DaimlerChrysler

Beyond the Borders Workshop

Intelligent Transportation Systems

3-5 February 2003

Michael L. Sena

Michael L. Sena Consulting AB

Mobility and Location Strategies

Beyond the Borders Workshop
Intelligent Transportation Systems

- Finding research topics which are not included in the typical research agenda today.
- Identifying issues and systems that may become important or relevant in the 2010-2020 time frame.
- Focus on both the internal development of the ITS field as well as the field's intersections with other disciplines.
- In other words, predict the future

”The past is a foreign country. They do things differently there--but why is the past so different from the future? Why do we remember the past, but not the future.”

THE GO BETWEEN
L.P. Hartley

”So why try to predict the future at all if it's so difficult, so nearly impossible? Because making predictions is one way to give warning when we see ourselves drifting in dangerous directions. Because prediction is a useful way of pointing out safer, wiser courses. Because, most of all, our tomorrow is the child of our today. Through thought and deed, we exert a great deal of influence over this child, even though we can't control it absolutely. Best to think about it, though. Best to try to shape it into something good. Best to do that for any child.”

A FEW RULES FOR PREDICTING THE FUTURE
Science-fiction author Octavia E. Butler

”The best way to predict the future is to create it.”

Peter F. Drucker

Where do we want to take the world in twenty years?

Transport policies and developments are not an end in themselves. They are a means to make life better for the citizens of the global village.

What problems do we want to solve? What problems do we want to avoid? What do we want to make better? A partial list:

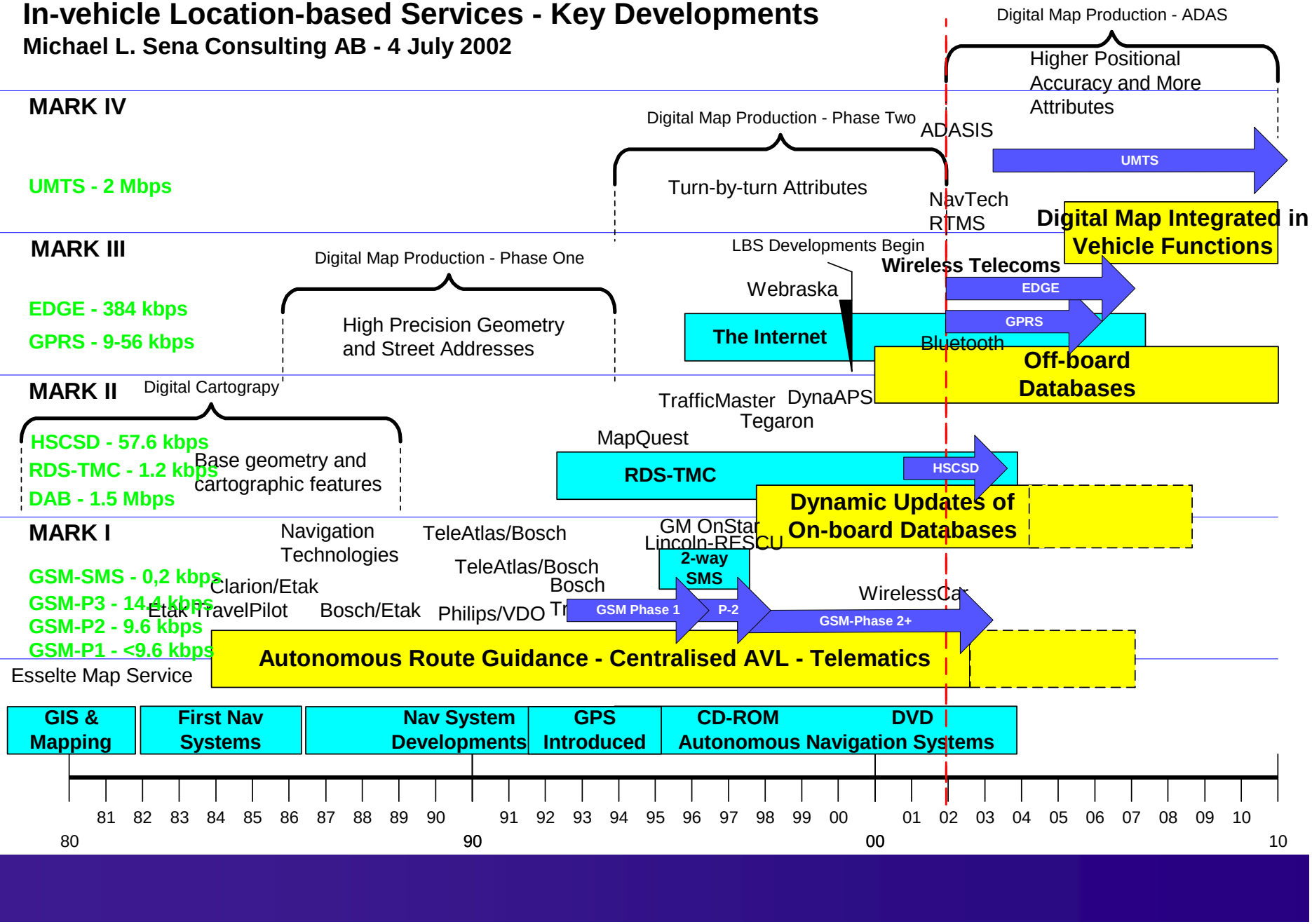
- Unsafe roads - trucks and cars sharing the same roadways
- Weather-related traffic accidents
- High speed driving in low speed conditions
- Poorly lighted streets; poor visibility in general
- Animals on roads; children and pedestrians mixing with vehicles
- Alcohol- and drug-related accidents
- Age-related accidents--young and elderly drivers
- Traffic congestion-induced accidents and violent behavior
- Environmental impacts of vehicles
- Make it possible for everyone to get to where they need to go--easily, conveniently, quickly, safely

The Past Twenty Years

1982	1992	2002
First PC's First major use of microprocessor	PC has major impact on working methods Networked PC's replace mainframe operations	Mature PC Market Portable PC's in common use Wireless devices performing PC functions
No Navigation Systems	First Autonomous Navigation Systems	First off-board routing data delivery to on-board devices
No Navigable Map Data	First Navigable Maps	First advanced driver assistance map data
No Mobile Telephones	First Mobile Telephones	Number of mobile telephones exceeds land line phones Wireless phones in cars
No GPS yet in operation, but satellites in orbit since '78	GPS not totally functional until July '95	GALILEO announced by EC
No Internet outside defense and university	Early use of Internet - No browser	Widespread use of Internet affects all industries
Mechanical driver restraints systems (seat belts) legislated	Electronic passive driver safety systems common	First active driver safety systems

In-vehicle Location-based Services - Key Developments

Michael L. Sena Consulting AB - 4 July 2002



Inventions Needed

Inevitable Events

- Catastrophic natural events will occur
- Health epidemics will break out
- Wars between nations will continue
- The effects of social and economic inequalities will be witnessed
- Accidents will happen

Predictable Events

- Our solar system will collapse in 4.5 billion years
- Our stock of petroleum will be used up in approximately 38 years, given current reserves and usage
- The growth of motorised vehicle usage in North America and Europe and some Asian countries will eventually exceed the supply of surfaces on which to drive these vehicles

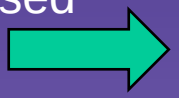
Inventions Needed

Inevitable	Invention	Predictable
	• Explore Space	Our solar system will collapse in 4.5 billion years
Catastrophic natural events	• Develop new methods of building	
	• Find and exploit new energy sources	Our stock of petroleum will be used up in approximately 38 years
Health epidemics	• Find new drugs	
	• Find new ways of moving that don't involve roads, or stop moving around as much as we are now doing	The growth of motorised vehicle usage in North America and Europe and some Asian countries will eventually exceed the supply of surfaces on which to drive these vehicles
Wars between nations and The effects of social and economic inequalities	• Develop new defense systems, or develop new political systems	

Inventions Needed

Inevitable → Invention → Predictable

As long as human beings operate vehicles, there will be errors made in how these vehhicles are used



- Pilotless Planes
- Engineerless Trains
- Driverless Cars
- Continuous driver support systems
- Training reinforcement systems

The Next Twenty Years

Inevitable	Invention	Predictable
Given the choice, individuals will choose to travel in their own vehicles, according to their own schedules	Personal Mobility	The tradeoff between societal costs and personal mobility will make the private automobile an increasingly less attractive option
Governments will legislate road usage pricing in order to reduce the societal costs of congestion	Collective Mobility	Traffic congestion will eventually eliminate the advantages of personal mobility
Globalisation will increase the need to transport goods for both manufacture and distribution, increasing the demand for road transport as the most cost effective option	Commercial Mobility	Traffic congestion will eliminate the advantages of trucks over fixed rail and air transport
Economic growth is now largely dependent on businesses and consumers using more data	Information Mobility	Information available to individuals will eventually exceed our ability to process and use it
Individuals desire more, not less, customisation	Ownership Mobility	Private cars will eventually become too expensive for most people to own

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Personal Mobility

”What Englishman will give his mind to politics as long as he can afford to keep his motor car.”

George Bernard Shaw

Neither Englishman, nor German, nor Italian, nor any European will be able to afford to keep his or her car in the not too distant future with increased vehicle taxes, higher fuel taxes, road user charges.

Goal: Allow individuals to keep the advantages of the private automobile while respecting environmental concerns and the strong societal desire to eliminate deaths and injuries caused by vehicles.

The Car

Purpose

To take a driver and passengers from one place to another. The family car is a cultural symbol as well as a personal statement.

Alternatives

• Walking, riding a bicycle, motorcycle, taking a bus, underground, train, boat or flying.

Prerequisites

• Driver's License

• Drivable roads

• Fuel

• Ability to pay for acquisition and operation

• A society's willingness to allow it

User's Value Proposition

It has proven to be an excellent tradeoff between privacy, convenience, comfort, and speed versus cost of ownership and operation, compared to the other transportation modes

The lines between the home and the family car are blurring. The family car has become a family room on wheels.

The Car Manufacturer's Dilemma: Developing vehicles that reflect the values of individuals in society

Sedan

Estate/Station Wagon

VAN

SUV/Light Truck

Cross-over

Personal Mobility

Today

- Automatic road charging
- Loop sensors in roads

Tomorrow

- Floating Car Data
- Car-to-Car communication
- Use-based road charging for private automobiles

2020

- Roads that open and close according to demand
- Cars that start journeys only when they can complete it within an agreed amount of time and at an agreed amount of cost
- Cars that eliminate the human error factor in driving
- A transportation monitoring and control infrastructure based on direct visual oversight - stationary high altitude cameras

The Next Twenty Years

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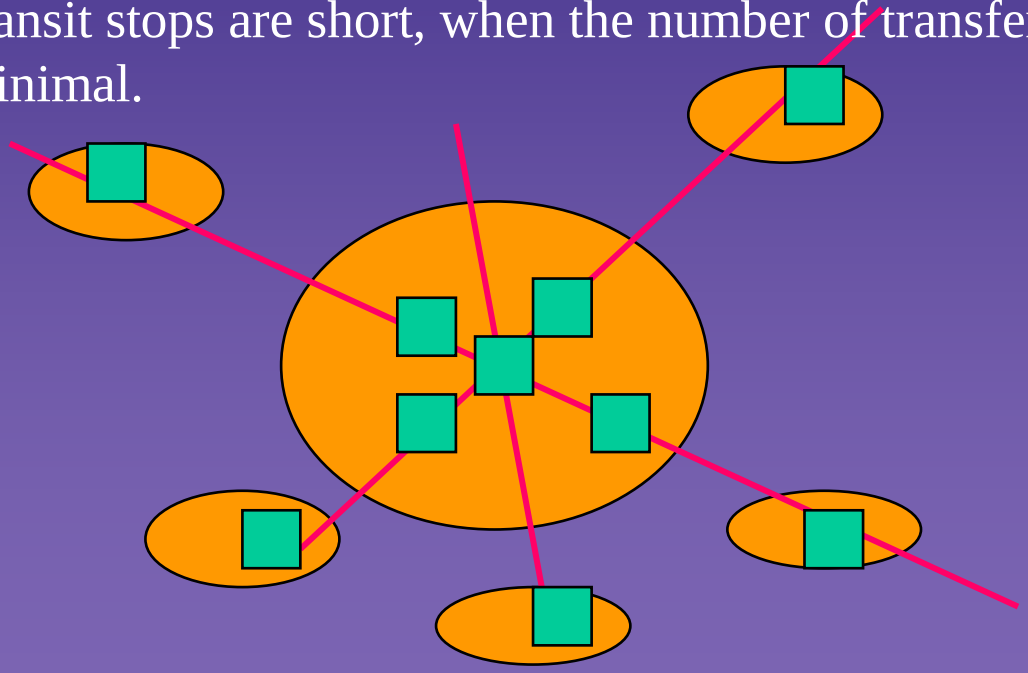
The Push for Inventions

The Pull for Inventions

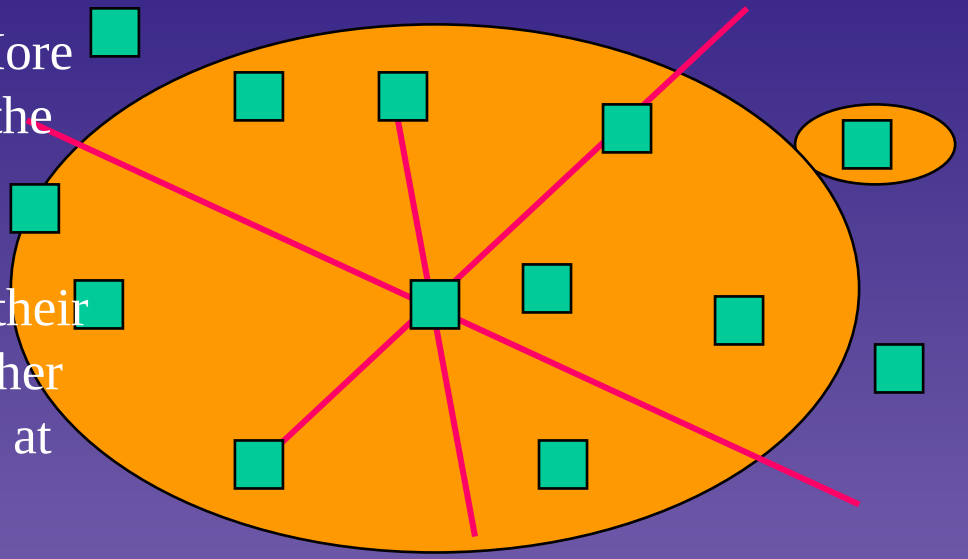
Collective Mobility

Settlement patterns no longer support collective transportation (rail, bus, tram) in most urban areas in North America and a growing number of European city regions. Mass transit works when destinations (commercial, recreational, industrial) are concentrated at nodes, when journey times from home to transit stops are short, when the number of transfers from mode to mode is minimal.



Collective Mobility

Jobs and people have moved to the suburbs during the past 30 years. More jobs are now in the suburbs than in the cities.



More people chose to live closer to their work in 2001 compared to 1991, rather than wanting to have a bigger house at lower cost with lower taxes.
Is travel to work finally becoming a negative factor in residential decision?.

Goal: Combine the advantages of personal mobility with other forms of transportation so that everyone, regardless of age, income or physical abilities, can travel to any destination.

Collective Mobility

Today

- Bus lanes, high-occupancy vehicle lanes, high occupancy tolling
- Ride sharing
- Real-time bus, train and rapid transit schedules

Tomorrow

- Collective transport operated by companies for employees and customers
- More restrictions on private automobiles
- Taxing land value increases to finance collective transport

2020

- Effective intermodal transit facilities
- Point-to-Point collective transportation
- Continuous (i.e. no waiting) collective transport
- Effective settlement policies to maximise use of collective transport options

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The Pull for Inventions

Commercial Mobility

Between 1997 and 2002, the amount of working time lost in Britain due to congestion increased 50%.

20% of Britain's trunk roads are congested more than 2 hours per day. 15% in The Netherlands; 7% in Germany; 5% in France

Source: Commission for Integrated Transport

Heavy truck traffic has increased by 60% in Sweden during the past 20 years, and now consists of 8% of road traffic. But trucks are involved in 22% of traffic-related deaths.

Goal: Allow commercial vehicles to continue to perform their functions unhindered by non-commercial vehicles, and without causing injury to their drivers, to other vehicle drivers or to the environment.

Commercial Mobility

Today:

- Fleet tracking systems

Tomorrow

- Lane departure warning
- Driver alerting systems
- Heavy Truck Attributes incorporated in navigable databases
- Increasingly stringent restrictions on truck transport

2020

- Complete separation of commercial vehicles and non-commercial vehicles
- Complete logistics capabilities
- Booking systems implemented for road travel

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The Push for Inventions

The Pull for Inventions

Information Mobility

- Driver information systems are not yet functioning as a personal guide
  - Delivering mathematical possibilities, not guidance
- Develop systems that work with the local environment, landmarks, signage
- Work with planners of cities to encourage them to improve wayfinding
- Still questions about government regulations
  - Are navigation systems and telematics systems going to be allowed?
- Still questions about whether systems needs to be embedded or can be portable
  - Technical, logistical, commercial, user issues are not yet clear
  - This stems in part from the lack of clear goals for telematics

Information Mobility

- Emergency authorities need to be integrated in the end-to-end solution
  - Telematics can deliver vital information directly to the authorities who will deliver emergency assistance. We need to work with these authorities to see that they receive it directly.
- Traffic information and road conditions
  - We need better methods of collecting and distributing traffic information. Probe vehicle research should be intensified
  - Governments and industry need to work together to support the available standards, not invent new formats

Goal: Allow personalisation of information interfaces in all types of vehicles.

Information Mobility

Today:

- Variable message signs
- Navigation Systems; RDS-TMC; Telematics systems; Internet portals

Tomorrow

- Location-based services delivered to the driver
- Interoperability of telematics devices and information sources
- Off-board databases
- Car-to-Car information sharing

2020

- Virtual information signs based on the information required by the driver at any particular time
- The driver sees the traffic situation well ahead and in enough time to make decisions about routes (A transportation monitoring and control infrastructure based on direct visual oversight - stationary high altitude cameras)
- 3D full windscreen display

Navigation

Purpose

To guide a driver in unfamiliar territory to a desired destination.

Alternatives

• Wayfinding is logical because of how streets and buildings are placed and named - the perfect world

• The driver is able to enlist the help of a personal guide

• Getting lost

• It is not an alternative to juggling a paper map while driving

Prerequisites

• Like a personal guide, it must have perfect local knowledge, never be wrong, but know what to do if things do go wrong.

• Like a personal guide, it must deliver directions that can be followed safely.

User's Value Proposition

A trade-off between the number of times one gets lost and the cost of acquiring a substitute for a personal guide.

Telematics - In-vehicle Location Based Services

Purpose

To allow the car and the driver to communicate with other cars, other drivers and the transportation service infrastructure.

Alternatives

• Stopping to find a telephone booth and hooking up a cable from the car with a dial-up modem.

• Having a guardian angel who can call for help anytime, anywhere

Prerequisites

• Integration with the vehicle's systems.

• Connectivity across all possible boundaries.

• A functioning service infrastructure

User's Value Proposition

A trade-off between the chances of having an accident or a mechanical problem, or requiring some form of emergency assistance and the cost of connectivity

Navigation System

Personal Guide

Personal Guide

Personal Guide

Personal Guide

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The Push for Inventions

The Pull for Inventions

Ownership Mobility

”The Model T will be available in any color, so long as it’s black.”

Henry Ford

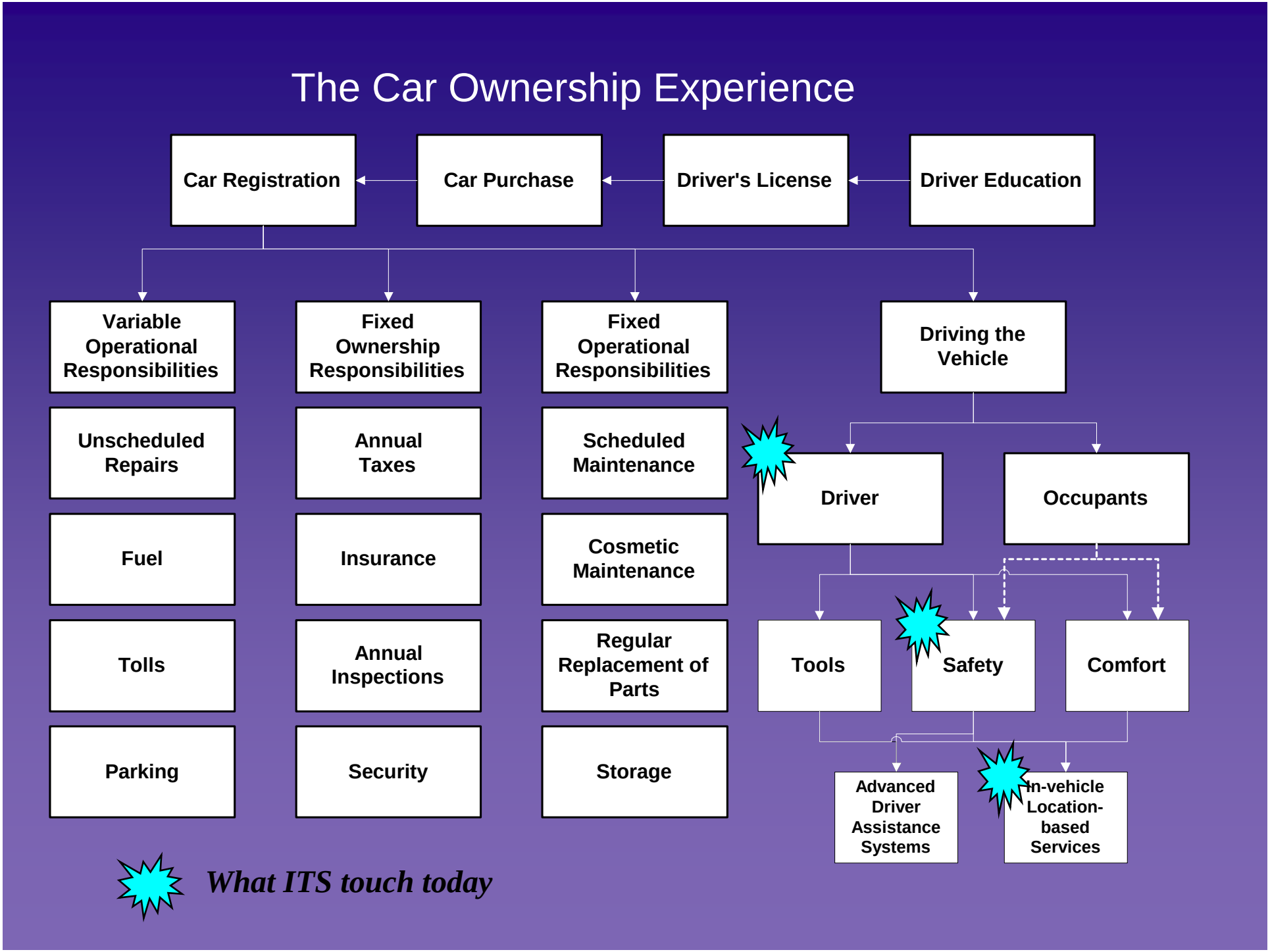
Build-to-Forcast → Build-to-Replacement → Build-to-Order → Modify-to-Order

Virtual Build-to-Order - find the car that meets the customer’s specifications

Customer builds own car and makes own modifications (the IKEA) model

Goal: Allow temporary personalisation of a vehicle, inside and out, by any individual authorised to operate the vehicle, or by automatic means.

The Car Ownership Experience



Ownership Mobility

Today:

- Car rental

Tomorrow

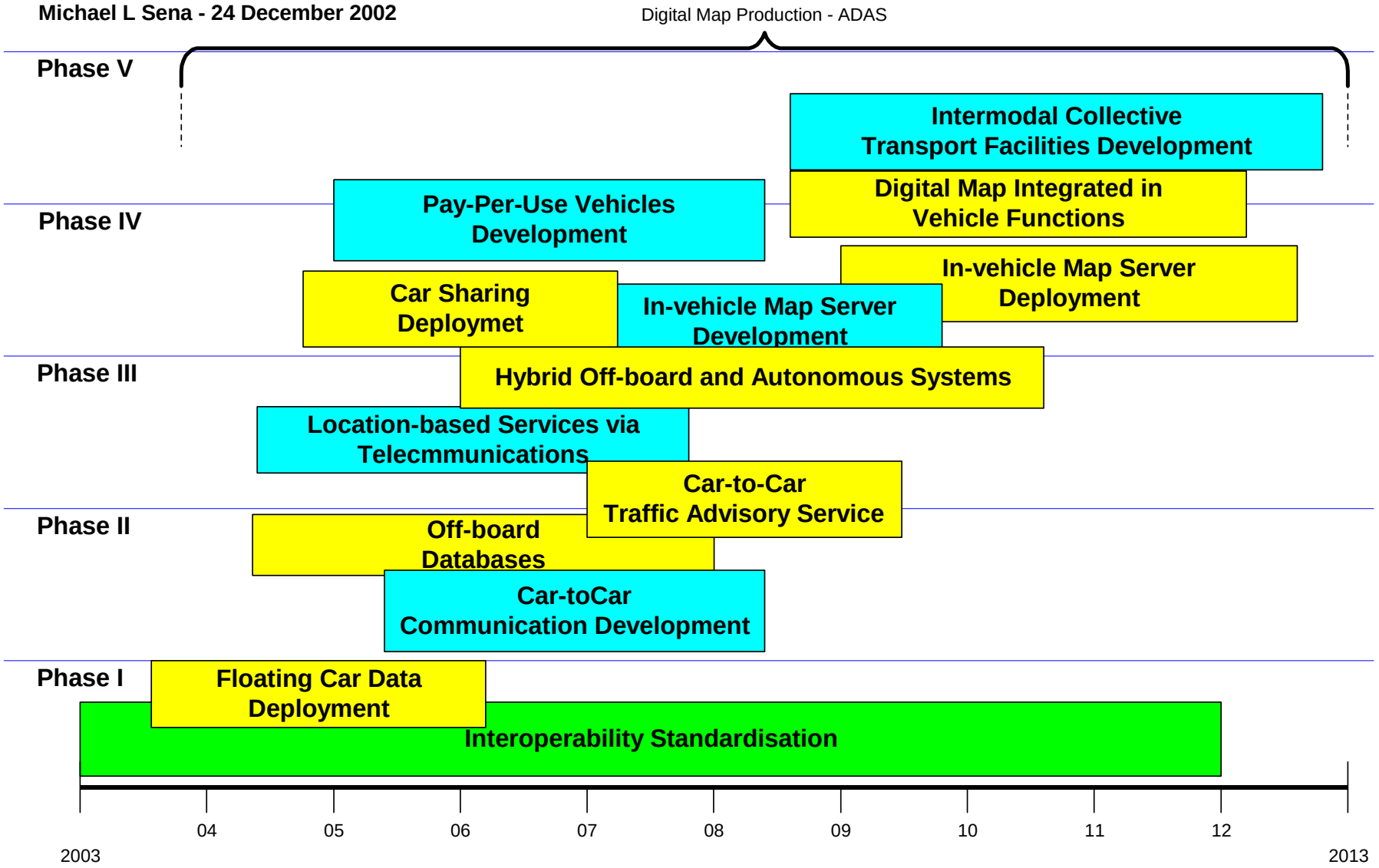
- Personalised driver settings
- Car-sharing

2020

- Vehicles that change colour and appearance to suit tastes of driver
- Vehicles that can visually signal when they have had an accident or are being driven by an unauthorised driver.
- Pay-per-Use Vehicles
- Reconfigurable Logic Chips to change nature of car performance

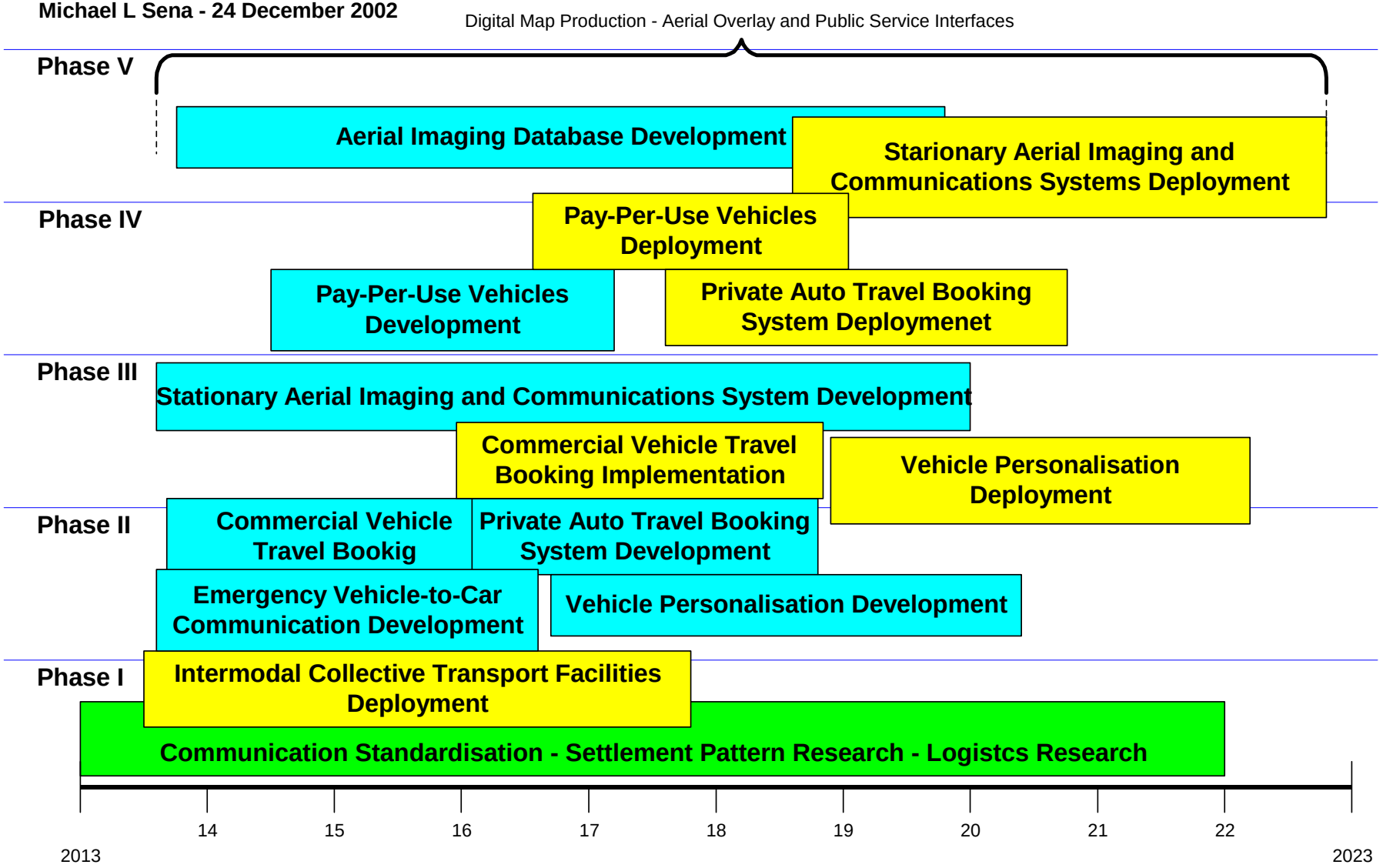
Atomotive OEMs In-vehicle Systems Development Roadmap - 2003-2013

Michael L Sena - 24 December 2002



Automotive OEMs In-vehicle Systems Development Roadmap - 2013-2023

Michael L Sena - 24 December 2002



Implictions for the Vehicle Industry

- Personal Mobility

  Develop personal tranport that adapts to the needs of the individual driver, the driving environment and the driving task.

- Collective Mobility

  Participate in developing a collective transport infrastructure that people want to use, that is truly integrated with and supportive of the personal transport system. Develop collective transport vehicles that can function in this infrastructure.

- Commercial Mobility

  Participate in developing the infrastructure in which heavy trucks can operate safely and effectively, and develop commercial vehicles that can function in this infrastructure.

…Continued

Implictions for the Vehicle Industry

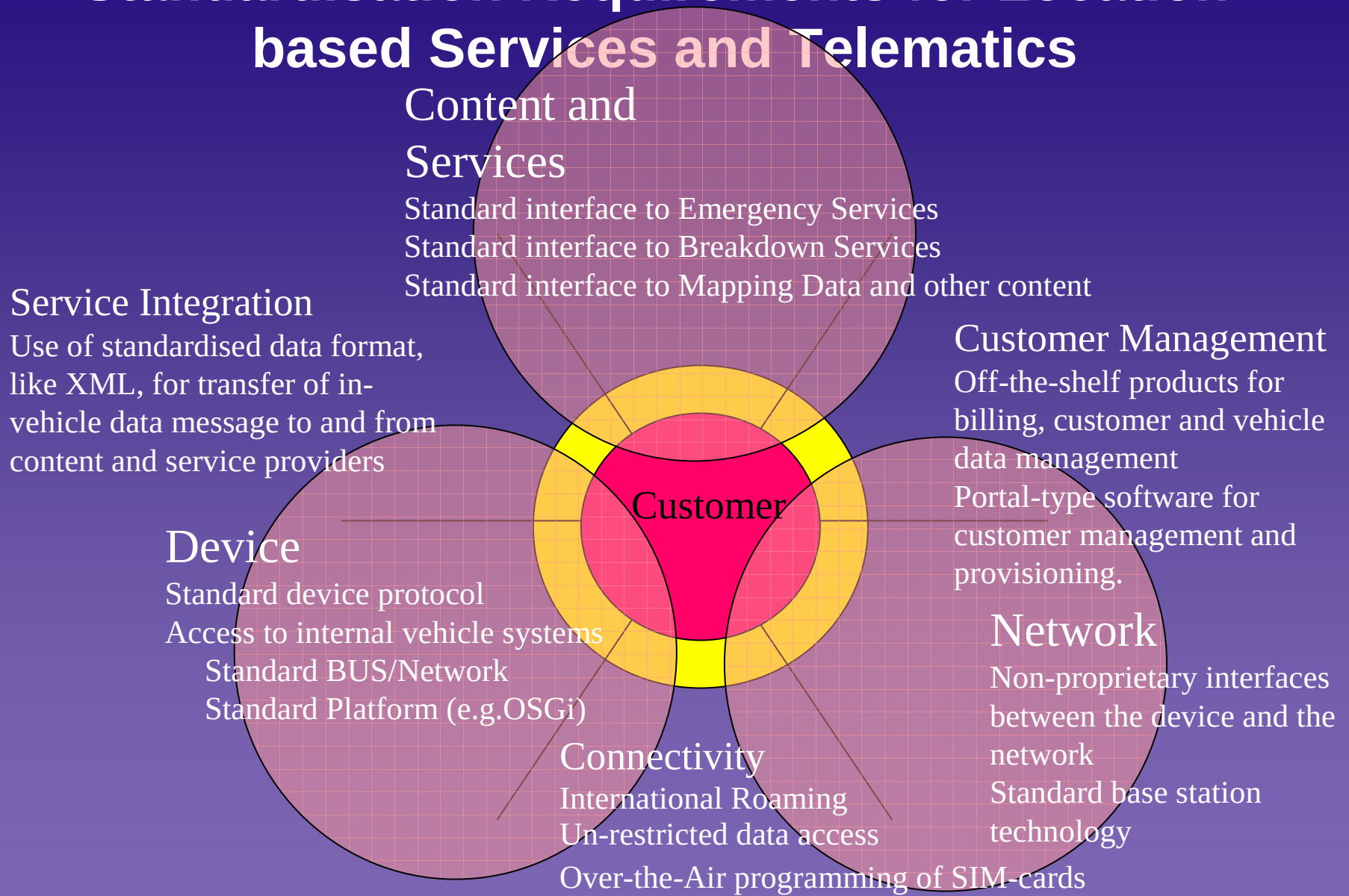
- Information Mobility

  Participate in developing a seeing, feeling and hearing information infrastructure that will allow drivers and passengers to obtain the information they need when they need it, and to communicate their needs and desires to the appropriate recipients.

- Ownership Mobility

  Develop vehicles that provide a personal sense of ownership to different drivers of these vehicles, and participate in developing the infrastructure that can manage the shifts of ownership

Standardisation Requirements for Location-based Services and Telematics



A Priority List for Owning and Driving an Automobile

- I will never have an accident or cause an accident while driving.
- If I do have an accident, neither I nor my passengers will be severely injured and we will receive help immediately.
- I will never have a mechanical problem while driving.
- If I do have a mechanical problem I will receive immediate assistance allowing me to continue my journey.
- I will never be lost.
- My car will never be stolen or broken into.
- I will never be delayed along a journey.
- If there is a delay, I will know the exact reason for it and how to avoid it.

While these areas are HIGHEST PRIORITY, they are still only a small portion of all the experiences connected to owning and driving an automobile.