

Dr. Ryokichi Onishi & Kiichi Iwasaki

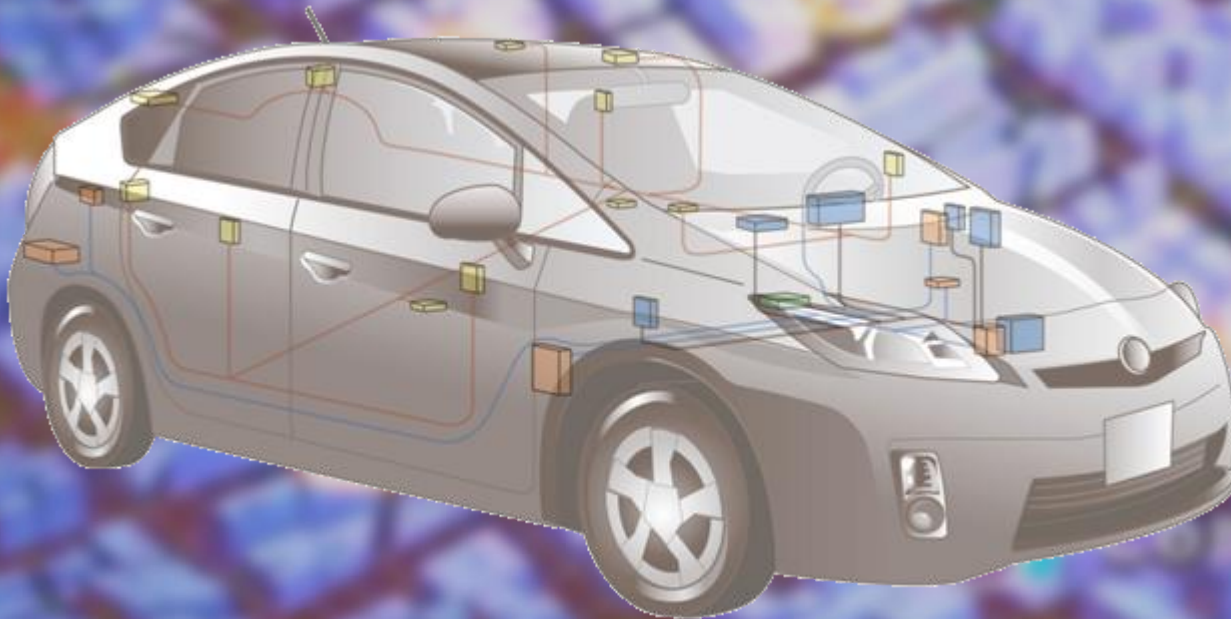
Group Leader / Project Manager

Toyota

TOYOTA

Automotive Edge Computing

Use Case and Requirement



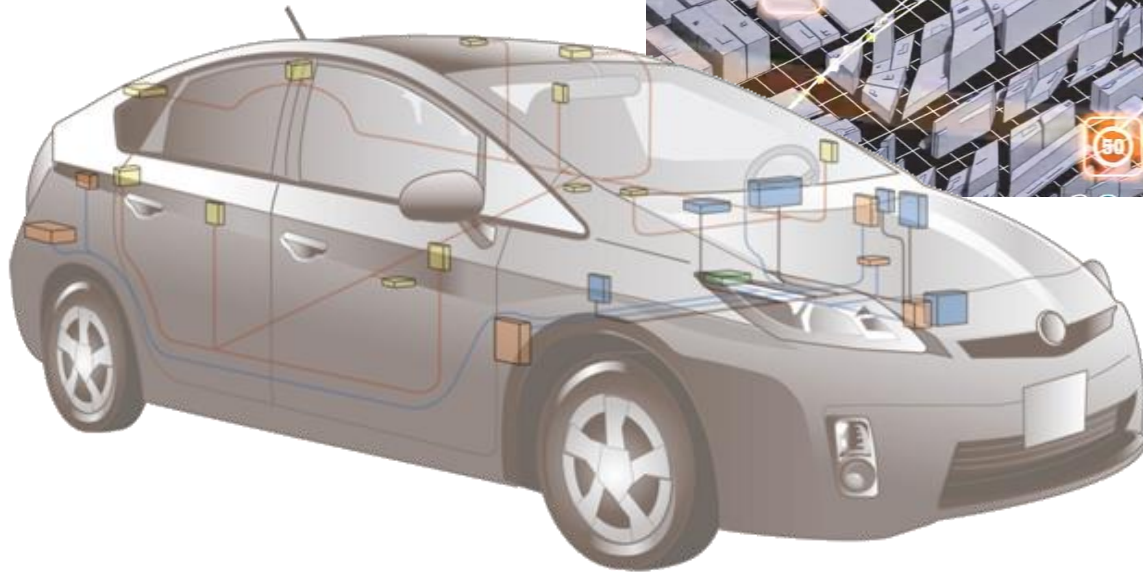
Kiichi Iwasaki
Ryokichi Onishi

Global Impact around 2025

TOYOTA

3

1EB
~10EB/mo.
Communication



100M units
Connected car

- Vision Connected Intelligence
- Issue Capacity and Scalability
- Solution Edge Computing
- Approach Community Basis

- Vision Connected Intelligence
- Issue Capacity and Scalability
- Solution Edge Computing
- Approach Community Basis

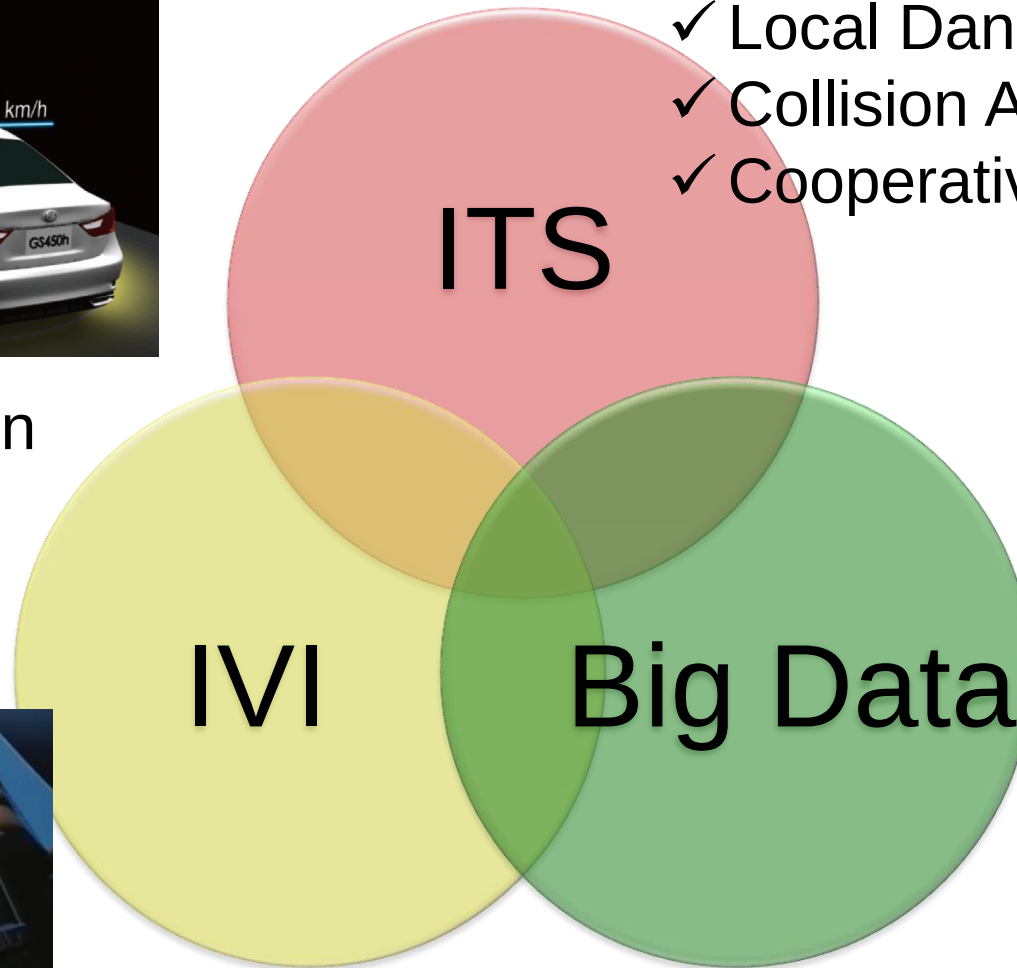
Connected Intelligence

TOYOTA

6



- ✓ Navigation
- ✓ Audio/TV
- ✓ Phone
- ✓ Internet



- ✓ Local Danger Warning
- ✓ Collision Avoidance
- ✓ Cooperative Adaptive Cruise Control

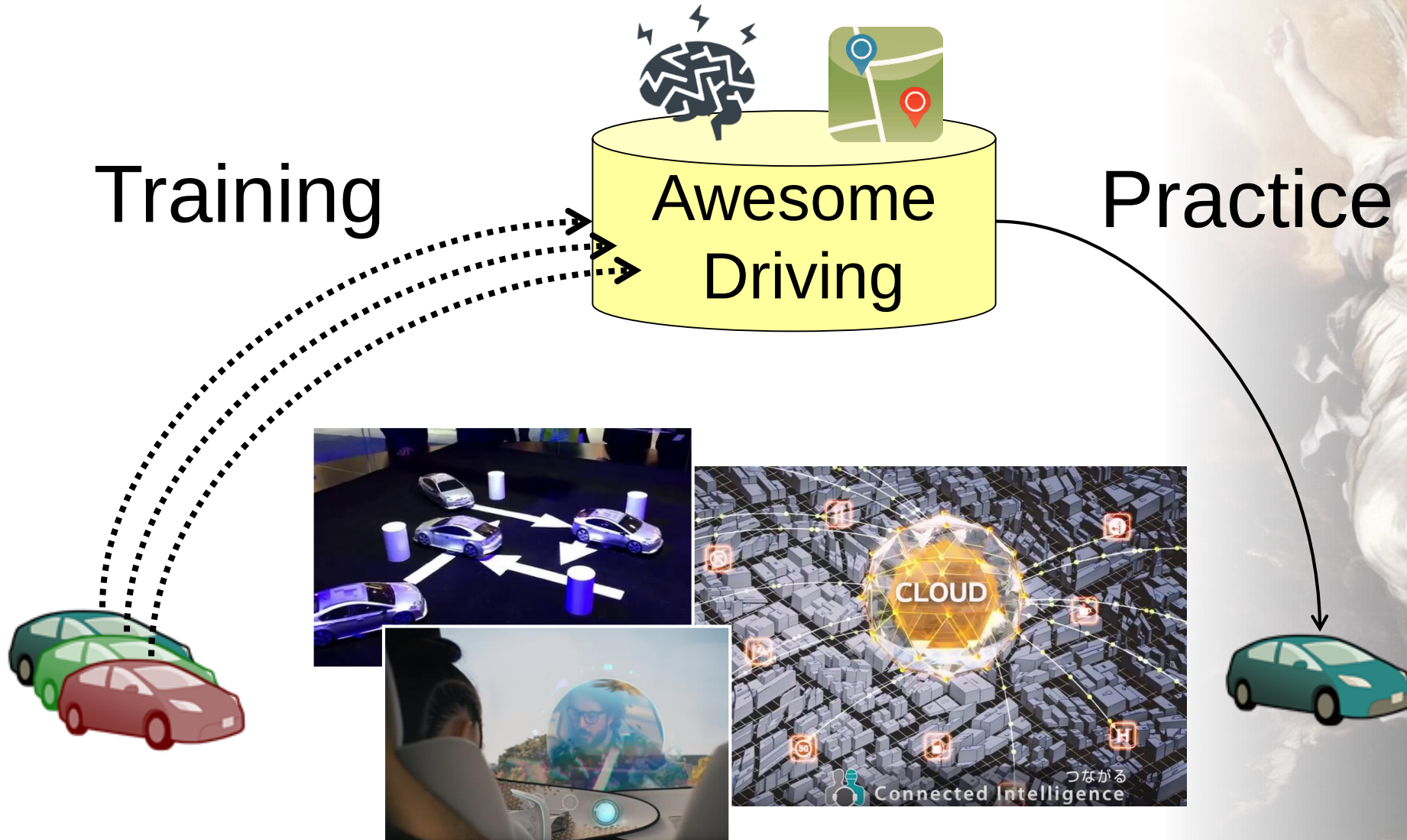


- ✓ Location Based Service
- ✓ Vehicle Quality Control
- ✓ High Definition Map
- ✓ Machine Learning

Machine Learning (Intelligent Driving)

TOYOTA

7

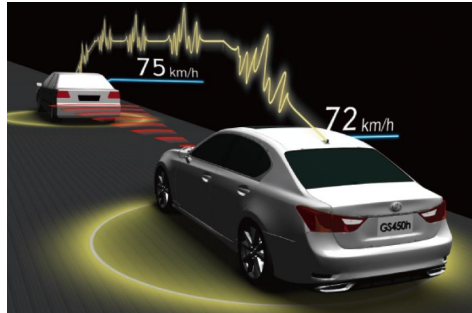


- Vision Connected Intelligence
- Issue Capacity and Scalability
- Solution Edge Computing
- Approach Community Basis

Diverse Requirements

TOYOTA

9



Safety

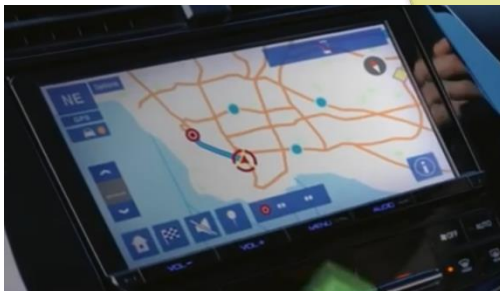
ITS

- P2P (sidelink)
 - Low latency
 - High reachability
- ☞ DSRC / Cellular V2X

Scope

User Experience

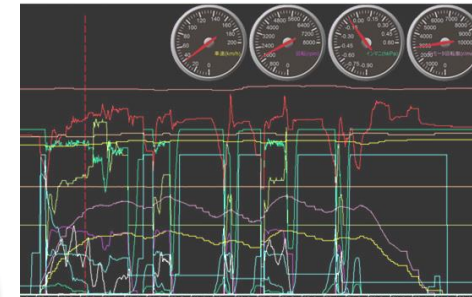
- Cloud (downlink)
 - High interactivity
- ☞ Cellular



IVI

Capacity

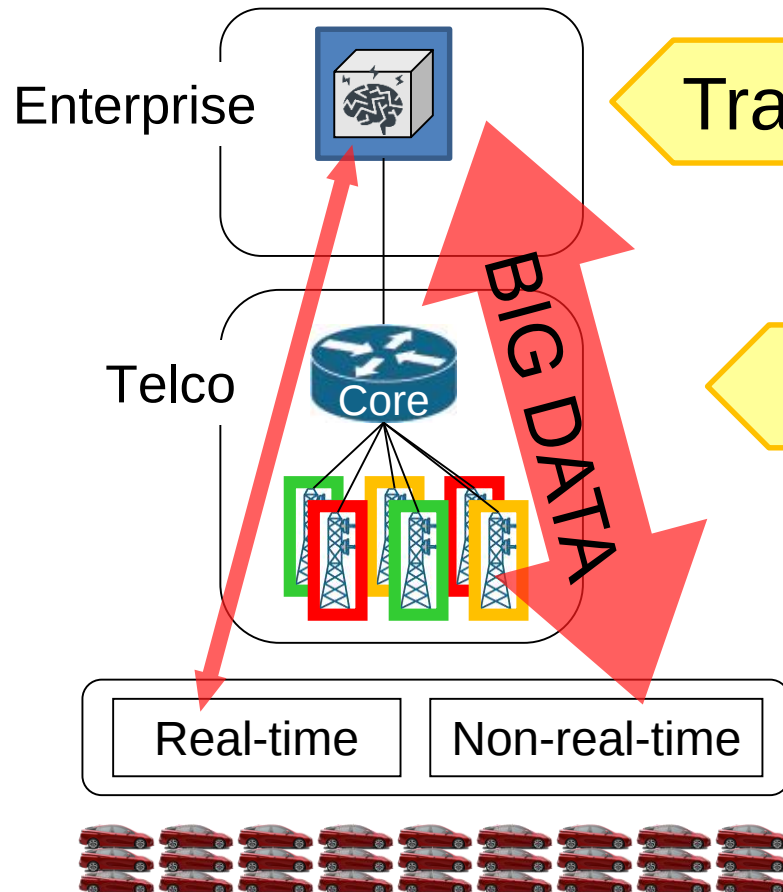
Big Data



- Cloud (uplink)
- Big data capacity
- Leverage of latency allowance

☞ WLAN and Cellular

■ Regional business forecast around 2025



Transaction: 30~300PB/month

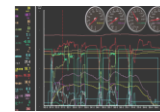
1 month
~ 1 year

Just for storing data
Assumption: 10GB/sec

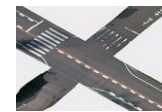
Traffic: 10~100GB /(month*unit)



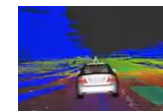
LBS



FOT



HD MAP



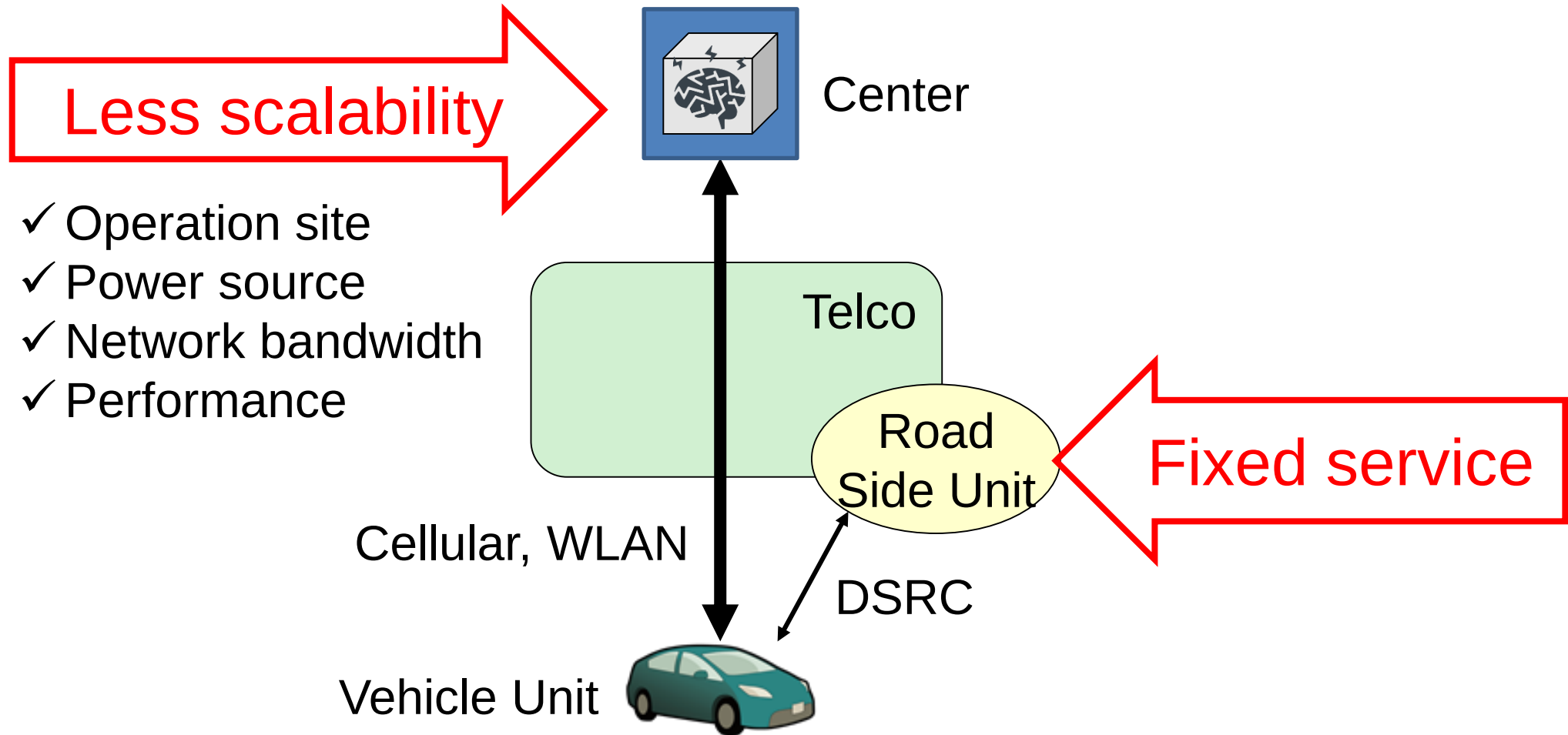
Situation



Emotion

Connected car: 3M units*

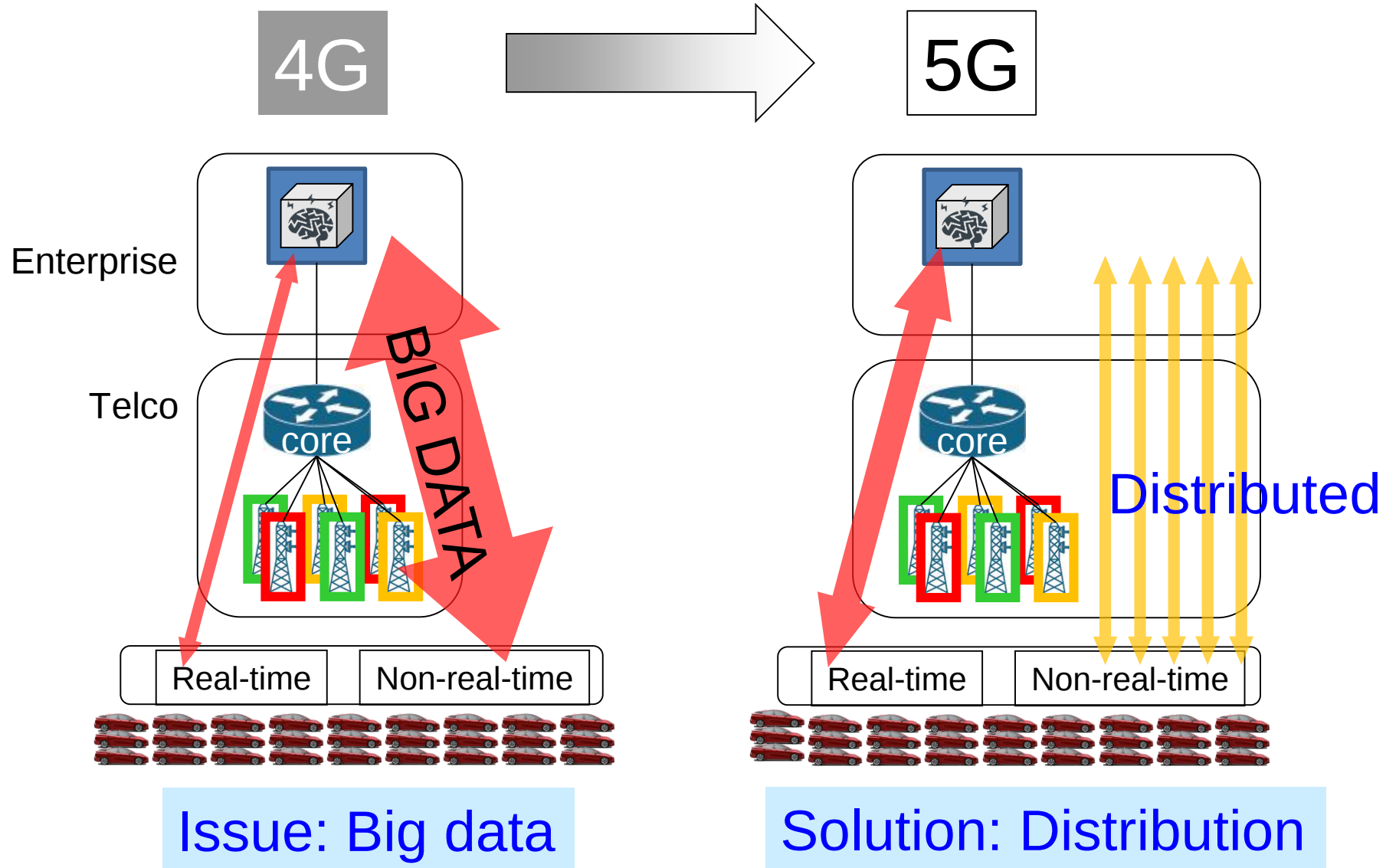
* Assuming 12% global share and 25% regional ratio



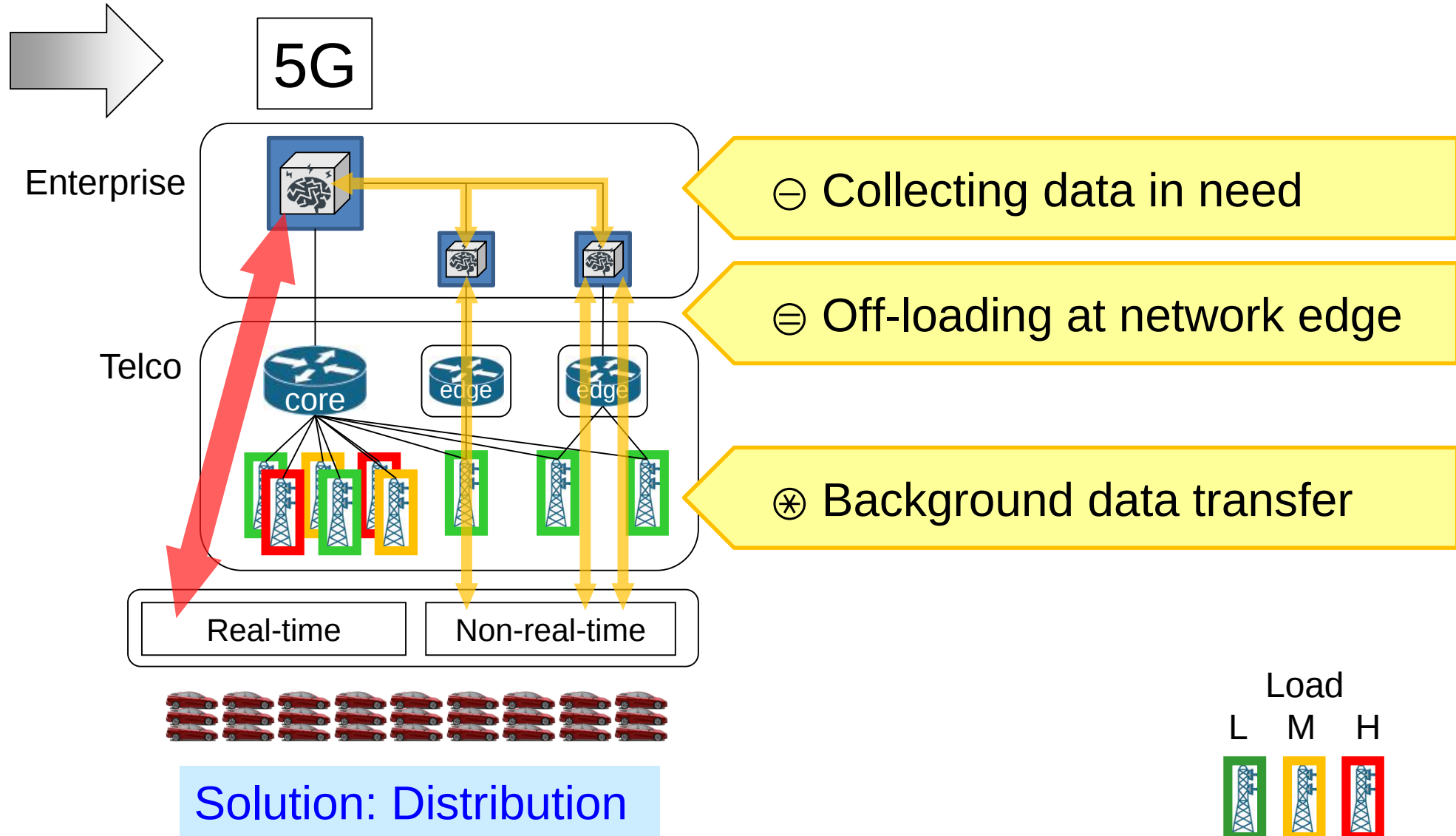
Difficult to introduce emerging services

- Vision Connected Intelligence
- Issue Capacity and Scalability
- Solution Edge Computing
- Approach Community Basis

Potential Solution

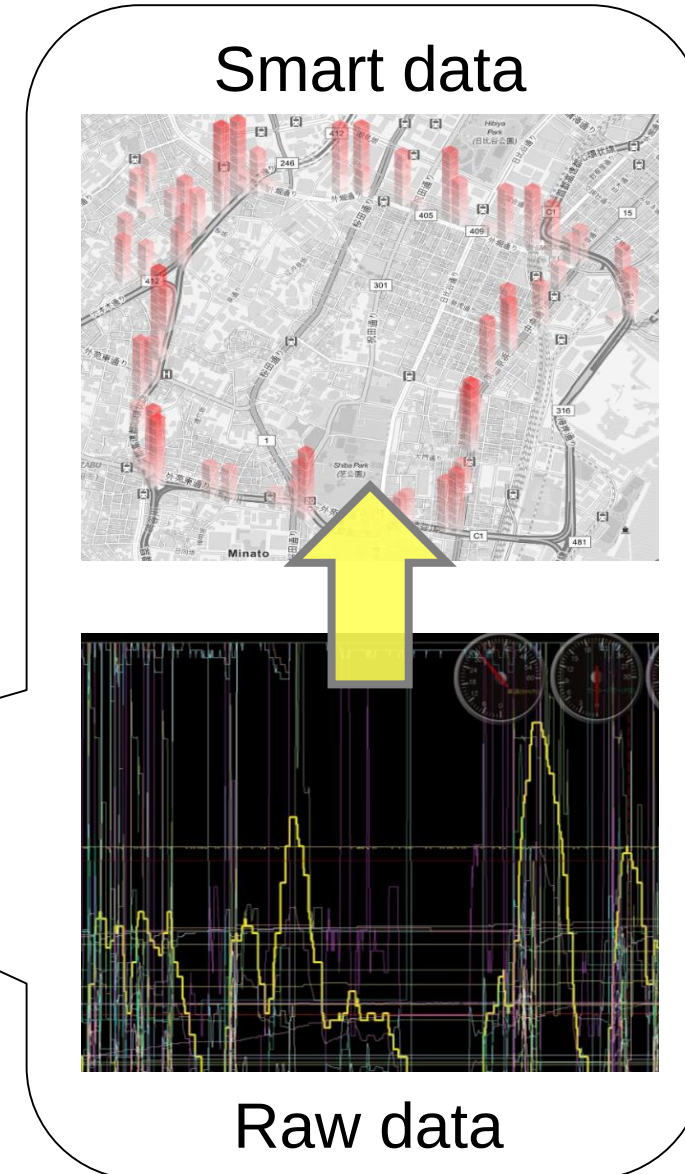
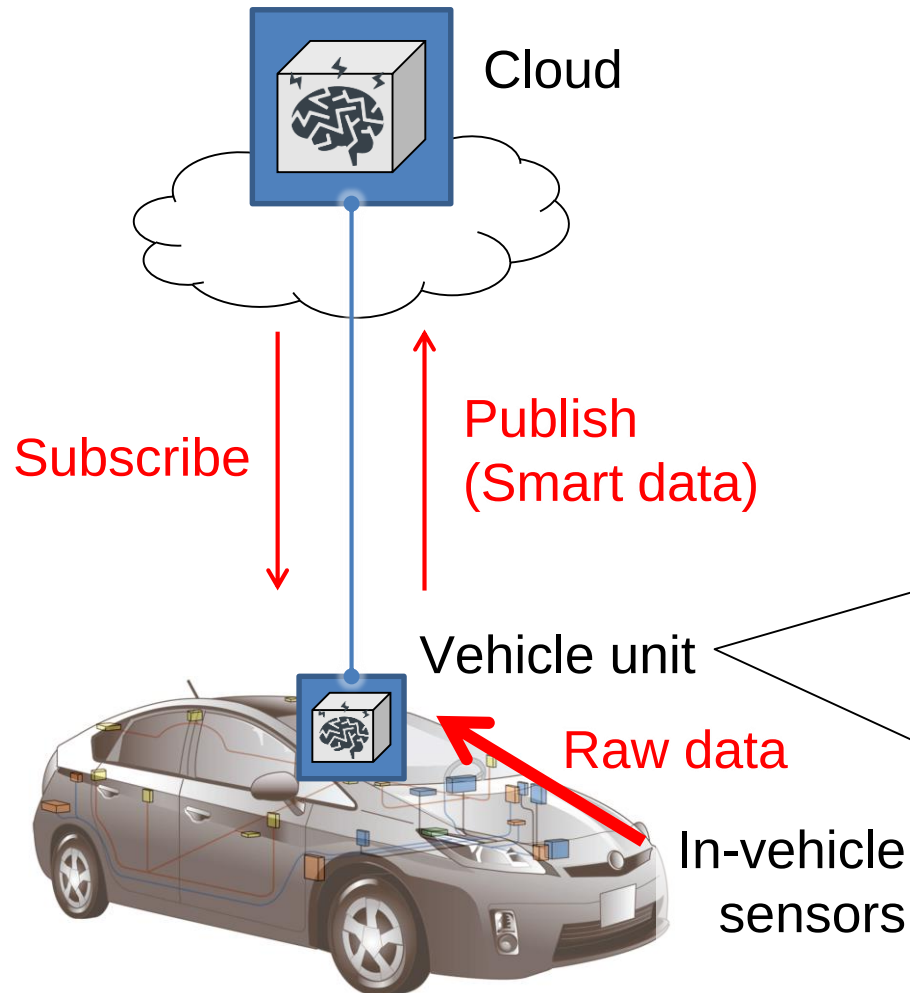


Potential Solution



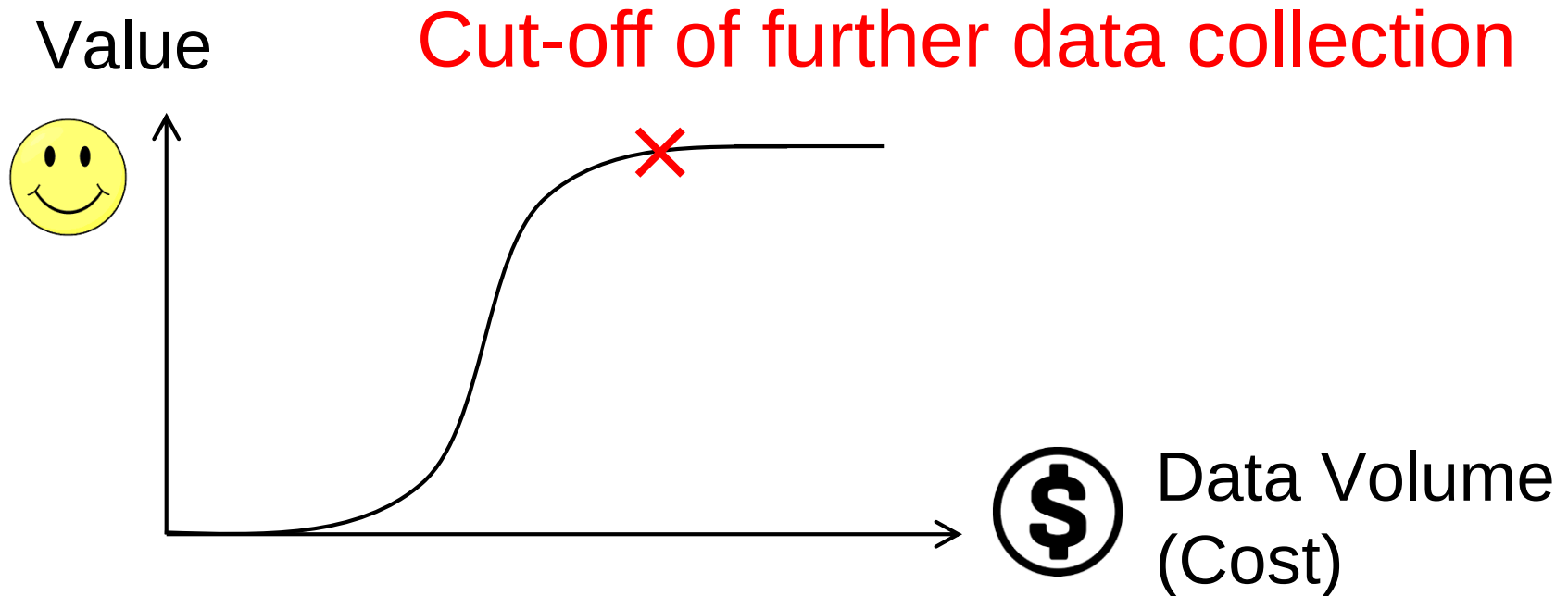
⊖ Collecting Data in Need

■ Data centric network



■ Decline data unwanted

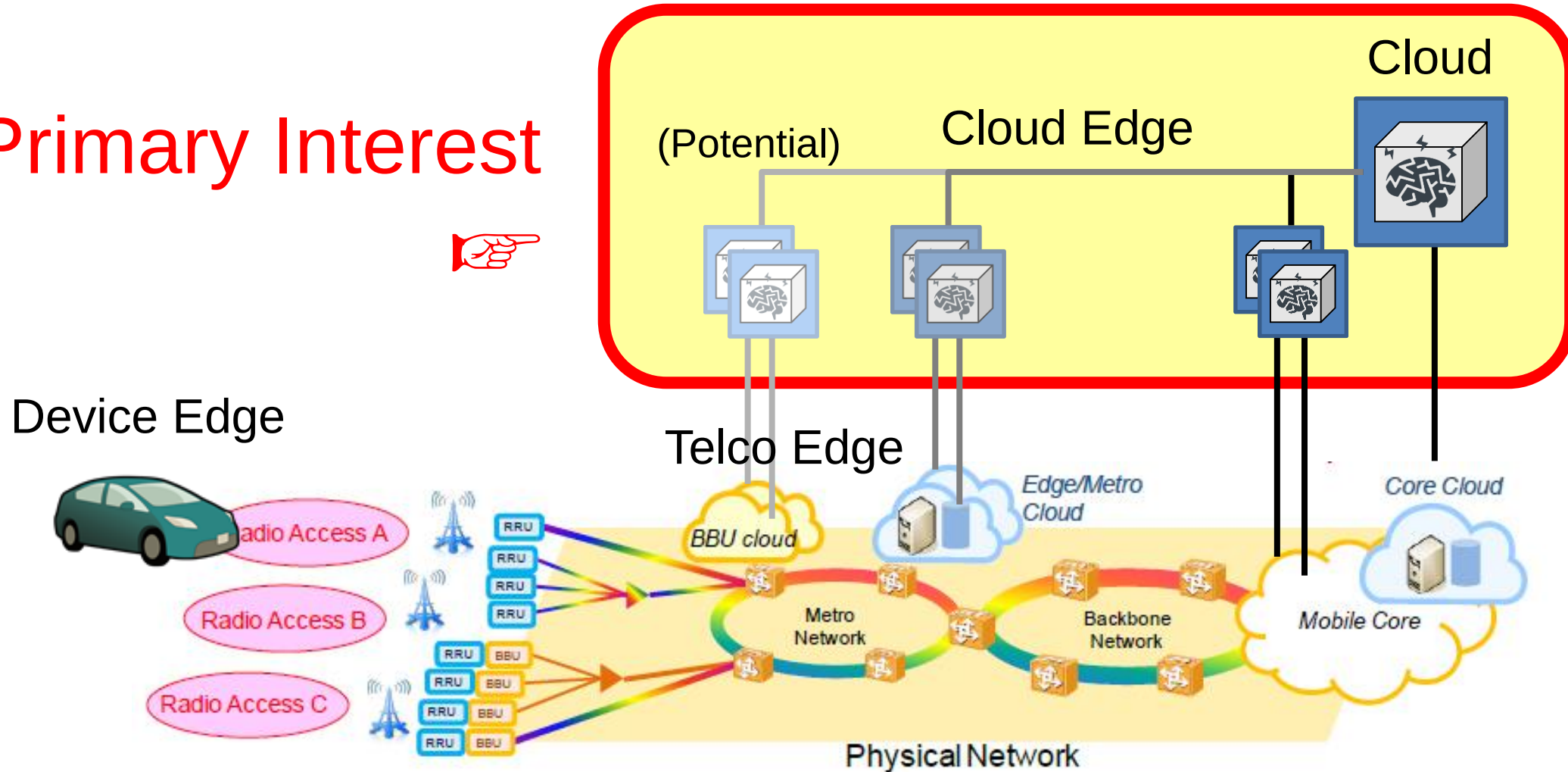
- ▣ Collected/Sufficient data
- ▣ Obsolete data



⊖ Off-loading at Network Edge

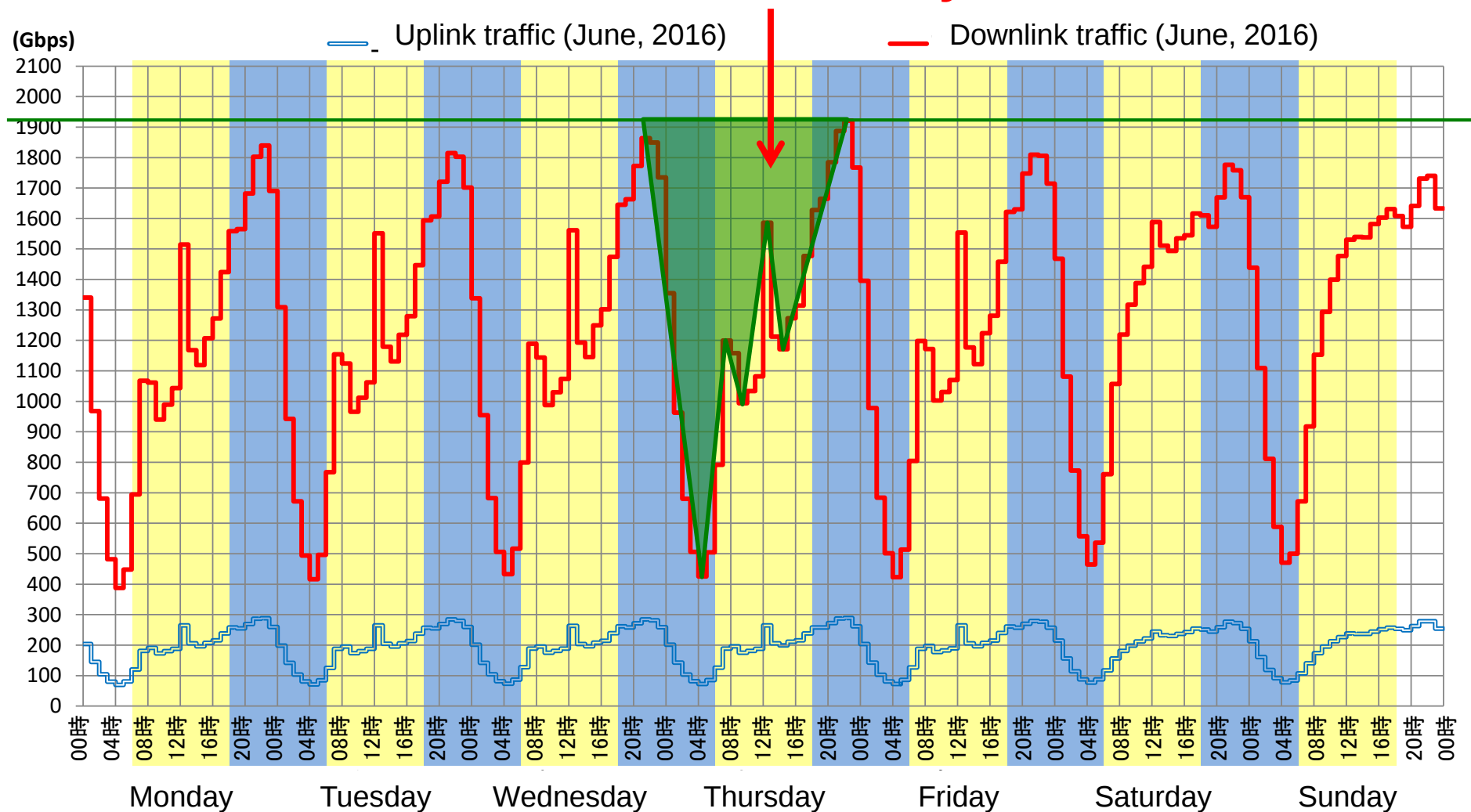
- Scale-out following service growth

Primary Interest



⊗ Background Data Transfer

Some network resource even in daytime







⊗ Background Data Transfer

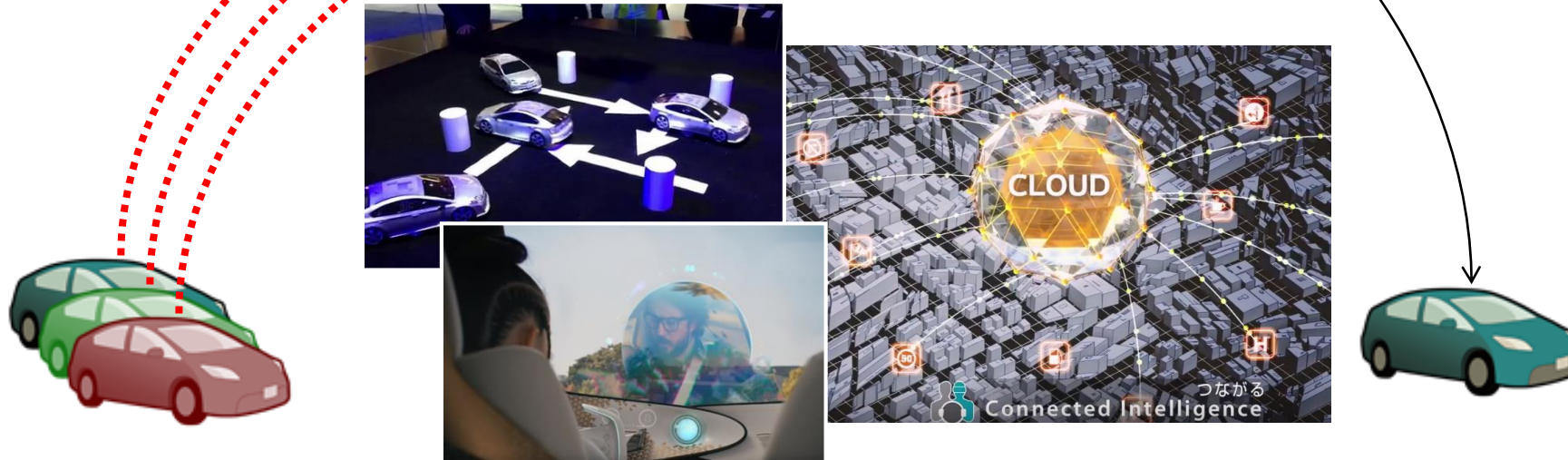
Training

- ✓ Non-real-time
- ✓ Big data



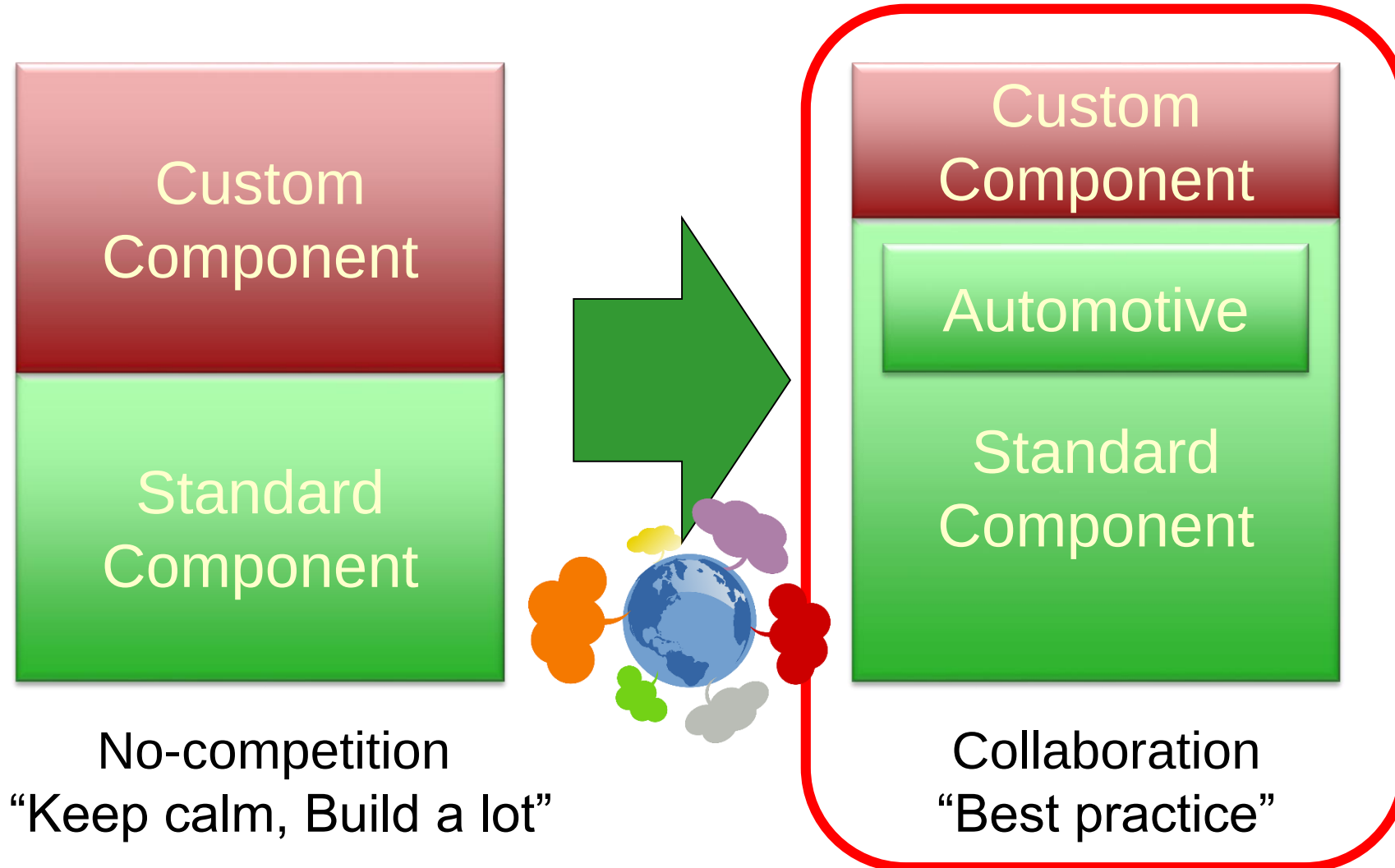
Practice

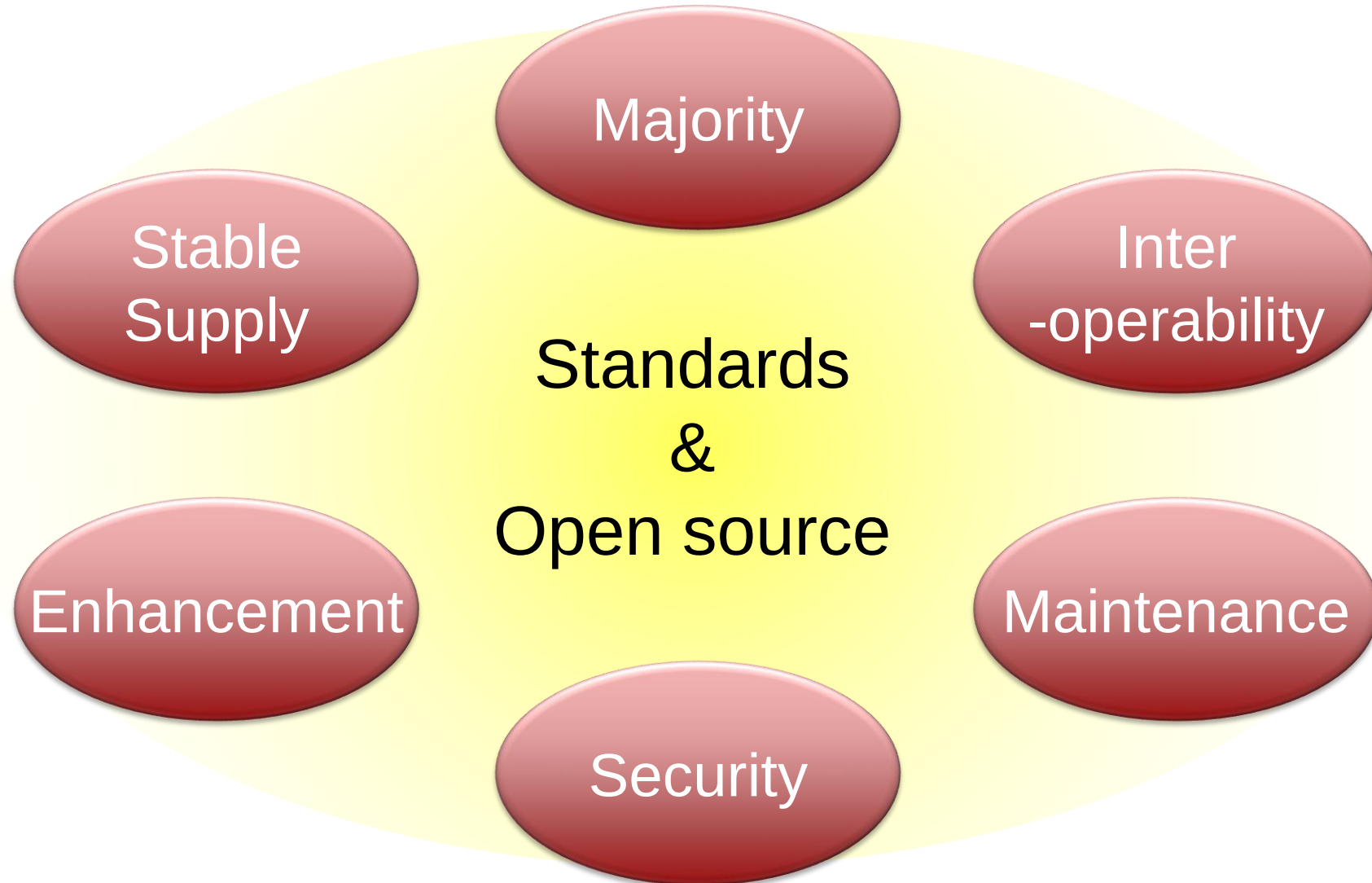
- ✓ Real-time
- ✓ Small data



- Vision Connected Intelligence
- Issue Capacity and Scalability
- Solution Edge Computing
- Approach Community Basis

Community-based Development





- Network and Computing for Automotive Big Data
- Initial focus on Vehicle to Cloud
- Global and Sustainable Ecosystem
- Leading Market Actors Join Forces
 - AT&T, Denso, Ericsson, Intel, KDDI, NTT and Toyota more in the pipe to join
 - <https://aecc.org/>



DENSO



KDDI



NTT docomo



- Marketing
 - Eco-system, Whitepaper
- Use case and requirement
- Specification
 - Functional Architecture
 - Protocol / APIs
 - Conformance Test
- Certification



Related Communities

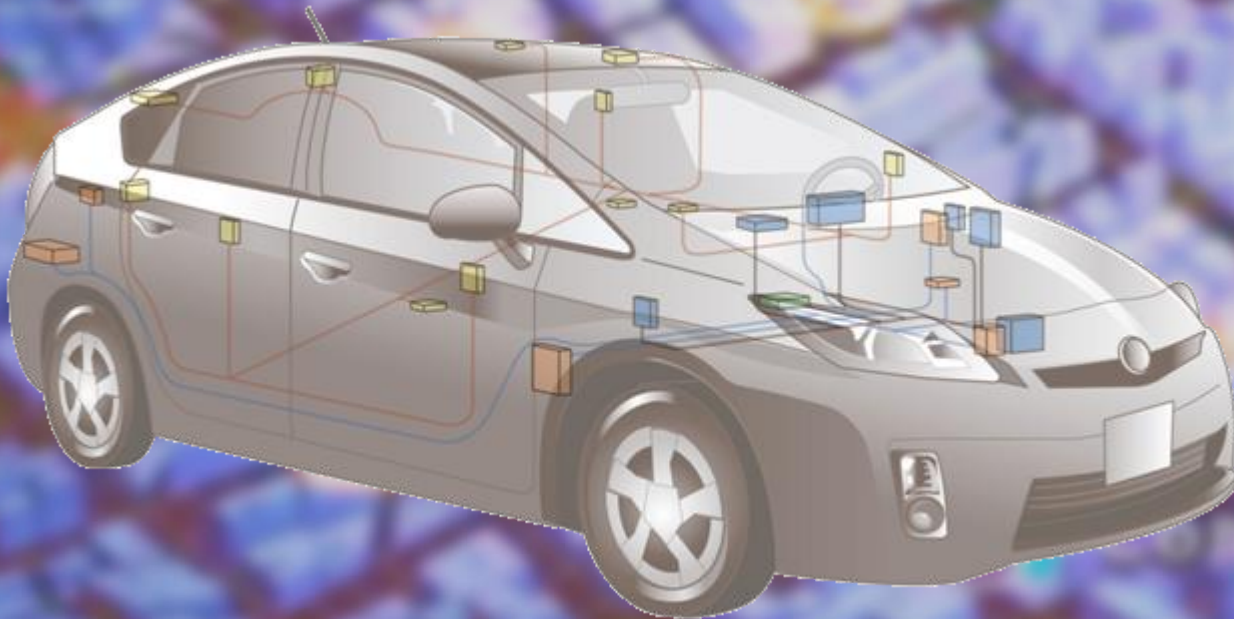


...

- Vision Connected Intelligence
for mobility evolution
- Issue Capacity and Scalability
for automotive big data
- Solution Edge Computing
“Cloud Edge”
- Approach Community Basis
“Automotive Edge Computing Consortium”

TOYOTA

Thank you!



Connected Intelligence