ThingSat, Open-Source CubeSat Payload Deployment

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***Abstract*—**

I. Introduction

Satellites, CubeSat:
IoT, Internet of Space Things: : Iridium, LoRa, 5G
Cube-Sat, Open-Source Initiatives:
RIOT, Open-Source:
Paper contributions:
Paper organization:

II. Background & Related Work

A. CubeSat

B. Cube Sat Protocol (CSP)

Architecture:

C. Open Source

[1], [2]
Why Open-Source Satellite Initiatives:
pyCube, etc.:

D. LoRa

[3]
CubeSat LoRa missions:
Research topics, challenges of LoRa in space:

E. RIOT

[4]
a) Overview of the Project:
b) Overview of the architecture:

III. ThingSat

A. Overview

Project timeline and participants:
Mission Goal:
Broad overview of Segments:

B. Architecture

Ground Segment Description:
Space Segment Description:
Control Segment:
OBC & Payload Communication Bus:

C. Telecommunications

link-budget Mission Control:
link-budget Mission:
available phy:

IV. Low Power Orbital Communication Architecture

A. Requirements

communication protocols:
software/firmware updates:
software/configuration updates requirements:

B. Architecture

1) OS: : RIOT
2) Network Stack: : COAP/LibCSP/CAN
3) Mission Workflow: : mission files
4) DevOps Workflow: : SUIT + containers
SUIT:
Containerization:

V. Implementation

A. Payload

1) Hardware:
MCU:
LoRa Radio:
LoRa Gateway:
2) Firmware:
libCSP:
CoAP:
CAN:
LoRaWAN:
Application Code:
3) Code Structure:

B. OBC Simulator

C. Continuos Integration - Leveraging OpenSource

RIOT:
ThingSat:

VI. Evaluation

A. Memory Footprint

B. Energy Footprint

C. Link-budget Footprint

D. Updates Latency

VII. Lessons Learned

VIII. Next Steps & Future Work

IX. Conclusion

Acknowledgment

References

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