metergram

READY TO ROAM?

YOUR GUIDE TO A SUCCESSFUL
OCPI IMPLEMENTATION

Executive Summary

Providing a seamless EV roaming experience is increasingly essential to the survival of Charging Station Operators (CSOs) and e-Mobility Service Providers (eMSPs).

Roaming is part of ensuring interoperability in the industry, which refers to how different systems, technologies, and devices can be set up to exchange information or data in a standardized and efficient manner.

In the EV industry, interoperability plays a crucial role. It allows EV drivers to charge their vehicles at a wider range of locations, thereby enhancing the customer experience and mitigating 'range anxiety'. For providers, interoperability presents a plethora of new business opportunities.

The challenge lies in preparing your systems for integration with other providers. Before you can start an EV roaming implementation, it's important to understand the technical and practical issues involved. This whitepaper will act as your guide.

What this Book Covers

01

Part One:

The Basics

The importance of interoperability

Why roaming is good for business

Finding your partners

About standards and protocols (especially OCPI)

02

Part Two:

Laying the Foundations

Preparing your data models, business systems, and IT platform for an OCPI implementation.

How better preparation reduces costly surprises later and results in a quicker time-to-market.

03

Part Three:

Practical Tips & Advice

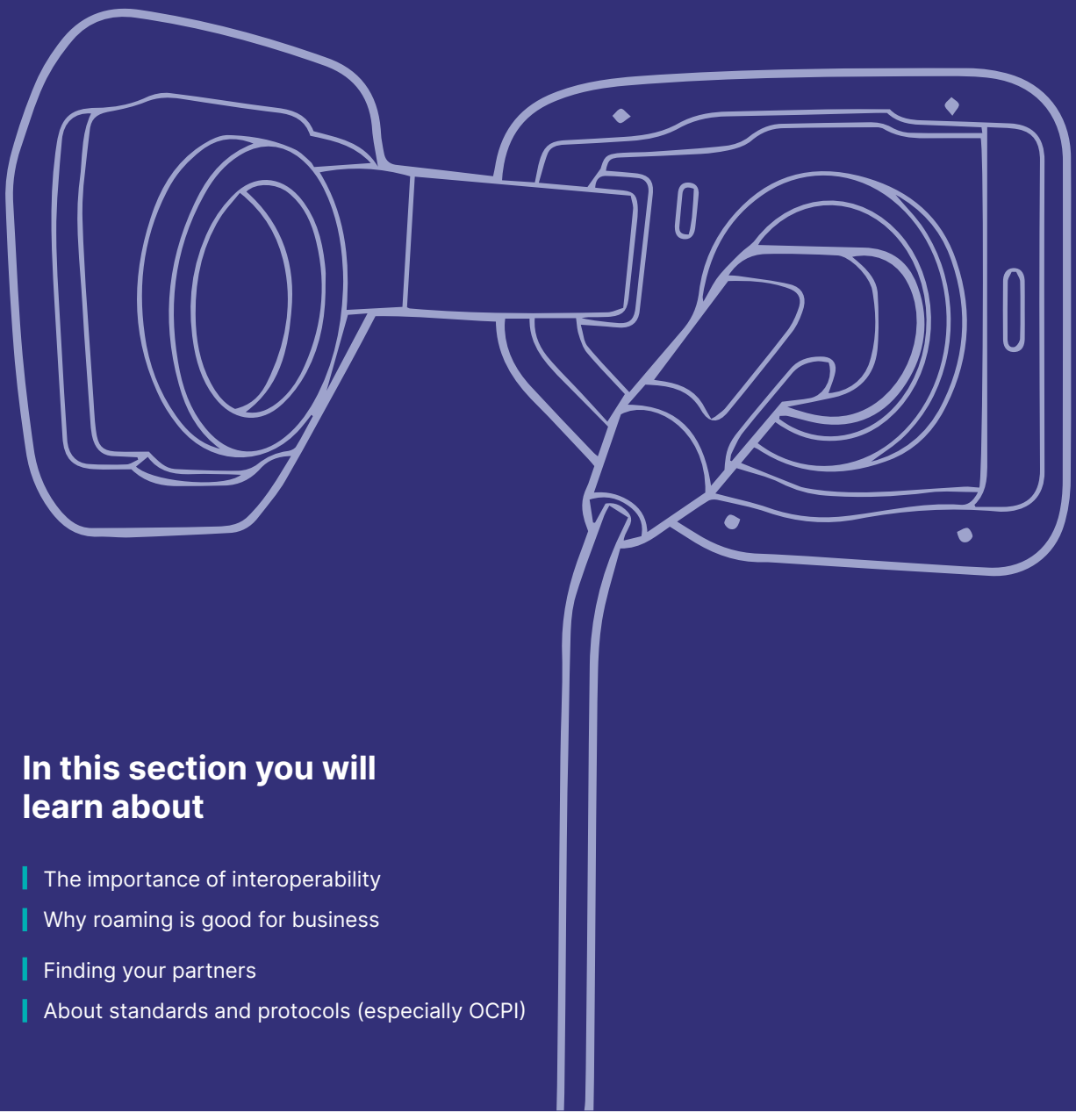
How to adopt an MVP mindset for roaming

Some practical ways you can start small whilst thinking big

Top tips gleaned from our extensive experience in the field

Part One

The Basics



In this section you will learn about

- The importance of interoperability
- Why roaming is good for business
- Finding your partners
- About standards and protocols (especially OCPI)

The Importance of Interoperability

Interoperability and roaming are concepts that most people are familiar with due to mobile phones. Thanks to international roaming agreements between mobile network operators, and system interfaces that allow "home" and "abroad" networks to integrate and share data, people can use their mobile phones anywhere in the world without purchasing a new SIM or signing up for an account with a local provider. The goal is for the user to be able to use any device, anywhere. This same concept is crucial to EV drivers who want to know that they can charge their vehicle wherever their travels may take them. Besides travel, roaming is also becoming increasingly important between local and national players. For example, car park operators or gas stations might want to provide charging services to their customers, so they create roaming relationships with local CSOs and leverage this offering in their marketing.

Interoperability, in this sense, will ensure that electric vehicle owners will be able to charge their cars at any available charging station, regardless of the provider or the technology used. The rising popularity of electric vehicles means that EV interoperability is now critical. To prepare for this trend, CSOs and eMSPs must learn the whys, hows, and challenges of interoperability and EV roaming.

Why Roaming is Good for Business

Providing roaming capabilities can be complicated and costly, but no CSO or eMSP can afford to stand on the sidelines.
The following advantages offer compelling reasons to go ahead with an EV roaming implementation:

Increased customer base, utilization, and revenue

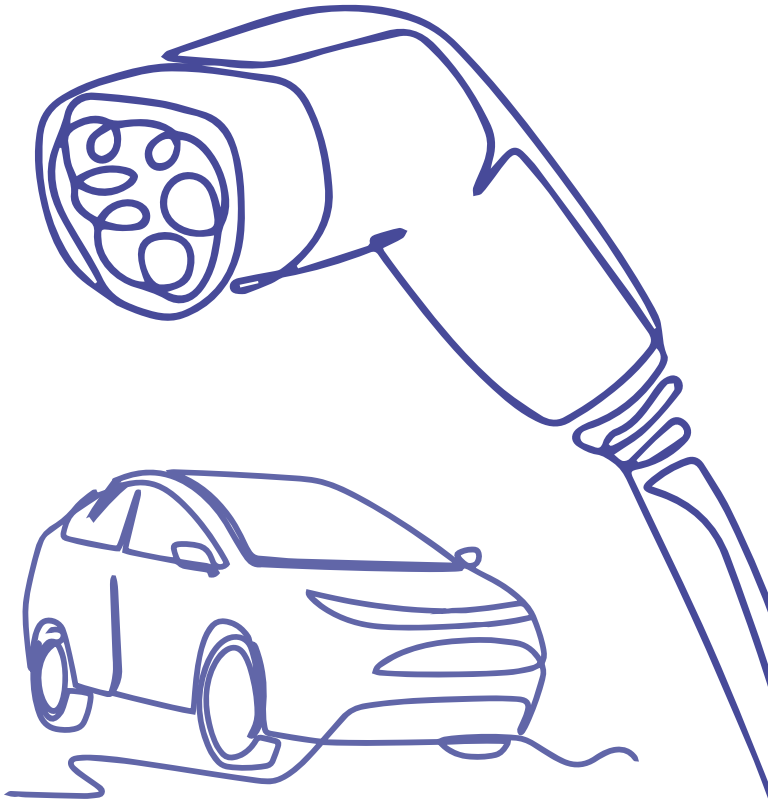
Opening up your charging stations to a larger pool of customers will open up new revenue avenues as well as increase the utilization of your existing stations.

Reduced costs

By collaborating with other EV charging providers, you can create agreements whereby the burdens and costs of installation, operation, and maintenance are shared. Done right, you can even lower your long-term IT costs.

Improved customer experience

Your customers will enjoy better service, which will increase brand loyalty.



Explore your Partnership Options

You understand the business benefits of roaming and are now ready to find suitable partners to help you expand your reach. Currently, CSOs or eMSPs have two main partnership options:

Bilateral agreements with specific partners

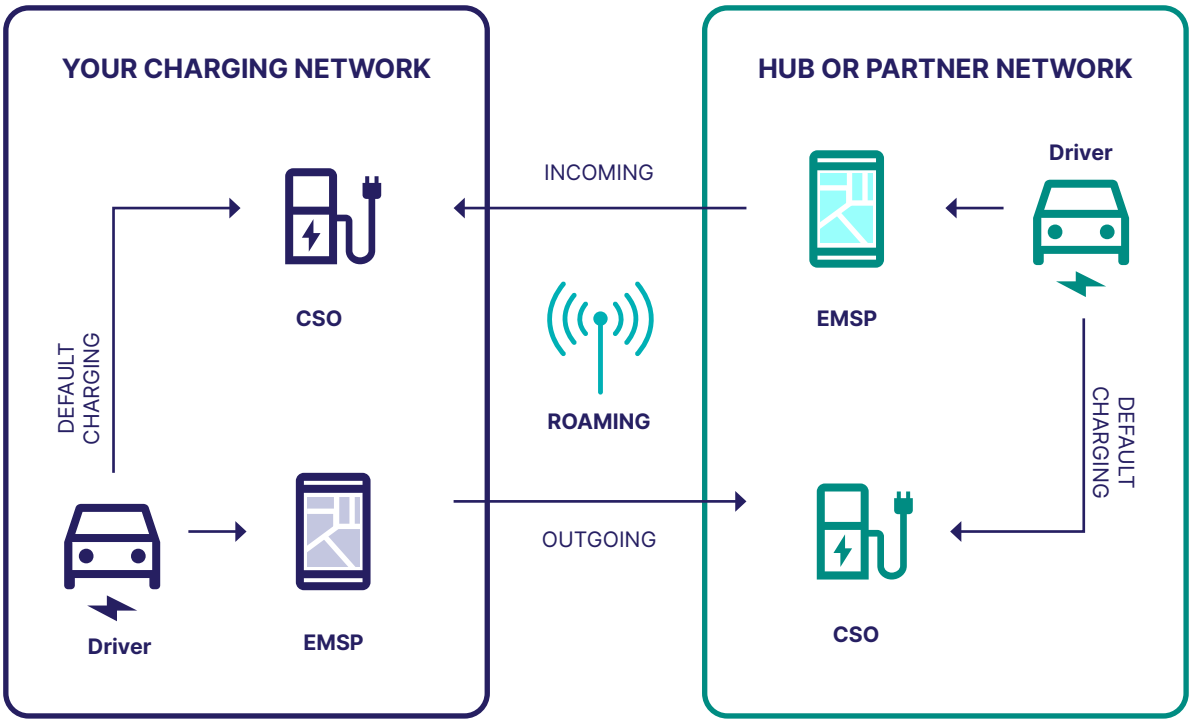
You can create a separate agreement with each partner you want to roam with. These peer-to-peer agreements are popular as they can help smaller operators consolidate their positions in the market and be "stronger together." Other players, such as car park service providers, may also seek bilateral agreements with charging operators so they can offer charging facilities in their parking lots.

Direct integration with a roaming hub

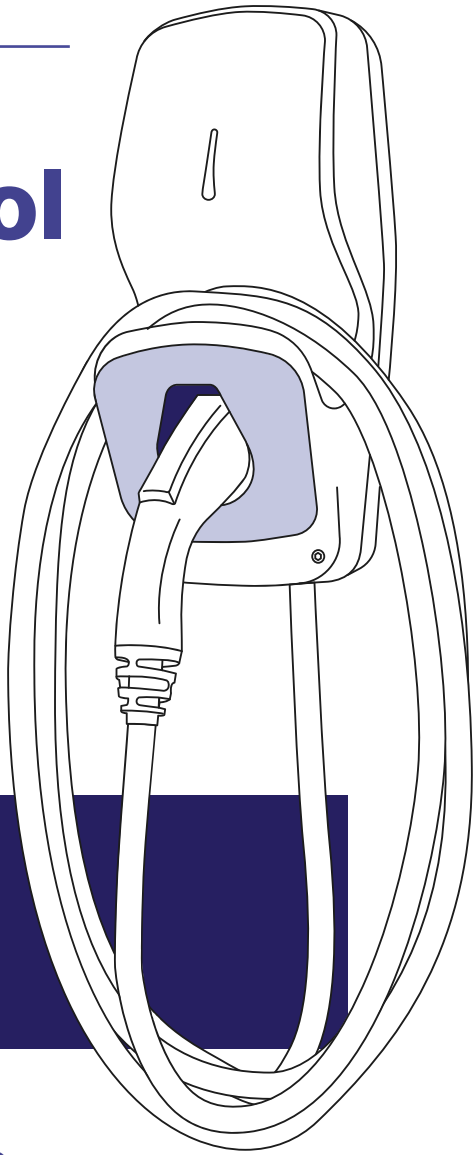
Through integrating with roaming hubs - such as Hubject and Gireve - you can give your customers access to any charging station within the roaming hub's network from only one integration. Some hubs may also support additional access to other services, including real-time monitoring of charging stations, simplified billing, and data analytics.

While hub integrations present numerous advantages, in some markets, CSOs and eMSPs are increasingly opting for peer-to-peer agreements, seeking more flexibility in terms of cost and pricing. To determine the most suitable strategy for your business, it's essential to assess your specific use case, and carefully consider the costs and benefits of each option. Consulting with experts in EV roaming implementations can streamline the decision-making process.

The potential roles and directions of roaming between a CSO and eMSP



Follow the Protocol



The goal of data protocols is to standardize the methods and processes by which systems transmit, receive, and interpret data, enabling smooth and reliable communication between them. In the EV world, several industry-specific protocols nowadays help us ease the transition into a global and interconnected EV charging infrastructure. They do so by standardizing the terminology, data models, format, and "rules" used when different systems exchange information about their charging points, customers, sessions, transactions, and more. Standardizing the technical framework and methods of EV roaming is pivotal to accomplishing seamless interoperability in the market, ultimately benefiting the end users by providing a better user experience.

There are currently four main protocols in use across the global market.

Two of these protocols - eMIP and OICP - are proprietary of the large roaming hubs Gireve and Hubject. The other two - OCHP and OCPI - are independent.

Short overview of the main protocols

	eMIP	OICP	OCHP	OCPI
Governing body	Gireve, a commercial roaming hub	Hubject, a commercial roaming hub	E-clearing.net, a non-commercial roaming hub	EVRoaming Foundation and its community
Supported roaming cases	Only Gireve's own roaming hub	Only Hubject's own roaming hub	Peer-to-peer and roaming hubs	Peer-to-peer and roaming hubs

As industries mature, one protocol tends to emerge as the dominant one and eventually becomes the "de facto" standard. As OCPI is currently the dominant framework shaping the industry, the rest of this paper will focus on that protocol.

LEARN MORE

For a more comprehensive guide to EV roaming protocols, read this summary on the EVRoaming Foundation's website. Still want more? Read the research report from the evRoaming4EU project.

OCPI in a Nutshell

The Open Charge Point Interface protocol (OCPI) is an open protocol for communication between CSOs and eMSPs. It is managed and maintained by the EVRoaming Foundation and its community, which ensures it remains independent and free to use, benefitting the whole EV industry.

OCPI serves as the backbone for a scalable, automated roaming setup, streamlining communication between the charging platforms of the various stakeholders. It supports all essential functionalities for managing and executing charging sessions. These include authorization, data exchange about charging stations, session management, transaction status events, and more.

Built on a RESTful API architecture over HTTP, OCPI employs the widely-used JSON data format for data representation. The protocol uses both 'pull' and 'push' methods for data exchange. This means a party can either request (pull) data when needed or receive (push) data automatically when there's an update, which helps with getting real-time updates and responses quickly.

At the time of writing, two major versions of the protocol are in use, and one is in development:

Version 2.1.1

This is the most widely adopted in current real-world implementations. It serves the purpose of roaming well and is supported by many of the major platforms and hubs.

Version 2.2.1

This contains several new and highly-desirable features. While many organizations are considering it for their future OCPI implementations, it is not the obvious version to start with depending on your roadmap.

Version 3.0

This version is currently under development and promises to include a range of exciting new features such as support for Plug & Charge and Autocharge, in addition to vastly upgraded communication and security/privacy features.

The OCPI protocol is divided into several different modules, each of which handles a specific aspect of the communication and data exchange between the systems. The main modules include:

Locations module

this handles the discovery of charging stations, and provides information about the location and availability of these.

Tariffs module

used together with the locations to provide details of the price that applies to a specific charge point and session.

Tokens module

manages user identification, and defines the exchange of tokens (e.g., end-user RFID tags).

Sessions module

handles the initiation and status of charging sessions. Can be used to "track" the status of a charging session in real time.

CDRs (Charge Detail Record) module

defines the exchange of completed charge sessions for billing and usage tracking.

Commands module

enables the remote control of charging stations, allowing the systems to e.g., start and stop a session.

In addition to these modules, the OCPI protocol also includes several additional features depending on the version, such as security mechanisms, smart charging support, and hub functionality. It's worth mentioning that the versatility of OCPI extends beyond just enabling roaming. It's increasingly being utilized in charging station monitoring, data export and report generation, and payment integrations. As the industry continues to evolve, updates and refinements to OCPI will follow suit. Staying on top of these changes is crucial.

Wrapping it up

To stay competitive in the current market, you need a plan and roadmap for EV roaming that takes the latest version of the OCPI protocol into account. While time-to-market should be a prime consideration, you must get all your ducks in a row before getting started, and this means answering any lingering doubts and questions you have about the scope and justification for the project, such as:

- Are you clear about your EV roaming business case, or do you need to explore this further?
- Will you act as both CSO and eMSP or just assume one of the roles?
- Are you planning to go all in with an "everybody to everybody" roaming agreement, or does it make more sense to implement a one-way roaming scenario with a single partner?

Prepare for OCPI!

Do you need help clarifying your business case or want advice about the scope of your OCPI implementation?

Get Metergram's tailored workshop packages covering strategic issues as well as tactical and practical advice.

- Legislation and industry trends - where is it heading?
- Key learnings from multiple real-world implementations
- Protocol overview and deep dive into the modules
- Data preparation & cleaning
- Fitting implementation into roadmaps and existing infrastructure

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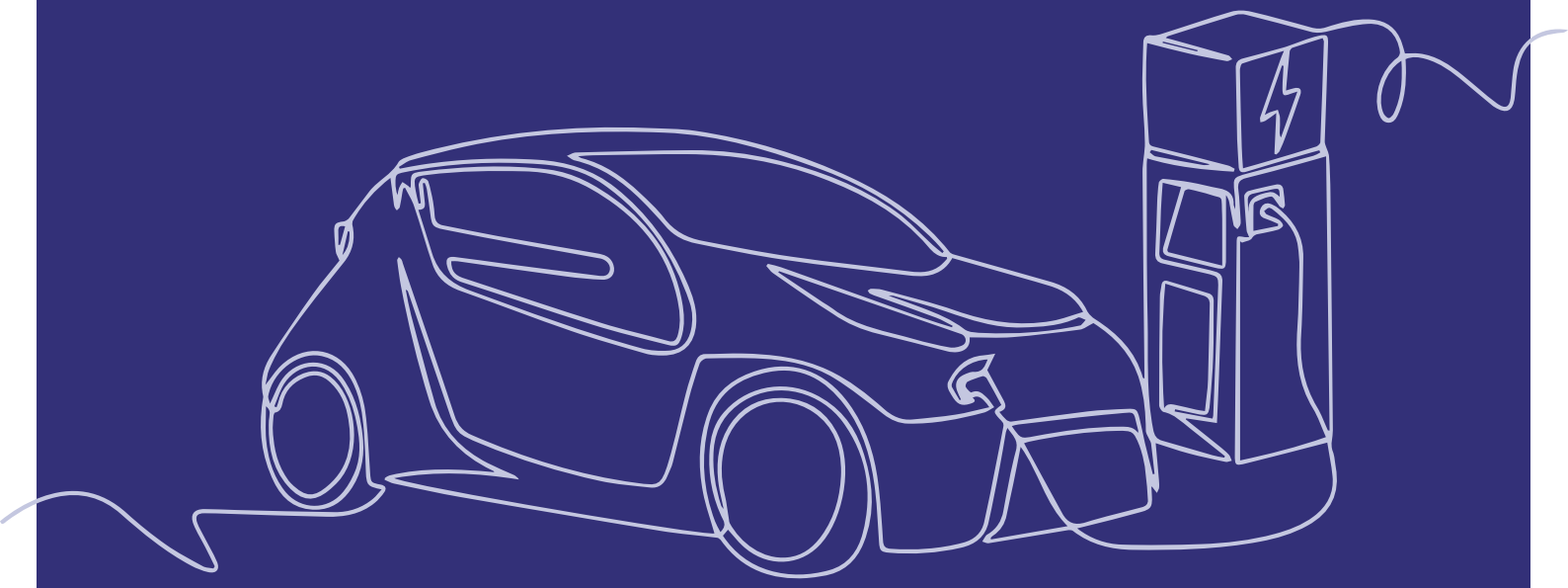
Part Two

Laying the Foundations



In this section you will learn about

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- How better preparation reduces costly surprises later and results in a quicker time-to-market.

Get Your Data in Order

Getting your models and actual data ready for an OCPI roaming implementation can be a lot more complicated than you think. Before you start, you will most likely have to do a considerable amount of housekeeping in your current systems. The following sections bring up some of these areas and exemplify some of the considerations you could be facing.

Where Are Your Chargers?

An obvious first focus area is a data entity such as the chargers themselves. Consider questions like:

- How are you representing your chargers across your systems landscape? What entities and what structure is used?
- Where do you keep the master data about the chargers and their configuration?
- How do you uniquely identify them, and their location in the physical world?
- What connects my charger IDs to my operations, or to the operations of others?

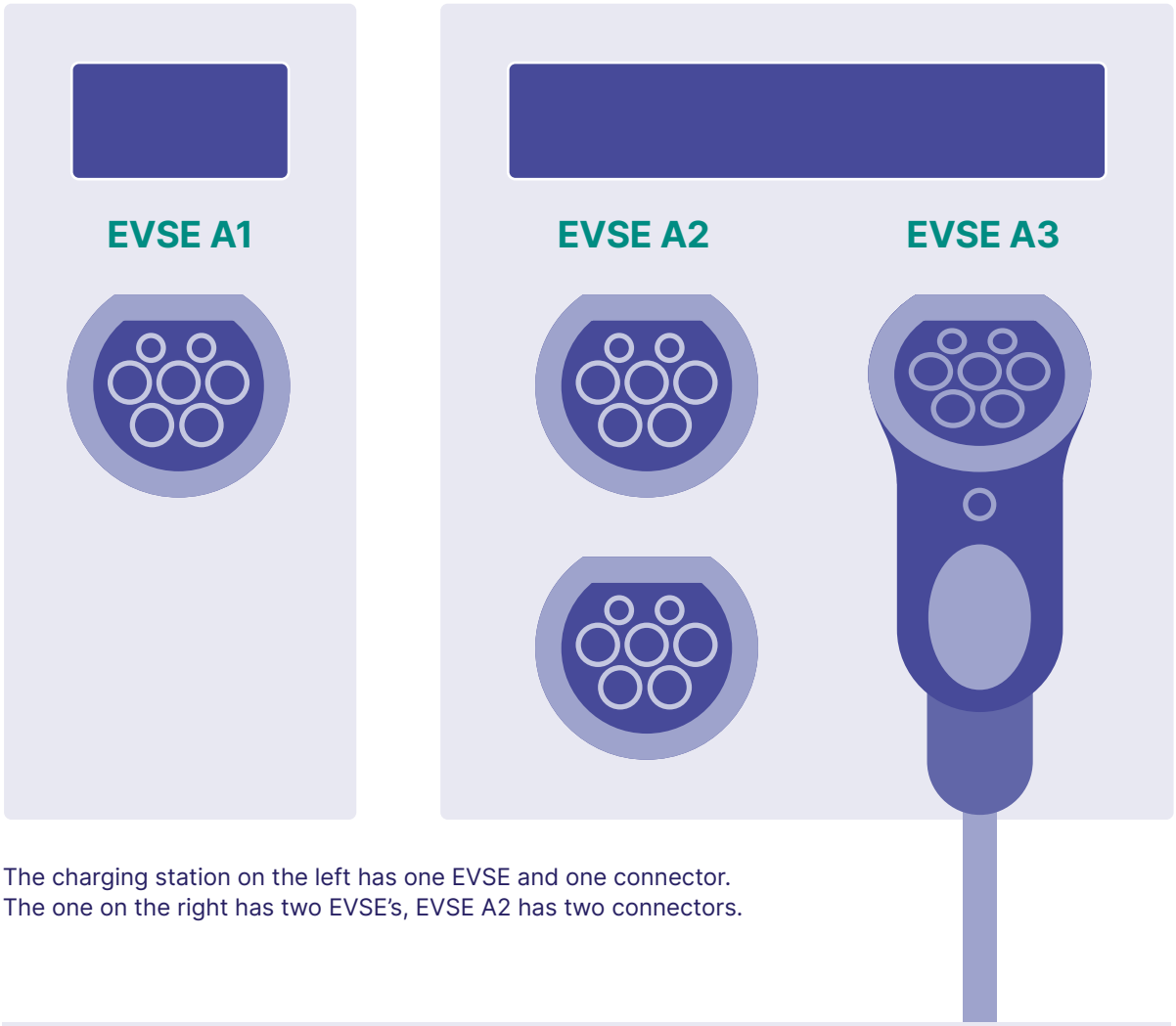
As an example of data preparation, in the world of OCPI, it's recommended to use the eMI3-based format as a unique identifier for chargers (EVSEs). The eMI3 syntax is a unique format that, in simple terms, requires you to present the ID in the format of

<EVSE ID> = <Country Code> <S> <Spot Operator ID> <S> <ID Type> <Power Outlet ID>

to ensure global identification. So, during your implementation, bear in mind that you might have to rename your chargers or, at the very least, create a mapping between the chargers' internal IDs and the new OCPI-compliant ones.

Another potential area for data preparation could be your system's entity-relationship model concerning charging stations and aligning it with EVSE terminology. The previously discussed ID technically belongs not to the charging station, but to an Electric Vehicle Supply Equipment (EVSE) unit. Defined as an 'independently operated and managed part of a Charge Point that can deliver energy to one EV at a time', an EVSE is distinct from a charge point, which can host multiple EVSEs. Further, mapping this to the concept of connectors in existing systems can be a complex task. While an EVSE can offer multiple connectors, only one can be active at any given time.

If you are using OCPP 2.x in the communication to your chargers, you're likely already familiar with the three-tier EVSE structure. In OCPI, a similar structure is used, but with another top-level entity – the location. Thus, in OCPI the structure is defined as 'location-EVSE-connector'.



The charging station on the left has one EVSE and one connector.
The one on the right has two EVSE's, EVSE A2 has two connectors.

It is common to see setups based on OCPP 1.5 or 1.6, where a complete restructuring of this data is needed. It might even be necessary to introduce new entities in your data models, new tables into your database, or even completely rethink how you represent your equipment in the field.

Who is Actually Charging?

It is not only physical equipment that needs to be represented according to OCPI standards, but also customers, drivers, and subscribers. In OCPI, a contract ID per definition identifies the EV driver within an eMSPs platform, and it is recommended to follow the eMI3 standard here as well. Analogous to the EVSE ID discussion above, for driver contracts, the so-called eMA ID syntax should be used instead.

In real-world scenarios, almost no platform represents the hierarchy and details of a customer, billing party, driver, subscription, token, or RFID in quite the same way. Add to this, references and constraints imposed e.g., by a fleet management scenario, and it gets even more complex. Some of the data might even be stored in a master ERP system, meaning that extensive mapping work and data cleanup operations could be needed before it is possible to even get started with the new models.

Align the Business Operations

In the above section, we discussed some of the questions and preparations that need to be addressed with regard to your current software platforms and models. However, your implementation also heavily impacts the business and operations side. For example, if it was necessary for you to rename the charging station IDs to enable roaming from other eMSPs, you might need to post new instructions and stickers with QR codes, and new EVSE IDs on all your equipment in the field. As this would be a costly endeavor, any clever technical workarounds identified in earlier phases of the implementation would pay off quickly now. In addition, bring your customer service team in early and inform them of all the changes. They will possibly have to assist other providers' customers now charging on your stations or vice versa.

Another major set of decisions you will need to make is in the area of pricing. The OCPI tariff module is versatile and flexible, but it will not necessarily cover all your pricing scenarios. For example, do you bill your customers only in terms of consumed energy and time, or do you impose charges or parking penalties with custom logic that might not be directly supported by OCPI? In our practice, we have seen examples of extremely complex tariffs and pricing schemes that are almost unique to each EVSE in the field, requiring the creation of thousands of OCPI-mapped tariffs. Such scenarios may be technically supported by the protocol, but they also introduce many practical consequences in real-world implementations.

Deciding on the actual prices for roaming transactions that apply to both end-users and partners, is another business decision that needs careful thought. You will also need to establish a process for invoicing and reconciling these transactions. Investigate whether the finance department has specific requirements for usage reporting, invoicing, or tax reporting across different jurisdictions, etc. It is imperative that you understand these requirements early in the project. If your implementation covers all aspects from scratch, it will avoid costly surprises when reporting or audit day arrives. Having a business analyst by your side during the project can help mitigate most, if not all, of these pitfalls.

Assess Your IT Landscape and Architecture

For a CSO, there are two typical ways of implementing OCPI. Either it is integrated directly into an existing Charging Station Management System (CSMS), or it is built as a separate platform (or set of services). This separate platform then usually communicates with the CSMS via custom APIs, event buses, and/or other shared resources. Which approach to pursue is highly dependent on factors such as existing architecture, technology stack, and future roadmap activities. Architectural decisions are also guided by factors such as which role the implementation will support. As an example, implementing OCPI in the pure role of an eMSP generally tends to involve less effort architecturally. Regardless, numerous considerations and challenges always need to be addressed when laying out new software and solutions architecture of this magnitude.

Here are some guidelines and pointers to get started:

- Always start by drawing out your current system or service landscape. Consider what services hold what data, and what are the defined roles of each?
- Once this is done, the roaming implementation can be fitted. You will also need to inventory all data needed according to the OCPI standard and map this to your own models and data sources.
- Identify what business logic flows need to be established to and from the OCPI side, and what integrations need to be built. Do you for example rely on a third-party ERP system that needs extension work?
- Research what endpoints your CSMS already provides out-of-the-box, and whether you would need to extend some of them. Often, some parts of an existing API can be re-used but rarely does it contain everything needed.

Bringing in a solutions architect with experience in OCPI can be helpful for all of the above. An experienced professional will be able to guide and support you in making a full analysis, mapping out all the integration points, and identifying any dependencies.

Wrapping it up

The practical complexity of an OCPI implementation means that turning to experienced professionals can make the difference between a smooth, hassle-free project and one that is delayed by unnecessary pitfalls. Before you begin, talk your project through with someone that understands all the aspects of launching such an endeavor.

Here are some preliminary steps:

- Make sure you know where your data lives and what structure it has.
- Consider whether you are ready for data cleaning, or do you need some help?
- Identify internal stakeholders in your organization, and bring in experts to explain the process to them and support them.
- Review your current solution architecture and how a roaming service would fit in.

Get the OCPI prep package!

Leverage our experience to avoid pitfalls and breeze through your OCPI implementation:

- Data cleanup
- Database preparation
- API set-up
- ERP integration
- Access to systems architects, business analysts, and QA & solutions architects

Contact us! sales@metergram.com

Part Three

Practical Tips & Advice

In this section you will learn about

- How to adopt an MVP mindset for roaming
- Some practical ways you can start small whilst thinking big
- Top tips gleaned from our extensive experience in the field

Build and Iterate:
The MVP Way

We have all heard about, or experienced, software projects that have been unsuccessful in terms of timeliness, budget, planning, scope creep, or any other reason imaginable. Though there is no surefire way to deliver an implementation of the magnitude we are discussing here, there are certainly ways to mitigate risks and avoid the most common pitfalls. Real-world experience, an excellent Software Development Lifecycle (SDLC) process, adherence to agile methods, and hands-on project governance are some that have proven themselves over the years. Another key factor is to "start small, whilst thinking big."

Often, the aforementioned approach is manifested in developing an MVP (Minimum Viable Product). There are several reasons why this has become such a popular concept, and thousands of great books, articles, and blog posts have been written about it. In the following sections, we focus on some tips specific to an MVP for a roaming implementation and OCPI. To start off, here is some general guidance and ideas on how to think about your MVP:

1. **Identify core functionality**
   Identify the essential features and functionalities of your implementation that will provide the most value to your users and stakeholders.
2. **Keep it simple**
   Your MVP should be simple. Avoid overcomplicating it with too many features, and don't worry too much about "future needs". Rather go for robustness.
3. **Test and iterate**
   Be agile. Test your MVP early and gather feedback. Use this feedback to make necessary changes, and iterate. Fail fast!
4. **Focus on scalability**
   Ensure your MVP is designed with scalability in mind. Consider how it will handle increased traffic and load. This will pay off sooner than you think...
5. **Be cost-effective**
   As an MVP, it should be cost-effective to develop and maintain. Keep costs low and focus on the business value delivered in each and every iteration.
6. **Have a clear vision**
   An MVP should be part of a larger vision for your product. Maintain a technical roadmap outlining what future iterations of the product will look like.

Implementing the MVP philosophy in practice can be challenging. Having an experienced Product Owner or Agile Coach on board can be instrumental in adapting this framework to your specific project and its limitations. If they have prior experience with OCPI implementations, it will certainly increase the likelihood that the project will meet its time, scope, and budget requirements.

MVP Ideas for OCPI & Roaming

Given the critical importance of interoperability on your roadmap today, the first goal should be to get your roaming project implemented in some capacity. You can always add functionality and expand later on. A crucial part of MVP thinking and speeding up time-to-market is to minimize the initial scope. With the right experience, it is possible to identify significant parts of a roaming implementation eligible for an iteration-based separation into the future backlog. These iterations can then be on-the-fly prioritized according to ever-changing business needs or budget constraints.

Here are some practical suggestions for minimizing the initial scope of your OCPI implementation:

Minimize the modules to implement. For instance, let your first implementation as CSO be with a charging station location data aggregator. This would, in essence, only require you to implement the locations module in order to share your stations and their availability. An early project win!

Limit your role in the OCPI ecosystem. Start out implementing only one of the roles (CSO or eMSP) even if your business acts as both. This way, you essentially cut the first iteration of development in half. Use the key learnings for the second half!

Keep it simple by initially sticking to the "pull" method of the protocol as much as possible. "Push" is actually not mandatory in OCPI, so start out simple by minimizing the logic needed. Once you pursue an implementation of both methods, try to refactor and reuse code logic.

Do a sparse implementation in regards to e.g. what object/entity data to include, and which query parameters to support (and how). Read the specification carefully and pay attention to what is actually required. Omitting unnecessary data, or keeping some logic extremely basic in the beginning, can really add up in terms of effort savings. This is why we have future iterations...

An important benefit of the iterative MVP approach is that you buy yourself some time to think through the bigger picture, prepare your existing platform, align external vendors, and start specifying internal APIs. All while getting started right away writing code, creating some essential scaffolding and groundwork that will be leveraged during the future full-blown implementation.

Prepare to Win!

You've built your OCPI platform, you've lined up a roaming agreement with your first roaming partner utilizing the new build, and now it's time to go live! But wait, in all the excitement of going live, it's easy to overlook all the work that precedes it. Here are some key learnings our industry professionals and partners have gleaned from real-world implementations that should help you prepare for a smooth and seamless go-live.

Have a roaming partner in mind from the start

Before you even start implementing OCPI, have a future roaming partner in mind. The best practice is to survey all your potential partners and research what version of OCPI they support. Also, look into things like what methods of push and pull to use in which scenarios and flows. Talk through the use cases with your future partners and "negotiate" exactly how things should be set up between you. This can save you time and effort, particularly if you can agree to leave certain optional parts out of the initial implementation.

Understand your counterparts' business and customers

Do they have any rare or special use cases or requirements? On what scale do they operate? How many EVSEs and sessions can you expect to face? Have you taken this volume and performance impact into account? Will their customers call your customer service if something goes wrong at your charging stations, and vice versa?

Know their OCPI platform

Do they use one of the major CSMS systems on the market? Then they will likely need to allocate vendor time or secure support agreements to get technical help if something goes wrong. Have they built their implementation in-house? If so, what level of EV knowledge does their development team have, and would it be beneficial to talk developer-to-developer or rather designate a single point of contact with a project manager or business analyst? In either case, check if your contact will be responsive, have a long backlog, work in long sprints, and will be willing to prioritize your project.

Test early and keep testing.

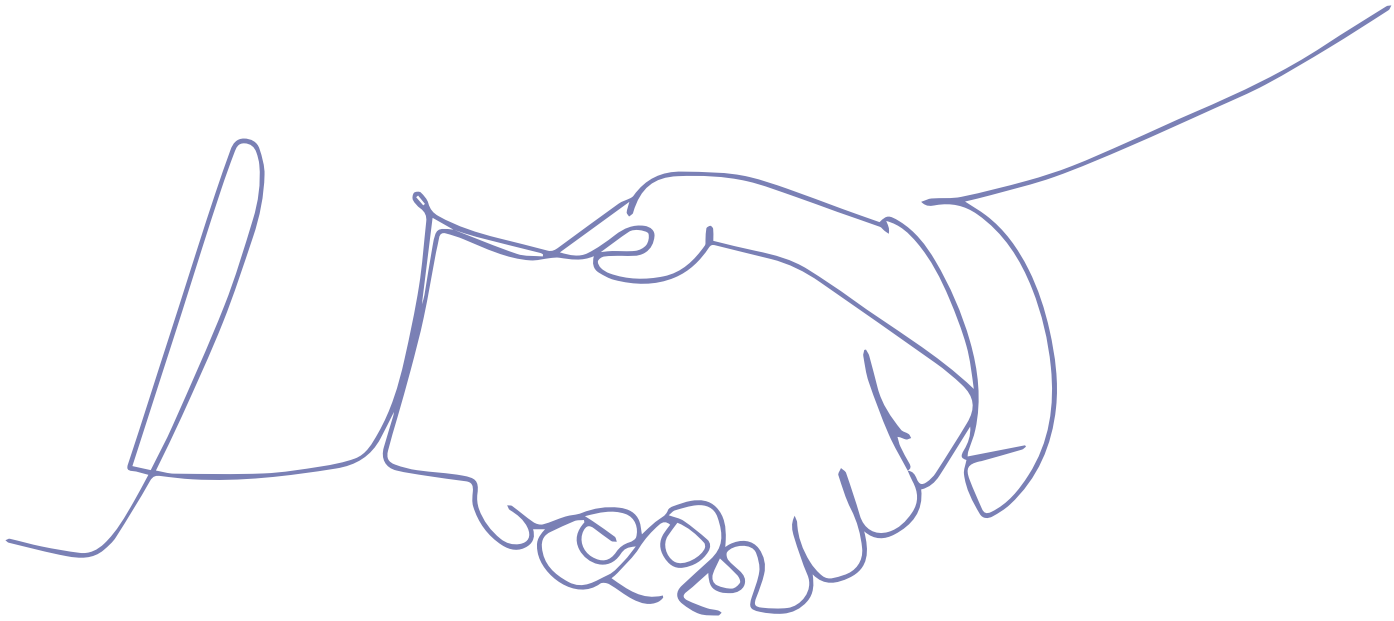
Make sure you have a QA environment (and preferably also one for staging.) Use this environment to start testing together with your roaming partner as early in the project as possible. Exchange credentials and get the environments talking to each other from day one. Then dedicate QA resources in your team and book regular "live" testing sessions together with their team. Work through test cases systematically and retest for each environment. Remember that production data differs from test data, and you never know when the configuration may have changed.

Anticipate failure and issues.

No integration is the same. Just because you successfully got through your first OCPI partner integration, the next one might throw up other unanticipated issues. OCPI is a great protocol but at the end of the day, it is the implementation itself that can lead to issues. There are many areas for misinterpretation and more bugs than one might expect. Even among the major platforms. Prepare to swallow your pride and implement hotfixes, tweaks, and slight side steps from the standard to get things up and running in the field.

Follow up and reconcile.

Once you are live with an OCPI integration, make sure to follow up by studying logs, running reports, and pulling data for reconciliation from your partners. This is especially important in the early stages of a new partnership, where things can get out of sync for a number of reasons. For example, temporary disruptions in network performance or systems availability to simple bugs or unforeseen business logic behavior. Keep an open dialogue with your counterparties; you are roaming partners, after all!



Start your OCPI implementation!

Work with Metergram to:

- Define your business case and project scope
- Get practical hands-on assistance with every stage of your OCPI implementation
- Gain access to relevant industry experts, including software engineers, database experts, business leaders, and more
- Enjoy a smooth and timely implementation that avoids common pitfalls

Contact us!

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About Metergram

We are system integrators and software developers with expertise in the field of digital EV charging infrastructure. We empower you to deliver exceptional value to your business and help you avoid all the practical pitfalls and caveats of real-world implementations.

At Metergram, we recognize the unique challenges and opportunities of the rapidly evolving EV charging industry. As your trusted development partner, we're committed to helping you accelerate your business.

Metergram is a founding member of the AVERE Interoperability task force and a contributing member of EVRoaming Foundation.

AVERE
The European Association for Electromobility

OPEN CHARGE ALLIANCE

EVRoaming Foundation
Realising cross-border charging

Your feedback is important to us.

Is there anything else you want us to cover?
What are your experiences with OCPI to date?
Have you got any stories or advice to share?

As a community striving towards the common goal of creating a better EV charging industry, we're in this together!

Get in touch!

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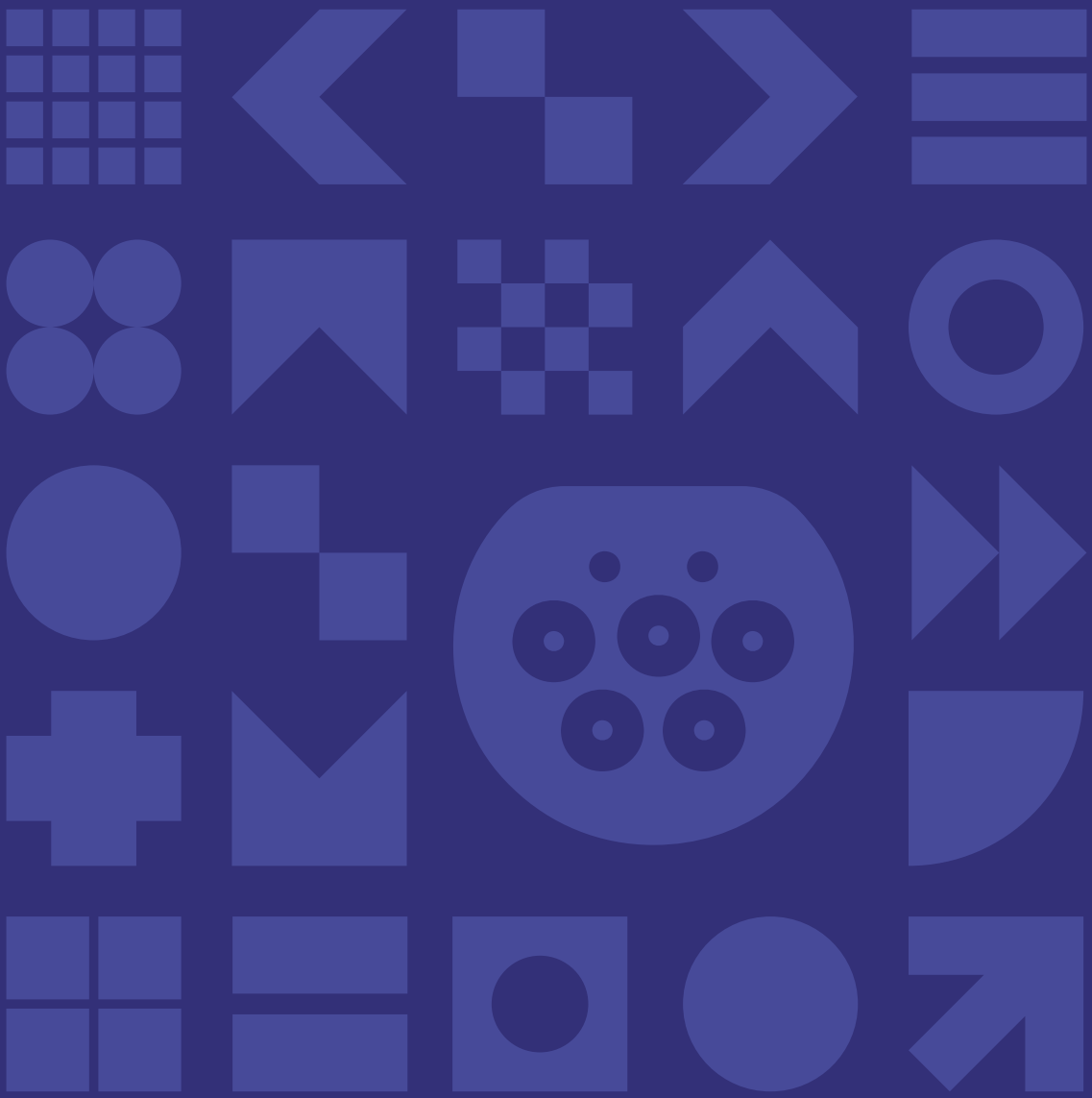

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