AUTOMATION SYSTEMS GROUP

Improving Energy Community interoperability

A Web of Things approach

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17.03.23

TU WIEN Informatics

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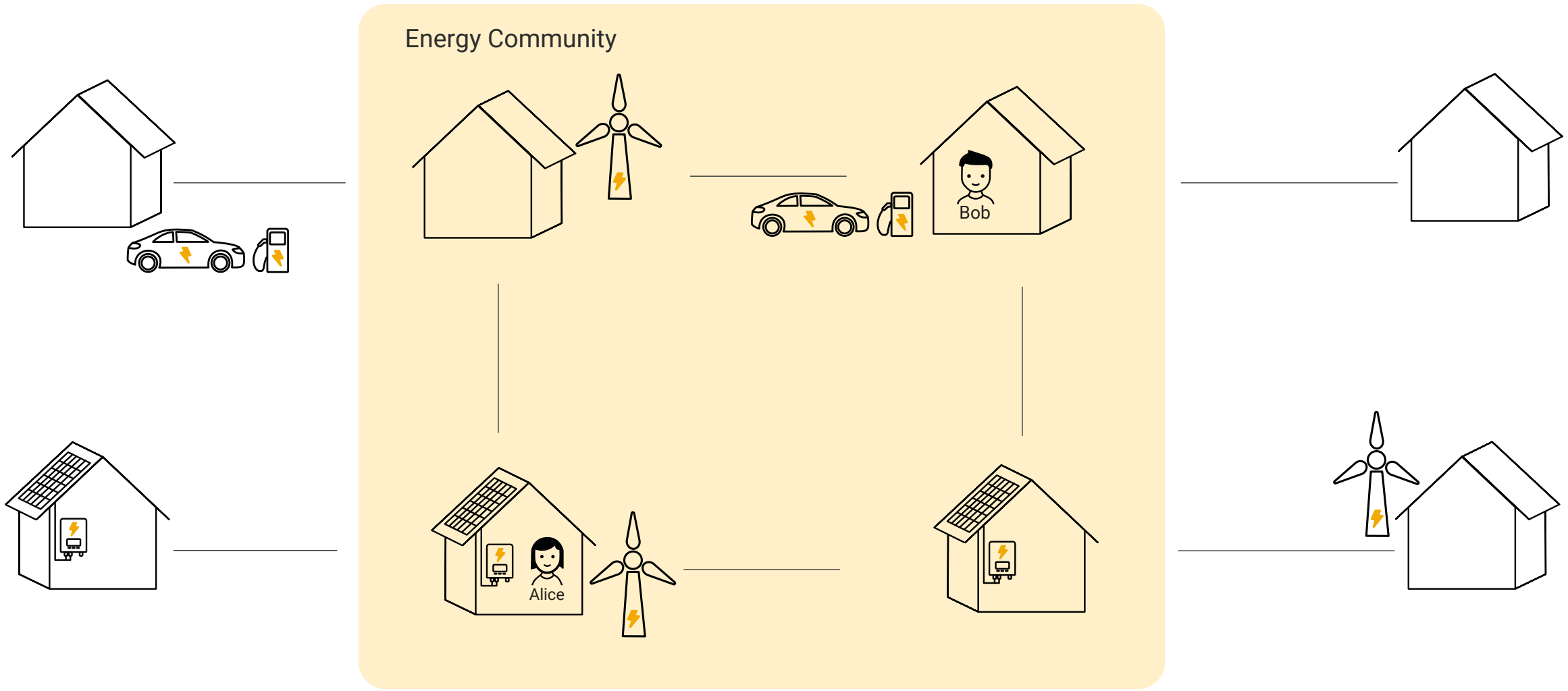
Use Case



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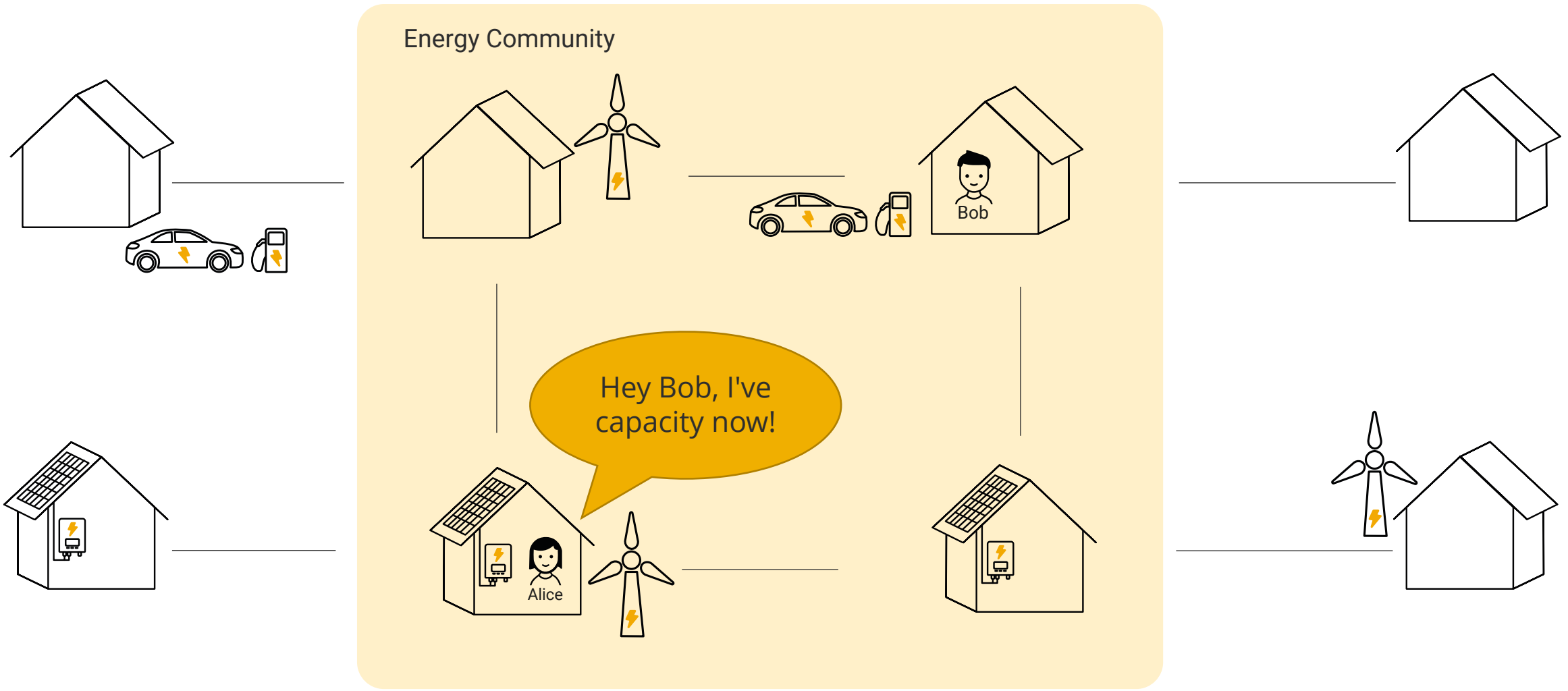

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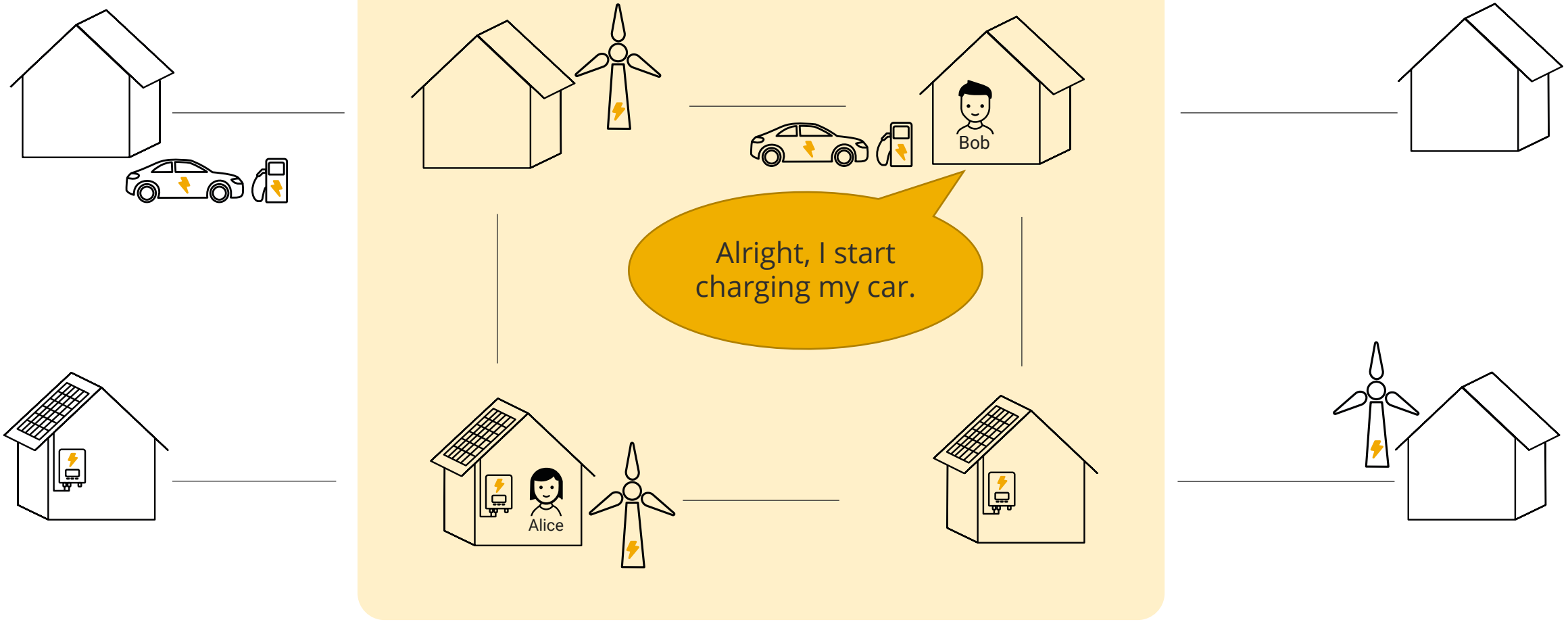

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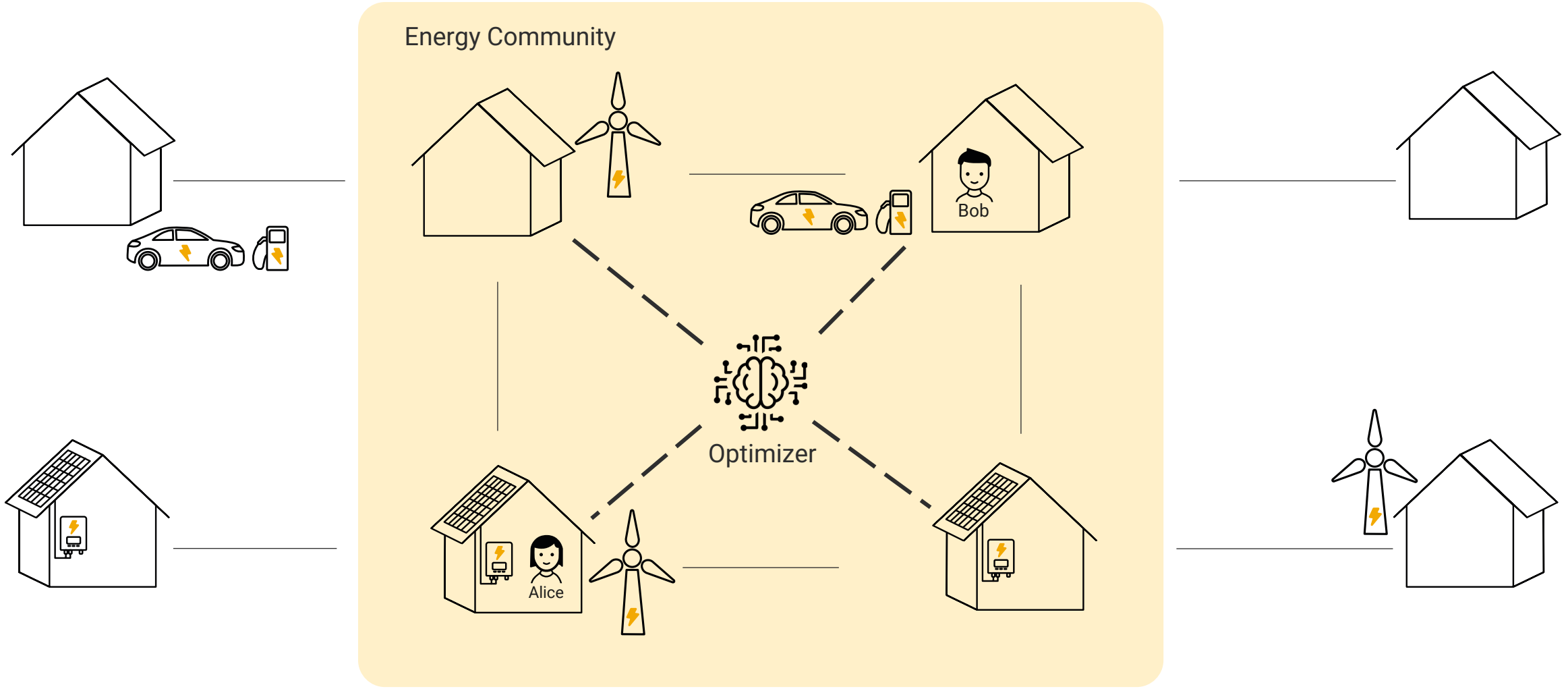
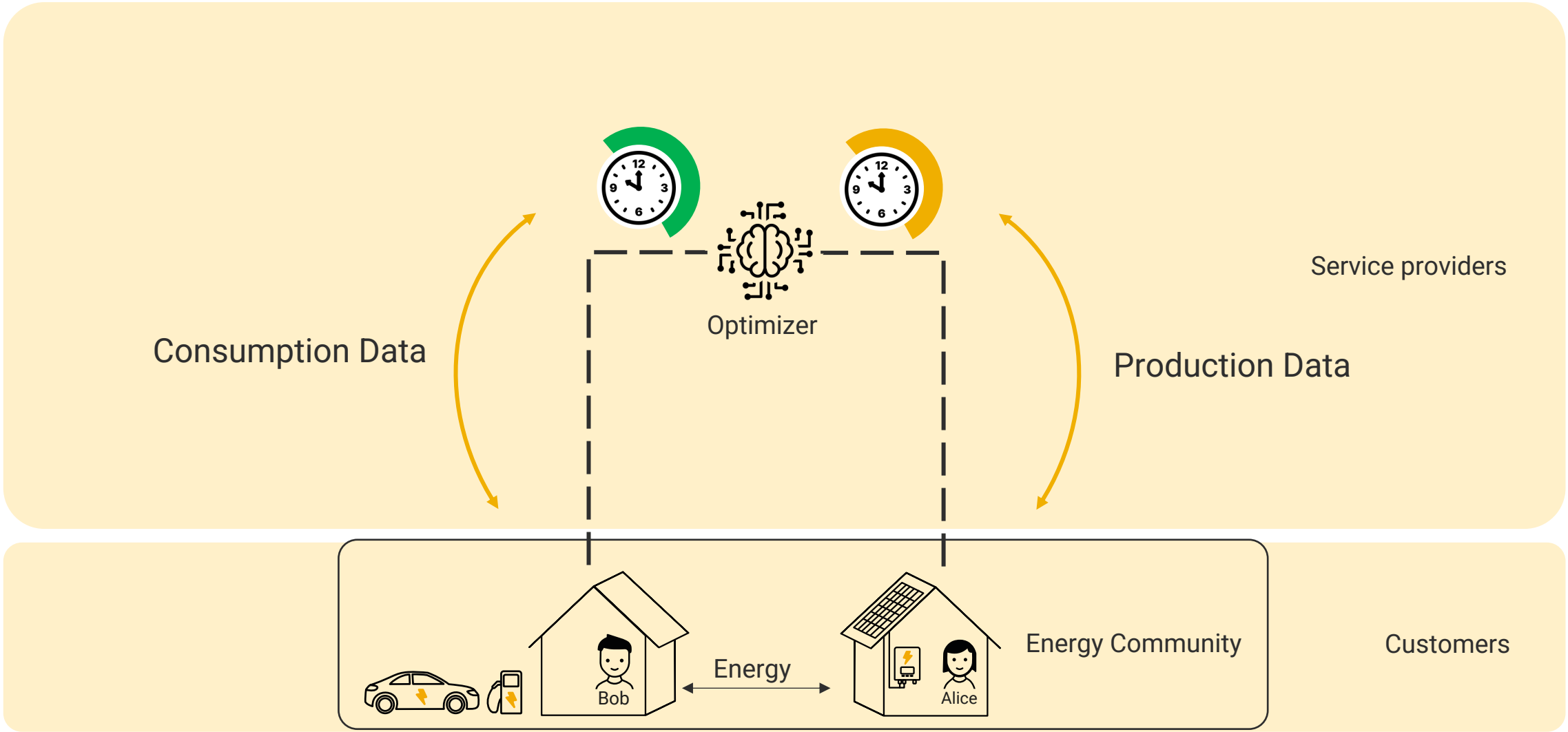


Communication



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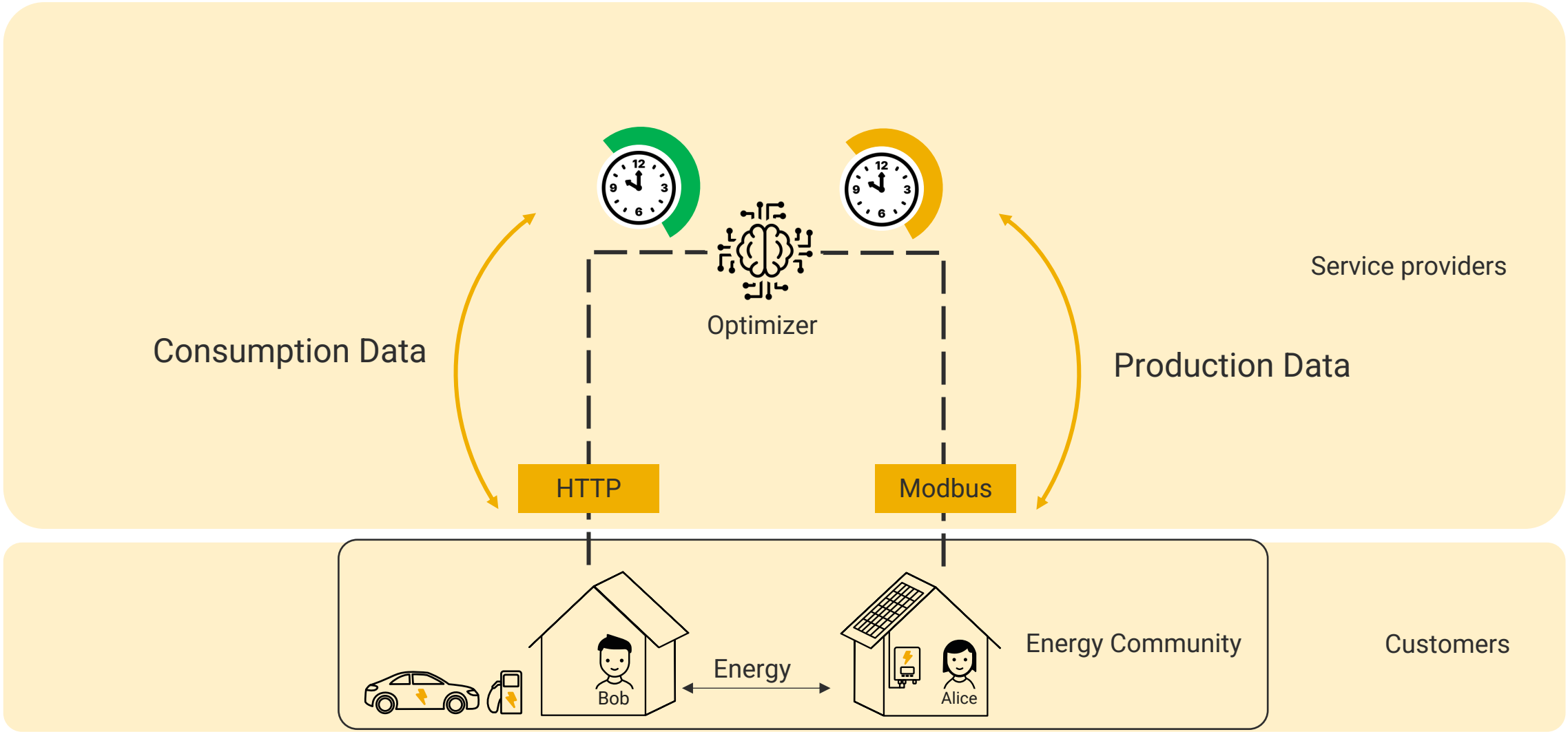

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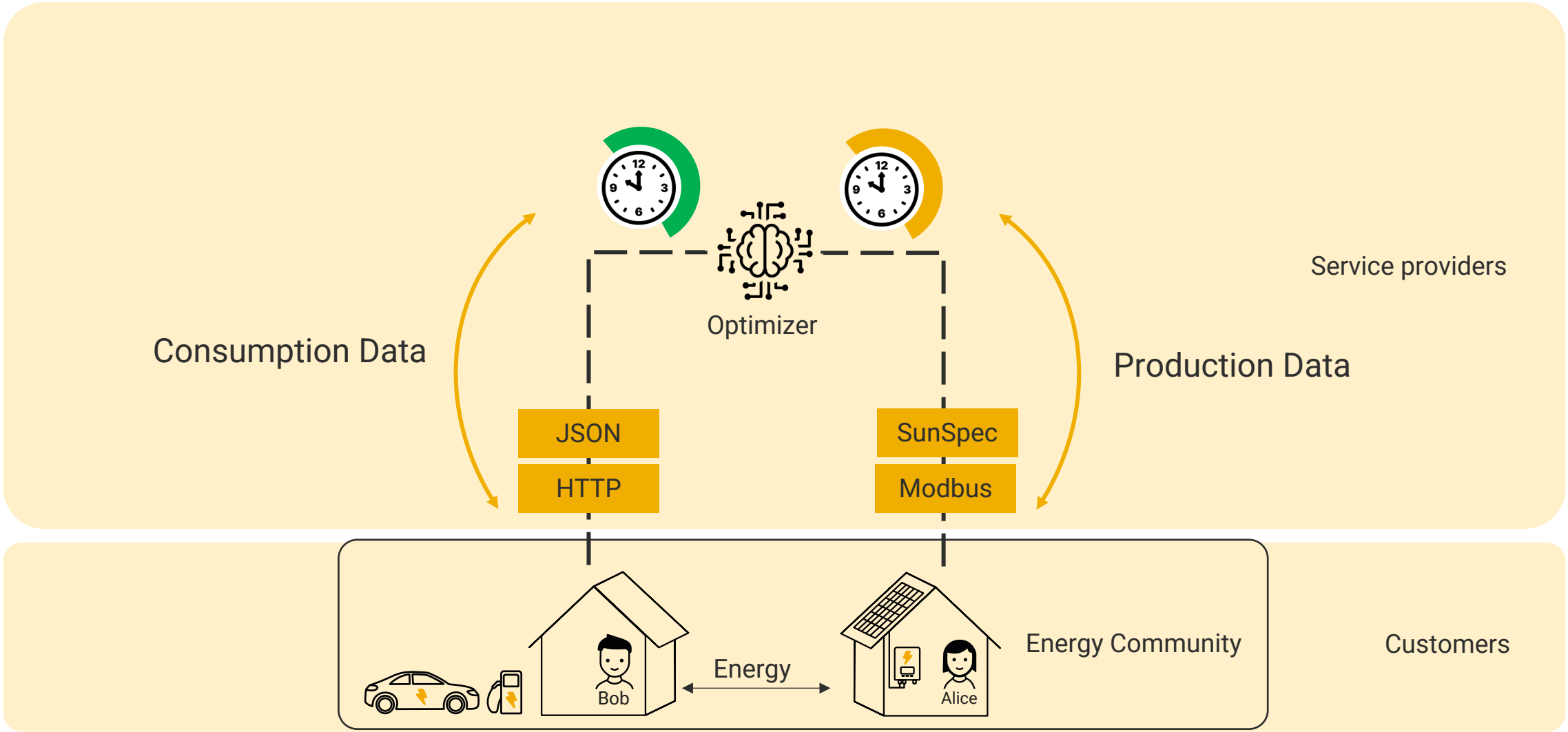

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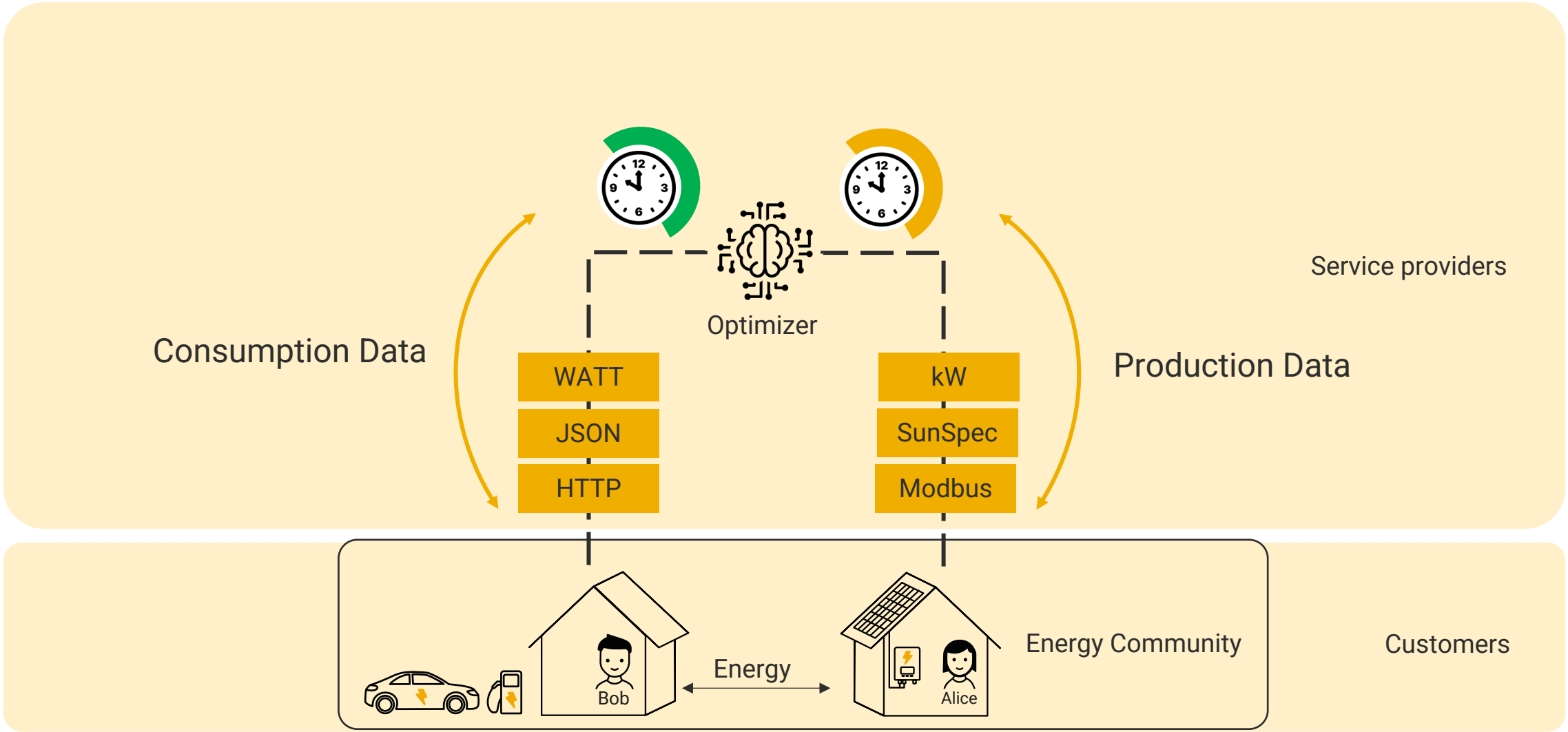

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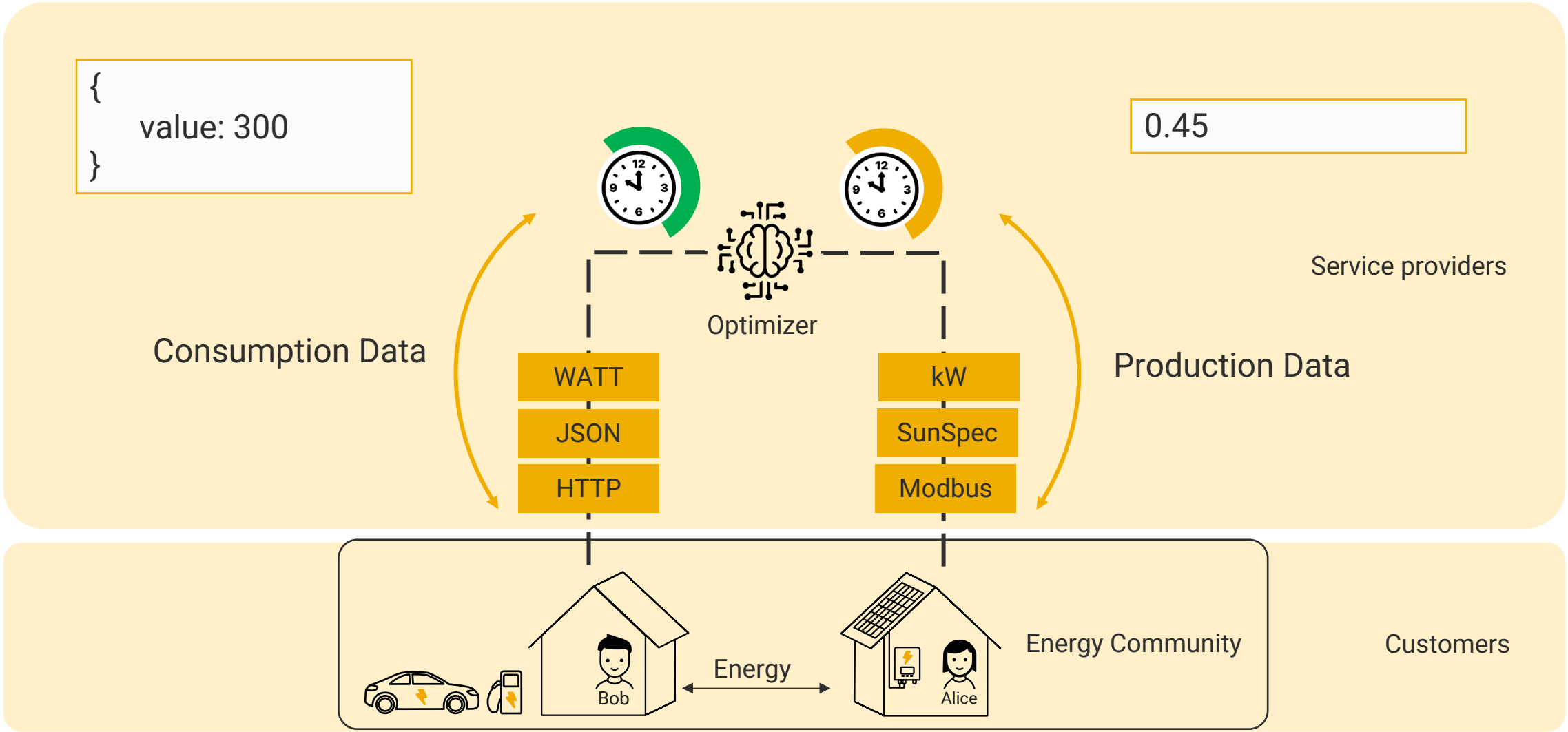
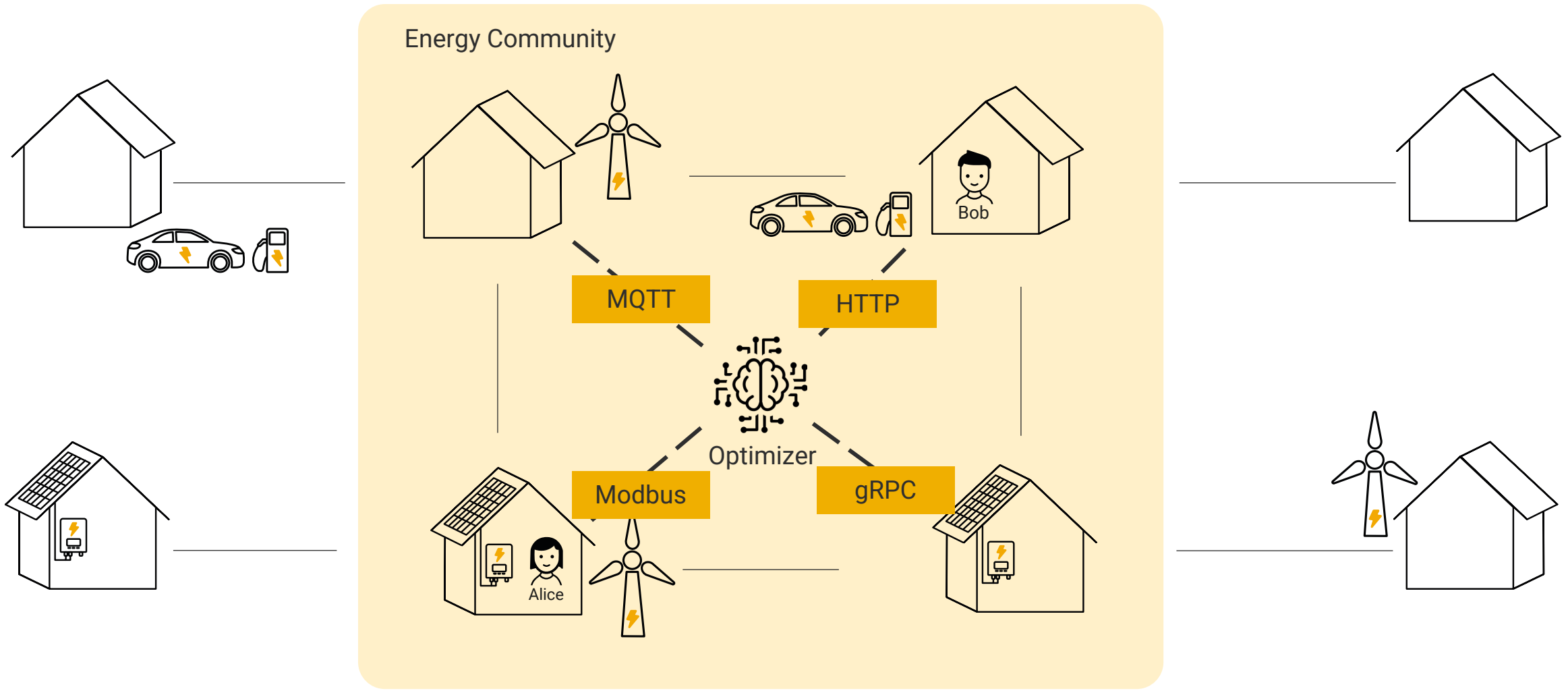
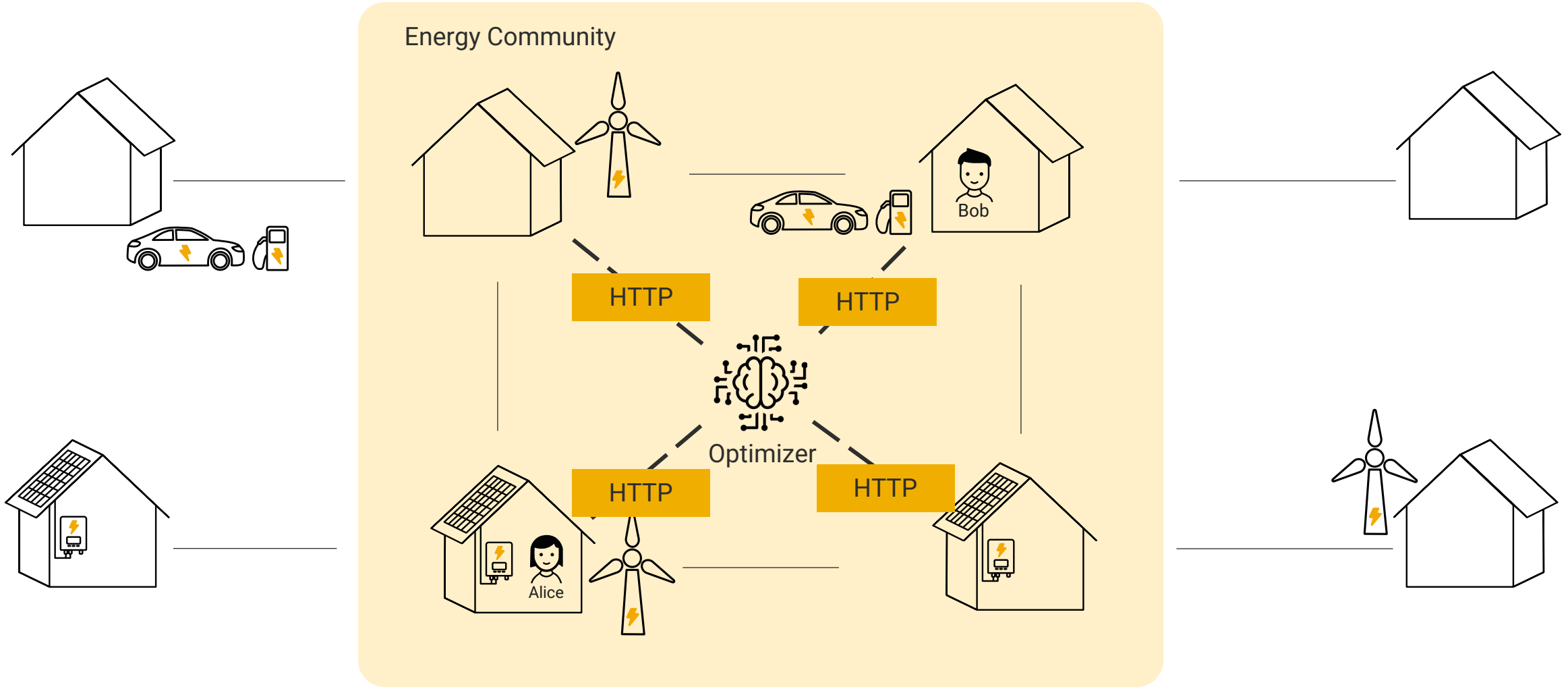


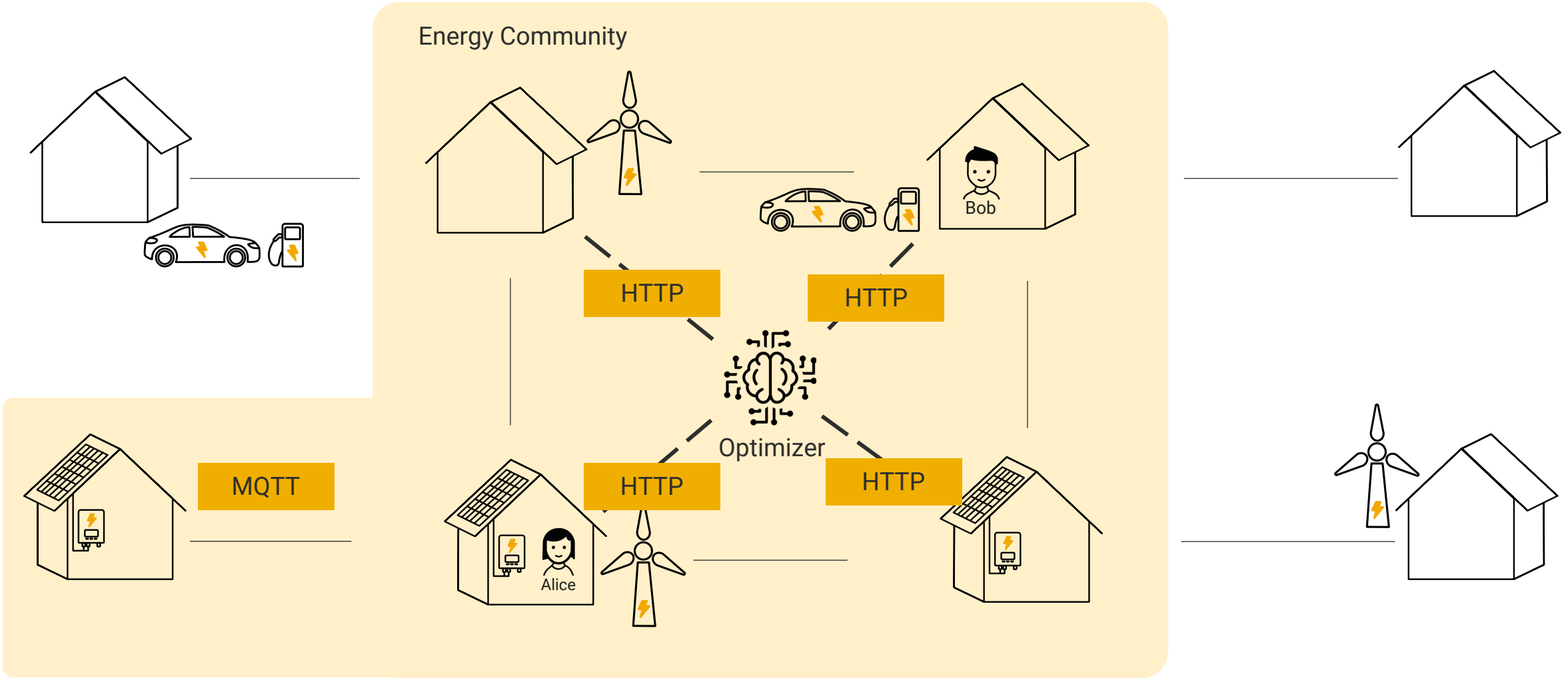
Problem


Energy Community
Bob
MQTT
HTTP
Optimizer
Modbus
gRPC
Alice

Possible solution: Mandatory standards



Problem 1: Incompatibility



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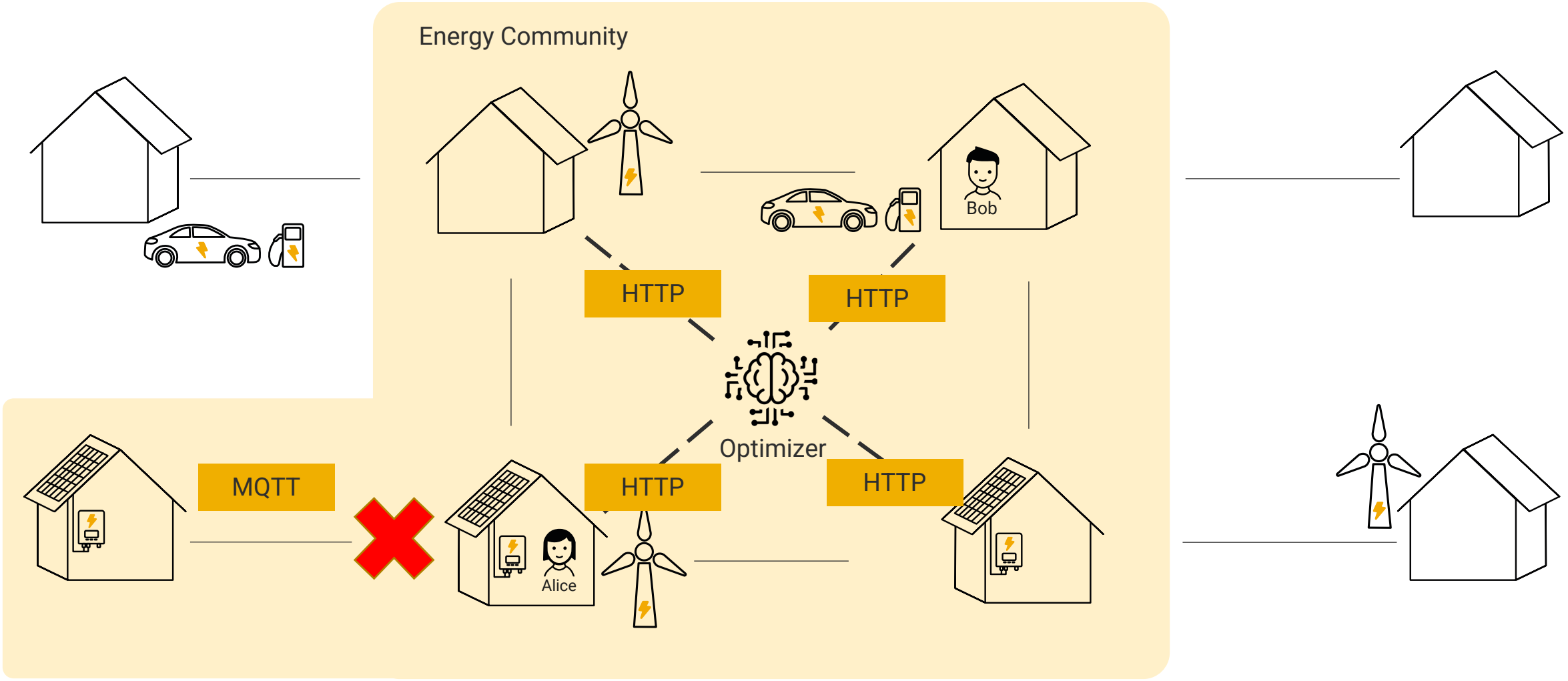
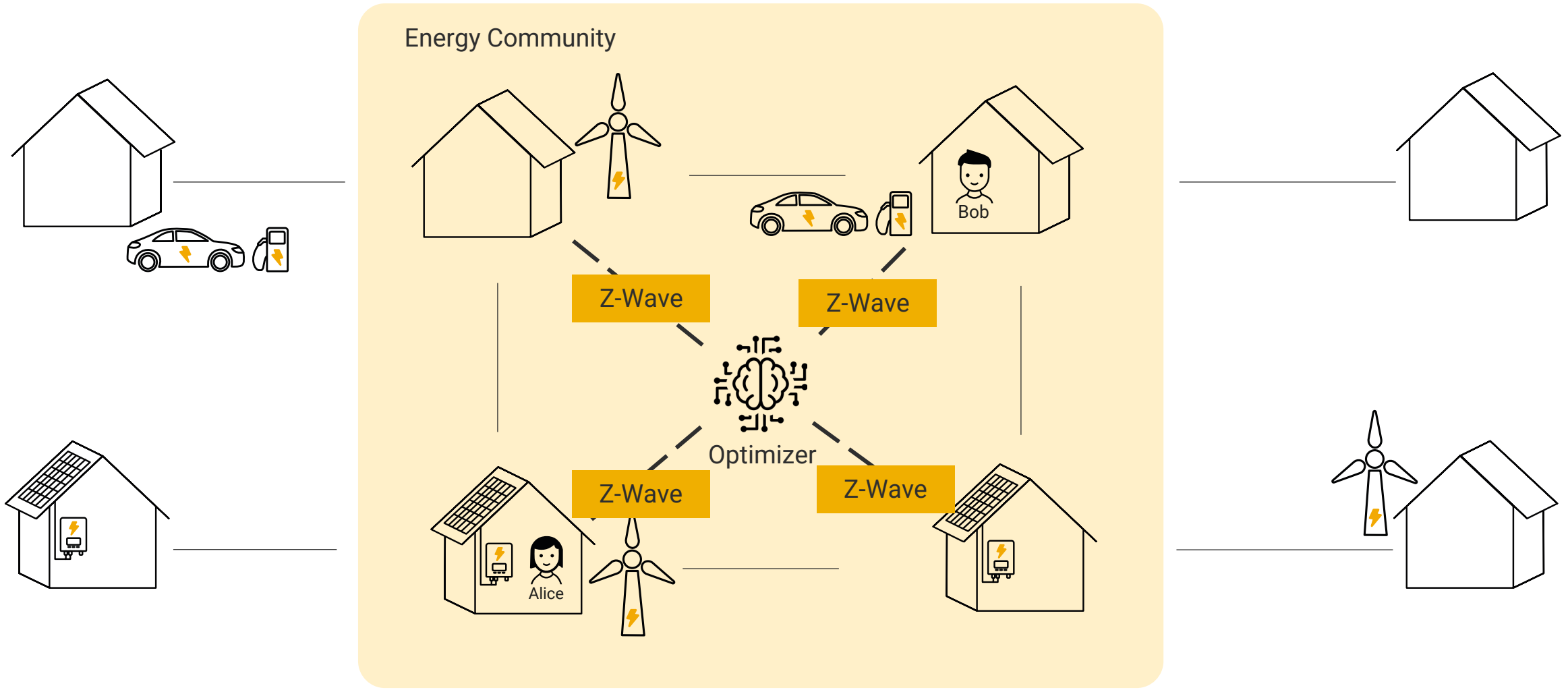
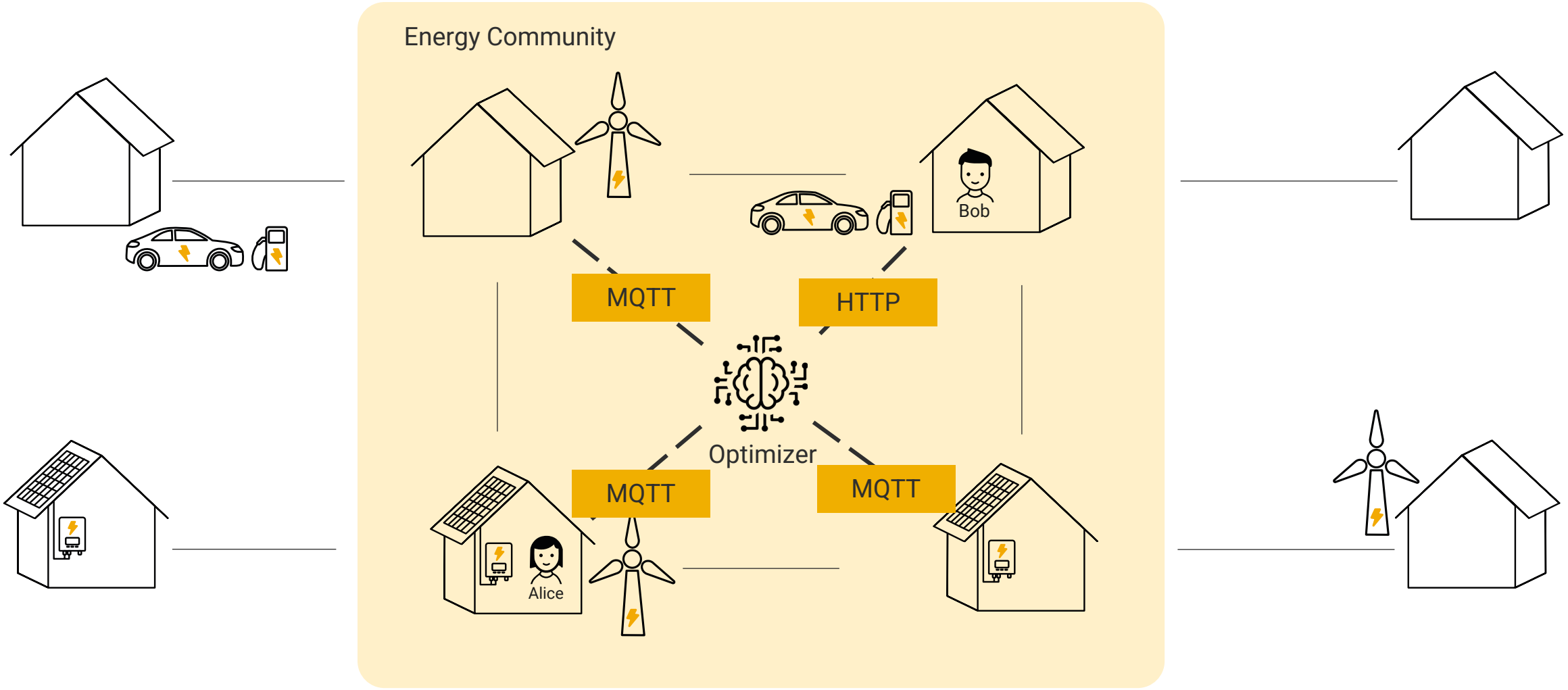


Problem 2: Lock-in



Problem 3: Suitability



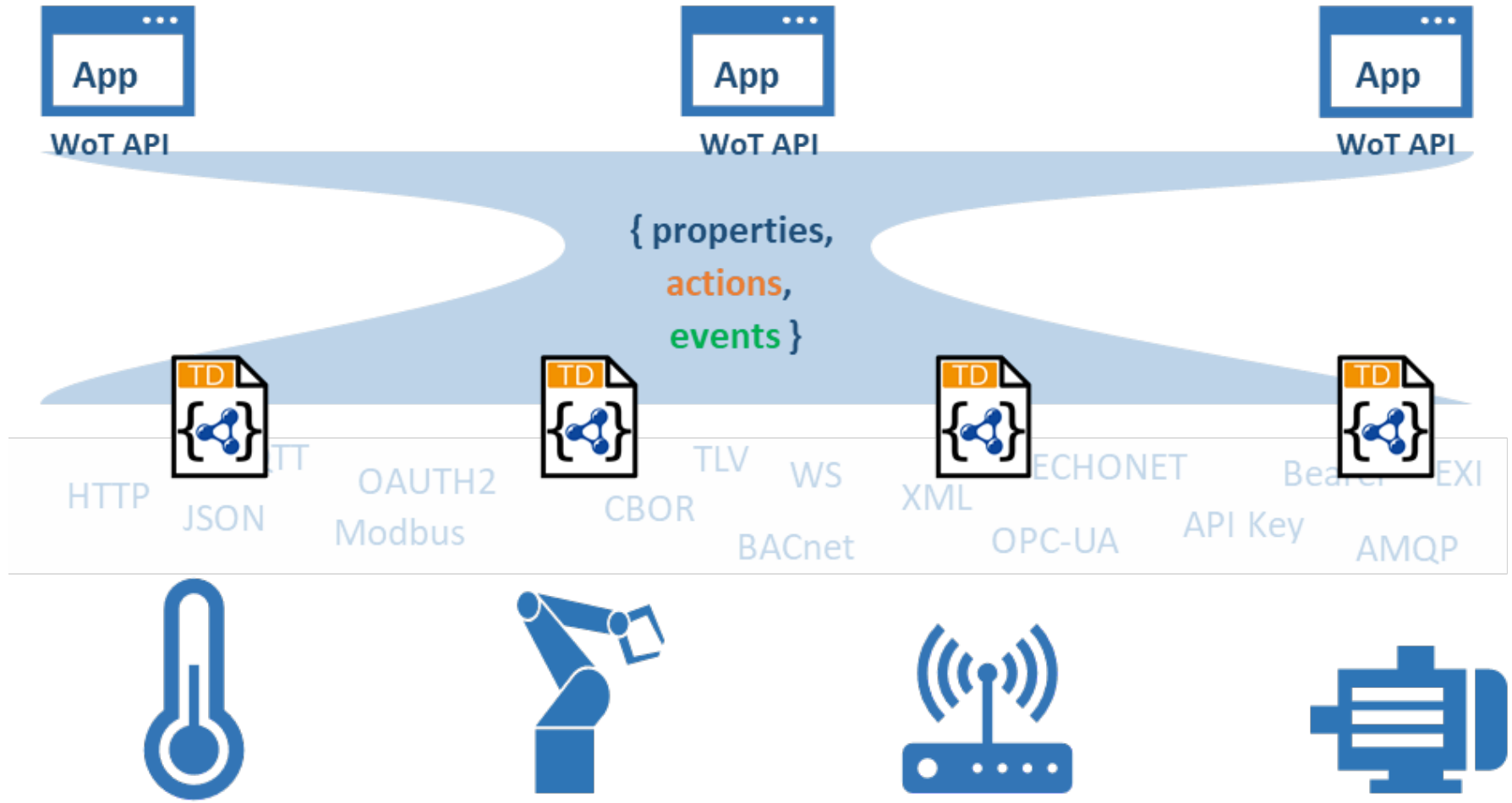
Alternative approach

Communicates over:
HTTP

Formats data in:
JSON

Represents in:
Power in kW

Web of Things



WoT Thing Description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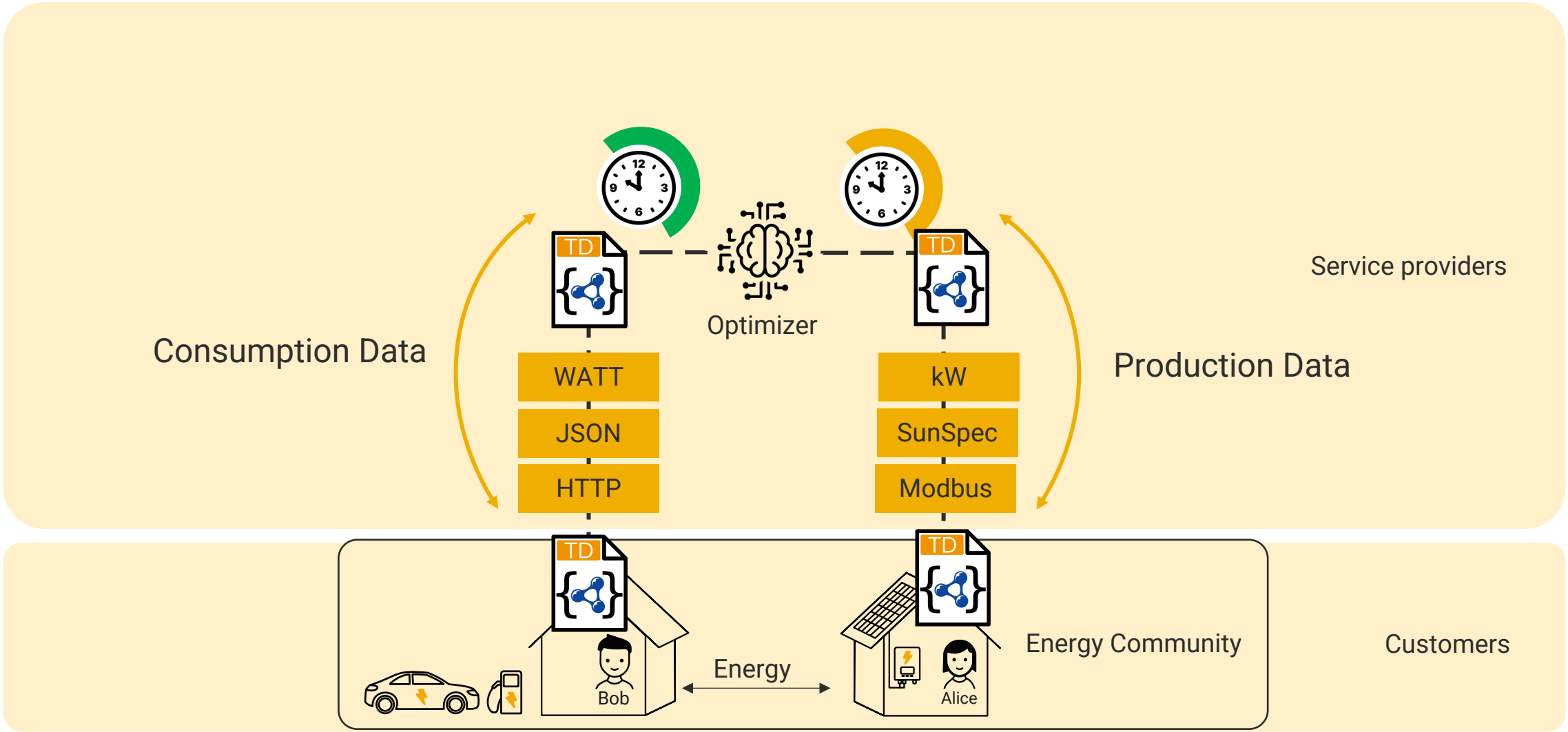
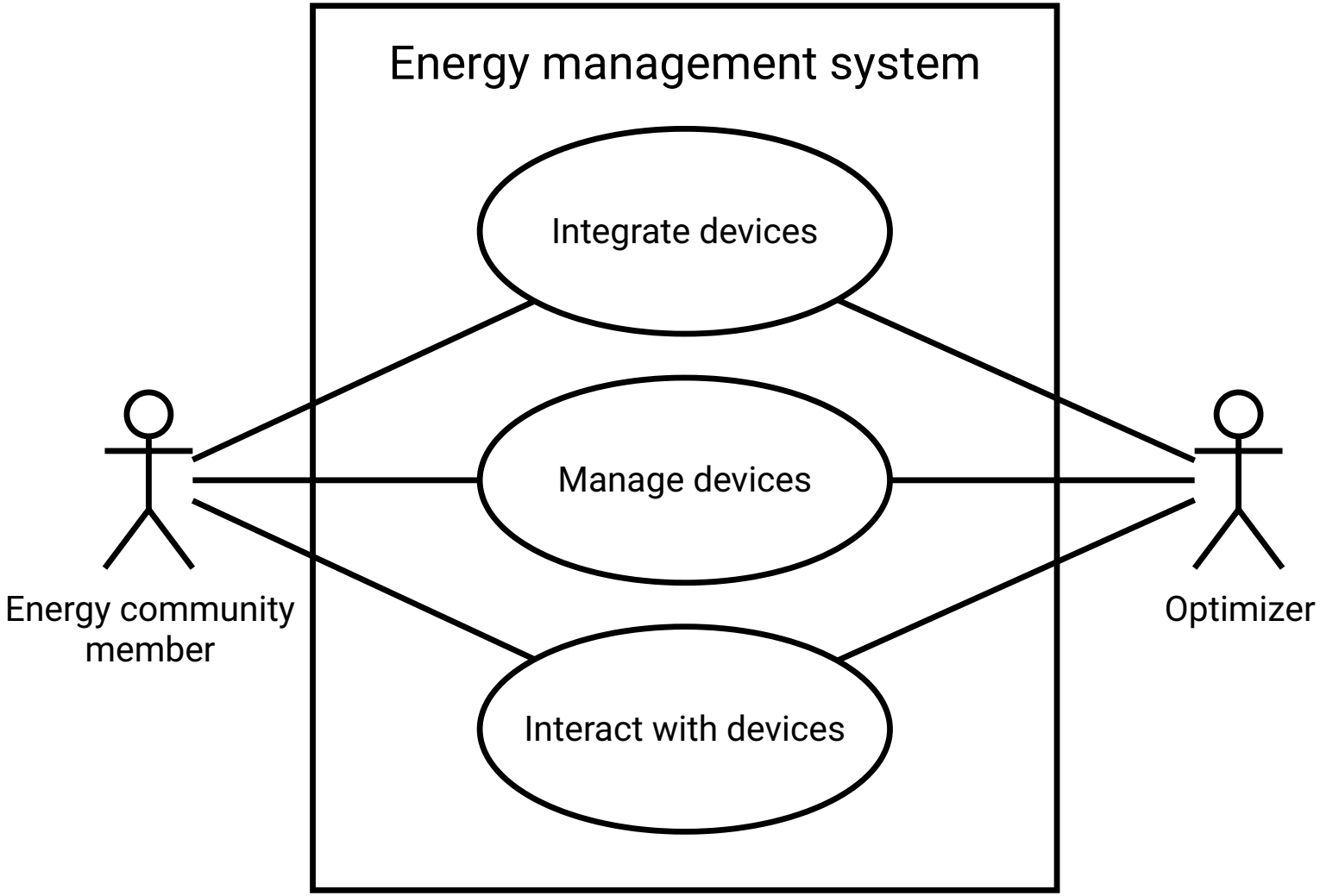
        "http://www.example.org/smart-energy",
        {
            "cov": "http://www.example.org/coap-binding#"
        }
    ],
    "@type": "smartmeter",
    ...
    "properties": {
        "status": {
            "type": "string",
            "readOnly": true,
            ...
            "forms": [{
                "op": "readproperty",
                "href": "coaps://my.smart-meter.at/status",
                "contentType": "application/cbor",
                "cov:methodName": "GET"
            }]
        }
    },
    "actions": {
        ...
    }
...
```

Communication requirements



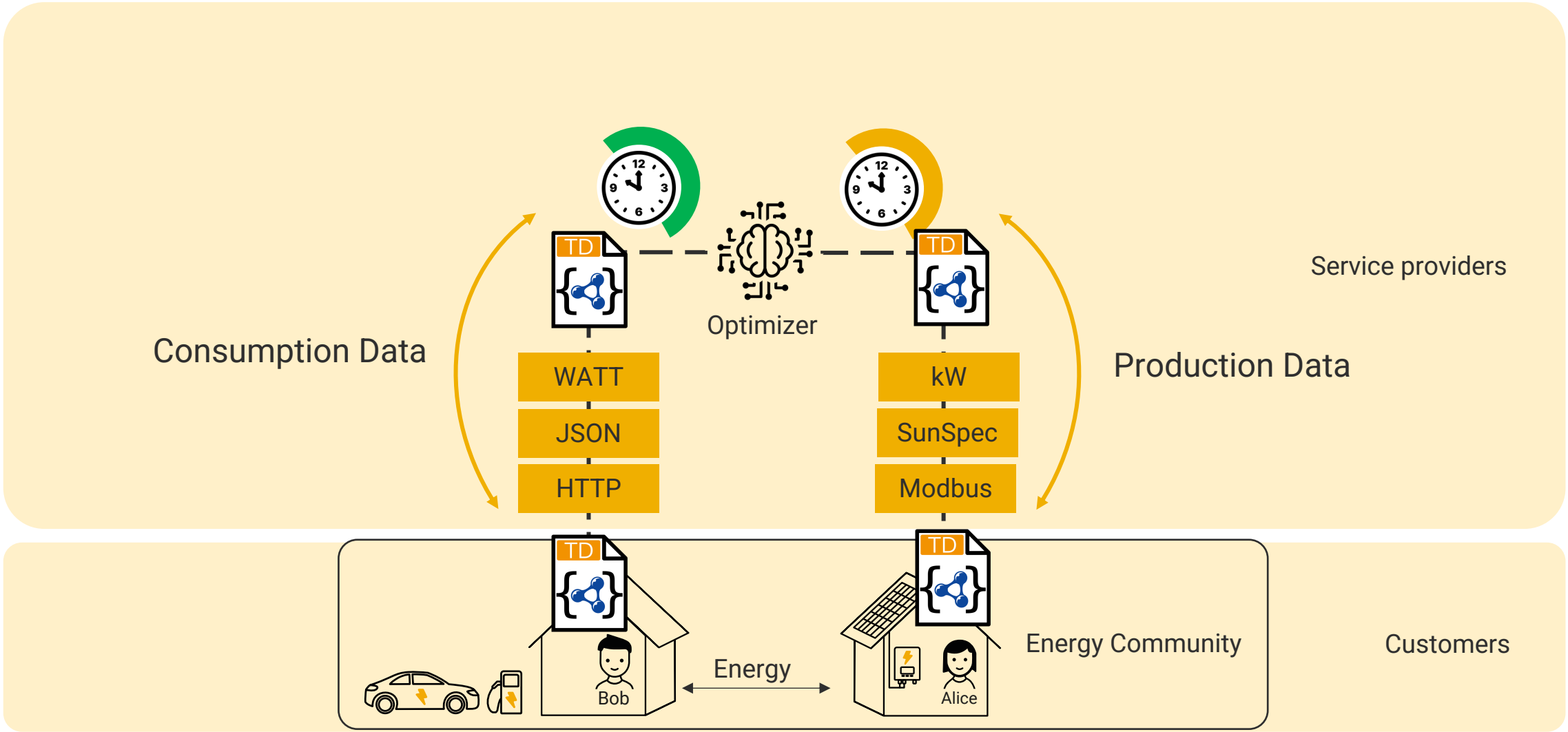
Functional requirements



Non-functional requirements

- Confidentiality and access control
- Extensibility
- Interoperability
- Low effort

Communication



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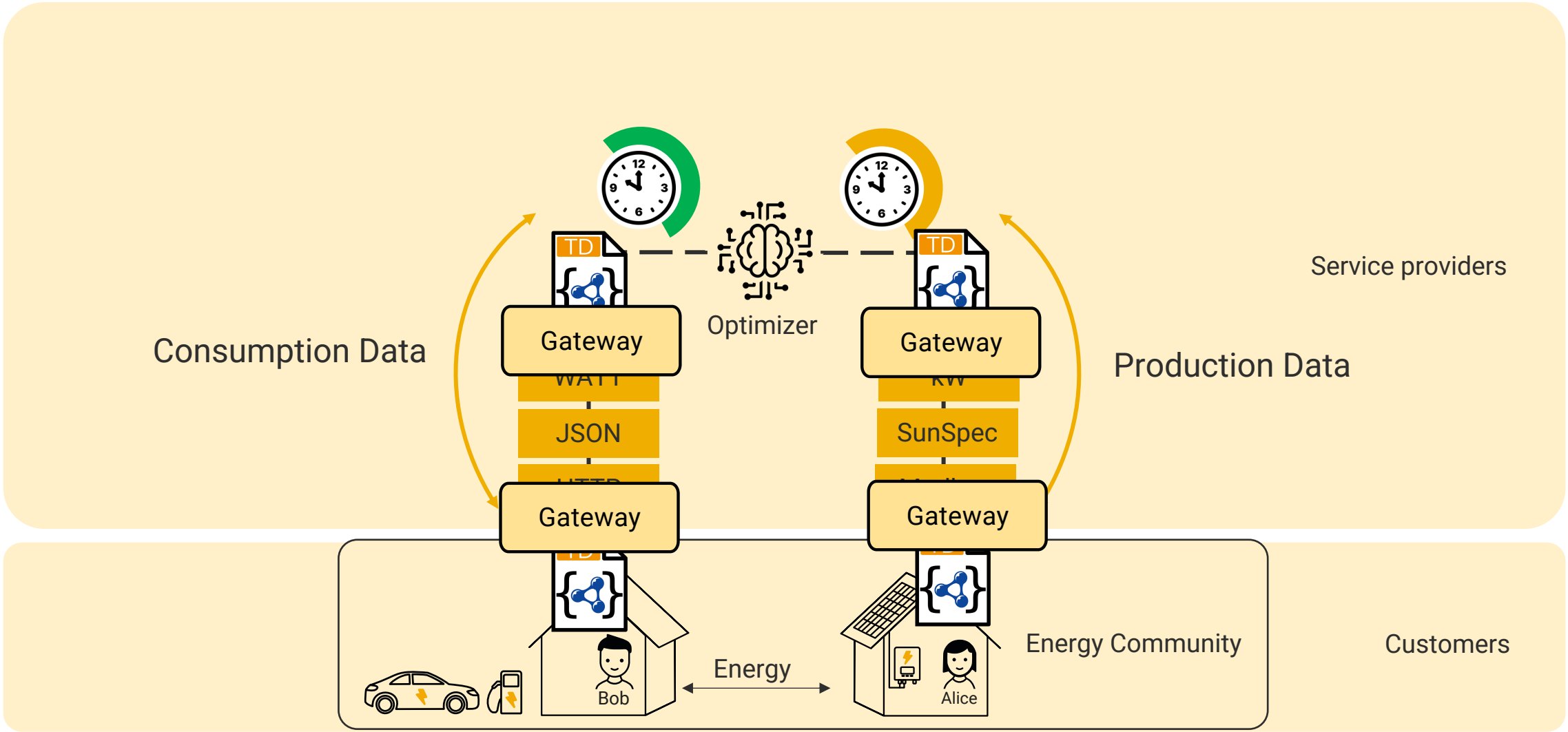

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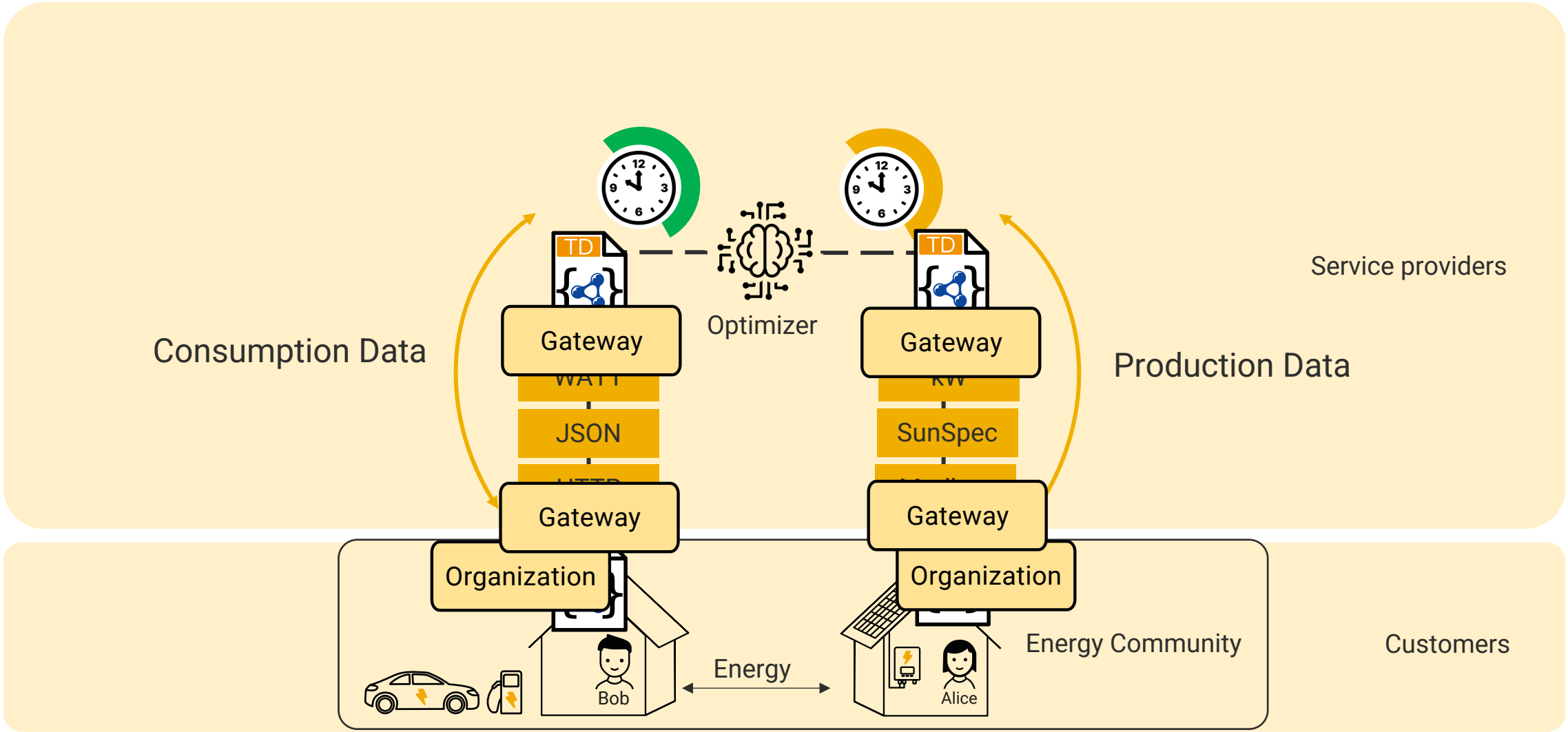

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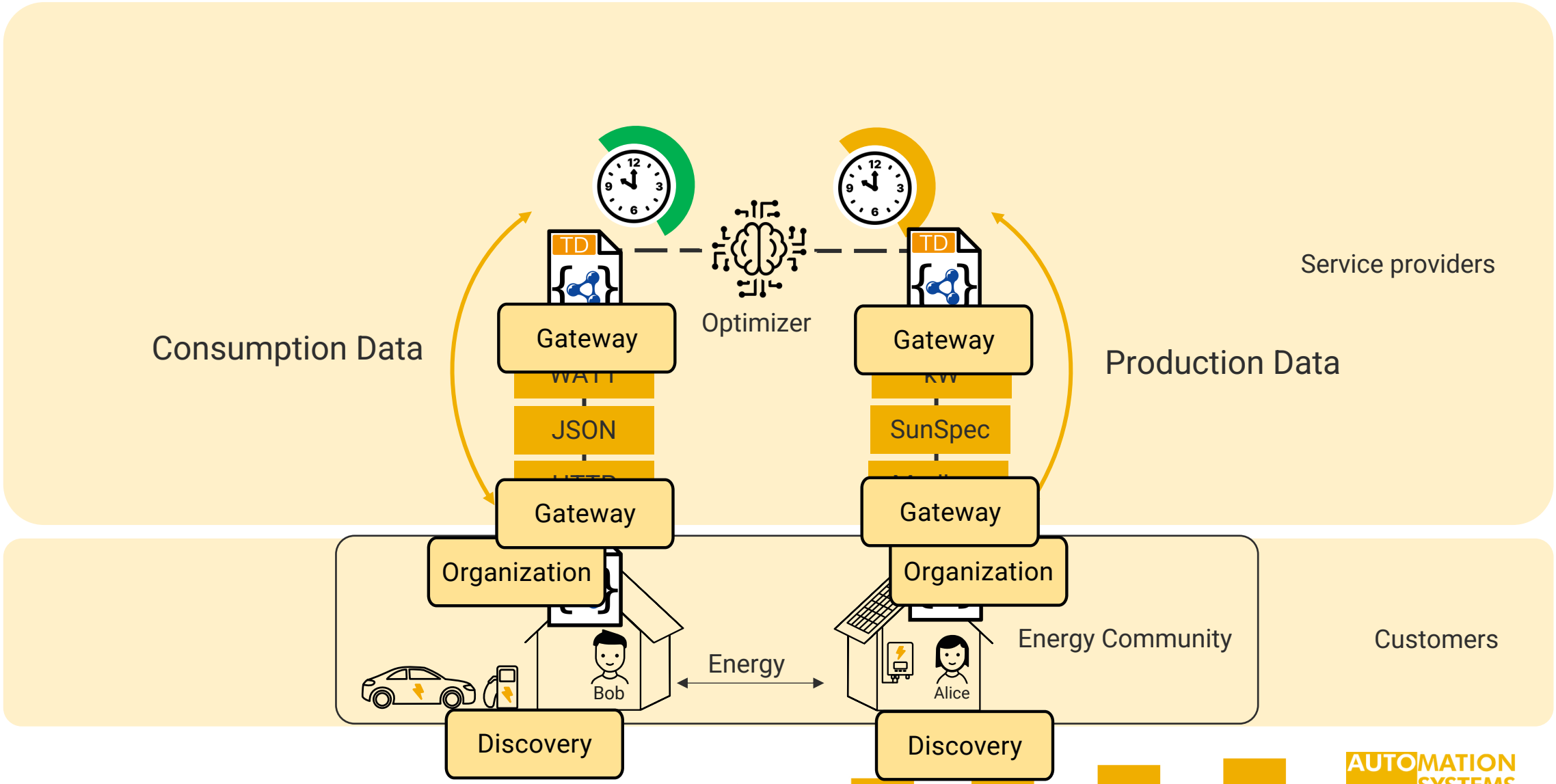

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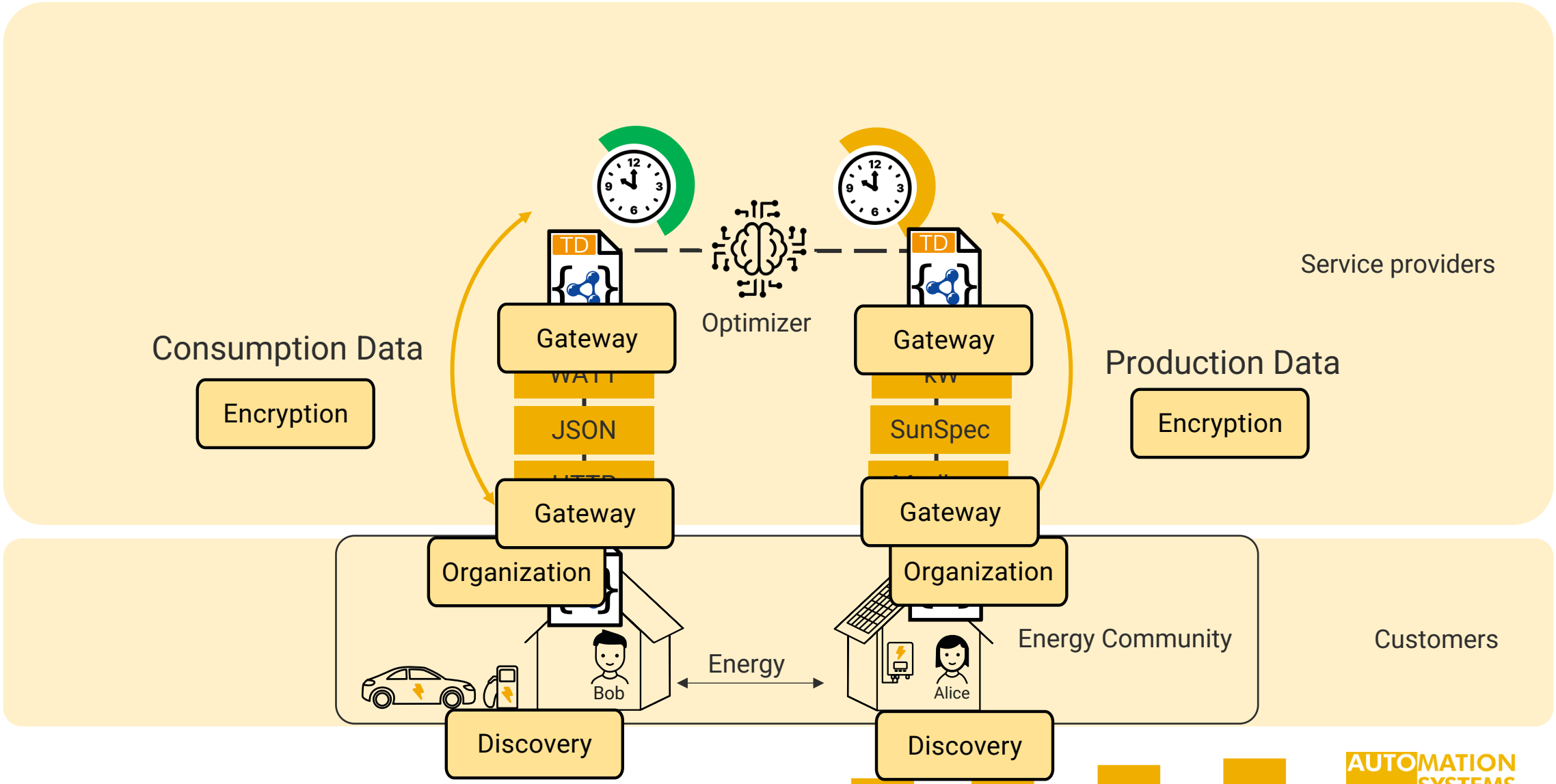

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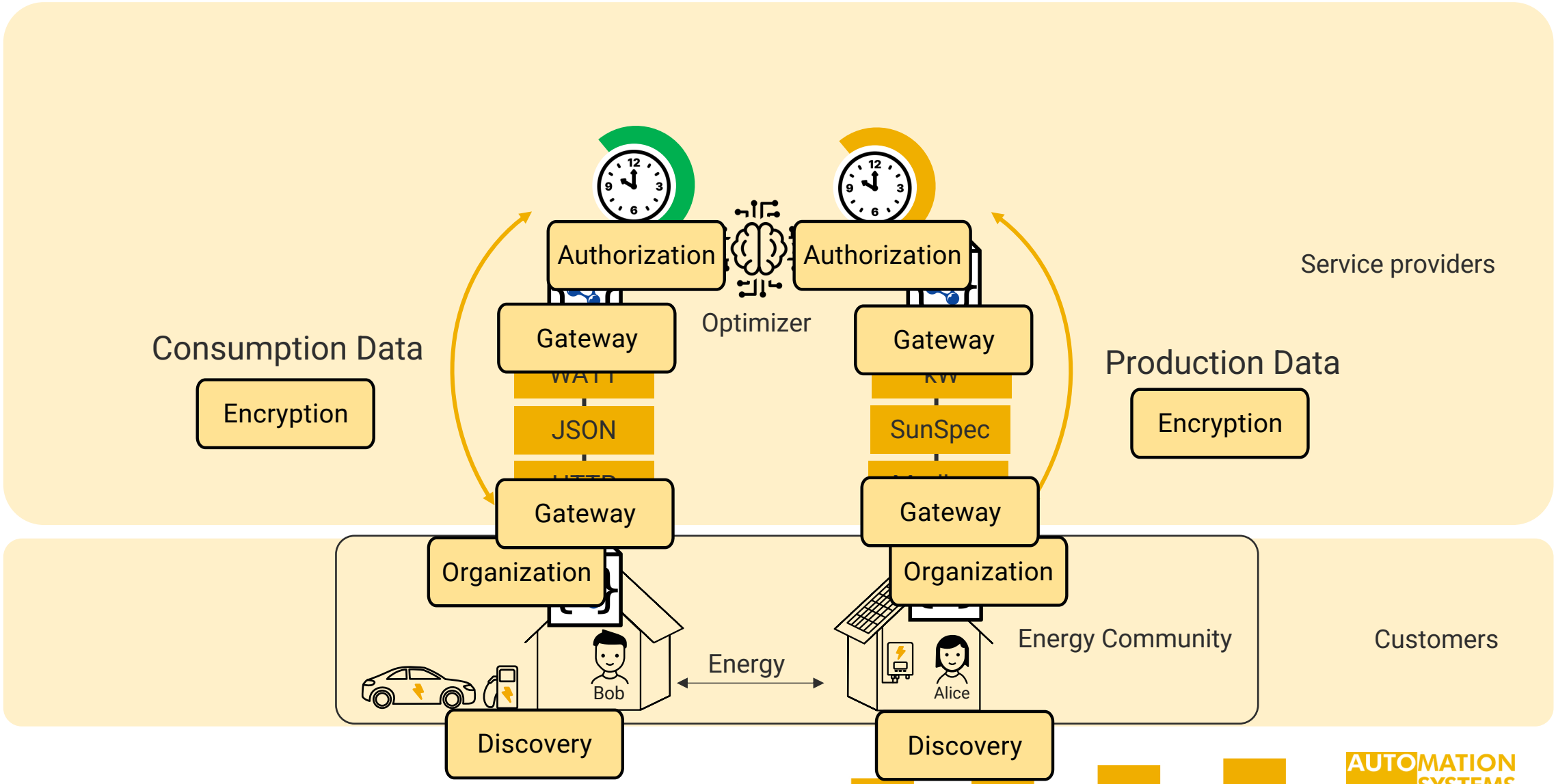
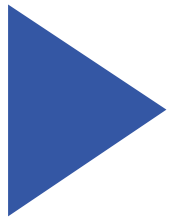


Services

Directory Service

Organization



Runtime Service

Gateway

Security Service

Authorization

Network Service

Encryption

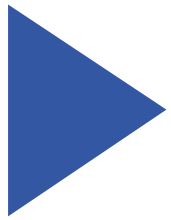
Discovery Service

Discovery

Services

Directory Service

Organization



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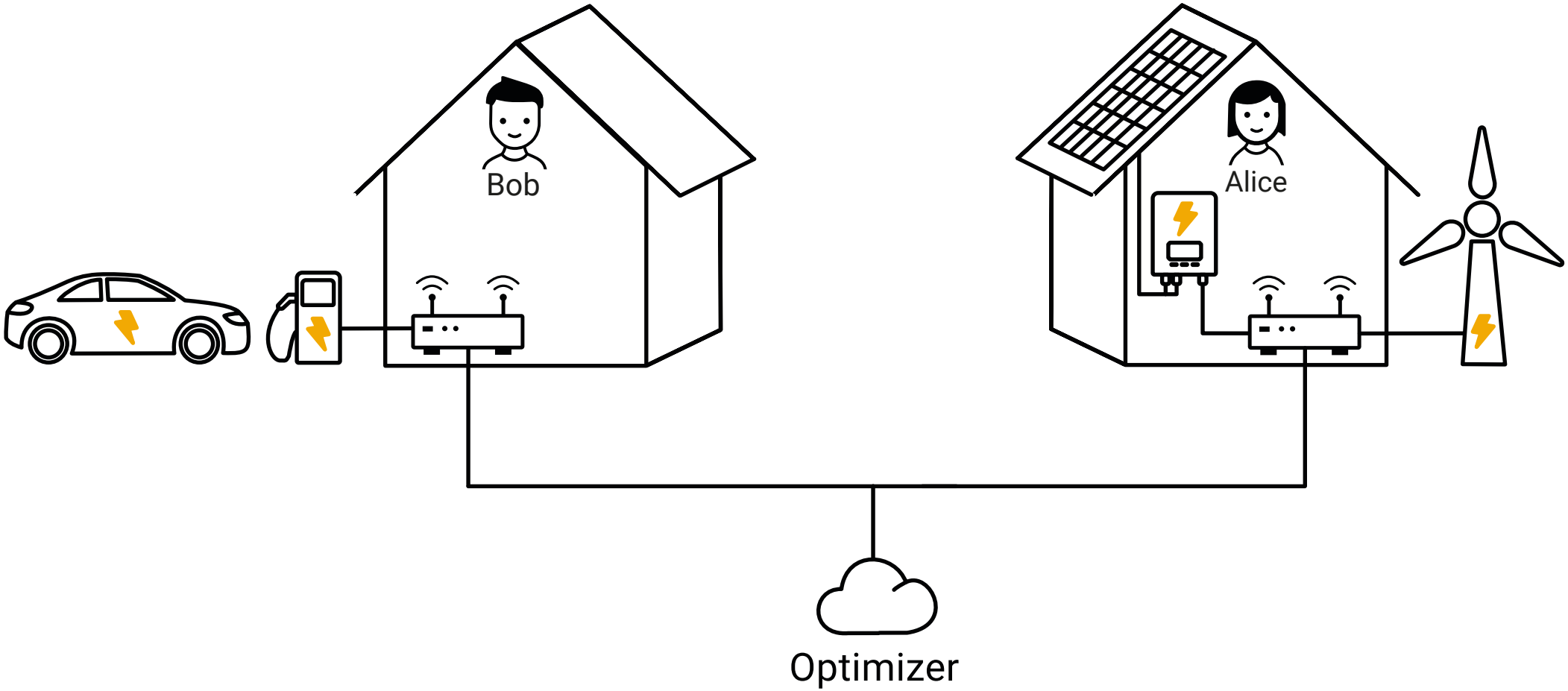
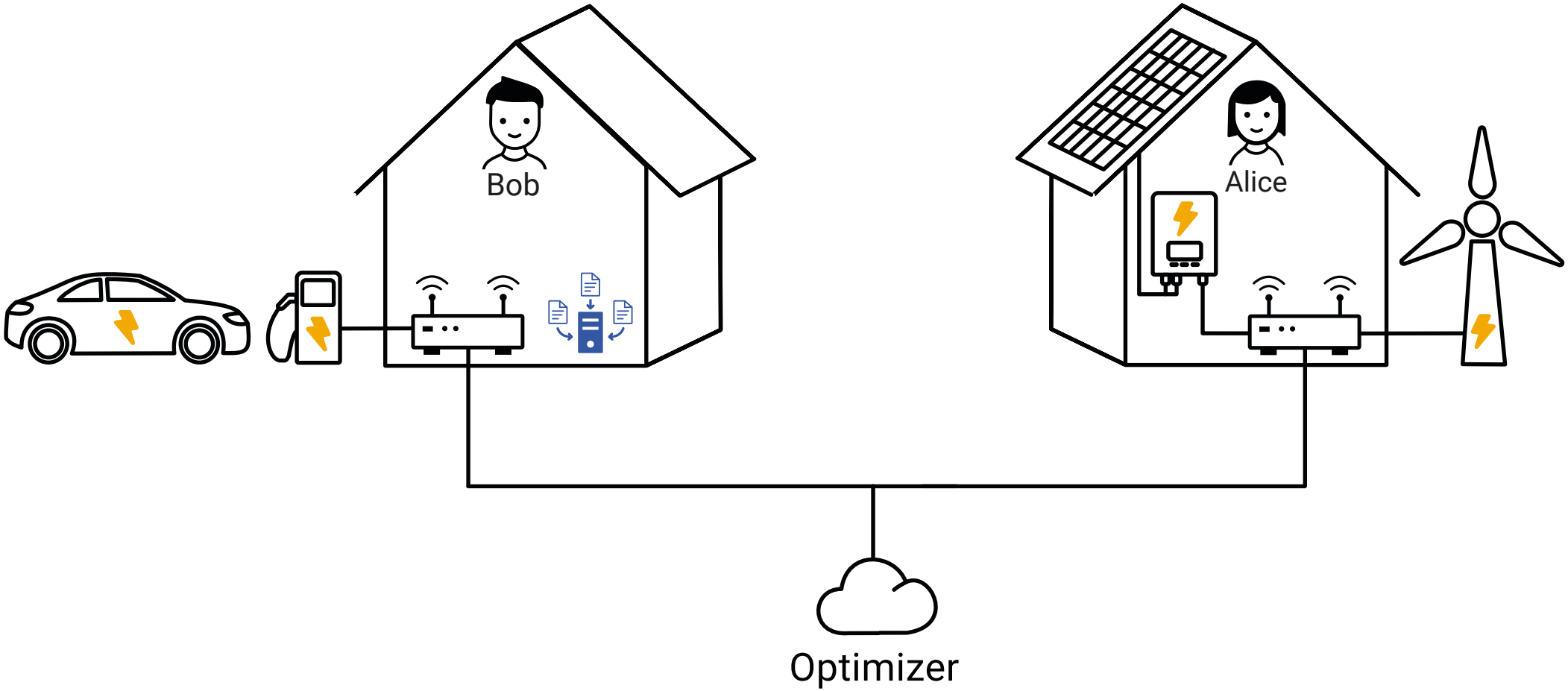
Service integration



Service integration



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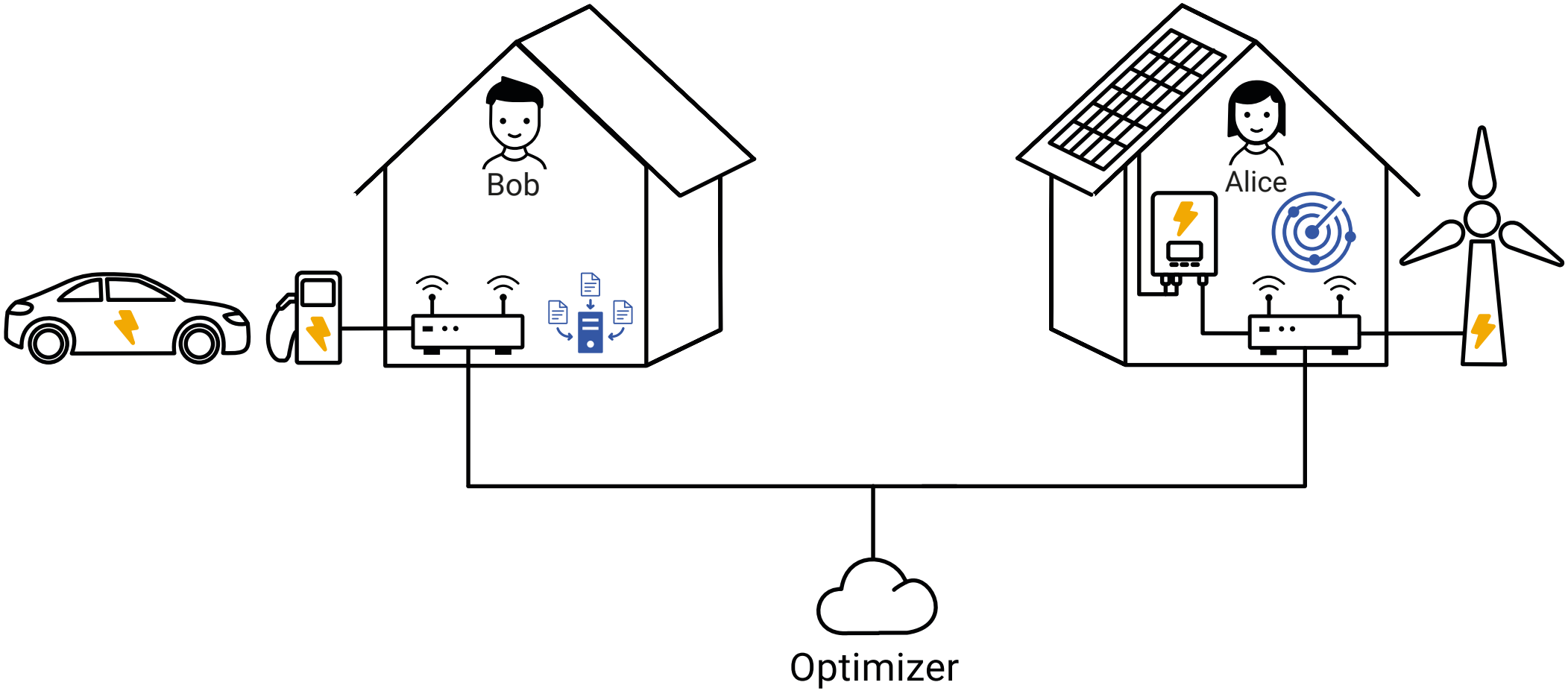
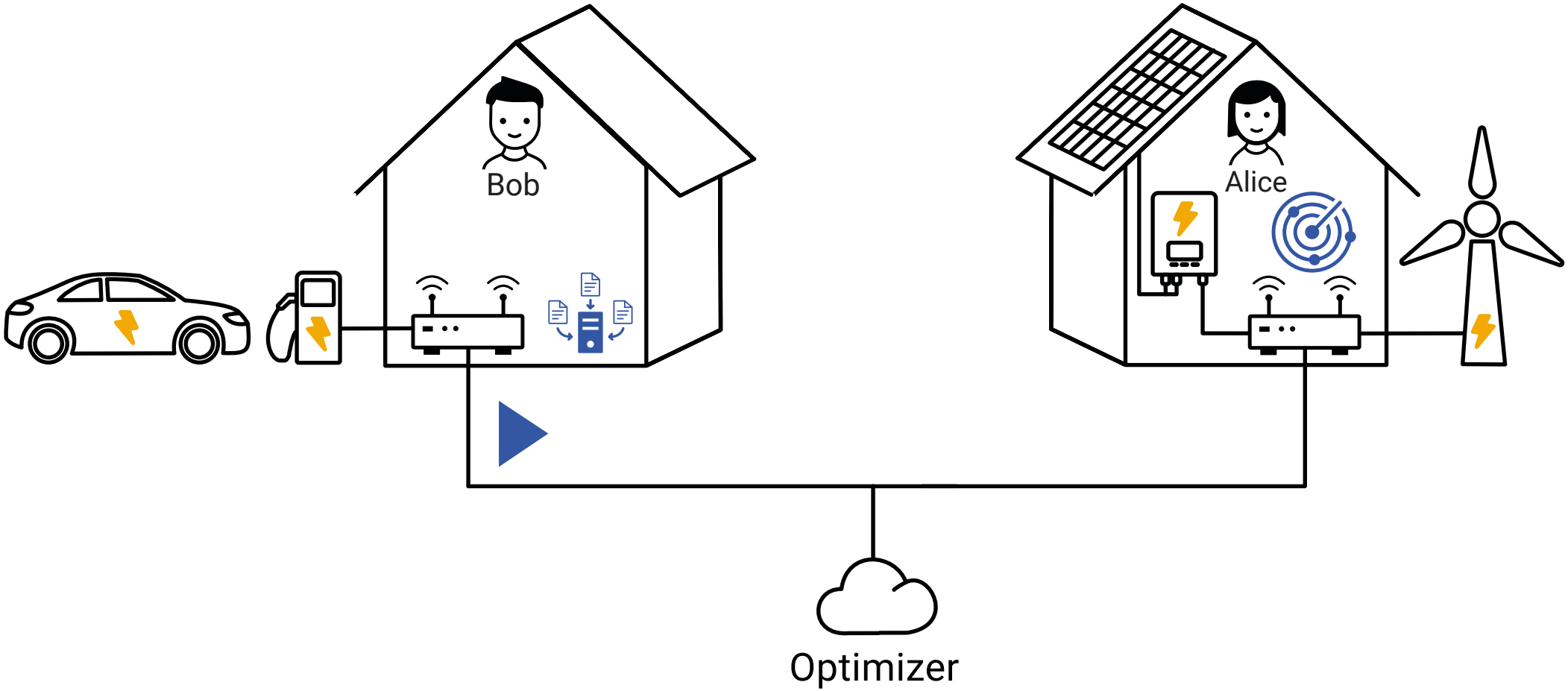


Service integration



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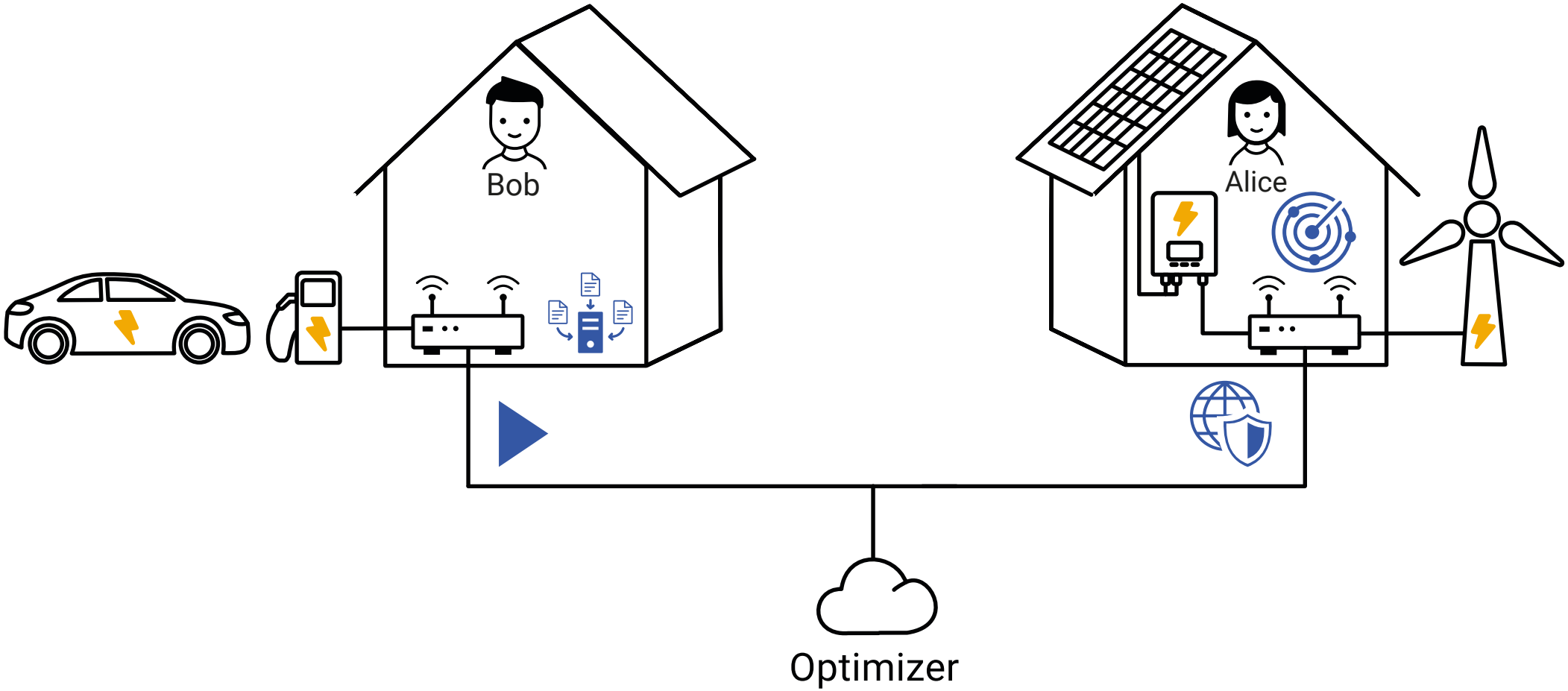

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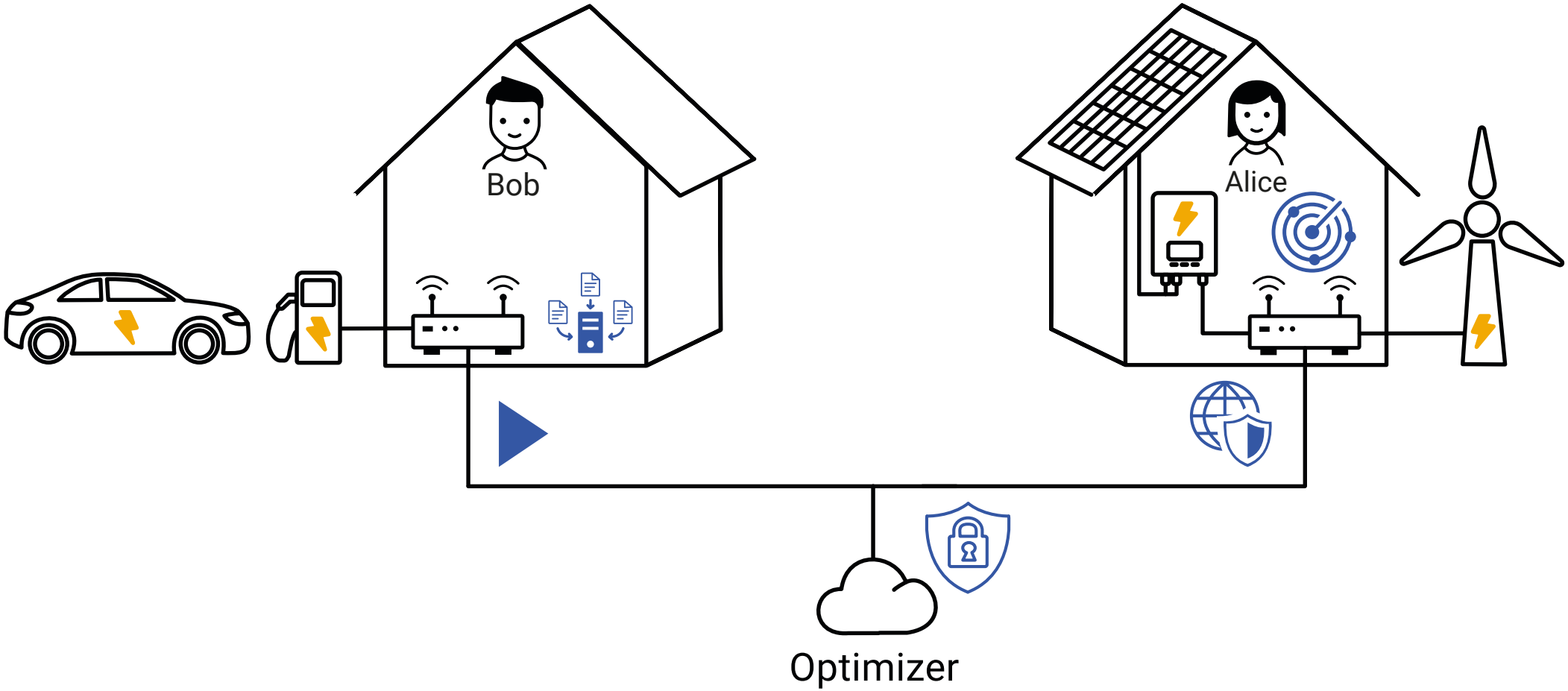
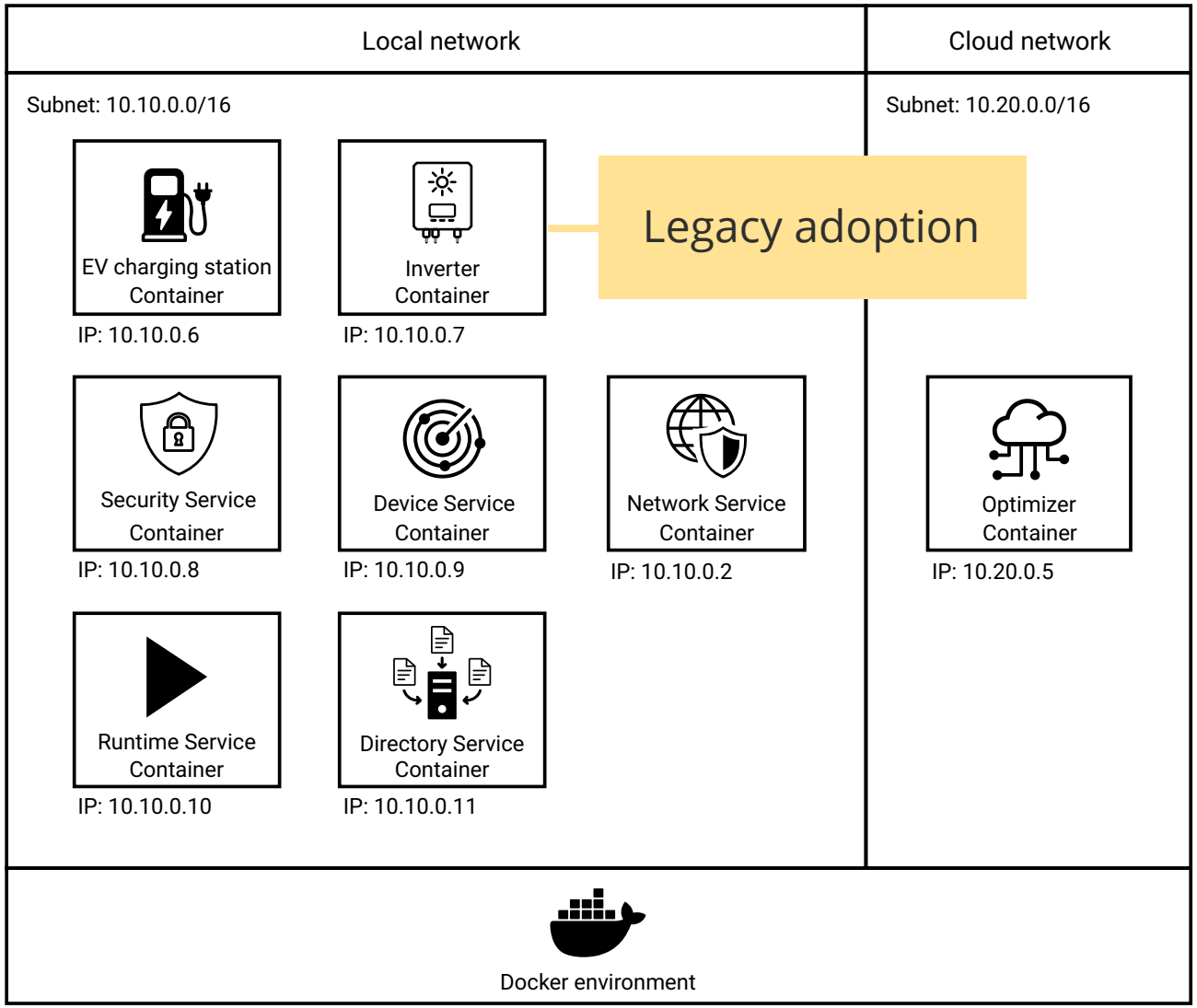


Testbed



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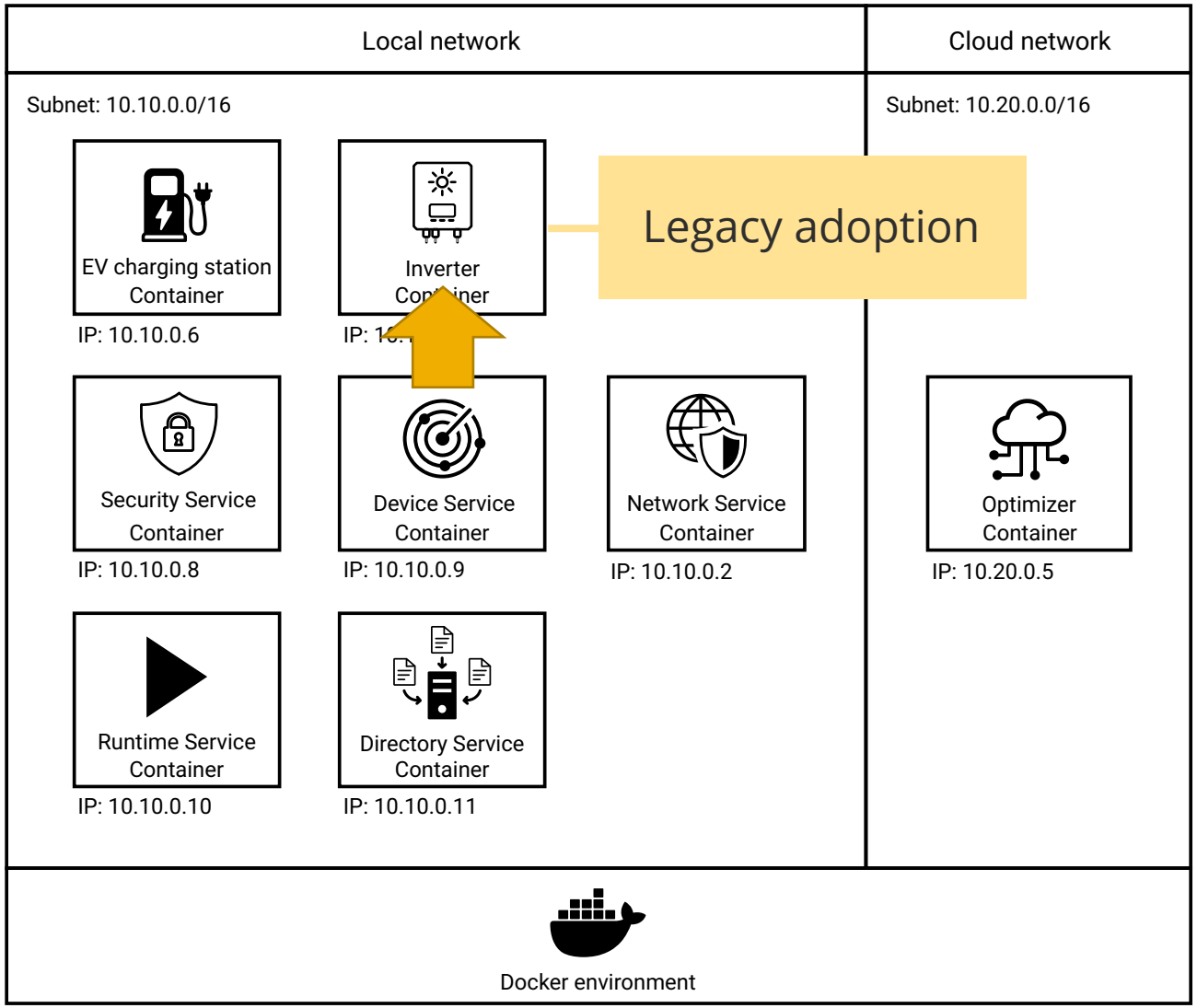
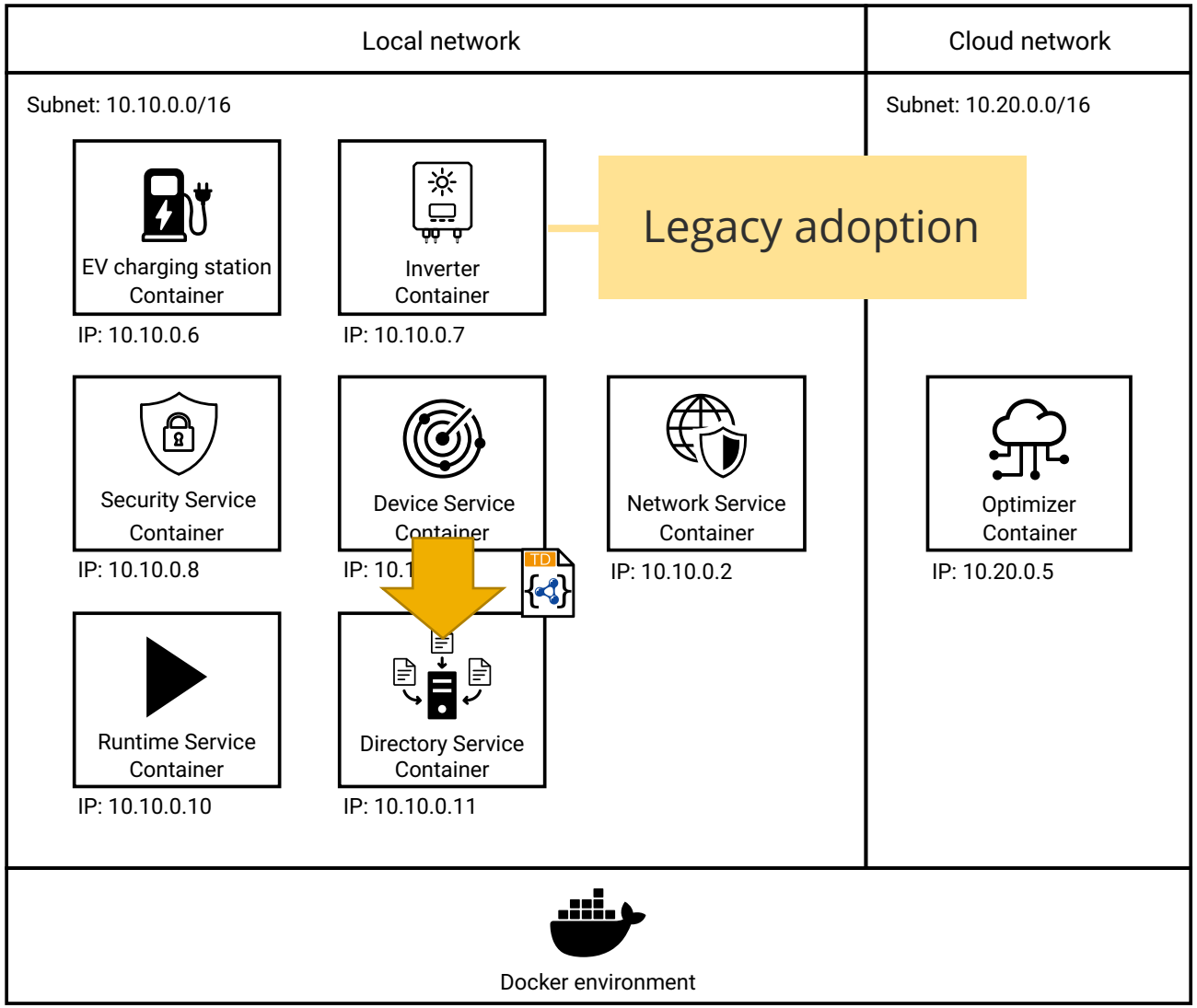

Local network
Cloud network
Subnet: 10.10.0.0/16
Subnet: 10.20.0.0/16
EV charging station Container
IP: 10.10.0.6
Inverter Container
IP: 10.10.0.7
Legacy adoption
Security Service Container
IP: 10.10.0.8
Device Service Container
IP: 10.10.0.9
Network Service Container
IP: 10.10.0.2
Optimizer Container
IP: 10.20.0.5
Runtime Service Container
IP: 10.10.0.10
Directory Service Container
IP: 10.10.0.11
Docker environment

Testbed



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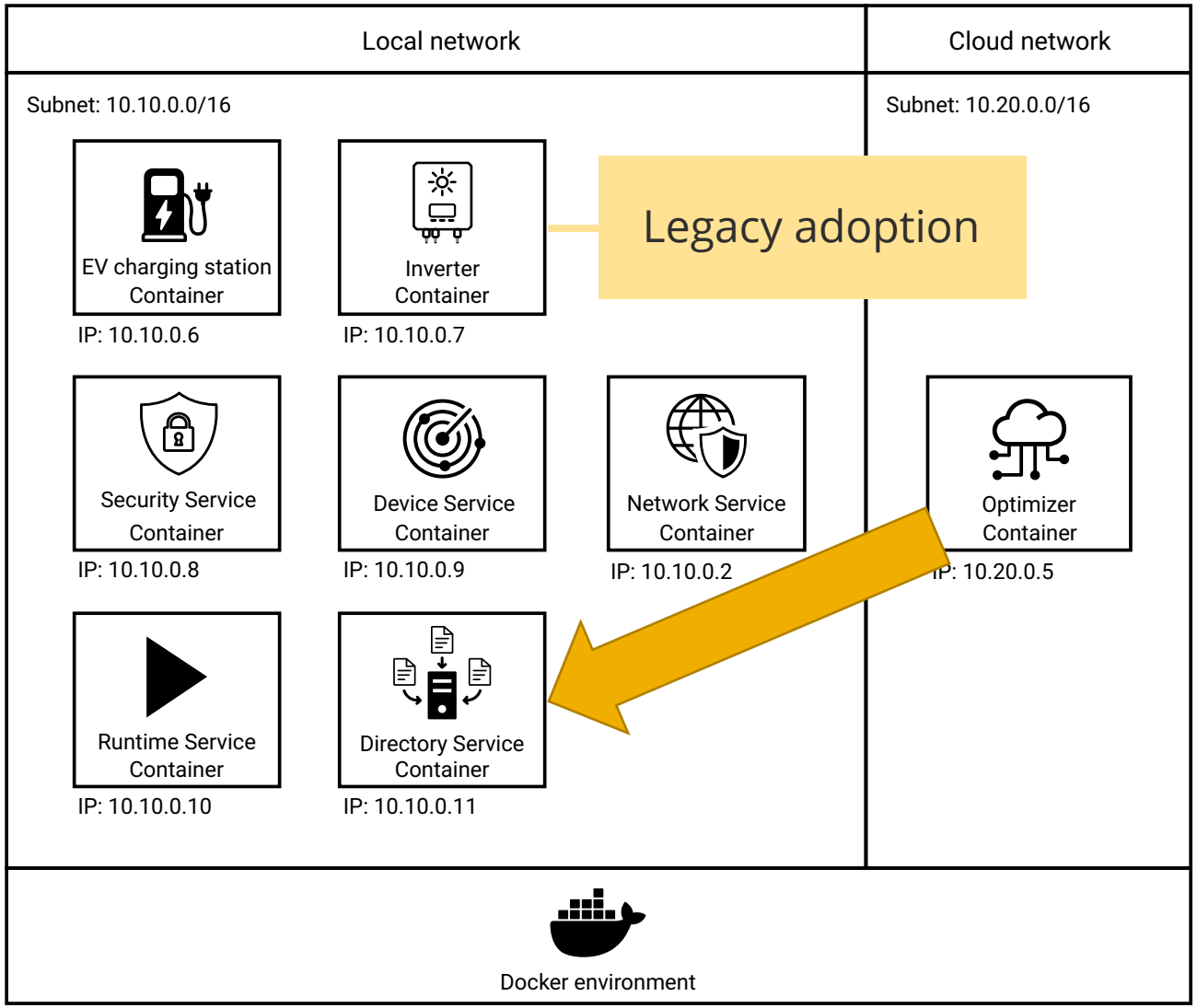

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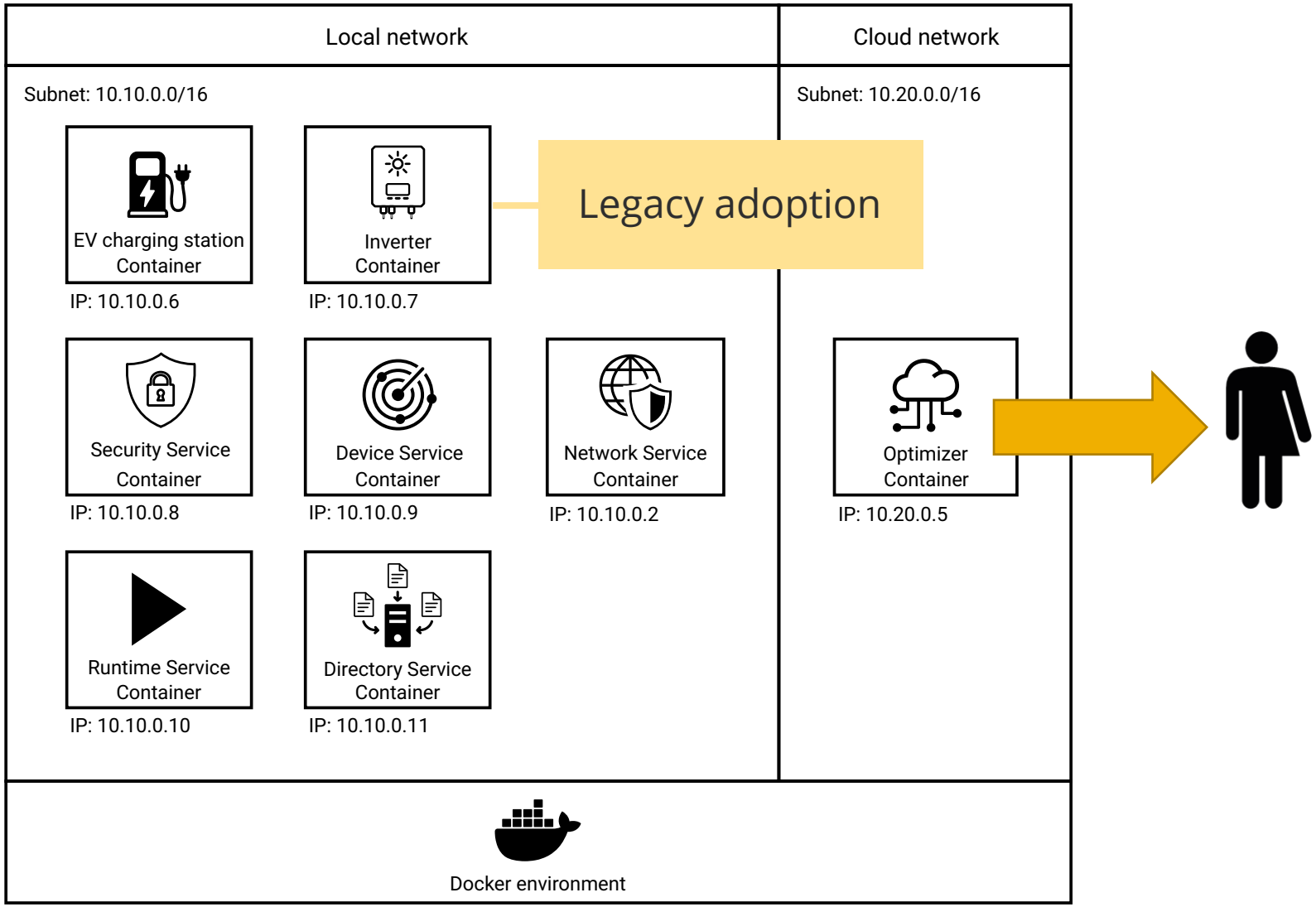
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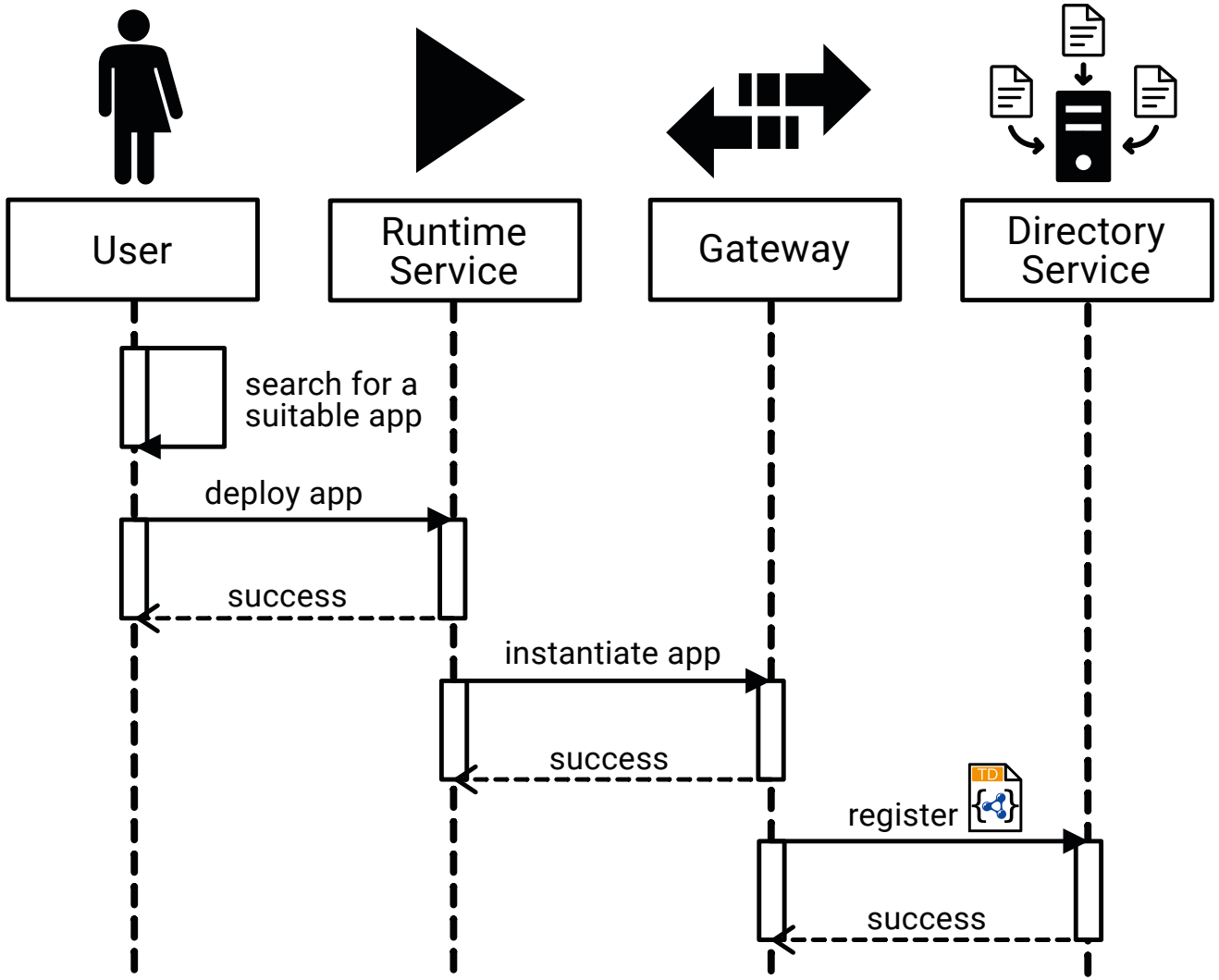
Docker environment

Gateway instantiation



Conclusion

- Summary
  - Description of the communication
  - Design of a variable ICT architecture
  - Shift of interoperability

- Open topics
  - Semantic interoperability
  - Gateway instantiation
  - Programmable world

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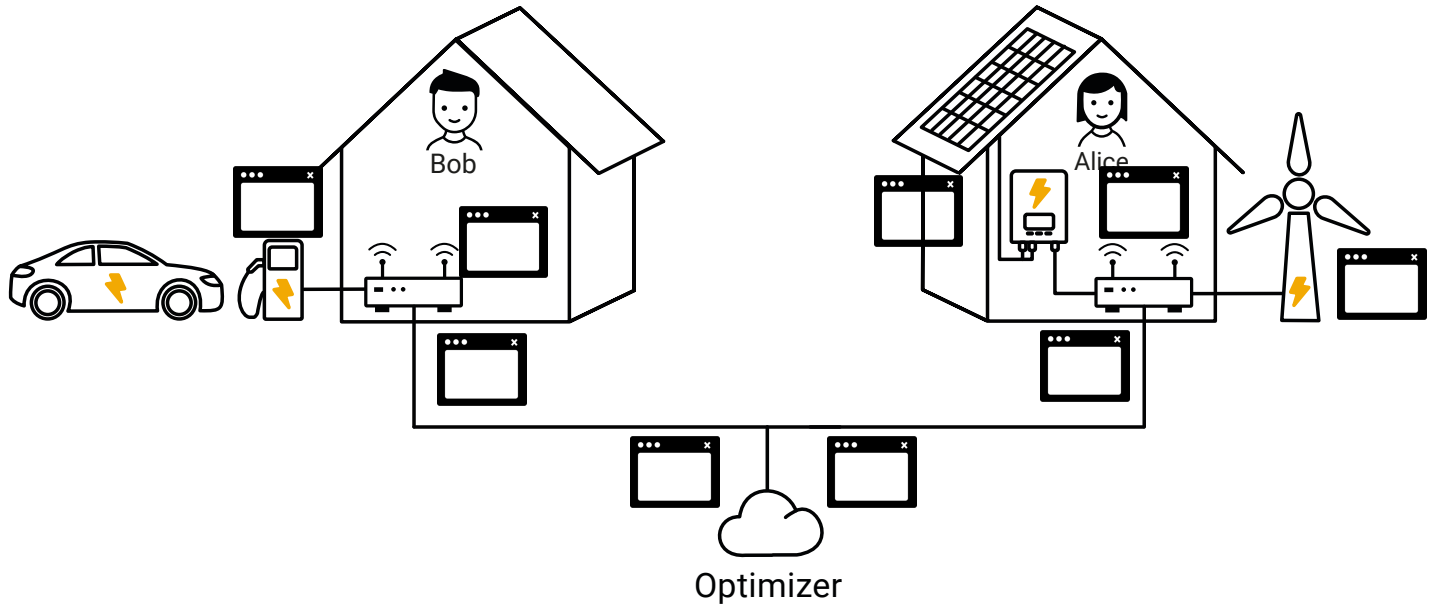

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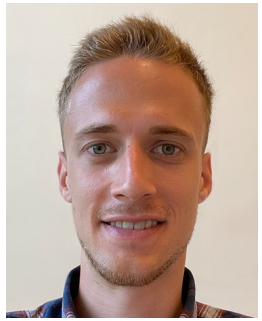

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leonhard.esterbauer@tuwien.ac.at

The findings of this work established during conducting research in the governmental supported project RES². This project is supported with the funds from the Climate and Energy Fund and implemented in the framework of the Program "Smart Cities Demo – Boosting Urban Innovation 2020".