
SatNOGS Documentation

Release 1

SatNOGS

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This is the development documentation for the [SatNOGS project](#).

If you are looking for documentation on how to use SatNOGS or build a ground station, please visit [our wiki](#).

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Contents:

1.1 SatNOGS client architecture

1.1.1 Overview

SatNOGS client is the part of our software stack that:

- Fetches observation jobs from the network.
- Schedules locally when the observation starts/ends.
- Does orbital calculation for the position of the observer and the tracked object (using `PyEphem`).
- Sends `rotctl/rigctl` commands to control **SatNOGS** rotator.
- Spawns processes to run demodulation/decoding software with the signal received as input.
- Posts observation data back to the network.

1.1.2 Modules

Following the paradigm of **SatNOGS** being extensively modular, **SatNOGS** client is designed to have discrete modules with specific functionality.

scheduler

- Build using `apscheduler` library.
- Stores tasks in `sqlite`.

Tasks

- `get_jobs`: Queries **SatNOGS Network API** to get jobs scheduled for the ground station.
- `spawn_observation`: Initiates an `Observer` instance and runs the observation.
- `post_observation_data`: Gathers output files, parses filename and posts data back to **SatNOGS Network API**.

`observer.observer`

Given initial description of the observation (`tle`, `start`, `end`)

- Checks input for sanity.
- Initializes `WorkerTrack` and `WorkerFreq` instances that start `rigctl/rotctl` communication using `trackstart` method.
- Starts/Stops GNU Radio script (`gr-satnogs`), which collects the data.
- Processes produced data from observation (ogg file, waterfall plotting).

`observer.worker`

- Facilitates as a worker for `rigctl/rotctl`.
- Is the lowest abstraction level on `rigctl/rotctl` communications.
- Tracks object until end of observation is reached.

`observer.orbital`

- Implements orbital calculations using `PyEphem`.
- Provides `pinpoint` method the returns alt/az position of tracked object.

`bin/scripts`

- `satnogs-client`: Run the scheduler queue in the background and fetch jobs from the network.

1.2 satnogsclient Package

1.2.1 satnogsclient Package

1.2.2 settings Module

1.2.3 Subpackages

`observer` Package

commsocket Module

```

class satnogsclient.observer.commsocket.Commsocket (ip, port)
    Handles connectivity with remote ctl demons Namely: rotctl and rigctl

    accept ()
    bind ()
    buffer_size
    connect ()
    disconnect ()
    ip
    is_connected
    listen ()
    port
    receive (size)
    send (message)
    send_not_recv (message)
    tasks_buffer_size

```

observer Module

orbital Module

```

satnogsclient.observer.orbital.pinpoint (observer_dict, satellite_dict, timestamp=None)
    Provides azimuth and altitude of tracked object.

```

args: observer_dict: dictionary with details of observation point. satellite_dict: dictionary with details of satellite. time: timestamp we want to use for pinpointing the observed object.

returns: Dictionary containing azimuth, altitude and “ok” for error detection.

worker Module

```

class satnogsclient.observer.worker.Worker (ip, port, time_to_stop=None,
                                             frequency=None, proc=None,
                                             sleep_time=None)

```

Class to facilitate as a worker for rotctl/rigctl.

```

check_observation_end_reached ()

```

```

is_alive

```

Returns if tracking loop is alive or not.

```

observer_dict = {}

```

```

satellite_dict = {}

```

```

send_to_socket ()

```

trackobject (*observer_dict, satellite_dict*)

Sets tracking object. Can also be called while tracking to manipulate observation.

trackstart (*port, start_thread*)

Starts the thread that communicates tracking info to remote socket. Stops by calling trackstop()

trackstop ()

Sets object flag to false and stops the tracking thread.

```
class satnogsclient.observer.worker.WorkerFreq(ip, port, time_to_stop=None,
                                               frequency=None, proc=None,
                                               sleep_time=None)
```

Bases: *satnogsclient.observer.worker.Worker*

send_to_socket (*p, sock*)

```
class satnogsclient.observer.worker.WorkerTrack(ip, port, time_to_stop=None,
                                                  frequency=None, proc=None,
                                                  sleep_time=None)
```

Bases: *satnogsclient.observer.worker.Worker*

send_to_socket (*p, sock*)

scheduler Package

scheduler Package

tasks Module

1.3 Installation

Note: These installation steps are intended to be used for contributing to the satnogs-client codebase. If you are interested in setting up satnogs-client for your ground station check the [wiki](#).

Requirements: You will need python, python-virtualenvwrapper, pip and git

1. Build the environment

Clone source code from the [repository](#):

```
$ git clone https://gitlab.com/librespacefoundation/satnogs/satnogs-client.git
```

Set up the virtual environment. On first run you should create it and link it to your project path.:

```
$ cd satnogs-client
$ mkvirtualenv satnogs-client -a .
```

Activate your python virtual environment:

```
$ workon satnogs-client
```

Install local development requirements:

```
$ pip install .
```

2.1 Installation

2.1.1 Docker Installation

1. Requirements

You will need `docker` and `docker-compose`.

2. Get the source code

Clone source code from the [repository](#):

```
$ git clone https://gitlab.com/librespacefoundation/satnogs/satnogs-network.git
$ cd satnogs-network
```

3. Configure settings

Set your environmental variables:

```
$ cp env-dist .env
```

4. Run it!

Run `satnogs-network`:

```
$ docker-compose up -d --build
```

5. Populate database

Create, setup and populate the database with demo data:

```
$ docker-compose exec web djangoctl.sh initialize
```

Your `satnogs-network` development instance is available in `localhost:8000`. Go hack!

2.1.2 VirtualEnv Installation

1. Requirements

You will need python, python-virtualenvwrapper, pip and git

2. Get the source code

Clone source code from the [repository](#):

```
$ git clone https://gitlab.com/librespacefoundation/satnogs/satnogs-network.git
$ cd satnogs-network
```

3. Build the environment

Set up the virtual environment. On first run you should create it and link it to your project path.:

```
$ mkvirtualenv satnogs-network -a .
```

4. Configure settings

Set your environmental variables:

```
$ cp env-dist .env
```

5. Run it!

Activate your python virtual environment:

```
$ workon satnogs-network
```

Just run it:

```
(satnogs-network)$ ./bin/djangoctl.sh develop .
```

6. Populate database

Create, setup and populate the database with demo data:

```
(satnogs-network)$ ./bin/djangoctl.sh initialize
```

Your satnogs-network development instance is available in localhost:8000. Go hack!

2.2 Contribute

Thank you for your interest in contributing to SatNOGS! There are always bugs to file; bugs to fix in code; improvements to be made to the documentation; and more.

The below instructions are for software developers who want to work on [satnogs-network code](#).

2.2.1 Git workflow

When you want to start contributing, you should follow the installation instructions, then...

1. (Optional) Set your cloned fork to track upstream changes (changes to the main repository), then fetch and merge changes from the upstream branch:

```
$ git remote add --track master upstream git://gitlab.com/librespacefoundation/  
↪satnogs/satnogs-network  
$ git fetch upstream  
$ git merge upstream/master
```

2. Set up a branch for a particular set of changes and switch to it:

```
$ git branch my_branch  
$ git checkout my_branch
```

3. Commit changes to the code!

4. Code!

5. Lint the code:

```
$ flake8 network
```

and fix any errors.

6. Commit changes to the code!

7. When you're done, figure out how many commits you've made:

```
$ git log
```

8. Squash all those commits into a single commit that has a [good git commit message](#). (Example assumes you made 4 commits):

```
$ git rebase -i HEAD~4
```

9. Use the interactive editor that pops up to pick/squash your commits:

```
pick 01d1239 [fix bug 893291] Make it go to 11  
squash 32as32p added the library and made some minor changes  
squash 30ame3z build the template  
squash 91pcla8 ugh fix a semicolon bug in that last commit
```

10. Push your changes to your fork:

```
$ git push origin my_branch
```

11. Issue a pull request on Gitlab to the dev branch (not master)

12. Wait to hear from one of the core developers. You can find us on irc or matrix in channel satnogs if you wish to discuss your MR in real time.

If you're asked to change your commit message, you can amend the message and force commit:

```
$ git commit --amend  
$ git push -f origin my_branch
```

If you're asked to make changes on your code you can stage them and amend the commit:

```
$ git add my_changed_files  
$ git commit --amend  
$ git push -f origin my_branch
```

If you need more Git expertise, a good resource is the [Git book](#).

2.2.2 Templates

satnogs-network uses [Django's template engine templates](#).

2.2.3 Frontend development

To be able to manage the required javascript libraries, install the development dependencies with npm:

```
$ npm install
```

Development tasks like the download of assets, code linting and tests are managed with gulp:

```
$ gulp
```

Frontend dependencies are stored in packages.json, handled by yarn. To add a new dependency, e.g. satellite.js, call:

```
$ yarn add satellite.js
```

Manually add the new required files to the list of "assets" in packages.json, then start the download with:

```
$ gulp assets
```

The assets are stored in the repository, thus don't forget to create a commit after you add/update/remove dependencies.

2.2.4 Simulating station heartbeats

Only stations which have been seen by the server in the last hour (by default, can be customized by *STATION_HEARTBEAT_TIME*) are taken into consideration when scheduling observations. In order to simulate an heartbeat of the stations 7, 23 and 42, the following command can be used

```
$ sudo docker-compose run web python manage.py update_station_last_seen 7 23 42
```

2.2.5 Coding Style

1. Four space indentation (no tabs), two whitespace on html documents.
2. Use single quotes for strings. Double quotes used only for html attributes.
3. Keep lines shorter than 100 characters when possible (especially at python code)

Follow the [PEP8](#) and [PEP257](#) Style Guides.

Most important things:

1. Separate top-level function and class definitions with two blank lines.
2. Method definitions inside a class are separated by a single blank line.
3. Use whitespace between comma separated values.
4. Use white space between assignments and expressions (except parameter values).
5. Don't use whitespace before or after parentheses, brackets or braces.
6. Classes should use CamelCase naming.
7. Functions should use lowercase naming.

2.2.6 What to work on

You can check [opened issues](#). We regularly open issues for tracking new features. You pick one and start coding.

2.3 Maintenance

2.3.1 Updating Python dependencies

To update the Python dependencies:

1. Execute script to refresh *requirements{-dev}.txt* files:

```
$ ./contrib/refresh-requirements.sh
```

2. Stage and commit *requirements{-dev}.txt* files

2.3.2 Updating frontend dependencies

The frontend dependencies are managed with *npm* as defined in the *package.json*. The following are required to perform an update of the dependencies:

1. Bump versions in *package.json*
2. Download and install the latest version of the dependencies

```
$ npm install
```

3. Move the installed version into to *satnogs-network* source tree

```
$ ./node_modules/.bin/gulp
```

4. Stage & commit the updated files in *network/static/*.

3.1 Installation

3.1.1 Docker Installation

1. Requirements

You will need `docker` and `docker-compose`.

2. Get the source code

Clone source code from the [repository](#):

```
$ git clone https://gitlab.com/librespacefoundation/satnogs/satnogs-db.git
$ cd satnogs-db
```

3. Configure settings

Set your environmental variables:

```
$ cp env-dist .env
```

4. Run it!

Run `satnogs-db`:

```
$ docker-compose up -d --build
```

5. Populate database

Create, setup and populate the database with demo data:

```
$ docker-compose exec web djangoctl.sh initialize
```

Your `satnogs-db` development instance is available in `localhost:8000`. Go hack!

3.1.2 VirtualEnv Installation

1. Requirements

You will need python, python-virtualenvwrapper, pip and git

2. Get the source code

Clone source code from the [repository](#):

```
$ git clone https://gitlab.com/librespacefoundation/satnogs/satnogs-db.git
$ cd satnogs-db
```

3. Build the environment

Set up the virtual environment. On first run you should create it and link it to your project path.:

```
$ mkvirtualenv satnogs-db -a .
```

4. Configure settings

Set your environmental variables:

```
$ cp env-dist .env
```

5. Run it!

Activate your python virtual environment:

```
$ workon satnogs-db
```

Just run it:

```
(satnogs-db)$ ./bin/djangoctl.sh develop .
```

6. Populate database

Create, setup and populate the database with demo data:

```
(satnogs-db)$ ./bin/djangoctl.sh initialize
```

Your satnogs-db development instance is available in localhost:8000. Go hack!

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3. Commit changes to the code!
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```
$ flake8 db
```

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10. Push your changes to your fork:

```
$ git push origin my_branch
```

11. Issue a pull request on Gitlab
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If you're asked to change your commit message, you can amend the message and force commit:

```
$ git commit --amend
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```

If you're asked to make changes on your code you can stage them and amend the commit:

```
$ git add my_changed_files
$ git commit --amend
$ git push -f origin my_branch
```

If you need more Git expertise, a good resource is the [Git book](#).

3.2.2 Templates

satnogs-db uses Django's [template engine](#) templates.

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The frontend dependencies are managed with *npm* as defined in the *package.json*. The following are required to perform an update of the dependencies:

1. Bump versions in *package.json*
2. Download and install the latest version of the dependencies

```
$ npm install
```
3. Move the installed version into to satnogs-db source tree

```
$ ./node_modules/.bin/gulp
```

4. Stage & commit the updated files in *db/static/*.

3.4 API

SatNOGS-DB API is a REST API that provides detailed information about Satellites and Transmitters. This document explains how to use the API to retrieve data for your application.

3.4.1 Using API Data

API access is public to anyone. No form of authentication is required. All API data are freely distributed under the [CC BY-SA](#) license.

3.4.2 API Methods

Satellites

The `satellites` method of the SatNOGS DB API returns all Satellites currently used for gathering Transmitters data.

Endpoint

```
https://db.satnogs.org/api/satellites/
```

Examples

Show a specific satellite using its Norad Cat ID:

Request:

```
/api/satellites/25544/?format=json
```

Response:

```
{
  "norad_cat_id": 25544,
  "name": "ISS (ZARYA)"
}
```


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