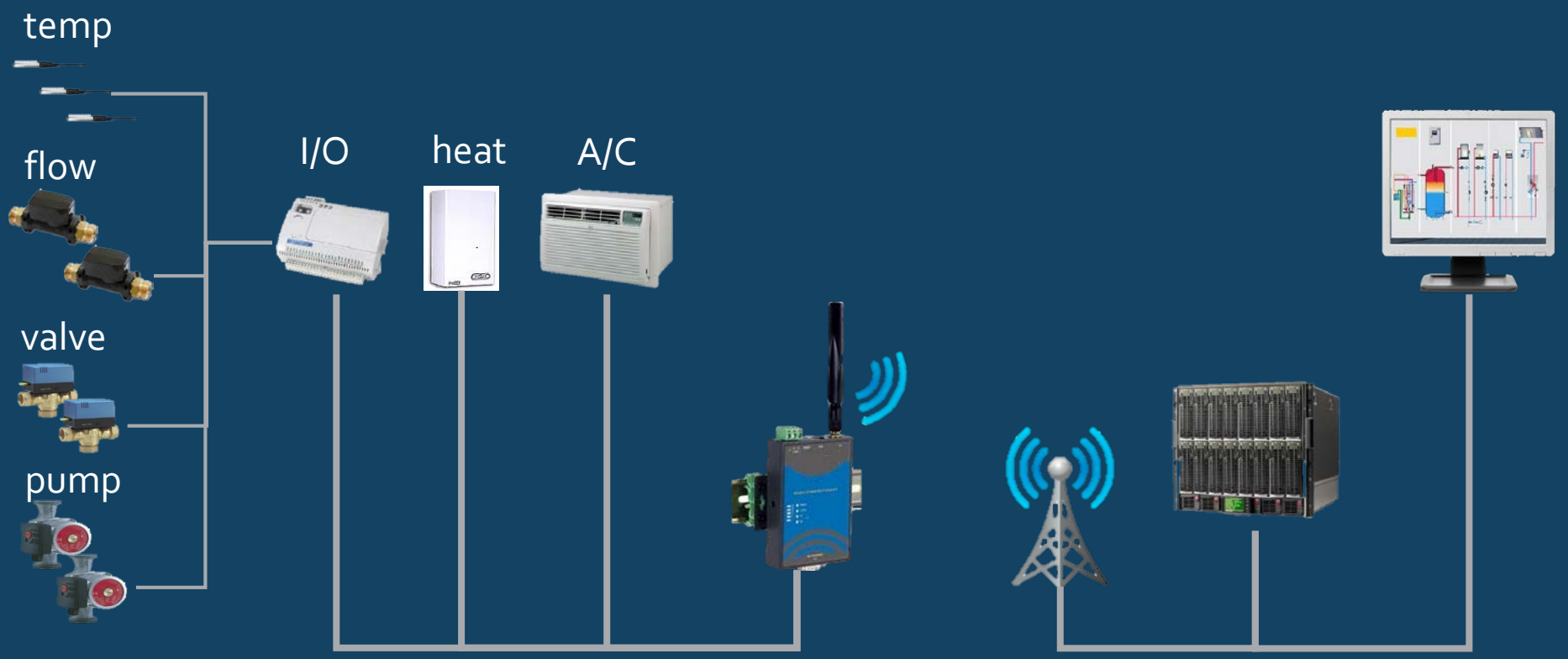
oneM2M Industry Day
Memphis, TN, July 12th 2017
Dr. Josef J. Blanz

oneM2M Basics & Outlook

Confusing Terms

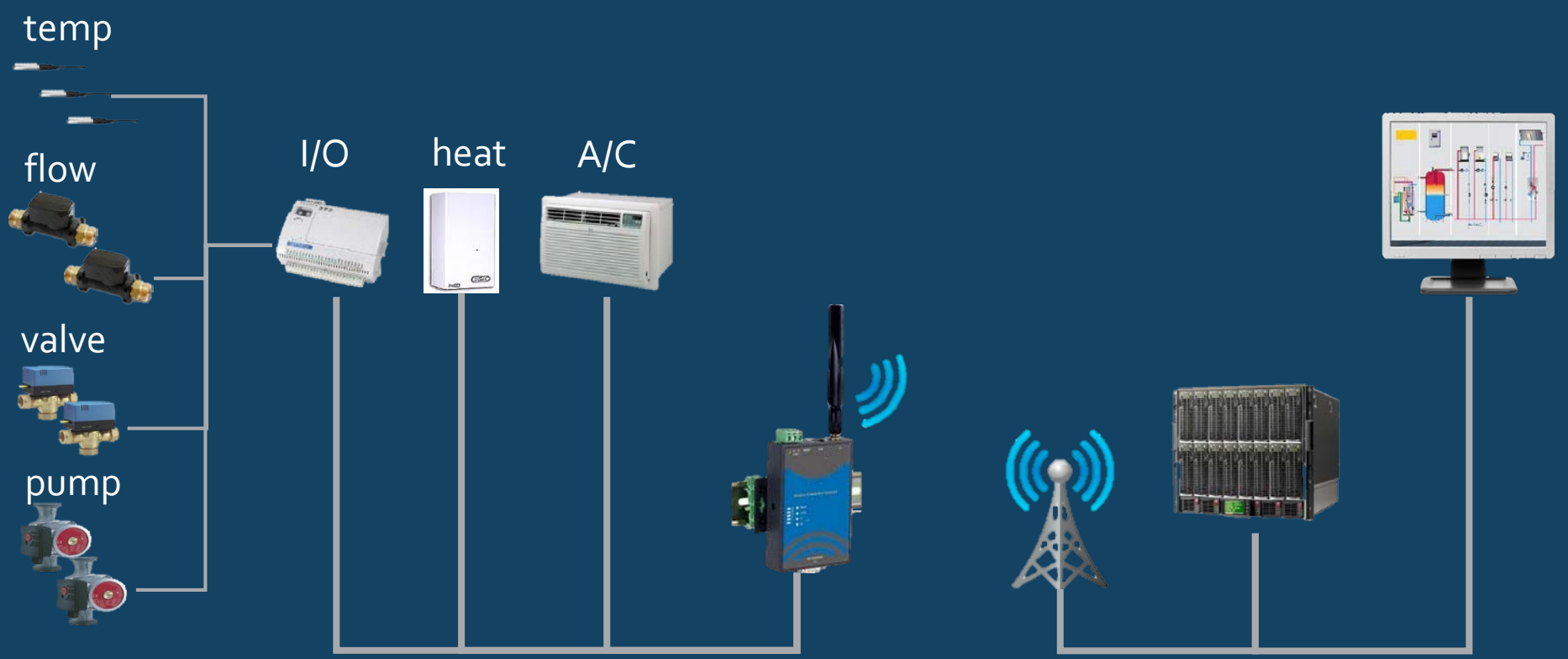
M2M MTC IoT IoE

Example



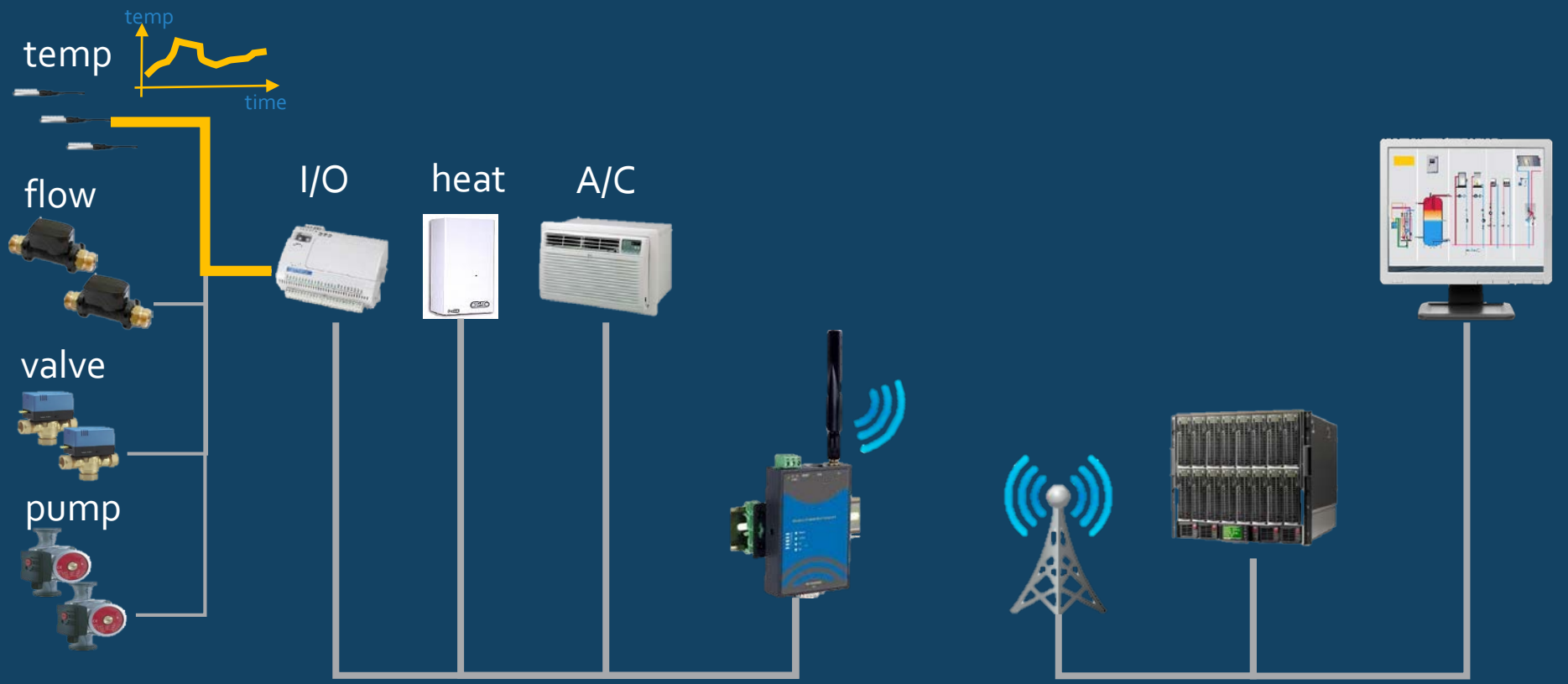
HVAC (Heating, Ventilation, Air Conditioning)

Example



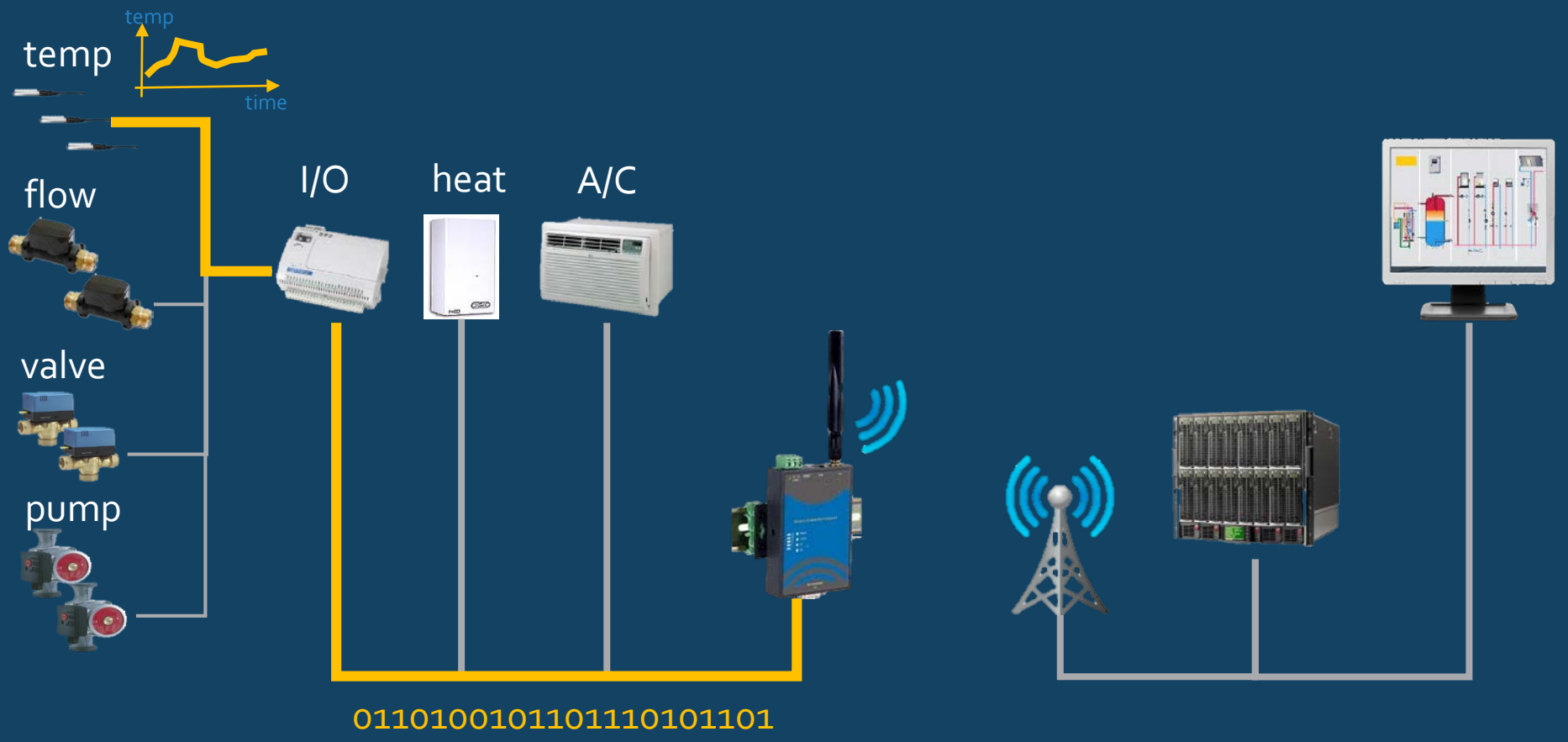
HVAC

M2M / MTC View



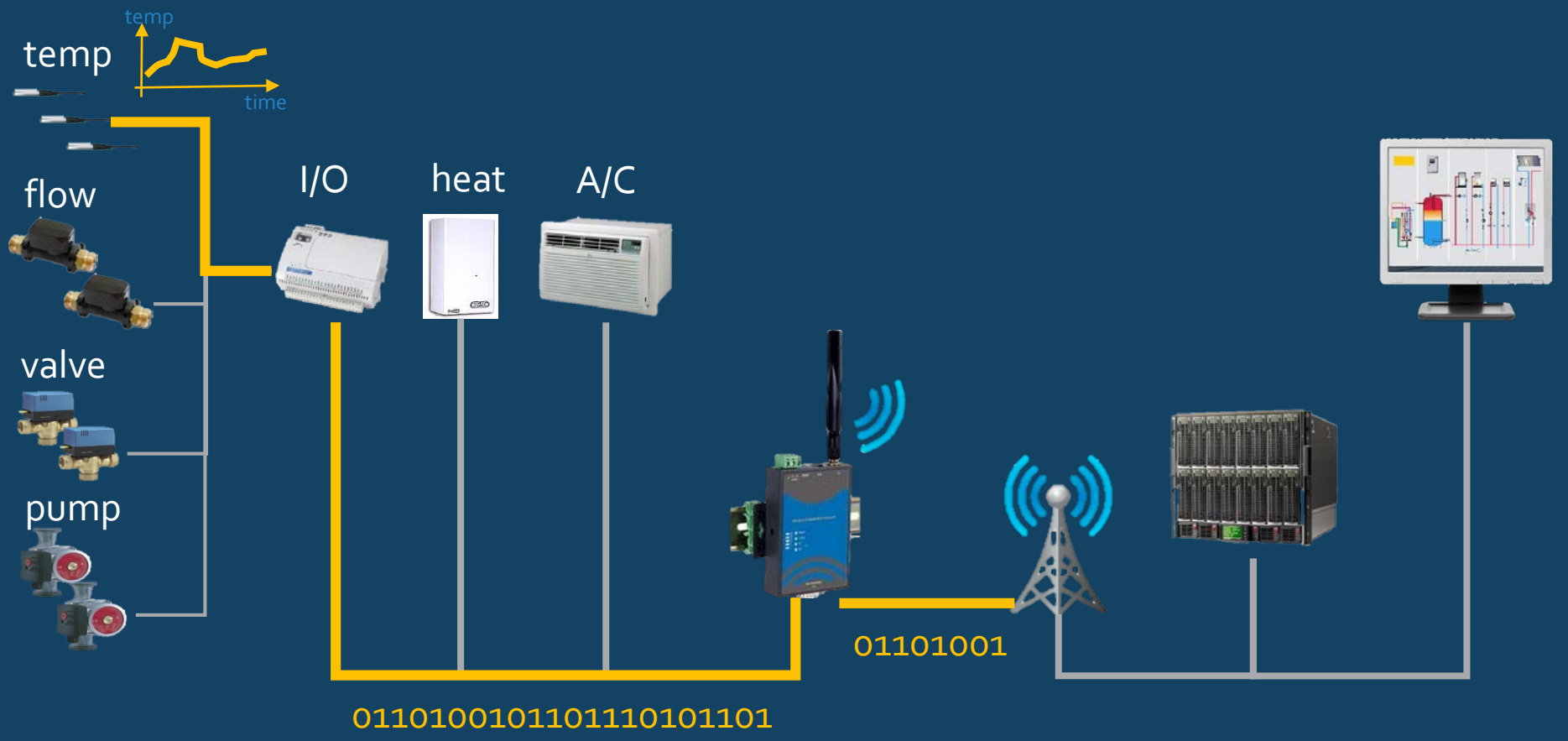
HVAC

M2M / MTC View



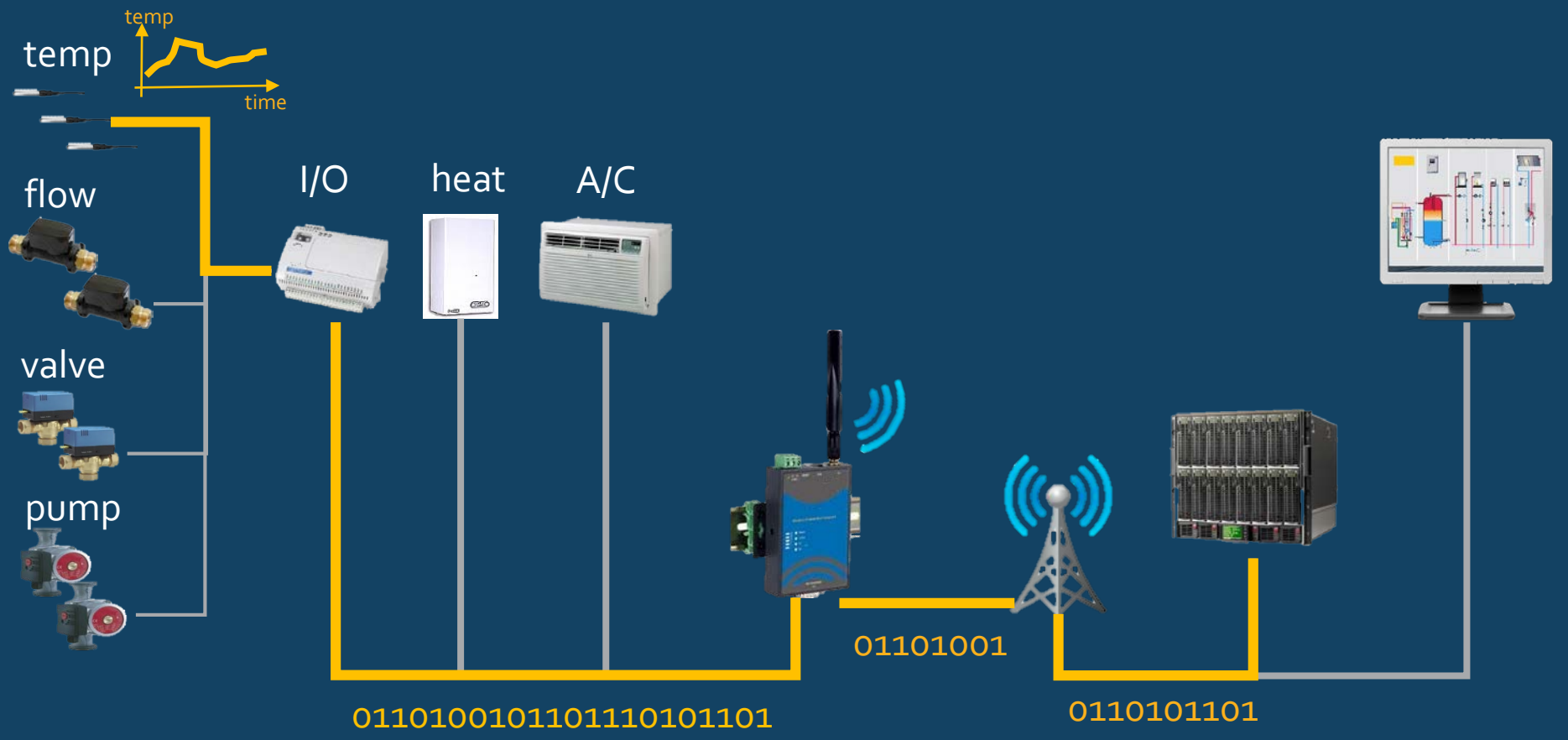
HVAC

M2M / MTC View



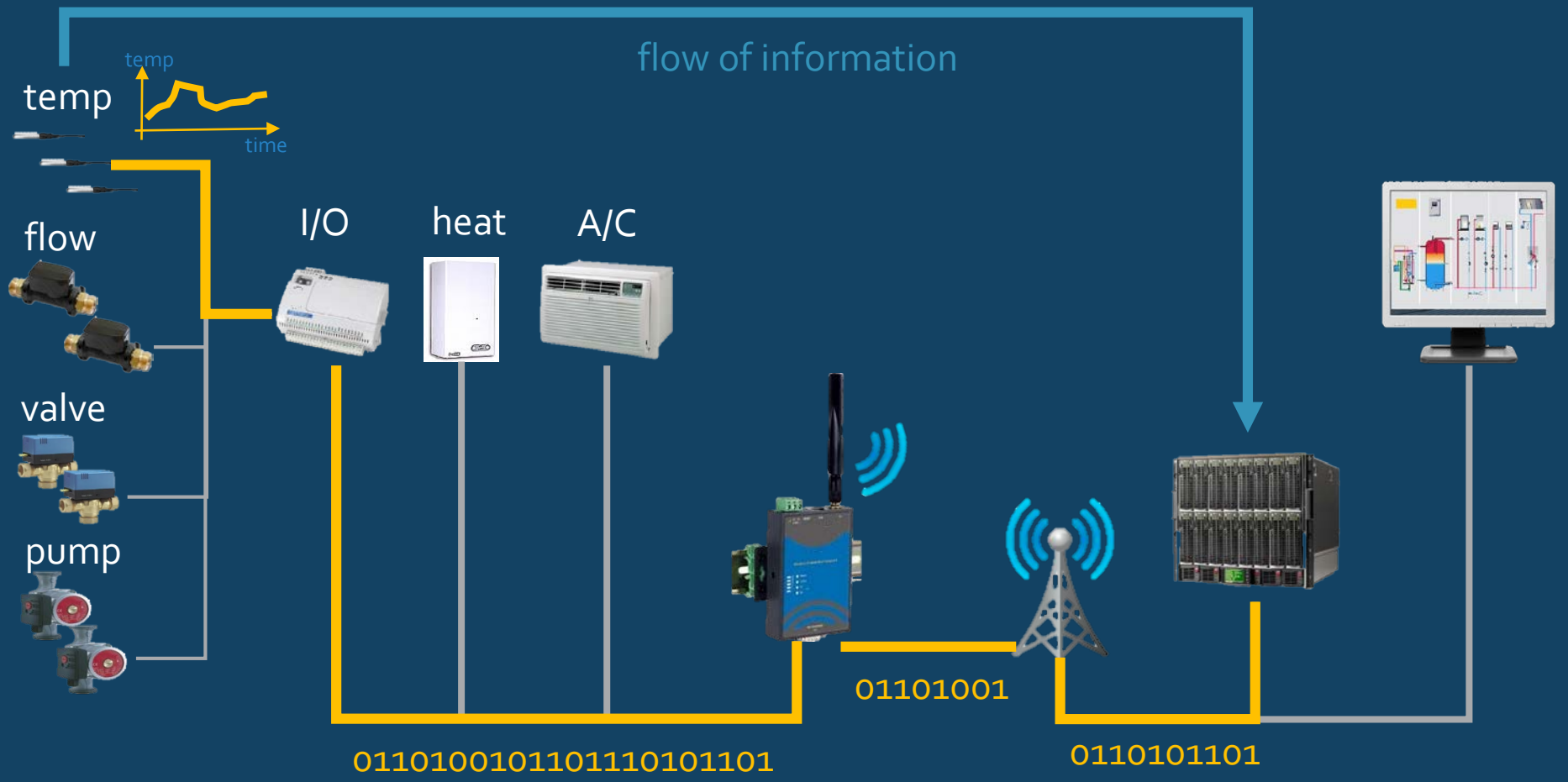
HVAC

M2M / MTC View



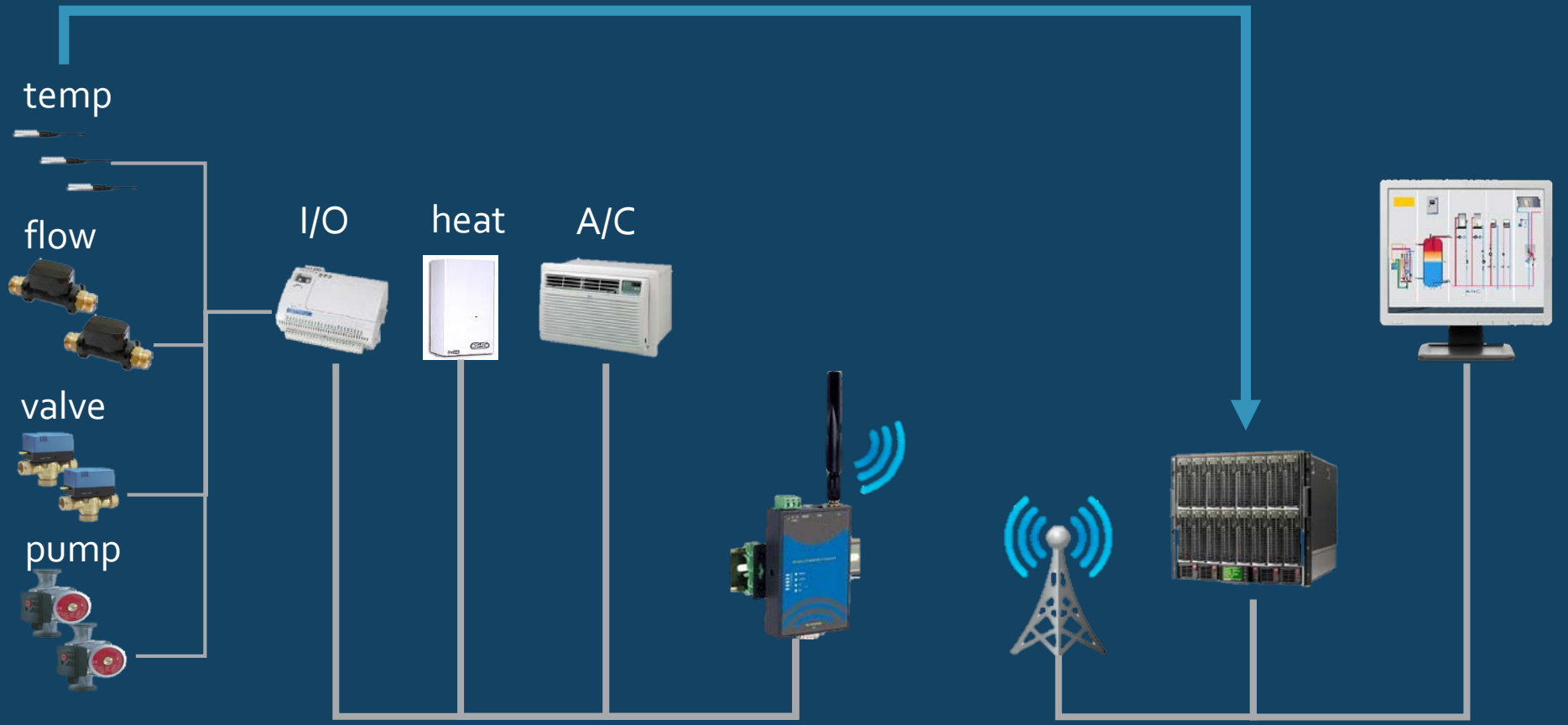
HVAC

M2M / MTC View



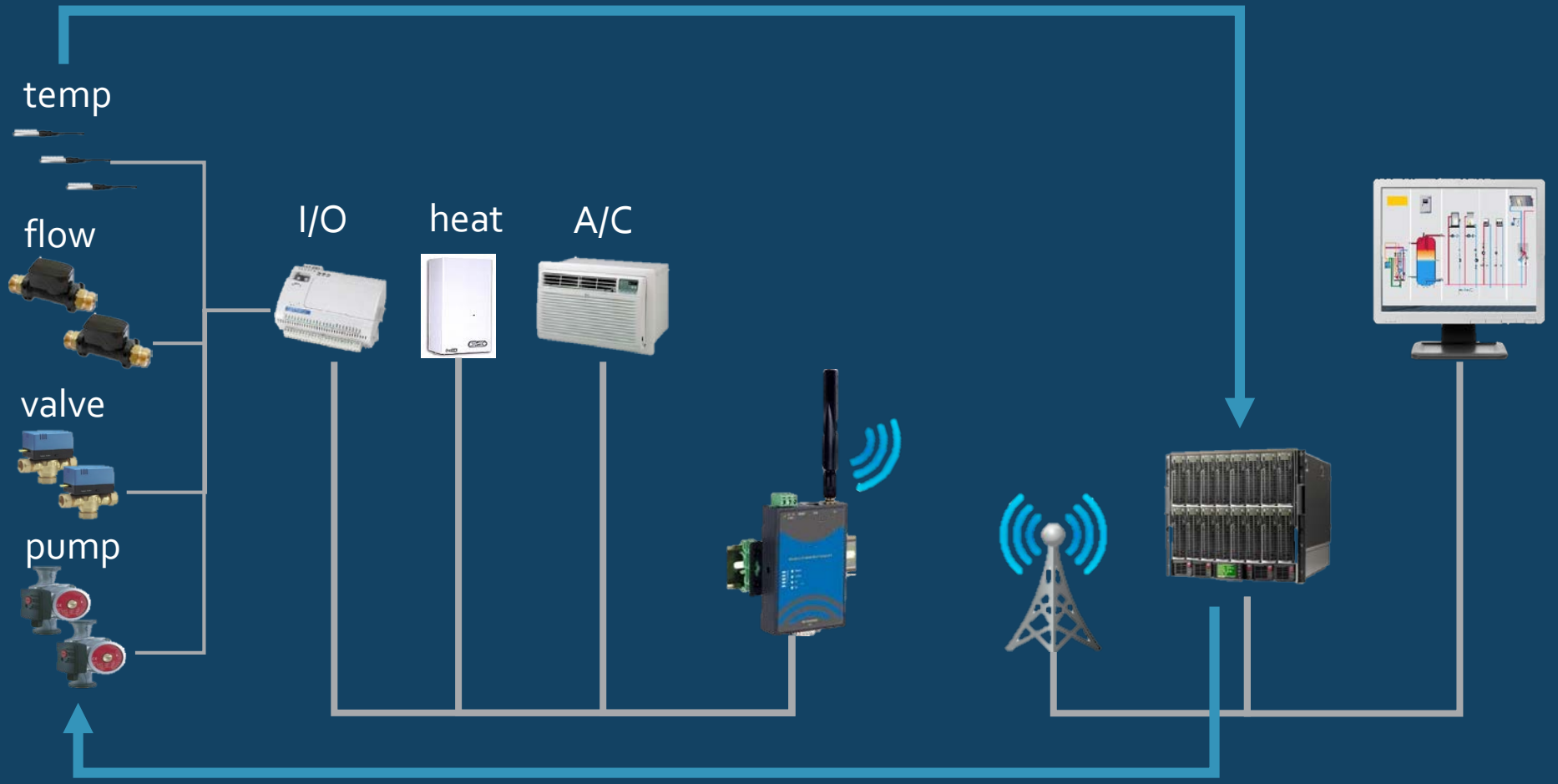
HVAC

M2M / MTC View



HVAC

M2M / MTC View

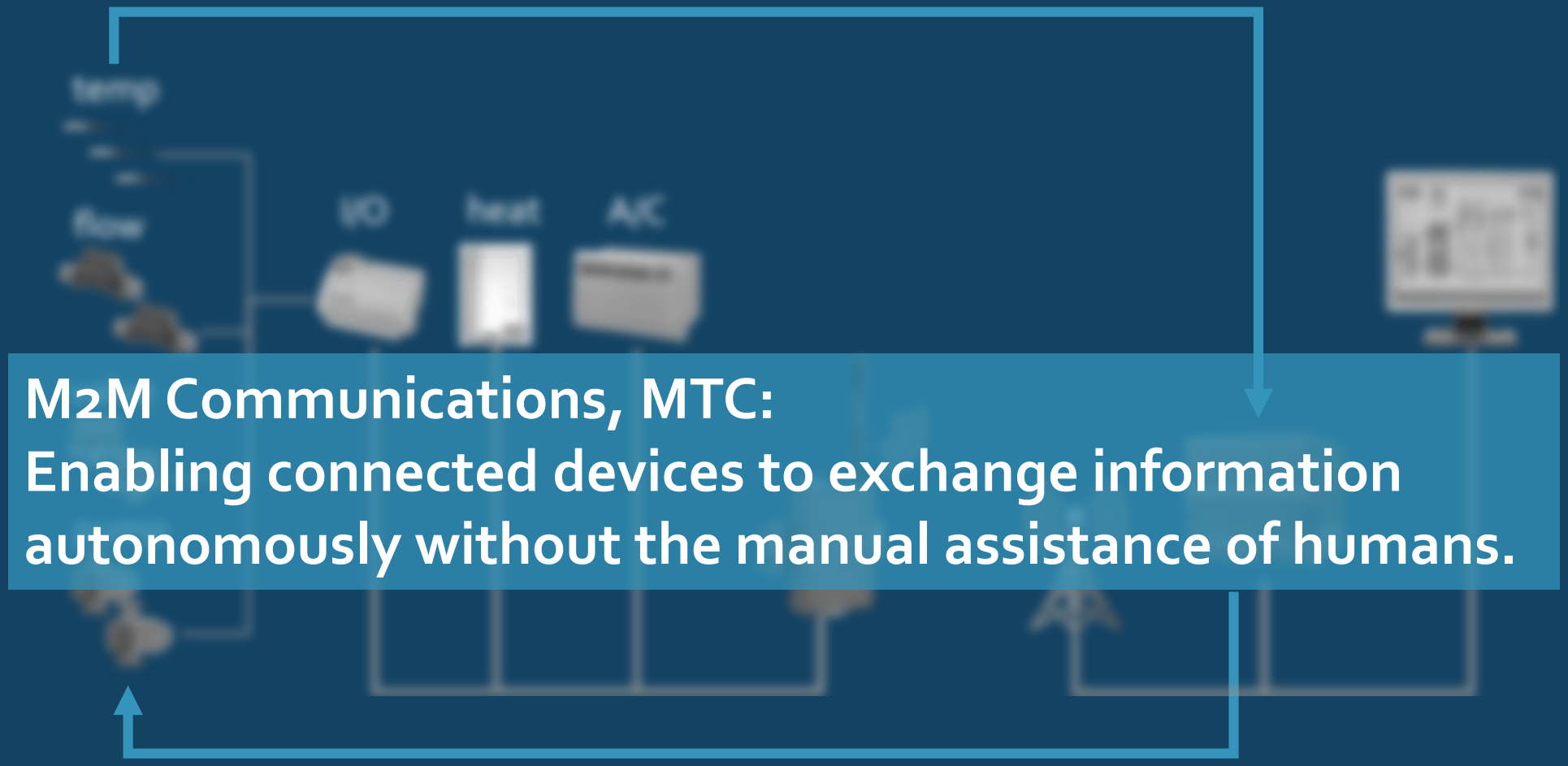


HVAC

M2M / MTC View

HVAC

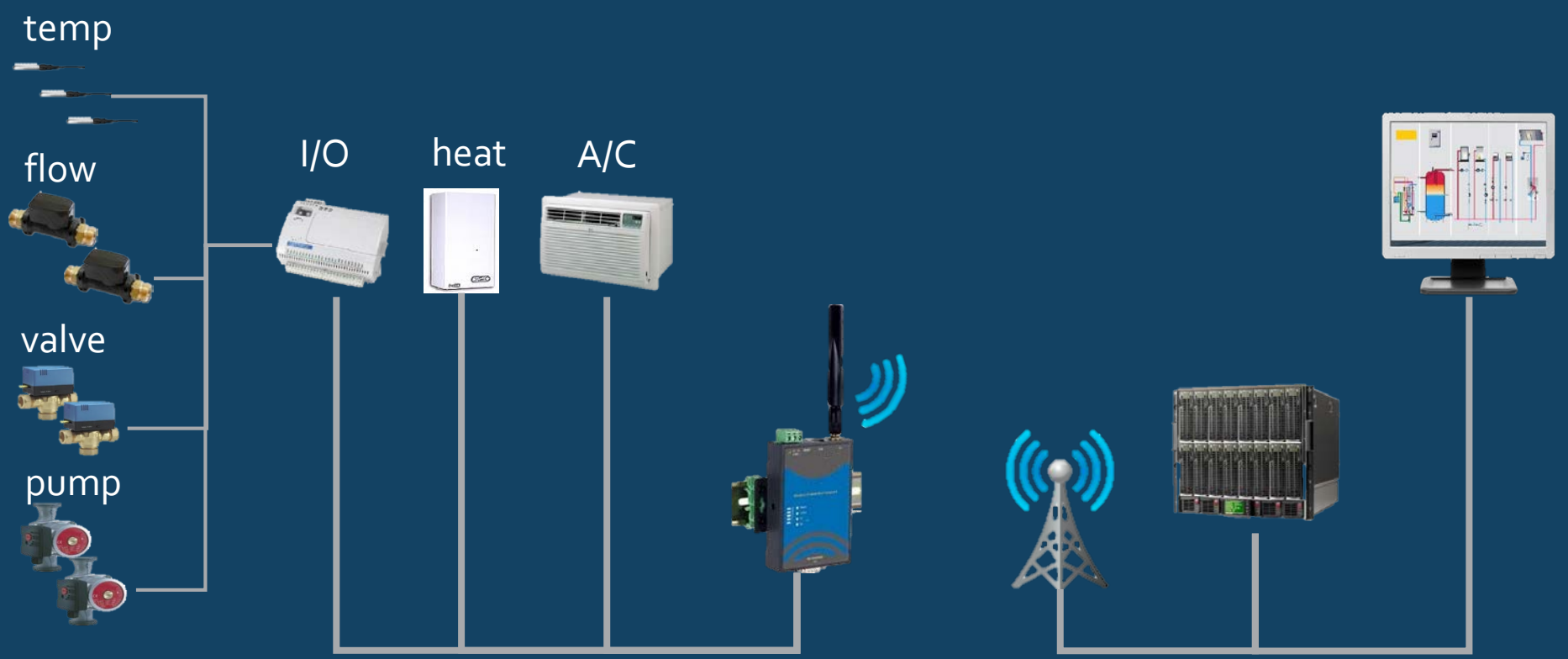
M2M / MTC View



M2M Communications, MTC:
Enabling connected devices to exchange information autonomously without the manual assistance of humans.

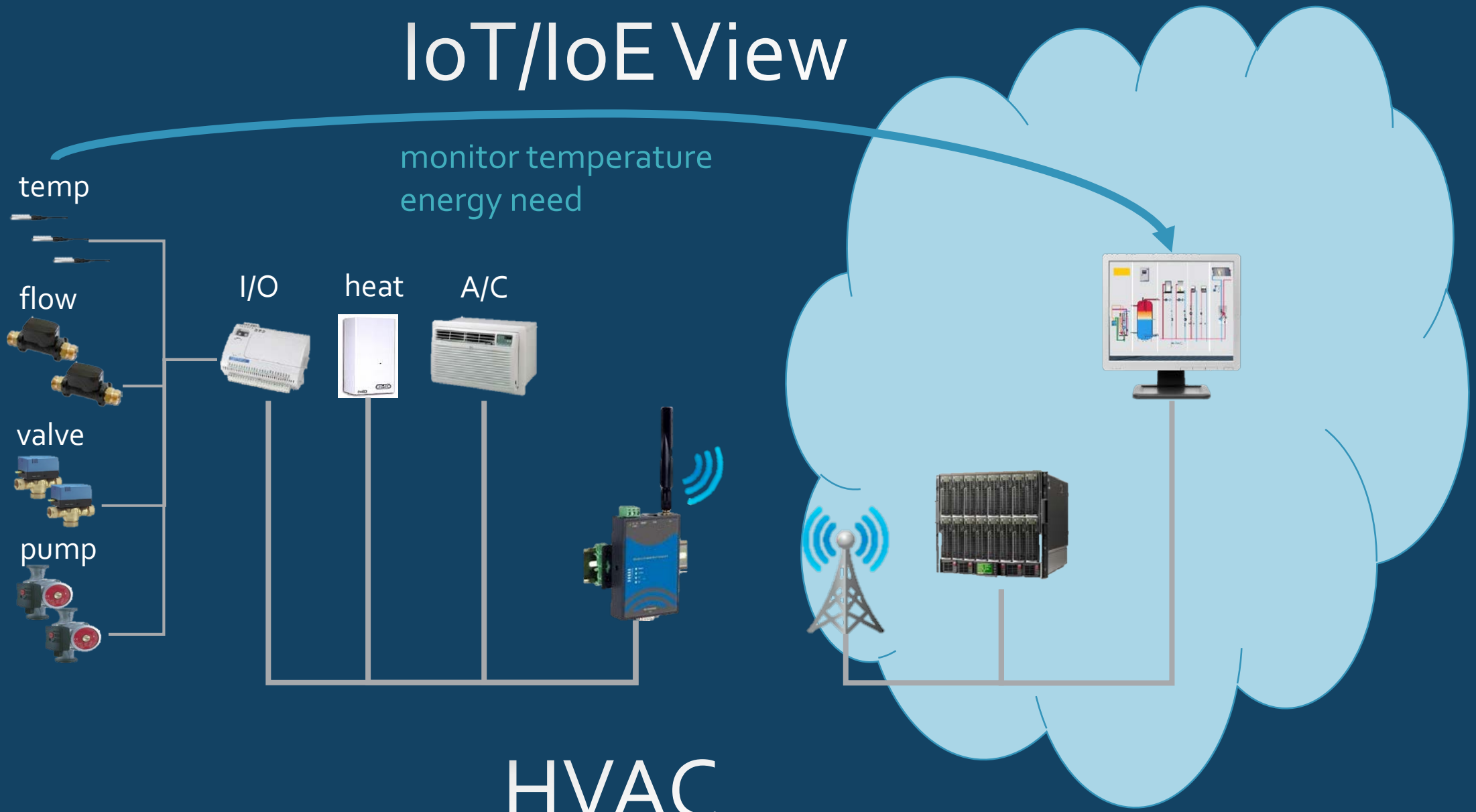
HVAC

IoT/IoE View



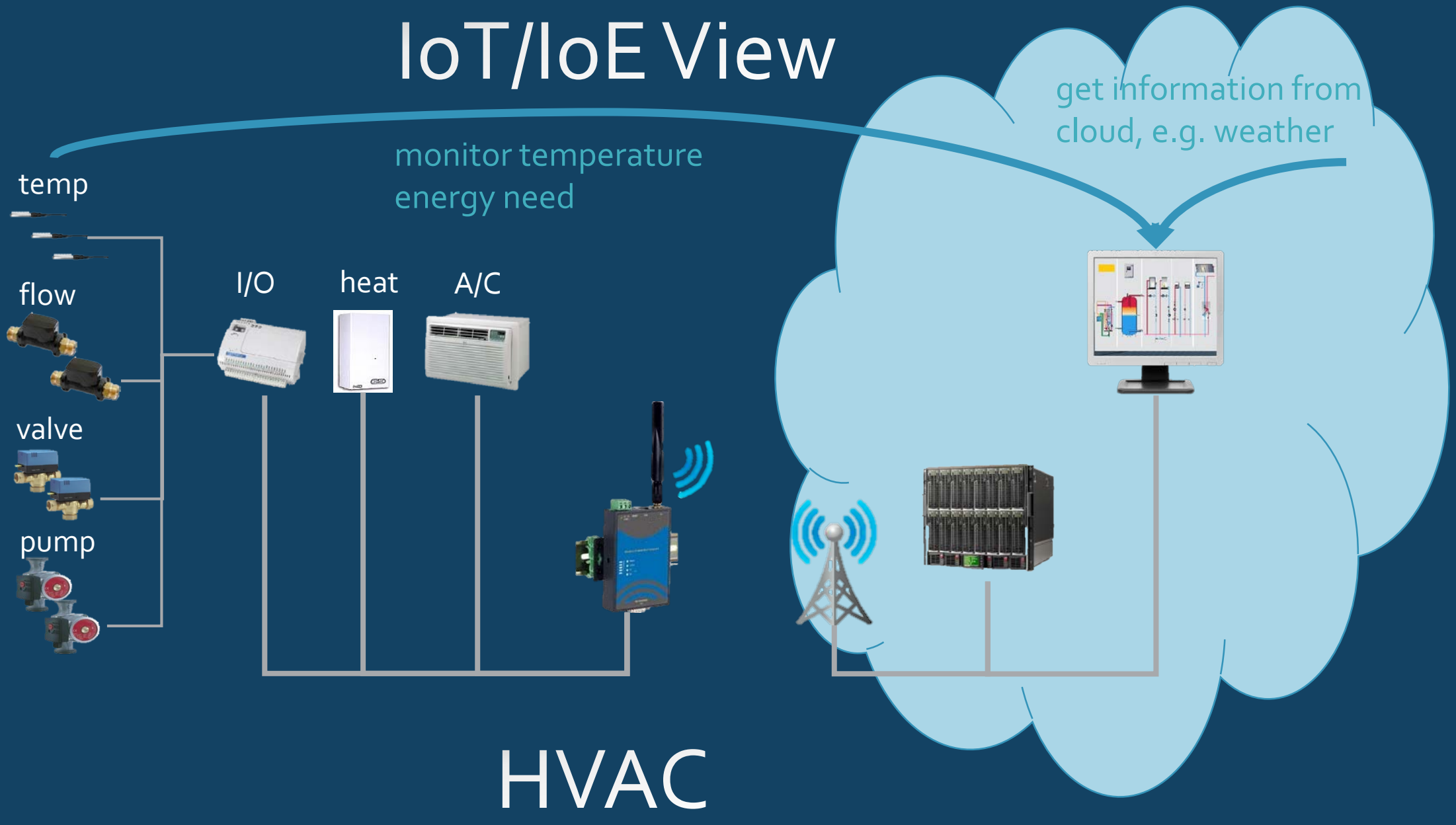
HVAC

IoT/IoE View



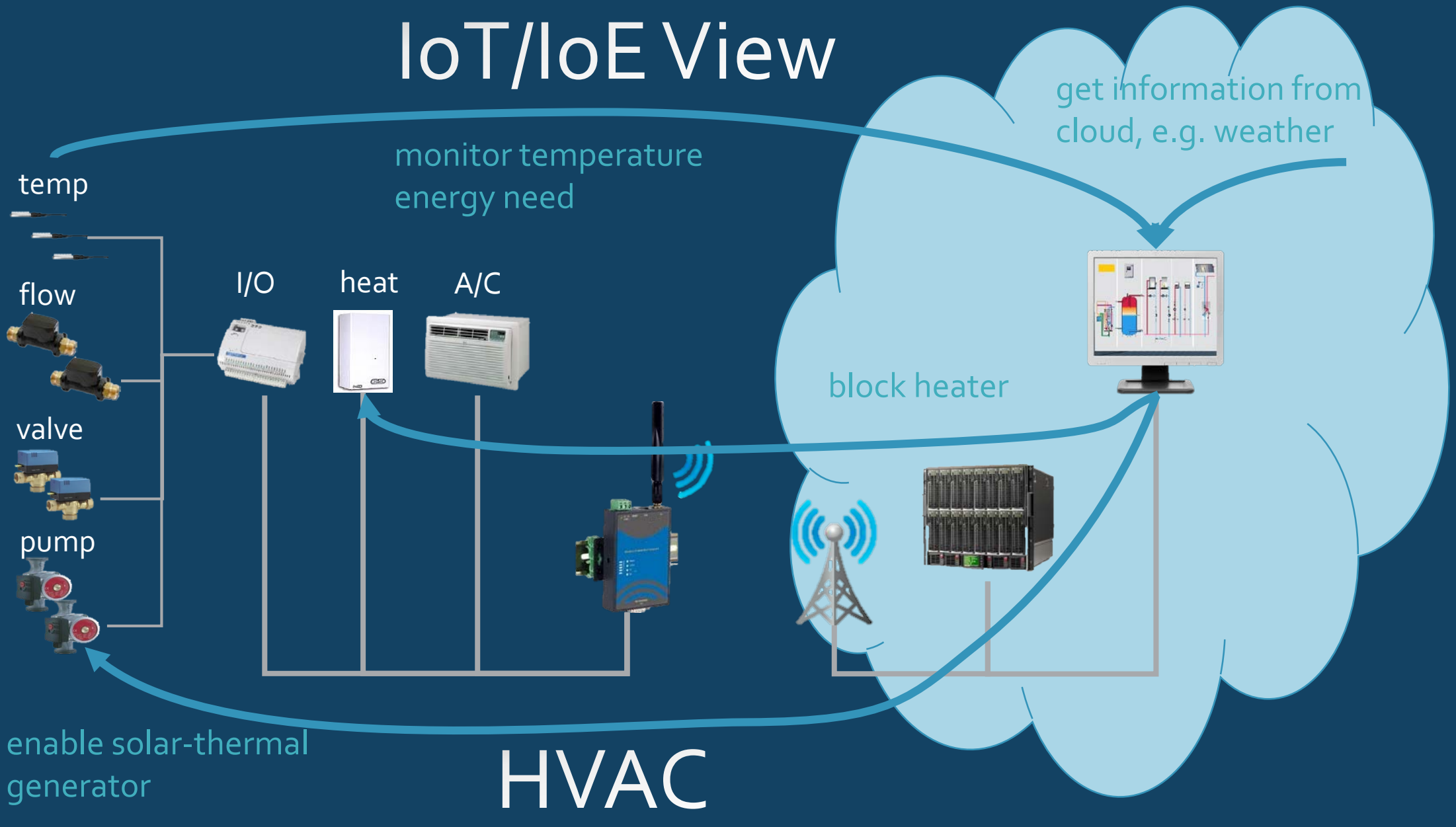
HVAC

IoT/IoE View

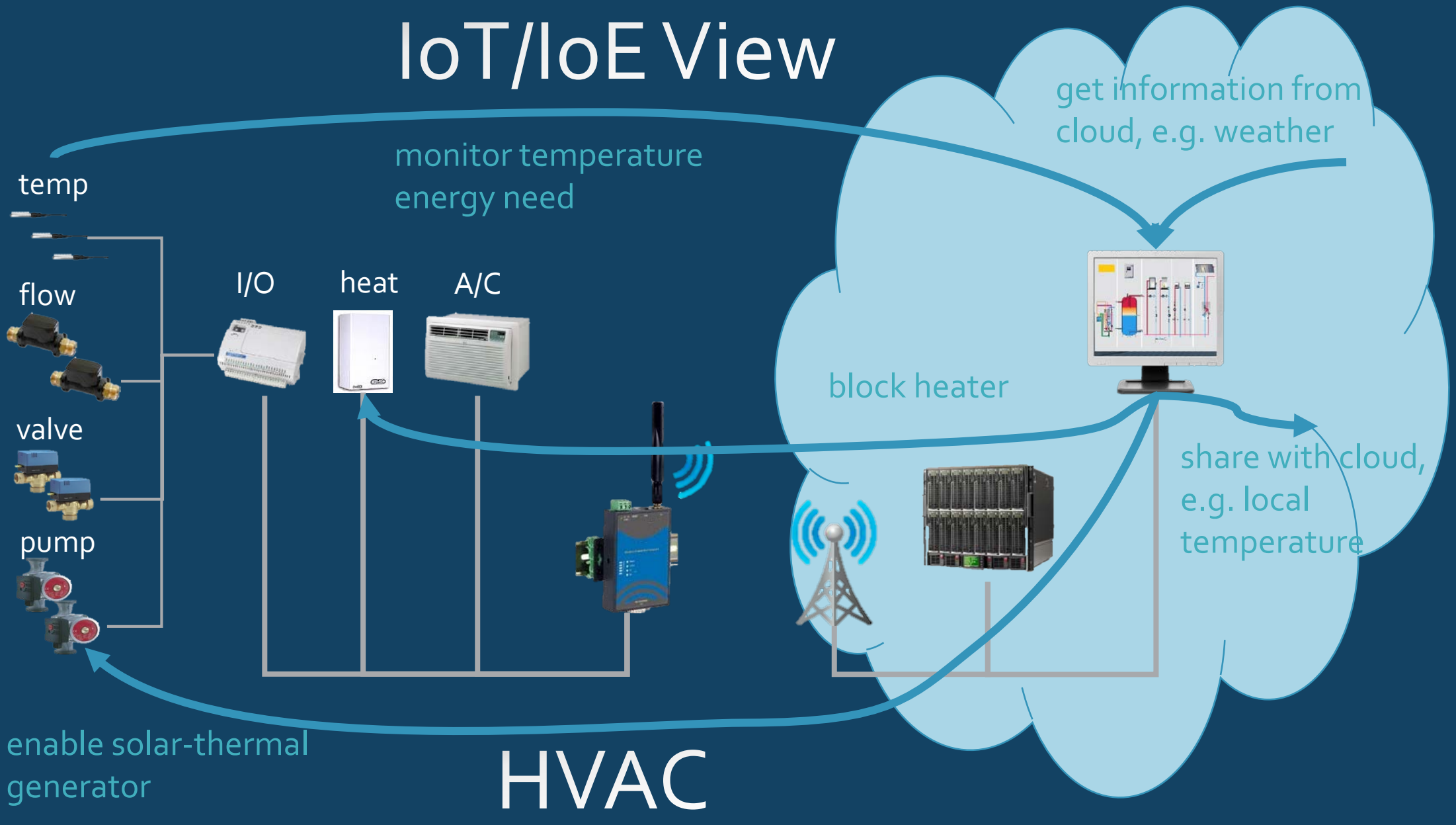


HVAC

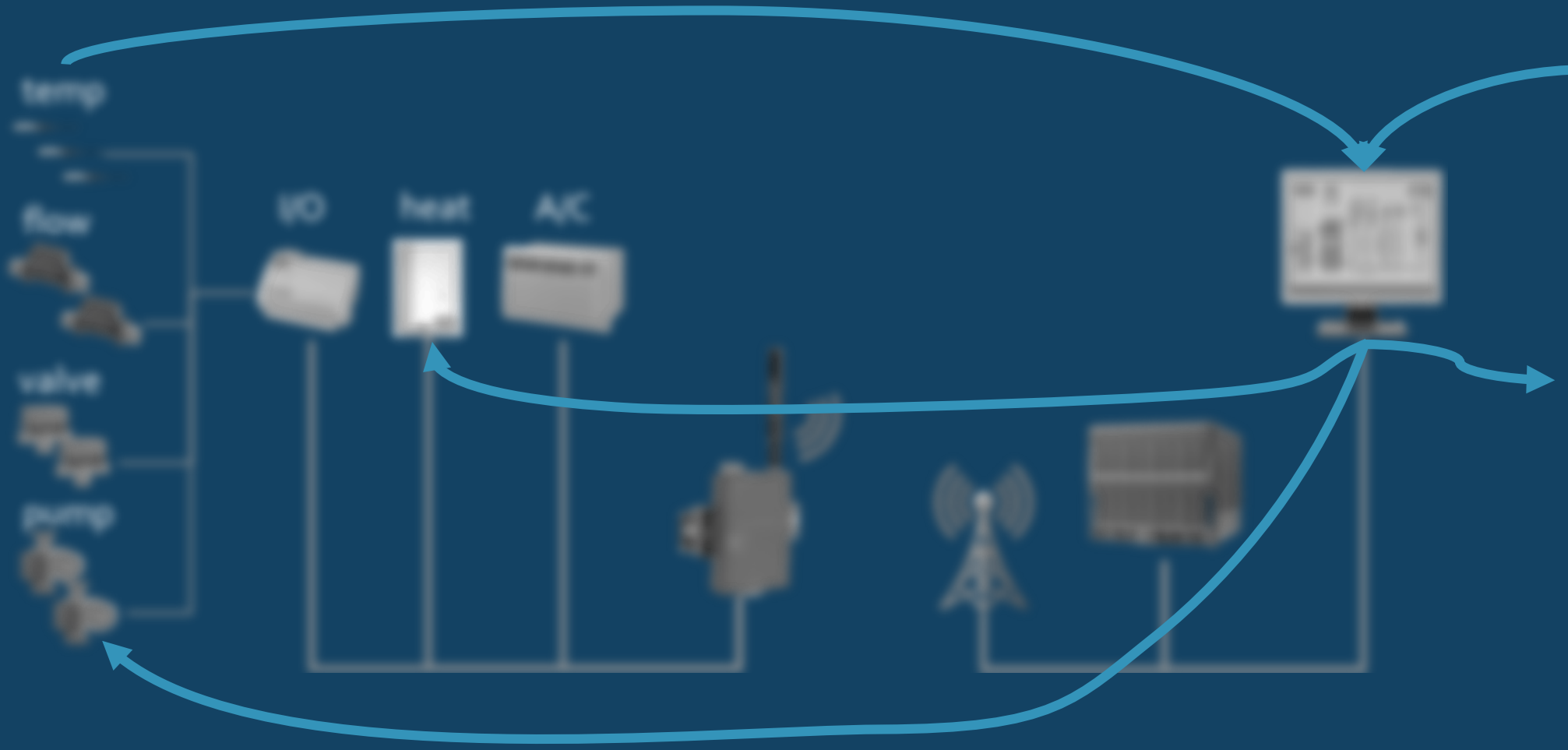
IoT/IoE View


get information from cloud, e.g. weather
monitor temperature energy need
temp
flow
valve
pump
I/O
heat
A/C
block heater
enable solar-thermal generator
HVAC

IoT/IoE View

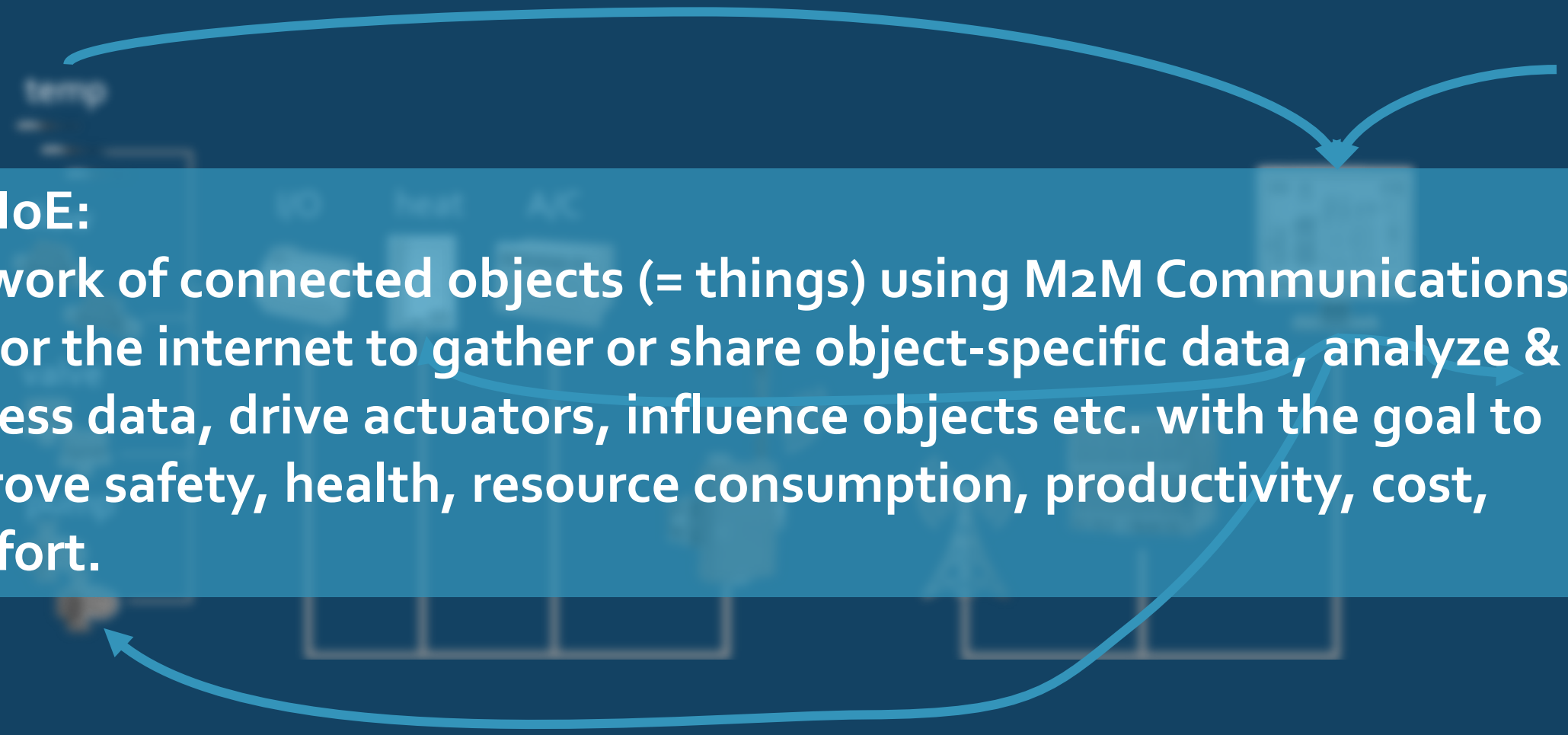

get information from cloud, e.g. weather
monitor temperature energy need
temp
flow
valve
pump
I/O
heat
A/C
block heater
share with cloud, e.g. local temperature
enable solar-thermal generator
HVAC

IoT/IoE View



HVAC

IoT/IoE View



IoT, IoE:
Network of connected objects (= things) using M2M Communications and/or the internet to gather or share object-specific data, analyze & process data, drive actuators, influence objects etc. with the goal to improve safety, health, resource consumption, productivity, cost, comfort.

HVAC

Confusing Terms

- M2M Machine-2-Machine (Communications)
- MTC Machine Type Communication
- IoT Internet of Things
- IoE Internet of Everything
- IIoT Industrial Internet of Things

Confusing Terms

- M2M
- MTC

Autonomous communication among connected devices without need for manual assistance of humans

- IoT Internet of Things
- IoE Internet of Everything
- IIoT Industrial Internet of Things

Confusing Terms

- M2M
- MTC

Autonomous communication among connected devices without need for manual assistance of humans

- IoT
- IoE

Network of connected objects (= things) using M2MCommunications & the internet & smart processing

- IIoT Industrial Internet of Things

Confusing Terms

- M2M
- MTC

Autonomous communication among connected devices without need for manual assistance of humans

- IoT
- IoE

Network of connected objects (= things) using M2MCommunications & the internet & smart processing

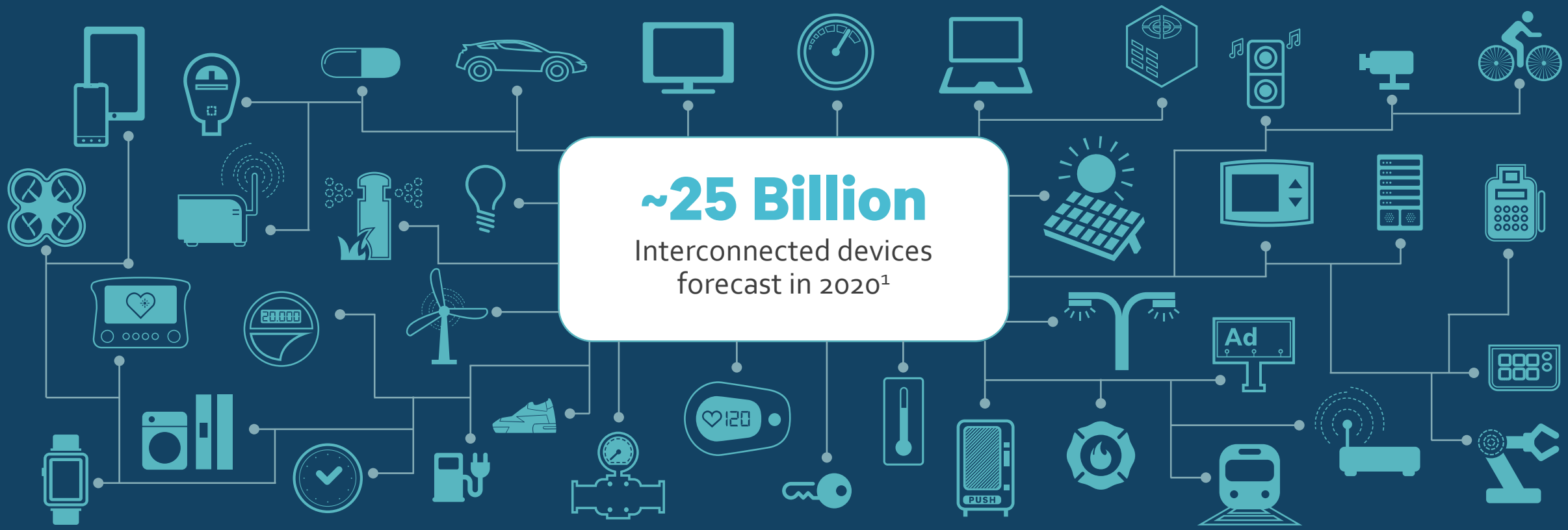
- IIoT Industrial Internet of Things

No precise definitions or sharp differentiation
Terms are used with similar meaning in various contexts
Using M2M / MTC and IoT interchangeably in what follows

Standards & Technology Landscape

What is going on?

IoT: Surge of connected things



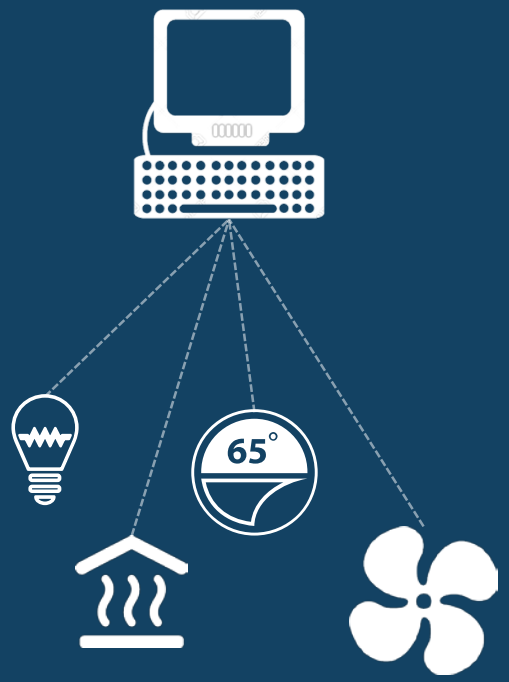
Transforming industries with innovative services and useful information

Connected Home | Automotive | Smart Cities | Retail | Education | Healthcare | Industrial

1 Source: Machina Research, February, 2014

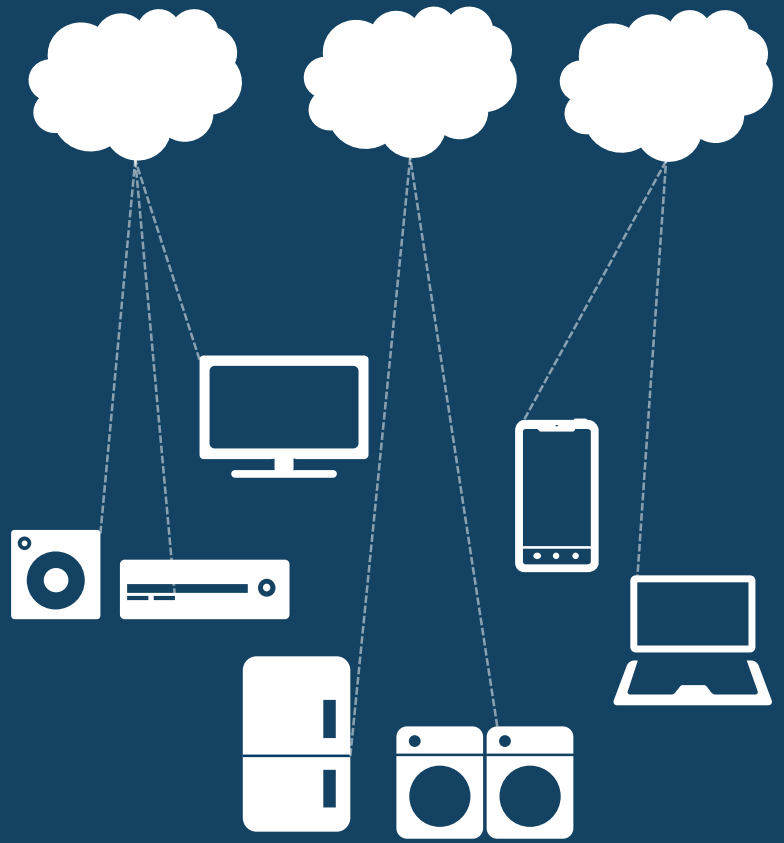
M2M/IoT Evolution

Master/Slave



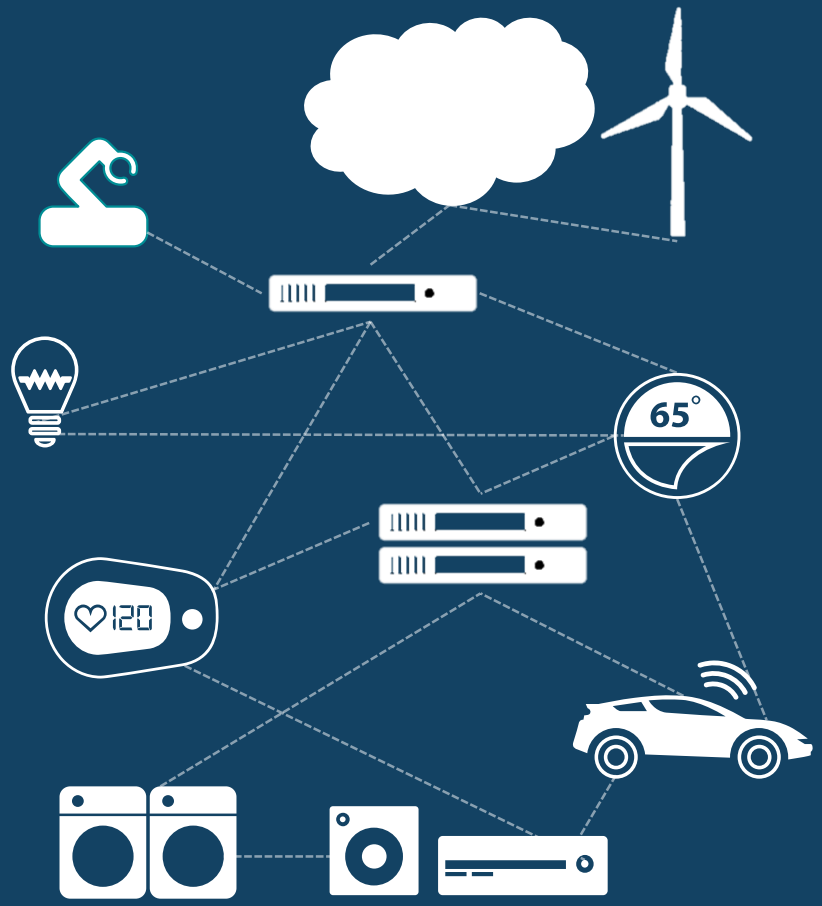
Yesterday

Device ⇔ Cloud



Today

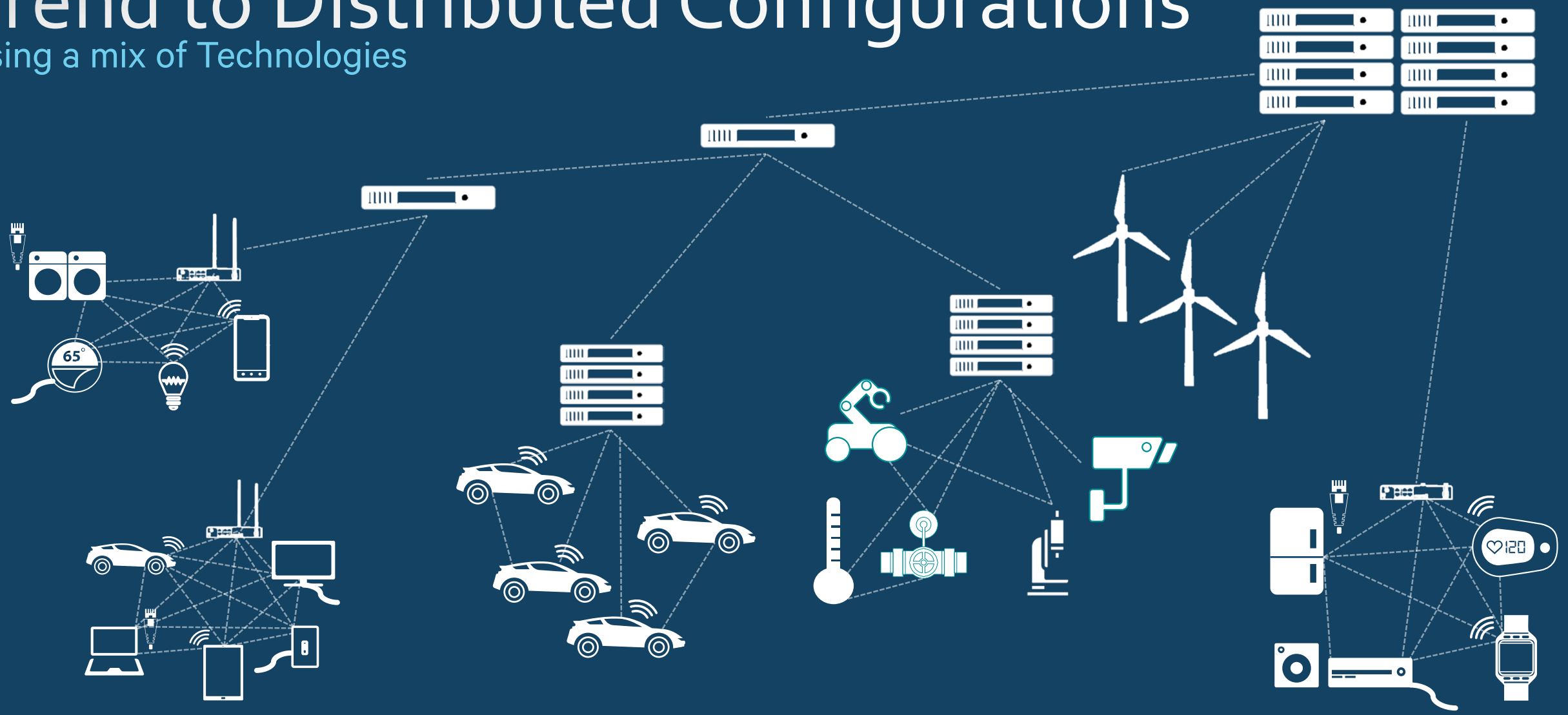
Distributed



Tomorrow

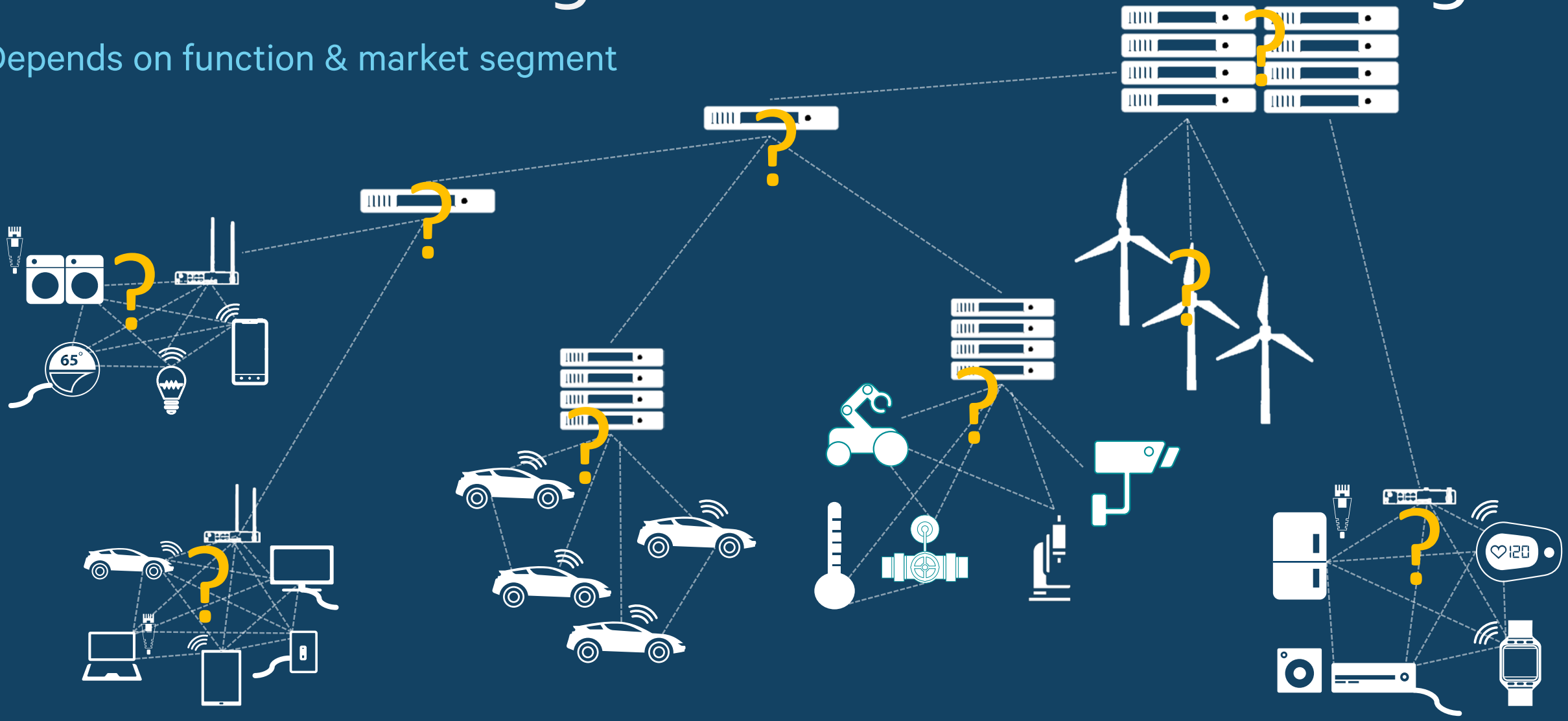
Trend to Distributed Configurations

Using a mix of Technologies



Which Technologies are used or will emerge?

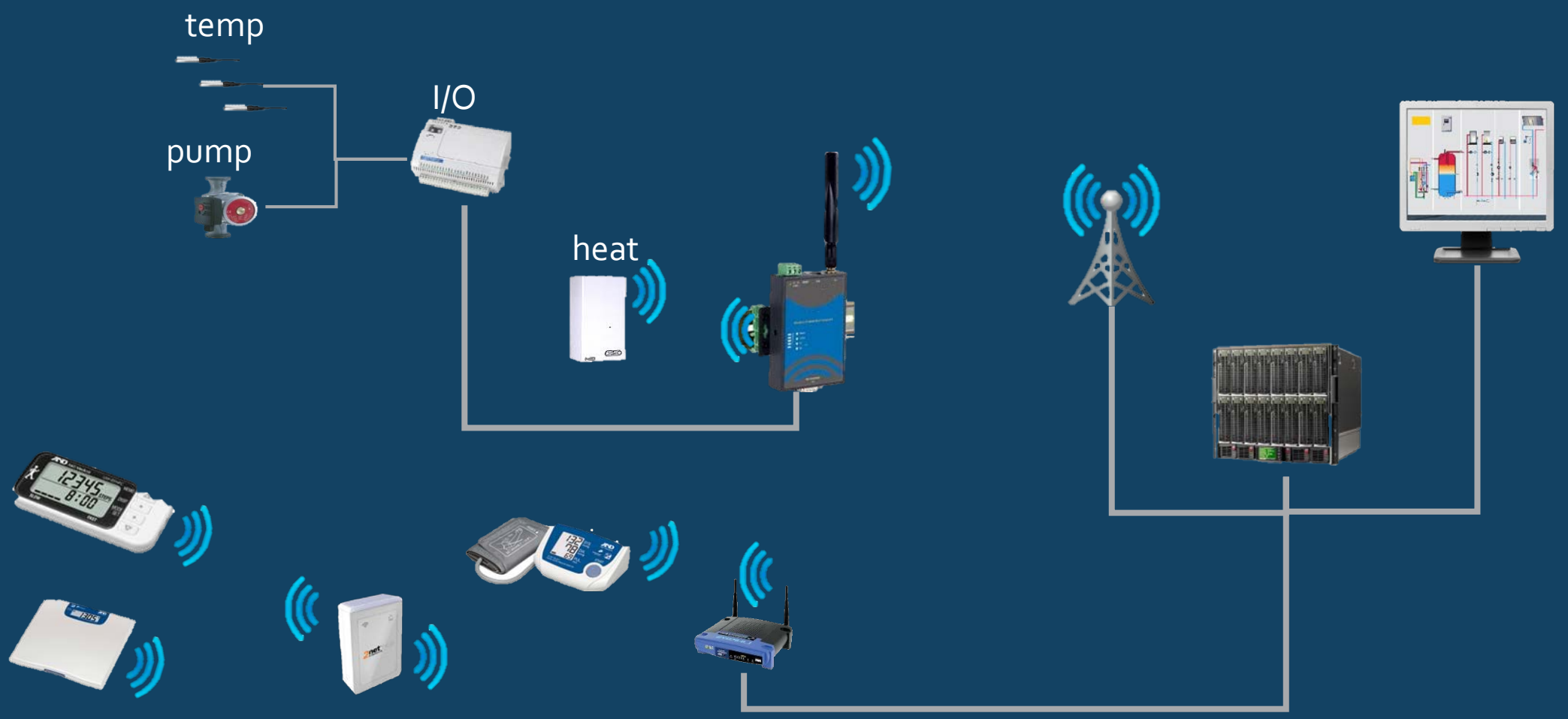
Depends on function & market segment



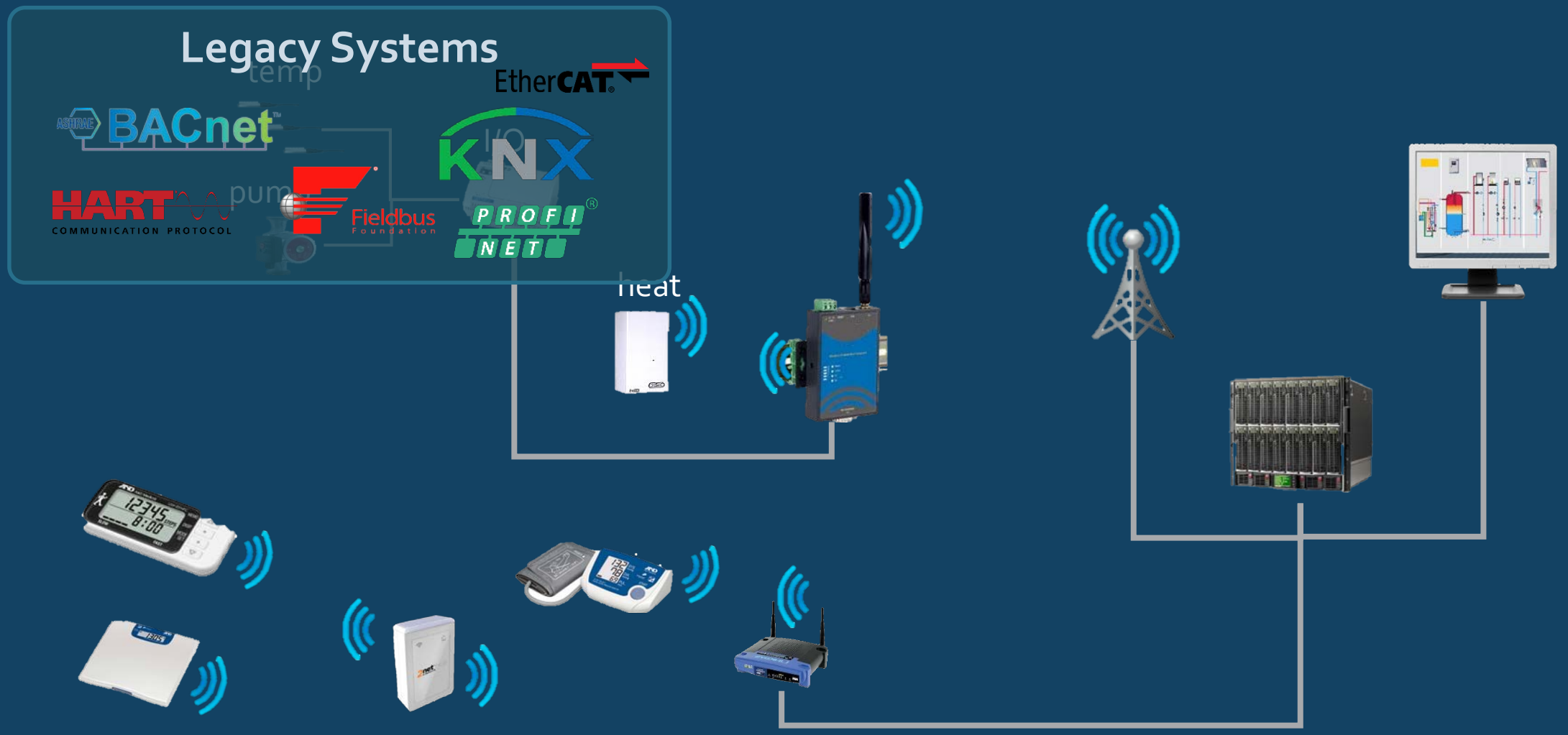
Jungle of Technologies, Standards, Consortia, OSS Projects

- Which groups actually specify technology, which are just doing marketing & promotion?
- Which technologies are used / will be used in M2M/IoT?
- Which technologies are overlapping or complementing each other?

Involved Transports



Involved Transports



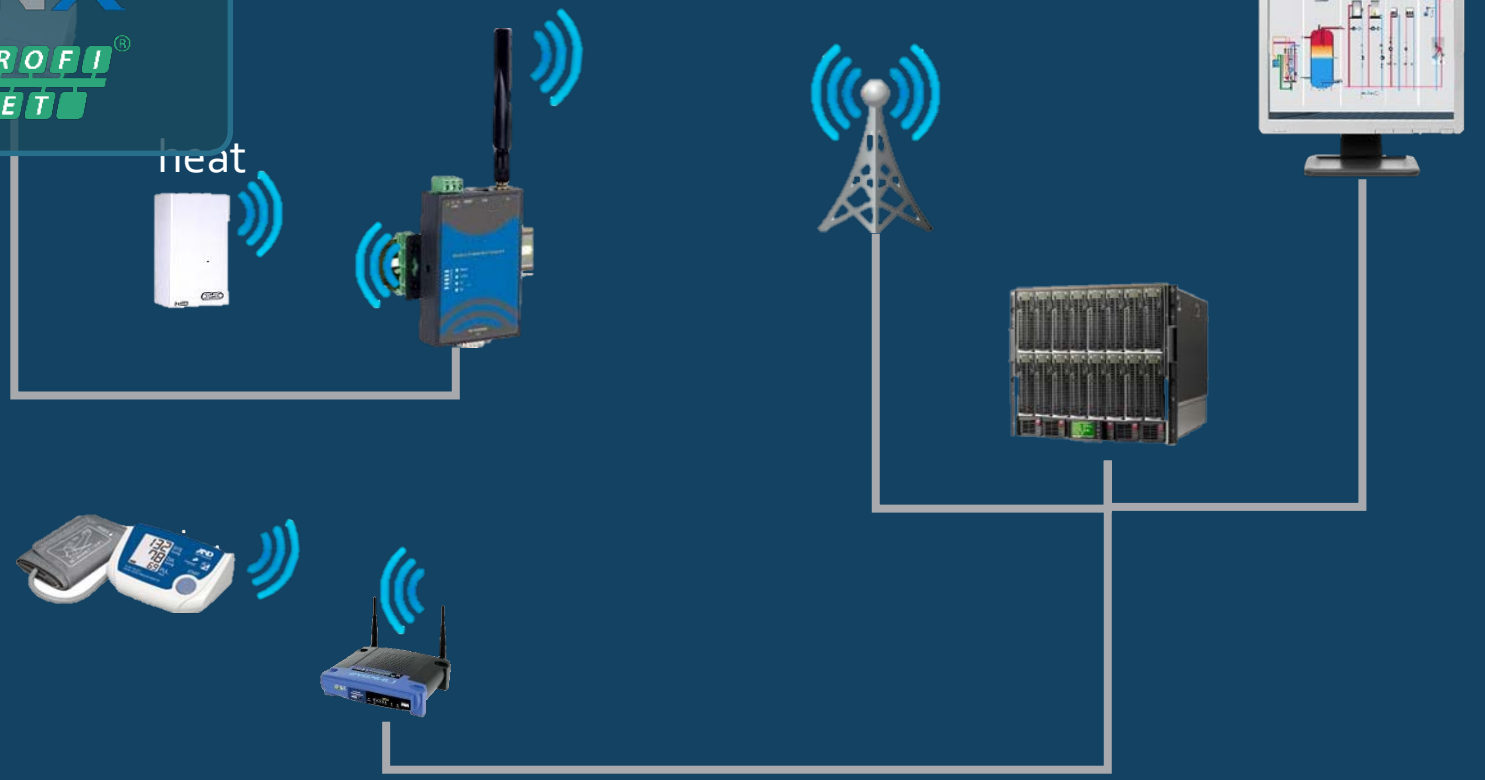
Involved Transports

Legacy Systems

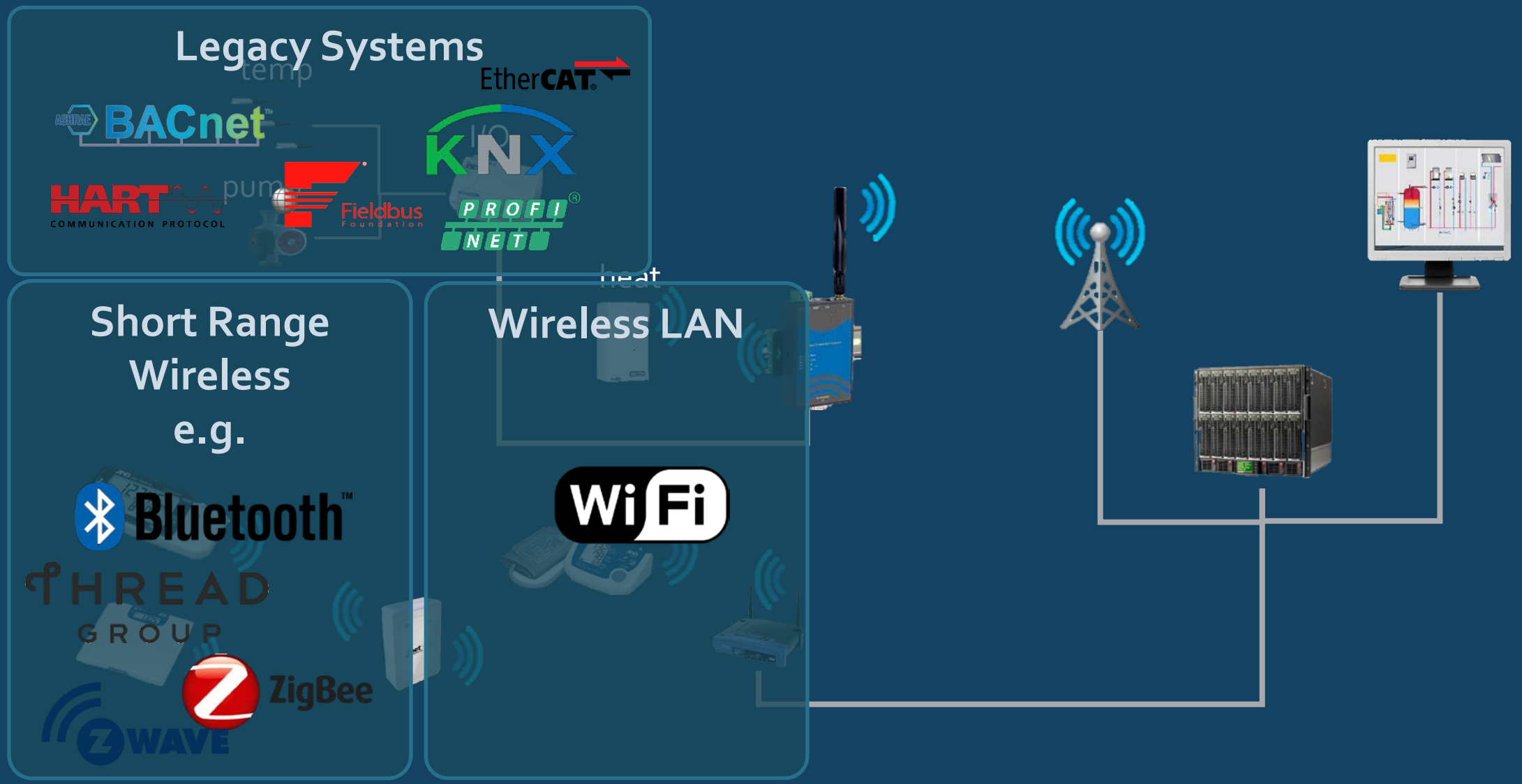
BACnet
EtherCAT
KNX
HART COMMUNICATION PROTOCOL
Fieldbus Foundation
PROFINET

Short Range Wireless e.g.

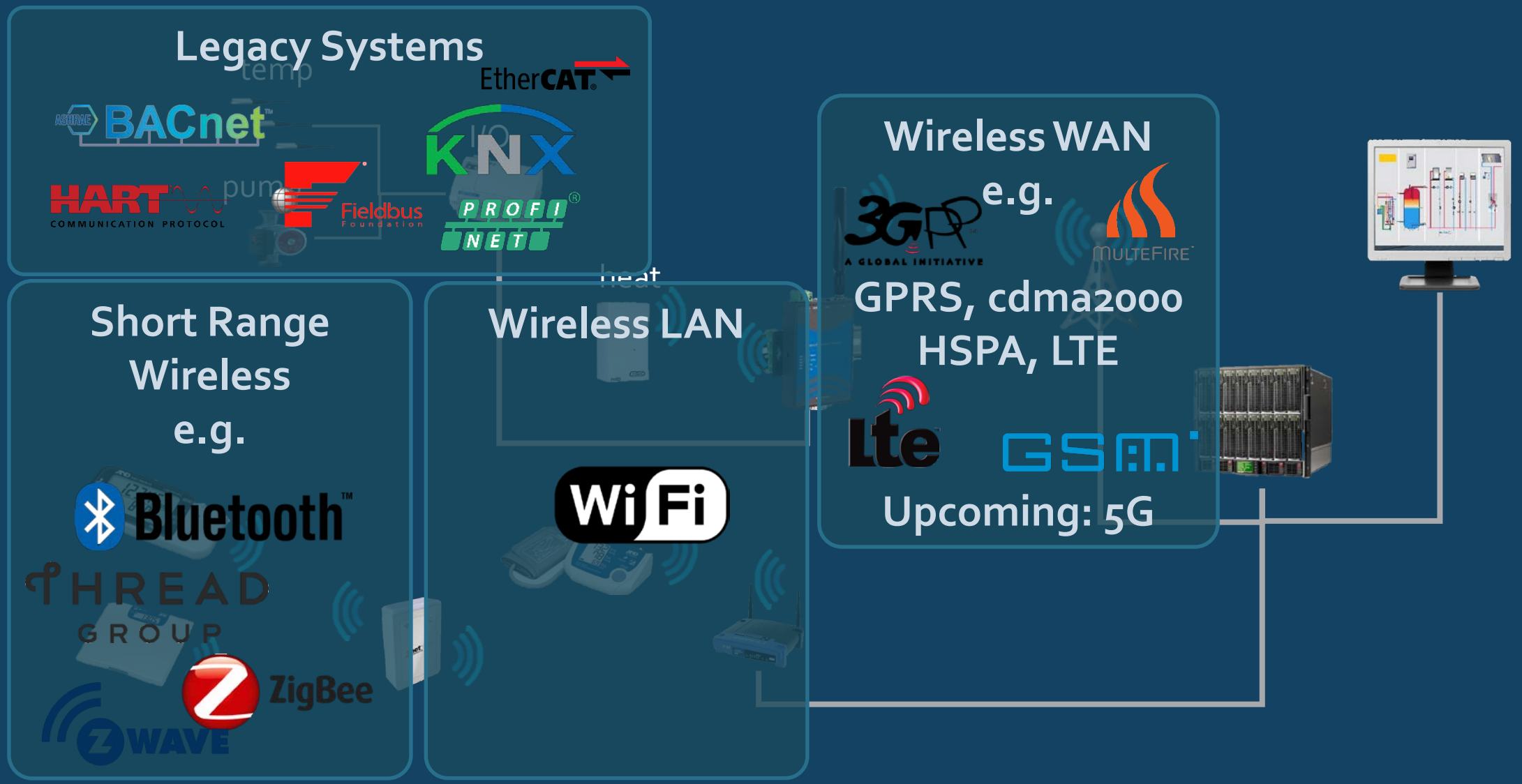
Bluetooth
THREAD GROUP
ZigBee
Z-WAVE



Involved Transports



Involved Transports



Involved Transports

Legacy Systems

BACnet
EtherCAT
KNX
HART
COMMUNICATION PROTOCOL
Fieldbus Foundation
PROFINET

Short Range Wireless

e.g.

Bluetooth
THREAD GROUP
ZigBee
Z-WAVE

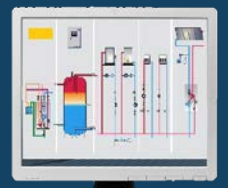
Wireless LAN

Wi Fi

Wireless WAN

e.g.

3GPP A GLOBAL INITIATIVE
MULTEFIRE
GPRS, cdma2000
HSPA, LTE
LTE
GSM
Upcoming: 5G



Fixed Networks

Internet

IEEE 802.3
ISO IEC

Organize Technologies in a "Stack" for M2M / IoT

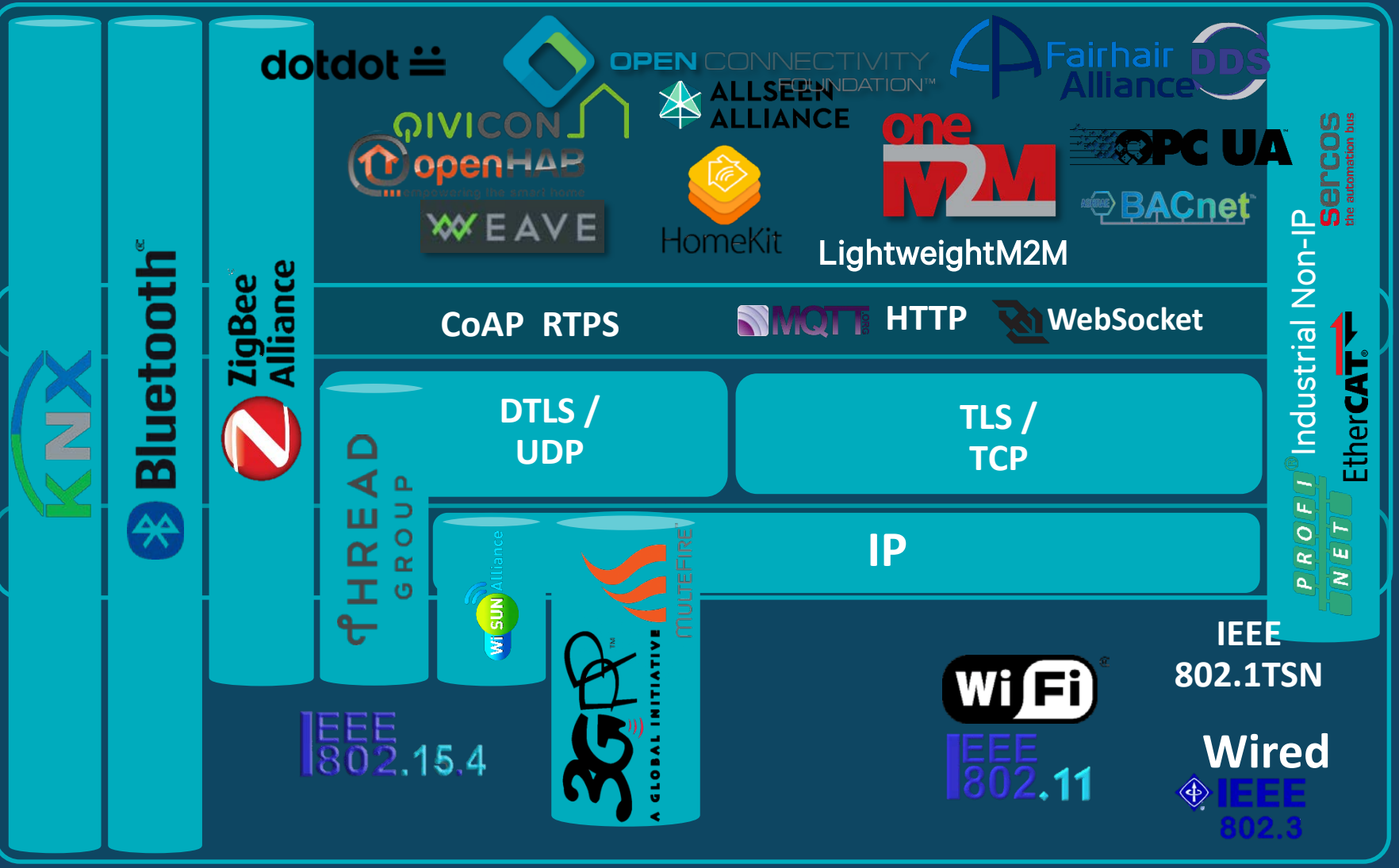
"OSI equivalent"

Applications — Custom IoT Applications

Service Layer
aka
Service Platform
Middleware
Enablement Platform

Protocols

Access

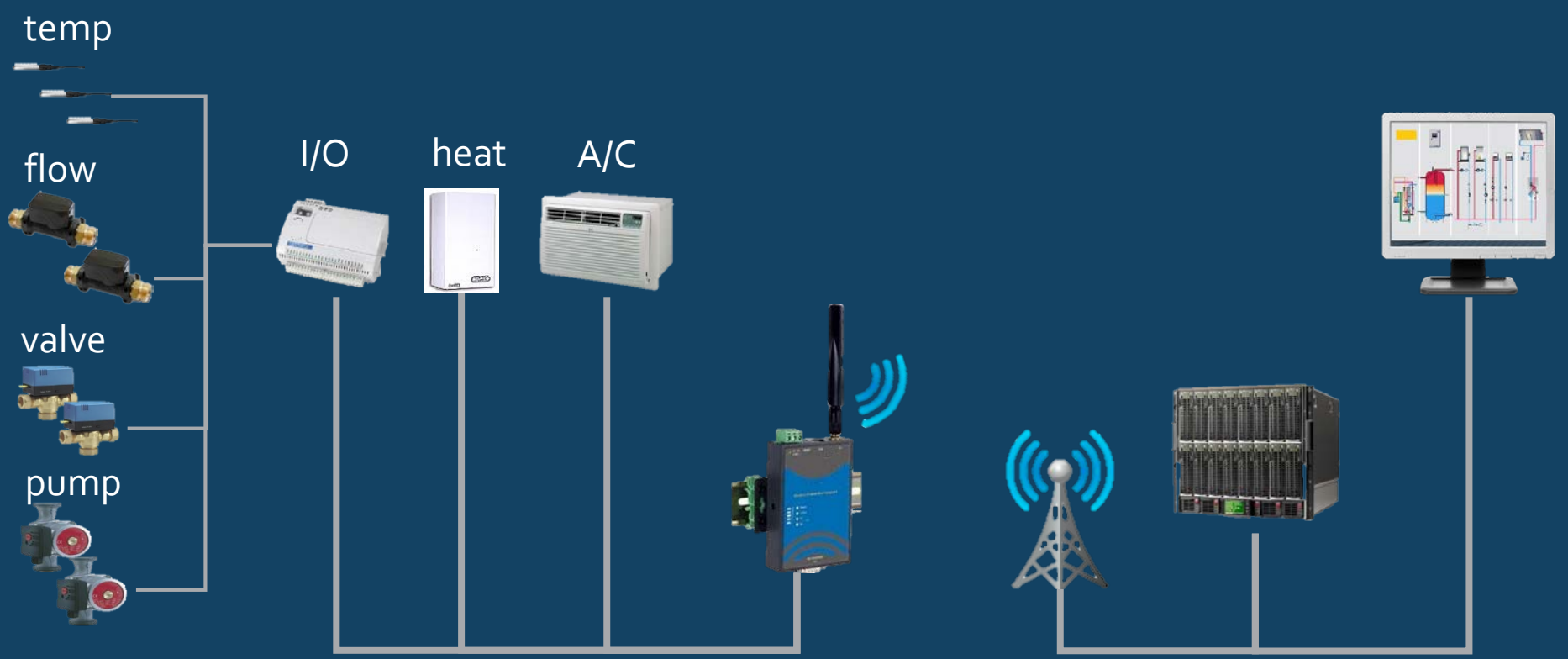


- Application
- Presentation
- Session
- Transport
- Network
- Link
- Physical

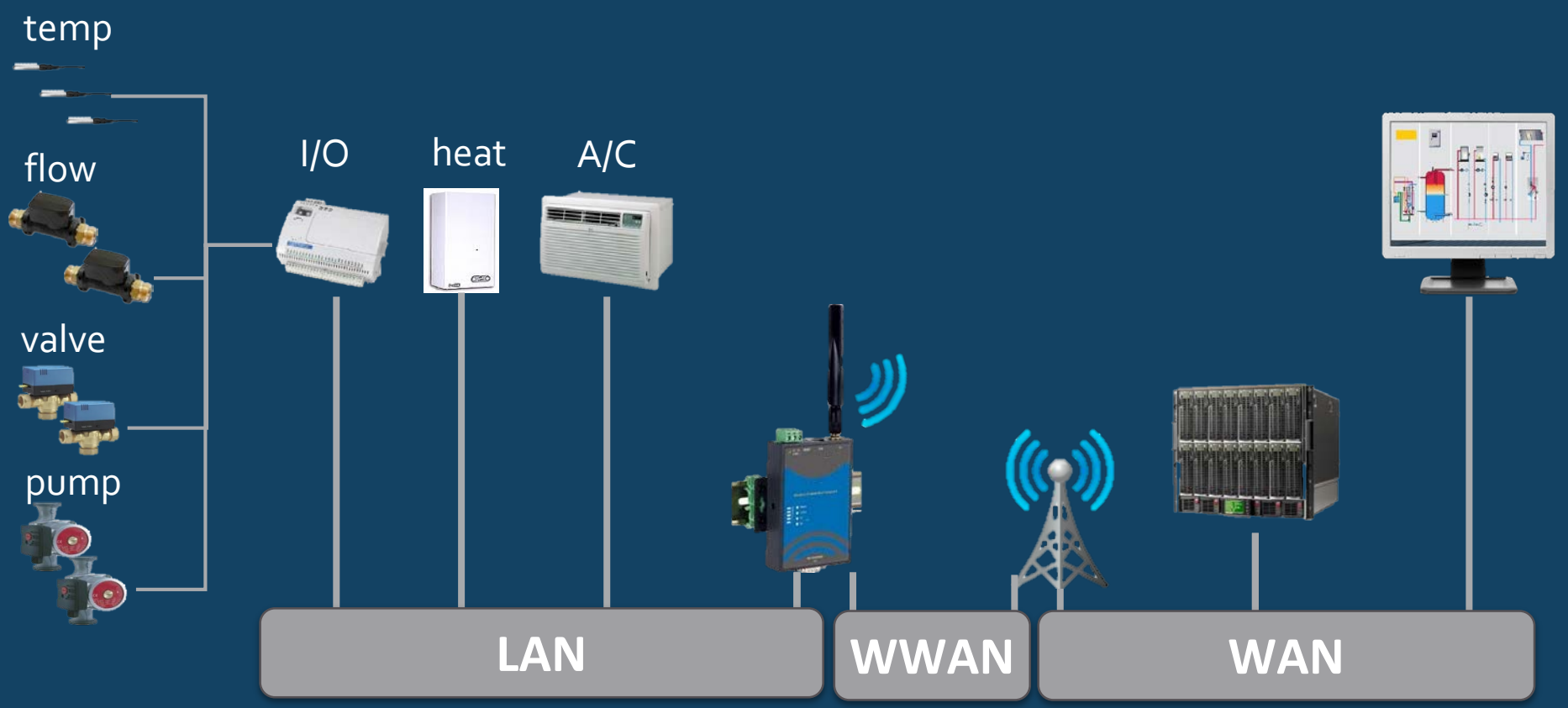
Horizontal Middleware Platform

M2M Service Layer

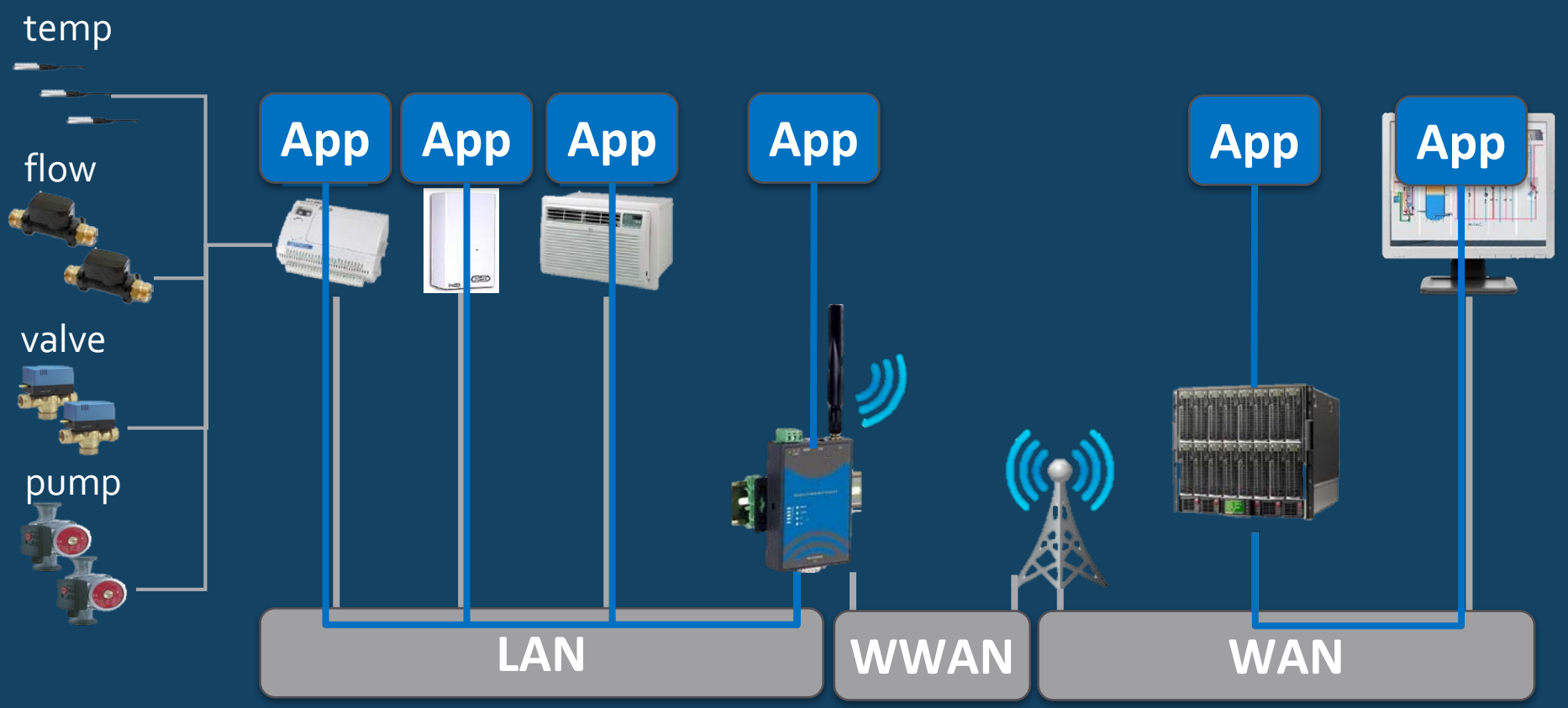
M2M Service Layer



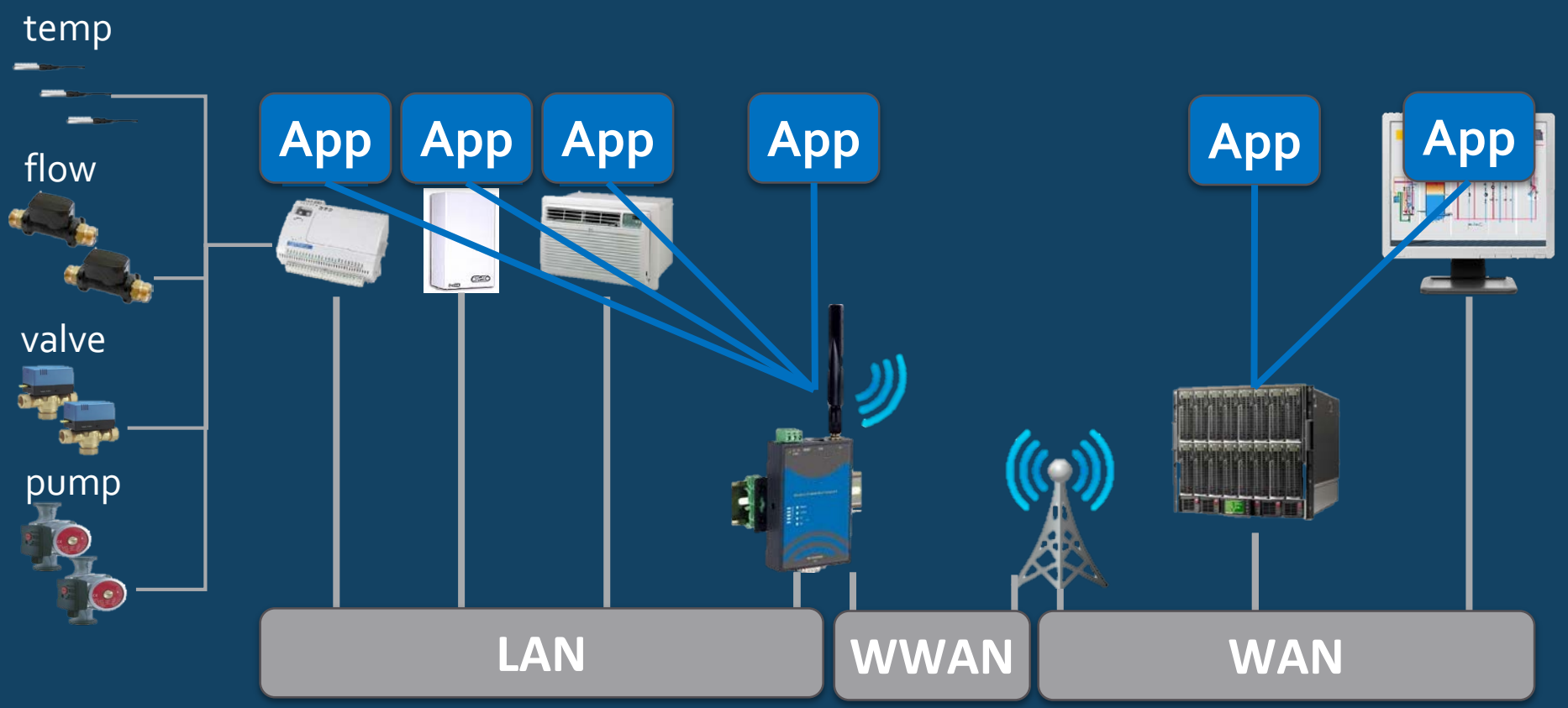
HVAC



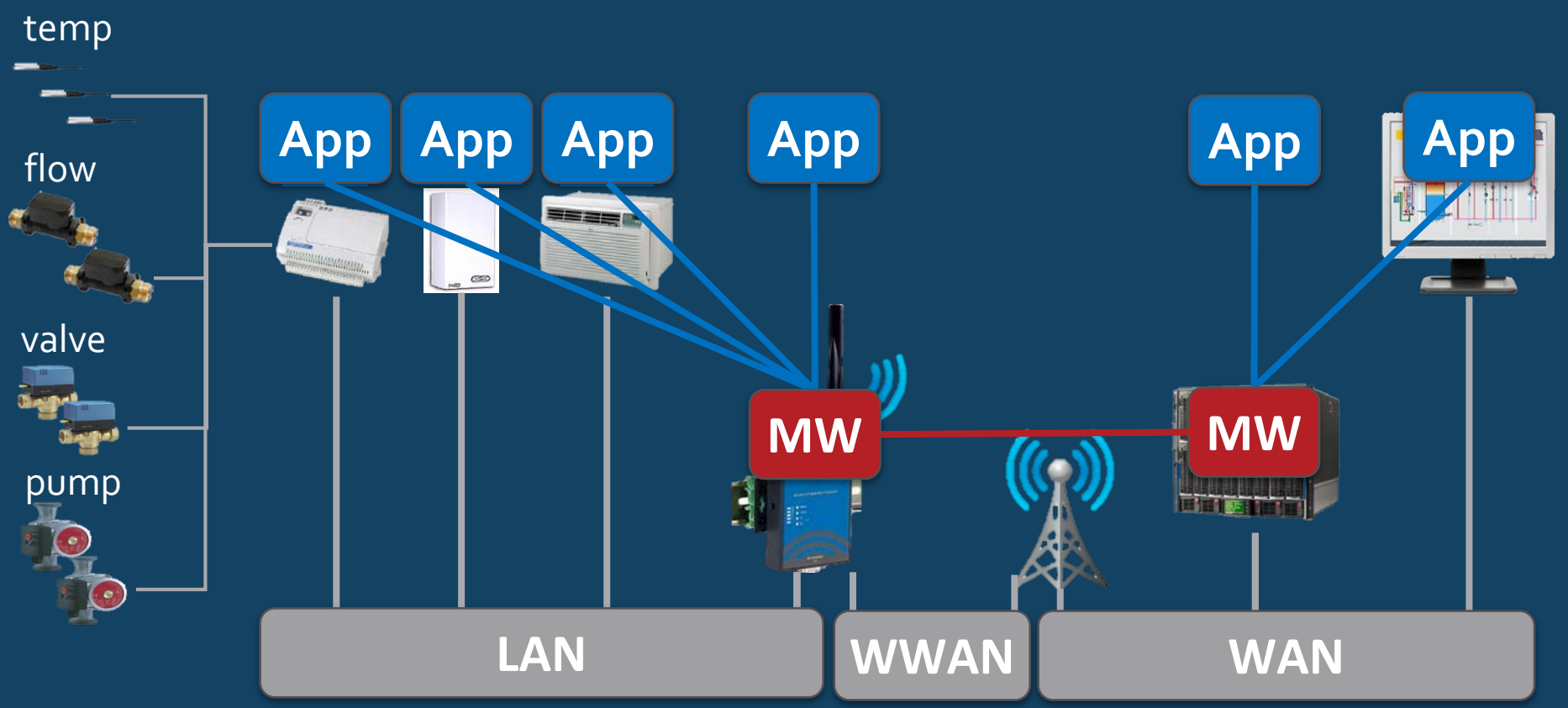
HVAC



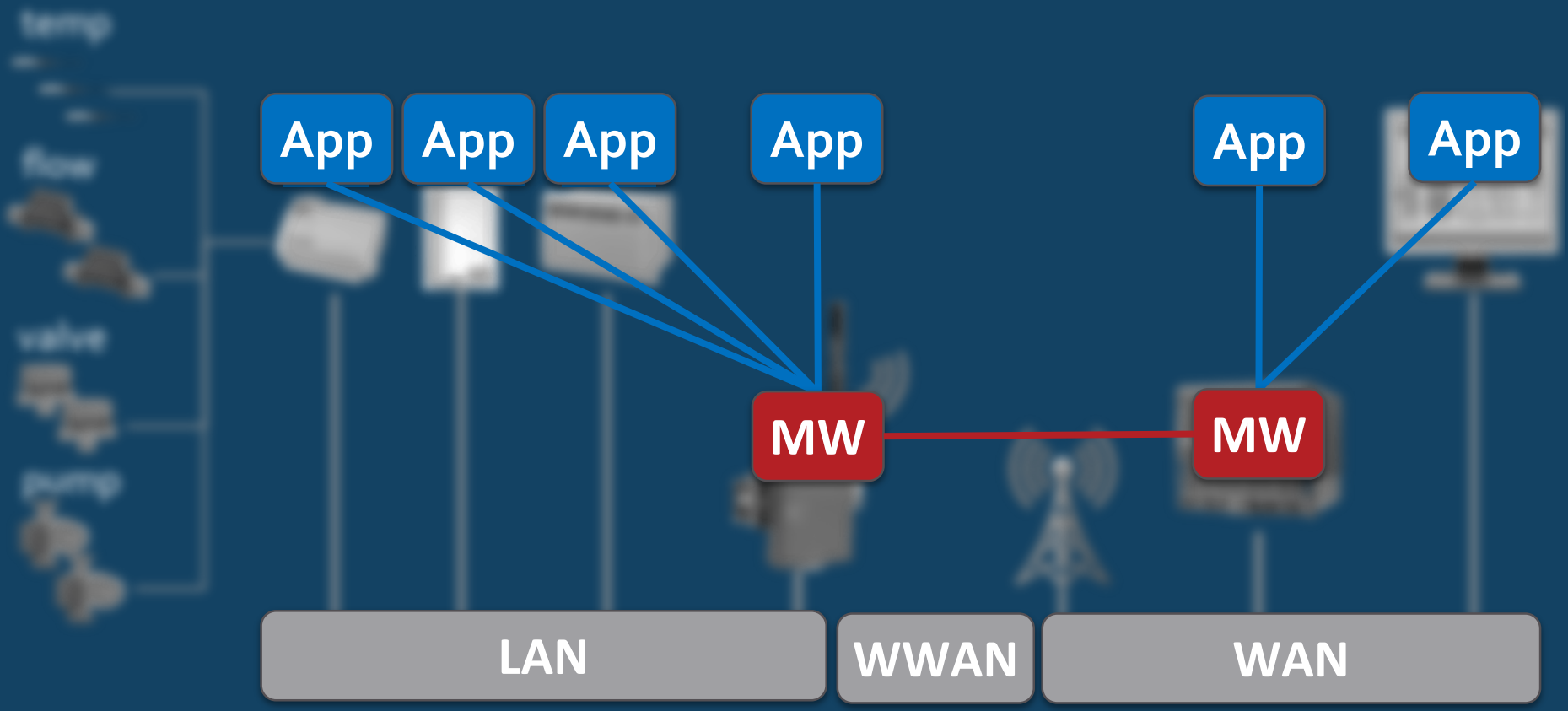
HVAC



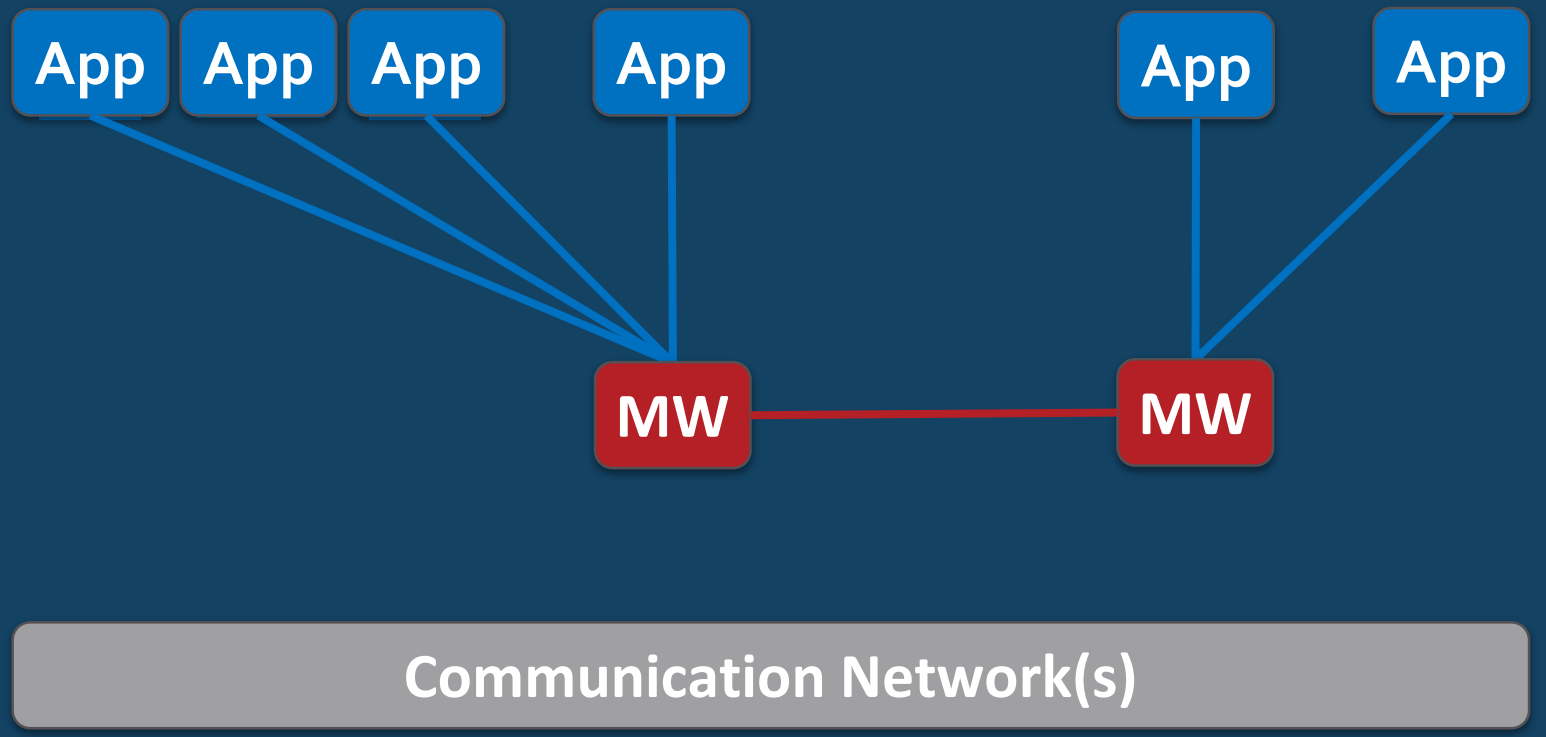
HVAC



HVAC

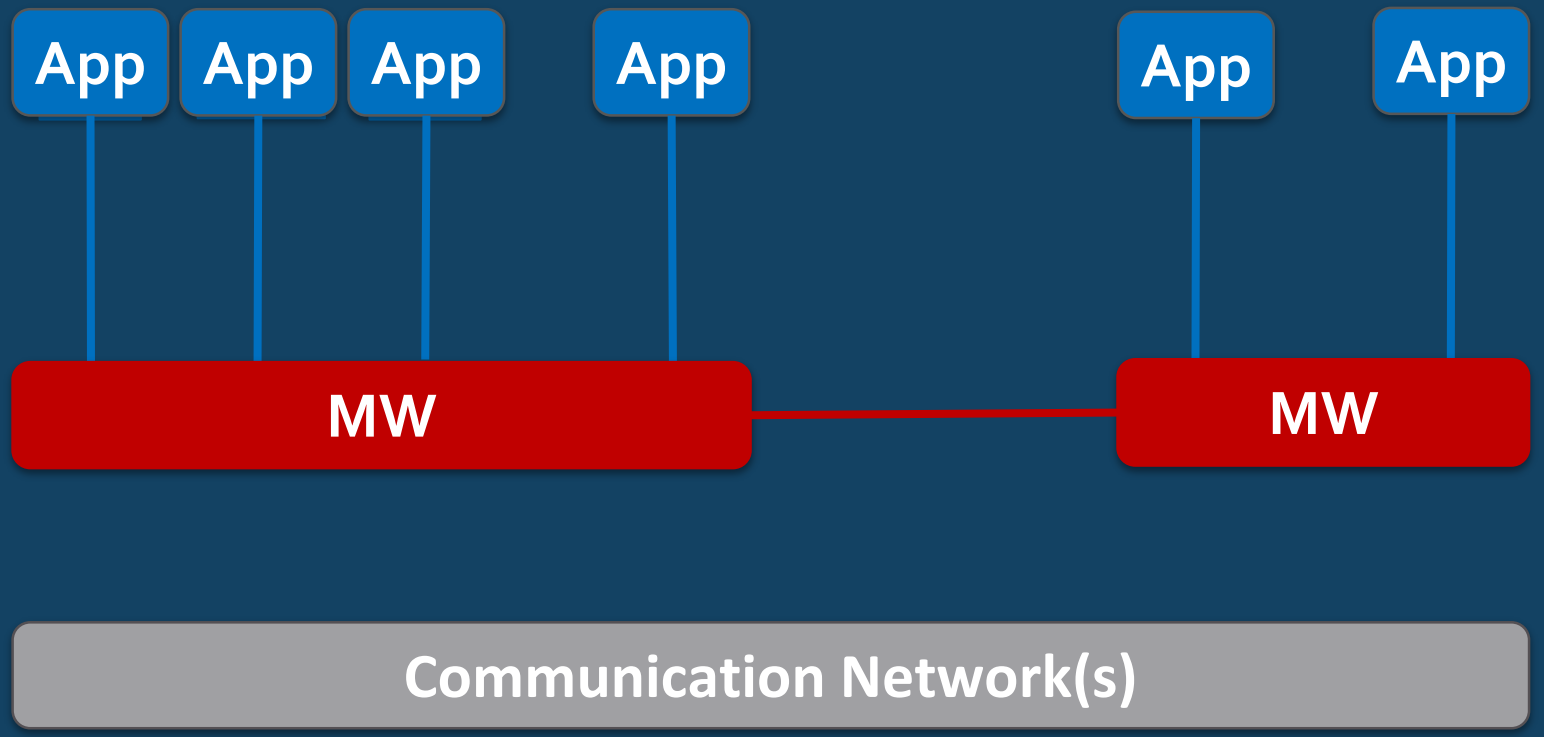


HVAC

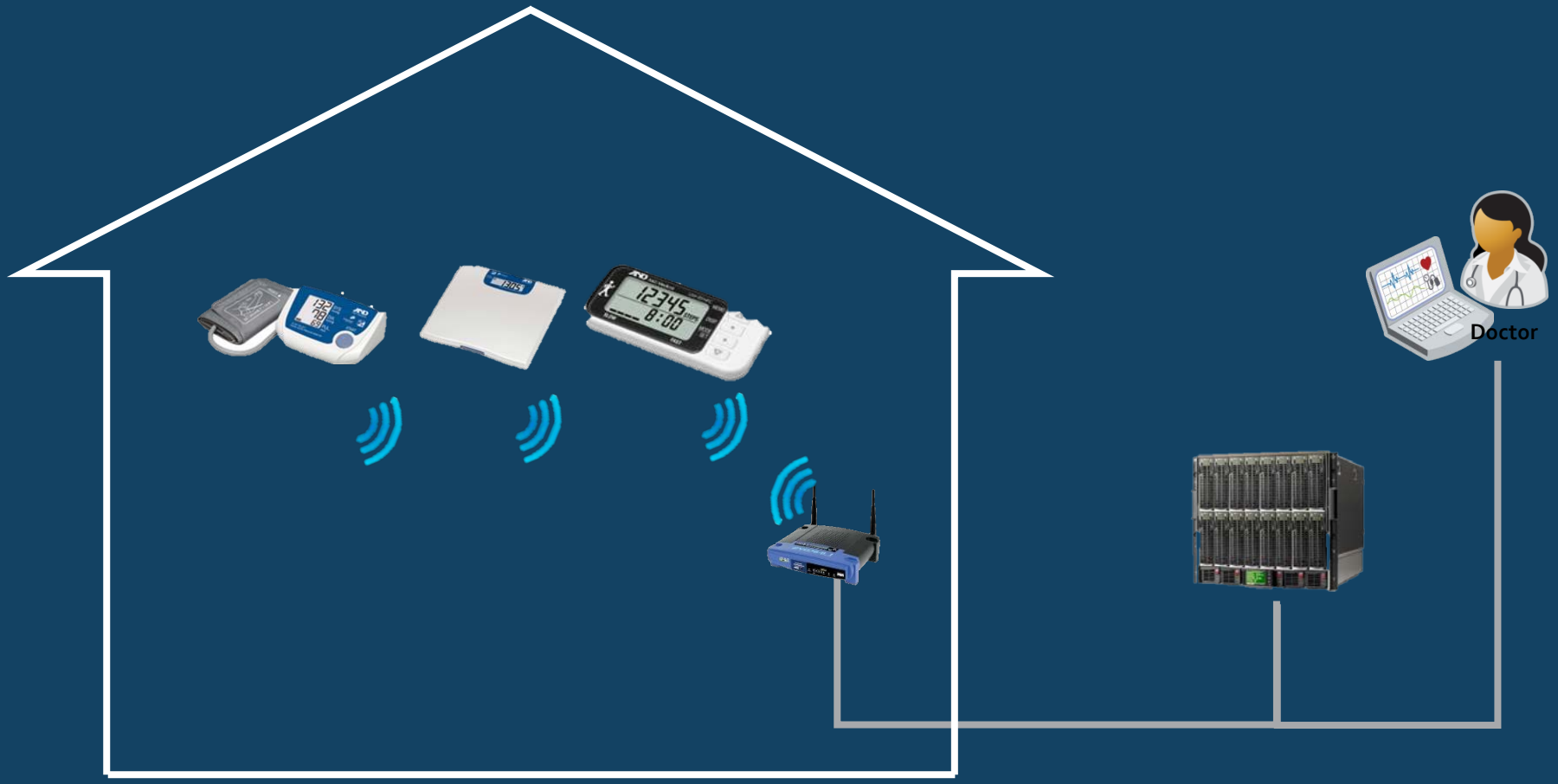


HVAC

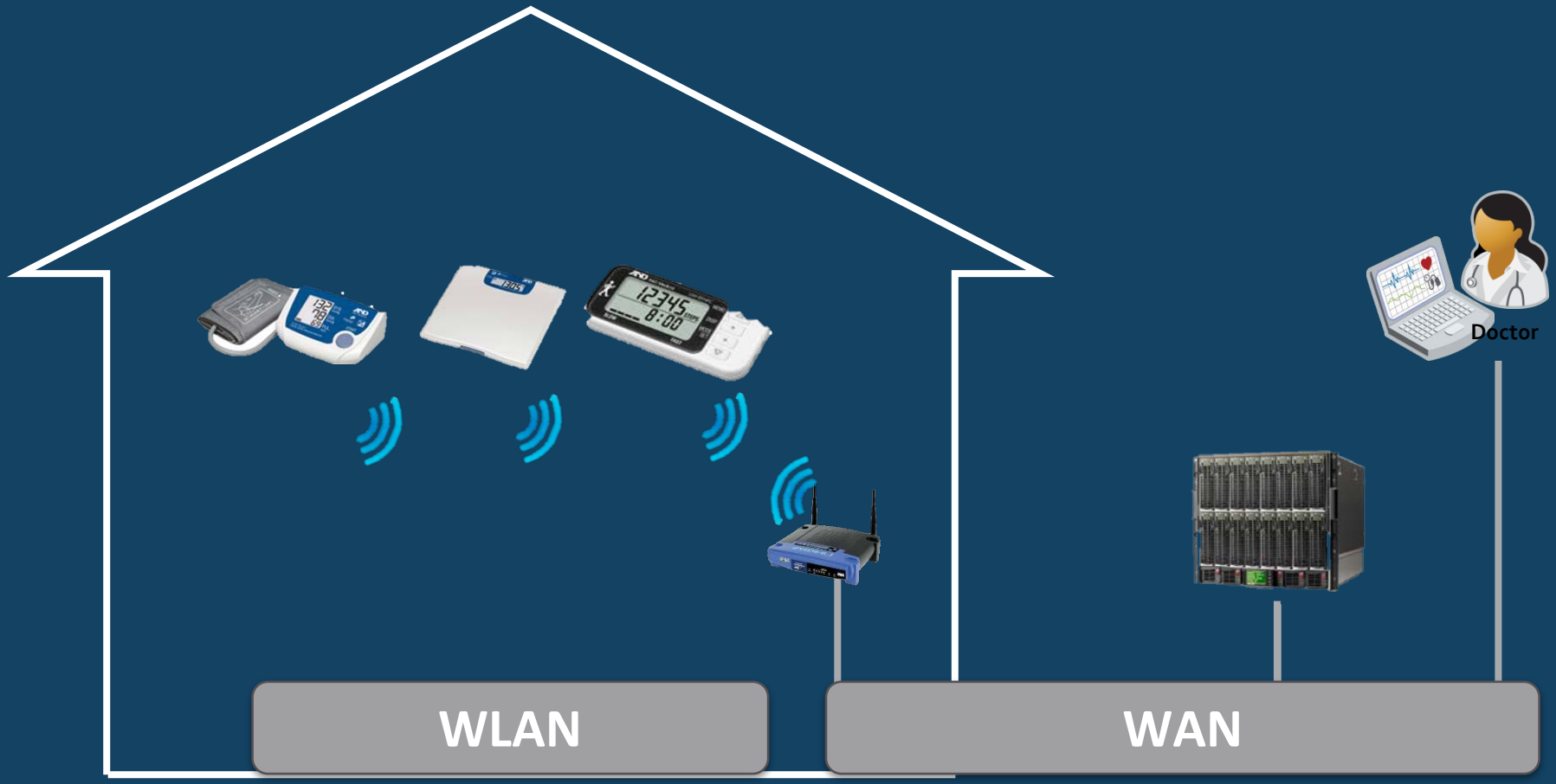
Functional Architecture



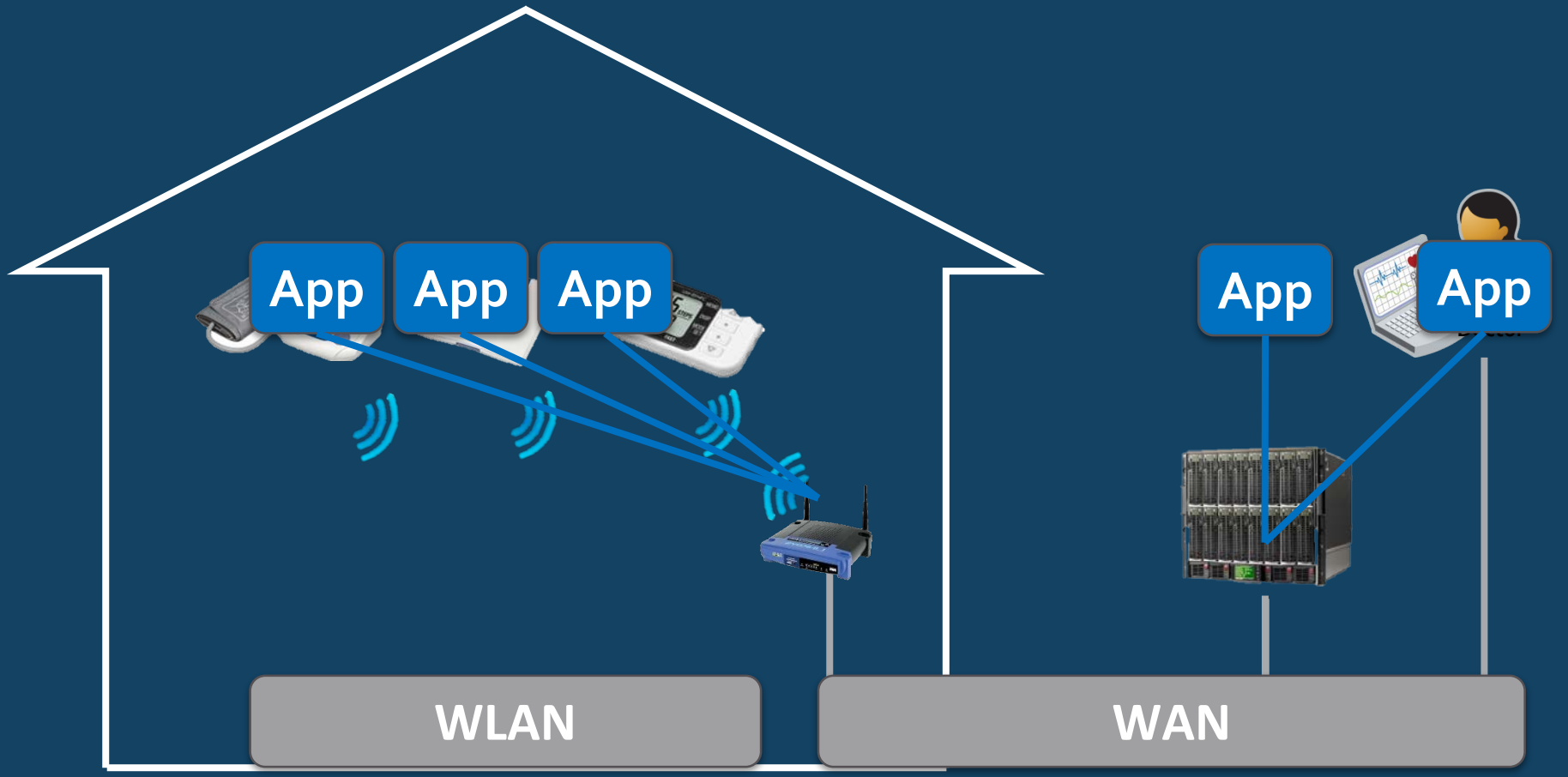
HVAC



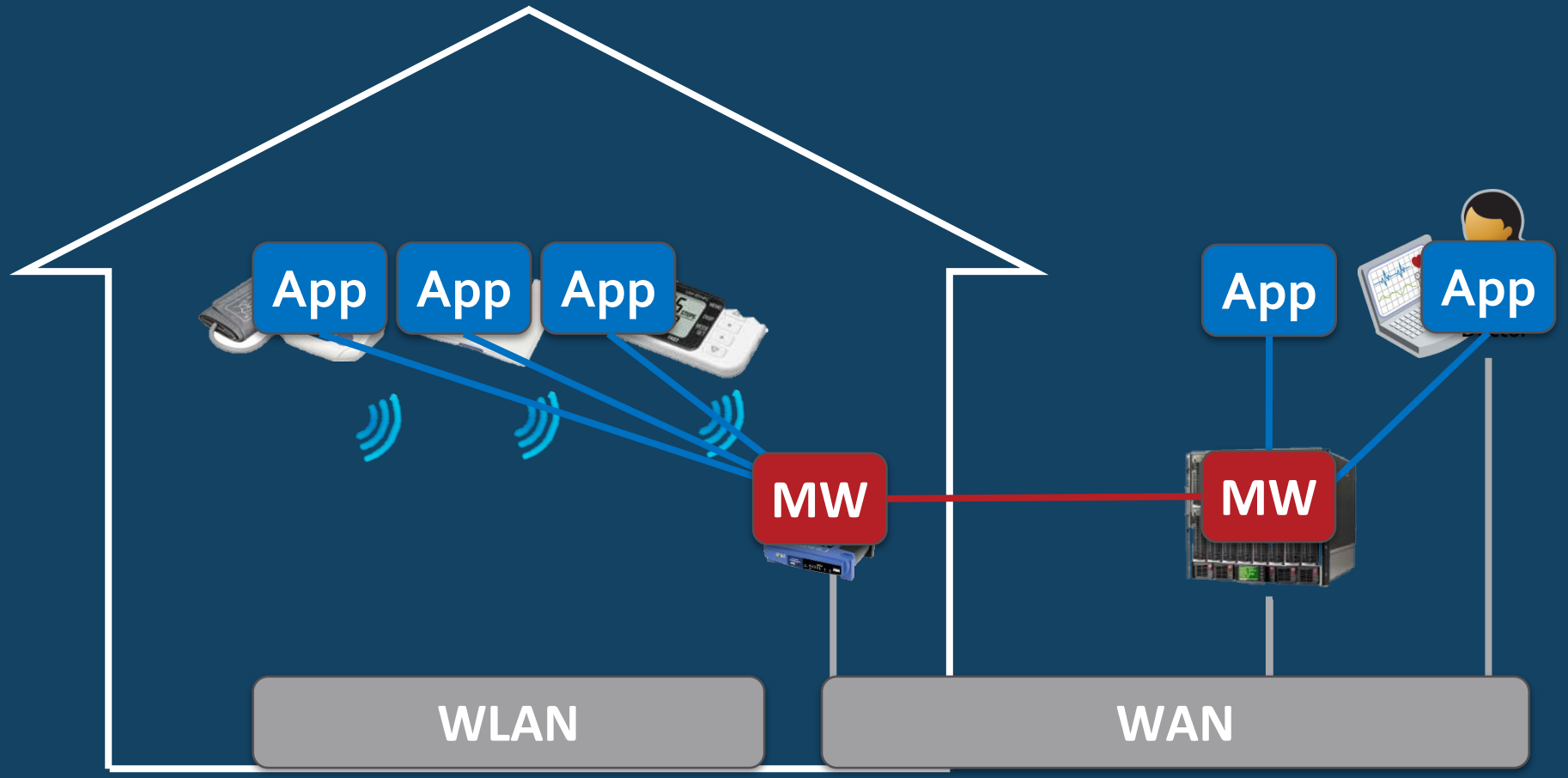
eHealth



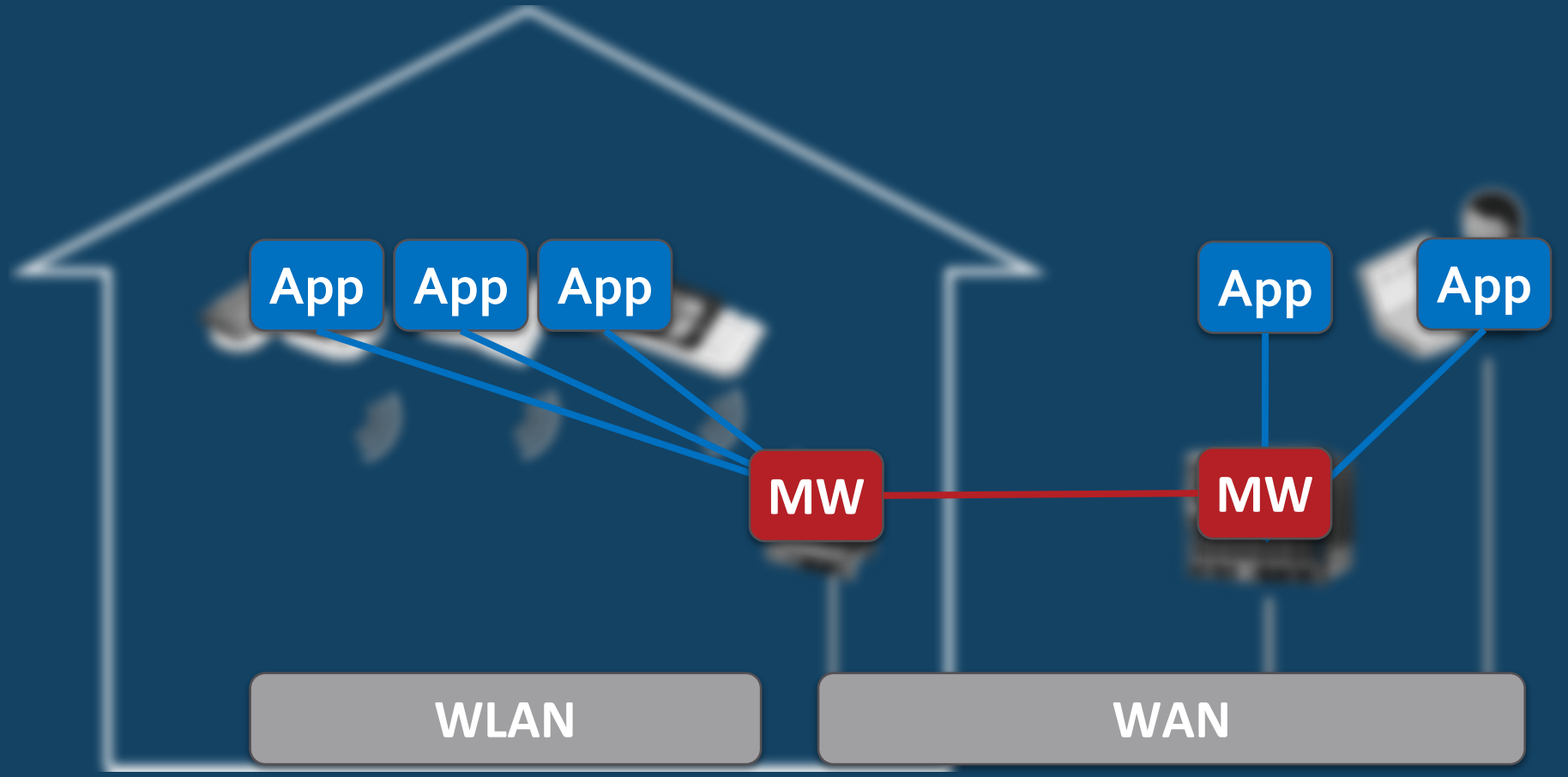
eHealth



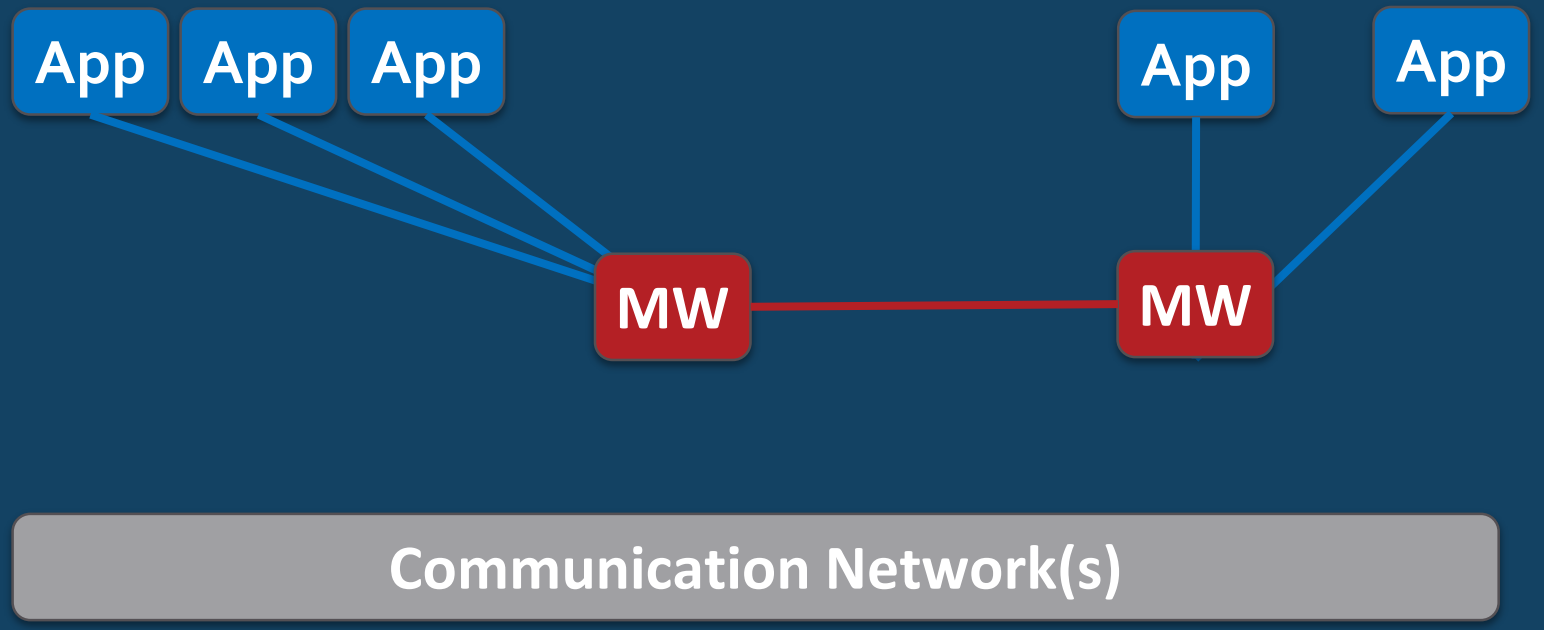
eHealth



eHealth



eHealth

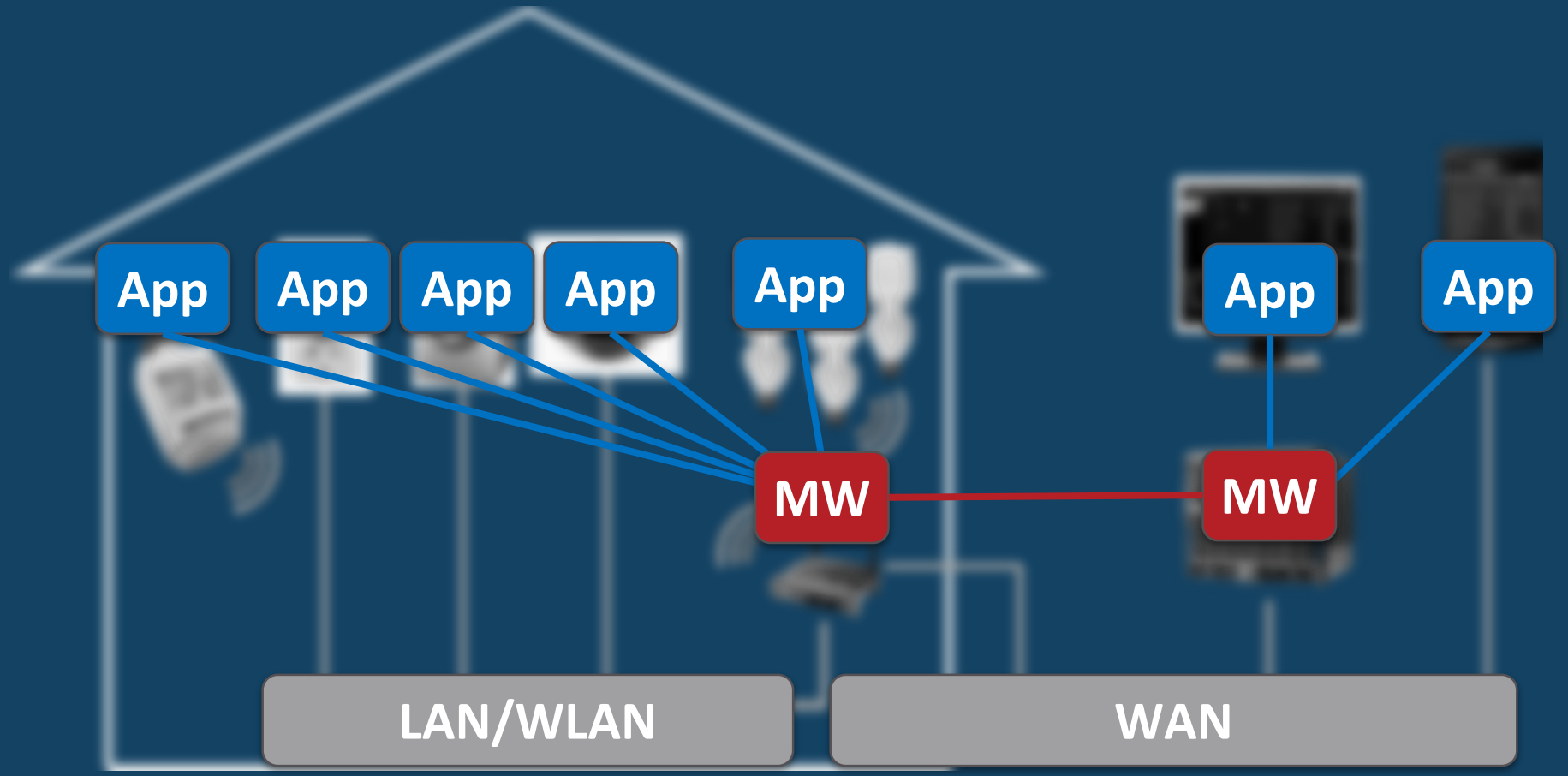


eHealth

Functional Architecture

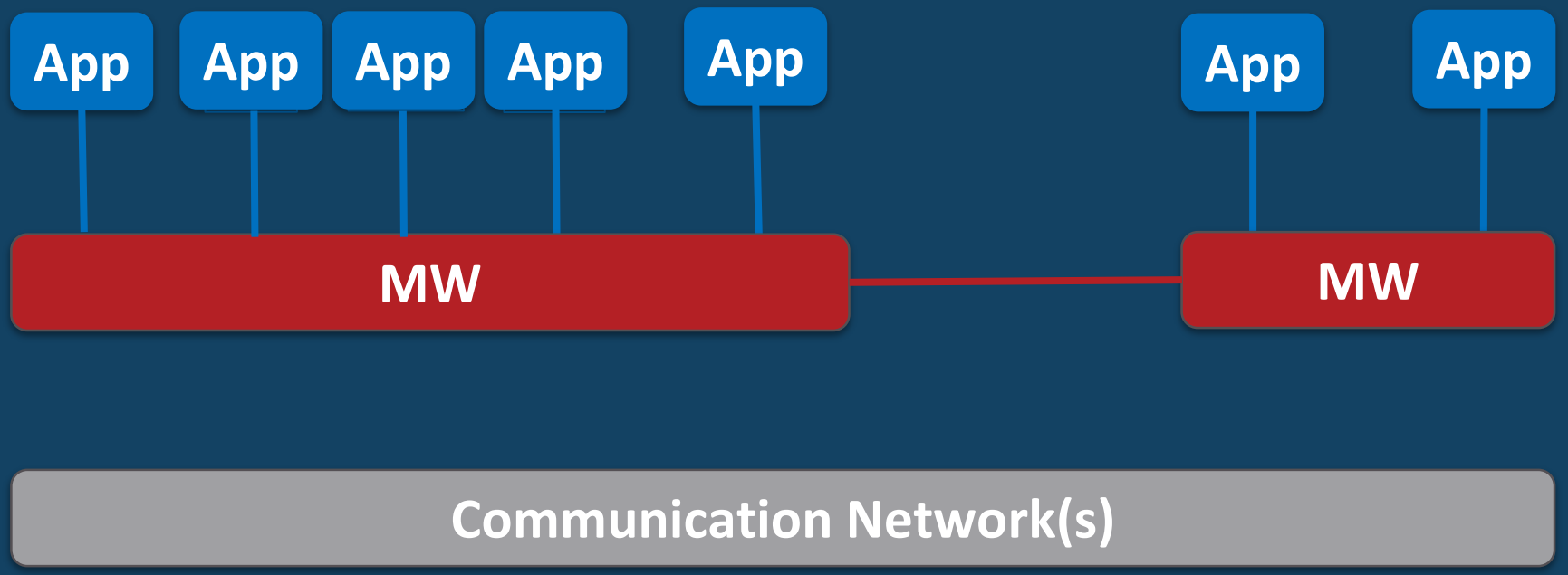
eHealth

Connected Home



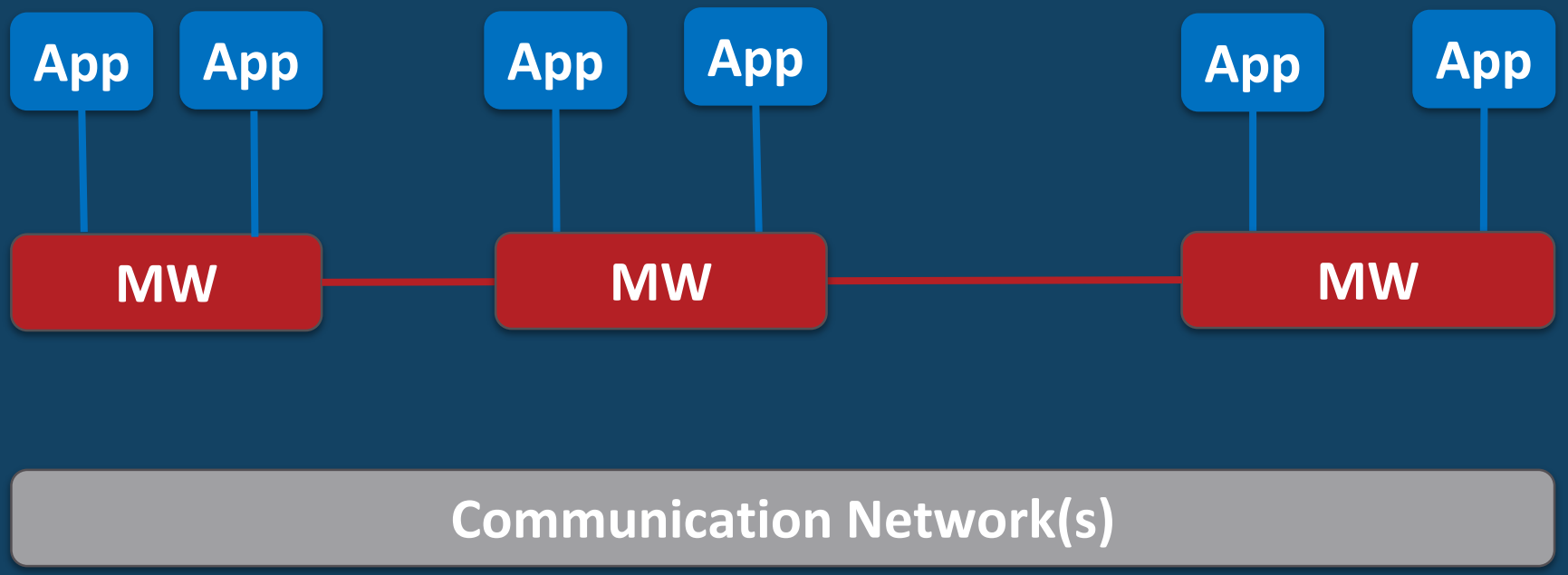
Connected Home

Functional Architecture



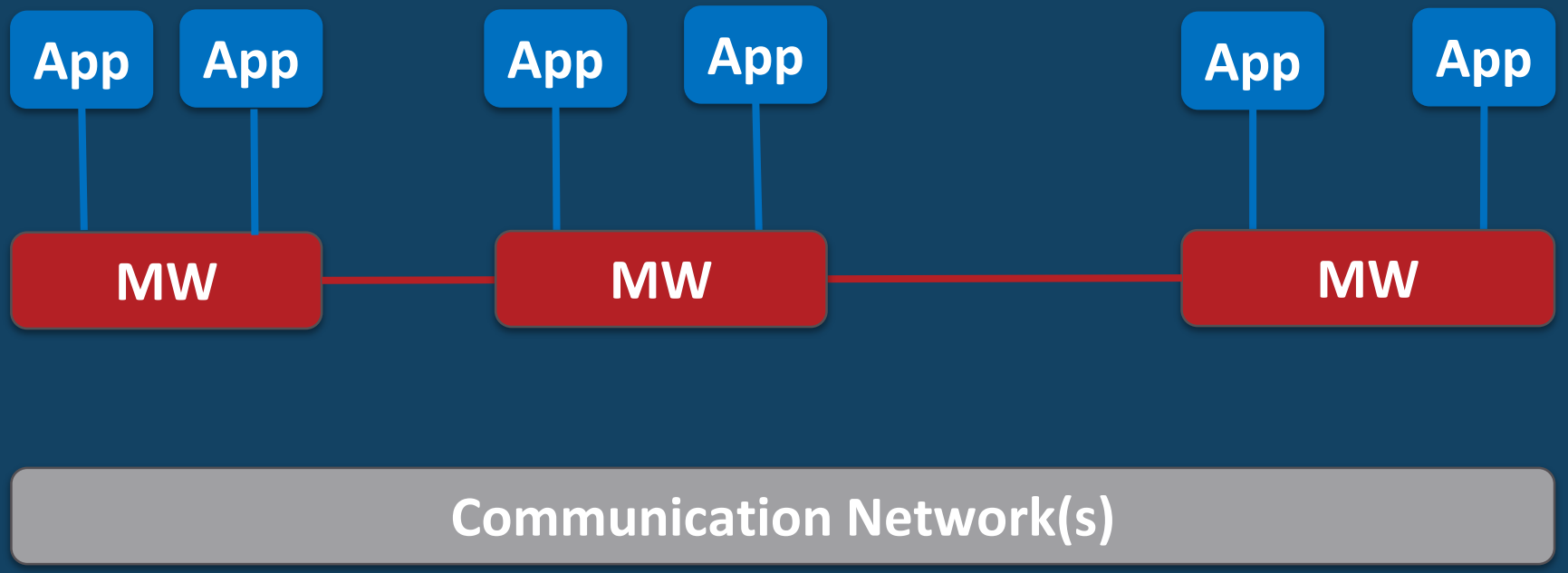
Connected Home

Functional Architecture



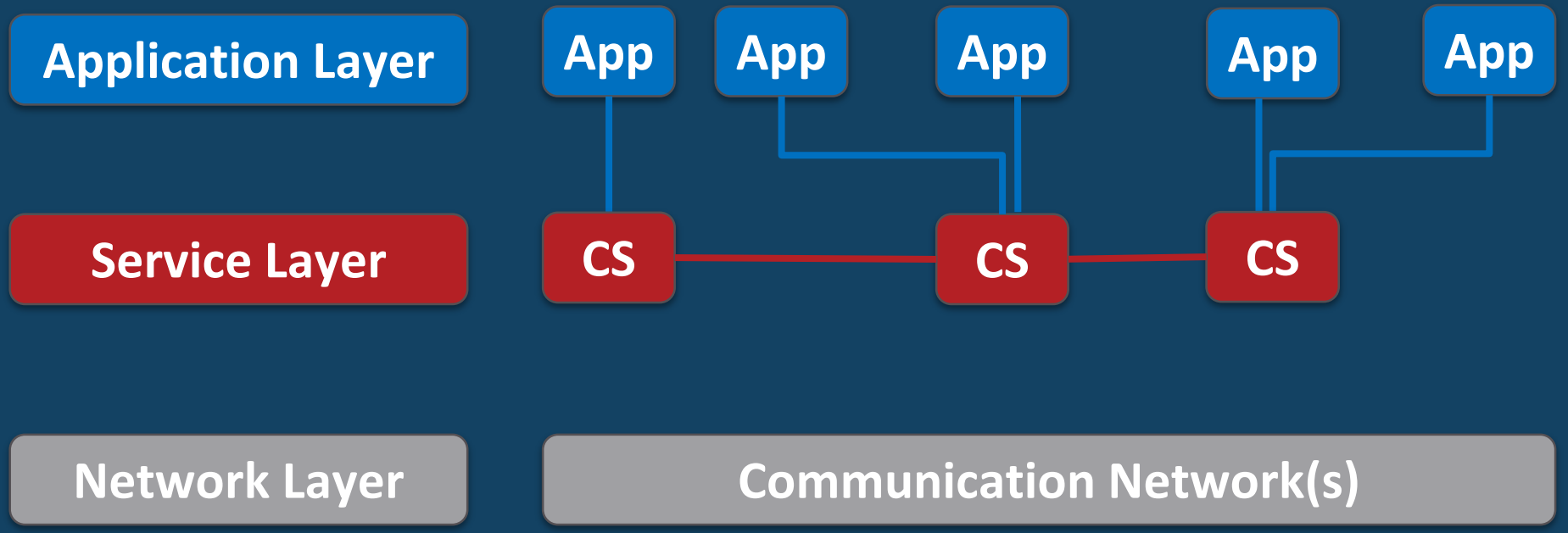
Automotive

Functional Architecture



Metering

M2M / IoT Service Layer



App: Applications
CS: Common Services

Standardized Open Horizontal M2M Service Layer

oneM2M Partnership

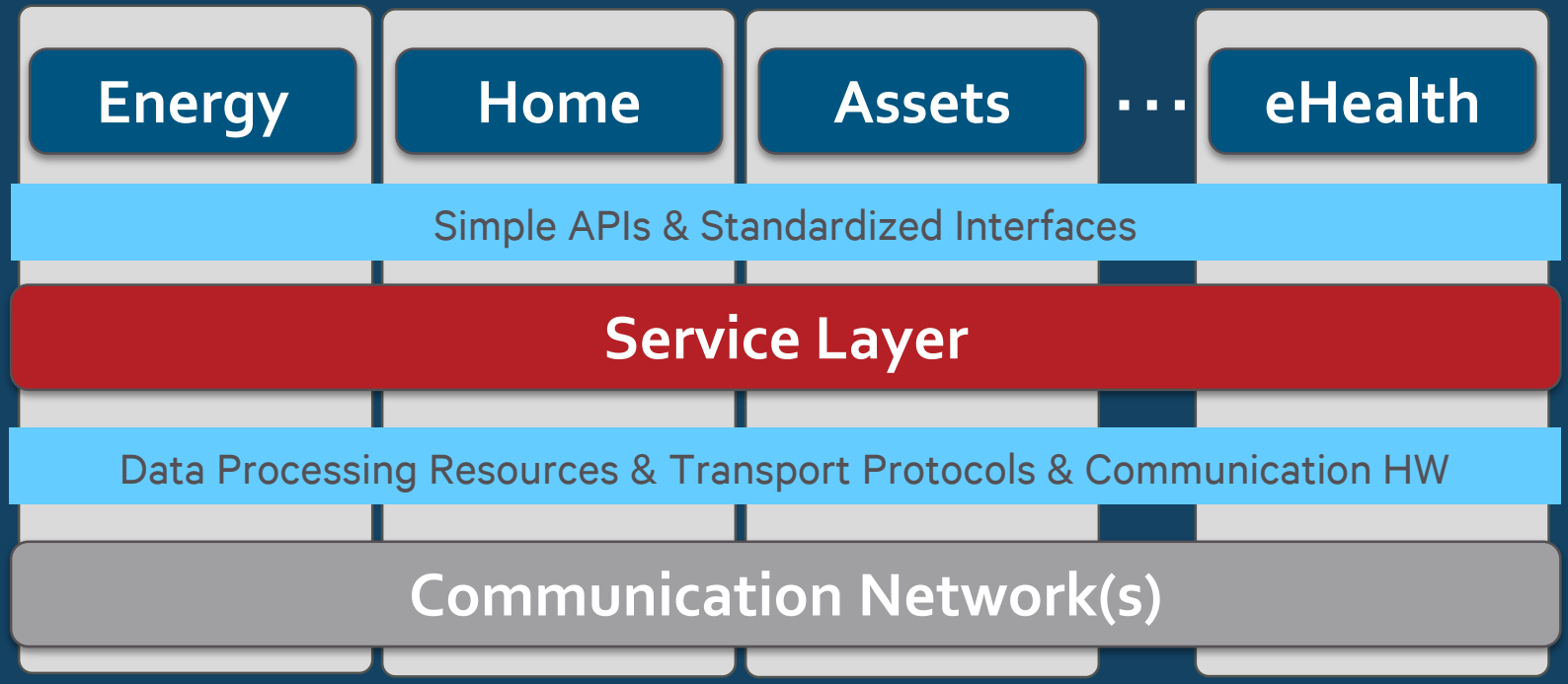
Motivation for oneM2M: Consolidation

Global partnership initiative: Consolidate standardization of M2M/IoT functions

oneM2M

- Partner Type 1: ARIB, ATIS, CCSA, ETSI, TIA, TTA, TTC & TSDSI: **All major Telecom SDOs around globe**
  - Members (e.g. companies) participate in oneM2M via admitting Partner Type 1
  - IPR policy of admitting Partner Type 1 organization is binding for members
  - Partner Type 1 organizations are committed to transpose specifications into standards
- Partner Type 2: BBF, CEN/CENELEC, New Generation M2M Consortium, OMA, Global Platform
  - Fora/Associations/Consortia participate & contribute in oneM2M with compatible IPR regime
- Milestones
  - Created in 2012
  - Published Rel-1 in 01/2015, Rel-2 in 08/2016
  - Rel-3 to be completed by Q1/2018
  - 4 interop test events so far

oneM2M: Standard for M2M / IoT



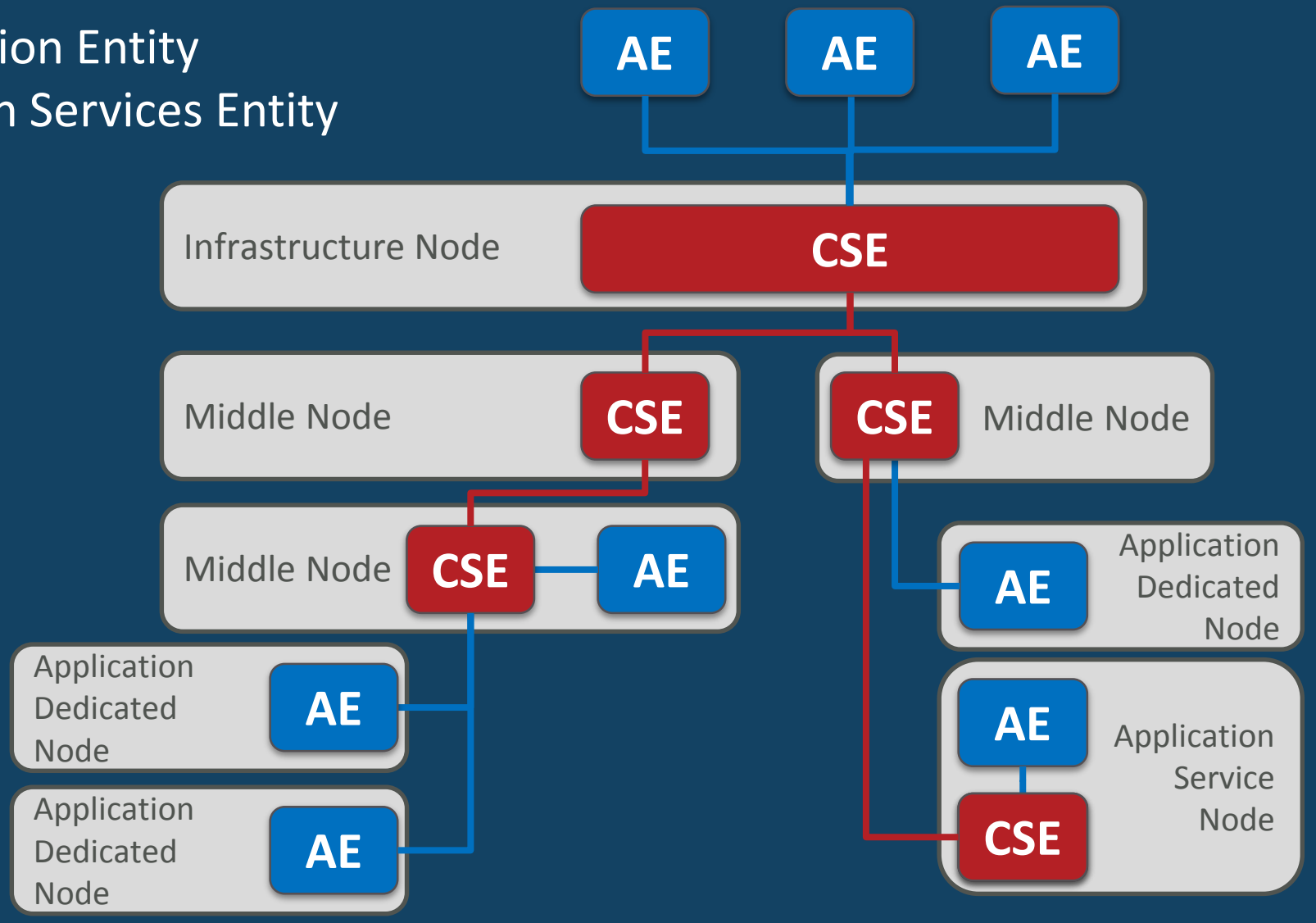
Horizontal layer of functions commonly needed across different market segments / not segment-specific

Similar to generic versus use case-specific computer/OS in early times of computers

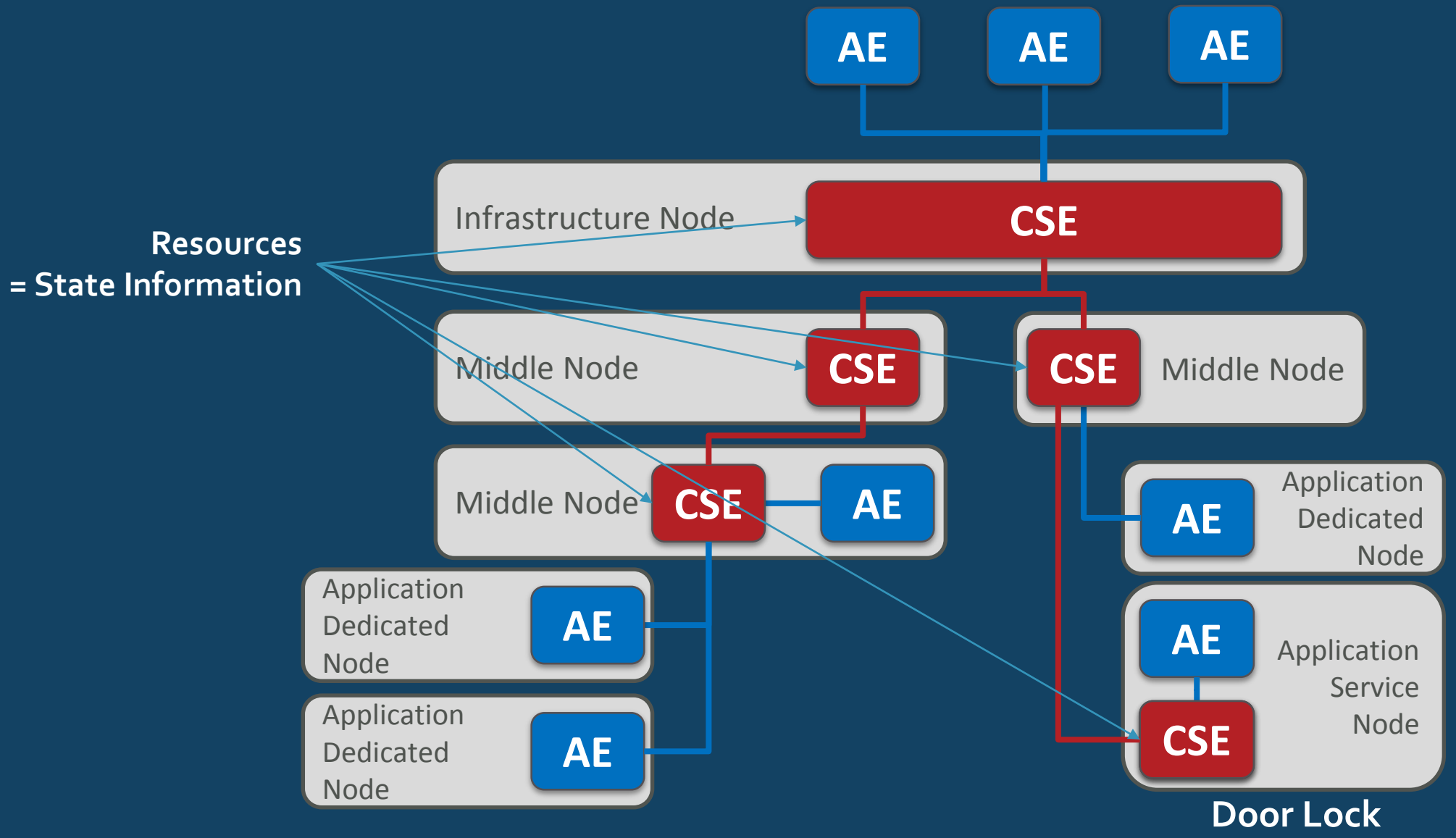
- Standard for a middleware platform
- Sits between applications and processing/communication HW
- On sensors, actors, gateways, cloud
- Authentication/authorization/encryption
- Connects producers/consumers securely
- Hides complexity of NW usage from apps
- Controls when communication happens
- Increases efficiency of data transport
- Stores and shares data
- Supports access control
- Notifies about events
- Talks to groups of things
- Manages devices on large scale

Topology

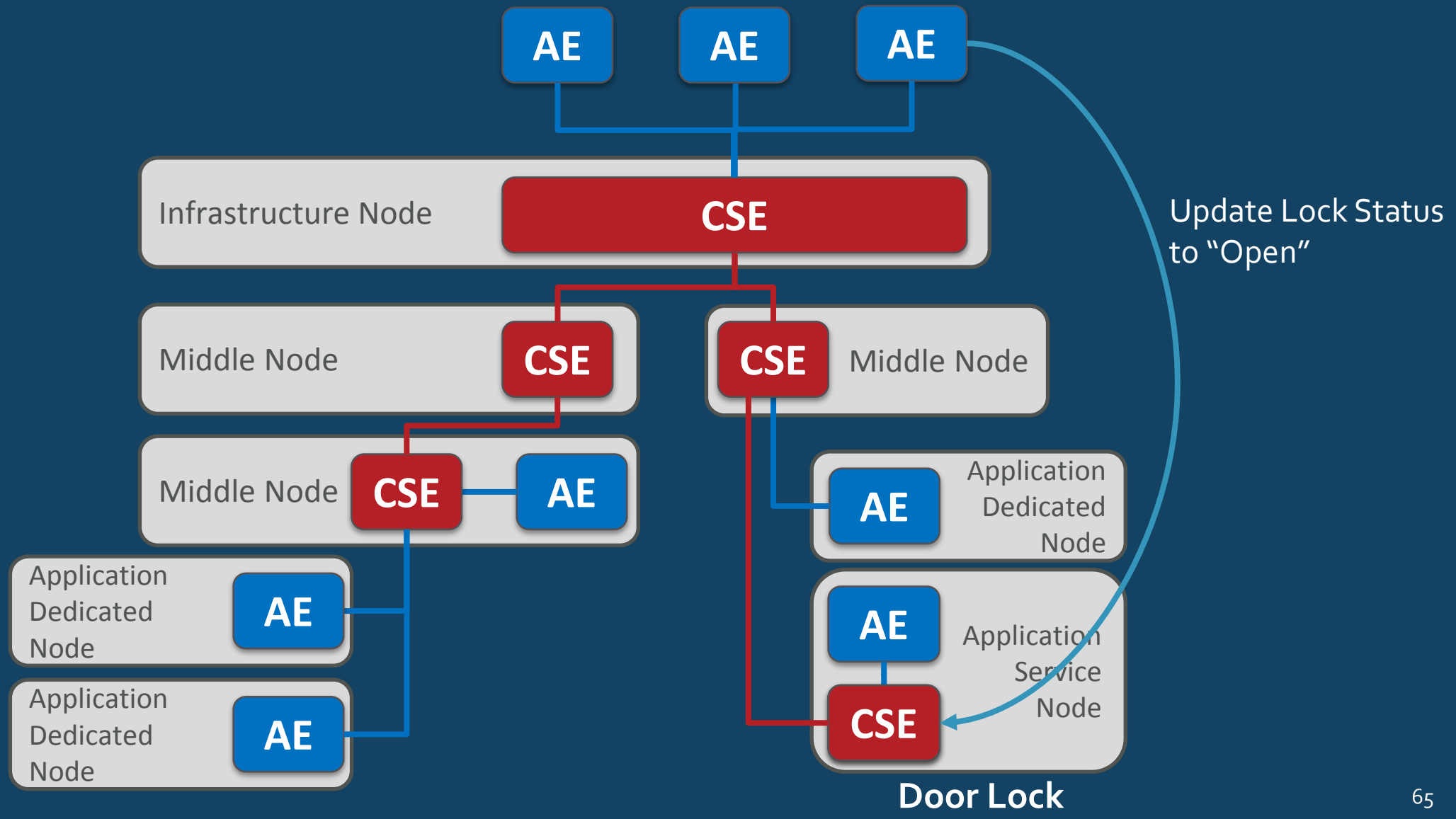
AE: Application Entity
CSE: Common Services Entity



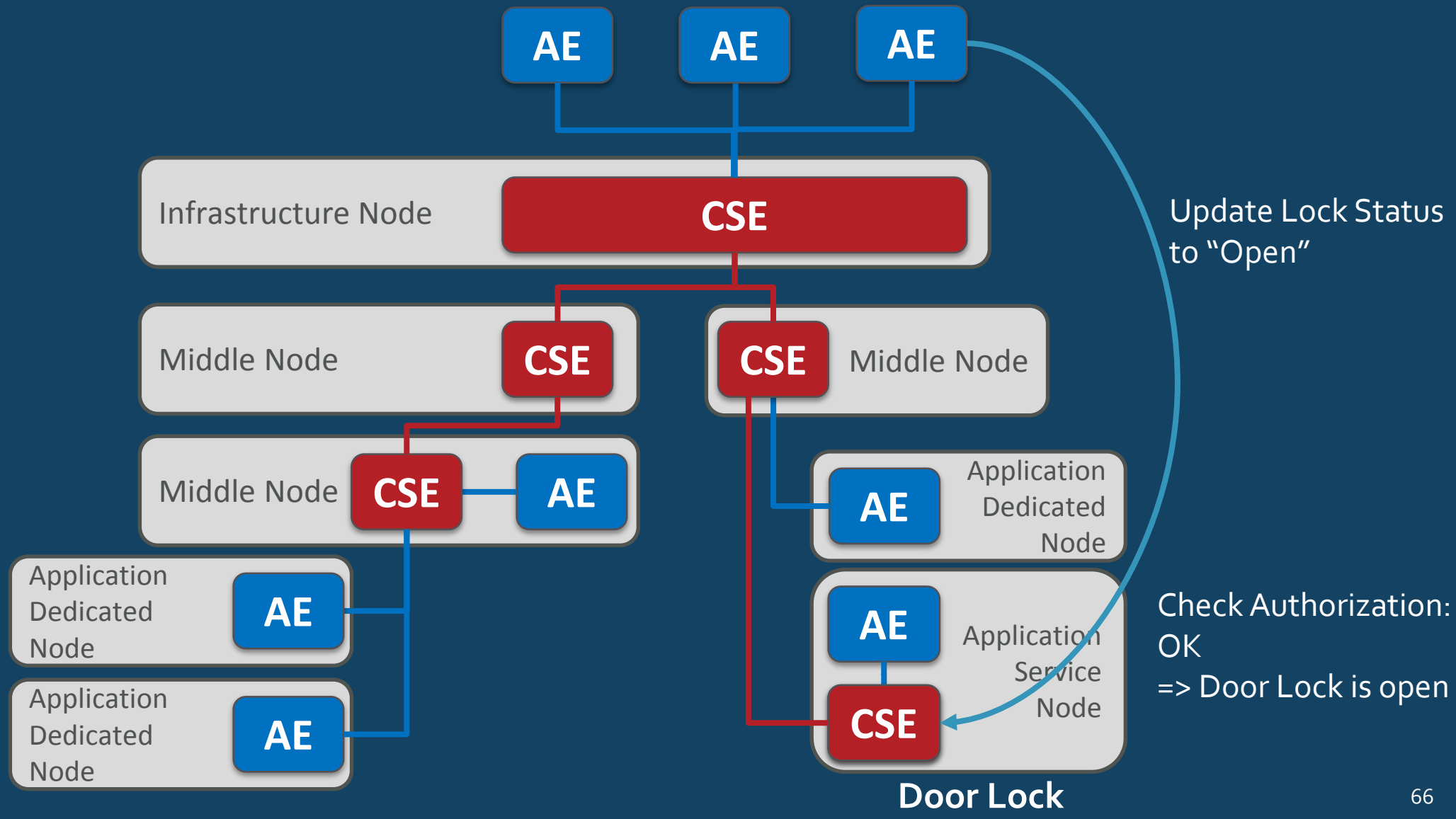
RESTful Style & Access Control



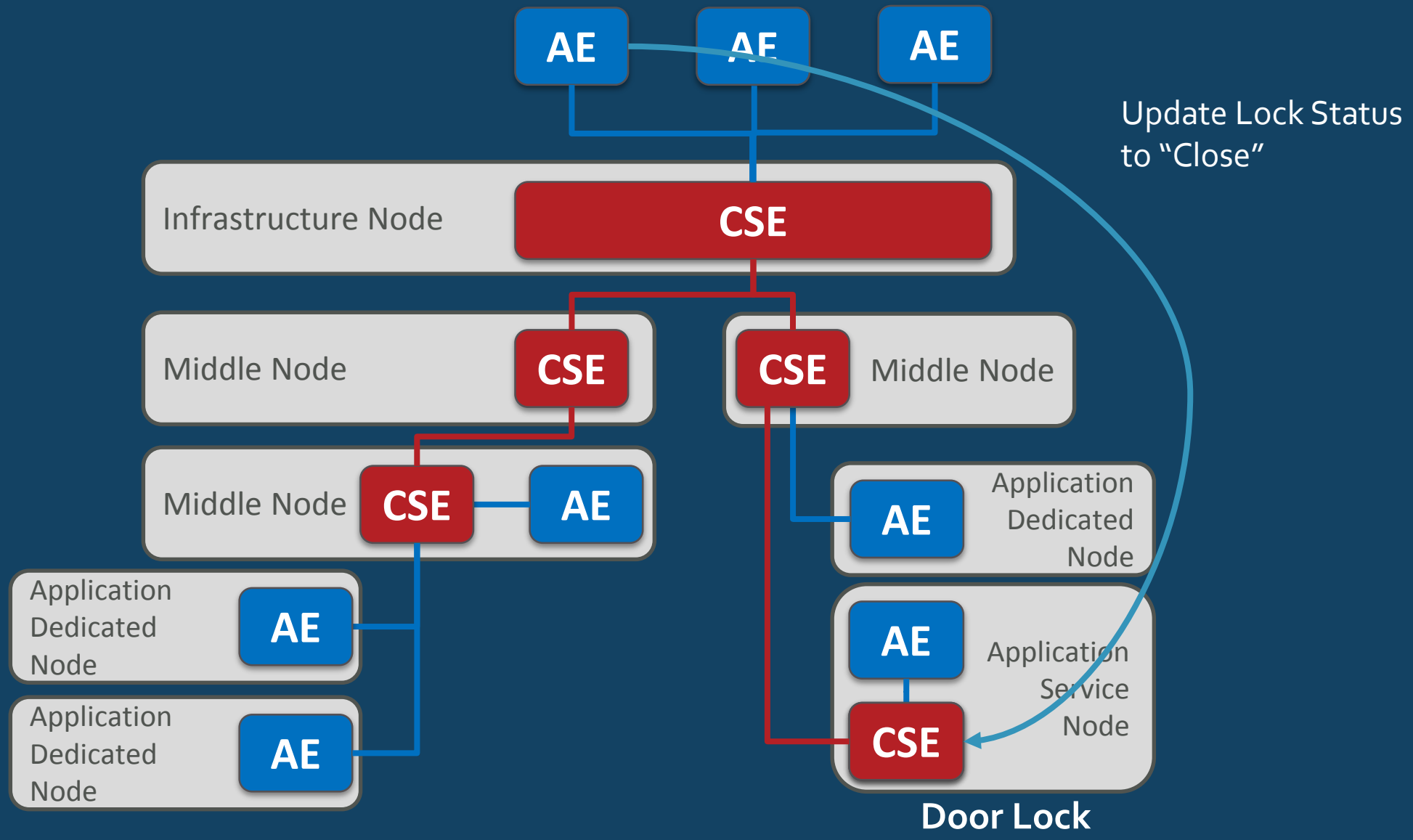
RESTful Style & Access Control



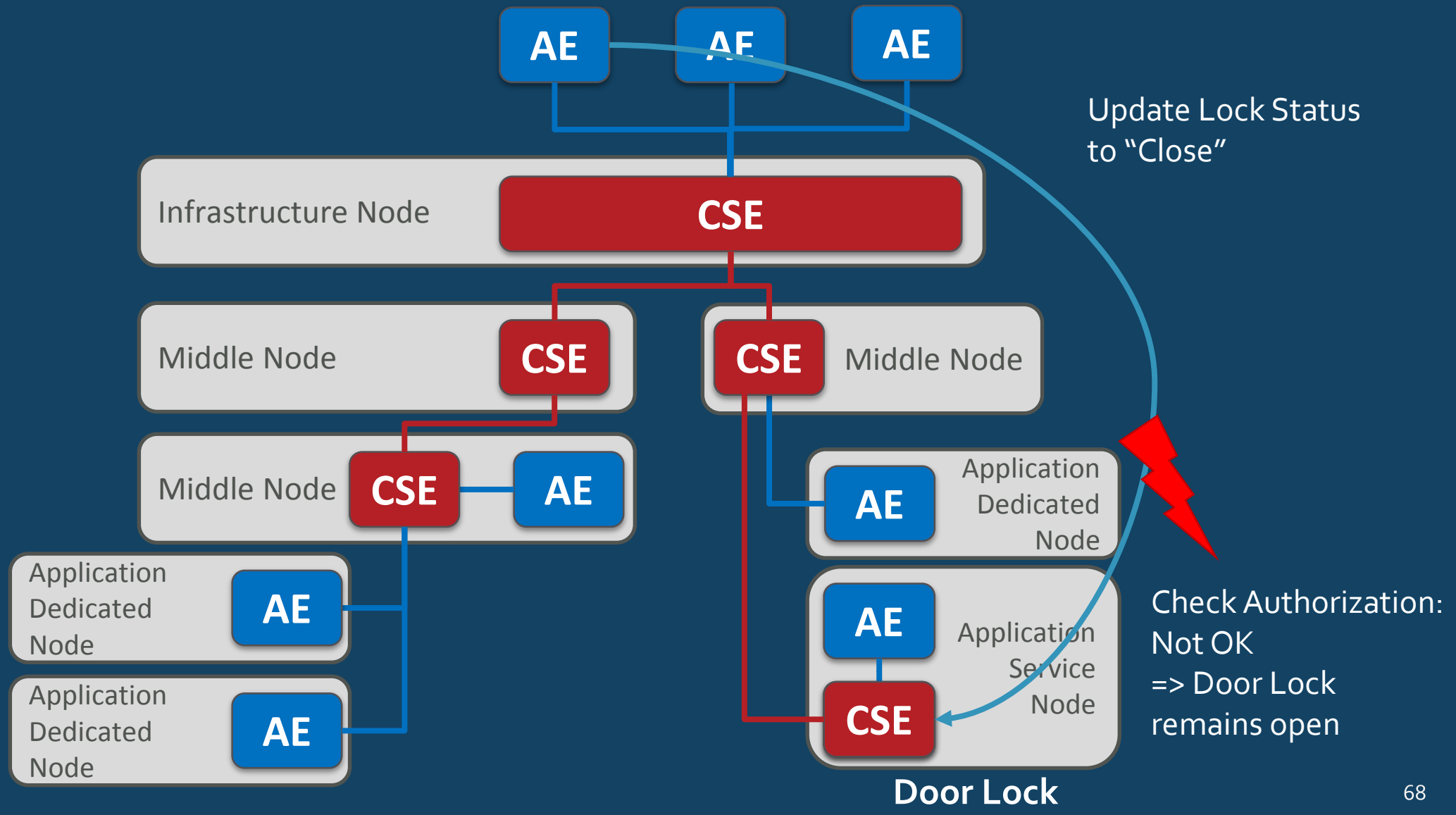
RESTful Style & Access Control



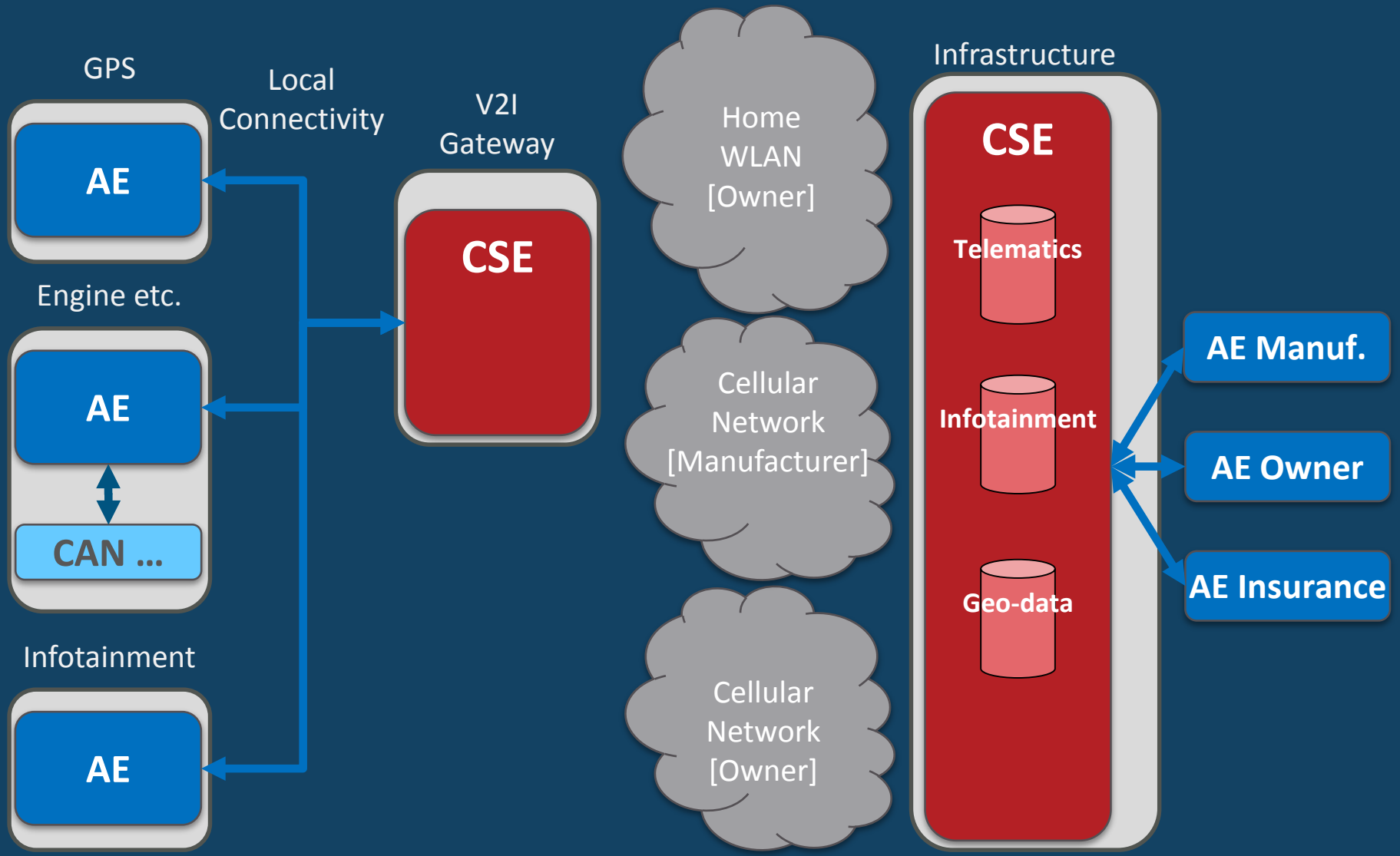
RESTful Style & Access Control



RESTful Style & Access Control

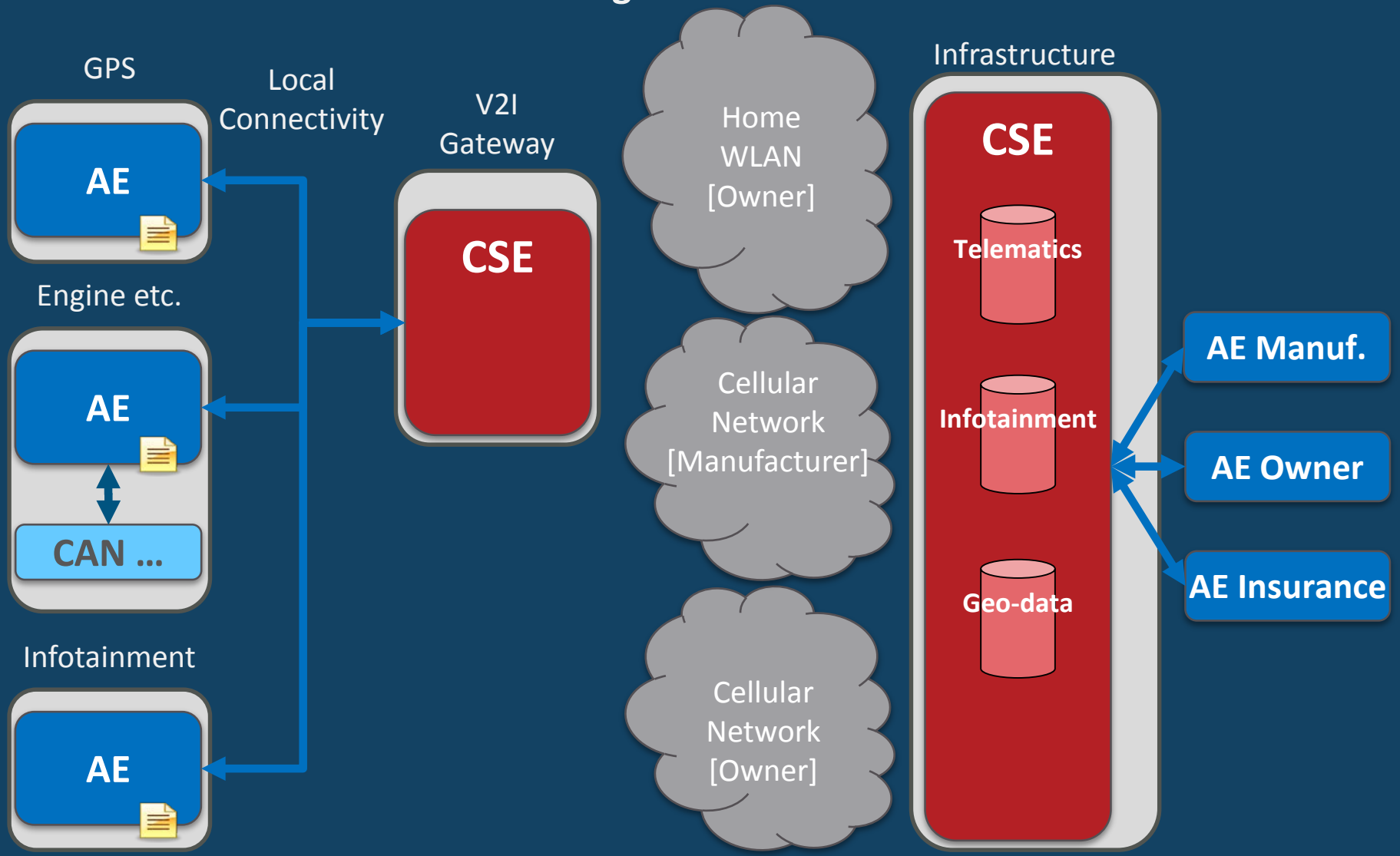


Efficient Data Sharing



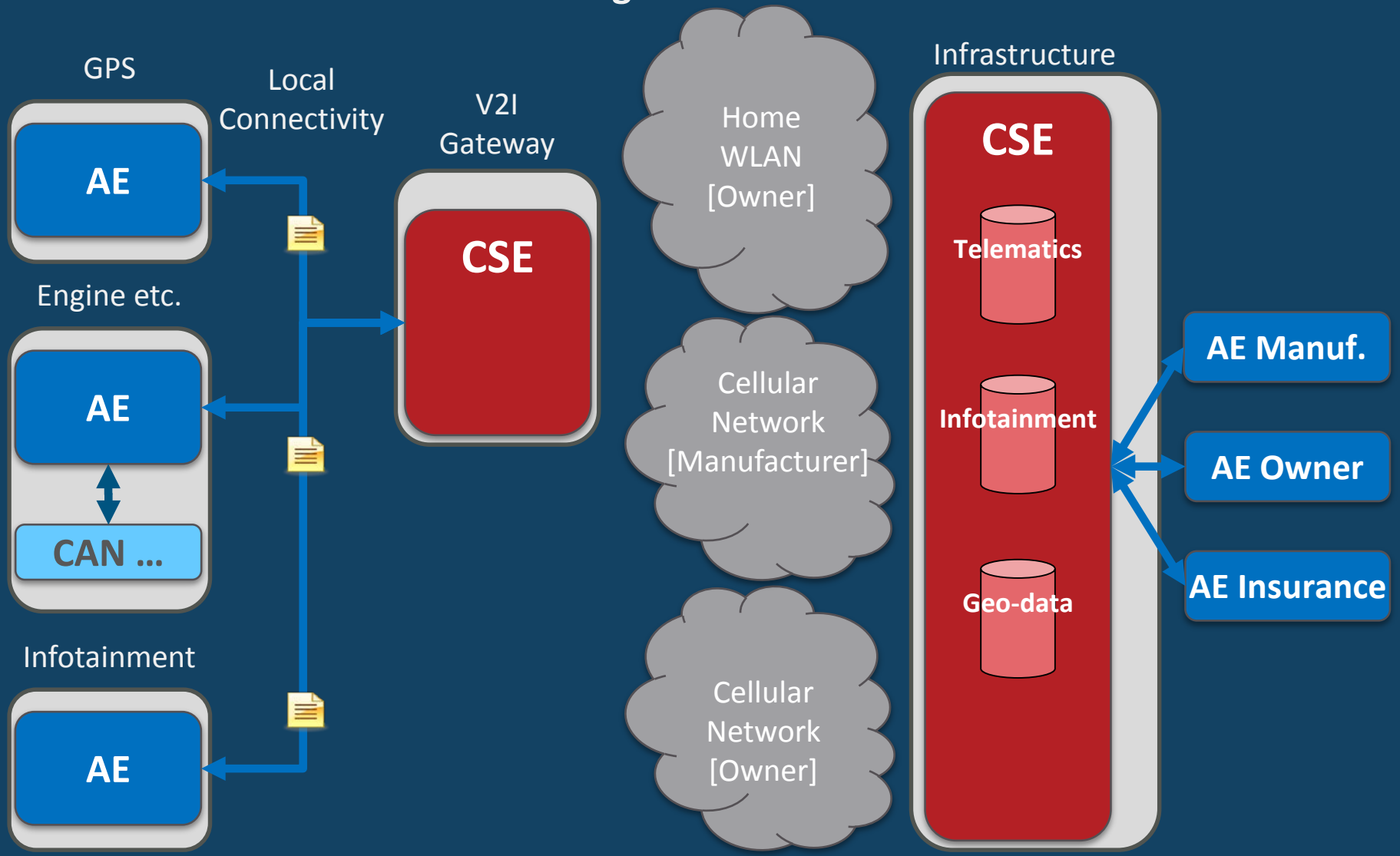
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



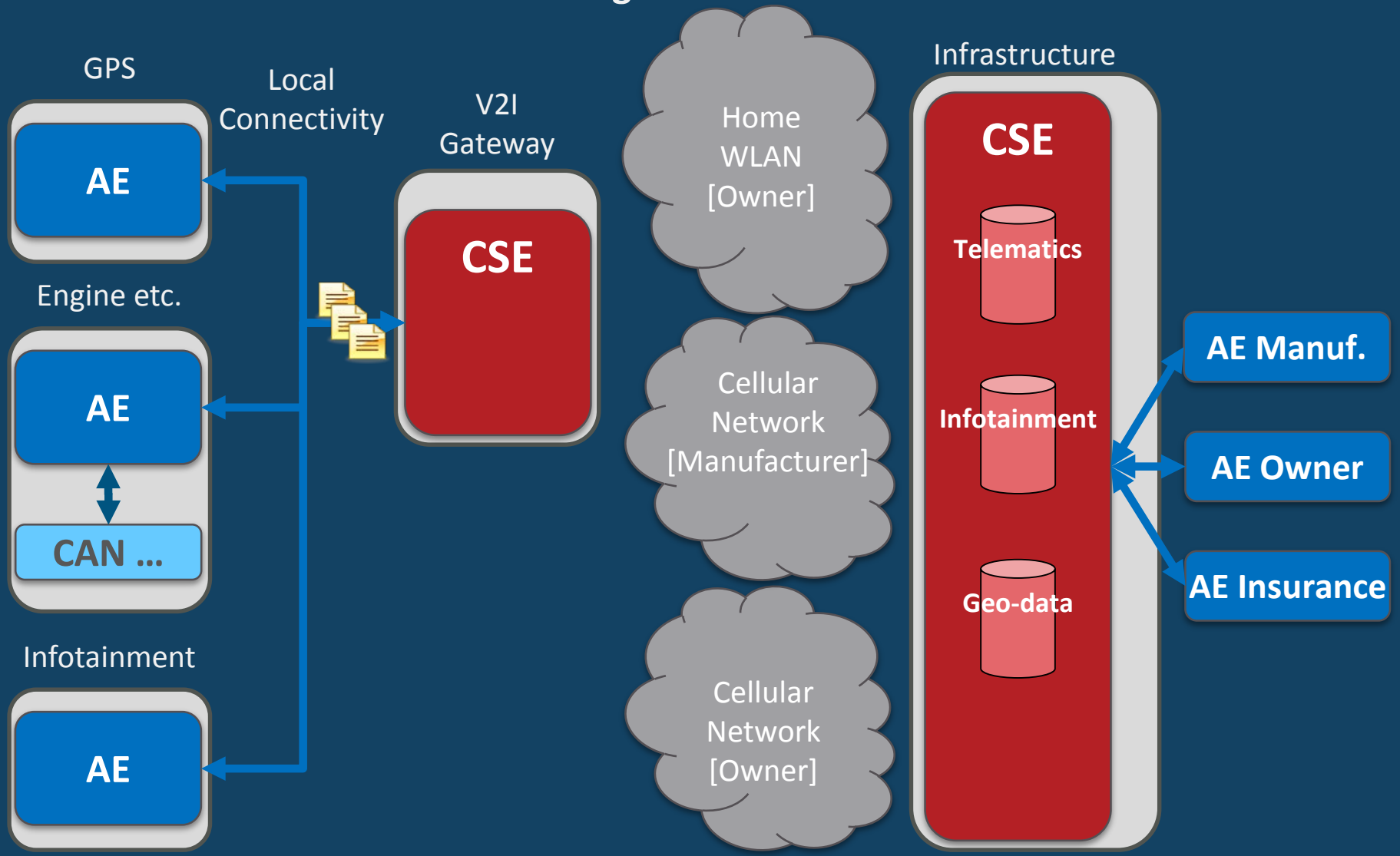
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



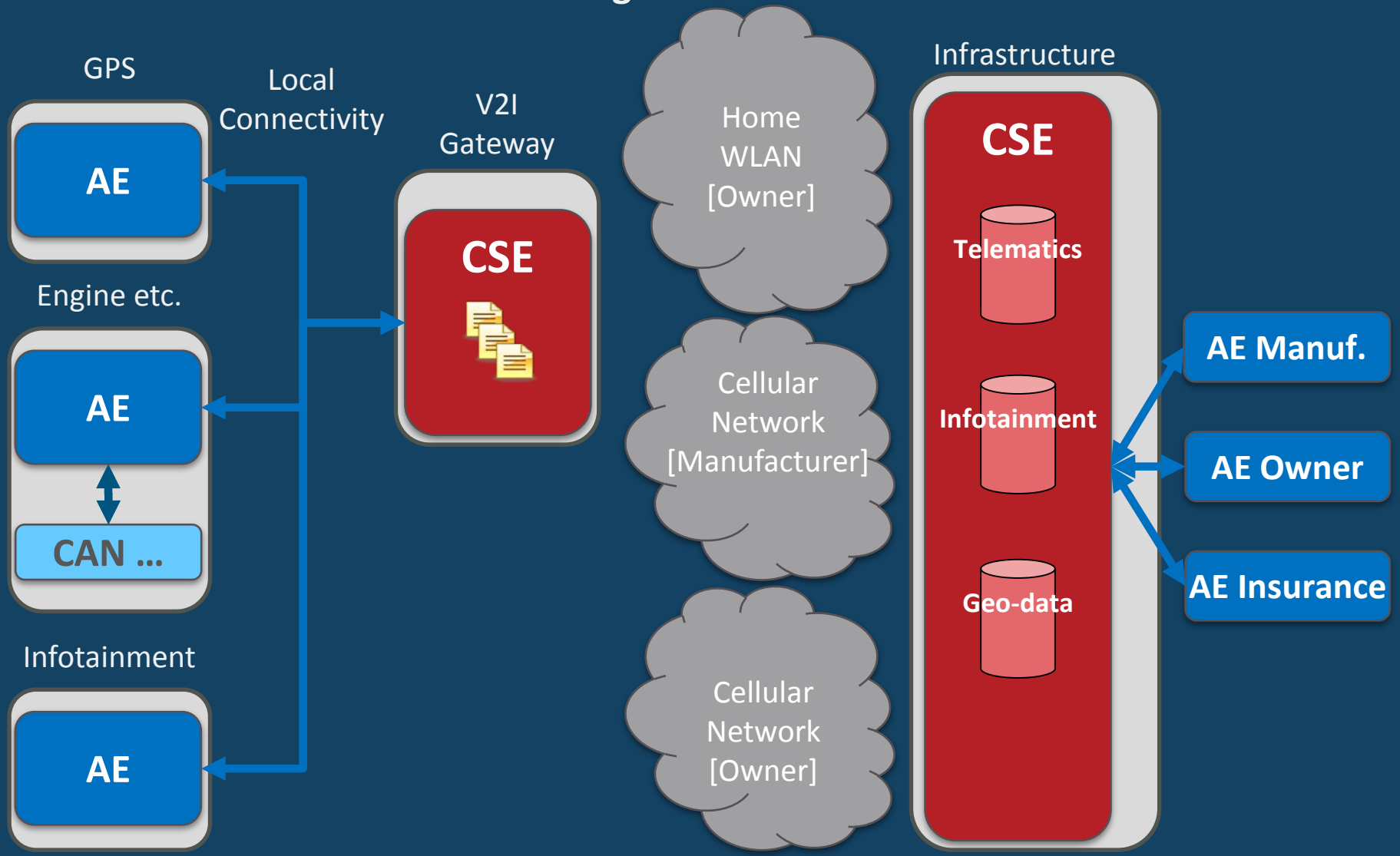
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



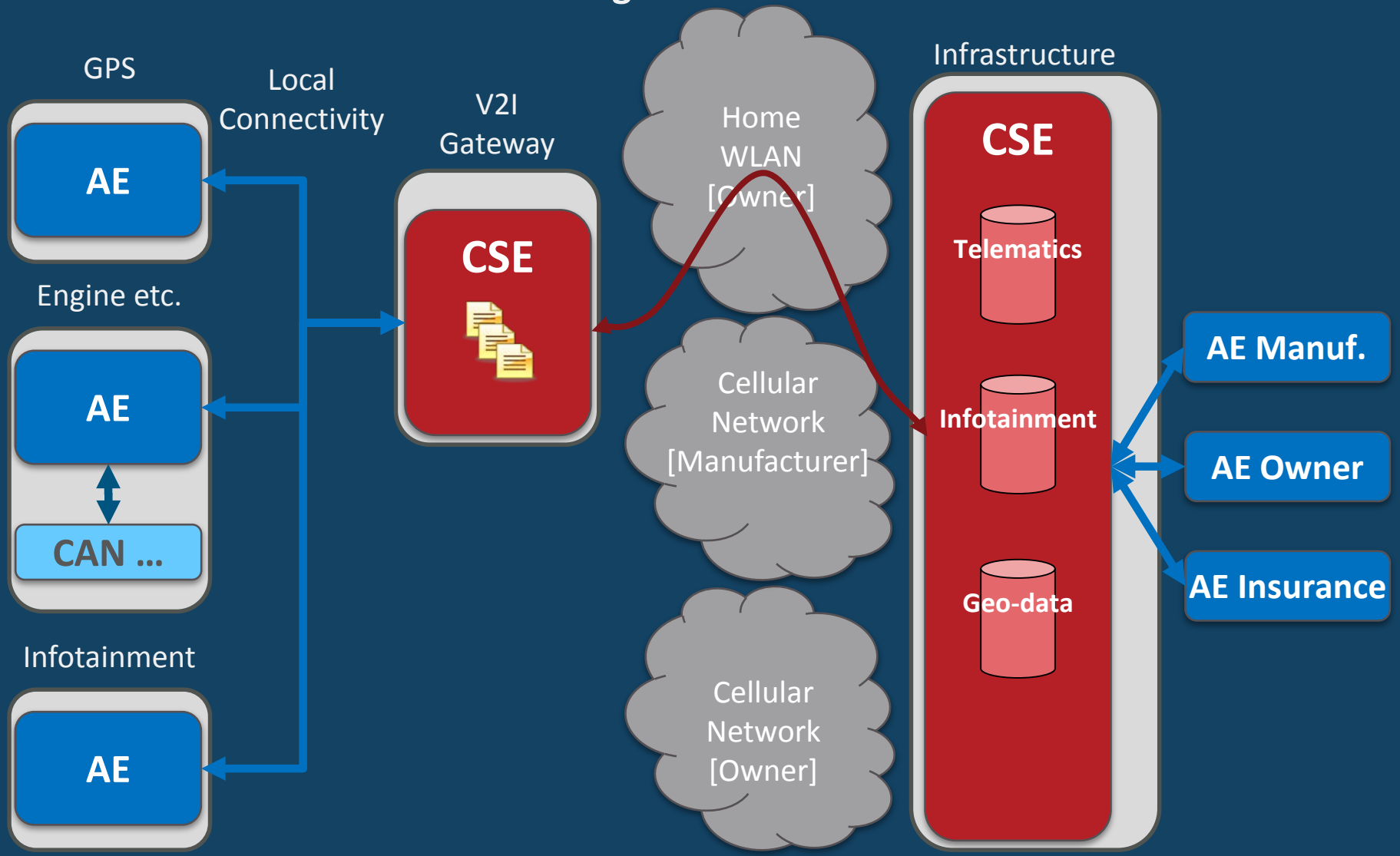
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



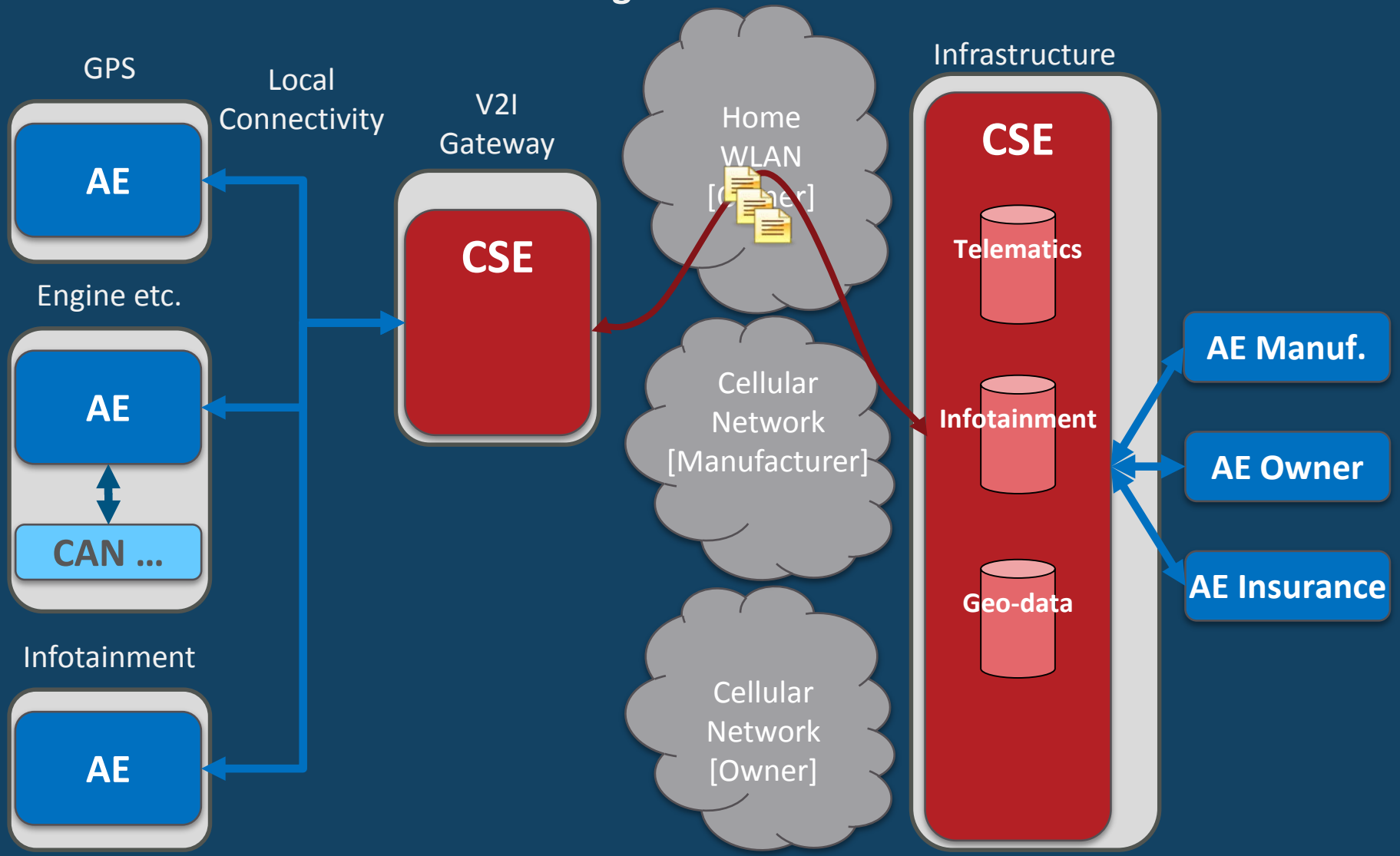
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



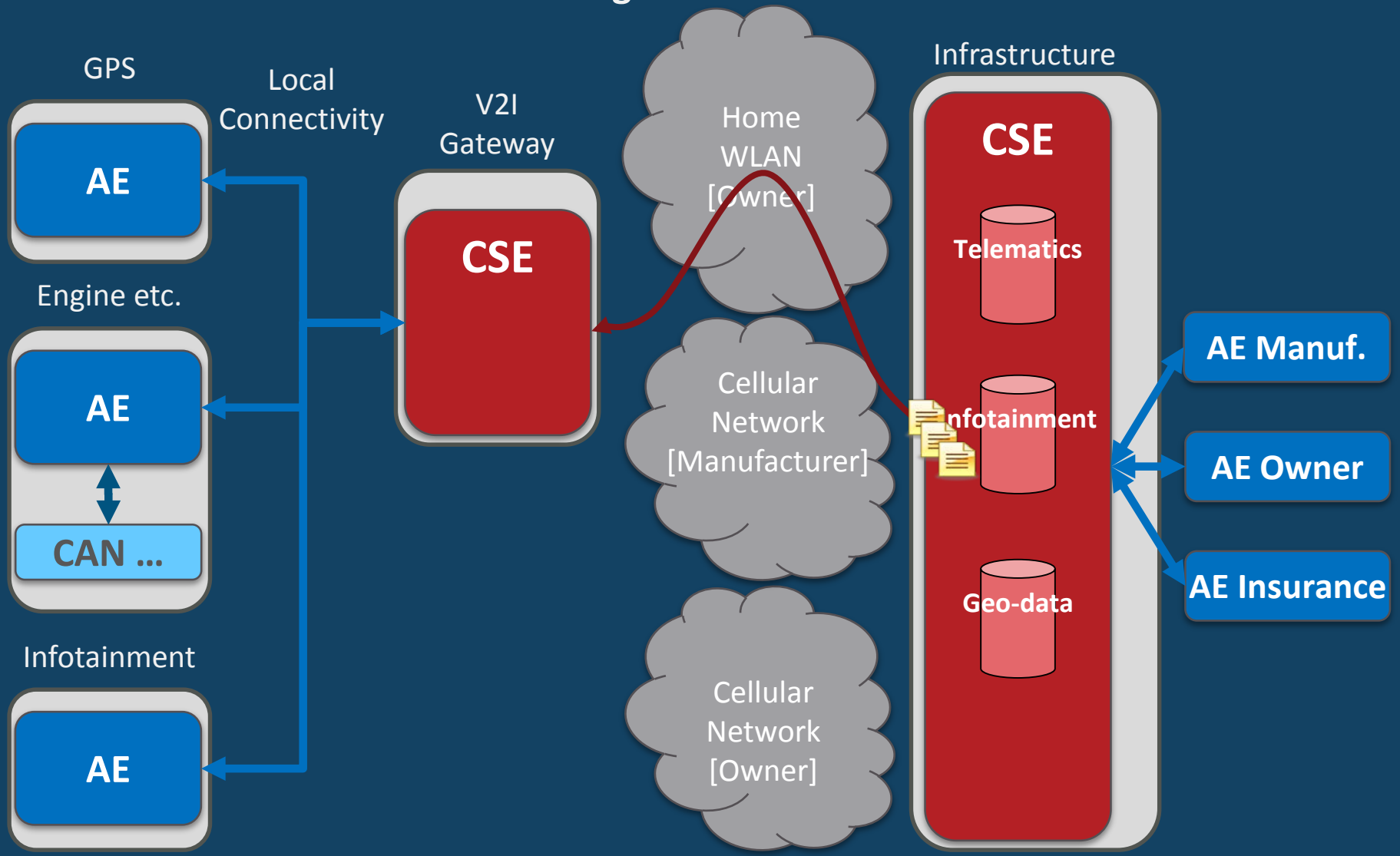
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



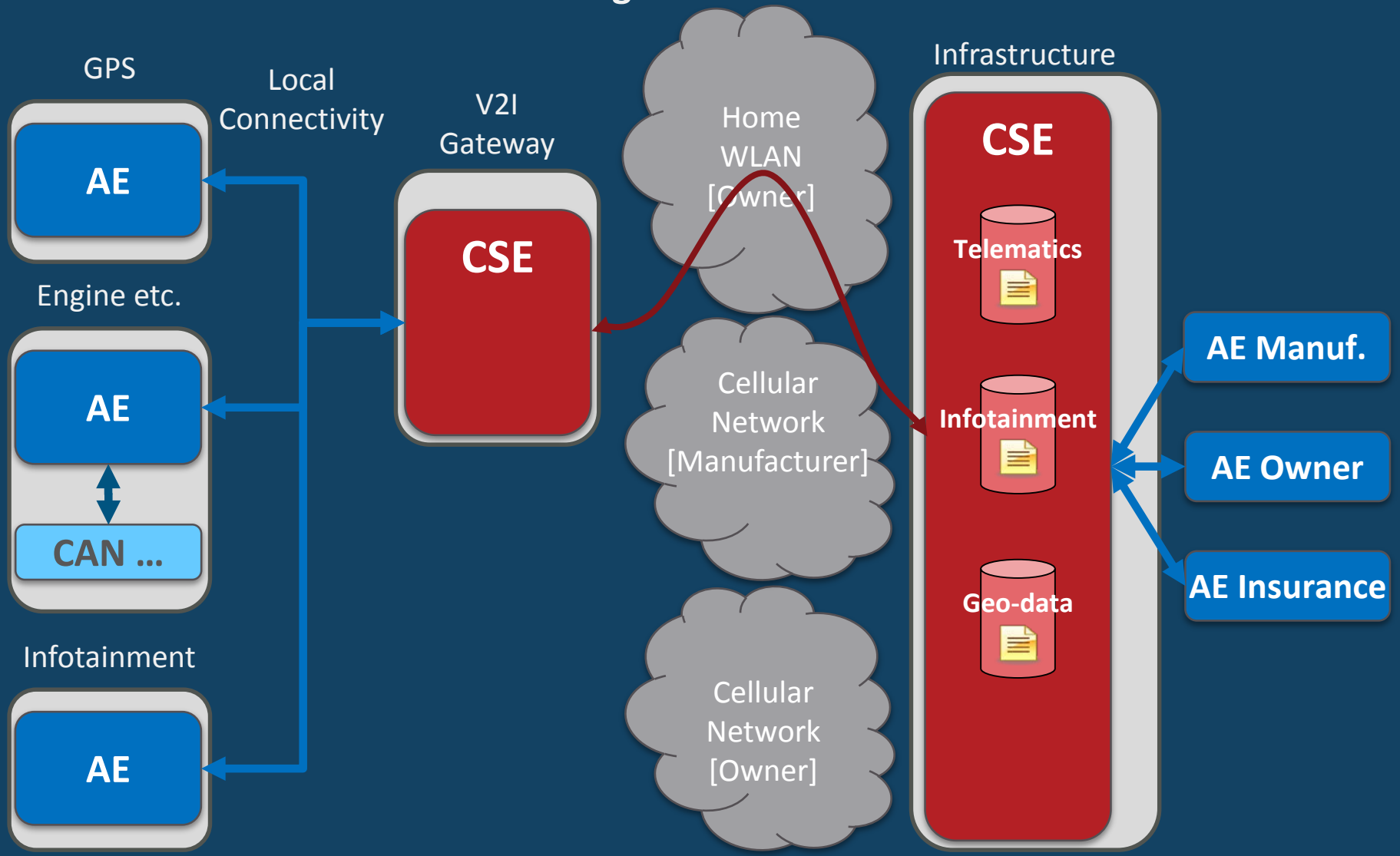
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



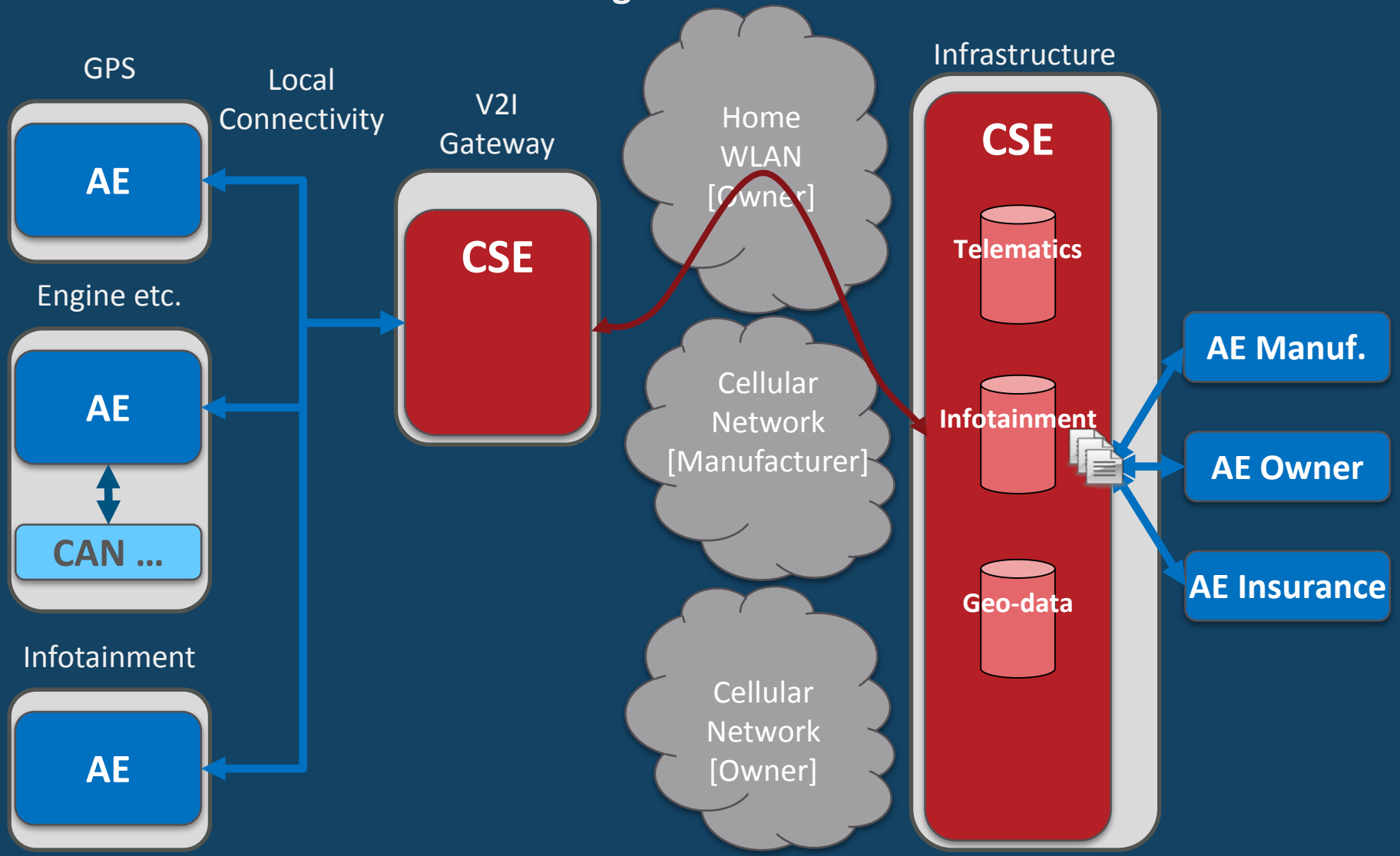
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



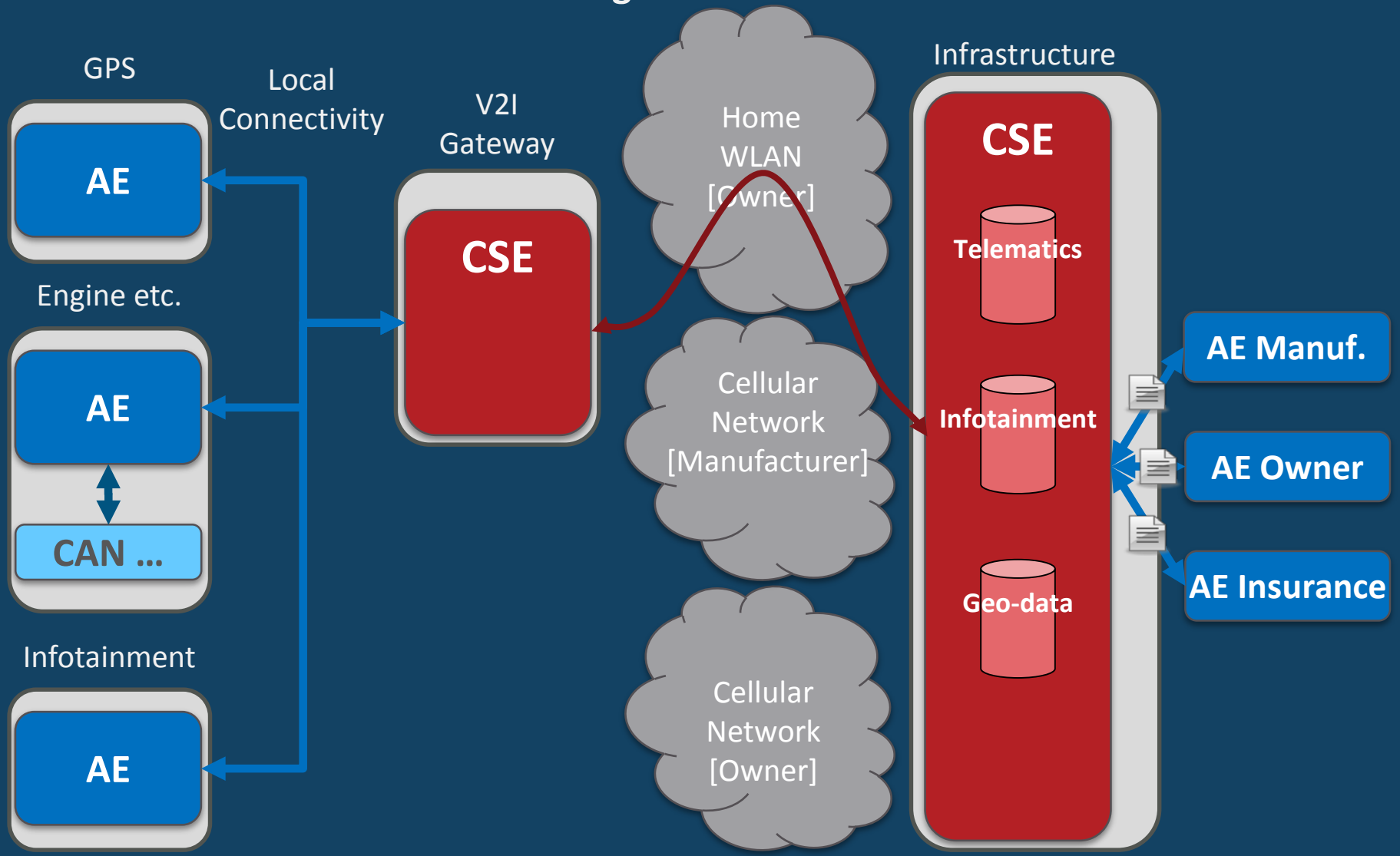
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



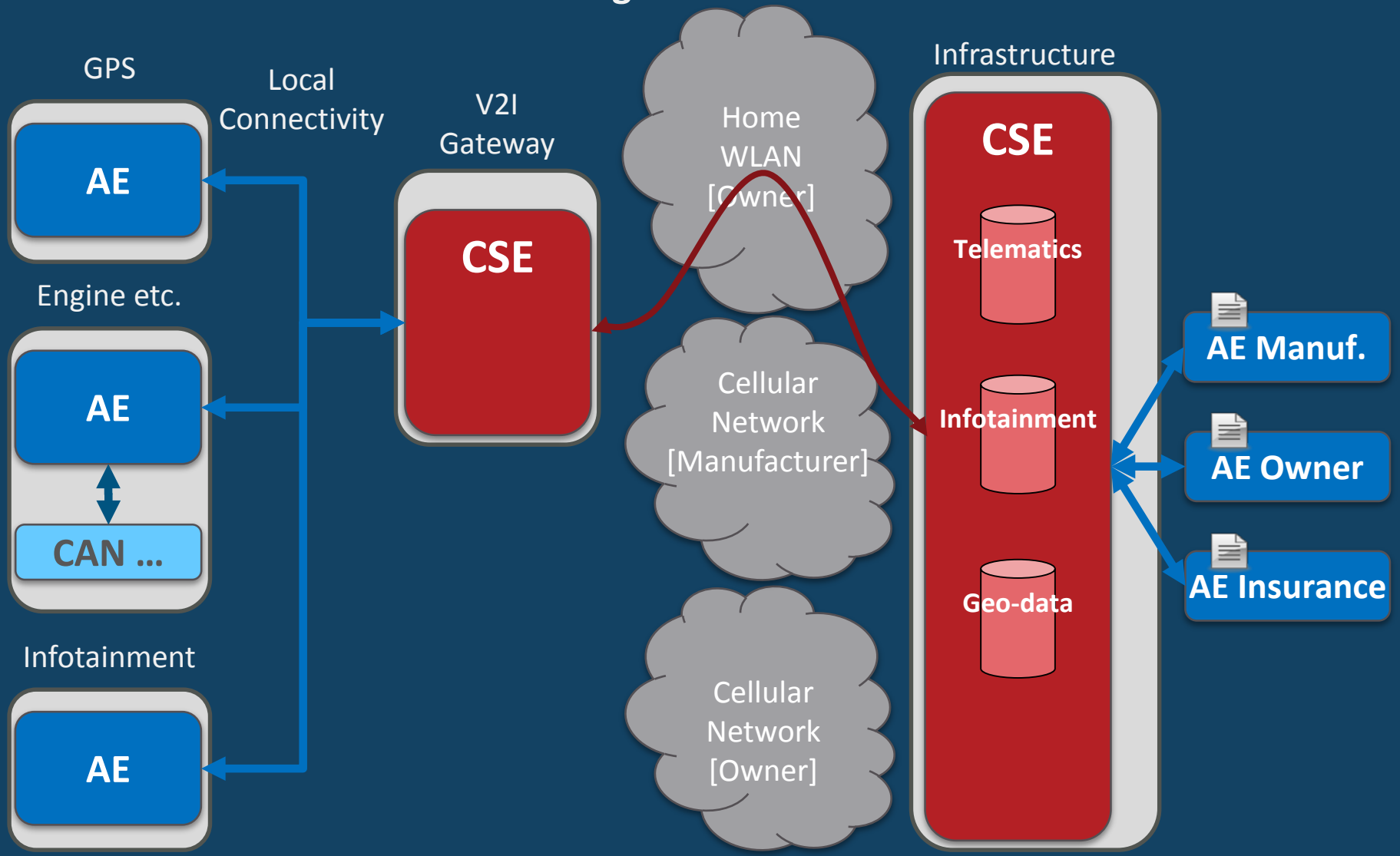
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



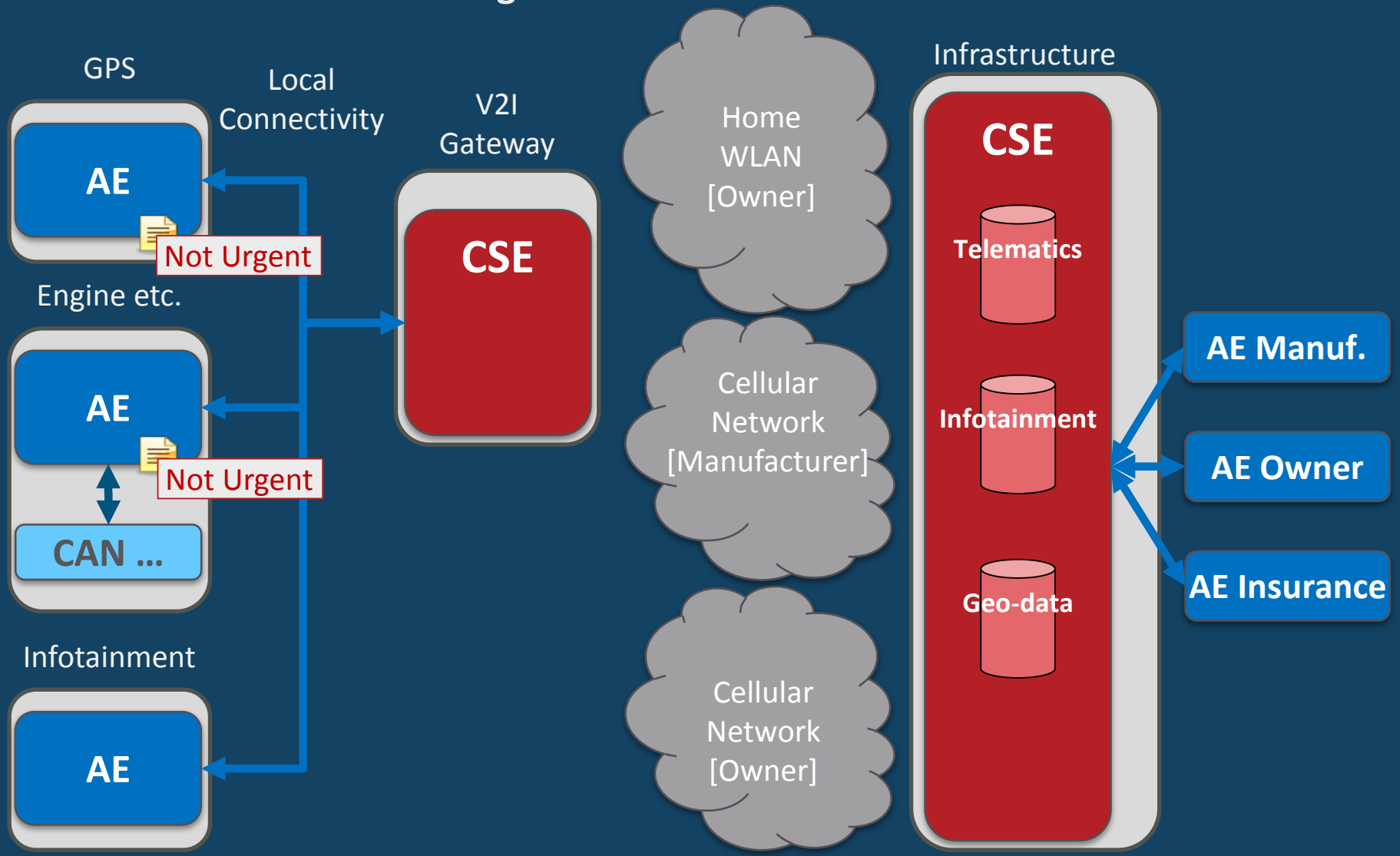
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



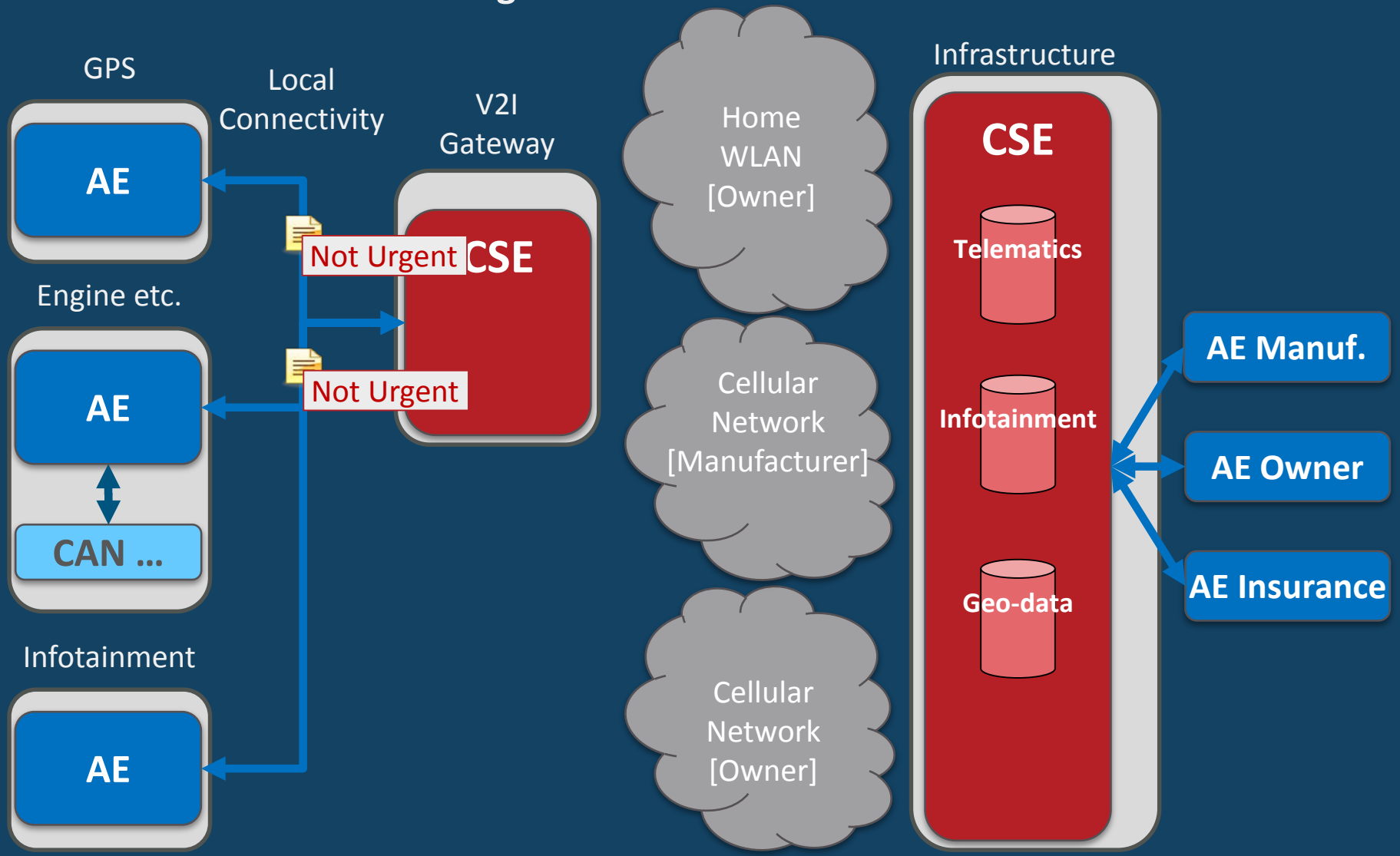
Efficient Data Sharing

On the road: Cellular Coverage



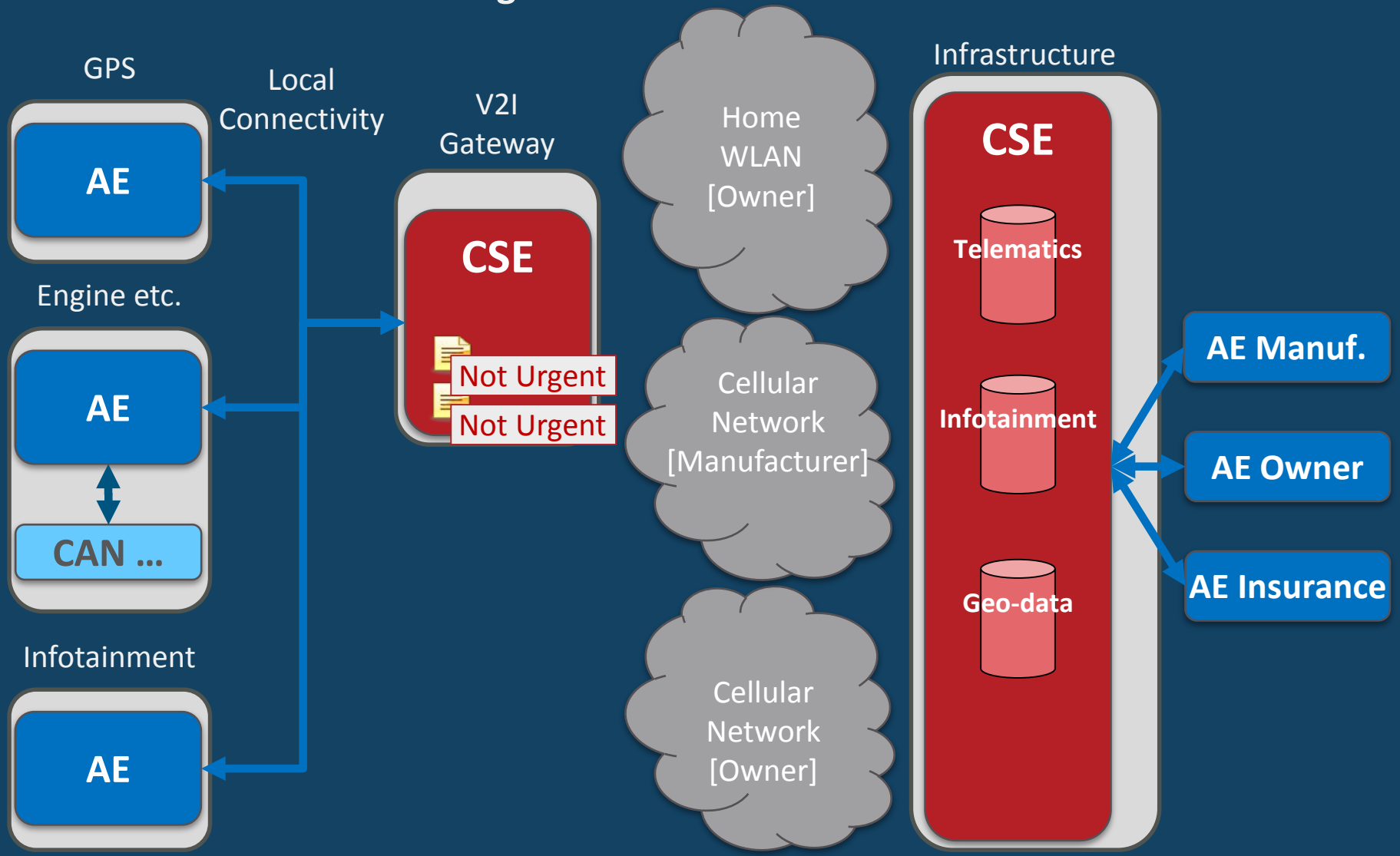
Efficient Data Sharing

On the road: Cellular Coverage



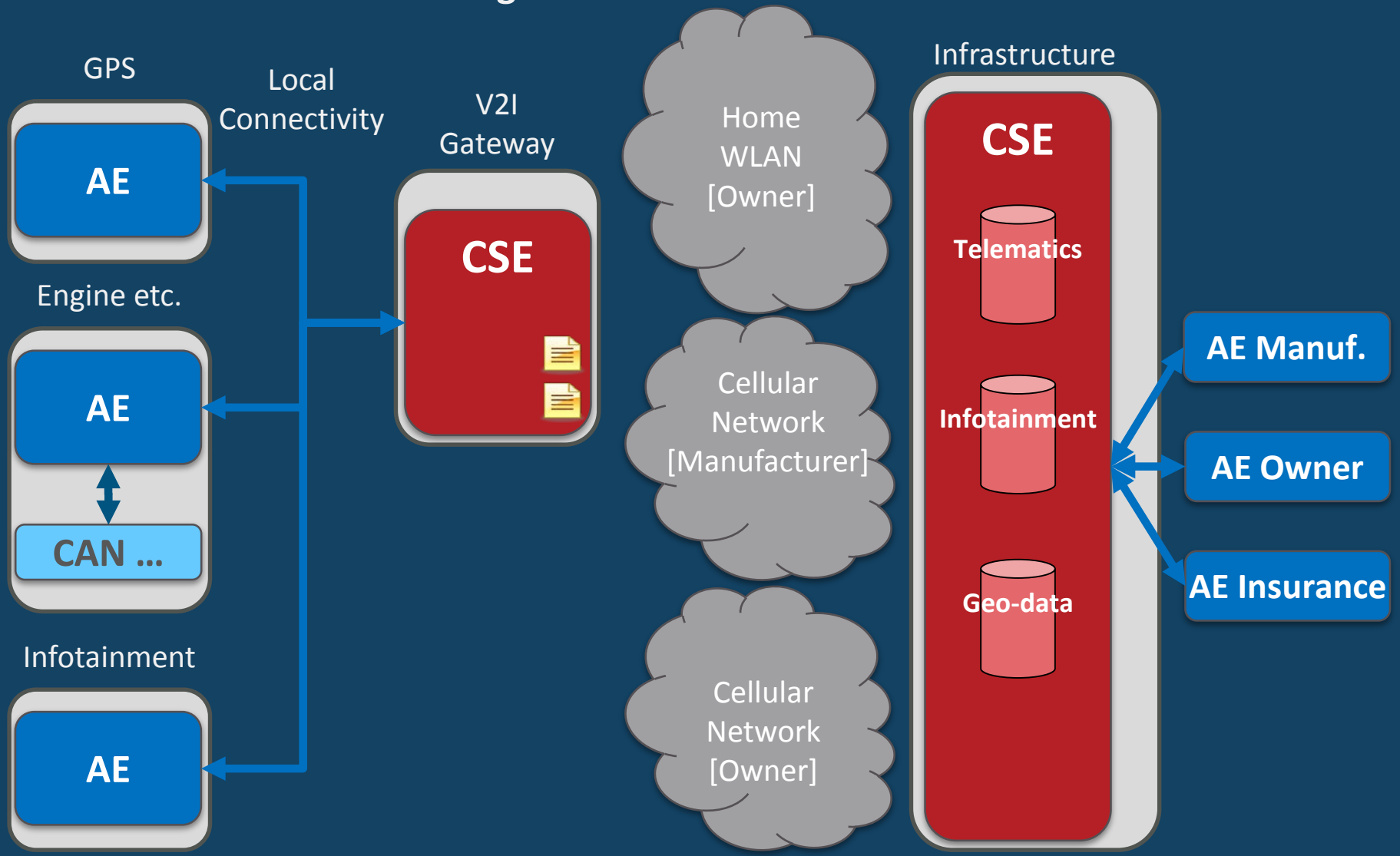
Efficient Data Sharing

On the road: Cellular Coverage



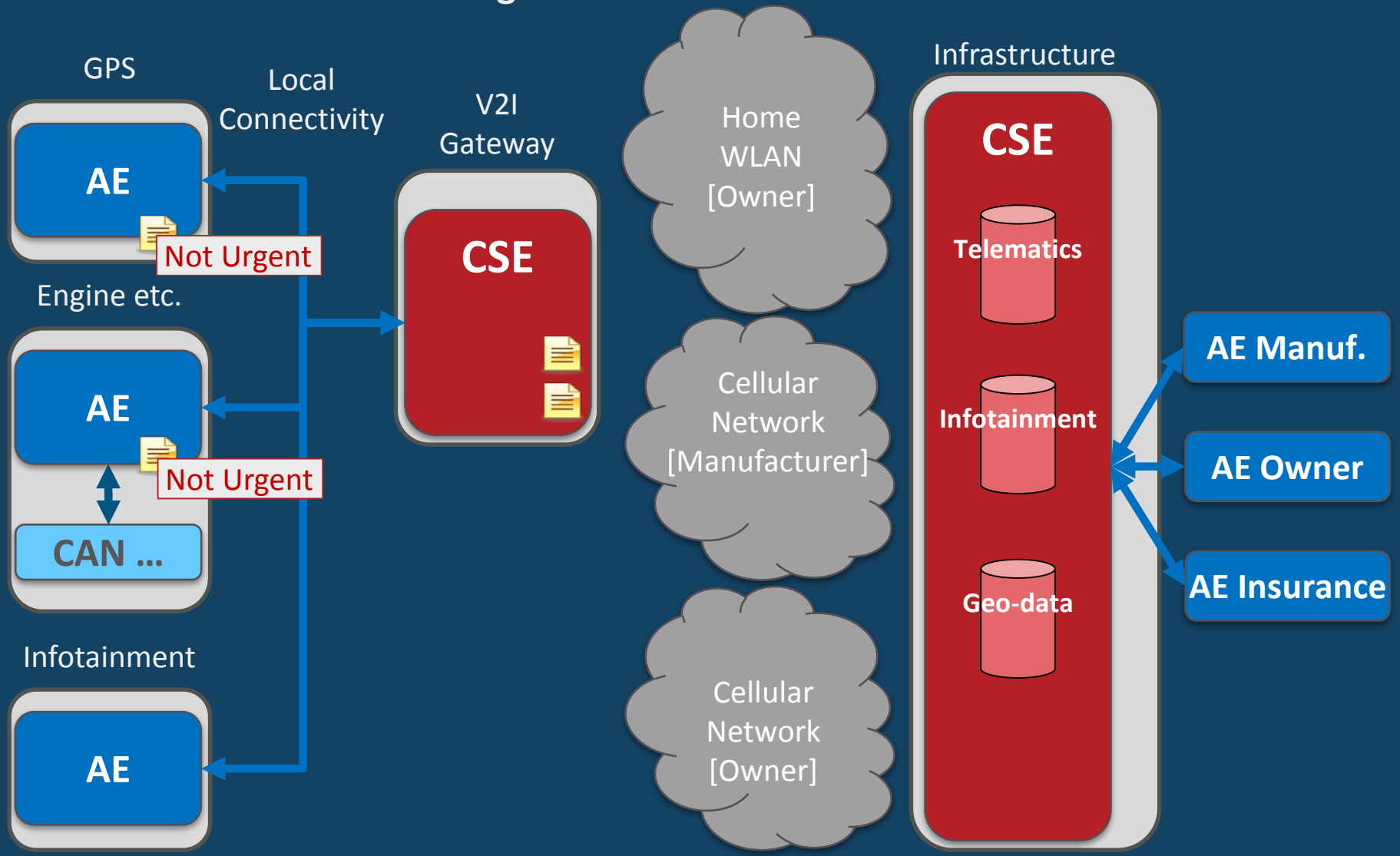
Efficient Data Sharing

On the road: Cellular Coverage



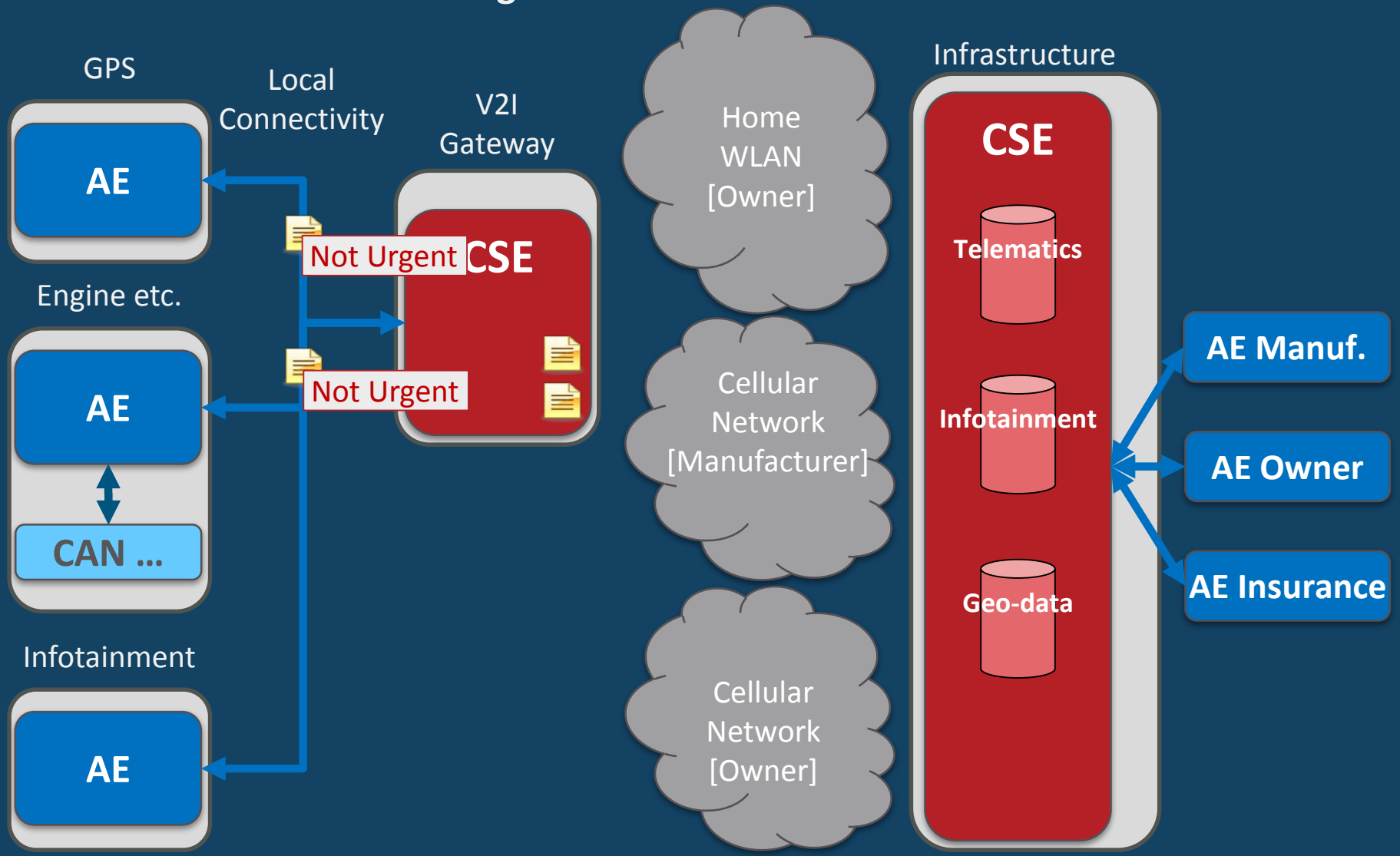
Efficient Data Sharing

On the road: Cellular Coverage



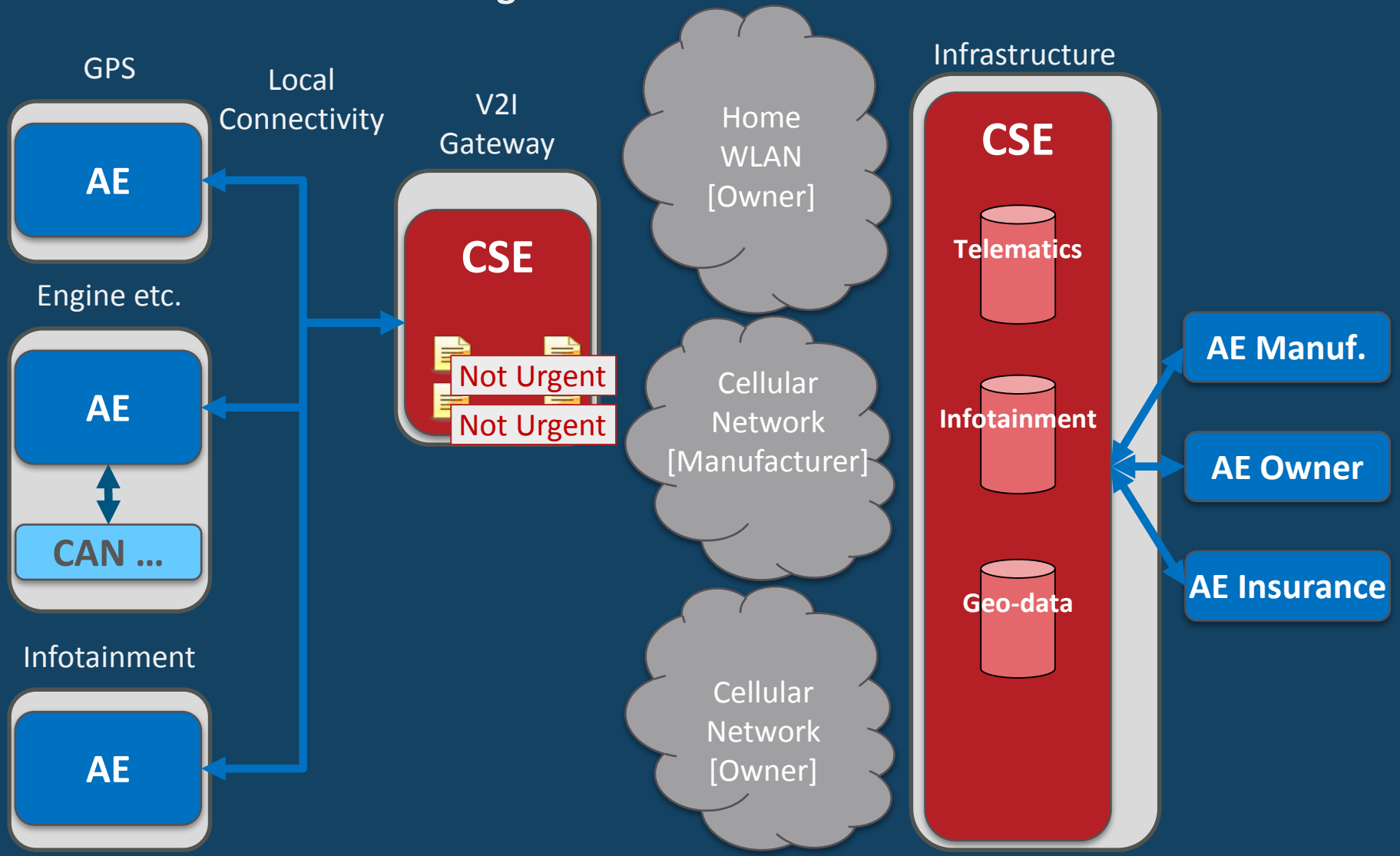
Efficient Data Sharing

On the road: Cellular Coverage



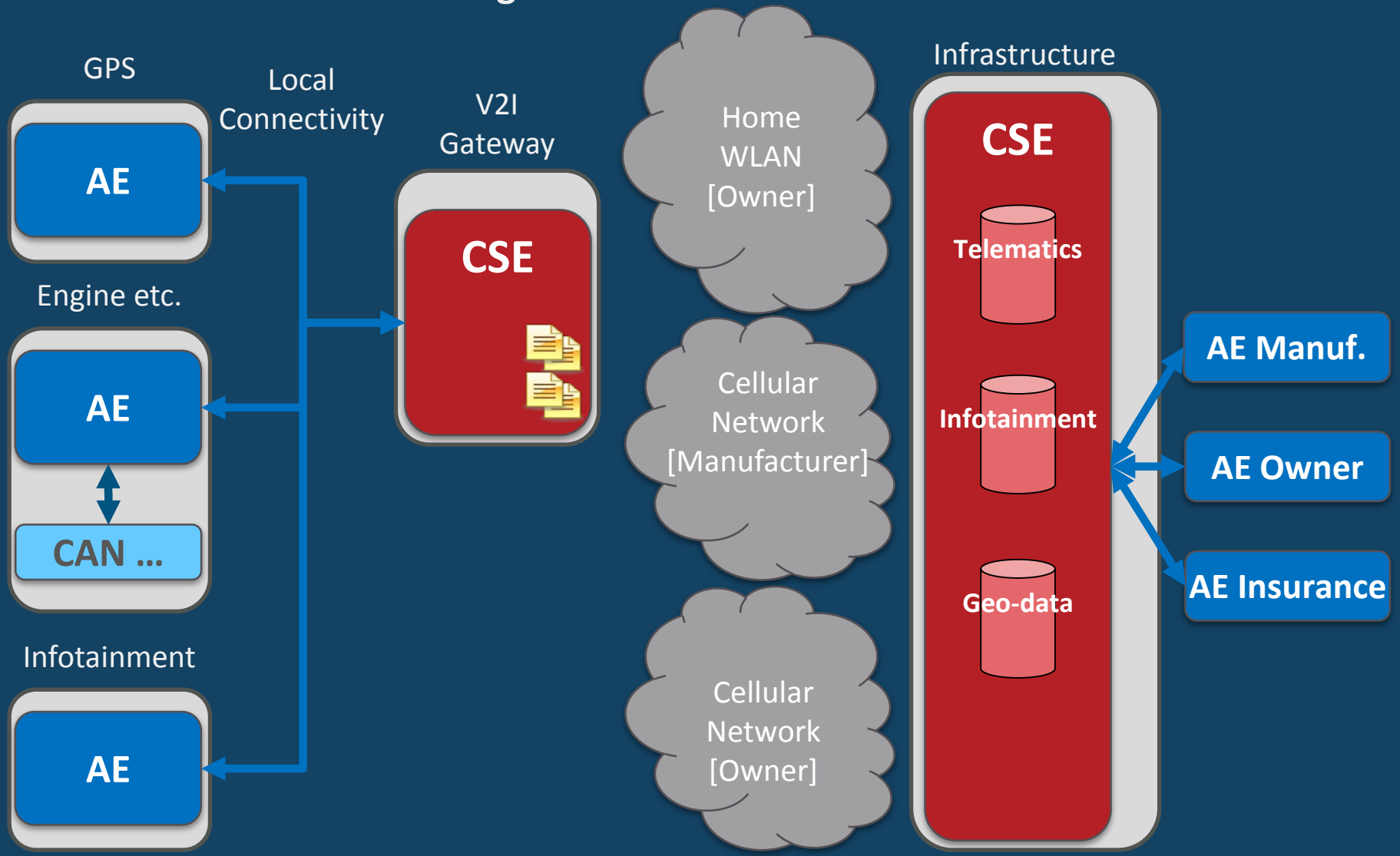
Efficient Data Sharing

On the road: Cellular Coverage



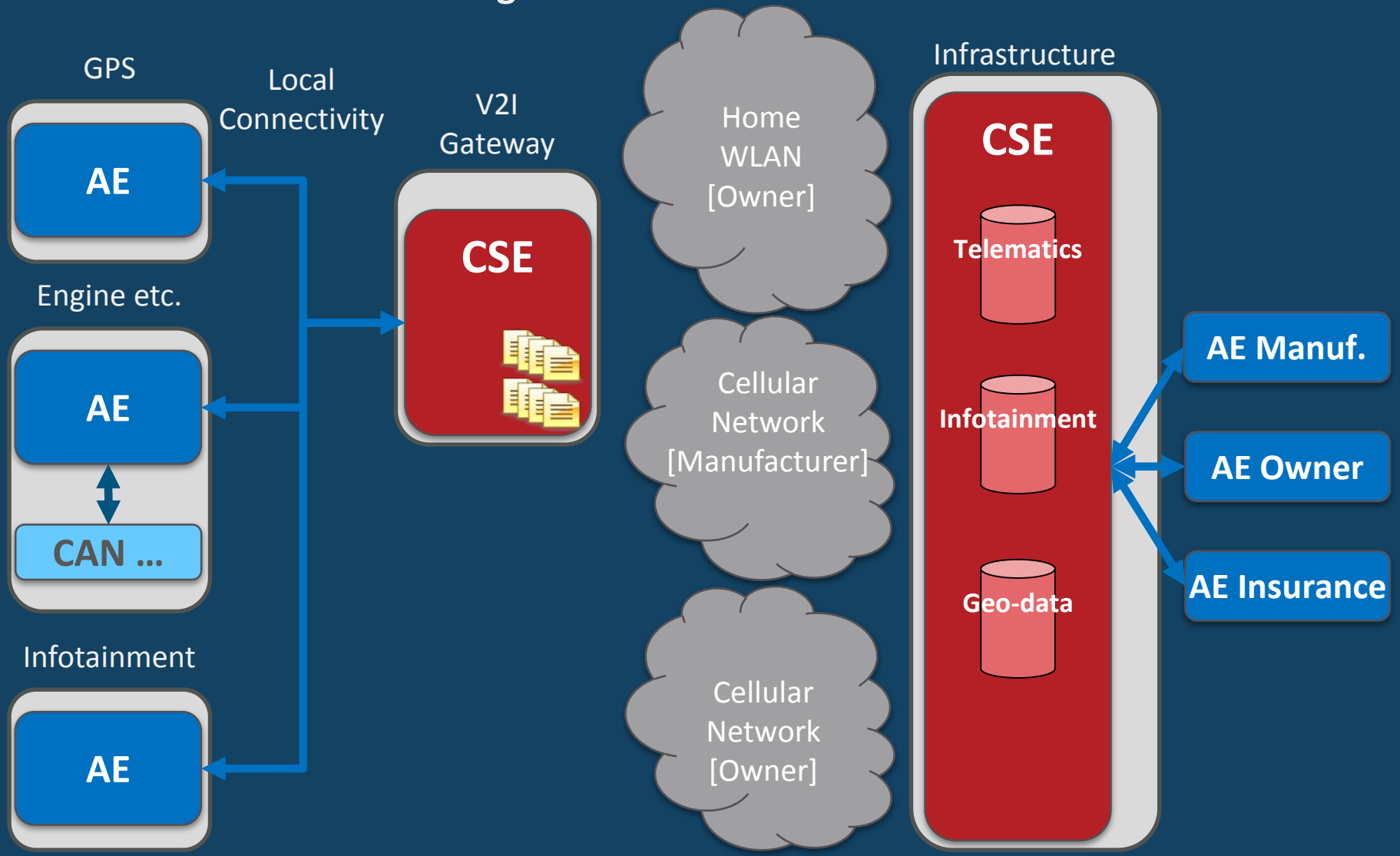
Efficient Data Sharing

On the road: Cellular Coverage



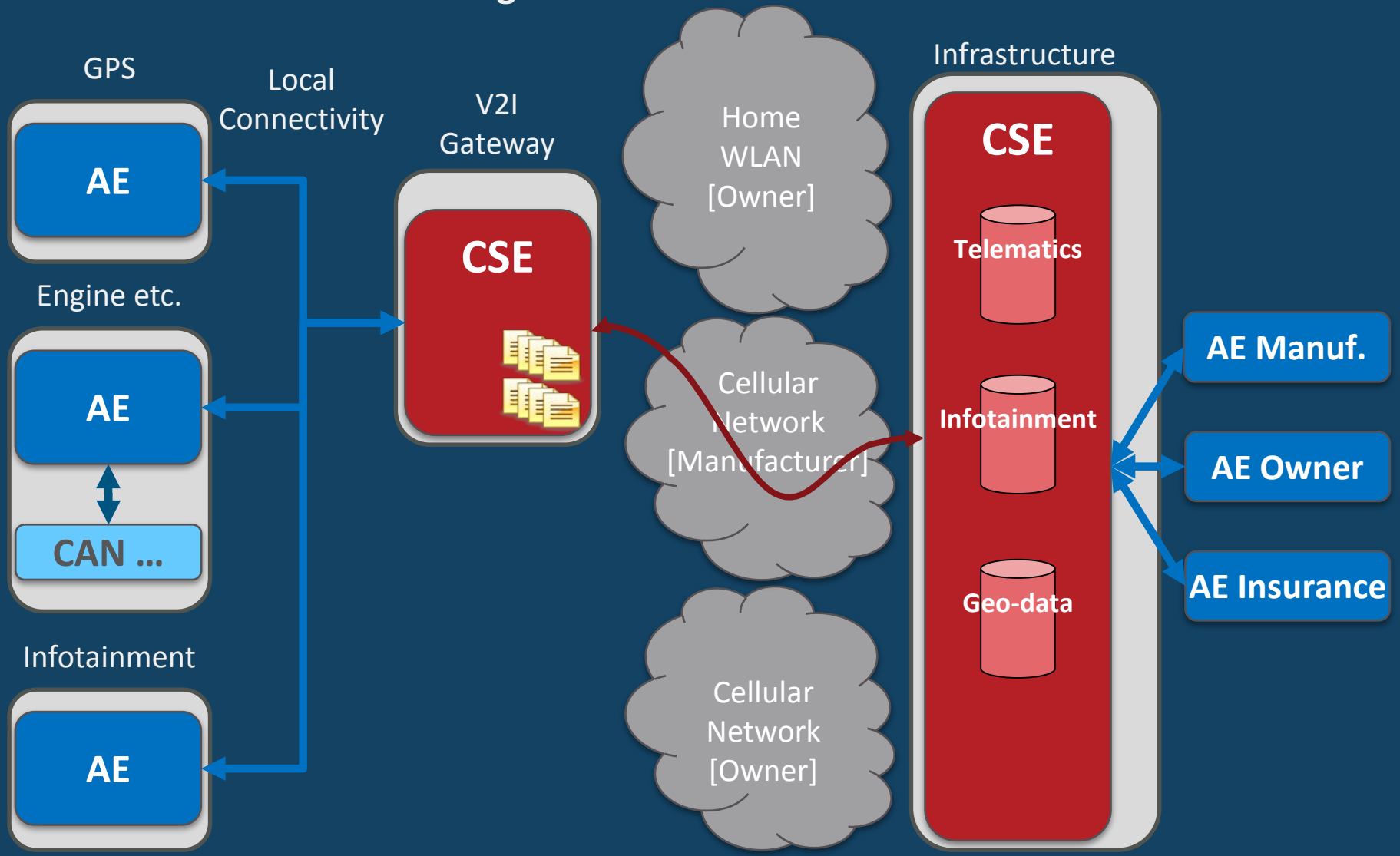
Efficient Data Sharing

On the road: Cellular Coverage



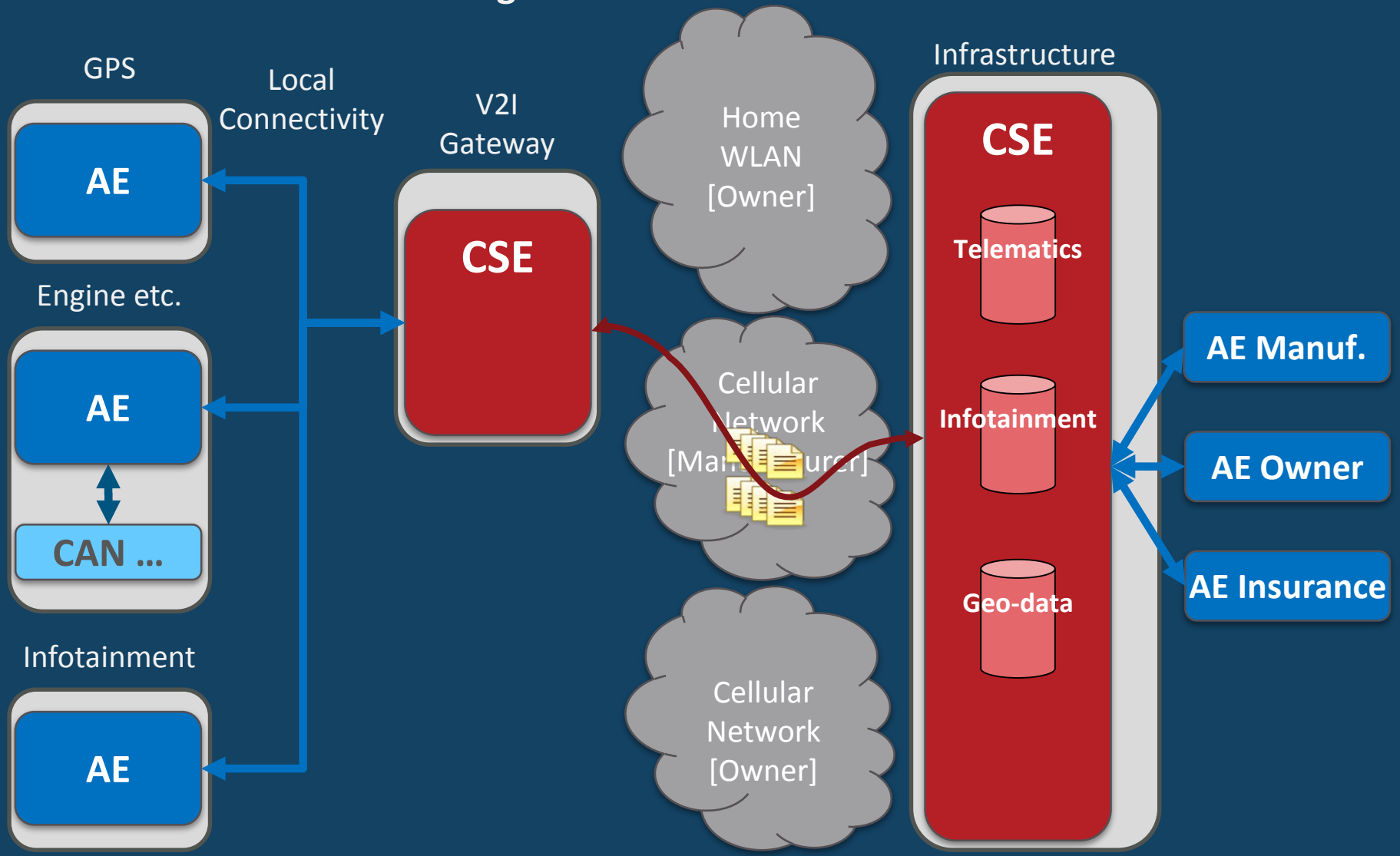
Efficient Data Sharing

On the road: Cellular Coverage



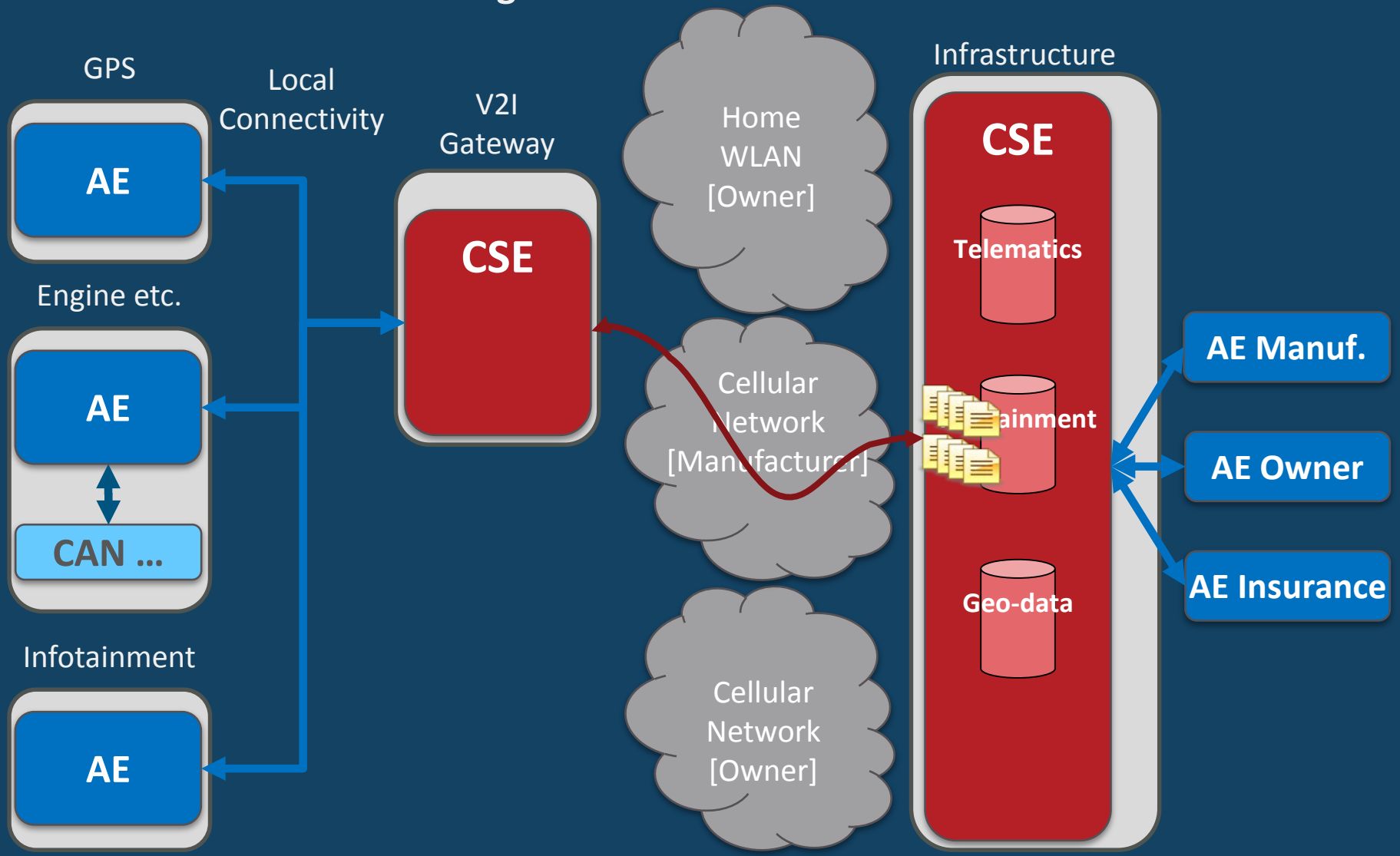
Efficient Data Sharing

On the road: Cellular Coverage



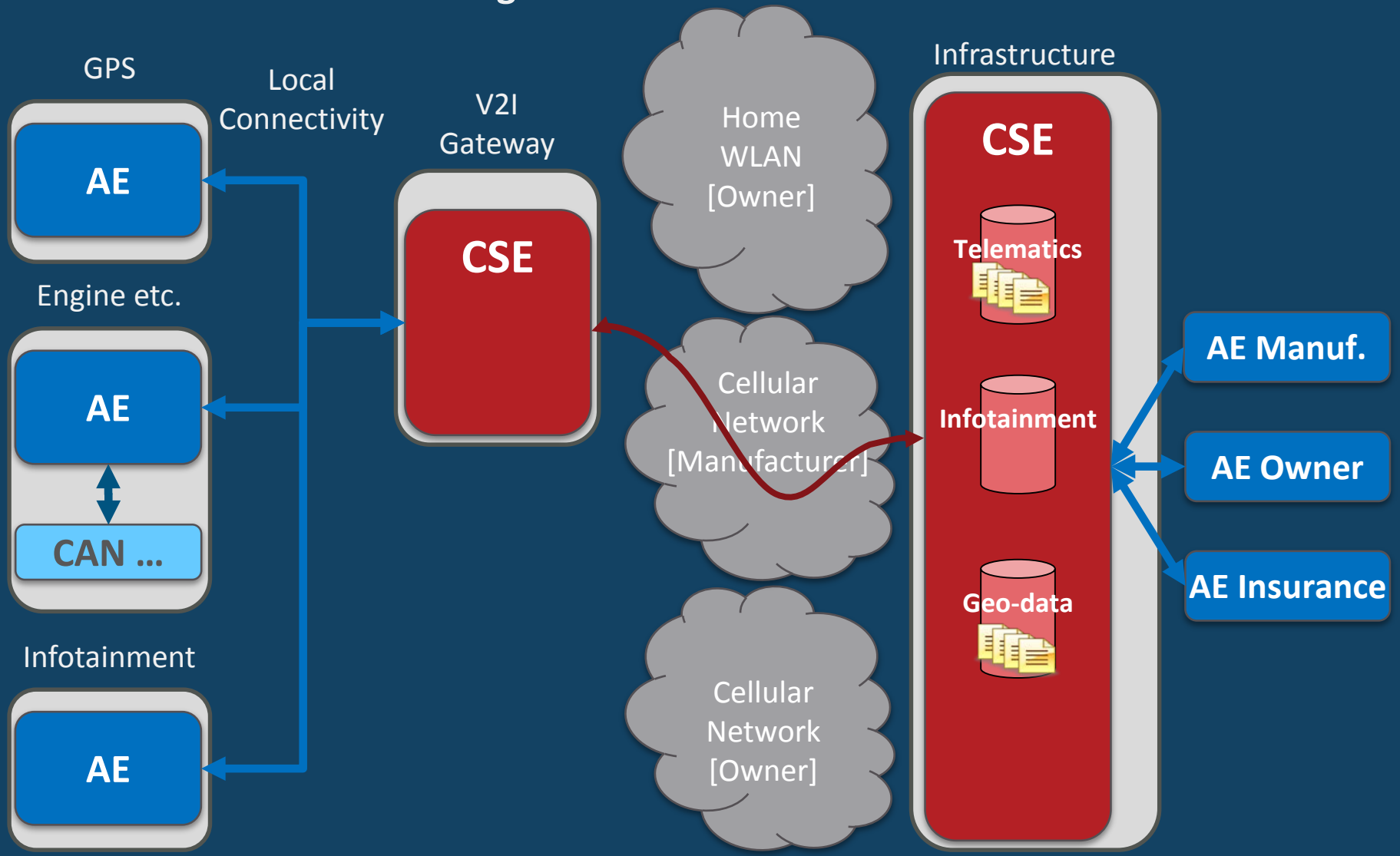
Efficient Data Sharing

On the road: Cellular Coverage



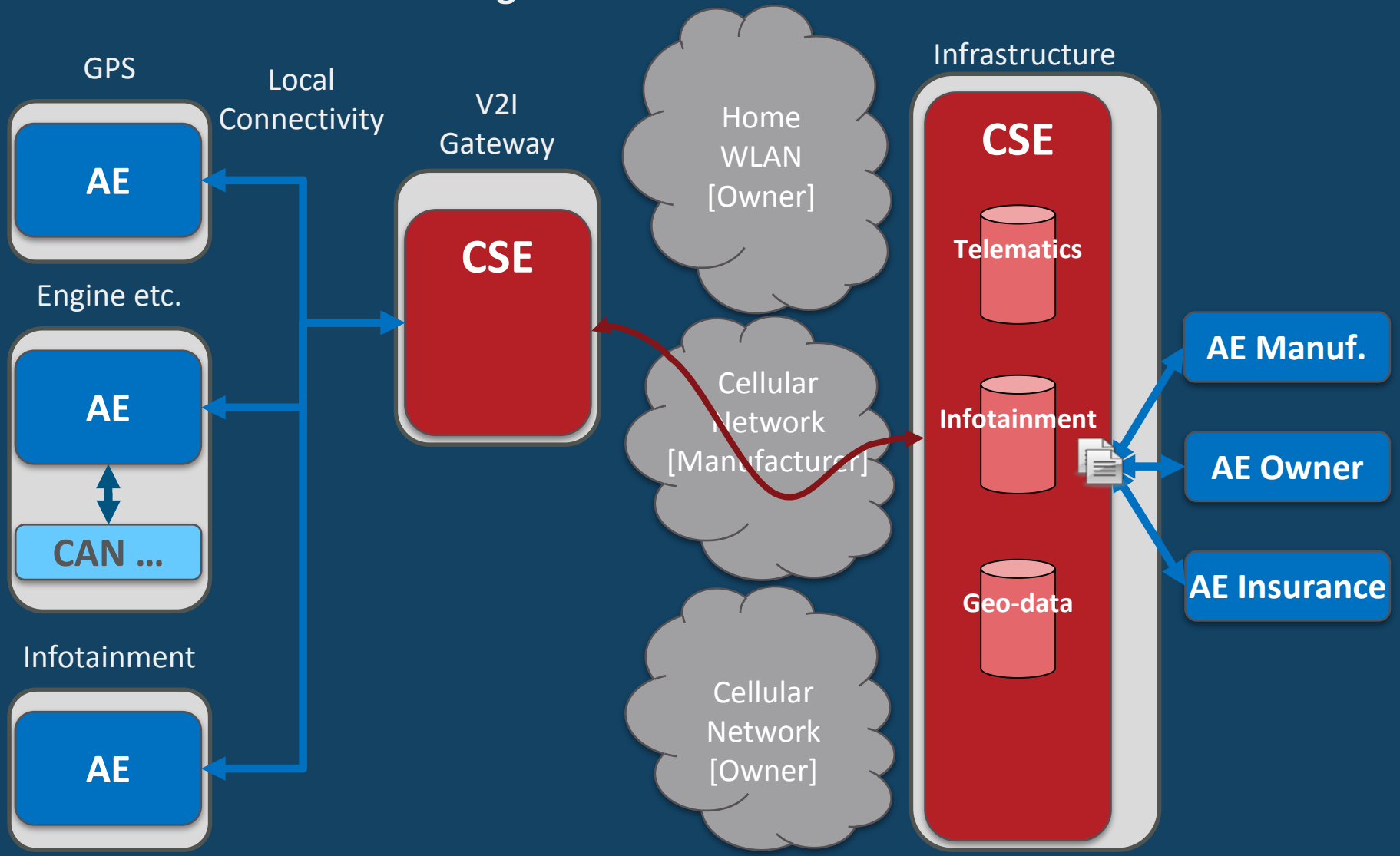
Efficient Data Sharing

On the road: Cellular Coverage



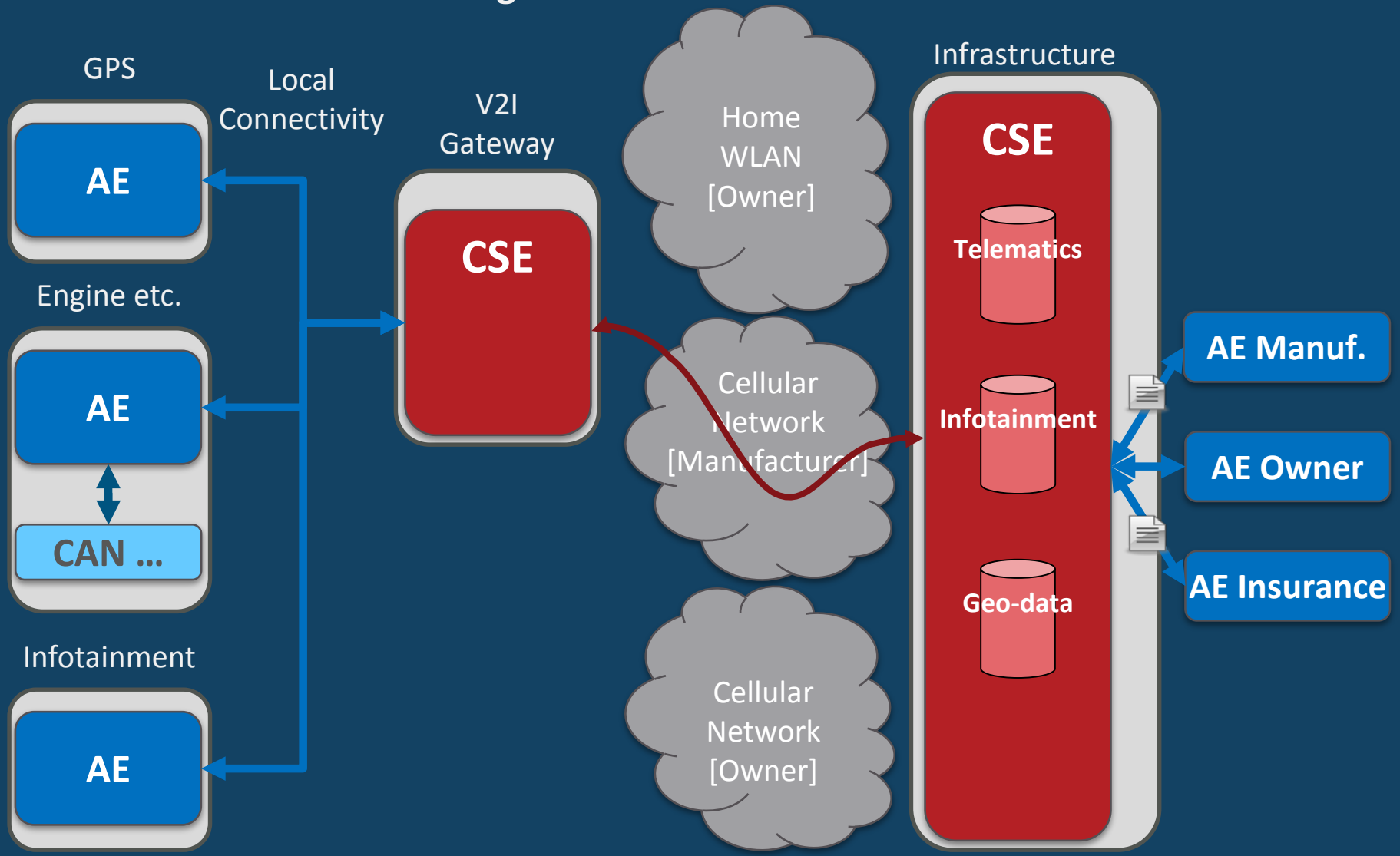
Efficient Data Sharing

On the road: Cellular Coverage



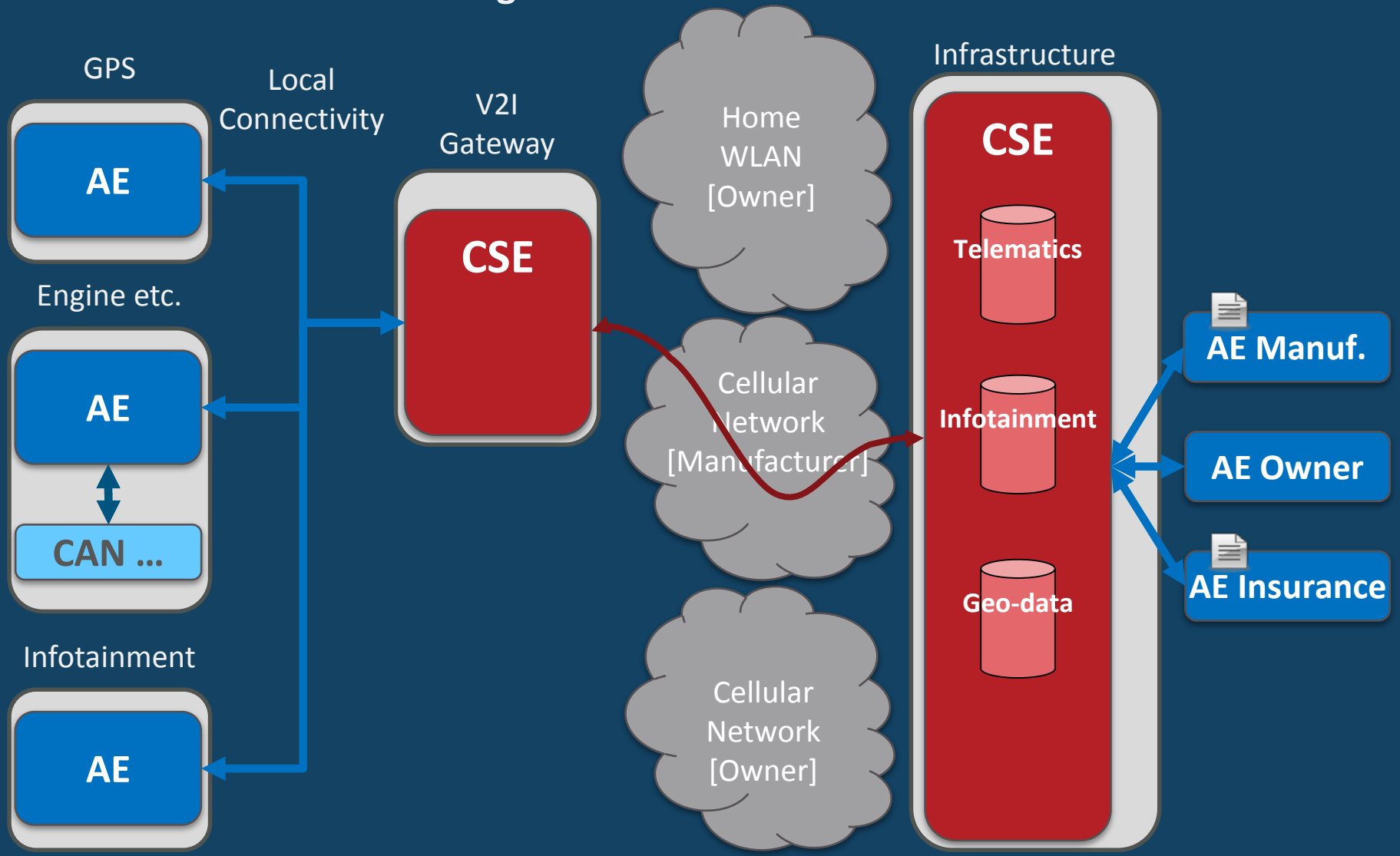
Efficient Data Sharing

On the road: Cellular Coverage



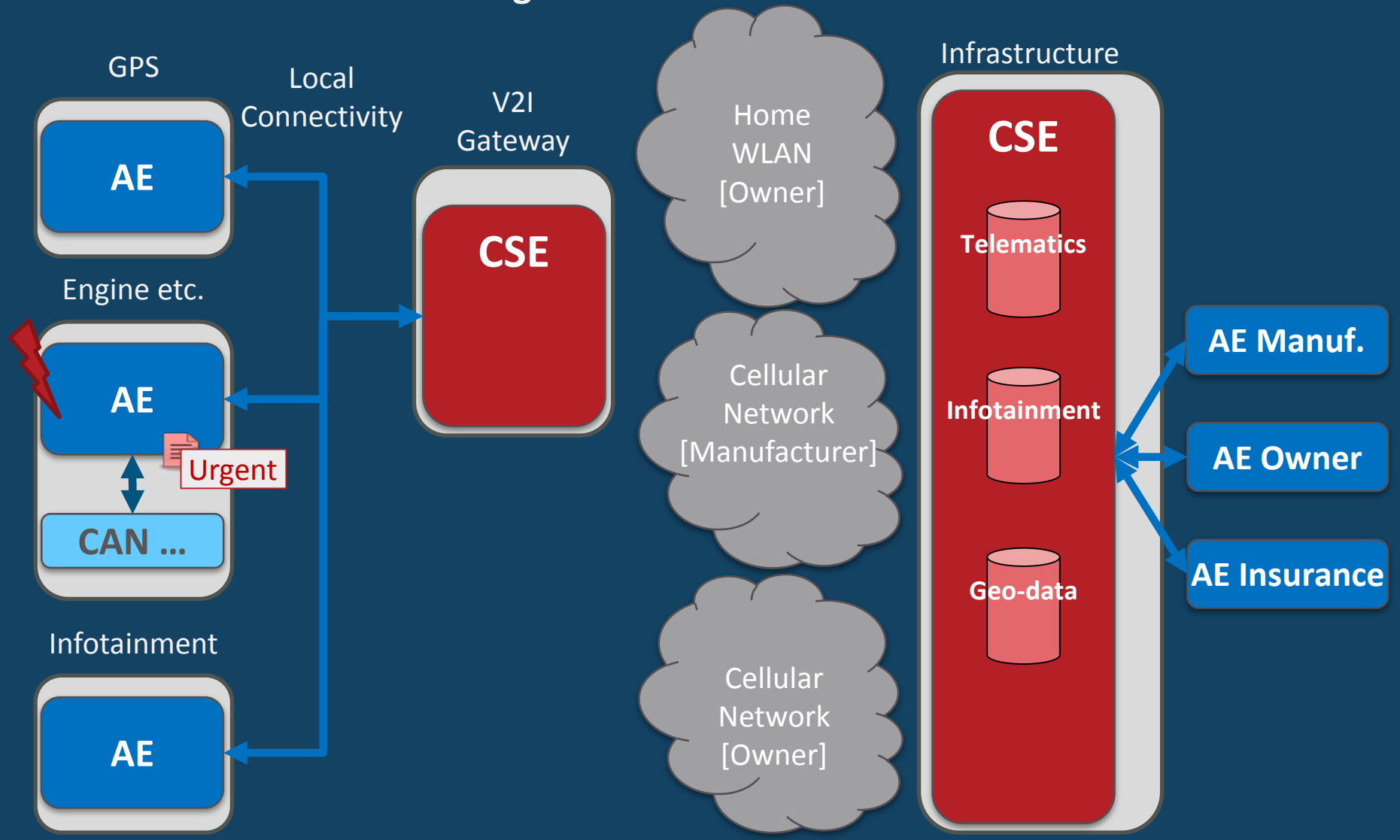
Efficient Data Sharing

On the road: Cellular Coverage



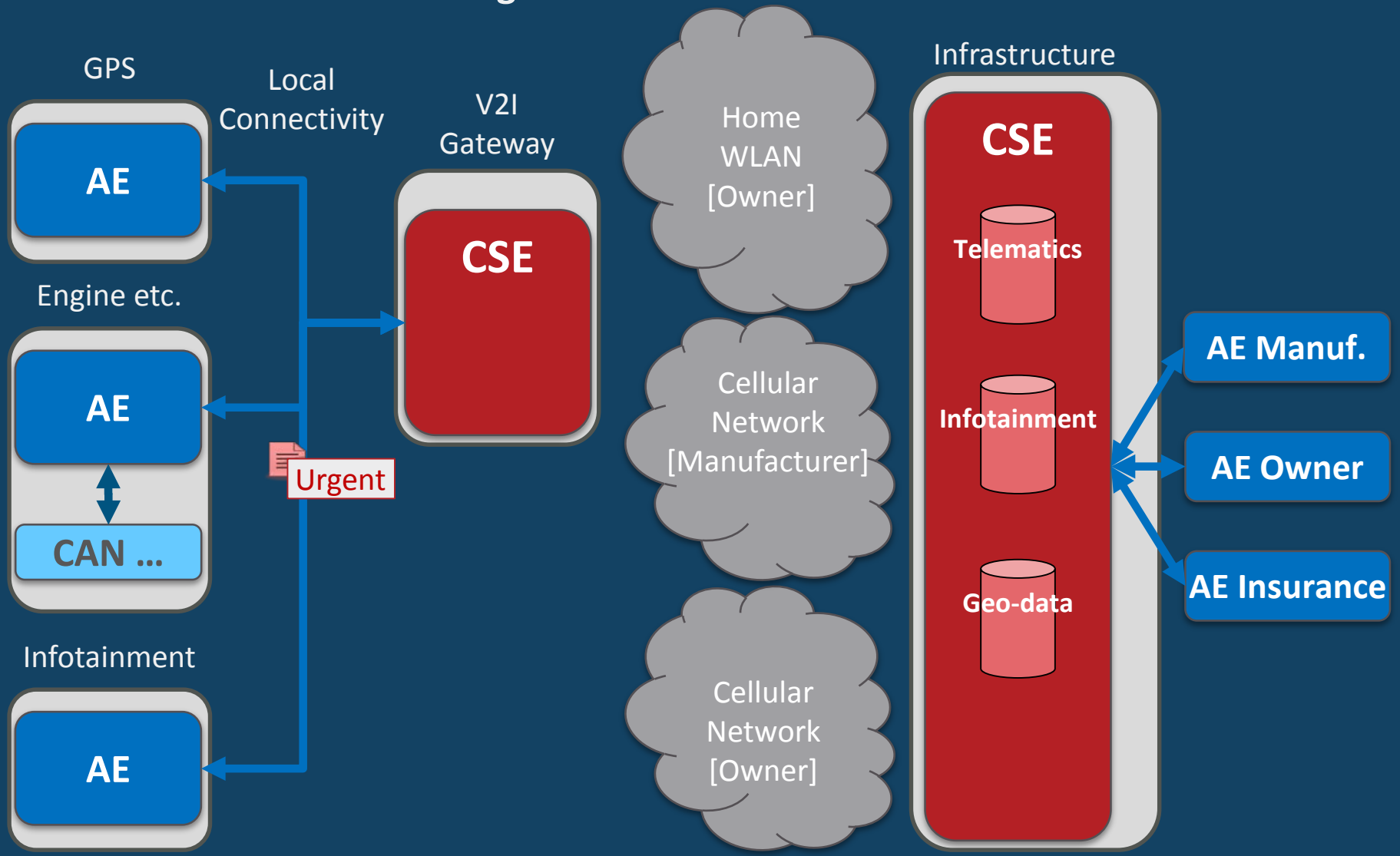
Efficient Data Sharing

On the road: Cellular Coverage



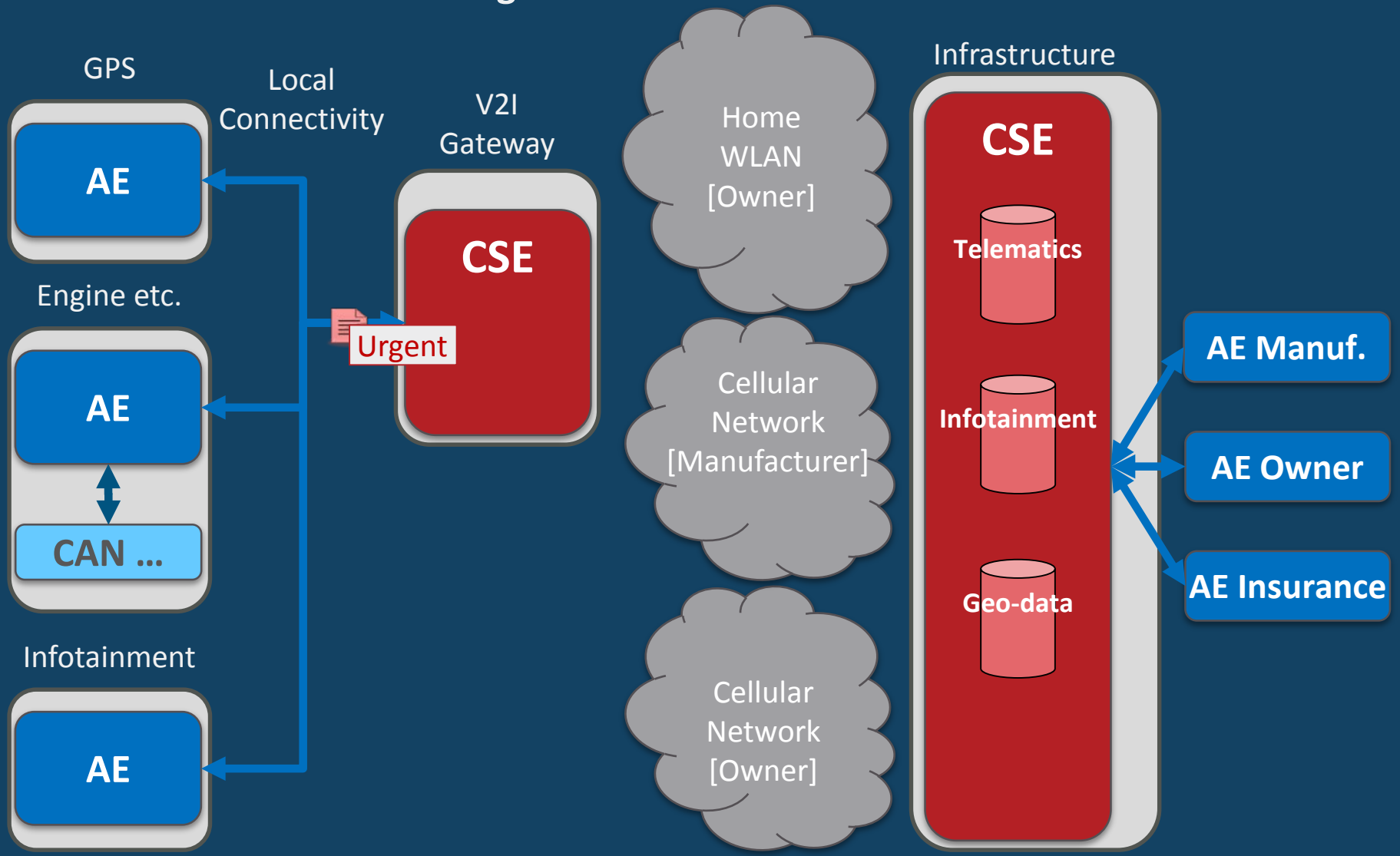
Efficient Data Sharing

On the road: Cellular Coverage



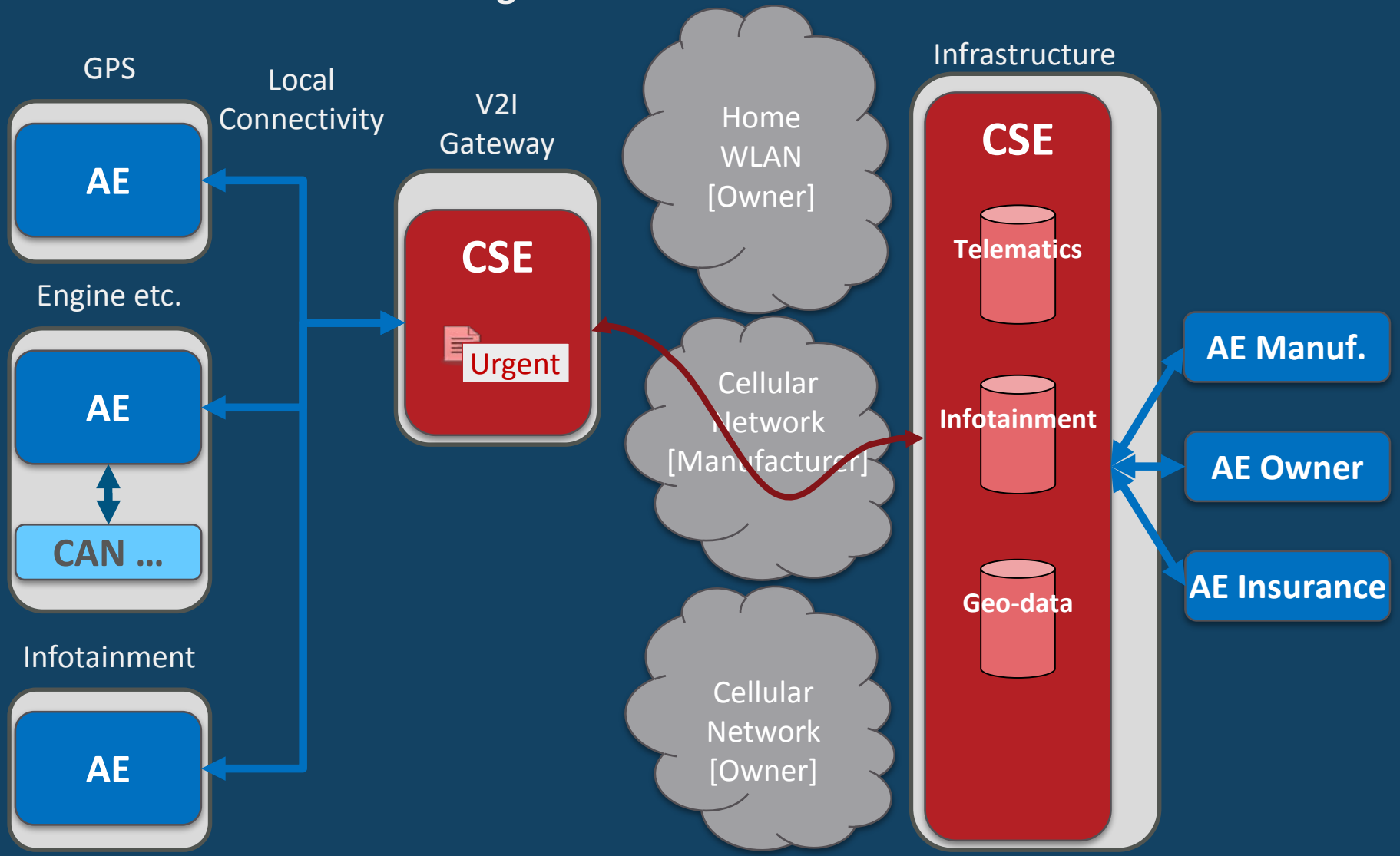
Efficient Data Sharing

On the road: Cellular Coverage



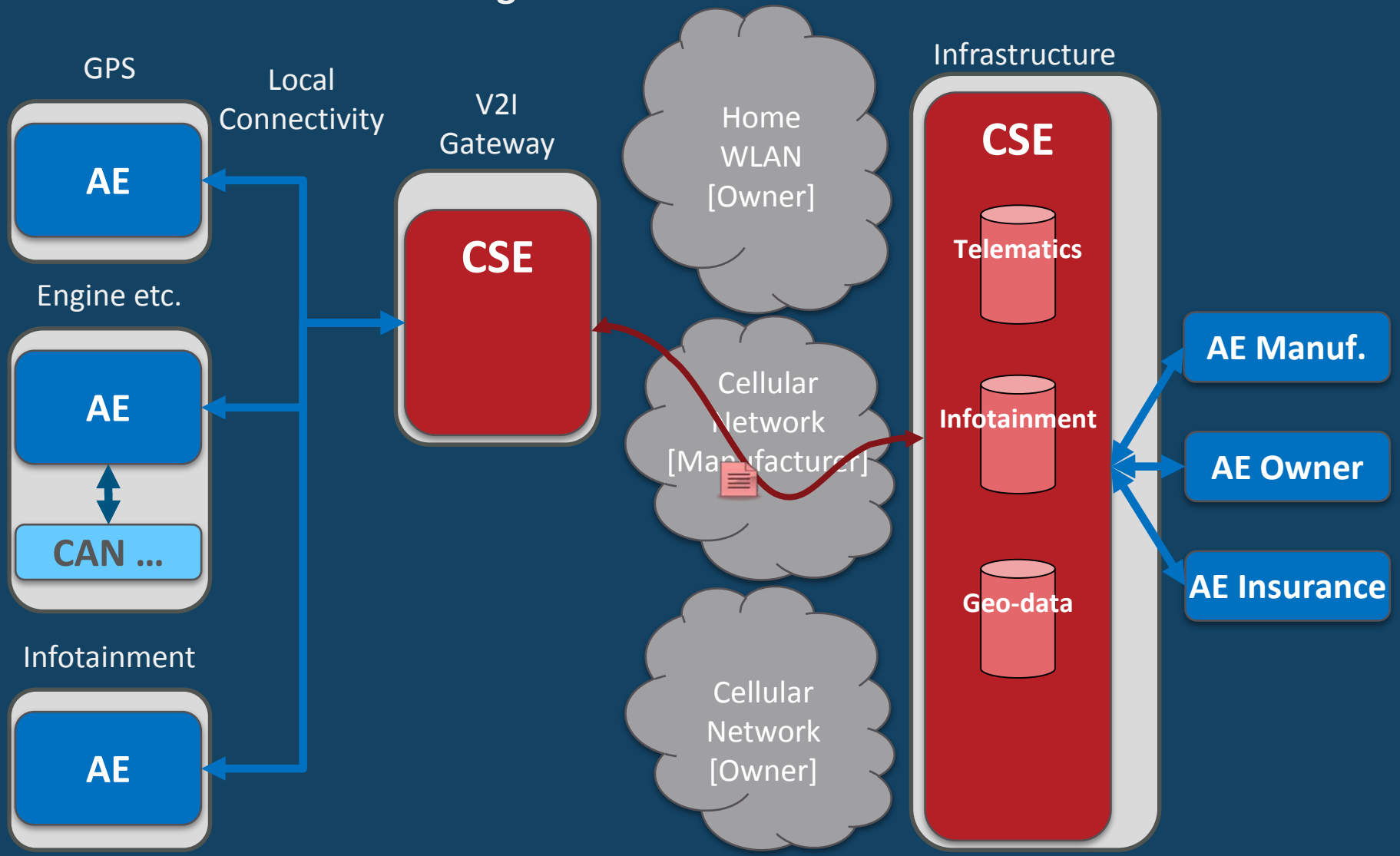
Efficient Data Sharing

On the road: Cellular Coverage



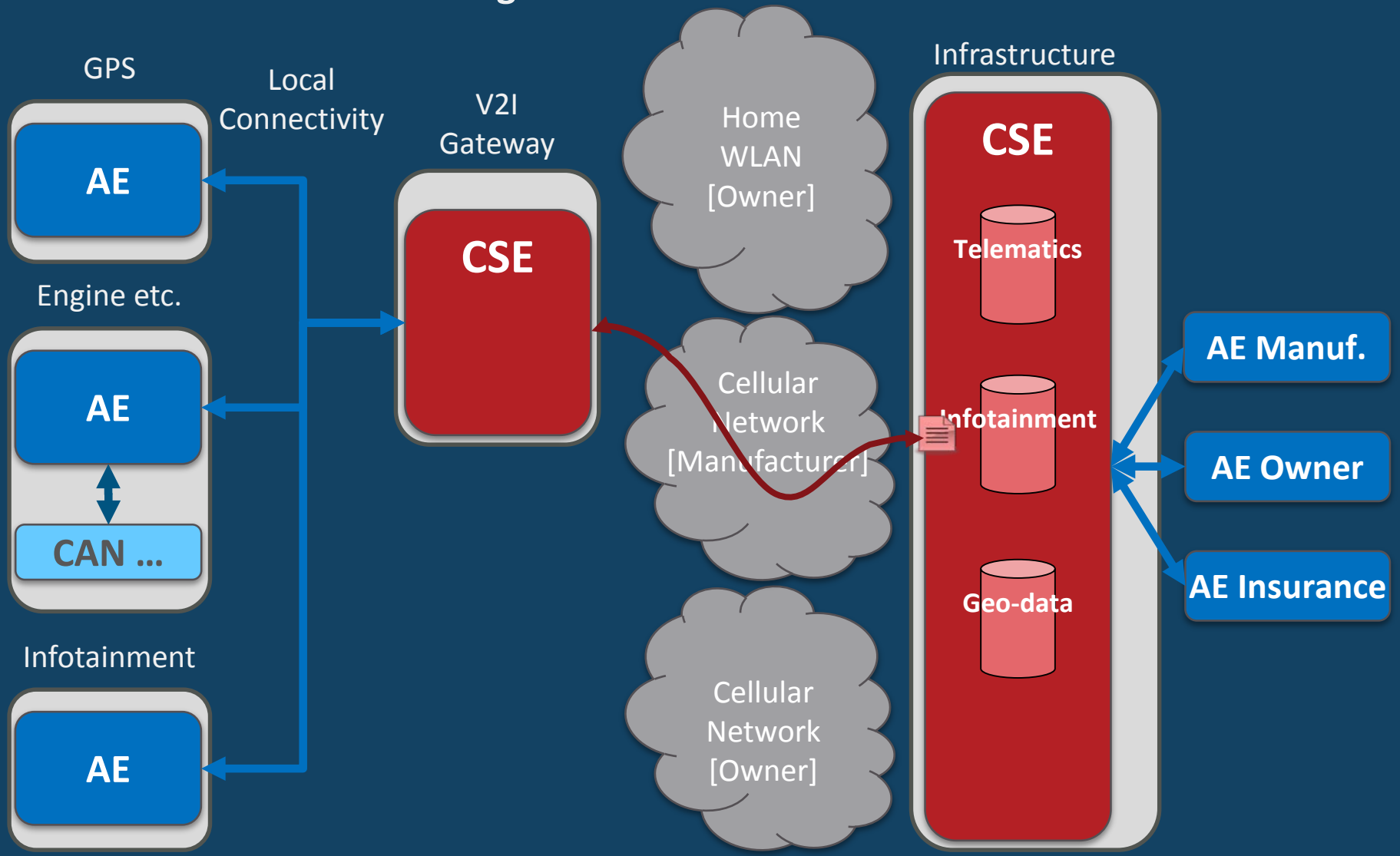
Efficient Data Sharing

On the road: Cellular Coverage



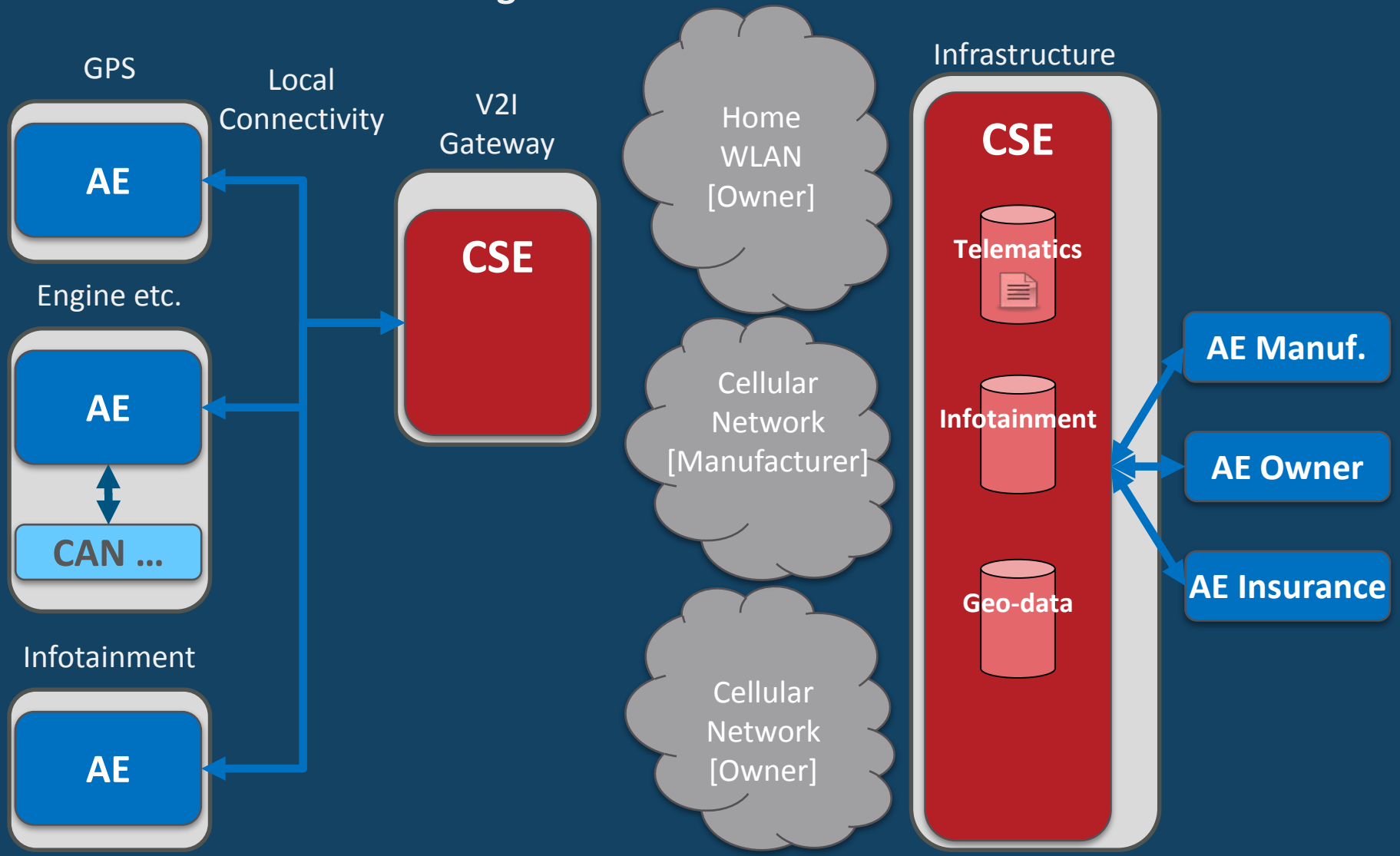
Efficient Data Sharing

On the road: Cellular Coverage



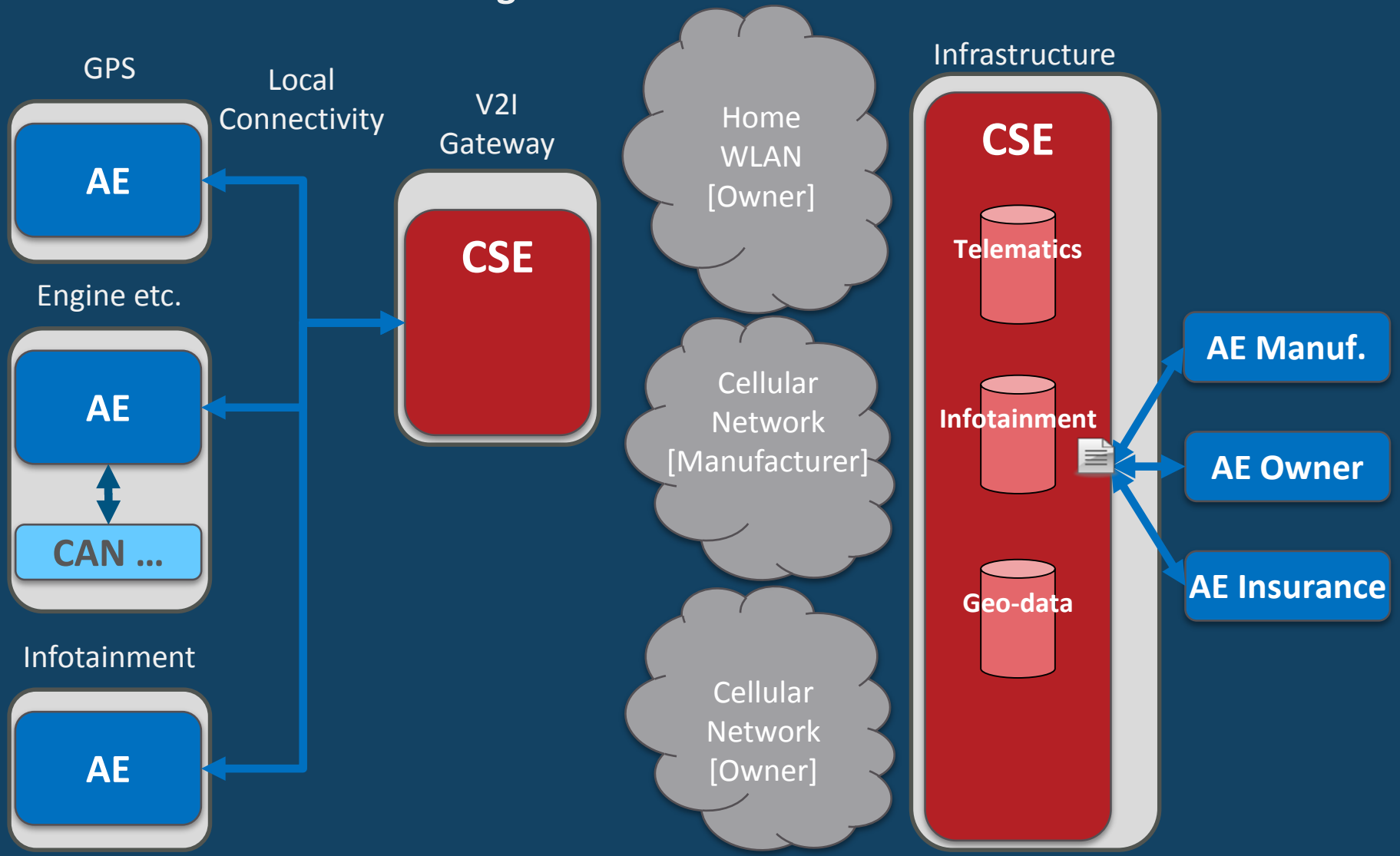
Efficient Data Sharing

On the road: Cellular Coverage



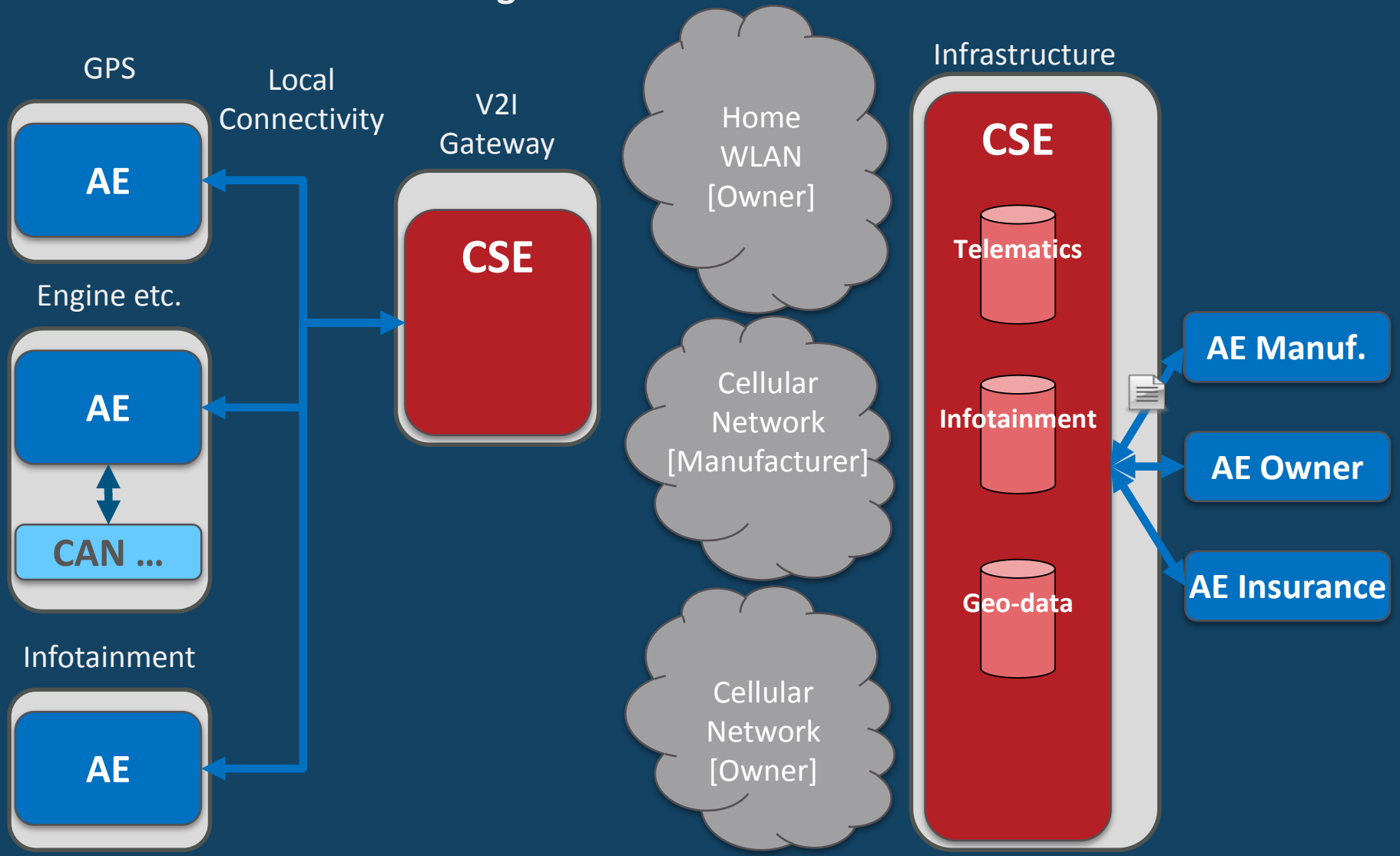
Efficient Data Sharing

On the road: Cellular Coverage



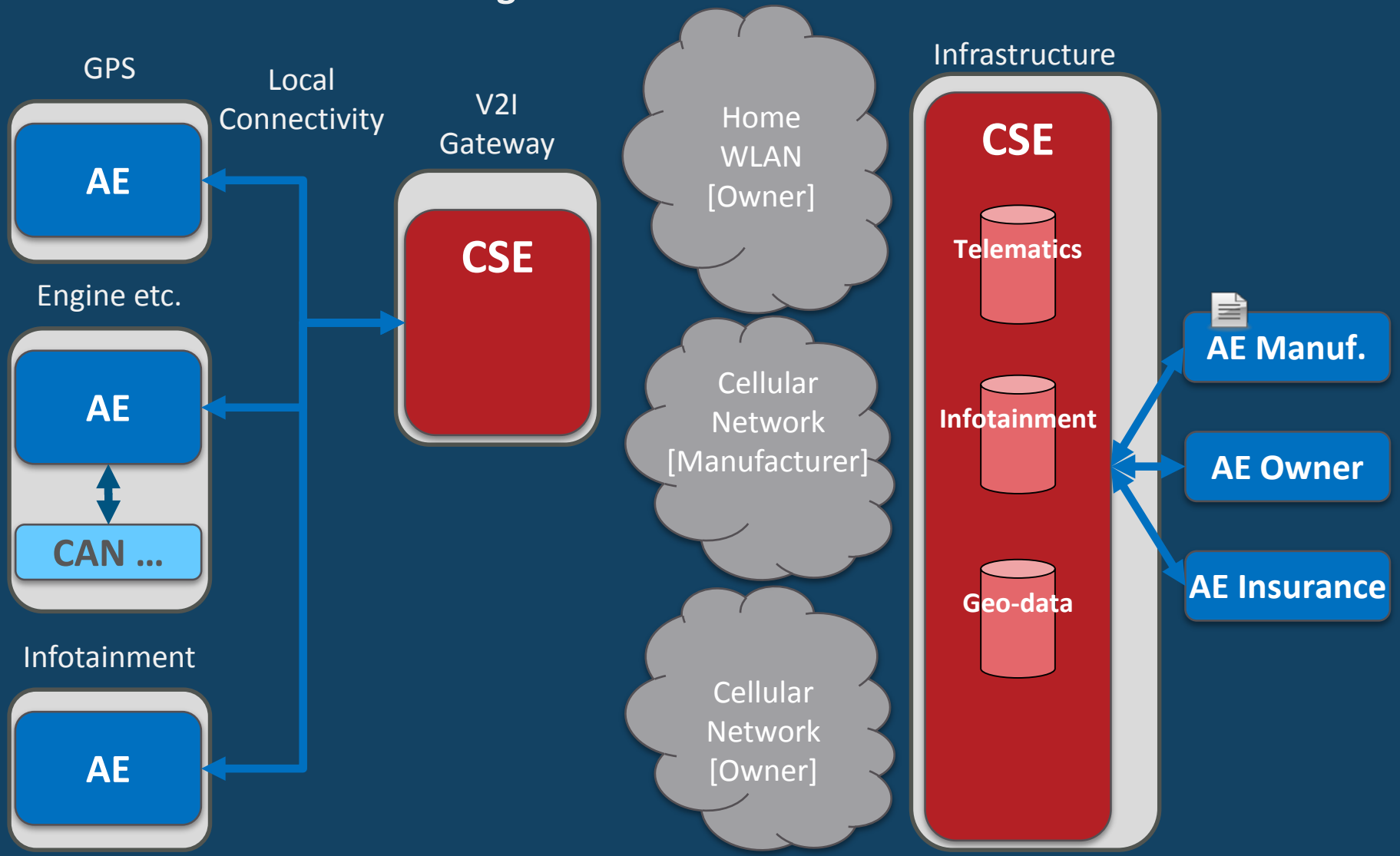
Efficient Data Sharing

On the road: Cellular Coverage



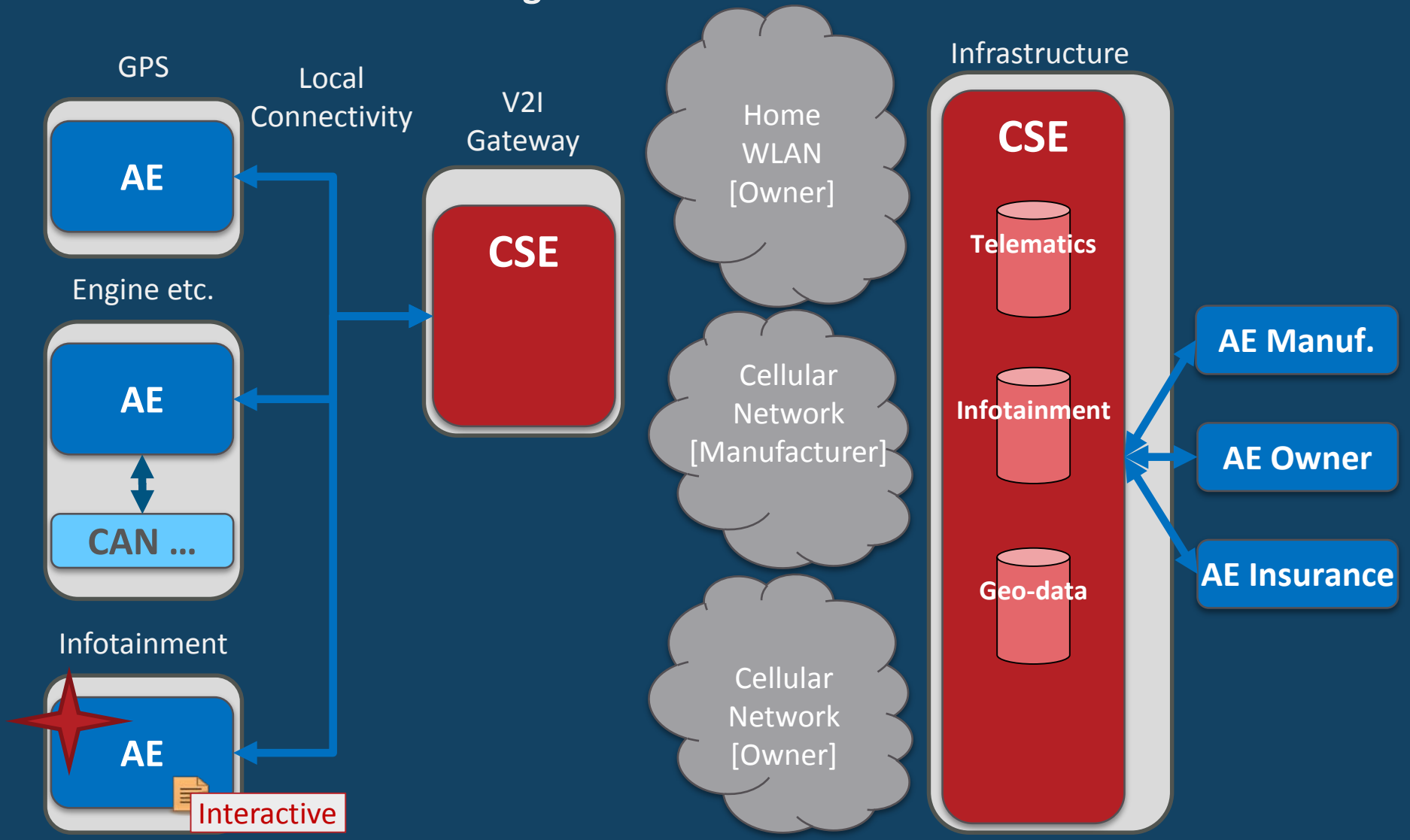
Efficient Data Sharing

On the road: Cellular Coverage



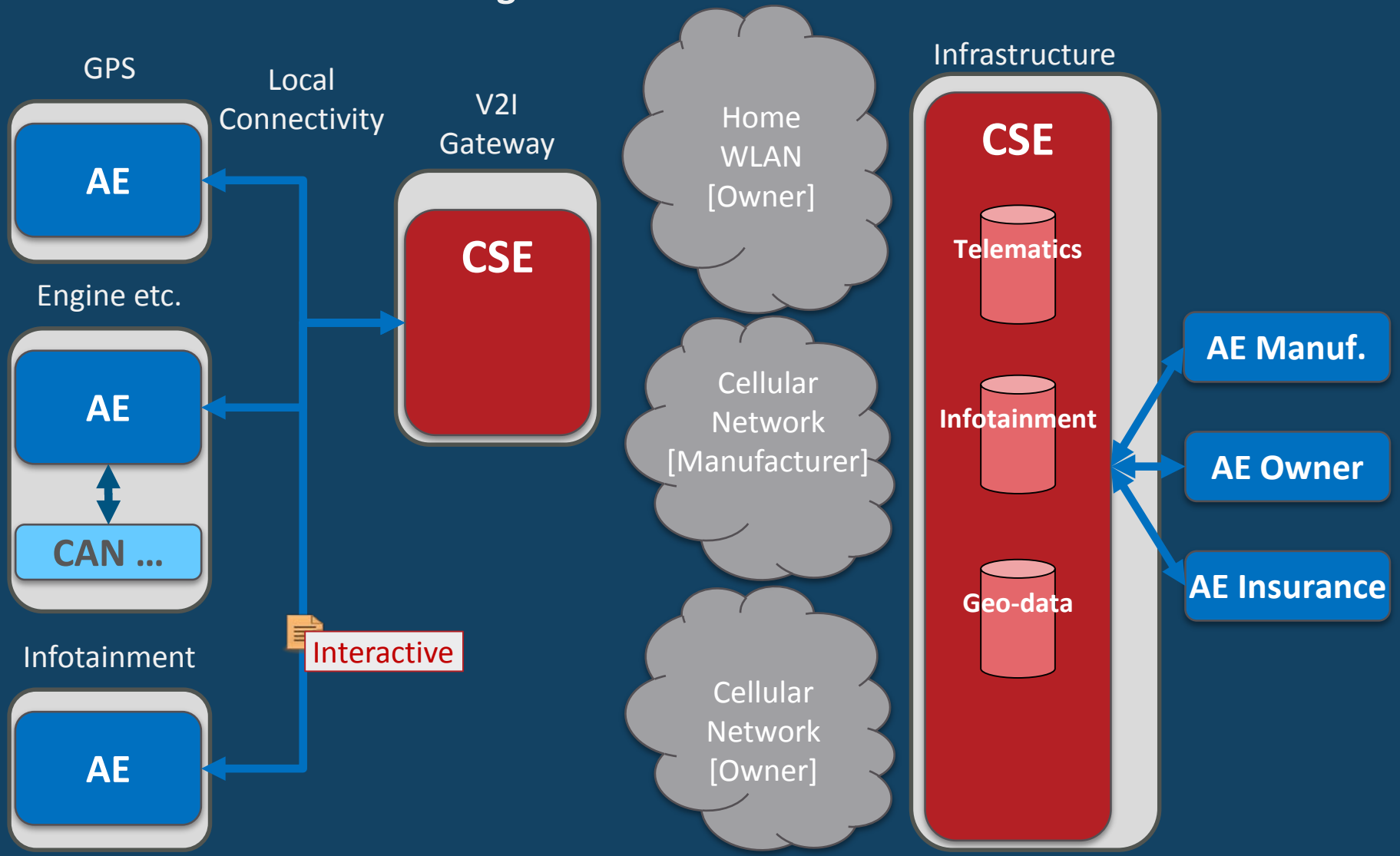
Efficient Data Sharing

On the road: Cellular Coverage



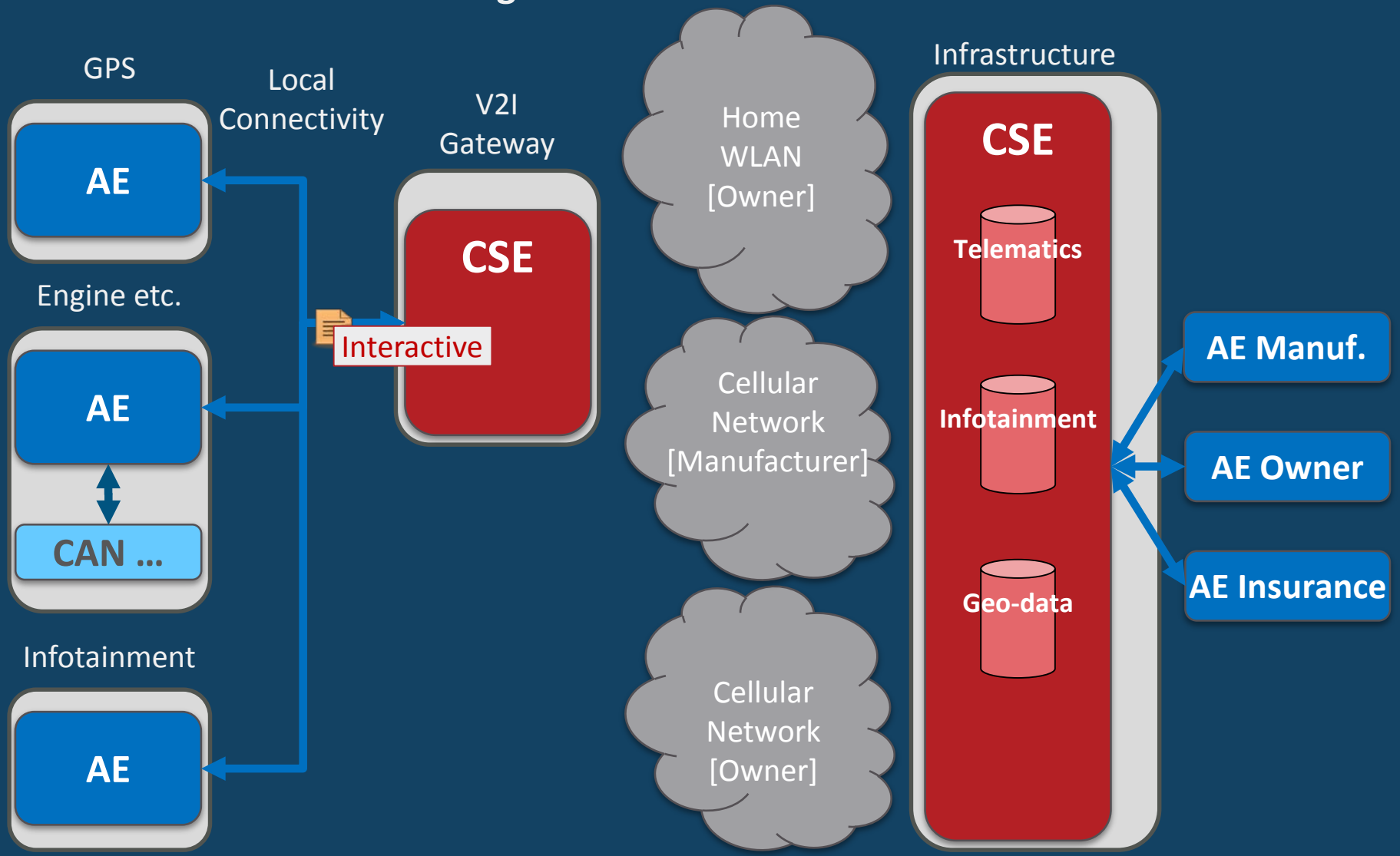
Efficient Data Sharing

On the road: Cellular Coverage



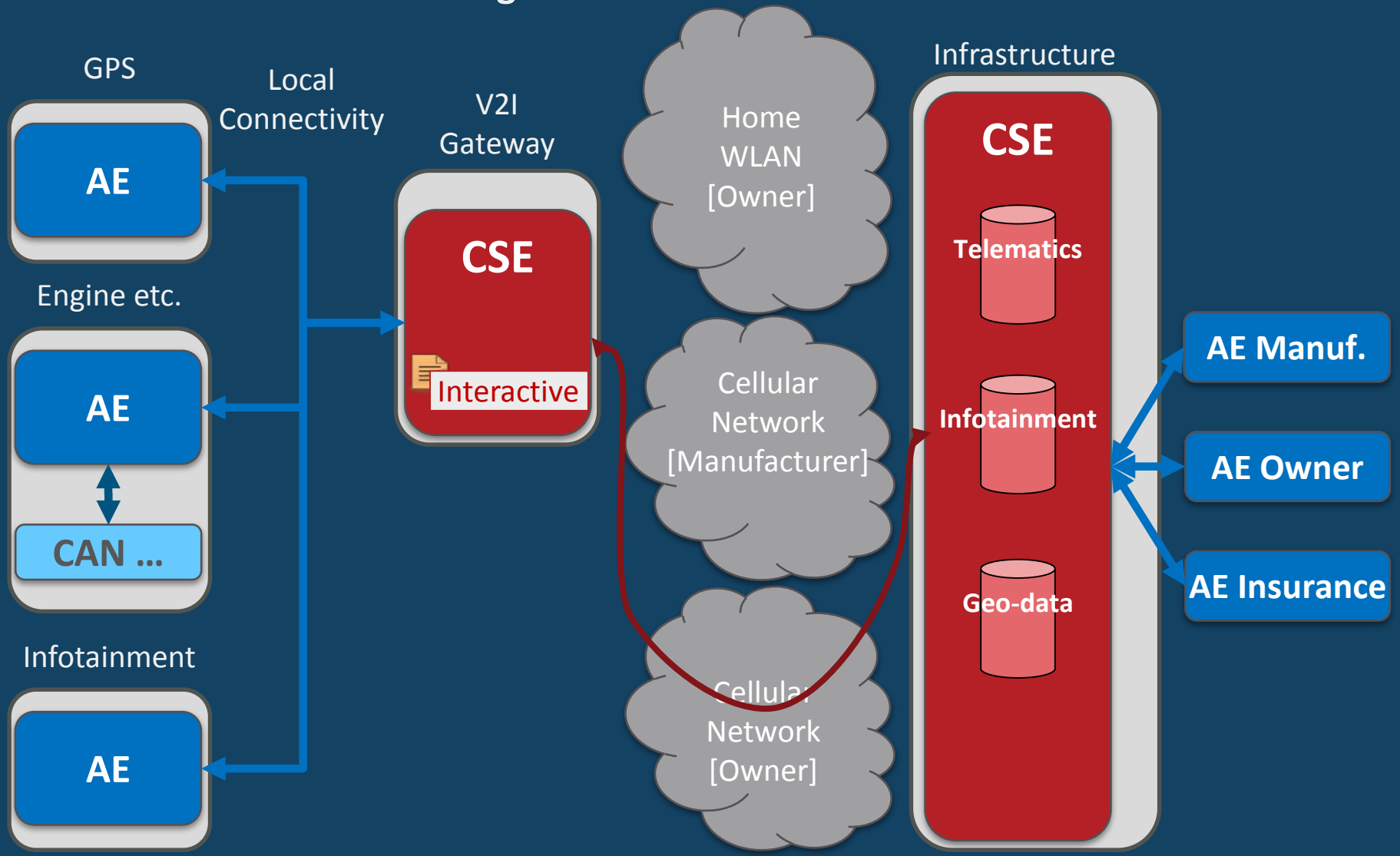
Efficient Data Sharing

On the road: Cellular Coverage



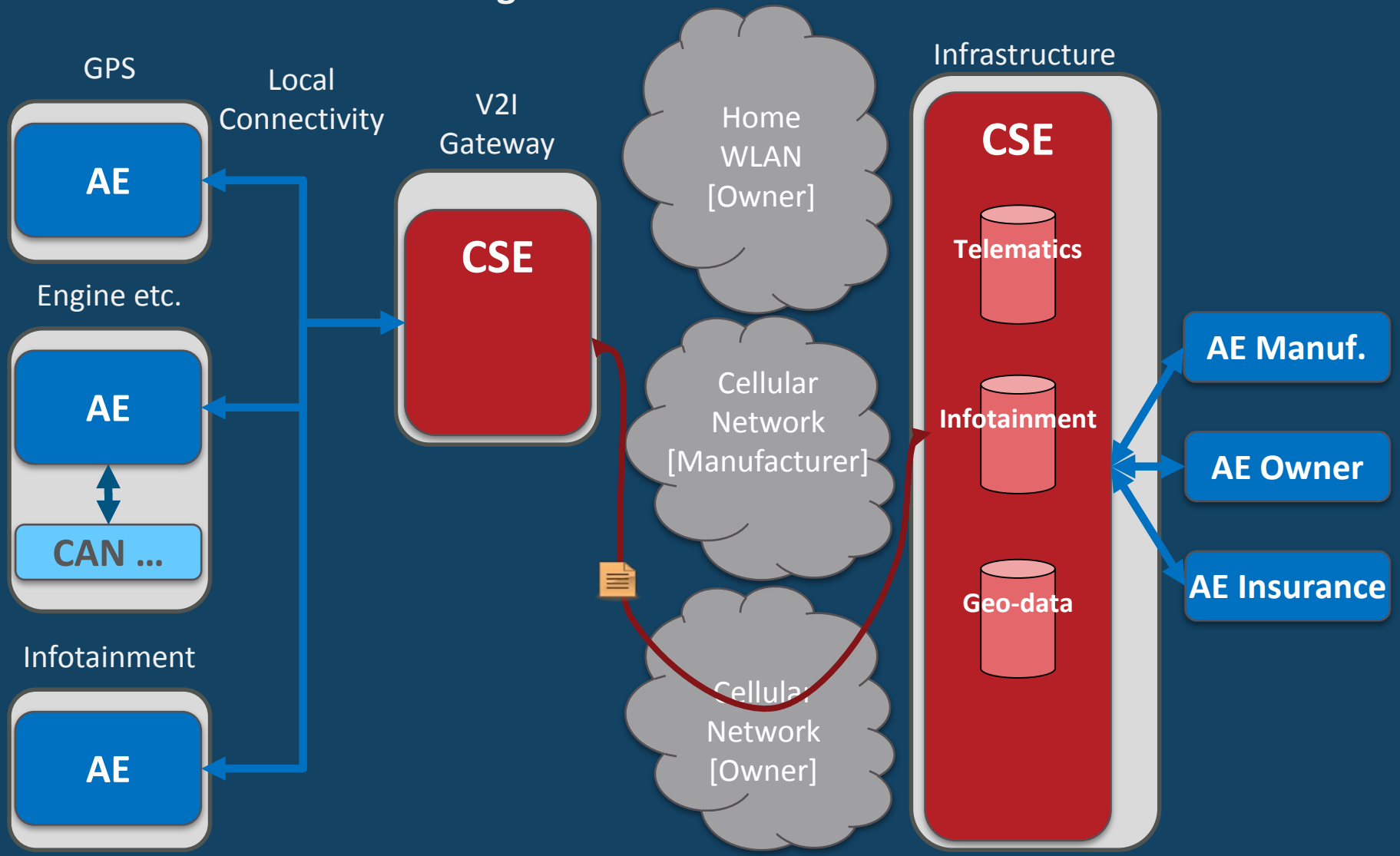
Efficient Data Sharing

On the road: Cellular Coverage



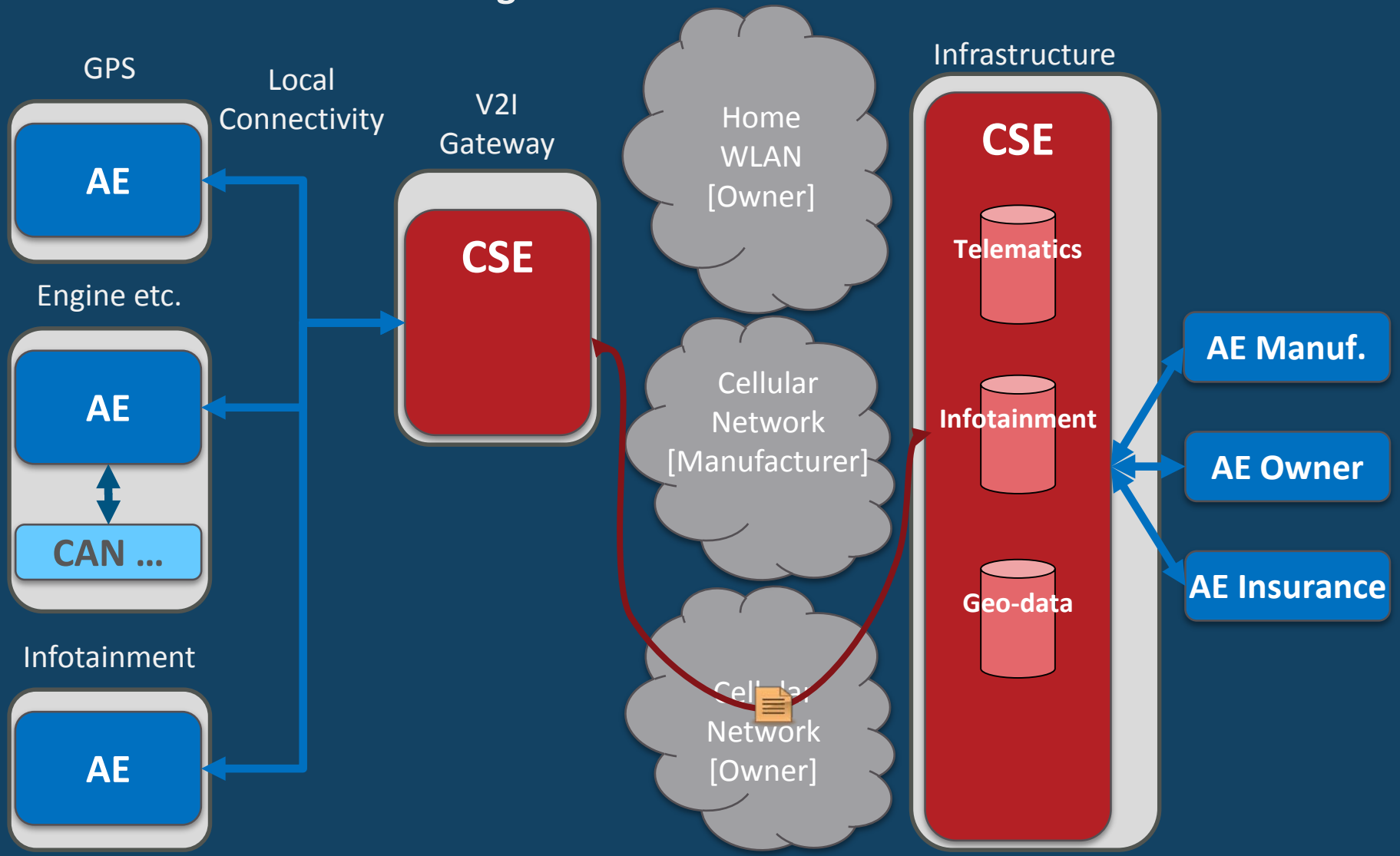
Efficient Data Sharing

On the road: Cellular Coverage



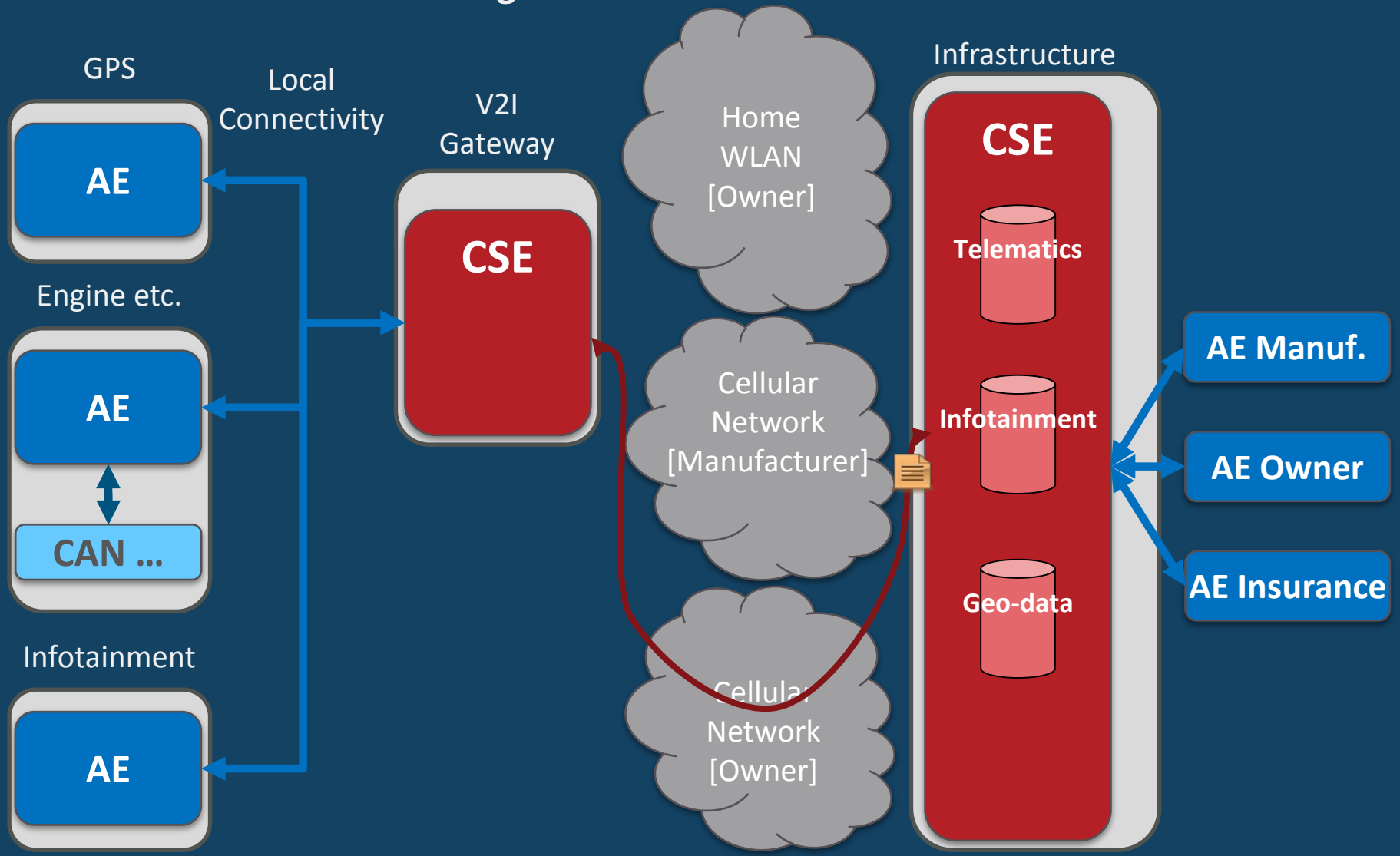
Efficient Data Sharing

On the road: Cellular Coverage



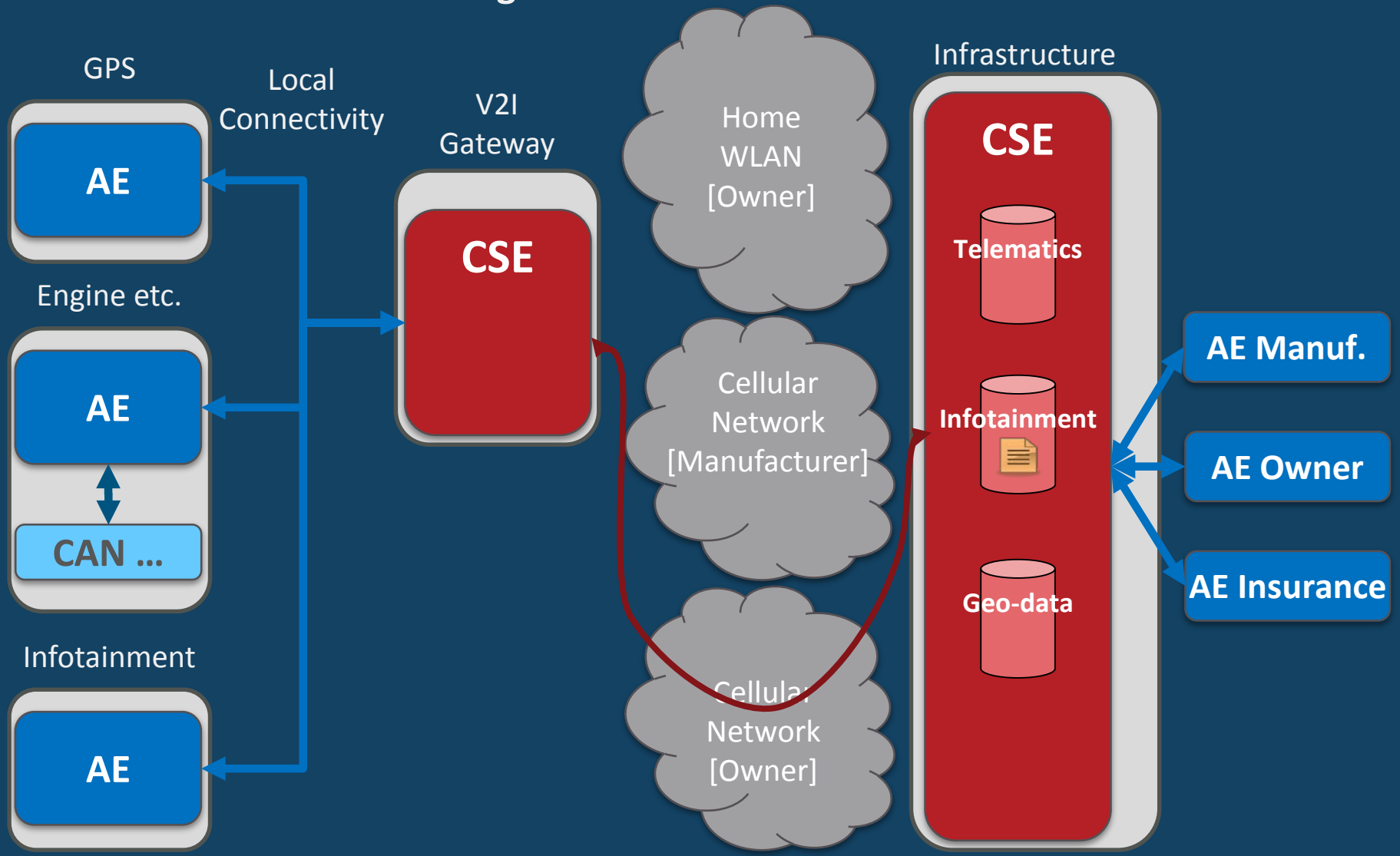
Efficient Data Sharing

On the road: Cellular Coverage



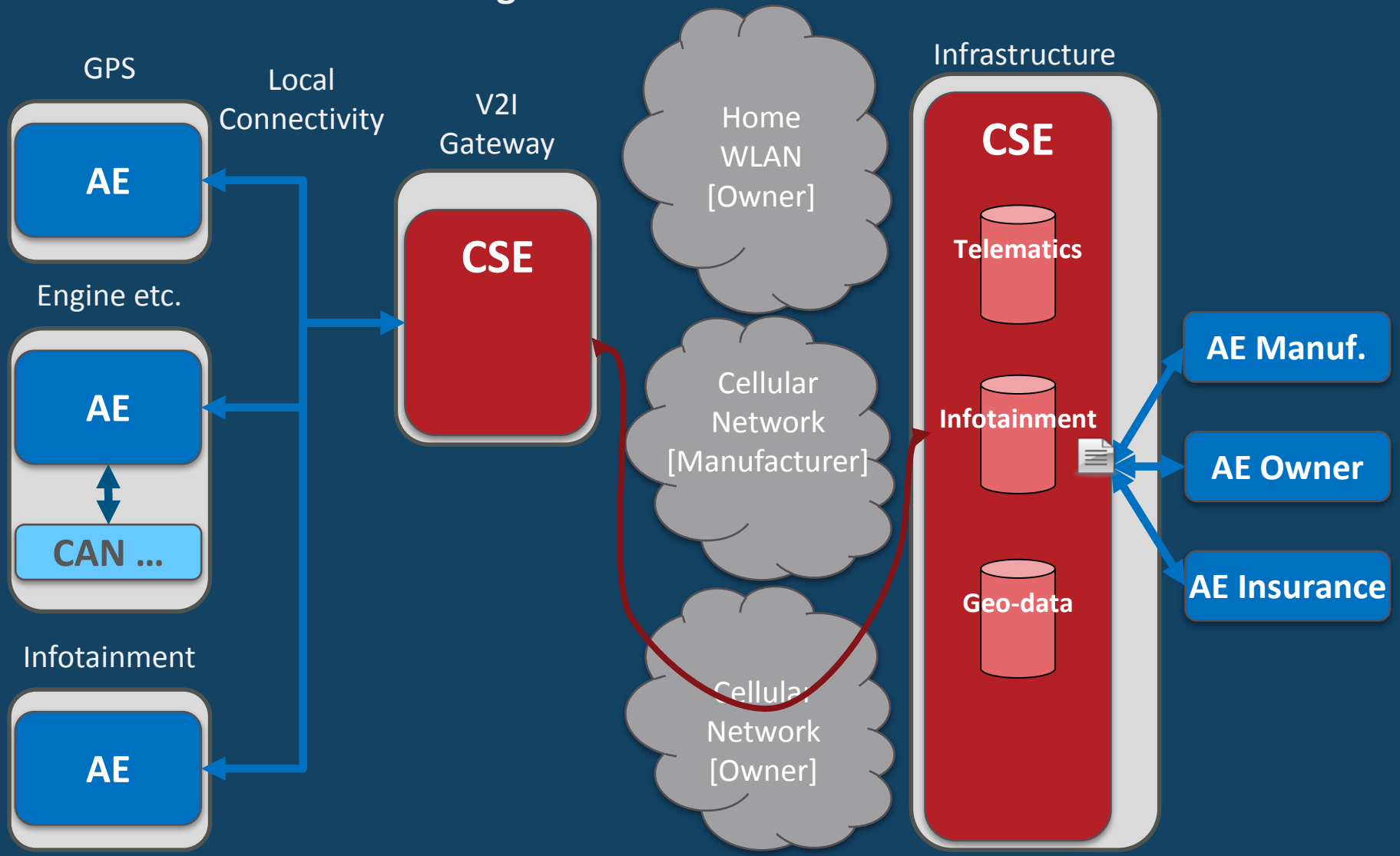
Efficient Data Sharing

On the road: Cellular Coverage



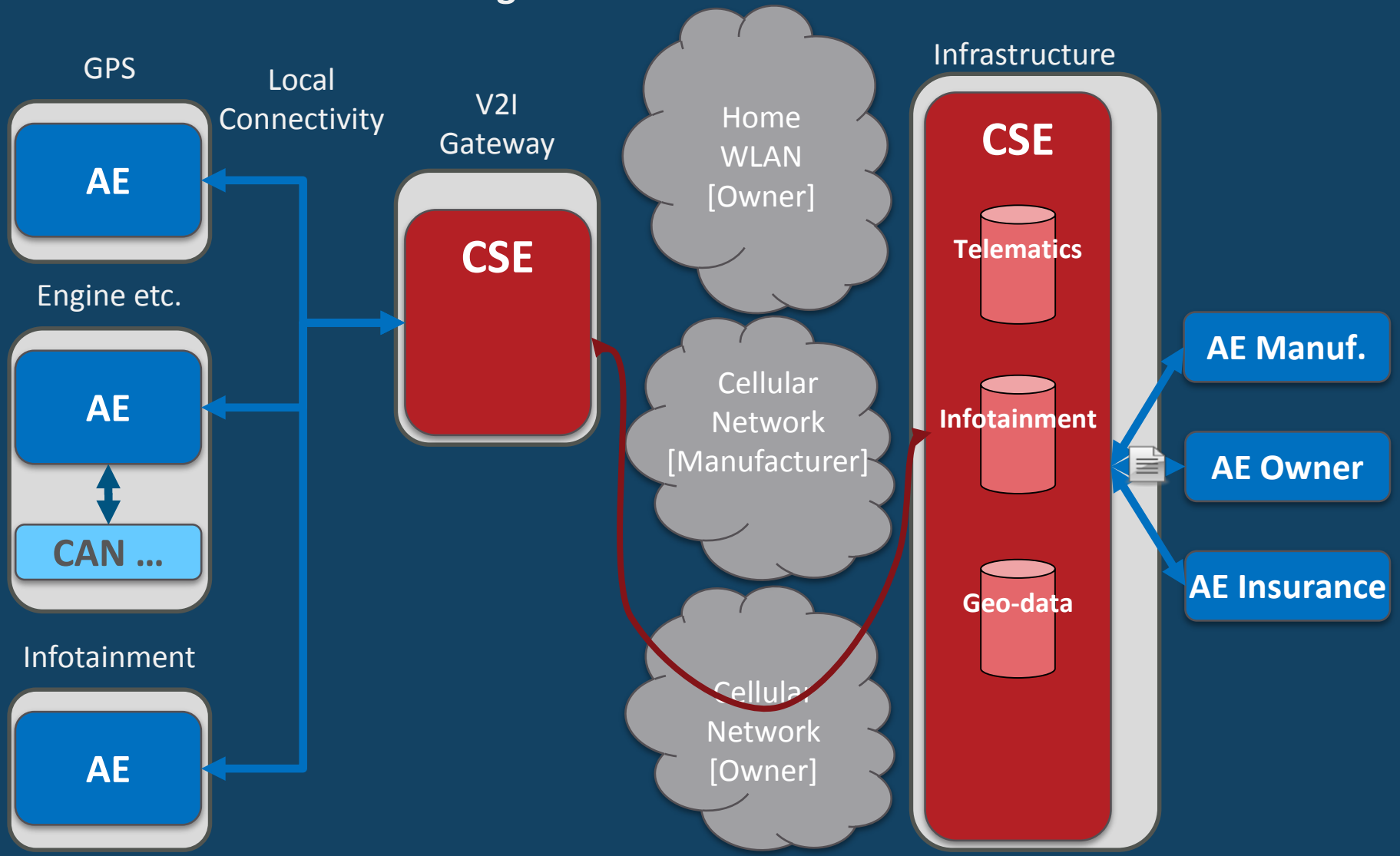
Efficient Data Sharing

On the road: Cellular Coverage



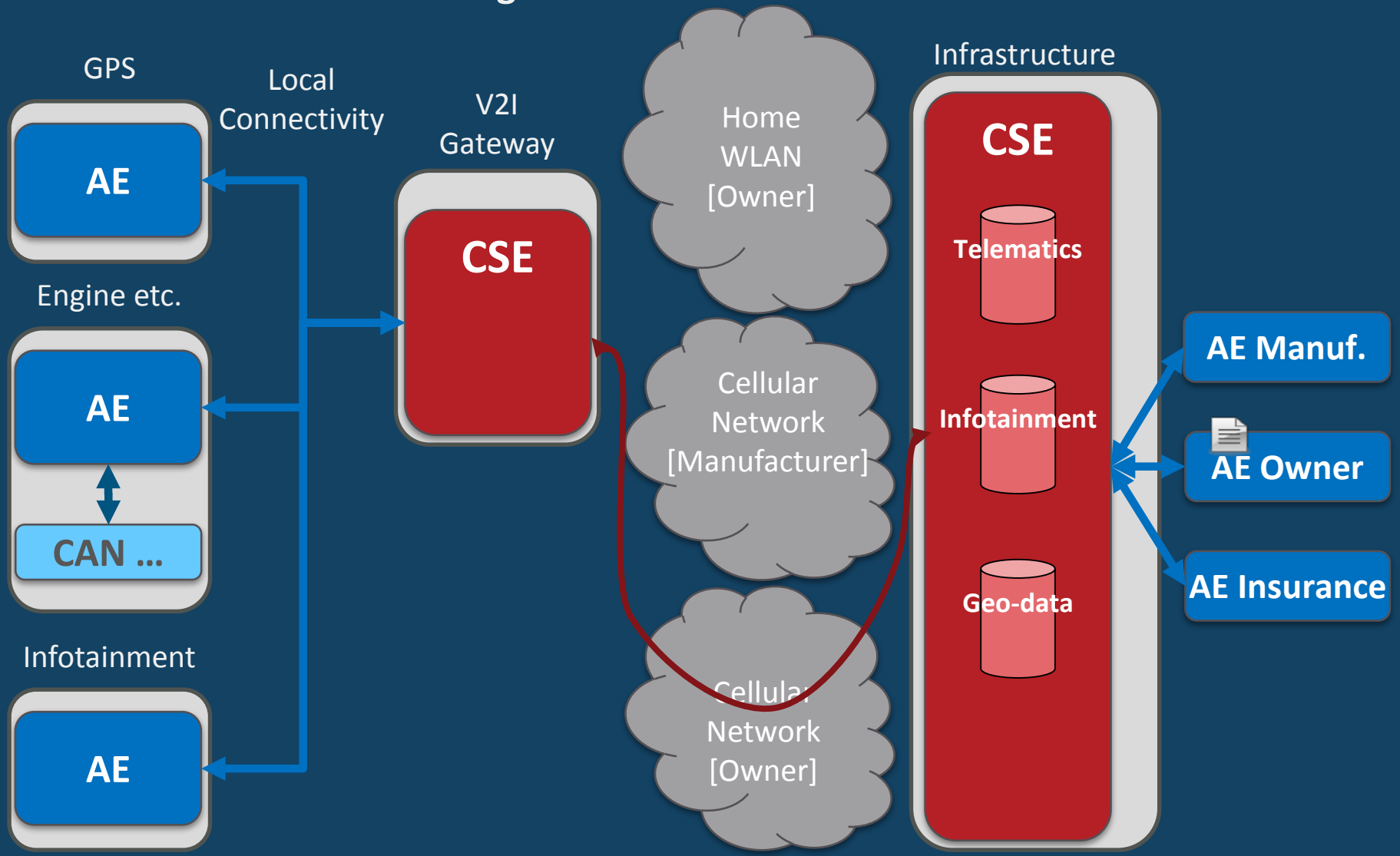
Efficient Data Sharing

On the road: Cellular Coverage



Efficient Data Sharing

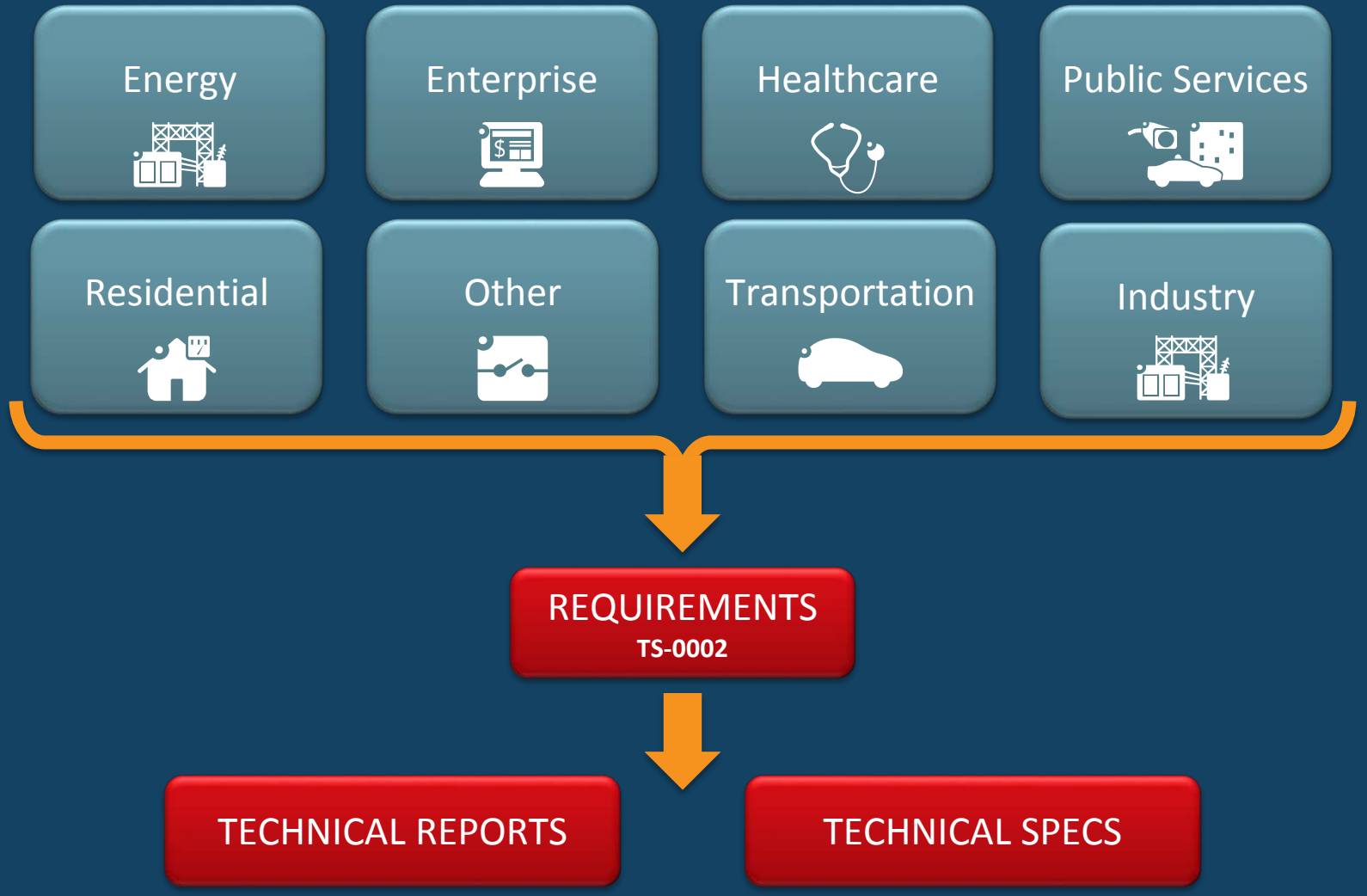
On the road: Cellular Coverage



Status Quo and Next Steps

Releases of oneM2M

Work Process



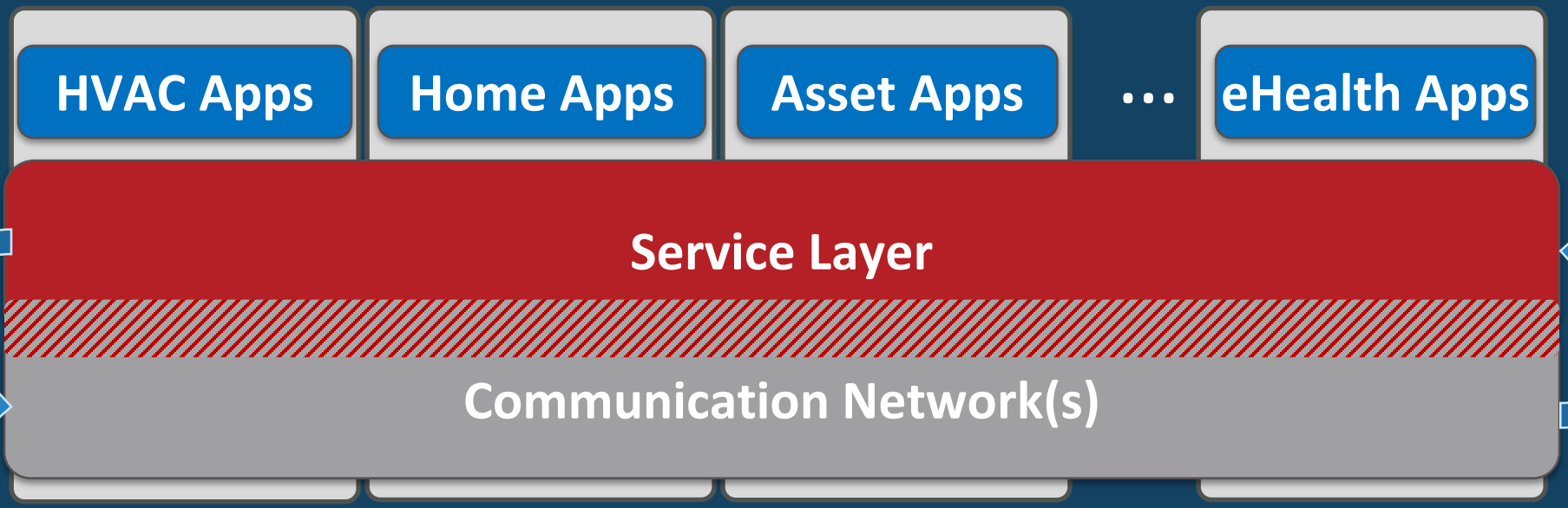
Key Features Rel-1 & 2

- Simple NW Usage, Enhanced Data Efficiency, NW Protection
  - Hides complexity of network technology from applications
  - Transport of M2M/IoE traffic gets very simple and more efficient at the same time
  - SL is in charge to enforce policies when which modem is used… not the applications
  - Capable to use MTC/M2M features of 3GPP (so far triggering, more for Rel-3)
- Reliable and Scalable Security
  - Hooks up entities using proven authentication/authorization/encryption
- Discovery & Data sharing based on Access Control
  - Share data amongst one or more stakeholders / applications
  - Possibly across different industry segments
- Device Management
  - Enable efficient management of large number of devices / nodes

Key Features Rel-1 & 2 (contd.)

- Selection of protocols: Pick what suits deployment scenario best
  - HTTP, CoAP, MQTT, Websockets
  - Serializations of data: XML, JSON, CBOR
- "Interworking Glue"
  - Proximal IoT: OCF/AllJoyn, LwM2M
  - Home Domain:
    Information models to bridge different eco systems
    Abstracting out specifics of Proximal IoT technology
    Alignment with OCF progressing
  - Industrial Domain:
    Some features in Rel-2 (time series)
    More to come in Rel-3 (OPC UA, DDS, Modbus)

Outlook Rel-3: 3GPP Interworking



Use MTC features of 3GPP Communication Network:

- Control features based on available meta information
- E.g. Power Saving Mode, Traffic Patterns
- Dynamically switch modes of operation / parameters

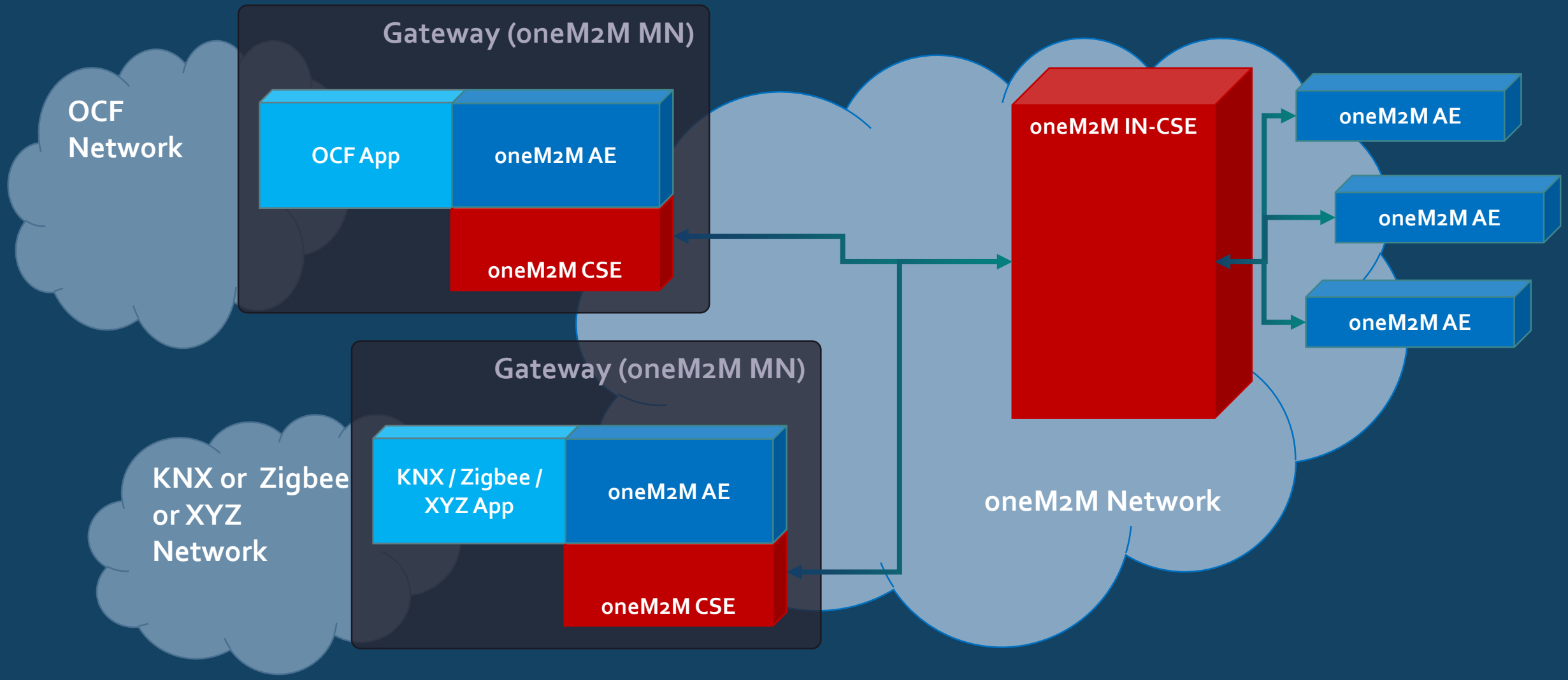
Provide information to oneM2M SL:

- Meta information for better scheduling
- Schedules of allowed network usage
- Information on location, loss of connectivity etc.

Appropriate interfaces of 3GPP (SCEF) being integrated with oneM2M provides efficiency & scalability enhancements

Outlook Rel-3: Proximal IoT Interworking

Other Technologies connected via oneM2M Entities & Ressource



Release 3 Highlights

- 3GPP Interworking
  - Tight integration with 3GPP features for MTC / NB-IoT (long sleep cycles etc.)
  - Usage of functions exposed by 3GPP via SCEF (Developer does not need to know)
  - Goal: Increase efficiency, lower power consumption, protect network, control traffic
- Proximal IoT Interworking
  - Generic scheme for "bridging" between oneM2M and other technologies
  - Improvement of existing OCF/AllJoyn/LwM2M interworking, addition of OSGi / W3C
  - Seamless functionality across border of Proximal IoT (Abstraction)
- Industrial Interworking
  - New "bridging" specifications for Modbus/DDS/OPC-UA
  - Relationship with IIC

Collaborations

Sharing/Reference (Liaison, workshop, …)

Interworking

Endorsement (adoption)

Partnership

Implementations

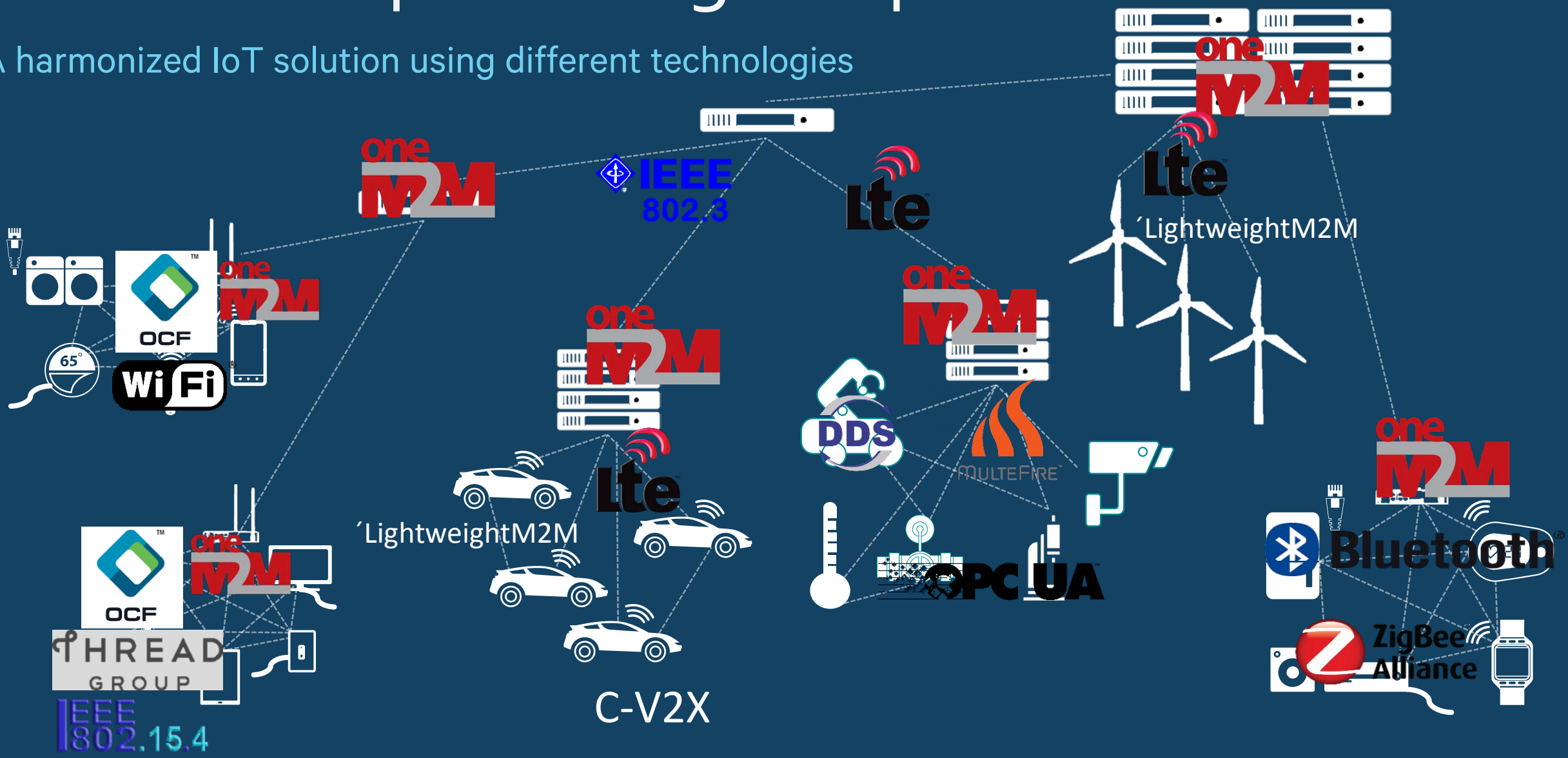
Industry-driven Open source implementations

Announcements, Demos, Commercial implementations

4 interop. events so far

oneM2M capable to glue “proximal” IoT

A harmonized IoT solution using different technologies



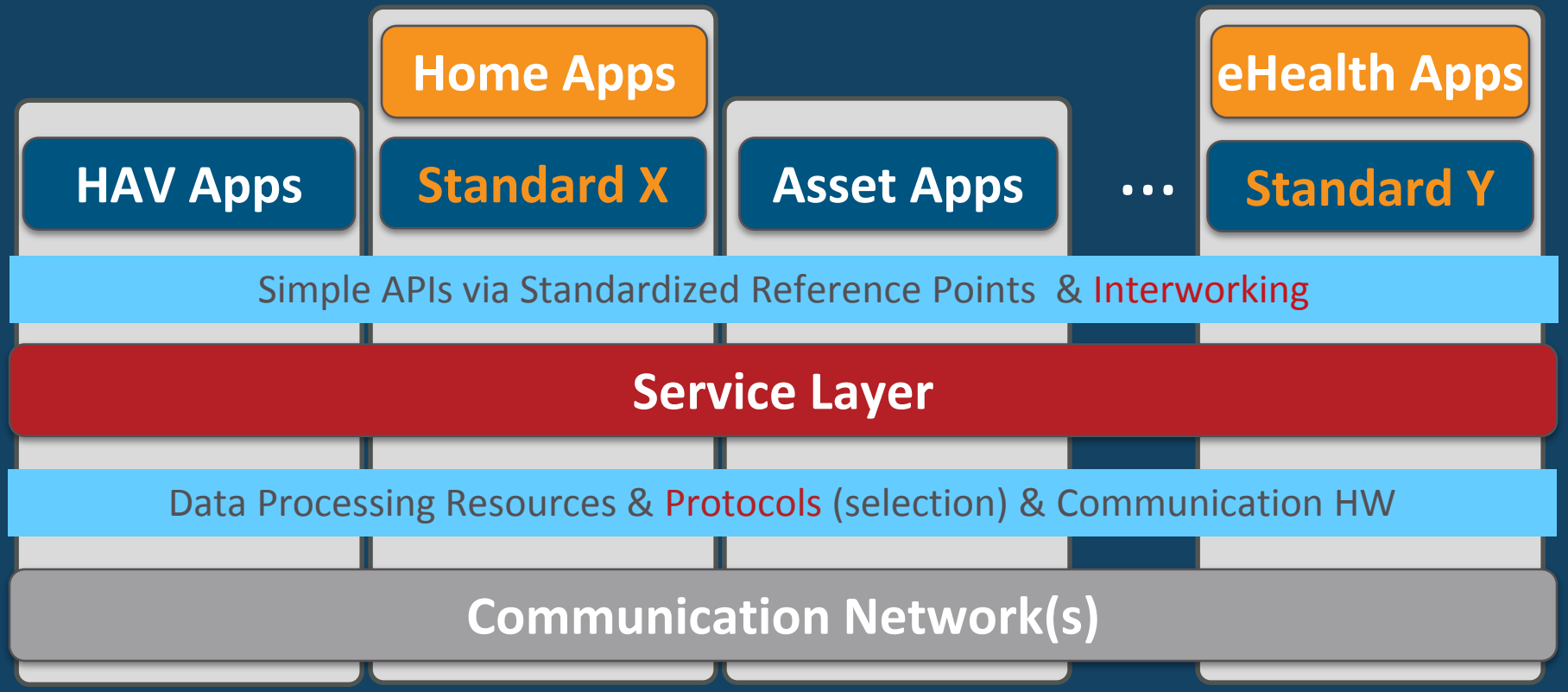
What's Next?

- Several IoT technologies are
  COMPLEMENTARY
  and
  not COMPETING
- Need to explain that and get a joint messaging out
- Intensify work with collaborating orgs to show synergies
- Remainder of this day is dedicated to that

Thank You!

Backup

Interworking



Impact:
Efficiency / Aggregation ↑
NW Protection ↑
Cost ↓
Fragmentation ↓
New Opportunities ↑

CAPEX Impact

Application Development

Simple APIs

e.g. Library

General Purpose Volume ↑

e.g. Modules or Gateways

Unified Platform

Server

Developer:

- CSE functions ready to use
- No module/network expert needed
- App development independent of underlying transport
- Standard message exchanges
- Focus on use case logic
- Faster development process

Service Deployment

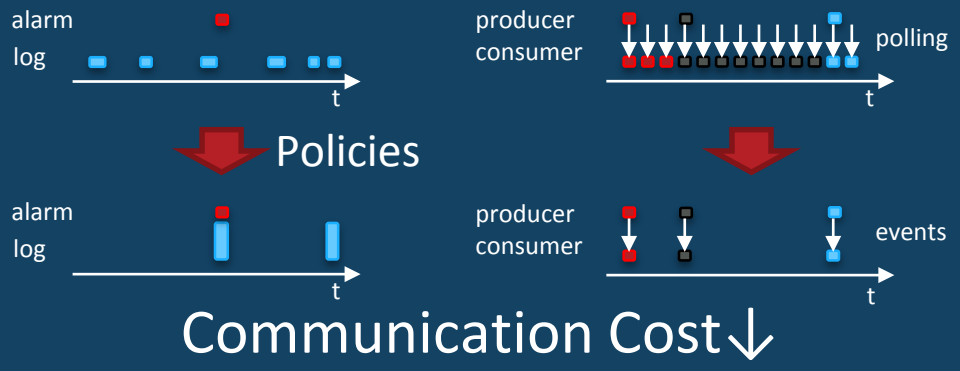
M2M/IoT Service Provider

- Only one platform
- Serves commonly needed functions to different use cases and applications
- Shared infrastructure & core service across different customers / verticals

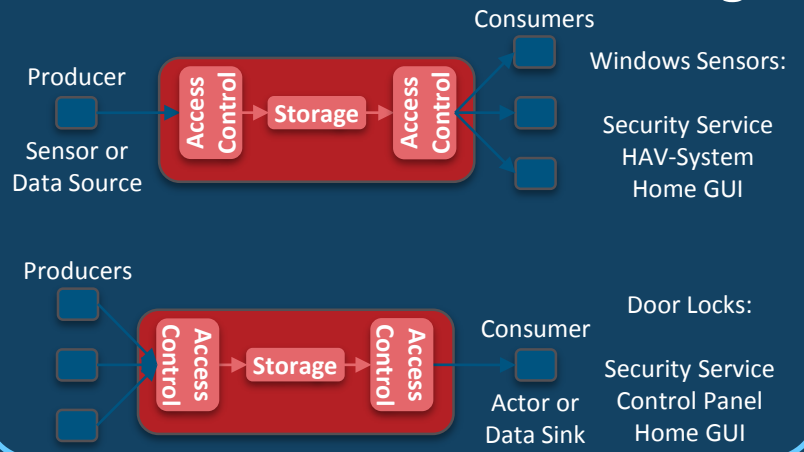
Lower CAPEX

OPEX Impact

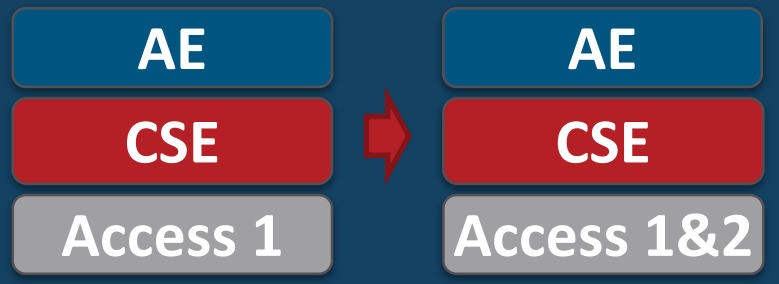
NW Efficiency & Protection



Sensor/Actor/Data Sharing



Certification: Flexible Choices



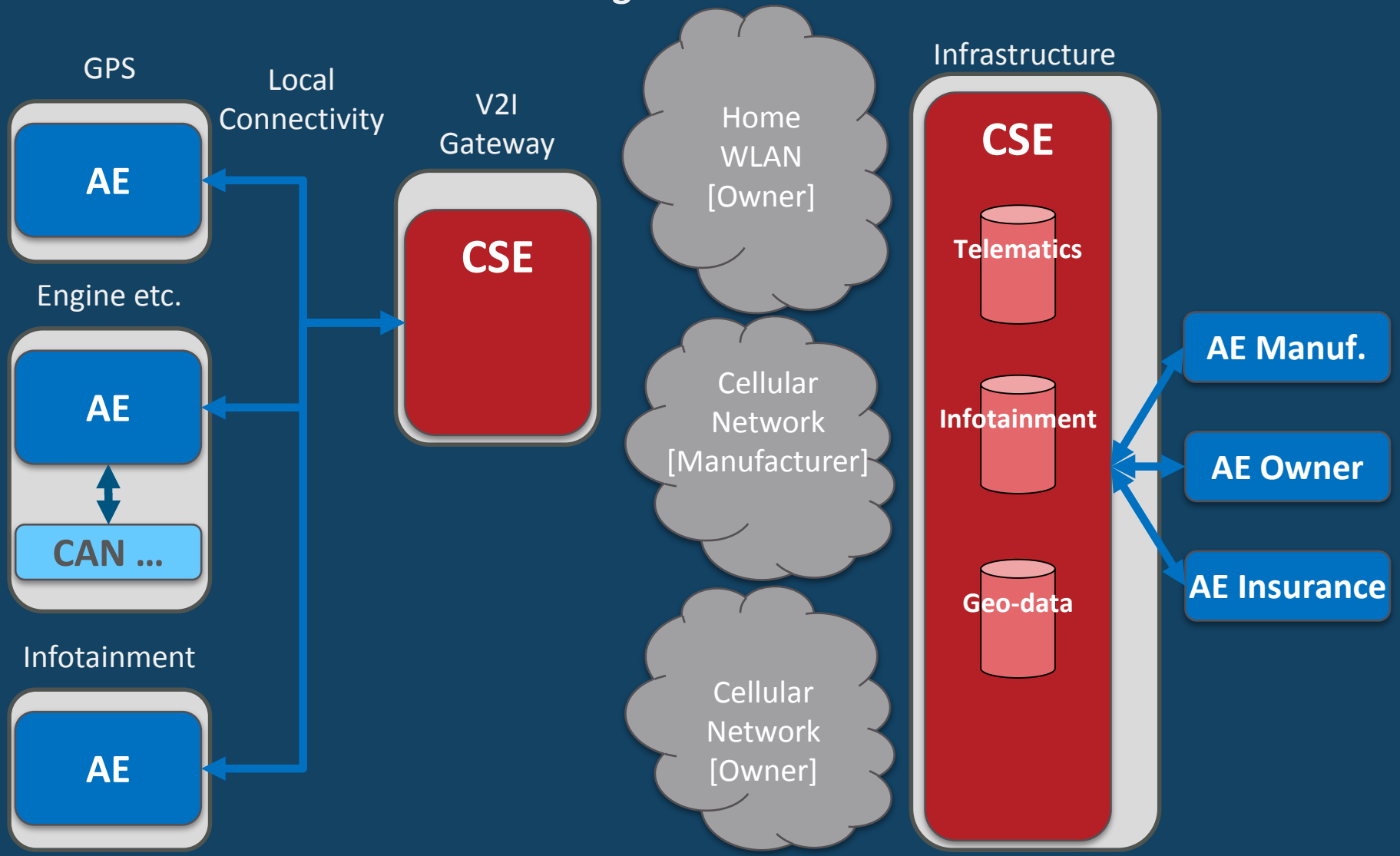
Lower OPEX

Single Platform

- Minimize maintenance expenses
- Shared infrastructure
- Scalable to volume/processing needed

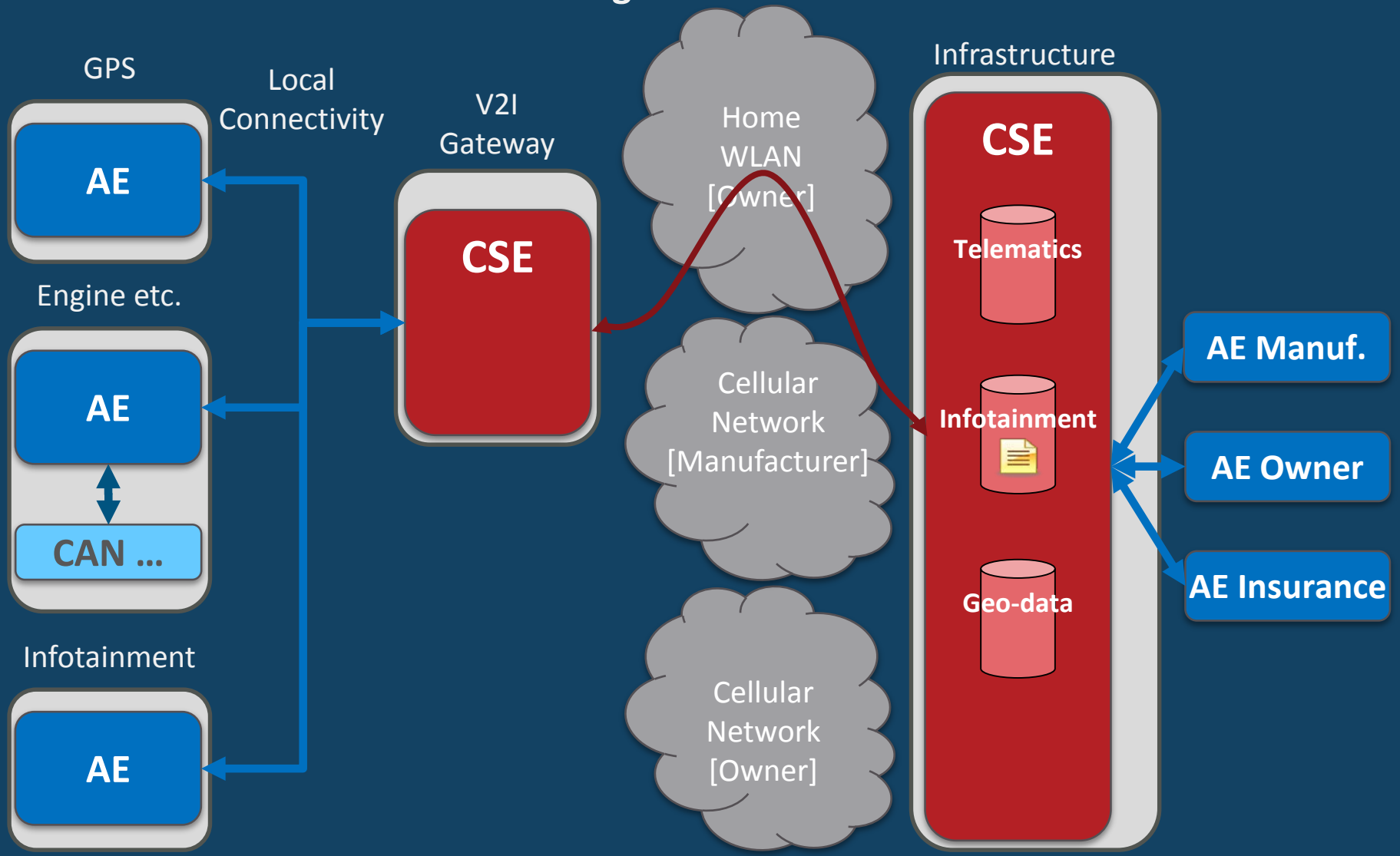
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



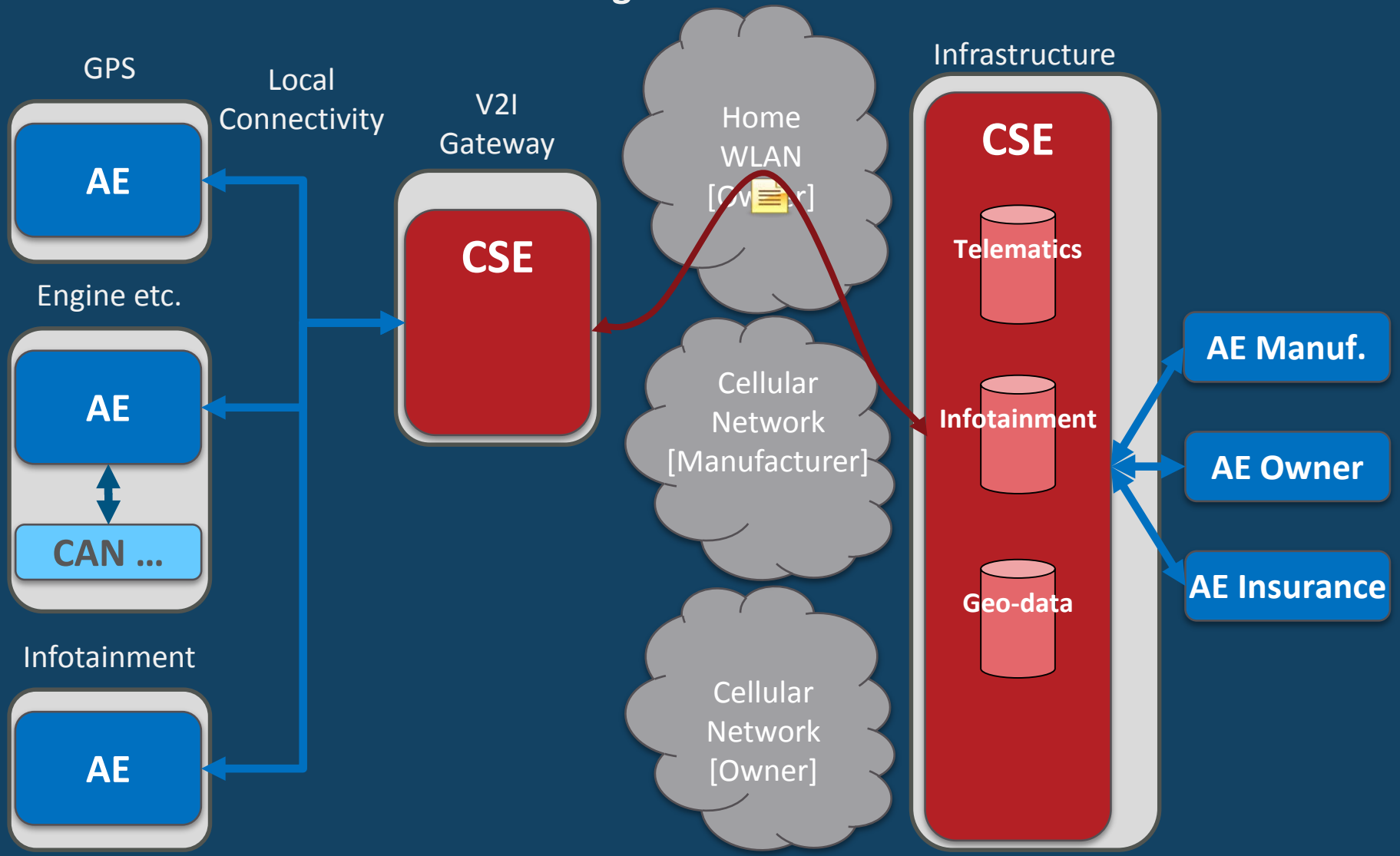
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



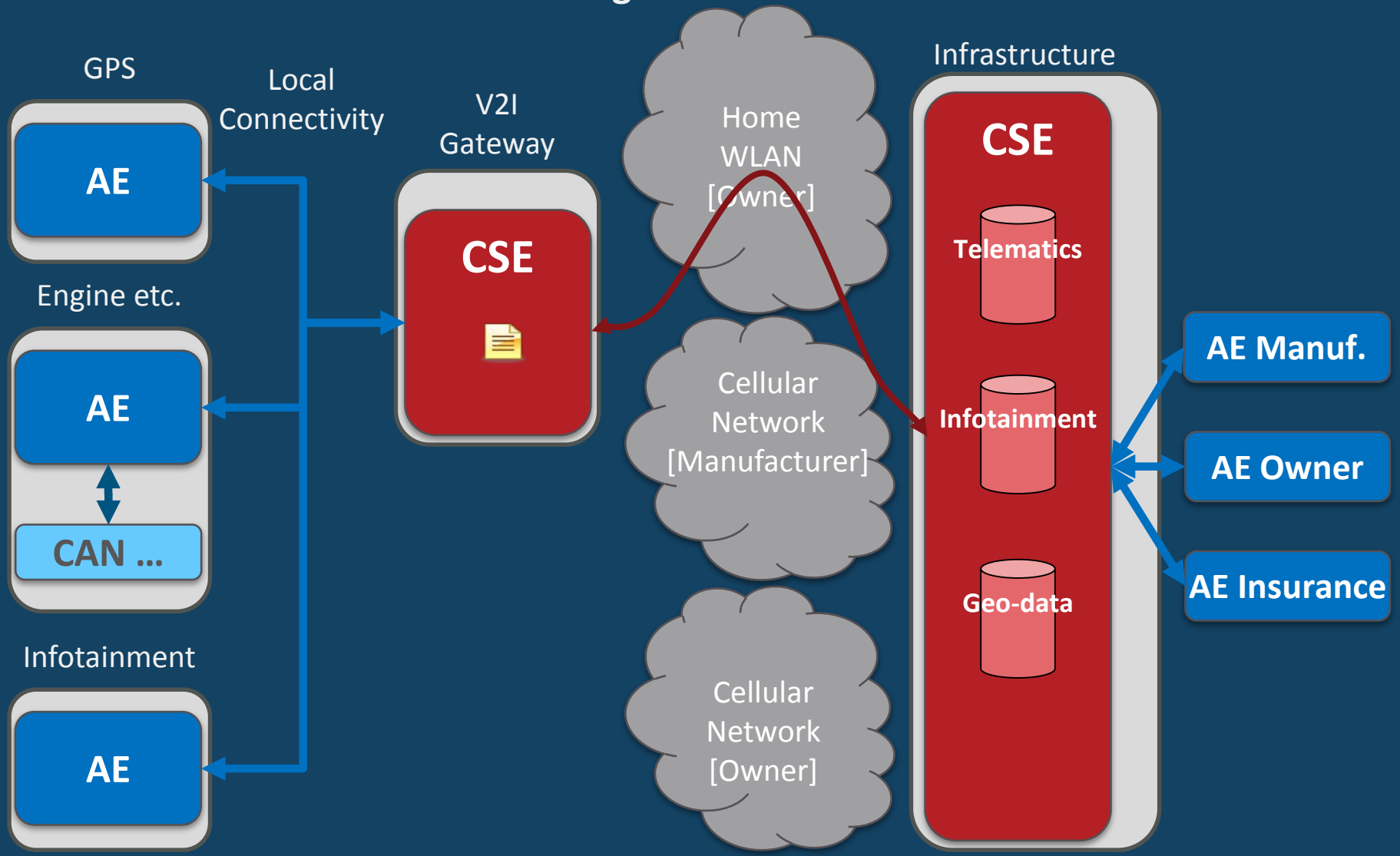
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



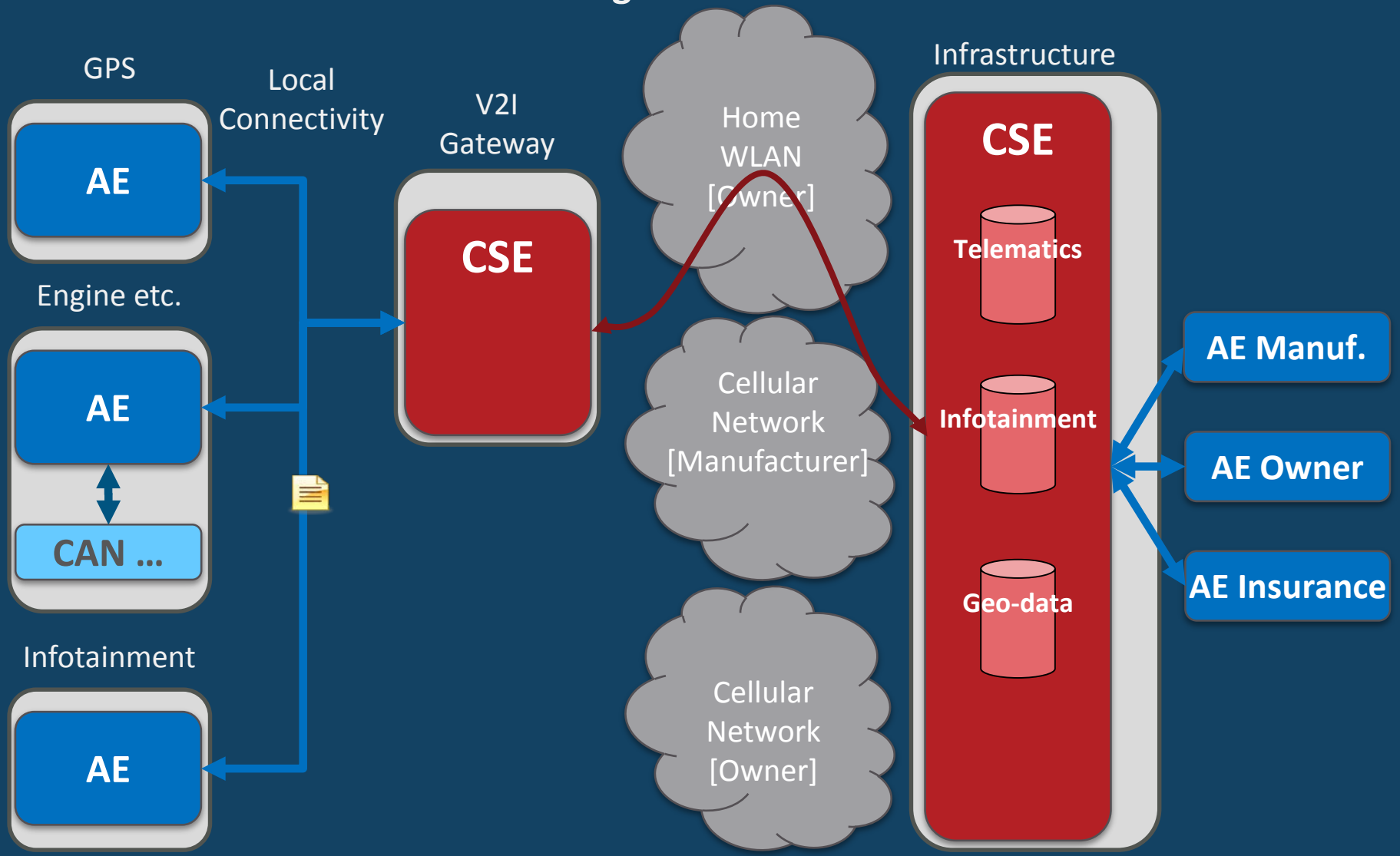
Efficient Data Sharing

At Home: In Owner's WLAN Coverage



Efficient Data Sharing

At Home: In Owner's WLAN Coverage



Efficient Data Sharing

At Home: In Owner's WLAN Coverage