What is a Connected Car

Connected Car System
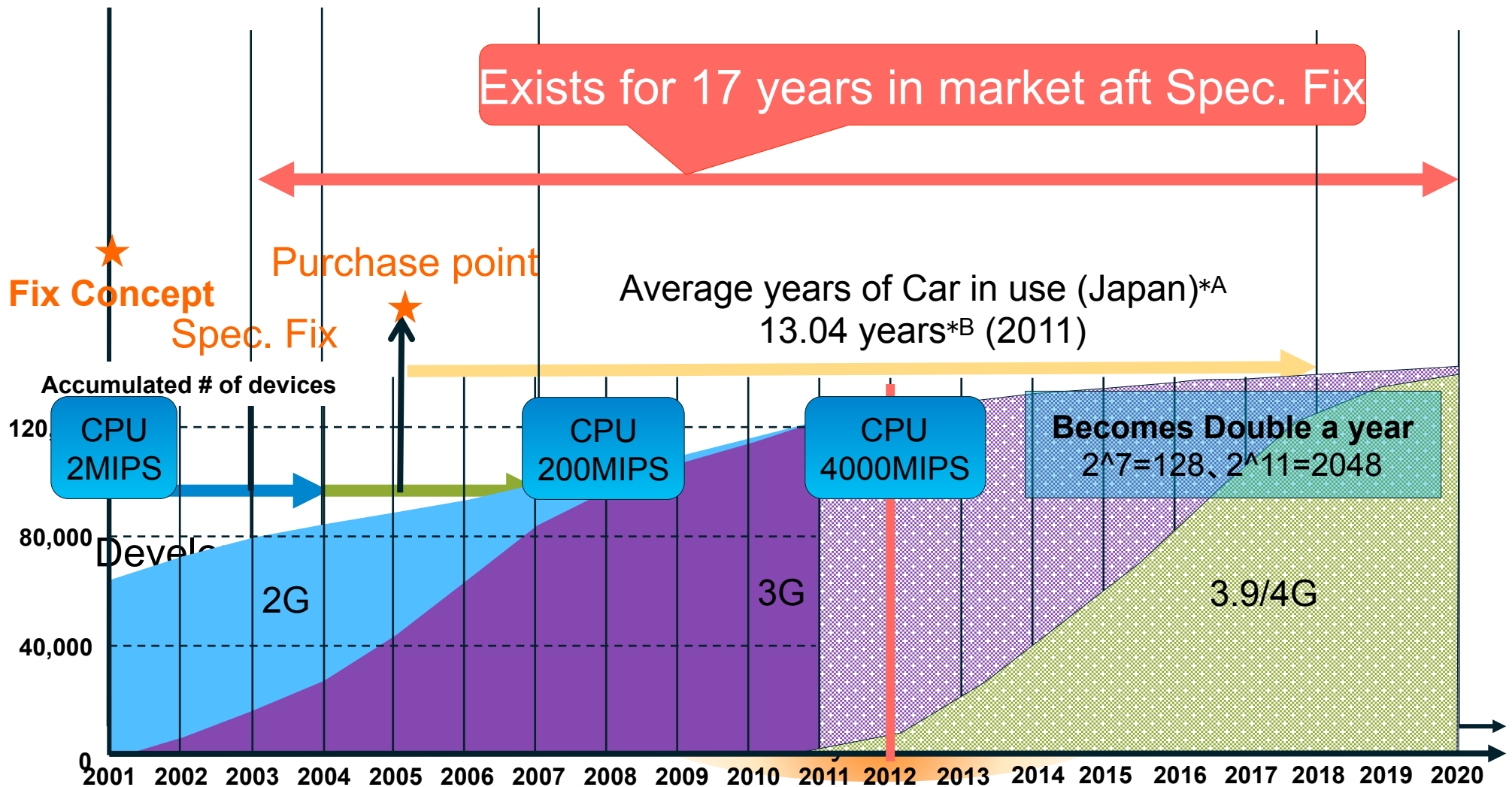
Web Server
- E-Mail
- Calendar
- Location
- SNS
- Traffic
- Weather

Home

Office

IVI

IVI*1) Client

NAVI | AV | SNS | Safety & Security

Service Applications

Human Machine Interface
Generic Operating Systems

Interface, Device Drivers・・・

Generic Car Hardware Parts
(CPU, Chipset, Memory・・・)

Bluetooth WiFi USB

WAN

Network Operator

Internet

Big Data M2M/ Cloud

Application/ Contents Service Providers

Data Center

Customer Data Base

3G/4G
Broadband
Always Connected
Fixed Rate
Low Cost

Probe DB

Embedded/ DSRC

Wall

Sensor Data
(Preferably, Read Only)

Control Area

Definitions of CAN and data formats are slightly different for OEMs and even among vehicle models within a company

Air-Con. | Battery | Inverter | Rader | Door Lock Un-Lock

CAN

Powertrain CAN

Multimedia CAN

ECU Manager | Instrumen t Panel

Cont.

ECUs | AB S | Transmission Cont. | Differential Cont.

・R&D
・Manufacturing
・Maintenance

VRM *2)

・Sales & Marketing
・Dealership Managemen t

CRM *3)

(intel)

Issues to embed ICT devices in Car
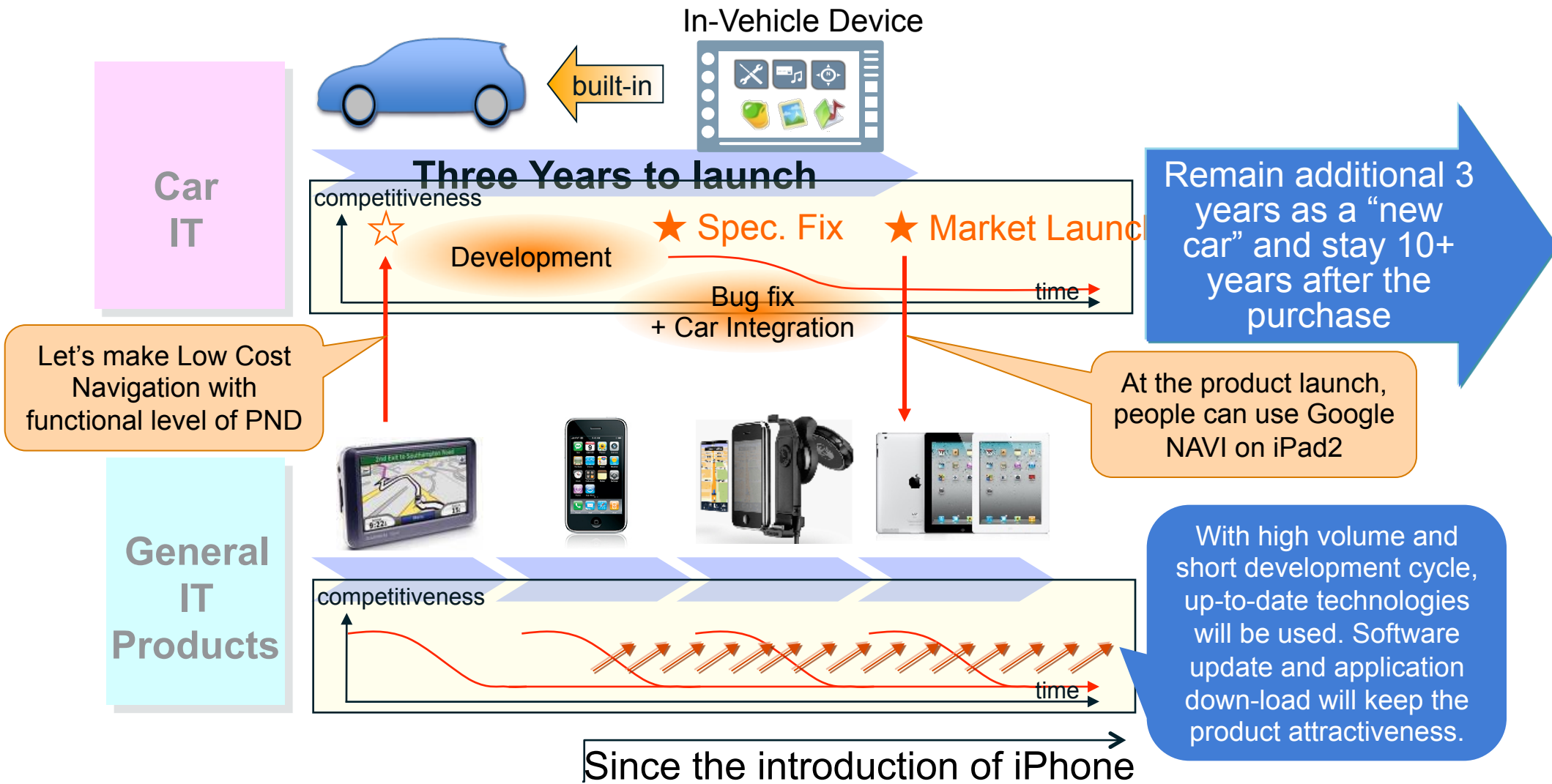
- Difference of product life cycle

*A) Years between sales as a new car until expiration of registry
*B) Data from Car Information Center (ref.. 10.60 years in 2001)
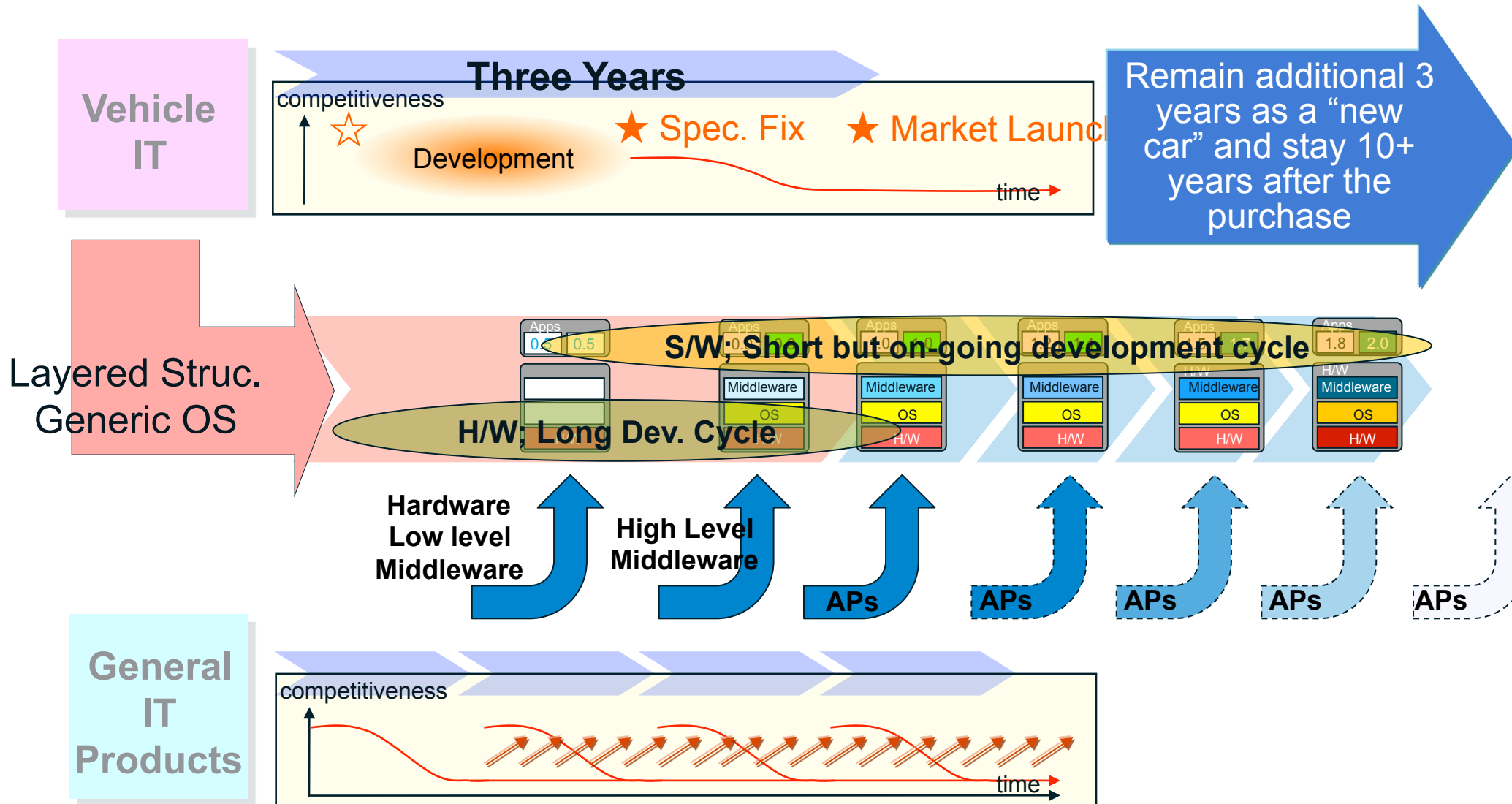*C) Average year of Car in use

Exists for 17 years in market aft Spec. Fix

Fix Concept

Purchase point

Spec. Fix

Average years of Car in use (Japan)*A
13.04 years*B (2011)

Accumulated # of devices

CPU 2MIPS

CPU 200MIPS

CPU 4000MIPS

Becomes Double a year
$2^7=128$、$2^{11}=2048$

120,

80,000

40,000

0

2G

3G

3.9/4G

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

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Issues to embed ICT devices in Car

• Long Dev. Cycle and Long Product Life of Cars

In-Vehicle Device

built-in

Car IT

Three Years to launch

competitiveness

☆   ★ Spec. Fix   ★ Market Launch

Development

Bug fix
+ Car Integration

time

Remain additional 3 years as a "new car" and stay 10+ years after the purchase

Let's make Low Cost Navigation with functional level of PND

At the product launch, people can use Google NAVI on iPad2

General IT Products

competitiveness

time

Since the introduction of iPhone

With high volume and short development cycle, up-to-date technologies will be used. Software update and application down-load will keep the product attractiveness.

(intel)

Application update will solve the problem

- **Future direction**

Vehicle IT

Three Years

competitiveness

☆ Development ★ Spec. Fix ★ Market Launch

time

Remain additional 3 years as a "new car" and stay 10+ years after the purchase

Layered Struc. Generic OS

Apps 0.5 0.5

S/W, Short but on-going development cycle

Apps 1.8 2.0

Middleware
OS
H/W

H/W, Long Dev. Cycle

Hardware Low level Middleware

High Level Middleware

APs

APs

APs

APs

APs

General IT Products

competitiveness

time

(intel)

Market Penetration of NAVI: Recent Change

- **Smartphone came into the market.**

Legend:
- Others
- West. Europe
- US
- China
- Japan
- NAVI
- PND

Smartphone

Market volume accelerates the advancements of technology.

Y-axis: 50M, 40M, 30M, 20M, 10M, 0

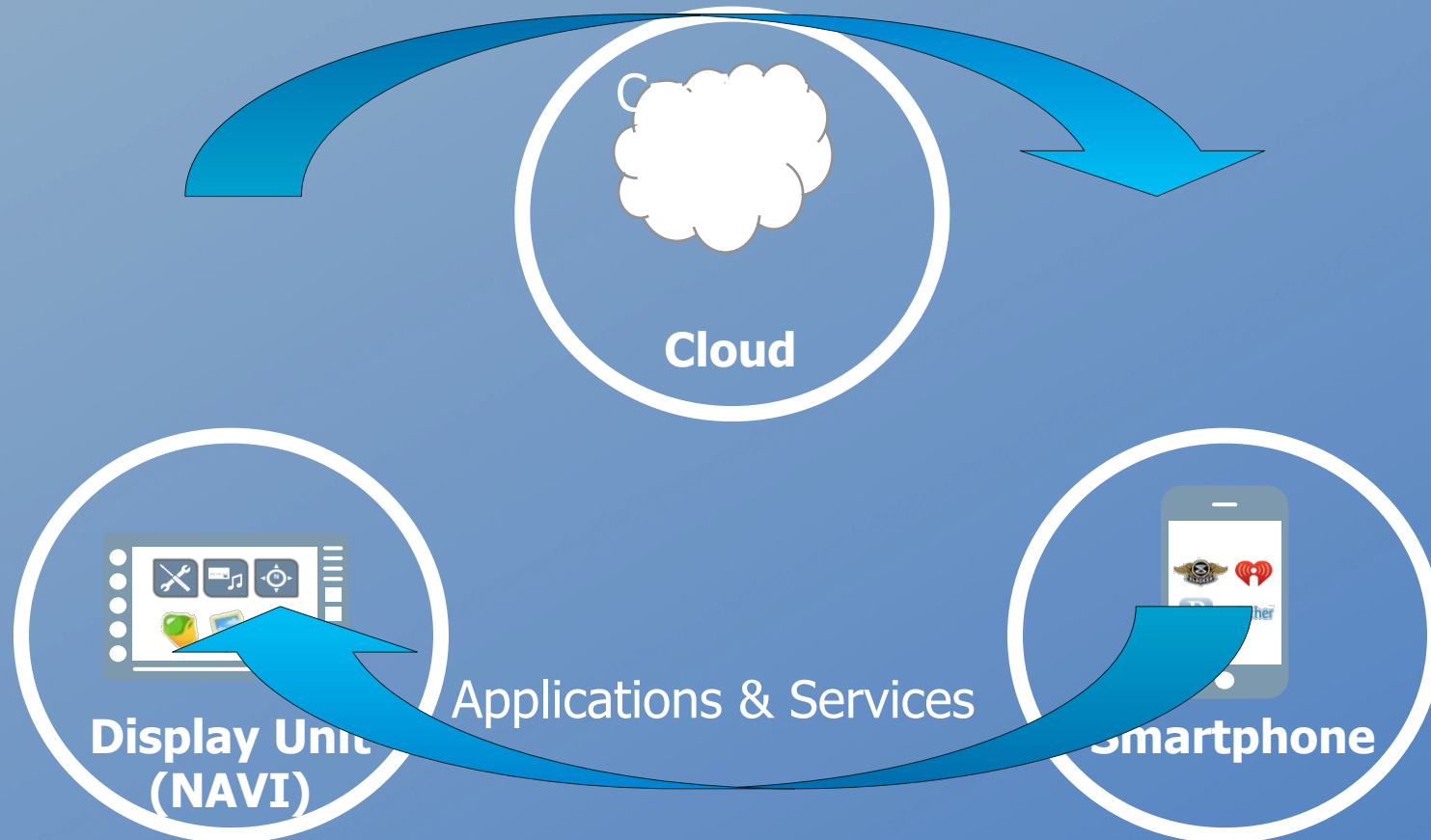X-axis: 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013

JEITA
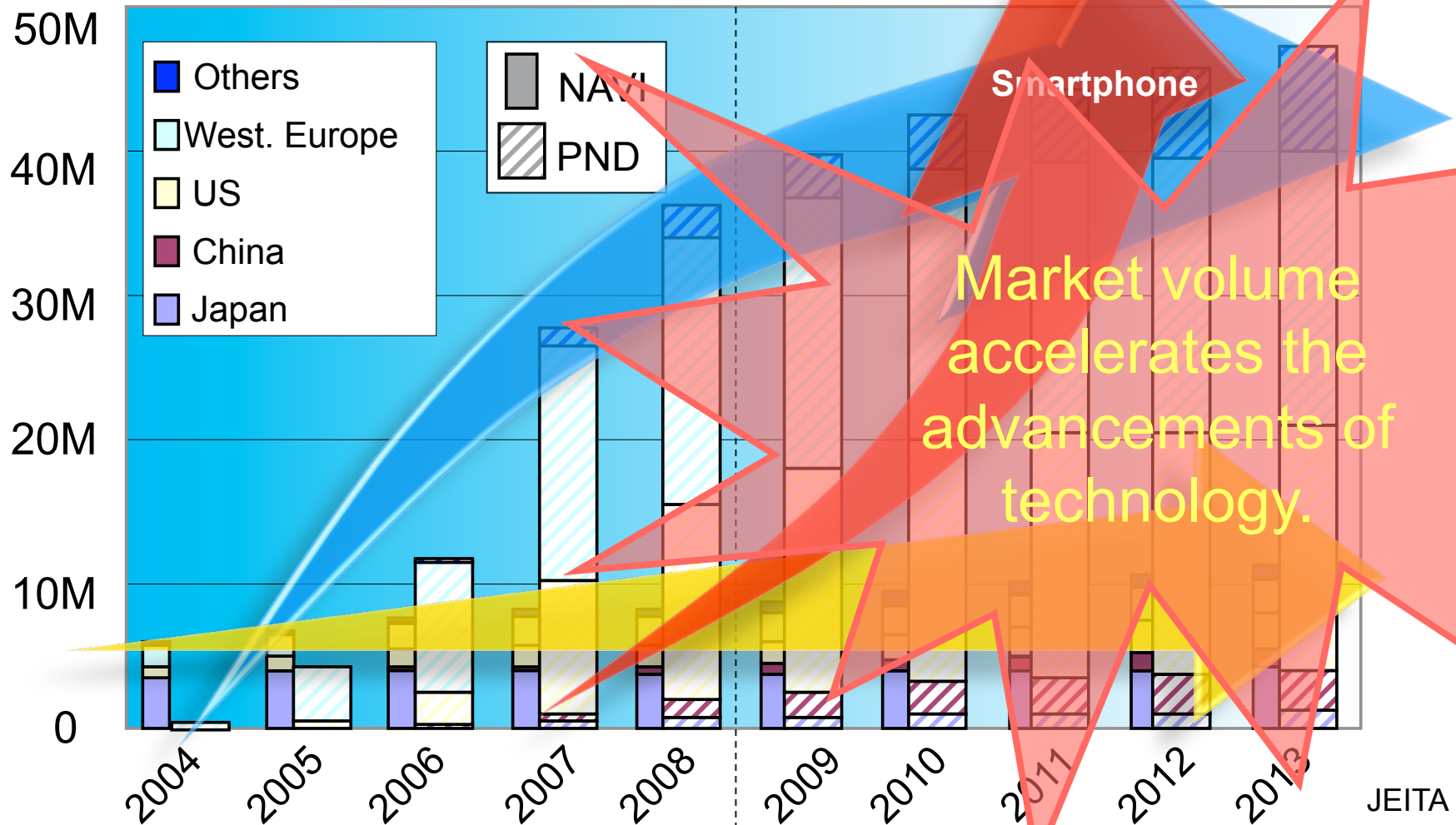
Contents and Services reside in the Cloud

- **Cloud** provides data processing
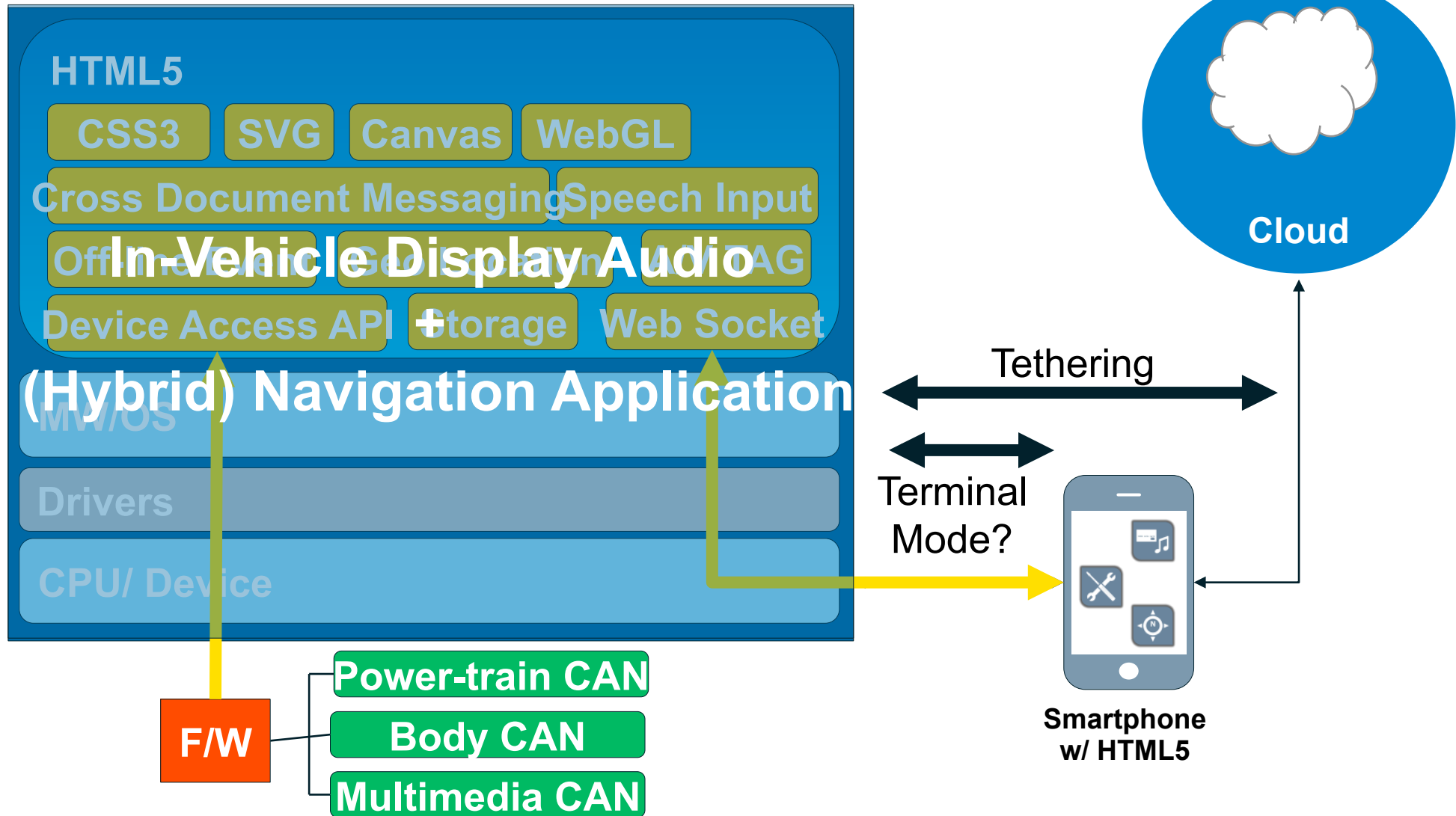- **User Devices** focus on intuitive and better UX and GUI

PC + Internet

INTERACTIVITY

Contents & Services

Data Base Oriented

Info-reference Oriented

Mobile Solution

Mobile Solution

Map

News

Stock

Navigation
Dictionary

Weather

Gourmet Guide

DATA SIZE

Train Exchange

Mobile Phone

MIDI Music

Petty Cash

Auction

Web-mail
e-mail

On-line Banking
e-Commerce

Movie

Video Clip
Digital TV Music DL Game

Mobile Solution

Mobile Solution

Transaction Oriented

Entertainment

On-line Game

Cloud Computing

Cloud Server

Relation between Car and Smartphone

Cloud

Amplifier, Speaker, Power, Private space, Probe

クルマ

Information (Safety, Comfort

stitcher

(intel)

Foreseeing the Future Trend

- ## Next Generation IVI
  - ### Three key entities

Cloud

Display Unit (NAVI)

Applications & Services

Smartphone

Modified from TeleNav data

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Role of HTML5 for IVI Client

- **HTML5**

HTML5

CSS3 SVG Canvas WebGL

Cross Document Messaging Speech Input

In-Vehicle Display Audio

Device Access API Storage Web Socket

(Hybrid) Navigation Application

MW/OS

Drivers

CPU/ Device

F/W

Power-train CAN

Body CAN

Multimedia CAN

Cloud

Tethering

Terminal Mode?

Smartphone w/ HTML5

(intel)

Example of Big Data Applications (already implemented in Japan)

Crowd Sourced MAP
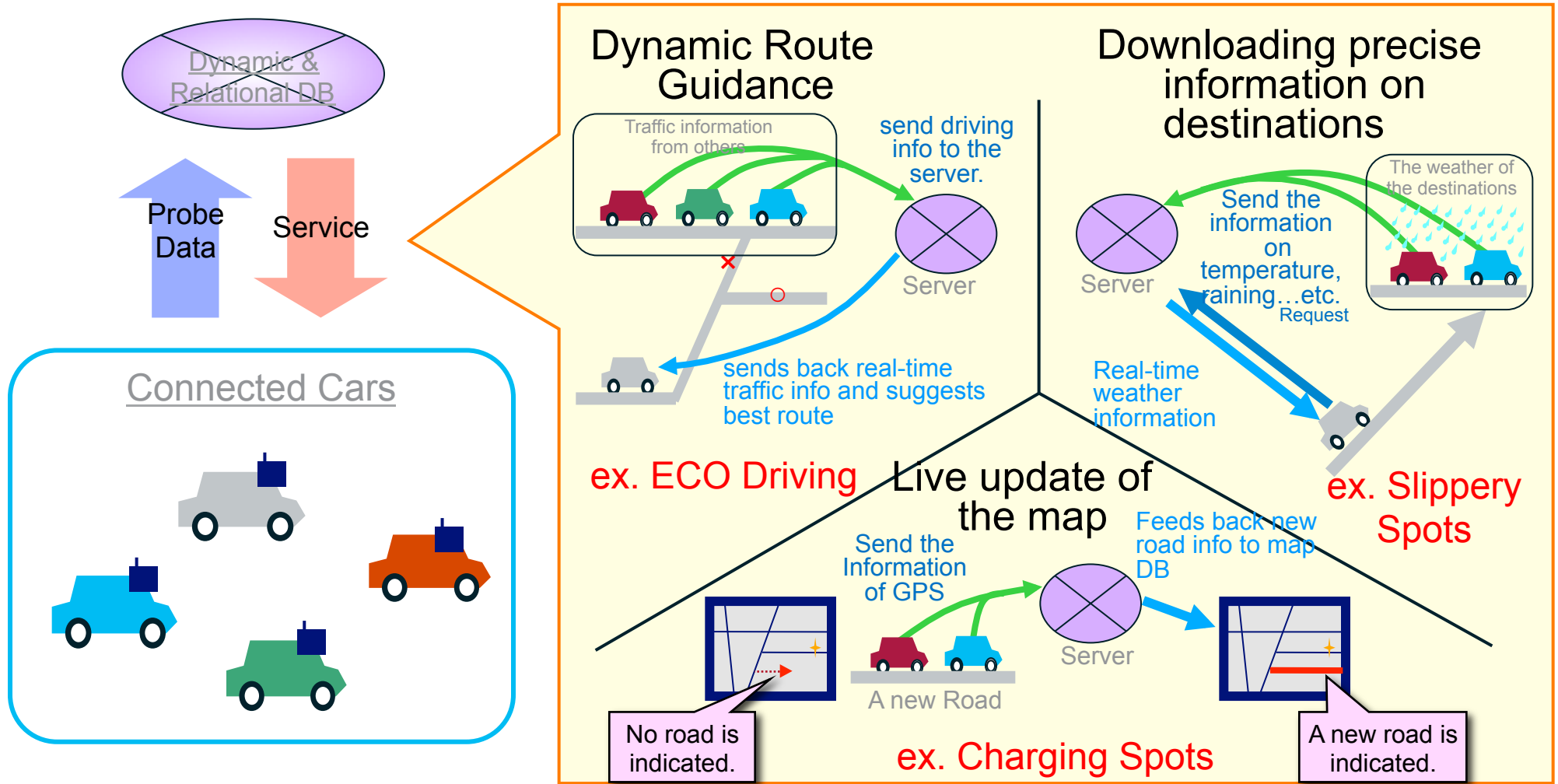
Crisis Response on Google Map

- **After the Earthquake, probe data were uploaded in collaboration with NISSAN, Toyota, Honda, and Pioneer in order to publish the functional roads on Google Map**
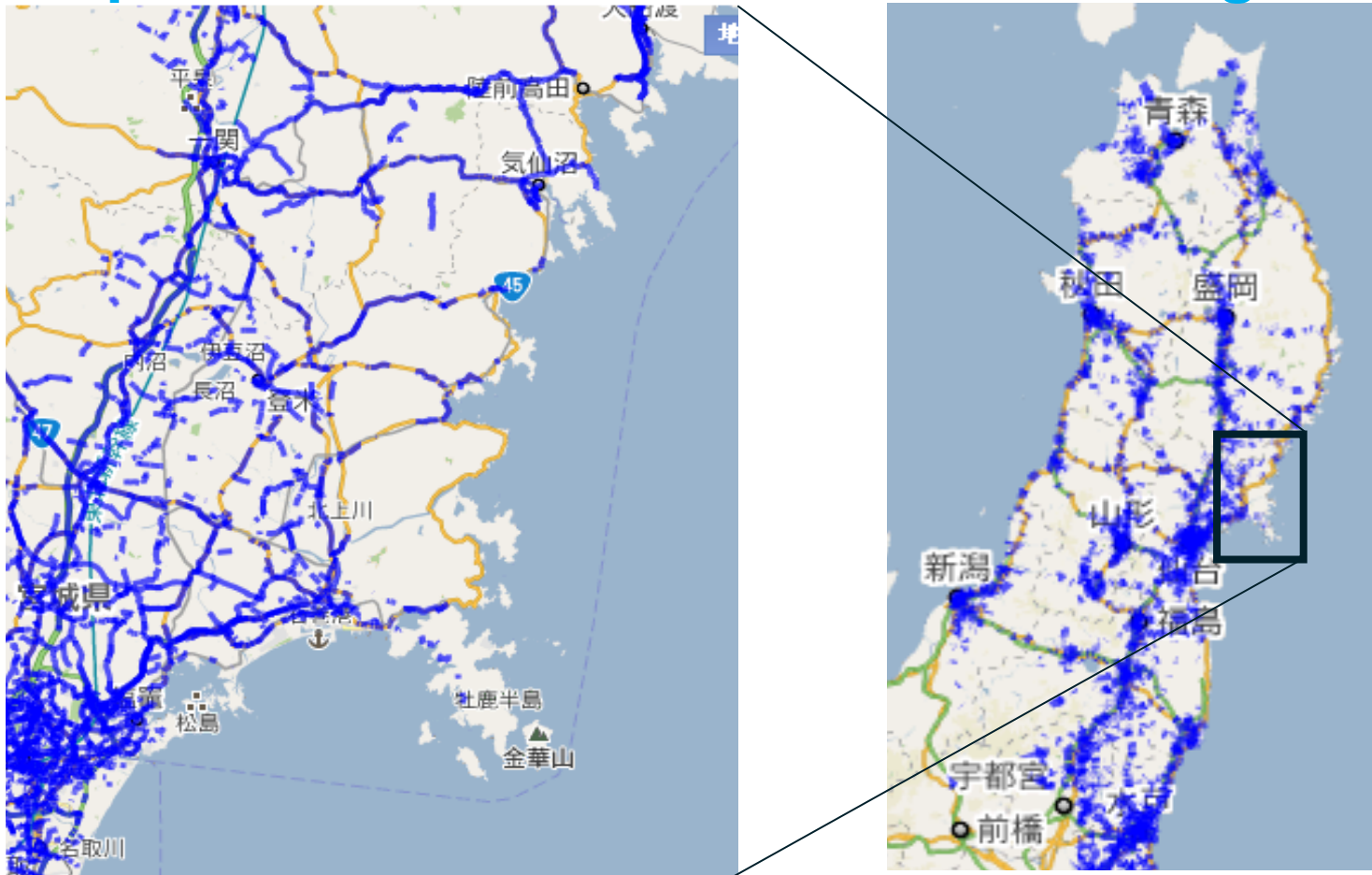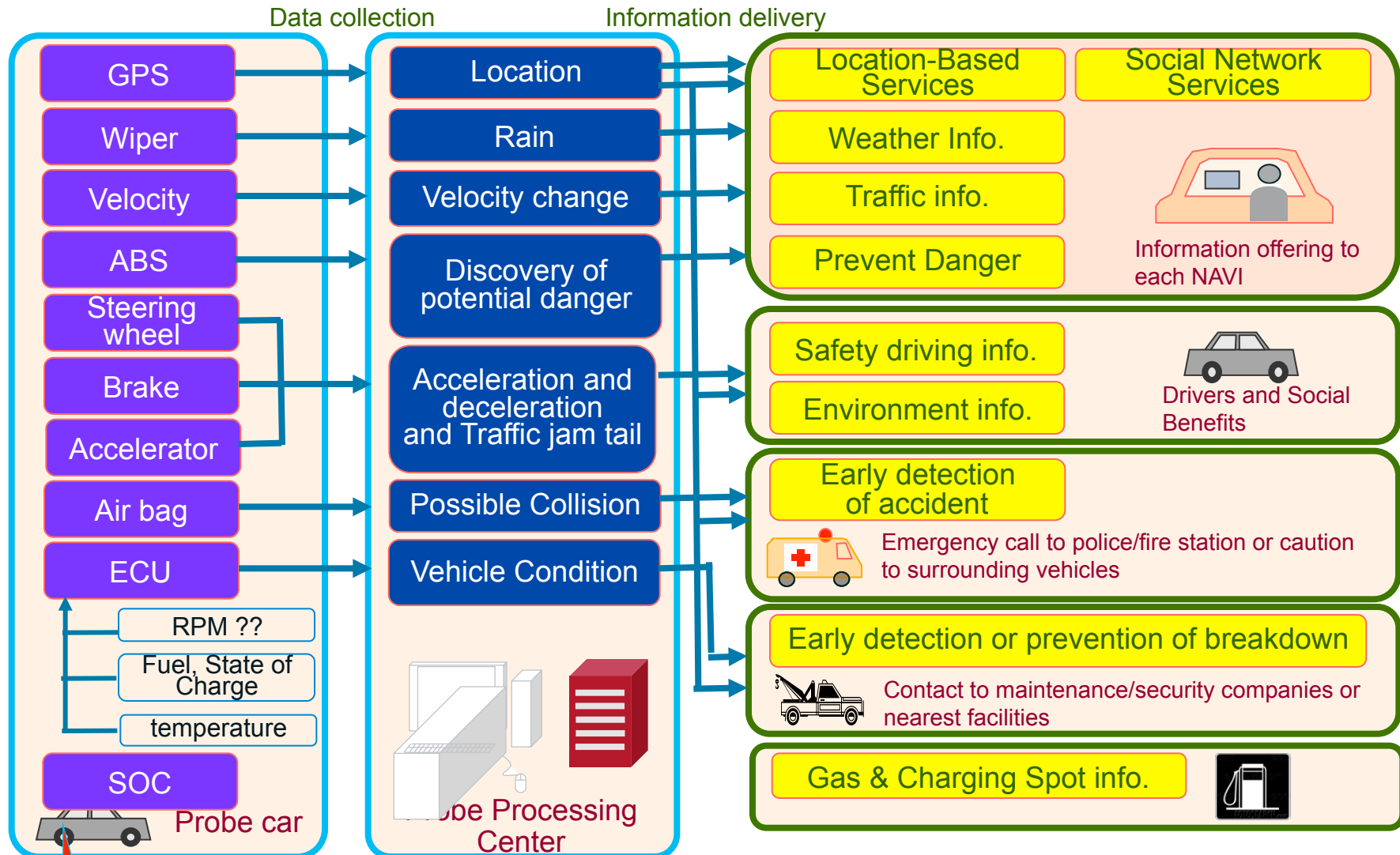

■ Road driven by somebody

Possibilities to apply Big Data Analysis

Probe data example	Statistical processing	Effective use of information

Data collection → Information delivery →

Probe data example:
- GPS
- Wiper
- Velocity
- ABS
- Steering wheel
- Brake
- Accelerator
- Air bag
- ECU
  - RPM ??
  - Fuel, State of Charge
  - temperature
- SOC

Probe car

Statistical processing:
- Location
- Rain
- Velocity change
- Discovery of potential danger
- Acceleration and deceleration and Traffic jam tail
- Possible Collision
- Vehicle Condition

Probe Processing Center

Effective use of information:

- Location-Based Services
- Social Network Services
  - Weather Info.
  - Traffic info.
  - Prevent Danger

  Information offering to each NAVI

- Safety driving info.
- Environment info.

  Drivers and Social Benefits

- Early detection of accident

  Emergency call to police/fire station or caution to surrounding vehicles

- Early detection or prevention of breakdown

  Contact to maintenance/security companies or nearest facilities
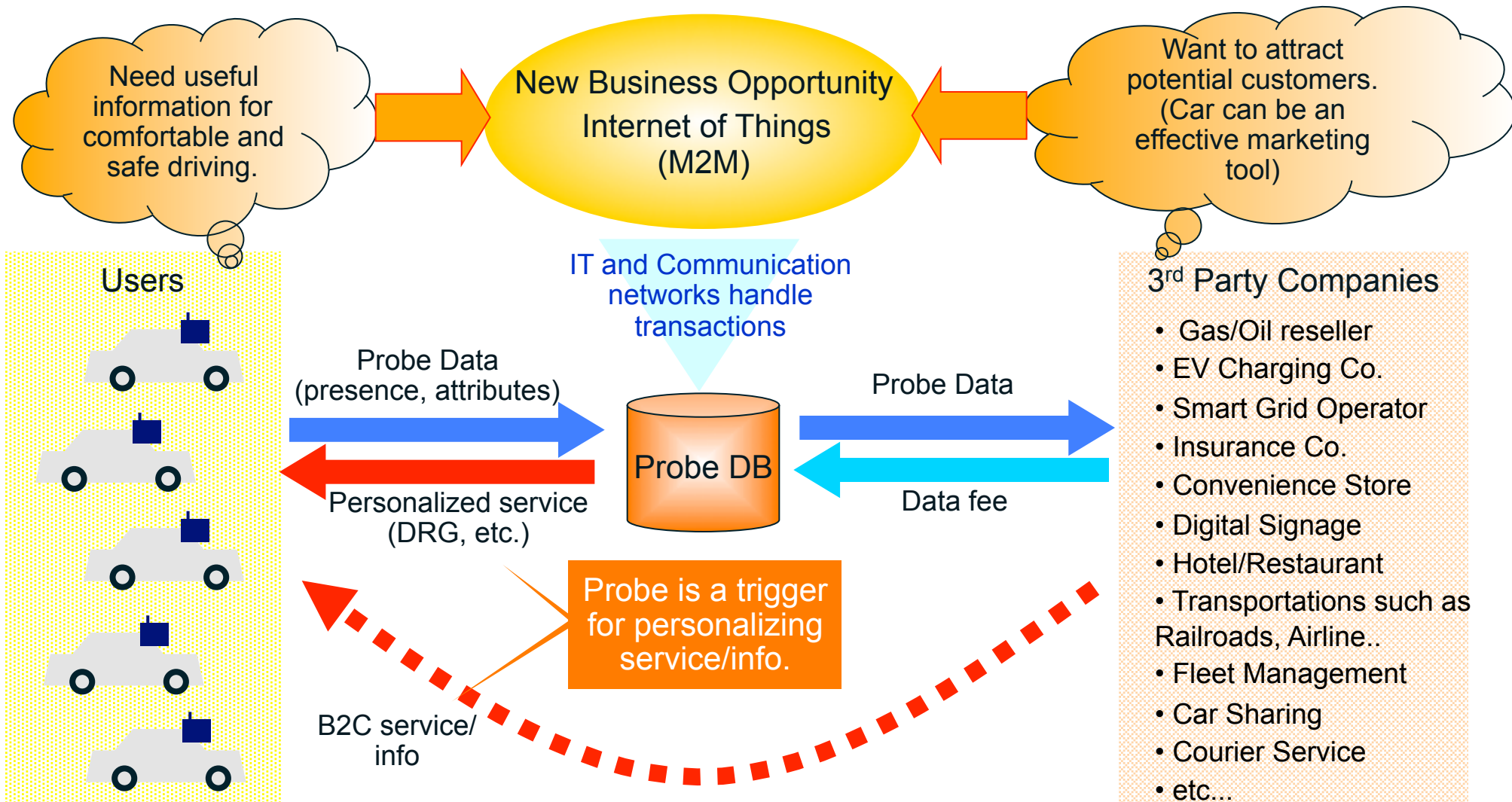
- Gas & Charging Spot info.

Providing attractive service first is key for acquiring critical mass and large probe data.

Source：National Museum of Emerging Science and Innovation

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New Mobile Service Opportunities w/Big Data

Need useful information for comfortable and safe driving.

New Business Opportunity Internet of Things (M2M)

Want to attract potential customers. (Car can be an effective marketing tool)

IT and Communication networks handle transactions

Users

Probe Data (presence, attributes)

Personalized service (DRG, etc.)

Probe DB

Probe Data

Data fee

3rd Party Companies

- Gas/Oil reseller
- EV Charging Co.
- Smart Grid Operator
- Insurance Co.
- Convenience Store
- Digital Signage
- Hotel/Restaurant
- Transportations such as Railroads, Airline..
- Fleet Management
- Car Sharing
- Courier Service
- etc...

Probe is a trigger for personalizing service/info.

B2C service/ info

Probe provides a unique advantage for Automotive Companies by providing probe-originated new service opportunities.
But.. data from large customer base is necessary.

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Data Size and Real-time requirements
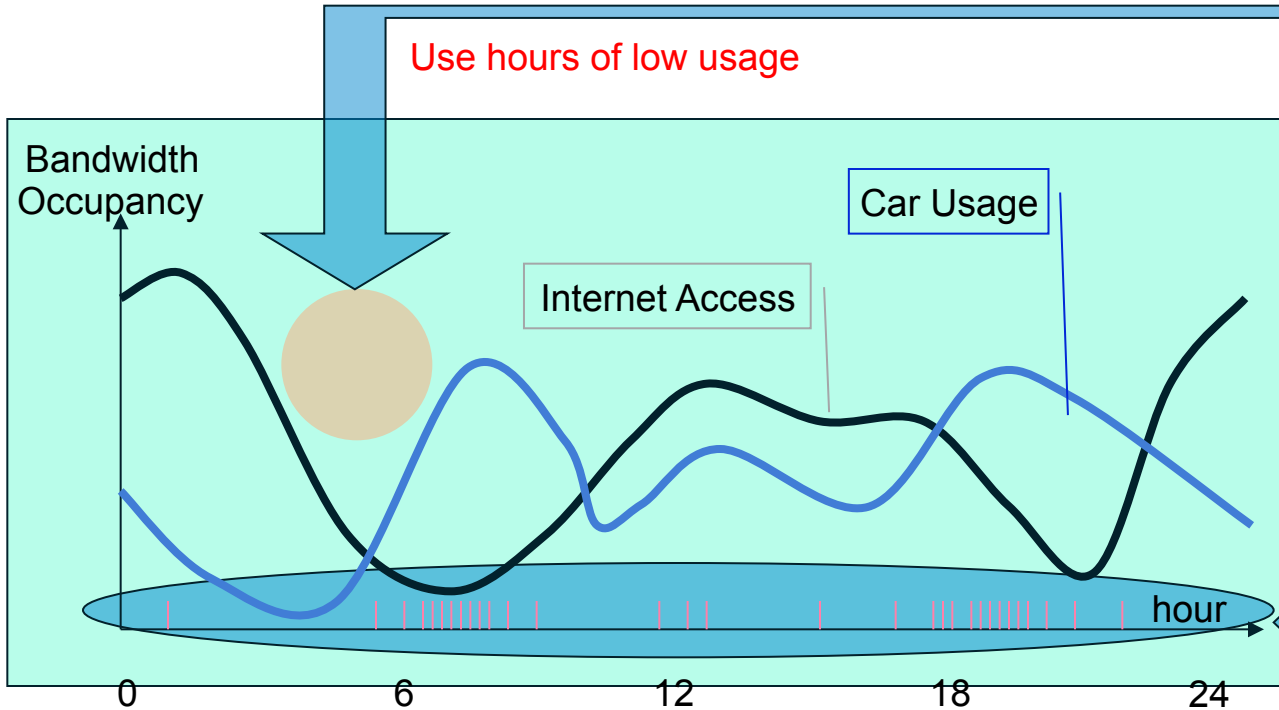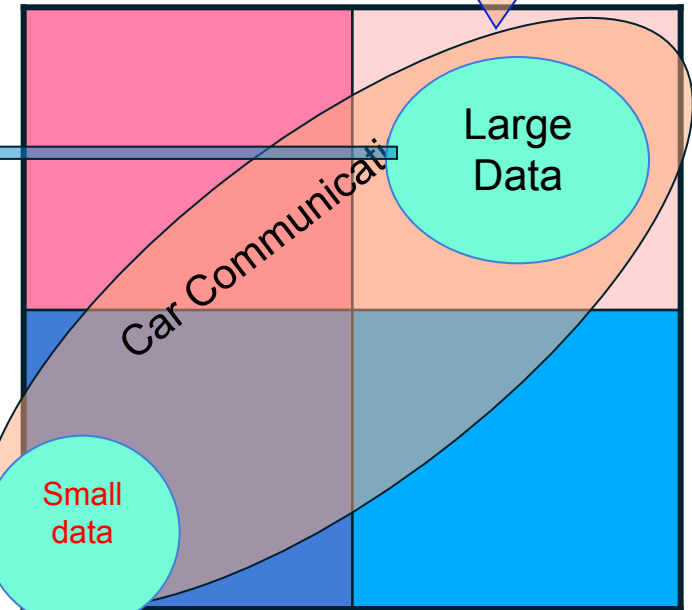
•Relation of Data size and Real-time Requirements
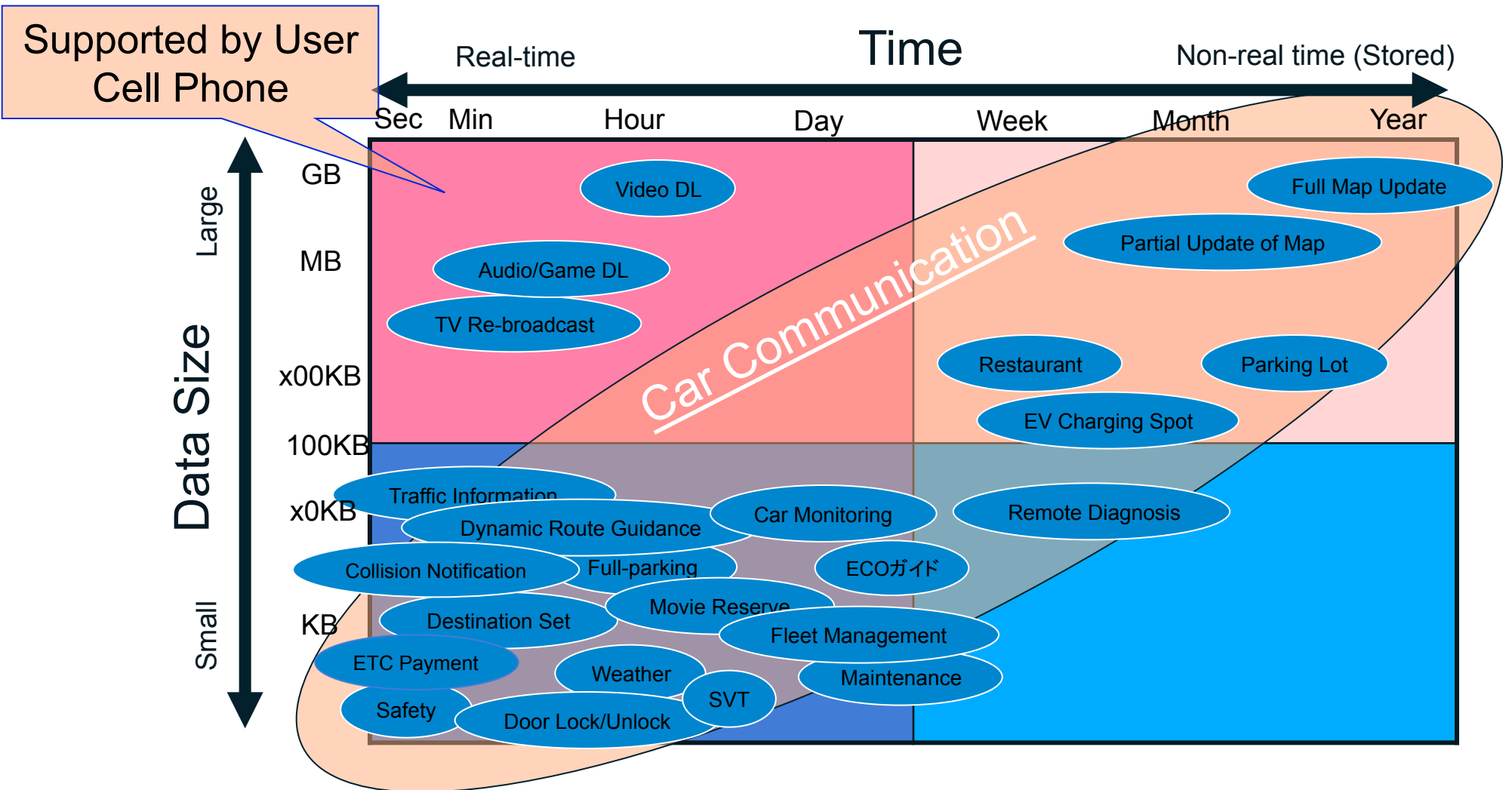
Dispersion of Communication Load

MVNO-like Dispersion

A

B

A+B

契約帯域量
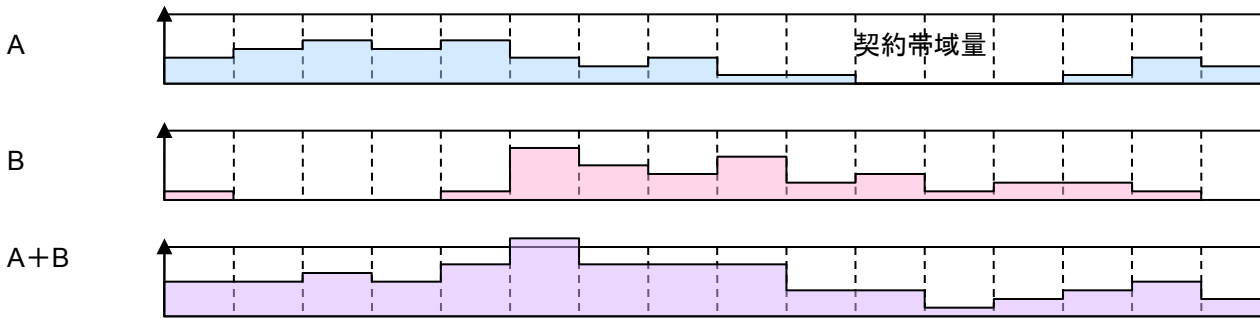
Characteristics of data
(Time・Data Size)

Can take time to download

Car Communication

Large Data

Small data

Use hours of low usage

Bandwidth Occupancy

Car Usage

Internet Access

hour

0   6   12   18   24

Access would be happened in proportion to Car usage

Small data but need to be real-time

14

Summary

- **Cars will be finally connected to wireless network and become a Cloud Computing Client**

- **HTML5 will be a "glue" which connects cars with Cloud-based services via Smartphone and pave the way for new service & business development**

- **It seems an obvious awareness, even for OEMs, that ICT implementation such as "Web and Automotive" requires horizontal collaborations among ICT and Automotive companies**

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Thank You