), Wireless Access in Vehicular Environments (WAVE), WAVE Short Message (WSM)

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Introduction

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This document replaces IEEE Std 1609.3™-2007.

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1. Overview

1.1 General

A WAVE system is a radio communications system intended to provide interoperable services to transportation. These services include those recognized by the U.S. National Intelligent Transportation Systems (ITS) Architecture and many others contemplated by the automotive and transportation infrastructure industries. These services include communications between vehicles and roadside units, vehicles and other vehicles, and perhaps communications among other WAVE devices. WAVE Networking Services provide management services and data delivery services between WAVE devices. This is but one component in the overall WAVE architecture, which includes IEEE P1609.1TM [B1],¹ IEEE P1609.2TM,² IEEE Std 1609.4TM, IEEE Std 802.11TM, and IEEE Std 802.11pTM. The WAVE architecture is described in IEEE P1609.0TM.

1.2 Scope

The scope of this standard is the specification of network and transport layer protocols and services that support multi-channel wireless connectivity between IEEE 802.11 Wireless Access in Vehicular Environments (WAVE) devices.

¹ The numbers in brackets correspond to those of the bibliography in Annex I.

² Information on references can be found in Clause 2.

1.3 Purpose

WAVE Networking Services represent layers 3 and 4 of the open system interconnect (OSI) communications stack. The purpose of this standard is to provide addressing and data delivery services within a WAVE system, providing multiple higher layer entities access to WAVE communication services. Upper layer support includes in-vehicle applications offering safety and convenience to their users.

1.4 Conformance

Per the *IEEE Style Manual* [B2], this standard includes normative and informative information. Normative text may describe mandatory or optional features. A mandatory feature may have optional as well as mandatory components. For example, a mandatory message may have optional fields. An optional feature may have components that are mandatory if the feature is supported. For example, an optional message might require a certain field. Additionally, a feature may be conditional on support of another feature. For example, if A is supported, at least one of B or C must be supported.

In this standard, features are designated as mandatory, optional, or conditional in the introduction to the subclause specifying the feature. The designation applies to the requirements found in the subclause itself as well as any subordinate subclauses, unless otherwise indicated. The word *shall*, when applied to a component of an optional feature, indicates that the component is mandatory if the feature is supported, i.e., conditional on support for the feature. The protocol implementation conformance statement (PICS) in Annex C summarizes the features and their components.

1.5 Document organization

Clause 1 provides an overview of the document. Clause 2 and Clause 3 contain references, definitions, and abbreviations, respectively. Clause 4 provides a general description of WAVE Networking Services. Clause 5 specifies the data plane elements of WAVE Networking Services, which carry higher layer data through the system. Clause 6 specifies the management plane functions that support system operations. Clause 7 defines the primitives used to communicate between WAVE Networking Services and other internal functional entities. Clause 8 specifies the format of WAVE Service Advertisements and Short Messages. Annex A and Annex B contain a description, and formal definition, of the management information employed by WAVE Networking Services. Annex C provides a PICS proforma. Annex D provides some examples of Networking Services usage. Annex E contains allocated *WAVE Element ID* values. Annex F specifies a supplement to the WAVE Short Message Protocol for safety applications. Annex G shows the contents of example WAVE packets. Annex H shows example Provider Service Identifiers. Annex I provides an informative bibliography and definitions.

1.6 Document conventions

Unless otherwise noted, conventions follow those in IEEE Std 802.11, including conventions for the ordering of information within data items as specified in Clause 8 of this standard.

Numbers are decimal unless otherwise noted, except Internet Protocol (IP) addresses, which are hexadecimal per the conventions defined in IETF RFC 2373. Numbers preceded by 0x indicate hexadecimal numbers, so that 0xFF is equivalent to “FF hexadecimal.” Numbers preceded by 0b are binary.

Words in italics refer to data items that are defined as either a field in an interface primitive, a field in an over the air message, or a data item in the management information base (MIB).