



Latest Trends in Connected Cars and Expectations for 5G

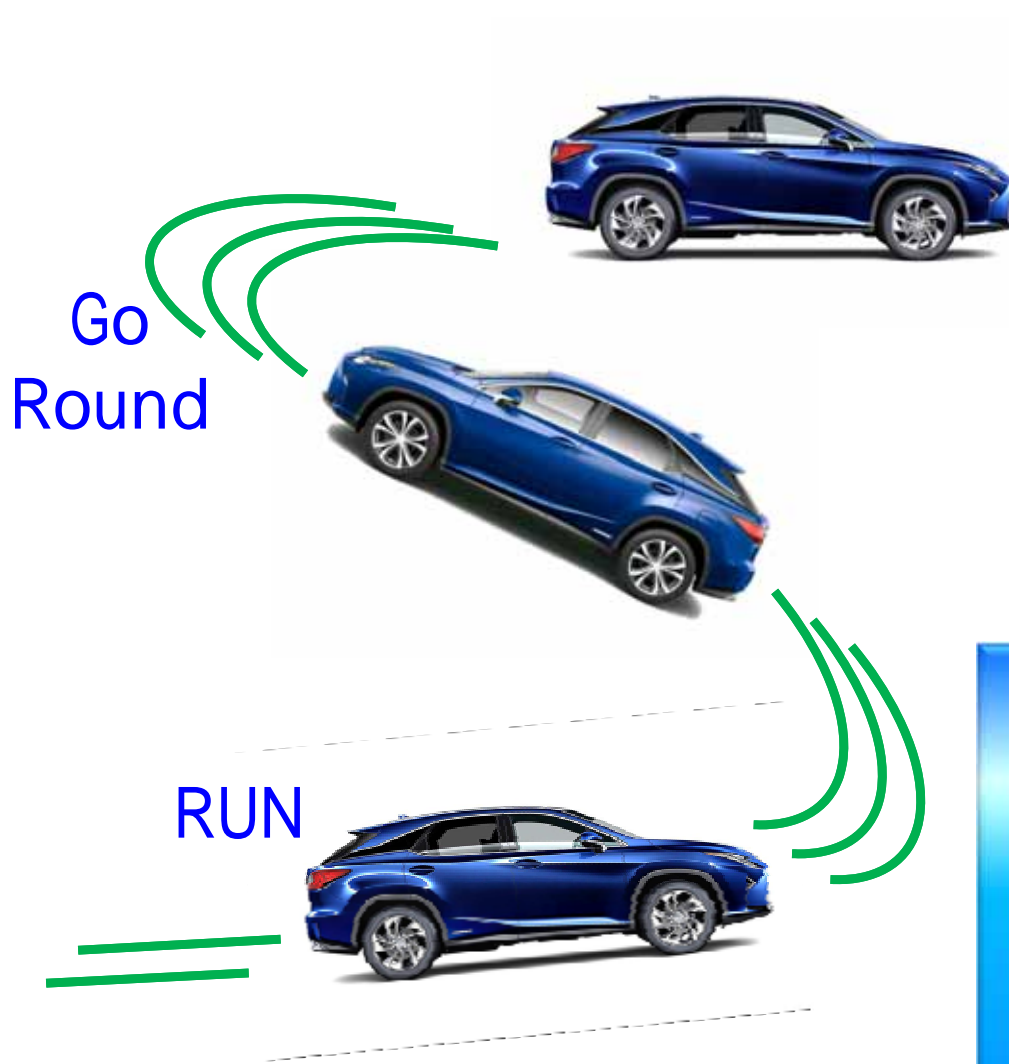
October 7, 2016

Hideaki SUGANUMA

ITS Planning Div.

Connected Company

TOYOTA MOTOR CORPORATION

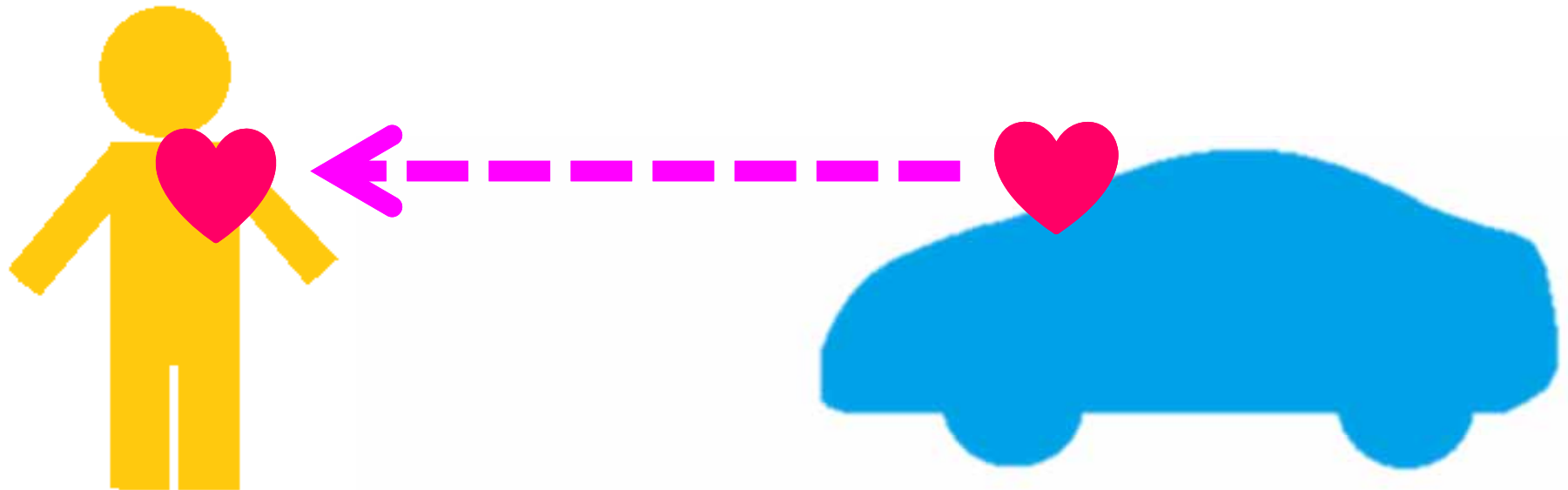


**RUN, Go Round, STOP
and CONNECT**

Enhance the added value of the car through the **4 connections**

- People
- Vehicles and Roads
- Community
- Society

Tconnect

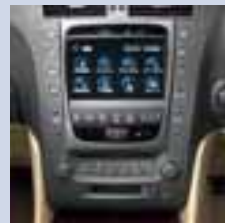
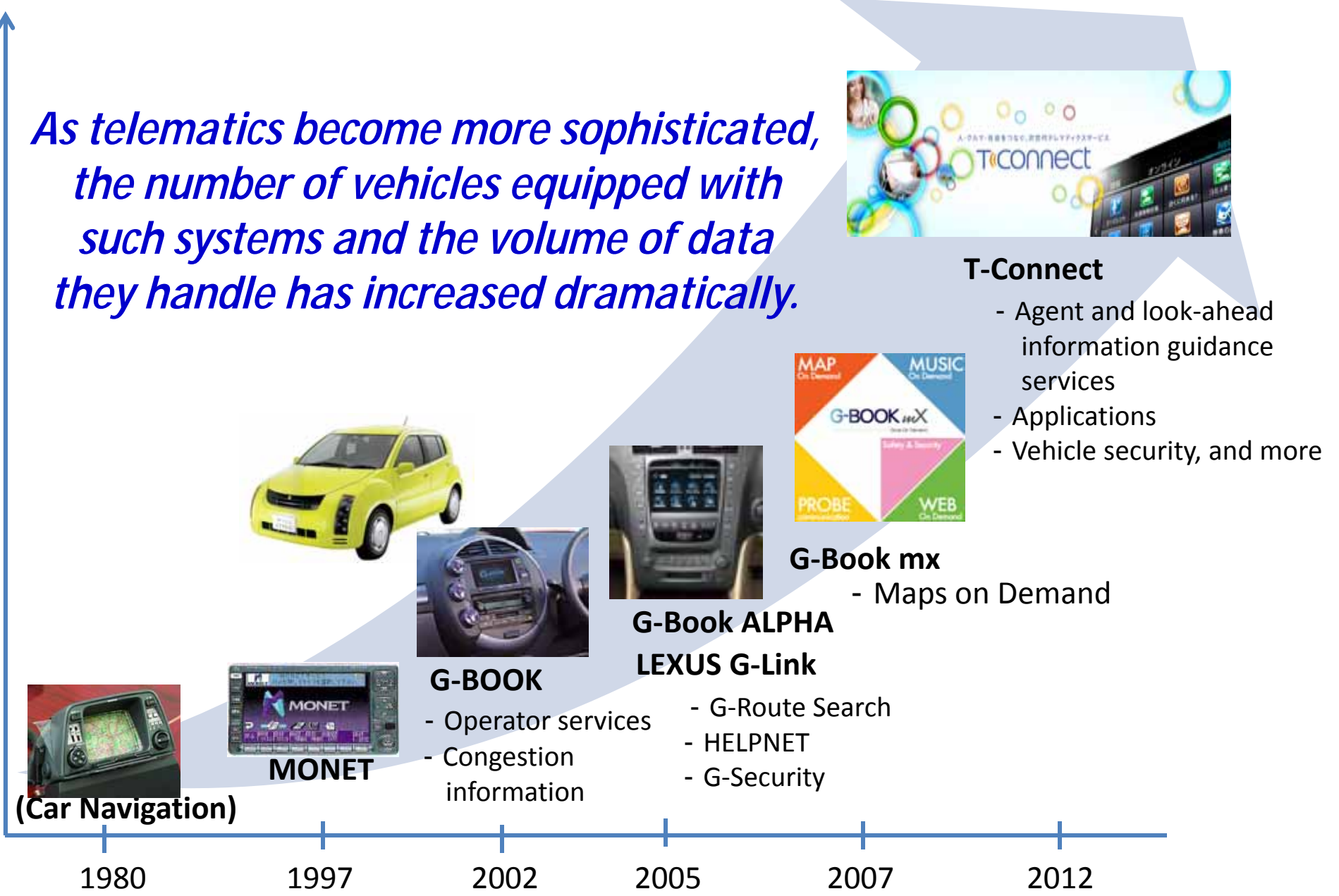


**The vehicle will become
a trusted partner
through close communication with the driver**

The History of Telematics Service

Level of service

As telematics become more sophisticated, the number of vehicles equipped with such systems and the volume of data they handle has increased dramatically.



Interactive voice response service

【ジャンル・条件検索、絞り込み検索例】



【施設名検索例】



【住所検索例】



【ニュース検索例】



Vehicle settings (e.g., air conditioner, locking and unlocking doors, lamps)



Set the air conditioner remotely



Recognize individuals



Remote operations



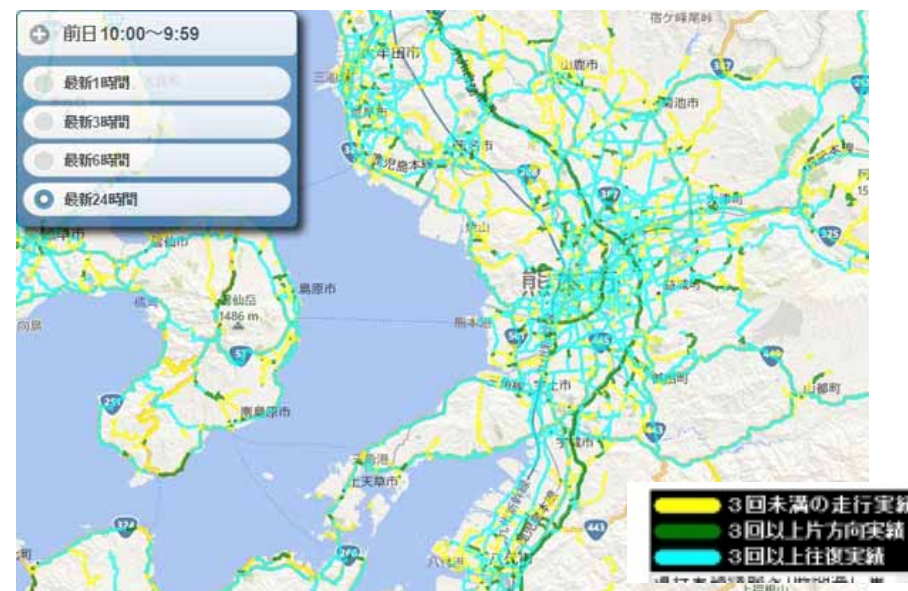
T-Probe traffic information

(Congestion status shown in colored segments on the map)



Map of traveled routes, information on facilities, and contributions

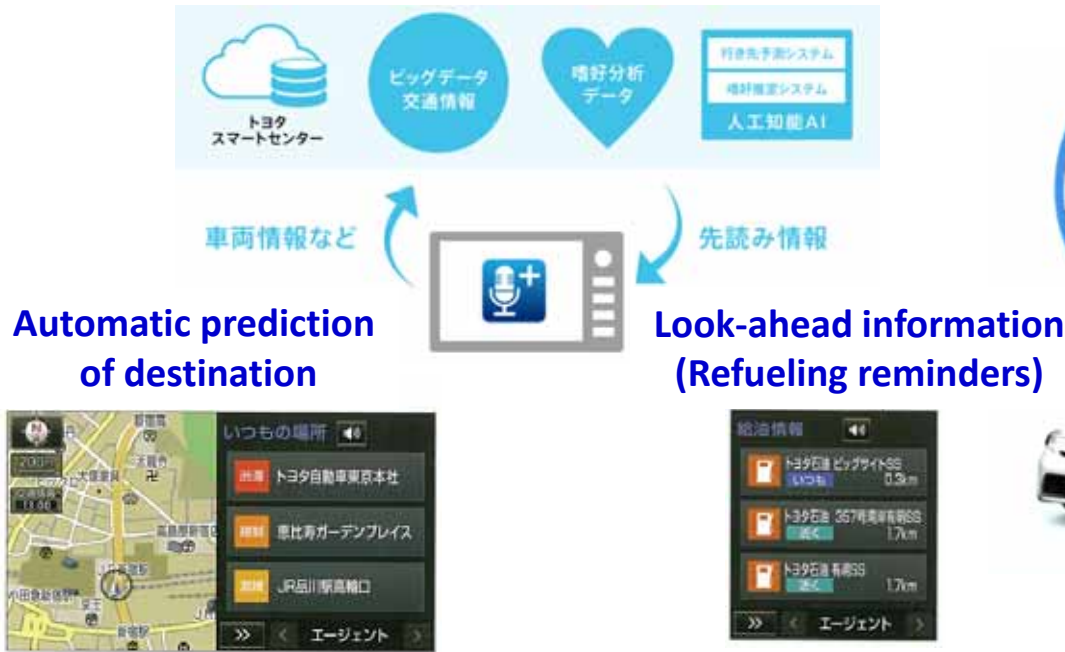
(Past traveled routes and volume of traffic shown in colored segments on the map)



Making Use of Big Data and AI

Look-ahead information guidance services

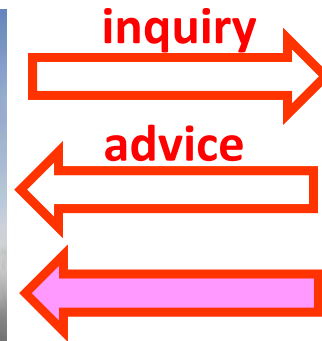
Data carried over when changing to a new vehicle



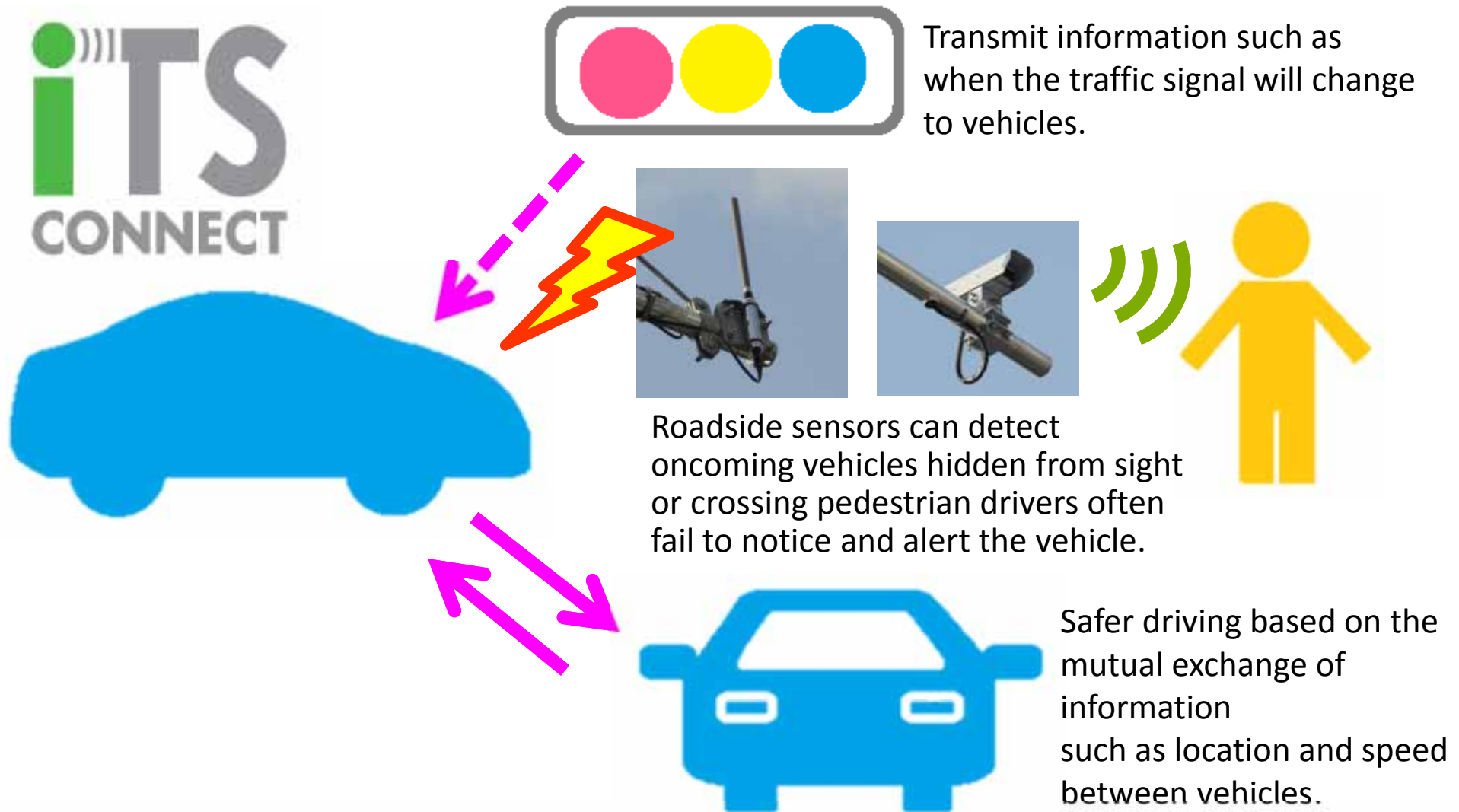
Repair and maintenance (including malfunction prediction) service

owner

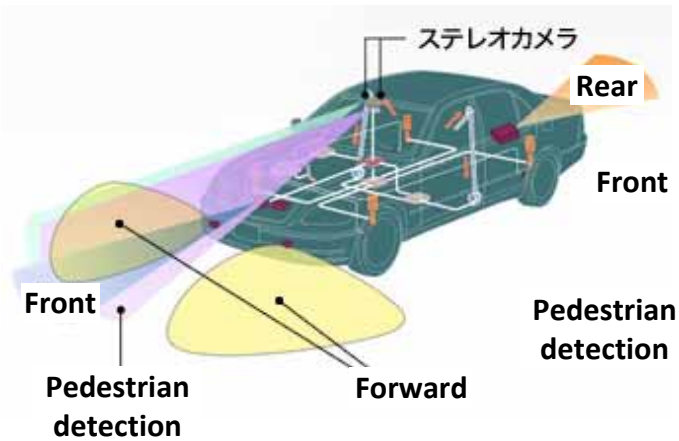
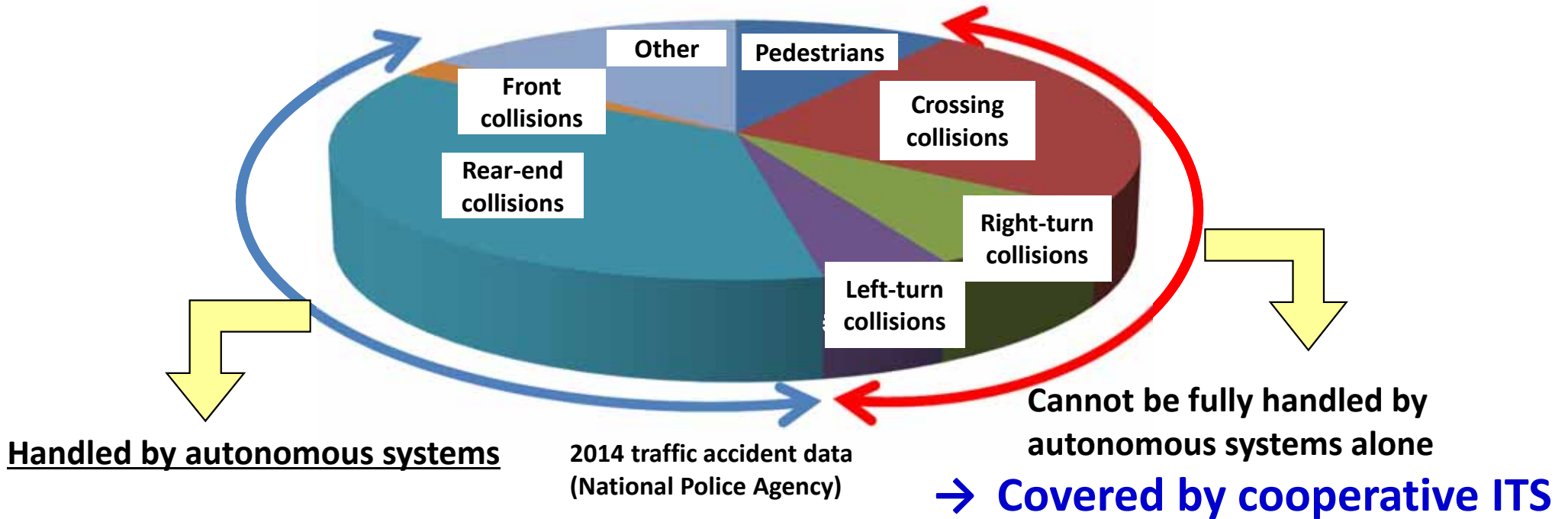
dealer



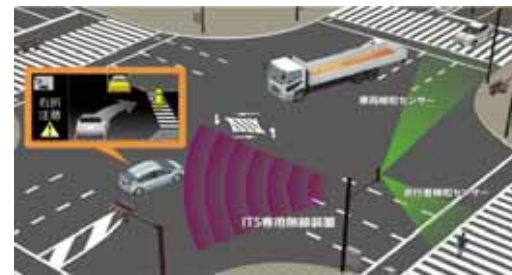
Automatic malfunction Diagnostics Maintenance reminders



**Toward the realization of Toyota's ultimate goal:
Zero casualties from traffic accident**



- Toyota Safety Sense
- Lexus Safety System+, and others



Roadside-to-vehicle cooperative systems



Vehicle-to-vehicle cooperative system

VICS : Vehicle Information and Communication System



ETC : Electronic Toll Collection



2015

Traffic congestion

Safety

Safe and Secure
Next generation ITS
"ITS Connect"

Traffic congestion status



VICIS

5.8GHz
DSRC



Infrared
beacon



ETC



ITS
スポット

DSSS



1996

2001

2009

2011

year

カーラインナップ トヨタの最新技術 ご購入サポート アクセサリー アフターサービス U-Car (中古車) おすすめ情報

トップ 安全技術 パワーユニット シャシー・制御 快適便利・運転支援

ホーム > トヨタの最新技術 > 安全技術 > ITS Connect

ITS Connect

Toyota Safety Sense P

Toyota Safety Sense C

JNCAP



ITS専用周波数で通信し 安全運転をサポート。

Toyota Safety Technology
ITS Connect



車内ディスプレイ

車両感知器

無線アンテナ

歩行者感知器

**dedicated ITS frequency
(760 MHz)**



Commercialized in October 1, 2015.

ITS Connectは、誰もが安全・安心な運転ができる「交通死傷者ゼロ」の社会を願って、開発された技術です。クルマに搭載したセンサーでは捉えきれない見通し外のクルマや人の存在、信号情報を、道路とクルマ、あるいはクルマ同士が直接通信して取得し、ドライバーに知らせることで安全運転を支援します。



Commercialized in December 9, 2015.



Commercialized in October 22, 2015.

<http://toyota.jp/technology/safety/itsconnect/>



Vehicle-to-Infrastructure communication

Red light warning



Signal change starting support



Right turn collision prevention

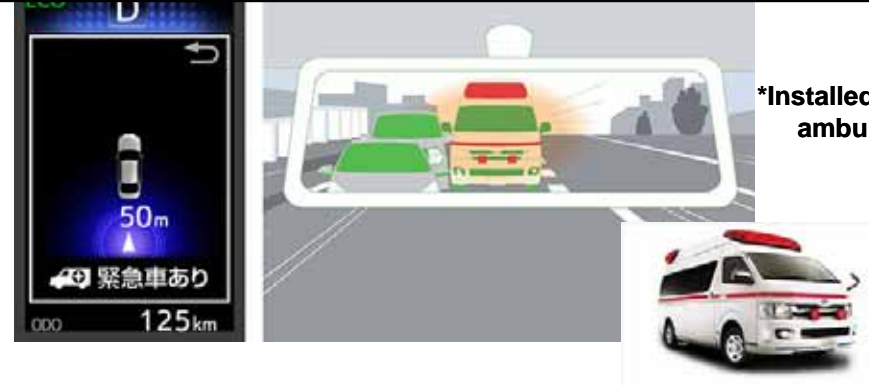


Vehicle-to-Vehicle communication

Cooperative adaptive Radar Cruise Control



Approaching Emergency vehicle Notification



*Installed in approx. 50 Nagoya ambulances (2014, 2015)

Increasing sophistication of PTPS*

(*Public Transportation Priority System)

Ensuring rapid and on-schedule mass transit

Detecting route buses

Approaching buses identified through V2I communications.

Detecting route buses

On roads with several signalized intersections, predict when the bus will pass through to facilitate its travel.

Shorter red lights

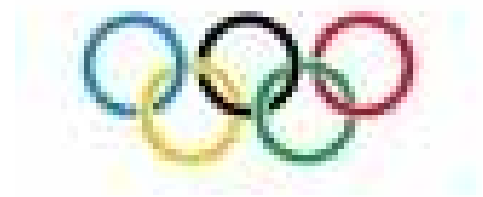
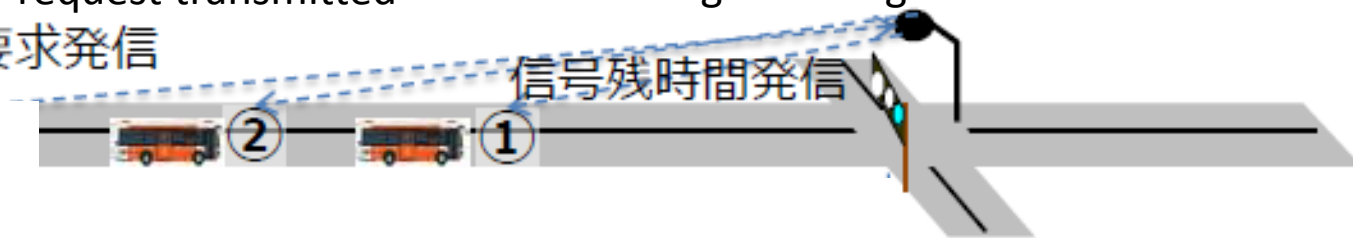
Priority request transmitted

優先要求発信

Longer green lights

Remaining traffic signal time transmitted

信号残時間発信



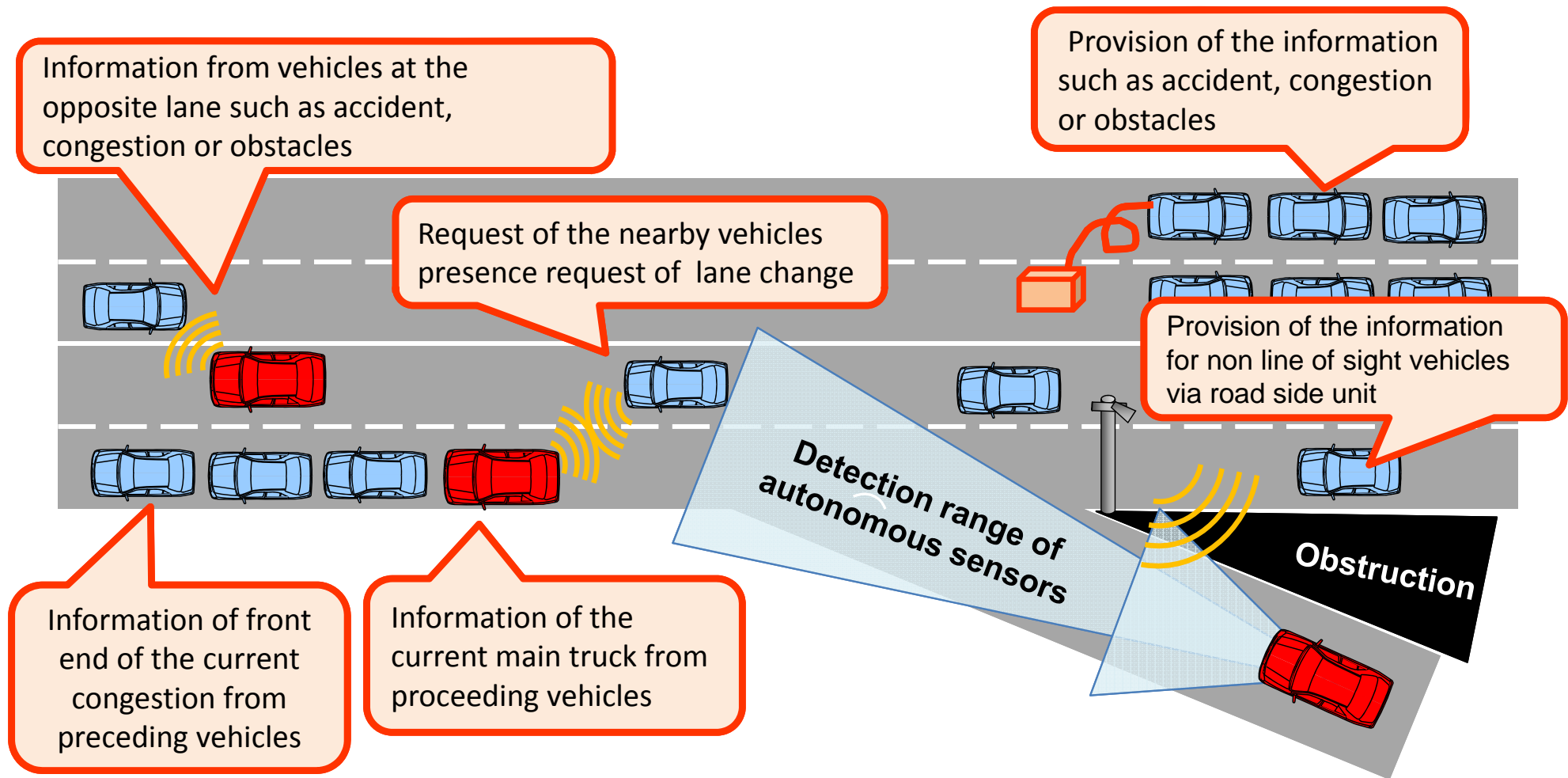


Look-ahead information from wireless communication helps smooth Automated driving

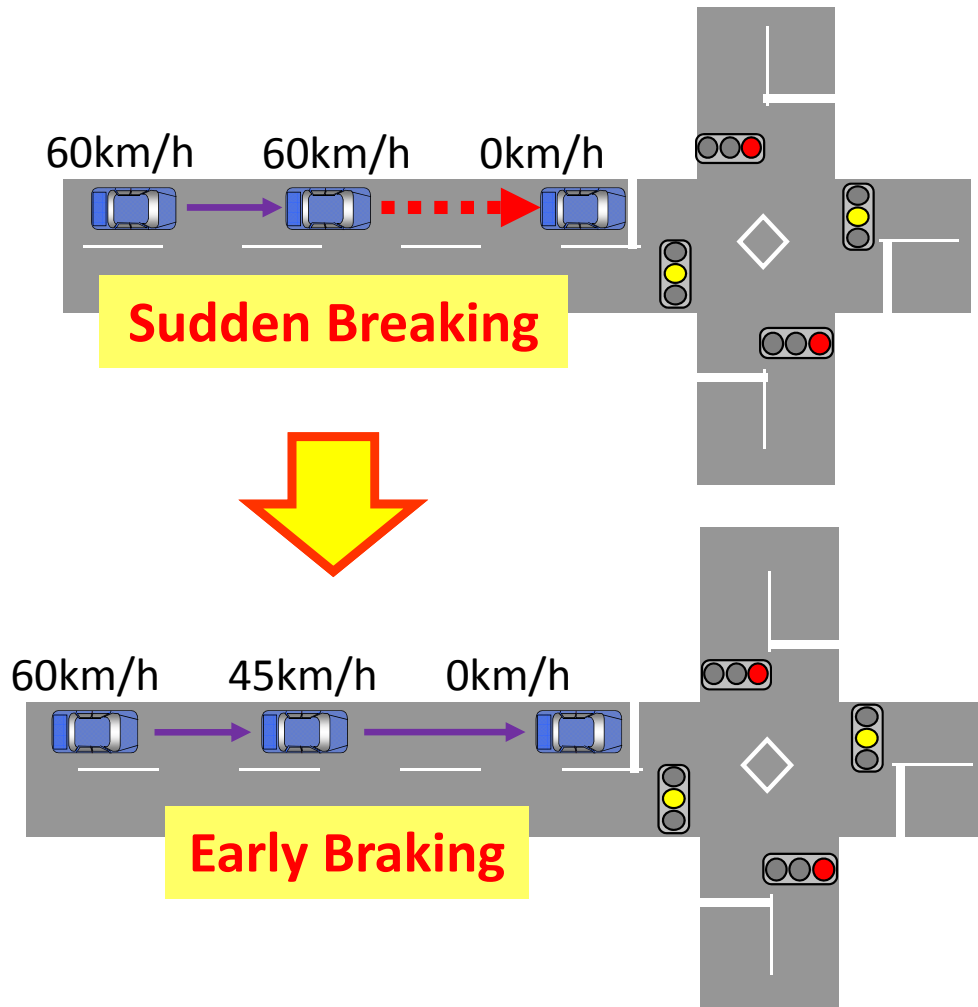
Roadside look-ahead information :

- ◆ Information that cannot be detect by autonomous sensors
- ◆ Coming Traffic signal information

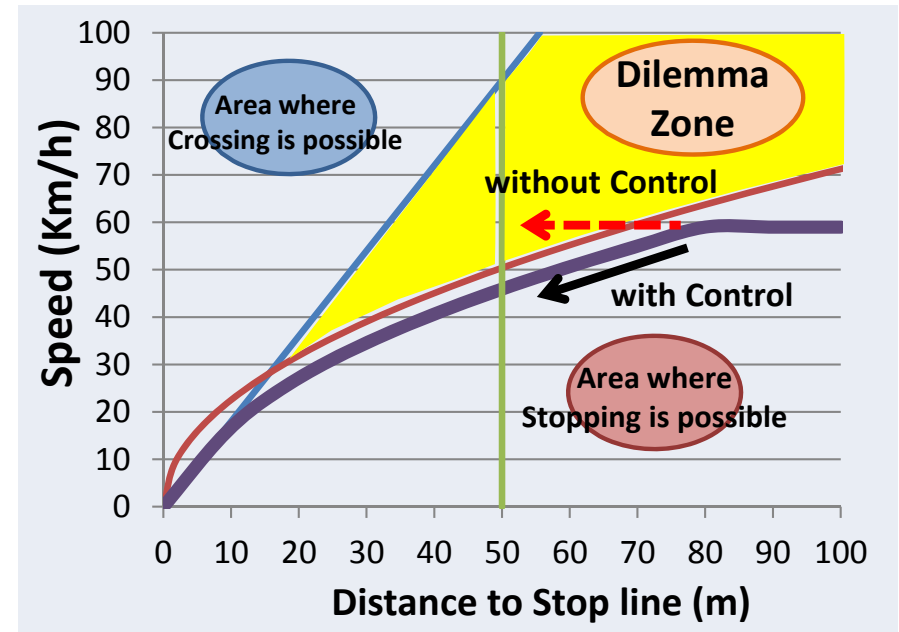
When merging into the main, the system preforms a **look-ahead of the position and speed of vehicles running in the main lane, as well as the traffic conditions at the merging point**, and then plots a course that includes the merging speed and location.



【 Go straight at the intersection **only with Autonomous sensors** 】



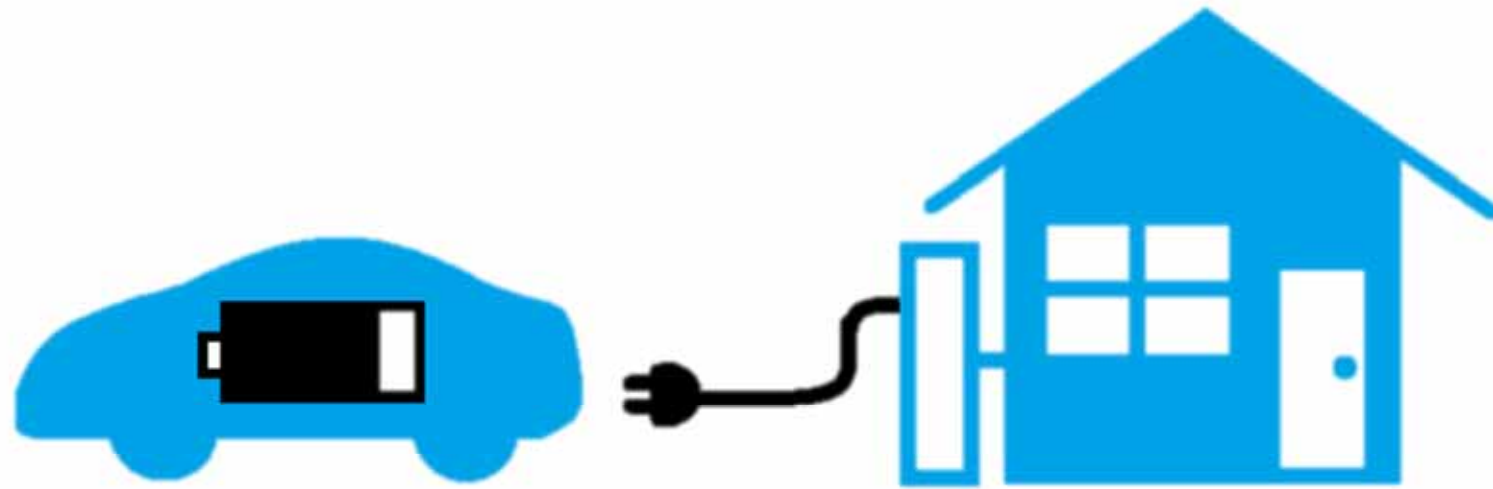
Recognize only real-time traffic signal information
→ **cannot make judgments on the Dilemma zone**



Receive traffic signal cycle information of which the car reach stop line
→ **Avoid entering the dilemma zone**

【 Go straight at the intersection **with Wireless communication** 】

Look-Ahead of traffic signal information is important for safe and smooth crossing



Optimizing the energy use of the entire community.
Activating **eco-friendly** lifestyles with high quality of life.



Building a **stress-free** traffic environment where everyone can move around as they wish.



Opened on April, 2014 (1.55ha)

Hydrogen Station



FC bus



Urban Food Production



Hogaraka House
: Supporting local production for local consumption



Smart House

Homes Connecting with Car



Smart Mobility Park

Let's experience cutting edge environmental technology!



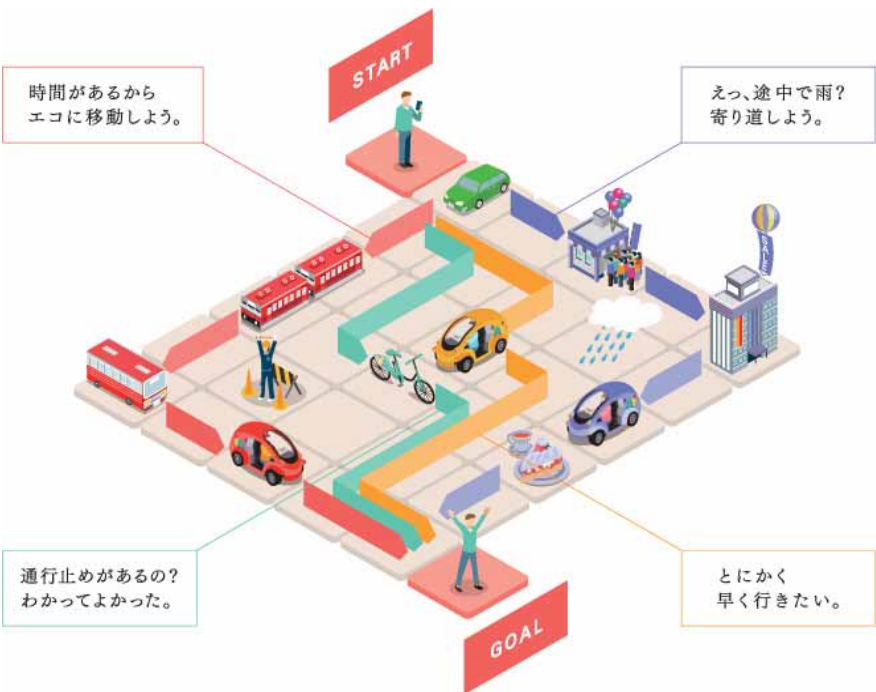
(Based on ecoful town HP)

Harmonious Mobility Network  *Ha:mo* (Since October, 2012)

**A transit system, which is people, city, and community friendly,
Designed to optimally integrate private cars and personal mobility
with public transportation**

Information service to support low-carbon, seamless transport

Ha:mo RIDE: A self-service car sharing system which complements public transportation by utilizing ultra-compact electric vehicles. Suitable for short-distance trip in towns at user's convenience



COMS

Produced by TOYOTA Auto Motor
Ultra-compact EV



PAS

Produced by Yamaha Motor
Electrically-power assisted bicycle

TOYOTA city

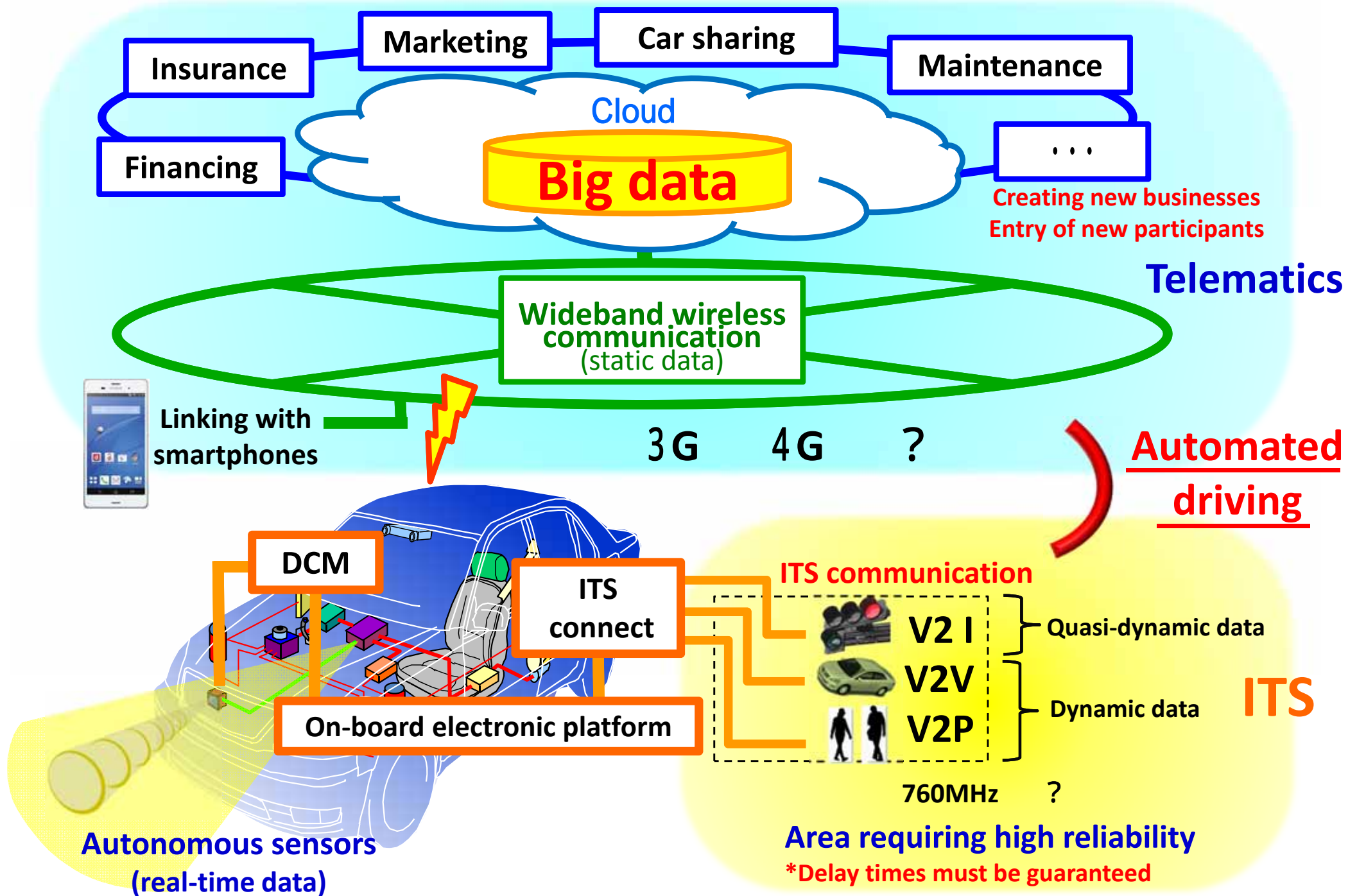


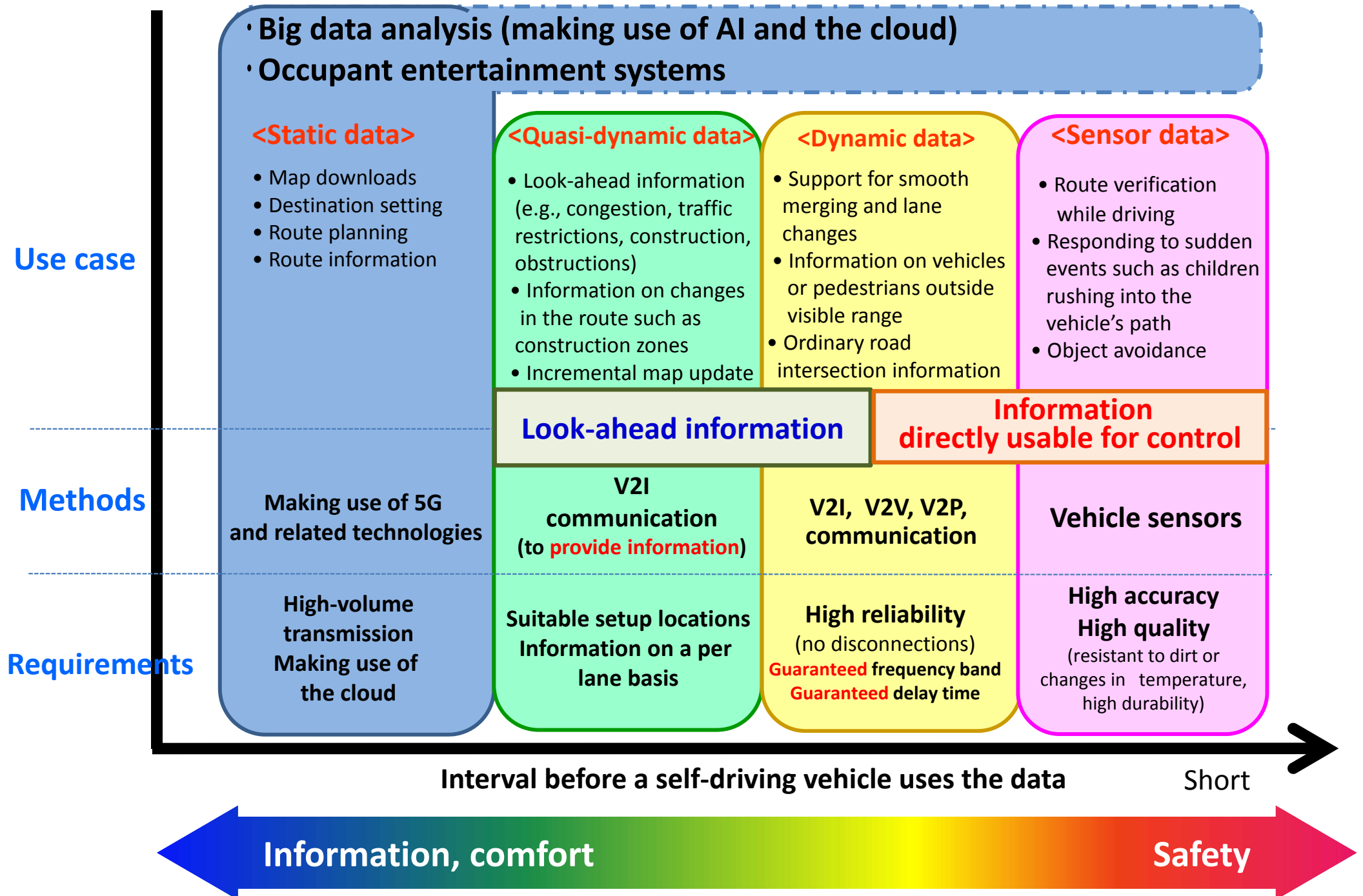
**GRENOBLE
(FRANCE)**

TOKYO



OKINAWA





- ✓ **Connected cars are bound to evolve even further.**
- ✓ **Applications and requirements for communications used in connected cars are diverse.**
- ✓ **5G is regarded as a promising technology for future infrastructure communications.**
- ✓ **However, satisfying the stringent demands imposed on connected car communications requires breaking with the past to develop new technologies and reinvent systems.**



We look forward to ideas that will have automakers saying

“We want in!”

Thank you for your attention

**Rewarded with a smile
by exceeding your expectations**

TOYOTA