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GLOBAL NAVIGATION SATELLITE SYSTEM PROFILE

Abstract:

The Global Navigation Satellite System (GNSS) Profile specification defines how a GNSS client device, such as a laptop computer, PDA, or phone capable of running navigation software, but lacking a GPS receiver, can obtain positioning data from a GNSS server device.

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Revision History

Revision	Date	Comments
D01r01	24 March 2006	Original GNSS work
D05r01	13 October 2006	Completing first draft
D05r02	31 October 2006	Updates based on WG comments
D05r03	02 November 2006	Use RFCOMM instead of SPP for transport
D05r04	14 November 2006	Removed SPP references missed I the last edit
D05r05	27 February 2007	Add some SPP things back in based on discussion comments
D05r06	9 April 2007	Misc updates
D05r07	21 April 2007	AHM Review version
D05r08	13 June 2007	Updated with BARB comments
D05r09/10	12 November 2007	Updates for coordination with test spec
D05r11	13 November 2007	Clean version for review as this one is way cluttered…
D05r12	21 December 2007	Switch to SPP based again, add SDL client record
D05r13	3 March 2008	Integrated comments from Rob H
D05r14	8 April 2008	SDP updates after discussions with Tim H
D05r15	11 April 2008	Updates from further BARB comments
D07r01	29 May 2008	Begin 0.7 revision after BARB approval of the 0.5 revision
D07r02	23 June 2008	Address comments from BTI review
D07r03	30 June 2008	Address review comments from Mindtree
D09r01	8 August 2008	Initial draft of 0.9 version
D09r02	3 October 2008	BARB and GNSS WG review comments addressed
D09r03	various	Working version
D09r04	29 October 2008	BARB comments addressed – next release version
D09r05	13 November 2008	One more comment from Tim
D09r08	21 Jan 2011	Remove proprietary features SDP fields
D09r09	24 Jan 2011	Missed a few references – continue 0908 edits
D09r10	28 June 2011	Prepare for BARB
D09r11	1 July 2011	Fixed typo
D09r12	18 August 2011	Addressed comments from CSR and Mindtree
D09r13	18 Jan 2012	Addressed comments from Broadcom
D09r14	25 Jan 2012	Clean version for voting
V10	14 March 2012	Adopted by the Bluetooth SIG Board of Directors

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Contents

1   Introduction

1.1   Scope

The GNSS profile provides a means for a GPS enabled device to share its position data with another device via a Bluetooth wireless technology based connection.

The GNSS profile specification defines the Serial Port Profile (SPP) based transport mechanism and associated service discovery record parameters needed to establish a service level connection between two devices. This specification also describes connection establishment and security procedures.

This specification mandates the use of the NMEA-0183 [1] protocol for transmission of position data between devices, but does not define the protocol itself. Refer to NMEA-0183 [1] for the protocol definition.

1.2   Conformance

If conformance to the GNSS Profile is claimed, all capabilities indicated as mandatory for this Profile shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All supported capabilities, mandatory, optional, and conditional, are subject to verification as part of the Bluetooth qualification program.

When a device supports multiple simultaneous profiles, including GNSS, the device shall be capable of supporting a GNSS session either with, or without, other profiles operating. In other words, a GNSS connection shall not be dependent on some other profile connection (HFP for example) being already established.

1.3   Profile Dependencies

A profile is dependent upon another profile when it re-uses parts of the other profile by explicitly referencing them.

The GNSS Profile is dependent upon the Serial Port Profile and the Generic Access Profile (GAP).

1.4   Bluetooth Specification Release Compatibility

The GNSS Profile is compatible with Bluetooth Core Specification Version 2.0 and higher.

1.5   Symbols, Conventions, and Definitions

1.5.1   Requirement Status Symbols

In this document, the following symbols are used:

- "M" for mandatory to support
- "O" for optional to support

- "X" for excluded (used for capabilities that may be supported by the unit but shall never be used in this use case)

- "C" for conditional to support

- "N/A" for not applicable (in the given context it is impossible to use this capability)

Some excluded capabilities are capabilities that, according to the relevant Bluetooth specification, are mandatory. These are features that may degrade operation of devices in this use case. Therefore, these features shall never be activated while a unit is operating as a unit within this use case.

1.5.2 Document Terminology

The Bluetooth SIG has adopted Section 13.1 of the IEEE Standards Style Manual, which dictates use of the words ``shall'', ``should'', ``may'', and ``can'' in the development of documentation, as follows:

- The word ***shall*** is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (***shall*** equals ***is required to***).

- The use of the word ***must*** is deprecated and shall not be used when stating mandatory requirements; ***must*** is used only to describe unavoidable situations.

- The use of the word ***will*** is deprecated and shall not be used when stating mandatory requirements; ***will*** is only used in statements of fact.

- The word ***should*** is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited (***should*** equals ***is recommended that***).

- The word ***may*** is used to indicate a course of action permissible within the limits of the standard (***may*** equals ***is permitted***).

- The word ***can*** is used for statements of possibility and capability, whether material, physical, or causal (***can*** equals ***is able to***).

2 Profile Overview

2.1 Protocol Stack

Figure 2.1 shows the protocols and entities used in this profile.
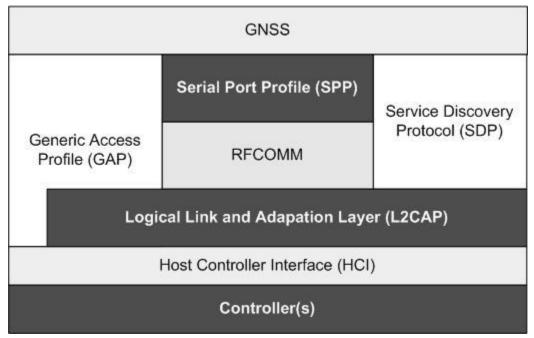

Figure 2.1: GNSS Protocol Stack
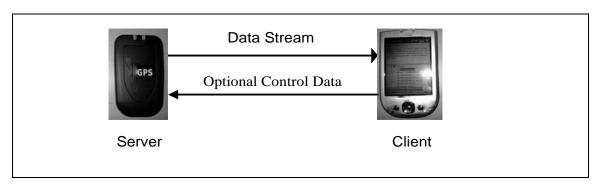
2.2 Roles and Applications

Figure 2.2: Example of Profile Roles

2.2.1 Profile Roles

The GNSS profile defines two roles for compliant devices. Typically a device will implement only one role, but both roles may be implemented in a single device.

Server: The GNSS server shall be capable of streaming NMEA-0183 formatted data over a serial data channel.

Client: The GNSS client shall be capable of receiving NMEA-0183 data from a serial data channel.

The full set of requirements for each role is found in this document in section 3.

2.2.2 Profile Applications

- A handheld GPS receiver possessing a small display can stream GPS data to a notebook computer providing a much larger display and, potentially, the use of more powerful navigation software.

- Some vehicles containing telematics devices (with GPS) use the position data only in support of the telematics application and do not provide a navigation capability to the driver. This data can be streamed to a portable navigation system or PC, which can provide the desired route guidance. The vehicle usually features an exterior-mounted GPS antenna providing better performance than a device that is completely contained within the vehicle.

- A commercial vehicle could provide a GPS stream to allow the driver to easily and automatically capture traveled-route data.

- If a *Bluetooth* radio is allowed on commercial air flights, passengers could track their progress using a personal computer or PND connected to the GPS stream from the plane.

- An example of a device implementing both server and client roles: A handheld GPS-enabled device implements GNSS server to allow the user to stream GPS data to a device with a larger screen, such as a notebook computer. The same device could be used in client mode when it is inside a GPS-equipped vehicle that does not allow a clear satellite signal to reach the device, such as an airplane as mentioned in the previous use case.

While this list is not exhaustive, it is representative of the many possible uses for this profile.

3   GNSS Requirements

3.1   Introduction

The following sections define the requirements of the GNSS profile.

3.2   Service Level Connection Establishment

Upon a user action or an internal event, the client shall initiate a Service Level Connection establishment procedure.

A Service Level Connection (SLC) is defined by the existence of a serial port profile (SPP) connection between the client and the server devices.

The client device shall be capable of initiating a GNSS service level connection establishment with a GNSS server.

The GNSS server device shall be capable of accepting a GNSS service level connection request from a GNSS client.

Connection establishment shall be performed as described in the Generic Access Profile [2].

Support for authentication and encryption are mandatory for a GNSS server and shall follow the procedures described in the Generic Access Profile [2].[1] Note that the use of authentication and encryption is mandatory for devices conforming to the Bluetooth Core Specification 2.1 + EDR and later when interoperating with a peer device that also conforms to the Bluetooth Core Specification 2.1 + EDR or later. A device may connect without authentication or encryption in order to interoperate with peer devices conforming to earlier versions of the Bluetooth Core Specification. Authentication and encryption are optional for a GNSS client conforming to the Bluetooth Core Specification 2.0 + EDR.

3.3   Service Level Connection Initialization

When an SPP connection has been established, the Service Level Connection shall be considered complete. No specific initialization procedure at the GNSS protocol level is defined.

3.4   Position and Satellite Data Stream Content

3.4.1   Streaming GPS Data

Once connected, the server shall begin streaming positioning data to the client. The streaming of positioning data shall begin by default. A request command from the client is not required.

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[1] The specifics of connection security will depend on the core specification versions of the client and server devices and will not be further described here.

The interval between positioning data updates is determined by the server device and cannot be controlled by the client role in this profile. For most applications, an interval of one to two seconds is a reasonable default. Server device designers should consider their own use cases and set the interval value appropriately. However, a suggested approach is to set the sniff interval to match the location update interval.

The data stream carried by the GNSS profile shall conform to the NMEA-0183 [1] specification and is not further specified in this profile. Product manufacturers will be responsible for verifying that their implementations of the GPS data transfers conform to the NMEA-0183 specification.

3.4.2 Proprietary Command and Data Exchanges

The GNSS profile does not define any client-to-server traffic; however, since there are already devices on the market that stream GPS data using *Bluetooth* technology, and also implement client-to-server messages, the use of proprietary exchanges between compatible devices is allowed.

A server that does not implement proprietary extensions shall ignore client-to-server messages.

A server that does implement proprietary extensions shall ignore client-to-server messages that it does not support.

3.4.3 Handling Unknown Message

Since some devices may attempt to utilize proprietary messages to extend the feature set defined in the profile, compliant devices shall ignore all unknown messages received during a connection session.

3.5 Service Level Disconnection

Either the server or the client device may initiate a service level disconnection.

4 Profile and Protocol Dependencies

4.1 Serial Port Profile Requirements

This profile requires compliance to the Serial Port Profile. For the purposes of reading the Serial Port Profile, the client shall be device A and the server shall be device B.

4.2 RFCOMM Interoperability Requirements

The SDP service record shall define the RFCOMM server channel number for this profile.

4.3 L2CAP Interoperability Requirements

For the L2CAP layer, no additions to the requirements as stated in the RFCOMM specification apply.

4.4 SDP Interoperability Requirements

The following service record (Table 4.1) is defined for the GNSS Profile. A service record is mandatory in the server device.

When requesting SDP records for the GNSS service, the requesting device shall search for the GNSS Server UUID, whichever one is appropriate. Since the target device may support more than one SPP-based profile, searching for the SPP UUID is not an effective strategy.

Item	Definition	Type	Value	Status	Default
ServiceClassIDList				M	
ServiceClass0		UUID	Serial Port Profile	M	
ServiceClass1		UUID	GNSS_Server	M	
ProtocolDescriptorList				M	
Protocol0		UUID	L2CAP	M	
Protocol1		UUID	RFCOMM	M	
ProtocolSpecific Parameter0	Server Channel	Uint8	N=server channel #	M	
BluetoothProfileDescriptorList				M	
Profile0	Supported Profiles	UUID	GNSS	M	GNSS
Param0	Profile Version	Uint16	0x0100[2]	M	

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[2] Indicating version GNSS 1.0

Global Navigation Satellite System (GNSS) Profile

Item	Definition	Type	Value	Status	Default
ServiceName	Display-able Text name	String	Manufacturer dependent	O	"GNSS Server"
SupportedFeatures	Features supported	Uint16	Device dependent	M	0x0000

Table 4.1: Service record definition – GNSS Server

Bit position (0=LSB)	SupportedFeatures Bit Definitions - Server	Default in Server
0 - 15	Reserved for future use – shall be set to zero	0

Table 4.2: Supported Features attribute value definition

4.4.1 Class of Device

A device implementing the Server role of GNSS shall set the "Positioning " bit in the Service Class field.

Values for the major and minor device class fields are not specified by this profile.

4.5 Generic Access Profile

This profile requires compliance to the Generic Access Profile.

This section defines the support requirements for the capabilities as defined in the Generic Access Profile [2].

4.5.1 Modes

Table 4.3 shows the support status for GAP Modes in this profile.

	Procedure	Support in Server	Support in Client
1	**Discoverability modes**		
	Non-discoverable mode	O	O
	Limited discoverable mode	C1	O
	General discoverable mode	C1	O
2	**Connectability modes**		
	Non-connectable mode	O	O
	Connectable mode	M	O
3	**Bondable modes**		
	Non-Bondable mode	O	O
	Bondable mode	M	O

Table 4.3: GAP modes

C1: Support for at least one of General Discoverable Mode or Limited Discoverable Mode is mandatory.

4.5.2 Security Aspects

Table 4.4 shows the support for security aspects within this profile.

Global Navigation Satellite System (GNSS) Profile

	Procedure	Support in Server	Support in Client
1	Authentication	O	O
2	Security modes		
	Security mode 1	C1	C1
	Security mode 2	C1	C1
	Security mode 3	C1	C1
	Security mode 4	C1	C1
3	Encryption	O	O

Table 4.4: Security aspects

C1: Support for at least one of the security modes 1, 2, 3, or 4 is mandatory.

4.5.3 Idle Mode Procedures

Table 4.5 shows the support status for Idle mode procedures within this profile:

	Procedure	Support in Server	Support in Client
1	General inquiry	O	M
2	Limited inquiry	O	O
3	Name discovery	O	O
4	Device discovery	O	O
5	Bonding	M	O

Table 4.5: Idle Mode procedures

4.5.4 Pairing and Bonding

The client and server should support pairing. Note that it is mandatory for devices conforming to the Bluetooth Core Specification 2.1 + EDR and later to support pairing.

The client may store the resulting link key and hence support Bonding. The server shall support Bonding to facilitate reconnect by a client which has stored the link key.

Global Navigation Satellite System (GNSS) Profile

5 Acronyms and Abbreviations

Abbreviation or Acronym	Meaning
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
MSC	Message Sequence Chart
NMEA	National Marine Electronics Association
SDP	Service Discovery Protocol

Table 5.1: Abbreviations and Acronyms

6 References

Number	Reference
[1]	NMEA-0183 Standard, Version 3.01 (released Jan. 2002)
[2]	Bluetooth Core Specification, Version 2.1+EDR, July 2007

Table 6.1: Reference documents

7 List of Figures

8 List of Tables