LECTURE

9

# E-CALL

# Traffic information systems

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# Lecture 6 - overview

- E-call

- Traffic information systems
  - RDS-TMC
  - TPEG

# E-CALL – what it is

- Automatic emergency call from vehicles

- In vehicle on-board eCall device
- This device transmits an emergency call to the most appropriate public service answering point (PSAP)
- Transmission contains also certain vehicle-related data (notably the vehicle's precise location)

- http://www.youtube.com/watch?v=iYJL0er6-Sw&feature=player_embedded#!

# E-call advantages

- After traffic accident people are often shocked unable to call for help or state their position
- E-call calls (either automatically of manualy) the emergency services and provides them with instant information about the precise location of the accident,
- Significant reduce of response time $\Rightarrow$ saving lives or decreasing seriousness of injuries

# E-call service principles

- Based on the use of the single European emergency number 112 *
- Emergency call can be triggered either manually by the occupants of the vehicle or automatically thanks to sensors installed in the vehicle
- European Commission project
- In future, all new vehicles should be equipped with this system
- Supported by the ACEA (European Automobile Manufacturers' Association)

# E-call components

- OBU unit in every vehicle, using various vehicle sensors + satellite navigation unit

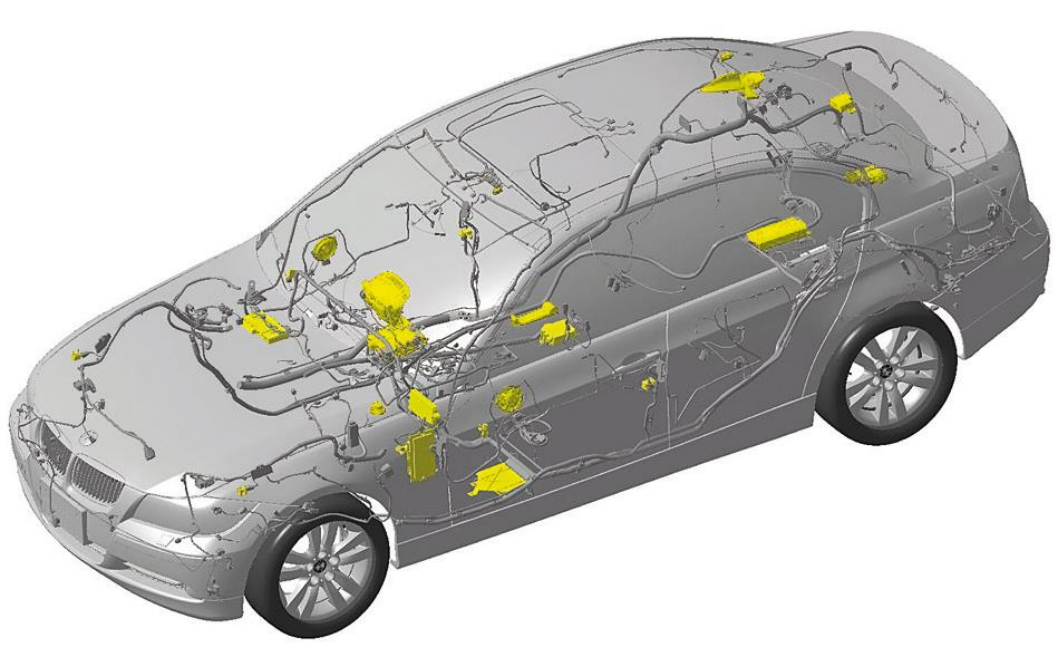

- Wireless communication system

- PSAP (Public service answering point)

+ Rescue emergency services (medical emergency service, fire brigade, police)

# E-call in-car components

- Sensors
  - Airbags
  - Crash sensors
  - ...



- Satellite navigation module (GPS receiver)
- Transmitter

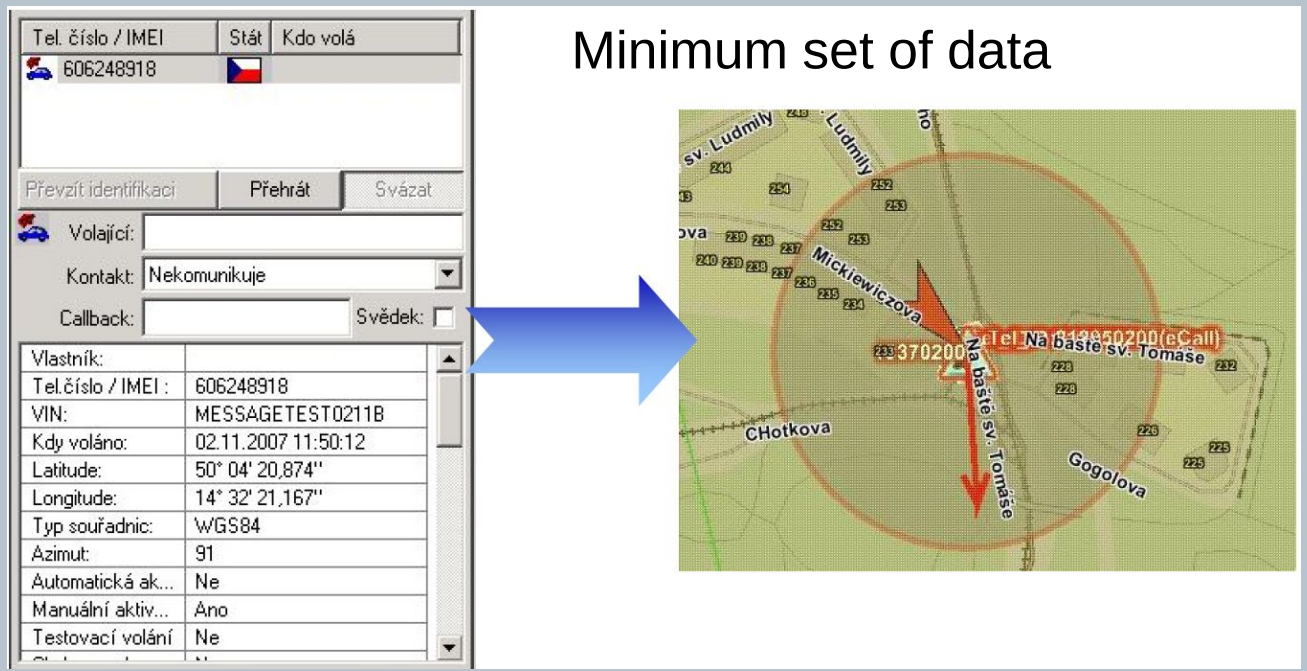
# Minimum set of data

- Information are sent as minimum set of data – contains basic data, such as
  - GPS Position
  - Direction of travel
  - Number of triggers of the call
  - Colour, make, model of the vehicle
  - Indicates which sensors are triggered: airbag, roll-over, front crash, side crash or rear crash sensor (at least two should be activated)
  - Time stamp of the event
  - Service Provider Identification and telephone number
  - Country ID
  - Special vehicle /user code.

# Wireless data transmission

- Using GSM network

- There were tests with the GPRS transmission, but in general data transmission has lower priority than voice



# PSAP (Public Service Answering Point)

- Centre receiving distress calls
- Human operator decides, which unit should be sent
  - Medics
  - Fire brigade
  - Police
- This centre should be in every larger city or area
- In the Czech Republic there are 14 centres (in every region)

# Conditions for successful system functioning

- Vehicle has to be equipped with the on-board unit broadcasting standardized data set
- Telecommunication network has to be able to transfer data into the PSAP centre with appropriate
- The PSAP system has to exist, to transfer the information in the minimal set of data to the operator

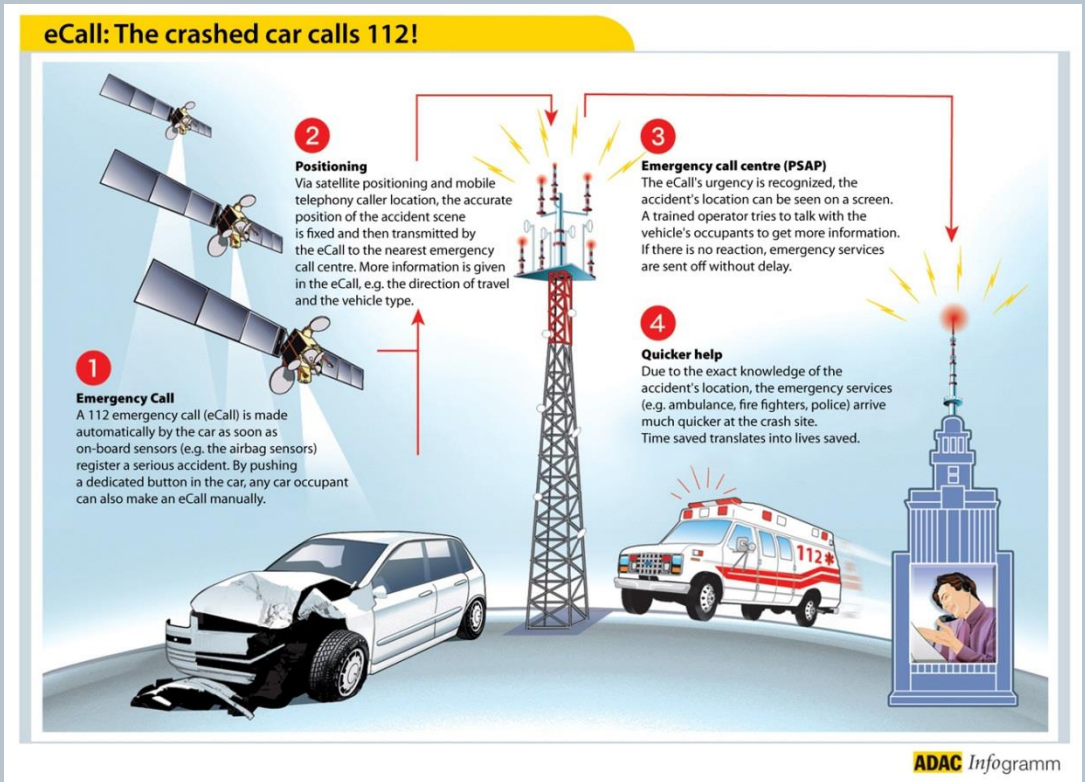
# Benefits

- According European Commission e-call could
  - save up to 2 500 lives a year in the EU
  - save up to 26 billions €
    - Thanks to reducing number of traffic accidents
    - Reducing congestions

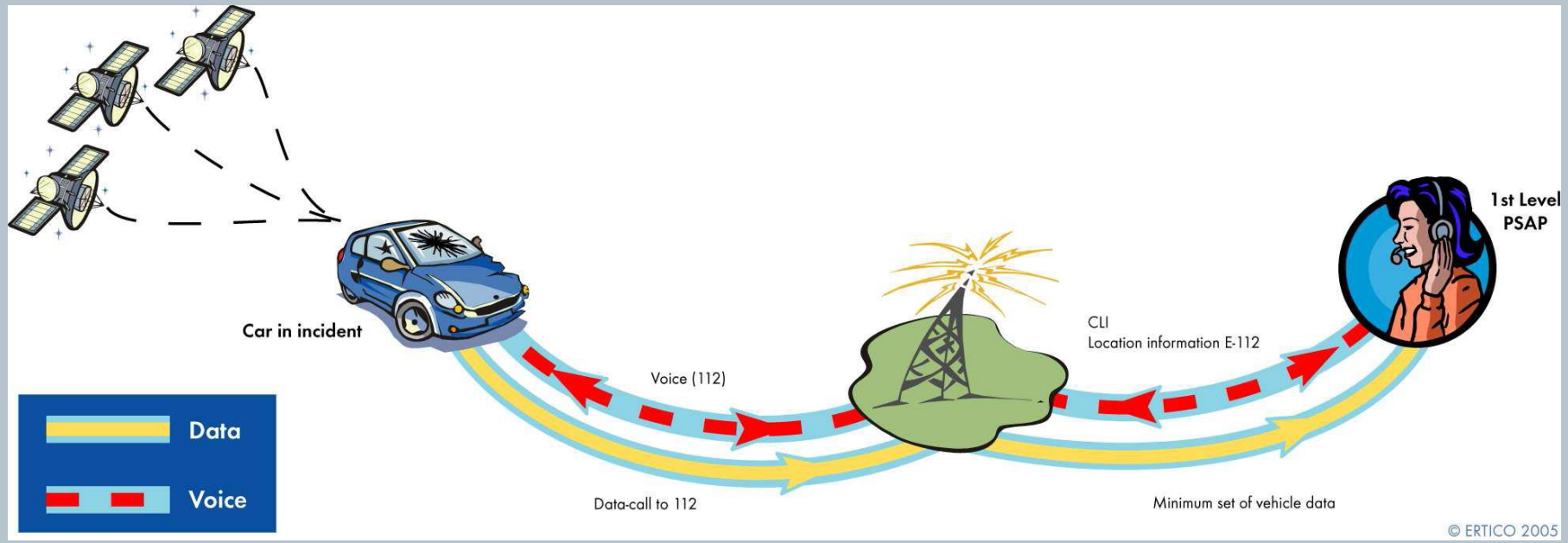
- (in Europe every year more than 1,3 million traffic accident, 1,7 million injuries causing 40 000 deaths – equivalent to 160 trillion € or 2% of GDP (gross domestic product)

# Costs

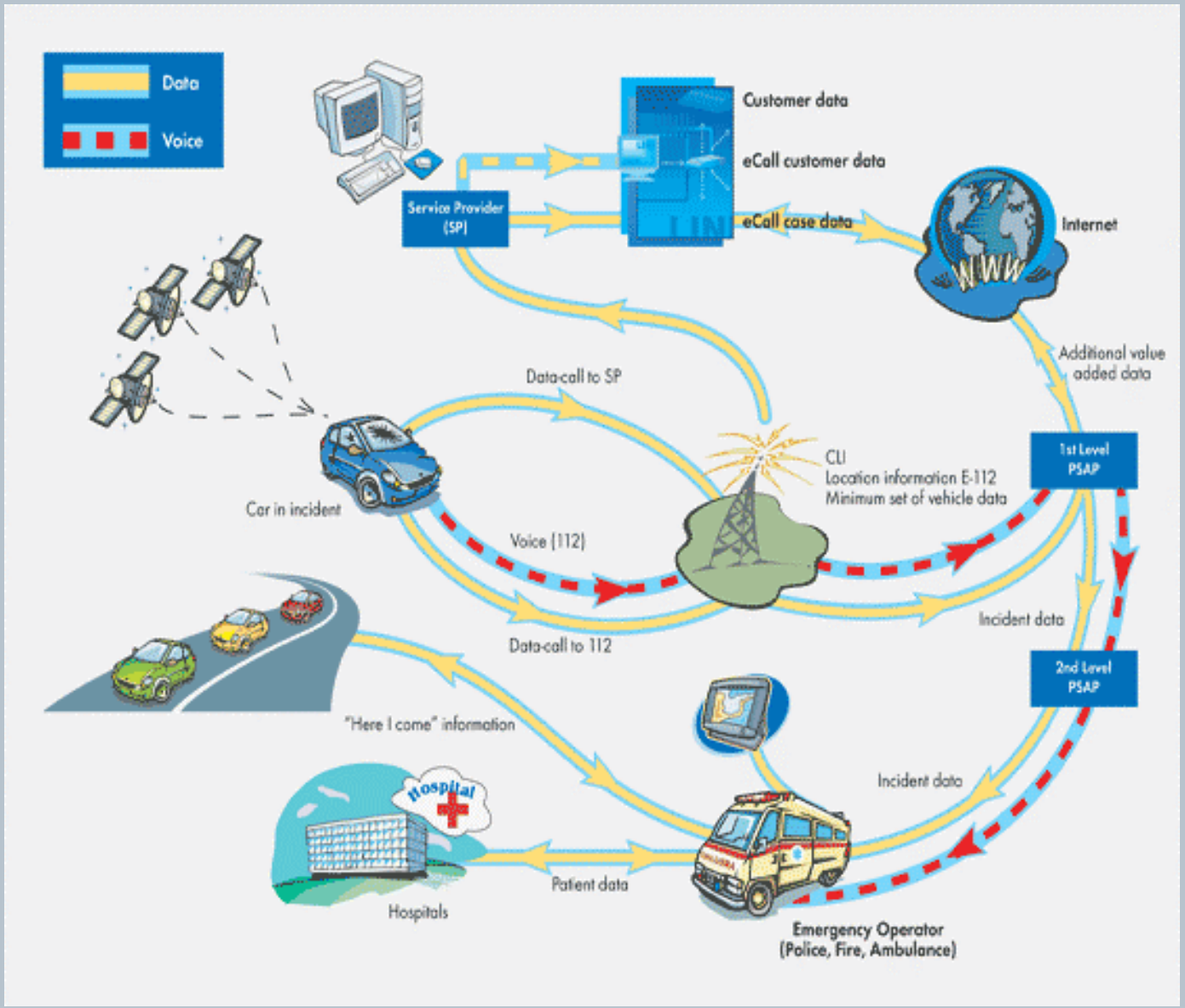
- Anticipated annual costs for introducing the system are 4,5 billions € – both costs for installing the system into vehicles and modernization of the centres



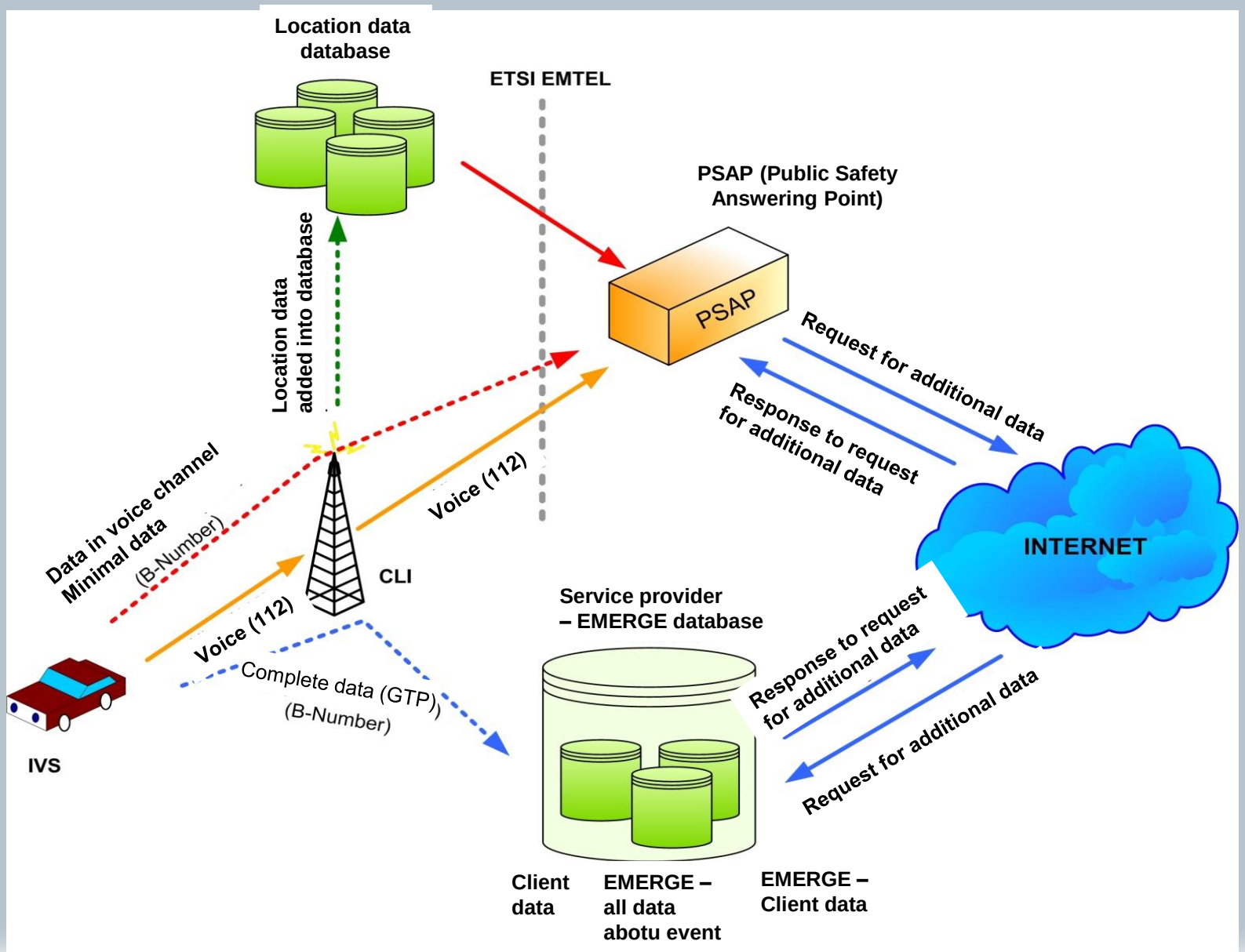
# Basic e-Call diagram



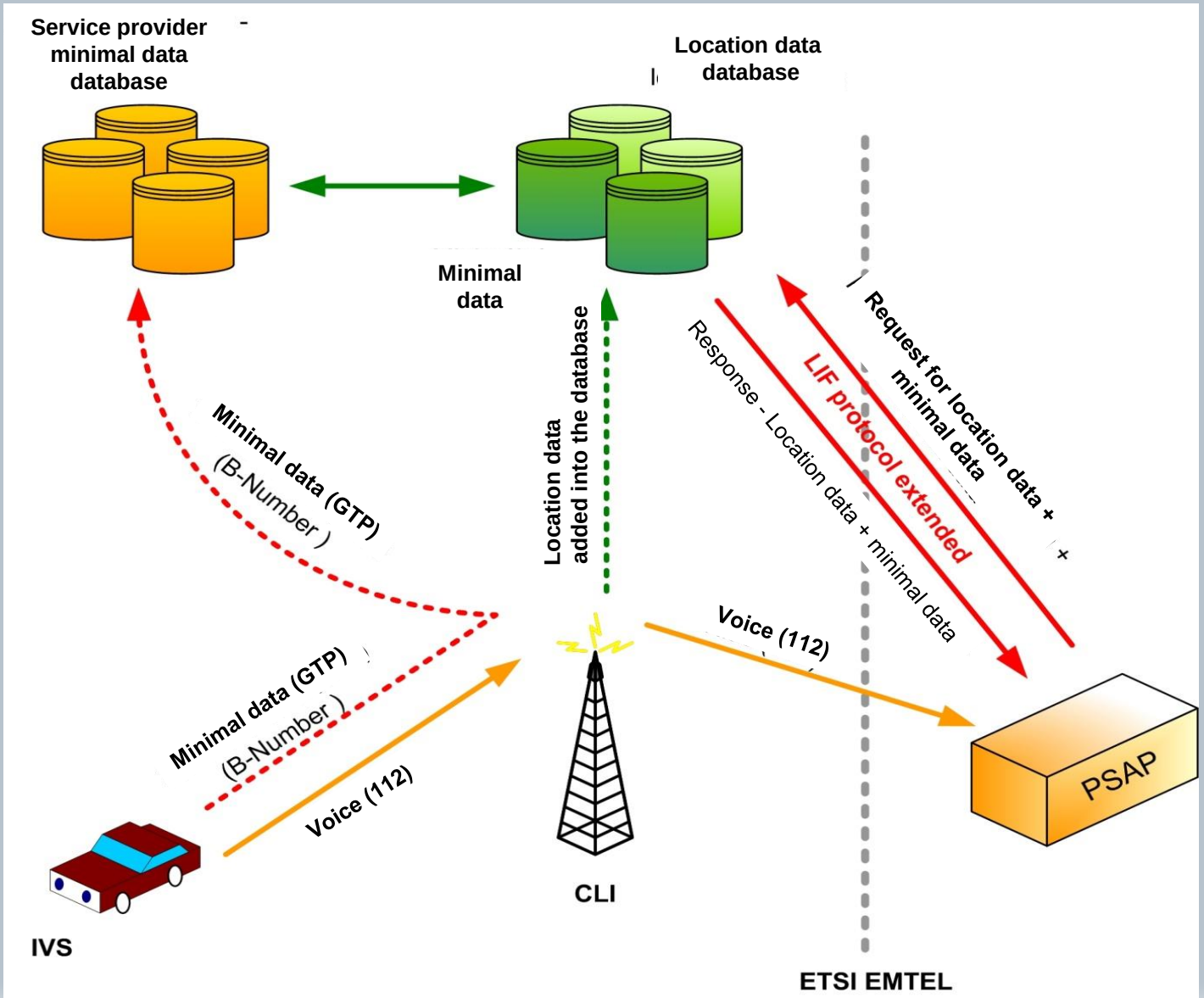
# Complex e-Call diagram



# Recommended E-call solution



# Temporary e-call solution



# Basic e-call processes

- Automated e-call with the service provider (SP) agreement
- Automated e-call without the service provider (SP) agreement
- Manual e-call by using the SOS button with the service provider (SP) agreement
- Manual e-call without the service provider (SP) agreement
- Error function – false call

# Protocol used for e-call

- GTP – Global Telematics Protocol – based on ACP and GATS protocols
- Its creation supported by ERTICO
- Used by many car construction companies
- One part of this protocol directly deals with e-call
- GTP has to follow criteria
  - One global protocol OTAP (over-the-air protocol)
  - Ability of using existing data transmission systems

# Problems

- Need for deployment in all member states
- System financing
- Necessity of agreement among car producers
- Reliability of vehicle sensors
- Etc.

# Time schedule

- The term has been shifted several times
- 2013 EC has adopted proposal establishing E-call as mandatory
- 2015 European parliament approval – E-call mandatory for all new passenger cars and small vans from April 2018

# Important EU documents

- COMMISSION RECOMMENDATION of 8.9.2011 on support for an EU-wide eCall service in electronic communication networks for the transmission of in-vehicle emergency calls based on 112 (‘eCalls’)
- COMMISSION DELEGATED REGULATION (EU) No 305/2013 of 26 November 2012 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the harmonised provision for an interoperable EU-wide eCall

# The Czech Republic

- In 2007 pilot project „public eCall 112“
  - Done in cooperation of
    - Ministry of Transport
    - Telefónica O2 Czech Republic
    - Fire rescue service
- Goal was to verify the transmission and vizualization of eCall data on a test system of service TCTV 112

# E-call in Europe - today

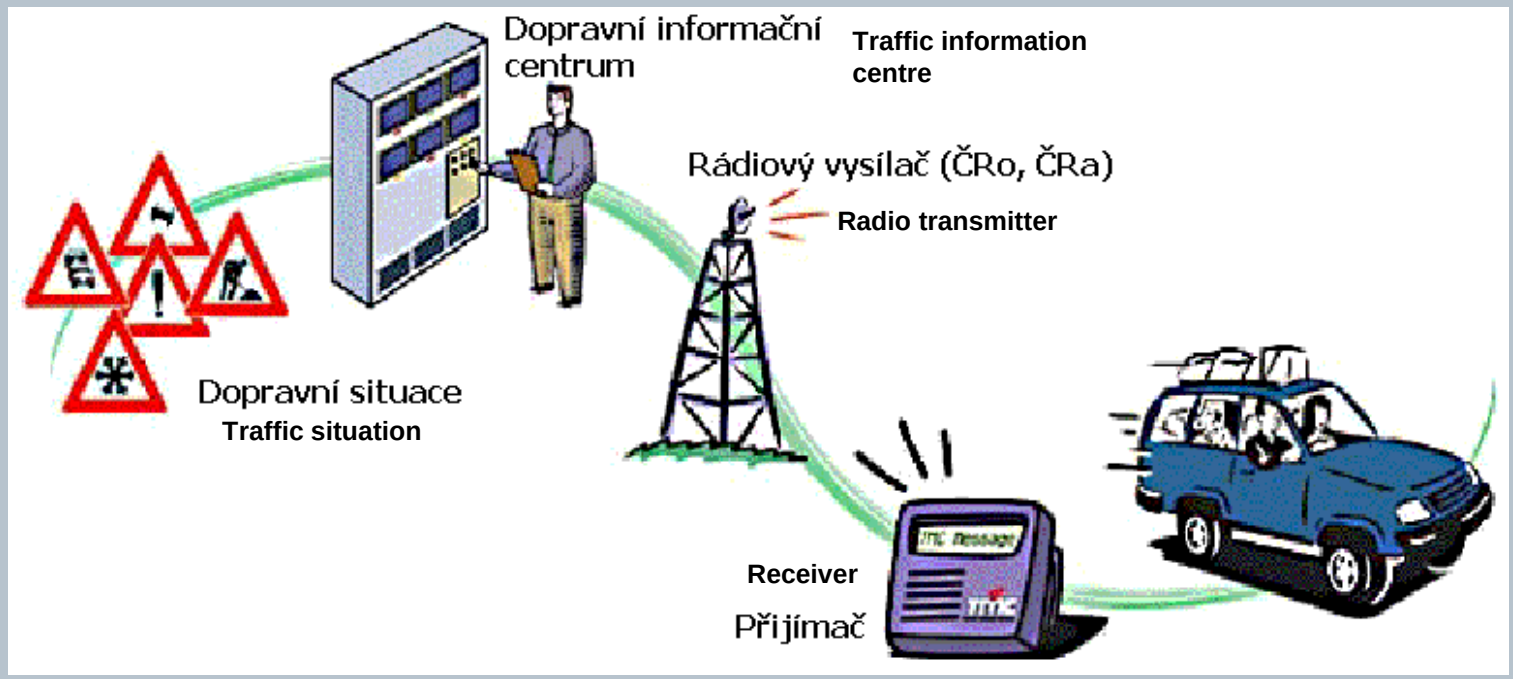
- Project HeERO (Harmonised eCall European Pilot)
- Started January 2011
- This three-year project is partially funded by the European Commission under the ICT PSP programme
- Gathers 40 partners from all over Europe, including user organisations and telecommunications companies
- Aiming at the operation tests
- 9 countries will prepare for the deployment of the necessary infrastructure in Europe - Croatia, Czech Republic, Finland, Germany, Greece, Italy, Romania, Sweden and The Netherlands

# Traffic information systems

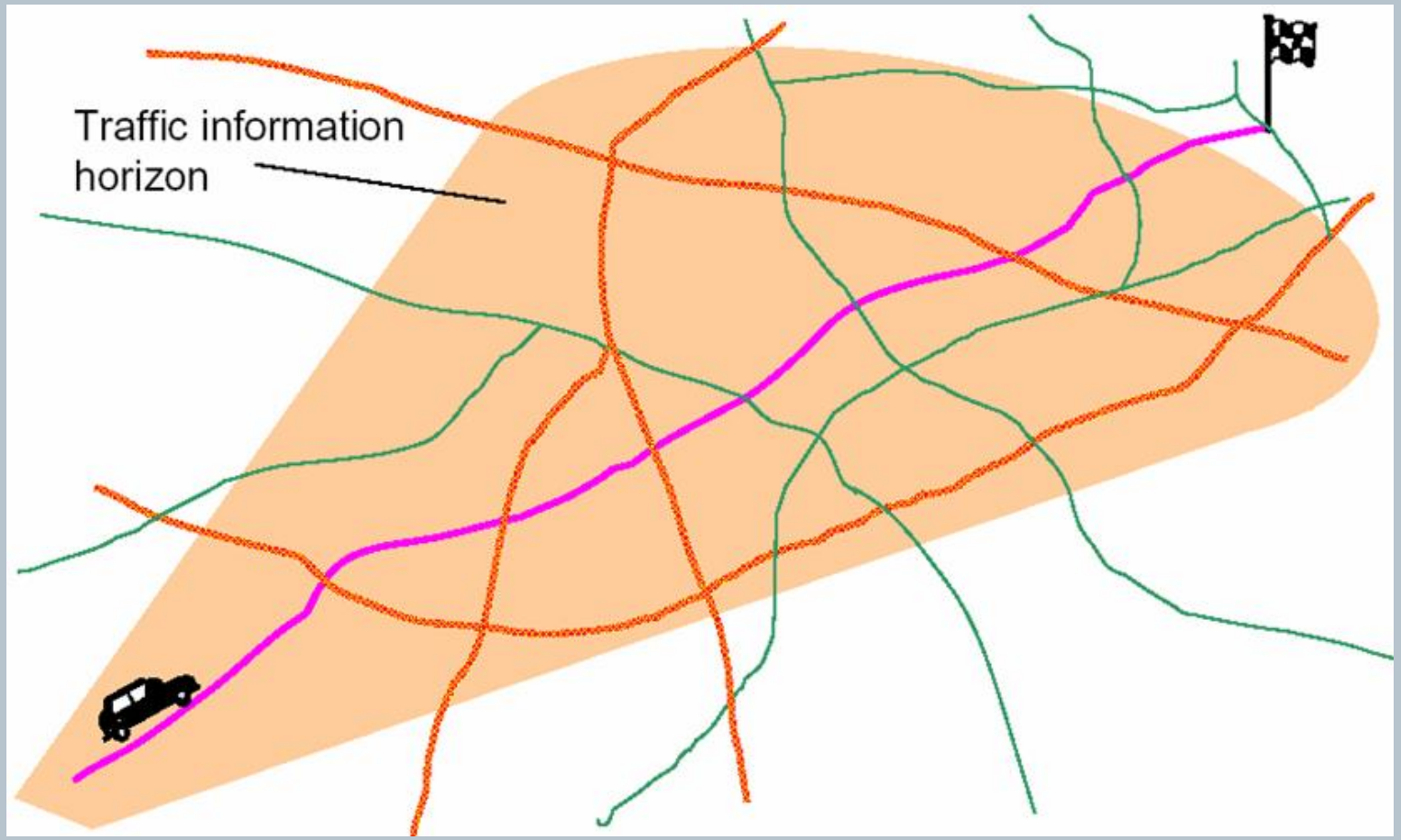
# RDS-TMC

# Radio Data System - Traffic Message Channel

- Dynamical navigation
  transmission of actual information in the vehicle



# Dynamic (in-car) navigation



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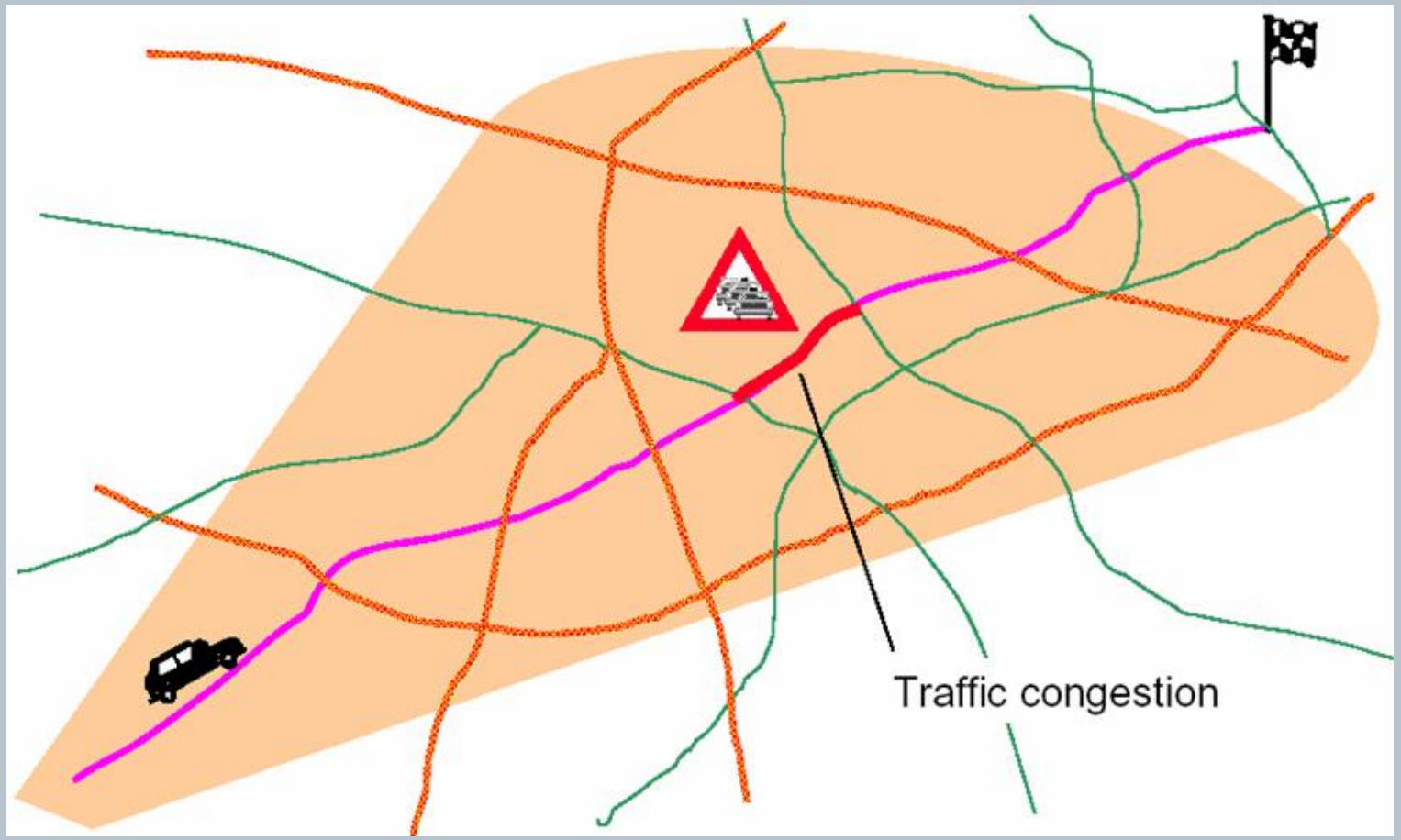

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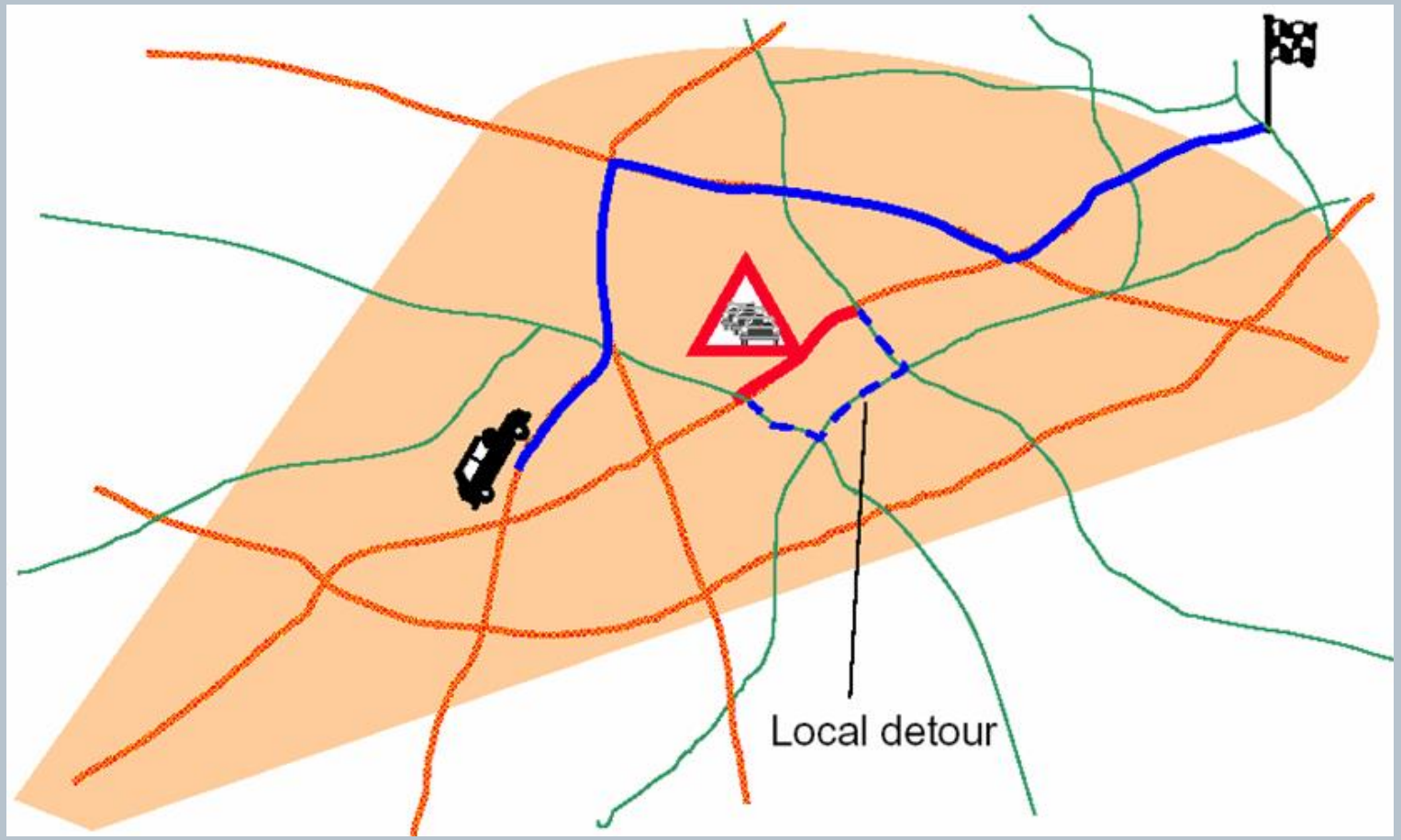

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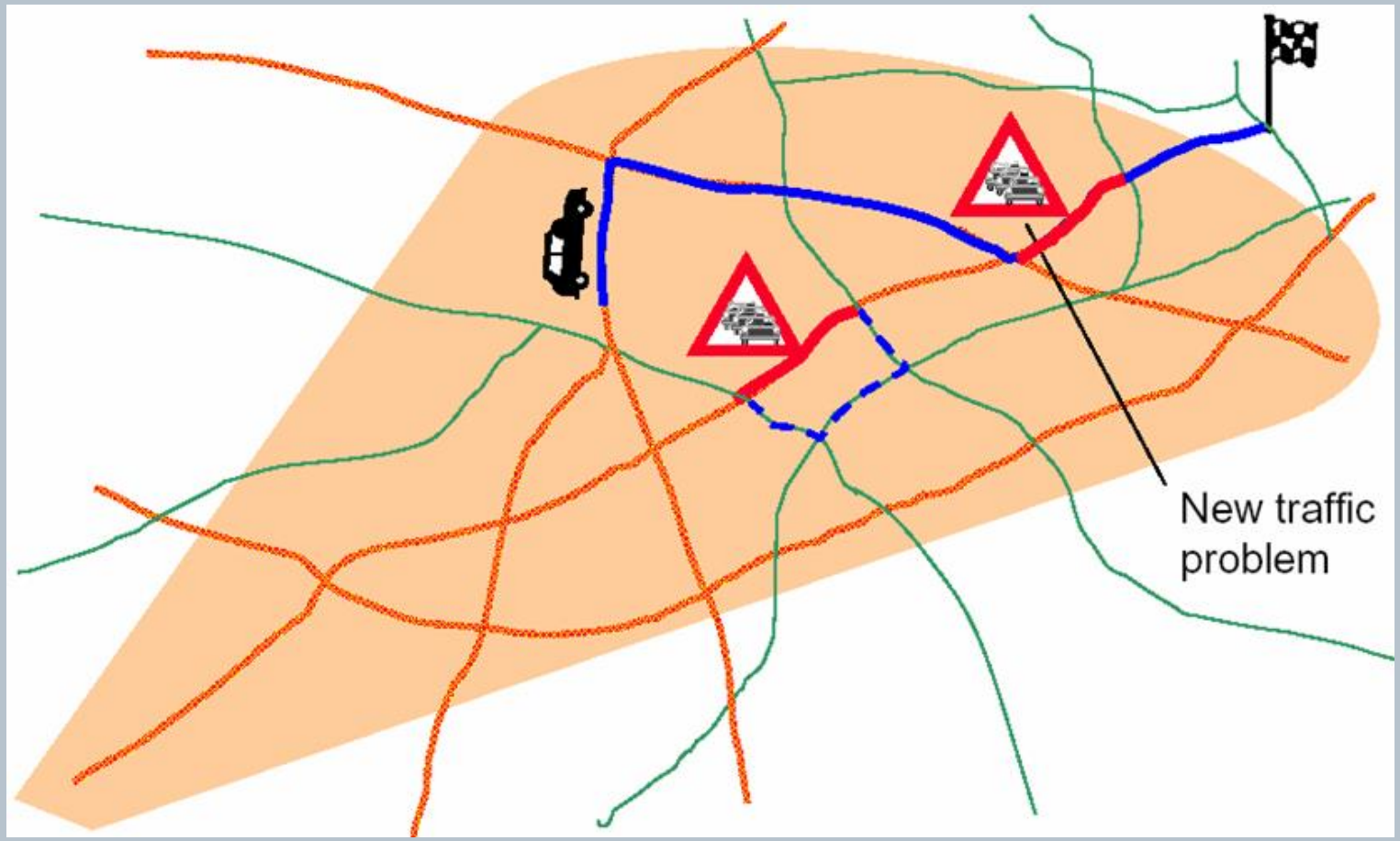

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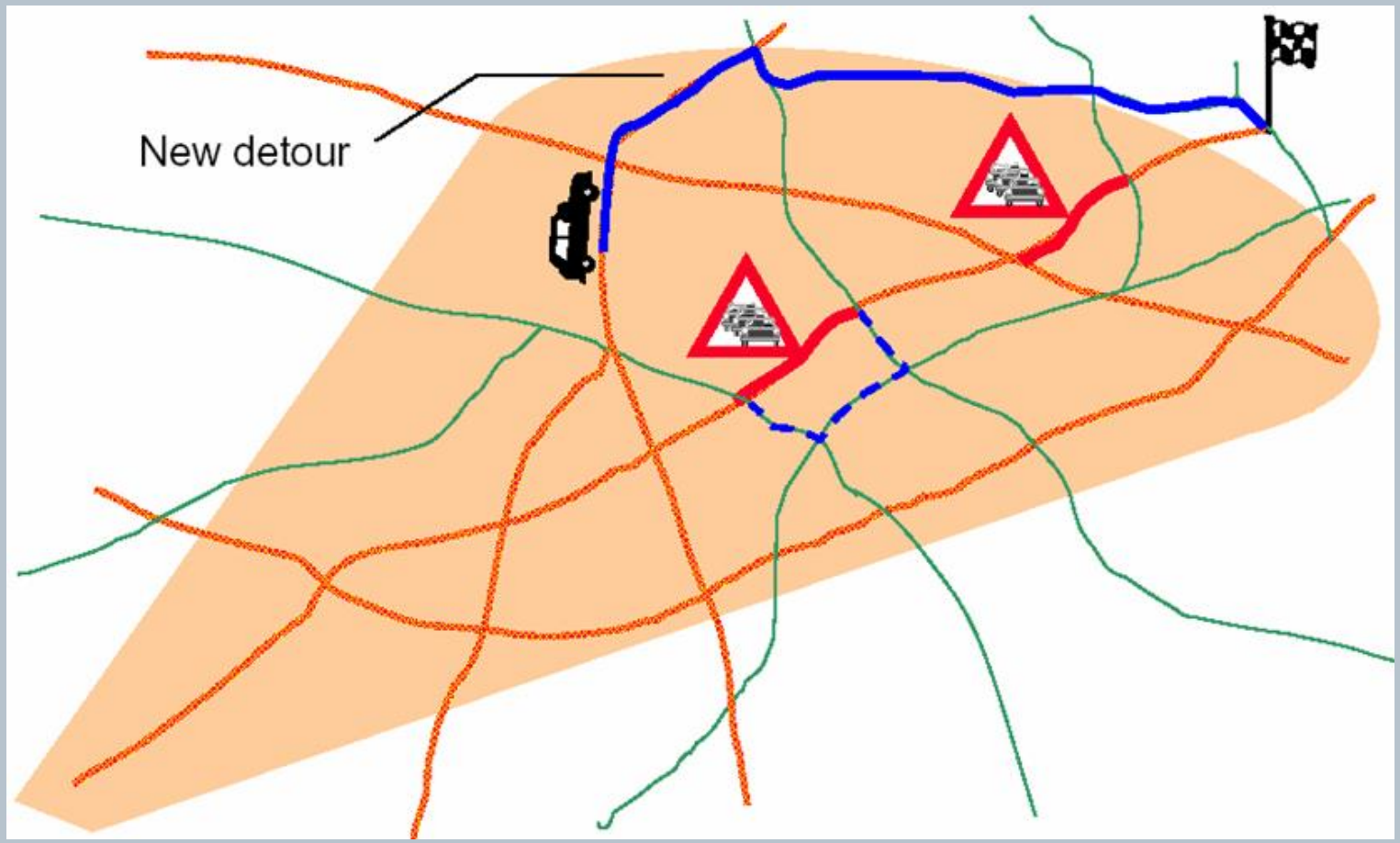


# RDS-TMC

- Service for providing transport and traffic information to driver before and during the travel
- Integrates all relevant information and gives drivers the possibility of optimizing their routes
- Information transmitted via the radio transmission in the VHF (very high frequency) band using RDS technology as **silent** part of FM transmission
- Information in the ALERT-C protocol
- Basis for real-time applications of traffic management and control and  for route planning

# ALERT-C protocol

- ALERT (Agreed Layer of European RDS-TMC)
- Created within European project EPISODE, where first inputs for RDS-TMC creation and standardization were defined
- Traffic information structured in 5 basic components

# Conditions for succesful using RDS-TMS

- RDS-TMC used for automated processing of traffic information by the end-device
- For successful receiving you need
  - Navigation device or radio receiver enabling TMC processing
  - Up-to date map of other data set containing location tables
  - Be located in the area of RDS-TMC transmission

# Traffic information structure in RDS-TMC

- Place – locality where particular event has happened

  For description of the locality serves pre-defined database containing all places on the transport network
- Event – short description of what has happened
- Time period – expected time frame when the event will be influencing the traffic
- Direction and extend stating in what direction of the communication the problem is located and to what extend – in the form of location table
- Diversion recommendations – information if it is recommended to drive round the problem

# Information transmission to the user

- Way of presenting depends on the end-device functionality
- Three basic (not excluding) possibilities - driver is informed via
  - Voice message – device „says“ the message
  - Text message – in the display of ration device
  - Graphical message – in the display of navigation device

# Necessary conditions of RDS-TMC system implementation

- Traffic information centre for collecting and further providing traffic information
- Network of radio transmitters covering particular area and transmitting the RDS-TMC messages
- User devices (not necessarily navigation devices) able to receive and process the RDS-TMC information

# Unified system of traffic information in the CR

- Gets data form different sources, eg.
  - Fire rescue service
  - police
  - Emergency medical service
  - Road video systems
  - Road operators
- Data are assembled in the National Traffic Information Centre
- National Traffic Information Centre distributes the data using various channels, including RDS-TMC

# RDS-TMC – basic data items

- Location tables – enable to key and decode the position of an event and thus assign an event to particular part of road network

- Catalogue of events – standardized the content of messages by organizing them into categories

# Location tables

- Serve for marking position of real world objects
- Every row in the table means particular geographic entity (e.g. crossing, road, important object, etc.)
- Creation of location tables – so called position coding
- Three main data types in the tables
  - Area – hierarchically sorted administrative units
  - Section – hierarchically sorted line units (section parts – sections – areas)
  - Point – functionally connected important traffic locations (crossing, etc.)

# Location table example

| Position Code | Code of position (sub)type | Road (crossing) number | First Name | Second name | Area code | Section code | Negative direction code | Positive direction code |
|---|---|---|---|---|---|---|---|---|
| 2009 | A6.2 | | Nové město | | 1 | | | |
| 949 | L3.0 | E1 | X-City | Y-City | 2023 | | 948 | 950 |
| 4420 | P3.2 | | Bridge | | 2023 | 949 | 4456 | 4423 |
| 4423 | P1.3 | J1 | Crossing J1 | N207 | 2023 | 949 | 4420 | 4459 |
| 4459 | P3.3 | | Parking place | | 2023 | 949 | 4423 | 4460 |
| 4460 | P1.3 | J2 | Crossing J2 | | 2023 | 949 | 4459 | 4461 |

# Using location tables

- The location tables have to be created when setting the locality in the system
- After an event occurs, system operator looks up in the location database respective items determining the position
- RDS-TMC information are transmitted from the Traffic information centre that collects all traffic information regarding the traffic
- RDS-TMC is one of the ways of distributing these information

# Catalogue of events - example

- standardized
- standard EN ISO 14819-2

| Degree of traffic | Actualization class | Event code | Row | Event description |
|---|---|---|---|---|
| 1 | 1 | 124 | 33 | Free traffic |
| 1-2 | 1 | 124 | 33 | Free traffic |
| 2 | 1 | 125 | 34 | Thickening traffic |
| 2-3 | 1 | 122 | 30 | Heavy traffic |
| 3 | 1 | 122 | 30 | Heavy traffic |
| 3-4 | 1 | 108 | 14 | Congestions forming |
| 4 | 1 | 115 | 23 | Slow traffic |
| 4-5 | 1 | 136 | 36 | Traffic congestion |
| 5 | 1 | 101 | 6 | Transport colaps |

# Using of location tables

- In the Czech Republic the CEDA company is responsible for creation of location tables
- Common procedure of using them
  - Map provider gives map data to the producer of navigation systems
  - Producer of navigation systems contact the developer of location tables in particular countries and implement them in the navigation system
- Problems
  - Location tables in the navigation system are not always up-to-date
  - Data may be incorrectly interpreted in the navigation system
  - Data may be handled with different priority than the driver expects (priority of events, etc.)

# RDS-TMC advantages

- Language independent presentation in the end-device
- Possibility of automatic processing, not only in navigation devices
- Used throughout Europe (in Western Europe already running, Eastern Europe is introducing – e.g. Romania, Hungary, Poland)
- Supported by large number of devices
- Offers actual and localized information
- Information presented in user‘s language
- Dynamic navigation

# RDS-TMC disadvangages

- Limited number of „live“ messages in the system
- According the decoding rules each message must be received at least 2x
- Regarding the bandwidth and the need to repeat the messages only 1 message per second is transmitted
- 5 minutes update → maximal number of „live“ messages 300!

# TPEG

# TPEG

- Created 1997 European Broadcasting Union established **Transport Protocol Experts Group** – protocol uses name of this group, development take 3 years
- Goal was: „to develop a new protocol for Traffic and Travel Information for use in the **multimedia broadcasting environment**. This will include applications, service and transport features which will enable travel related messages to be coded, decoded, filtered and **understood both by humans (visually and/or audibly) and by agent systems**.“
- Data stored in XML database

# TPEG applications

- Data not only about traffic
  - RTM – Road Traffic Message
  - PTI – Public Transport Information
  - PKI – Parking information
  - CTT – Congestion and Travel Time
  - TEC – Traffic Event Compact
  - WEA – Weather information for travellers

# First TPEG applications

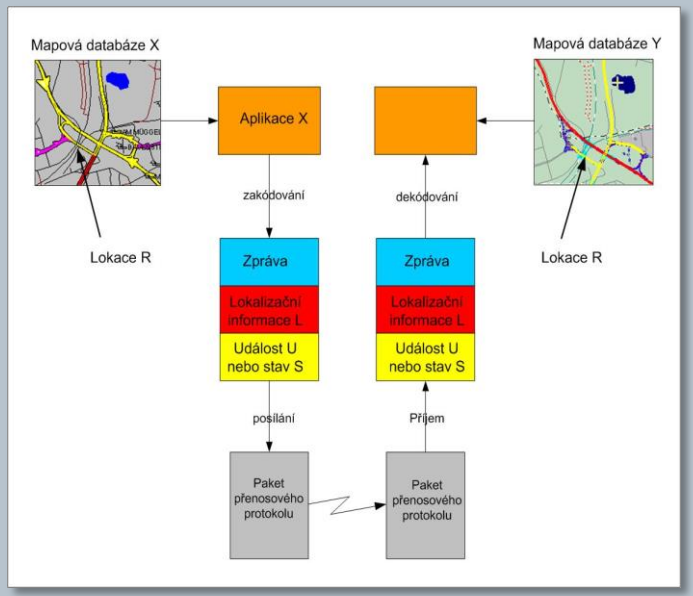
- RTM – Road Traffic Message
  - Similar function as RDS-TMC
- PTI – Public Transport Information
  - Travel timetables, trip planning, etc.

# Location Referencing

- Two possibilities
  - Structured text description – similar to TMC,
    - For thin client OBU
    - Example for TPEG TPEG-TMC
  - Or projecting in the map
    - Thick client OBU

# TPEG Location Referencing

- Native TPEG Location Referencing TPEG-loc
  - Clasic structured text descrition together with the coordinates
  - 7 types of place
    - Large Area
    - Nodal area
    - Segment
    - Intersection point
    - Framed point
    - Non-linked point
    - Connected point
- Lokalization AGORA-C
  - Not using data sets
  - Suitable for map updating
  - Receiver and transmitter can have different map data



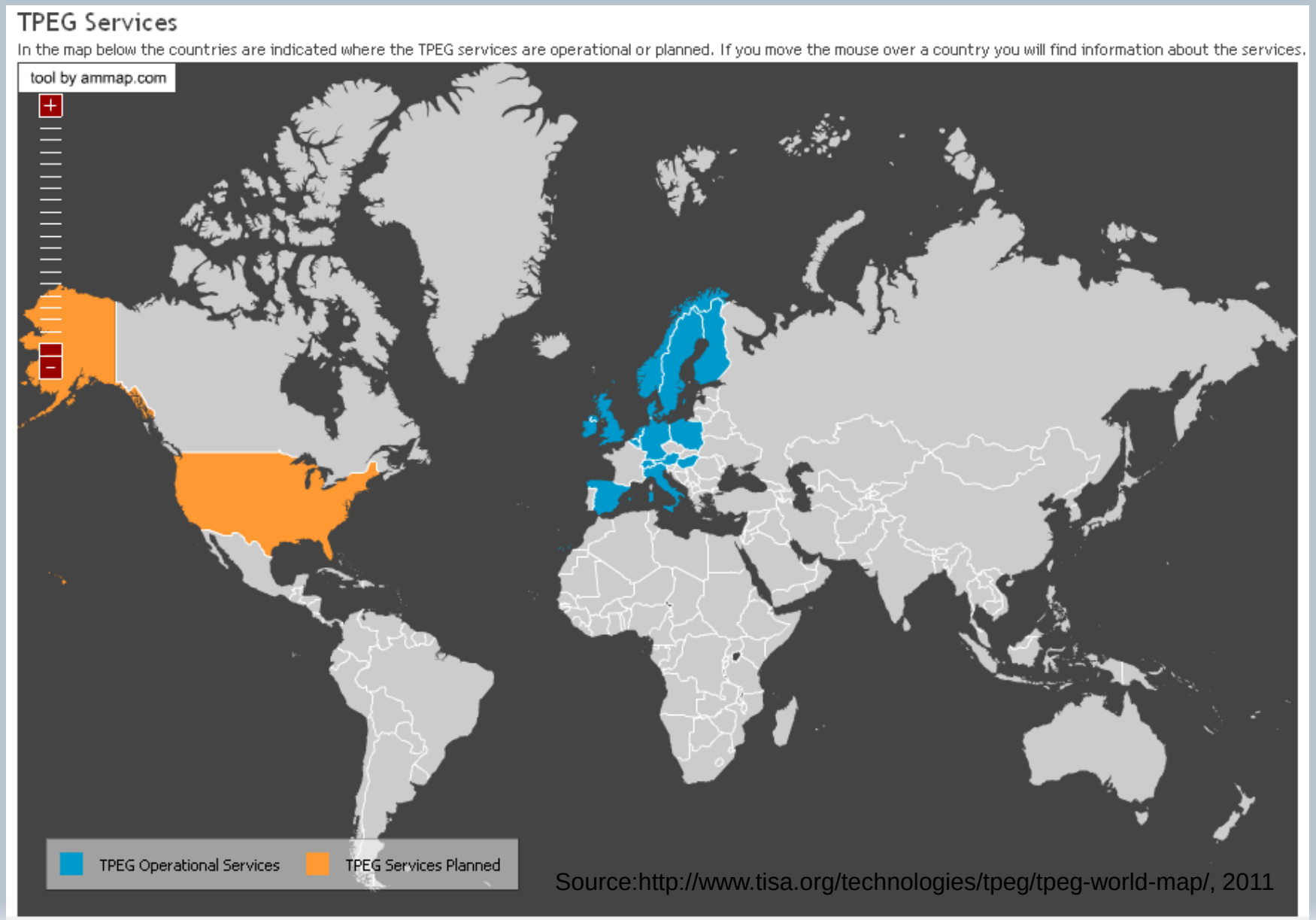

Zdroj: projekt AGORA

# TPEG transmission

- DAB/DMB (~ 1.5 Mbps)
  - Ideal environment for transmission of additional services
  - easy TPEG implementation
  - Higher transmission speed

- Internet via
  - GPRS
  - WiFi

# TPEG deployment




Source:http://www.tisa.org/technologies/tpeg/tpeg-world-map/, 2011

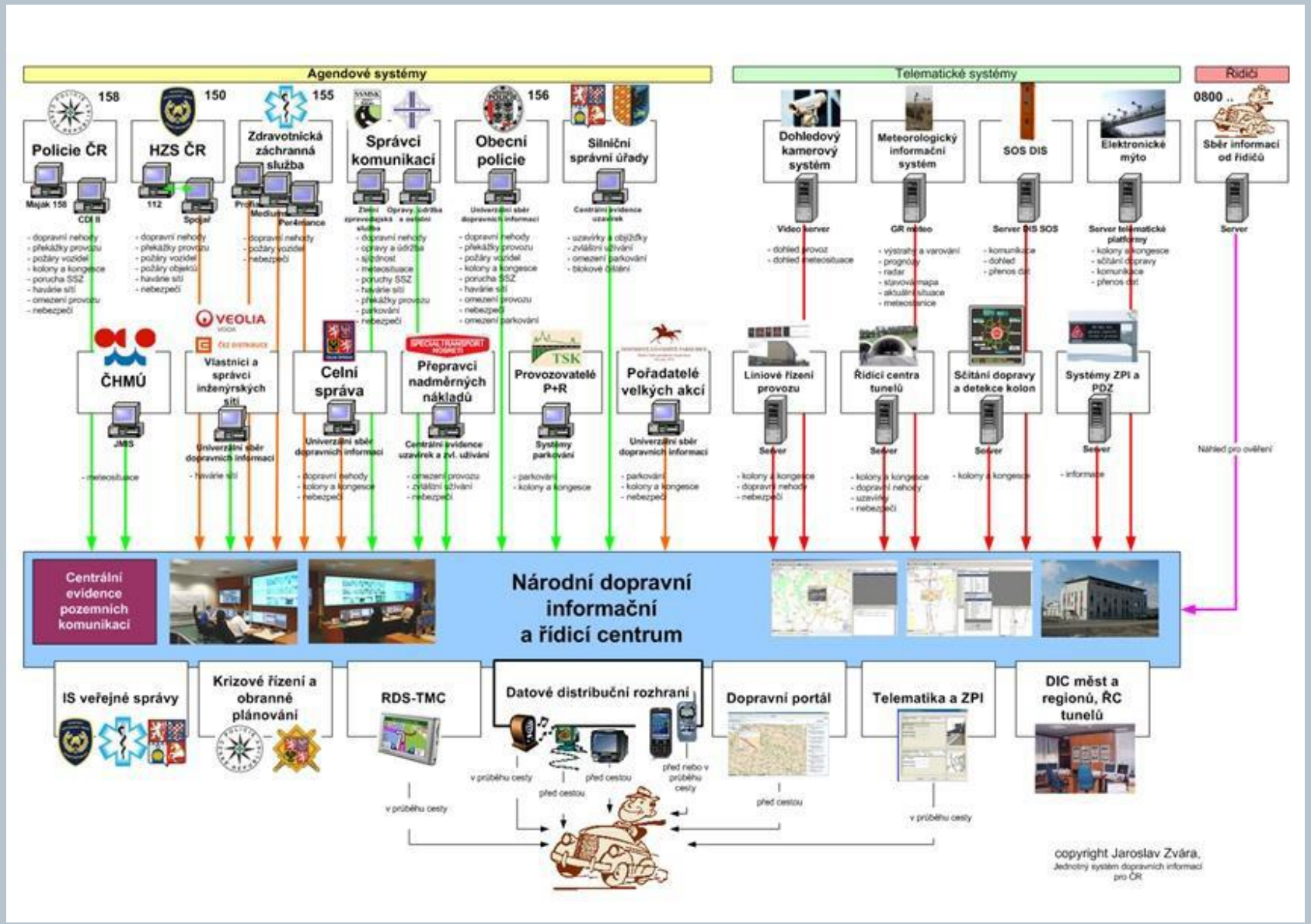
# Traffic information distribution in the CR

- National traffic information centre
  - In operation from 2005
  - Located in Ostrava
- Location of the Unified Traffic Information System of the Czech Republic
- Ensures
  - Verification of transmitted data
  - Completion of the traffic data
  - Distribution of traffic information
  - Application operation
  - Archive management
  - Etc.

# National traffic information centre

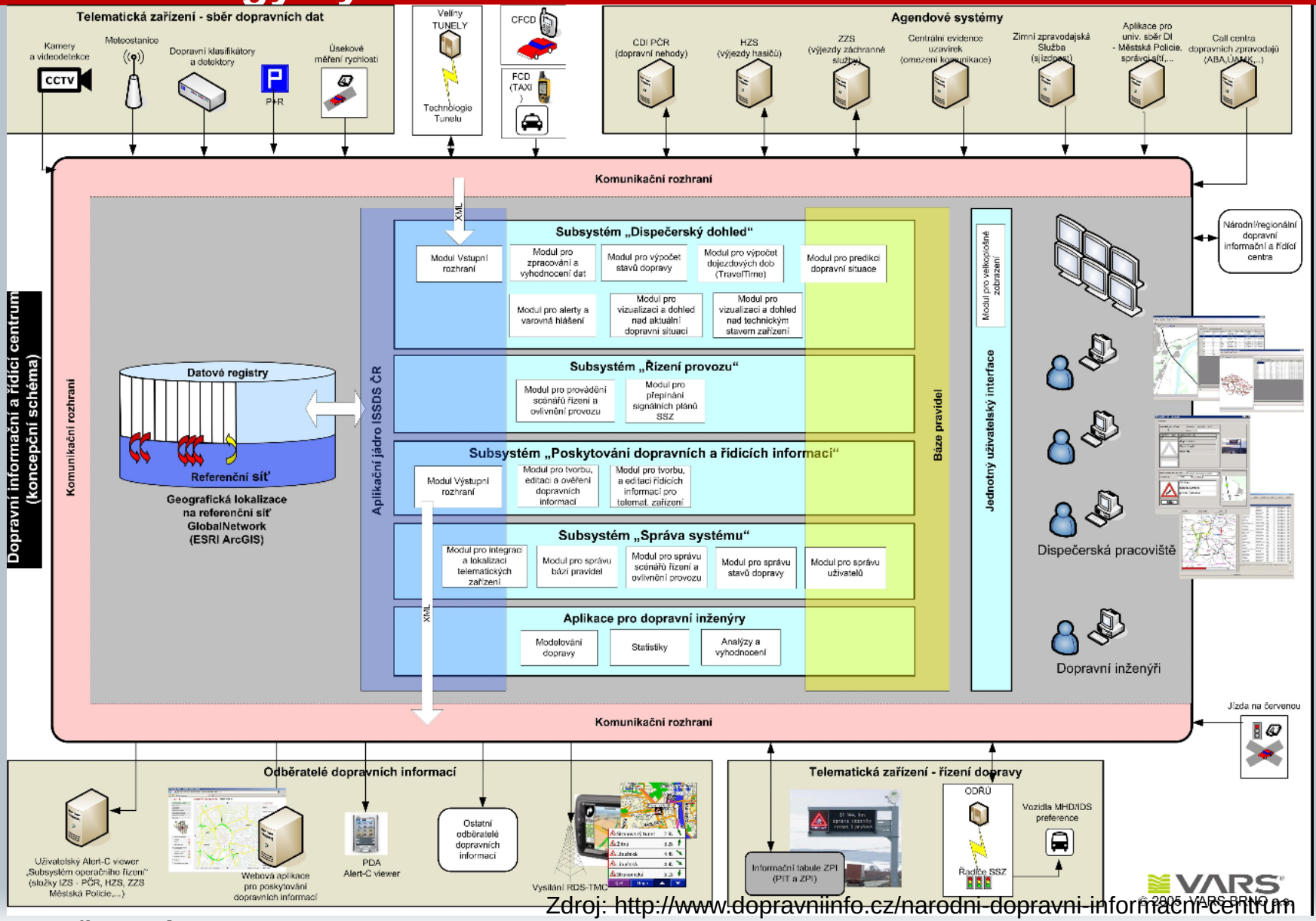
- Traffic data collection from
  - Emergency rescue services
  - Radio transmission
  - Video-detection
  - Infrastructure operators
  - Weather systems
  - Etc.
- Traffic data distribution via
  - RDS-TMC
  - Data distribution interface
  - Traffic portal www.dopravniinfo.cz
  - Traffic management centres
  - Variable message signs

# Unified Traffic Information System Scheme




Zdroj: http://www.dopravniinfo.cz/jsdi

# National traffic information centre – technology system schema




Zdroj: http://www.dopravniinfo.cz/narodni-dopravni-informacni-centrum

# Conclusion
## Benefits of systems for providing traffic information

- Increasing traffic safety
- Decreasing uncertainty for decision making by providing information about traffic situation
- Higher usage of existing traffic infrastructure
- Lowering drivers stress
- Lowering ecological load

# Thank you for your attention

# References

- e-call web pages http://ec.europa.eu/information_society/activities/112/index_en.htm
- http://www.worlddab.org/introduction_to_digital_broadcasting/applications_list/tmc_tpeg
- www.rds-tmc.cz
- www.rozhlas.cz
- www.hzscr.cz
- www.tisa.org