OPENGGD

PROTOCOL FOR THE SERVER THAT RECEIVES GPS DATA

Version 0.0.1

This document describes the protocol between a client that delivers position data and the OpenGGD server that receives and collects the position data.

1. SEQUENCE OF EVENTS

1.1.TCP communication establishment

The communication is initiated by a client, that attempts to connect to the OpenGGD server through a specific port -29057 by default-.

1.2.Unique Identifier of the client and protocol version

The client, once the TCP link is established, must send an unique identifier -UID- and the protocol version that has been implemented. The server must check and validate both values.

The UID can be hard-coded inside the tracking device, or can be obtained from the serial number of the tracking device -or from the source of position data-.

The server must keep a database with all UID allowed to connect; this database establishes a relationship between the UID and a pair “FIELD/USER” -this info is necessary in order to keep an organized database-. An administrator must maintain this database, by inserting, changing and deleting these UID's and their pair FIELD/USER..

If the UID or protocol is not valid, the server will close the connection with no answer.

1.3.Features of the tracking device

The server may ask for the type of tracking system that the tracking device uses -i.e. GPS, GSM triangulation, Galileo, Argos, etc-.

The server may also ask for a brief description of the tracking device.

1.4.Position data

The server will ask for the minimum time interval between the packets sent by the client. The answer will be a packet with this time interval in seconds.

Then the server will send a packet indicating that the client is allowed to send position data.

The data that the client sends will have a specific codification, as explained later. Every packet with position data sent by the client must be confirmed by the server. Several position frames can be sent inside a packet.

1.5.Errors

The server may send a packet indicating that some information given by the client was not valid. That usually means that the packet sent by the client was wrong -i.e. the prefix or the size of the packet was wrong-.

Then the client must stop sending packets, and wait for a request from the server.

If the client receives this packet after having sent several position data packets, the client should retransmit those position data packets that have not yet been accepted.

1.6.Closing the connection

Once the client has finished sending position data, it will send a specific packet asking to close the connection. The server will then close the TCP link.

The server will also close the connection in the following situations:

- If a long time has passed since the last packet was received from the client.
- If the client sends the same wrong packet n times -n is a value coded in the source code-.
- Other reasons.

In these cases, the server will send a specific packet indicating that the connection has been terminated, and will close the TCP link.

2. PACKETS

Every packet must have a prefix that indicates the type of packet sent. This prefix consist of two bytes.

The byte order for binary fields larger than one byte will be big-endian.

2.1.Client to Server packets

a) UID and protocol version

	Bytes	Description
Prefix	2	0xE001
UID	4	Binary value that uniquely identifies the tracking device. This value must be validated by the server. The server will keep a table with all UID allowed to connect. This table will establish a relationship between the UID and a FIELD/USER pair. A value of 0xFFFFFFFF is not allowed.
Protocol version	2	Binary value that identifies the protocol that the client has implemented. The most significant byte indicates the protocol version. The least significant byte indicates the revision of the protocol. Current values are: 0x0001- Protocol 0, revision 1

b) Tracking system

	Bytes	Description

Prefix	2	0xA001
Tracking system	4	Binary value that identifies the tracking system that the device uses to get position data. For current values see Appendix A. A tracking device may implement several tracking systems, therefore these values can be combined with a bitwise OR operation.

c) Description of the tracking device

	Bytes	**Description**
Prefix	2	0xA002
Length	1	String length in bytes of the Description field -from 0 to 255-
Description	255 (max)	ASCII string that defines the tracking device used to get position data. It isn't a null-terminated char array.

d) Time interval between positions packets

	Bytes	**Description**
Prefix	2	0xA003
Tracking system	2	Binary value that indicates the minimum time in seconds between the delivery of two packets with position data. For example, if a client wants to export a track file to the server, this value should be 0, because the delay between two packets will be almost zero -even if the positions inside the file were captured at a lower rate-.

e) Position data

	Bytes	**Description**
Prefix	2	0xF001
Order number of this packet	2	Binary value indicating the order number of this packet. This value must be sequential, from 0 to 0xFFFF. The server will use this value to confirm the acceptance of this packet.
Number of position frames	1	Binary value that indicates the number of frames in this packet which contain position information.
Position frame (there can be several frames)	2	**Mask of valid position information.** This field indicates which fields in this frame contain valid position information. Current values are: 0x0001 – UID 0x0002 – Date/time 0x0004 – Longitude/latitude 0x0008 – Longitude/latitude resolution 0x0010 – Altitude 0x0020 – Speed 0x0040 – Movement detection flag 0x0080 – Movement direction 0x0100 – Precision of the position measurement 0x0200 – Quality of the position measurement These values can be combined with a bitwise OR operation. UID, date/time and longitude/latitude values are a must.
	4	**UID** Binary value that uniquely identifies the tracking device.

	4	**Date** Binary value that stores the date, according to this order: DAY as the least significant byte, MONTH as the second least significant byte, and YEAR as the two most significant bytes. It could be calculated according to this formula: YEAR<<16 | MONTH<<8 | DAY Values for months are from 1 to 12 Values for days are from 1 to 31
	4	**Time.** Binary value that stores the UTC time, according to this order: HUNDREDTH OF A SECOND as the least significant byte, SECONDS as the second least significant byte, MINUTE as the second most significant byte, and HOUR as the most significant byte. It could be calculated according to this formula: HOUR<<24 | MINUTE<<16 | SECONDS <<8 | HUNDREDTH_OF_A_SECOND Values for hours range from 0 to 23. Values for minutes and seconds range from 0 to 59.
	4	**Longitude -and resolution-** Binary value that stores the longitude in the 27 least significant bits, calculated according to this formula: 180*60*60*100+LONGITUDE The value of LONGITUDE must be in hundredth of a second, and its sign must be negative for east longitude. When this unit conversion is done, it might appear that the measurement has more resolution than the original value. Five most significant bits could be used to indicate the resolution of the original units. For current values see Appendix B.
	4	**Latitude -and resolution-** Binary value that stores the latitude in the 26 least significant bits, calculated according to this formula: 90*60*60*100+LATITUDE The value of LATITUDE must be in hundredth of a second, and its sign must be negative for south latitude. When this unit conversion is done, it might appear that the measurement has more resolution than the original value. Five most significant bits could be used to indicate the resolution of the original units. For current values see Appendix B.
	4	**Altitude. Speed. Movement detection flag.** The value of altitude must be stored in the 17 least significant bits. It corresponds to a binary value calculated according to this formula: 30000+ALTITUDE The value of ALTITUDE must be in tenths of a meter. The value of speed must be stored in the following 14 bits of this field. Its units are tenths of a kilometer per hour. The value of the movement detection flag must be stored in the most significant bit of the field. A value of 1 means that a movement detection has occurred.
	2	**Movement direction.** Binary value that stores the movement direction of the vehicle. Its units are hundredths of a degree, from 0 to 360 degrees.
	4	**Precision of the position measurement. Quality of the position measurement.** The value of precision must be stored in the 24 least significant bits. It corresponds to a binary value that indicates a circle of uncertainty around the actual position. This field stores the radius of that circle of uncertainty, in tenths of a meter.

		The value of quality must be stored in the 8 most significant bits. It corresponds to a binary value that estimates the quality of the position measurement. It is a percentage that goes from 0 -worst quality- to 100 -best quality-.

f) Closing the connection

	Bytes	Description
Prefix	2	0xC0FF

2.2.Server to Client packets

a) Rejection of a packet

	Bytes	Description
Prefix	2	0xC801

b) Asking for the tracking system

	Bytes	Description
Prefix	2	0xD001

c) Asking for the description of the tracking device

	Bytes	Description
Prefix	2	0xD002

d) Asking for the time interval between positions packets

	Bytes	Description
Prefix	2	0xD003

e) Allowing position data packets

	Bytes	Description
Prefix	2	0xC002

f) Acceptance of the last position data packet

	Bytes	Description
Prefix	2	0xA001
Last packet accepted	2	Binary value indicating the order number of the last packet sent by the client that has been accepted.

g) Rejection of the last position data packet

	Bytes	Description
Prefix	2	0xA801

Packet rejected	2	Binary value indicating the order number of the packet sent by the client that has been rejected. No answer is required, but the client should correct and send again that position data packet.
Position frame rejected	1	Order number of the wrong frame inside the packet sent by the client. The first frame is number 0. The rejection of a frame means the rejection of the whole packet.
Mask of the wrong position information	2	This field indicates which fields in the frame were considered as wrong. Current values are: 0x0001 – UID 0x0002 – Date/time 0x0004 – Longitude/latitude 0x0008 – Longitude/latitude resolution 0x0010 – Altitude 0x0020 – Speed 0x0040 – Movement detection flag 0x0080 – Movement direction 0x0100 – Precision of the position measurement 0x0200 – Quality of the position measurement These values can be combined with a bitwise OR operation.

h) Closing the connection

	Bytes	**Description**
Prefix	2	0xC0FF

APPENDIX A. TRACKING SYSTEMS

This table is incomplete. New tracking systems can be included in the future, therefore it should be stored in a configuration file, to avoid new revisions of the protocol

0x00000000	UNKNOWN
0x00000001	GPS
0x00000002	GSM TRIANGULATION
0x00000004	ARGOS
0x00000008	GALILEO
0xFFFFFFFF	FEATURE NOT IMPLEMENTED

APPENDIX B. UNITS RESOLUTION

Minimum step between two original values	Worse precision -longitude at the Equator-	Radius of the circle of uncertainty	**Encoded binary value**
<0.01"	<0.005"	<0.16m	00000
0.01"	0.005"	0.16m	00001
0.012"=0.0002'	0.006"	0.19m	00010
0.02"	0.010"	0.31m	00011
0.03"=0.0005'	0.015"	0.46m	00100
0.05"	0.025"	0.77m	00101
0.06”=0.0010'	0.03"	0.93m	00110
0.10"	0.05"	1.55m	00111
0.12"=0.0020'	0.06"	1.86m	01000
0.20"	0.10"	3.10m	01001
0.30"=0.0050'	0.15"	4.64m	01010
0.50"	0.25"	7.73m	01011
0.6"=0.0100'	0.30"	9.28m	01100
1"	0.50"	15.5m	01101
1.2"=0.0200'	0.60"	18.6m	01110
2"	1.00"	30.9m	01111
3"=0.0500'	1.50"	46.4m	10000
5"	2.50"	77.3m	10001
6"=0.1000'	3.00"	92.8m	10010
10"	5.00"	155m	10011
12"=0.2000'	6.00"	186m	10100
15"	7.25"	224m	10101
20"	10.00"	309m	10110
30"=0.5000'	15.00"	464m	10111
1'	30.00"	928m	11000
2'	1'	1855m	11001
5'	2.5'	4638m	11010
10'	5'	9276m	11011
15'	7.5'	13914m	11100
20'	10'	18553m	11101
30'	15'	27829m	11110
>30'	>15'	>27829m	11111

APPENDIX C. CHANGELOG

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- Big-endian is specified as the default byte order for binary fields.
- Day, month and year are stored in specific bytes inside the date field.
- Time field also stores hundredth of a second.
- Hundredth of a second, second, minute and year are stored in specific bytes inside the time field.
- Tracking system is a 4 byte value.
- Description of the tracking device isn't a null terminated string anymore. A new field that indicates the string length is included.
- Number of position frames is a 1 byte value.
- Position frame rejected is a 1 byte value.
- Values for Mask of Valid Position Information field have been rearranged.
- Quality and Precision fields have been joined into one field.
- UID is a 4 byte value
- Position data frame includes a field for UID

Ver-0.0.0

- First release of this document