T-EVSE

Make charging station software development more reliable

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Version : 2

Trialog has been working on EV charging for more than 10 years, which has allowed to develop a strong expertise on Electro-Mobility charge protocols like IEC 61851, DIN 70121, ISO 15118 and OCPP.
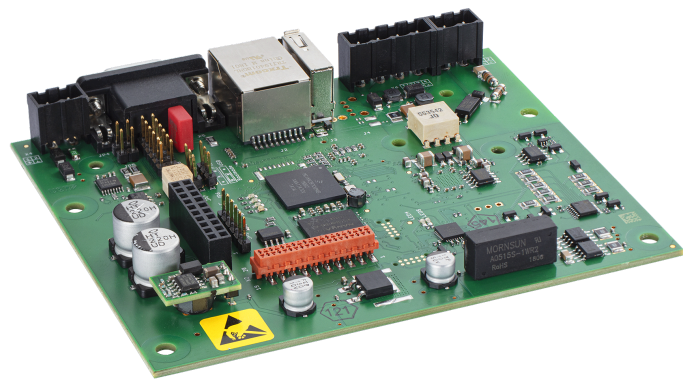In this context, Trialog has developed several communication stacks and validation tools.

T-EVSE is one of the Trialog code bases: a full ISO 15118 and OCPP implementation **ready-to-deploy on your own hardware**.
Connect the T-EVSE modules with your drivers, deploy T-EVSE on your hardware and start charging!
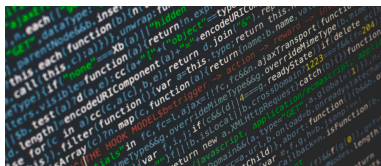
T-EVSE code base

$\longrightarrow$

Your hardware

T-EVSE supports AC Basic Charging, DC DIN 70121, AC/DC ISO 15118-2 on multiple connectors. Connect it to its OCPP Controller, thanks to the built-in ZeroMQ interface, to manage several EVSE using OCPP 1.6 or 2.0.1.
AC/DC V2G ISO 15118-20 and ISO 15118-2 Plug&Charge are also available as an option.

Protocols Overview

AC Basic Charging	Included ▾
DC DIN 70121	Included ▾
DC ISO 15118-2	Included ▾
AC ISO 15118-2	Included ▾
DC V2G ISO 15118-20	Option ▾
AC V2G ISO 15118-20	Option ▾
DC CHAdeMO 0.9-2.0	Option ▾
OCPP 1.6	Included ▾
OCPP 2.0.1	Included ▾

Features Overview

AC Basic Charging

T-EVSE supports AC Basic Charging using IEC 61851-1.

AC / DC CCS Charging

T-EVSE integrates Trialog's CCS communication stack called YaCCS supporting any type of CCS communication, from DIN 70121 to ISO 15118-20.
Its full-features: AC, DC, SmartCharging, Renegotiation, Pause mechanism and PnC.

T-EVSE also integrates CCS lower layers thanks to SLACC, Trialog's ISO 15118-3 communication stack for PLC.

Available versions

- DIN 70121
- ISO 15118-3 / ISO 15118-2
- ISO 15118-3 / ISO 15118-20 V2G → provided as an additional option

Supported PLC chipset

- QCA7000/5 from Qualcomm
- ST2100 from IoTecha
- MSE1021 from Vertexcom → to be tested
- Lumissil → to be tested

DIN 70121 / ISO 15118-3 / ISO 15118-2 Supported Features

Functions	Current Status	Details
PLC SLAC	100%	*Note: Calibrating the PLC power emission on each carrier to -75dBm/Hz is not in the scope of the stack because it depends of the internal hardware and wiring of the EVSE.*
SDP	100%	
TCP	100%	
TLS 1.2	100%	Note: *Providing the relevant certificates and private keys is not in the scope of the stack.*
SupportedAppProtocol	100%	
DC Message Set	100%	
AC Messaget Set	100%	
EIM Message Set	100%	

Plug&Charge Message Set	100%	Note: *Providing the relevant certificates and private keys is not in the scope of the stack.*
SmartCharging	100%	
Renegotiation	100%	
Pause / Resume	100%	

ISO 15118-3 / ISO 15118-20 Supported Features

ISO 15118-20 is available as an additional option.

Features	Current status	Details
PLC SLAC	100%	Note: *Calibrating the PLC power emission on each carrier to -75dBm/Hz is not in the scope of the stack because it depends on the internal hardware and wiring of the EVSE.*
SDP	100%	
TCP	100%	
TLS 1.3 with Mutual Auth	100%	Note: *Providing the relevant certificates and private keys is not in the scope of the stack.*
SupportedAppProtocol	100 %	
DC Message Set	100 %	Working and validated solution available today. Development of some optional fields is still in progress.
DC Message Set for BPT	100 %	
AC Message Set	100 %	
AC Message Set for BPT	100 %	
ACD Message Set	Not included	

WPT Message Set	Not included	
EIM Message Set	100 %	
Plug&Charge Message Set	To be scheduled	Note: *Providing the relevant certificates and private keys is not in the scope of the stack.*
Dynamic mode	100 %	
Scheduled mode	To be scheduled	
Renegotiation	100%	
Service Renegotiation	100%	
Pause / Resume	Release 2024	

OCPP Monitoring and control

Thanks to its ZeroMQ CSMQ interface (Charging Station MQ), T-EVSE is usable with OCPP. The CSMQ interface messages have been designed to be compatible with the OCPP data model. You can use T-EVSE CSMQ interface, to connect your EVSE to:
- an external OCPP module;
- or directly to the OCPP Controller module provided with T-EVSE.
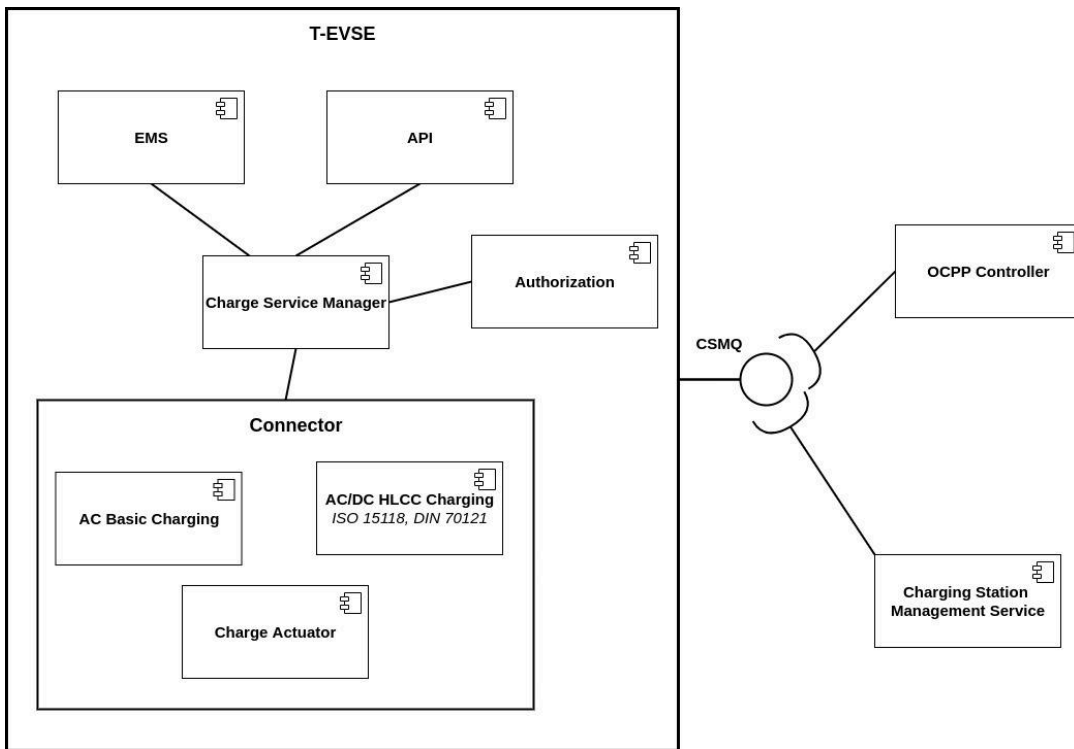
T-EVSE Package architecture

The OCPP Controller provided by Trialog embeds QOCPP-CS, Trialog's OCPP stack for charging stations, with full support of **OCPP 1.6 and OCPP 2.0.1**.
QOCPP-CS is **OCPP 2.0.1 certified** for Core and Advanced Security profiles.

State Machine based charge management

T-EVSE works with different state machines as interfaces to retrieve/send commands to your hardware drivers, and provides an extensive data model that contains all data required to operate a charging session, including the security checks.

Based on all this information, the stack will decide when to go in charge according to the CCS standards, or IEC 61851 if basic charging is used.

Easy to integrate, easy to configure

T-EVSE is meant to handle all the normative requirements of ISO 15118. To integrate it in your codebase, the only required things are:
- provide the power module state (only DC)
- populate T-EVSE data model with the charging station data (min/max ratings,…)
- take actions based on T-EVSE state as described in T-EVSE specification

You can adapt the configuration (authorization timeout, specific behaviours) or override existing software parts to make T-EVSE fit your exact needs.

Additionally, the ZeroMQ CSMQ interface is provided to be able to send data to an external OCPP module and/or to the charging station software. This interface can be disabled.

Technical Details

The T-EVSE stack is developed as a C/C++ programs using Boost libraries for the CCS stack, Qt for all the remaining software, and the OpenSSL library for TLS and PnC:

- C++11 is a minimal requirement
- Boost is known to be compatible with at least GCC, C++0x: 4.4.7
- Qt minimal version shall be 5.15

The T-EVSE stack is regularly used on Linux based OS with kernel 4.9.11 or 5.4:

- Minimal Linux kernel version: 3.4
- Link with the Qualcomm PLC modem using the qcaspi driver of the Linux kernel
- Compatible with at least Intel and ARM architectures

Typical hardware: Freescale i.MX287, RAM 128MB.

Minimum hardware requirement to connect the Qualcomm PLC Modem:

- SPI Bus to connect to the chipset
- 4 GPIOS for chipset configuration
- 3.3V (Pmax 1W)

Note: The ST2100 can only be used on IoTecha hardware. IoTecha is providing the driver licence.

Validation and interoperability

T-EVSE is ready to use and integrates reliable software stacks :

- YaCCS is deployed in more than **3000 DC stations** in France by **2 manufacturers**
  - Maybe more since we do not have access to all numbers

- YaCCS is currently under integration and deployment by **7 more AC and DC manufacturers** around the World
  - 2 manufacturers are using ISO 15118-20
- Deployed in **4 test labs** in Europe for AC and DC
  - 3 labs are using ISO 15118-20

YaCCS is fully validated:

- Participated to **4 CharIN Testivals** (2019, 2021, 2022, 2023)
- Participated to the first **ISO 15118-20** vTestival
- Tested with Trialog's **ComboCS** and **Vector** test systems
  - Partially tested with **Comemso** and **Keysight** test systems during Testivals
- **Regular testing with new cars** in 1 test lab in France (Trialog/W&W)
- **Regular testing with cars** in 1 test lab in Netherland (ElaadNL)

The interoperability with the following EVs has for example been covered using a test environment. *This is a very short and incomplete list, provided as an example.*

EV model	Protocol	Type
Daimler Smart	ISO 15118-2 ▾	AC ▾
EV ComboCS	ISO 15118-2 ▾ ISO 15118-20 ▾ DIN 70121 ▾	AC ▾ DC ▾
Porsche Cayenne	ISO 15118-2 ▾	AC ▾
Porsche Taycan	ISO 15118-2 ▾	AC ▾ DC ▾
BMW i3	ISO 15118-2 ▾ DIN 70121 ▾	DC ▾
BWM ID3	ISO 15118-2 ▾ DIN 70121 ▾	DC ▾

VW e-UP	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Tesla model S	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Renault Zoé 2	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Peugeot e-2008	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Peugeot e-208	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Kia e-Niro	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Jaguar I-Pace	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Hyundai Ioniq 2	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Hyundai Ioniq	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Honda e	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Fiat e500	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
DS3 Crossback e-tense	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾
Dacia Spring	ISO 15118-2 ▾	DIN 70121 ▾	DC ▾

T-EVSE is still actively maintained by Trialog to:

- fix eventual remaining bugs
- test with new electric vehicle models to increase interoperability coverage

- facilitate the usage or the compilation of the stacks
- ensure the correct behaviour regarding the current consensus of the normative group and ISO 15118 user group.

Contact us

*For more information about **T-EVSE**, please contact us: emobilitysales@trialog.com.*

Not interested in T-EVSE because you already have your own EVSE software? You can also acquire the software blocks separately (QOCPP-CS, YaCCS, YaCHA), and integrate them yourself.