Monitoring activities of satellite data processing services in real-time with SDDS Live Monitor

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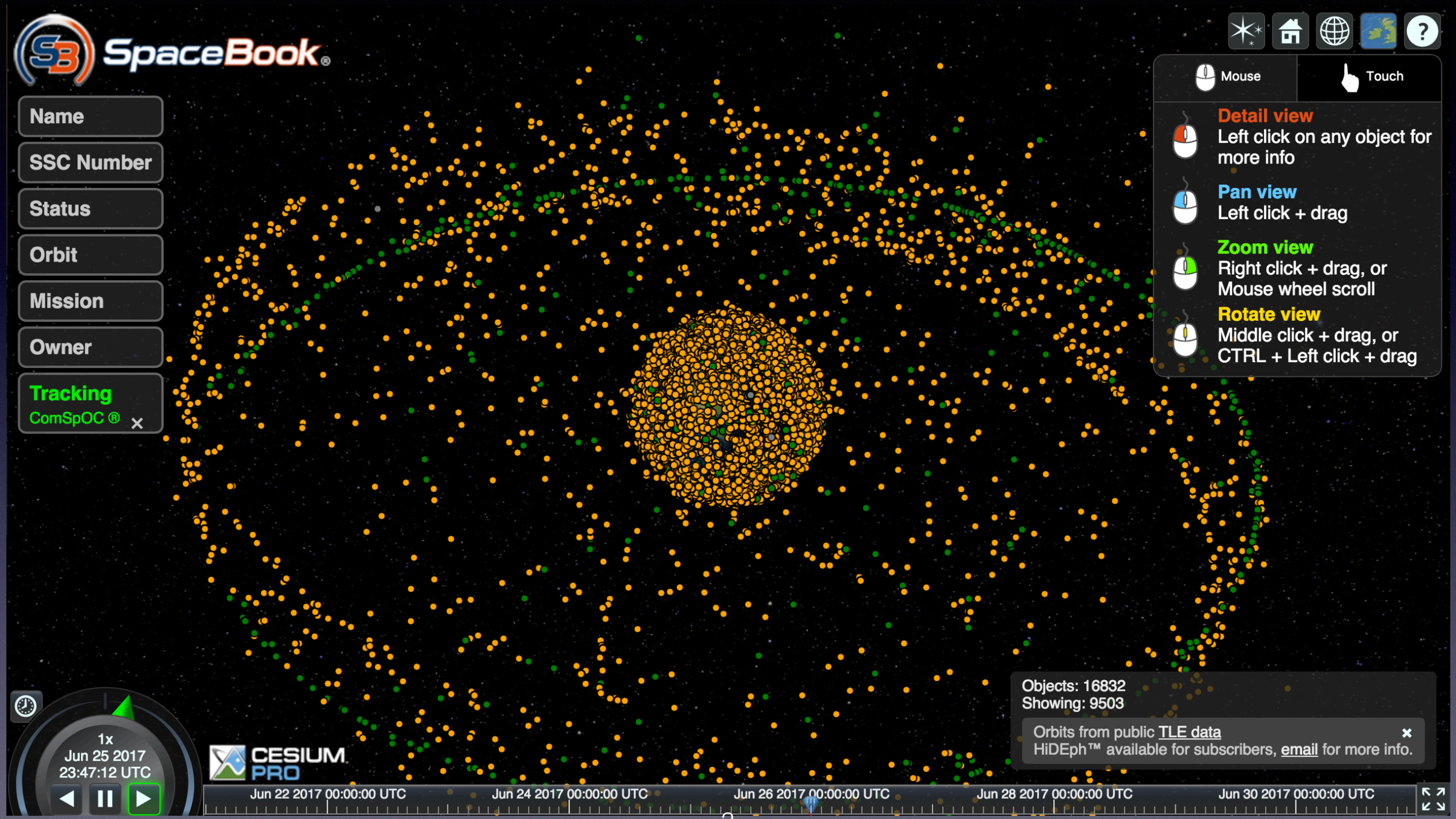
Satellites around the Earth



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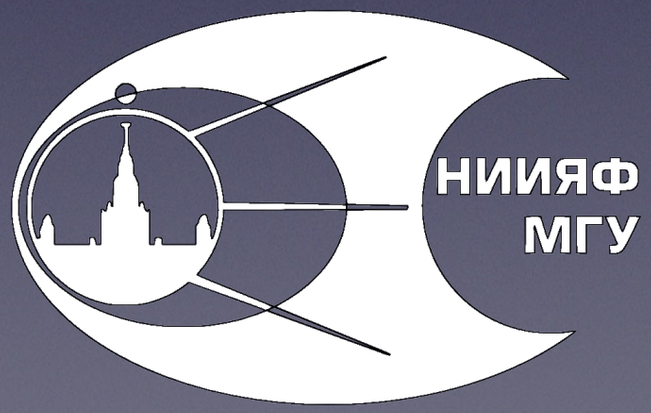
http://apps.agi.com/SatelliteViewer/


NATIONAL WEATHER SERVICE


iSWA
solar
heliosphere
magnetosphere
ionosphere
planetary


esa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The unified data storage challenge

- Connections to data sources (HTTP(S), FTP(S), PPTP, IPSEC, IKEv2, etc.)
- Data formats (raw, txt, csv, XML, JSON, CDF3/4, HDF4/5, fits, png, jpeg, etc.)
- Hierarchy of onboard instruments and their data unit
- Data validation and correctness

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A system to collect & process satellite data

- Fully automatic
- Satellite adding needs a minimum of coding
- Real-time monitoring and notification
- Data access UI for scientists
- API for developers

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SDDS Overview

Satellite

Radio Channel

Ground Station

Ethernet

Storage Server - Data Source

Internet

Backend

Satellite Controller

SDDS Libs

PostgreSQL

RabbitMQ Message Broker

Apache Webserver

RESTful API, WebSocket

Frontend

Reporter

Live Monitor

Plot Service

Data Access Service

Other Services

Internet

Users

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Live Monitor

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Goals

- Notifying of state changes and erroneous conditions of each system component (service)
- Creating reports of each run for each satellite
- Operator UI
- Customisable notification services for 3rd party applications

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Existing solutions

- SAS products for banking and finance
- Nagios / Zabbix for IT infrastructure

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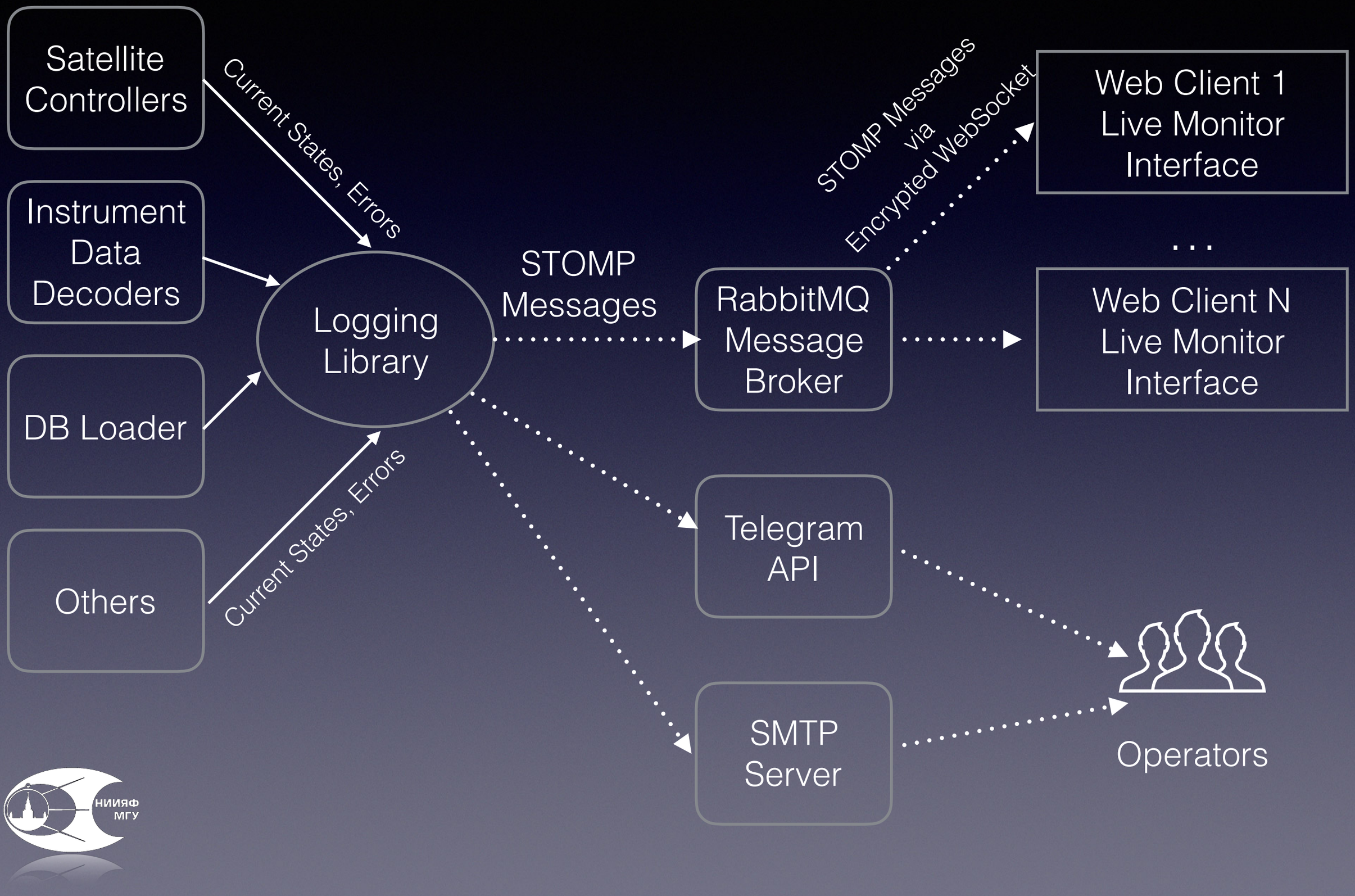
Live Monitor Overview



Software Stack

- Python, Javascript, JSON
- Apache, Django, RabbitMQ
- React, Websocket/SockJS, STOMP
- Telegram

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Logging library

- Based on Python logging module
- 4 levels: DEBUG, INFO, WARNING, ERROR
- Supports: stdout, smtp, Telegram, websocket (via RabbitMQ)
- Format: [<timestamp>] [<pid>] <module>: <line_number>: <level>: <message>

Sublime Text File Edit Selection Find View Goto Tools Project Window Help 84 % Mon 26 Jun 14:02:39

ace.log — swx

ace.log

```
[2017-06-26 06:30:01] [11514] sd_downloader[ace]: 1230: INFO: Running sd_downloader.pyc in automatic mode, PID = 11514
[2017-06-26 06:30:01] [11514] sd_downloader[ace]: 763: INFO: Wrote process ID to /home/smdc/sdds/downloader/ace.pid
[2017-06-26 06:30:01] [11514] sd_downloader[ace]: 1290: INFO: Started #connect
[2017-06-26 06:30:01] [11514] sd_downloader[ace]: 255: INFO: Direct connection = True
[2017-06-26 06:30:03] [11514] sd_downloader[ace]: 233: INFO: Connected to URL http://legacy-www.swpc.noaa.gov/ftpdir/lists/ace/
[2017-06-26 06:30:05] [11514] sd_downloader[ace]: 1337: INFO: Stopped #connect
[2017-06-26 06:30:05] [11514] sd_downloader[ace]: 1290: INFO: Started #download
[2017-06-26 06:30:05] [11514] sd_downloader[ace]: 521: INFO: Downloading file ace_swepam_1m.txt
[2017-06-26 06:30:05] [11514] sd_downloader[ace]: 530: INFO: Downloaded file and moved to /mnt/buffer/binary/ace_swepam_1m.txt
[2017-06-26 06:30:05] [11514] sd_downloader[ace]: 521: INFO: Downloading file ace_sis_5m.txt
[2017-06-26 06:30:05] [11514] sd_downloader[ace]: 530: INFO: Downloaded file and moved to /mnt/buffer/binary/ace_sis_5m.txt
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 521: INFO: Downloading file ace_mag_1m.txt
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 530: INFO: Downloaded file and moved to /mnt/buffer/binary/ace_mag_1m.txt
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 521: INFO: Downloading file ace_epam_5m.txt
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 530: INFO: Downloaded file and moved to /mnt/buffer/binary/ace_epam_5m.txt
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 1337: INFO: Stopped #download
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 1290: INFO: Started #extract
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 588: INFO: Cleaning all directories starting with ace_epam_5m
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 786: INFO: Moving files for instrument epam
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 815: INFO: Moving src = /mnt/buffer/binary/ace_epam_5m.txt to dst = /mnt/buffer/ace_epam_5m/epam/L0
[2017-06-26 06:30:06] [11514] sd_downloader[ace]: 588: INFO: Cleaning all directories starting with ace_mag_1m
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 786: INFO: Moving files for instrument mag
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 815: INFO: Moving src = /mnt/buffer/binary/ace_mag_1m.txt to dst = /mnt/buffer/ace_mag_1m/mag/L0
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 588: INFO: Cleaning all directories starting with ace_sis_5m
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 786: INFO: Moving files for instrument sis
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 815: INFO: Moving src = /mnt/buffer/binary/ace_sis_5m.txt to dst = /mnt/buffer/ace_sis_5m/sis/L0
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 588: INFO: Cleaning all directories starting with ace_swepam_1m
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 786: INFO: Moving files for instrument swepam
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 815: INFO: Moving src = /mnt/buffer/binary/ace_swepam_1m.txt to dst = /mnt/buffer/ace_swepam_1m/swepam/L0
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1337: INFO: Stopped #extract
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1290: INFO: Started #process
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1315: INFO: Started #epam
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 929: INFO: Running decoder for instrument epam
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1027: INFO: Finished running decoder epam
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1317: INFO: Stopped #epam
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1315: INFO: Started #mag
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 929: INFO: Running decoder for instrument mag
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1027: INFO: Finished running decoder mag
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1317: INFO: Stopped #mag
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1315: INFO: Started #sis
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 929: INFO: Running decoder for instrument sis
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1027: INFO: Finished running decoder sis
[2017-06-26 06:30:07] [11514] sd_downloader[ace]: 1317: INFO: Stopped #sis
[2017-06-26 06:30:08] [11514] sd_downloader[ace]: 1315: INFO: Started #swepam
```

.* Aa “” nlst Find Find Prev Find All

68 lines, 7060 characters selected | 376 misspelled words | Tab Size: 2 | Python

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RabbitMQ

- 1 message queue for each service
- Encrypted connection (TLS) with authentication
- Publish-subscribe scenario
- Simple (or Streaming) Text Oriented Message Protocol (STOMP)

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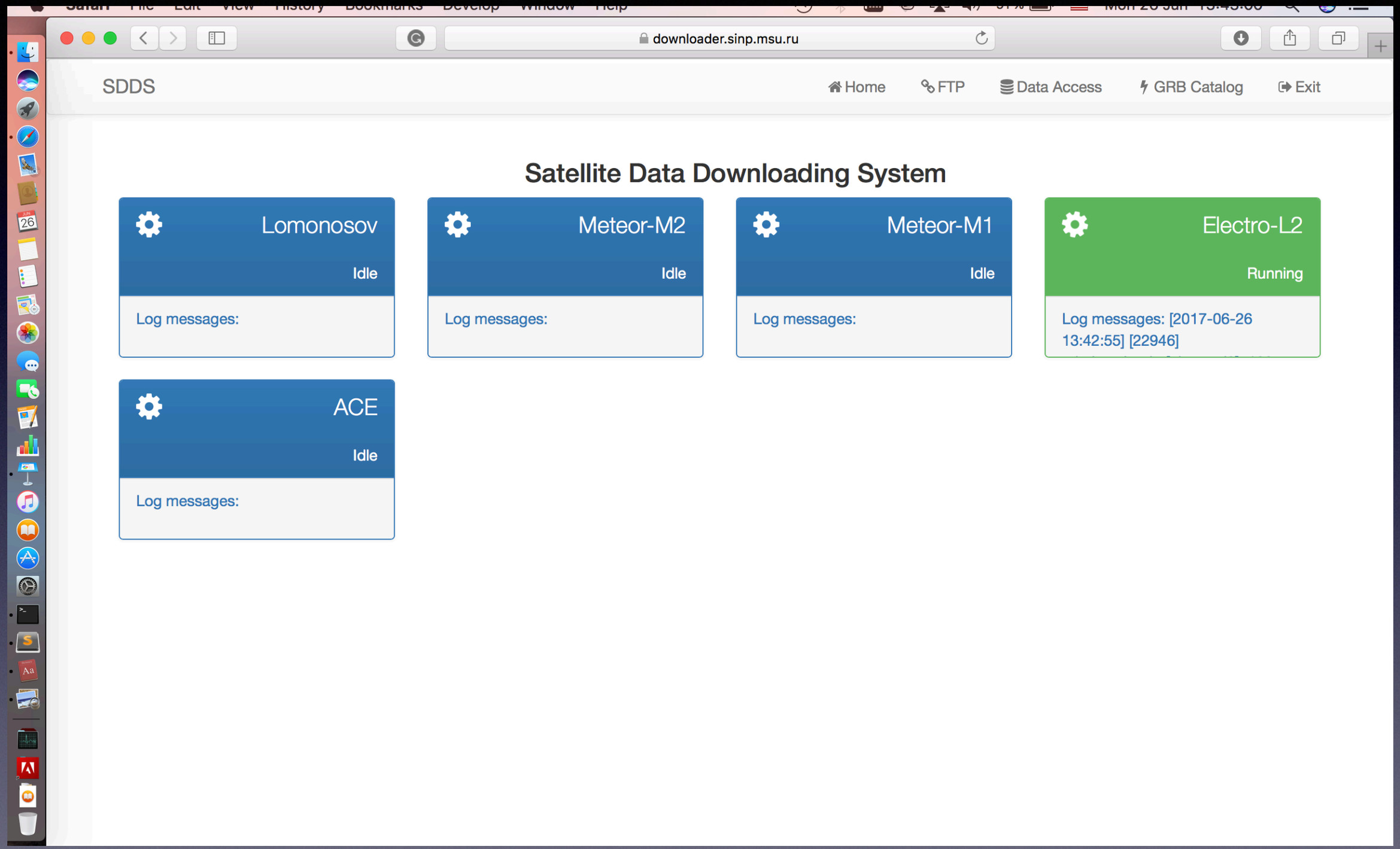
Web UI - all satellites



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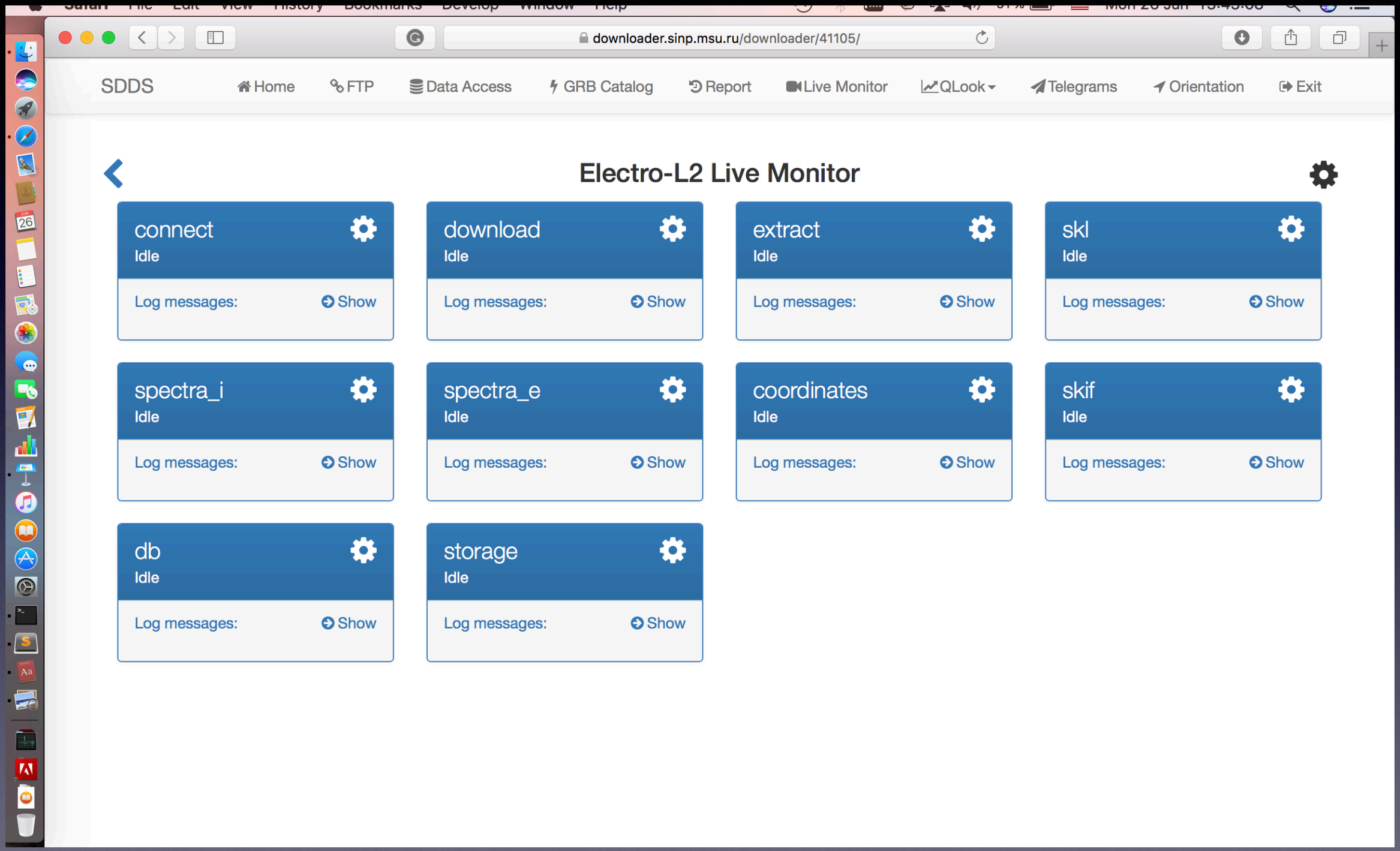
Web UI - Electro-L2



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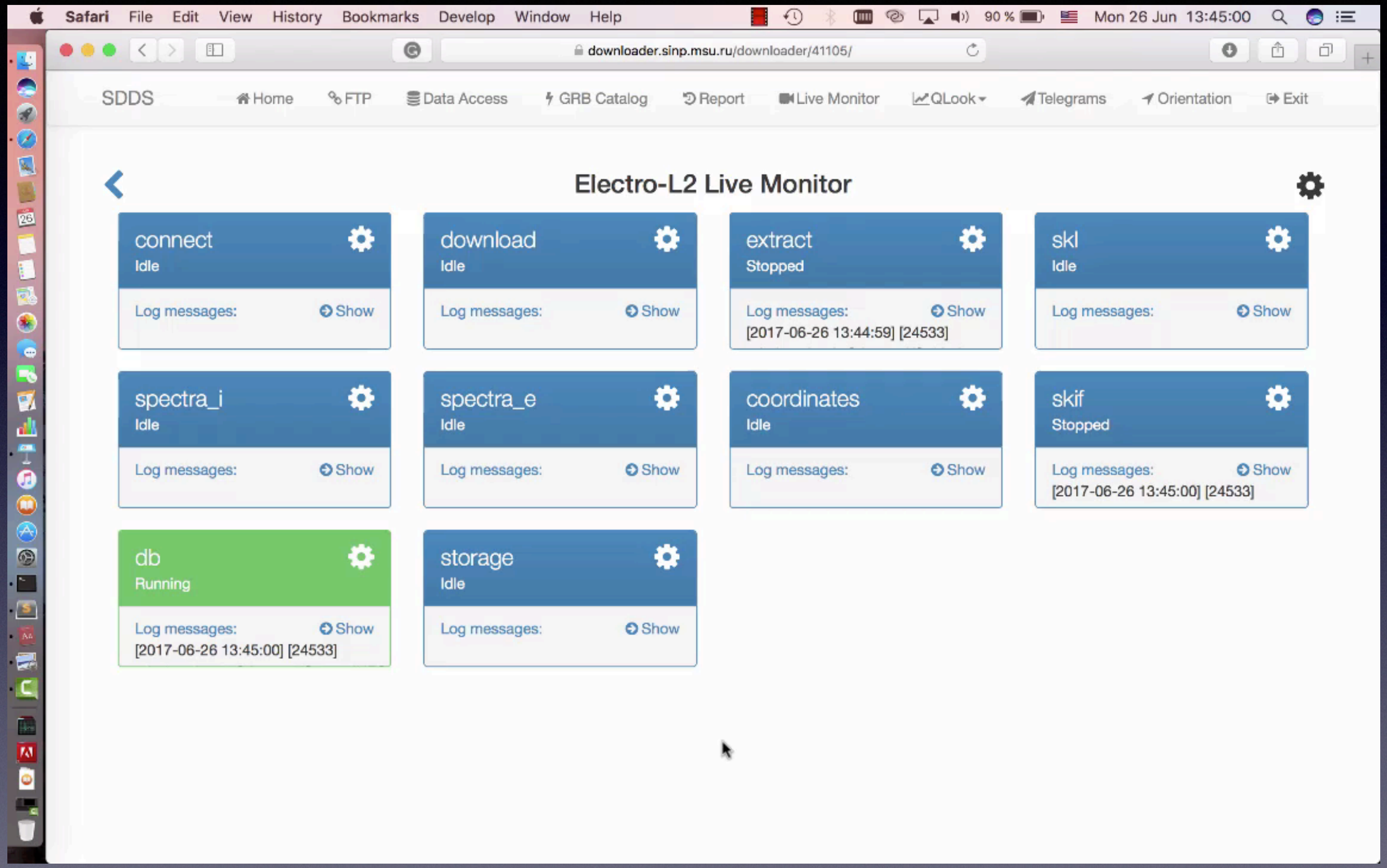
Web UI - Electro-L2



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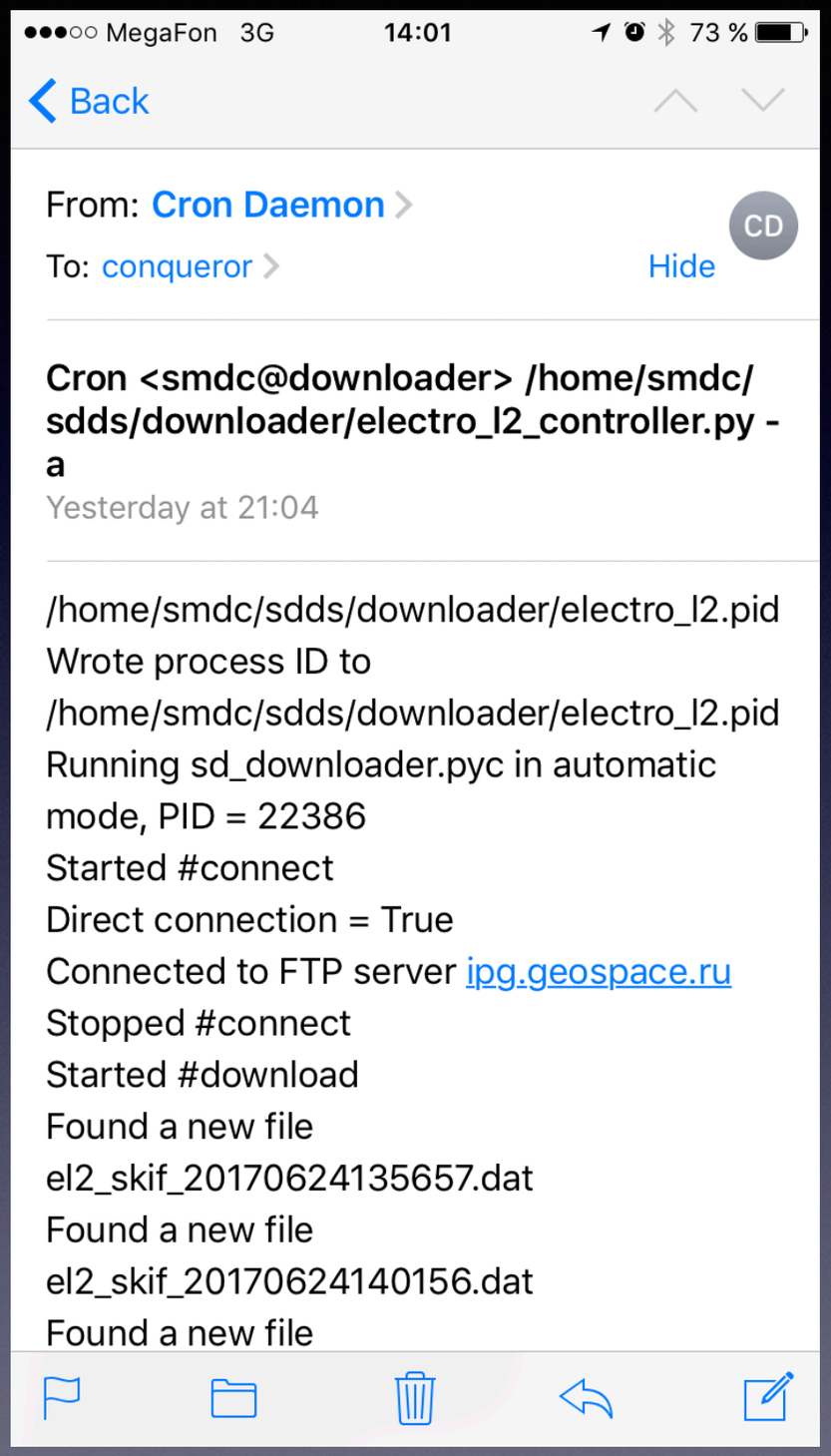
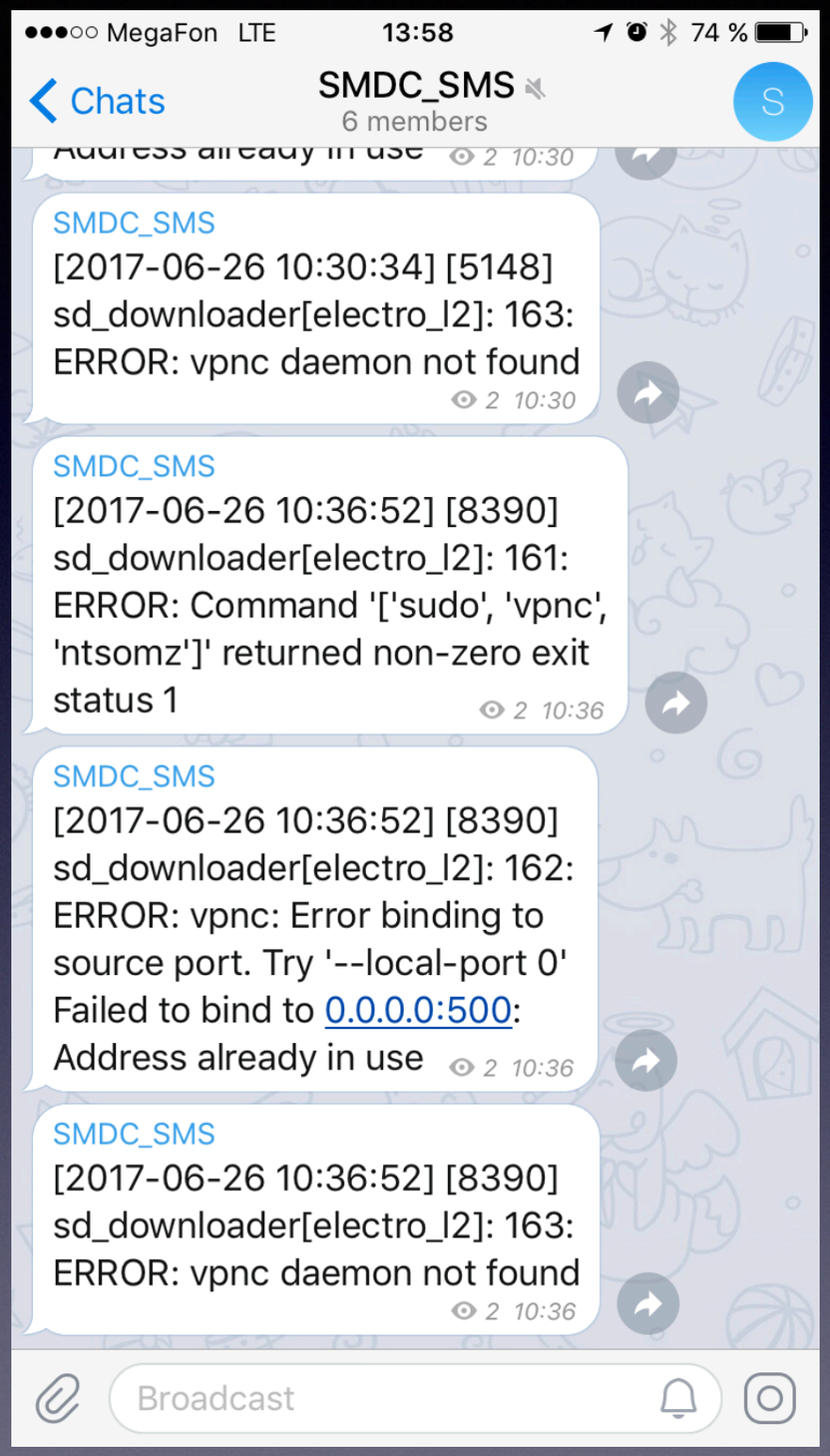
Notification - email & Telegram





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Notification Management API

- Add a service to be monitored by Live Monitor
- Enable/Disable notification for the whole service
- Enable/Disable notification via Telegram
- Enable/Disable notification for each stage of a service(in future)
- Processing control via Telegram bot - stop a service when an error occurs (in future)

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Current Status

- 1 year of operation
- >10 GB of raw data / day
- >12.3 TB of data (total)
- <100 msg/s, max - >10000 msg/s (E5-2650 2.60GHz / 8GB / 1Gb Ethernet)

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Conclusion

- A system for near real-time satellite data processing
- A real-time monitoring framework
- UI for operators
- Notification via mails & Telegram messenger
- API for developers

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“FAQ => nguyendmitri@gmail.com :)”

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