

RACCOON OS - A Free, Open Source Operating System for Secure Space Applications

Sunday 26 October 2025 14:50 (20 minutes)

RACCOON OS is an open source operating system based for secure space applications based on Linux, which is being developed at the Technical University of Berlin with support from the German Aerospace Agency (DLR) and partners like Quantum Galactics GmbH and the Helmholtz Center for Information Security (CISPA).

The goal of this project is to create a free, easy to use and secure platform for developing and operating space applications. The main use case for RACCOON OS is in the role of a Payload Data Handling system, i.e. applications requiring significant computing and storage resources, although it can also be used to perform the tasks of a basic On-board Computer (telemetry, parameter management, etc.)

A key aspect which is sometimes disregarded in NewSpace missions is computer/information security. Surveys and research into this has shown that the majority of missions lack any form of command authentication, and in many cases critical security vulnerabilities that would allow an attacker to take control of the satellite are present in self-made and commercial spacecraft platform software.

To this end we are working on a minimal, widely portable Linux distribution that builds in certain security features like Secure Boot, application sandboxing using `syd-sandbox` and, importantly, a bandwidth-minimizing differential update process using `OSTree`.

In addition to the Linux distribution, RACCOON OS consists of a set of standard userspace programs (`rcn_usr_comm` application, `rcn_usr_cfdp` server, `rcn_usr_launch` monitoring daemon, etc.) and a framework for writing space applications using the ECSS Packet Utilisation standard.

All of the frameworks and applications are written in Rust, although end user applications can be written in any programming language of choice. Communication between applications happens through the Zenoh middleware, which is also written in Rust and supports mutual authentication between peers and access control.

We are also investing in general improvements to the open source support for standards like CFDP (CCSDS File Delivery Protocol), PUS, and SDLS (Space Data Link Security) protocol. This year, together with our partners we were able to sponsor a basic implementation of SDLS in Yamcs.

In this presentation we would also like to talk about the upcoming missions running RACCOON OS that we have in the near-term pipeline, and our plans for making development of RACCOON OS sustainable. Finally, we would like to invite anyone to join our community and contribute in any way that they can - we certainly have a lot of work on our hands :)

Authors: FREYMUTH, Jens (TU Berlin); DIEZ, Jose Manuel (TU Berlin); HERZOG, Philipp (TU Berlin)

Presenter: DIEZ, Jose Manuel (TU Berlin)

Session Classification: 7th Session