EVSmartCloud™ CUEPEN POWER

EVSmartCloud™ is a cloud-based platform for electric vehicle (EV) charging network. We plan to operate a comprehensive charging ecosystem that fulfills EV drivers needs wherever they may be—at home, at work or on the go—by ensuring a consistently simple and seamless experience. EVSmartCloud would offer a smart home charging solution for both single-family houses and multi-unit residential buildings, as well as access to thousands of public charging stations across the country. EVSmartCloud also plan to provide turnkey solutions to property managers, business owners, employers, municipal administrators and its ecosystem partners (OEMs, e-Mobility fleets….) who wish to support EV adoption by supplying charging services.

EVSmartCloud™ will be a cloud-based management server that will be developed by Cuepen Power, where the stations will be part of a network. This allows owners to remotely manage the charging stations, to obtain usage data, to manage the charging rates, to add charging stations based on demand and to enable Smart-Grid & Renewable-Energy-Grid functions such as the management of the demand charge to avoid being overcharged on their electric bill.

EVSmartCloud: The Implementation

Each charging station will be a hybrid charging station with renewable energy grid integrated to Power grid. A battery bank will be provided to store the additional power generated by Solar for meeting future demands of charging the vehicles when grid power is not available, for instance during power-blackouts for few hours. Each of the sub-systems will be a connected system taking to the central gateway for control and data processing. The block diagram of overall communication system is shown in figure 1.0 below

A group of smart charging stations will form a charging station network connected to a cloud-based centralized management server. This central server, which is the heart of the network, will contain the management software, the database, and the communication interfaces which enable the operation of the network, and support the electric vehicle drivers and station owners.
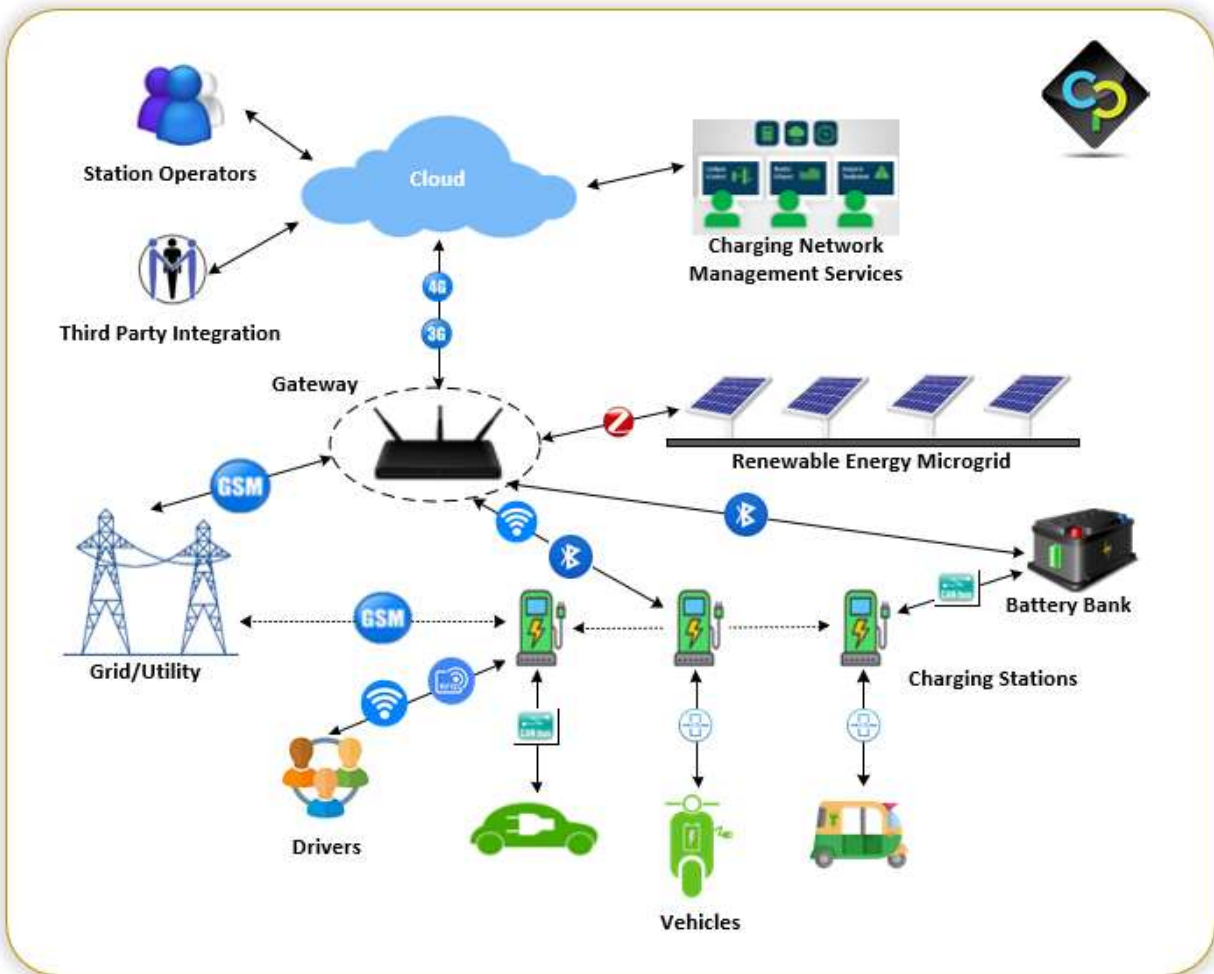
Figure 1 Cuepen Smart Charging Station Communication Eco-System

Each network possesses its own web portal, giving access to various information about charging station use and access to various configuration options depending on the type of user. In fact, there are five types of network users:

- Network operator
- Station owner
- The EV Driver (user)
- The third-party integrated into the network (such as corporate, municipality)
- Power grid (sharing the information for load management)

Digitally networked stations can help an owner/operator/organization to determine overall system usage as well as identify shortcomings and potential solutions for the charging system. Level of use, time of use, vehicle type, duration of use, and energy factors are just some of the parameters that can be monitored and evaluated.

The EVSmartCloud Network would have embedded Energy Management integrating the grid data and renewable energy data with charging needs. This provides

- Layer of agility to the EV charging process
- Communication between electric vehicles (EVs) and the power grid
- Communication between electric vehicles (EVs) and the Renewable Energy grid
- Charging based on the grid condition and the vehicle's battery state
- Effectively manage charging during peak hours
- Advanced grid & environmental parameters (T, V, A, W, power factor, Freq.)
- Circuit load balancing and diagnostics
- Automatic notifications for every operator as per his privileges
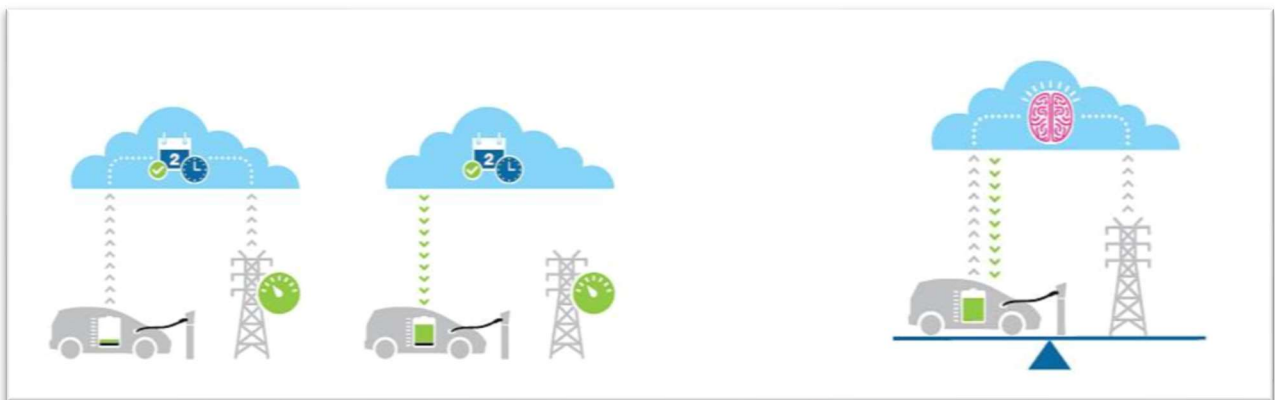
Also, the network would provide the flexibility of integration to multiple third parties

- Smart Home integration
- Corporates who need it as part of employee portals

EVSmartCloud: Network Software

EVSmartCloud^{TM} EV Charging Network Software enables utilities, smart cities, workplaces, apartments and condos, businesses and automakers to deploy and manage their own network of smart EV charging stations at scale. EVSmartCloud^{TM} software is an end-to-end EV charging network management solution that simplifies owning and operating charging infrastructure.

EVSmartCloud: Built on Open Standards & Open Charging Network

EVSmartCloud^{TM} Network Software is to be built on open standards and utilize the Open Charge Point Protocol (OCPP). This means that our software can communicate between charging stations, networks and the utility IT infrastructure. The EVSmartCloud^{TM} Platform should provide

its users great flexibility, as it supports a wide range of charging hardware options, can communicate with other software platforms, and integrate into utility demand response programs.

- OCPP Compliant
- Easy Integration with each of the ecosystem partners
- Third-party charging stations integrated solutions: such as Schneider, Delta, Leviton, Eaton run in parallel to our own charging stations
- Provide more data to more partners than any other
- APIs for micro-infrastructure partners to integrate into their applications
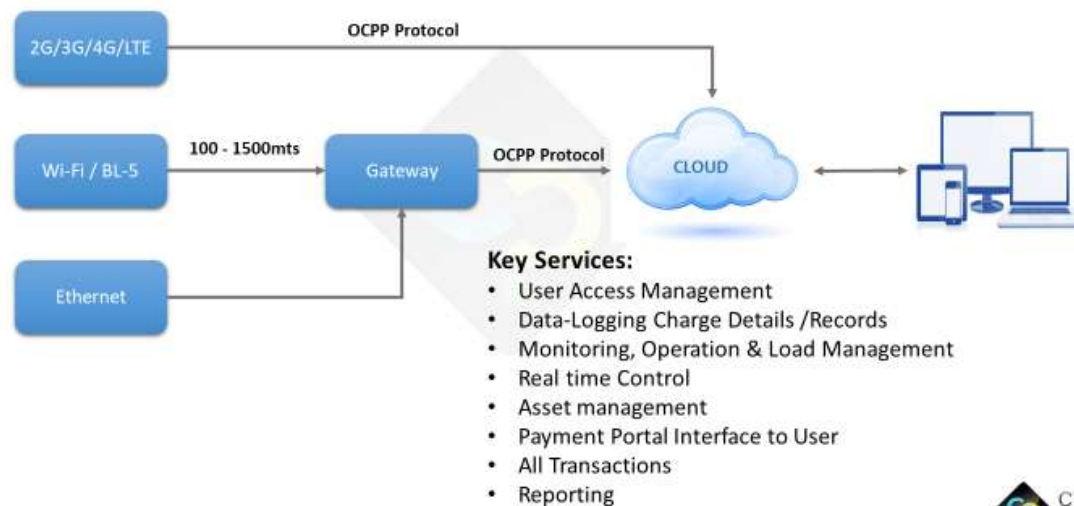
Network Software: Key Functions

Asset Management / Network Management

Each of the asset (charging station or solar grid, battery, gateway, central protection unit) installed at the charging station need to be monitored and tracked. A unique ID should be assigned to these equipment during installation and details of each equipment/asset.

Cloud will ensure to keep all data related to the equipment in one place, easily accessible to anyone with the required rights. The software would have a location and ownership properties,

power and communication configurations, and other related documentation of each charger to keep track over the growth of your network and simplify later maintenance.

Network-wide real time monitoring of the charging stations should show the analytics and health of every charging port and related components at a glance, including real-time status of EV chargers, updates and reporting.

- Real-time monitoring of your network of charging stations
- View status and performance of each charging station
- Receive instant fault notifications

Operator Access Management

The software/system should be able to open any part of your infrastructure to the staff or other business partners to divide daily management tasks or give access to specific information for their clients. It should allow to set user predefined roles or define your own rights for operators to micro-manage who can see and use the system.

The dashboard should allow the operator to:

- View amount of electricity consumed
- See live status of all charging stations under his control
- View utilization numbers
- View charged time and parked time
- Calculate costs for electricity consumption
- Calculate revenue earned
- Export data on a session by session basis

Driver / User Engagement

The users need to register into the system with his personal and validation details such as AADHAR card. An accepted RFID card would be provided to the user for accessing the charging stations across the network and data of the card should be integrated into his personal details.

A PIN code need to be generated for the user randomly whenever he accesses the station for charging for authentication and approval.

Software should provide flexibility to easily manage the users, identifications, contracts, loyalty bonuses, payers, and invoices in one place. New users can be registered manually by their operators or automatically through one of the end user interfaces and assigned different identifications to unlock your charging stations.

Deeper customer engagement with is through mobile app and web portal that should provide a smooth, integrated experience. User should have a configuration module that allows for remotely configuring settings of a charger such as switching on or off the authorization, setting

maximum charge time, remote restarting if needed and disabling or enabling chargers when desired.

Drivers should easily locate chargers, enjoy multiple payment options, check charging status and get notifications.

- Remotely start and stop a charging sessions
- Configure charging parameters
- Pay for charging directly from smart phone
- Get real time charging updates and check progress

Flexible Pricing Options

Software should provide flexibility to set time of use rates by incorporating pricing signals from a third-party source, such as ISO or utility day-ahead pricing. Set your own rates by time intervals to incentivize charging during certain periods or set up a connection fee and offer free charging. One should be able to even create a monthly subscription plan and tailor it by group, with both virtual groups – say new users who get a free month of charging – or a physical group, such as individuals at a certain workplace who get a discount.

- Set charging fees based on usage, time, or session
- Assign physical or virtual groups different pricing rates
- Establish a flat monthly rate or connection fee

Software should provide flexibility for operators to target different groups of EV drivers by creating intuitive pre-paid or subscription-based packages available for your registered users, or simply offer pay-per-use charging rates.

Predictive Analytics & Usage Reporting

With real time data monitored and past utilization data, EVSmartCloud should offer predictive insights into when maintenance will be required to mitigate unplanned downtime or failures, with proactive alerts helping to increase charger uptime.

- View charging utilization data by port, charger, or location
- Create and download customizable reports
- Track key operational performance indicators and schedule maintenance activities

Get automatic summary reports with statistics for a chosen time-period or notifications about special events directly in your inbox. Detailed reports about the operation of your infrastructure should be possible to be created based on many different parameters.

Remote monitoring and advanced diagnostics features

Real-time insights on component level such as the status of all boards, monitoring of hundreds of parameters and settings such as cabinet temperature, humidity, SW and HW versions of each board.

Billing Engine

The billing engine should link all recorded charging sessions with your users to automatically create billing data for the final invoices, considering all relevant contracts and prices entered in the system.

All billing data should be possible to be exported from the system manually in a standard format or over an API provided by CuepenPower and included with the system.

Support for Multiple Payment Modes

Users should have options to choose from a variety of payment types, for example post payment with subscription (which can be bundled with other services) or pre-paid tokens for charging (stored on RFID cards or in the app).

More payment types as per latest payment-portals need to be enabled in the dedicated end-user interface.

Service, Operations and Maintenance

Manage and monitor all tasks related to maintenance support from beginning to end. New tasks can be added by operators or requested by end users on the field through one of your user interfaces.

Maintain all firmware versions inside the system to control how and when to update your equipment.

The advanced service technology enables you to monitor individual EV charging stations and all the surrounding components. We also offer a 24/7 customer support center to assist users and ensure charger availability.

Renewable Energy charging and load optimization

Monitor the load balancing parameters for power distribution between renewable energy, utilization of battery energy stored and grid power

- Monitor the Solar parameters, Battery parameters
- Transmit the operating conditions of the load balancing
- User to set automatic priority or configure by over-riding the internal set parameters

Interface for end users

Smartphone app

Customized smartphone/mobile application, the users should have everything they need to find, book, and unlock a charging station suitable for their vehicle. All data on infrastructure and pricing offers that operator inserts in your back office is instantly shown in the user interface and vice versa; all data or bookings entered by the users are automatically transmitted to your backend system.

- View all public charging spots: Find a public charging station near you that's open, available, and ready to be used.
- Locate nearest and optimum one based on distance or price of the operator, operating timing, Self/Assistance driven stations…etc : Use location services to easily find the closest charger, filter on charger type, and create a list of your favorite charging spots. The mobile app should make it easier for you to charge on -the-go.
- View pricing of each of the operators
- Access and track his usage data: The app should keep the user informed with real-time updates, charging status, history and payment details
- Access promotions of operators
- Access and Track additional parameters of the vehicle

Mobile and Online Payment

In addition to other payment methods, the integrated user interface should allow a seamless introduction of mobile and online ad hoc post-payment and pre-payment for charging with credit cards and PayTM with simple user registration that can be completed on the spot.

Booking of Charging Stations

Real-time connection between your back and front-end software tools should enable the user to support the entire booking / canceling process on any of your charging stations, complete with finding of suitable stations and automatic sync of booking information between the two systems.

Web portal

Functionalities of the native mobile application should be replicated in a responsive web portal accessible by any device via standard browsers.

The web portal can be integrated in any online presence and should offer an additional channel for operators/ clients who need more than a mobile app linked with a single registered user.

Help Desk for End users

Through the built-in ticketing channel, the operators or customers can give you valuable feedback on their charging experience, which you can easily transform into maintenance tasks for your team.

The replies should be instantly sent to the user with insight on the steps operator/network maintenance team are taking to offer the highest quality service.

Help Guide & FAQs

Help guide should have FAQs, how to use the stations, How to do payments, Do & Don'ts, Contact details of the nearby personal to help, any other relevant training material/PPTs/Video content

Connectivity with Other Systems

Plug and Play chargers

On the level of hardware, the system should manage any charging station regardless of type and manufacturer, provided it follows the latest OCPP industry standards. Most charging stations should be added in a simple Plug & Play manner, with new models being added regularly or upon request.

Roaming integrated

On the level of connection with other e-mobility actors, one should be able to connect to the roaming platform of your choice via different protocols (OCHP, OICP, ..etc).

Extensive API selection

Each module of the system should provide input for further use (e.g. for accounting, custom types of identifications, or payment possibilities) in other external or legacy systems. An API access is offered to clients upon request.

Custom Access Management

The enterprise/operation should be able to decide himself who and how can access their system by assigning specific access roles and rights, building a multi-level structure that supports thier business model and operations.

Security

Authenticate Users and Service Providers

Encrypt Communications to Preserve Privacy

Grid Balancing Services

Manage the complexity of EV charging and transform your charging assets into a flexible grid resource. Based on open standards, our EV charging network software enables grid operators to aggregate and control their EV charging loads to ensure an efficient and balanced grid.

Demand Response

Use time-based rates to reduce or shift electricity usage during periods of peak demand

Balance Charging

Curtail charging during grid events or to prevent system overload

Optimize Supply

Leverage local distributed energy resources (Renewable Energy) during periods of high demand

Future Needs for integration

Energy Markets Data

access to data streams used in EVSmartCloud™ through predictive model and dispatch algorithms, including real-time and day-ahead energy pricing & volume across multiple ISOs, frequency regulation pricing, etc.

Predictive Grid API

Access to certain outputs of the predictive grid model, such as pricing probability curves by interval of day, economic value distributions for various geographic aggregations, etc.

Predictive Load API

access to additional outputs of the predictive load model, such as forecasted energy use for the next session, forecasted plug-in / unplug times, forecasted load curves, etc.

Predictive Battery Health API

Access the battery health of the vehicles and predict the life-time of the batteries and inform users on their usage cycles and how they can improve battery life.

Predictive Spending API

Access the charging cycles across the life time of the vehicle from registration to every charge down and predict insights into vehicle usage and spending ratios of the users