

Space-testing of picoD3TN through ESA's OPS-SAT Space Lab Program

Max Chateau^{1, 2} Marius Feldmann¹ Felix Walter¹

¹D3TN GmbH

²Polytech Montpellier, University of Montpellier

IEEE WISEE 2026 - STINT Workshop

I Background: ESA OPS-SAT Space Lab Program

What is the OPS-SAT Space Lab ?

- Service provided by the European Space Agency (ESA) for European and Canadian institutions and industries.
- Allows to **realise space experiments** fast and with massively reduced cost, with the goal to accelerate innovation.
- Uses Linux as execution environment for the experiments.
- Operated by ESA - European Space Operations Centre. (ESOC)

OPS-SAT website: <https://opssat.esa.int/>

II picoD3TN, a Rust BP implementation by D3TN

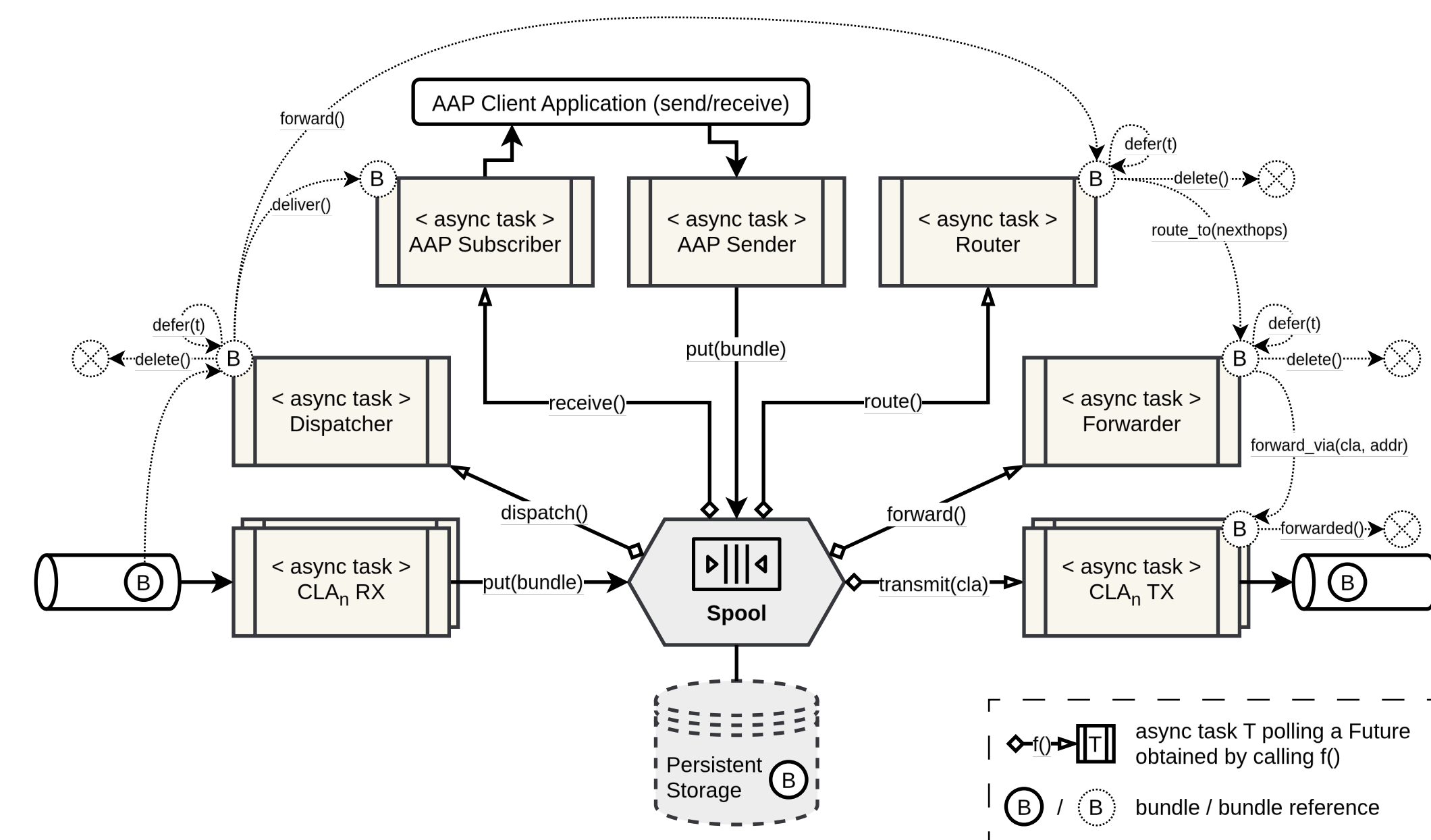


Figure: Overall structure of picoD3TN BPA

picoD3TN

What is picoD3TN ?

- Open-Source and lightweight implementation of the **Bundle Protocol (BP)** v7 in Rust.
- Developed based on our experience with **µD3TN** and a modern, storage-centric architecture.
- Compatible with **µD3TN** and applications building on top of it, due to usage of the Application Agent Protocol version 2 (AAP2); supports **BPsec**.
- Space-Tested through the OPS-SAT Space Lab on the OPS-SAT PRETTY.
- Uses BPsec implementation from Hardy. (a BP implementation done by Aalyria)

Main advantages of this BP implementation

- Lightweight, intended to be used on "Edge nodes" due to its simple behaviour.
- `no-std`: Components can be used on microcontrollers.
- Commercial support and integration services offered by D3TN.

picoD3TN's repository: <https://gitlab.com/d3tn/picod3tn>

Hardy's repository: <https://github.com/ricktaylor/hardy>

III Space Field Tests for picoD3TN

- Test 1: simple ping-pong test to validate picoD3TN fundamentally.
- Test 2: **BPsec**, transferring signed and encrypted Bundles.
- Test 3: exploring **SAND** and UDPCL for node discovery.

Test details

- Tests performed successfully, involving the **OPS-SAT PRETTY**.
- 16 bundles** were sent by each source and destination node for each experiment.

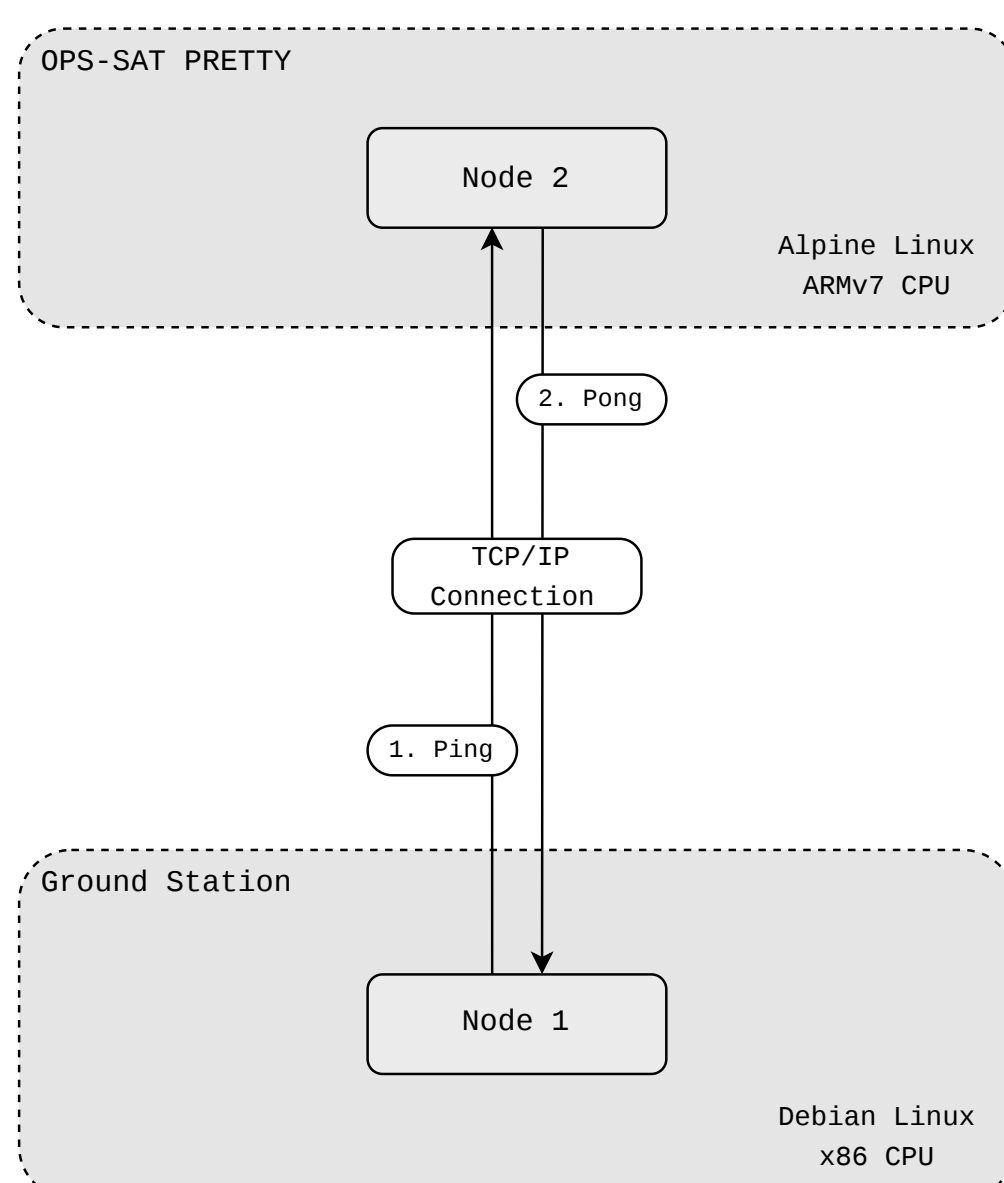


Figure: Test 1: Flow of the Ping Experiment

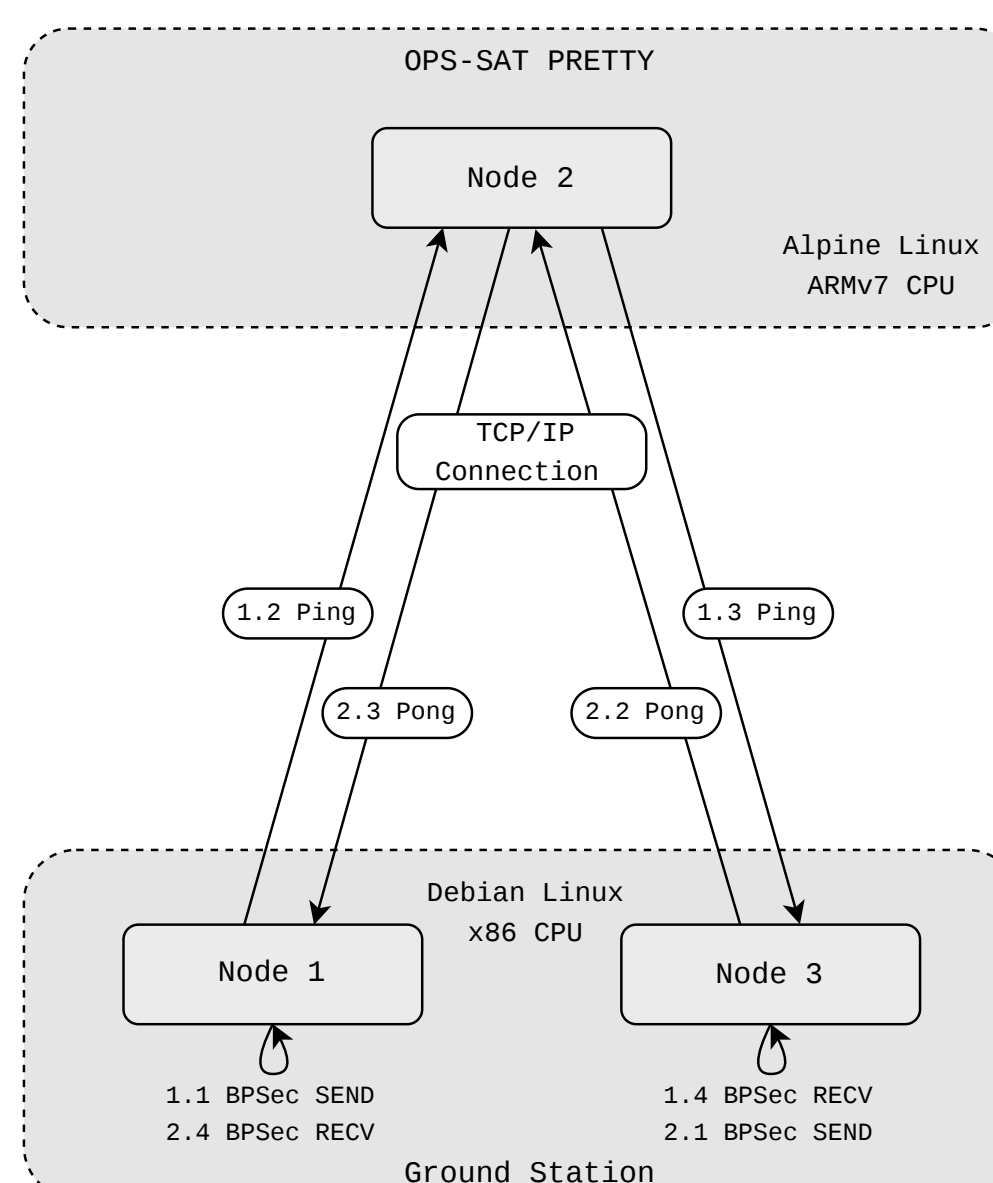


Figure: Test 2: Flow of the BPsec Experiment, signing (BIB) and encryption (BCB) added to each bundle's payload block

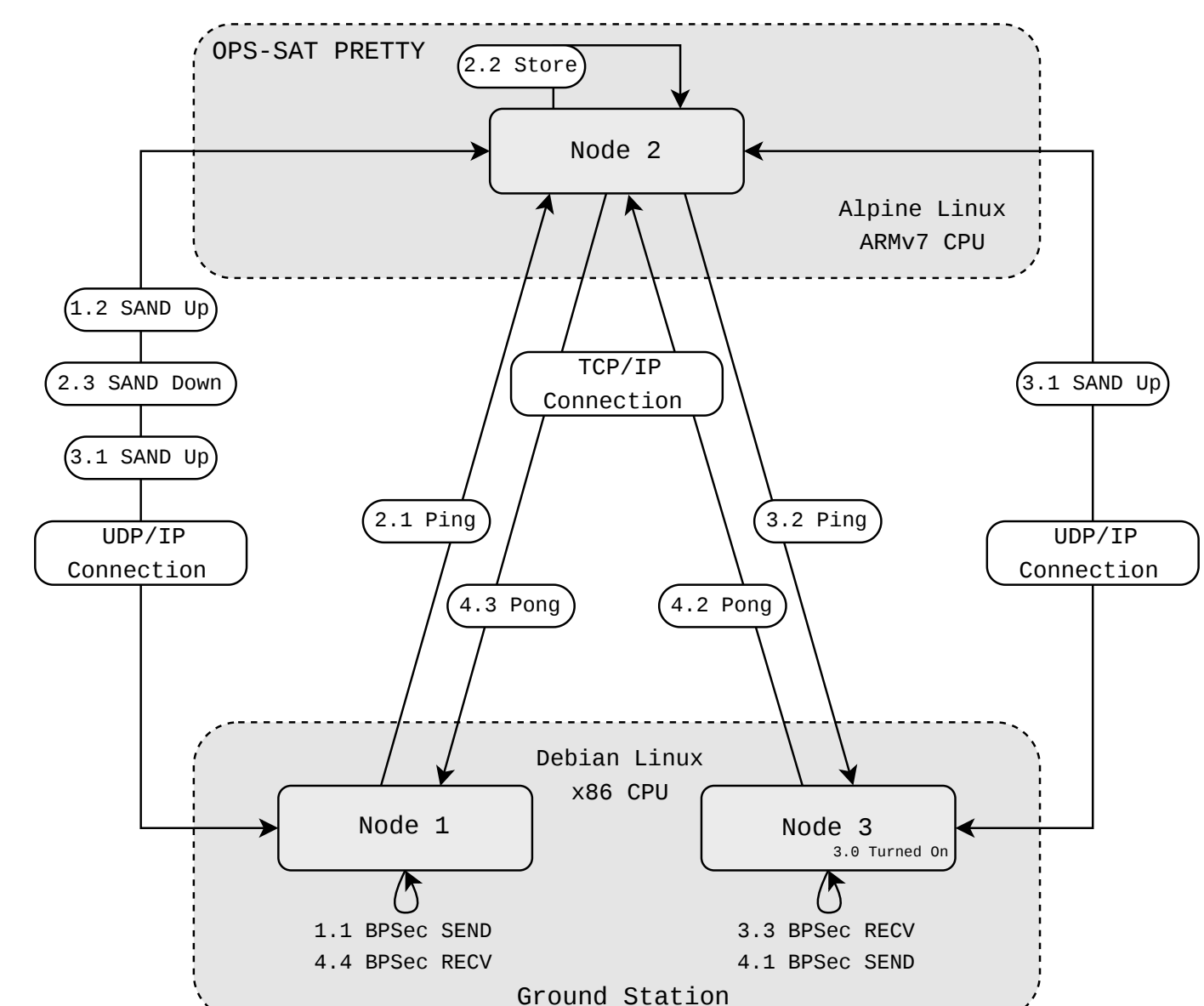
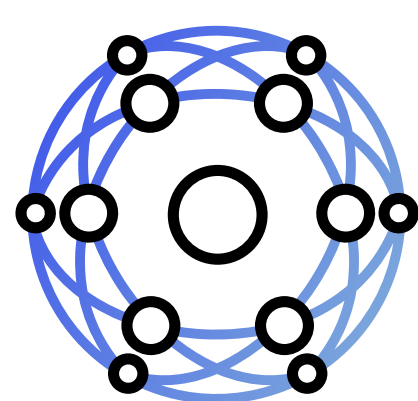


Figure: Test 3: Flow of the final experiment, involving BPsec, SAND and UDPCL, (ran on FLAT-SAT, OPS-SAT tests still ongoing)

IV Acknowledgments and References

Thanks to OPS-SAT team, in particular Nuno Carvalho and Maximilian Henkel who helped us a lot during the experimentation process.



STINT Workshop 2026
Co-located with IEEE WISEE 2026 - Leuven, Belgium
14-15 September 2026