EVerest: One stack to charge them all?

About me

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Background in computer science
and robotics

Working @ PIONIX on EVerest since 2021

About EVerest

- A complete software stack for EV chargers
- Runs on embedded Linux
- **Apache 2.0 License**
- Aims to support many different HW platforms
  - **and you can build your own!**
- Includes numerous modules:
  - Board support drivers for AC and DC chargers
    - HLC: SLAC, DIN SPEC 70121 / ISO15118-2/20
  - OCPP 2.0.1 and 1.6
  - Power meters, DC power supplies
- C++17, JavaScript, Python and Rust support

How it all began…
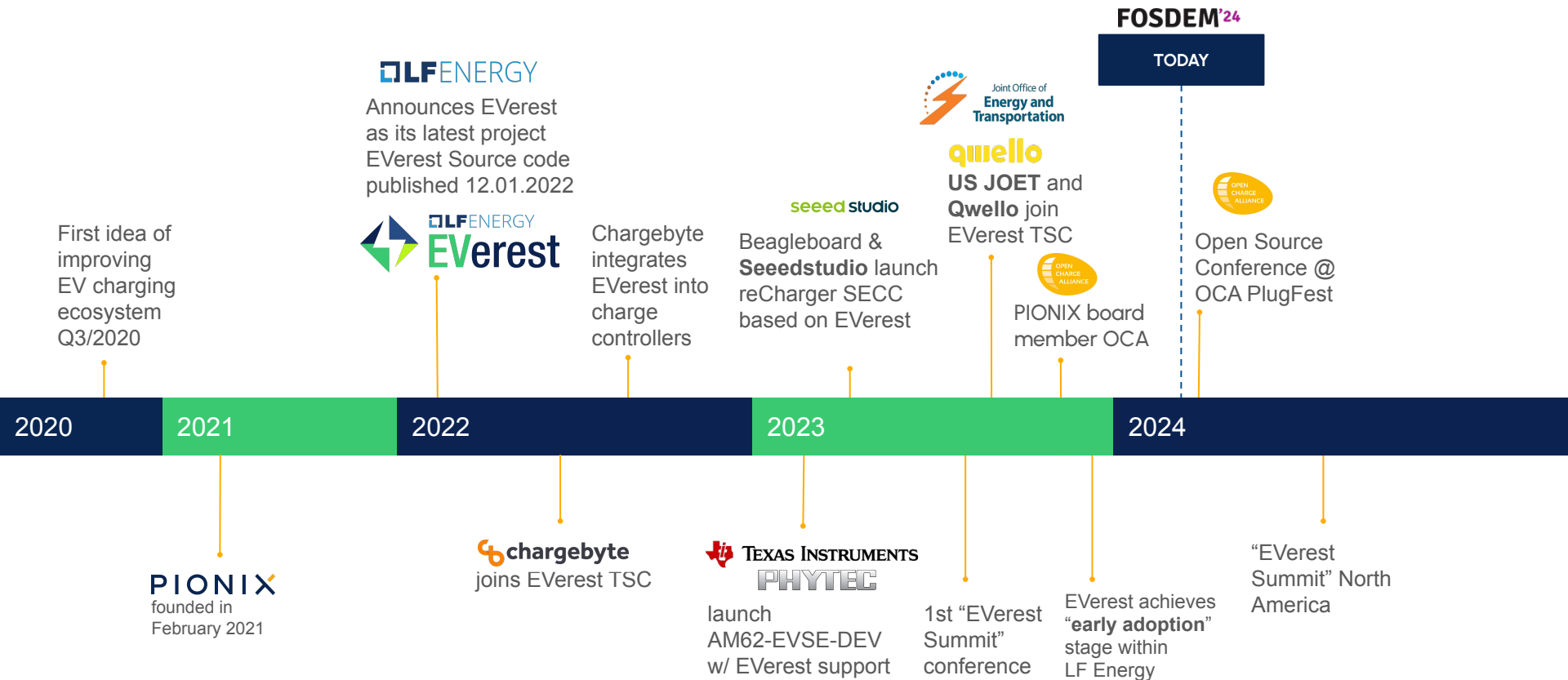
First idea of improving EV charging ecosystem Q3/2020

LF ENERGY
Announces EVerest as its latest project EVerest Source code published 12.01.2022

LF ENERGY EVerest

Chargebyte integrates EVerest into charge controllers

seeed studio
Beagleboard & **Seeedstudio** launch reCharger SECC based on EVerest

Joint Office of **Energy and Transportation**

qwello
US JOET and **Qwello** join EVerest TSC

OPEN CHARGE ALLIANCE
PIONIX board member OCA

FOSDEM'24
TODAY

OPEN CHARGE ALLIANCE
Open Source Conference @ OCA PlugFest

2020	2021	2022	2023	2024

PIONIX
founded in February 2021

chargebyte
joins EVerest TSC
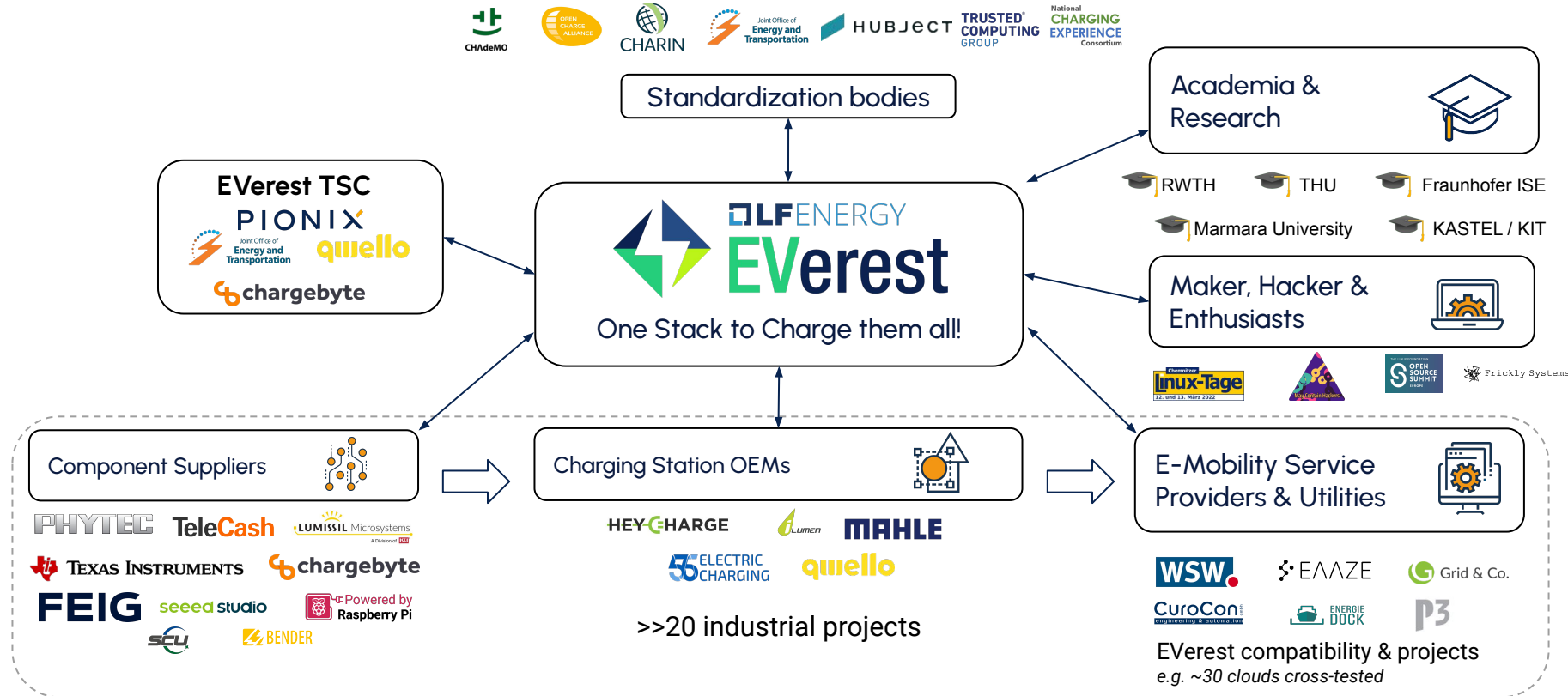
TEXAS INSTRUMENTS
PHYTEC
launch AM62-EVSE-DEV w/ EVerest support

1st "EVerest Summit" conference

EVerest achieves "**early adoption**" stage within LF Energy

"EVerest Summit" North America

Emerging ecosystem

Standardization bodies

Academia & Research
- RWTH
- THU
- Fraunhofer ISE
- Marmara University
- KASTEL / KIT

EVerest TSC
PIONIX
Joint Office of Energy and Transportation
qwello
chargebyte

LF ENERGY
EVerest
One Stack to Charge them all!

Maker, Hacker & Enthusiasts

Component Suppliers
- PHYTEC
- TeleCash
- LUMISSIL Microsystems A Division of ISSI
- Texas Instruments
- chargebyte
- FEIG
- seeed studio
- Powered by Raspberry Pi
- SCU
- BENDER

Charging Station OEMs
- HEY CHARGE
- lumen
- MAHLE
- 55 ELECTRIC CHARGING
- qwello

>>20 industrial projects

E-Mobility Service Providers & Utilities
- WSW.
- EAAZE
- Grid & Co.
- CuroCon engineering & automation
- ENERGIE DOCK
- P3

EVerest compatibility & projects
e.g. ~30 clouds cross-tested

2023: Lots of contributions

New Contributors ⓘ
New contributors are **up** 📈 **by +873%** vs. the previous time period.

Contributors ⓘ
Active Contributors **increased by 539%** 📈 vs. the previous time period.
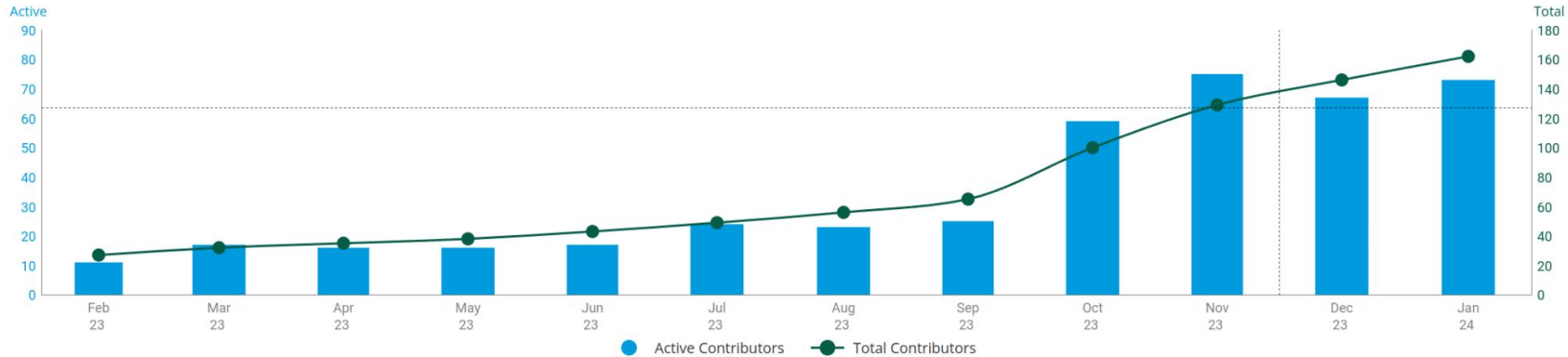
Pull Request Participants
70 +311.76%

Pull Requests Reviewed
883 +168%

Review Comments for Pull Request
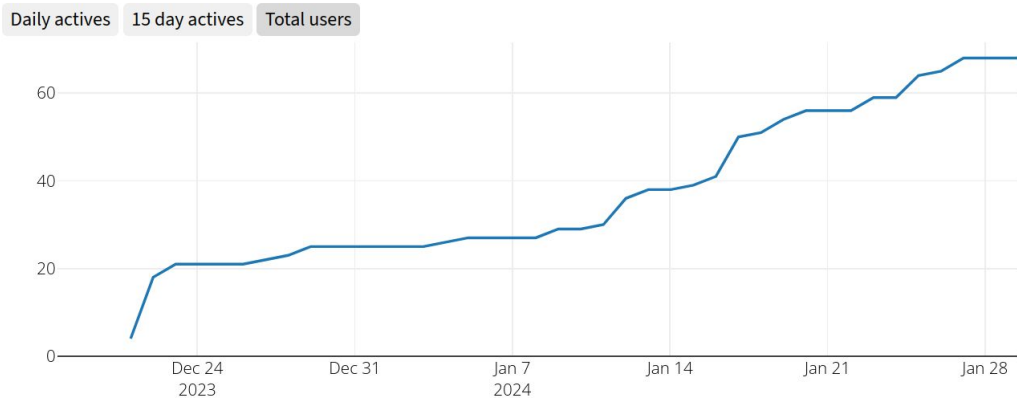**2169** +400%

Code Reviews
2454 +358%

● Active Contributors — Total Contributors

A fast growing community

Active users (lfenergy.zulipchat.com)

Daily actives | 15 day actives | Total users

everest@lists.lfenergy.org messages

Source: lists.lfenergy.org/g/everest

Messages sent over time (lfenergy.zulipchat.com)

Daily | Weekly | Cumulative

— Me — Humans — Bots
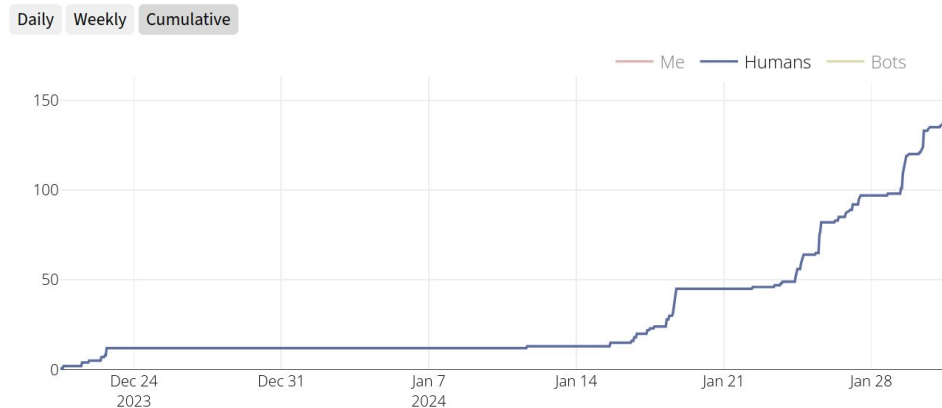
Source: lfenergy.zulipchat.com/stats

New organizational structure

Breakdown in Working Groups to enable and manage further growth

🏎️ Car Communication (eg. ISO15118)
🌥️ Cloud Communication (eg. OCPP)
🛠️ EVerest Framework & Tools
🧪 CI/CD and Testing
🤔 General and Q&A

Entrypoint for all discussions:
#Everest on lfenergy.zulipchat.com

STREAMS ▼ +

\# EVerest
\# EVerest: Car com.
\# EVerest: Cloud communication
\# EVerest: Framework & Tools
\# EVerest: Testing & CI
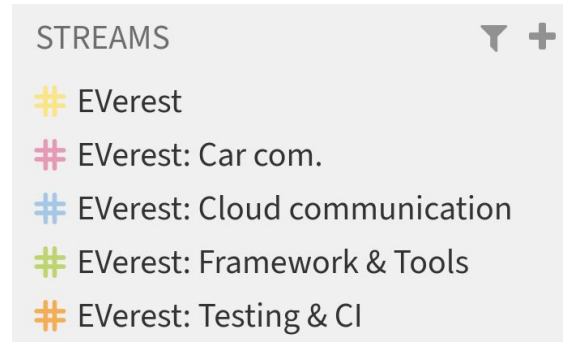
Some 2023 Milestones

- **10 "monthly" source-code releases of everest-core**

- 2024.1.0 ❄️ has just been released

- Updates to meta-everest yocto layer (kirkstone)
  based on these releases

Updated release strategy coming in the next couple of weeks

Some 2023 Milestones

- OCPP 2.0.1 Core & advanced security profile
  - Very active development on OCPP 2.0.1
- OCPP 1.6 continuously improved
- Well tested: DIN SPEC 70121, ISO15118-2 including Plug and Charge (PnC) First charging sessions with ISO15118-20 DC

- Attended 2 OCA OCPP plugfests in Arnhem
- Tested ISO15118 at 3 CharIN testivals (Arnhem, Valencia, Cleveland)

AC Open Hardware: YAK + YETI

CERN Open Hardware Licence Version 2 - Permissive

Details:

"EVerest: AC and DC electric vehicle charging with open source
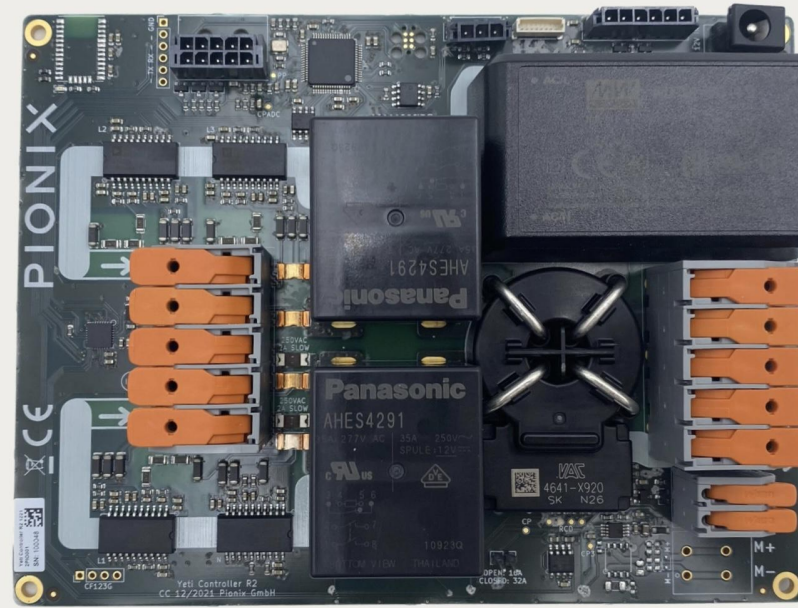software and hardware"
@ FOSDEM 2023
https://archive.fosdem.org/2023/schedule/event/energy_everest/

"EVerest: Electric Vehicle Chargers With Open Hardware and Software"
@ Embedded Open Source Summit 2023
https://eoss2023.sched.com/event/1LaQq/everest-electric-vehicle-charg
ers-with-open-hardware-and-software-kai-uwe-hermann-pionix-gmbh

Source: github.com/PionixPublic/reference-hardware

DIY DC Hardware using YETI & YAK

CAN

ModBus

DC contactors

AC Grid input

AC/DC converter module

optional: DC power meter

Isolation Monitor

DC to Car

10 wires for 12V, UART, CP, GPIOs

+12V for Yak/Yeti supply. GND is connected to PE onboard.

switch DC contactors with 12/24V signal

12V/24V input for DC contactor coil voltage switching

+12/24/...V

PE

PE

CP

for DC PP/lock motor is unconnected

Source: github.com/PionixPublic/reference-hardware
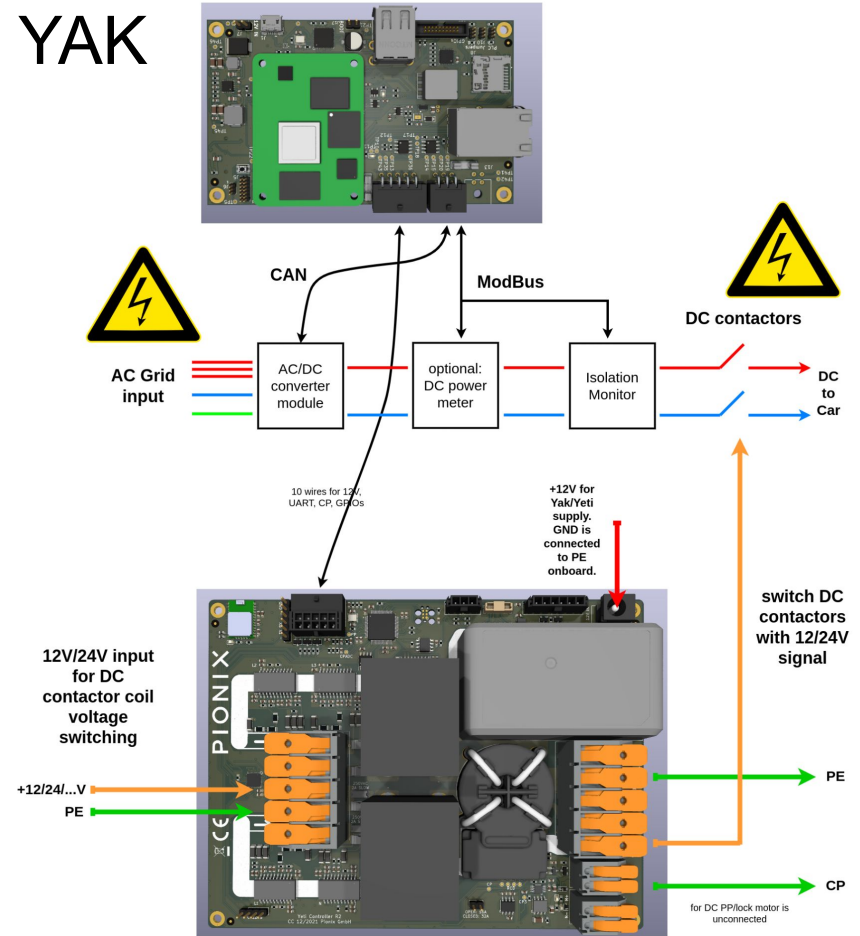
µMWC - Micro Megawatt Charger

- Powered by EVerest, driver included in everest-core
- CCS: up to 1250V, up to 0.8mA, up to 1W
- Local OCPP backend
- Battery Powered
- Full communication and charging session testing
  - incl. isolation monitor etc.
- Additionally: AC protocol testing (without power delivery)

First prototype: early 2023   **Finished product: end of 2023**

μMWC - Micro Megawatt Charger

- Portable/handheld DC charger
- Easy generation of log files and packet dumps
- Logfiles on EVerest github

github.com/EVerest/logfiles

Testing Logfiles

This repository contains logfiles from EVerest charging session on different hardware with real cars. Usually it includes EVerest session logs, tcp dumps as well as OCPP logs (if it was used). This repository does not include all cars tested with EVerest, but only log files from dedicated test events at Pionix. Charging sessions were performed with EvseV2G module as HLC implementation unless otherwise noted in the foldername. Qualcomm QCA7k was used as PLC unless noted (some are with Lumissil CG5317).

Legend:

✔️ works correctly, logs included in case of HLC

❌ supported by car but not working with EVerest

⬜ not supported by car

🔄 supports (unofficially) bidirectional charging with EVerest energy manager (limits given in table)

❓ no logfiles in this repository or support unknown

Fully electric vehicles (European markets)

Manufacturer	Model, fw version	AC BASIC	DIN SPEC 70121 DC	ISO15118-2 DC	ISO15118-2 AC	C...

EV simulation today

- Small electric quad with CCS Port
- Runs EVerest with EV simulation
- ISO15118-2/20 & DIN SPEC 70121 compatible

EV simulation in 2024

- Native C++ car simulator in EVerest
  - DIN 70121 & ISO15118-2 EV Side
  - EvManager
- Including ISO15118-20
  - AC uni- and bidirectional (BPT)
  - DC uni- and bidirectional (BPT)
- First CHAdeMO 1.1 version

Roadmap for 2024 (in no particular order)

- Native C++ EV Simulation
- Complete OCPP 2.0.1 implementation
- Integrate OCPP 2.1 (once the spec has been released)
- ISO 15118-20
  - C++ based EXI parser + parser generator
  - Plug'n Charge
  - AC unidirectional and bidirectional (BPT)
  - DC bidirectional (BPT)
- First CHAdeMO prototype

How to get involved

- **EVerest**
  - documentation for details on mailing lists, group chats and working group meetings: everest.github.io
  - source code: github.com/EVerest
- **Open hardware**
  - github.com/PionixPublic/reference-hardware
  - github.com/PionixPublic/yeti-firmware

Looking forward to your engagement and contributions!