Telematics Workshop

An In-vehicle Mobile Services Strategy for Automotive

Michael L. Sena Consulting AB

1 December 2004

Telematics Workshop - 1 December 2004

An In-vehicle Mobile Services Strategy for Automotive

Purpose of Workshop

- To provide a framework for Automotive which can be used to develop an in-vehicle mobile services strategy that will be presented to management for review and approval.

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An In-vehicle Mobile Services Strategy for Automotive

Issues to explore are:

- Telematics Market Developments
- Services
- Technology and platform
- Value Chain and Business Models
- Competitor Strategies
- Consumers
- Sales and distribution
- Partnerships

First, a few definitions:

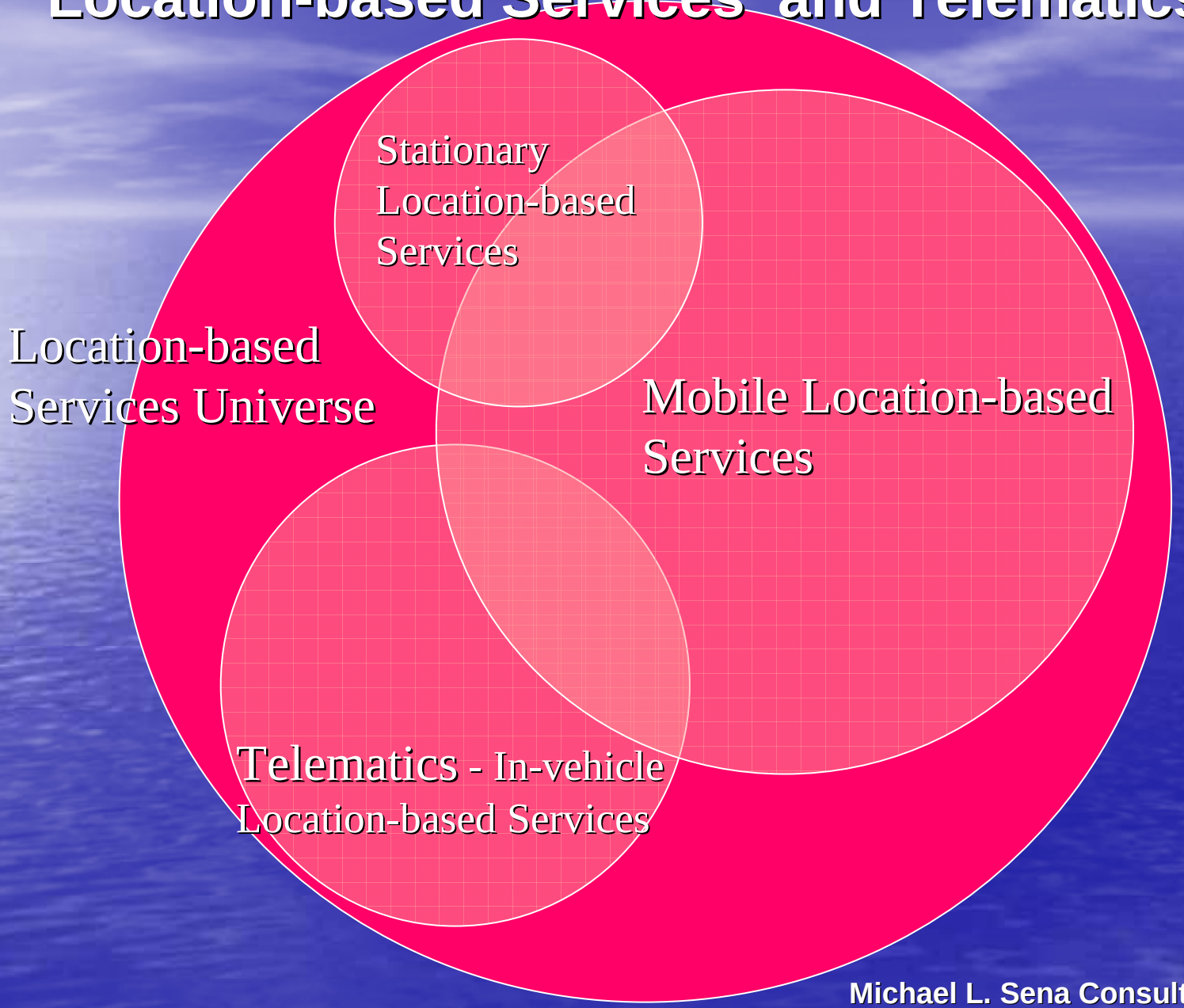
Mobile Services *- Any type of service that can be delivered to a wireless device, such as financial services, weather, Internet access, personal information management, m-commerce, entertainment.*

Location-based Services *– A subset of mobile services. Location-based services deliver information and assistance to individuals who use position-enabled devices to communicate their location via a wireless network to service and content providers.*

Mobile Applications and Location-based Services

- Location-based services are currently estimated to be ranked fifth in popularity amount the constellation of seven primary mobile services (Source: ARC Group: Future Mobile Handsets; 2001 ed.)
- The same report projects that by 2006 these services will be ranked first, with approximately 24% of mobile users accessing them.

Location-based Services and Telematics



More definitions:

Telematics *— the application of digital information, location sensing and mobile communications in the vehicle environment. This does not include autonomous navigation systems which predominate the market. One-way communications to the vehicle, such as RDS-TMC,cell broadcasting and paging, are not, strictly speaking, a telematics since the receiving device does not communicate its location.*

Any kind of vehicle service intended to promote safety, productivity, mobility and/or convenience, which relies on a wireless communication link and includes a positioning system.

A subset of Location-based Services.

Telematics

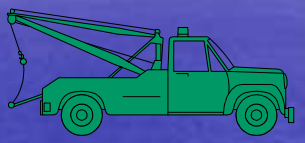
Position by GPS

Communication by satellite

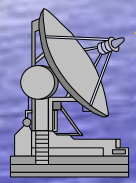
Voice-interactive Route Guidance

Technical assistance

Remote diagnostics



Roadside assistance



DATA

DATA

Communication by cellular

Customer Service Centre

Concierge services

PSAP

112/911

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Telematics

Vehicle ID
Driver details

Exact Location of Incident

Automotive

Fuel consumption
Error codes

Deliver Required
Assistance

Fleets

Parameter settings
New software

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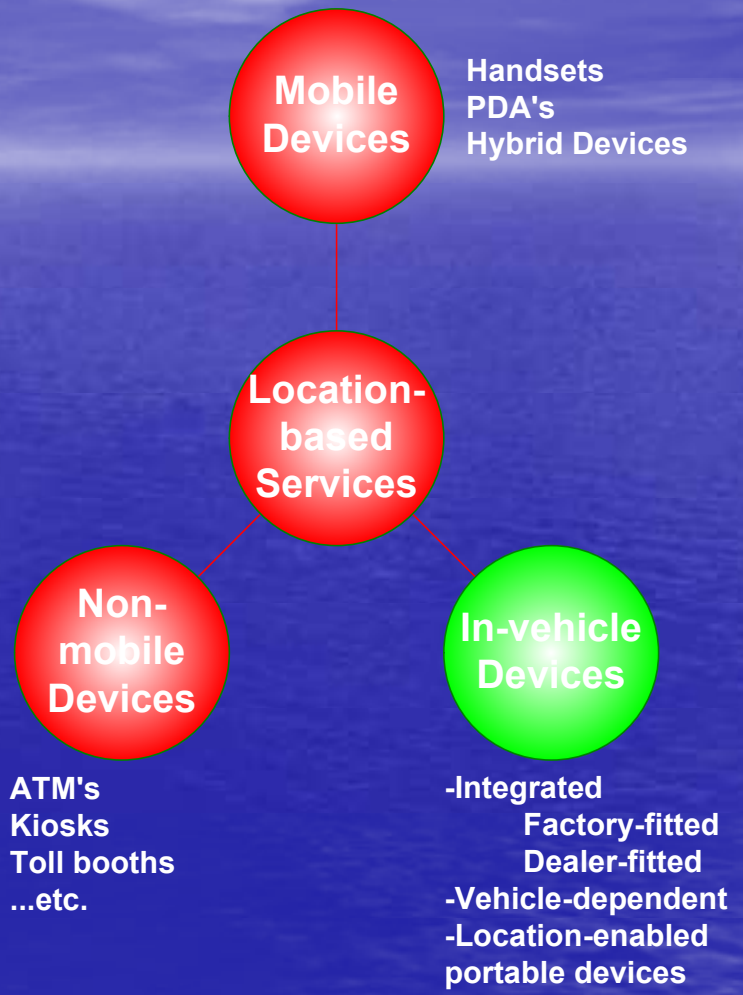
Location-based Service Devices

- Location-based services are delivered to three types of devices:
  - Mobile Devices, such as handsets, PDA's and hybrid appliances.
  - Non-mobile devices such as ATM's, information kiosks, toll booths and other stationary devices that are more conveniently connected via wireless technologies than fixed lines
  - In-vehicle devices
- There are three types of in-vehicle devices:
  - Devices integrated with the vehicle's systems that are an integral part of the vehicle's design
  - Devices that are portable and can be installed in any vehicle, but which are dependent on connections to the vehicle's systems for their operation
  - Portable devices that can be taken in and out of the vehicle and require no connection to the vehicle's systems



Today's In-vehicle Devices

There are three parallel tracks, with different technologies, industry structures, value chains and opportunities for Automotive:

- Integrated In-vehicle Services Solutions

  -The IVSU is either vehicle OEM factory-fitted or dealer-installed, and the vehicle is designed for integrated installation.

  -The IVSU is connected to vehicle systems, such as speedometer and airbag sensors, and to built-in GPS and mobile telephone antenna.

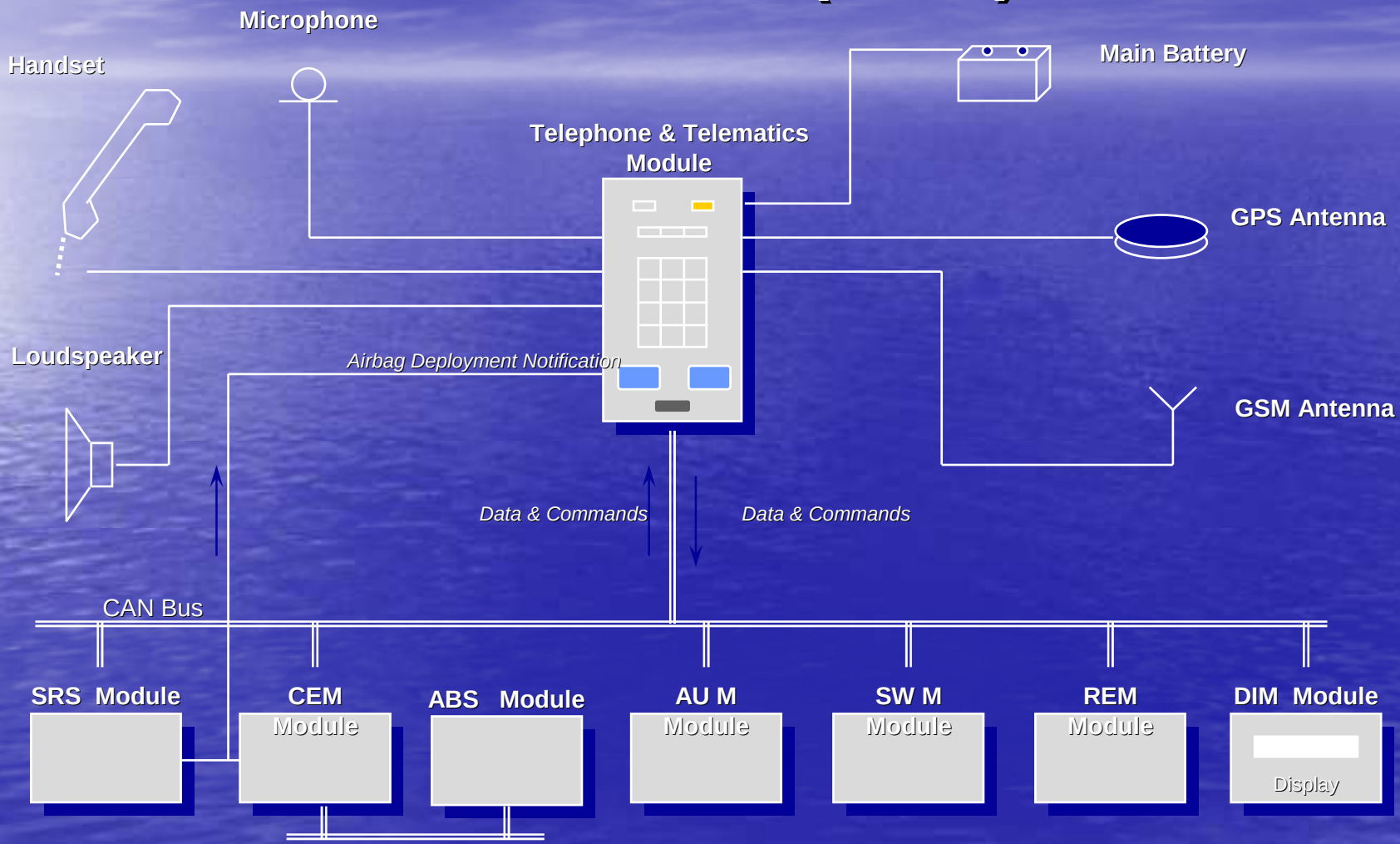
- Vehicle-dependent Solutions

  -Connection to vehicle systems is minimal or is similar to any other aftermarket system, such as navigation systems, but the system cannot be used outside of the vehicle environment

- Location-enabled Portable Solutions

  -The vehicle is not pre-designed to accept the IVSU.

Wireless-enabled In-Vehicle Services Unit (IVSU)



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Services types for In-vehicle Devices

- The preceding diagram shows the components of a wireless-enabled in-vehicle services unit (telematics system).
- A set of components can either be packaged with the IVSU, or provided by the host vehicle. These are:
  - Loudspeaker
  - Handset
  - Microphone
  - Battery
  - GPS antenna
  - Phone antenna
- Other components are embedded in the vehicle and can be accessed directly if the IVSU is tightly integrated, or via a gateway. These components vary according to the vehicle manufacturer, however the most important are:
  - Safety Restraint System module
  - ABS system
  - Display module
  - Memory management unit
  - Software management module
  - Door and window management module

Service Types for In-vehicle Devices

There are three principal groupings of services for in-vehicle devices:

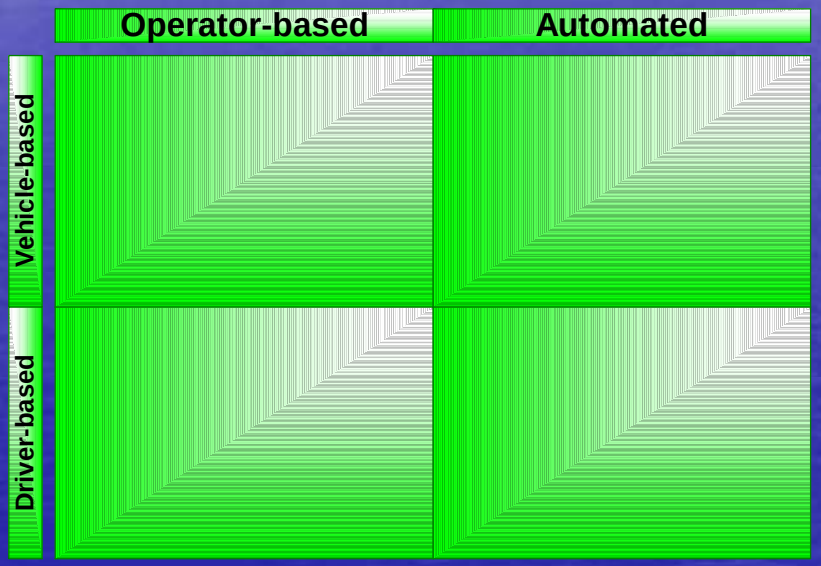
- Personal Safety - these include services related to potential life-threatening situations, such as accidents or vehicle breakdowns. These services are the single most important reason that drivers in the US choose to install systems in their new vehicles.
- Vehicle Security - these are services that are primarily for the care and protection of the vehicle, but also provide the owner with added peace of mind.
- Convenience - these are services that enhance the driving experience, save the driver time, or provide information when it is most useful. Route planning and directions and traffic information are the services most valued in European markets. Tolling applications would fall under this category.

Services for In-vehicle Devices

- Integrated devices have the advantage over vehicle-dependent devices in being able to deliver the full range of services, including vehicle security, personal safety and convenience.
- Integrated systems can access the OEM's internal data bus to receive information from the vehicle's sensors, to send commands to internally-controlled systems, and to share devices that are used for other applications devices.
- Vehicle-dependent devices require installation to connect to the vehicle's battery and loudspeakers, but must include built-in GPS, GSM, microphone and display. Connection to internal systems is not currently possible. Most of the vehicle security and airbag deployment notification services are also not possible.
- Portable devices that are Location-based (i.e. Have some form of positioning capability) can provide limited in-vehicle services, similar to those provided outside the vehicle environment.

Services for In-vehicle Devices

- Another way to view vehicle services is by dividing them according to the delivery method and their primary focus.
- Services can be delivered by human operators, which is the main delivery method used in current in-vehicle wireless-enabled systems.
- Services can also be delivered by automated portals. They can be automatic voice recognition/text-to-speech servers or text input/text -and-graphic output.
- Services that are vehicle-based include those which are directly related to the operation of the vehicle or to the vehicle's controls.
- Services that are driver-based include those that could be provided outside the vehicle environment or do not depend on the vehicle's systems for execution.



Services for In-vehicle Devices: Delivery Method and Primary Focus

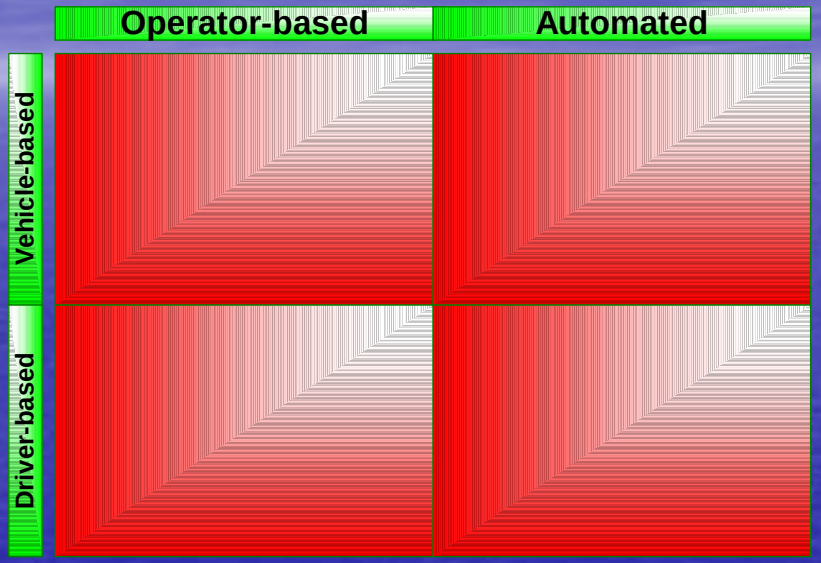
	Operator-based	Automated
Vehicle-based	Emergency Services Roadside Assistance Theft Notification Stolen Vehicle Tracking Technical Assistance	Remote Diagnostics Dynamic Advanced Driver Assistance Systems Remote Door Controls Automated Tolling
Driver-based	Concierge Services Route Planning and Directions Traffic and Traveller Info Position Advice	Route Planning and Directions Traffic and Traveller Information Postion Advice All other mobile services adapted to the driver environment

Automotive's Perspective on Services

- Which services does Automotive see itself delivering to its customers?
  - Driver-based
  - Vehicle-based

- Does Automotive wish to have live operator serivces?
  - Roadside assistance
  - Emergency assistance
  - Concierge

- Automotive could provide vehicle-based automated services, but this would require integrated systems and close co-operation with the vehicle in-vehicle system developers.



In-vehicle Systems and Services Market Status

In-vehicle Services Potential

”The basic premise for the demand for In-vehicle Services is based on the long hours that consumers waste in cars” (Deutsche Bank)

Average Time Spent in Vehicles (h/year)

	USA	Europe
Total:	541	274
As Driver:	340	183
As Passenger:	201	91

(Source: Roland Berger analysis 2000)

From this we can draw the conclusion that In-vehicle services have a significant potential – there is a clearly defined context and environment in which services will be accessed.

BUT, we cannot draw any conclusions on what device the consumer will choose to access these In-vehicle services.

Another question remains to be answered: Will customers access different services in the in-vehicle environment, compared to when being on the move outside the vehicle?

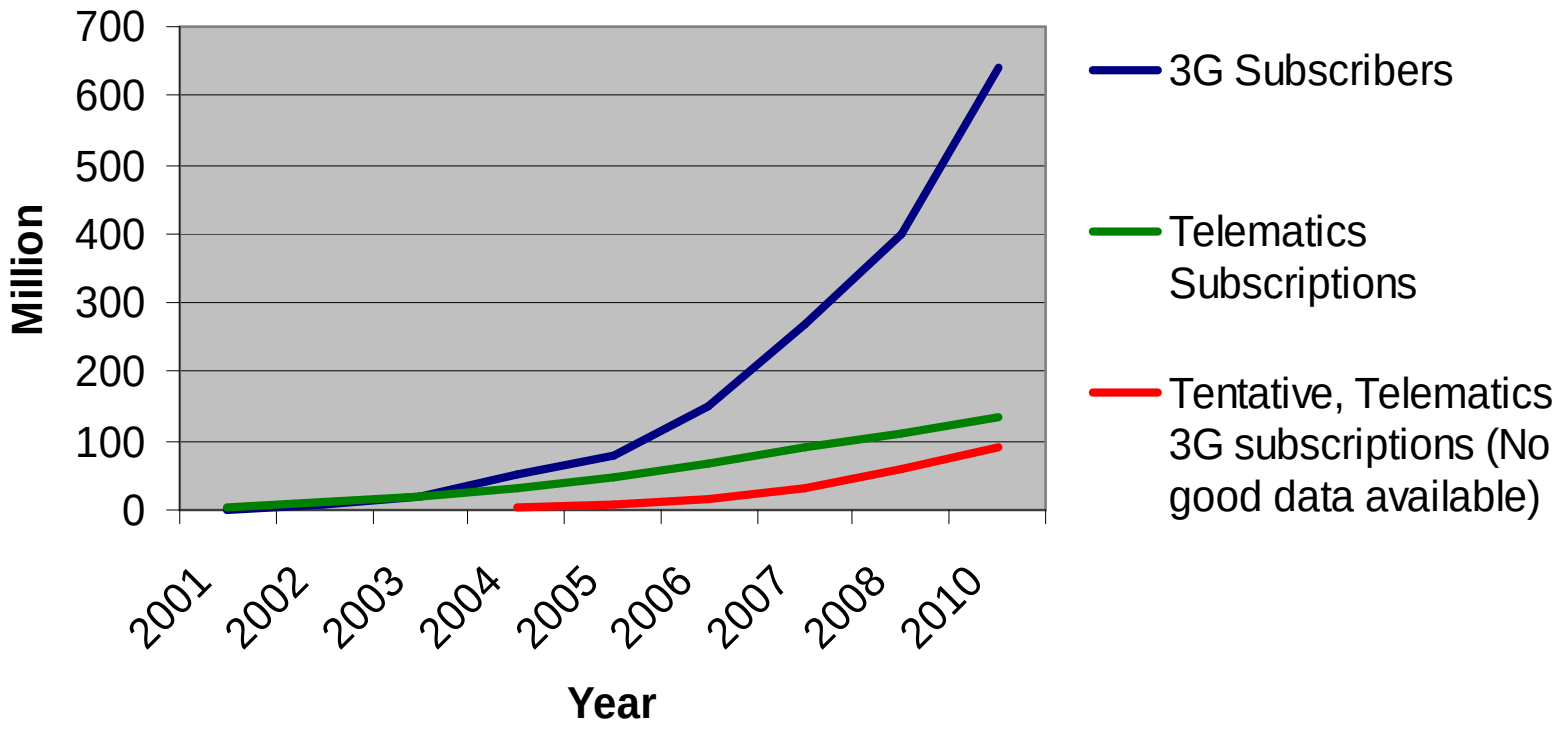
Size of the market

When discussing the size of the market for in-vehicle Services we investigate three basic issues:

- **The number of in-vehicle services-equipped vehicles - Telematics and Autonomous In-vehicle Navigation systems**
- **The number of 2.5G (GPRS) and 3G (UMTS) subscribers**
- **Whether these markets eventually converge**

It appears that these two markets, In-vehicle Services and 2.5G and 3G Services, will not converge for the first few years, due to very low penetration of 2.5G and 3G terminals fitted in vehicles.

Size of the market



There will be a significant difference between between the number of 2.5G and 3G terminals on the market and the number of the factory fitted in new vehicles.

Size of the market - Conclusion

- **The In-vehicle Services market takes off slowly, but it does take off and it is potentially very large – looking beyond 2010.**
- **There is a great uncertainty regarding the penetration of factory fitted 2.5G and 3G terminals in vehicles.**
- **During 2001 – 2005, very few of the factory fitted terminals in Europe will be 2.5G and 3G terminals. This means that there will be a significant gap between portable 2.5G and 3G devices and factory fitted 2.5G and 3G terminals.**
- **AND MOST IMPORTANTLY: Consumers will probably have time to get to know and utilise their portable 2.5G and 3G terminals before penetration of factory fitted 2.5G and 3G terminals in the vehicle reaches significant levels.**

Size of the market – Integrated devices

Forecasted market penetration of basic Factory Fitted (Integrated) Telematics Devices on new cars. Less than 5%, of those devices are expected to be 2.5G and 3G devices.

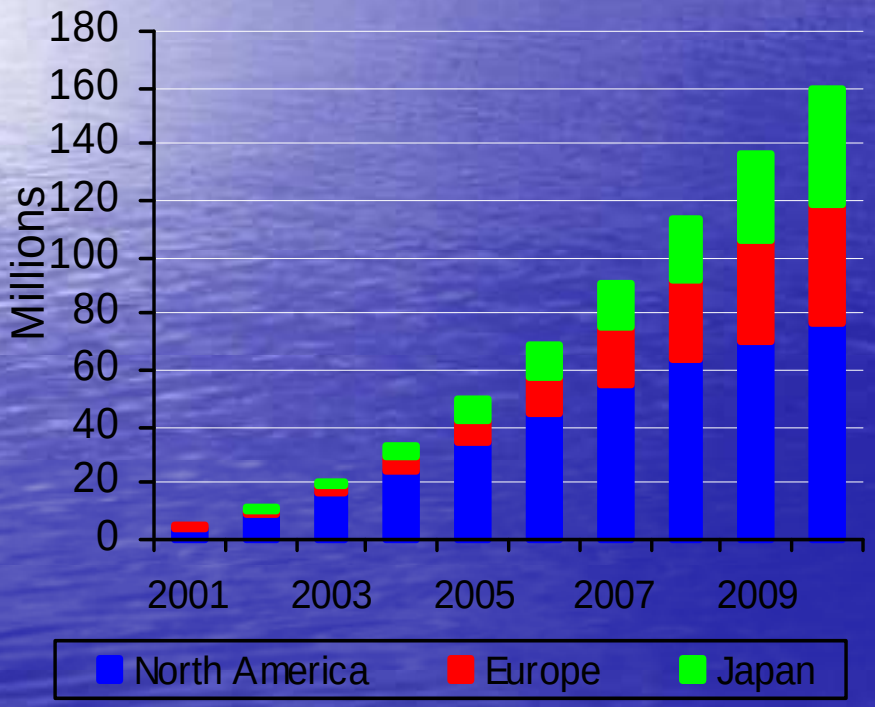
	2001	2002	2003	2004	2005	~100% of new cars
Europe (Accumulated)	3% (480k)	7% (1.7M)	22% (5.7M)	33% (11.6M)	55% (22M)	**2007**
North America (Acc.)	5% (1.6M)	25% (6.1M)	47% (14.5M)	75% (28M)	100% (~46M)	**2005**
AsiaPacific (Acc.)	4% (900k)	7% (2.1M)	13% (4.5M)	20% (8.1M)	30% (13.5M)	**2010**

There are approximately 18 million vehicles manufactured annually in each of these three markets (US, Asia, Europe)

Source: WirelessCar internal, 2001

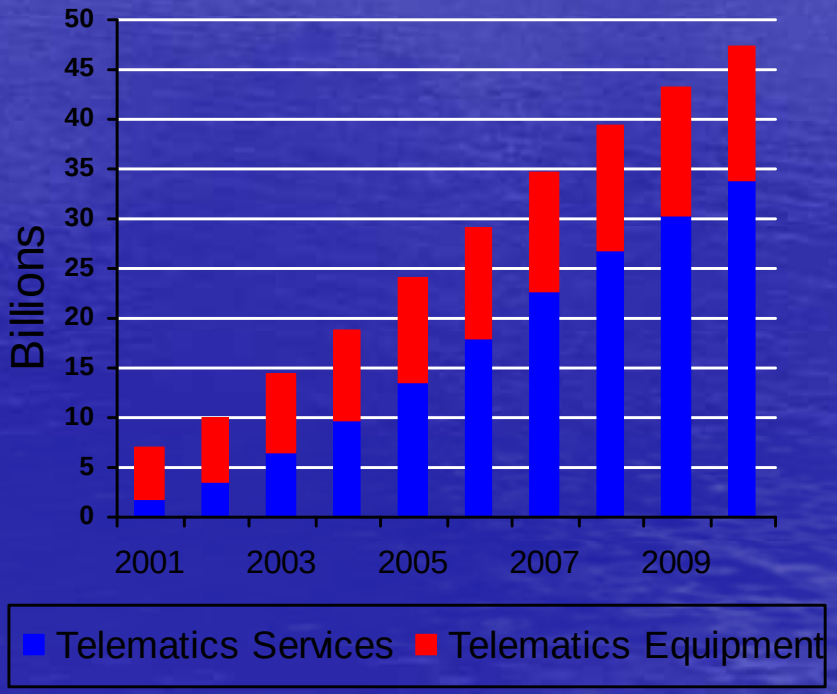
Size of the market – In-vehicle Services Subscribers

Subscribers to In-vehicle services are projected to grow significantly in the next 10 years



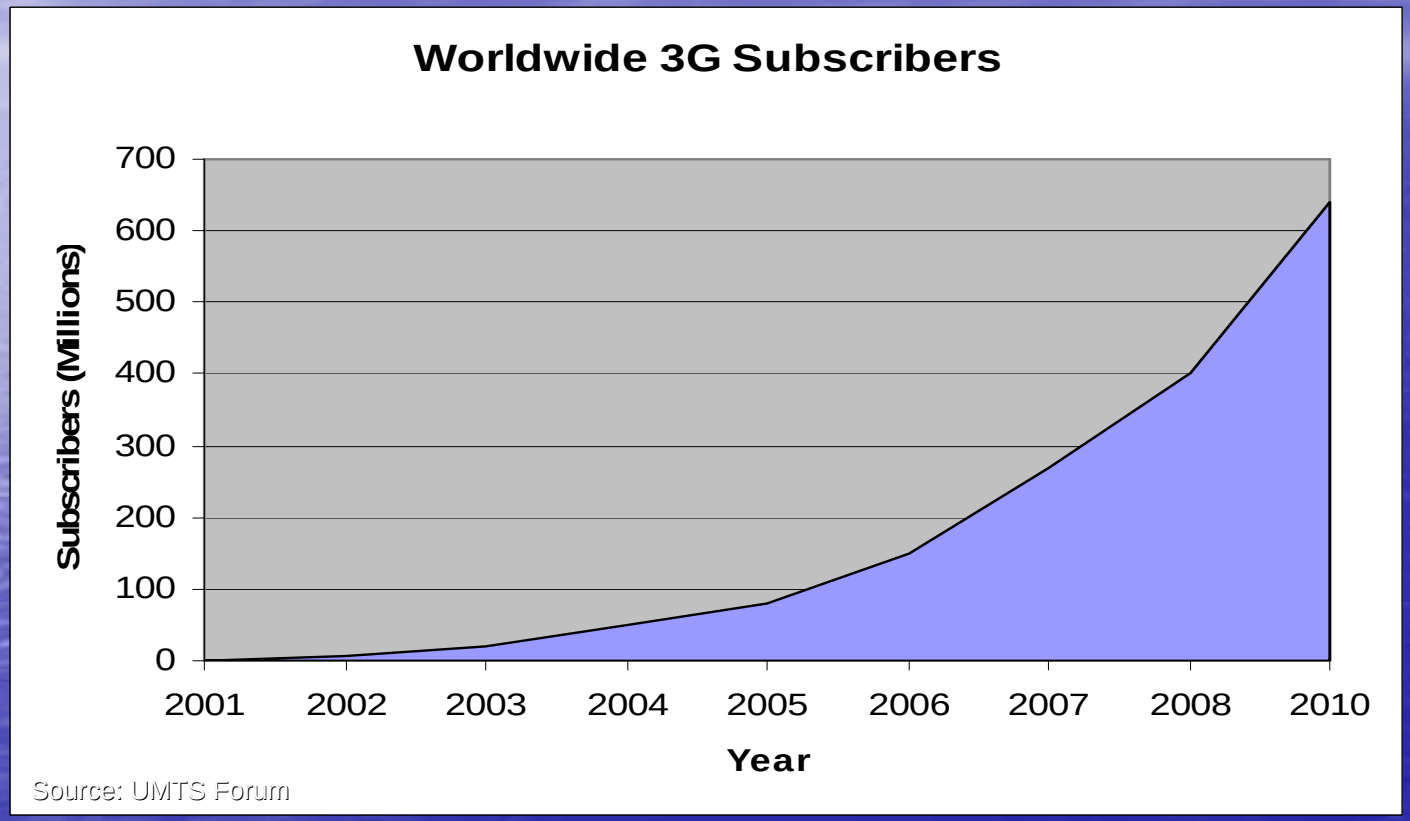
Source: UBS Warburg

In-vehicle services will reach $47.2 BUSD by 2010



Size of the market – 2.5G and 3G Subscribers

The number of vehicle integrated 2.5G and 3G terminals will only be a fraction of the total number of 2.5G and 3G terminals on the market during 2001-2010.



- **By 2010, 28% of mobile subscribers will be served over 2.5G and 3G Networks.**

In Vehicle Navigation
Current Market Status

Route Guidance Systems Manufacturers

Europe in 1999 - 16 (12 in 1998)

North America in 1999 - 8 (6 in 1998)

Number of Vehicle Models Factory Equipped with RGS

Europe in 1999 - 63 (43 in 1998)

North America in 1999 - 18 (10 in 1998)

Annual Shipments of Route Guidance Systems

Europe in 1999 - 500,000 (220,000 in 1998)

Europe in 2000 - 1 000,000

North America in 1999 - 120,000 (30,000 in 1998)

In-vehicle Services – What does the consumer say?

Highlighted findings & implications:

- 65% of customers feel that In-vehicle Services systems influence their car selection decision. (ATX Technologies)

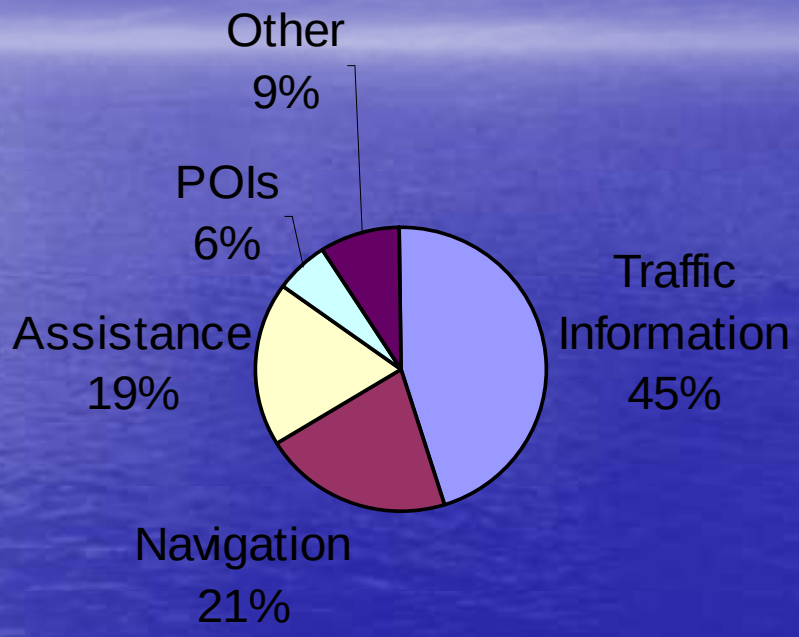
  Implication: OEMs will be/are trying to control In-vehicle Services.

- 40-50% of consumers consistently showed interest in In-vehicle Services. The interest correlated with cellular usage and was consistent across sex, age group and income level. (Motorola)

  Implication: Interest in In-vehicle Services is expected to rise with higher penetration of mobile phones and services. Segmentation will be difficult.

There is a large market

Services – What have consumers asked for?



Source: ERTICO

In-vehicle Services – What does the consumer say?

Highlighted findings & implications:

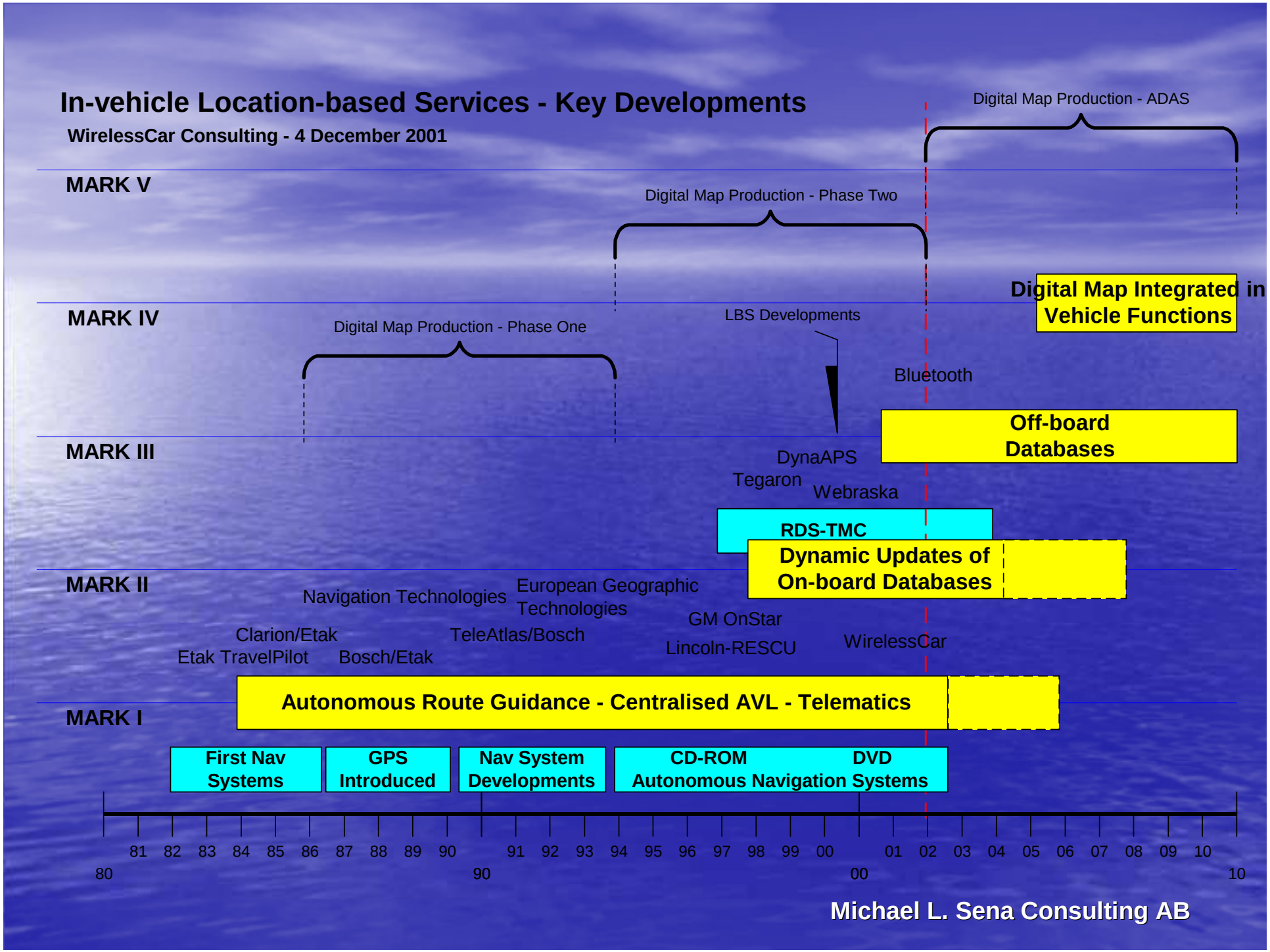
- More than two thirds of current In-vehicle Services users want to access some telematics functions outside their vehicle. (ATX Technologies)
  Implication: In-vehicle Services include services which can be delivered both inside and outside the vehicle. Services have to be adapted to be possible to access and use both from within and from outside the vehicle environment.

- Consumers want the option to turn off certain functions in their in-vehicle devices (Motorola)
  Implication: OEMs have to let the customer control their personal information.

- Customized subscriptions, across brands and segments, and transaction based billing will win out with customers. (Dain Rauscher Wessels)
  Implication: OEMs have to tailor their In-vehicle Service offering across different segments.

Consumers want control of their services!

The In-vehicle Location-based Services: Key Developments and Technology Roadmap


In-vehicle Location-based Services - Key Developments
WirelessCar Consulting - 4 December 2001
MARK V
MARK IV
MARK III
MARK II
MARK I
Digital Map Production - ADAS
Digital Map Production - Phase Two
Digital Map Production - Phase One
LBS Developments
Digital Map Integrated in Vehicle Functions
Bluetooth
Off-board Databases
DynaAPS
Tegaron
Webraska
RDS-TMC
Dynamic Updates of On-board Databases
Navigation Technologies
European Geographic Technologies
Clarion/Etak
Etak TravelPilot
Bosch/Etak
TeleAtlas/Bosch
GM OnStar
Lincoln-RESCU
WirelessCar
Autonomous Route Guidance - Centralised AVL - Telematics
First Nav Systems
GPS Introduced
Nav System Developments
CD-ROM Autonomous Navigation Systems
DVD
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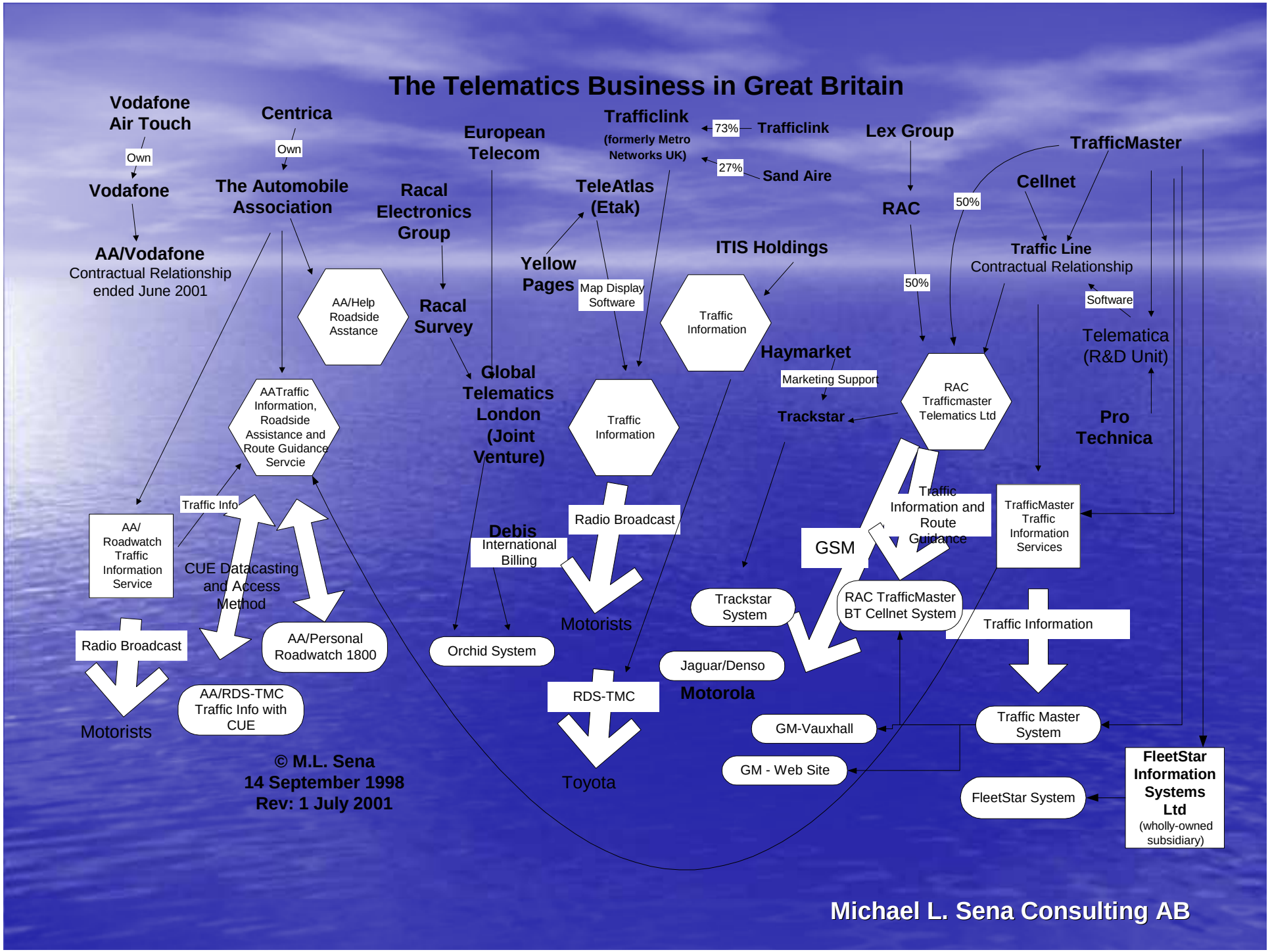
The Telematics Business in Great Britain
Vodafone Air Touch
Own
Vodafone
AA/Vodafone
Contractual Relationship ended June 2001
Centrica
Own
The Automobile Association
AA/Help Roadside Assstance
AATraffic Information, Roadside Assistance and Route Guidance Servcie
Traffic Info
AA/ Roadwatch Traffic Information Service
CUE Datacasting and Access Method
Radio Broadcast
Motorists
AA/Personal Roadwatch 1800
AA/RDS-TMC Traffic Info with CUE
Racal Electronics Group
Racal Survey
European Telecom
Global Telematics London (Joint Venture)
Debis
International Billing
Orchid System
Trafficlink
(formerly Metro Networks UK)
73%
Trafficlink
27%
Sand Aire
TeleAtlas (Etak)
Yellow Pages
Map Display Software
Traffic Information
Radio Broadcast
Motorists
RDS-TMC
Toyota
ITIS Holdings
Traffic Information
Haymarket
Marketing Support
Trackstar
Trackstar System
Jaguar/Denso
Motorola
Lex Group
RAC
50%
50%
RAC Trafficmaster Telematics Ltd
GSM
Traffic Information and Route Guidance
RAC TrafficMaster BT Cellnet System
GM-Vauxhall
GM - Web Site
TrafficMaster
Cellnet
Traffic Line
Contractual Relationship
Software
Telematica (R&D Unit)
Pro Technica
TrafficMaster Traffic Information Services
Traffic Information
Traffic Master System
FleetStar System
FleetStar Information Systems Ltd
(wholly-owned subsidiary)
© M.L. Sena
14 September 1998
Rev: 1 July 2001
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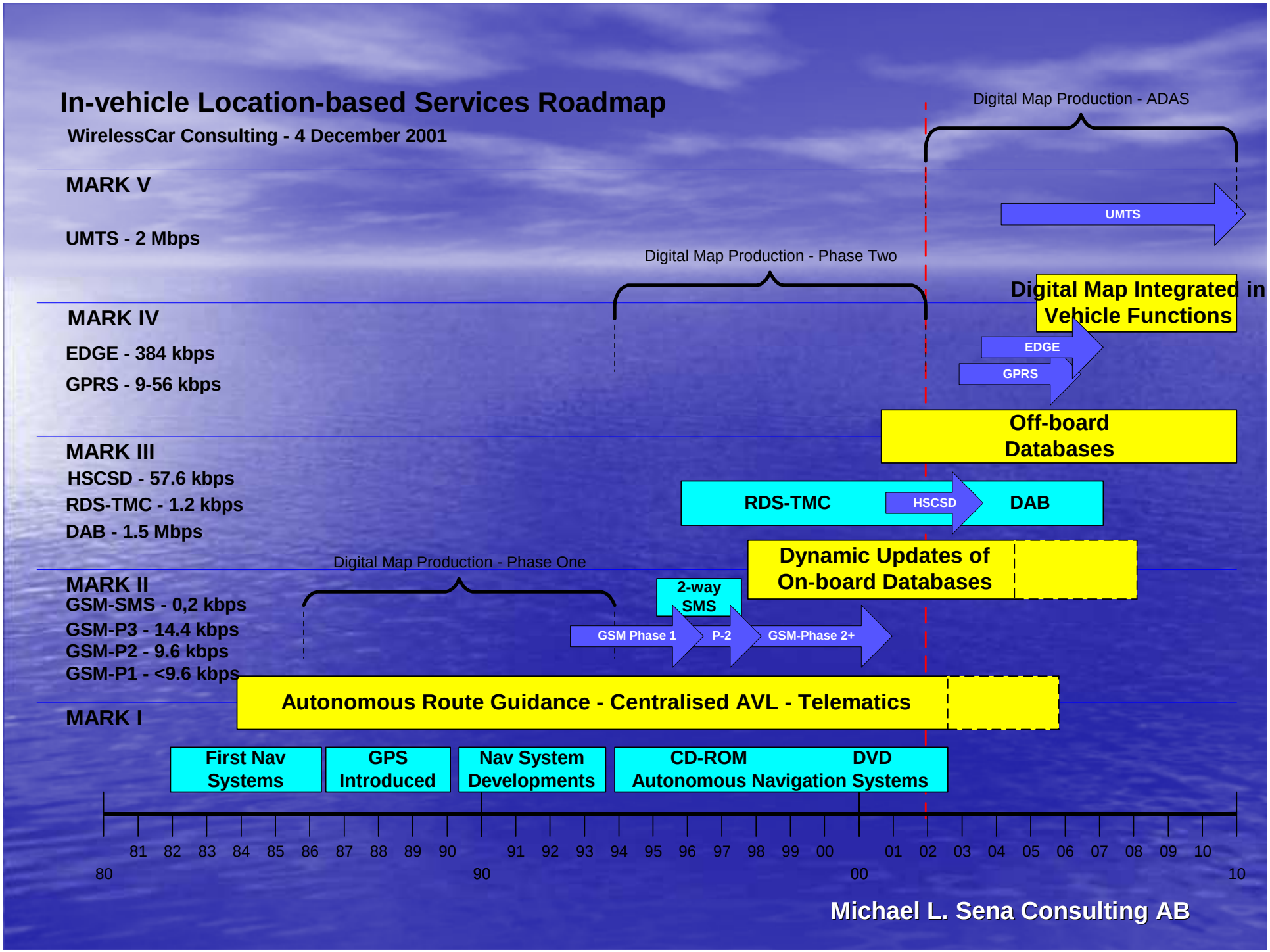
In-vehicle Location-based Services Roadmap
WirelessCar Consulting - 4 December 2001
MARK V
UMTS - 2 Mbps
MARK IV
EDGE - 384 kbps
GPRS - 9-56 kbps
MARK III
HSCSD - 57.6 kbps
RDS-TMC - 1.2 kbps
DAB - 1.5 Mbps
MARK II
GSM-SMS - 0,2 kbps
GSM-P3 - 14.4 kbps
GSM-P2 - 9.6 kbps
GSM-P1 - <9.6 kbps
MARK I
Digital Map Production - ADAS
UMTS
Digital Map Production - Phase Two
Digital Map Integrated in Vehicle Functions
EDGE
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RDS-TMC
HSCSD
DAB
Dynamic Updates of On-board Databases
Digital Map Production - Phase One
2-way SMS
GSM Phase 1
P-2
GSM-Phase 2+
Autonomous Route Guidance - Centralised AVL - Telematics
First Nav Systems
GPS Introduced
Nav System Developments
CD-ROM Autonomous Navigation Systems
DVD
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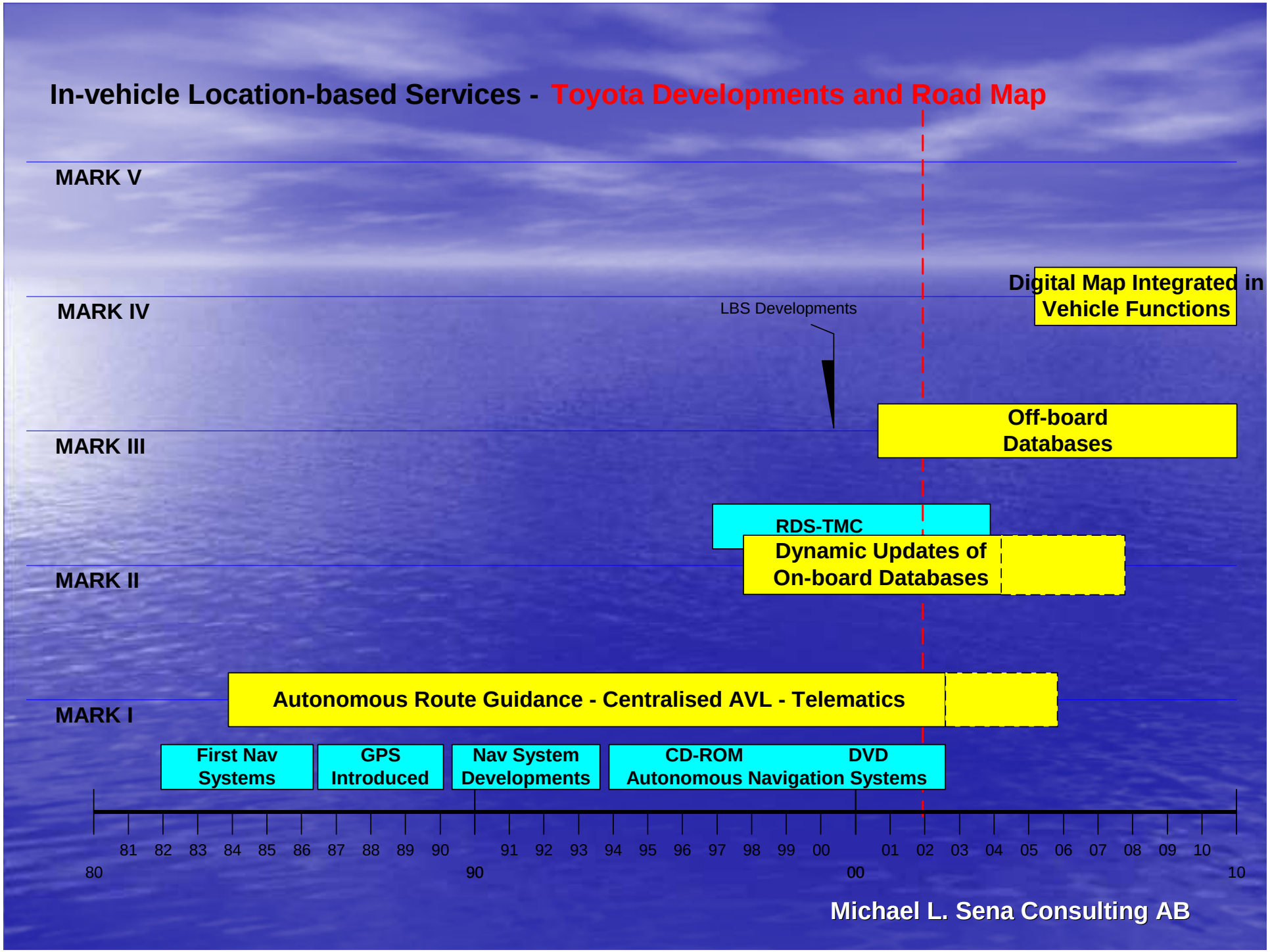
In-vehicle Location-based Services - Toyota Developments and Road Map
MARK V
MARK IV
MARK III
MARK II
MARK I
LBS Developments
Digital Map Integrated in Vehicle Functions
Off-board Databases
RDS-TMC
Dynamic Updates of On-board Databases
Autonomous Route Guidance - Centralised AVL - Telematics
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The In-vehicle Systems and Services Value Chain

Background

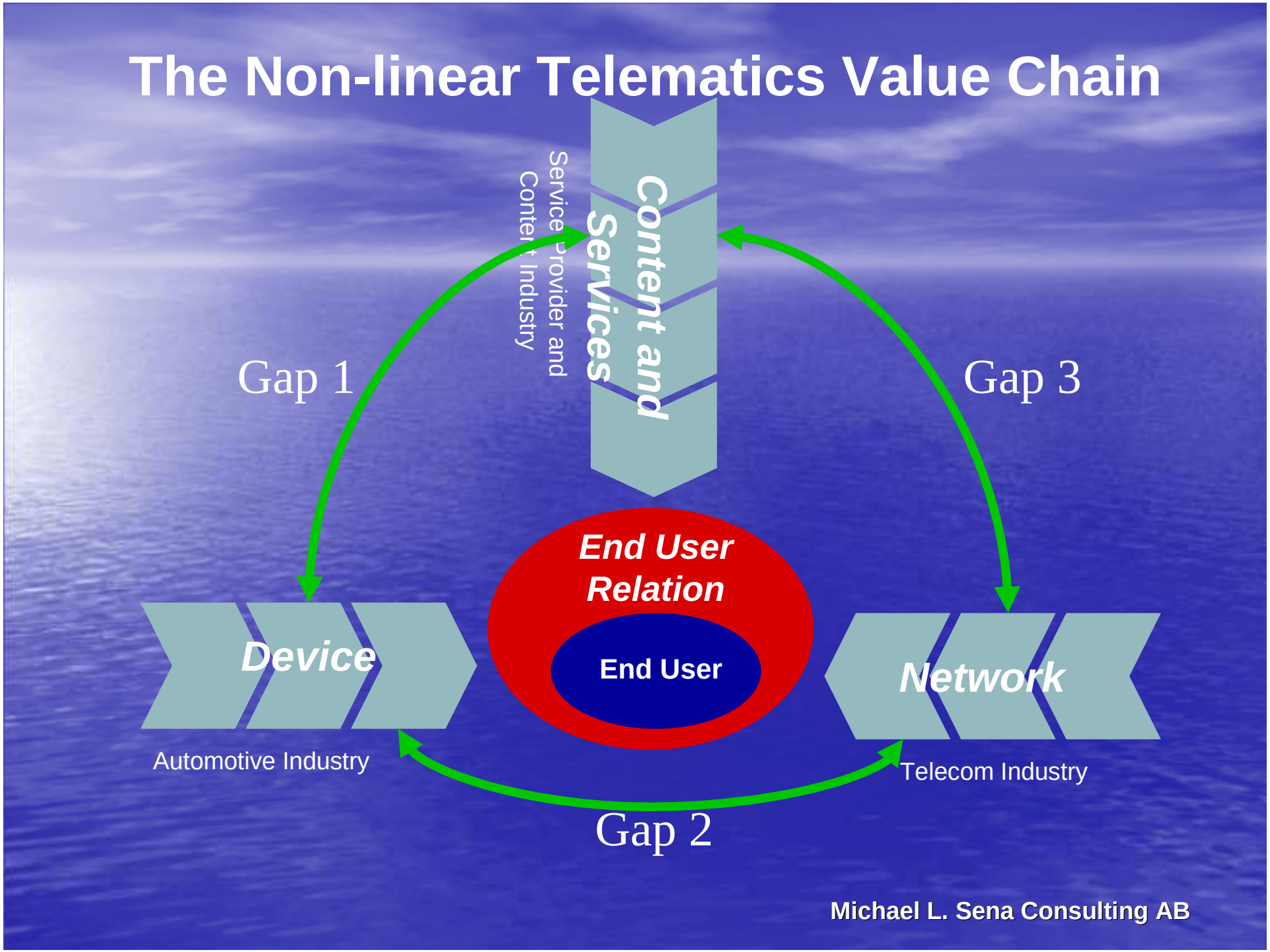
- Market research indicates that there is a latent consumer demand for location-enabled in-vehicle driver information, particularly traffic information and emergency services.
- The reasons that this demand is latent, and not satisfied, is because there is currently a three-way gap between available content (including both information and services), the ability to deliver this content to the vehicle, and the ability of the on-board systems to process this content.
- There is no shortage of in-vehicle devices, including systems that are integrated in the vehicle, those that are after-market installed and dependent on the vehicle for operation, and a growing number of portable devices that can be used in the vehicle environment.
- There is an overlap between the location-enabled services for vehicles and those for out-of-vehicle, portable systems.
- Similar systems and content are used on the off-board delivery side for both vehicle-based and out-of-vehicle systems. Digital map data from suppliers such as Navigation Technologies and location-based information servers are used interchangeably for both types of systems.
- In-vehicle systems have their own special requirements that are more demanding than out-of-vehicle portable devices, and it is those differences, as well as the similarities, that are the focus of this report.

The Traditional Linear View of the Telematics Value Chain:

Content Providers	Service Providers/ Aggregators	Network Operators	Terminal Manufacturers	Customers
Map Data	Auto Clubs	Telecoms	Audio and Navigation System Vendors	OEM's
Traffic Data	Dedicated Telematics Services	Wireless Carriers	Telephone System Vendors	Service Providers
Roadside Assistance Services		SMS-C suppliers	Computer System Vendors	Hardware Providers
Emergency Assistance				

We will provide a more complete view of the value chain showing the interrelationships among the three primary components: Device, Content & Services, and Network

The Non-linear Telematics Value Chain



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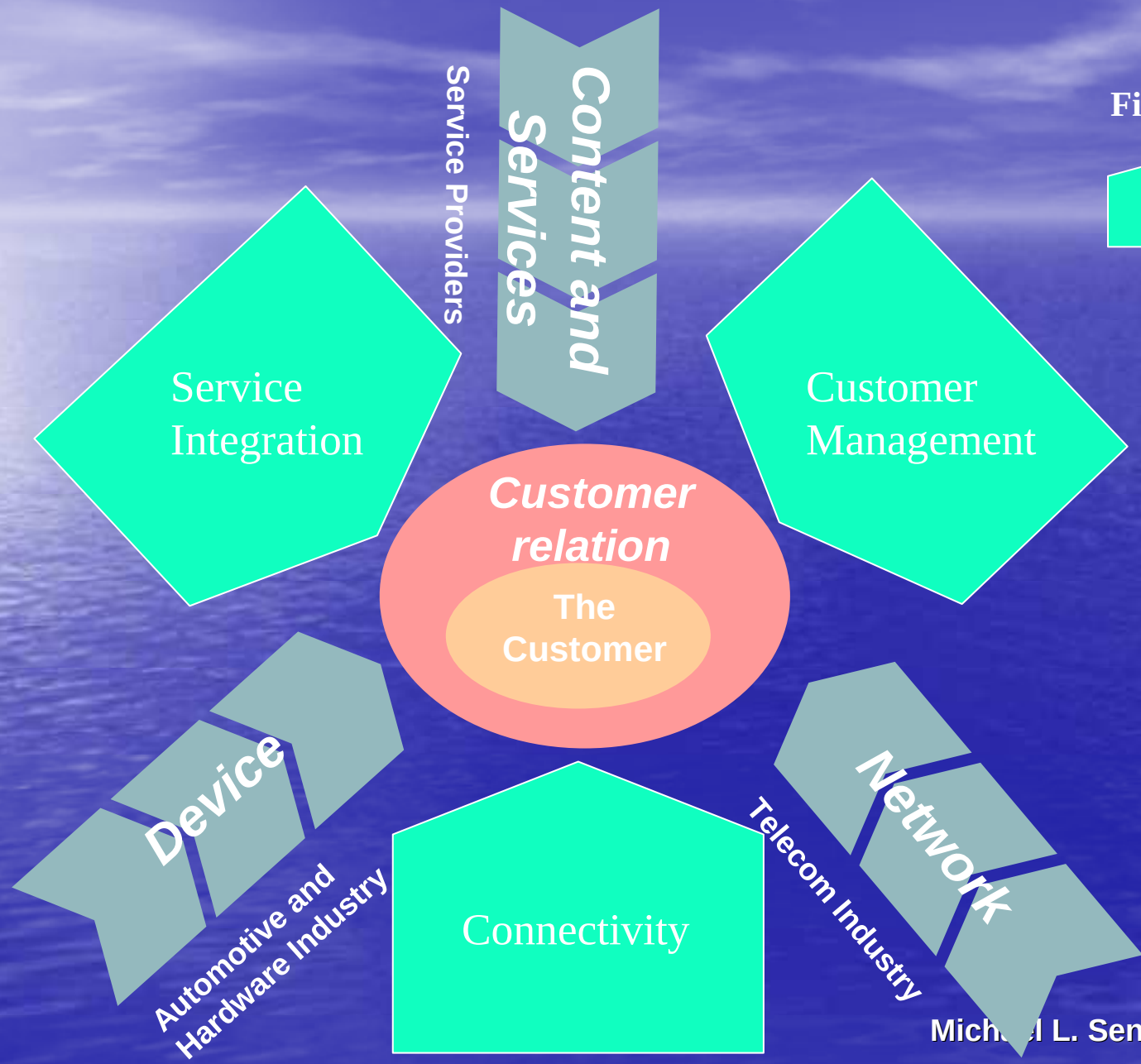
The Telematics Value Chain



Filling the Gaps

Customer Management
- Billing
- Provisioning
- Customer and Vehicle Database
- Database interfaces

Connectivity
- Data message routing to and from Vehicle
- Routing of data messages to and from Service Providers

Service Integration
- IP connection to multiple content and service providers
- Data message conversion to and from Service Providers

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The In-Vehicle Services Industry Structure
The Actors

Network Operators – NO

Operate and own wireless networks, develop and deliver services, bill customers.

-Sub Categories: MVNOs, Wireless Service Providers

Vehicle Manufacturers – OEM

Manufacture and sell vehicles.

In-Vehicle Services (Telematics) Service Providers – TSP

Coordinate and operate In-Vehicle Services platforms and services - Tegaron, Vodafone Passo, Targa, OnStar

-Sub Categories: ISPs, Customer Service Centres (CSC) - Auto Clubs, Mondial, Europe Assistance

Content/Service Providers – C/SP

Produce and aggregate content and services.

-Sub Categories: ASPs, Portals, NavTech, Tele Atlas, LBS system developers, Webraska

Hardware Manufacturers – HW

Manufacture embedded and portable In-Vehicle Services systems.

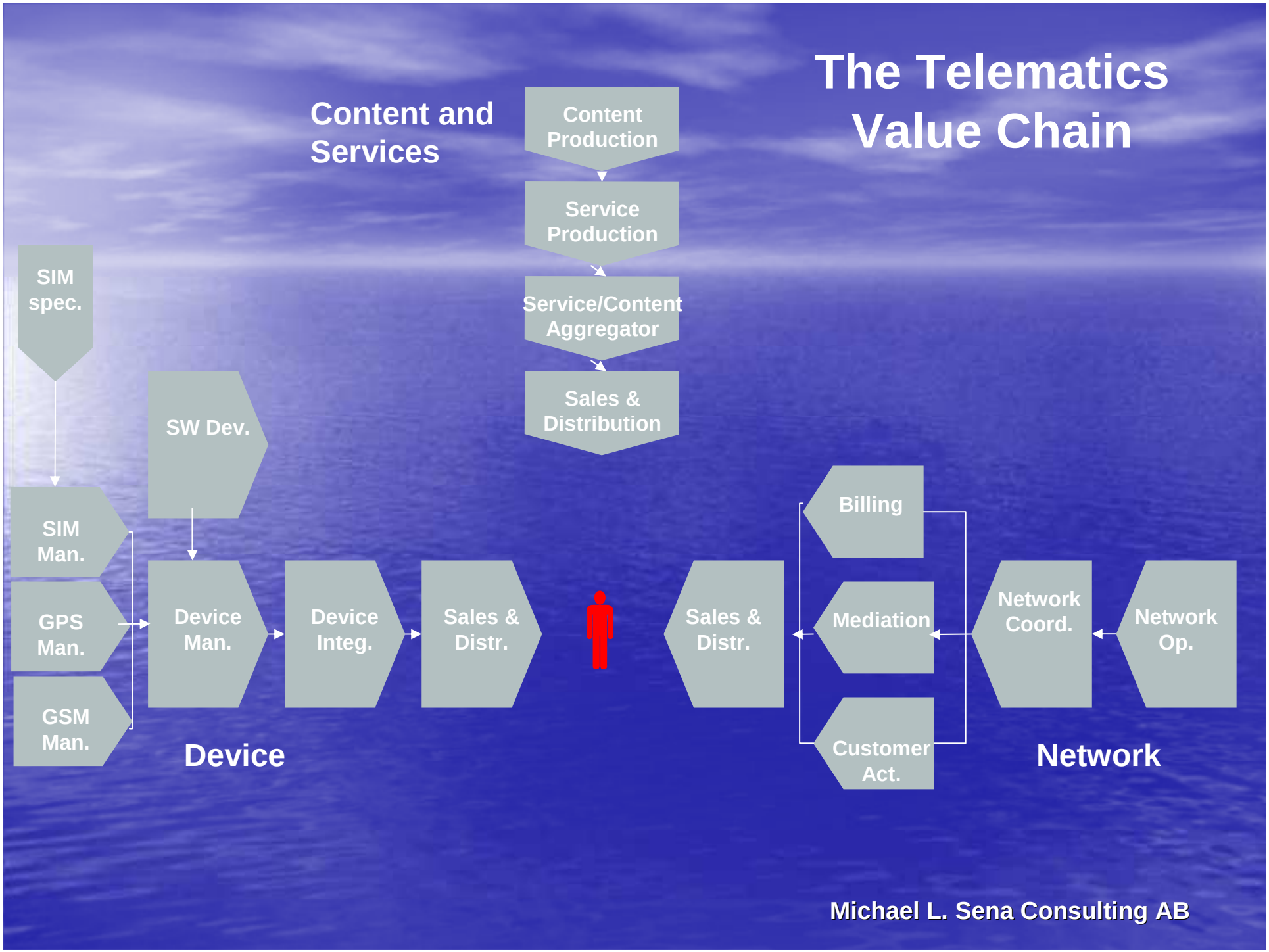
-Sub Categories: Systems Suppliers, Mobile Terminal Manufacturers

Software Developers – SW

Develop SW-platforms, management systems, OS and other SW for embedded in- or extra vehicle systems

-Sub Categories: Software developers

The Telematics Value Chain



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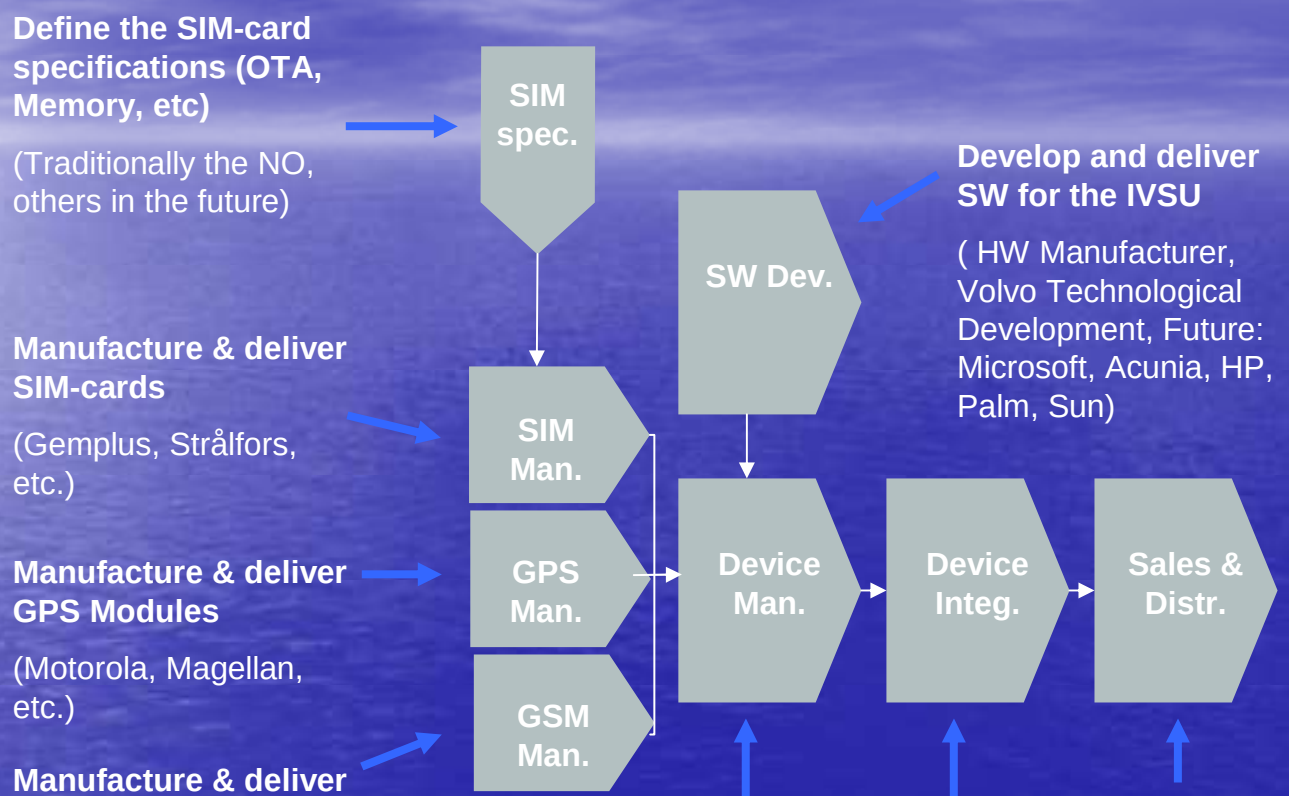
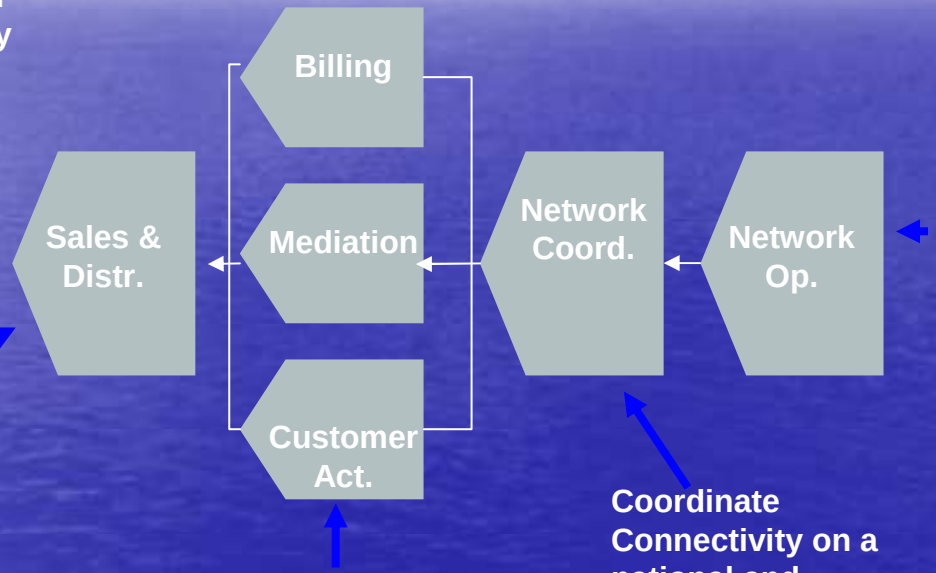
Telematics Definitions: Device



Telematics Definitions: Network

*** A Wireless Service Provider for Wireless Services intended for In-Vehicle Services delivery could be any of the actors active in the Value Chain.**



Build, own & Operate Wireless Networks

(H3G, Orange, D1, +many more, 159 only in Europe)

Branding and Customer "ownership"

(Network Operators, but also different types of Service Providers***** and MVNOs)

(Orange, Virgin, Volvo)

Operation of Services & Customer administration

(Network Operators, but also different types of Wireless Service Providers***** and MVNOs)

(Orange, Virgin, WirelessCar)

Coordinate Connectivity on a national and international level

(Network Operators through roaming. Service Providers***** and MVNOs through access services (SMS-C etc.)

(Orange, Virgin, WirelessCar)

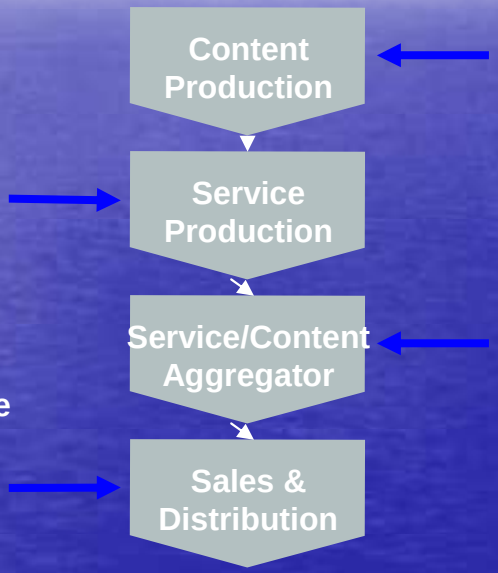
Telematics Definitions: Content and Services

Production of In-Vehicle or Mobile Services

(GenRad, Webraska, ADAC, Mondial, InfoSpace and many, many more)

Branding, Sales & Distribution of the services.

(Automotive, OnStar, Volvo, Ford, Mercedes, NOs, ADAC, Mondial)



Production of Content intended for use in In-Vehicle or Mobile Services)

(Trafficmaster, DDG, ADAC, NavTech, TeleAtlas, CNN, Time-Warner)

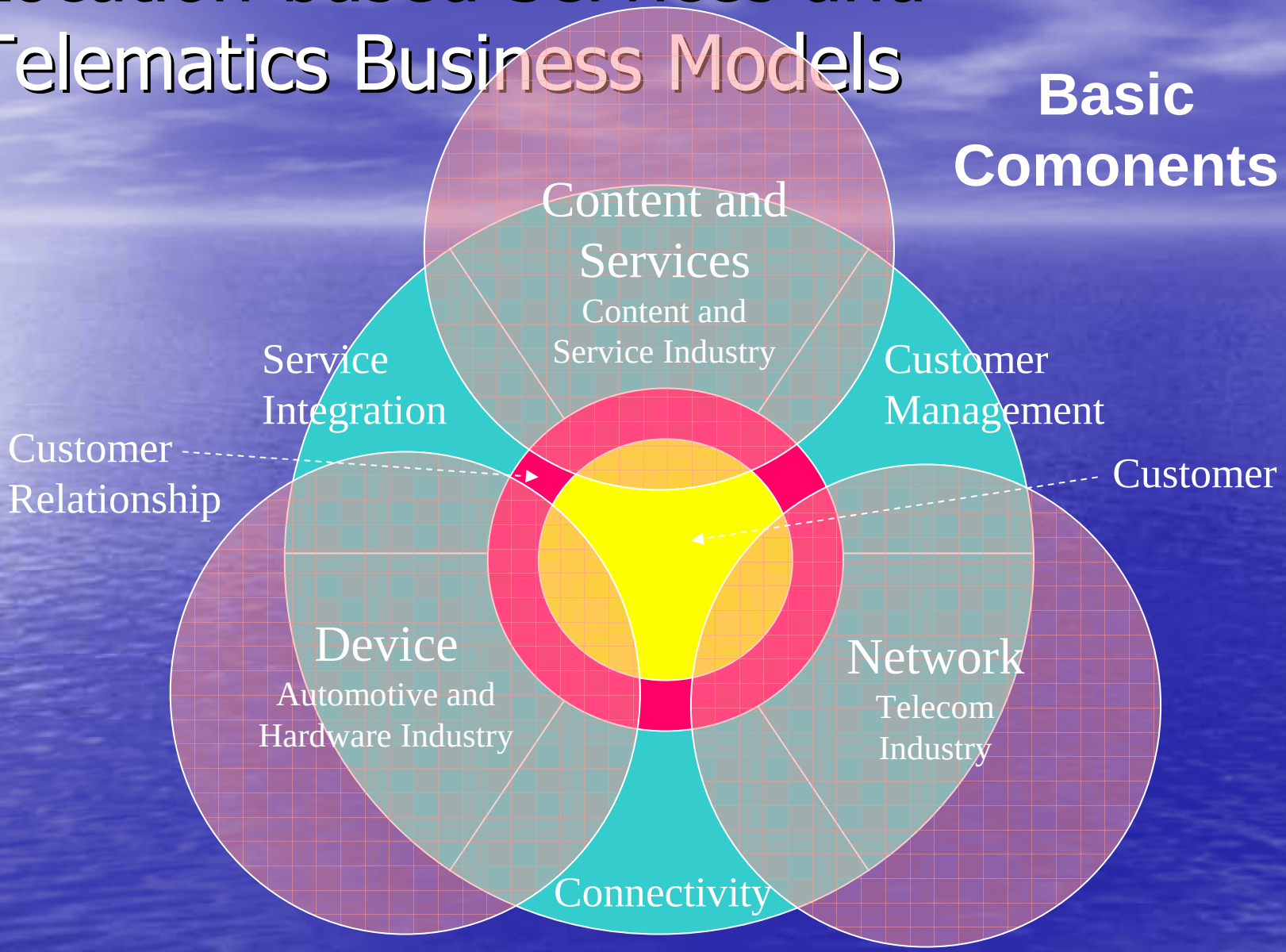
Aggregation of Services to be delivered to the In-Vehicle Environment.

(WirelessCar, Tegaron, Vodafone-Passo, OnStar, ATX. Also Portals, NOs.)

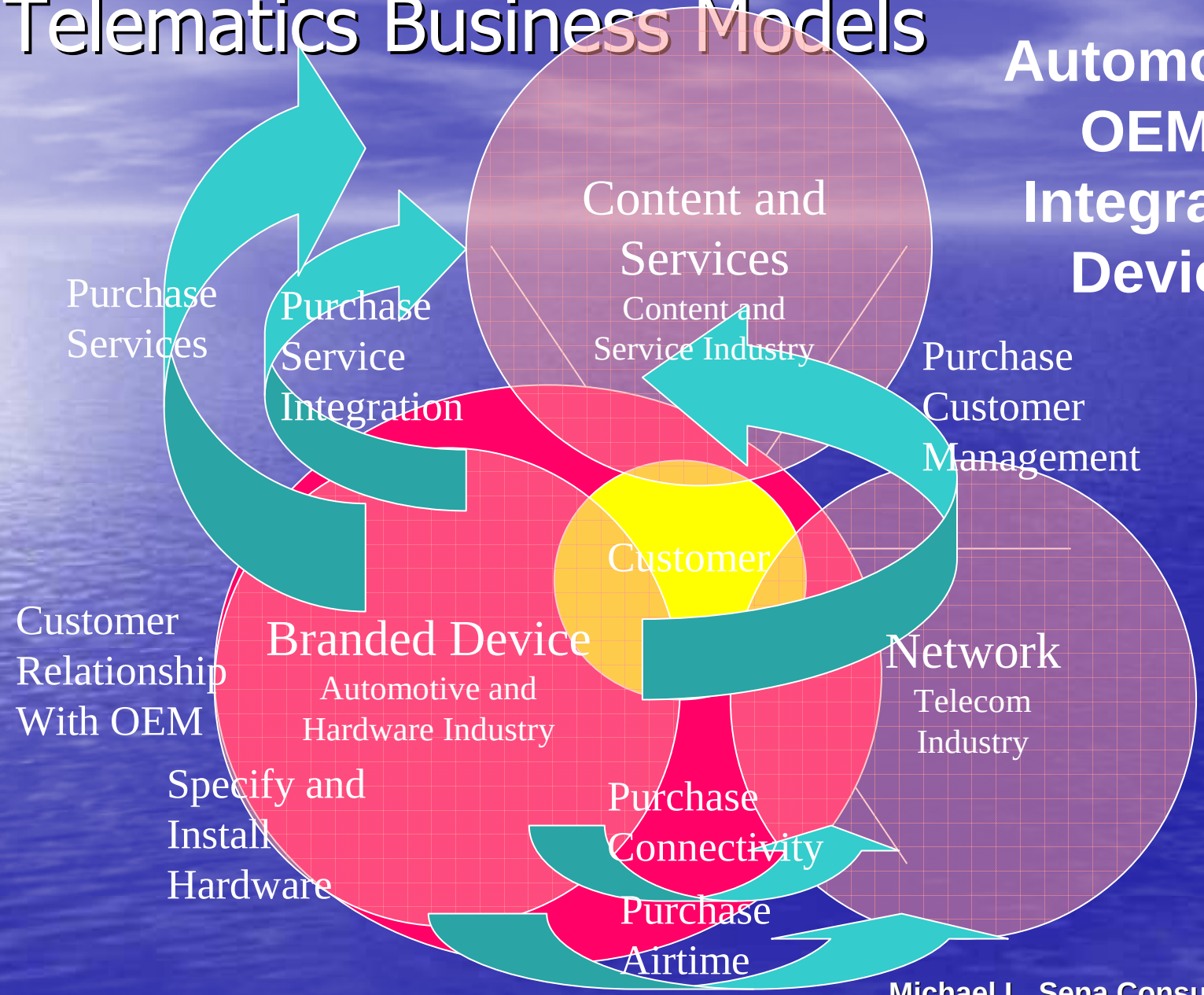
Location-based Services and Telematics Business Models

Location-based Services and Telematics Business Models

Basic Comonents



Location-based Services and Telematics Business Models



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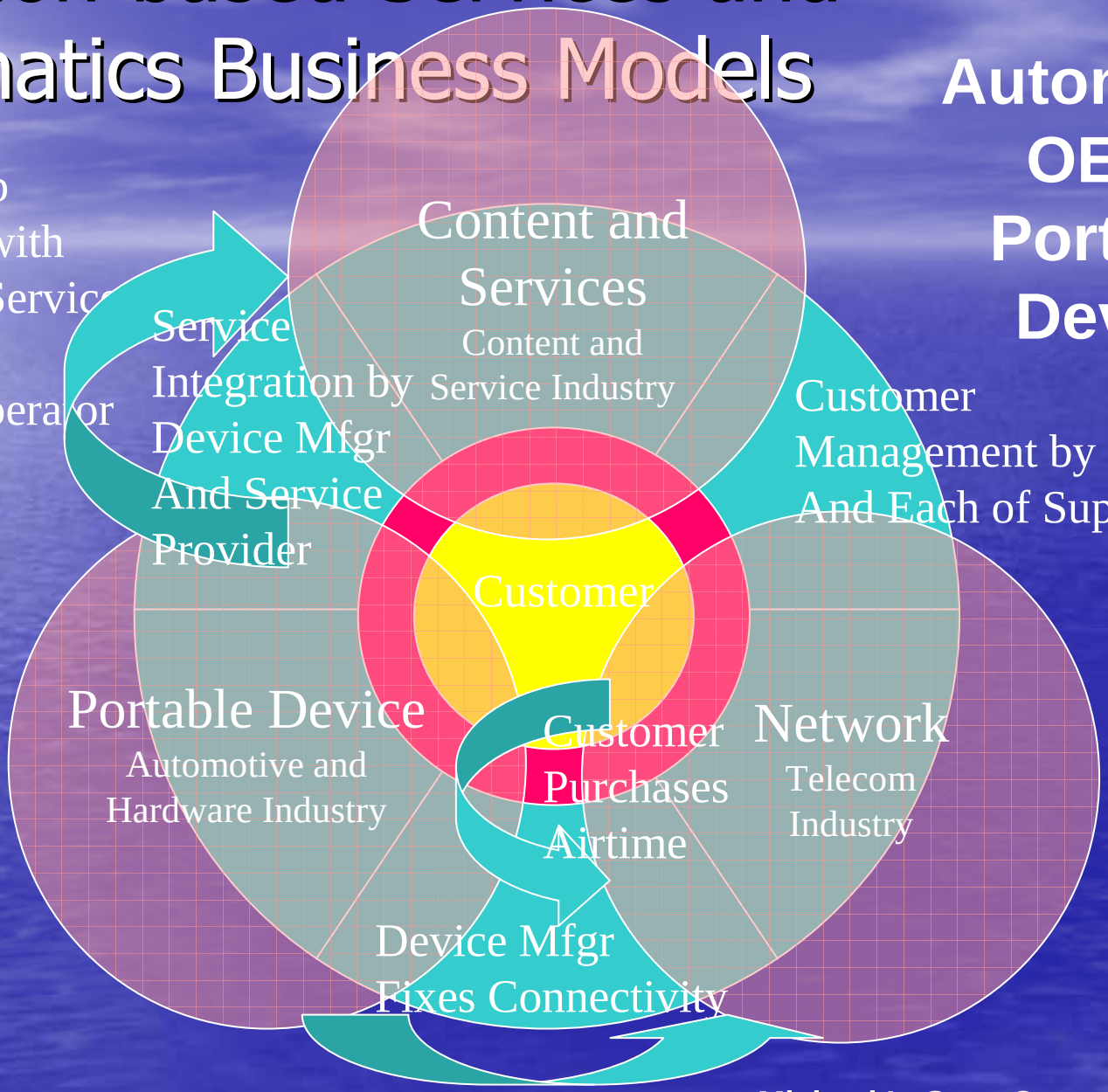
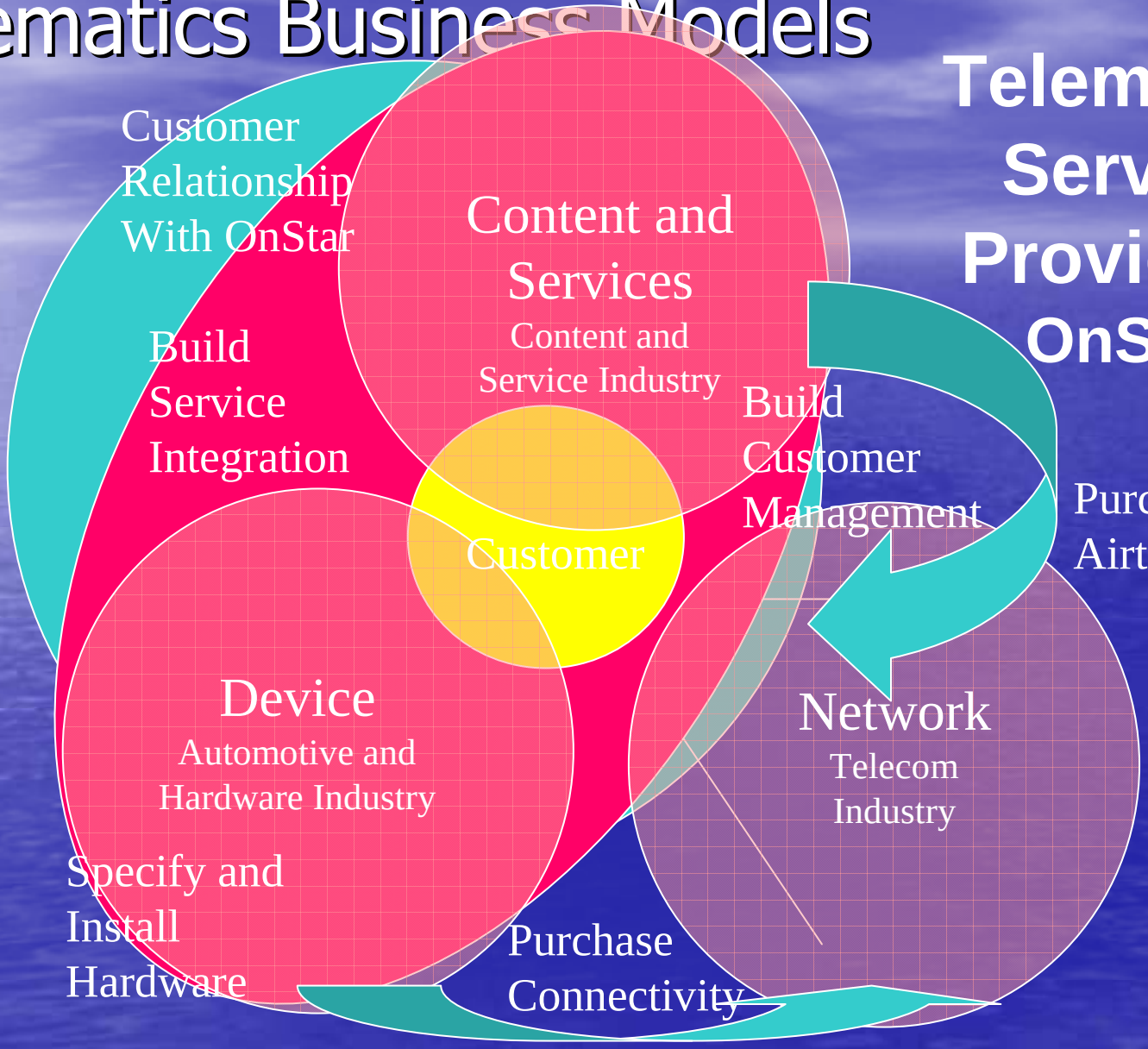
Location-based Services and Telematics Business Models

Automotive OEM - Portable Device

Customer Relationship Separately with Content & Service OEM and Network Operator

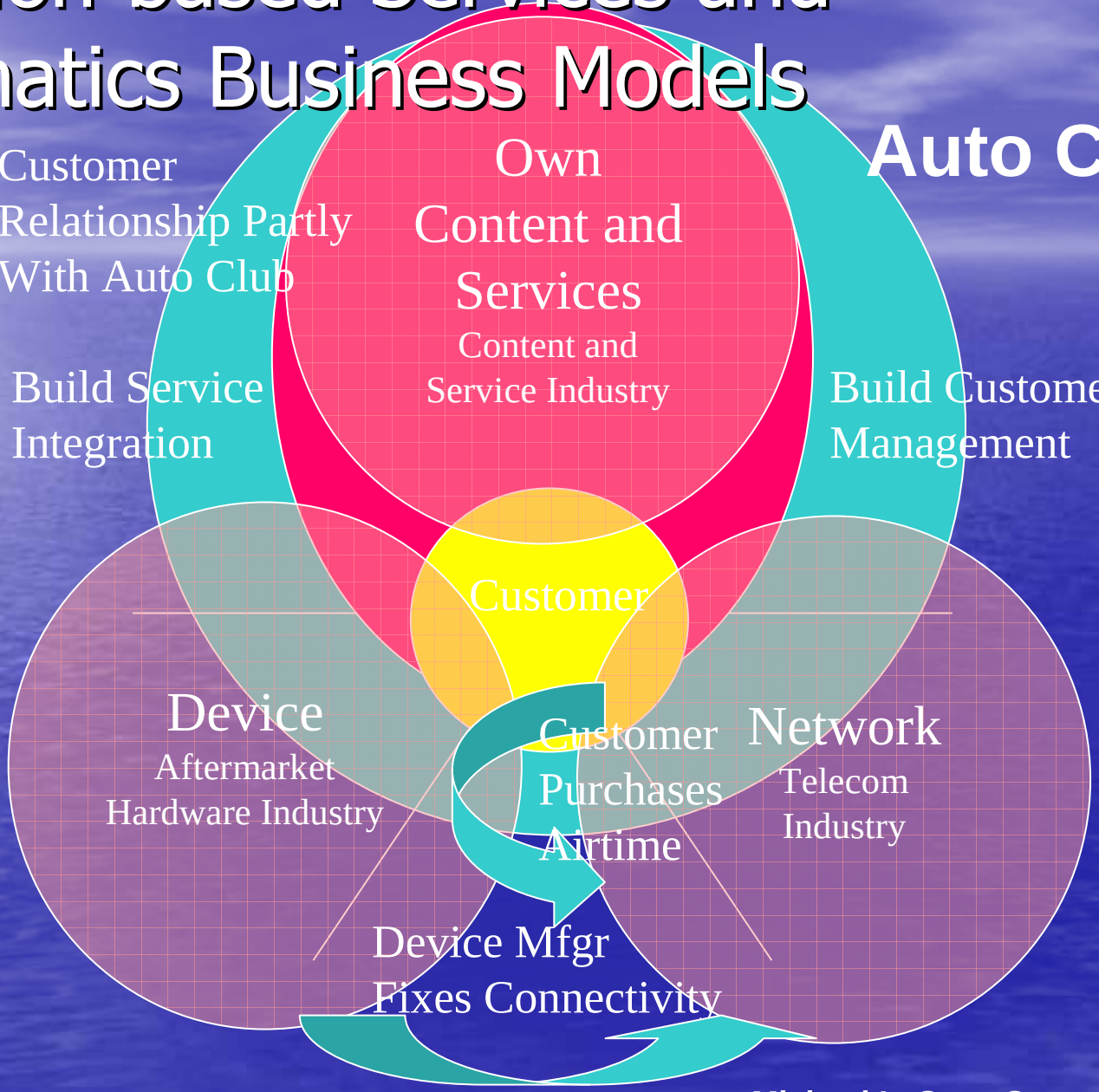


Location-based Services and Telematics Business Models

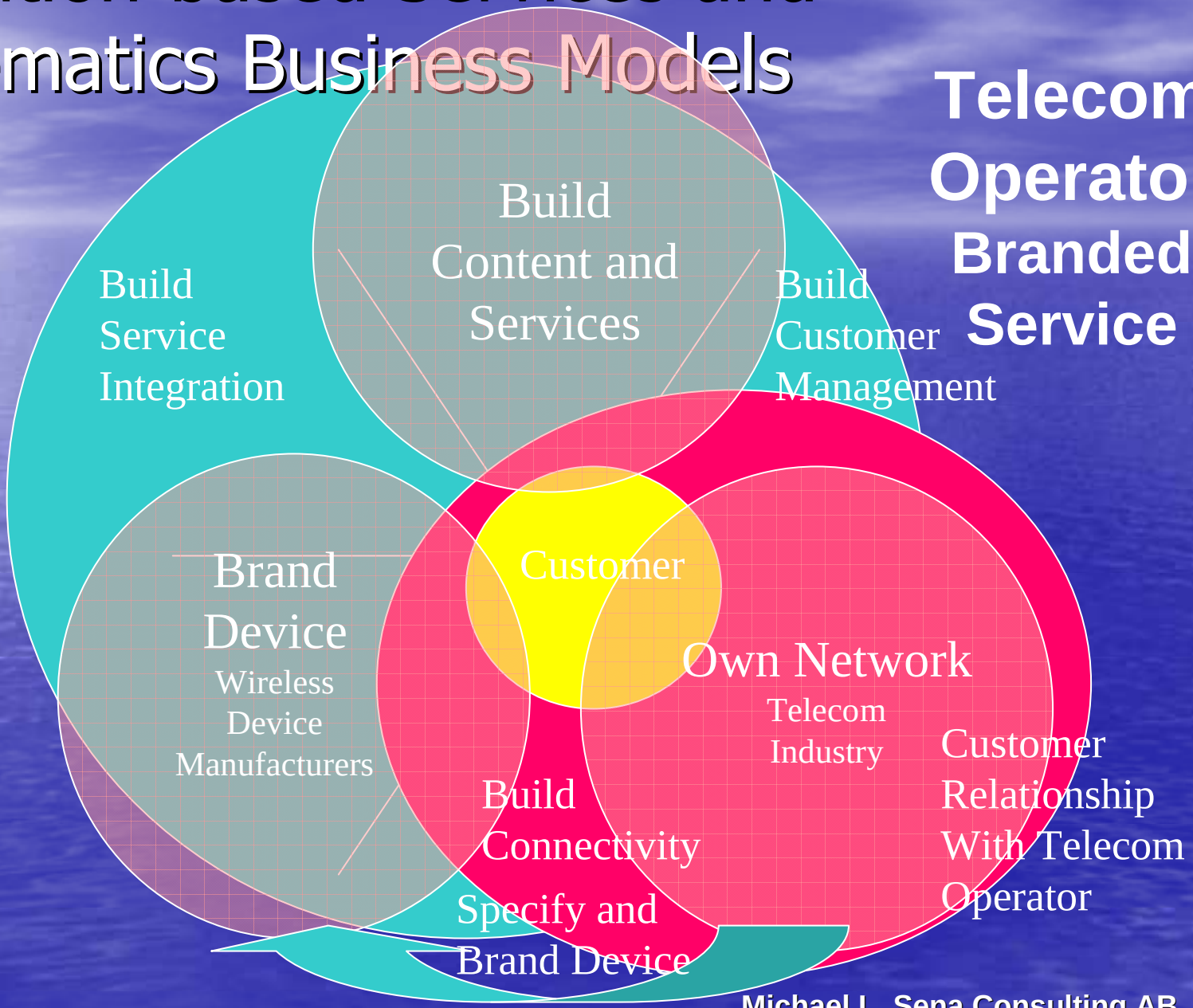


Telematics Service Provider - OnStar

Location-based Services and Telematics Business Models



Location-based Services and Telematics Business Models



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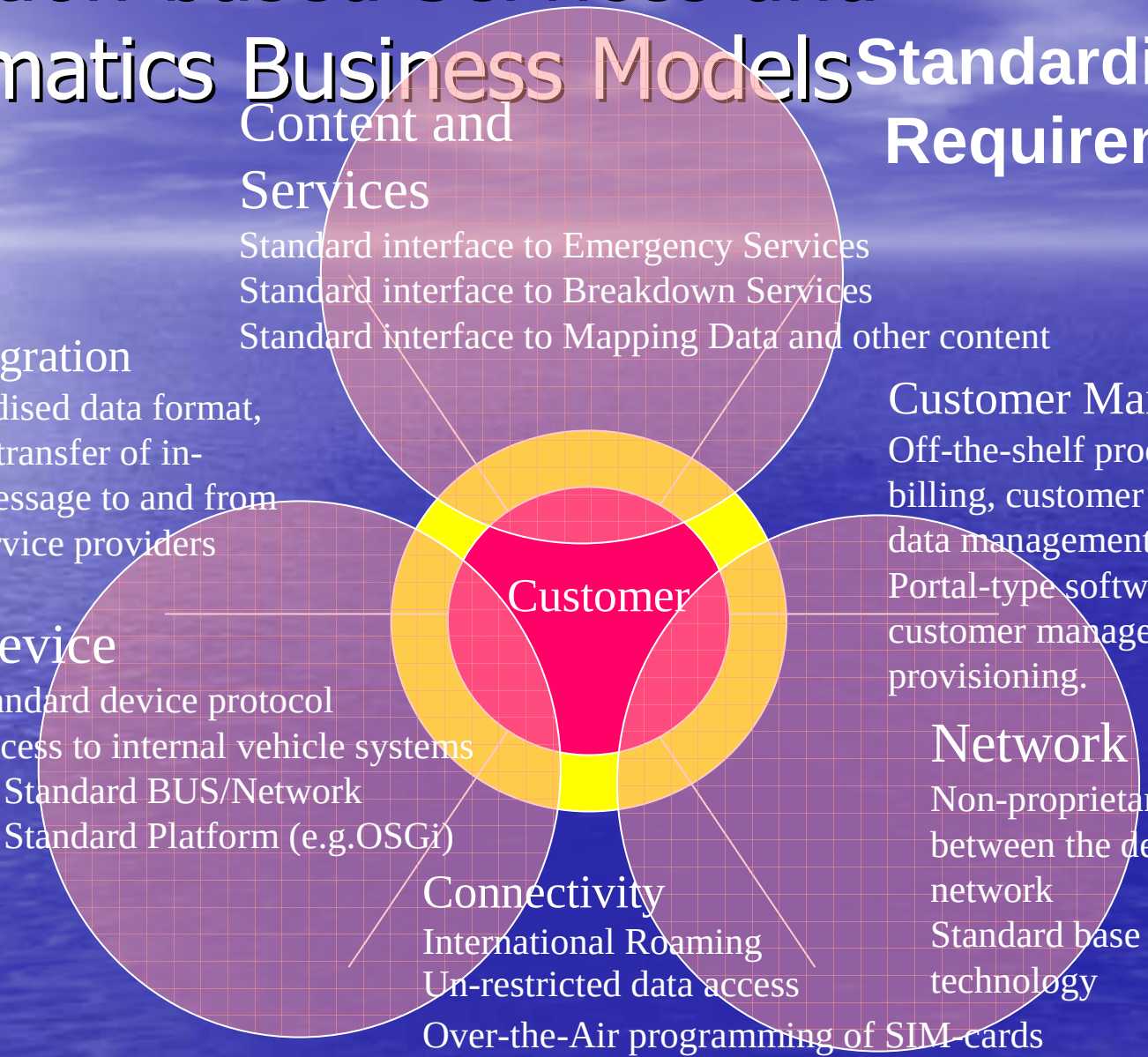
Location-based Services and Telematics Business Models

Standardisation Requirements



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Product Roadmap

In-vehicle Services Product Roadmap

Analytical framework:

What In-vehicle Services should Automotive focus on?

- The In-vehicle Service Market Potential
- Penetration of Factory fitted systems
- Penetration of 2.5G and 3G terminals in vehicles
- What Device?
- What category of In-vehicle Service?
- Penetration Potential for Services
- Revenue Potential for Services
- TTM issues
- Automotives existing service offering

Suggested Product Roadmap to be discussed and explored.

In-vehicle Services Product Roadmap

- **Initial thoughts:**
  - The amount of research performed on consumer expectations, likeliness for adoption and willingness to pay for in-vehicle services is very low.
  - When undertaking research on consumer acceptance and willingness to pay for non-existing services in new markets, one has to accept that only general conclusions can be drawn.
  - Nevertheless, it is still useful to explore these issues using basic research and experiences in order to point toward a reasonable direction.

In-vehicle Services – What Device?

The purpose of the matrix on the next slide is to explore which Service Category (Vehicle Security, Personal Safety or Convenience) can be accessed using the various types of in-vehicle devices (Vehicle Integrated, Vehicle-dependent or Portable)

Explanation:

- **Only one type of device can be used**
- **Two types of devices can be used**
- **All devices can be used**

Service Mapping – Device vs. Service

	Vehicle Integrated Device	Vehicle-dependent Device	Portable Device
Vehicle Security Services	• Remote Diagnostics • Theft Notification • Remote Software Download • Dynamic Advanced Driver Assistance • Stolen Vehicle Tracking	• Stolen Vehicle Tracking	Explanation one type of device two types of devices any of the three devices
Personal Safety Services	• Automatic Airbag Deployment Notification ◦ Emergency Assistance • Roadside Breakdown Assistance	◦ Emergency Assistance ◦ Roadside Breakdown Assistance	◦ Emergency Assistance ◦ Roadside Breakdown Assistance
Convenience Services	◦ Remote Door Lock/Unlock ◦ Route Planning and Directions ◦ Concierge Services ◦ Position Advice ◦ Traffic Information ◦ Technical Assistance ◦ Internet Access ◦ Multimedia entertainment ◦ POIs ◦ Intranet Access ◦ Weather Alerts ◦ Messaging ◦ Gaming • E-commerce • Automated Tolling	◦ Concierge Services ◦ Route Planning and Directions ◦ Position Advice ◦ Traffic Information ◦ Technical Assistance ◦ Internet Access ◦ Multimedia entertainment ◦ POIs ◦ Intranet Access ◦ Weather Alerts ◦ Messaging ◦ Gaming ◦ E-commerce ◦ Automated Tolling	◦ Concierge Services ◦ Route Planning and Directions ◦ Position Advice ◦ Traffic Information ◦ Technical Assistance ◦ Internet Access ◦ Multimedia entertainment ◦ POIs ◦ Intranet Access ◦ Weather Alerts ◦ Messaging ◦ Gaming ◦ E-commerce ◦ Automated Tolling

A majority of the services can be accessed using any device

Services – What is the Penetration vs. Revenue Potential?

- The Next few slides outline the current view of Revenue and Penetration potential for telematics. The information is summarised in a Penetration vs. Revenue potential matrix.
- The purpose of the matrix is to identify In-vehicle services generating high revenues.

NOTE: The graphs show general trends, not aimed at a specific market, OEM brand, consumer segment etc. Therefore only general conclusions can be drawn from these figures.

Penetration versus Revenue Potential In-vehicle Services

NOTICE:The matrix does not consider volume or TTM for different services.

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Sources: ARC Group, ATX Technologies, Roland Berger analysis

Conclusion – Penetration vs. Device

- The sweet spots--defined by high penetration and high revenue potential--are found among the Convenience Services. Given the expected penetration rate for 2.5G and 3G terminals in vehicles, the real market potential is related to delivering Convenience services to Portable and Vehicle-dependent devices.
- It is important to note though, that selling Personal Safety and Security Services may be a qualifying factor when selling In-vehicle Services. It would be possible to decouple the Personal Safety Services and Security Services from the Convenience Services on Portable and Vehicle-dependent devices, but not on the Integrated Devices.

Integrated Services – Penetration

	2000	2005	2010
Vehicle Security Services			
• Dynamic Advanced Driver Assistance	L	L	LM
• Remote Diagnostics	L	LM	HM
• Remote Software Download	L	LM	HM
• Stolen Vehicle Tracking	L	HM	H
• Theft Notification	L	HM	H
Personal Safety Services			
• Automatic Airbag Deployment Notification	L	H	H
• Emergency Assistance	L	H	H
• Roadside Breakdown Assistance	L	H	H
Convenience Services			
• Automated Tolling	L	LM	HM
• Intranet Access	L	LM	HM
• Multimedia entertainment	L	LM	HM
• Internet Access	L	LM	HM
• Gaming	L	LM	H
• E-commerce	L	HM	H
• Traffic Information	L	HM	H
• POIs	L	HM	H
• Weather Alerts	L	HM	H
• Remote Door Lock/Unlock	L	H	H
• Route Planning and Directions	L	H	H
• Concierge Services	L	H	H
• Position Advice	L	H	H
• Messaging	L	H	H
• Technical Assistance	L	H	H

Explanation:

L	<5%	(LOW)
LM	5-15%	(LOW-MEDIUM)
HM	15-25%	(HIGH-MEDIUM)
H	>25%	(HIGH)

Sources: WirelessCar internal, Roland Berger, Deutsche Bank, ATX Technologies

Services – Revenue Potential

The big issues:

- **Will customers pay?**
- **If so, how much?**

We see several different scenarios, relating to different types of services:

	Vehicle Integrated Device	Vehicle-dependent Device	Portable Device
Vehicle Security Services	• Probably no, or very low cost to the consumer. Pay per usage for tracking services. • LOW or NO revenues	• Only service is tracking. Will probable be based on a pay per usage basis. • LOW revenues	• Not available
Personal Safety Services	• In short term fixed yearly fees, including voice and data, and in the future probably included when buying the car. • LOW or NO fees	• Fixed fee subscriptions not including the voice-traffic which is billed seperately. • POTENTIALLY HIGH Rev.	• Fixed fee subscriptions not including the voice-traffic which is billed seperately. • POTENTIALLY HIGH Rev.
Convenience Services	• Pay per usage and possibly a fixed yearly or monthly fee. Similar to regular mobile terminal subscription. • POTENTIALLY HIGH Rev.	• Pay per usage and possibly a fixed yearly or monthly fee. Similar to regular mobile terminal subscription. • POTENTIALLY HIGH Rev.	•Pay per usage and possibly a fixed yearly or monthly fee. Similar to regular mobile terminal subscription. • POTENTIALLY HIGH Rev.

Summary from Product Road Map Analysis

- In-vehicle services are a potentially large market.
- Portable devices will rule the market in the short term due to low penetration of vehicle-integrated 2.5G and 3G devices.
- Consumers will learn to use the 2.5G and 3G services on their portable devices before these devices are integrated into the vehicle, again this is due to low penetration of vehicle-integrated 2.5G and 3G devices.
- Essentially the same Convenience Services will be used inside and outside the vehicle.
- Convenience Services have the highest potential penetration and revenues.
- Personal Safety and Security Services might prove to be a qualifying factor for Integrated Devices.

European Challenges for Wireless-enabled In-vehicle Services Delivery Design

European Challenges: Services and Content

- Emergency Assistance Services
  - Each country has different regulations regarding how services are provided.
  - In certain countries there is a central SOS center that dispatches ambulance and police to an incident.
  - In other countries, emergency calls are routed to local dispatch centers.
  - Some countries allow an intermediary to screen emergency calls, in other countries calls must be routed directly to the authorities.
  - There are no standards defined for pan-European service.
- Roadside Assistance Services
  - Roadside assistance services in Europe are dominated by the country-based automobile clubs--The AA, RAC, ADAC, ACI etc.
  - An umbrella organisation of these clubs has been formed, called ARC, but these clubs operate as a federation, not as a single provider.
  - Services are delivered according to each club's standards.
  - International roadside assistance providers, such as Mondial and Europe Assistance, have a single standard for service delivery, but the services are organised on a country-by-country basis.

European Challenges: Services and Content

- Traffic and Traveller Information
  - Traffic content is collected and distributed on a country-by-country basis.
  - RDS-TMC is the most widespread method used for distributing traffic information, and each country has public and/or private groups developing the RDS-TMC databases, collecting and disseminating the traffic information.
  - Other methods, such as Trafficmaster's in the UK and Germany, or DDG's in Germany, are also country-based.
- Route Guidance
  - Turn-by-turn route guidance is an example of a service that can be delivered on a pan-European basis.
  - Companies such as Webraska can collect street-level data for all those European countries where it is available from data suppliers (NavTech, Tele Atlas), and deliver an automated service equally well as a local service provider.
  - Local knowledge of points of interest, events, regulations is more easily the domain of local service providers, but it will be difficult for even a country-based service provider to know the best routes in each city or town.

European Challenges: System and Network

- The Vehicle OEM requirements
  - The vehicle OEM provides the greatest challenge to system and service providers, as well as to network operators.
  - They would like their systems to operate everywhere, with minimum connection and operations costs.
  - They would like to have the option of branding the system and service themselves, and providing all service through their own dealer networks.

Mandatory

•Pan-European (or global) system architecture – same system installed in every market.

•Minimum cost to add new markets.

•Minimum parts in catalogue (i.e. Single SIM-card if factory-installed).

•No duplication of services that are covered under warranty (e.g. roadside assistance.

•Maximum GSM coverage in every country (i.e. No dead spots due to having only one operator).

•Conformance to all local laws and regulations

•Wide range of service possibilities without system modification

Optional

•OEM-branded system, service and invoice

•Local dealer focus for customers

European Challenges: Service Delivery

Service Delivery Design

- Each company providing in-vehicle services develops its own delivery design, from installation and activation to support, from service delivery to invoicing.

Example

- Sales – Volvo Dealer
- System Repair – Volvo Dealer
- Service Type – Operator-based only
- Customer Contact – Single voice and data contact per country – data routed via WirelessCar, voice direct to country CSC.
- CSC Ownership – Service provider – Falck (ARC associate)
- CSC – Specialist in emergency and roadside assistance
- Database – Single, centralised at WirelessCar
- Invoice – Volvo-branded. Billing info assembled by WirelessCar

Variables

- Who sells the system: Dealer, Hardware Supplier, Service Provider, other?
- Who provides repair service for the system?
- What services are offered: Operator-based, Automated, both?
- Is there a single point of contact for the customer in each country—a customer service center—or multiple points depending on the service required/desired?
- Who owns the customer service center(s): OEM, service providers, other?
- Is the customer service center a specialist in one or more areas, or is it a call-forwarding center only?
- Is there a single, centralised customer and vehicle database, or are there distributed databases in each country?
- Is there an OEM branded invoice, or do the service providers each send their own invoice to the customer?

European Telematics System Architecture

Variables

- System Design
  - Is the Telematics System factory-, dealer- or customer-installed?
  - Is it possible to upgrade components of the system?
  - Is the system crash-proof (backup battery, backup GSM and GPS antennas)?
- SIM-Card Related
  - Is the SIM-card factory-, dealer- or customer-installed?
  - Is the SIM-card pre-programmed, is it an ordinary private SIM-card, or is it both?
  - Is it possible to change information on the SIM-card, or is it fixed during manufacturing?

European Telematics System Architecture

Variables

- System Logic
  - Are there always at least two connections to the service provider, one voice and one data?
  - Does the vehicle always call to the local customer service center, or does it call to the home CSC?
  - Are there fail-safe backup routines if standard numbers cannot be reached (e.g. call 112, send DTMF)?
  - Is the software on-board location sensitive, or does it provide only location coordinates to an off-board location sensing service?
- What telematics protocol is used?

Analysis of Variables

System Installation	To a large degree, installation method determines degree of integration with the in-vehicle systems. Factory- and OEM dealer-installed systems have the highest degree of integration.
System Upgradeability	Tightly integrated systems that are special-fitted are more difficult to upgrade than standard fits (radio DIN) or portable.
Crash-proofness	Built-in systems have higher possibility for surviving a crash than portable. Individual system developers decide on crash survivability by deciding whether to include back-up equipment.
SIM-card Installation	The principal reason for factory installation is to secure the SIM-card in the unit. Factory installation reduces the flexibility of customers to use their private SIM-cards, but makes it easier to pre-program the numbers that the system will contact.
SIM-card Programming	Pre-programming at the manufacturer is the least desirable option, but is the only option at present for embedded SIM-cards. Private cards offer the best local market pricing, but they require modification to be used effectively in in-vehicle service environments, particularly with integrated systems.
Changing SIM-card Data	Ideally, SIM-cards could be re-programmed with new and changed telephone numbers to service centers and logical numbers for SMS-C's.

Analysis of Variables

Multiple Connections	Systems that have only a voice or data connection, rather than both communication methods, risk having a message not delivered. An SMS might be lost or blocked while voice might get through, or voice might not connect when an SMS is delivered.
Calling Logic	This is a result of the service delivery design, the SIM-card design and network agreements. For operator-based services, the local CSC will eventually have to be the contact point. Calling directly to this service point saves time.
Fail-safe Routines	Back-up systems, such as DTMF, allow data connections when SMS service is lost. Contacting the emergency systems automatically when all other systems are unavailable can provide the best service in emergency cases, but these services are not able to receive data, only voice.
On-board Software	The more logic that can be placed on board the vehicle, the more independent it is. However, putting software on-board means updating every vehicle, rather than updating a central facility.
Protocols	Communications and data transfer protocols determine the scope of possible services and the level of services that can be provided.

Major Technical Difficulties

Requirements

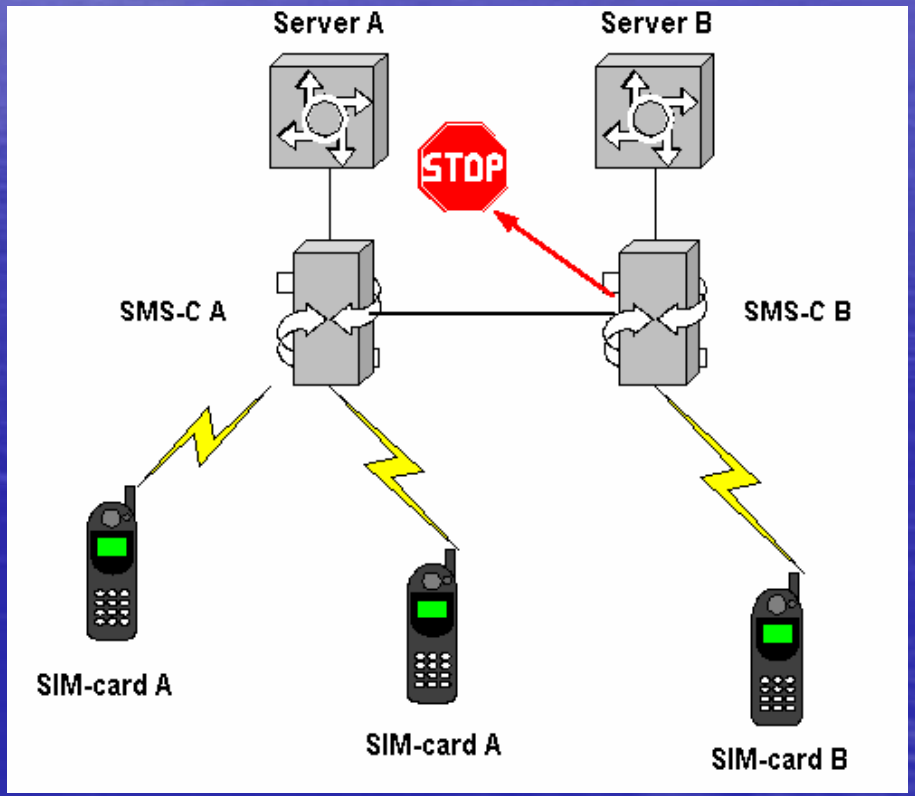
- The system needs to know which number(s) to call for voice contact, and to which SMS-C(s) to direct the data message in every country where service is offered.
- The system needs to know what to do when it is in a country where service is not offered. Does it call the home country, the local emergency assistance authorities, or do nothing at all?

Options

- Voice number(s) and SMS-C address(es) are on-board the vehicle (either on the SIM-card or in software), the system is location-sensitive (ie. It knows in which country it is located), and the proper phone number(s) and SMS-C address(es) are contacted.
- Voice number(s) and service provider SMS-C address(es) are off-board. The system is not location-sensitive. The system is pre-programmed to contact a telematics service provider via SMS and to send location coordinates. The telematics service provider identifies where the system is located and sends back to the system the voice number(s) and SMS-C address(es) of the appropriate service provider(s).
- Problem: if the SMS is not delivered, there is no back-up voice call made.

Major Network Difficulties

- The GSM network operators have now provided for maximum voice coverage for European customers through roaming agreements.
- Phone-to-Phone SMS traffic is also covered in these roaming agreements.
- However, in order to access a network provider's servers or portals, the caller must be a subscriber to that network.
- This means that other solutions for providing pan-European access to telematics customers' records must be found.



SIM-Card and Network Options

Options for SIM-card

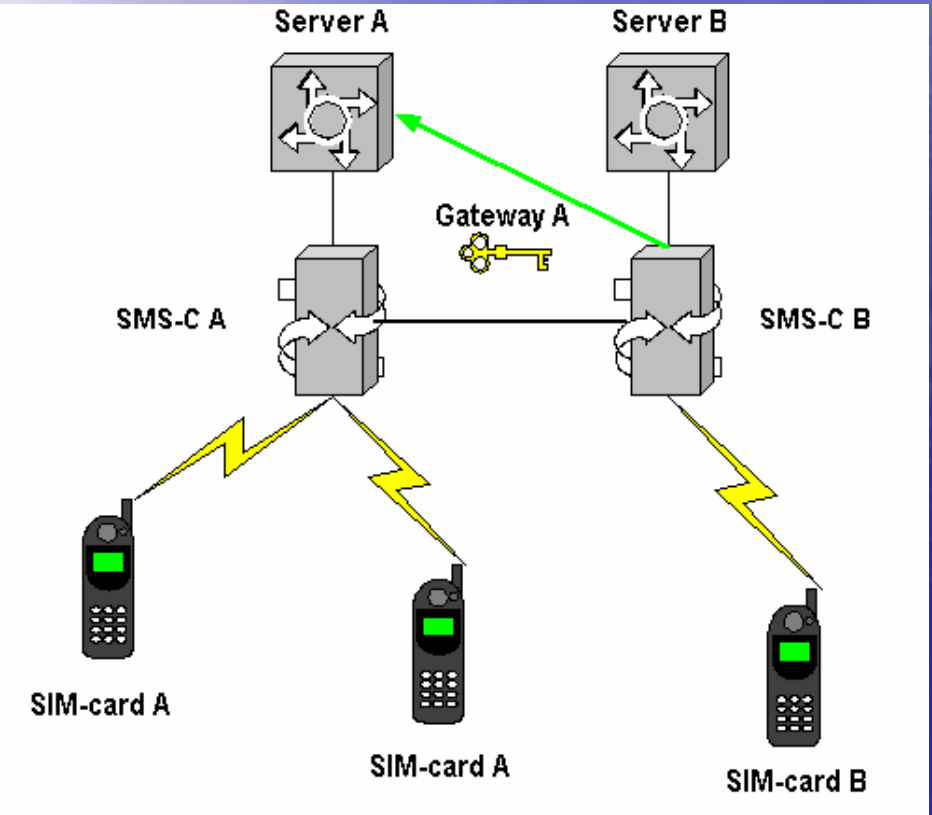
- Pre-programmed SIM-card with telephone number(s) and/or address(es) loaded on the SIM-card at the time of manufacturing, or through some other process prior to delivery to the customer.
- Private SIM-card
  - Numbers stored on telematics system
  - Numbers loaded to SIM-card at activation of subscription

With 3G, these same issues will be present. Access to the mobile device will continue to be via a network operator, and the options for network services will be the same.

Options for Network Services to Connect from the Telematics System to the Telematics Service Provider

- Telematics SIM-card with central SMS-C. This eliminates the problem with a SIM-card in one operator's network not being able to address a server in another operator's network.
- Private SIM-card
  - Provide a gateway from each of the SMS-C's to the TSP (called creating a Large Account.
  - Open SMS-C for other operators by providing a list of authorised users at the terminating SMS-C
  - Implement a Virtual SMS-C, which makes addressing an SMS-C similar to calling a mobile station

Gateway



Description

Provide a gateway from each of the SMS-C's to the TSP (called creating a Large Account.

Establish Large Account at each operator

There must be reversed billing implemented

External SMS-C connections must be possible

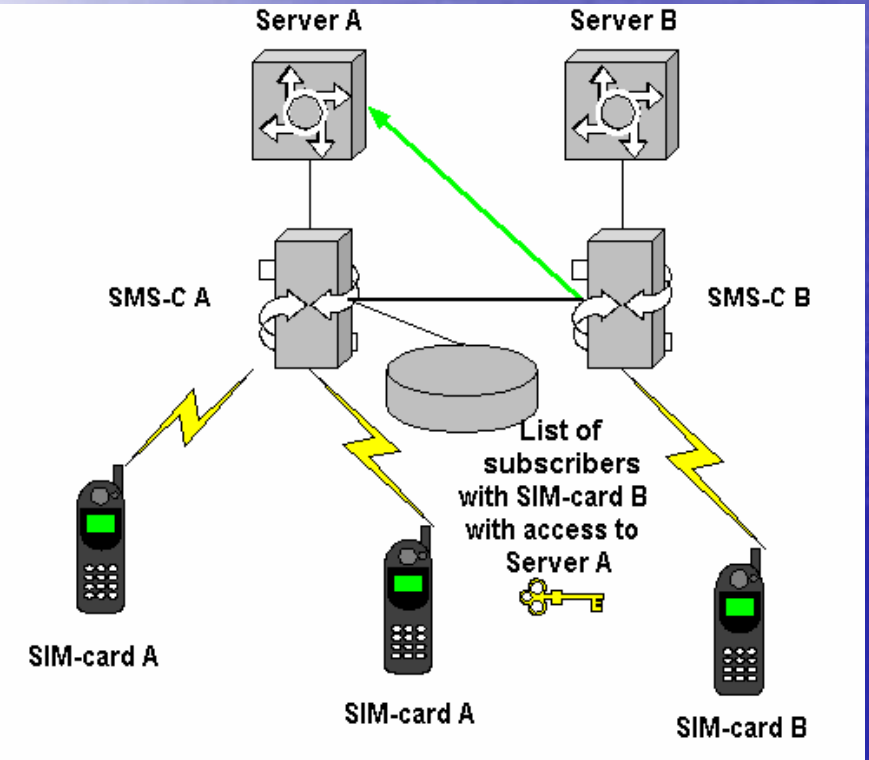
Pros

- Always use the local operator, so costs are lowest
- Best control on billing

Cons

- There are 159 operators in Europe in 50 regions, and this means 159 separate initiatives.
- Operators can still close their SMS-C's to non-subscribers, particularly for data going to the mobile station.

Authorised List



Description

Open SMS-C for those not having a subscription with the operator

Have a system for provisioning of new customer

Change SMS-C address

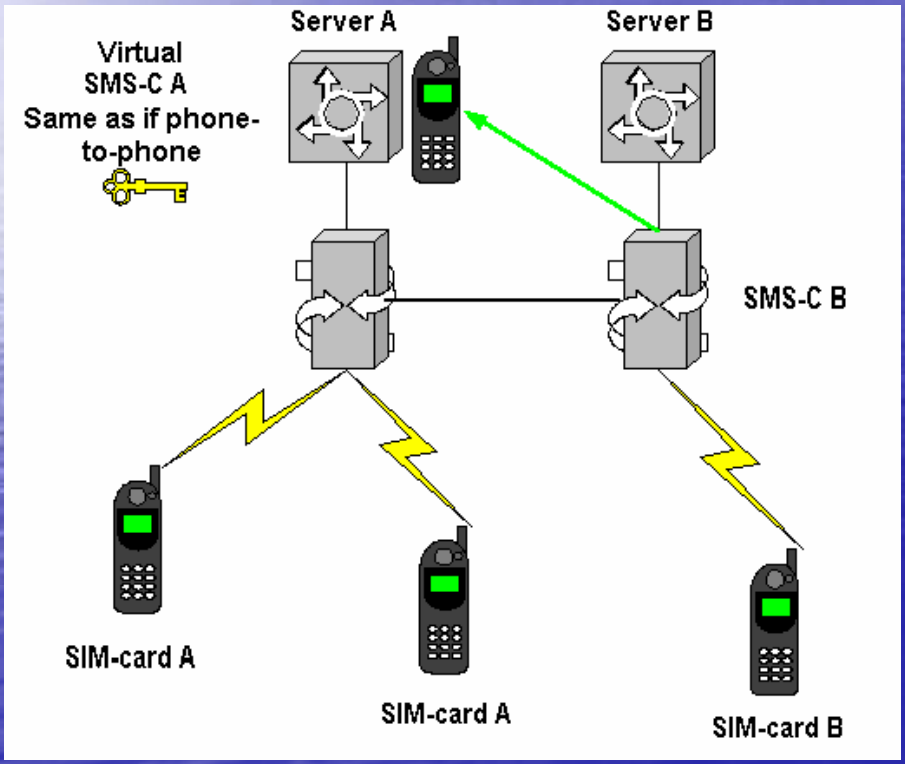
Pros

- Does not require working with 159 different operators
- Customer costs are on only the terminating network

Cons

- Very time intensive to establish the list and register each authorised user.
- Can have a negative effect for customer by making it difficult to use mobile device for normal SMS service.
- Operator is left out of the revenue stream

Virtual SMSC



Description

Implement a Virtual SMS-C, which makes addressing an SMS-C similar to calling a mobile station

Pros

- Does not require working with 159 different operators

Cons

- There can be an interconnect cost, and this could be high
- If there is no interconnect agreement between operators, the message can be blocked

In-vehicle System Unit Protocols

- The wireless-enabled in-vehicle services unit (IVSU) sends messages to and receives messages from a service provider, or providers, using a specific protocol.
- Protocols for message transfer are today primarily device- or application-specific. The two protocols that dominate the installed based of systems currently in use are:
  - GATS - Global Automotive Telematics Standard
  - ACP - Motorola's proprietary Automotive Communications Protocol
- Each of these protocols is implemented in different versions for each specific device, including Motorola's own implementation of ACP
- Efforts are underway to find a common ground between GATS and ACP, and to develop a WAP wrapper for GATS. However, there will continue to be legacy systems that will require access even if a common standard is achieved.
- Efforts are being made to standardize data transfer and data access inside the vehicle (AMI-C, IDB and MOST), between devices in and outside the vehicle (Bluetooth), and between the vehicle and outside services (OSGi).
- AMI-C: Automotive Multimedia Interface Collaboration. Developing a set of common specifications for a multimedia interface to vehicle electronic systems in order to allow a variety of computer-based electronic devices in the vehicle. Has approximately a dozen members.
- IDB Forum: ITS Data Bus. A consortium of automakers, suppliers and electronics industry players who are developing code for an in-vehicle network that allows electronic devices to communicate with each other and with the vehicle electronics.

In-vehicle System Unit Protocols

- The need to become deeply involved in any of these initiatives is directly related to the level of involvement an application will have with the vehicle's performance, or the amount of information required from the vehicle to execute an application.
- For location-enabled services, the primary data requirements are the latitude and longitude of the vehicle and its bearing. A standard method of presenting this data would mean that a service provider like H3G could have a single interface for this data.
- Delivering data to the vehicle remains device- and application dependent, even with OSGi, MOST, etc. There still needs to be some form of browser for an Internet-enabled device, and each browser has its special protocol.
- The MAGIC Services Initiative addresses the data provision side. (continued next page)

- MOST: Media Oriented Systems Transport. An initiative with similar aims as AMI-C. Founded by German car makers Audi, BMW and DaimlerChrysler, it has over 60 company members.
- OSGi: Open Services Gateway Initiative. It is non-profit corporation working to define open standards for delivery of multiple services over wide-area networks to local networks and devices, including vehicles. An OSGi-compliant service gateway in a vehicle would manage access to on-board systems and data, and deliver this information to off-board systems.
- MAGIC: Mobile Automotive Geographic Information Core.

In-vehicle System Unit Protocols

- The MAGIC Services Initiative addresses the data provision side. The goal of the initiative is to develop a set of application programming interfaces and protocols designed to create an optimal development and deployment environment for navigation, in-vehicle services and location-sensitive service applications. The specification will support graphic map rendering, access to on-board data for map matching, and demand-driven uploading from off-board servers of navigation data.
- Goals statement:
  - Enable B2B delivery of mobile geographic data
  - Leverage existing open standards, such as XML
  - Support mobile devices regardless of platform
  - Operate over both wireless and wired networks
  - Support a variety of transport protocols
  - Use existing Internet and Web standards and technologies.
- MAGIC: Mobile Automotive Geographic Information Core. It is an industry-led standardisation effort. (www.MAGICServicesForum.org)
- Original founding members include:
  - Alpine Electronics
  - Increment-P Corporation (Pioneer)
  - Matsushita Electric Industrial Co. (Panasonic)
  - Microsoft
  - MobileGIS Ltd.
  - Telcontar
  - Tele Atlas
  - VDO/Siemens
  - Xanavi Informatics Corp.
- Navigation Technologies has recently joined

Implementation Examples

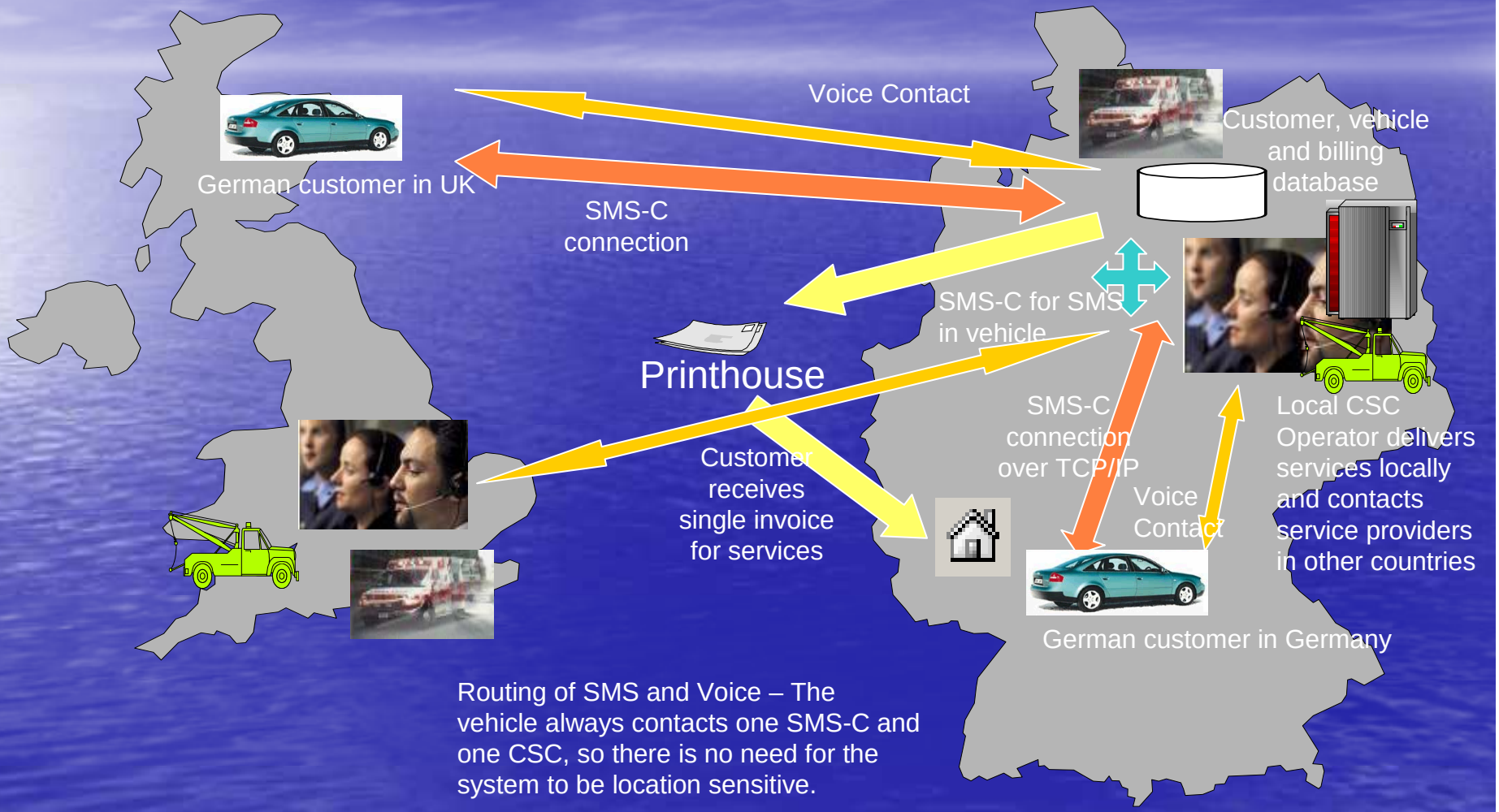
- Describe current technical and business implementations showing in diagrammatic form the relationships among the companies delivering an end-to-end in-vehicle services solution.
- Identify the major advantages and disadvantages of each of the implementation options.
- Identify how H3G can participate in each of the options.

- CSC - Customer Service Center - This is the content or service provider who is the primary contact for the end user. They either deliver the services or content, or arrange for its delivery.
- Home vs. Local CSC - The home CSC is the CSC in the market where the customer is resident, or in which the customer's telephone subscription is registered. The local CSC is the CSC in the country where services are desired.
- ARC - A European organisation comprising eight motoring and tourist associatinos with associated member associations in the remainder of the European countries.

Implementation Options

Home Market Servers and Services	The ARC Solution - The vehicle always directs voice and data to the customer's home CSC. It is then up to the home CSC to organise local services.
Local Servers with Local Services	The vehicle always directs voice and data to the local CSC. This provides the quickest service delivery. Requires that the vehicle is location sensitive. Requires that each CSC has access to the customer's records. Language can be a problem. If the vehicle cannot access the local server, there can be no services when a customer is out of the home country.
Central Services and Local Services	The vehicle always directs voice and data to the home CSC when in the home territory, and to a central CSC when outside the home territory.
Central Server with Central/Regional Services	The vehicle always directs voice and data to a central CSC and services are delivered from central or regional centers. Requires no intelligence on-board since location and service delivery are determined by the central CSC.
Central Server with Local Services	The vehicle always directs voice to the local CSC and data to the central telematics server. The central in-vehicle services server directs the data message to the local CSC.

Home Market Servers and Services
The ARC Solution



Routing of SMS and Voice – The vehicle always contacts one SMS-C and one CSC, so there is no need for the system to be location sensitive.

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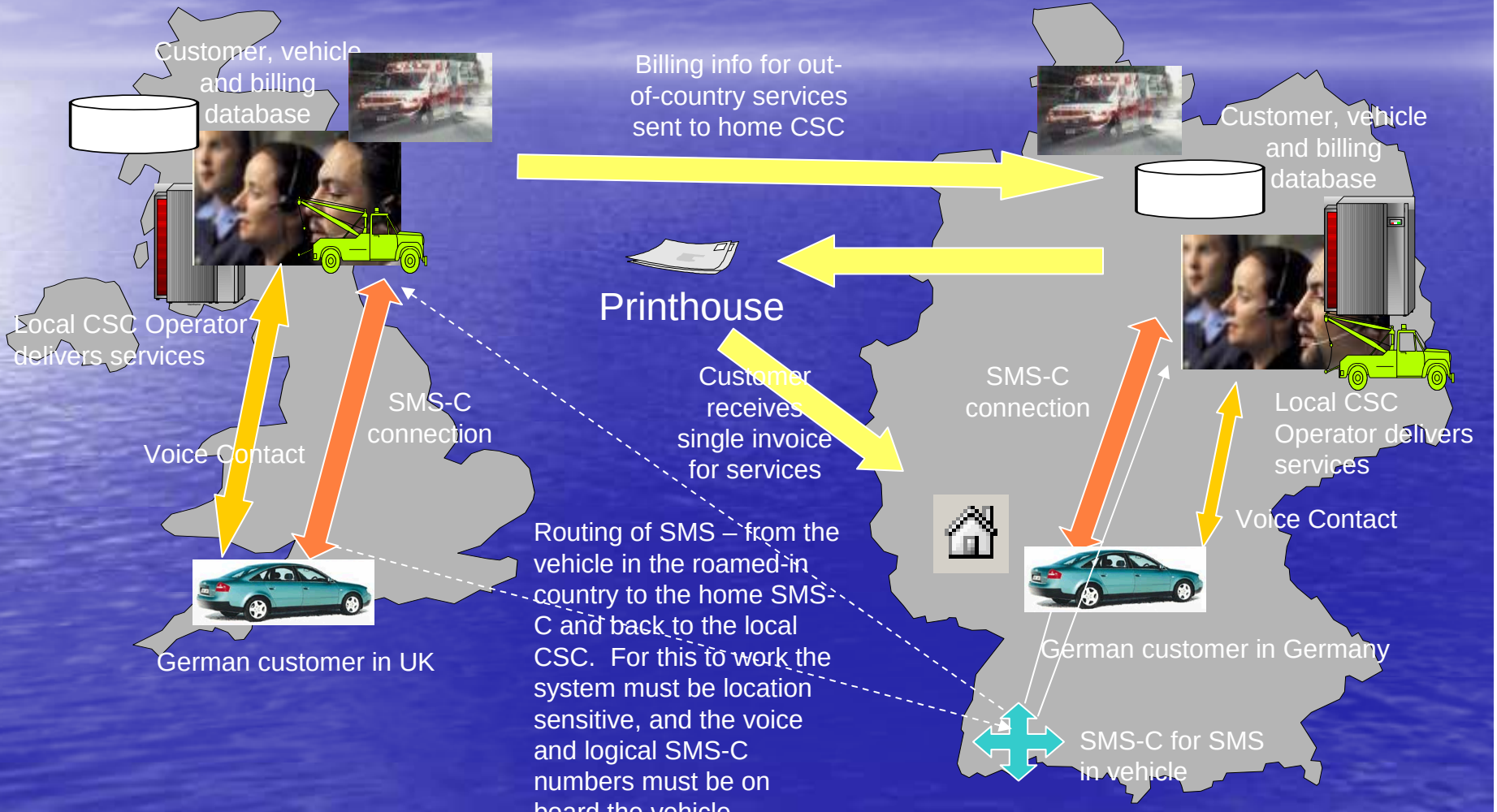
Local Servers with Local Services



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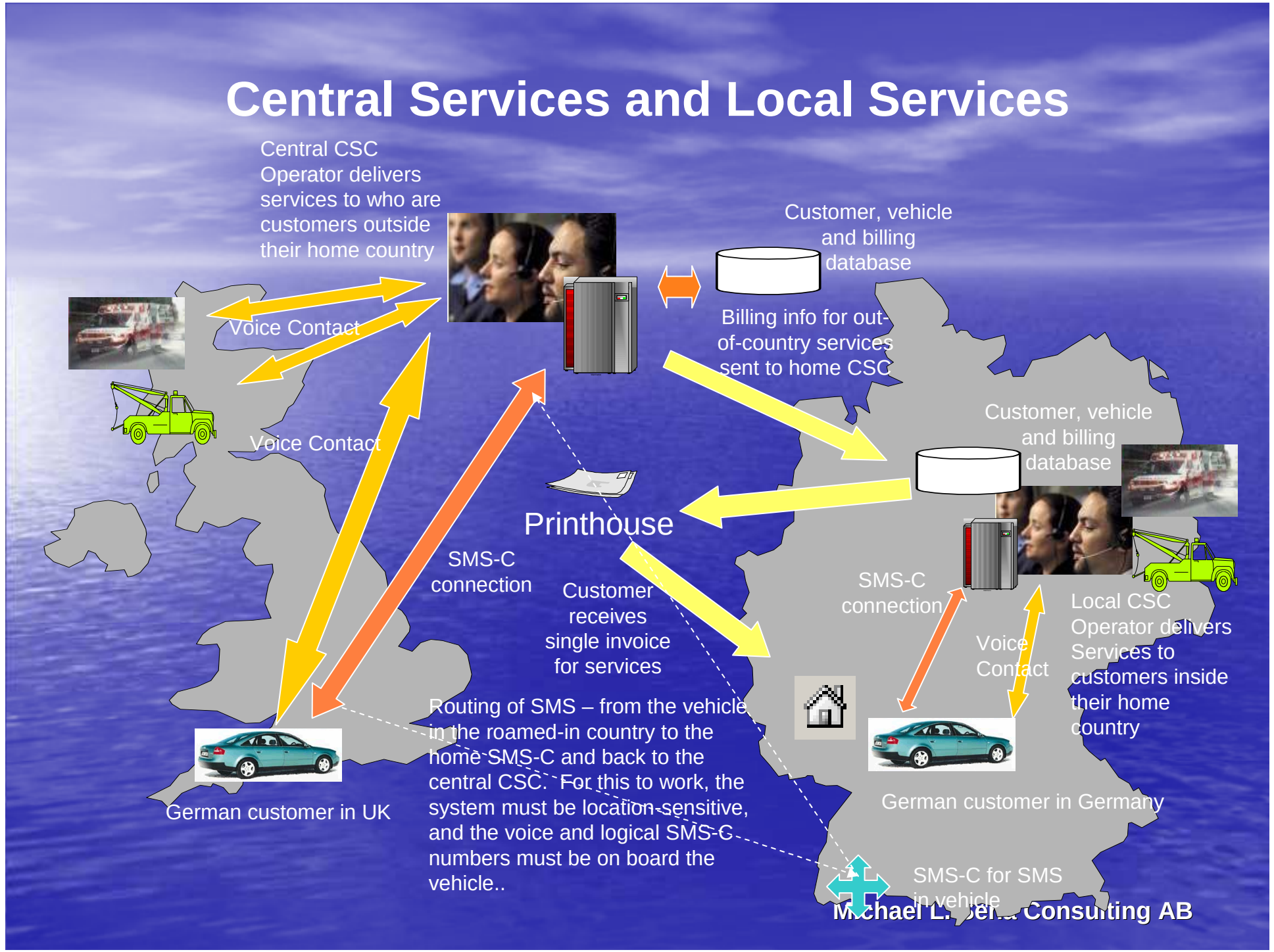
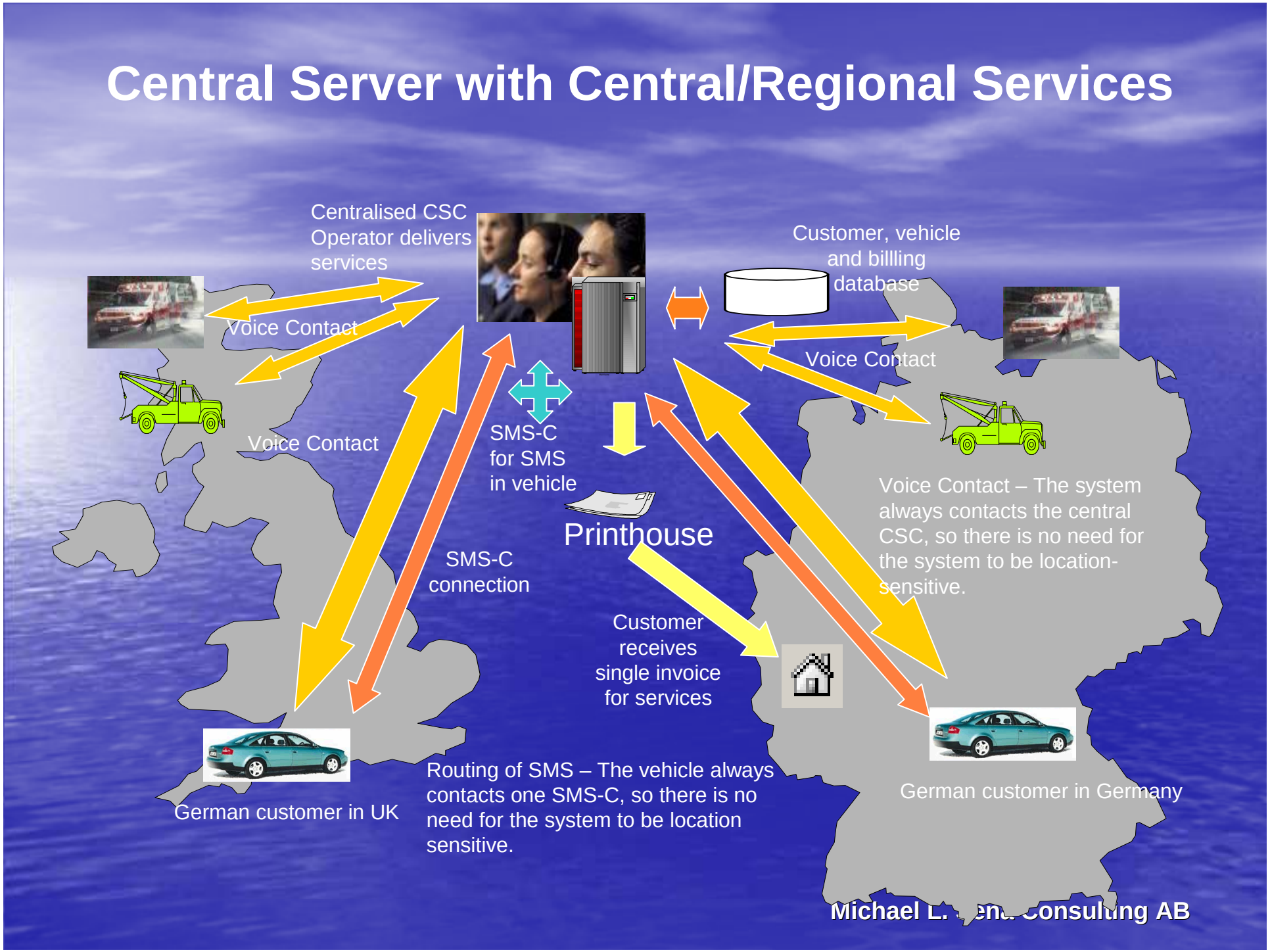
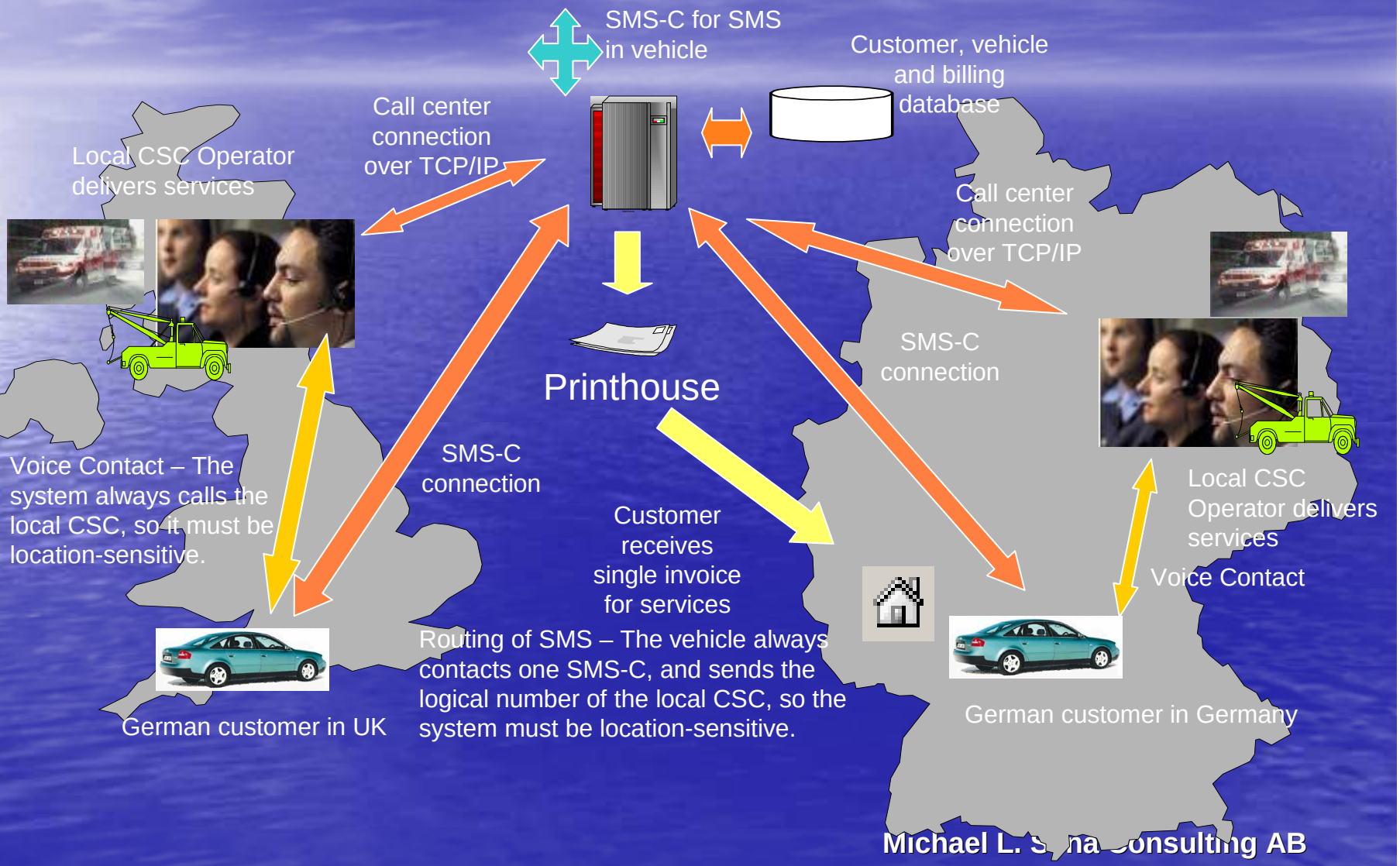
Central Services and Local Services



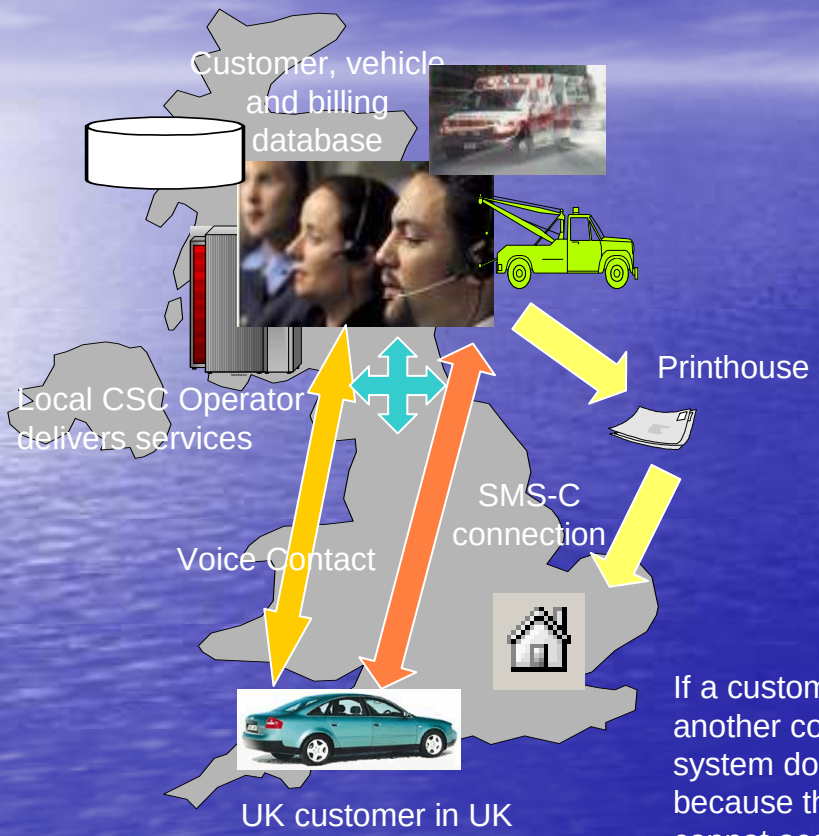
Central Server with Central/Regional Services



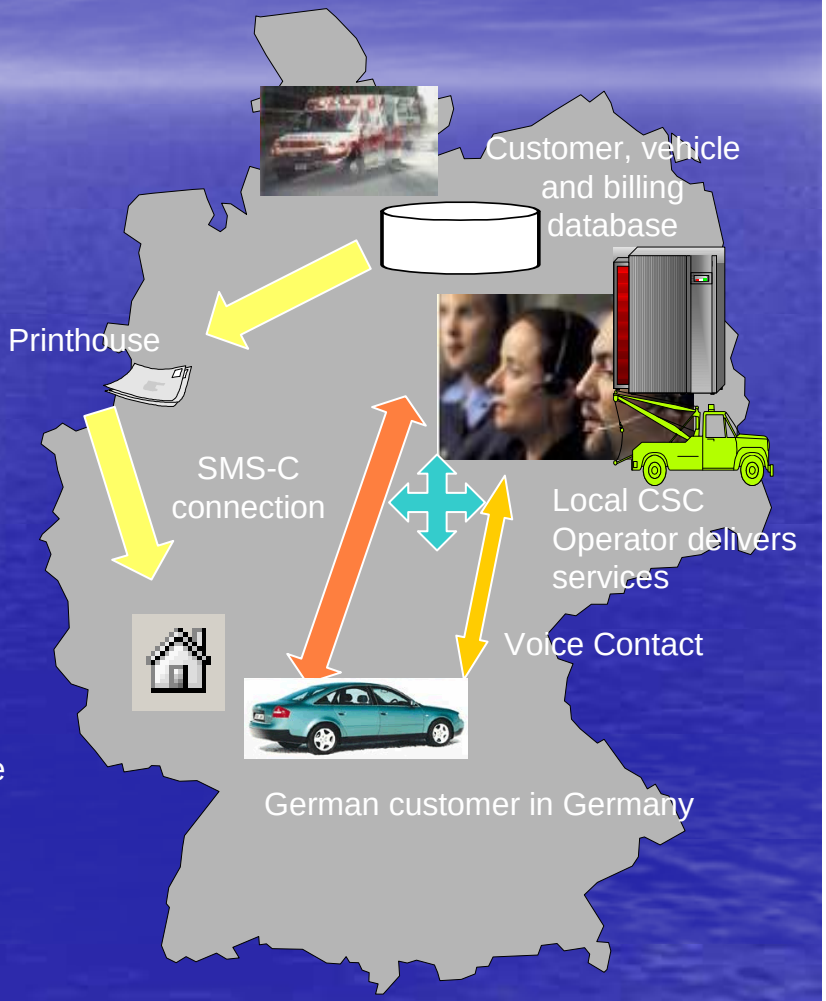
Central Server with Local Services
The WirelessCar/Volvo Cars Solution



Local Servers with Local Services
No Cross-border Services



If a customer travels to another country, the system does not operate because the customer cannot access the local server, and there are no agreements in place for handling out-of-market customers.



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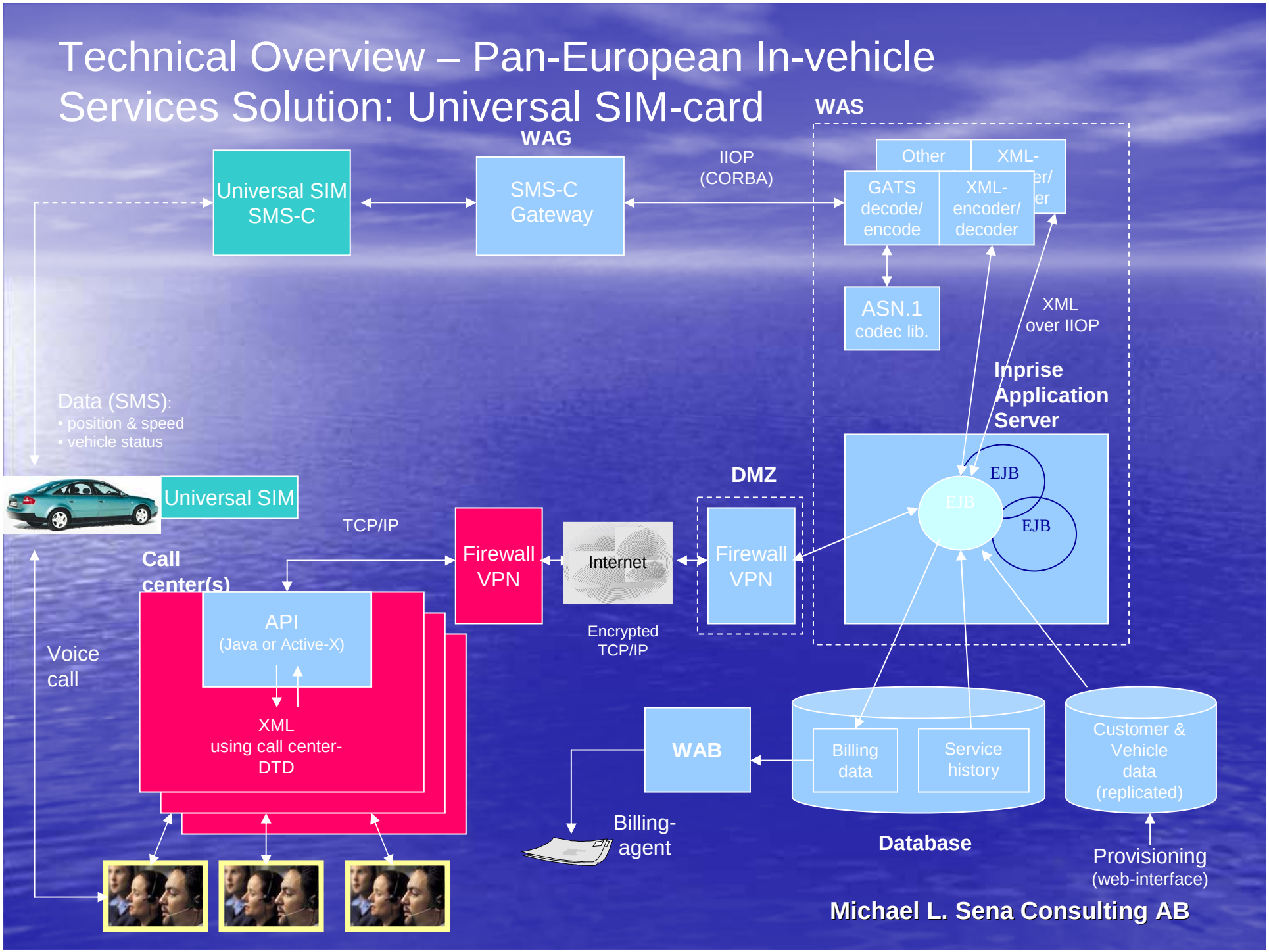
Pan-European In-vehicle Services Solution

- True pan-European services will allow any in-vehicle services customer the freedom to travel to any country in Europe and receive the complete range of services that are available in customer's home market.
- Providing this level of service requires a technical solution that can manage the multiple connections to service providers via different networks, and a business solution that resolves the inherent complexity of cross-border relationships.
- It must be possible to implement a pan-European in-vehicle services solution using either a dedicated SIM-card, or a multi-choice country SIM-card solution.

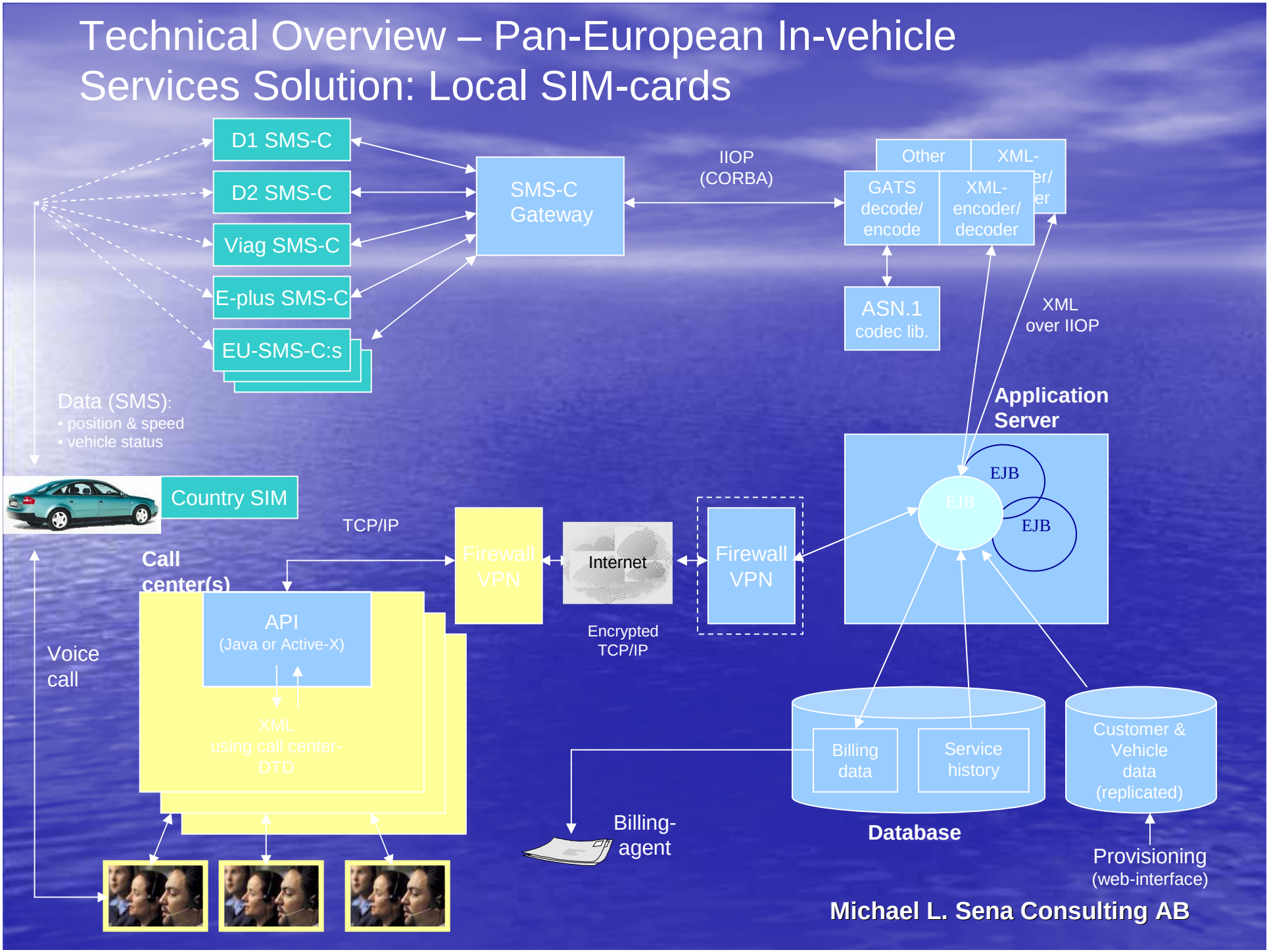
Two options are shown in the following slides for pan-European service provision:

1. Universal SIM-card: A single SIM-card that is either factory-fitted or dealer installed, is programmed to send messages to a single SMS-C. The in-vehicle software can either be programmed to phone the local CSC, or the TSP can provide the correct number.
2. Local SIM-cards: The customer has a choice of multiple local SIM-cards, all of which can be programmed to direct the data message to a single SMS-C.

Technical Overview – Pan-European In-vehicle Services Solution: Universal SIM-card



Technical Overview – Pan-European In-vehicle Services Solution: Local SIM-cards



Recommendations