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Inteligentni transportni sistemi - Komunikacija med vozili - Geomreženje - 1. del: Zahteve

Intelligent Transport Systems (ITS) - Vehicular Communications - GeoNetworking - Part 1: Requirements

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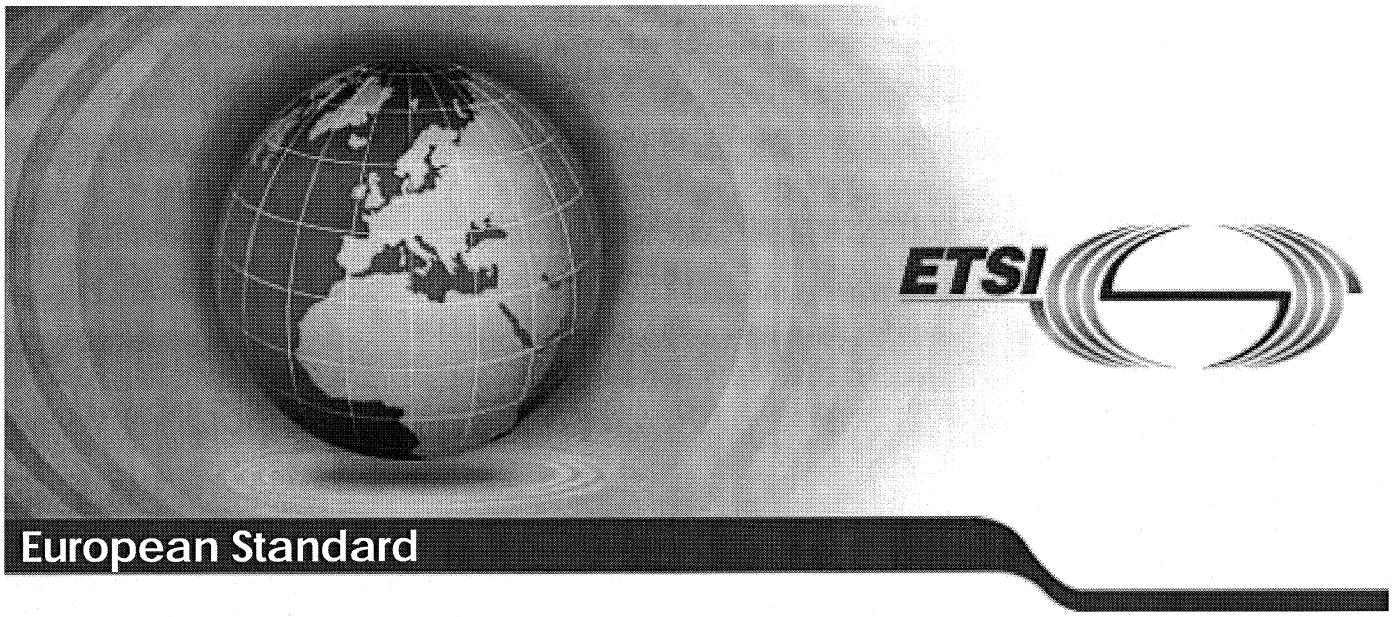

Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 1: Requirements

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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 1 of a multi-part deliverable covering Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking, as identified below:

Part 1: "Requirements";

Part 2: "Scenarios";

Part 3: "Network architecture";

Part 4: "Geographical addressing and forwarding for point-to-point and point-to-multipoint communications";

Part 5: "Transport protocols";

Part 6: "Internet integration".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Introduction

Wireless communication is a cornerstone of future Intelligent Transport Systems (ITS). Many ITS applications require the dissemination of information with a rapid and direct communication, which can be achieved by ad hoc networking. GeoNetworking is a network-layer protocol for mobile ad hoc communication based on wireless technology, such as ITS-G5. It provides communication in mobile environments without the need for a coordinating infrastructure. GeoNetworking utilizes geographical positions for dissemination of information and transport of data packets. It offers communication over multiple wireless hops, where nodes in the network forward data packets on behalf of each other to extend the communication range. Originally proposed for general mobile ad hoc networks, variants of GeoNetworking have been proposed for other network types, such as vehicular ad hoc networks (VANETs), mesh networks and wireless sensor networks. Therefore, GeoNetworking can also be regarded as a family of network protocols based on the usage of geographical positions for addressing and transport of data packets in different types of networks.

In VANETs, GeoNetworking provides wireless communication among vehicles and among vehicles and fixed stations along the roads. GeoNetworking works connectionless and fully distributed based on ad hoc network concepts, with intermittent or even without infrastructure access. The principles of GeoNetworking meet the specific requirements of vehicular environments: It is well suited for highly mobile network nodes and frequent changes in the network topology. Moreover, GeoNetworking flexibly supports heterogeneous application requirements, including applications for road safety, traffic efficiency and infotainment. More specifically, it enables periodic transmission of safety status messages at high rate, rapid multi-hop dissemination of packets in geographical regions for emergency warnings, and unicast packet transport for Internet applications.

GeoNetworking basically provides two, strongly coupled functions: *geographical addressing* and *geographical forwarding*. Unlike addressing in conventional networks, in which a node has a communication name linked to its identity (e.g. a node's IP address), GeoNetworking can send data packets to a node by its position or to multiple nodes in a geographical region. For forwarding, GeoNetworking assumes that every node has a partial view of the network topology in its vicinity and that every packet carries a geographical address, such as the geographical position or geographical area as the destination. When a node receives a data packet, it compares the geo-address in the data packet and the node's view on the network topology, and makes an autonomous forwarding decision. As a results, packets are forwarded "on the fly", without need for setup and maintenance of routing tables in the nodes.

The most innovative method for distribution of information enabled by geographical routing is to target messages to certain geographical areas. In practise, a vehicle can select and specify a well-delimited geographic area to which messages should be delivered. Intermediate vehicles serve as message relays and only the vehicles located within the target area process the message and further send it to corresponding applications. In this way, only vehicles that are actually affected by a dangerous situation or a traffic notification are notified, whereas vehicles unaffected by the event are not targeted.

Basically, geographical routing comprises the following forwarding schemes:

- GeoUnicast: figure 1 shows a possible method of packet delivery between two nodes via multiple wireless hops. When a node wishes to send a unicast packet, it first determines the destination's position and then forwards the data packet to a node towards the destination, which in turn re-forwards the packet along the path until the packet reaches the destination.

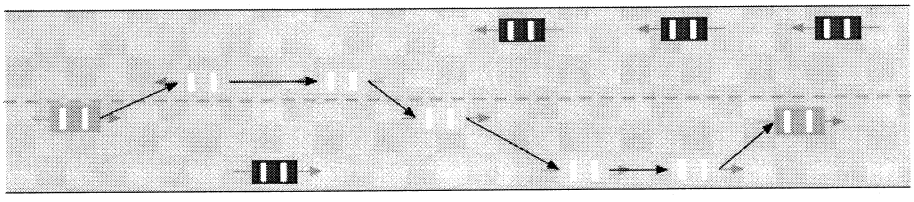

Figure 1: GeoUnicast

- GeoBroadcast: figure 2 shows a possible method of geographical broadcast. A packet is forwarded hop-by-hop until it reaches the destination area determined by the packet, and nodes rebroadcast the packet if they are located inside the destination area. GeoAnycast is different from geographical broadcast in that a node within the destination area will not re-broadcast any received packets.

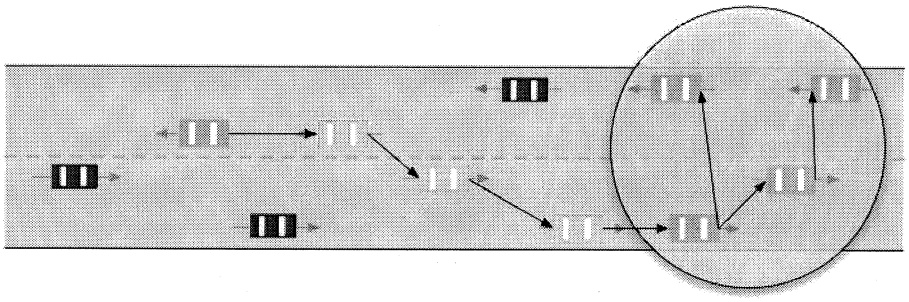

Figure 2: GeoBroadcast

- Topologically-scoped broadcast: figure 3 shows rebroadcasting of a data packet from a source to all nodes in the n-hop neighbourhood. Single-hop broadcast is a specific case of topologically-scoped broadcast, which is used to send packets only to one-hop neighbourhood.

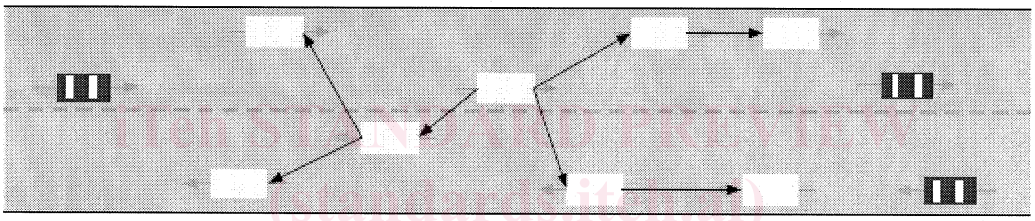

Figure 3: Topologically-scoped broadcast

1 Scope

The present document specifies, at an abstract level, the general, functional and performance requirements that apply to the GeoNetworking protocols (EN 302 636-4 [i.1], -5 [i.2] and -6 [i.3]) for use in ETSI ITS G5 access technology (EN 302 663 [i.4]).

The present document is applicable to ITS stations implementing ETSI ITS G5 access technology (EN 302 663 [i.4]) and the GeoNetworking protocols (EN 302 636-4 [i.1], -5 [i.2] and -6 [i.3]) for both single hop and multi-hop communications.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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2.1 Normative references

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 302 665: "Intelligent Transport Systems (ITS); Communications Architecture".

[2] ETSI TS 101 539-1: "Intelligent Transport Systems (ITS); V2X Applications; Part 1: Road Hazard Signalling (RHS) application requirements specification".

[3] ETSI TS 102 637-1: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 1: Functional Requirements".

[4] ETSI TS 102 687: "Intelligent Transport Systems (ITS); Decentralized Congestion Control Mechanisms for Intelligent Transport Systems operating in the 5 GHz range; Access layer part".

[5] ETSI EN 302 636-2: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 2: Scenarios".

[6] ETSI TS 102 636-3: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network architecture".

[7] IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".

[8] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".

[9] IETF RFC 3775: "Mobility Support in IPv6".

[10] IETF RFC 3963: "Network Mobility (NEMO) Basic Support Protocol".

[11] IETF RFC 5648: "Multiple Care-of Addresses Registration".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 302 636-4 (all parts): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications".

[i.2] ETSI EN 302 636-5 (all parts): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols".

[i.3] ETSI EN 302 636-6 (all parts): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 6: Internet Integration".

[i.4] ETSI EN 302 663: "Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [6] and the following apply:

ad hoc communication: communication in an ad hoc network

Transmission Power Control (TPC): mechanisms to adjust transmission power on wireless channel

Transmission Rate Control (TRC): mechanisms to adjust the rate of sending messages via the wireless channel

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in [6], [4] and the following apply:

MCoA	Multiple Care-of Addresses Registration
NEMO	Network Mobility
TPC	Transmission Power Control
TRC	Transmission Rate Control
VANET	Vehicular Ad hoc Network

4 Design guidelines

The GeoNetworking protocols as defined in this standard series shall be designed to:

- efficiently disseminate safety and traffic efficiency messages considering functional requirements on applications as specified in [3];
- support all communication scenarios specified in [5];
- transparently transport IPv6 packets with minimum changes to IPv6;
- support privacy and security functions;
- support different communication media and interfaces as specified in [1].