

Use of the IEEE Assigned Provider Service Identifier Field in Wireless Access in Vehicular Environments (WAVE)

Introduction

The Provider Service Identifier (PSID) is a four-byte numeric field used by the IEEE Standard 1609™ family of standards to identify a particular application entity. It is used in announcement messages from “provider” Wireless Access in Vehicular Environments (WAVE) devices to identify that this application’s service is provided by this device. Other “user” devices host applications that may be users of such a service. The user device receives these announcements and determines when there is a match between the roadside service provider and the in-vehicle local service user. The PSID value determines if there is a match between these service providers and corresponding service users.

WAVE is a means of communicating between vehicles (cars and trucks) and between roadside systems and vehicles. These standards, together with IEEE Std. 802.11™-REVma, are used to provide full interoperability between WAVE devices mounted on the vehicles and the roadside.

Standards

IEEE Std 1609.1™-2006, Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE) — Resource Manager

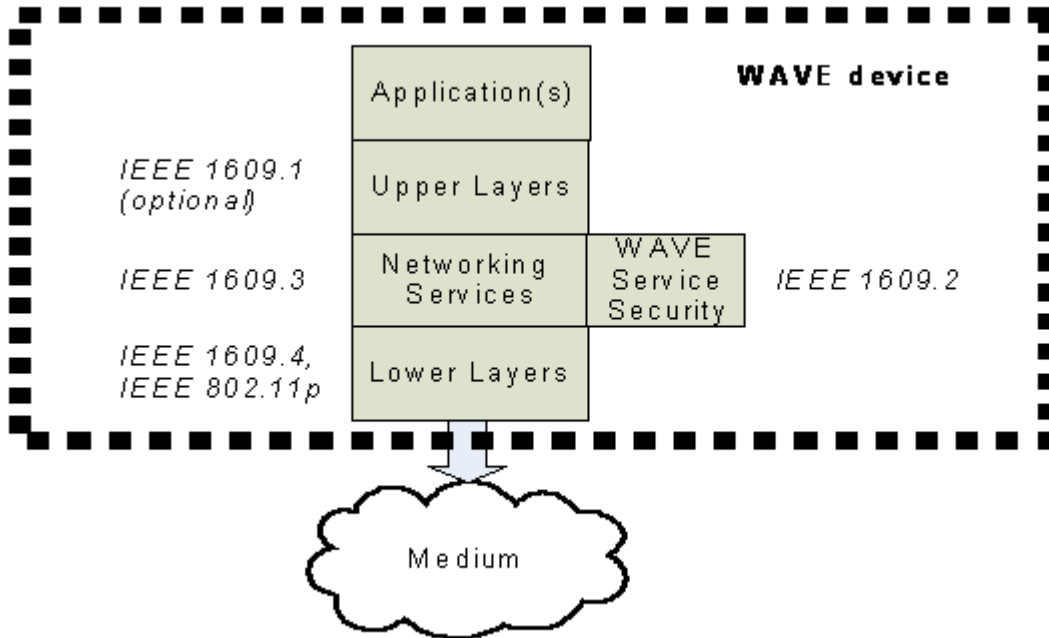
IEEE Std 1609.2™-2006, Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE) — Security Services for Applications and Management Messages

IEEE Std 1609.3™-2007, Trial-use Standard for Wireless Access in Vehicular Environments (WAVE) — Networking Services

IEEE Std 1609.4™-2006, Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE) — Multi-Channel Operation

WAVE Overview

The IEEE 1609™ standards represent the upper layers of the ISO Open System Interconnection (OSI) Reference Model communications stack, with IEEE Std. 802.11-REVma™ (using the 802.11p amendment) as shown in the figure.



WAVE Implementation Example

A typical implementation would have an application installed on a roadside device that is intended to interact (exchange messages and data) with vehicles as they drive past this device. In this example, the roadside application would be considered to be providing a service to passing vehicles, which would be users of this service. To avoid every car from having to establish a communications link with every roadside device that it passes, the roadside device periodically (e.g., every 100ms) transmits an announcement message that identifies applications that it hosts to passing vehicles. The roadside devices offering services are known as “service providers.”

The vehicles passing roadside units compare the list of services provided with the list of services installed in the vehicle’s onboard unit. The PSID is the registered numerical value representing this application/service. The PSID therefore must uniquely identify a particular application for both devices to know if they have matching services. If the PSID were not registered, there would be no assurance that the value used was unique to that application, and could result in extraneous communications links being formed that could negatively impact the loading of the radio channels and thus degrade service to all.

This example is of a roadside device offering services to passing vehicles, however many uses for WAVE are of vehicle to vehicle communications, with no roadside

device involved. The announcement message described in the example may also be sent from a device in the vehicle.

Goal of WAVE System

The WAVE system was developed with a primary goal of enabling vehicular safety applications. These require a high degree of reliability and interoperability, so that a message sent from one car is not only received by all other cars in the immediate area regardless of the make/model, but its meaning and data content is fully understood by these other cars so that they make the appropriate response.

Several changes from the basic technology (IEEE Std. 802.11-REVma™ which is also known as Wi-Fi™) were required to achieve this goal. The most significant change is to accommodate an extremely short time in which devices must recognize each other and transmit messages to each other. A large number of these safety applications require response times measured in milliseconds.

The normal IEEE Std. 802.11-REVma™ means of recognizing nearby stations and associating with them (establishing a link between two or more devices) cannot be used because it can take multiple seconds to complete. For this reason, the periodic transmission of announcement messages defined in IEEE Std 1609.3™ are used to replace the beacons used in IEEE Std. 802.11-REVma™.

These announcement messages, in addition to many other parameters, contain the PSID so that devices receiving the announcement can immediately determine if they should respond or not. In some cases, data contained within the announcement message itself can be directly forwarded to the appropriate application without first establishing a communications link, thus further shortening the response times. Again, this is accomplished by including the PSID in the announcement so that the intended application is identified without first requiring a bi-directional data exchange to establish a link.

Application and User Service Identity

A general rule, not a requirement, is that a given PSID identifies a specific application or user service that includes a standardized data dictionary and message set. This is the means by which all data being transmitted is in a known set and ordering of parameters. Such data dictionary or message set standards will typically also identify the expected response or action to take upon receipt of one of these messages. When full interoperability is not required, then a standardized data dictionary or message set is not required.

Every application using WAVE communications system must have a registered PSID value to identify it. Registration is required to ensure that the value used is unique

to this application. Without a valid PSID, the application cannot be installed, and thus cannot operate, in a WAVE system.

PSID Use

Use of an existing PSID should be considered before applying for a new assignment. There may already be an application similar to the new one being developed. If the existing PSID, and any data dictionary or message set developed for it, is intended to perform a similar user service, consideration should be given to using this existing PSID. In such cases, the organization responsible for the pre-existing PSID can be identified from the registration list and can be contacted to obtain additional information about the application(s) supported. Even if a new PSID is still required, this organization may be able to expand upon any existing data dictionary and message set standards to accommodate the new application.