Coaty

Publish OSS to drive Industrial Research & Innovation Projects

Open Source @ Siemens 2022

SIEMENS

\+ Open Source Software + Projects

SIEMENS

Coaty + Open Source Software + Projects

Scope of today:
Experience of more than five years OSS journey

No Code ☹
No Architectures ☹

SIEMENS

Coaty OSS Evolution
From Technical Demand to Research Stream ”Collaborative IoT”

1 Technical Demand

- Internal Research Project
- Init of Coaty framework due to technology gap
- Inner Source

2 New Research Stream & Open Source

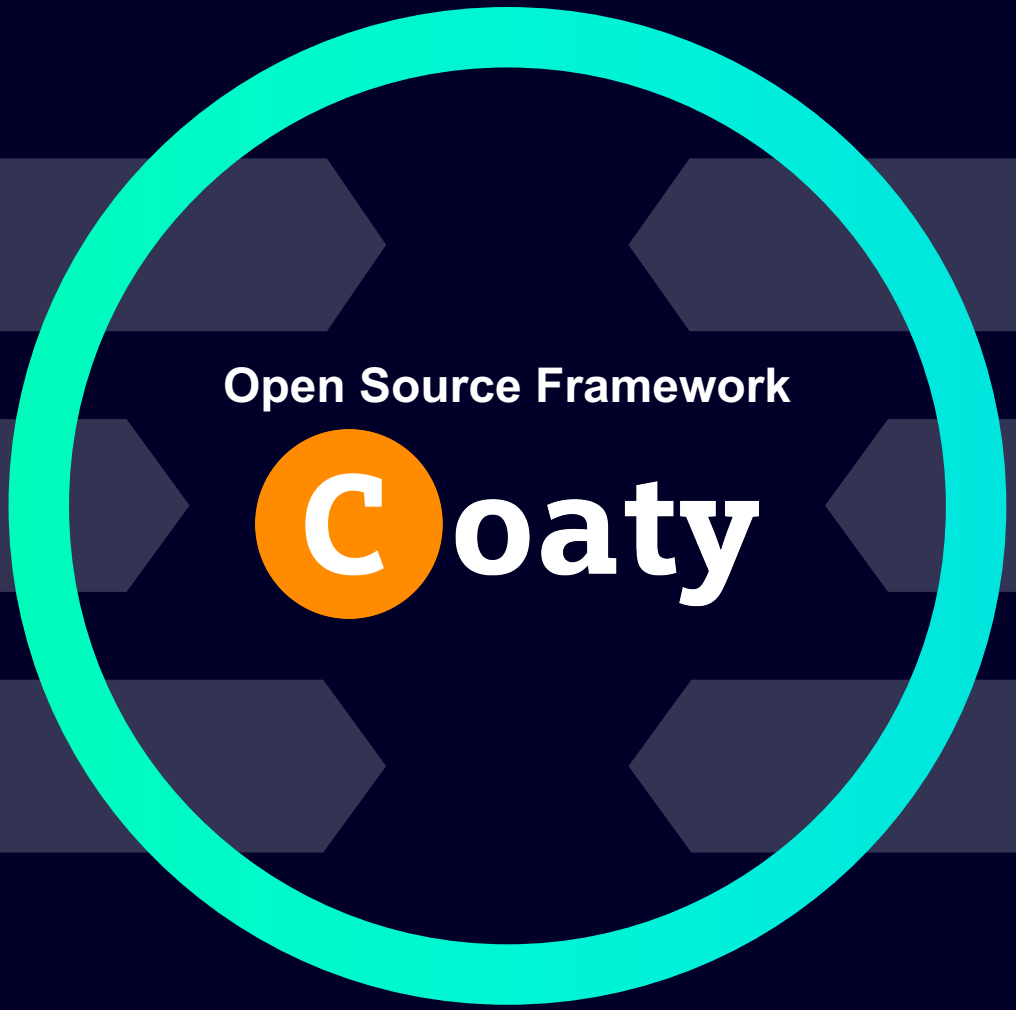
- First public funded project
- Research “Collaborative IoT”
- “Tinder for the industrial IoT”
- OSS publication of Coaty

3 Research & OSS Project Portfolio

- Public funded research projects
- Business product innovation projects
- Multiple OSS projects

SIEMENS

Driving forces for Coaty as Open Source Software Framework



Software Project Demand
Implement something you need what is not yet available

Collaboration Demand
Rationale for going open source

Project Demand
Project line-up demanding and supporting open source

Collaboration and Publication Model
OSS work model matching your objectives

Publication Infrastructure
Home for your open source software matching your needs with little efforts

Financing and Roadmap
Continuity of projects and usage

SIEMENS

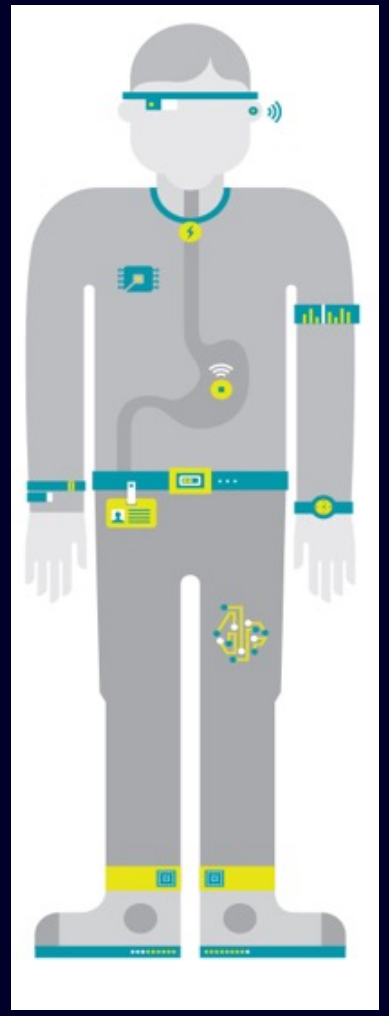
The rationale behind the start of Coaty in 2016
Digital Worker – a Siemens research project

Project Objective

- Research the application of mobile devices and wearables in the context of humans working on industrial sites (e.g., factories)
- Build a standardized platform to run applications on wearable devices for “Digital Workers”,
  - as universal way to access information & services
  - that works alongside existing IT systems
- Execute and develop the project in co-creation with various stakeholders in living labs

Challenge

- Build tangible prototypes of solutions and ideas quickly
- Handle heterogenity in factory infrastructure
- Handle heterogenity in devices and systems
- Handle heterogenity in use cases and scenarios
- Limited project resources



Solution

- Pre-invest in architecture and development of a software framework to match the challenges
- Decouple the different functional components
- Focus on reconfiguration of system of systems
- Inner source

Result

- Large set of re-usable components and tangible prototypes
- Living labs with Siemens factory
- First version of Coaty

- Identification of large re-use potential for Industrial IoT in general
  → New research stream „Collaborative IoT“
  → Coaty as enabler

SIEMENS

What is Coaty?

Reference model for Coaty and Collaborative IoT

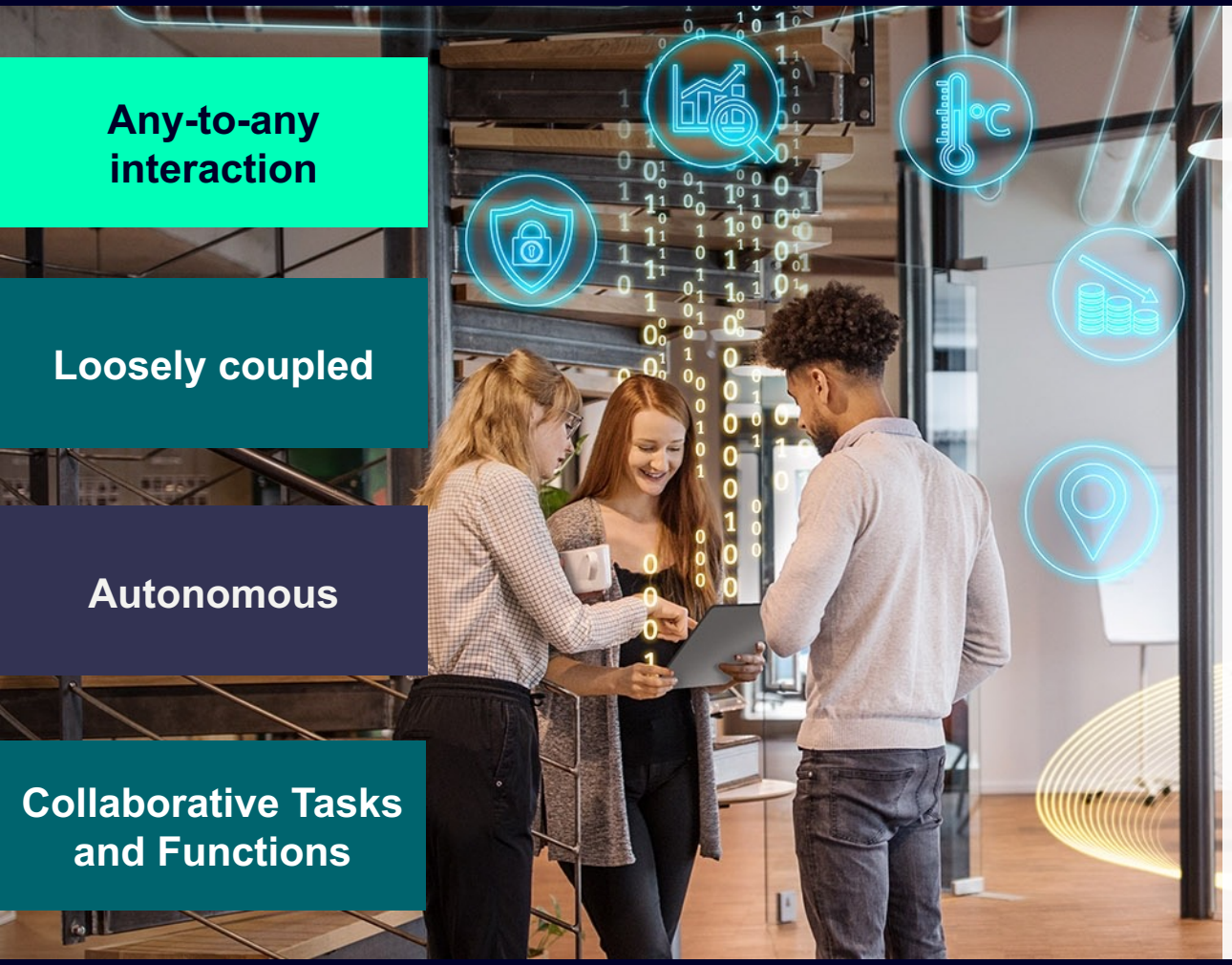
Interacting Humans

SIEMENS

Coaty a programming framework for ’Systems’ of autonomous ’Systems’

SIEMENS

Coaty a programming framework for ’Systems’ of autonomous ’Systems’

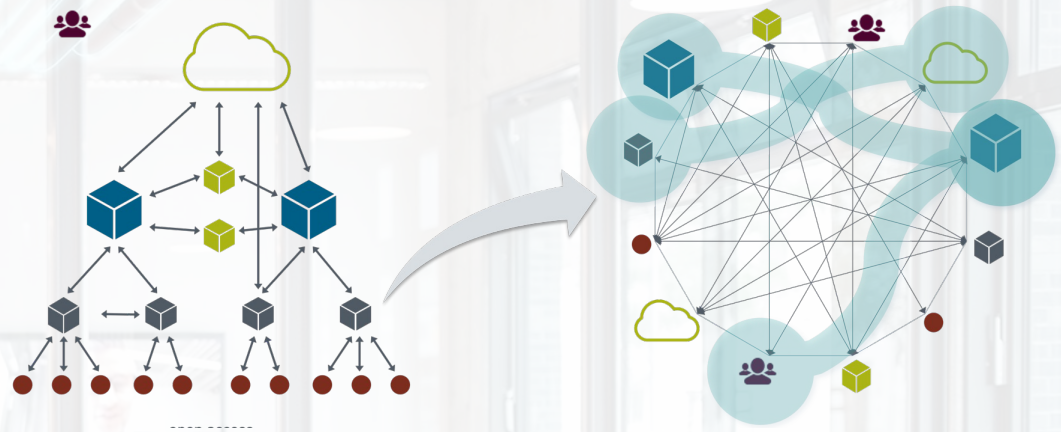


Any-to-any interaction

Loosely coupled

Autonomous

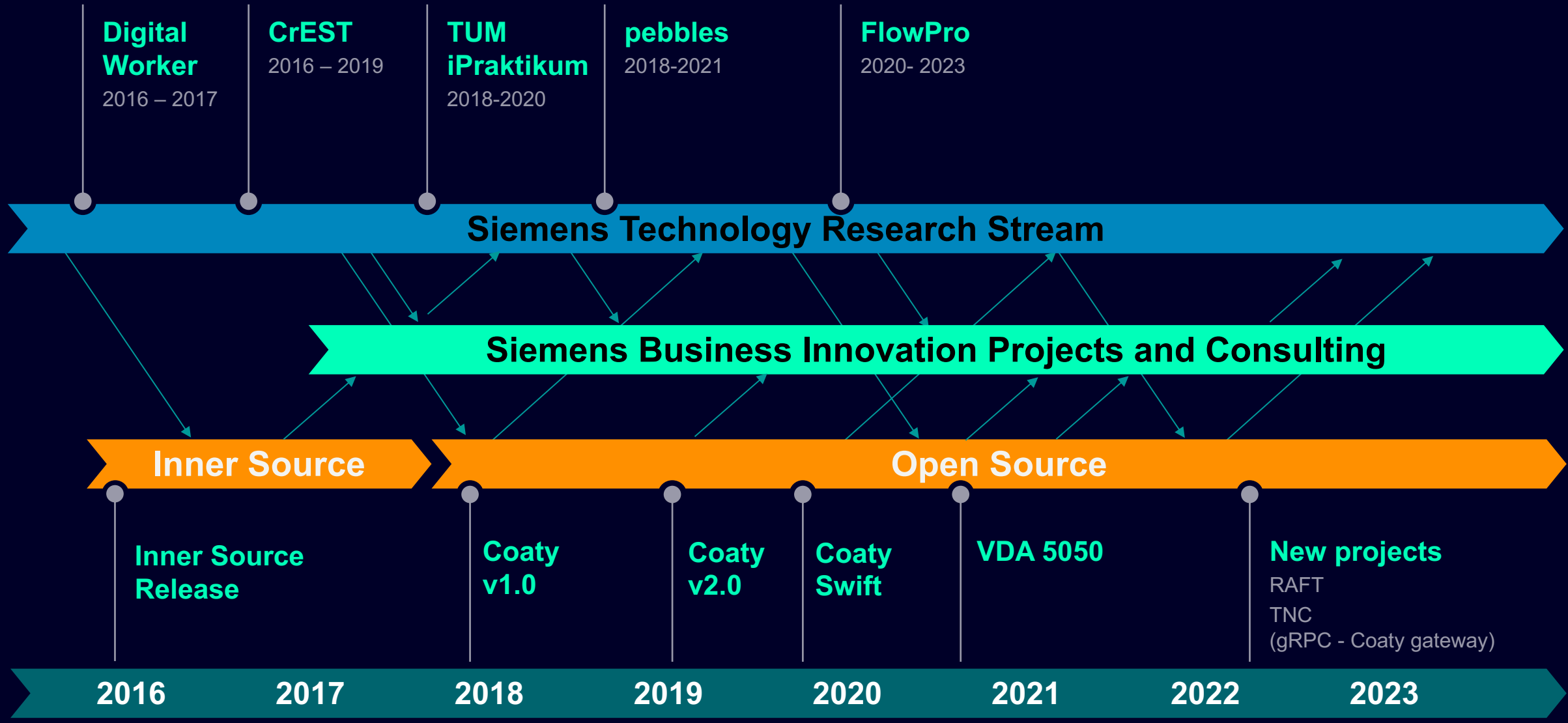
Collaborative Tasks and Functions



“Coaty as programming framework to tackle the paradigm shift towards decentralized, collaborative systems of autonomous systems “

SIEMENS

History of Coaty and Collaborative IoT
The evolution towards a research and business project ecosystem with OSS



SIEMENS

pebbles

Managing decentralized energy systems by regional peer to peer energy trading

Project Objective

Research and demonstrate a platform for local energy trading (using a peer-to-peer model) integrating grid usefulness into the market mechanism in regional “energy-supply areas”.

Implementation of pilot in the city of Wilpoldsried.

Coaty Usage

- Build a standardized system connector
- Manage communication in decentralized prosumer scenarios
- Manage plug-and-perform scenario for heterogeneous systems
- Integrate persistency anf analytics functions for decentralized system topology

Open-Source Benefit

- Ease of cooperation with project partners
- Kick start of basic system implementation

SIEMENS

CrEST, FlowPro, Siemens Product Innovation

Self-organizing production and logistics.

Project Objective

Research and develop a system which enables transport systems and transport requesters to coordinate in a self-organizing fashion without the need of a central coordinating and managing component.

Coaty Usage

- Interaction framework between all system entities
- Manage heterogeneity
- Framework to gain interoperability
- Decentralized coordination and fleet-management
- Integration of new functionalities and technologies
- Legacy system integration

Open-Source Benefit

- Ease of cooperation with project partners
- Tool to understand challenges and needs of partners and customers
- Kick-start implementation and early tangible and testable system setups
- Direct re-use of research results in business innovation projects

SIEMENS

Way of working and Publication Infrastructure
Move project to OSS foundation or not?

- Publish on our own (e.g. on GitHub, GitLab)
  - Key objective: Make your work available for others,

    ease cooperation and co-creation based on your work
- Publish via foundation
  - Key objective: Community building and marketing,

    grow the project by contributions of others, get publication support

→ Our Decision for now: Publish on our own
  → Better objective match, as our focus is on building applications based on Coaty, not on Coaty per se
  → Significant efforts for community building, presence in foundation, etc.
  → But: Needs to be continuously revisited

SIEMENS

Experience with Open Source

OSS works like a boomerang: Throw it and catch new contacts & opportunities

- Contact with new external users aside from known project partners
- Contact with Siemens Business Units by third-party publications:

  heise-online, Siemens Press Releases, publicly funded projects, citations, etc.
- Contact with Siemens Business Units by their external customers

→ Promote your OSS on external channels to get in touch with potential users

Rama (https://commons.wikimedia.org/wiki/File:Boomerang-ETHOC_026590-P8190456-white.jpg), „Boomerang-ETHOC 026590-P8190456-white“,Format, https://creativecommons.org/licenses/by-sa/3.0/fr/deed.en

SIEMENS

Experience with Open Source – Contributions

Eat your own dog food

- Most issues and feature requests arise by using Coaty in our own projects
- The vast majority of Coaty users are satisfied with the framework as is
- Amount of open issues by community is manageable: mostly questions and application errors, few Coaty errors

→ Upstream contributions to critical dependencies of Coaty are crucial for industrial applications: mqtt-js, libp2p, WAMP client/router, ...

Germany (https://commons.wikimedia.org/wiki/File:A_Dog_biscuit.jpg), „A Dog biscuit“, https://creativecommons.org/licenses/by-sa/2.0/legalcode

SIEMENS

Experience with Open Source – Maintenance

Und ewig grüßt das Murmeltier / Groundhog day movie

- JavaScript ecosystem consists of millions of modularized versioned packages many of which are outdated and/or no longer maintained
- *npm dependency hell* – OSS depends on a large hierarchy of direct and indirect dependencies where sub-dependencies may exist in multiple versions
- You cannot directly control and fix dependencies, just open issues, wait for patch releases, or contribute to those that accept PRs timely
- Violation of semantic versioning is common: breaking changes in minor or patch releases of dependencies may break your system at runtime

→ Be cautious about upgrading deps, regression testing is a must

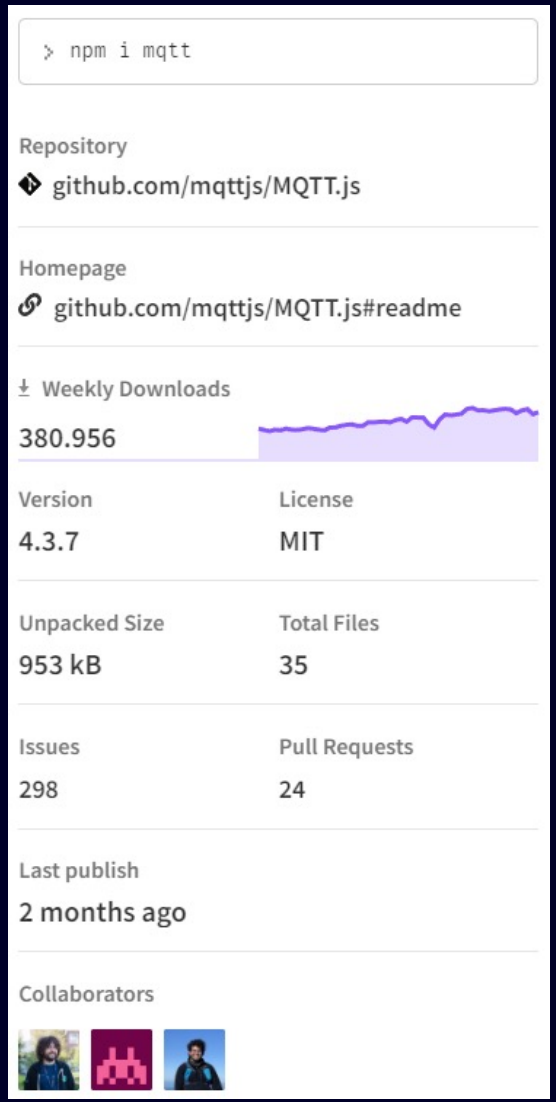
SIEMENS

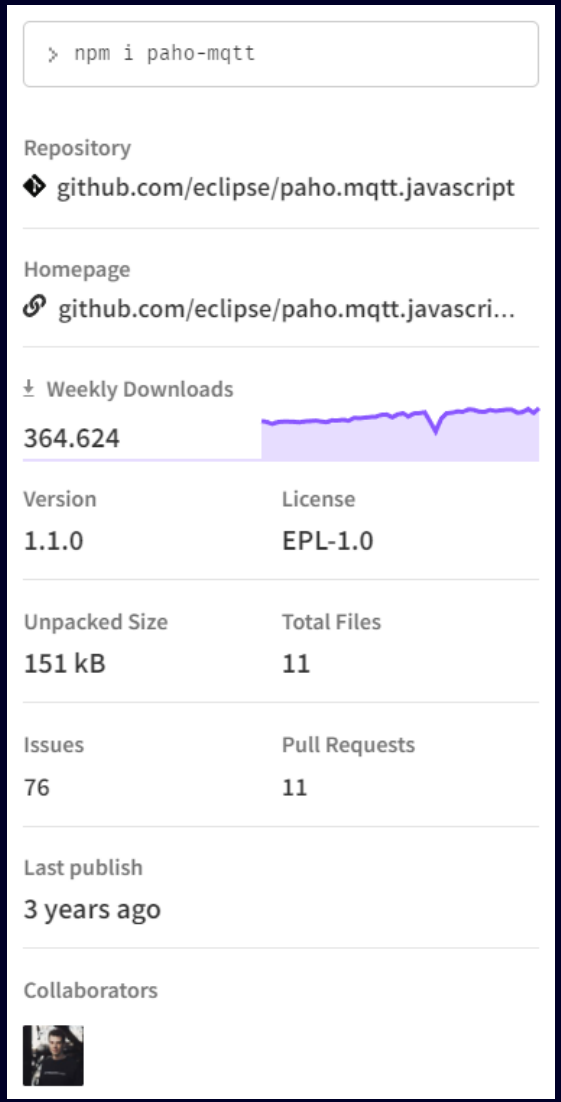
Experience with Open Source – Maintenance

Choose your direct dependencies wisely

- Don’t rely on number of stars and popularity (alone)
- Are *critical* open issues handled timely?
- Are open PRs accepted timely?
- Are new versions released routinely?
- Is code base sound?
- Are dependencies sound?

→ Keep direct dependencies to a minimum





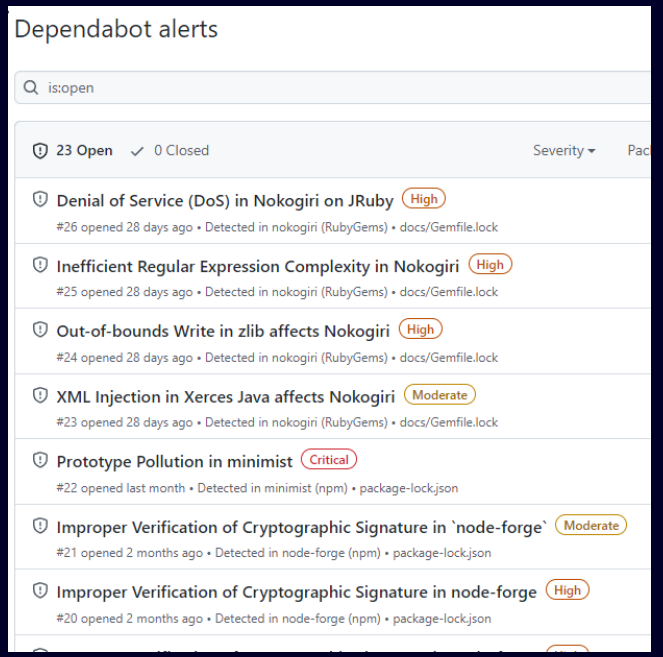
SIEMENS

Experience with Open Source – Security Auditing on GitHub

Managing security vulnerabilities (of dependencies) is time-consuming and never-ending

- *Security policy* – define how users should report vulnerabilities for a repository
- *Security advisories* – privately discuss, fix, and publish information about security flaws and weaknesses in your code
- *Code scanning alerts* – auto-detect common vulnerability and coding errors

- *Dependabot alerts* – get notified when one of your dependencies has vulnerabilities; auto-upgrade to non-vulnerable version in package-lock file



→ Be careful with automatic security upgrades, version bumping may introduce breaking changes nevertheless

SIEMENS

Publish OSS to drive Industrial Research & Innovation Projects

Coaty

Conclusions

- Coaty as OSS is a success story
  - No downsides
  - Strengthen and speed up research & innovation projects
  - New contacts, ideas and opportunities internally and externally
  - Openness is an innovation driver
- But …
  - Choose the right way of working
  - Deliver quality and be reactive

How we continue

- Follow approach ”Publish OSS components and make upstream contributions if your business and project fits”
- Always be a bit more open :-)
- Continuously revisit way of working
- We have 2 to 3 OSS projects in the pipeline ;-)

SIEMENS

Contact

Published by Siemens AG

Dr. Markus Sauer
E-mail markussauer@siemens.com

Dr. Hubertus Hohl
E-mail hubertus.hohl@siemens.com

T CED SES-DE
Otto-Hahn-Ring 6
81739 Munich
Germany

Vision Pitch
“Collaborative, autonomous IIoT”
https://www.youtube.com/watch?v=KUh8qzNES7Y

Coaty

Coaty Project
https://coaty.io/

SIEMENS