QR SOLVE

e-mobility charging platform
bespoke solution software development

Foundation

State-of-the-art, secure charging platform

QRSOLVE e-mobility charging platform is developed to support different inteligent chargers base on known market standards.
Platform gives support to manufacturing, firmware management, charging process in a secure way.

Elastic adapters approach allows to support many standards and custom IoT devices suporing REST, asynchronous and WebSocket API within the Cloud microservices architecture.
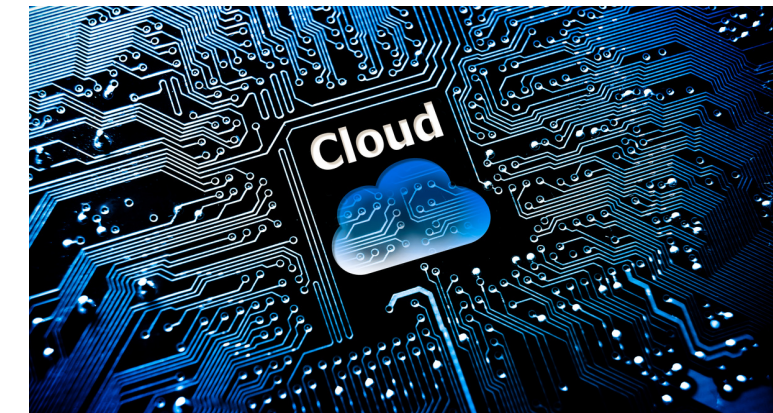

Large scale, worldwide ready

Thanks to the efficient architecture, well implementation and native Cloud mechanisms based on 300+ edge locations around the world platform can easily support hundreds of thousands working IoT chargers.

Technology	Standard	API functions
Cloud	**OCPP**	**100+**

Core Platform Functionalities

- **CHARGING**
  Process transaction events, calculate energy values, data aggregation

- **INTELIGENT CHARGE SCHEDULING**
  Night charging planner, enercy price calculations, individual tarrifs

- **RFID BASED AUTHORISATION**
  App enrollment, certificate based security

- **MANUFACTURING SUPPORT**
  QR code registering, Whitelisting devices, Mac address assignment

- **ENROLLMENT PROCESS**
  Certificate based charger and mobile registering, guest mode handling

- **FIRMWARE MANAGEMENT**
  Firmware distribution, groups management, rolling update

Step 1 Manufacturing

Production — **Whitelists**

Production process is supported by whitelisting devices, and identification by QRCode.
Administrator can easily identify and manage devices.

Enrollment — **Certificates, MAC, Firmware**

Device generates key pairs and exchange public key with the platform.
Mac address is assigned.
Latest stable firmware image is deploying to the device. Device is ready to release.

Releasing — **Release to the market using QRCode**

Manufacturing process is supporting by registering charger box with the charger using two special security codes - for the charger and for the box.

Pairing — **User pairs charger with mobile app**

During unboxing user connects his charger with mobile app and becomes an owner of the device. User can manage owners and invite guests.
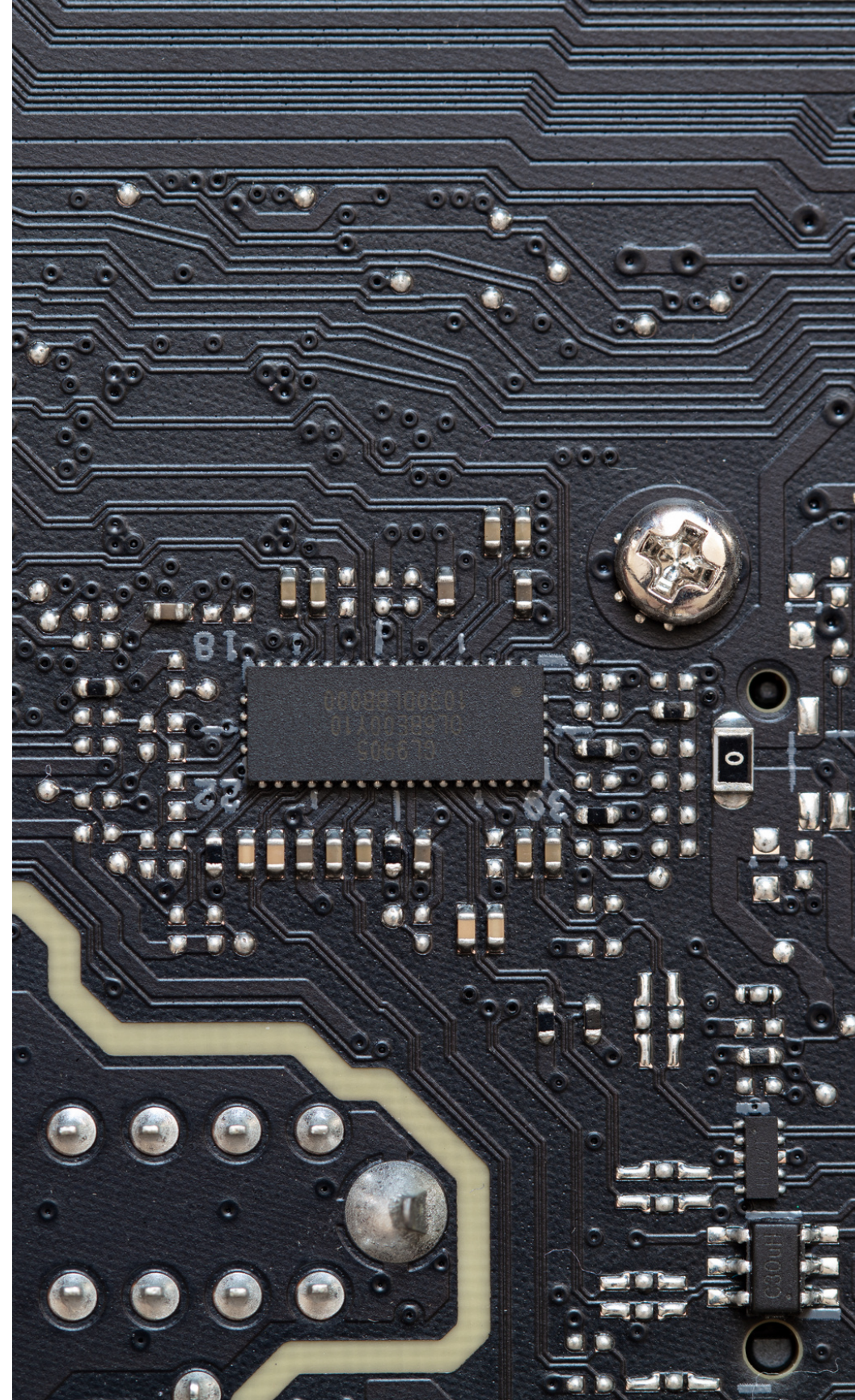
Step 2 Onboarding

Process compliant with cybersecurity for industry IEC 62443 standard

01 **Mobile app installation**

02 **Connecting mobile app with the Platform**

03 **User authentication**

04 **Scanning QRCode from the charger**

05 **Scanning security QRCode from the box**

06 **Enrolling as an owner of the device**

07 **Co-owners and guests invitations**

Security first

SECURE ACCESS PROCESS BASED ON CERTIFICATES

Step 3 Firmware

Signed firmware images are distributing to IoT chargers frequently and transparently using A/B policy

01 **Defining hardware families**

02 **Defining channels**

03 **Assigning charger to the channel & family**

04 **Uploading new firmware image**

05 **Defininging rolling update policy**

06 **Managing rolling update**

07 **Updating chargers firmware**

Elasticic updates

ROLLING UPDATE FOR MILLIONS OF DEVICES

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Step 4 Charging

☑ Charging stated from the app

Anytime the user can start new charging using mobile app. Transaction is registered and monitored by central module. All the data are accessible in a real-time mode and available for all owners of the charger. Anytime charging can be stopped with the app.

💡 Charging transactions

Every time when user starts charging, system registers new charging transaction and processes all the data from chargers like energy meters to build charging history.
Charging history can be analysed by the user and might be available for system administrators via administration dashboard console.

☑ Charging started from the RFID card

RFID card which belongs to the user is registered in the system and propagated to all his chargers.
Depends on a configuration RFID authorisation might be required or not.
Using RFID every transaction can be easily identified and assigned to the card.

☑ Charging started by the guest

Charger owners can invite guests using an e-mail invitation.
After accept the invitation guest user receives appropriate certificate dedicated to communicate directly with the privileged charger.
Using those credential and direct communication with the charger a new transaction can be started in guest mode.

Step 5 Scheduler

Tariff

Night tariffs and user configuration

User can define default price per energy unit and night tariff exclusions. Based on that system is able to choose the most efficient charging parameters.

Calculation

System calculation for charging price

User can set requested price, time or energy to get charging parameters.

Scheduler

Define scheduled charging

Based on above calculation, system sends a charging scheduler to requested charges.

Plug-in

Connect the EV using cable

According to scheduled charging parameters charger starts EV charging in given timeframes

Done

Automatic stop charging

When end date/time expires, the charging transaction stops automatically.

Architecture

01 Cloud based

- Native cloud based solution
- Worldwide high availability
- Highest data confidentiality
- Autoscaling
- Automated upgrade and migrations
- Clear maintenance model

02 Elasticity

- Microservices architecture
- Extendable services
- Well designed REST API, asnc API, WebSocket API
- Scalability and lightweight
- State-of-the-art design
- User friendly configuration

03 Security

- Compilance with IEC-62443 cybersecurity
- x.509 PKI for restrict access
- Access-control list management
- Mutual TLS security for data in transit
- Data at rest encryption
- oAuth2 for API access

04 Technology

- Runtime: AWS native, Kubernetes compatibility
- Backend: Docker images, Java, SpringBoot
- Frontend: Angular
- API: REST 3 Maturity Level - HATEOAS
- Storage & Stream: RDS, PostgreSQL/MySQL, Redis, Kinesis
- DevOps: GitLab CI/CD, Terraform

Standards

Open Charge Point Protocol 2.0.1 messages

- E02 / E01 / E03 - Start Transaction / Update transaction
- E09 - Stop Transaction
- E09 - When cable disconnected on EV-side
- G01 - Status Notification
- G02 - Heartbeat
- J02 - Sending transaction related Meter Values
- J03 - Charging Loop with metering information exchange
- K01 - SetChargingProfile
- K10 - Clear Charging Profile
- L03 - Publish Firmware file on Local Controller
- N08 - Periodic Event
- P - Data transfer

Security

- IEC 62443
- x.509 PKI
- oAuth2
- JWT
- Keycloak
- Cognito

Infrastructure

- Network LoadBalancers
- RDS storage
- Redis Cache
- Kinesis Streams
- Public and Private zones
- Worldwide edge locations

Architecture

- Microservices
- Microfrontend
- Single sign-On
- Loose coupling
- TOGAF compliant

Technology

- API Versioning
- REST 3 level API
- Shift Left Testing
- Pipeline deployment
- Infrastructure as Code

Thank You

We're here to help you

Your proven Technology Partner

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