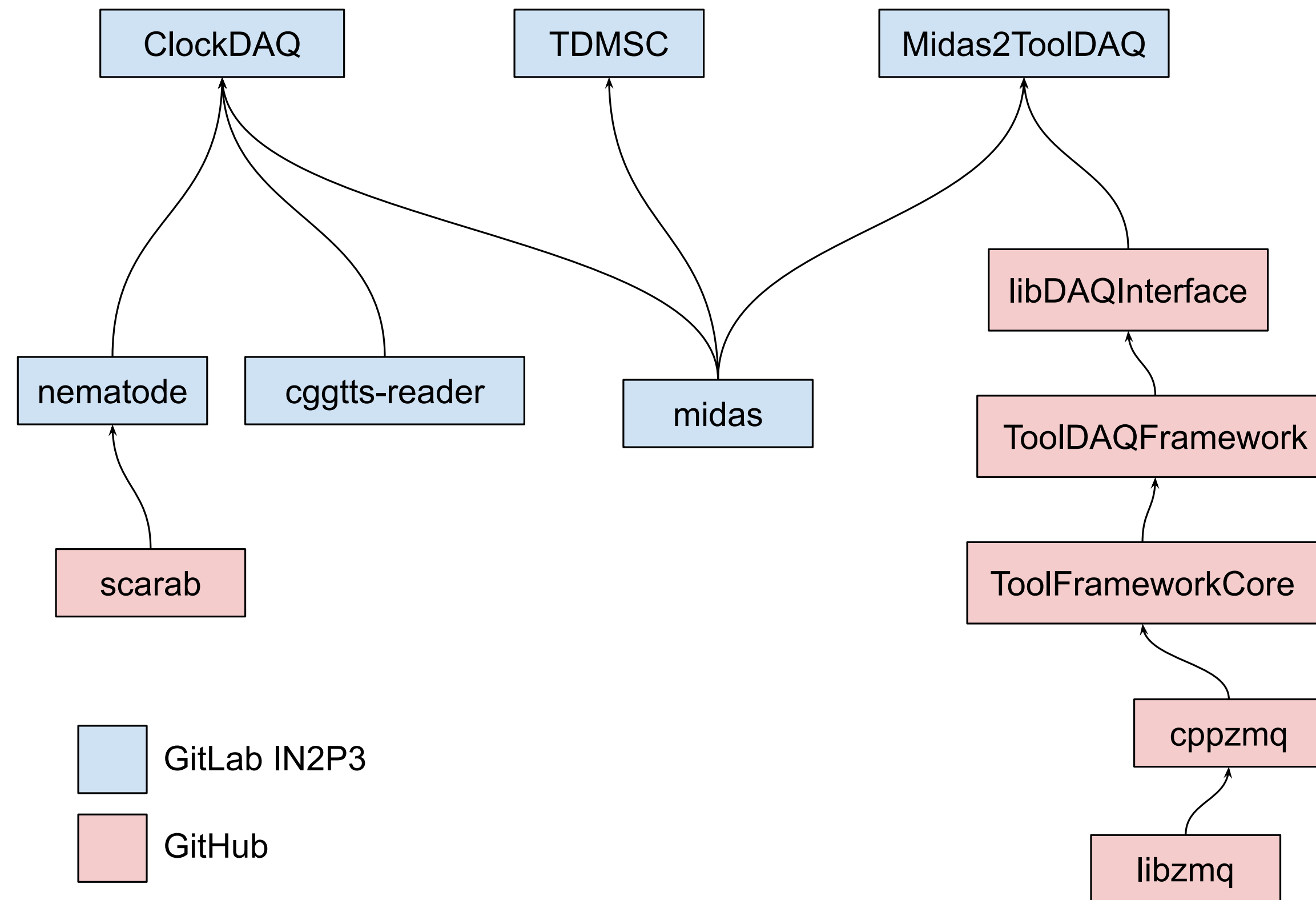


NMEA and CGGTTS Readers

The Great Chasm

Split the original ClockDAQ GitLab repository into 3 repositories:

- <https://gitlab.in2p3.fr/hk/clocks/tdmsc>: TDM slow control and script for the test bench?
- <https://gitlab.in2p3.fr/hk/clocks/midas2tooldaq>: Midas to ToolDAQ interface
- <https://gitlab.in2p3.fr/hk/clocks/clockdaq>: Time generation slow control and DAQ



Septentrio outputs

- Access to GNSS monitoring webpage on Ipngnss01:80
- download logging files (CGGTTS, RINEX, SBF...)
 - setup a NMEA/BINEX/SBF TCP server

For NMEA files:

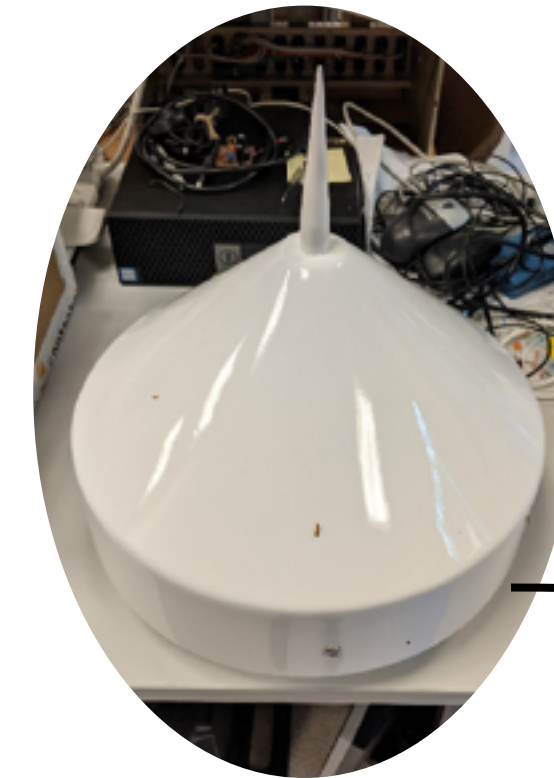
- **listen to port 28000 and interpret lines on the fly**

For CGGTTS:

- **continuously read the CGGTTS files on the receiver**
- copy them somewhere safe once they are complete (**TBD**)

For SBF:

- log and copy somewhere safe (**TBD**)
- listen to port X and interpret lines on the fly (**TBD?**)



Lab network

Setting the NMEA stream

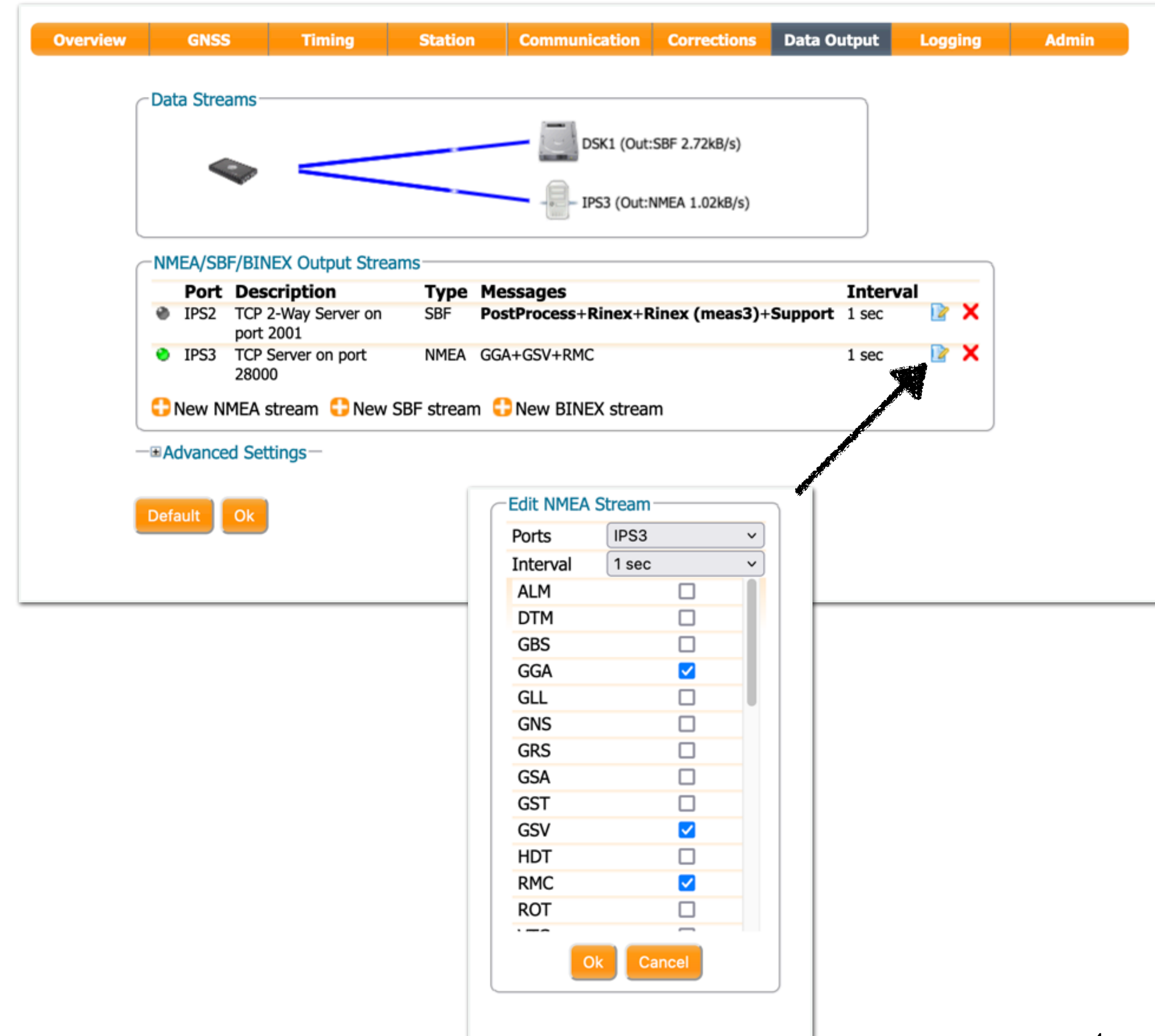
Select a TCP (send only) IP server

- pushes to port 28000
- only extract GGA, GSV and RMC data (see next slide)

Then listen to the port 28000:

```

import socket
client_socket = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
client_socket.connect(('134.158.152.105', 28000))
while True:
    data = client_socket.recv(512)
    print("%s" % data)
  
```



The screenshot shows the 'Data Output' configuration page. At the top, there are tabs for Overview, GNSS, Timing, Station, Communication, Corrections, Data Output (selected), Logging, and Admin. Below the tabs, a 'Data Streams' diagram shows a device connected to DSK1 (Out:SBF 2.72kB/s) and IPS3 (Out:NMEA 1.02kB/s). The 'NMEA/SBF/BINEX Output Streams' table is as follows:

| Port | Description | Type | Messages | Interval | | |
|------|-------------------------------|------|---|----------|--|--|
| IPS2 | TCP 2-Way Server on port 2001 | SBF | PostProcess+Rinex+Rinex (meas3)+Support | 1 sec | | |
| IPS3 | TCP Server on port 28000 | NMEA | GGA+GSV+RMC | 1 sec | | |

Below the table are buttons for '+ New NMEA stream', '+ New SBF stream', and '+ New BINEX stream'. An 'Advanced Settings' section is partially visible. An 'Edit NMEA Stream' dialog is open for the 'IPS3' stream, showing the following configuration:

- Ports: IPS3
- Interval: 1 sec
- ALM:
- DTM:
- GBS:
- GGA:
- GLL:
- GNS:
- GRS:
- GSA:
- GST:
- GSV:
- HDT:
- RMC:
- ROT:

The dialog has 'Ok' and 'Cancel' buttons at the bottom.

National Marine Electronics Association (NMEA) 0183
Sequence of sentences containing navigation informations

Typical sentence:

`$<ID:2><Type:3><Contenu>*<clé:2>`

- ID:
 - GP (GPS),
 - GL (GLONASS),
 - GA (Galileo),
 - PXXXX (proprietary command)
- Type:
 - **GGA - Global Positioning System Fix Data**
 - *GSA - GPS DOP and active satellites → based on previous discussions, this could be of interest!*
 - **GSV - Satellites in view**
 - **RMC - Recommended Minimum Navigation Information**
 - PGTOP - Antenna status (3: external antenna, 2: internal antenna, 1: error)

More information: <https://gpsd.gitlab.io/gpsd/NMEA.html>

NMEA: example

```
$GPGGA,092750.000,5321.6802,N,00630.3372,W,1,8,1.03,61.7,M,55.2,M,,*76
```

→ Fixed position of the receiver (“fix”) (5321.6802° N, 630.3372° W)

```
$GPGSA,A,3,10,07,05,02,29,04,08,13,,,,,1.72,1.03,1.38*0A
```

→ Identification of the satellites used in the fix (A: automatique; 3: fix 3D; satellites: 02, 04, 05, 07, 08, 10, 13, 29...)

```
$GPGSV,3,1,11,10,63,137,17,07,61,098,15,05,59,290,20,08,54,157,30*70
```

→ Coordinates (elevation, azimuthal angle) and signal-to-noise ratio for in view satellites (3,1: 3 pages-1st page)

```
$GPGSV,3,2,11,02,39,223,19,13,28,070,17,26,23,252,,04,14,186,14*79
```

→ Coordinates (elevation, azimuthal angle) and signal-to-noise ratio for in view satellites (3,2: 3 pages-2nd page)

```
$GPGSV,3,3,11,29,09,301,24,16,09,020,,36,,,*76
```

→ Coordinates (elevation, azimuthal angle) and signal-to-noise ratio for in view satellites (3,3: 3 pages-3th page)

```
$GPRMC,092750.000,A,5321.6802,N,00630.3372,W,0.02,31.66,280511,,,A*43
```

→ Minimal information about the receiver position (5321.6802° N, 630.3372° W)

```
$GPGGA,092751.000,5321.6802,N,00630.3371,W,1,8,1.03,61.7,M,55.3,M,,*75
```

```
$GPGSA,A,3,10,07,05,02,29,04,08,13,,,,,1.72,1.03,1.38*0A
```

```
$GPGSV,3,1,11,10,63,137,17,07,61,098,15,05,59,290,20,08,54,157,30*70
```

```
$GPGSV,3,2,11,02,39,223,16,13,28,070,17,26,23,252,,04,14,186,15*77
```

```
$GPGSV,3,3,11,29,09,301,24,16,09,020,,36,,,*76
```

```
$GPRMC,092751.000,A,5321.6802,N,00630.3371,W,0.06,31.66,280511,,,A*45
```

Existing NMEA decoder in C++: [NemaTode](#)

→ Forked on IN2P3 GitLab: <https://gitlab.in2p3.fr/hk/clocks/nematode>

→ Can convert NMEA commands into txt files for analyses

Upon completing almanach (a.k.a. reading the GSV pages), returns the list of satellites with

- PRN (identification number — unique for each satellite)
- Elevation and azimuthal angle
- SNR

Adding GSA?

- Should be easy to do since all the infrastructure for receiving and decoding things is in place!

GSA?

Nematode mostly extracts:

- DOP (global/horizontal/vertical)
- fix type

I guess this is what we could extract also from the SBF files?

If the information is available via this NMEA command, using NMEA instead of SBF avoids developing another monitoring tool that interfaces with SBF? This doesn't prevent us to record SBF files for later offline analysis...

Thoughts?

```

/*  -- EXAMPLE --
$GPGSA,A,3,04,05,,09,12,,,24,,,,,2.5,1.3,2.1*39

$GPGSA,A,3,18,21,22,14,27,19,,,,,,4.4,2.7,3.4*32

```

Where:

```

GSA      Satellite status
[0] A      Auto selection of 2D or 3D fix (M = manual)
[1] 3      3D fix - values include: 1 = no fix
           2 = 2D fix
           3 = 3D fix
[2-13] 04,05... PRNs of satellites used for fix (space for 12)
[14] 2.5   PDOP (dilution of precision)
[15] 1.3   Horizontal dilution of precision (HDOP)
[16] 2.1   Vertical dilution of precision (VDOP)
[16] *39   the checksum data, always begins with *
*/

```

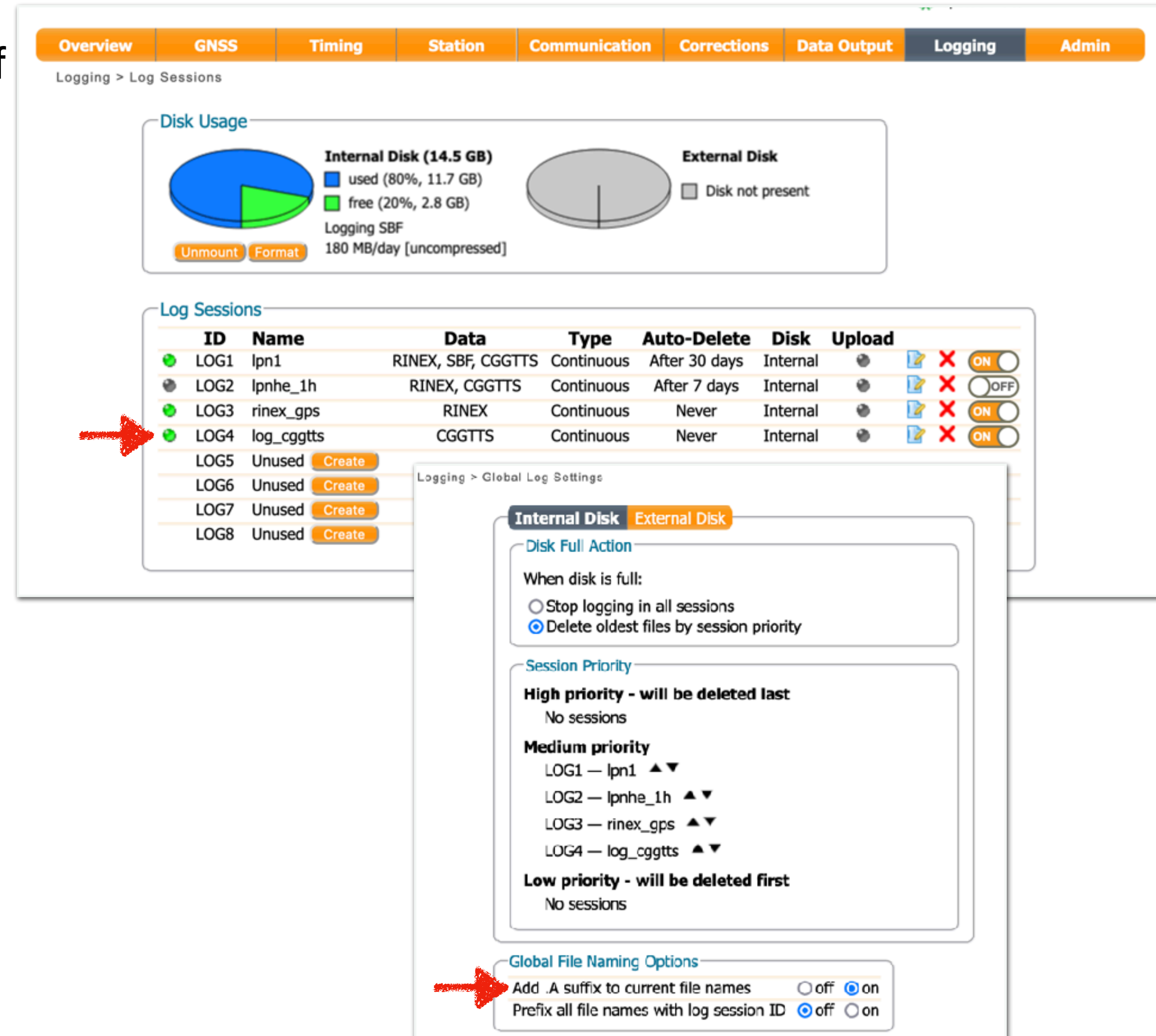

Produced by the receiver by internal conversion of RINEX files

Currently using LOG4 (CGGTTS only)

- Files saved on the internal disk
- Could setup a FTP push to a remote computer

Method consists in

- looking for the active file (.A suffix) (every 10 sec)
- extracting latest info
- interpreting the header and the new lines



Logging > Log Sessions

Disk Usage

Internal Disk (14.5 GB)

- used (80%, 11.7 GB)
- free (20%, 2.8 GB)

Logging SBF
180 MB/day [uncompressed]

External Disk

- Disk not present

Log Sessions

| ID | Name | Data | Type | Auto-Delete | Disk | Upload |
|------|-----------|------------------------|------------|---------------|----------|-------------------------------------|
| LOG1 | lpn1 | RINEX, SBF, CGGTTS | Continuous | After 30 days | Internal | <input checked="" type="checkbox"/> |
| LOG2 | lpnhe_1h | RINEX, CGGTTS | Continuous | After 7 days | Internal | <input type="checkbox"/> |
| LOG3 | rinex_gps | RINEX | Continuous | Never | Internal | <input checked="" type="checkbox"/> |
| LOG4 | log_cggts | CGGTTS | Continuous | Never | Internal | <input checked="" type="checkbox"/> |
| LOG5 | Unused | Create | | | | |
| LOG6 | Unused | Create | | | | |
| LOG7 | Unused | Create | | | | |
| LOG8 | Unused | Create | | | | |

Logging > Global Log Settings

Internal Disk External Disk

Disk Full Action

When disk is full:

- Stop logging in all sessions
- Delete oldest files by session priority

Session Priority

High priority - will be deleted last

No sessions

Medium priority

LOG1 — lpn1 ▲▼

LOG2 — lpnhe_1h ▲▼

LOG3 — rinex_gps ▲▼

LOG4 — log_cggts ▲▼

Low priority - will be deleted first

No sessions

Global File Naming Options

Add .A suffix to current file names off on

Prefix all file names with log session ID off on

CGGTTS file content

CGGTTS GENERIC DATA FORMAT VERSION = 2E

REV DATE = 00-00-000

RCVR = PolaRx5TR (5.3.2) SN3222543

CH = 80

IMS = PolaRx5TR

LAB = Tokai

X = 4201670.132 m

Y = 172825.507 m

Z = 4779558.436 m

FRAME = ITRF

COMMENTS = LS=18; EIMask=0deg;

INT DLY = 25.8 ns (GPS P1), 22.9 ns (GPS P2) CAL_ID = Calibration at OP vs OP73

CAB DLY = 505.0 ns

REF DLY = 0.0 ns

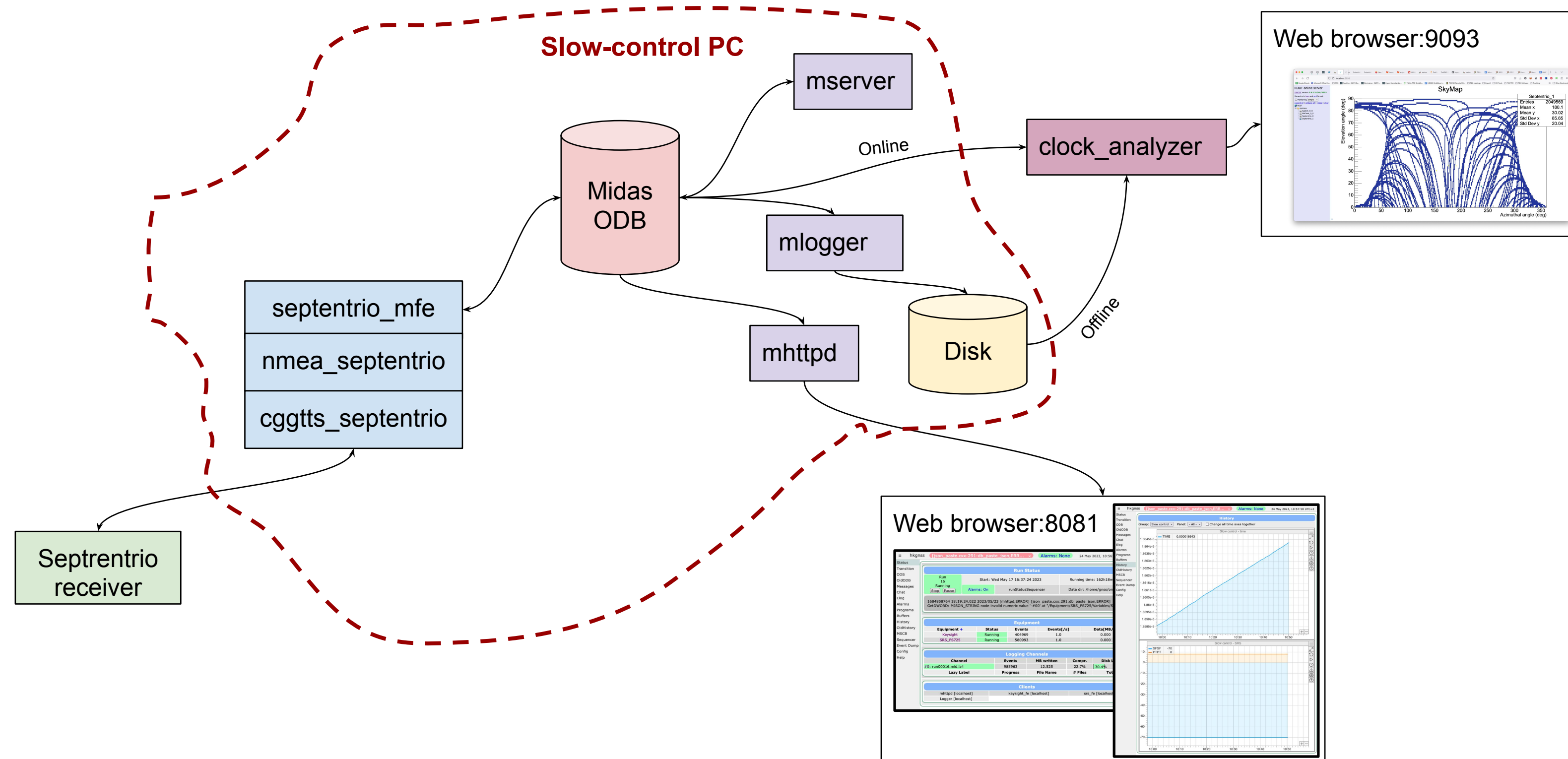
REF = WR-UTC(OP)

CKSUM = 46

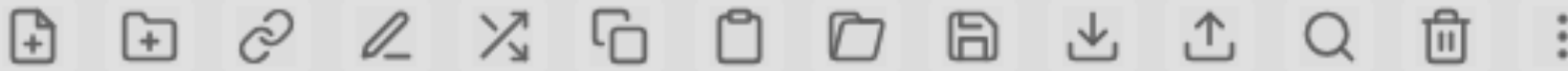
| SAT | CL | MJD | STTIME | TRKL | ELV | AZTH | REFSV | SRSV | REFSYS | SRSYS | DSG | IOE | MDTR | SMDT | MDIO | SMDI | MSIO | SMSI | ISG | FR | HC | FRC | CK |
|-----|----|--------|--------|------|------|------|----------|------|---------|-------|------|--------|------|--------|------|--------|------|--------|------|--------|------|--------|------|
| | | hhmmss | s | .1dg | .1dg | .1ns | .1ps/s | .1ns | .1ps/s | .1ns | .1ns | .1ps/s | .1ns | .1ps/s | .1ns | .1ps/s | .1ns | .1ps/s | .1ns | .1ps/s | .1ns | .1ps/s | .1ns |
| G04 | FF | 60578 | 000600 | 780 | 44 | 2940 | -3460099 | 332 | 1038676 | 403 | 56 | 179 | 936 | 563 | 97 | -119 | 97 | -119 | 36 | 0 | 0 | L3P | EB |
| G05 | FF | 60578 | 000600 | 780 | 185 | 485 | 2915517 | 286 | 1038647 | 274 | 45 | 56 | 252 | 14 | 107 | -2 | 107 | -2 | 35 | 0 | 0 | L3P | 75 |
| G16 | FF | 60578 | 000600 | 780 | 435 | 3004 | 2759627 | 149 | 1038651 | 251 | 24 | 7 | 118 | -16 | 91 | 21 | 91 | 21 | 18 | 0 | 0 | L3P | 5D |
| G18 | FF | 60578 | 000600 | 780 | 677 | 1196 | 7590096 | 269 | 1038641 | 249 | 13 | 63 | 88 | -2 | 93 | 27 | 93 | 27 | 9 | 0 | 0 | L3P | 69 |
| G20 | FF | 60578 | 000600 | 780 | 42 | 235 | -2664401 | 72 | 1038653 | 68 | 122 | 11 | 973 | 778 | 121 | 172 | 121 | 172 | 85 | 0 | 0 | L3P | 91 |
| G23 | FF | 60578 | 000600 | 780 | 76 | 1427 | -2236545 | 359 | 1038671 | 442 | 87 | 73 | 592 | -439 | 225 | -192 | 225 | -192 | 66 | 0 | 0 | L3P | 04 |
| G25 | FF | 60578 | 000600 | 780 | 77 | 1272 | -3957628 | 435 | 1038652 | 435 | 79 | 4 | 588 | 432 | 239 | -122 | 239 | -122 | 52 | 0 | 0 | L3P | E1 |
| G26 | FF | 60578 | 000600 | 780 | 780 | 2661 | 325797 | 419 | 1038650 | 332 | 9 | 68 | 83 | -1 | 85 | -38 | 85 | -38 | 7 | 0 | 0 | L3P | 56 |
| G27 | FF | 60578 | 000600 | 780 | 186 | 2611 | 1378816 | 284 | 1038666 | 280 | 27 | 113 | 253 | -81 | 170 | -27 | 170 | -27 | 17 | 0 | 0 | L3P | CD |
| G28 | FF | 60578 | 000600 | 780 | 211 | 1948 | 5270845 | 399 | 1038649 | 264 | 27 | 111 | 224 | 73 | 201 | 57 | 201 | 57 | 21 | 0 | 0 | L3P | A3 |
| G29 | FF | 60578 | 000600 | 780 | 331 | 690 | 6795390 | 216 | 1038650 | 241 | 27 | 12 | 148 | 26 | 108 | 48 | 108 | 48 | 21 | 0 | 0 | L3P | 7E |
| G31 | FF | 60578 | 000600 | 780 | 429 | 2271 | 3281370 | 305 | 1038656 | 309 | 20 | 8 | 119 | 13 | 119 | -5 | 119 | -5 | 15 | 0 | 0 | L3P | 62 |
| G05 | FF | 60578 | 002200 | 780 | 169 | 418 | 2915810 | 324 | 1038928 | 311 | 37 | 56 | 276 | 36 | 88 | -24 | 88 | -24 | 29 | 0 | 0 | L3P | 86 |
| G16 | FF | 60578 | 002200 | 780 | 508 | 3006 | 2759820 | 208 | 1038942 | 309 | 13 | 7 | 105 | -11 | 78 | -19 | 78 | -19 | 11 | 0 | 0 | L3P | 7C |

Strategy:

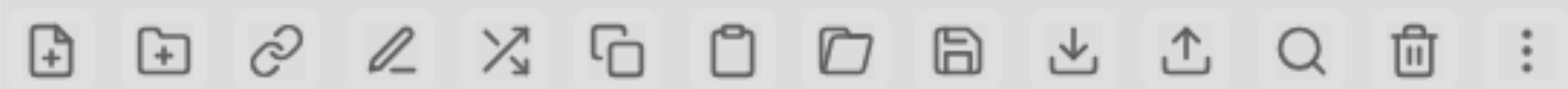
- One Midas front-end per Septentrio receiver
- 2 instruments (1 for NMEA logging, 1 for CGGTTS info) per front-end
- Read data from stream/file and store info in the ODB
- ODB readout for semi-online (e.g. GPS/clock corrections) and offline analyses → rootana/others?



NMEA Equipment sample

| Online Database Browser | | | | | | |
|--|---------------------------------|----------|------|------|---------|------|
| Equipment / nmea_septentrio | | | | | | |
|  | | | | | | |
| Key | Value | Type | #Val | Size | Written | Mode |
| ▶ Common | | | | | | |
| ▼ Settings | | | | | | |
| Address | 134.158.152.105 | STRING | 1 | 32 | 5d | RWD |
| Port | 28000 (0x6D60) | INT32 | 1 | 4 | 5d | RWD |
| Grid display | <input type="text" value="No"/> | BOOL | 1 | 4 | 3d | RWD |
| ▶ Statistics | | | | | | |
| ▼ Variables | | | | | | |
| PRNO | * | ▼ UINT32 | 14 | 4 | 0s | RWD |
| | [0] 0x00000004 (4) | | | | | |
| | [1] 0x0000001F (31) | | | | | |
| | [2] 0x00000015 (21) | | | | | |
| | [3] 0x0000001C (28) | | | | | |
| | [4] 0x00000006 (6) | | | | | |
| | [5] 0x00000009 (9) | | | | | |
| | [6] 0x00000002 (2) | | | | | |
| | [7] 0x00000011 (17) | | | | | |
| | [8] 0x00000013 (19) | | | | | |
| | [9] 0x00000003 (3) | | | | | |
| | [10] 0x0000000C (12) | | | | | |
| | [11] 0x00000031 (49) | | | | | |
| | [12] 0x00000024 (36) | | | | | |
| | [13] 0x00000022 (34) | | | | | |
| AZIO | * | ▶ DOUBLE | 14 | 8 | 0s | RWD |
| ELE0 | * | ▶ DOUBLE | 14 | 8 | 0s | RWD |
| SNR0 | * | ▶ DOUBLE | 14 | 8 | 0s | RWD |

CGGTTS Equipment sample

| Online Database Browser | |
|--|---|
| Equipment / cggts_septentrio | |
|  | |
| Key | Value |
| Common | |
| Settings | |
| Latest Date | 20240930 (0x134DA22) |
| Latest Time | 121800 (0x1DBC8) |
| Grid display | <input type="text" value="No"/> |
| IP | 134.158.152.105 |
| Port | 22 (0x16) |
| Username | midas |
| Password | XXXXXXXXXX |
| Remote path | /DSK1/SSN/LOG4_log_cggts |
| Variables | |
| NSA0 | 10 (0xA) |
| PRN0 | * |
| AZIO | * |
| ELE0 | * |
| REF0 | * |
| SRS0 | * |
| MJD0 | 60583 (0xECA7) |
| STT0 | 121800 (0x1DBC8) |
| Statistics | |