

# European DSRC Applications Developments

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# Outline of presentation

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- Status of DSRC standardisation
- Technical characteristics
- Electronic Toll Collection
- Infrastructure to vehicle communication
- Vehicle to vehicle communication
- Conclusion



# Rules of standardisation in Europe

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- CEN : Comité Européen de Normalisation  
(*European Committee for Standardisation*)
  - co-operation with ISO as much as possible
- ENV : European Norm Voluntary
  - implementation is not compulsory (voluntary)
  - revised after a period of 3 years
  - DSRC norms voted in 1997
- EN : European Norm
  - implementation is compulsory
  - DSRC finally voted in 2003-2004 !



# CEN DSRC norms

Reference	Voted	Subject
EN 12253	2004	L1 - Physical layer $\mu$ W 5,8 GHz
EN 12795	2003	L2 - Data link layer (MAC/LLC)
EN 12834	2003	L7 - Application layer
EN 13372	2004	DSRC profiles for RTTT applications
EN ISO 14906	2004	Electronic Fee Collection - Application interface definition



# Norms for EFC application

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- ❑ ENV ISO 14904 : EFC Interface specification for clearing between operators (2002)
- ❑ EN ISO 14907 : EFC Test procedures for user and fixed equipment (2004)
- ❑ ENV ISO 17573 : EFC System architecture for vehicle related transport service (2003)
- ❑ ENV ISO 17574 : EFC Security framework (2003)
- ❑ prENV ISO 17575 : Application interface definition for CN/GNSS based EFC



# CEN DSRC Technical characteristics

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- Frequency bands:
  - 2 European channels : 5,795 – 5,805 GHz (10 MHz)
  - 2 “national” channels : 5,805 – 5,815 GHz
- Data rate :
  - down link : 500 Kbits/s
  - up link : 250 Kbits/s
- Power budget :
  - RSE max. EIRP : +33 dBm
  - incident power min. : -43 dBm
- Passive OBU :
  - reflecting and keying of the carrier wave received from the RSE (no  $\mu$ W oscillator in the OBU)
- Communication zone : 10-20 m



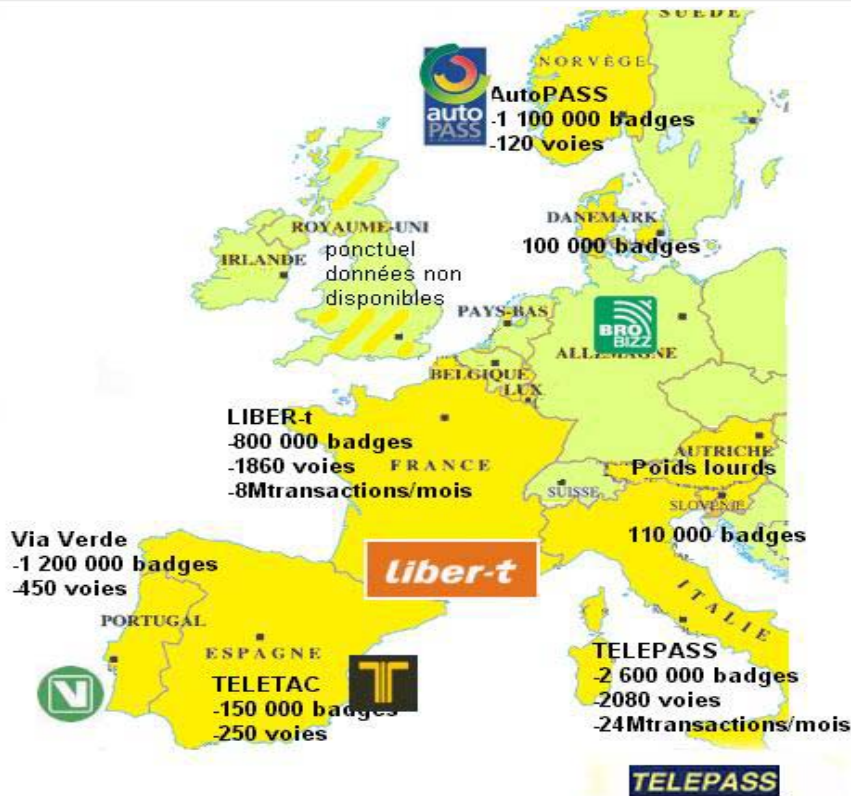
# DSRC current applications

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- ETC – Electronic Toll Collection
  - by far the largest DSRC application in volume
  
- Other payment applications
  - payment of parking facilities
  - payment of fuel in gas stations
  - access control to city centres



# ETC systems in Europe



- ❑ More than 9 million users
- ❑ About 10 000 ETC lanes
- ❑ 150 million ETC transactions / month
- ❑ Interoperability ... at national level only
- ❑ European Directive for Interoperability
- ❑ Introduction of GPS/GSM based ETC systems (Germany in 2005, UK ?)





# ETC systems in Europe (mid 2004)

Countries	ETC Name	NB of tags	NB of ETC lanes
Italy	TELEPASS	4 000 000	2 500
Portugal	VIA VERDE	1 600 000	500
France	LIBER-T	1 100 000	3 200
Norway	AutoPASS	1 100 000	250
Austria	GO !	350 000	2 500
Spain	VIA-T	300 000	800
Denmark	BroBIZZ	150 000	8
Sweden	BroBIZZ	100 000	6
UK	DarTAG	150 000	100
Ireland	?	50 000	25
Greece	?	35 000	50

Non CEN compliant

CEN compliant after upgrade

# ETC in different configurations



**Liber-t**



**GO**



# Existing DSRC applications

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- Traffic, weather, incident data collection
- Travellers information
- Alert information, warning
- Travel times measurement
- Hazardous transport vehicles monitoring
- Intelligent Speed Adaptation



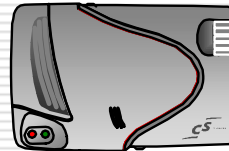
# AIDA : Information on Highways



AIDA antenna



AIDA tag and OBU



- Road information
- Safety messages
- Traffic and weather data collection
- Incidents detection



# AIDA : principles of data transmission

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Data processing and transmission to the vehicles



Communication with the vehicles



# The AIDA services

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**AIDA : an on-board system providing real time information dedicated to safe and comfortable highway driving**

## **Traffic conditions**

- accidents
- perturbances
- road works
- traffic jams

## **Road information**

- recommended exits
- distance to next exits
- estimated time of arrival
- relief routes

## **Weather conditions**

- fog
- low temperature
- heavy rain

## **Personalised traffic information**

- tourist information
- petrol stations with brand and price
- service and rest areas

## **Interactive services**

- incidents signalling



# MARTA

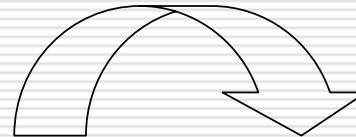
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- ❑ European harmonisation of TTI systems using DSRC communication (1998-2001)
- ❑ Inputs coming mainly from AIDA (France) and RTA (UK)
- ❑ prENV ISO 14822 : Medium range pre-information via DSRC : General specification
- ❑ Draft of standard now ready for vote

# DELTA = DSRC tag integration in the vehicle



Objective : Integration of the DSRC tag as  
standard equipment in the vehicle







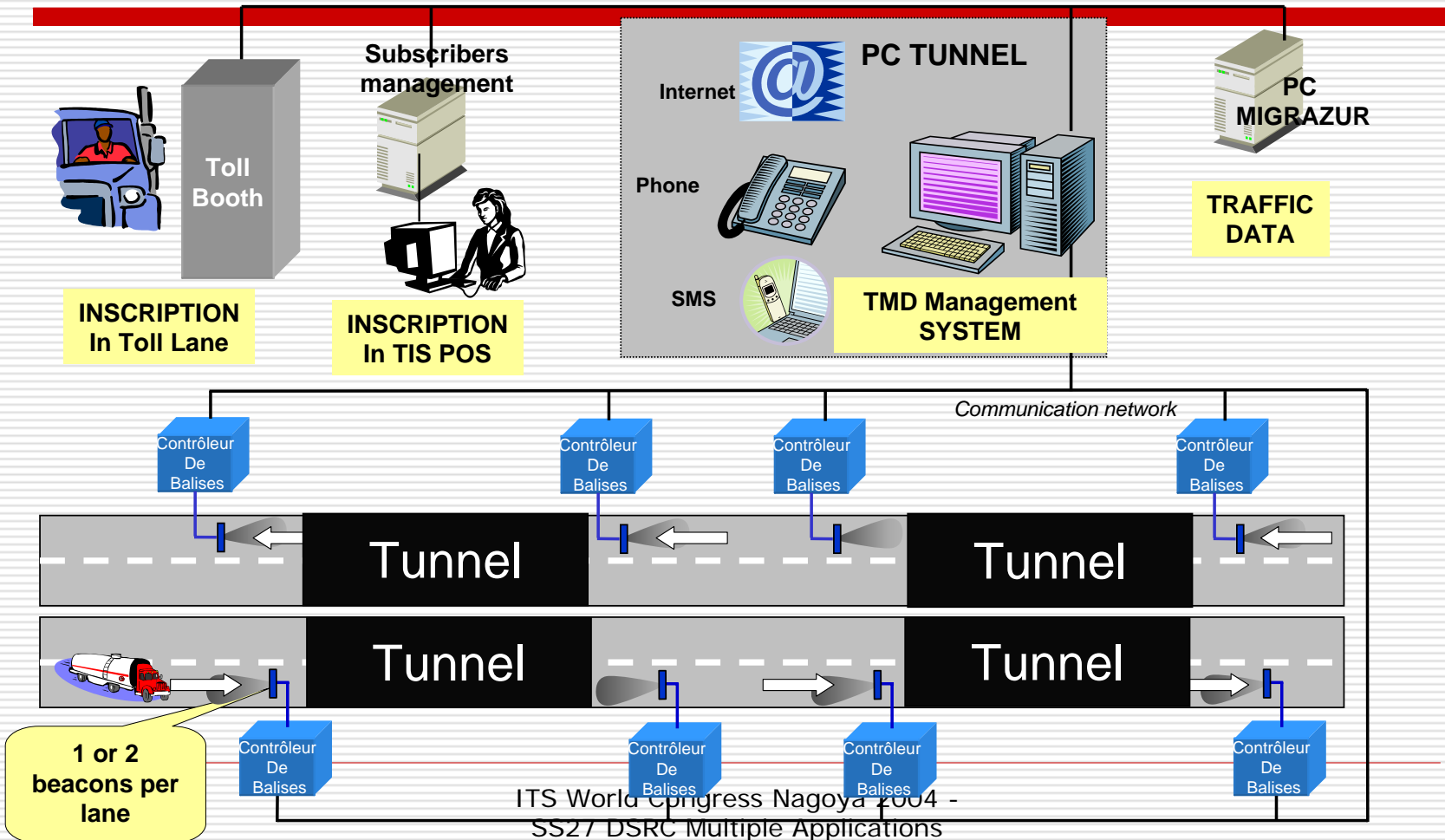
# Travel times measurement

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- ❑ Beacons installed over each traffic lanes
- ❑ Interval : 5 - 20 Km
- ❑ All vehicles with ETC tag
- ❑ Privacy = anonymous !
- ❑ 2 techniques :
  - Read only (ID) : AREA, ESCOTA
  - R/W (D\_PASS) : COFIROUTE
- ❑ Processing in central system

# Hazardous transport vehicles monitoring





# Vehicle to vehicle communication

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- TRAVIATA project
- MTNET
- IVHW
- CarTALK2000
- FleetNet
- ... ..
- Co-operative Systems



# TRAVIATA project

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- An attempt to perform V-V communication via DSRC
  - Emergency warning between vehicles
- CEN DSRC not suitable for V-V :
  - good communication at 20 m max
  - probability of good communication at 50 m if messages repeated 100 times
  - communication not possible at more than 100 m



# MTNET

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- MTNET developed and tested in ARCOS  
(*ARCOS = Concerted action for safe driving*)
  - 5,915 – 5,935 GHz, band allocated for safety in transport
  - 2 Mbits/s, robust, multi-point
  - transmitter power : 100 mW
  - range : > 500 m, extensible with relays on vehicles or infrastructure
  - MTNET is in line with CALM M5

# IVHW

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- Radio transmission of alerts between vehicles
- Communication : up to 1 km (100 mW)
- Expandable to vehicle – infrastructure communication
  - transmitters on emergency call boxes
- Frequency band : 869 MHz (free)
- Low cost transmitter/receiver



# CarTALK2000

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- Application : co-operative driver assistance
- Inter-vehicle communication based on a mobile ad hoc network
  - UTRA-TDD radio system developed by Siemens
  - adaptation of the centrally organised UMTS technology to a decentralised, mobile ad-hoc network
- Frequency : 2010 – 2020 MHz
- Supports high speed mobility : < 500 Km/h



# Co-operative Systems (1)

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- Objective : safe, efficient and comfortable driving
- Principles : information exchanged between vehicles and infrastructure
- Possible applications :
  - Alert info and warning
  - Speed Alert
  - Intelligent Speed Adaptation
  - Early breaking
  - Longitudinal control
  - Lateral control
  - ...
  - Automated vehicles / highway



# Co-operative Systems (2)

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- European Commission FP6 call for proposal expected in December 2004
- eSafety – Co-operative Systems for Road Transport
  - “road operators, infrastructure, vehicles, their drivers and other road users will co-operate to deliver the most efficient, safe, secure and comfortable journeys”
  - “the vehicle-vehicle and vehicle-infrastructure co-operative systems will contribute to these objectives beyond the improvements achievable with stand-alone systems”
- Several projects in preparation to cover this theme
- Projects time schedule : 2005-2008



# Conclusion

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- ❑ Stand alone systems are not sufficient to improve road safety
- ❑ Co-operative systems are required
- ❑ V-V and V-I reliable communications are essential
- ❑ CEN DSRC systems do not provide an adequate solution
- ❑ UHF, UMTS, WiFi, WiMAX, 802.11x explored as possible solutions
- ❑ Research will be carried out within EU FP6
- ❑ Partnership between all stakeholders is foreseen
- ❑ *Communication network shall be managed by road authorities/operators*