OGN Core message format

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Version 0.1 draft 3

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 Object	Array of: [3, [addr_type, binary] addr_types: 0 - Random, 1 - ICAO, 2 - Flarm, 3 - OGN Example: [3, [2, 0x112233]

OGN Object ID to OGN APRS mappings

OGN APRS message addr. part	OGN Object ID	Comment
TEST>OGNSDR,TCPIP*,**qAC**,GLIDERN4:	[2, “TEST]	OGN Station recognized by: - qAC type, - no id.. in APRS comment
FLRAABBCC>APRS,**qAS**,TEST: . **id06AABBCC** .	[3, [2, AABBCC]]	OGN Object type: - qAS type, - id found in APRS comment OGN addr. type used.

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	[1, “Core1”]	Station status data
2	Station position	[2, “EPKA]	1	[1, “Core1”]	Station position

Message types for object type 3 - OGN Object.

Type	Description	Source	Destination	Path	Body
1	Object position	[3, [2, 0x112233]	1	[2, “EPKA”]	Position data

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 status

Parameter id	Description	Format	Description
1*	Receive time	Integer	Unix time
23	Comment	String	APRS comment (not recognized)

2 - OGN station position

Parameter id	Description	Format	Description
1*	Receive time	Integer	Unix time
2*	Latitude/Longitude	[Signed Integer, Signed Integer]	Degrees multiplied by 2^23. Positive: N, E.
3	Altitude	Signed Integer	Unit: feet

Message bodies for object type 3 - OGN Object

1 - Position data

Parameter id	Description	Format	Description
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	GPS altitude	Integer	Unit: feet
4	Baro altitude	Integer	Using std. pressure. Note: both altitude types could be sent in the same packet.
5	Track	Integer	deg
6	Speed	Integer	knots
23	Comment	String	APRS comment (not recognized)

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 big-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 - e.g. topics arrangement, user access rights are currently designed.

MQTT brokers access method

Because of minimal security, completely anonymous access to OGNCore MQTT brokers is disabled. However, usernames and passwords used by OGN users are publicly known.

There is one user defined that should be used to access glidernet data:

MQTT user name: ogn
MQTT user password: glidernet

MQTT topics

Currently, it is possible to subscribe to **“glidernet”** topic.
Topic’s purpose is similar to full-feed APRS connection: all data gathered by glidernet are published there.
The same CBOR format is used but without the prefix used in TCP transport.