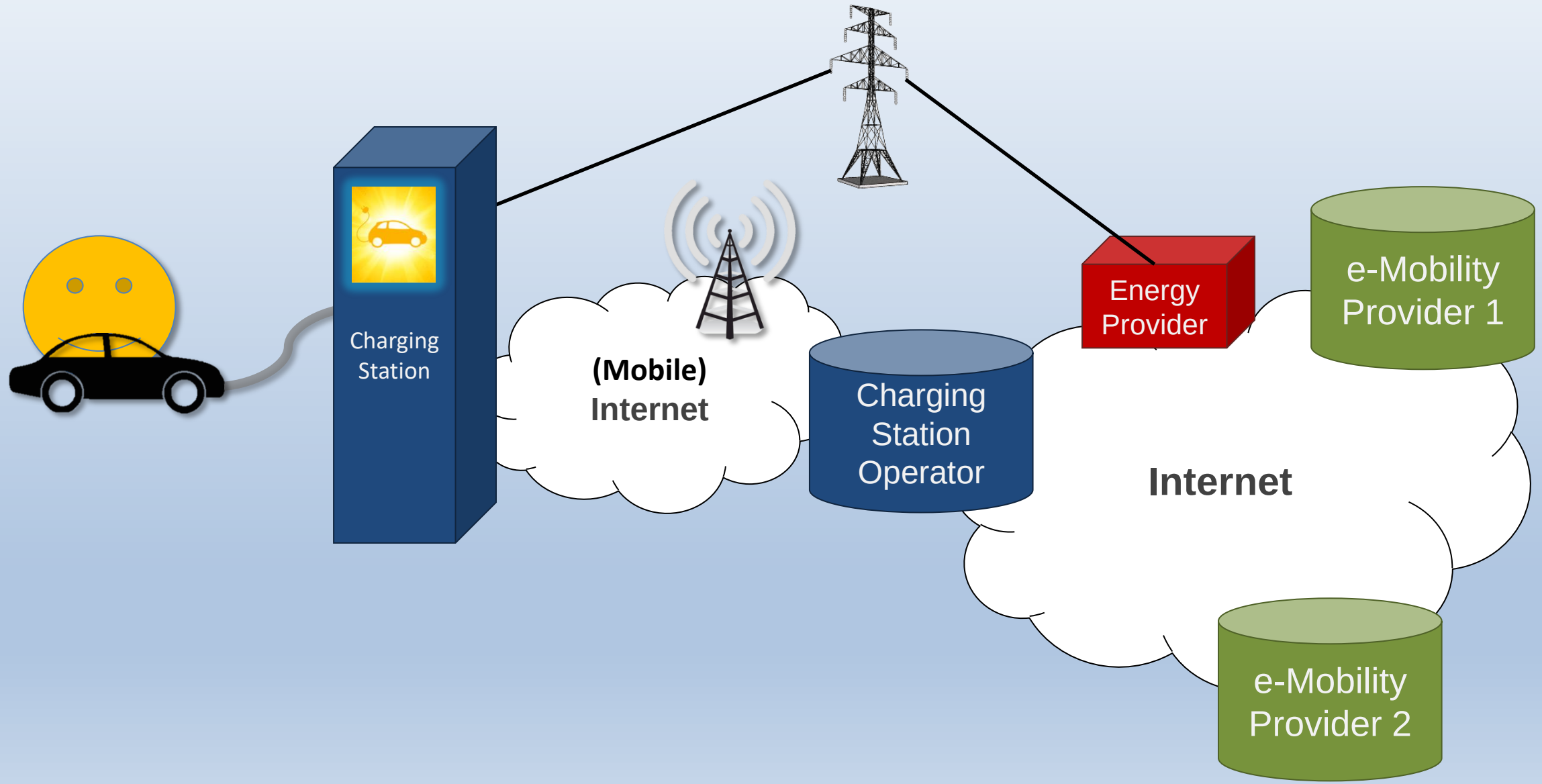
Open Charging Cloud

Security and Privacy
in the current e-mobility charging infrastructure

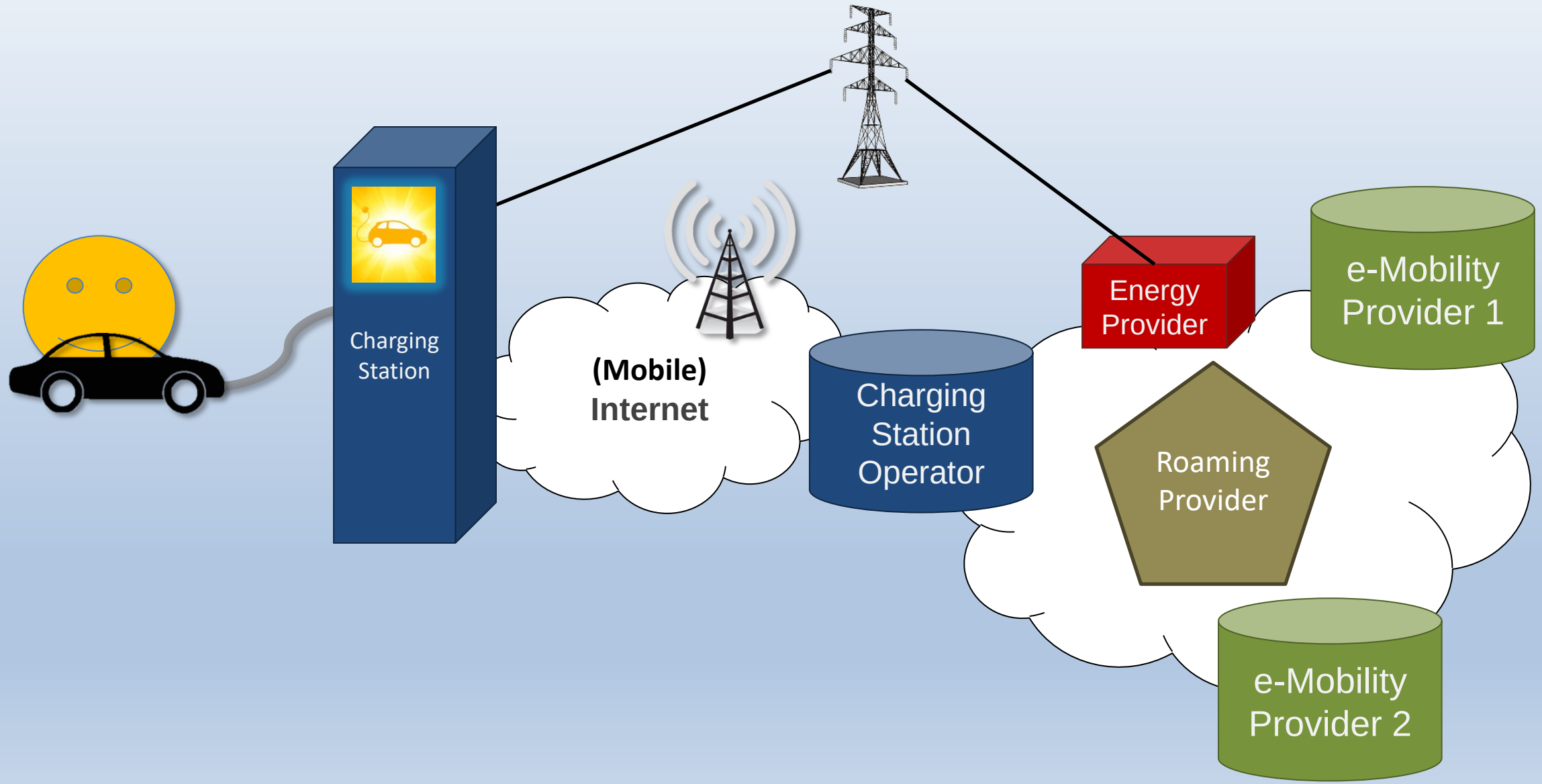

Where?
When?
How to pay?


e-Mobility is 101%
IoeT

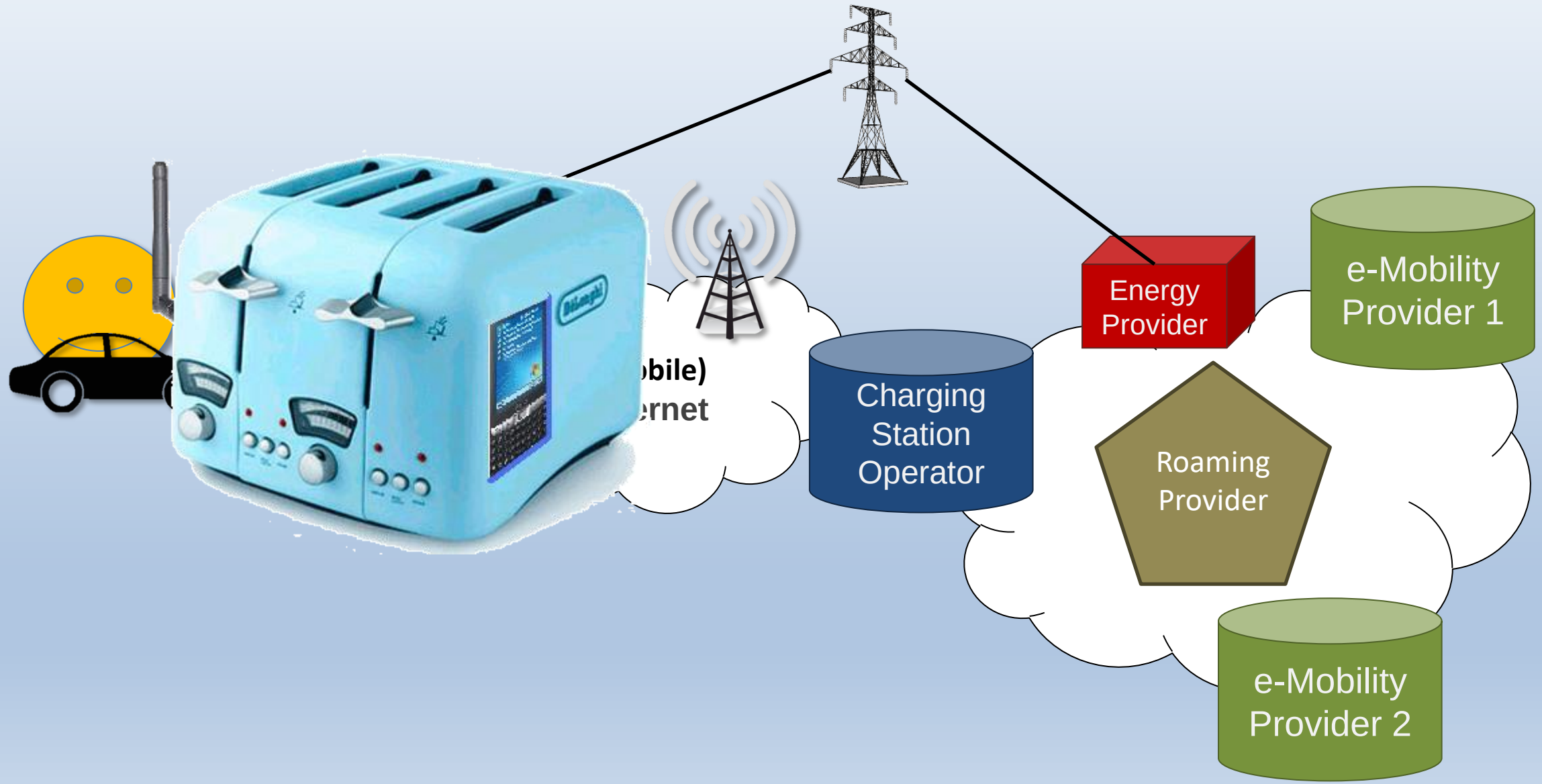
E-Mobility Network Architecture



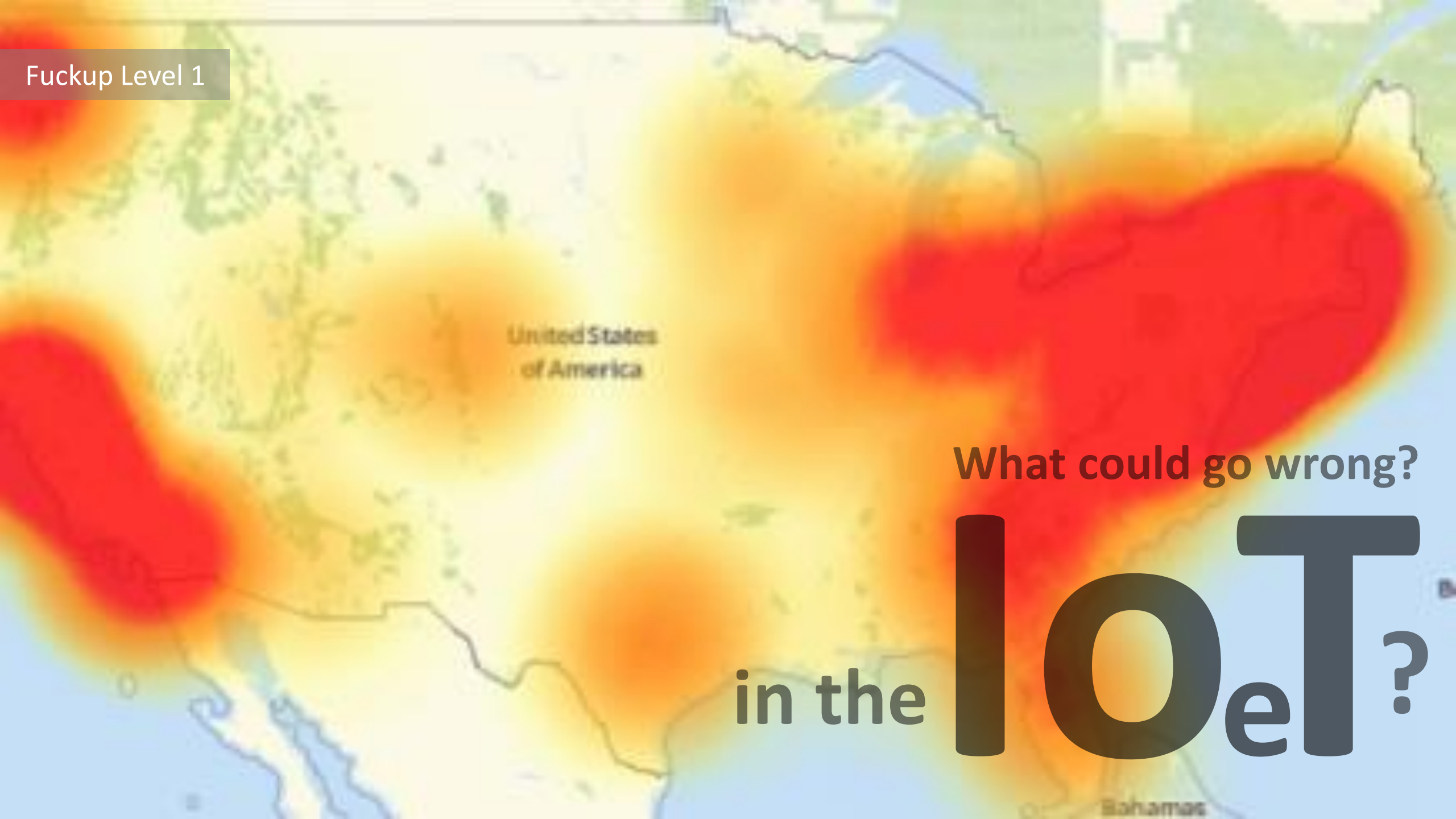
E-Mobility Network Architecture



E-Mobility Network Architecture



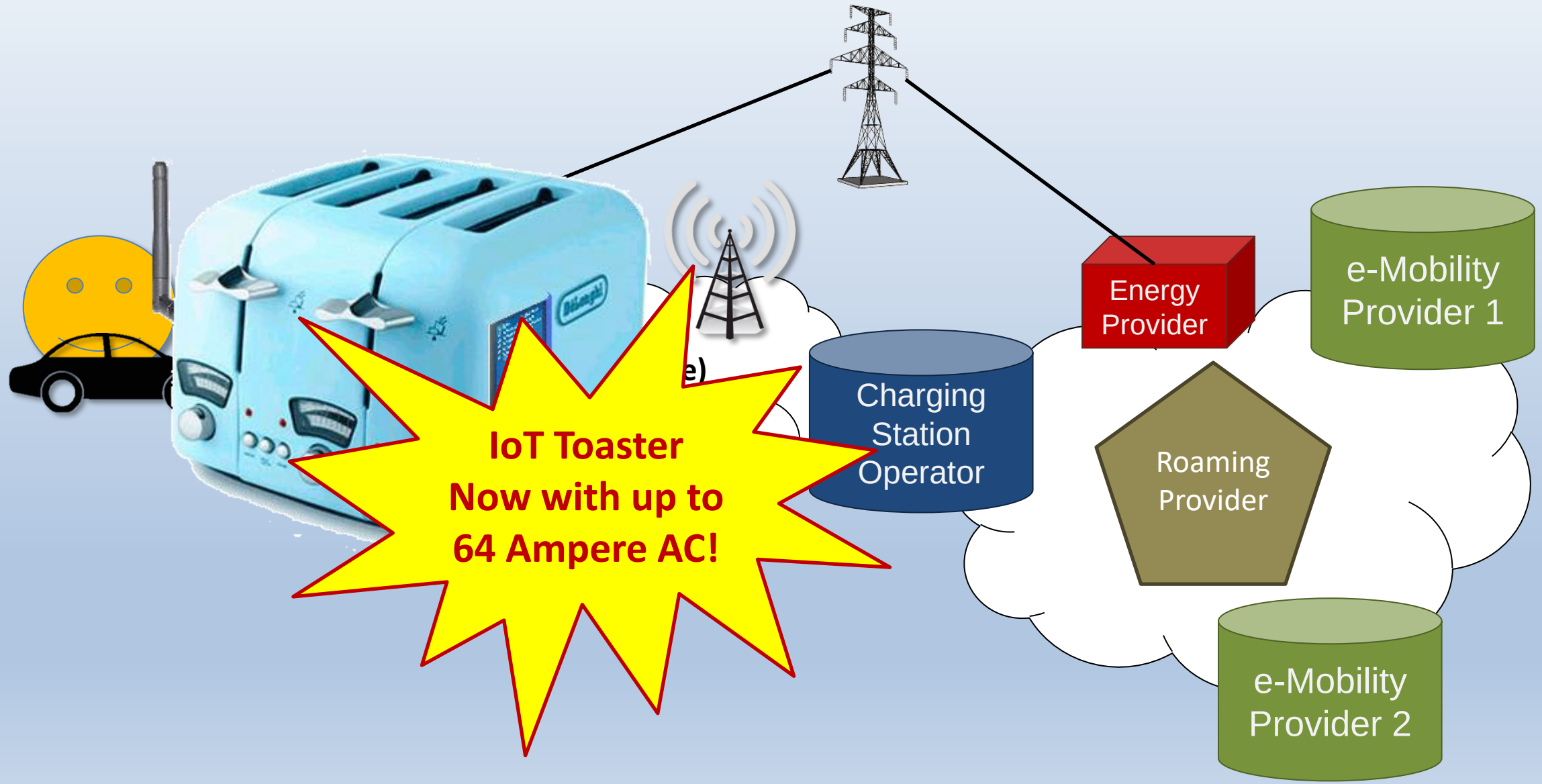
Fuckup Level 1



What could go wrong?

in the IoT?

E-Mobility Network Architecture




Fuckup Level 2
What could go wrong?
Someone „just“ stopped “smart charging”
10000 e-cars
in the IoT?

Fuckup Level 3

Der Staat gegen das Internet der unsicheren Dinge

Vom "digitalen Rettungsschuss" über Software-Haftung zum IT-Gütesiegel: Wie die Politik vielleicht retten kann, was der Markt im Internet der unsicheren Dinge vermasselt.

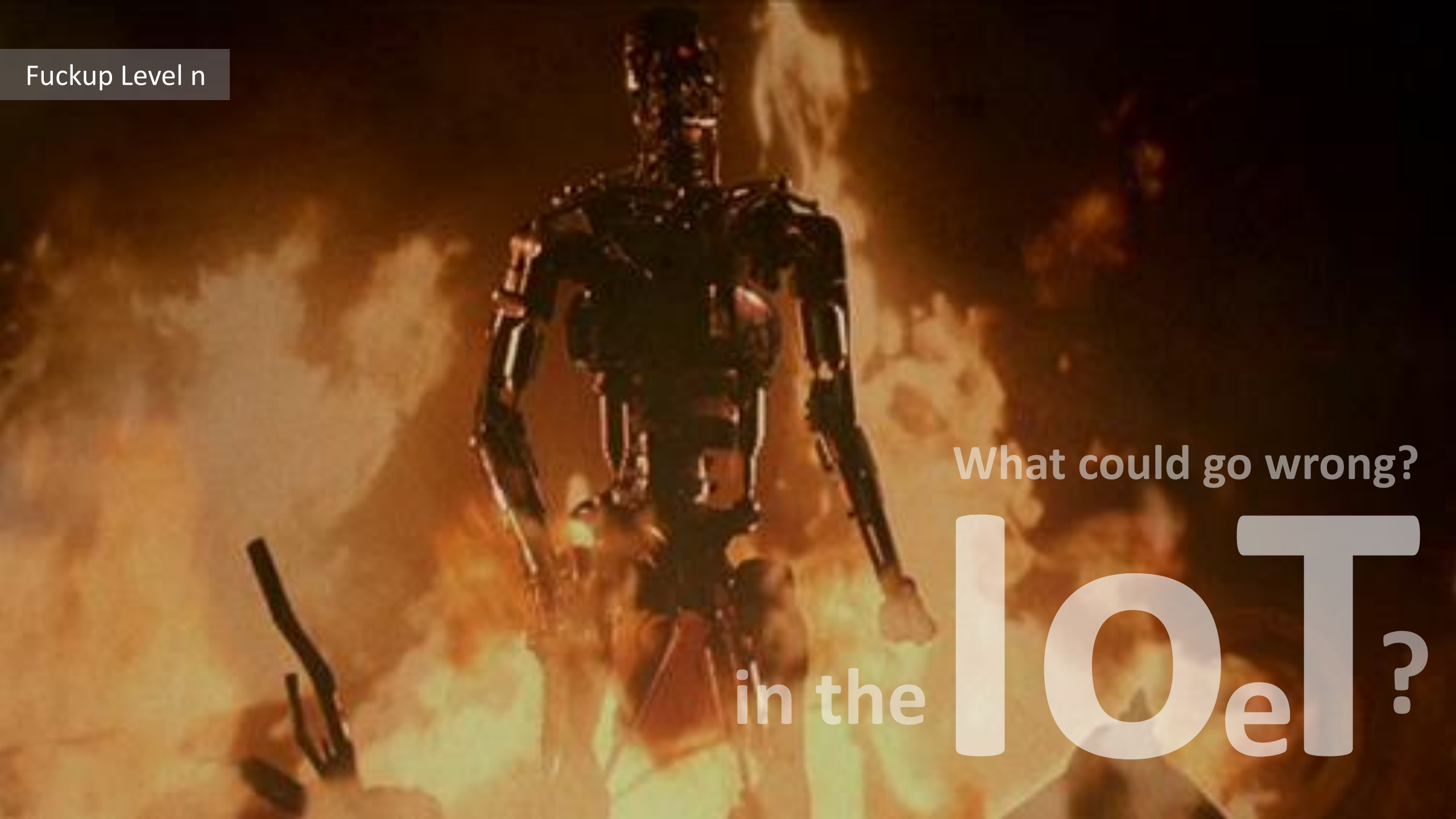
Von **Jan-Peter Kleinhans**

5. November 2016, 8:33 Uhr / 74 Kommentare

What could go wrong?

in the IoT?

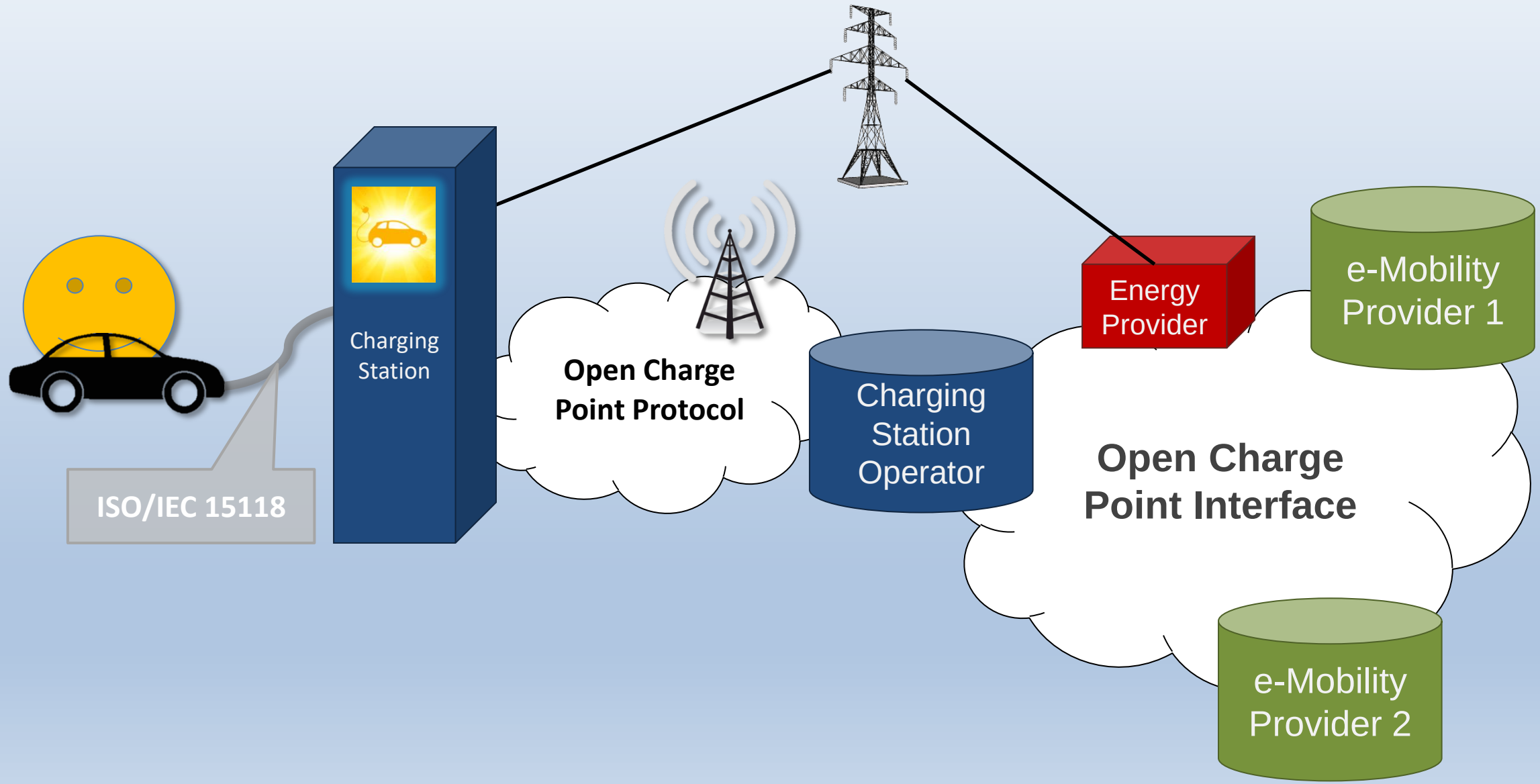

Fuckup Level 4
What could go wrong?
in the IoT?


Fuckup Level n
What could go wrong?
in the IoT?

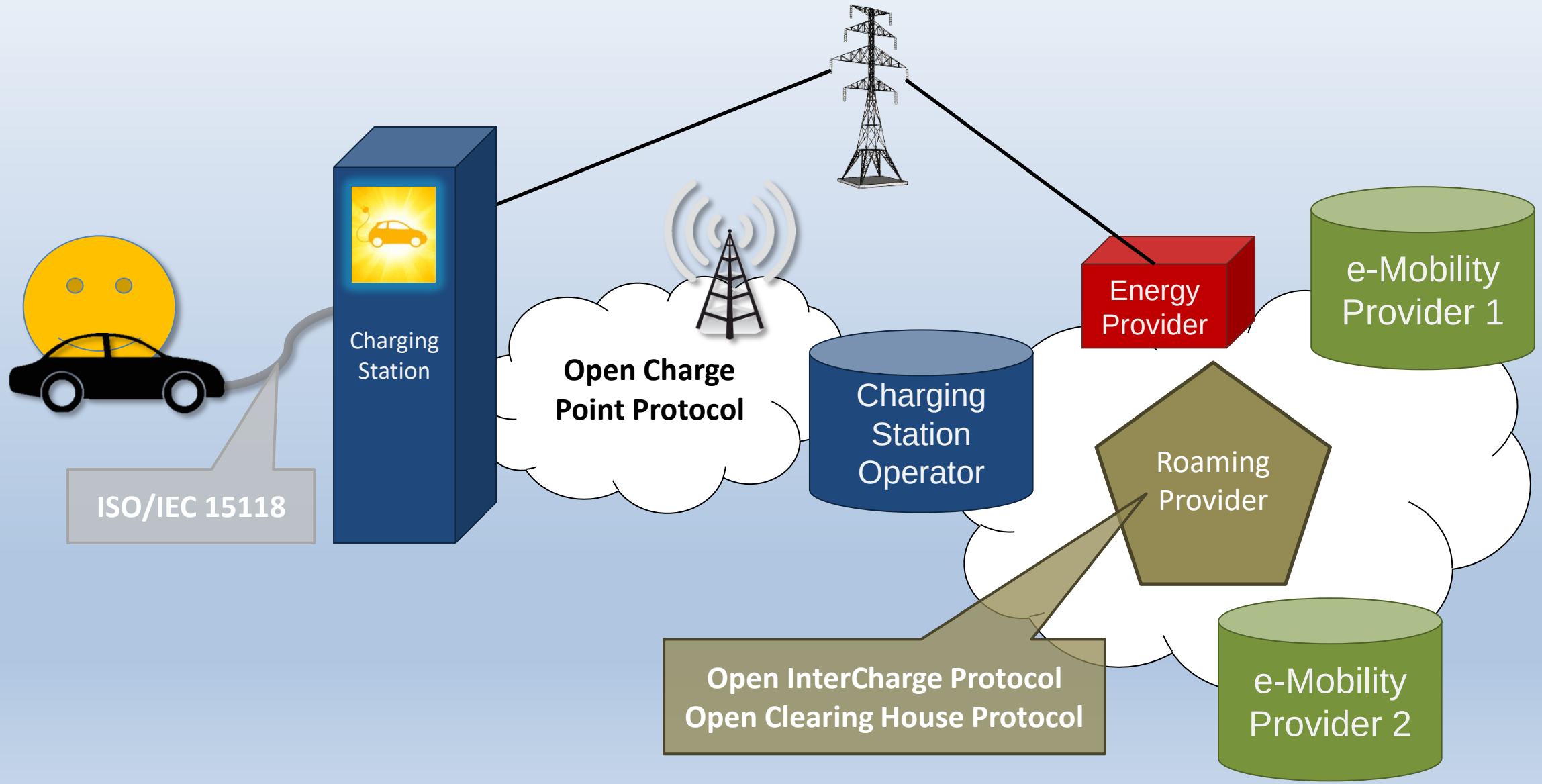
Network Architecture

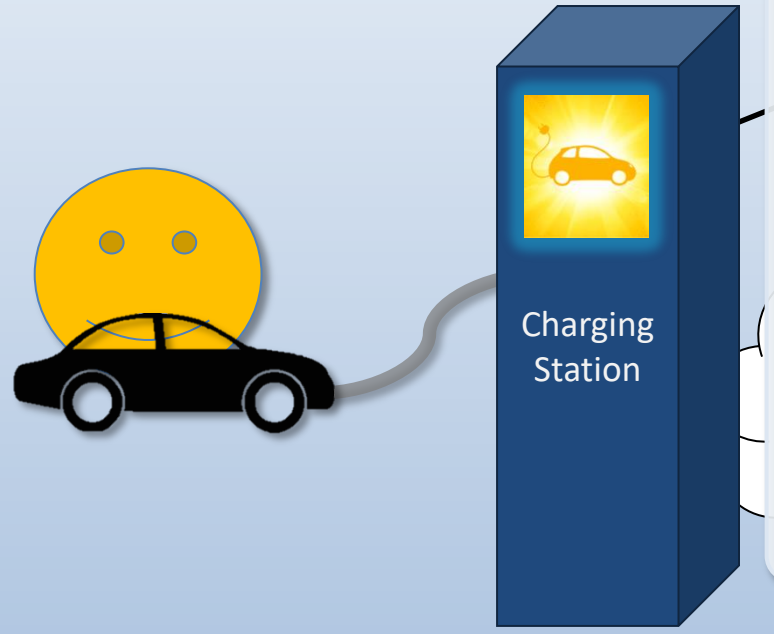
for charging e-vehicles

E-Mobility Network Architecture



E-Mobility Network Architecture



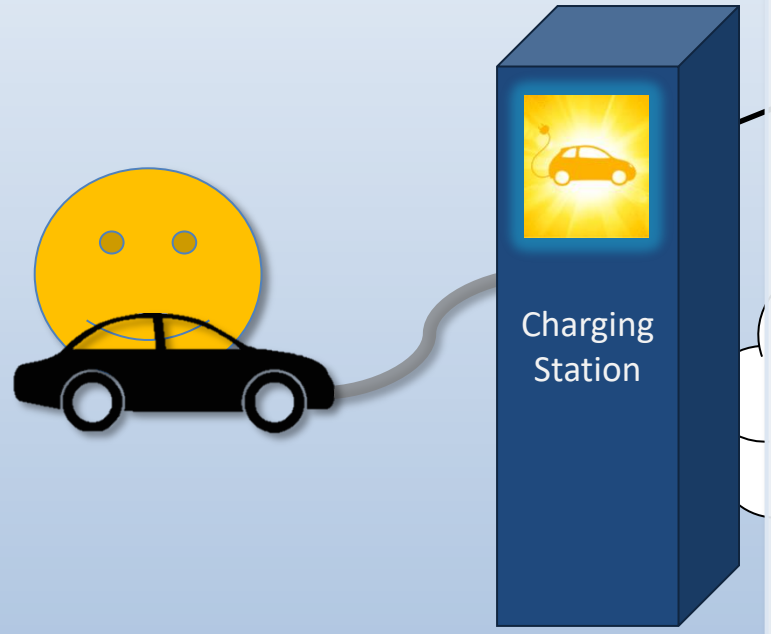


- Current version: OCPP v1.6
  http://www.openchargealliance.org
- Worldwide utility-driven de facto ICT standard to manage charge points located in the streets
- HTTP/SOAP on both devices…
- …or HTTP/WebSocket/JSON

Station
Operator

Open Charge Point Protocol

E-Mobility Network Architecture

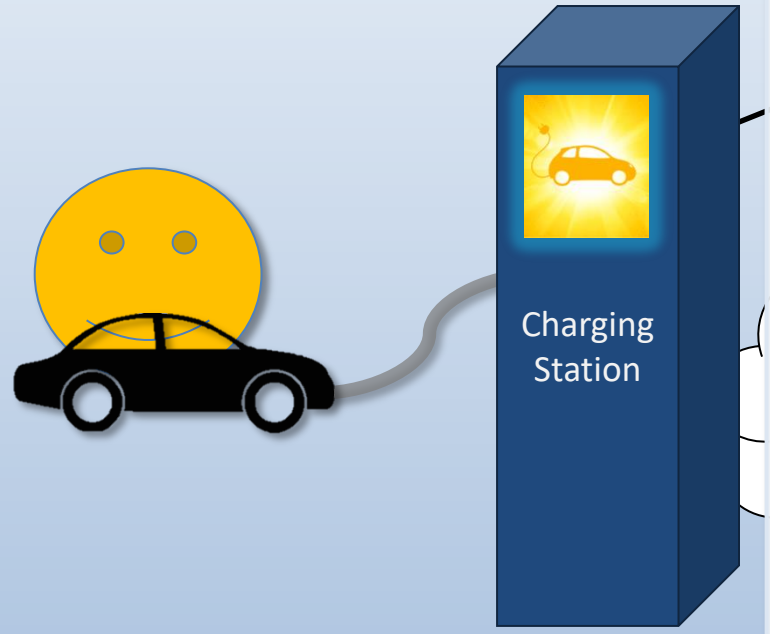


- Suggests use of TLS with client certs and VPNs/Private APNs when SOAP is used
- Discourages use of TLS because of communication overhead and client cert management complexity 

- No standardized methods to manage network setting, certs, CA certs, … most operators rely on network security or proprietary protocols

  → **There is no practical security at all!**

Open Charge Point Protocol



- What about firmware updates?

```
<soap:Envelope xmlns:soap = "http://www.w3.org/2003/05/soap-envelope"
               xmlns:wsa  = "http://www.w3.org/2005/08/addressing"
               xmlns:ns   = "urn://Ocpp/Cp/2015/10/">

   <soap:Body>
      <ns:updateFirmwareRequest>

         <ns:retrieveDate>?</ns:retrieveDate>
         <ns:location>?</ns:location>
         <ns:retries>?</ns:retries>                <!--Optional:-->
         <ns:retryInterval>?</ns:retryInterval>    <!--Optional:-->

      </ns:updateFirmwareRequest>
   </soap:Body>
</soap:Envelope>
```

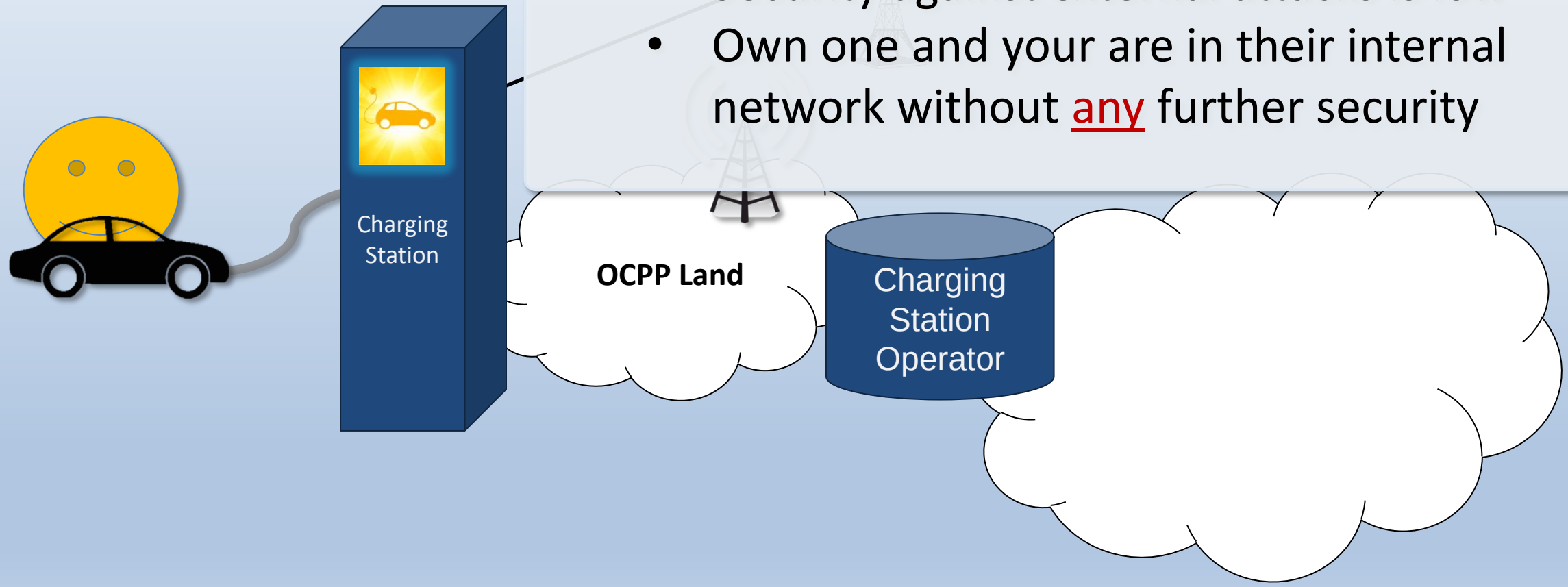
→ **No security against even accidental mistakes**

Open Charge Point Protocol

E-Mobility Network Architecture

Conclusions

- Physical access to charging stations is easy
- Security against external attacks is low
- Own one and your are in their internal network without any further security

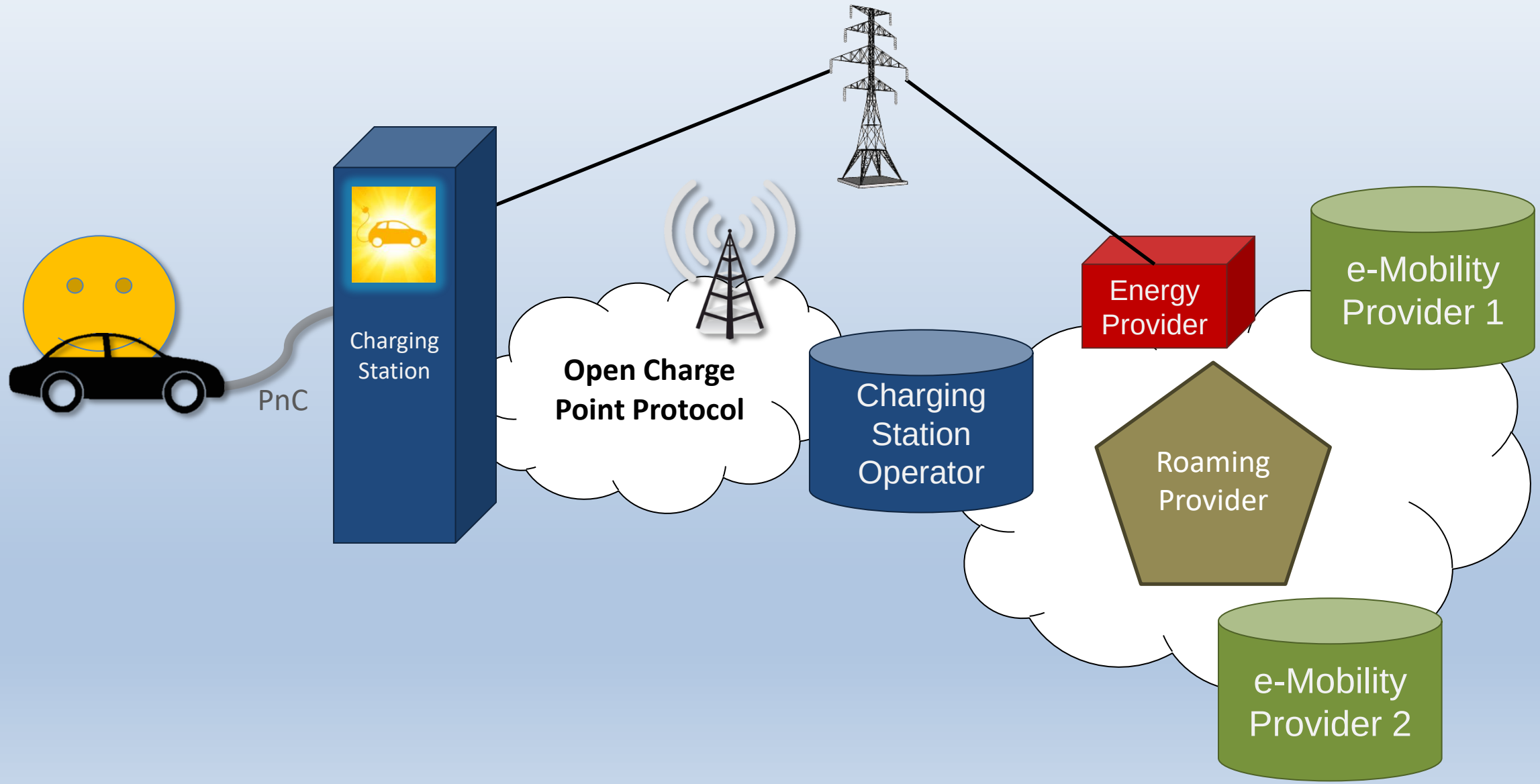


Open Charge Point Protocol

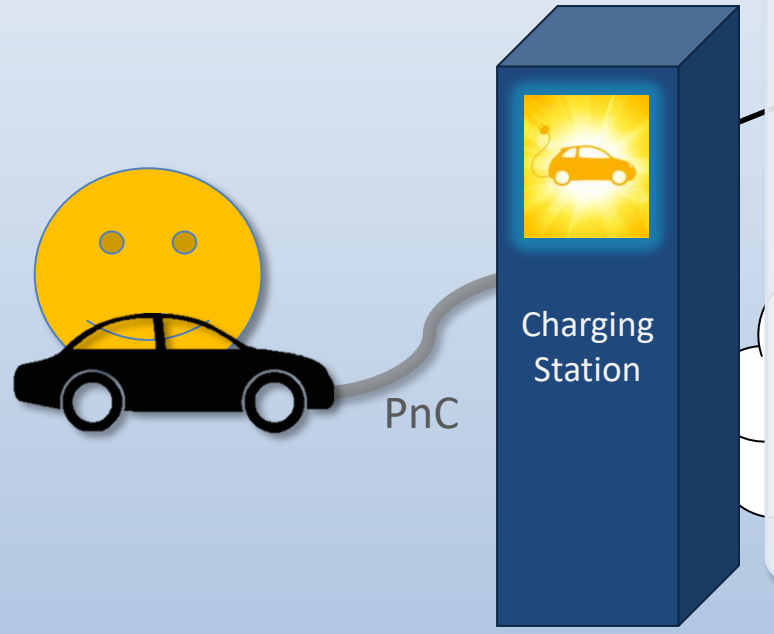
Local & Remote Authentication

at a Charging Station

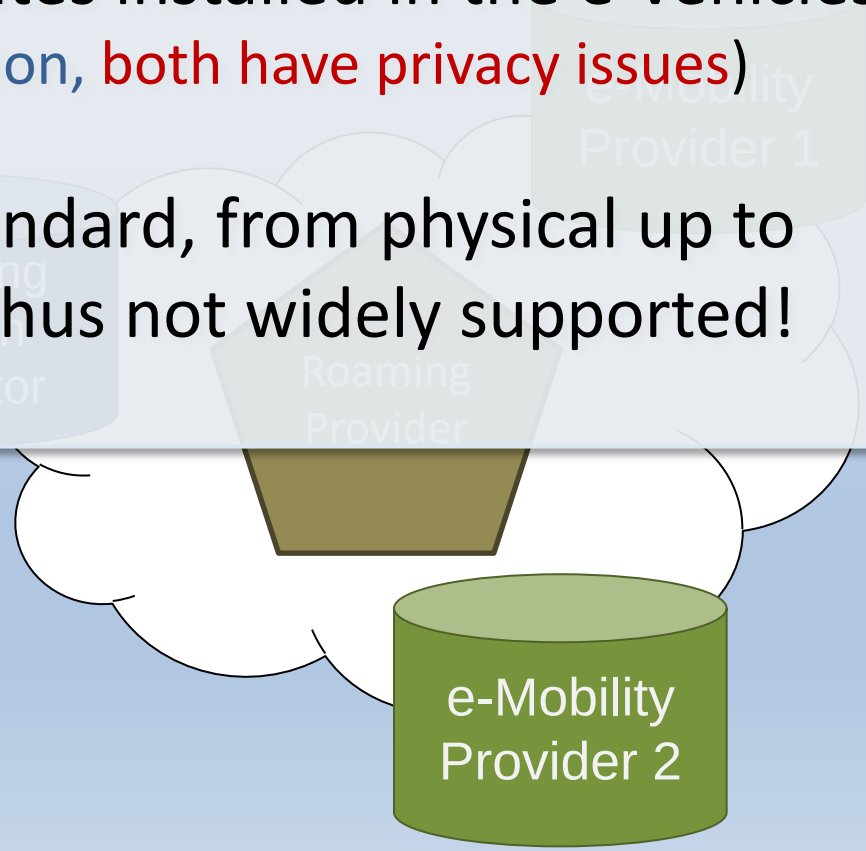
Local Authentication via PnC or RFID



Local Authentication via PnC or RFID

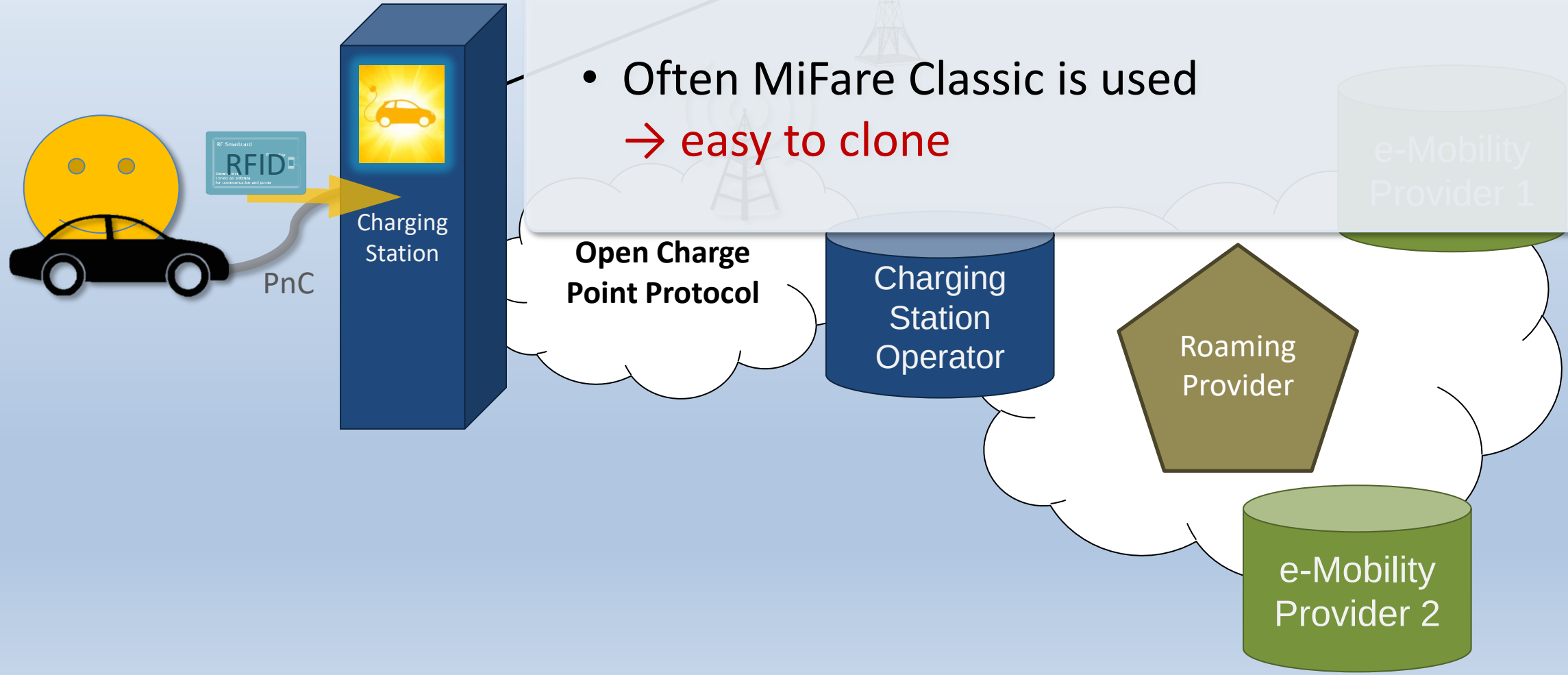


- ISO/IEC 15118 Plug-and-Charge Authentication is based on e-Mobility Account/Contract Identification (eMAId / EVCOID) (online authentication)…
  …and/or certificates installed in the e-vehicles (offline authentication, both have privacy issues)
- Very complex standard, from physical up to the data layer… thus not widely supported!



Local Authentication via PnC or RFID

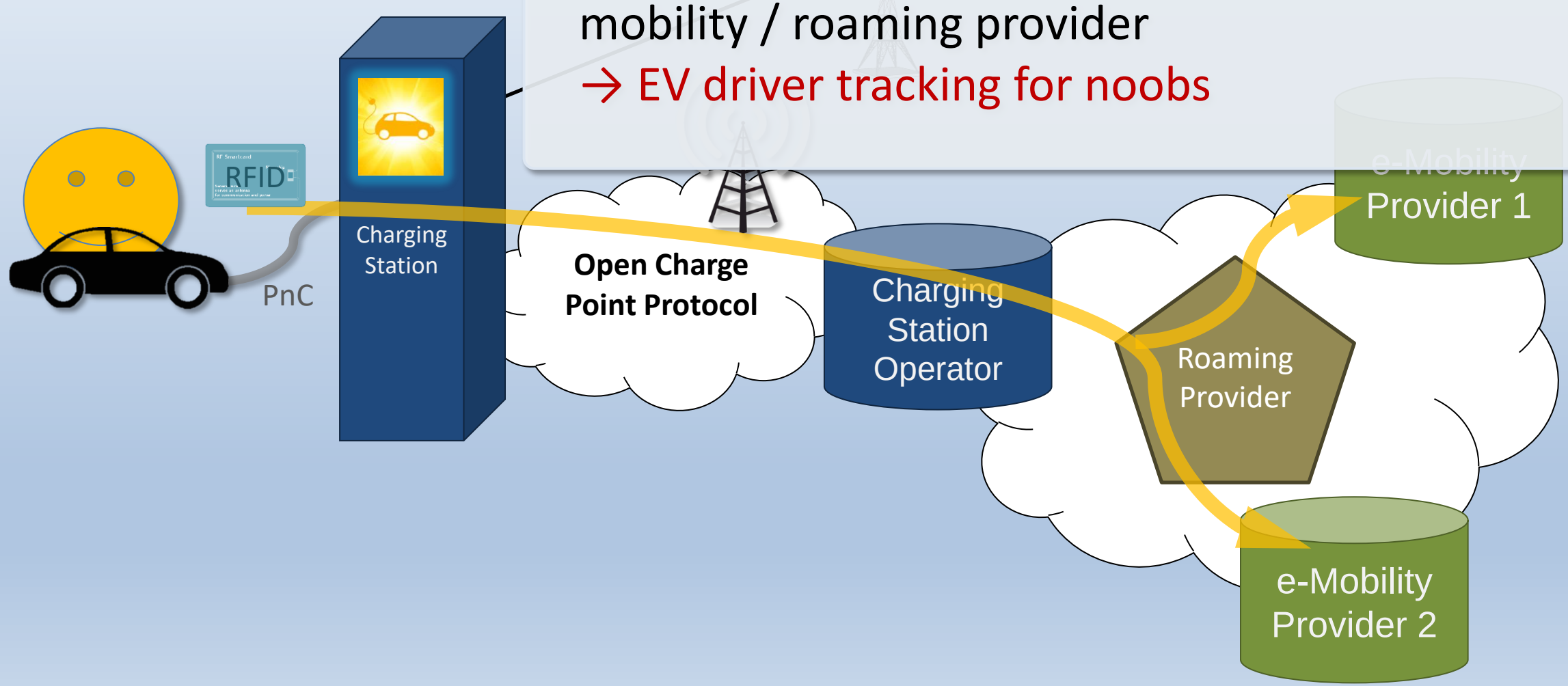
- Authentication based solely on the unique Id of RFID card.
  → easy to wiretap and spoof, free-energy
- Often MiFare Classic is used
  → easy to clone



Local Authentication via PnC or RFID

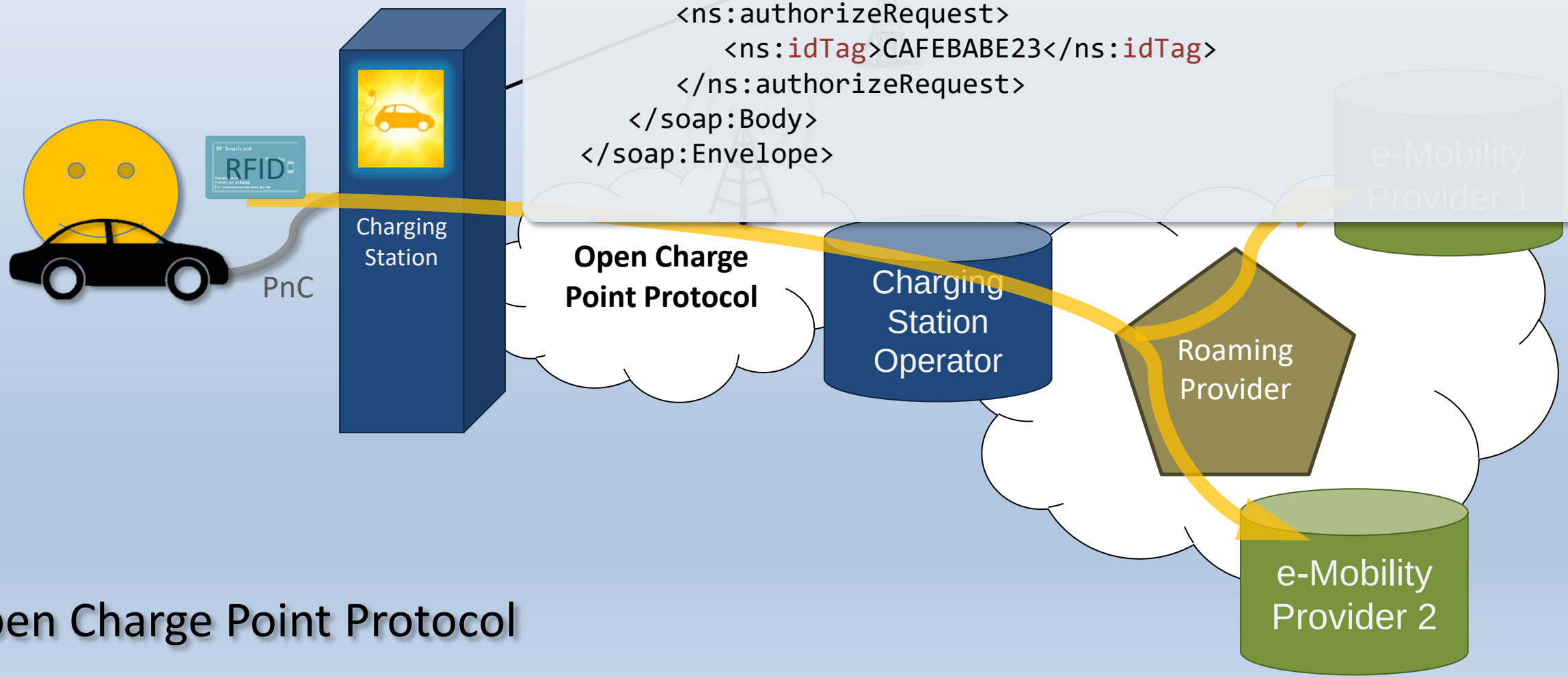
Flat RFID Id schema means the related e-mobility provider is unknown and RFID Id + charging station Id is broadcasted to any e-mobility / roaming provider

→ EV driver tracking for noobs



Local Authentication via PnC or RFID

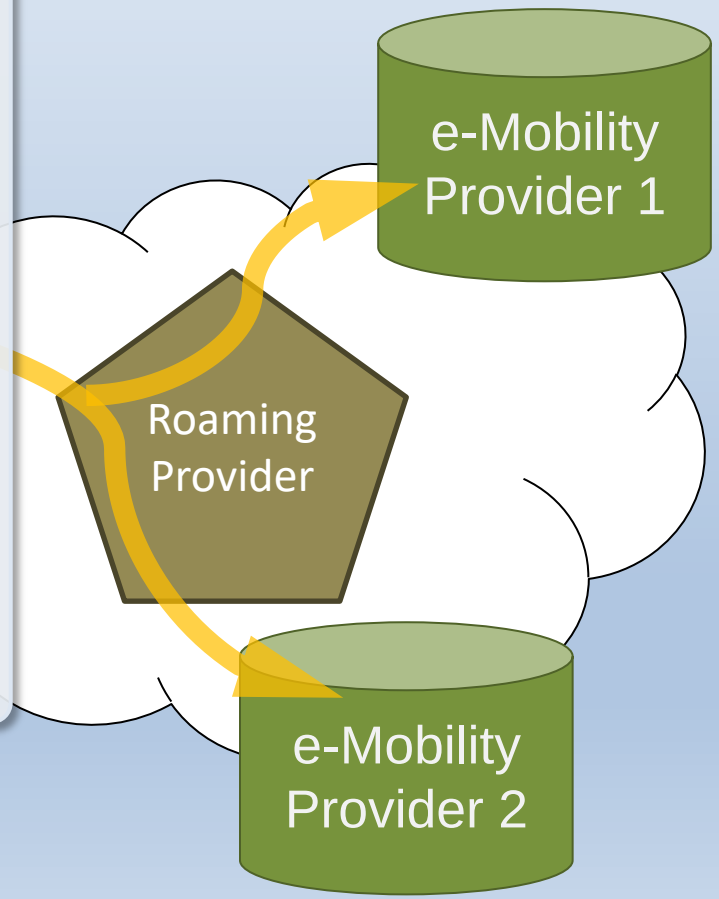
```
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
               xmlns:ns  ="urn://Ocpp/Cs/2015/10/">
   <soap:Header>
      <ns:chargeBoxIdentity>?</ns:chargeBoxIdentity>
   </soap:Header>
   <soap:Body>
      <ns:authorizeRequest>
         <ns:idTag>CAFEBABE23</ns:idTag>
      </ns:authorizeRequest>
   </soap:Body>
</soap:Envelope>
```



Open Charge Point Protocol

Local Authentication via PnC or RFID

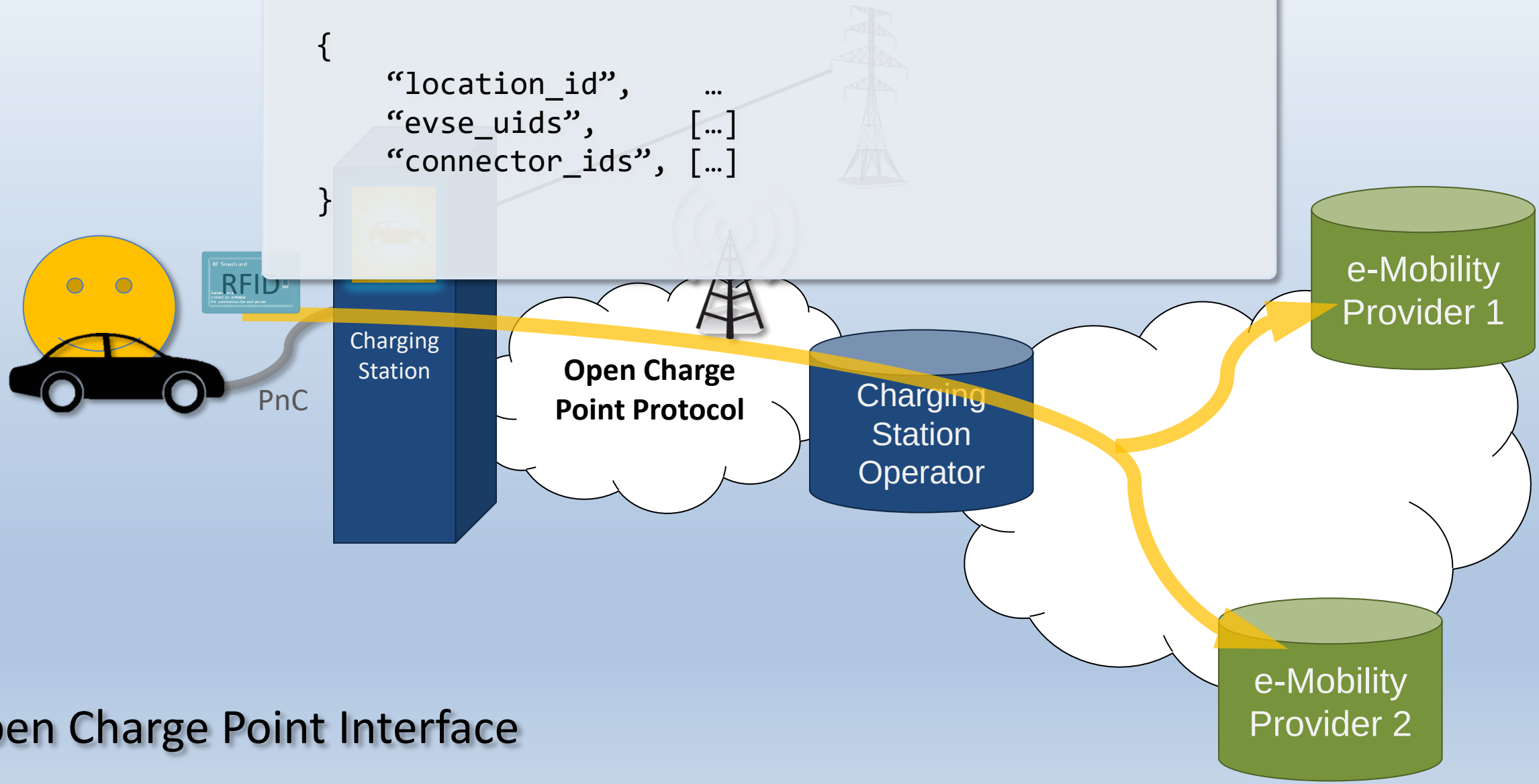
```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:v2     ="http://www.hubject.com/b2b/services/authorization/v2.0"
                  xmlns:v21    ="http://www.hubject.com/b2b/services/commontypes/v2.0">

   <soapenv:Header/>
   <soapenv:Body>
      <v2:eRoamingAuthorizeStart>

         <v2:SessionID>?</v2:SessionID>                    <!--Optional:-->
         <v2:EVSEID>DE*GEF*1234567*1</v2:EVSEID>           <!--Optional:-->
         <v2:PartnerProductID>AC1</v2:PartnerProductID>    <!--Optional:-->

         <v2:Identification>
            <v21:RFIDmifarefamilyIdentification>
               <v21:UID>CAFEBABE23</v21:UID>
            </v21:RFIDmifarefamilyIdentification>
         </v2:Identification>

      </v2:eRoamingAuthorizeStart>
   </soapenv:Body>
</soapenv:Envelope>
```



Open InterCharge Protocol

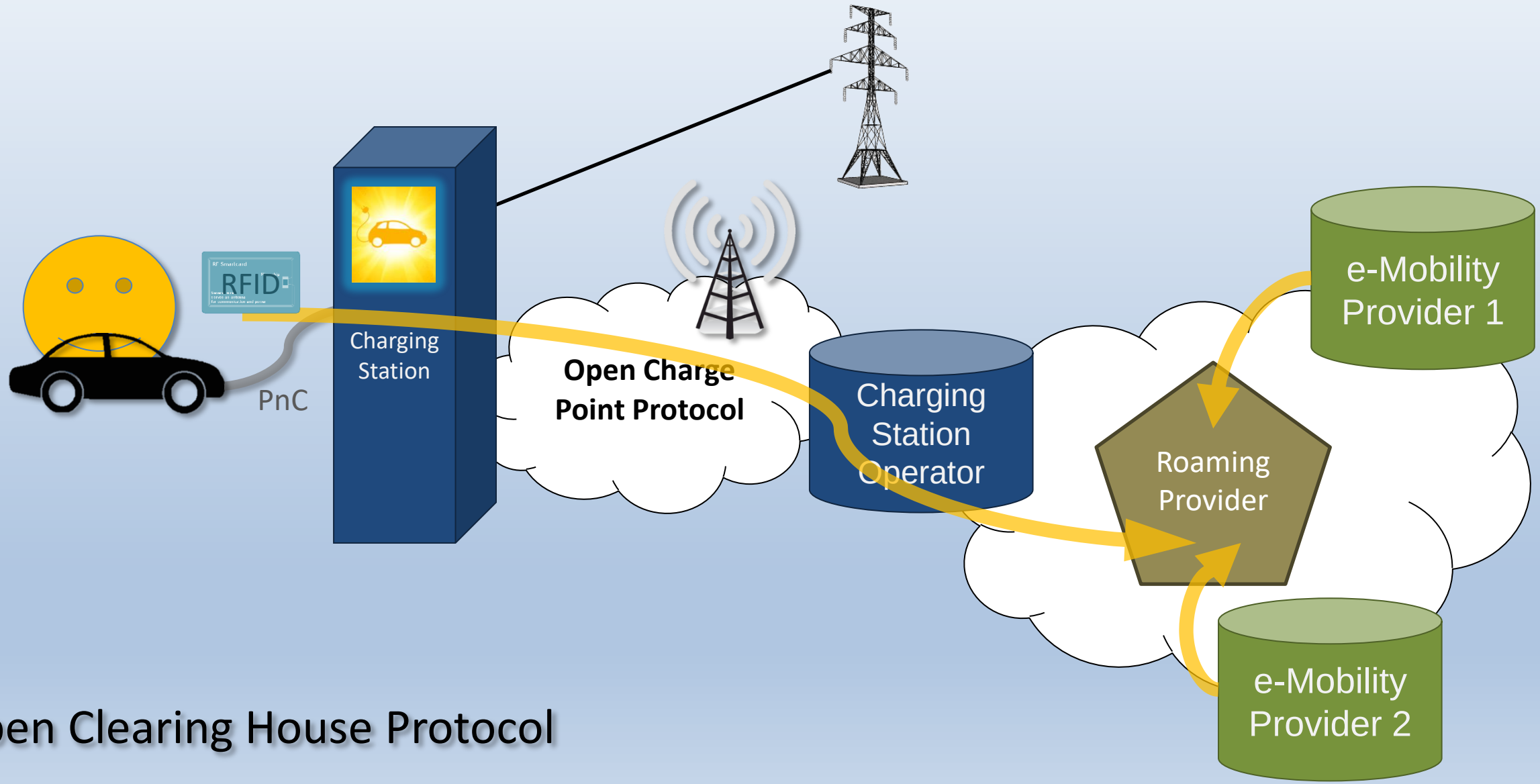
Local Authentication via PnC or RFID

```
POST /ocpi/emsp/2.0/tokens/{token_uid}/authorize

{
    “location_id”,     …
    “evse_uids”,      […]
    “connector_ids”, […]
}
```



Open Charge Point Interface

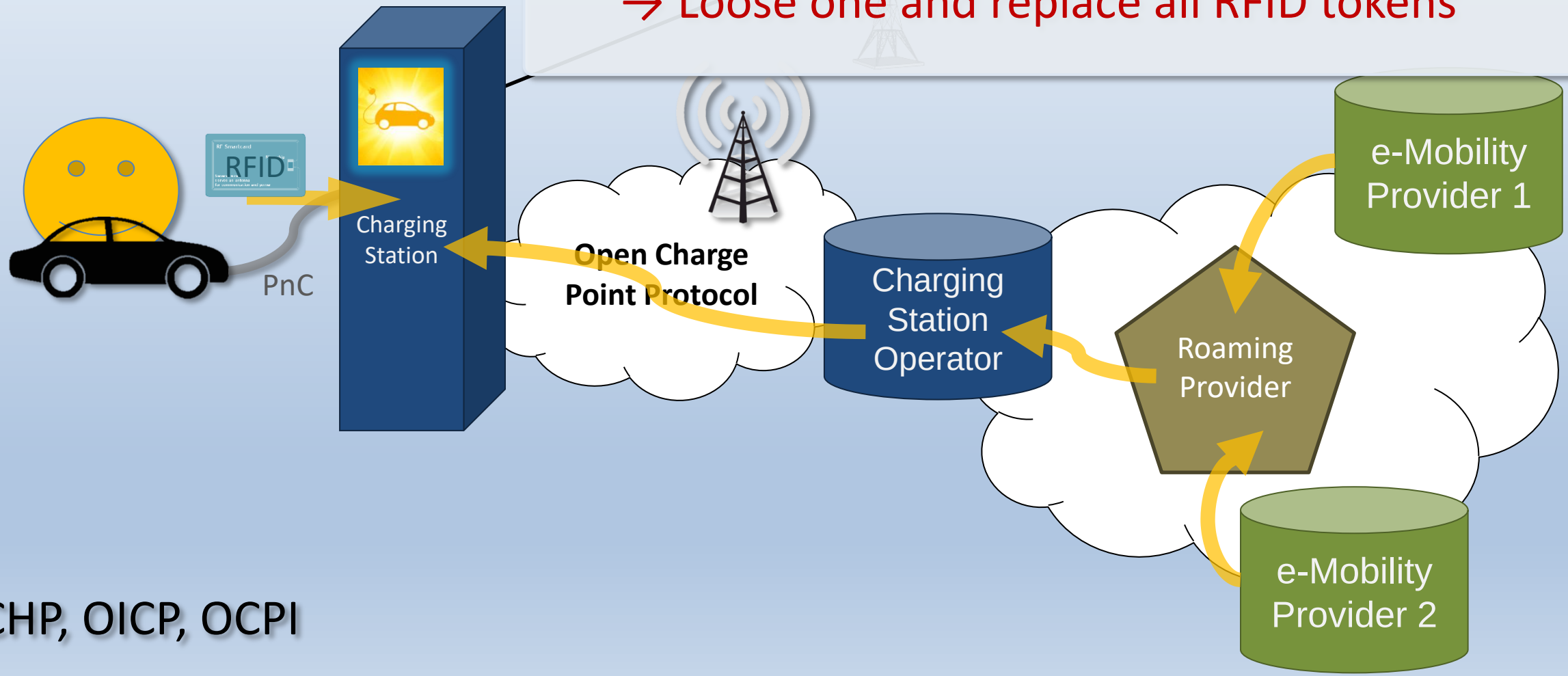
Local Authentication via PnC or RFID



Open Clearing House Protocol

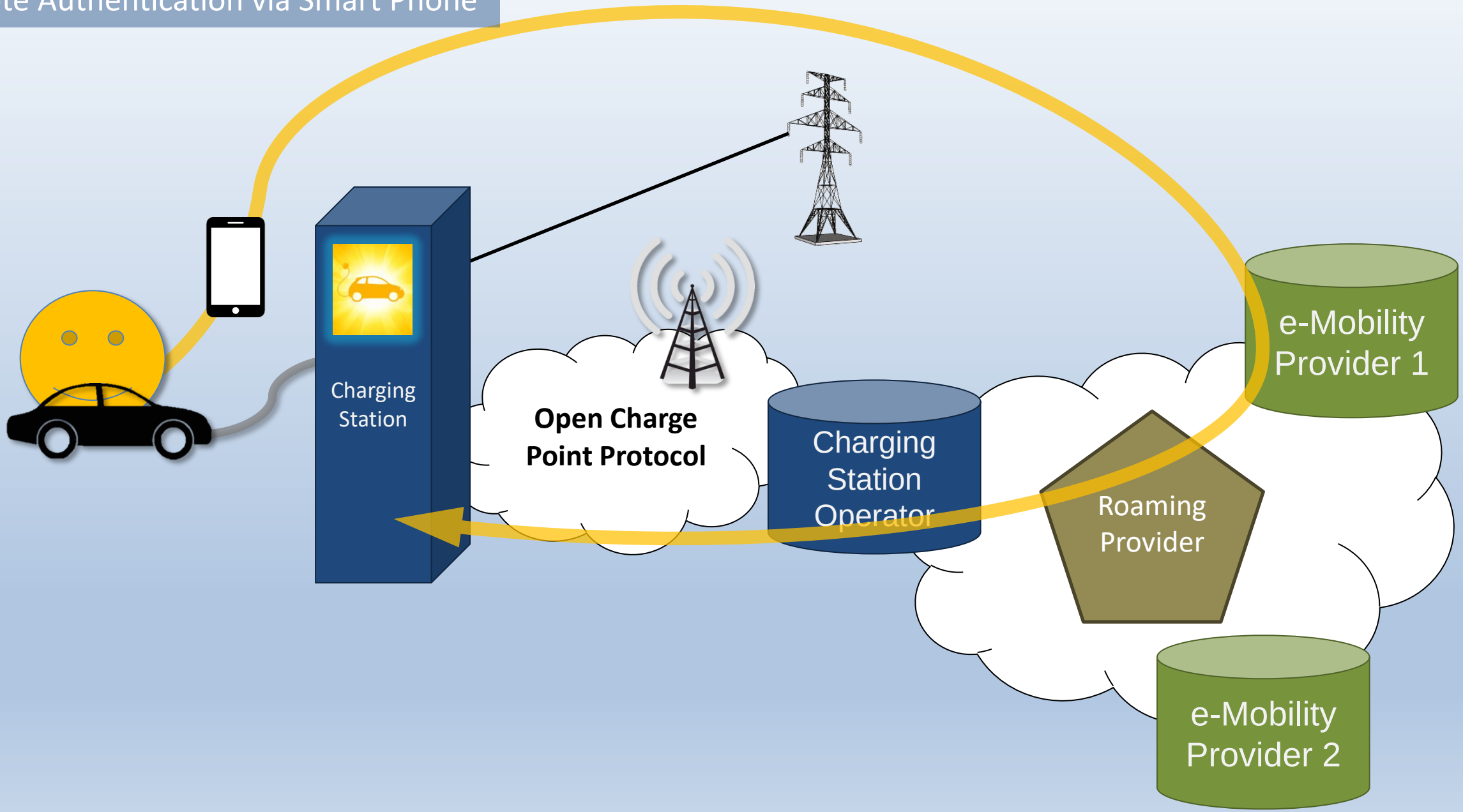
Local Authentication via PnC or RFID

- RFID Id is checked against a local whitelists
  → Ids of 10000s of customers in 10000s of IoT devices in 10000s of streets
  → Loose one and replace all RFID tokens



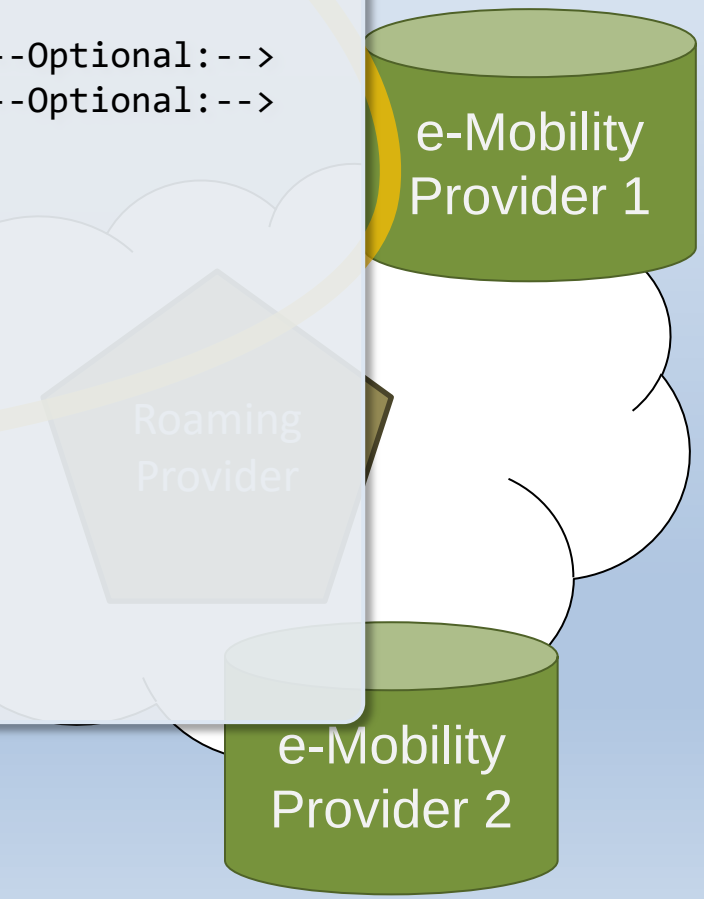
OCHP, OICP, OCPI

Remote Authentication via Smart Phone



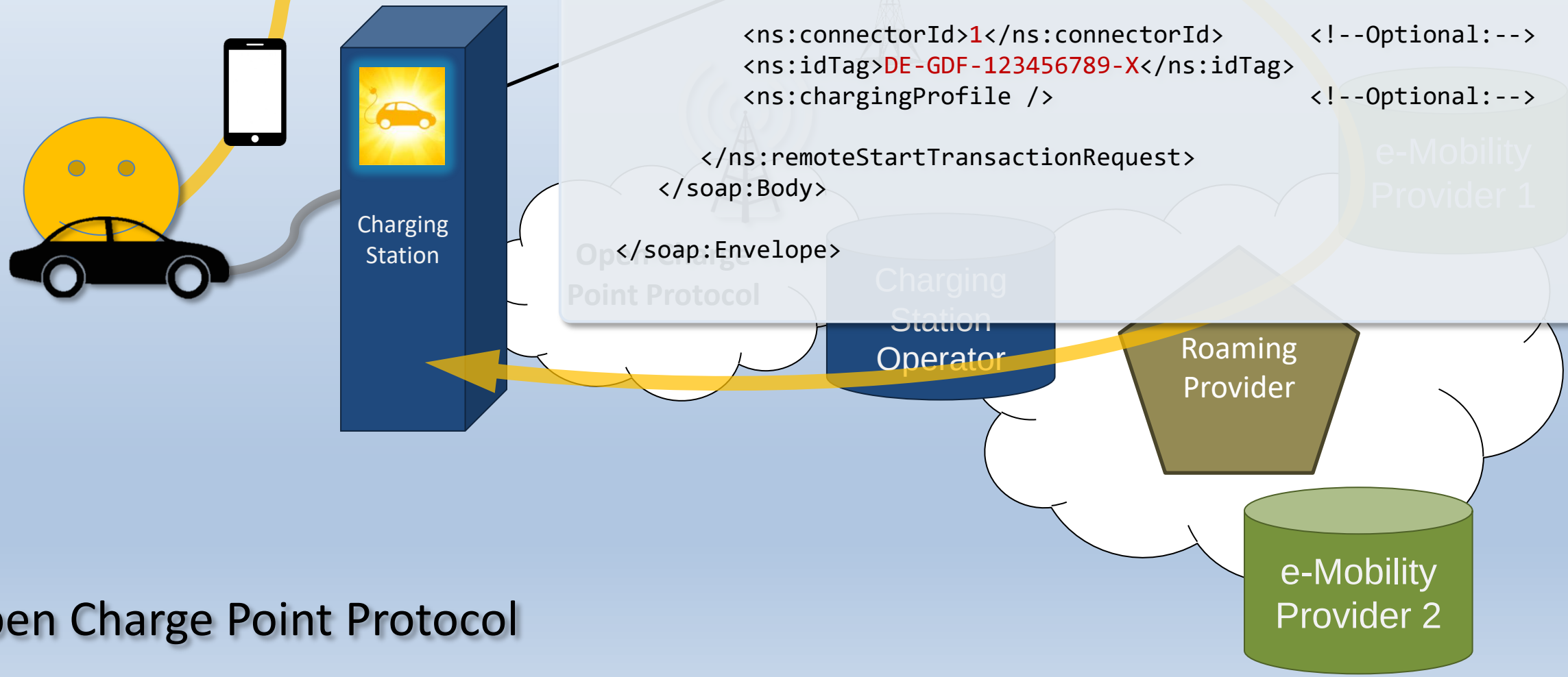
Remote Authentication via Smart Phone

```
<soapenv:Envelope xmlns:soapenv      ="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:Authorization="http://www.hubject.com/b2b/services/authorization/v2.0"
                  xmlns:CommonTypes  ="http://www.hubject.com/b2b/services/commontypes/v2.0">

   <soapenv:Body>
      <Authorization:eRoamingAuthorizeRemoteStart>

         <Authorization:SessionID>?</Authorization:SessionID>                <!--Optional:-->
         <Authorization:PartnerProductID>?</Authorization:PartnerProductID>  <!--Optional:-->
         <Authorization:EVSEID>DE*GEF*123456789*1</Authorization:EVSEID>

         <Authorization:Identification>
            <CommonTypes:RemoteIdentification>
               <CommonTypes:EVCOID>DE-GDF-123456789-X</CommonTypes:EVCOID>
            </CommonTypes:RemoteIdentification>
         </Authorization:Identification>

      </Authorization:eRoamingAuthorizeRemoteStart>

   </soapenv:Body>
</soapenv:Envelope>
```



Remote Authentication via Smart Phone

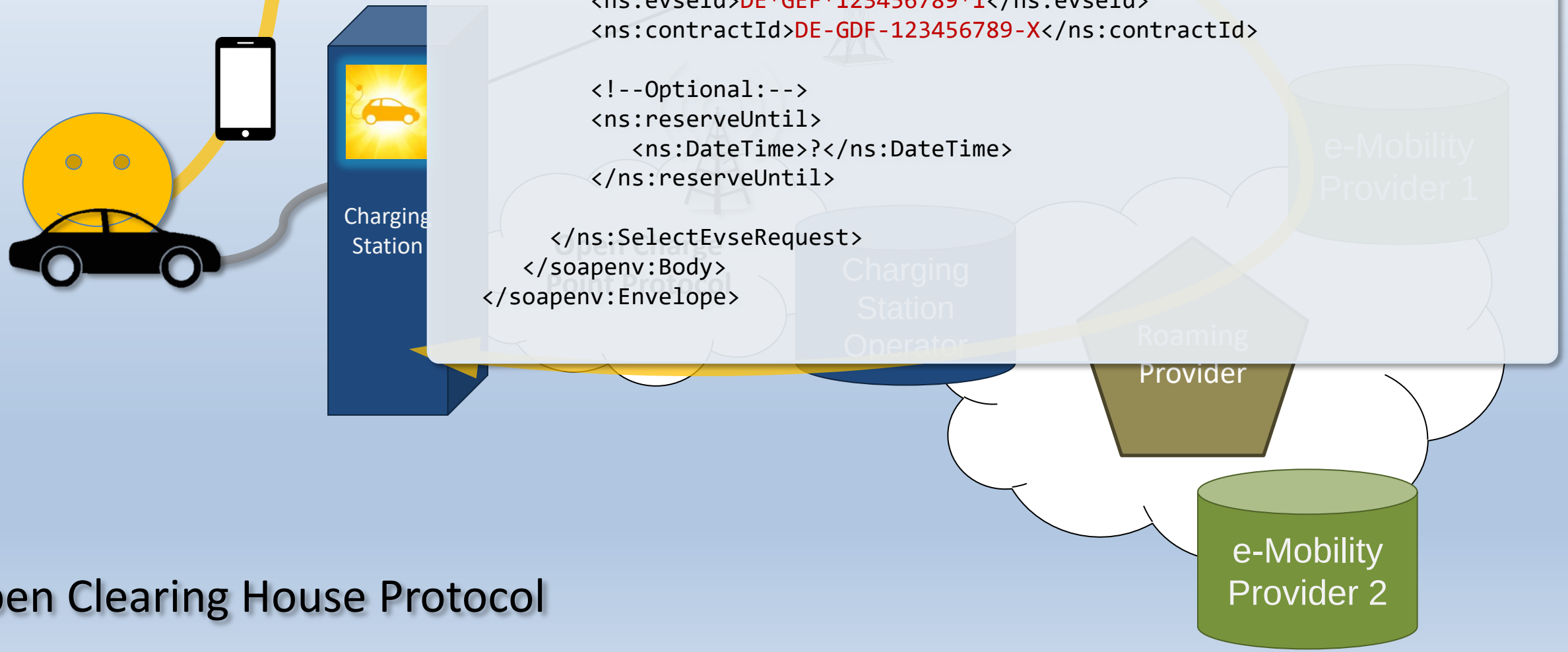
```
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
               xmlns:wsa ="http://www.w3.org/2005/08/addressing"
               xmlns:ns  ="urn://Ocpp/Cp/2015/10/">

   <soap:Body>
      <ns:remoteStartTransactionRequest>

         <ns:connectorId>1</ns:connectorId>      <!--Optional:-->
         <ns:idTag>DE-GDF-123456789-X</ns:idTag>
         <ns:chargingProfile />                  <!--Optional:-->

      </ns:remoteStartTransactionRequest>
   </soap:Body>

</soap:Envelope>
```



Open Charge Point Protocol

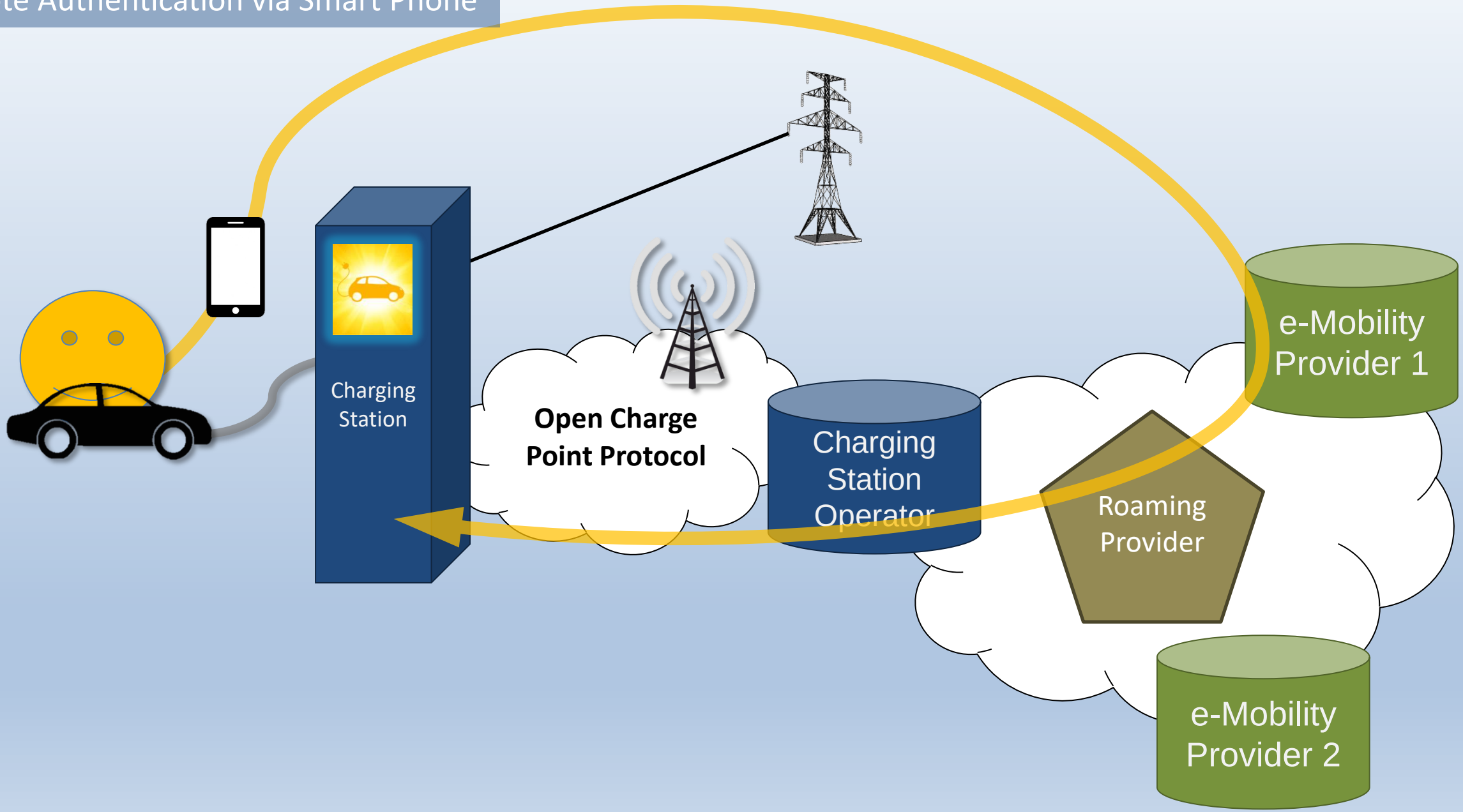
Remote Authentication via Smart Phone

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:ns     ="http://ochp.eu/1.4">

<soapenv:Body>
     <ns:SelectEvseRequest>

        <ns:evseId>DE*GEF*123456789*1</ns:evseId>
        <ns:contractId>DE-GDF-123456789-X</ns:contractId>

        <!--Optional:-->
        <ns:reserveUntil>
           <ns:DateTime>?</ns:DateTime>
        </ns:reserveUntil>

     </ns:SelectEvseRequest>
   </soapenv:Body>
</soapenv:Envelope>
```



Open Clearing House Protocol

Remote Authentication via Smart Phone

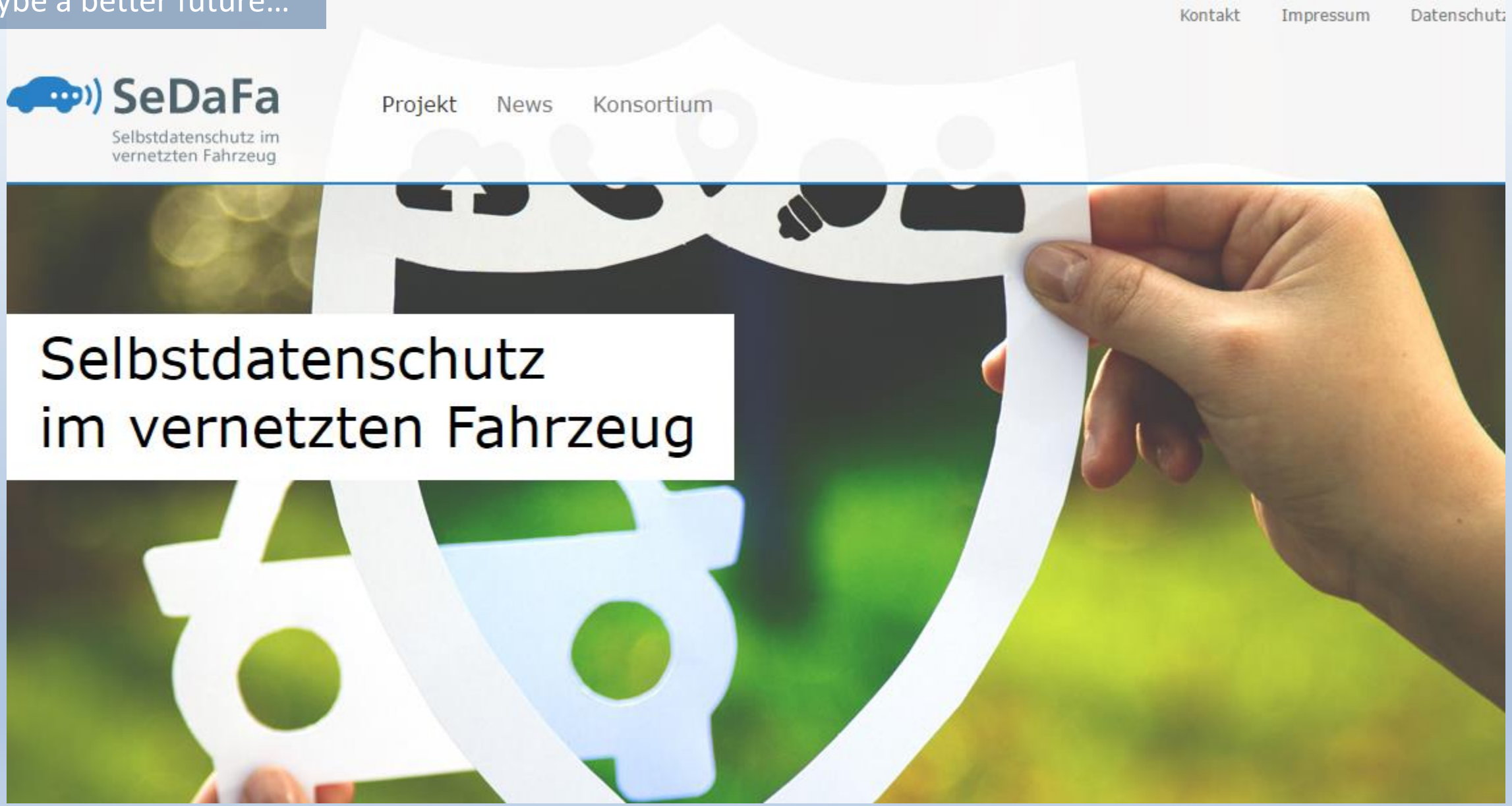



Little sisters are watching!

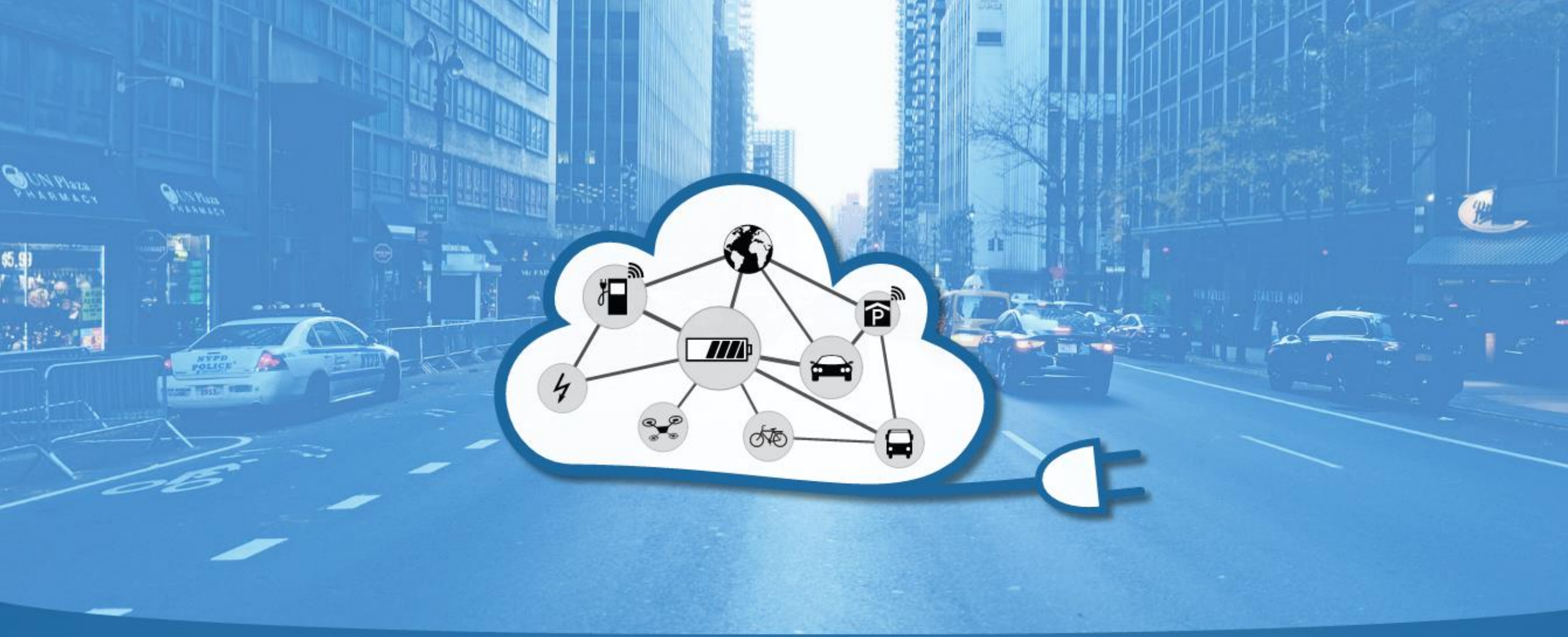
They are willing to change…

Stiftung Datenschutz agrees that it seems very likely, that the current e-mobility charging infrastructure violates privacy laws.

Maybe a better future…



Sadly, in the past it did not work out very well…



Open Charging Cloud

GraphDefined GmbH

mail@open.charging.cloud
PGP/GPG 065B 20E3 1FDC C624 C438 907D D977 5D7B 13F6 7088
https://open.charging.cloud

Twitter: @OCCloud GitHub: OpenChargingCloud