MENDER
by Northern.tech

Community Fueled OTA for Zephyr (and other µCs)

Josef Holzmayr, Head of Developer Relations, Mender

EOSS 2023/Zephyr Project Developer Summit - June 28, 2023

About me

Josef Holzmayr

Head of Developer Relations at Mender

Yocto Project Community Manager

OpenEmbedded Social Media Manager

Contact me

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@theyoctojester@fosstodon.org

About you

Hardware Developer?

Firmware Developer?

Embedded Linux?

Yocto?

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About this presentation

Every form of interaction will be rewarded
... until I run out of chocolate.

Some ideas:

- Good: Tell me what you like.
- Better: Tell me what you don't like.
- Best: Tell me where I am wrong.
- Helpful: Ask for a clarification.
- Practical: Ask for chocolate.

Image attribution: User:-donald- - Wikimedia Commons

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Who we are

Based in San Francisco / Oslo

History

Northern.tech, developers of Mender, was founded in 2008

Dedication

Highly technical team dedicated to solving our customers' challenges

Mission

To deliver a secure best-in-class OTA solution to world's connected devices

Validation

Support of European Commission Horizon 2020 Research & Innovation

Expertise

Over 10 years spent ensuring the security of embedded systems at scale

Trust

Trusted by the world's largest brands

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Agenda

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Introduction

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Joël

03.

OTA Updates

04.

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05.

Client Side

06.

Wrapping up

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Joël

01

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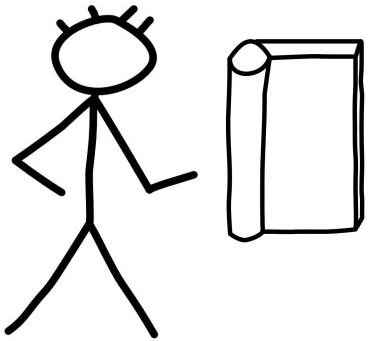
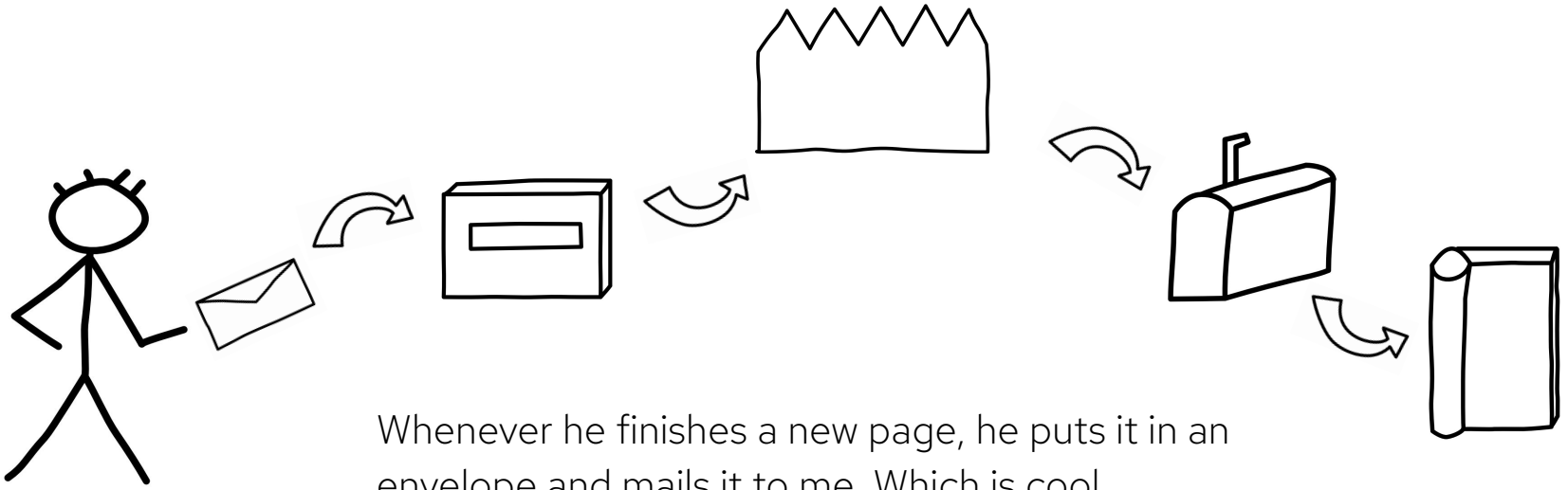
My friend Joël



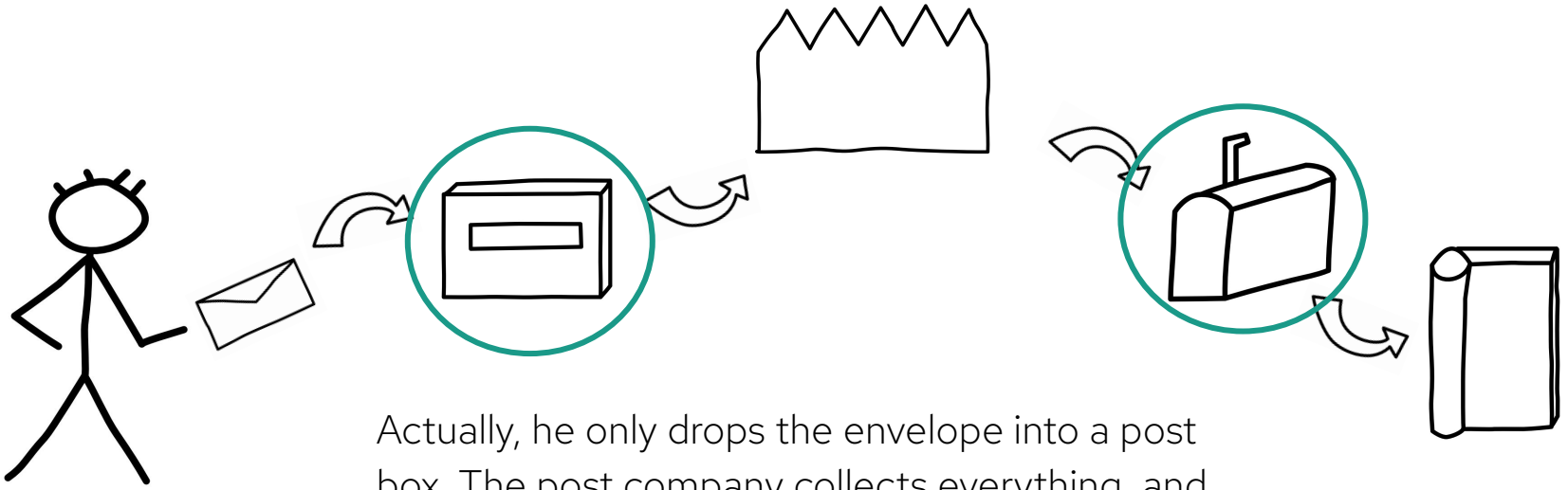
I've got a friend called Joël. As a hobby, he makes scrapbook pages and sends them out to his friends. By now, I've got a collection book into which I put all of the pages he sends to me.

My friend Joël



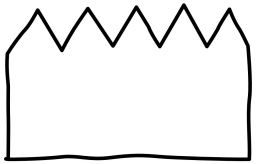
Whenever he finishes a new page, he puts it in an envelope and mails it to me. Which is cool, because he lives in France, and I'm in Germany.

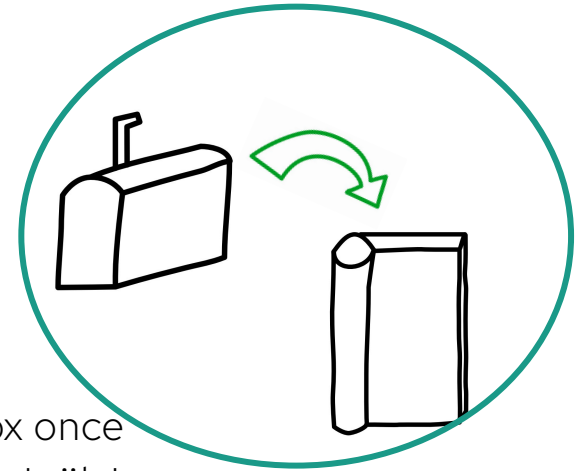
My friend Joël

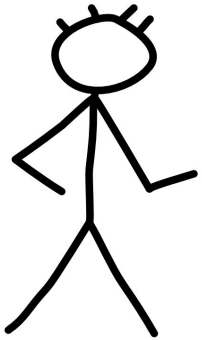


Actually, he only drops the envelope into a post box. The post company collects everything, and then puts just the envelopes for me, specifically, into my mailbox.

My friend Joël

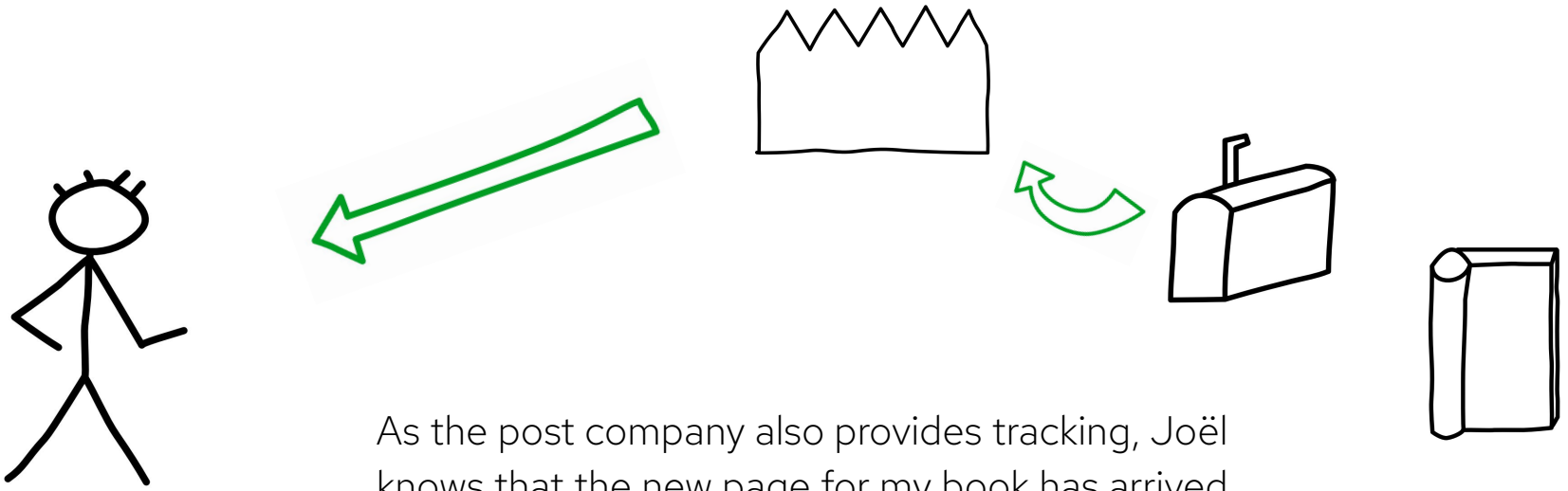






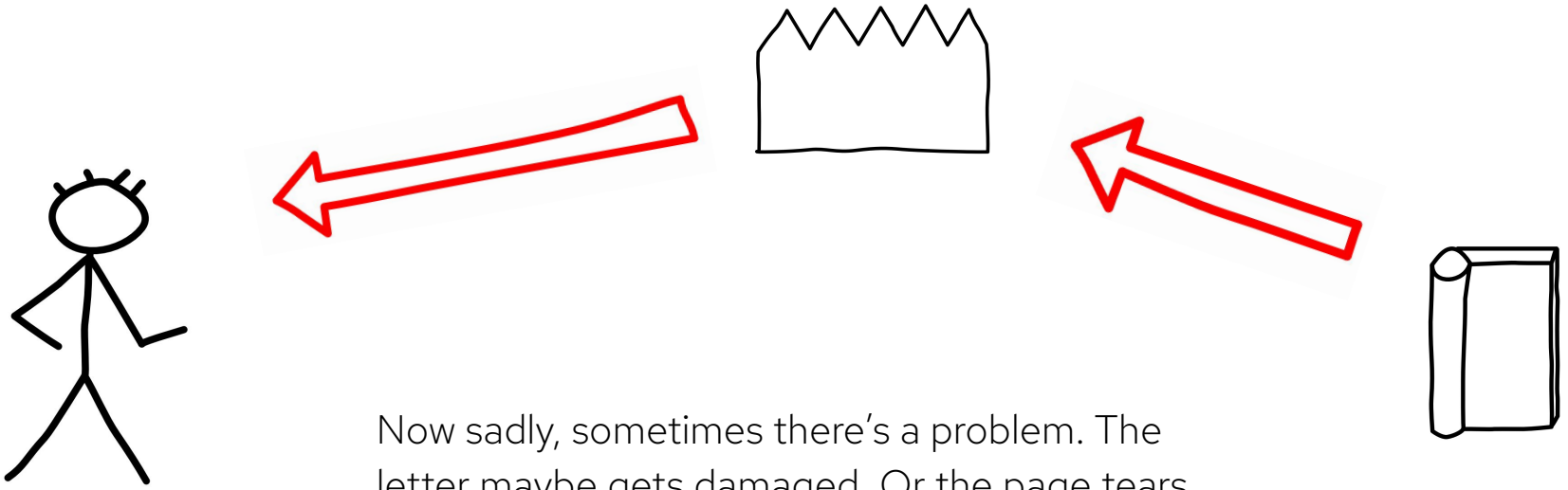
That's really convenient. I check the mailbox once a day or so. Whenever there's a letter from Joël, I can just take the new page out and put it into my book.

My friend Joël



As the post company also provides tracking, Joël knows that the new page for my book has arrived.

My friend Joël



Now sadly, sometimes there's a problem. The letter maybe gets damaged. Or the page tears when inserting it.
Luckily, I can also report this to the postal service, and they will inform Joël.

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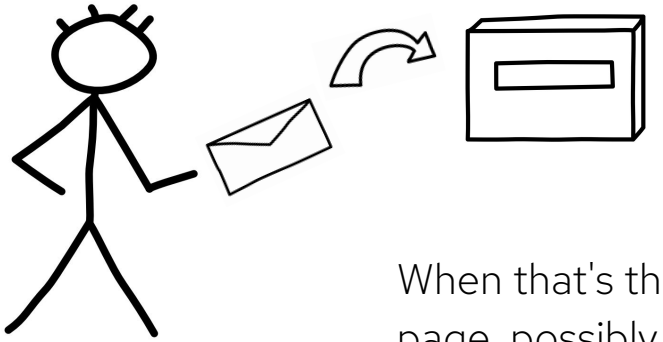
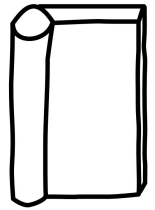
My friend Joël





When that's the case, Joël can send me a new page, possibly in improved packaging.

In the meantime, no harm is done, I can still enjoy the book.

OTA Updates

02

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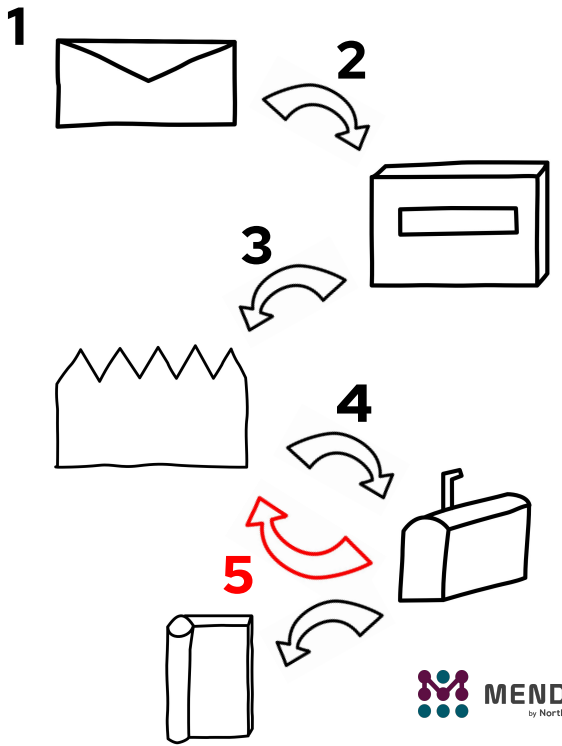
It’s actually the same.

Now lets say, Joël is actually a software developer who needs to ship updates over the air.

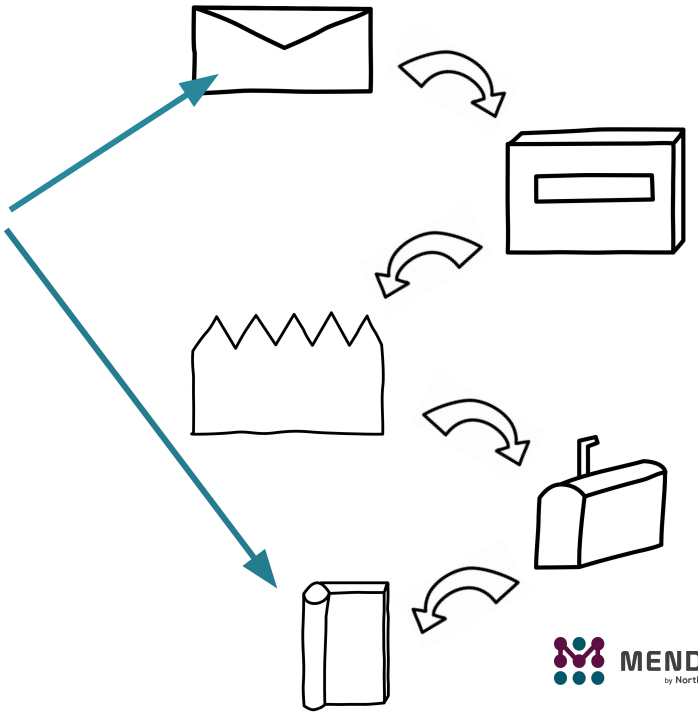
1. He prepares an update for shipping
2. The update is uploaded to the OTA management system
3. Only updates matching the target device are deployed to it
4. If everything is fine, Joël gets an ack.
5. If something goes wrong, Joël gets an error message and can react, while knowing that the OTA solution has rolled back to the last known good version, and the device is still functional.



Lets go open source now.

As opposed to a real postal service which is a monopoly, or at least an oligopoly - we should be able to do this ourselves in software.

We can build devices running Zephyr, for example. And we can create updates for those.



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Server Side

03

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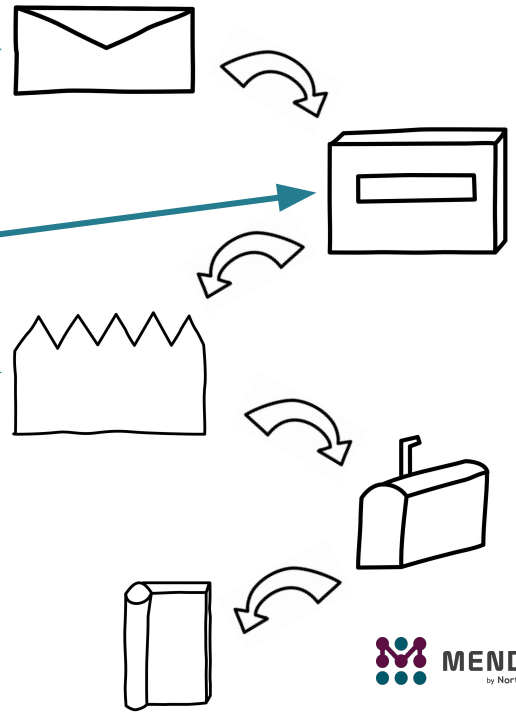
Be your own postal service.

(for software)

Mender is an APL2.0-licensed OTA solution.

It offers, amongst other features:

- Payload format agnostic,
  we really don't care what your software looks like
- Fully documented API,
  to upload new artifacts for example
- Self-hostable,
  because you should not be locked into one service



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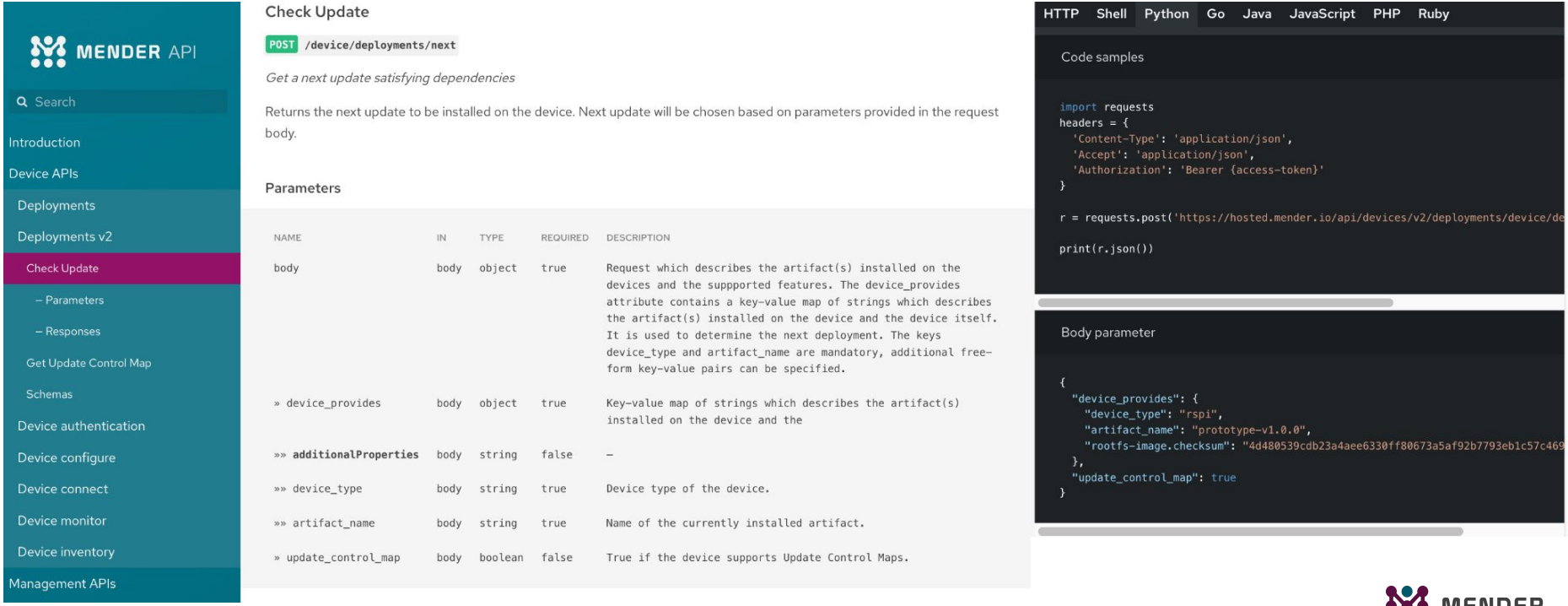
The key is: documentation

Part 1: API



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The key is: documentation

Part 2: Artifact format

Preview | Code | Blame | 501 lines (391 loc) · 15.4 KB | Raw

Mender Artifact file format

File extension: `.mender`

The tree below describes the layout of files inside the main file, which is hosted inside a standard tar archive.

Note that there are some restrictions on ordering of the files, described in the "Ordering" section.

version 3

```
-artifact.mender (tar format)
  |
  +---version
  |
  +---manifest
  |
  +---manifest.sig
  |
  +---manifest-augment
  |
  +---header.tar.gz (tar format)
```

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Client Side

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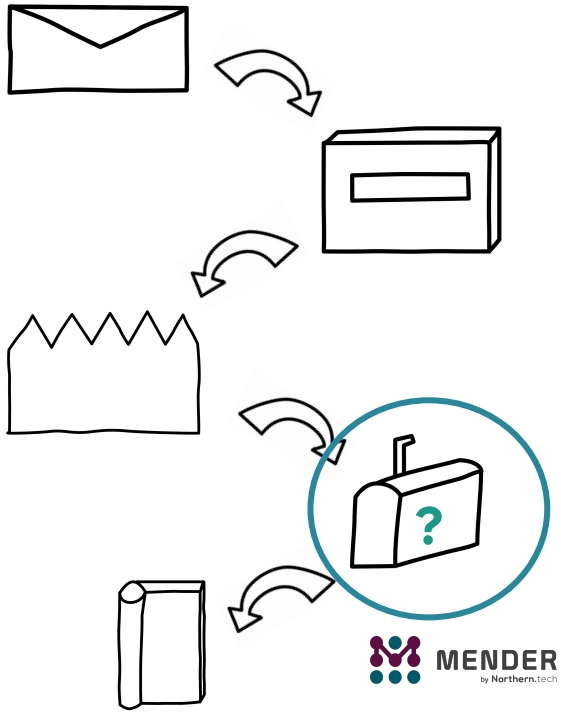
The last thing missing

(for software)

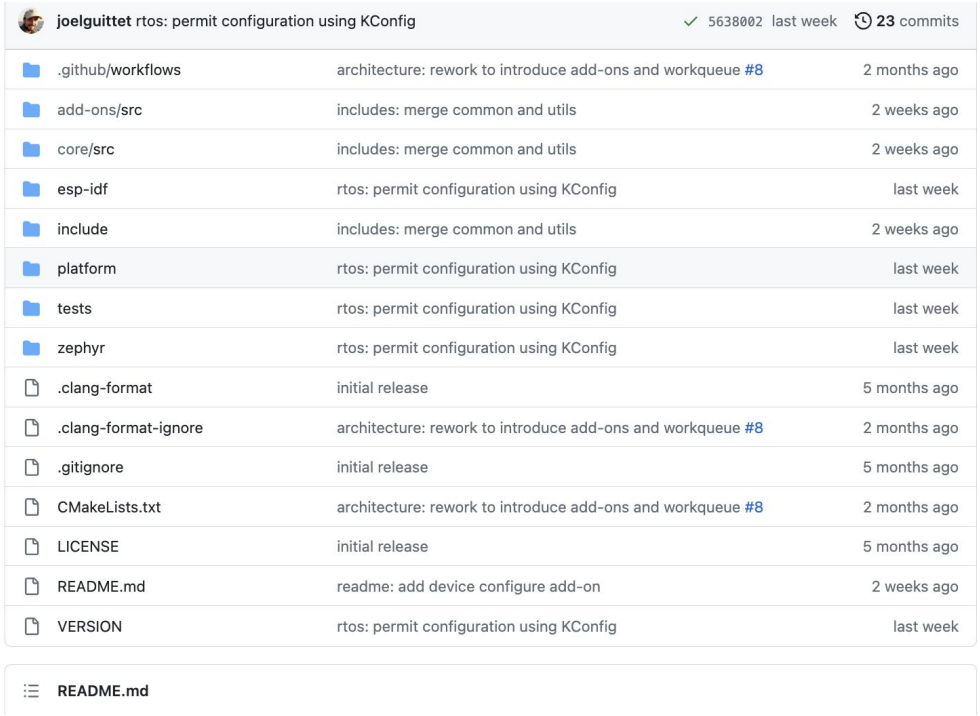
In order to complete our OTA solution, we still need the “mailbox”.

- Accept incoming Artifacts
  - Understands the metadata
- Applies them to device
  - Either streams or copies to storage
  - Flips the A/B partitions
  - Reports success
- Handles rollback, if things go wrong
  - Flipts the A/B partitions back
  - Reports error



mender-mcu-client

https://github.com/joelguittet/mender-mcu-client



joelguittet rtos: permit configuration using KConfig — 5638002 last week — 23 commits

.github/workflows	architecture: rework to introduce add-ons and workqueue #8	2 months ago
add-ons/src	includes: merge common and utils	2 weeks ago
core/src	includes: merge common and utils	2 weeks ago
esp-idf	rtos: permit configuration using KConfig	last week
include	includes: merge common and utils	2 weeks ago
platform	rtos: permit configuration using KConfig	last week
tests	rtos: permit configuration using KConfig	last week
zephyr	rtos: permit configuration using KConfig	last week
.clang-format	initial release	5 months ago
.clang-format-ignore	architecture: rework to introduce add-ons and workqueue #8	2 months ago
.gitignore	initial release	5 months ago
CMakeLists.txt	architecture: rework to introduce add-ons and workqueue #8	2 months ago
LICENSE	initial release	5 months ago
README.md	readme: add device configure add-on	2 weeks ago
VERSION	rtos: permit configuration using KConfig	last week

README.md

cool to have it

ota mcu mender

Readme
MIT license
Activity
8 stars
2 watching
2 forks
Report repository

Releases 5

0.5.0 Latest
last week

+ 4 releases

Packages

No packages published

Languages

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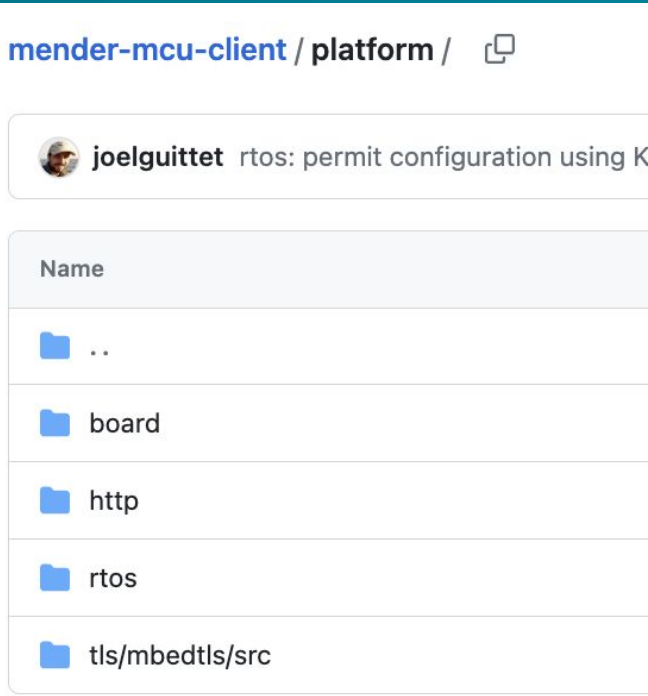
mender-mcu-client

https://github.com/joelguittet/mender-mcu-client

Platform portability by design. Requires wrappers/implementations for:

- HTTPS client, respectively TLS
- Thread/Process primitives
- Writing to ROM
- Switching partitions



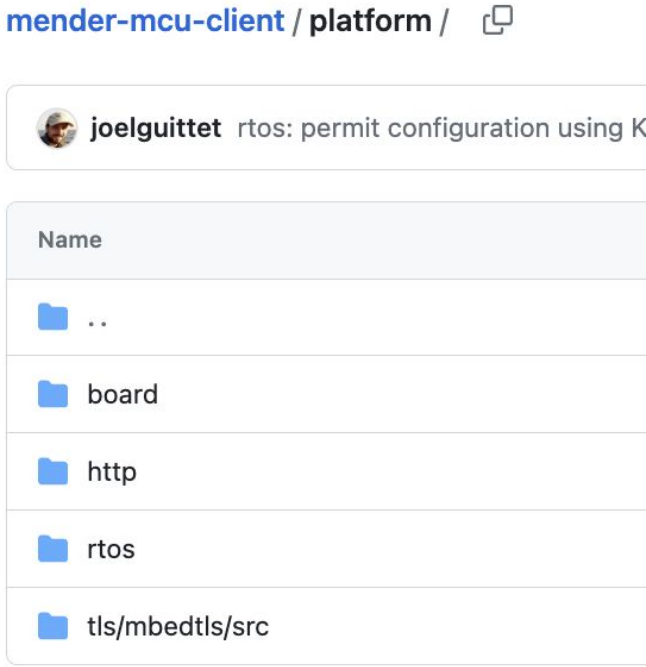
Going to Zephyr

https://github.com/joelguittet/mender-stm32l4a6-zephyr-example

Example integration of the MCU client on Zephyr:

- NUCLEO-L4A6ZG evaluation board
- W5500 ethernet module
- Zephyr v3.3.0
- Leverages MCUboot
- cJSON
    - no other dependencies

Currently the artifacts are limited on uncompressed payloads.



Demo time

04

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Future directions

04

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What is to come

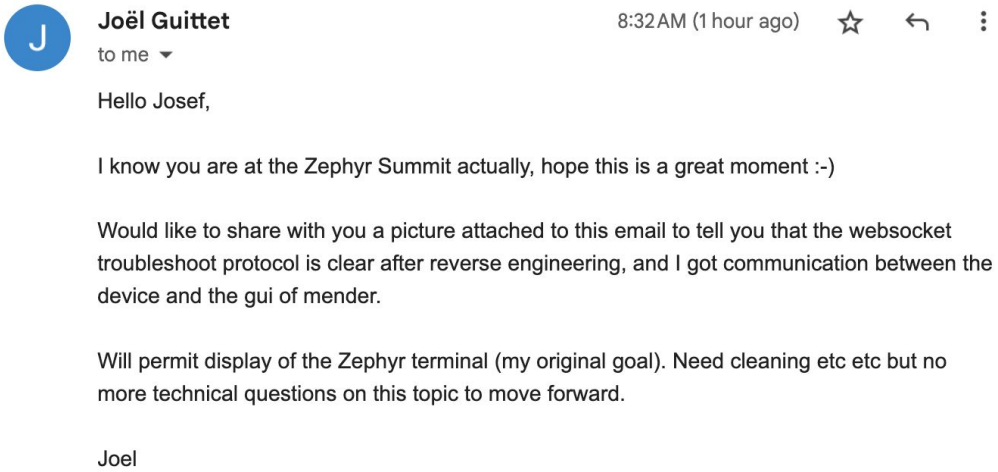
- The official client is currently being rewritten to C++, with Zephyr being on the roadmap.
  - First stand-alone release just right now
  - Slightly different focus, all open too
  - Go and test, contribute
    - We're even looking for partners here

What is to come

- Mender has a remote terminal feature
  - Connecting that to the Zephyr shell

What is to come

- Mender has a remote terminal feature
  - Connecting that to the Zephyr shell ✅



Joël Guittet 8:32 AM (1 hour ago)

to me

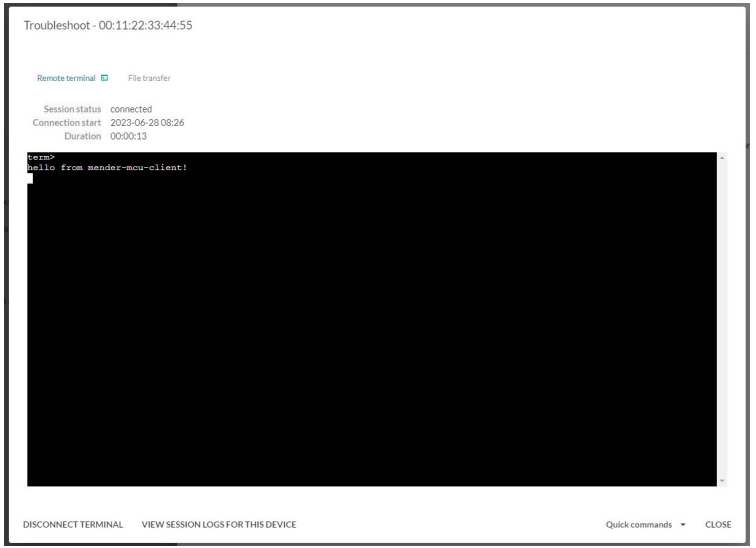
Hello Josef,

I know you are at the Zephyr Summit actually, hope this is a great moment :-)

Would like to share with you a picture attached to this email to tell you that the websocket troubleshoot protocol is clear after reverse engineering, and I got communication between the device and the gui of mender.

Will permit display of the Zephyr terminal (my original goal). Need cleaning etc etc but no more technical questions on this topic to move forward.

Joel



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ELC tech showcase

Find me at the Mender showcase table

- Enter your business card, I will raffle out a BeaglePlay at 18:30

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Wrapping up

05

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OTA Updates

Don’t leave home without it.

Any connected device needs OTA updates.

You can avoid vendor and device platform lock in - not just Linux OR Zephyr OR ...

Open Source Software guarantees control and verifiability of what your devices run.

Mender is here to help you with that.

Image attribution: https://youtu.be/VB8_S0ZzRCQ?t=28

Questions & Answers

Q: What are the licenses?

A: Everything Mender is APL-2.0, Joël's client is MIT.

Q: What other platforms do you support?

A: Official Go client: Linux, Joël's clients, currently ESP-IDP (FreeRTOS) and Zephyr.

Q: Is there a production-ready set up of the server available?

A: We provide a helm chart to run the Mender server in your k8s cluster.

Q: What is the commercial aspect?

A: We offer a hosted instance, an extended Enterprise license and services.

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Thank You

Contact Us

https://mender.io