



Libre Space
Foundation

Empowering Open-Source Space Technologies

challenges & opportunities in unlocking
open-source collaboration in space

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Timeline



2011: hackerspace.gr physical space for open technologies in Athens,GR opens its doors

2014: during a NASA Space Apps Challenge hackathon SatNOGS, a satellite ground-station network starts

2014: SatNOGS wins the 1st Hackaday Prize approx 200k

2015: Libre Space Foundation est.

2017: UPSat 1st open-source satellite in orbit

2022: 1st open-source deployer in orbit



Vision, Mission, and Ideals



MISSION: Open and Accessible Outer Space for all

VISION: to promote, advance and develop libre (free and open source) technologies and knowledge for space. To do that, we design, develop and deliver space related projects ranging from Ground Station equipment to global monitoring Networks and satellite missions.

MANIFESTO: manifesto.libre.space

Open-source

Open-source software: GPLv3, AGPLv3, LGPLv3

Hardware: CERN OHLv2

Data: CC-BY-SA

gitlab.com/librespacefoundation/

docs.libre.space

Projects



SatNOGS: the largest satellite ground-station network in the world feat. 400+ stations in 50+ countries.



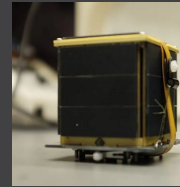
UPSat: 1st open-source hardware & software satellite in orbit in 2017



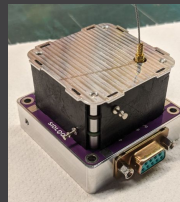
SatNOGS COMMS: open-source CubeSat signal analysis and communications module



PICOBUS: open-source PocketQube pico-satellite orbital deployer in orbit in 2022



QUBIK: open-source PocketQube (5x5x5cm) pico-satellites in orbit in 2022



SIDLOC: spacecraft identification and localization protocol and open-source software and hardware implementation

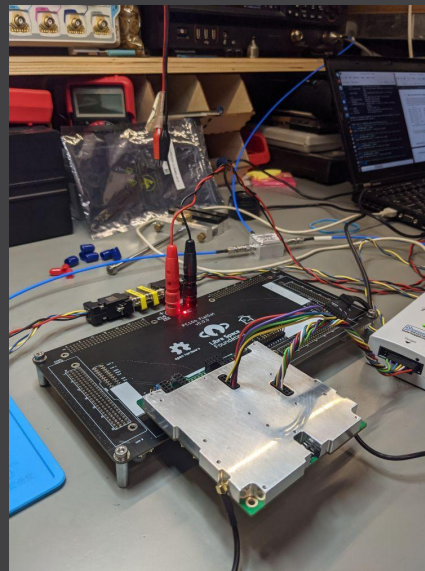
Impact of open-source in space

Rapid Prototyping and iterations: SatNOGS COMMS used by other teams p.e. AUTH next door or SatNOGS station iterations for imperial hardware.

Innovative uses: Alternative solutions, p.e SatNOGS-COMMS used for Ionospheric disturbance analysis

Global Collaboration: Teams can literally work and assist across the world, even without NDAs etc p.e SatNOGS Network

Lower barriers of entry: A person can assist a satellite team from their backyard



Using open-source for space

Open-source solutions can provide robust and efficient solutions to daily operations, community, and development needs.

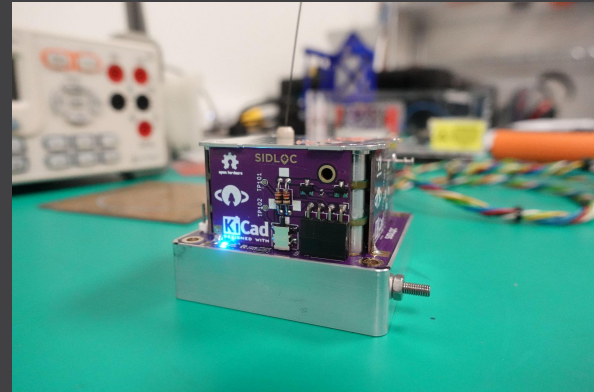
LSF uses several other open-source projects, in some cases actively assisting development.

Daily interaction with other open-source projects allows for adoption of good practises and ideas (not only code).

Open-source solutions allow for interoperability within the organization and with external entities.

Examples of open-source used in LSF

GNU/Linux, Django, MariaDB, WordPress, Discourse, Matrix, GNURadio, Arduino, NextCloud, Jitsi, BigBlueButton, Drawio, KiCAD, FreeCAD, Grafana, LaTeX, GitLab, indigo, much much much more



Challenges and Opportunities

Space is hard, especially orbital hardware has few ways to be fixed.

Numerous regulations and standards

Space used to be (and to some extent still is) the domain of powerful nations and gigantic corporations.

Proprietary solutions and secrecy

Space is a capital intensive industry.

Open-source could be a solution for more robust systems

There are established ways to propose new standards and they can provide a framework to work with

Miniaturization has impacted that and allows for lower bars of entry

They may impact innovation several entities (public and private) are open to openness.

There are ways to achieve sustainability with niche solutions

Common Grounds of LSF with KDE

Both foster communities to democratize access to technology

Thriving through community

Similar tooling like (GitLab, BBB etc)

Collaborative and transparent

Promoting open culture



> diff lsf kde

Domain specific challenges (aka space is hard)

Purpose-driven solutions (not generic computing)

LSF might need to engage the community in specialized ways suitable to space.

Hard deadlines, testing, specialized QA measures might be common.

KDE hardware commitment.

Time between commits and execution can be months, even year then...



Key lessons learned so far

sky is not the limit for open-source

challenges can foster innovation

community participation is key

collaboration can have geometric impact

Open-source orgs should seek to learn more from their peers

There are ways to collaborate among open-source projects directly or through over umbrella orgs

Questions?

ASK AWAY

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Thank you!

Per liberum, Ad astra

libre.space

Our vision for space:
manifesto.libre.space