GENIVI Alliance

GENIVI Document CS00063

EnhancedPositionService

Component Specification

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GENIVI Alliance

Abstract:
This document provides the Component Specification for the EnhancedPositionService

Keywords:
GENIVI, EnhancedPositionService, GPS, GNSS, Sensors, Dead-Reckoning.

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GENIVI Alliance
2400 Camino Ramon, Suite 375
San Ramon, CA 94583, USA

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Revision History

The following table shows the revision history for this document.

Document Revision History

Date	Version	Author	Description
10-Dec-2014	3.0.0-alpha	Marco Residori, XS Embedded (now part of Mentor Graphics)	Updated API documentation and sequence diagrams. This is the first version of this document that uses the new GENIVI component specification template. Improvements after EG-LBS reiew
19-Jan-2015	3.0.0-alpha	Helmut Schmidt Continental Automotive GmbH	Update text according remaining review comments
21.Jan-2015	3.0.0	Marco Residori, XS Embedded (now part of Mentor Graphics)	Changed status to “Accepted”
16-Dec-2015	4.0.0-alpha	Marco Residori, Mentor Graphics	Updated API documentation in preparation to Release 4.0.0
25-Jan-2016	4.0.0	Marco Residori, Mentor Graphics	Release 4.0.0
11-Feb-2016	4.0.0	Marco Residori, Mentor Graphics	Updated document ID (26 → 51) as requested by SAT
23-Jun-2016	4.0.0	Marco Residori, Mentor Graphics	Fixed ticket GT-3345 (interface description layout generated from XML files). Corrected some links to Git repositories.
25-Jan-2017	5.0.0	Marco Residori, Mentor Graphics	Updated API documentation in preparation to Release 5.0.0 API documentation generated from Franca fidl files using Doxygen.

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1 Introduction

1.1 System Overview

The GENIVI Software Platform is a platform consisting of standardized middleware, application layer interfaces and frameworks defined or adopted by the GENIVI Alliance.

1.2 Component Overview

The EnhancedPositionService is a software component of the above mentioned GENIVI Software Platform that offers positioning information to client applications.

To calculate the current vehicle position, data from a GNSS receiver (e.g. GPS data) and available vehicle sensors (e.g. gyroscope and wheel ticks) are taken into account (dead-reckoning). In this way the EnhancedPositionService can calculate the current position even on roads, where the GNSS signal is too weak (e.g. in a tunnel, or in a parking garage) or too inaccurate (e.g. in a city or in a canyon).

1.3 Document Overview

This document describes the architecture and the interface of the GENIVI EnhancedPositionService.

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2 References

The following standards and specifications contain provisions, which through reference in this document constitute provisions of this specification. All the standards and specifications listed are normative references. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the standards and specifications indicated below.

[1] "GENIVI GNSSService – Component Specification" - https://github.com/GENIVI/positioning/tree/master/gnss-service/doc

[2] "GENIVI SensorsService – Component Specification" – https://github.com/GENIVI/positioning/tree/master/sensors-service/doc

[3] GENIVI UML Model - https://svn.genivi.org/uml-model/genivi/trunk

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3 Glossary

Acronym	Term	Definition
GNSS	Global Navigation Satellite System	GNSS is a space-based satellite navigation system that provides location and time information.
GPS	Global Positioning System	GPS is a space-based GNSS maintained by the United States government.
GLONASS	Globalnaya navigatsionnaya sputnikovaya sistema	GLONASS is a space-based GNSS operated by the Russian Aerospace Defence Forces.
BDS	BeiDou Navigation Satellite System	BDS is a Chinese GNSS, also known as COMPASS.
	Galileo	Galileo is a GNSS currently being built by the European Union (EU) and European Space Agency (ESA).
	Vehicle Sensors	Vehicle sensors are sensors used for positioning calculation which are located either in the vehicle itself or directly in the unit where the EnhancedPositionService is deployed. Examples are Gyroscopes, Accelerometers, wheel tick or vehicle speed sensors.
DR	Dead Reckoning	In strict sense: A technique that calculates the current position of a vehicle by integrating the relative changes in heading and distance over time since leaving a known starting point. The starting point can be determined e.g. from a GNSS system and the heading and distance changes can be determined from the vehicle sensors. In a more common sense: The fusion of GNSS and vehicle sensor data to calculate improved position and velocity. I.e. even when a GNSS fix is available.

Table 1 – Acronym and Term Definitions

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4 Requirements

The requirements related to the EnhancedPositionService are located in the GENIVI UML model (see [3]) in the package *GENIVI Model/LogicalView/SW Platform requirements/Location Based Services/Positioning.*

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5 Constraints and Assumptions

This is a handwritten chapter that summarizes the constraints and assumptions done in the project for the component.

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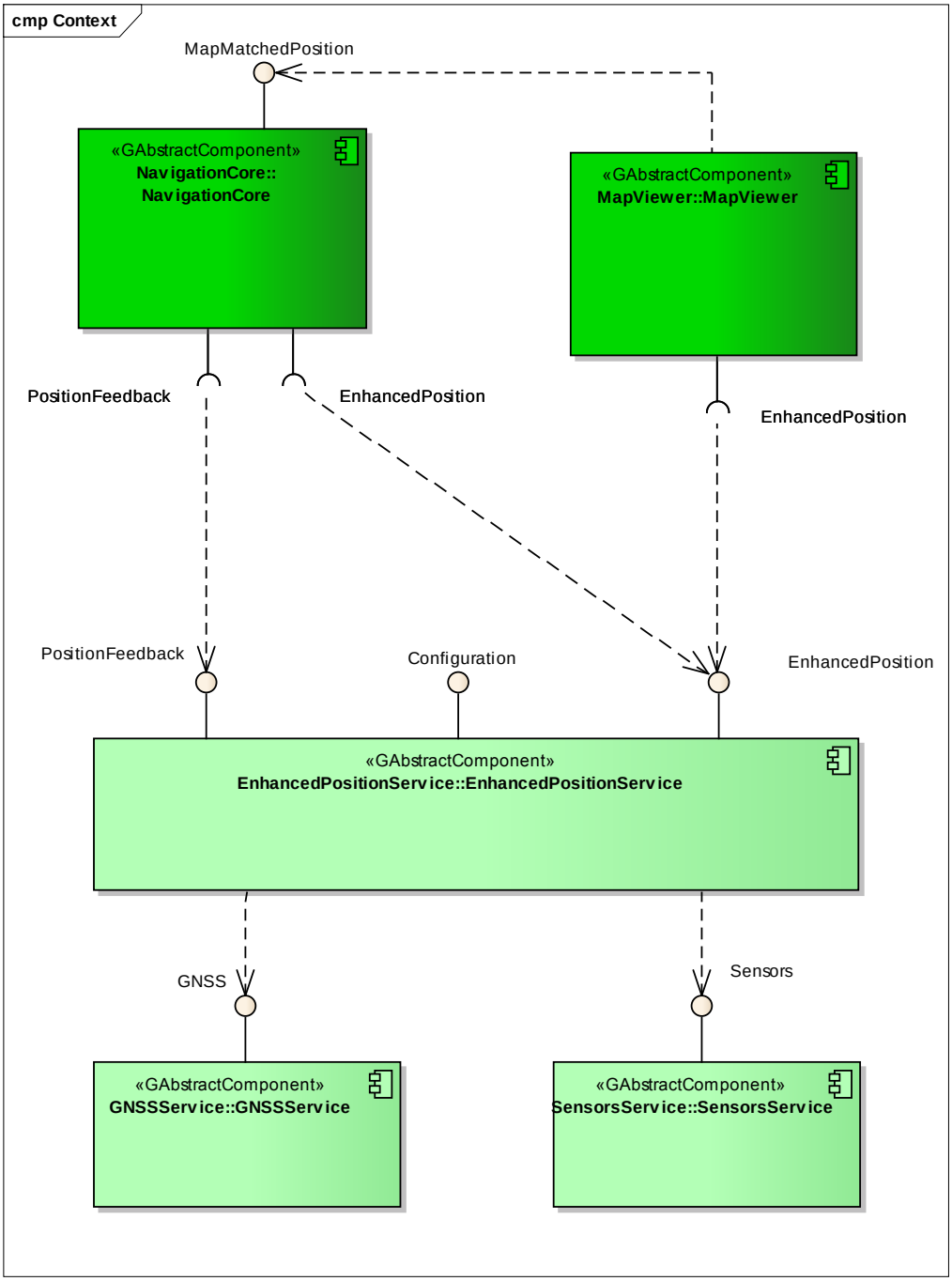
6 Architecture

The information in this chapter is provided only for information purpose; this is not a normative part.

6.1 Architecture Overview

The following component diagram shows how the EnhancedPositionService interacts with other GENIVI components:

- GNSSService (C library)
- SensorsService (C library)
- NavigationCore (example of client application)
- MapViewer (example of client application)



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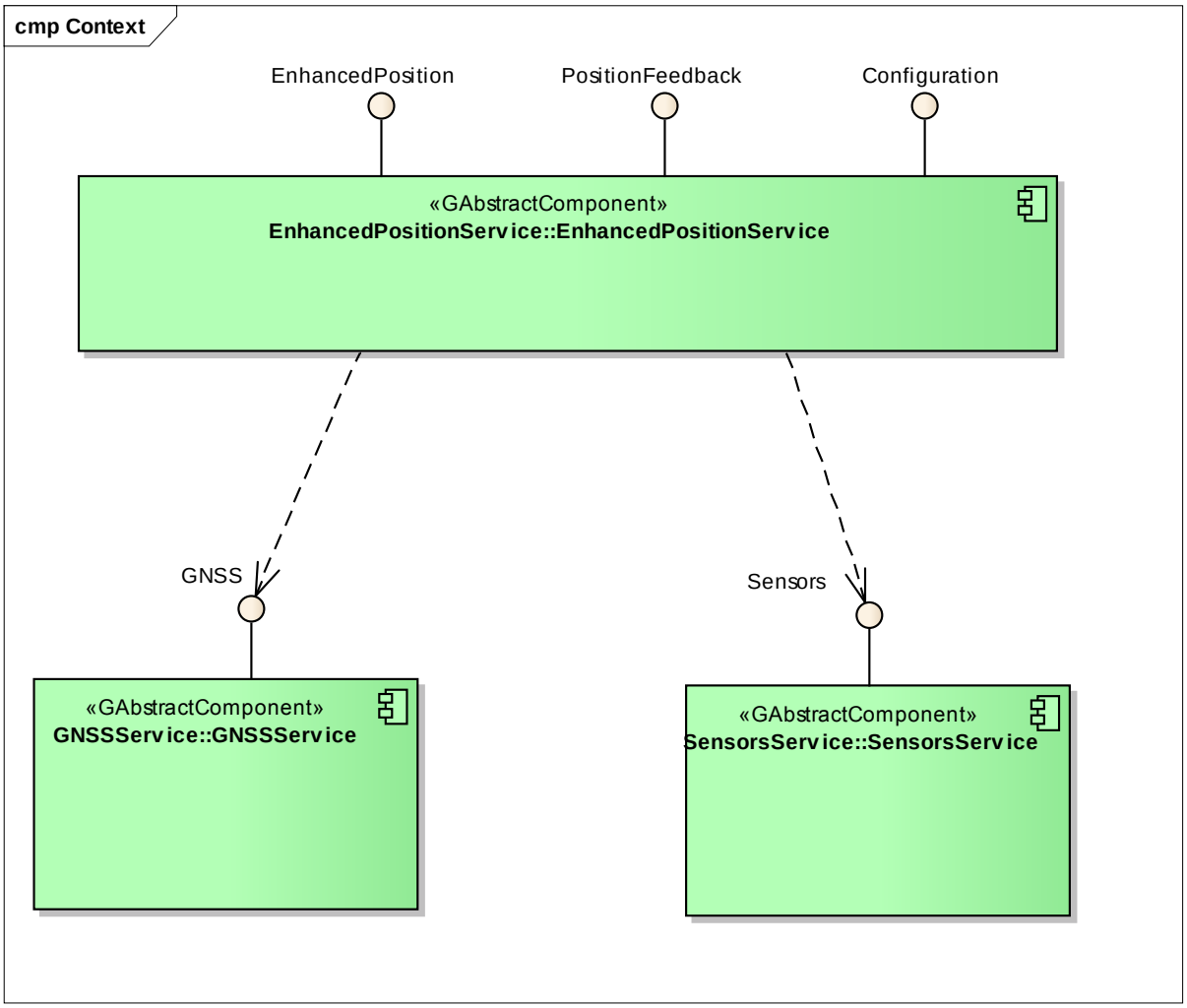
6.1.1 Component Dependencies

The EnhancedPositionService depends on the following GENIVI components:

- GNSSService (library)
- SensorsService (library)



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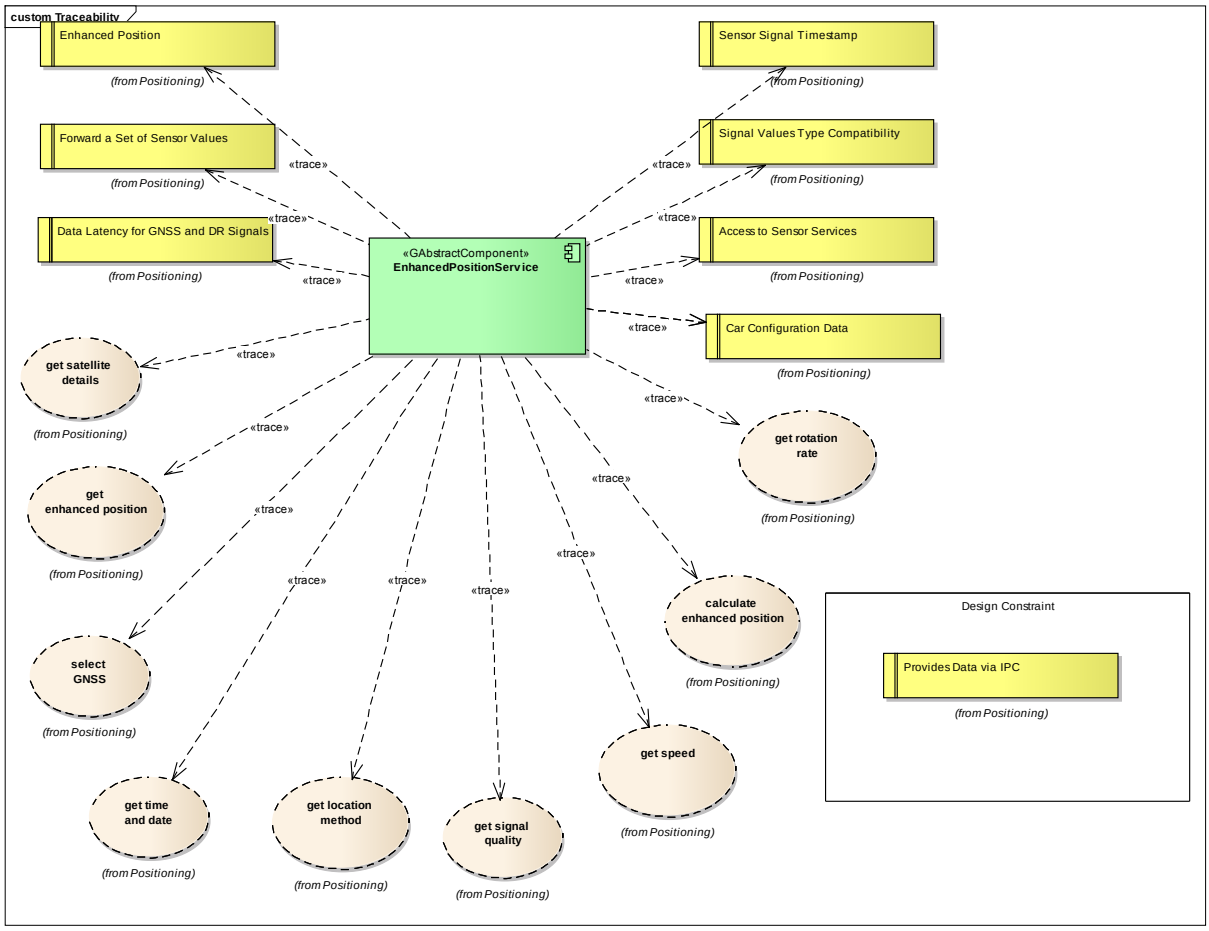
6.1.2 Component Traceability

The following diagrams shows to which requirements and use cases realizations the EnhancedPositionService is traced to:



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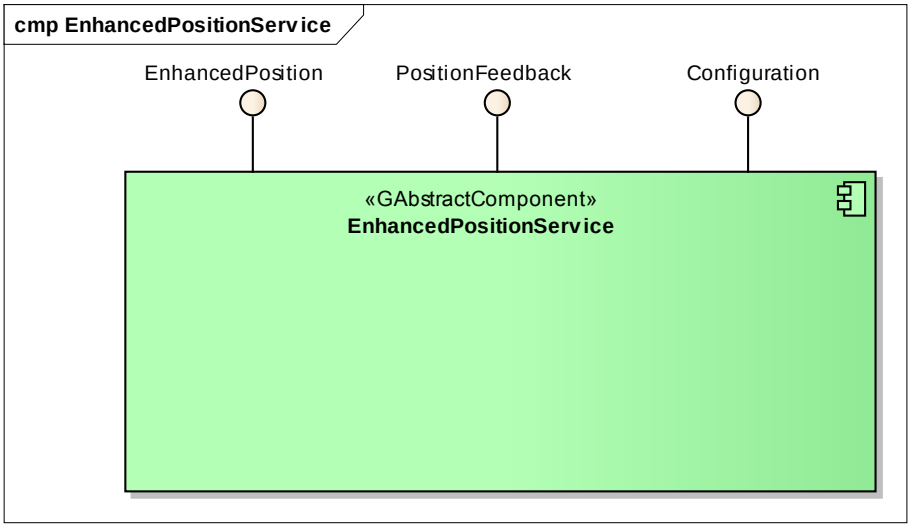
6.2 EnhancedPositionService



6.2.1 Responsibility and Features

The EnhancedPositionService is a software component that offers positioning information to client applications.

To calculate the current vehicle position, data from a GNSS receiver (e.g. GPS data) and available vehicle sensors (e.g. gyroscope and wheel ticks) are taken into account (dead-reckoning). In this way the EnhancedPositionService can calculate the current position even on roads, where the GNSS signal is too weak (e.g. in a tunnel, or in a parking garage).

The result of the map matching can be provided as feedback to this module by the NavigationCore component. This component is the main client of the GNSSService and of the SensorsService.

The EnhancedPositionService will be typically implemented as a multi-client daemon with a D-Bus interface.

6.2.2 Provided Interfaces

• **EnhancedPosition**: This interface provides a ’filtered’ position that takes into account the value coming from the vehicle sensors (dead-reckoning).

• **PositionFeedback**: This interface offers methods that allows the NavigationCore to provide a position feedback to the EnhancedPositionService. The component that implements the Position-Feedback interface requires the data provided by a ‘map matcher‘ (typically the NavigationCore component). The PositionFeedback is an added improvement which does not negatively affect systems that don´t support maps or have a map-matching feature.

• **Configuration**: This interface allows a client application to manage configuration parameters, like the GNSS type.

6.2.3 Required Interfaces

- **GNSS**: This interface abstracts the access to a GNSS device. Please see [1].
- **Sensors**: This interface abstracts the access to vehicle sensors. Please see [2].

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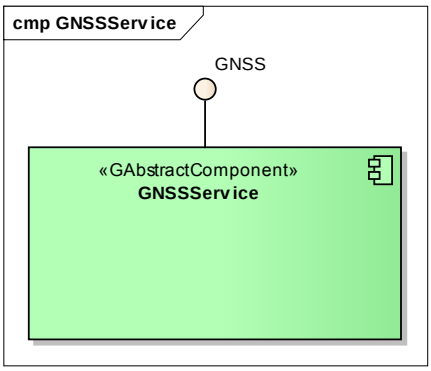
6.3 GNSSService



6.3.1 Responsibility and Features

The GNSSService is a component that retrieves positioning data from a GNSS receiver (e.g. NMEA sentences from a GPS receiver) and presents them to its client applications.

The GNSSService will be typically implemented as a single-client library.

6.3.2 Provided Interfaces

The interfaces provided by this component are described at [1].

6.3.3 Required Interfaces

None.

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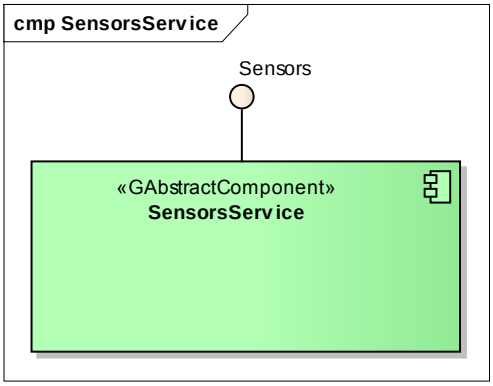
6.4 SensorsService



6.4.1 Responsibility and Features

The SensorsService is a component that retrieves sensor data from several vehicle sensors (e.g. gyroscope, wheel ticks) and presents them to its client applications.

The SensorsService will be typically implemented as a single-client library.

6.4.2 Provided Interfaces

The interfaces provided by this component are described at [2].

6.4.3 Required Interfaces

None.

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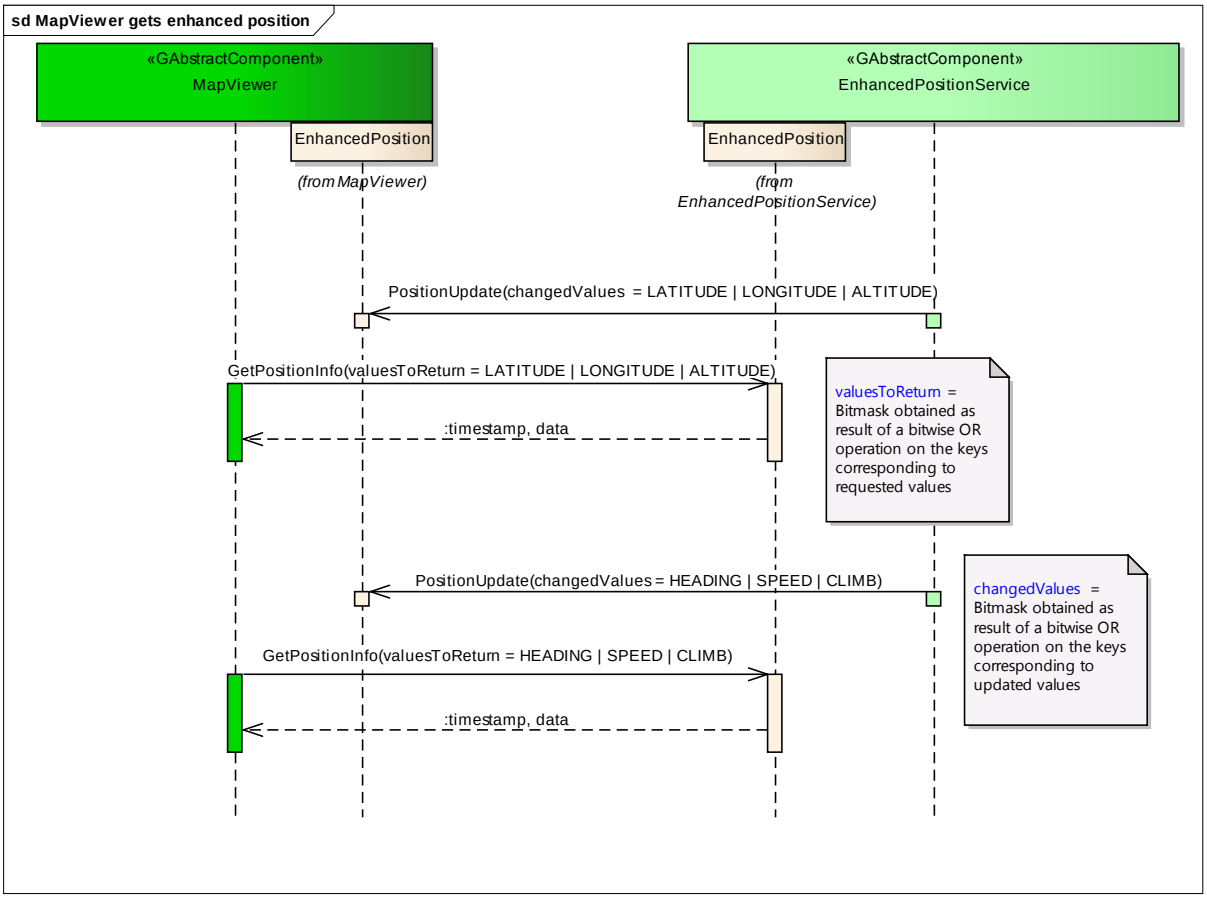
7 Collaboration

7.1 Get Enhanced Position

7.1.1 MapViewer retrieves enhanced position

The following sequence diagram describes how a client application can retrieve the vehicle position.



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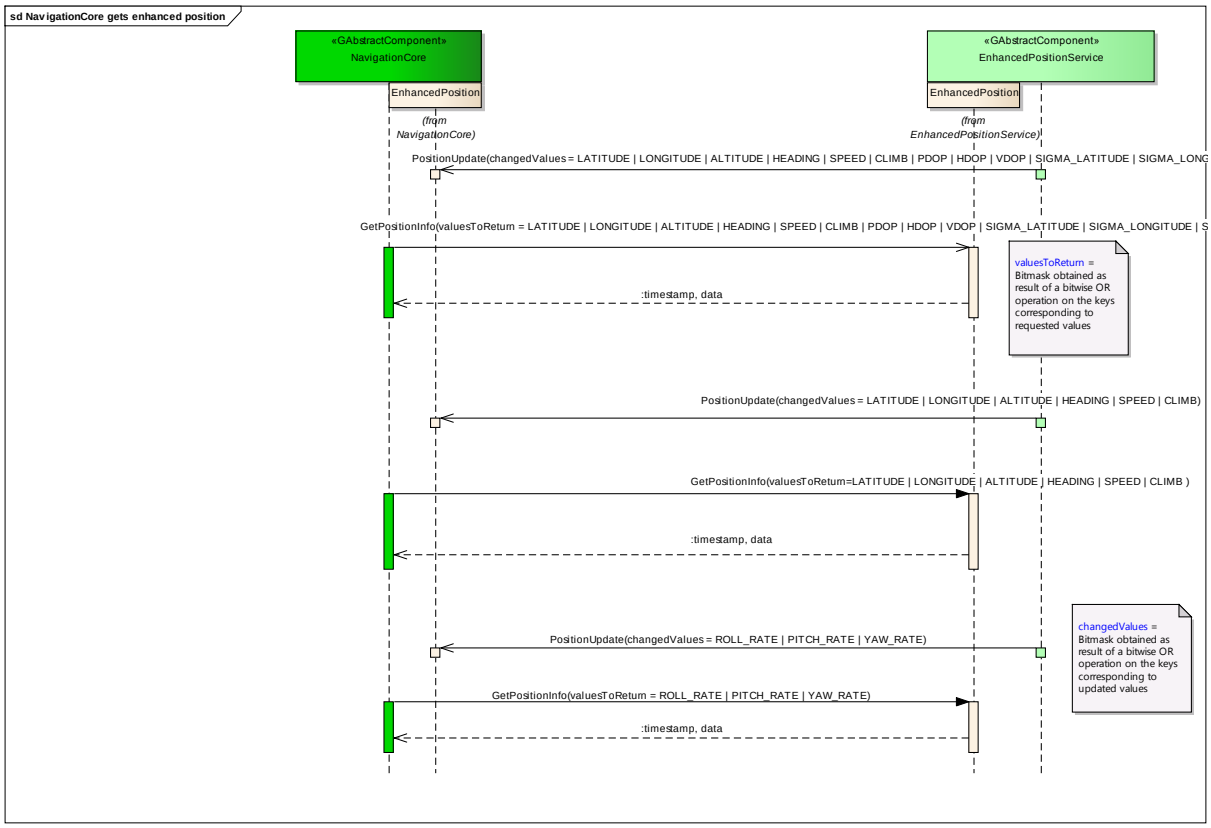
7.1.2 NavigationCore retrieves enhanced position

The following sequence diagram describes how a client application can retrieve the vehicle position.



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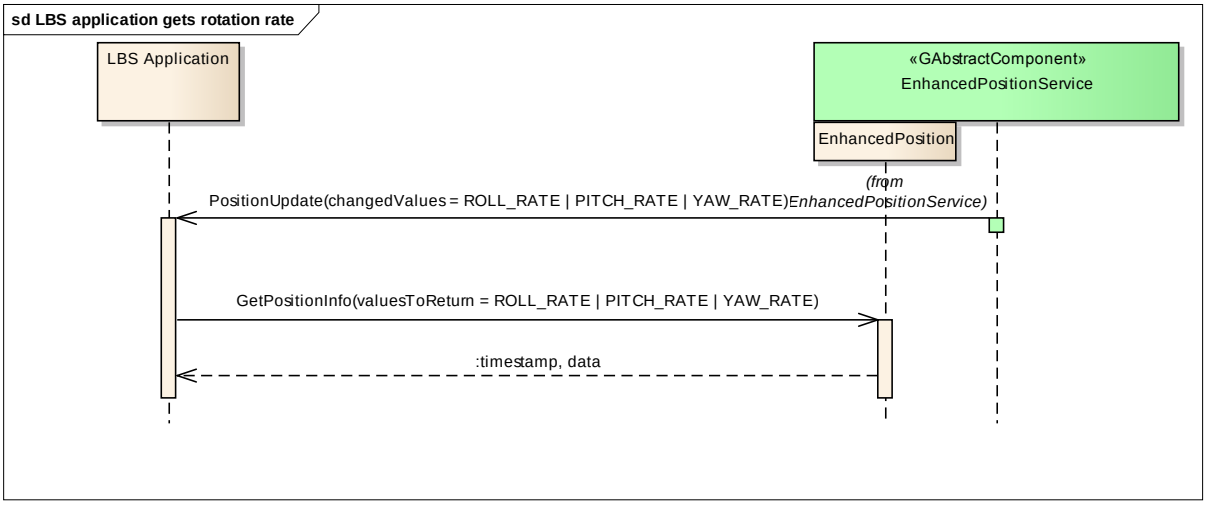
7.2 Get Rotation Rate

7.2.1 LBS Application retrieves rotation rate

The following sequence diagram describes how a client application can retrieve the vehicle rotation rate.



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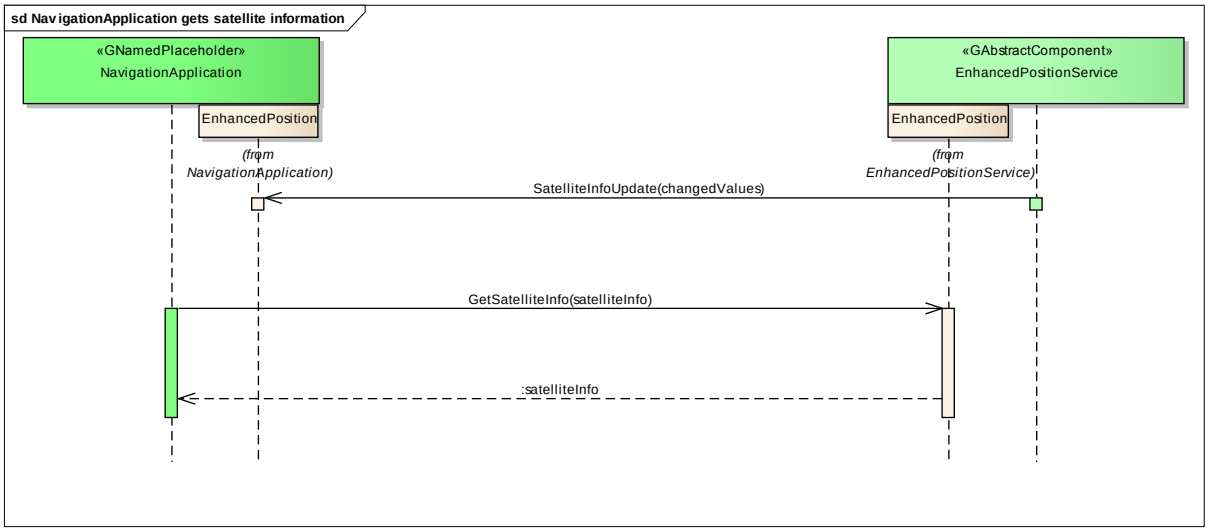
7.3 Get Satellite Details

7.3.1 Navigation Application retrieves satellite information

The following sequence diagram describes how a client application can retrieve satellite information.



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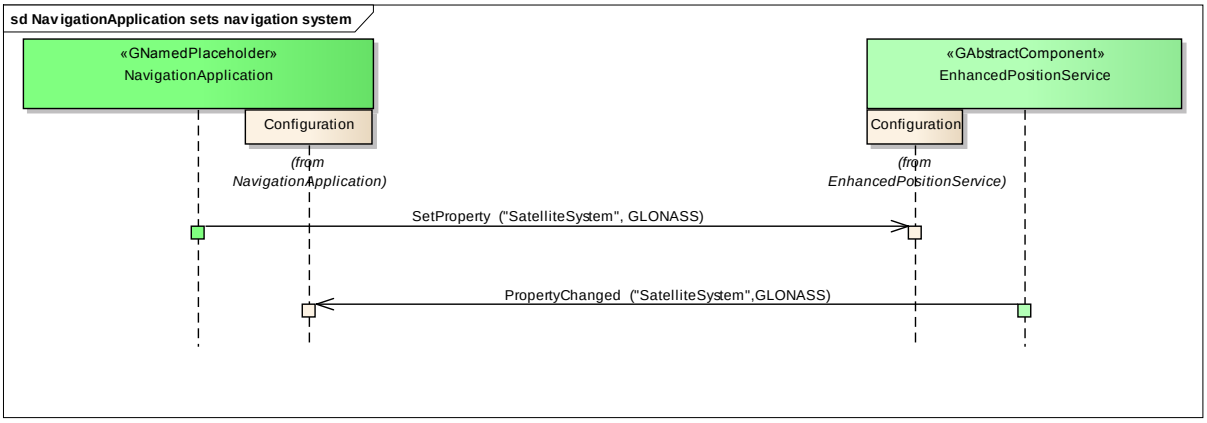
7.4 Set Navigation System

7.4.1 Navigation Application sets navigation system

The following sequence diagram describes how a client application can set the satellite system.



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8 Implementation

8.1 Available Implementation details

A Proof of concept (PoC) of the EnhancedPositionServiceis is available at:
https://github.com/GENIVI/positioning

8.2 Usage examples

Please see the examples contained in in the folder:
enhanced-position-service/franca/test/test-scripts

8.3 Test Plan

Please see: *positioning/enhanced-position-service/franca/doc/testplan.txt*

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9 Interfaces

The following pages describe the interfaces of the EnhancedPositionService.

9.1 Git Repository

The EnhancedPositionService interfaces can be found in the folder:
positioning/enhanced-position-service/franca/api/

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EnhancedPositionService

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Wed Feb 22 2017 07:22:27

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Modules

- genivi

1.2 org::genivi Module Reference

Modules

- module EnhancedPositionService

1.3 org::genivi::EnhancedPositionService Module Reference

Classes

- interface Configuration
- interface EnhancedPosition
- interface EnhancedPosition_client
- interface EnhancedPositionServiceTypes
- interface PositionFeedback

2 Class Documentation

2.1 org::genivi::EnhancedPositionService::Configuration Interface Reference

Public Member Functions

- void GetVersion (out Version version)
- void GetSupportedSatelliteSystems (out SatelliteSystem satelliteSystems)

Public Attributes

- SatSystem SatelliteSystem
- UpdateInterval Int32

2.1.1 Detailed Description

#comment : Configuration = This interface allows a client application to set and retrieve configuration options

2.1.2 Member Function Documentation

2.1.2.1 void org::genivi::EnhancedPositionService::Configuration::GetSupportedSatelliteSystems (out SatelliteSystem *satelliteSystems*)

#comment : GetSupportedSatelliteSystems = This method returns a list of supported satellite systems

2.1.2.2 void org::genivi::EnhancedPositionService::Configuration::GetVersion (out Version *version*)

#comment : GetVersion = This method returns the API version implemented by the server application

2.1.3 Member Data Documentation

2.1.3.1 UpdateInterval org::genivi::EnhancedPositionService::Configuration::Int32

#comment : UpdateInterval = update interval

2.1.3.2 SatSystem org::genivi::EnhancedPositionService::Configuration::SatelliteSystem

#comment : SatSystem = satellite system (GPS, GLONASS, ...)

The documentation for this interface was generated from the following file:

- Configuration.fidl

2.2 org::genivi::EnhancedPositionService::EnhancedPosition Interface Reference

Public Member Functions

- void GetVersion (out Version version)
- void GetPositionInfo (in Bitmask valuesToReturn, out Timestamp timestamp, out PositionInfo data)
- void GetSatelliteInfo (out Timestamp timestamp, out SatelliteInfo satelliteInfo)
- void GetTime (out Timestamp timestamp, out TimeInfo time)

2.2.1 Detailed Description

#comment : EnhancedPosition = This interface offers functionalities to retrieve the enhanced position of the vehicle

2.2.2 Member Function Documentation

2.2.2.1 void org::genivi::EnhancedPositionService::EnhancedPosition::GetPositionInfo (in Bitmask *valuesToReturn,* out Timestamp *timestamp,* out PositionInfo *data*)

#comment : GetPositionInfo = This method returns a given set of positioning data (e.g. Position, Course, Accuracy, Status, ...) Note: If a requested value is invalid, it's not returned to the client application

2.2.2.2 void org::genivi::EnhancedPositionService::EnhancedPosition::GetSatelliteInfo (out Timestamp *timestamp,* out SatelliteInfo *satelliteInfo*)

#comment : GetSatelliteInfo = This method returns information about the current satellite constellation Note: If a requested value is invalid, it's not returned to the client application

2.2.2.3 void org::genivi::EnhancedPositionService::EnhancedPosition::GetTime (out Timestamp *timestamp,* out TimeInfo *time*)

#comment : GetTime = This method returns UTC time and date. Note: If a requested value is invalid, it's not returned to the client application

2.2.2.4 void org::genivi::EnhancedPositionService::EnhancedPosition::GetVersion (out Version *version*)

#comment : GetVersion = This method returns the API version implemented by the server application

The documentation for this interface was generated from the following file:

- EnhancedPosition.fidl

2.3 org::genivi::EnhancedPositionService::EnhancedPosition_client Interface Reference

Public Member Functions

- void PositionUpdate (in Bitmask changedValues)

2.3.1 Member Function Documentation

2.3.1.1 void org::genivi::EnhancedPositionService::EnhancedPosition_client::PositionUpdate (in Bitmask *changedValues*)

broadcast #comment : PositionUpdate = This signal is called to notify a client application of a position change. The update frequency is implementation specific. The maximal allowed frequency is 10Hz

The documentation for this interface was generated from the following file:

- EnhancedPosition.fidl

2.4 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes Interface Reference

Classes

- struct SatelliteInfo
- union Value
- struct Version

Public Types

- enum PositionInfoKey {
  LATITUDE = 1, LONGITUDE = 2, ALTITUDE = 4, HEADING = 8,
  SPEED = 16, CLIMB = 32, ROLL_RATE = 64, PITCH_RATE = 128,
  YAW_RATE = 256, PDOP = 512, HDOP = 1024, VDOP = 2048,
  USED_SATELLITES = 4096, TRACKED_SATELLITES = 8192, VISIBLE_SATELLITES = 16384, SIGMA_↩
  HPOSITION = 32768,
  SIGMA_ALTITUDE = 65536, SIGMA_HEADING = 131072, SIGMA_SPEED = 262144, SIGMA_CLIMB = 524288,
  GNSS_FIX_STATUS = 1048576, DR_STATUS = 2097152, RELIABILTY_INDEX = 4194304 }
- enum SatelliteSystem { GPS = 1, GLONASS = 2, GALILEO = 3, COMPASS = 4 }
- enum TimeInfoKey {
  YEAR = 16777216, MONTH = 33554432, DAY = 67108864, HOUR = 134217728,
  MINUTE = 268435456, SECOND = 536870912, MS = 1073741824 }
- enum PositionFeedbackKey {
  LATITUDE = 1, LONGITUDE = 2, ALTITUDE = 4, HEADING = 8,
  SPEED = 16, CLIMB = 32, RELIABILTY_INDEX = 4194304 }
- enum PositionFeedbackType { MAP_MATCHED_FEEDBACK = 1, TEST_FEEDBACK = 2 }
- typedef UInt64 Timestamp
- typedef UInt64 Bitmask

Public Attributes

- map_PositionInfo PositionInfoKey =>Value
- map_TimeInfo TimeInfoKey =>Value
- map_PositionFeedbackInfo PositionFeedbackType =>Value

2.4.1 Member Typedef Documentation

2.4.1.1 typedef UInt64 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Bitmask

2.4.1.2 typedef UInt64 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Timestamp

2.4.2 Member Enumeration Documentation

2.4.2.1 enum org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::PositionFeedback↩ Key

Enumerator

LATITUDE

LONGITUDE

ALTITUDE

HEADING

SPEED

CLIMB

RELIABILTY_INDEX

2.4.2.2 enum org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::PositionFeedback↩ Type

Enumerator

MAP_MATCHED_FEEDBACK

TEST_FEEDBACK

2.4.2.3 enum org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::PositionInfoKey

Enumerator

LATITUDE

LONGITUDE

ALTITUDE

HEADING

SPEED

CLIMB

ROLL_RATE

PITCH_RATE

YAW_RATE

PDOP

HDOP

VDOP

USED_SATELLITES

TRACKED_SATELLITES

VISIBLE_SATELLITES

SIGMA_HPOSITION

SIGMA_ALTITUDE

SIGMA_HEADING

SIGMA_SPEED

SIGMA_CLIMB

GNSS_FIX_STATUS

DR_STATUS

RELIABILTY_INDEX

2.4.2.4 enum org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteSystem

Enumerator

GPS

GLONASS

GALILEO

COMPASS

2.4.2.5 enum org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::TimeInfoKey

Enumerator

YEAR

MONTH

DAY

HOUR

MINUTE

SECOND

MS

2.4.3 Member Data Documentation

2.4.3.1 map_PositionFeedbackInfo org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::↩ PositionFeedbackType =>Value

2.4.3.2 map_PositionInfo org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Position↩ InfoKey =>Value

2.4.3.3 map_TimeInfo org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::TimeInfoKey =>Value

The documentation for this interface was generated from the following file:

- EnhancedPositionServiceTypes.fidl

2.5 org::genivi::EnhancedPositionService::PositionFeedback Interface Reference

Public Member Functions

- void GetVersion (out Version version)
- void SetPositionFeedback (in PositionFeedbackInfo feedback, in UInt64 timestamp, in PositionFeedbackType feedbackType)

2.5.1 Detailed Description

#comment : PositionFeedback = This interface allows the application implementing the map-matching algorithm to provide a position feedback to the EnhancedPositionService

2.5.2 Member Function Documentation

2.5.2.1 void org::genivi::EnhancedPositionService::PositionFeedback::GetVersion (out Version *version*)

#comment : GetVersion = This method returns the API version implemented by the server application

2.5.2.2 void org::genivi::EnhancedPositionService::PositionFeedback::SetPositionFeedback (in PositionFeedbackInfo *feedback,* in UInt64 *timestamp,* in PositionFeedbackType *feedbackType*)

#comment : SetPositionFeedback = This method allows a client application to provide the EnhancedPositionService with a position feedback

The documentation for this interface was generated from the following file:

- PositionFeedback.fidl

2.6 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo Struct Reference

Public Attributes

- SatelliteSystem system
- UInt32 satellitId
- UInt32 azimuth
- UInt32 elevation
- UInt32 cNo
- Boolean inUse

2.6.1 Member Data Documentation

2.6.1.1 UInt32 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo::azimuth

2.6.1.2 UInt32 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo::cNo

2.6.1.3 UInt32 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo::elevation

2.6.1.4 Boolean org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo::inUse

2.6.1.5 UInt32 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo::satellitId

2.6.1.6 SatelliteSystem org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo::system

The documentation for this struct was generated from the following file:

- EnhancedPositionServiceTypes.fidl

2.7 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Value Union Reference

Public Attributes

- UInt64 uInt64Value
- Double doubleValue
- Float floatValue
- String stringValue

2.7.1 Member Data Documentation

2.7.1.1 Double org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Value::doubleValue

2.7.1.2 Float org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Value::floatValue

2.7.1.3 String org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Value::stringValue

2.7.1.4 UInt64 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Value::uInt64Value

The documentation for this union was generated from the following file:

- EnhancedPositionServiceTypes.fidl

2.8 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Version Struct Reference

Public Attributes

- UInt16 maj
- UInt16 min
- UInt16 mic
- String date

2.8.1 Member Data Documentation

2.8.1.1 String org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Version::date

2.8.1.2 UInt16 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Version::maj

2.8.1.3 UInt16 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Version::mic

2.8.1.4 UInt16 org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Version::min

The documentation for this struct was generated from the following file:

- EnhancedPositionServiceTypes.fidl

3 File Documentation

3.1 Configuration.fidl File Reference

Classes

- interface org::genivi::EnhancedPositionService::Configuration

Modules

- module org::genivi::EnhancedPositionService

3.2 EnhancedPosition.fidl File Reference

Classes

- interface org::genivi::EnhancedPositionService::EnhancedPosition
- interface org::genivi::EnhancedPositionService::EnhancedPosition_client

Modules

- module org::genivi::EnhancedPositionService

3.3 EnhancedPositionServiceTypes.fidl File Reference

Classes

- interface org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes
- struct org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Version
- union org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::Value
- struct org::genivi::EnhancedPositionService::EnhancedPositionServiceTypes::SatelliteInfo

Modules

- module org::genivi::EnhancedPositionService

3.4 PositionFeedback.fidl File Reference

Classes

- interface org::genivi::EnhancedPositionService::PositionFeedback

Modules

- module org::genivi::EnhancedPositionService

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