OGN Core message format

Sylwester Barański, Dariusz Żbik

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Purpose

The purpose of this document is to design and/or document a new messaging standard to be used by Open Glider Network. The standard should preserve all existing APRS messaging functionality, extending it with options dedicated to the aviation community. Another goal is to decrease the size of messages exchanged.

1. Selected standard - CBOR (Concise Binary Object Representation)

To keep messages short, binary representation is required (in contrast to text representation used by APRS). It is possible to propose a custom format of data packing, but selecting an existing standard is good long-term practice.
There are plenty of binary messaging standards on the market - one of them should be selected.
Following requirements were taken into account during selection of standard:
- short messaging (but not at the cost of complexity),
- simple implementation for embedded devices,
- extensibility,
- recognized standard (RFC and IANA standardization),
- support for cryptography.

CBOR standard RFC 7049 meets all requirements and was proposed for OGN, with the idea to extend it with COSE (RFC 8152) cryptography extensions (if required) in future.
Web page: http://cbor.io/

2. OGN Core message format.

Message format proposed is similar to APRS messaging with extendability in mind and minimizing message size.

OGN Core Message format is a five element CBOR Array (type 4 message).

[source, destination, type, body, path]

Following fields are defined:

source	OGN address - object ID,
destination	OGN address - object ID,
type	Integer identifier describing type of body massage,
body	payload (can be array or map),
path	object ID or object ID list - current path of the message.

OGN Object ID

Object ID is a universal identifier for all OGN objects. It could be:

- object_type [integer] - when the whole range of object type is considered,
- CBOR Array with two fields: when particular device is addressed:

[object_type, object_identifier]

There are following names used for types, which corresponds to CBOR values:

Integer - CBOR Type 0 unsigned integer,
Signed Integer - CBOR Type 1 signed integer,
Binary - CBOR Type 2 unstructured byte string.
String - CBOR Type 3 UTF-8 text string,

Object type (integer)	Object description	Object identifier for the type:
0	Local object ID - local message exchanged between parties on selected link: - system login messages, - keep-alive messages.	Integer 0 - currently connected server,
1	OGN Core Server, glidernet service. Messages targeted to this entity will be presented on tracking pages, stored on database etc., basically - all existing OGN functionality.	Options: ● Integer 1 - currently connected server, ● Array of: [1, String] - selected Core server. Example: [1, “Core1”]
2	OGN Station	Array of: [2, String] Example: [1, “EPKA”]
3	OGN Tracker	Array of: [3, Binary] Example: [3, 0x112233445566]
4	Flarm	Array of: [4, Binary] Example: [4, 0x112233445566]
5	User, Client, Service, etc	Array of: [5, String]

		Example: [5, “Emergency1”] [5, “OGNLive”]
…	…	…

OGN Core message types

Following list presents all message types handled by OGN Core with example Object IDs.
Message body will be presented in plain text, as it is not relevant for this part. Message body format is described in other chapters. Message types should be interpreted with a source id of the message.

Message types for object type 0 - local messages.

Those messages are marked with local id for both source and destination.

Type	Description	Source	Destination	Path	Body
0	Link keep alive message	0	0	[]	Keep alive data
1	Login request	0	0	[]	Login parameters
2	Login response	0	0	[]	Login response

Message types for object type 1 - OGN Core Server.

Type	Description	Source	Destination	Path	Body
1	Status data	[1, “Core1”]	[1, “Core2”]	[]	Server status data

Message types for object type 2 - OGN Station.

Type	Description	Source	Destination	Path	Body
1	Status data	[2, “EPKA]	1	[]	Station status data

Message types for object type 3 - OGN Tracker.

Type	Description	Source	Destination	Path	Body
1	OGN tracker position	[3, 0x11223344]	1	[2, “EPKA”]	Position data

Message types for object type 4 - FLARM

Type	Description	Source	Destination	Path	Body
1	FLARM position	[4, 0x11223344]	1	[2, “EPKA”]	Position data

Message types for object type 5 - User, Client, Service

Type	Description	Source	Destination	Path	Body
1	Data request	[5, “Emerg1”]	1	[]	Request for data Parameters: type, area.

Message bodies

Message body data is a CBOR map (type 5) encapsulated in CBOR binary. Each field name should be a small integer number for compactness. Those fields are later named “parameters”. Some parameters are mandatory, they are marked with “*”.

Message bodies for object type 0 - local messages

0 - Keep Alive message message body

Message body is empty for KA messages.

1 - Login request message body

Parameter id	Description	Format	Description
1*	Login name	OGN Object ID	OGN identifier Example: [2, “EPKA”]

2 - Login response message body

Parameter id	Description	Format	Description
1*	Server name	OGN Object ID	OGN identifier Example: [1, “Core1”]
2*	Response	Integer	Numeric value of response: 0 - server full, 1 - access granted, 2 - access denied.

Message bodies for object type 1 - OGN Core Server

1 - OGN Core Server reporting status

Parameter id	Description	Format	Description

Message bodies for object type 2 - OGN Station

1 - OGN station reporting status

Parameter id	Description	Format	Description

Message bodies for object type 3 - OGN Tracker

1 - OGN Tracker position

Parameter id	Description	Format	Description
0	RAW packet	Binary	RAW FLARM/OGN packet received by station. Note - msg_source_id could contain only Object_type when it is not possible to identify source_id of the packet.
1	Receiving time	Integer	Unix time stamp.
2	Latitude/Longitude	[Signed Integer, Signed Integer]	Degrees multiplied by 2^23 to fill 4 bytes. positive - N, E.
3	Speed	Integer	0,1 km/h
4	Track	Integer	deg
5	GPS altitude	Integer	Unit: dm (0.1m)
6	Baro altitude	Integer	Using std. pressure. Note: both altitude types could be sent in the same packet.
7	Vario	Signed Integer	Unit: 0.1 m/s
8	Rotation	Signed Integer	Unit: ???
…	…	…	…
16	Signal level	Signed Integer	cB
17	Signal deviation	Signed Integer	hHZ
18	Packet error	Integer	Number of errors
19	GPS ?	[Integer, Integer]	What is this???
…	…	…	…
100	timeout	Integer	Connection timeout was detected. Timer value in seconds included. Note: last position and data will be attached to the message body.
101	stopped	Integer	Object stopped, threshold in seconds included.

102	delay	Integer	Message was delayed globally by OGN Core by x seconds.

Message bodies for object type 4 - FLARM

1 - FLARM position

The same as for OGN tracker position

Message types for object type 5 - User, Client, Service

1 - Data request

Parameter id	Description	Format	Description
1	Name filter	String list	Requested IDs
2	Position filter	TBD	TBD

Complete message examples

Messages presented here could be decoded online using https://cbor.me/

Message examples for object type 0 - local messages

0 - Keep Alive message example

Message is not accepting any parameters:

CBOR format:
[0, 0, 0, {}, []]
Hex:
85 00 00 00 a0 80

1 - Login request message example

EPKA station logging:

CBOR format:
[0, 0, 1, {1: [2, "EPKA"]}, []]
Hex:
85 00 00 01 a1 01 82 02 64 45 50 4b 41 80

2 - Login response message example

OGN Core1 server response to login (access granted):

CBOR format:
[0, 0, 2, {1: [1, "Core1"], 2: 1}, []]
Hex:
85 00 00 02 a2 01 82 01 65 43 6f 72 65 31 02 01 80

OGN Core message transport

OGN Core is designed with the idea to use different transport types at the same time.

TCP/IP

Default TCP port number is 8701.

Each message is prefixed with a length of CBOR packet encoded as 2-byte little-endian.

Logging process

1. Client connects to OGNCore TCP port.
2. Within 10 seconds client sends “Login request message” (type: 0/1),
3. Client receives “Login response message” (0/2) with login request status:
    0 - server full,
    1 - access granted,
    2 - access denied.
    When the response is other than 1, TCP connection is closed by the server.
4. After successful connection, the server sends “Keep Alive” message after each 20 seconds.
5. Server expects “Keep Alive” or other valid messages from the client at least every 10 minutes.

MQTT

MQTT transport is currently designed.