joynr

April 2018 | distributed applications made easy

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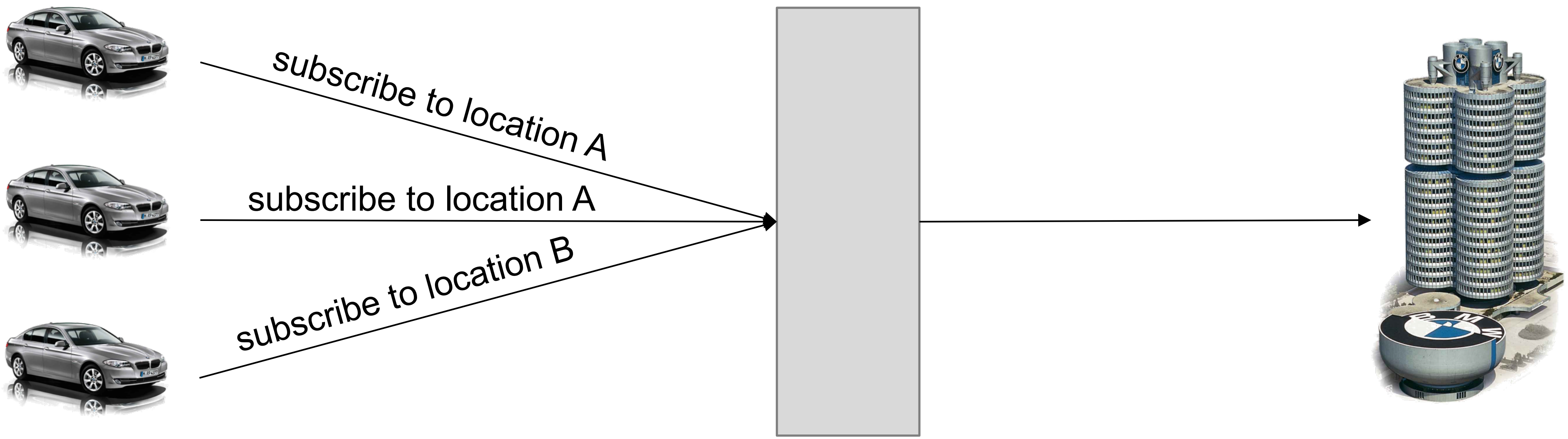
Agenda

- Developing a connected feature
- Technical overview of joynr
- joynr use cases @ BMW
- joynr’s development model

Developing a connected feature

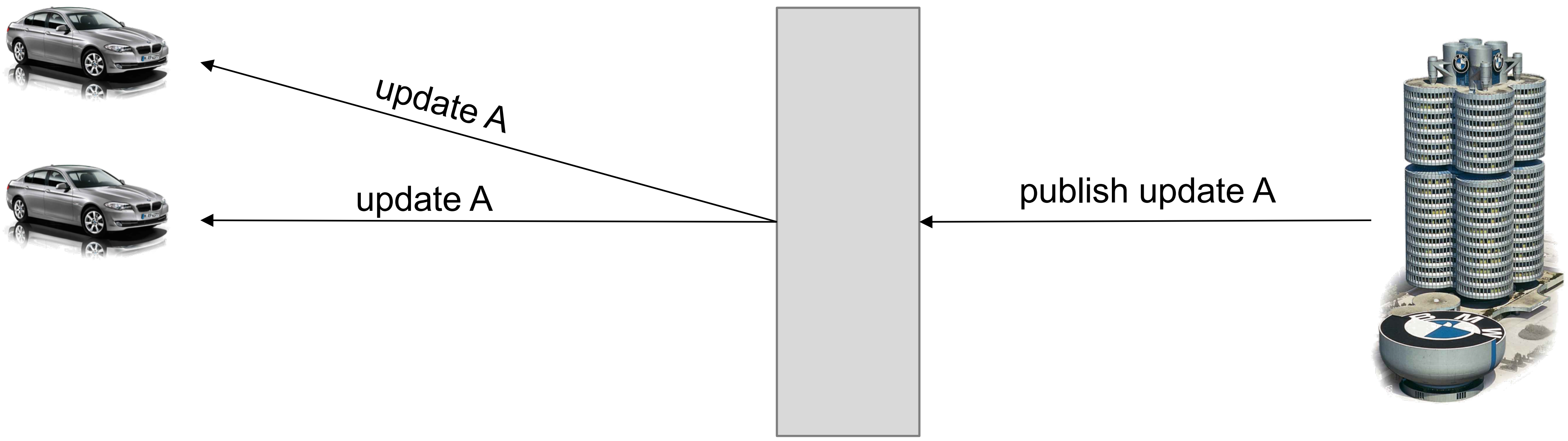
Sample Application: TrafficInfo

Requirement 1: Communication



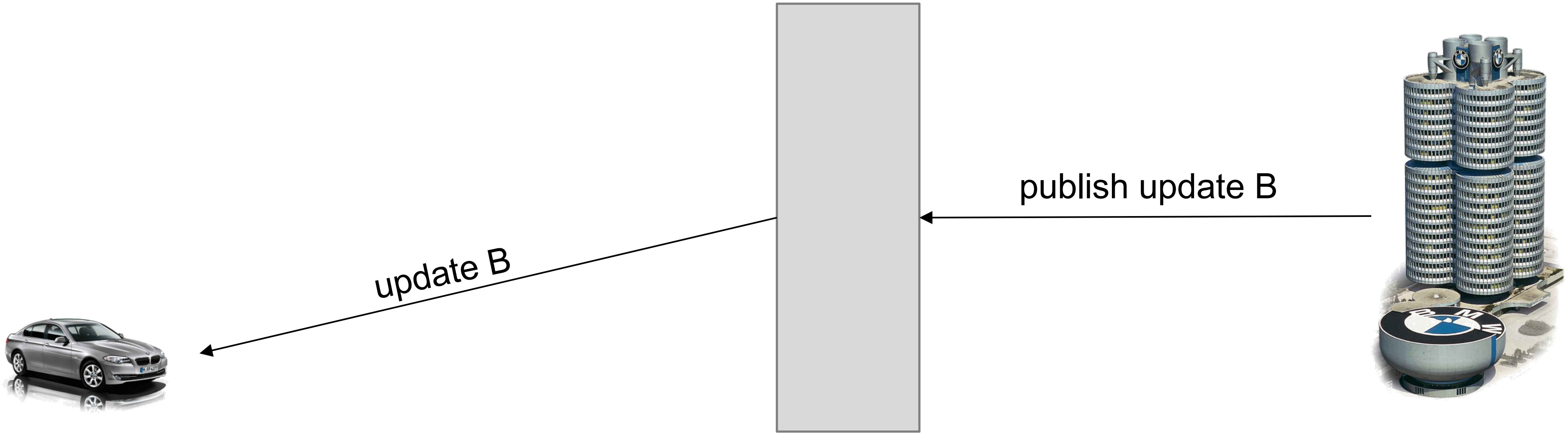
Sample Application: TrafficInfo

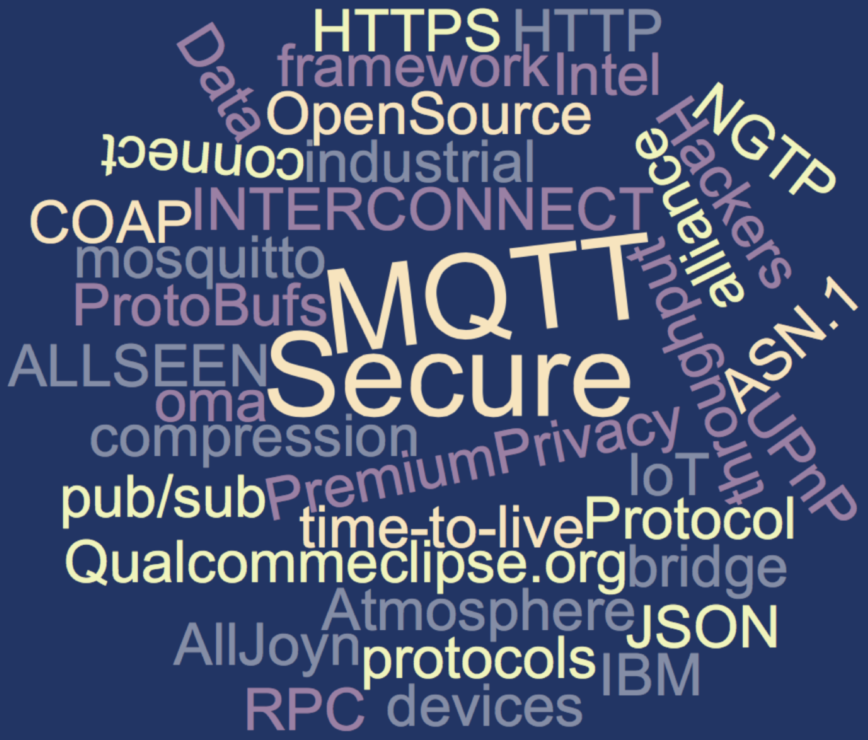
Requirement 1: Communication



Sample Application: TrafficInfo

Requirement 1: Communication




HTTPS
HTTP
Data
framework
Intel
OpenSource
connect
industrial
NGTP
Hackers
alliance
COAP
INTERCONNECT
mosquitto
throughput
MQTT
ProtoBufs
ASN.1
ALLSEEN
Secure
oma
UPnP
compression
Premium
Privacy
IoT
pub/sub
time-to-live
Protocol
Qualcomm
eclipse.org
bridge
Atmosphere
JSON
AllJoyn
protocols
IBM
RPC
devices

MQTT

MQTT is a publish-subscribe-based "lightweight" messaging protocol for use on top of the TCP/IP protocol.

MQTT

Sample Application: TrafficInfo

Requirement 2: Interface and Datatypes

geocast:

- subscribe to sampleapplication/TRAFFIC to receive traffic updates
- subscribe to sampleapplication/ACCIDENT to receive accident overlays

ACCIDENT contains:

- location
- numberOfLanesBlocked
- Direction

TRAFFIC contains...

modelling

MQTT

Sample Application: TrafficInfo

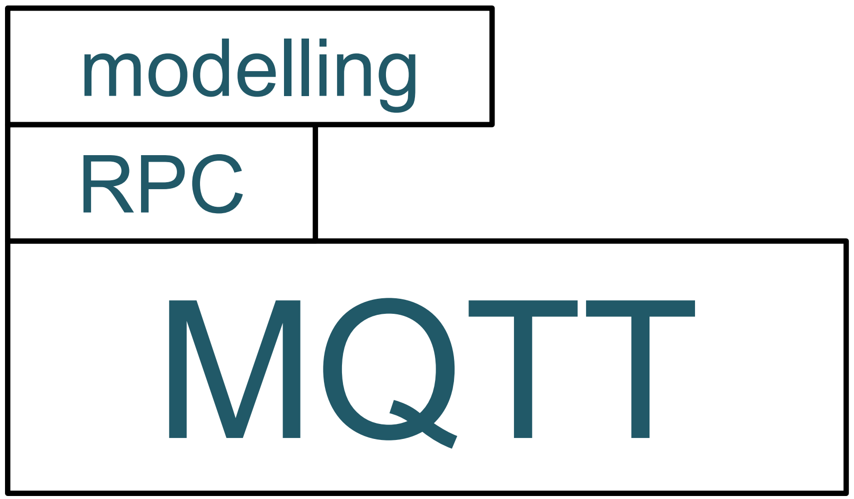
Requirement 3: Send commands and associate responses

trigger topics:

- trigger is sent on sampleapplication/$VIN containing triggerId
- response is sent on sampleapplication/responses with triggerId

vehicle sends detected accidents:

- detected accident is sent on sampleapplication/accidentdetected
- response is sent on sampleapplication/$VIN/accidentdetected



modelling

RPC

MQTT

Sample Application: TrafficInfo

Requirement 4: Data serialization

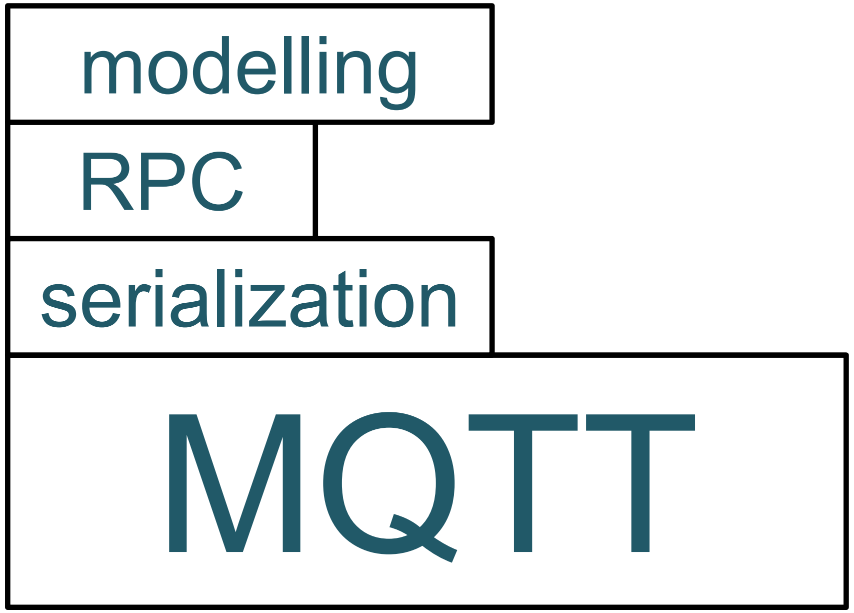
JSON
JavaScript Object Notation

ASN.1

protobuf
Protocol Buffers

CAP'N PROTO
cerealization protocol

MessagePack



modelling

RPC

serialization

MQTT

Sample Application: TrafficInfo

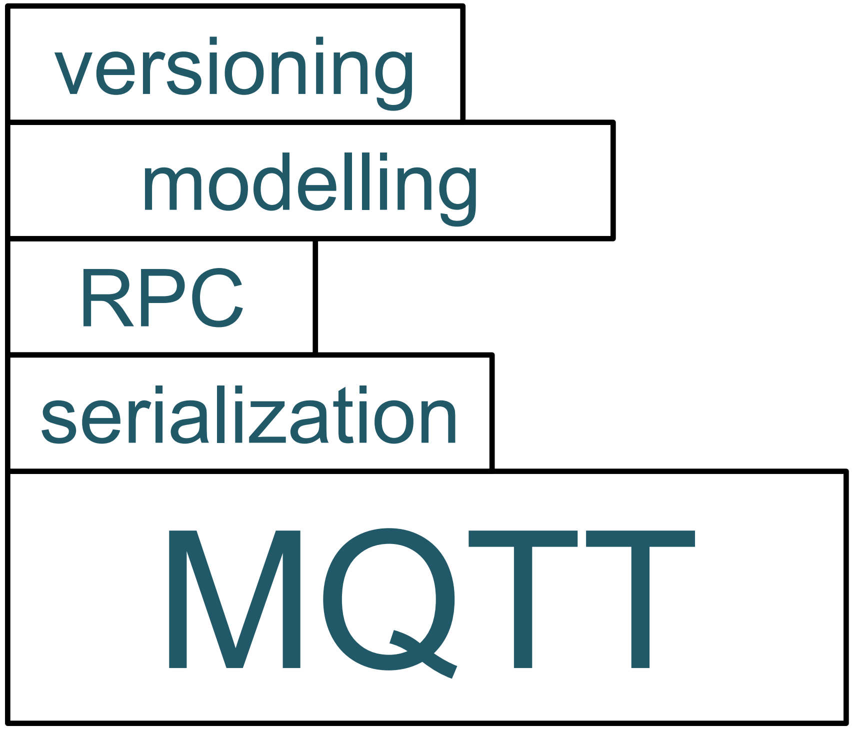
Requirement 5: Interface versioning

ACCIDENT events extended to support autonomous driving :

- blockedShape: raster outlines the areas of lanes affected

geocast:

- subscribe to sampleapplication/TRAFFIC to receive traffic updates
- subscribe to sampleapplication/**v2**/ACCIDENT to receive accident overlays



versioning

modelling

RPC

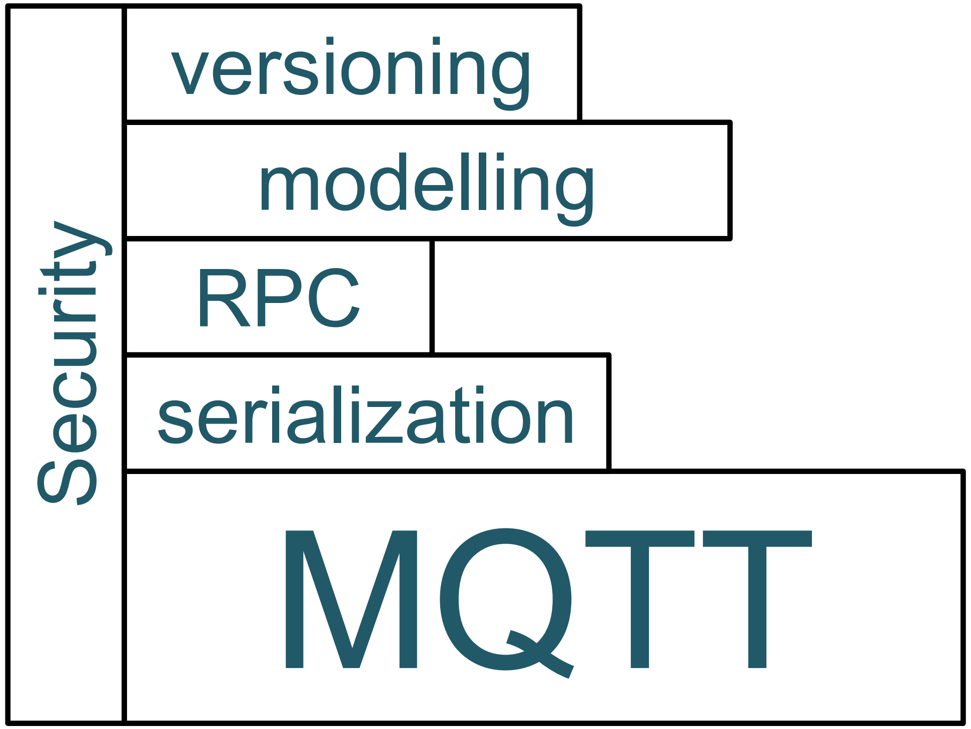
serialization

MQTT

Sample Application: TrafficInfo

Requirement 6: Security

Message integrity must be guaranteed to prevent spoofed accident warnings from being disseminated in the system.



Security

versioning

modelling

RPC

serialization

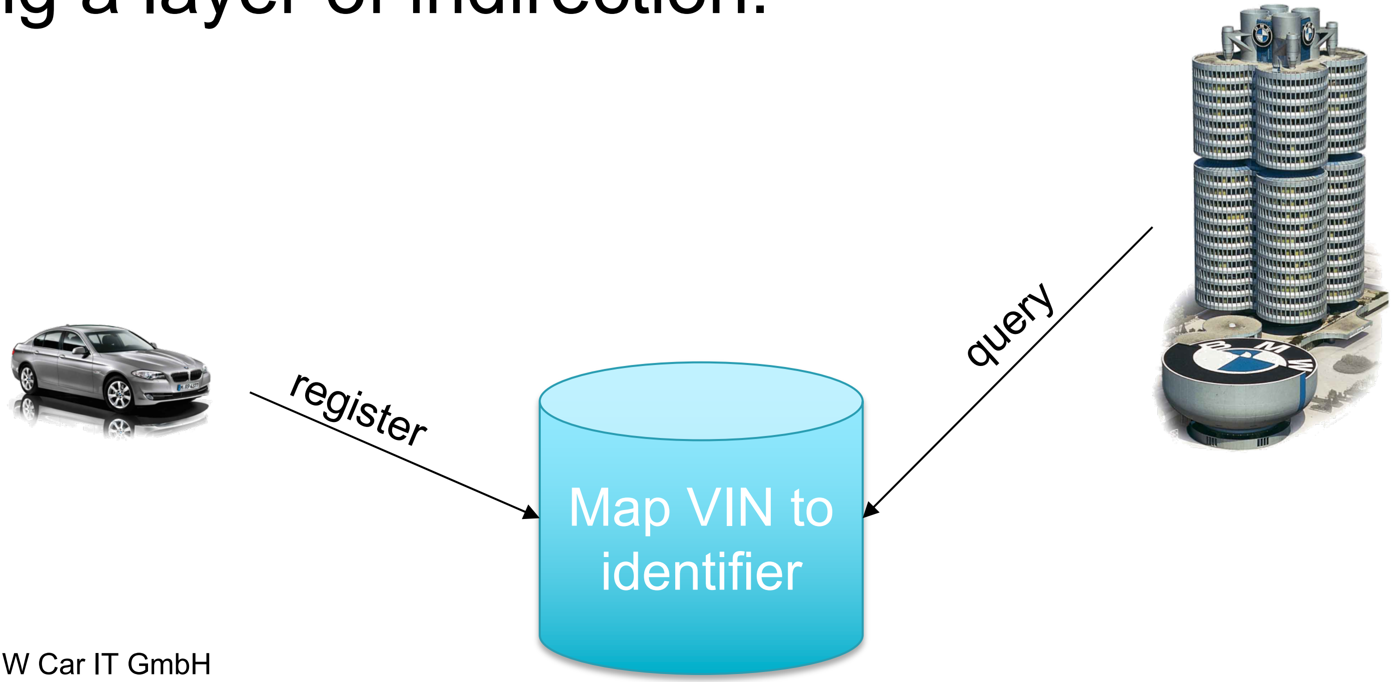
MQTT

Sample Application: TrafficInfo

Requirement 6: Privacy

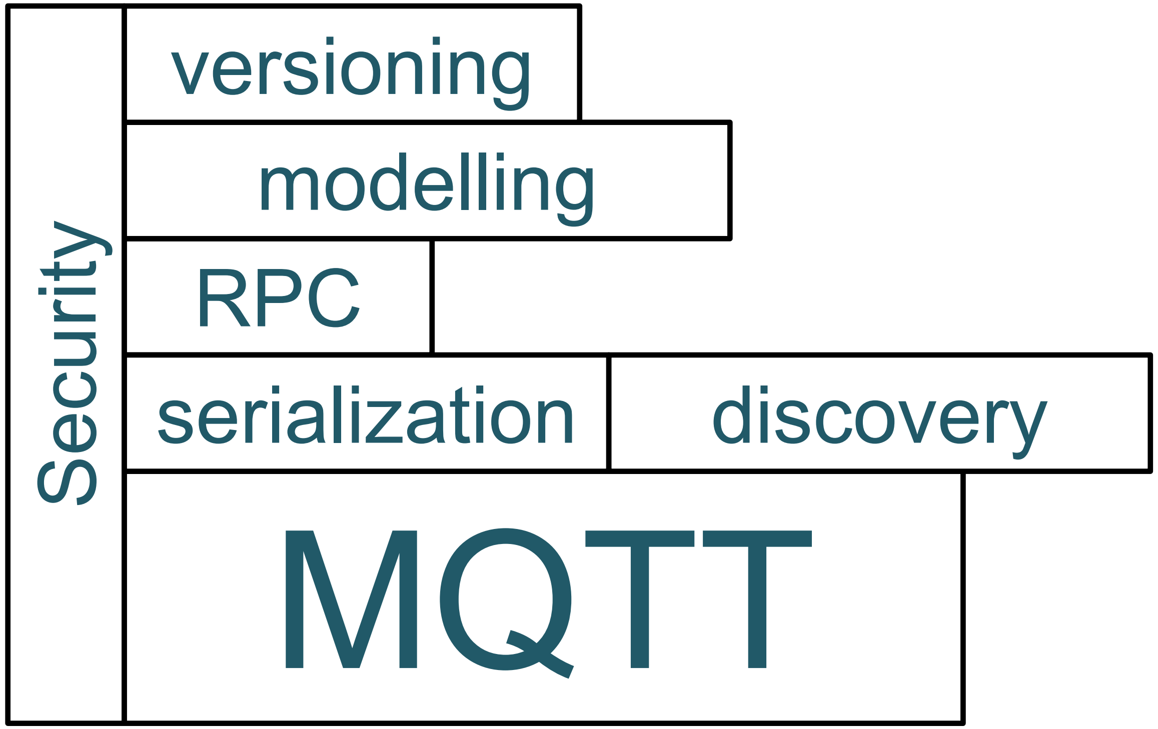
Data privacy law in effect, VIN cannot be longer used in MQTT topic.

Solution: Adding a layer of indirection.



Resulting stack

- For this specific use case
- **Other applications have similar requirements**



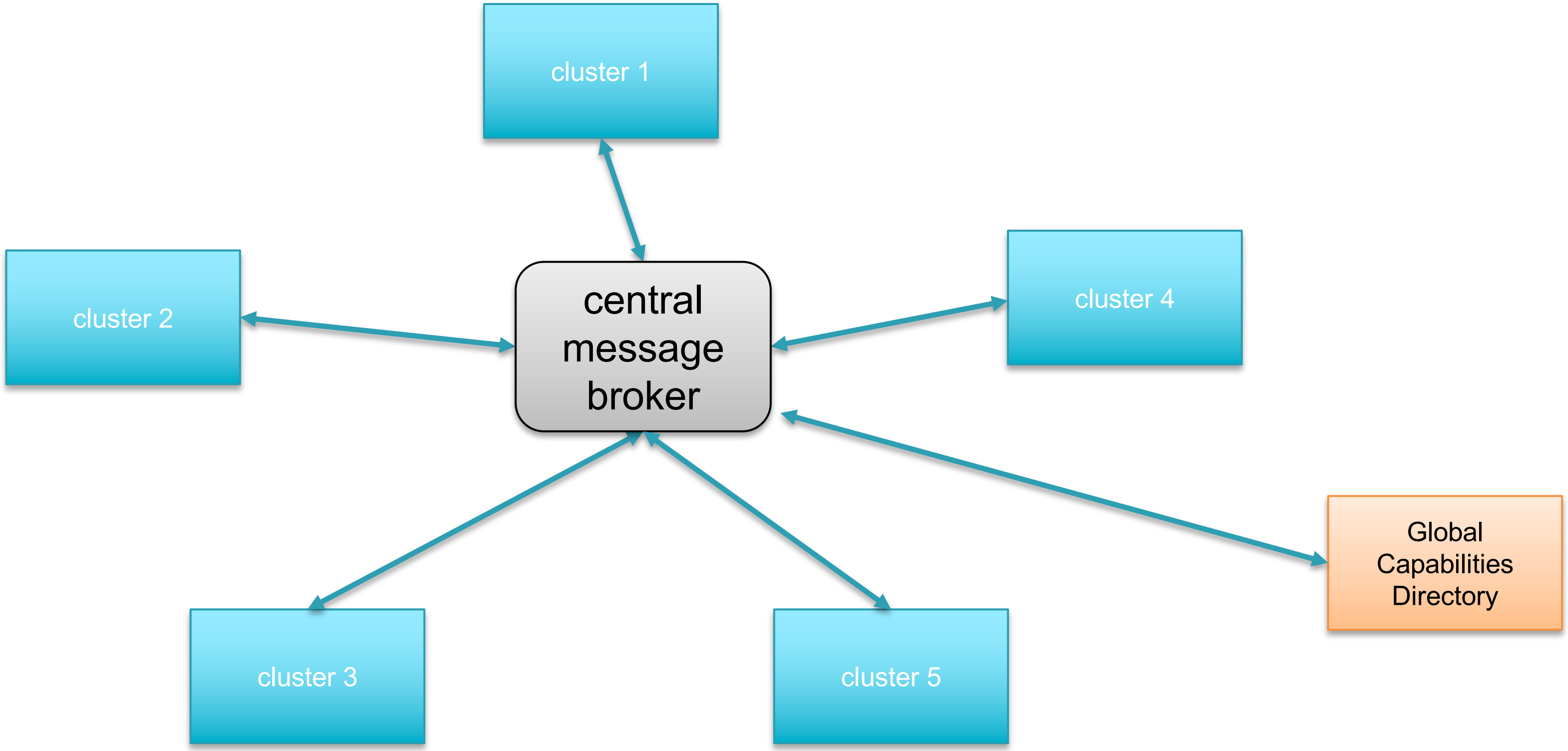
Our generalized solution

joynr is a fault-tolerant, typed communications-middleware **abstraction** framework for applications and services deployed to vehicles, consumer devices and backend servers that need to interact with each other.

Technical overview of joynr

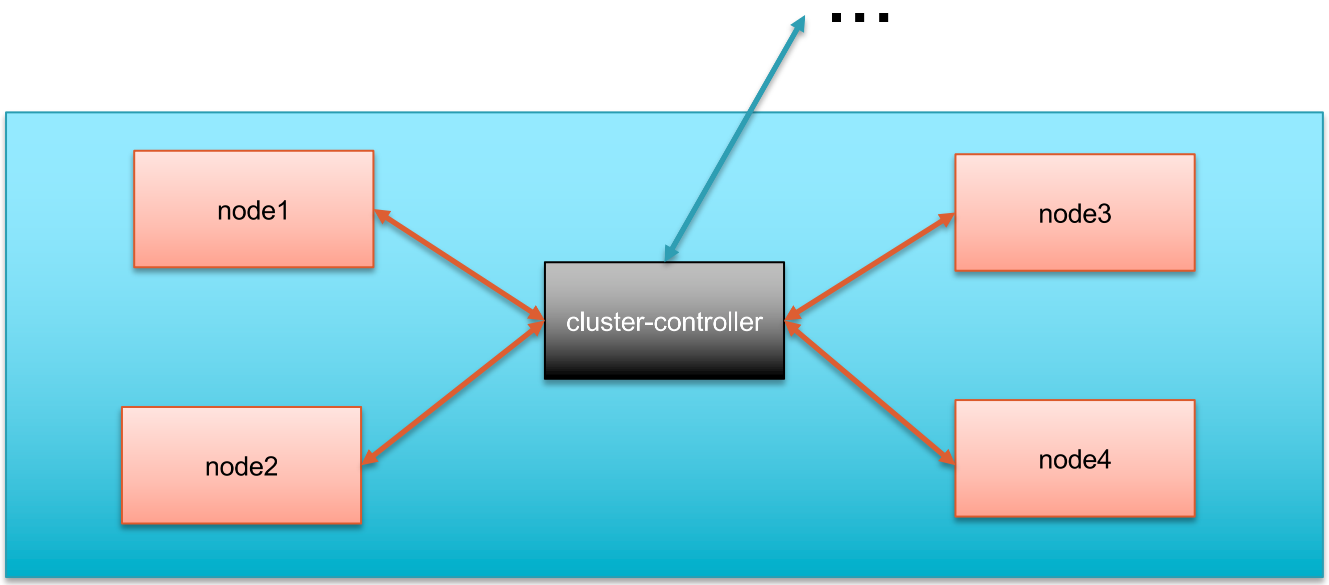
High level architecture – Global communication

The joynr network is structured in interconnected clusters:



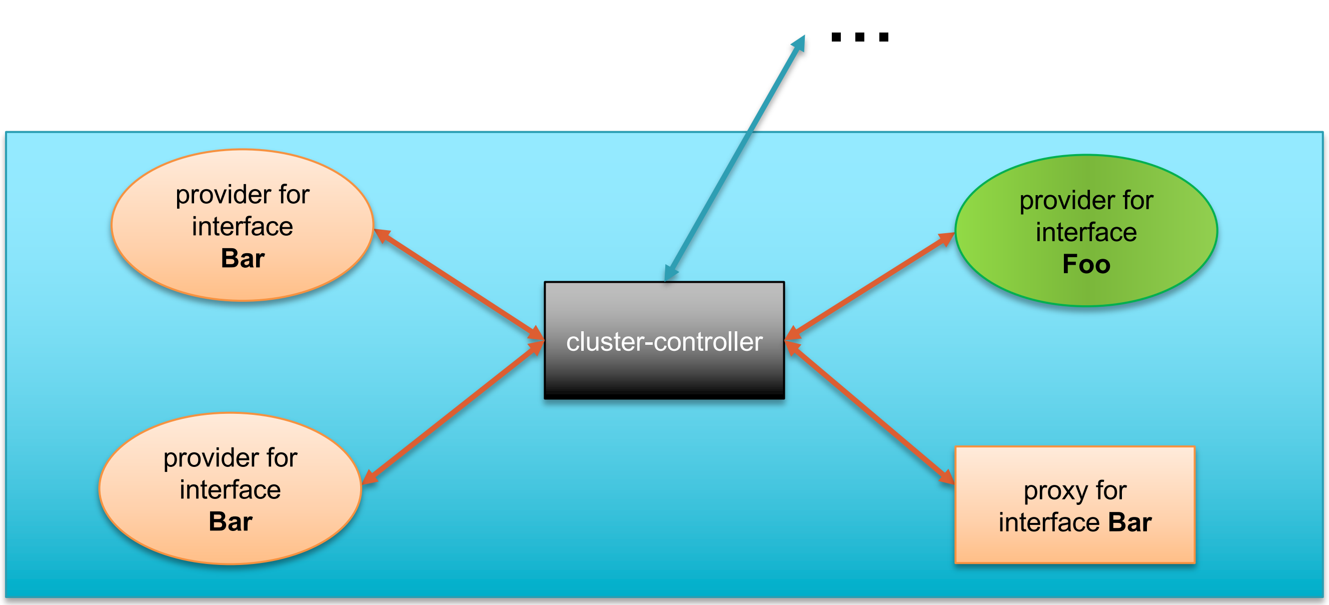
High level architecture – local communication

- each cluster is managed by a cluster-controller
- maintains the connectivity to the outside world
- acts as a message broker
- provides a discovery service for nodes connected to it



High level architecture – local communication

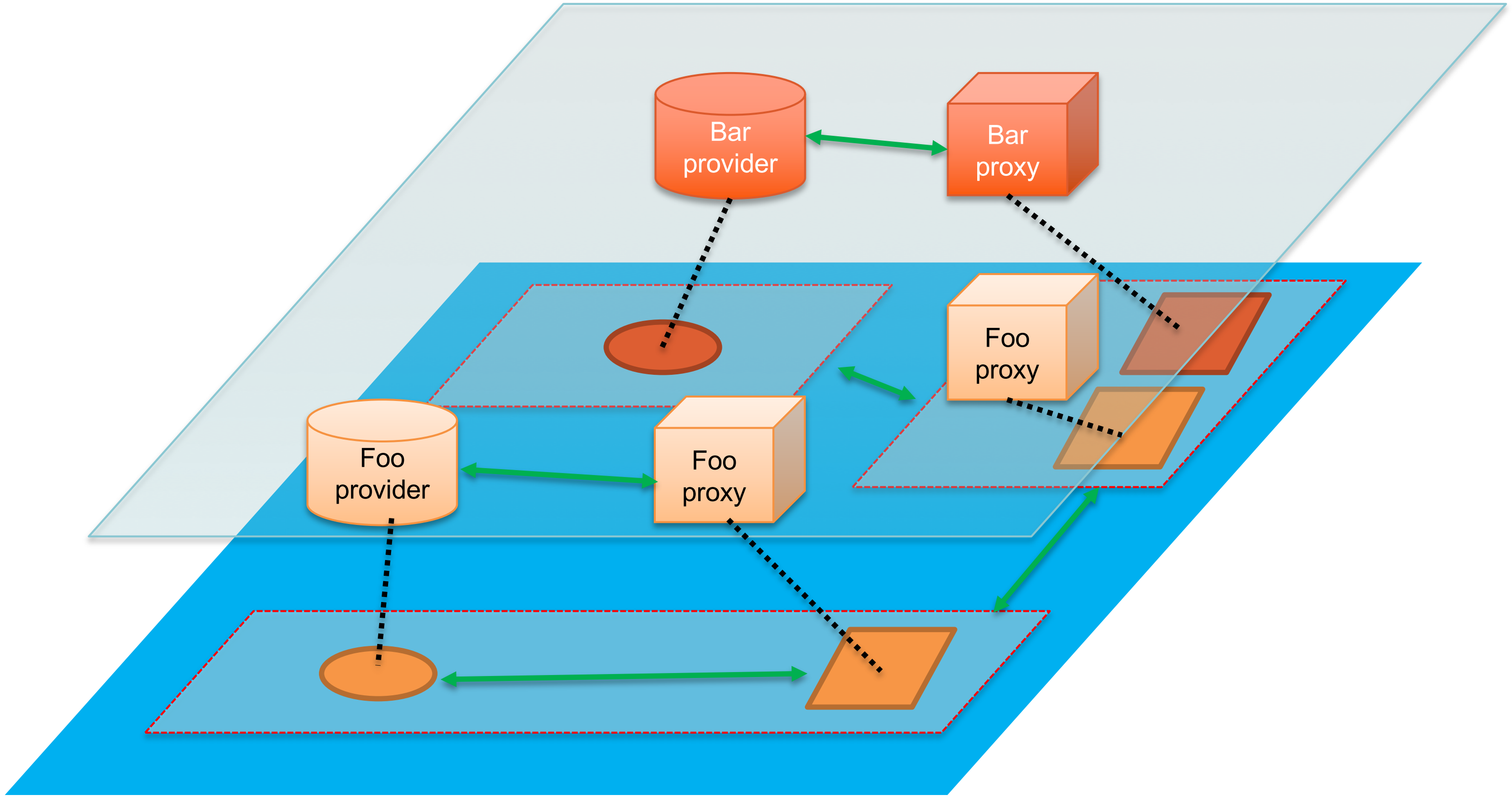
- each node is
  - either a provider implementing an interface
  - or a proxy accessing an interface.
- multiple providers can implement the same interface within a cluster



…
provider for interface **Bar**
provider for interface **Foo**
cluster-controller
provider for interface **Bar**
proxy for interface **Bar**

Message routing

- joynr is an overlay network
- each node has its globally unique identifier



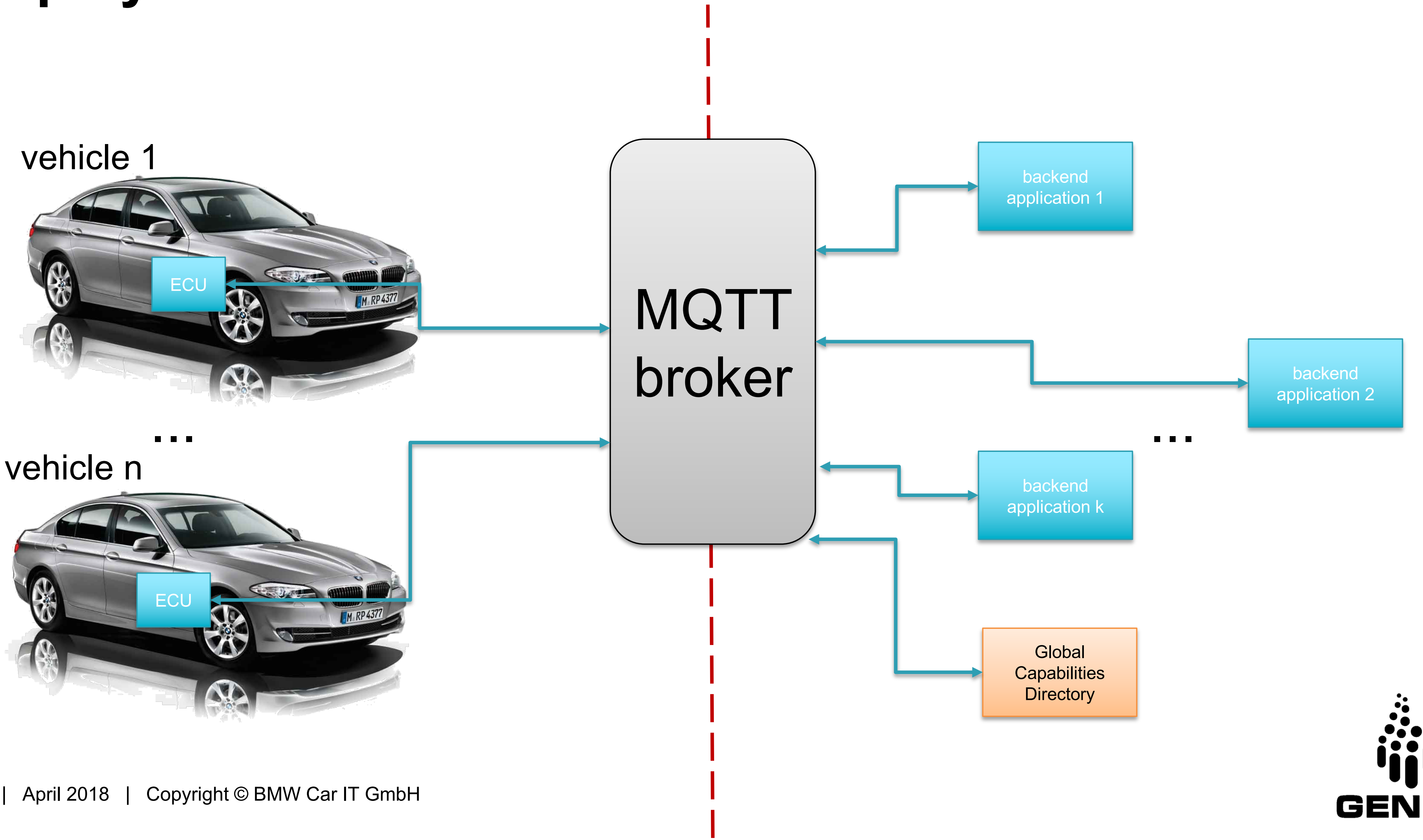
GENIVI®

Technical details

- implementations currently exist in
  - C++
  - Java / JEE
  - JavaScript
- based on Franca IDL
- currently supports WebSockets, HTTP and MQTT as transport layers

joynr use cases @ BMW

Deployment


vehicle 1
ECU
...
vehicle n
ECU
MQTT broker
backend application 1
backend application 2
...
backend application k
Global Capabilities Directory

joynr use cases @ BMW

- Unidirectional uploading of data
- Dissemination of information to a multitude of receivers
  - Multicasting
  - Geocasting
- RPC in both directions
  - Trigger actions on vehicle remotely
  - Access backend data on demand from vehicle
- intra-ECU communication

joynr’s development model

Development model

- joynr is an open source project: https://github.com/bmwcarit/joynr
- licensed under Apache 2.0
- development and maintenance by BMW Car IT GmbH
- **contributions and pull requests are welcome!**

Thank you!

Visit joynr at http://joynr.io

Contact us: joynr@bmw-carit.de