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EV Interoperability Field Testing: comprehensive, agile, and customer-focused solutions for reliable charging experiences

Challenge

The e-mobility ecosystem has experienced significant growth and development over the past few decades. Early electric vehicles (EVs) faced limitations primarily due to battery technology, limited driving range, and a lack of charging infrastructure. However, advancements in battery technology and improvements in charging infrastructure have significantly increased the practicality and appeal of EVs to consumers. This progress has led to a rapidly expanding ecosystem, consisting of EV manufacturers, charging network providers, and electric vehicle supply equipment (EVSE) manufacturers.

The global EV charging infrastructure market was valued at USD 25.83 billion in 2023 and is expected to grow at a compound annual growth rate (CAGR) of 25.4% from 2024 to 2030 [1].

Figure (1) illustrates the key components of EV charging infrastructure. The Charging Station Management System (CSMS) is responsible for managing and overseeing EV charging sessions through the Open Charge Point Protocol (OCPP). OCPP serves as the communication link between the EVSE and CSMS, enabling real time data exchange for each charging session.

[1] EV Charging Infrastructure Market Size & Share Report 2030, published by Grand View Research. Source: https://www.grandviewresearch.com/industry-analysis/electric-vehicle-charger-and-charging-station-market

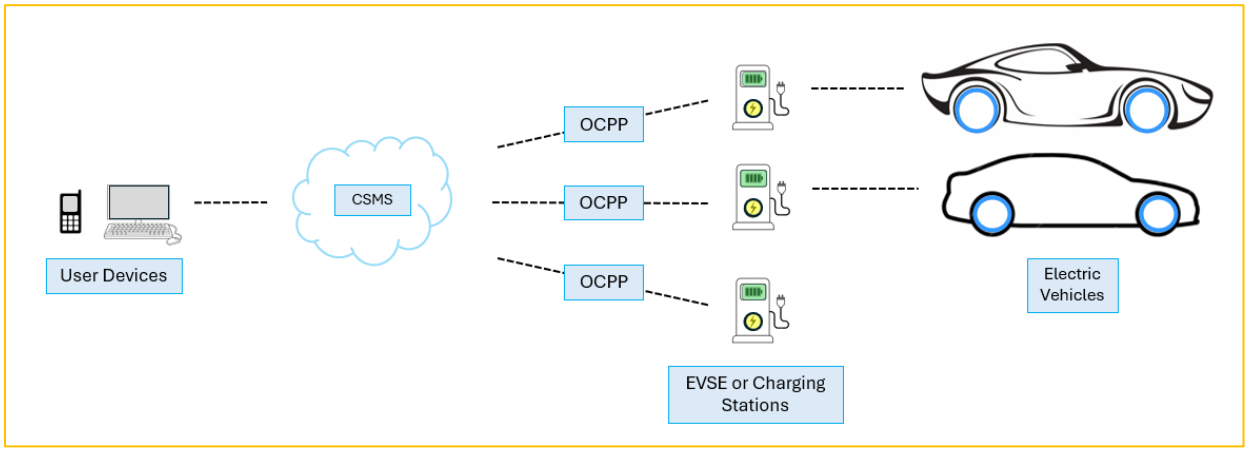

Figure (1) – Components of EV Charging Infrastructure.

In 2025, an Original Equipment Manufacturer (OEM) plans to launch a new high-end EV in North America, covering the USA and Canada. With the rapid expansion of the EV charging infrastructure, potential compatibility challenges may emerge between EVs and EVSE from different manufacturers. Given the diverse set of players contributing to the e-mobility ecosystem, ensuring seamless interoperability across different EVs and charging equipment necessitates rigorous testing and validation efforts.

To address these challenges, EagleTC has partnered with the OEM to conduct ongoing field testing aimed at identifying and resolving interoperability issues specific to the USA and Canadian markets.

Solution

EagleTC dedicated three test engineers and a program manager exclusively to this project. With the launch of the new EV in North America, a comprehensive testing plan was developed to ensure broad coverage of different EVSEs across various states, ultimately verifying compatibility across a wide range of charging networks and equipment. EagleTC collaborated closely with the customer and undertook the following key activities:

- **EVSE Selection and Coverage**: A list of multiple EVSEs was populated for testing, based on a range of criteria including manufacturer, charging

network, charging speed, and geographical coverage, as detailed in Table (1). The testing included locations in both the USA and Canada, covering a variety of charging networks and equipment manufacturers to ensure diverse testing environments.

Country	States/Provinces	Charging Networks	EVSE Manufacturers	Charging Speeds
USA	Michigan, Chicago, Florida, New York, Indiana, Kentucky, Washington, Ohio, Tennessee, Alabama, Georgia, North and South Carolina, Pennsylvania, Vermont, Virginia and West Virginia.	EVGO, ChargePoint, Red-E, Tesla, Volta, ChargeLab, EV Connect, Ivy, Shell Recharge, Electrify America, and ChargerSync, etc.	BTC Power, Signet ABB, Ads-Tec, eCamion, Blink, Delta, Tesla, etc.	50KW-350KW DC fast charge, AC Level 2.
Canada	Ontario and Quebec.	EVGO, ChargePoint, Red-E, Tesla, Volta, ChargeLab, EV Connect, Ivy, Shell Recharge, Electrify Canada, Flo, Circuit Electric, SWITCH, Petro-Canada, and Circle K, etc.		

Table 1 – Methodology for Populating Multiple EVSE.

- **Route Planning:** Routes, addresses, charging station availability, charging speeds, and plug types were planned using PlugShare. Figure (2) illustrates an example of a planned route.

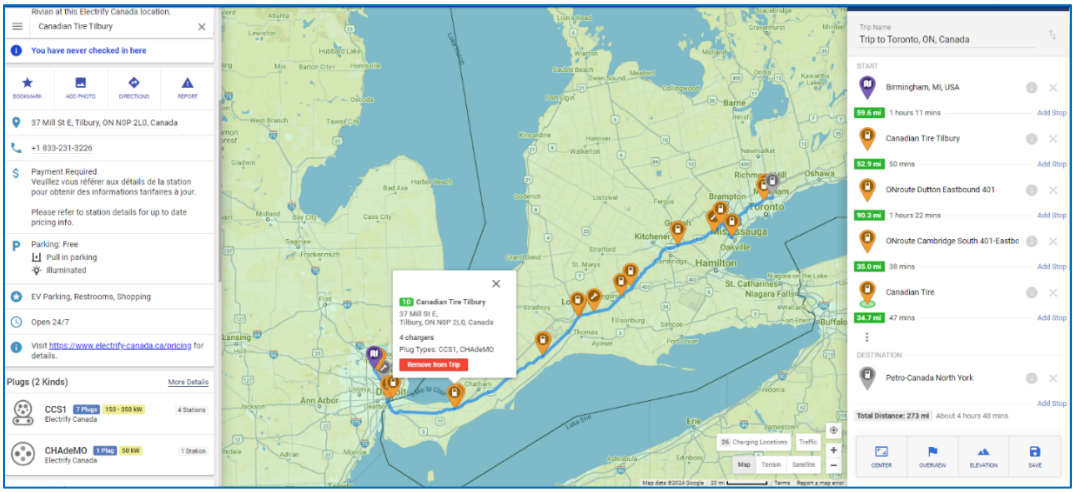

Figure (2) – Planned Route for Testing.

- **App Integration and Payment Setup**: Various EV charging station apps were downloaded, and payment accounts were set up for different providers, including Electrify America, Red E, ChargePoint, EVGO, and Tesla. This step ensured readiness for real time testing at each charging station. Figure (3) provides an example of one of the downloaded apps.
- **Daily Testing and Data Upload**: The test team conducted daily drives to specific EVSEs based on the planned routes. Test results, Vector CAN logs, photos, details of the EVSEs, and any additional observations were uploaded in real time to the customer's portal, allowing for immediate analysis and feedback.
- **Daily Review Meetings**: EagleTC held daily calls with the customer to discuss the day's testing results, review planned routes, and synchronize schedules for new software releases and fixes.
- **Software Updates and Retesting**: The Electric Vehicle Communication Controller (EVCC) was updated with both official and pre-development software releases, followed by retesting to confirm that identified issues were resolved and to maintain data consistency over time.

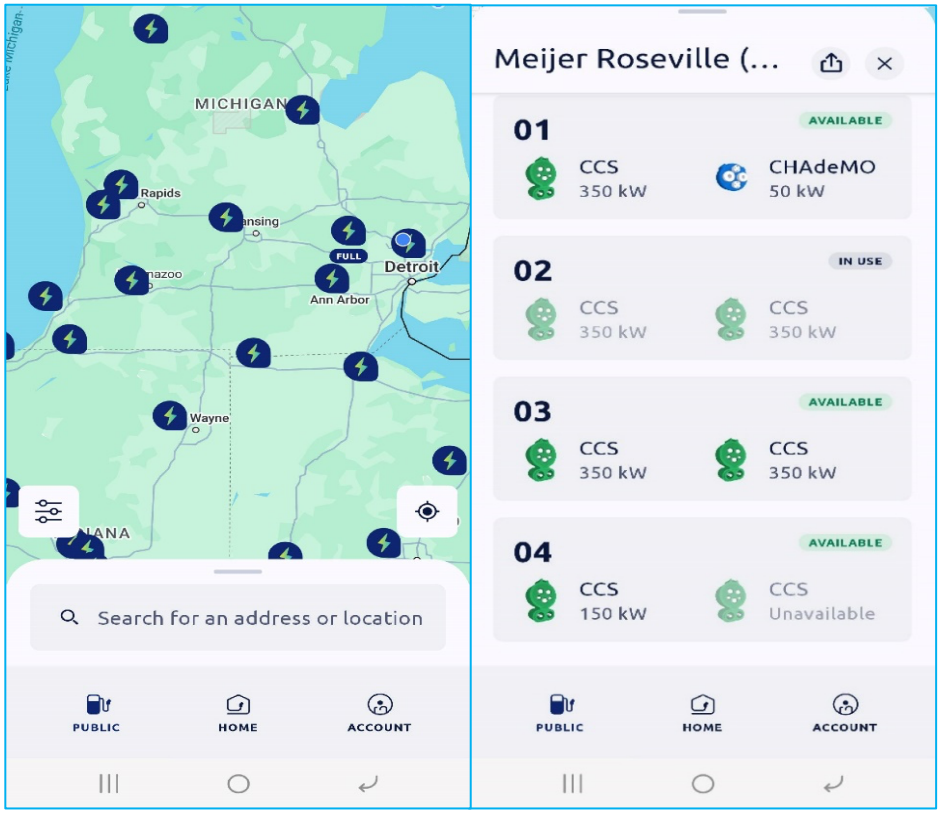

Figure (3) – Example of Downloaded App.

- **Participation in CharIN Testival 2024**: EagleTC accompanied the OEM engineers to the CharIN Testival NORTH AMERICA 2024 in Ohio to support interoperability testing, capture logs, and assist with further investigation as needed.

Results

Since being awarded this continuous project in 2024, EagleTC has worked closely with the customer to conduct comprehensive EV charging ground tests across multiple locations in the United States and Canada. After the completion of the first milestone, EagleTC consistently provided valuable feedback, meticulously documenting issues and observations for the customer. The following key highlights underscore EagleTC's competence in executing this project with excellence:

- **Extensive EVSE Testing**: EagleTC successfully tested over 500 EVSE units across seventeen states in the USA and two provinces in Canada, as detailed in Table 1. Detailed test results were uploaded daily, enabling the customer to analyze data in real time.
- **Effective Issue Resolution**: EagleTC collaborated closely with the OEM to resolve all identified software issues, continuously testing pre-development builds to ensure robust fixes. In addition, EagleTC attended key industry events with the customer, further supporting the customer's success and ensuring optimal interoperability.
- **Milestone Summary**: Upon completion of the first milestone, EagleTC compiled a concise summary of the test results, providing the OEM with a clear understanding of findings and recommendations.

This project demonstrates EagleTC's ongoing ability to:

- Deploy teams on the ground with short notice, while developing strategic plans and testing routes efficiently.
- Implement cost-effective solutions by minimizing overhead costs through efficient resource allocation, comprehensive tester training, and robust program management processes.
- Provide prompt customer support, ensuring issues and concerns are communicated in real time.
- Adapt seamlessly to changing circumstances while consistently delivering accurate and timely results.