The Latest Trends of Internet ITS
Vehicles in a Ubiquitous Computing Environment

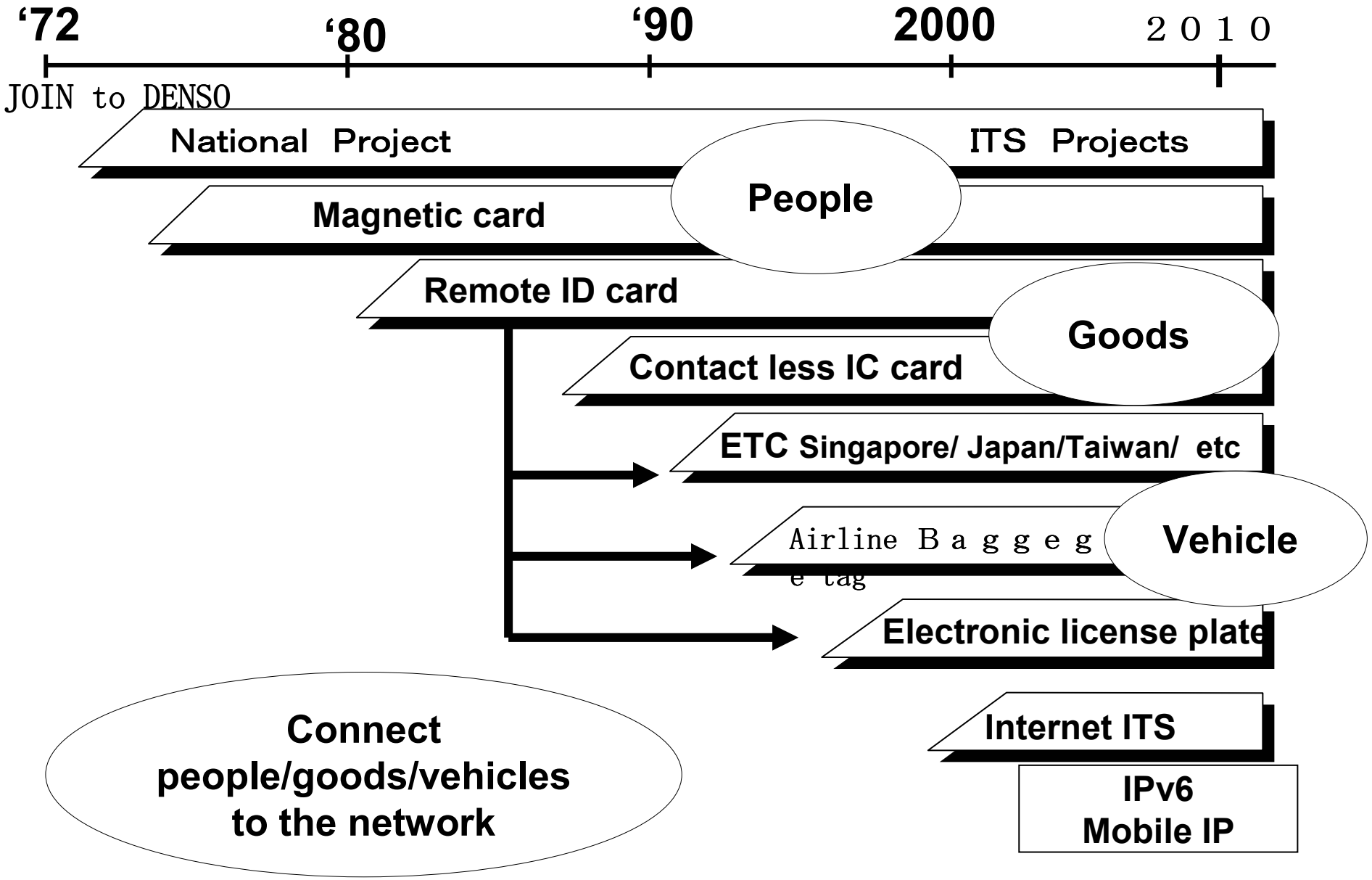
The latest outline of vehicle networking

Naoki Tokitsu
Director of
Internet ITS Consortium

General Manager of
DENSO Corporation
June 6, 2007

CONTENTS

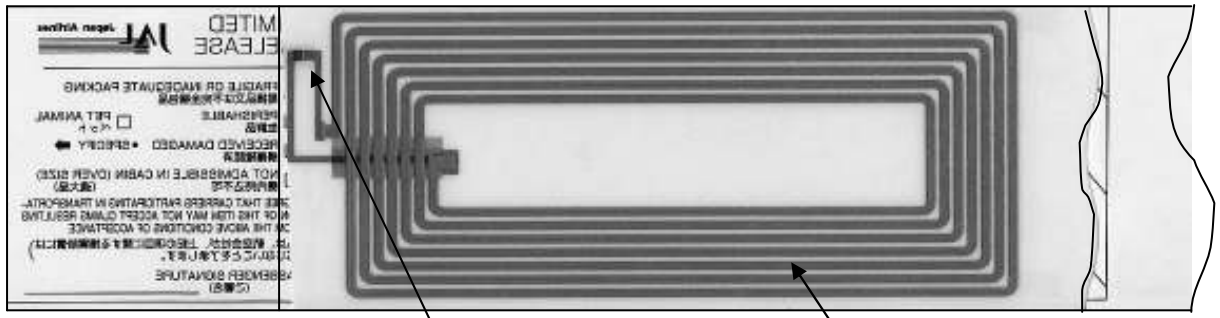
My ITS Career Background



Baggage Tag with RF- ID Technology

hand-carry baggage tag

Backside



IC chip

13.56 MHz antenna circuit (printed scheme) Direct print to paper material

Experimental Phase

Tokyo (Narita) Osaka (Kansai) Nagoya (chubu)

Electronic License Plate

License plate has an IC chip that stores vehicle ID information (license plate and vehicle registration information). Includes wireless communication module, which utilizes 5.8 GHz microwave frequency.

MLIT's merits

- Rationalization of vehicle registration procedure (Computerized procedure)
- International standardization approach from Japan Proposal to Proposal to ISO

MLIT:Ministry of Land, Infrastructure and transportation

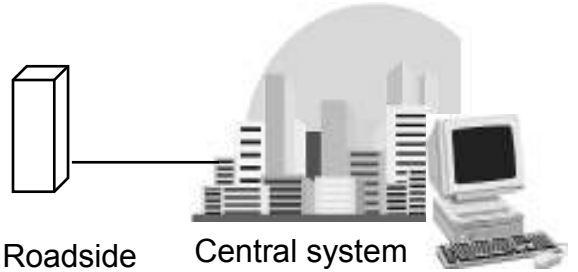
Society's merits from infrastructure

- Electronic operational support
- Cost reduction of vehicle identification equipment
- Allowance for private sectors' utilization

End users' merits

- Preferential treatment for handicapped/aged people and low emission vehicles
- Convenience (utilization by social organization)

Wireless module (newly developed)



SMART plate introduction overview

- Defined as vehicle-common infrastructure *'Overall basic traffic policy trend at the beginning of 21st century' by Ministry of Transport

- Some Transportation Bureaus started implementation in 2003.

- Can attach to any vehicle, both new and existing
  *At the time of vehicle inspection
Max. 3 years to complete entire population
(Vehicles to be attached: 75 million vehicles)

- Utilize 5.8 GHz microwave frequency

Integration to Internet ITS

Networking Vehicle

Introduction (Predictions)

- All vehicles will be connected to the network by 2010
- A seamless information society will emerge
- New businesses will be created by focusing on vehicles

History of ITS in Japan

in 1973: Traffic control experiments in Tokyo（my first job)

in 1987: Car navigation implementation

in 1996: VICS (Traffic information) implementation

in 1998: Mayday system implementation

in 2000: ETC implementation

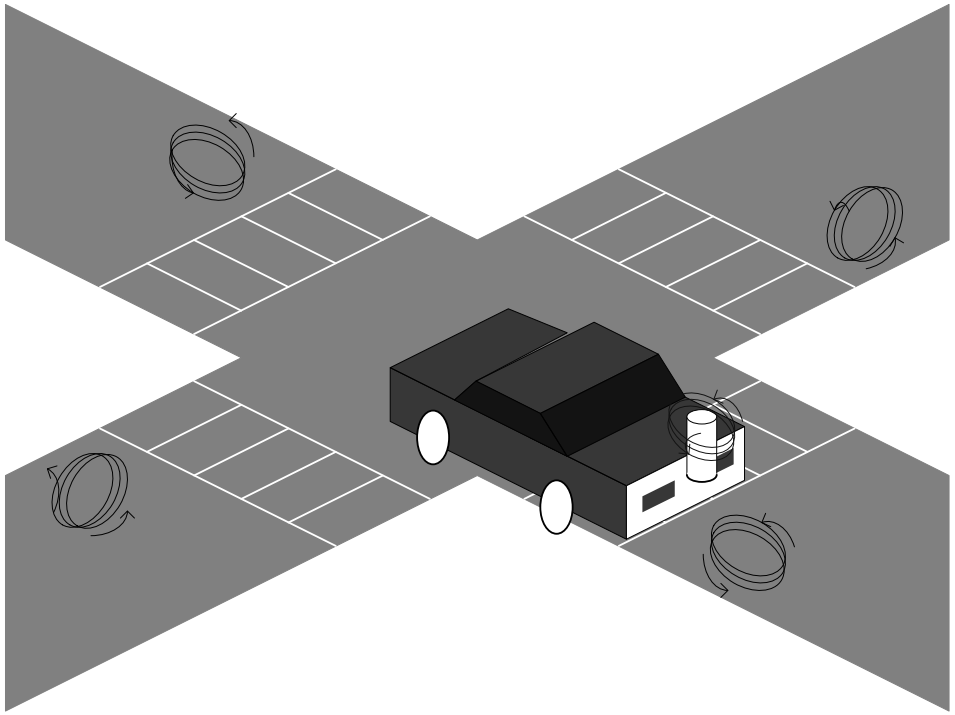
in 2001: **Internet ITS field tests (Government Project)**

2000 vehicles connected to internet

in 2002: ＩＩＣ established・・・More than 100 companies

FIRST PROJECT in 1973

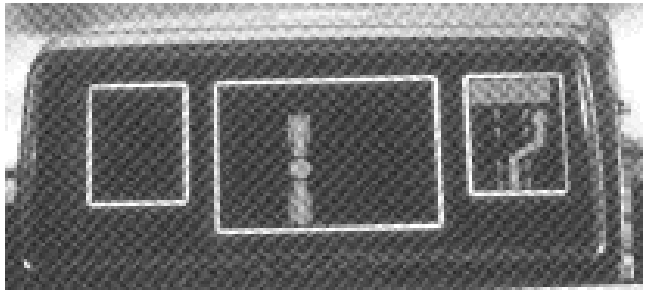
Big project \6000M

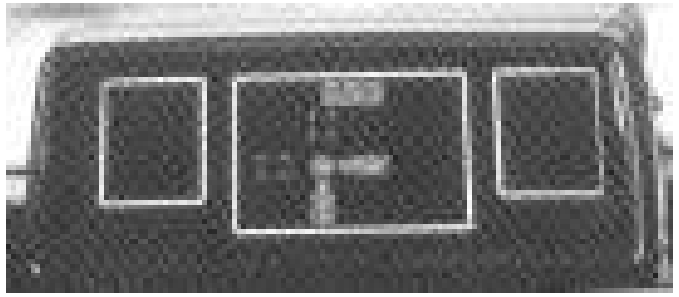


Magnetic Coupling Communication

Man-Machine Interface

Display





Input

From Shinjuku

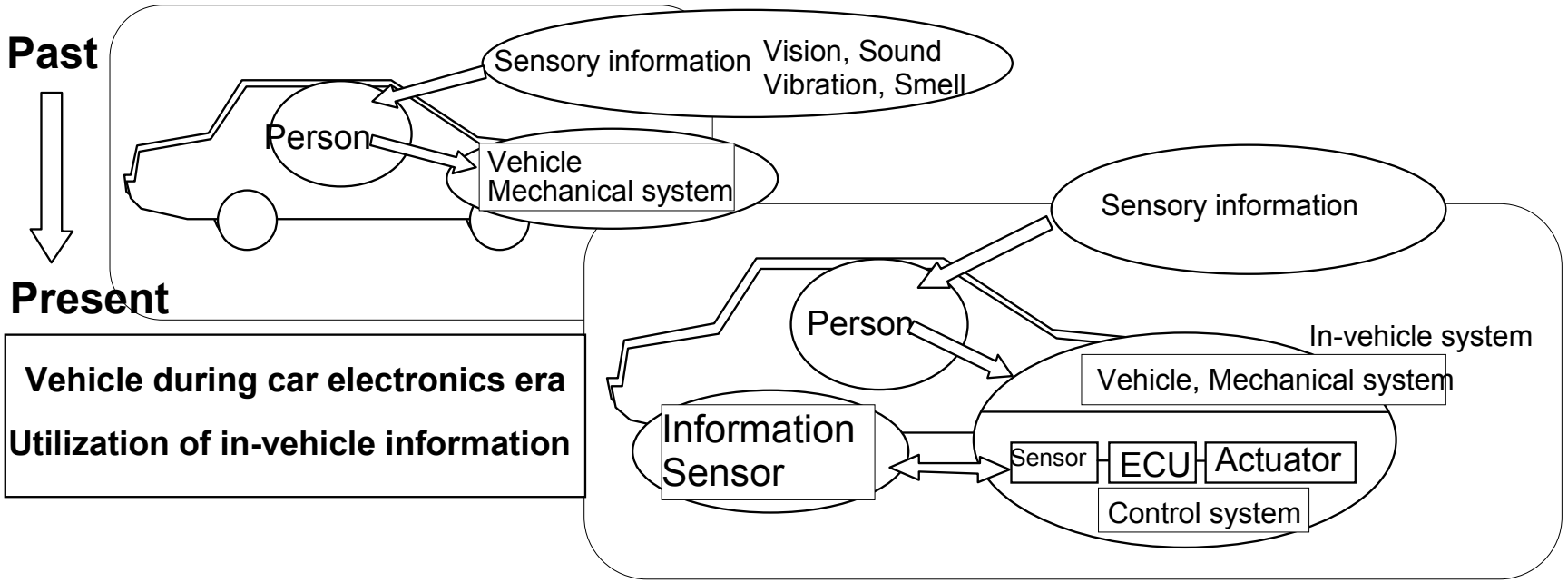
1	2	3	4	5	6	7

From shibuya

1	3	8	6	4	2	0

First Navigation System in the World

Vehicle Evolution



Present In-vehicle Systems with Car Electronics

Power train control

- Engine control (gasoline & diesel)
- Transmission
- Throttle control
- Igniter
- Distributor-less ignition

Body control

- Air conditioning system
- Air bag system
- Door control system
- Key-less entry
- Immobilizer system
- Lamp control

More Than 60 Electronics system In the car

Drive control

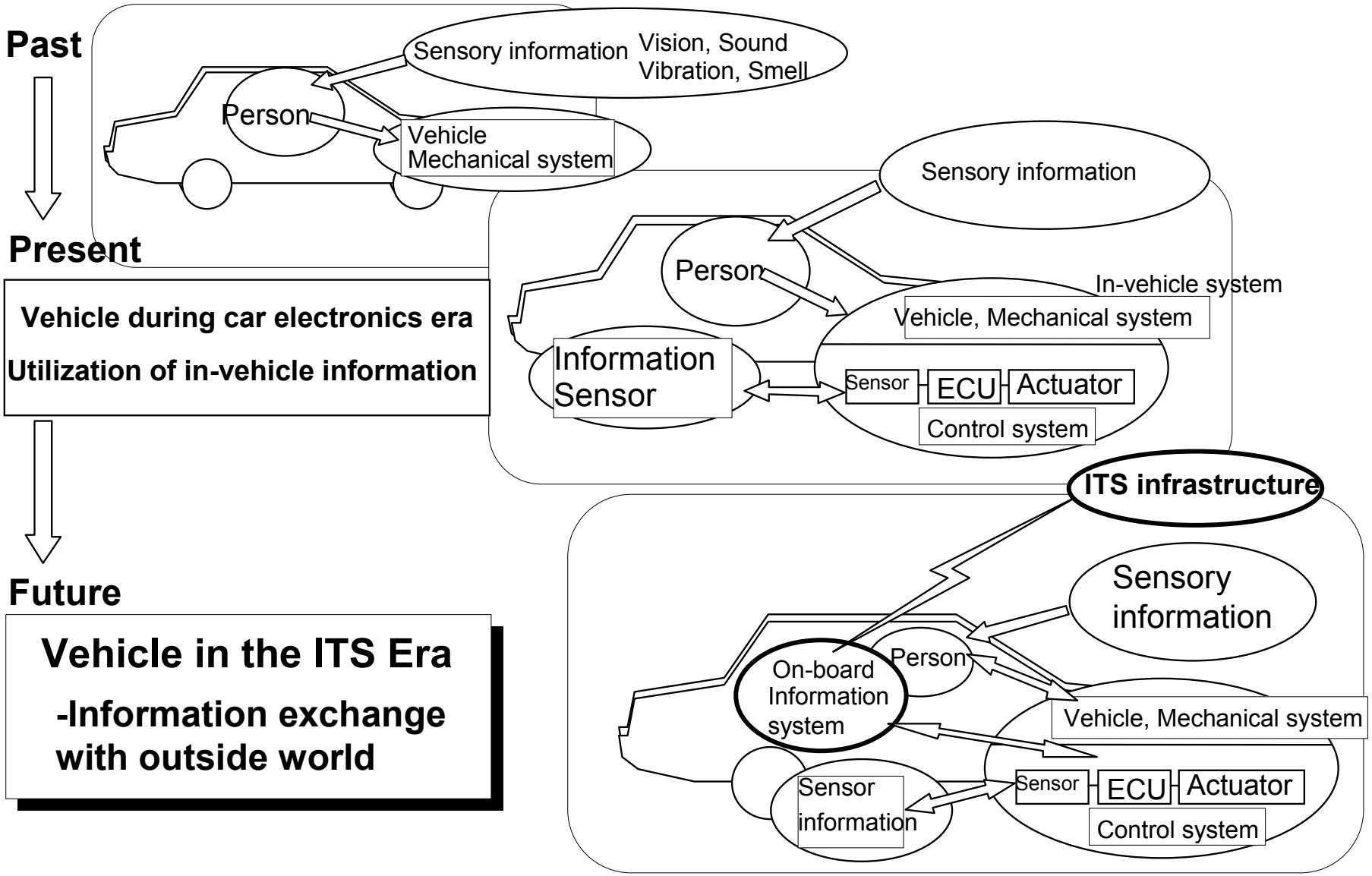
- VSC (Vehicle Stability Cont.)
- Power steering control
- 4 WD control
- Suspension control
- Vehicle posture control
- ABS control (Anti-lock Brake Sys.)
- Traction control
- Cruise control

ITS

Information communication

- Navigation system
- VICS
- ETC
- Car telephone
- In-vehicle LAN
- AV system

Vehicle Evolution



DEVELOPMENT OF ETC SYSTEM

In 1994

ETC : Electronic Toll Collection

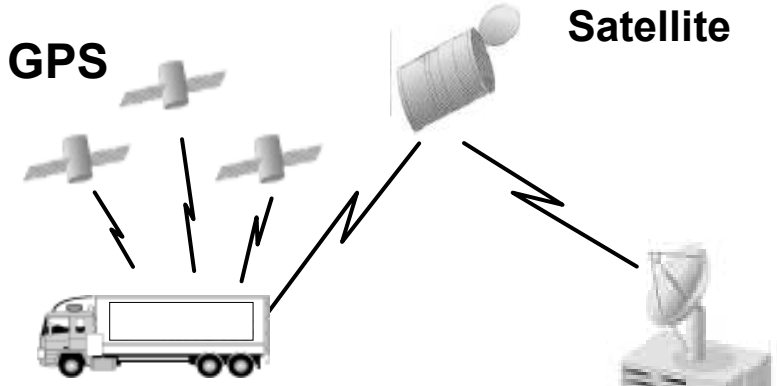
Singapore Taiwan China USA UK & Japan

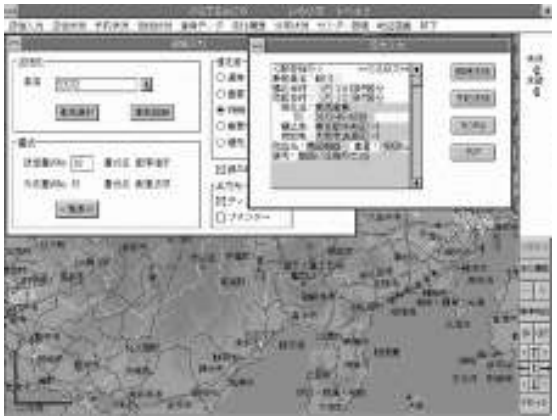
OmniTRACS in 1995

Commercial vehicle operation system utilizing satellites
- Mobile Media Net was established in 1996.
- 3000 vehicles under operation.

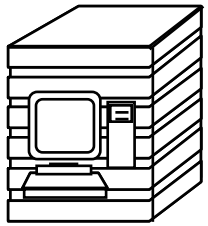
OmniTRACS

AVOS: Advanced Vehicle Operation System



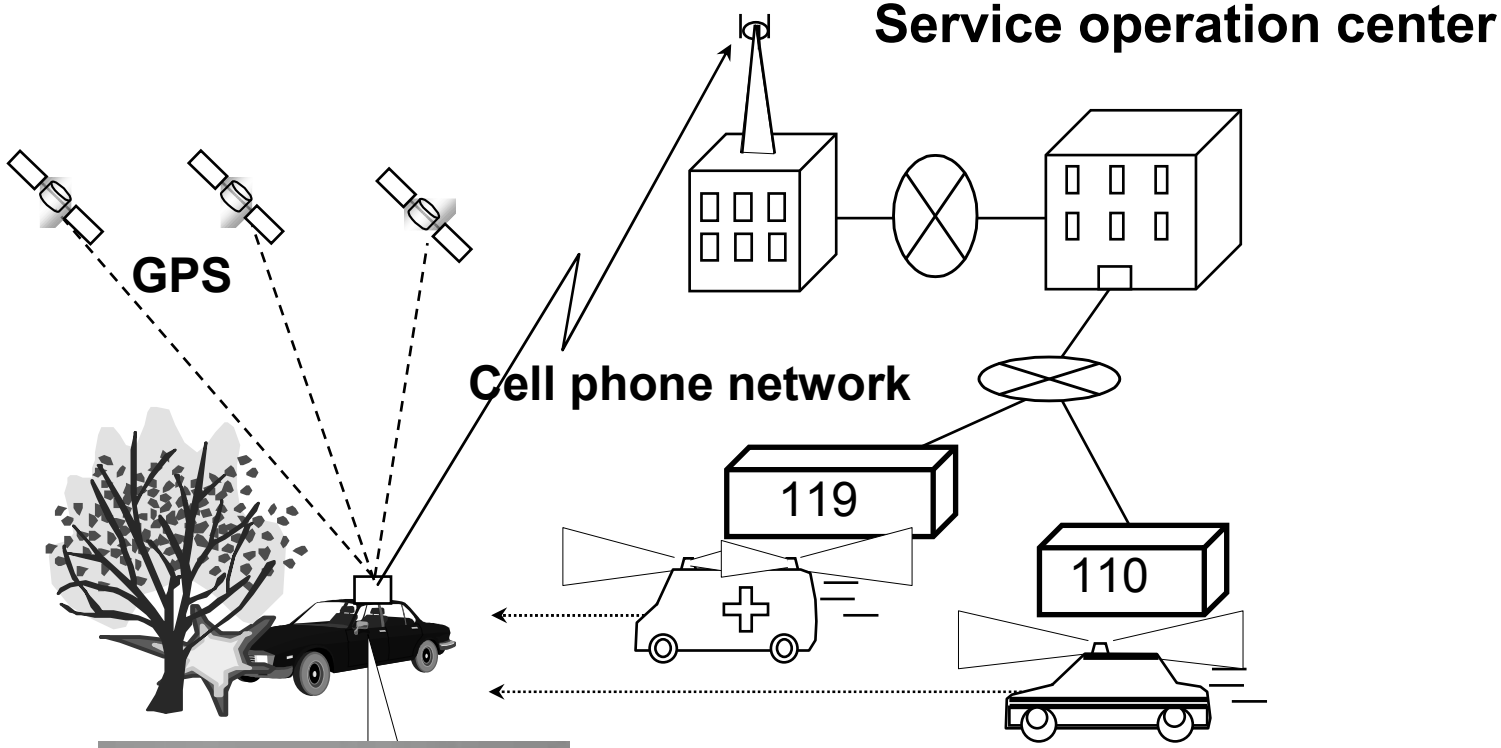


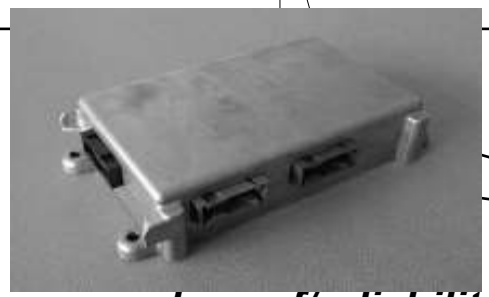
Truck positions are shown on the map.



Operation center of logistics company

Mayday System in 1998





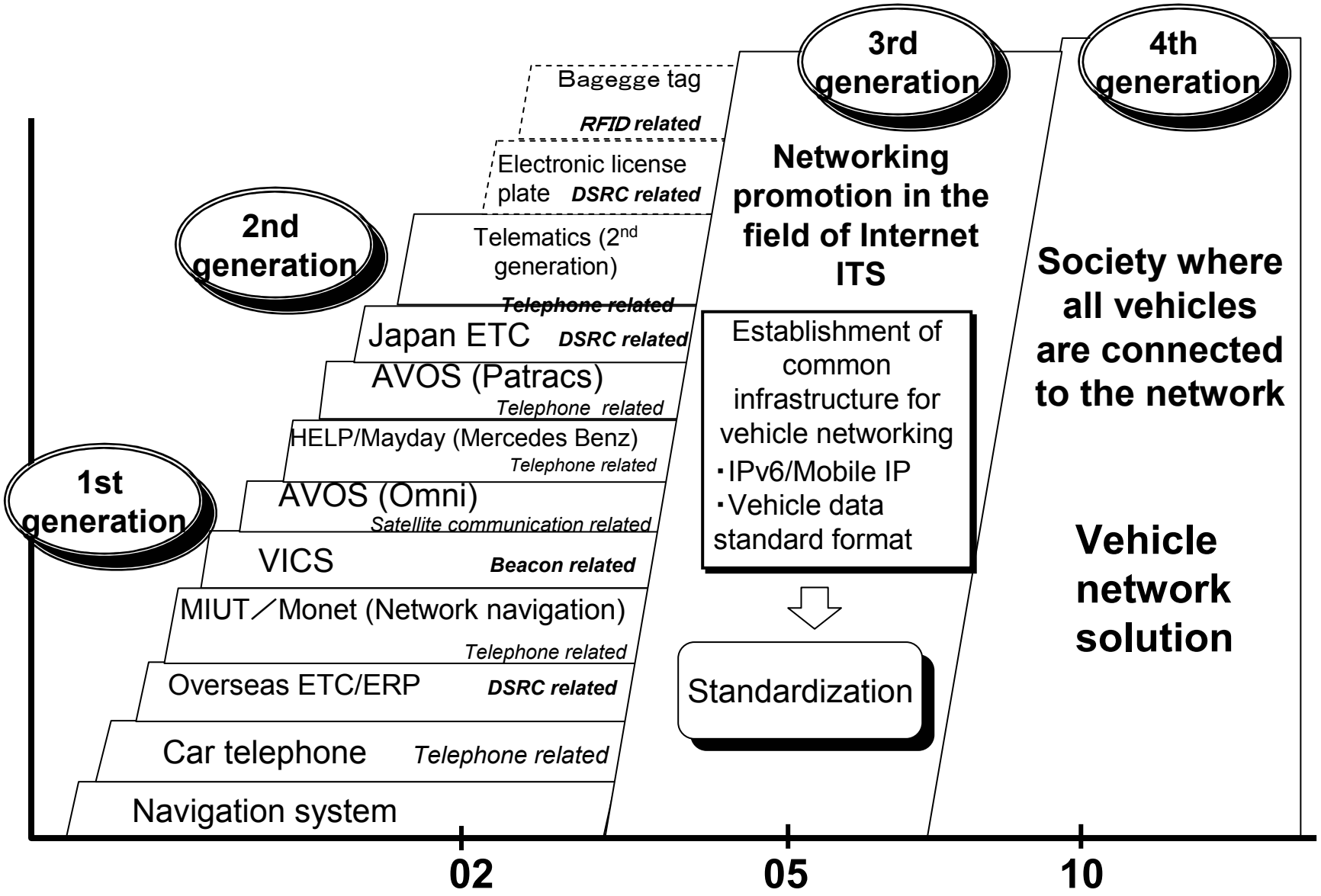
Focus on crashproof/reliability

Mercedes Benz E-call service

- **Implemented model: Mercedes S class (standard equipment)**
- **Started full implementation from 1998.**

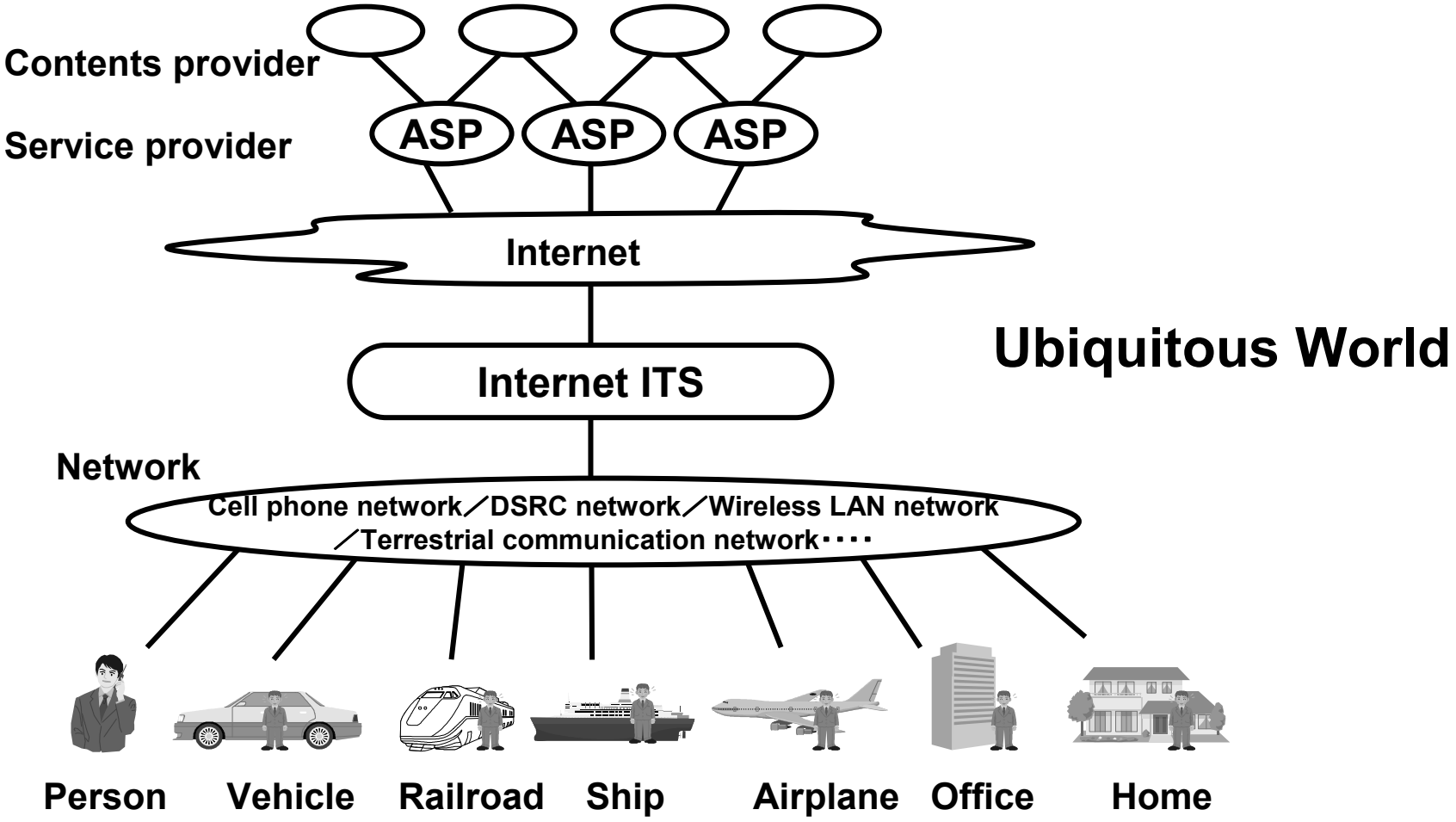
Telematics Generations

ex ; DENSO's business



Ideal World (our target)

Seamless multimodal environment



Ubiquitous World

Establishing seamless connection with home ,office,mobile and VEHICLE by shifting to general-purpose infrastructure, the Internet

Two Projects started

In 2000

A. Probe information system

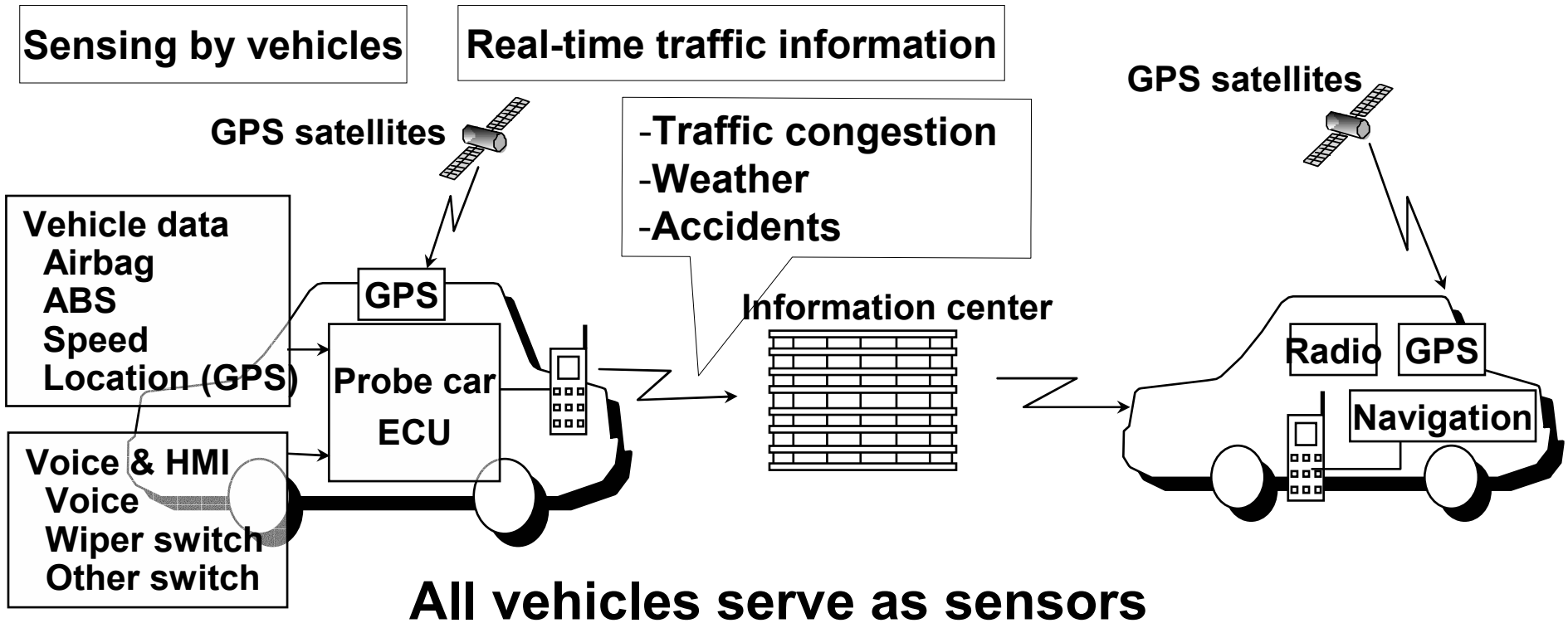
Using vehicles as mobile sensor

In 2001

B. Internet ITS

Connecting all vehicles via the Internet

Probe Information System



All vehicles serve as sensors (connected via communication networks).

Paradigm shift

Investment in infrastructure ⇒ **Investment in on-board unit**

A. Probe information system (Vehicle Speed and Traffic Condition)

B. Probe information system

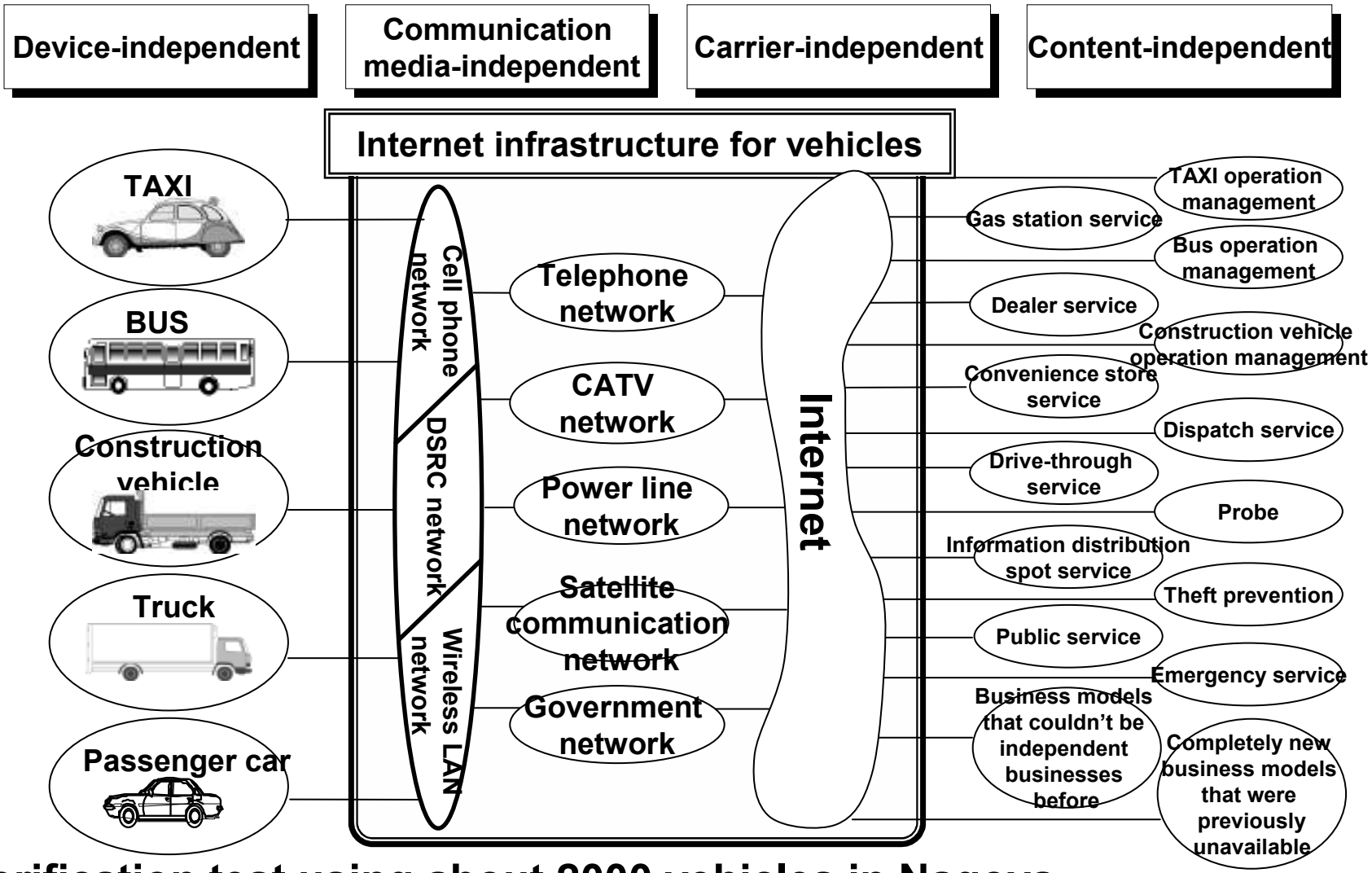
- ”Weather rainfall” status with “Wiper data”
- ”Safety Driving & Road” status from “Camera”

”Dangerous Point” status with “Braking data”

Every car send the –G data to center

Center delivery to car “ALARM”

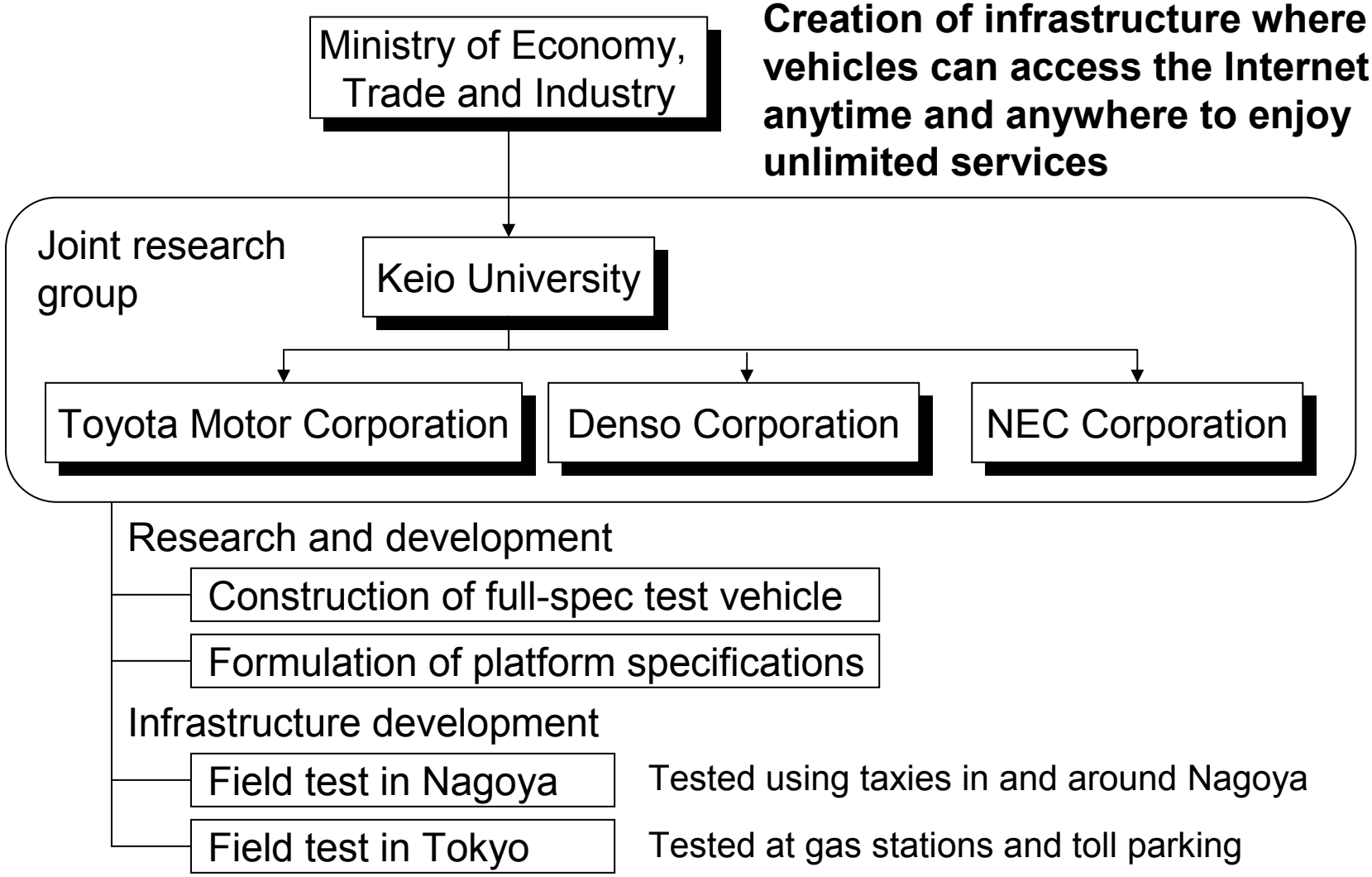
Internet ITS



Verification test using about 2000 vehicles in Nagoya started from March '02

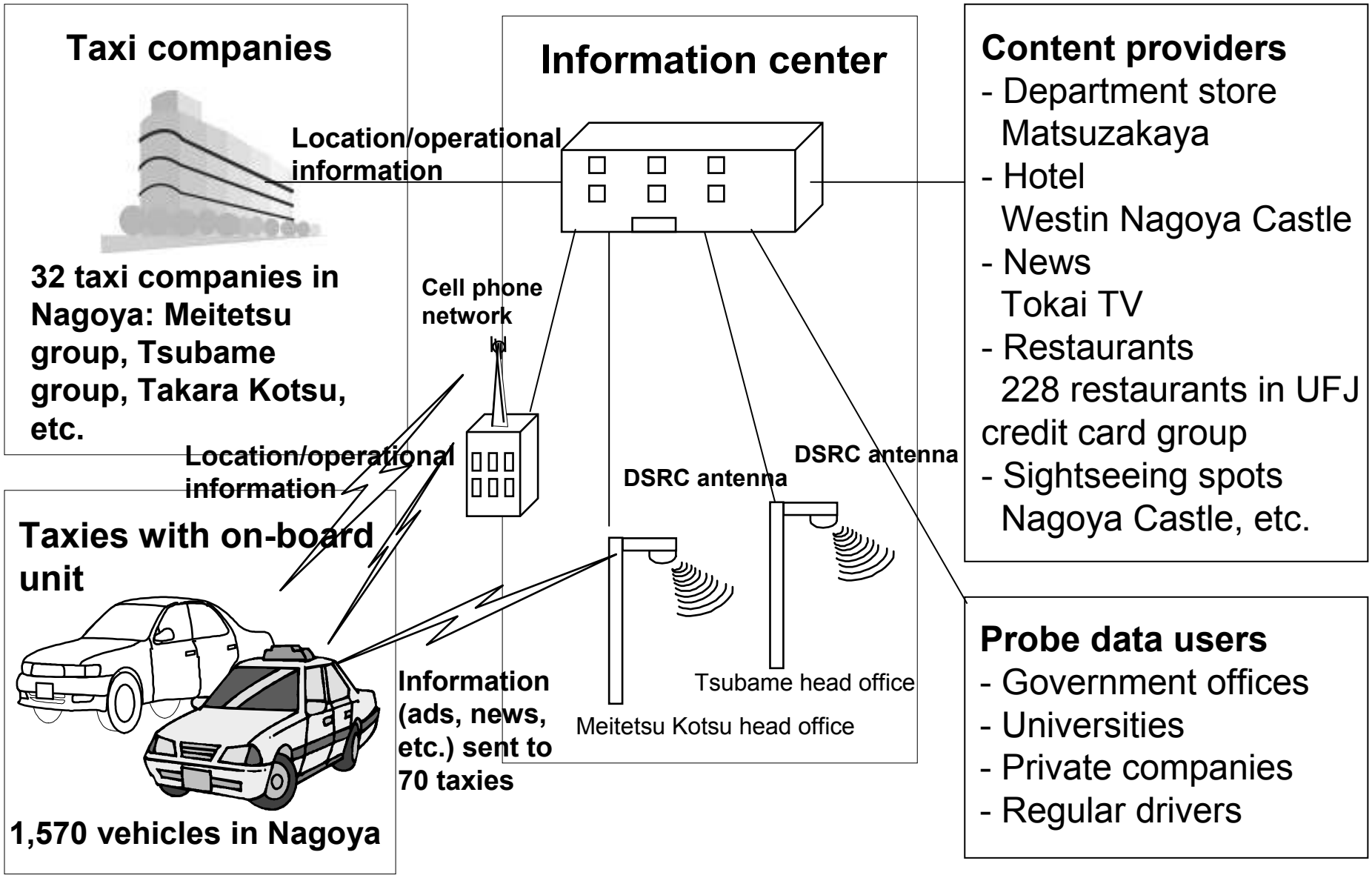
to World Congress on ITS in Nagoya in '04, Expo Aichi in '05

Organization of Internet ITS



Field tests using approx. 2000 vehicles from January to March, 2002

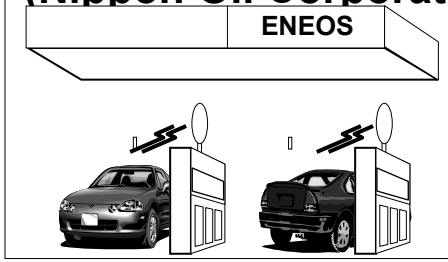
Overview of Field Test in Nagoya



Overview of Field Test in Tokyo

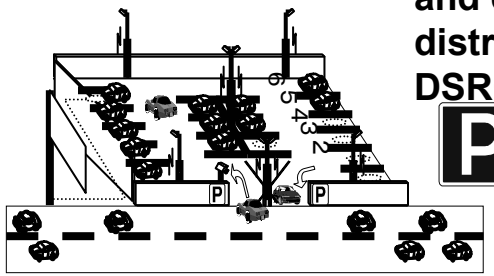
Total number of test vehicles: 70 vehicles

Service station (Nippon Oil Corporation)



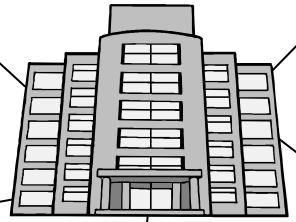
Service guidance and contents distribution (via DSRC)

Parking lot (Park 24)



Cashless payment and contents distribution (via DSRC)

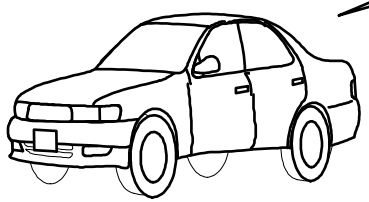
Information center



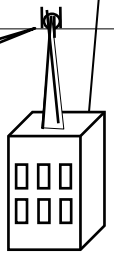
Cashless payment provider
-"Edy"bitWallet

Contents provider
- "Dr. Drive"
  Nippon Oil Corporation
- "Hot Pepper"
  Recruit
- "Map data"
  Zenrin
- "MONET"

Vehicle



Local contents distribution (via cell phone network)

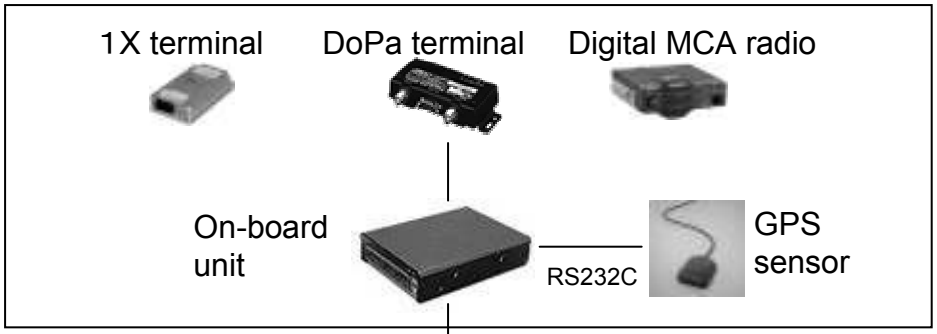


Cell phone network

DSRC (Dedicated Short Range Communication) is also used in electronic toll collection systems.

Internet ITS On-board System Architecture

Basic architecture



Peripheral equipment (option)

Function

・Message transmission/reception (500 characters) between control PC and REGIO and display of received message available.

Function

・Message transmission/reception (500 characters) between control PC and PDA and display of received message available. Incoming message is notified by LED flashing.

Function

・Message transmission/reception (500 characters) between control PC and navi. Incoming message is notified to driver by LED or displaying 'Message received.' on screen.

・Destination sent from control server can be set through coordinating with navi.

・Navi's position information can be utilized by mobile server.

・Destination can be transmitted from navi to control PC.

REGIO — RS232C

- Windshield wiper signal — SW signal (0-12V)
- Occupied/vacant — Support 3 types
- Door signal

PDA — RS232C

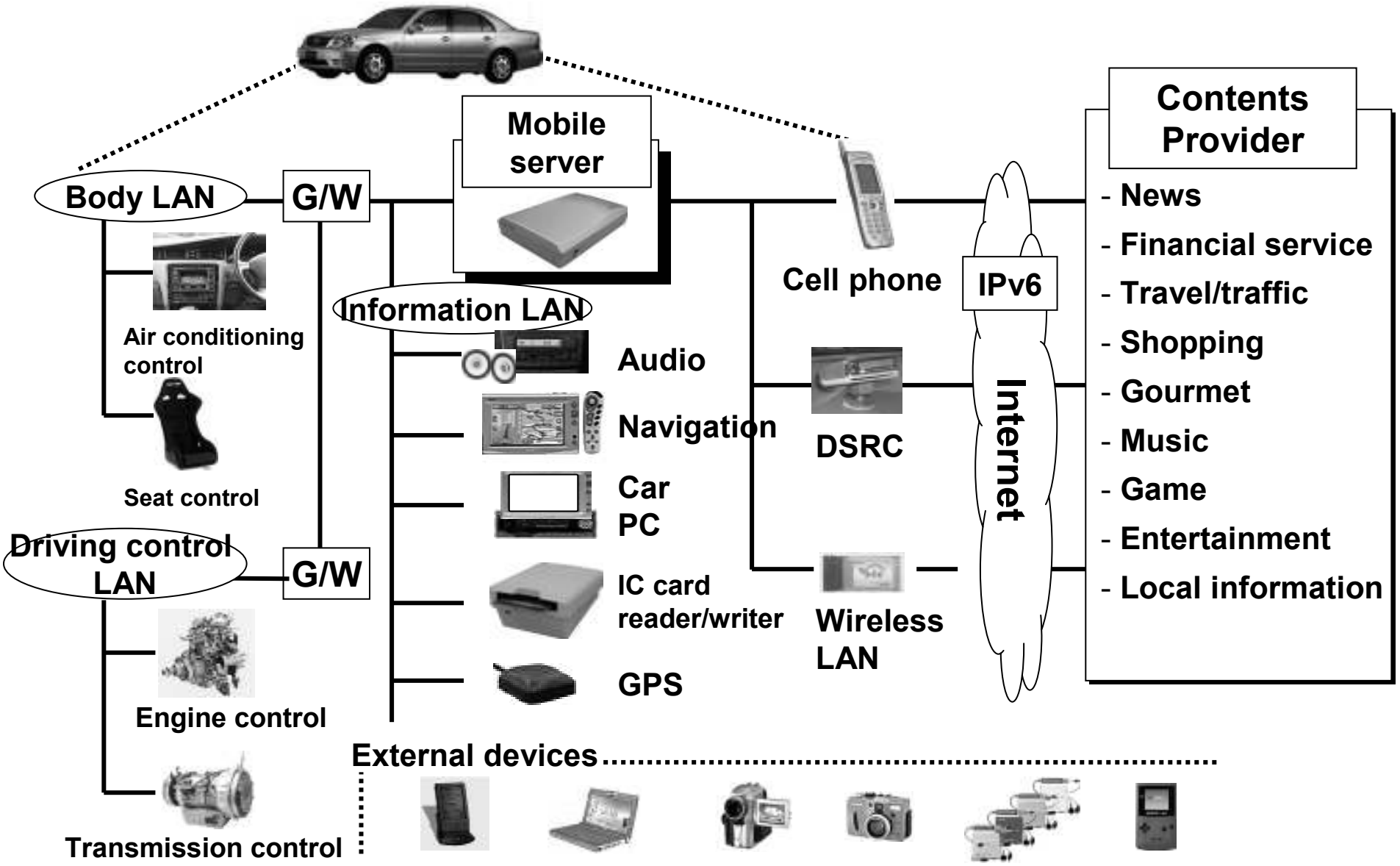
- Speed sensor — Pulse signal (Support sensor pulse of 2-25)

RS232C — I/ F BOX

- ・Ignition timing control
- ・Air float rate
- ・Engine rpm
- ・Throttle position
- …

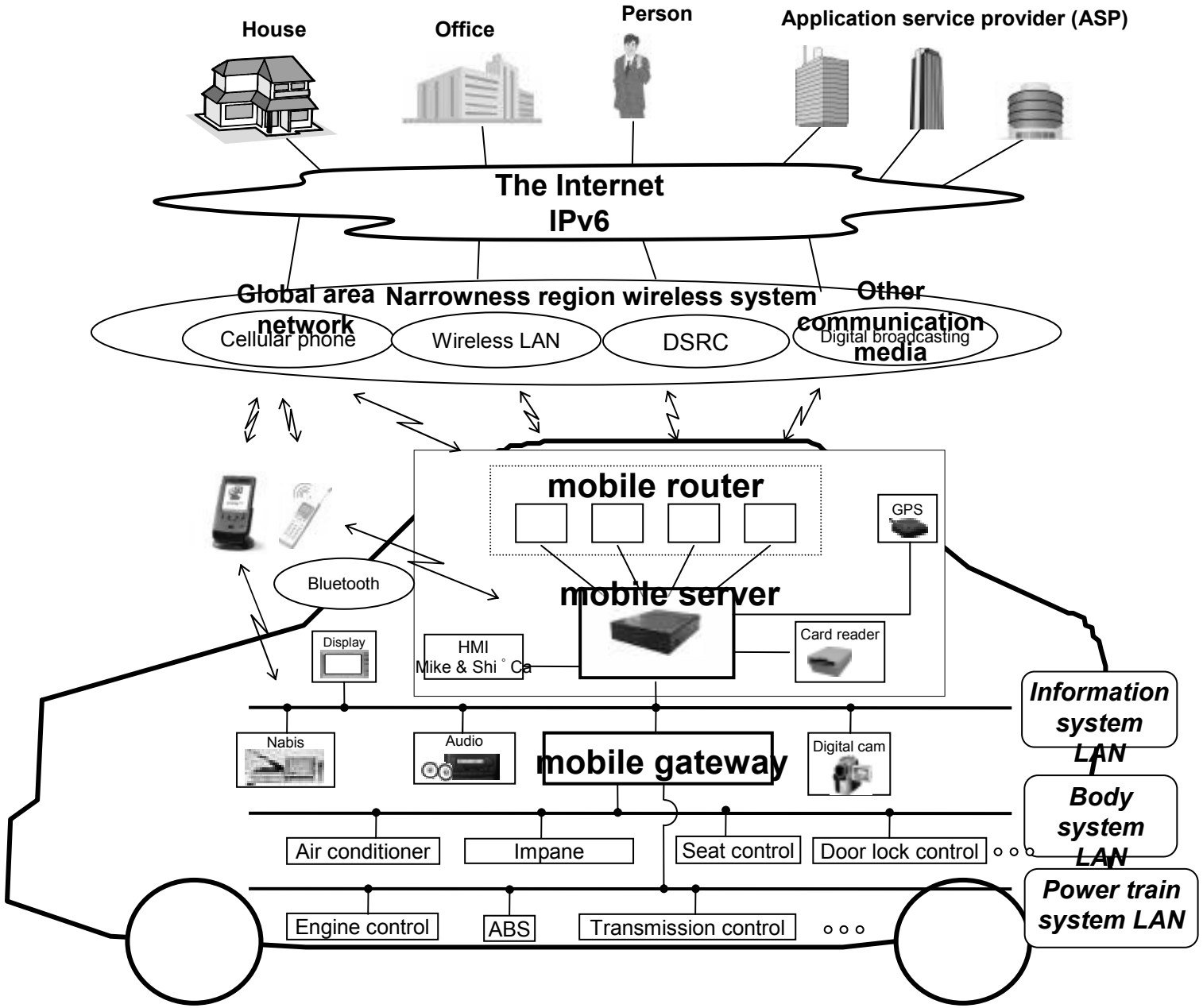
Dedicated navigation — RS422

On-board Platform Idea in 2002

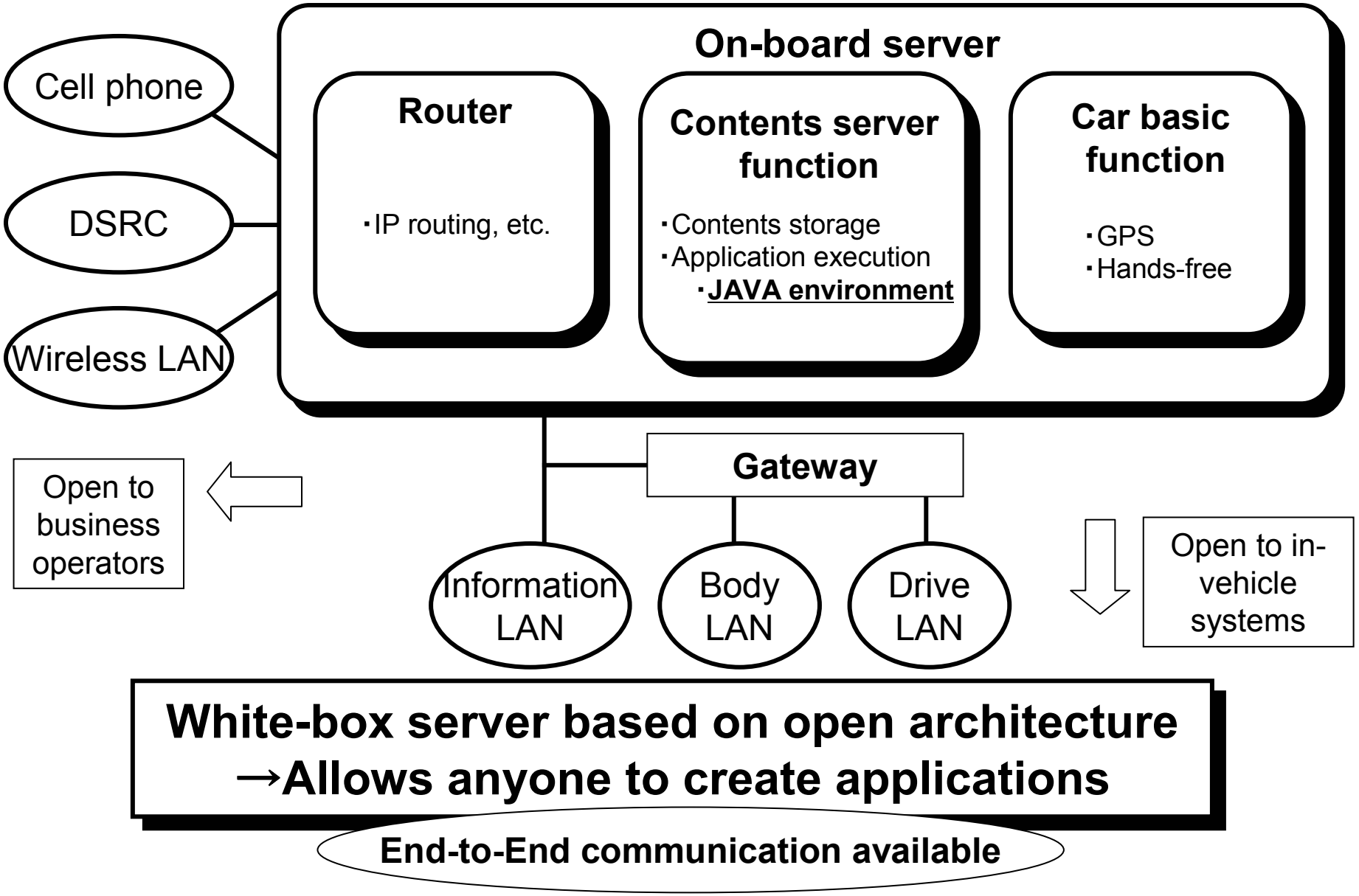


Necessity of in-vehicle platform making

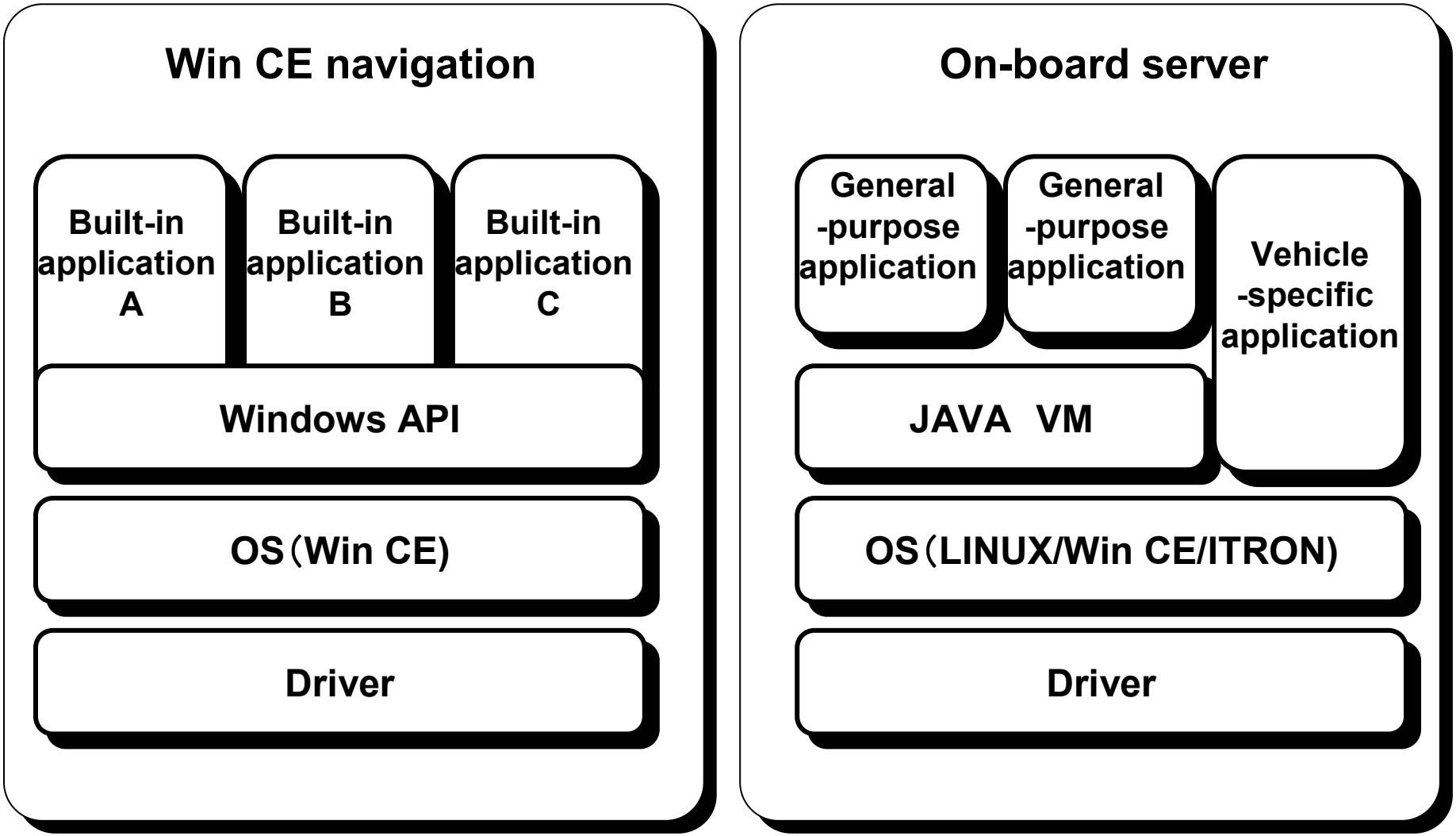
2003 making



On-board Server Functions



Software Architecture Example



The Internet ITS Consortium was established in October, 2002, with the participation of about 100 different companies.

The Consortium will make full use of upcoming events in Nagoya, includingthe 2004 ITS World Congress and the 2005 Nagoya World Expo."

2002年(平成14年)12月20日(金曜日)

中日新聞 (第3種郵便物認可)

進むインターネットITS

車載端末に各種情報

実用化へ100社大同団結

次世代型の〝走る情報端末〟の実現に向け、トヨタ自動車やデンソー、NEC、三菱総合研究所などが中心となって、この秋に設立した「インターネットITS(高度道路交通システム)協議会」は、近く東京都内に開設する実験室でテストを行い、来年秋を目標に、実用化のベースとなる通信システムの開発を急ぐ方針だ。

基盤システム 来年にも開発

インターネットITSは、携帯電話など通信技術を活用し、インターネット自由で活性化した市場が誕生する」と話す。その車載端末で利用するシステム。渋滞情報、映画や音楽などの娯楽情報の受信、レストランやホテルの予約など多彩なサービスが受けられる。

協議会事務局は「実用化されれば、誰でも参加。このほかソニー、システム開発を急ぐ。協日立製作所、富士通、松議会ではこうした成果下通信工業、東芝、Nを、ITS世界会議や日本国際博覧会(愛・地球博)が開かれる〇四、〇五年に名古屋で計画している、十五万台を利用した大規模な実証実験につなげていく方針だ。

トヨタなどの呼び掛けで設立された協議会には、自動車メーカーからはトヨタのほか、三菱自動車工業、富士重工業、マツダ、スズキなどが参

可能なビジネスとなり、サービス内容で競争する

TTドコモ、KDDIなど計百社が大同団結し

ビスが受けられる。

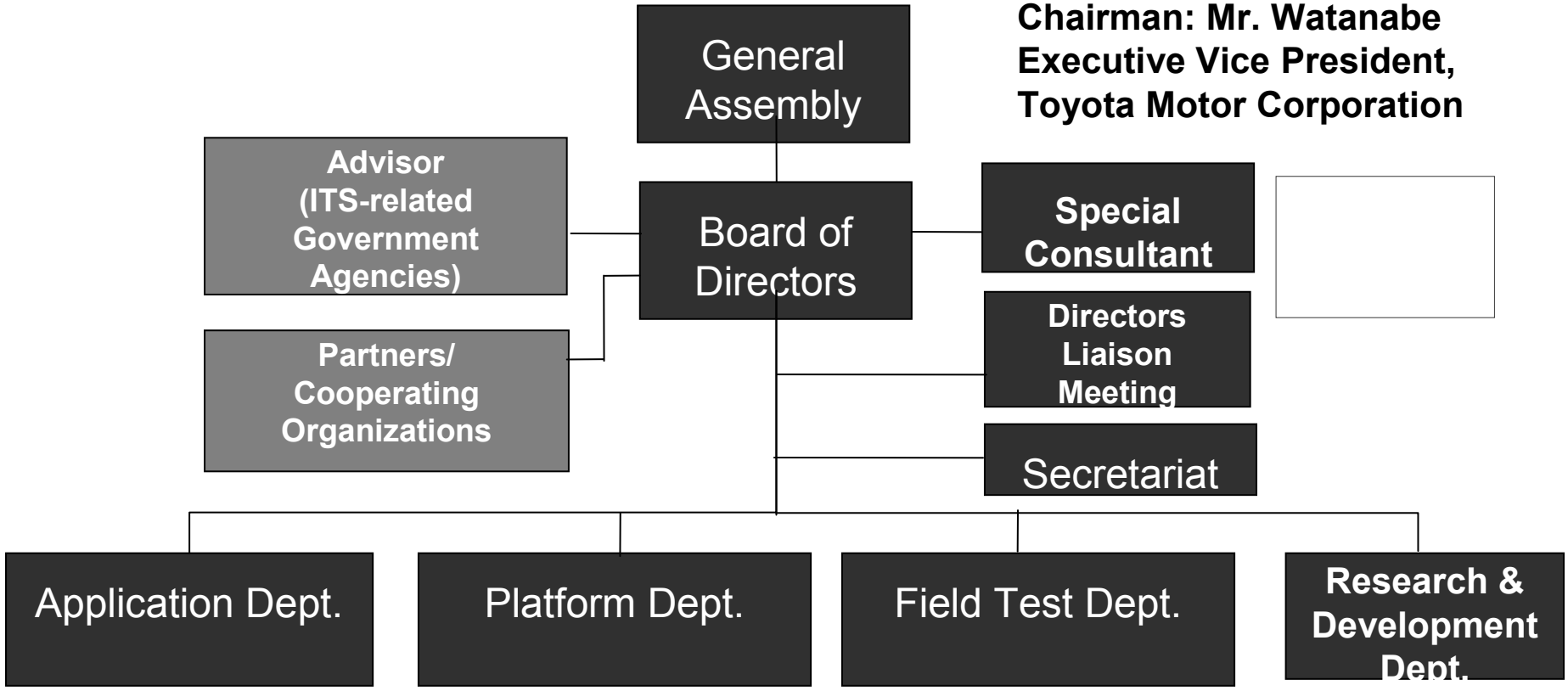
プリズム

Internet ITS Consortium (IIC)

Organization

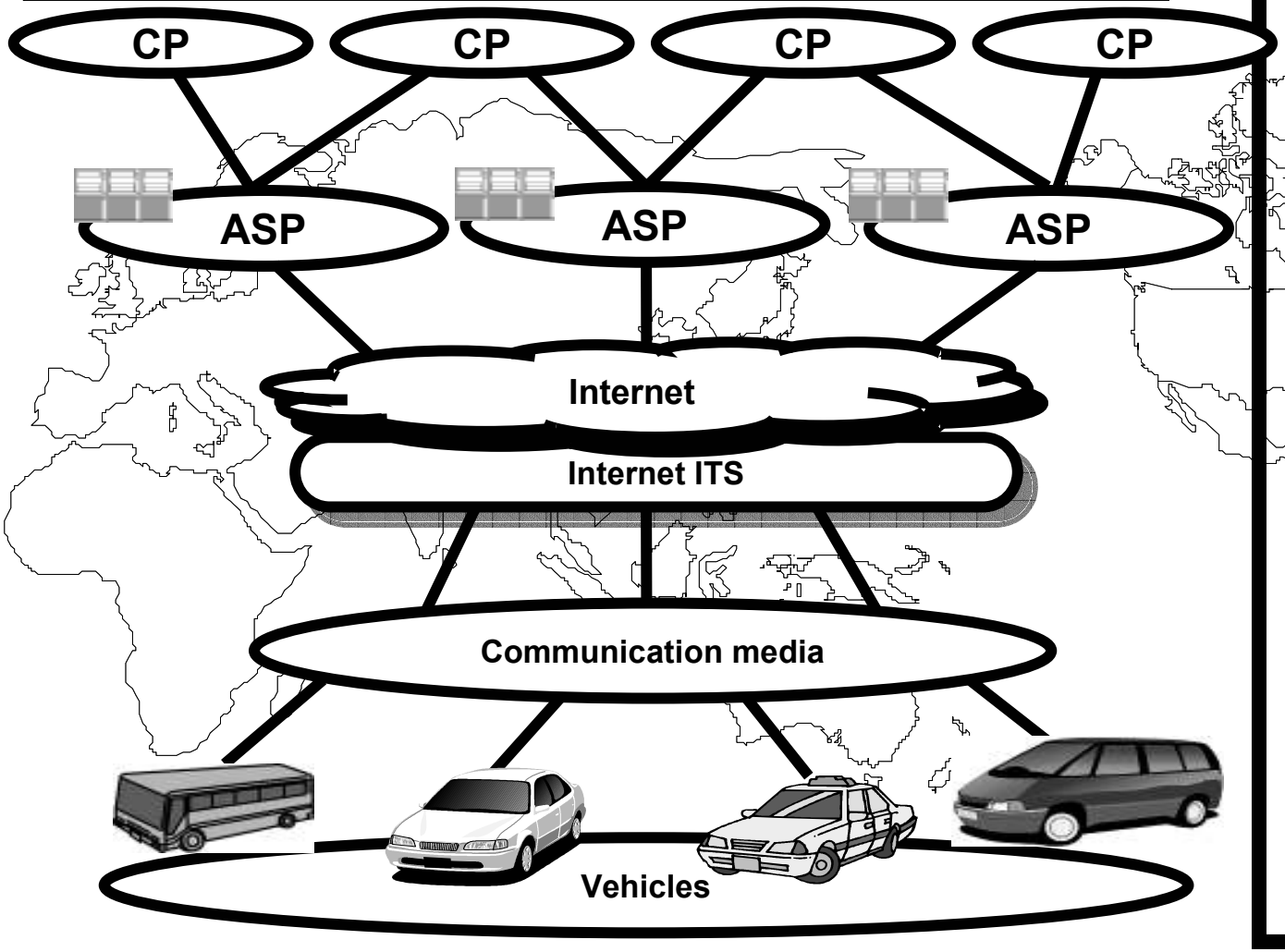
Members: 105 companies
8 universities

Chairman: Mr. Watanabe
Executive Vice President,
Toyota Motor Corporation



Structure of the Internet ITS

Players from all categories required for commercialization of ITS services participate in the consortium to create new businesses.



Internet ITS Consortium

- -Content providers
- -Map/music distribution
- -Insurance/banking
- -Roadside assistance
- -Security services, etc.

- -ASPs
- -Payment/security
- -Middleware

- -ISPs
- -System integrators
- -Platform supplier
- -Server vendors

- -Type I carriers
- -Type II carriers
- -Roadside infrastructure
- -Store infrastructure

- -Automakers
- -Automotive parts suppliers
- -In-vehicle equipment suppliers
- -Transport operators

The Internet ITS Program

2006

Aiming at making to the real business

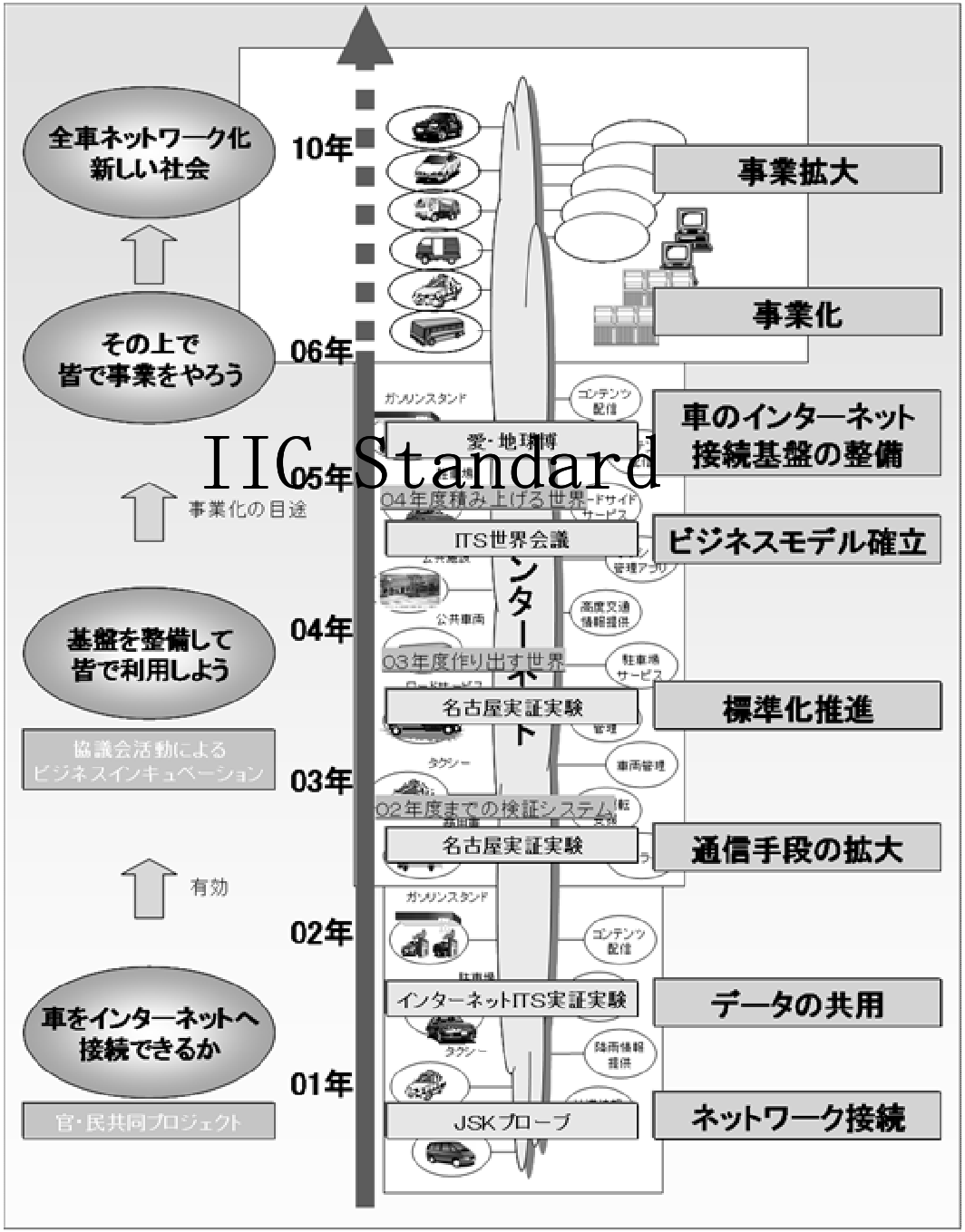
2002

It starts by

internet ITS

2001

It starts by the probe



The world at which the Internet ITS aims

Making in 2001

The society that can freely treat information by all scenes of life is achieving informatization has progressed accelerating. The office home and the person have already been made a network. Informatization by all scenes is completed if the left movable body enters the companion.

Making the car that exceeds 70 million a net can only achieve not only participation in the information society but also a better, newer traffic society. Environment-friendly car society (ITS) is constructed more safely and comfortably, and the business society of 70 million scales that not is up to now is created.

As for the economic effect, the expectation that the platform that is expected the big one, and is constructed here becomes securing global competitiveness for the auto sector of Japan is great.

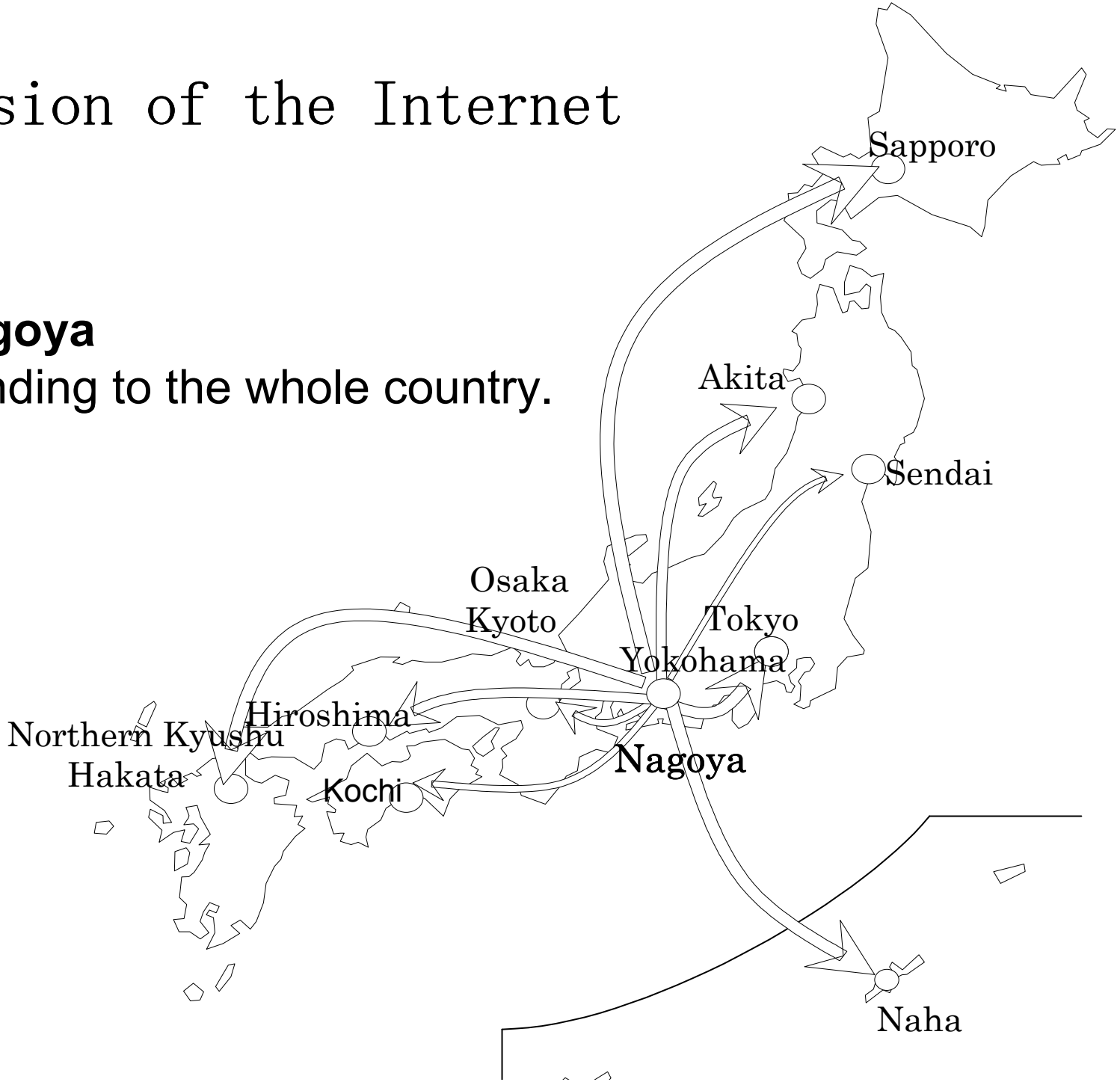
The activity for the achievement of the following forecasts is advanced.

A new business that centers on the car that achieves a seamless information society from which all cars are made a network is created in 2010. new car life appears.

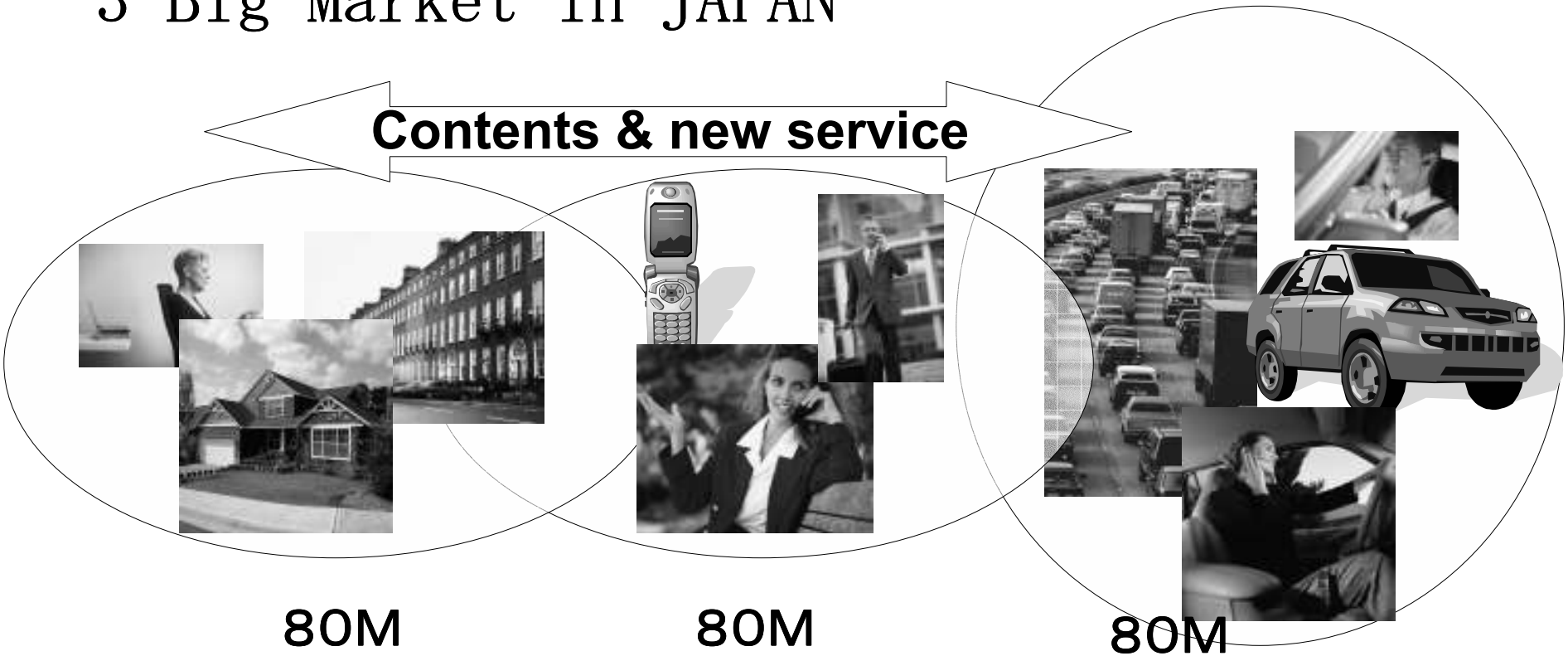
Expansion of the Internet ITS

From Nagoya

It is expanding to the whole country.



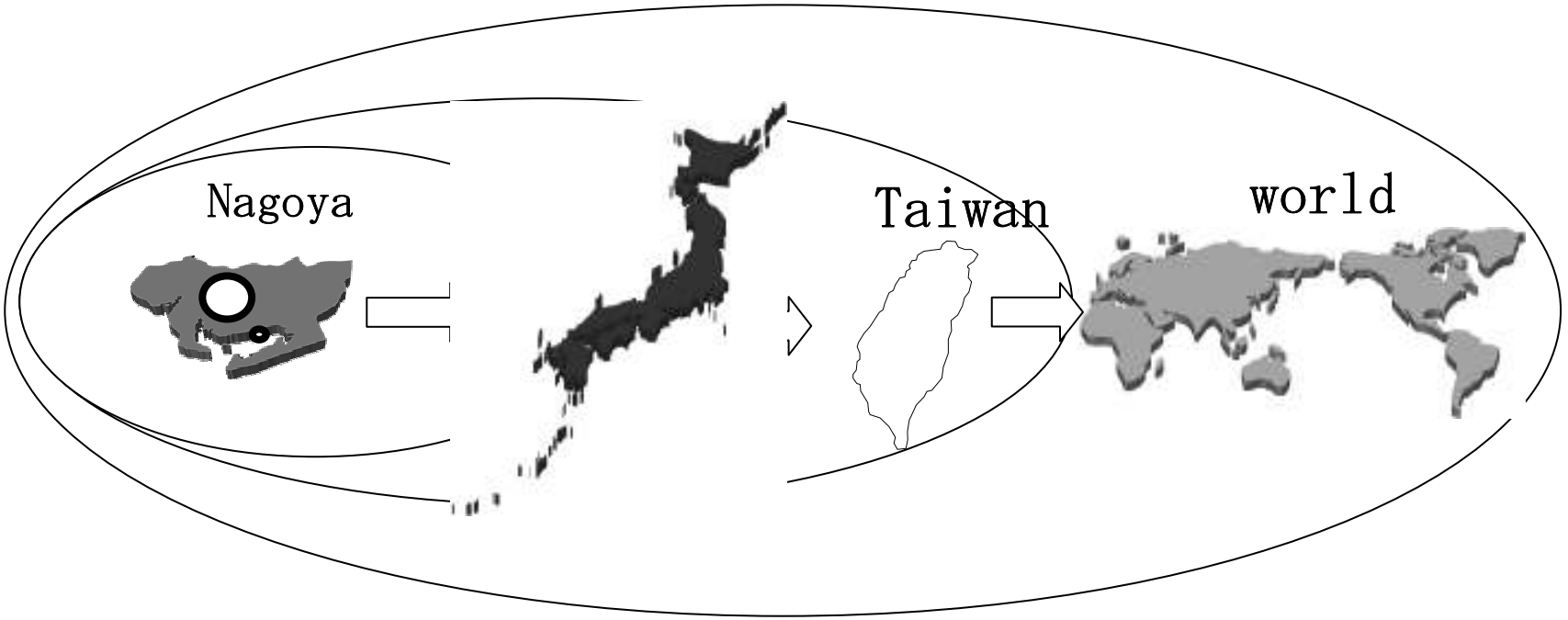
3 Big Market in JAPAN



New NAVIGATION system from Taiwan

PND ··· Win. Linux base

From Japan to the world



Creation of new car society