The LibreCube Ecosystem: How to Use, How to Contribute

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LibreCube Initiative
Ecosystem, the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space.

*Encyclopaedia Britannica*
Ecosystems

- python
- NumPy
- IPython
- SciPy
- matplotlib
- SymPy
- Mayavi
- pandas
- StatsModels
- scikits-image
- PyTables
- NetworkX
Ecosystems

- Brain
- Peripherals
- Sensors
- Slip shoes
- Resistant frame
- Battery
- Robot servos
- Power electronics

ROS
LibreCube's Vision

Open Source Space and Earth Exploration

- Open Source Everything
- Space Standards
- Reference Architecture
Build your Mission

LibreCubeSat
Build your Mission

LibreCubeSat

LibreCubeDrone

LibreCubeRover
Standards

- Open Space Standards

- Dedicated Workgroups (if needed)
Mission Operations Services

Components

Infrastructure

Services
Interaction Patterns

**Sequence Diagrams**

1. **SEND Interaction Pattern**
   - **Consumer** sends a `SEND` message to the **Provider**.
   - **Provider** acknowledges the `SEND` message.

2. **SUBMIT Interaction Pattern**
   - **Consumer** submits a `SUBMIT` message to the **Provider**.
   - **Provider** acknowledges the `SUBMIT` message with an `ACK`.
Protocol Stack

- **Application Layer**
  - Consumer/Provider

- **MO Services Layer**
  - Mission Operations Services Layer
    - COM, Common, M&C, Automation, Scheduling, Time, ...
  - Abstract service specification defined in terms of the MAL

- **Message Abstraction Layer**
  - Messaging Abstraction Layer (MAL)
    - Generic Interaction Patterns, Access Control, Quality of Service
  - Abstract messaging infrastructure

- **Transport Layer**
  - Messaging Technology
  - Mapping of the MAL to encoding and transport
MAL Deployment

- Space Packets
- CCSDS Frames
- Radio Link
- TCP or ZMTP
- TCP or ZMTP
- TCP or ZMTP
How to Use

https://gitlab.com/librecube/elements

- LC-3103
  LibreCube LC-3103 Flatsat Board

- LC-3201
  LibreCube 1U Test-POD

- LC-3202
  LibreCube 2U Test-POD
# How to Contribute

https://gitlab.com/librecube/prototypes

<table>
<thead>
<tr>
<th>Repository</th>
<th>Description</th>
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<tbody>
<tr>
<td>gnuradio-ccsds-frames</td>
<td>Exchanging CCSDS frames via GNURadio and (cheap) SDRs.</td>
</tr>
<tr>
<td>power-control-and-distribution-unit</td>
<td>A reliable and robust PCDU for space application</td>
</tr>
<tr>
<td>python-link-budget</td>
<td>A configurable and extensible Python3 module that outputs link budget margins for a given time range.</td>
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<tr>
<td>python-mal</td>
<td>Python implementation of message abstraction layer</td>
</tr>
<tr>
<td>micropython-space-can</td>
<td>Space-ready CAN bus for micropython based on ECSS-CANbus Extension Protocol and ISO 15762-2</td>
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Let's Talk!