



WHITEPAPER

Standard interfaces for charging e-buses

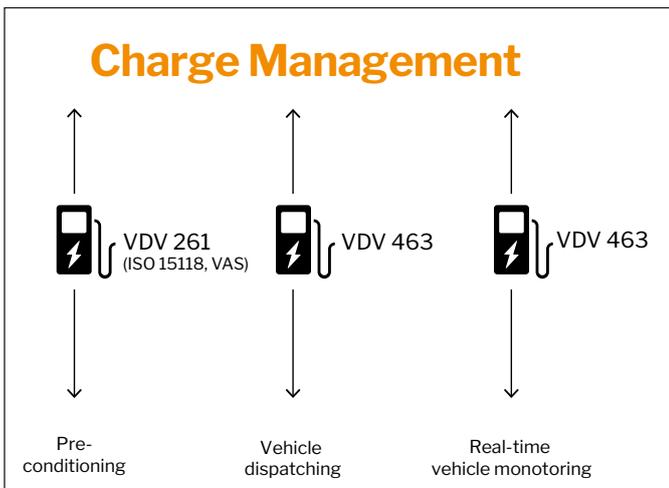
Interoperability in data exchange for Charge Management

It has become increasingly evident during recent years that focusing on interoperability within e-mobility projects is hugely important. Ensuring compliance with common technical standards and smooth interaction between the systems simplifies things greatly. Compared to diesel buses, filling up e-buses is a far more

complex and lengthier task. In addition, the limited range of e-buses means that the charge status has to be monitored constantly. This requires interoperability with ITCS (Intermodal Transport Control System) but also with other systems such as a charge management system.

More complex data communication

Transport companies receive software support when they make a decision to implement e-mobility. This covers all new tasks and includes an ITCS adapted to the requirements of e-buses, a planning and depot management system, a system for range forecasting and a charge management system. As wide-ranging as transport companies' projects are, they all have one thing in common – they need an intelligent charging concept to ensure that their vehicles are charged as required, as cost-effectively and gentle on the battery as possible.



Data communication standards.

Some buses may need to be preconditioned and they must be ready to leave the depot with the right amount of charge. The charging process chain of vehicle, charging infrastructure and charge and depot management system needs a complex data communication setup.

Compliance with existing standards

An increasing number of tenders require compliance with existing standards. **SAE J1939** regulates communication between vehicle components. **VDV 238** or **FMS** (Fleet Management Standard) regulates the data exchange between the vehicle and the on-board computer. Developed by a consortium of manufacturers, FMS is a communication protocol and a physical interface for transferring vehicle data to the on-board computer in a uniform way, regardless of manufacturer.

OCPP (Open Charge Point Protocol) and ISO 15118 are standards for data exchange between the vehicle and external components. **OCPP** is an application protocol and standardizes the transfer of data between charging stations and a charge management system. **ISO 15118** is an interface description for data exchange between the charging station and vehicle.

Not limited to one particular manufacturer

Standard interfaces for communication mean that companies no longer have to develop their own solutions which tend to entail long periods of integration and require considerable effort. The main advantage is flexibility thanks to open interfaces and, as a



A fleet of busses in Deventer (Netherlands) uses management for charging.

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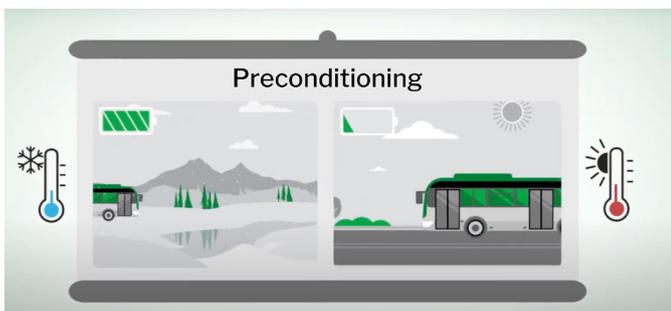
E-Mobility projects demand that we pay attention to interoperability from the outset.

Stefan Krause,
Product Manager
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result, they are not limited to a particular manufacturer. This guarantees compatibility, which in turn, greatly simplifies processes. For data communication to work as it should, all system components required for the charging processes must use standardised interfaces which have been developed in recent years. Many transport companies have already come to recognise and profit from this.

Vehicle preconditioning: VDV 261

VDV specification 261 from the Association of German Transport Companies (VDV) is based on ISO 15118 and regulates preconditioning between the charge management software and the vehicle via the charging station. An intelligent charge management system can adjust the inside temperature of a bus before it sets off.



VDV 261: While connected, the bus is heated or cooled, to the correct temperature.

In VDV 261, the charging station is used as a place for transferring data. Preconditioning is negotiated directly between the vehicle and the charge management system. The advantage is that this works automatically for all buses. No manual intervention is required which increases productivity and safety. In addition, preconditioning battery-operated vehicles gives them a better range as the energy required to heat or cool the vehicle is not taken from the battery but from the power grid.

When the electric bus is connected to the charging station, it transmits data that can determine precisely if and what kind of preconditioning it needs. The vehicle is fully prepared and ready to go at its time of departure. The challenge lies in achieving smooth communication between the vehicle and the charge management system via the charging station because this chain of communication and its encryption has to be coordinated with all points. In short, VDV specification 261 increases



Electric bus is preconditioned while plugged in.

es passenger comfort, helps with the range and saves time and also money.

Communication with external systems: VDV 463

VDV specification 463, for communication between external components such as the depot management and charge management systems, was developed just last year. Its job is to mediate between the charge management system and upstream systems such as ITCS or a bus depot management system. These systems record actual data which is exchanged all the time and in both directions. This interface was developed for three applications:

1. **Manage circulation** and provide charge request (from ITCS and BMS to the charge management system: new or change request)
2. **Control charging process** and transfer information about the charging processes (from the charge management system to ITCS)
3. Implement a **preconditioning request** from an upstream system in charge management and return the current status

Interoperable data communication

These interfaces make data exchange possible between the system components and are therefore essential for interoperable data communication. However, another factor that also frequently complicates matters is, if vehicles and charging stations made by different manufacturers are spread over different lo-



A complex data exchange is required to manage e-bus charging processes.

cations. All of these components need to be able to seamlessly communicate with one another, and in particular a central charge management software has to be able to map and manage all of these components.



Bus operators receive valuable information which simplify their tasks.

Challenges going forward

Even when the existing interfaces are used, a charge management system cannot simply be “plugged and played”. Many manufacturers are still coming to terms with how to technically implement these standards. The greatest challenge faced in any e-project is therefore establishing high quality and standard compliant communication between the components to implement these standards correctly to ensure the data content has sufficient availability and depth of detail. Whereas communication between the charging station and charge management using OCPP often works well, preconditioning the vehicle still requires a considerable amount of implementation work. CarMedialab collaborates closely with a range of vehicle manufacturers to support implementation and ensure correct preconditioning. Adopting ISO 15118 for communication between the charging station and vehicle also requires a

great amount of detail and a high level of expertise in coordination with vehicle manufacturers.

The standardised FMS interface for transferring vehicle data to the on-board computer is particularly significant with regard to the limited range of e-buses mentioned previously. This standard is especially important because information about the charging status and the remaining battery capacity must be available at all times to ensure the smooth operation of electric buses. The information transferred is hugely important as the range is limited by current battery capacities and the energy consumption of electric buses depends on a range of parameters (such as the temperature on a given day, the number of passengers or the topology of the route). The range does not decrease linearly as a result, which is why the data availability and the quality of the data transferred are so critical for the processes. Unfortunately, as yet not all vehicles manufacturers are able to provide these to a sufficient degree. In addition, the FMS interface which was originally developed for diesel motors does not yet have enough e-mobility parameters. The recently published VDV specification 238 will solve



The Hamburg-Holstein GmbH transport company uses MOBILEcharge intelligent charge management.

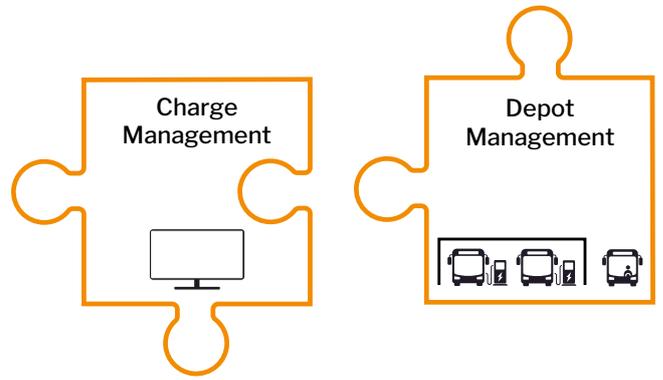
the problem of missing vehicle data and will hopefully be implemented by vehicle manufacturers as soon as possible.

Summary

Interoperability, which is to say, the ability of two systems to work together, is essential. If the interfaces of the systems are open, cooperation between two or more programs or systems can work. That means there are no problems accessing or implementing e-buses when several systems are integrated. Users of the systems profit because changes can be made directly and



With a good charge management system, the e-fleet is easily managed.



Compatibility between Charge Management and Depot Management saves time and money.

charging is always cost efficient. Since manual work isn't required, interoperability makes an important contribution to digitalization.

Looking ahead

VDV has recognized this requirement, as has ITXPT, an organization which has made it its goal to promote interoperability in the field of public transport. ITXPT is to specify an interface for transferring battery information, charging status, average consumption, information about the motor, air conditioning and other data. The recently published VDV specification from



January 2023 will help to pave the way to interoperability and simplify E-bus operations. Both of these standards will be a further step to attaining interoperability. This would mean that those involved can once again concentrate on the information content and not have to spend an unnecessary amount of time and resources trying to acquire data as is still often the case at the moment.

However, this is not “plug and play” either. For the moment, particularly in the area of charge management, a competent partner is still going to be essential to pro-

vide the relevant expertise for setting up what is essentially a complex data structure.

The intelligent charge management system, MOBILE-charge, is developed and distributed by CarMedialab. The INIT subsidiary has wide range of know-how in the interplay of charge management, e-vehicles and IT infrastructure and has extensive worldwide project experience.

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