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Intelligent transport systems — Mobility integration — Role and functional model for mobility services using low earth orbit (LEO) satellite system

WD/CIB/DTR/TR

Systèmes de transport intelligents — Intégration des services de la mobilité — Modèle de rôle utilisant des satellites en orbite terrestre basse (LEO)

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A model manuscript of a draft International Standard (known as "The Rice Model") is available at https://www.iso.org/iso/model_document-rice_model.pdf

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally ~~conducted~~carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part- 1. In particular, the different approval criteria needed for the different types of ISO ~~documents~~document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part- 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at ~~www.iso.org/members.html~~www.iso.org/members.html.

Introduction

Recent implementation of low earth orbit (LEO) satellite communication systems (e.g., OneWeb, Starlink) offer advantages in large coverage area, capacity, access, latency, and resilience compared to other systems; these characteristics offer benefit when used for smart mobility services. This report work defines a role and functional model of LEO in. With the cooperation of communication expert group WG16, this technical report is created by WG19.

WG19 is active in creating international standardization for the smart city mobility integration.

This document defines a role and functional model of LEO.

The background information can be found in References [12] to[24].

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Intelligent transport systems ~~—Communications—ITS communication role~~ — Mobility integration — Role and functional model for mobility using low earth orbit (LEO) satellite system

1 Scope

This document describes a basic role and functional model for mobility services using low earth orbit satellite systems. It provides:

a) ~~a)~~ a description of concept of a role and functional model using a low earth orbit satellite system for mobility services;

b) ~~b)~~ a description of the concept of operations, and the role models;

c) ~~c)~~ a conceptual architecture between actors involved;

d) ~~d)~~ references for the key documents on which the architecture is based;

e) ~~e)~~ a mobility service use case summary.

In-vehicle control system is not in the scope of this document.

This document scope is limited to mobility services using physical and digital infrastructure.

NOTE The physical infrastructure facilities include for example, battery charging facilities, dynamic charging facilities for battery electric vehicles, physical infrastructure markings, physical traffic regulation signs, mobility monitoring facilities, emergency response service support facilities, traffic operation control centre facilities, fee collection service facilities (e.g. road usage fee), battery EV charging facilities, online reservation and online mobility usage fee payment facilities, and other infrastructure platform facilities that support ITS mobility services.

This document can contribute to the development of mobility service standards using LEO satellite system business cases.

2 Normative references

There are no normative references for this document.

3 Terms and definitions

~~For the purposes of this document, the following~~No terms and definitions ~~apply~~are listed in this document.

ISO and IEC maintain ~~terminological~~terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at ~~https://www.iso.org/obp~~https://www.iso.org/obp

— IEC Electropedia: available at ~~http://www.electropedia.org/~~https://www.electropedia.org/

4 ~~Symbols (and abbreviated~~Abbreviated terms~~)~~

~~AM automated mobility~~

~~BEV battery electric vehicle~~

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~~EFC electronic fee collection~~

~~EV electric vehicle~~

~~FCV fuel cell vehicle~~

~~LEO low earth orbit~~

~~Take advantage~~

AM automated mobility

BEV battery electric vehicle

EFC electronic fee collection

EV electric vehicle

FCV fuel cell vehicle

LEO low earth orbit

5 Advantages of low latency in LEO satellite constellation

- LEO (LEO (<~~2000km~~2 000 km, but often <~~500km~~500 km orbit) satellite constellations promise lower latency than traditional satellite systems because signals only need travel a tenth or less of the distance required by geosynchronous orbiting satellites (geosynchronous orbits are 22,500 km altitude).

- These constellations are planned to use hundreds (OneWeb) or thousands (Starlink) of satellites with future upgrades to potentially include more than 30,000 satellites.

- Starlink also plans to use a laser-based inter-satellite communication path when communicating parties access the network through different satellites. This will take advantage of the superior speed of laser signals in a vacuum, compared to fiber-optic links that are typically used between ground stations.

- LEO satellites connect with ground stations with radio wave path such as Ka (~~12GHz~~12 GHz) and/or Ku (~~24GHz~~24 GHz) bands as gateway to the ground network.

- Devices on the ground connect to the LEO service through a terrestrial network to the ground station, or directly to the LEO satellite using a constellation-specific satellite antenna.

- Mobility service providers can provide services through LEO satellites in addition to conventional ground communication media, if necessary, as backup.

- A few satellites can provide service to an entire region without creating un-serviced zones; additional satellites can serve an increased user density and expand geographic coverage.

- Compared to terrestrial wired networks, LEO constellations can more readily provide low latency, high capacity, to remote and rural locations.

- LEO constellations offer a resilience advantage over other communications techniques that rely on a single point through which all data flows.

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