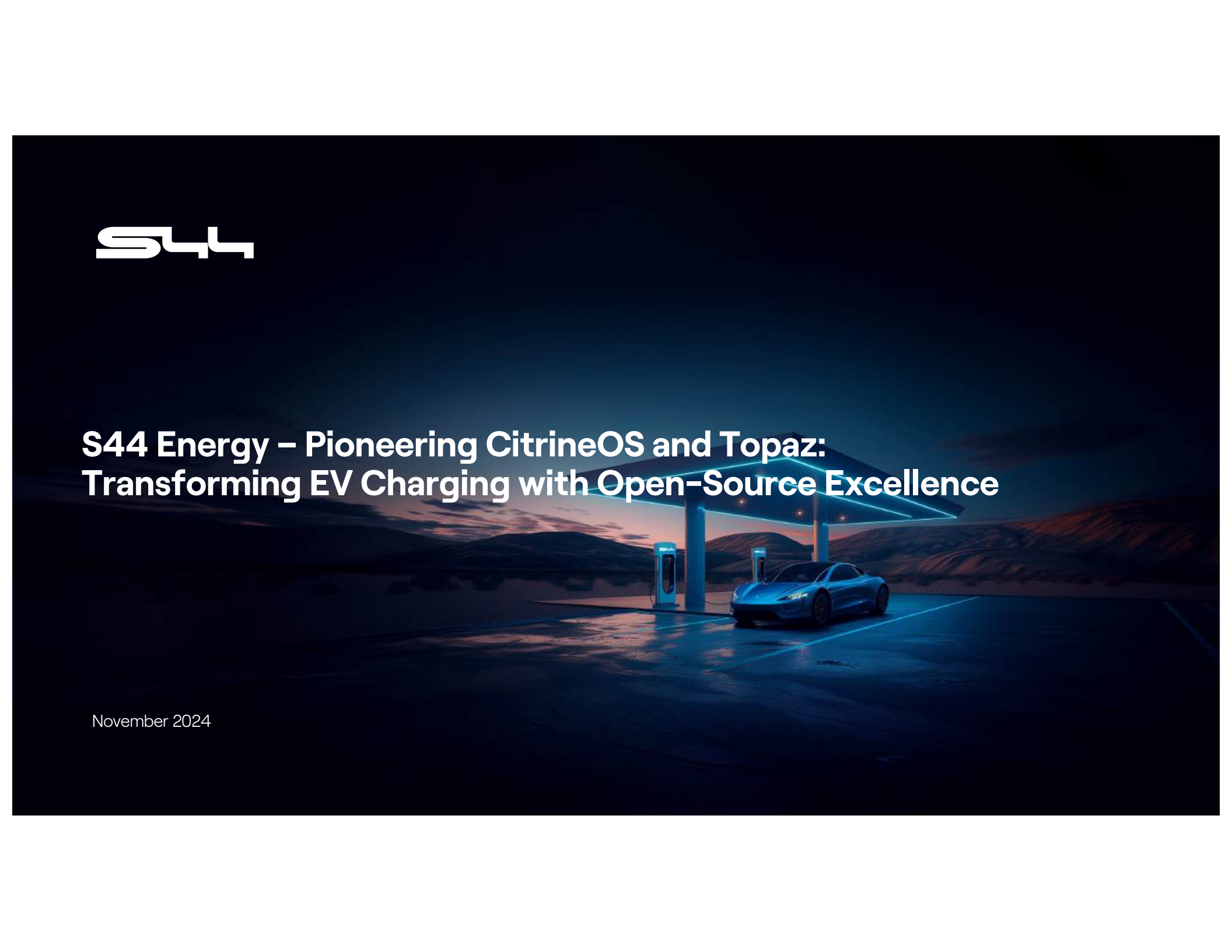




S44 Energy – Pioneering CitrineOS and Topaz: Transforming EV Charging with Open-Source Excellence

November 2024





About S44 Energy

Creators of CitrineOS and Topaz: Revolutionizing EV Charging with Open-Source Innovation.

Driving EV Charging Innovation for Over a Decade

- 10 years of expertise in e-mobility software development (U.S. & Germany)
- Driving EV adoption through cutting-edge technology
- Custom CPO, MSP and customer-facing applications
- Active in EV Roaming Foundation, defining OCPI 3.0 protocol evolution
- OCPP 1.6 & 2.0.1 expertise & implementation
- Integrated eMSP solutions & mobile apps with 9 OEMs
- Authored LF Energy project, CitrineOS OCPP 2.0.1 CSMS



Experience & Open-Source

- We are strategic partners to EV charging pioneers
- We built the second largest EV charging network in North America between 2020 and 2022
- We launched **CitrineOS** in Oct. 2023, the first open-source OCPP 2.0.1* -focused CSMS (Charge Station Management System) adopted by the Linux Foundation Energy in Nov 2023
- Leveraging CitrineOS as the foundation, we also created Topaz, a commercial CSMS owned by the customers who implement it
- We have strong expertise in open charging standards
- We are experts in electrification software products





S44 Energy Open-Source CSMS Software, CitrineOS

Built to Support OCPP 2.0.1 & Subsequent Protocols

 **CitrineOS** is a robust, open-source platform designed to stabilize the fragmented market and solve the key challenges plaguing the EV charging industry.

Our solution leverages OCPP 2.0.1 to provide better data, enhanced reliability, and a scalable approach that supports the growth of EV infrastructure. Our goal is to revolutionize the electrification industry by breaking free from isolated solutions and embracing open standards.

Scaling the sector requires harnessing open implementation to drive unparalleled growth and innovation.

The Foundation for Future-Proof EV Charging Networks

Built on Open Standards: Ensures universal compatibility with any hardware, future-proofing charging infrastructure.

Modular Design: Easily customized to meet evolving needs and integrate new technologies, ensuring scalability.

Open-Source Benefits: Community-driven innovation ensures continuous improvement and cost-efficiency.



What's Inside OCPP 2.0.1



Device
Management



Websocket
Security Profiles



Improved
Transaction
Processing



ISO 15118
Plug & Charge



Secure OTA
Firmware Updates

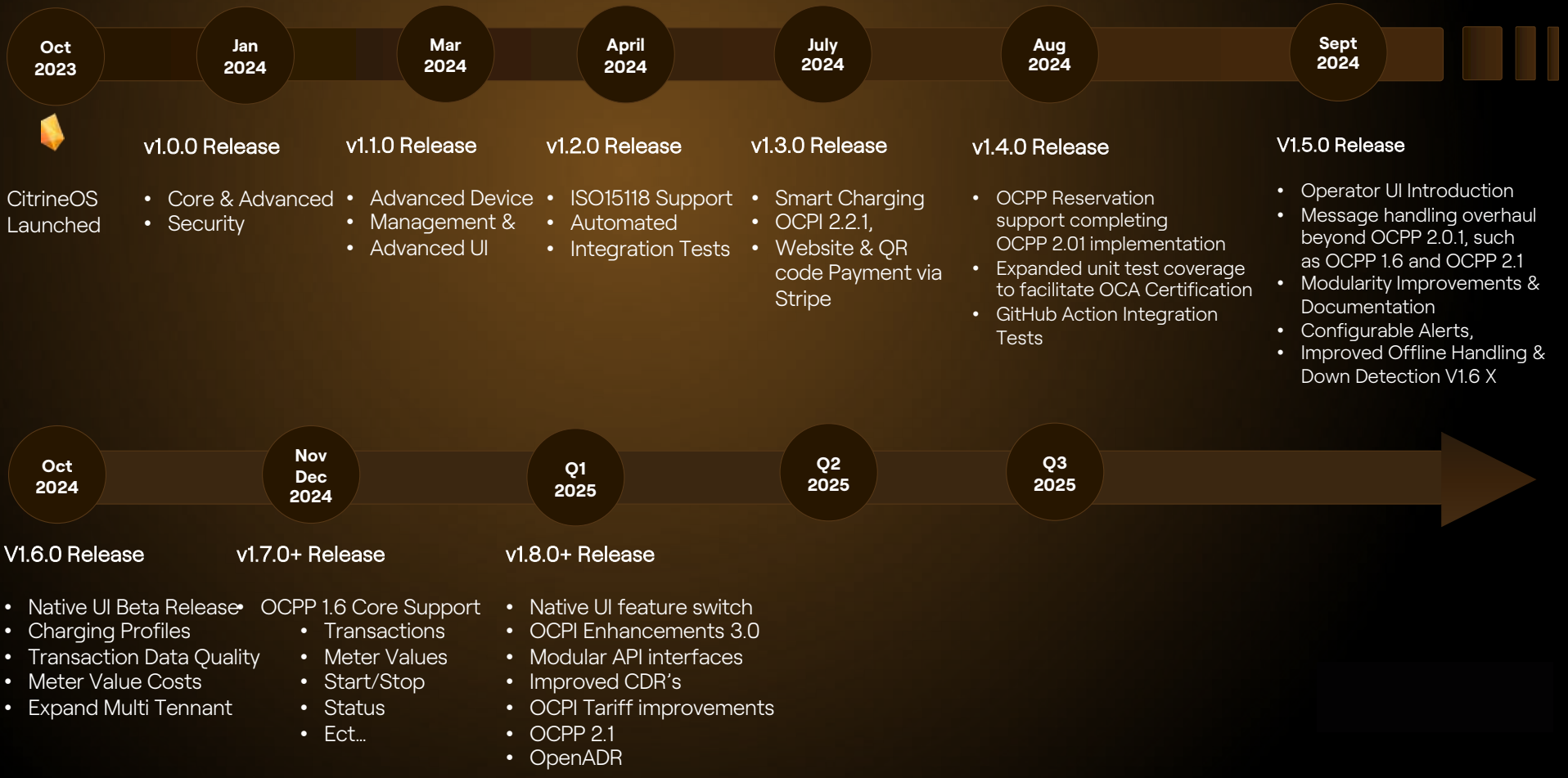
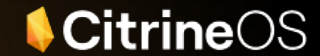


UI Control:
Pricing & Images



Improved
Offline Behavior

CitrineOS at a Glance



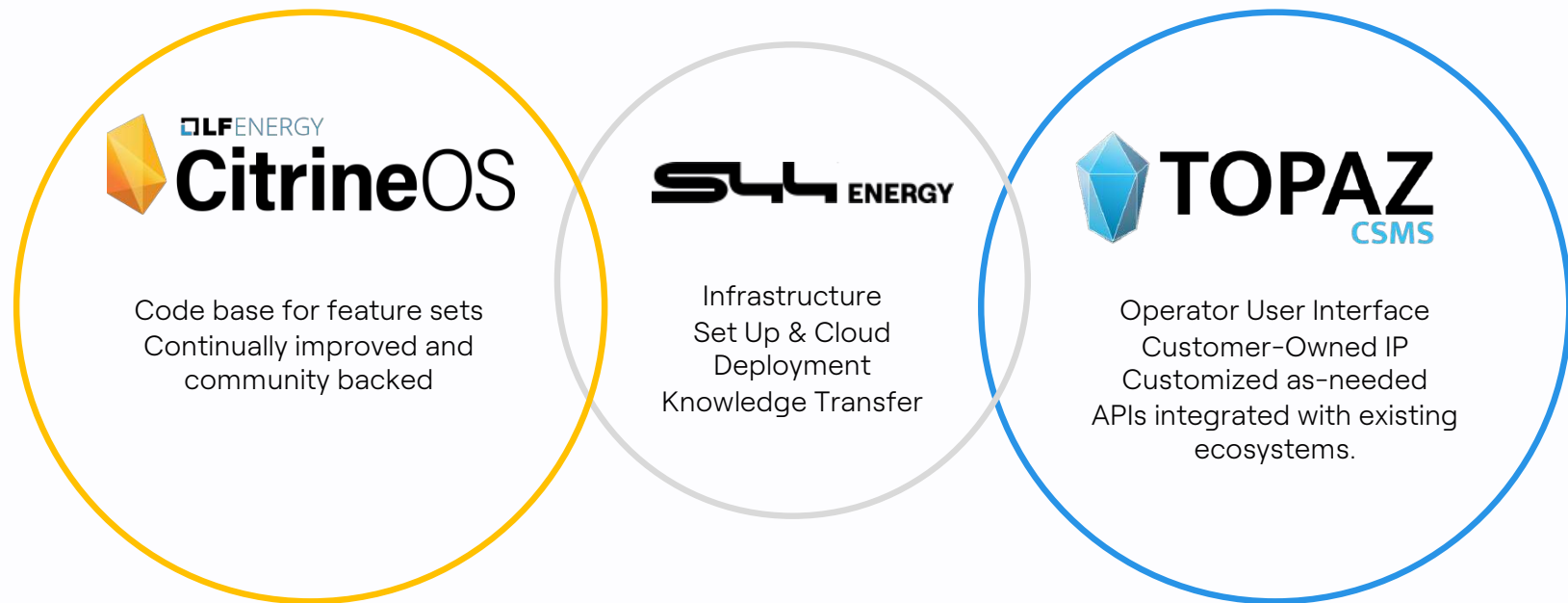


Topaz CSMS: Built on Open-Source Foundations

Customizable CSMS Solution with Customer-Owned IP Tailored to Unique Needs

How We Deploy Topaz CSMS

Open-Source Foundation Provided by CitrineOS Cuts Down on Costs and Deployment Time



Topaz CSMS Tiers

Flexible, scalable options to meet diverse customer needs:

- ✓ **SaaS Model:** Tiered pricing based on charger volume, with discounts for larger deployments. Provides predictable monthly costs for easier budgeting.*
- ✓ **Custom Development:** Pricing based on project scope and complexity, ensuring clients pay only for needed services. Transparent cost estimates included.
- ✓ **Enterprise Solution:** One-time fee for full feature access, simplifying budgeting with all-inclusive support.

All models are customizable, with potential discounts for high volume or long-term partnerships.

**S44 Energy owns Intellectual Property (IP) for all SaaS whereas Custom and Enterprise Models pass the IP to the purchasing client.*



S44

CSMS Solutions Overview



SaaS CSMS

S44's SaaS model offers an all-inclusive solution for clients, handling software hosting, deployment, and support for their EV charging needs through a modular, API-driven ecosystem. Our tiered pricing structure allows clients to seamlessly scale as their EV adoption grows.



Custom Approach

Using our CitrineOS open-source solution as code base, we deliver custom applications up to 80% faster and more cost-effectively. From EV charging to energy management, S44 builds tailored solutions, features, and integrations to meet each client's unique specifications.



Enterprise CSMS

Large organizations need powerful tools, seamless connectivity, and data integration. Our Enterprise package offers IP ownership options and extensive integration, built on an API-first, modular architecture for easy ecosystem compatibility.



API's, Updates & Features

Forward Thinking & Custom

Software Enhancements & Updates

New software versions & updates via open-source standard processes:

Keep close to OCPP-OCPI protocols –

- S44 recommends keeping to OCPP/OCPI protocols
- Customized solutions off the OS code may require changes to accept

New version releases are updated via GitHub

- Notifications via GitHub
- Notification via S44

Update Process:

Ongoing Client Self Updates:

- New software version released & posted/notification
- Changes are pulled into current custom set up via GitHub Pull Request
- Testing is performed
- Adjustments may be needed or diagnosed

S44 Managed Updates

- S44 managed/supported/retained clients get the benefit of S44 completing the new version release for our clients on a regular release cycle ongoing basis





CitrineOS Central System API's

OCPP 2.0.1 Messaging



Transactions API

- Cost Updated
- Get Transaction Status
- Transaction
- Tariff
- System Configuration



OCPP Router API

- Subscription
- System Configuration



OCPP Certificates API

- Certificate Signed
- Install Certificate
- TLS Certificate
- Certificate Chain
- Root Certificate
- System Configuration



Smart Charging API

- Clear Charging Profile
- Get Charging Profiles
- Get Charging Profile
- Cleared Charging Limit
- Get Composite Schedule
- System Configuration



Configuration API

- Set Network Profile
- Clear Display Message
- Get Display Message
- Publish Firmware
- Set Display Message
- Unpublish Firmware Reset
- Change Availability
- Trigger Message Boot
- Password
- System Configuration



EV Driver API

- Request Start
- Transaction
- Request Stop
- Transaction
- Cancel Reservation
- Reserve Now
- Unlock Connector
- Clear Cache
- Send Local List
- Get Local List Version
- Authorization
- Authorization
- Restrictions



Monitoring API

- Set Variable
- Monitoring
- Clear Variable
- Monitoring
- Set Monitoring
- Level
- Set Monitor Base
- Set Variables
- Variable Attribute
- System Configurations



Reporting API

- Get Base Report
- Get Report
- Get Monitoring Report
- Get Logs
- Custom Information
- System Configuration



CitrineOS Central System API's

OCPP 2.0.1 Messaging



Commands Module API

Commands Post



Versions Module API

Get Versions



Charging Profiles Module API

Get Active Charging Profile
Delete Charging Profile
Update Charging Profile



Sessions Module API

Get Sessions
Update Charging Preferences



CRDs Module API

Get CRDs



Locations API

Get Locations
Get Location ID
Get EVSE by ID
Get Connector by ID
Create Location



Credentials Module API

Get Credentials
Post Credentials
Put
Delete
Register Credentials as a Token
Delete Tenant
Unregister Client
Generate Credentials Token
Regenerate Credentials Token



Tariffs Module API

Get Tariffs
Update Tariffs
Broadcast Tariffs
Delete Tariffs



Tokens Module API

Get Tokens
Put Token
Patch Token
Fetch Tokens
Get Active Tokens Job Status
Fetch Tokens Action
Get Fetch Tokens Job Status
Delete Fetch Tokens Job Status



A Charge Station Management System Built on CitrineOS Open-Source Foundation

Station Management:

- ✓ Charger Hardware Communication
- ✓ Commissioning OCPP 2.0.1 + 1.6
- ✓ Transaction Support OCPP 2.0.1 + 1.6
- ✓ Authorize and Payments
- ✓ Monitoring & Reporting
- ✓ OTA Firmware Updates
- ✓ Charger Remote Control
- ✓ Device Logs
- ✓ Digital Asset Management for Charger UI
- ✓ Data Pipelines

OCPI

- ✓ Full CPO Interface
 - Commands
 - Charging Profiles
 - Locations
 - Etc.
- ✓ API Security
- ✓ External API Management
- ✓ Roaming Network Support

UI

- ✓ Native Operator UI Included
- ✓ Custom UI Interface or pipe to existing UI's are available

Tariff Management

- ✓ Full Pricing UI
- ✓ Tariff CRUD API & OCPI Integration
- ✓ Automatic Invoice Generation
- ✓ Dynamic Pricing
- ✓ Incentive creation (e.g. Free kWh bundles)

ISO 15118-2 Plug 'n Charge & ISO 15118-20

- ✓ Leaf & Contract certificate management
- ✓ CA of choice (Hsubject, SAE, etc.)***

Infrastructure

- ✓ AWS-Azure-Kubernetes Networking***
- ✓ ECS Hosting
- ✓ Event Management
- ✓ Data Storage & Warehouse
- ✓ Data Reports & Visualizations
- ✓ API Management (Kong)
- ✓ CI/CD
- ✓ Tooling (Jenkins, Sonar, etc.)

Advanced Custom Features:

- ✓ Advanced Device Management
- ✓ Fleet Management
- ✓ Multi-Tenant with Account Portal
- ✓ High Unit Test coverage
- ✓ Automated Integration & Load Testing
- ✓ L1 Support Integration
- ✓ Data Migration from SaaS CSMS

Transactions

- ✓ Integrated Authorization
- ✓ Payments via Stripe

Q&A

- ✓ Both Manual & Automated, & Transparent
- ✓ Prod-like Environment
- ✓ Agile workflow





Partner with S44 Energy on your EV Charging Solution!

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