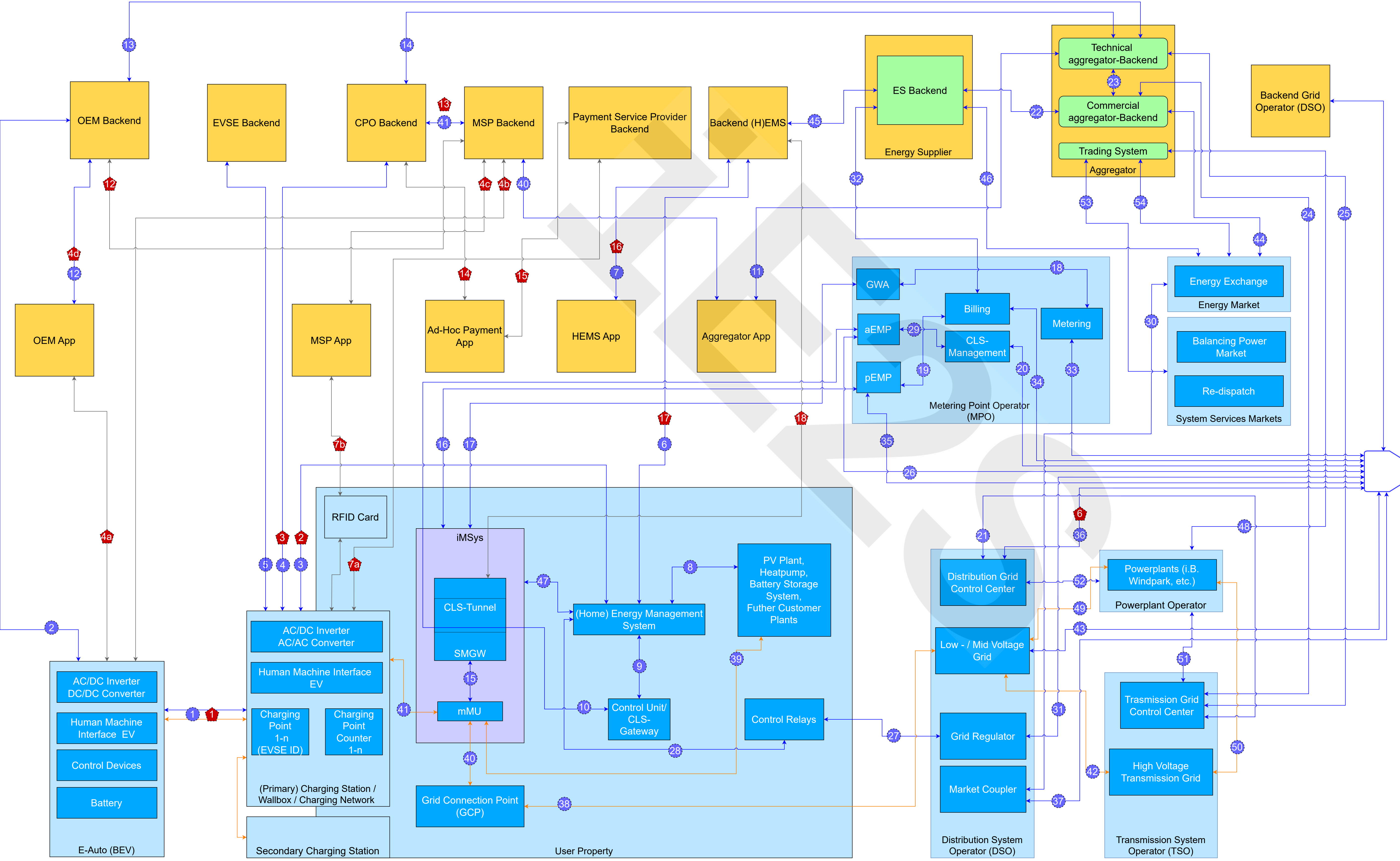


Unified and Overall System Architecture - V3.0

System Architecture for interoperable bi-directional charging V3.0



- Components and actors
- Backend/Software
- Data communication
- Physical Electricity exchange
- Interfaces of Wirkkette Laden Architecture, which are not included into InterBDL Architecture
- Interfaces: InterBDL Architecture
- Interfaces: Wirkkette Laden Architecture
- Graphical element for binding more interfaces

For further details and your feedback, please scan the QR Code



iE2S

Schnittstellen		Schnittstellenbeschreibung	Protokolle, Standards & Normen (tlw. abhängig von Use Case, Hersteller & Technologie)
1	BEV - EVSE	The interface between the vehicle and the charging device enables bidirectional energy and information exchange. It is used to negotiate charging and discharging parameters, control the charging process, and transmit status and error messages. It is based on physical connections (power transmission) and digital communication (control and signaling data).	IEC 61851 (Basic-Charging Communications); ISO 15118-2/-20 (High-Level-Communication, V2G, Smart Charging); IEC 62196 (Plug Requirements, i.e. Typ 2, CCS); DIN SPEC 70121
2	BEV - OEM Backend	The interface connects the vehicle directly to the vehicle manufacturer's backend. It is used to exchange vehicle and battery data, remote functions (e.g., charging planning, software updates), and to support value-added services.	Mobile communications standards (LTE, 5G); Proprietary OEM APIs
3	EVSE - HEMS	The charging device uses this connection to exchange information with the HEMS. The aim is to coordinate charging processes with local energy sources (e.g., PV system) and consumers in order to increase self-consumption, reduce costs, or support grid-friendly charging.	IEC 63380, EEBUS
4	EVSE - CPO Backend	Charging devices are connected to the backend of the charge point operator (CPO) via this interface. Among other things, this interface is used to monitor the operating status, billing, and user authorization.	IEC 63110, OCCP 2.0.1 / 2.1
5	EVSE - EVSE Backend	The connection enables communication between the charging device and the operator backend. It is used for status monitoring, fault diagnosis, and firmware updates.	IEC 63110, OCCP 2.0.1 / 2.1
6	HEMS - HEMS Backend	The HEMS communicates with its backend via this interface. Typical functions include remote monitoring, software updates, and the provision of energy data for analysis, optimization, or service purposes.	REST, MQTT (Cloud-APIs)
7	HEMS Backend - HEMS App	Users access HEMS functions via their app through this interface. It enables the visualization of energy data, the configuration of settings, and the control of charging processes and other consumers.	REST
8	HEMS - Customer Plants (PV, WP, etc.)	The HEMS is connected to local producers and consumers such as photovoltaic systems, battery storage units, and heat pumps. It is used to exchange operating data and transmit control commands in order to optimally coordinate generation and consumption in the household.	EEBUS, Modbus/TCP, Sunspec, proprietary interfaces
9	Control Unit / CLS-Gateway - HEMS	The control unit sends a control command and information on power limitation (from the MSB) to the HEMS, thereby enabling load control to be implemented in accordance with Section 14a of the German Energy Industry Act (EnWG). The data communicated includes power limitation, status feedback (e.g., current consumption), and time control (duration of the limitation). Communication can take place using the EEBUS protocol, for example.	EEBUS, CLS-Kanal über SMGW (BSI TR-03109), Modbus/TCP, proprietäre Herstellerprotokolle
10	aEMP-System (via CLS-Tunnel through SMGW) - Control Unit (CLS-Gateway)	This interface enables communication between the aEMP (usually the grid operator or external service provider) and the control unit, which forwards the control command to the controllable consumption device (e.g., wallbox). This allows control commands to be transmitted from the aEMP to the control unit, e.g., for load limitation, and status information to be fed back. The use of the SMGW's CLS tunnel enables secure and encrypted transmission.	CLS-Tunnel
11	Techn. Aggregator Backend - Aggregator App	The aggregator app is the front-end user interface of the technical aggregator. It is made available to every user. Users can connect, monitor, and manage their BEVs via this app. The aggregator app can provide information about the history of charging processes, the active power status of the BEVs, the power direction (unidirectional or bidirectional energy transport), among other things. This information comes from the technical aggregator backend.	REST-APIs, MQTT, Websocket
12	BEV-App - OEM Backend	The front-end user interface of the BEV, where users can view and control relevant information about their vehicle.	REST-APIs, MQTT, Websocket, OEM proprietary Protokolle
13	Techn. Aggregator Backend - OEM Backend	Optional: The technical aggregator requests information about the individual BEVs from the OEM backend, giving the technical aggregator the authority to send commands and control the BEV's charging processes (primarily via SoC settings). Charging requests based on vehicle and user data are transmitted (if necessary) to the HEMS backend or the aggregator backend.	Proprietary Interfaces
14	Techn. Aggregator Backend - CPO Backend	The technical aggregator receives the current data from the vehicles connected to the charging points and, after processing and trading, sends back the charging schedules so that the CPO can control the charging points.	OCCP 2.0.1, IEC 63110
15	SMGW - moderne Metering Unit	The interface between SMGW and mMU creates an intelligent and secure connection for recording, managing, and forwarding consumption data and supports the implementation of legal requirements in metering point operation.	Wired, Mbus
16	pEMP-system - iMSys	Relevant measurement data (TAF 7/9/10/14) are transmitted to the MSB as pEMP.	BSI TR-03109
17	Gateway-Admin - iMSys	The gateway administrator uses this connection to manage the intelligent metering system (iMSys). This includes configuration, secure communication, firmware updates, and the transmission of control or metering data in accordance with legal requirements.	BSI TR-03109, DIN VDE V 0418-63-8
18	Gateway-Admin - MPO Metering	This interface is primarily used for the administration and operation of the SMGW. Communicated data includes, for example, the provision of billing-relevant data from iMSys for MPO metering or the provision of relevant status data for the CLS tunnel from the GWA to the MSB.	BSI TR-03109, DIN VDE V 0418-63-8
19	MPO Billing - pEMP-system	The pEMP sends smart meter data to the MPO for billing purposes.	i.e. AS4 (MaKo 2022)
20	DSO Backend - CLS-Management	This interface enables the DSO to send control commands to controllable consumption devices in the context of Section 14a of the German Energy Industry Act (EnWG) via the CLS management of the SMGW.	BSI TR-03109
21	Distribution Grid Control Center - Leitwarte (TSO)	Communication between the control rooms of smaller and larger regions for network stability purposes.	IEC 60870
22	EP Backend - Comm. Aggr. Backend	The energy supplier transmits electricity market prices to the commercial aggregator. The aggregator exchanges information on the availability and use of flexibilities with the energy supplier. The energy supplier purchases electricity for the EVSE for consumers or prosumers and supplies the electricity. The commercial aggregator trades electricity volumes on the exchange (e.g., in the context of flexibility marketing). The balancing group manager is responsible for balancing within the supply balancing group.	AS4 (MaKo 2022)
23	Comm. Aggr. Backend - Techn. Aggr. Backend	Custom-built interface for data exchange regarding power plant schedules and energy sold and purchased. Time series data is provided by both sides, so that both parties have data on minimum and maximum power and energy, prices, and actual energy sold or purchased in 15-minute intervals.	Proprietary Interface
24	Control Center (TSO) - Comm. Aggr. Backend	The transmission system operator (TSO) provides the aggregator with grid-relevant information, such as the frequency level. On this basis, the aggregator can bundle flexibilities and market them as control power or redispatch services. Billing is carried out according to current market logic via a balancing group manager (BGM). Technically, standardized protocols such as IEC 60870-5-104/101 are used for the control power connection, as well as secure gateways in the TSO's data center; in addition, BSI specifications and communication requirements within the framework of Redispatch 2.0 apply.	IEC 60870-5-104/101, ENTSO-E specifications, IEC 61850 (proprietary)
25	Control Center (TSO) - Techn. Aggr. Backend	Signal retrieval of balancing energy via a secure channel. The technical aggregator transmits the control signals from the TSO to the plant for the provision of balancing energy. There must be no delay in the response speed for frequency control.	IEC 60870-5-104/101, ENTSO-E specifications, IEC 61850 (proprietary)
26	DSO Backend - aEMP-System	Information about load curtailment (dimming) and feeders (compensation).	BSI TR-03109
27	DSO Grid Regulator - Control-Relays	The distribution system operator (DSO) can indirectly control consumers or producers in the household via this connection. The control relay implements specifications from the grid controller, such as load reduction or feed-in limitation, and transmits these to the HEMS or directly to connected systems. Outdated but still existing technology.	ripple control
28	Control-Relays - HEMS	The control relay transmits control commands from the grid operator or other actors to the HEMS. The HEMS implements the specifications by regulating connected consumers or generators accordingly.	Potential free contact
29	CLS-Management - aEMP-System	Integrating CLS management into the aEMP system makes it possible to respond to grid requirements, support grid stability, and create flexibility in the energy system.	tbd
30	MaCo - Energy Market	The distribution system operator uses this interface to exchange standardized messages with market participants such as suppliers, balancing group managers, and aggregators. The aim is to ensure billing, balancing, and grid stability within the framework of statutory market communication.	AS4 (MaKo 2022)
31	Grid Regulator (DSO) - DSO-Backend	Information about load curtailment (dimming) and feeders (compensation)	Proprietary interface
32	Billing MPO - Energy Provider Backend	Provision of energy-related data, such as meter readings and measurement periods, as a prerequisite for billing.	AS4 (MaKo 2022)
33	Metering - DSO Backend	Exchange of technical details of the meters for the properties.	Proprietary interface
34	DSO Backend - Billing MPO	Information on billing-related data, in particular for the compensation of taxes and levies in the case of grid regulation and Section 14a of the German Energy Industry Act (EnWG).	AS4 (MaKo 2022)
35	pEMP-System - DSO Backend	Transmission of current values from smart meters (grid status determination)	AS4 (MaKo 2022)
36	Distribution Grid Control Center - DSO Backend	Control commands for central generators and loads, possibly schedule transmission. The control room retrieves all necessary data from the DSO systems (asset management, connection management, GIS).	AS4 (MaKo 2022)
37	MaCo - DSO Backend	Connection of the DSO to the public energy market in order to buy and sell large quantities of electricity.	AS4 (MaKo 2022)
38	GCP - Low-/Mid Voltage Grid	The grid connection point is the connection between the property and the power grid for the supply of electricity.	VDE-AR-N 4100 / 4105 / 4110, DSO-specific technical connection conditions (TAB)
39	mMU - Customer Plants	Electricity is supplied from the modern measuring unit to the respective customer installations via the property's electrical network.	VDE-AR-N 4100 / 4105 / 4110, DSO-specific technical connection conditions (TAB)
40	GCP - mMU	The modern measuring device is responsible for continuously measuring the current loads at the property's grid connection point.	Dependent on the producer
41	GCP - EVSE	At the grid connection point, the charging device is electrically connected to the distribution grid. This is where the energy transfer for charging and, if applicable, regenerative braking takes place, as well as the implementation of protection and safety requirements.	VDE-AR-N 4100 / 4105 / 4110, DSO-specific technical connection conditions (TAB)
42	Low-/Mid Voltage Grid - High Voltage Transmission Grid	The high-voltage current is physically transported through the TSO grid to the DSO grid and transformed.	Via transofermer station
43	Low-/Mid Voltage Grid - DSO Backend	The DSO receives network-relevant information on the current status of the network.	IEC 60870-5-104
44	Comm. Aggr. Backend - Energy Market	The commercial aggregator acts as a trader in the energy market to buy and sell the energy offered (or required) by all possible parties.	Via commercial aggregator
45	(H)EMS Backend - Energy Provider Backend	HEMS receives data on current electricity prices from the energy supplier, as in the case of dynamic electricity tariffs.	REST API
46	Energy Provider Backend - Energy Market	The energy supplier/electricity provider receives price lists from the energy market in order to compile its prices and hedge.	tbd
47	(H)EMS - iMSys	HEMS uses the intelligent measurement system (iMSys) to record energy flows and ensure secure connection to market and grid operators. This allows measured values to be transmitted and control commands to be implemented in accordance with legal requirements.	Herstellerspezifisch
48	Kraftwerkbetreiber - Trading System	Power plant operators report generation data and other technical data. They receive schedules, dispatch signals, and other forecast information. Overall, this communication enables the marketing of energy and participation in balancing energy and redispatch processes.	AS4
49	Low-/Mid Voltage Grid - Powerplant	Power plants use this connection to feed electrical energy into the distribution grid or to draw auxiliary power. At the same time, protection and control mechanisms are implemented to ensure grid stability and operational safety.	VDE-AR-N 4110 / 4120
50	High Voltage Transmission Grid - Powerplant	Power plants are connected directly to the transmission grid via this interface and feed large amounts of energy into it. In addition to energy transmission, grid support and control power functions are also provided to ensure frequency and voltage stability.	VDE-AR-N 4120 / 4130
51	Transmission Grid Control Center - Powerplant Operator	Operating data, schedules, and control energy requests are exchanged between transmission system operators and power plant operators. This communication enables the safe operation of power plants and the provision of system services for grid stability.	IEC 60870-5-104/101
52	Distribution Grid Control Center - Powerplant Operator	Distribution system operators and power plant operators use this connection to coordinate the operation of decentralized generation plants. This includes, among other things, the transmission of operating statuses, redispatch requests, and grid support measures to ensure secure distribution system operation.	IEC 60870-5-104
53	Trading System - System Services Markets	Energy traders submit bids in auctions and other mechanisms in the various system services markets. They receive the results of the mechanisms regarding the rejection or acceptance of their bids and use this information to derive operating data, schedules, opportunities, and, for example, control energy reserves.	IEC 60870-5-104/101
54	Trading System - Energy Market	Energy traders submit bids in auctions and other mechanisms on various wholesale marketplaces. They receive the results of the mechanisms regarding the rejection or acceptance of their bids and use this information to derive operating data, schedules, and opportunities.	IEC 60870-5-104

Komponenten

Komponentenbeschreibung

BEV	Battery Electric Vehicle: Electric car (not plug-in-hybrid)
BEV App	Mobile app for controlling the electric vehicle (usually provided by the OEM)
EVSE	Electric Vehicle Supply Equipment: Charging infrastructure for electric vehicles (regardless of technology and whether private or public)
(H)EMS	(Home) Energy management system: the central management system for controlling all connected components within the property.
(H)EMS App	App for controlling and setting up the (H)EMS
Customer Plants	Any customer systems that are connected to the (H)EMS and can be controlled, such as PV systems, battery storage systems, heat pumps, etc.
iMSys	Intelligent metering system: Hardware component that combines the mMU, SMGW, and CLS tunnel. (In the future, possibly also the SE/CLS gateway)
mMU	Modern measuring unit: bidirectional and digital electricity meter
SMGW	Smart meter gateway: "Gateway" that monitors communication between MSB and property and uses encryption to allow access only to specific participants.
CLS-Tunnel	Controllable Local System Tunnel: Communication channel for highly secure transmission of requests to the property.
CU / CLS-Gateway	Control unit / CLS gateway: Receives requests from the aEMT and forwards these commands to the property. (May become part of iMSys in the future)
Aggregator App	Communication structure of the property with the aggregator to manage settings and communicate information.
(H)EMS Backend	Backend system of the (H)EMS manufacturer and operator. Used to improve the system and detect errors and possible updates.
CPO Backend	Charging Point Operator Backend System for monitoring and controlling the charging infrastructure. (Very prominent in the public sector)
OEM Backend	The vehicle manufacturer's backend serves as a central platform for vehicle data, remote functions, and value-added services such as charging planning or software updates.
EVSE Backend	The charging infrastructure backend centrally manages connected charging points and supports functions such as monitoring, control, billing, and software updates.
Techn. Aggregator Backend	The technical aggregator backend bundles and controls the flexibility of different vehicles or charging processes in order to make them available in line with grid or market requirements.
Trading System	The trading system is the energy trader's central management and control system for trading on energy and system services markets, taking into account technical operational readiness, availability, price- and cost-related information, forecasts for relevant parameters, and other external information such as weather data.
Commercial Aggregator Backend	The commercial aggregator backend handles the marketing of the bundled flexibilities on the energy market and billing with market players.
Energy Provider Backend	The energy provider's backend supports the processing of supply contracts, forecasts, billing, and the exchange of market communication data with grid and market players.
COntrol Center	Responsible for monitoring the power grid and its functionality
Grid Controller	Regulates voltage fluctuations in the grid and stabilizes voltage changes
MPO Backend	The backend of the metering point operator (MPO) processes measurement data from smart metering systems, ensures its secure provision to authorized market participants, and supports billing and market processes.
aEMP-System	The aEMP system (active external market participants) enables authorized market participants to securely access measurement values and control information from smart metering systems.
pEMP-System	A pEMP system (passive external market participant) receives measurement data from smart metering systems in read-only mode, without being able to actively send control commands itself.
GWA	The gateway administrator is responsible for the operation, configuration, and secure communication of the smart meter gateways and ensures compliance with legal requirements.
DSO-Backend	The distribution system operator's backend is used for network monitoring, controlling decentralized systems, and market communication with other players.
CLS-Management	CLS management (Controllable Local System) encompasses the connection and control of external devices via the smart meter gateway, for example for load management or grid-related control.
Control Relays	A control relay implements external switching specifications and forwards them to the home energy management system or directly to connected devices.
CPO Backend	The Charge Point Operator's backend is used to manage charging points, authorize user transactions, and handle billing and operational processes.
MSP App	The mobility service provider's app enables end customers to access charging information, authenticate at charging points, and bill for charging processes.
MSP Backend	The mobility service provider's backend processes customer data, tariffs, and roaming information and coordinates the handling of charging processes with CPO backends.
Payment App	A payment app enables users to directly process charging transactions or energy services via mobile payment transactions.
Payment Service Provider Backend	Transactions are processed, payments authorized, and interfaces to banks or credit card providers provided in the payment service provider's backend.
Billing	The distribution network operator's billing system supports the creation and processing of network charges as well as the handling of regulatory market processes.
Metering	The distribution network operator's metering system collects and validates measurement data and makes it available for billing, network management, and market communication.
Energy Market	The energy market comprises trading platforms such as EPEX for electricity exchange trading and the balancing power market, where flexibility and system services are provided to stabilize the grid.
Powerplant Operator	A power plant operator is responsible for the operation of generation facilities and markets the energy generated and any system services offered on the energy market.
DSO	The distribution system operator is responsible for planning, operating, and maintaining the local power grid and ensures safe, reliable grid operation.
TSO	A transmission system operator operates the high-voltage and extra-high-voltage grid, ensures system security, and coordinates supraregional electricity transmission and the provision of balancing services.
MSP	A mobility service provider offers end customers access to public charging infrastructure, handles contract and billing processing, and enables the use of different charging point operators via roaming.