PEEK traffic solutions

CVIS

Cooperative Urban

30 slides
105 minutes

interactive session
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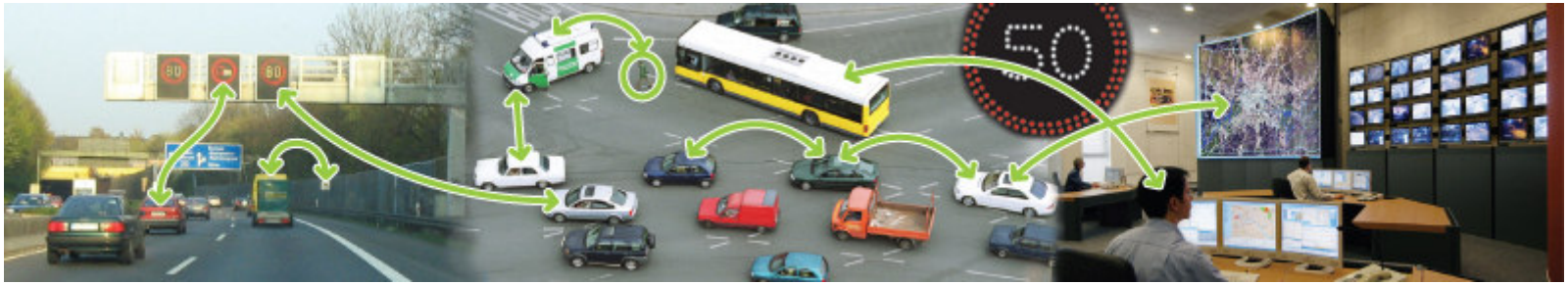


Today's content

- Round table
- Purpose workshop
- About CURB
  - Goal
  - Innovation
- About the architecture
  - Figure
  - About the Core Technology
  - About the Applications
- WP2
  - Summary
  - Selection of UN
  - Selection of UC (the basis for proving key applications concepts)
  - → FEEDBACK ROUND 1
  - Selection of key requirements
  - → FEEDBACK ROUND 2

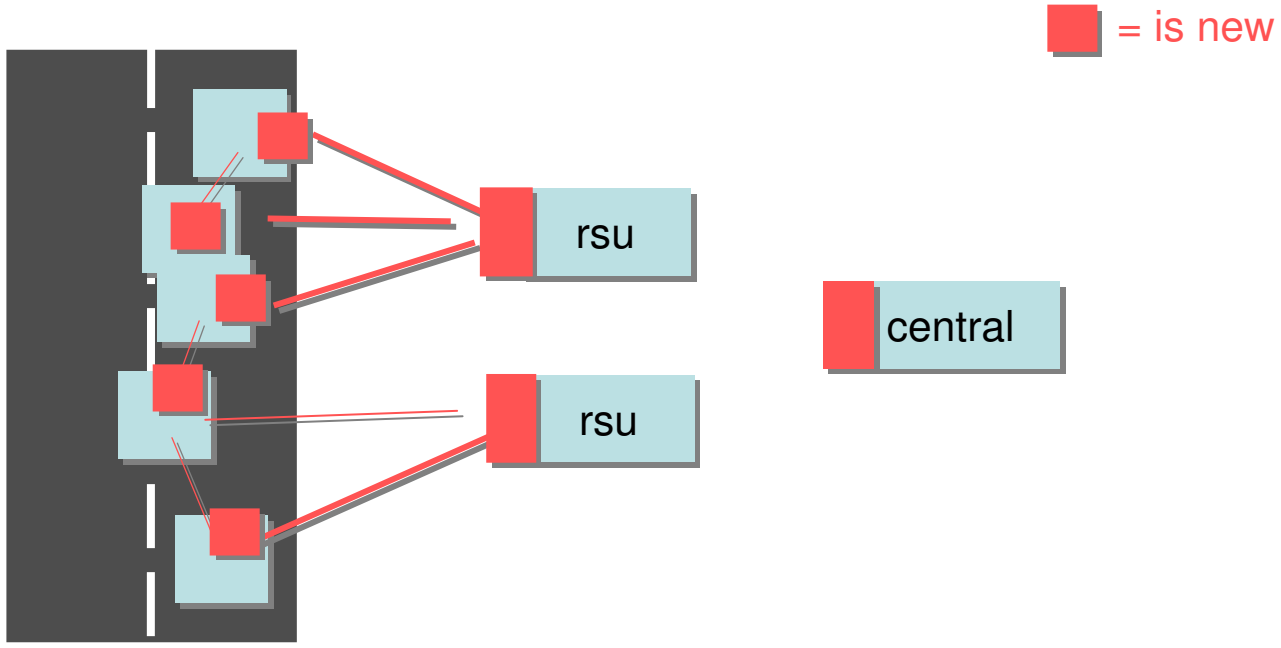
Goals

- CURB Goal:
  - Improve efficiency, safety and the roadside environment
  - Improve driver comfort
  - How? → by making use of intensive exchange of real time information between vehicles and infrastructure

- CURB Sub-goals:
  - Increase intersection efficiency
    - additional benefits safety, user comfort and a better environment
  - Increase central efficiency and adaptive rerouting
  - Efficient use of available road space
    - by dynamic allocation of lanes reserved for certain user groups

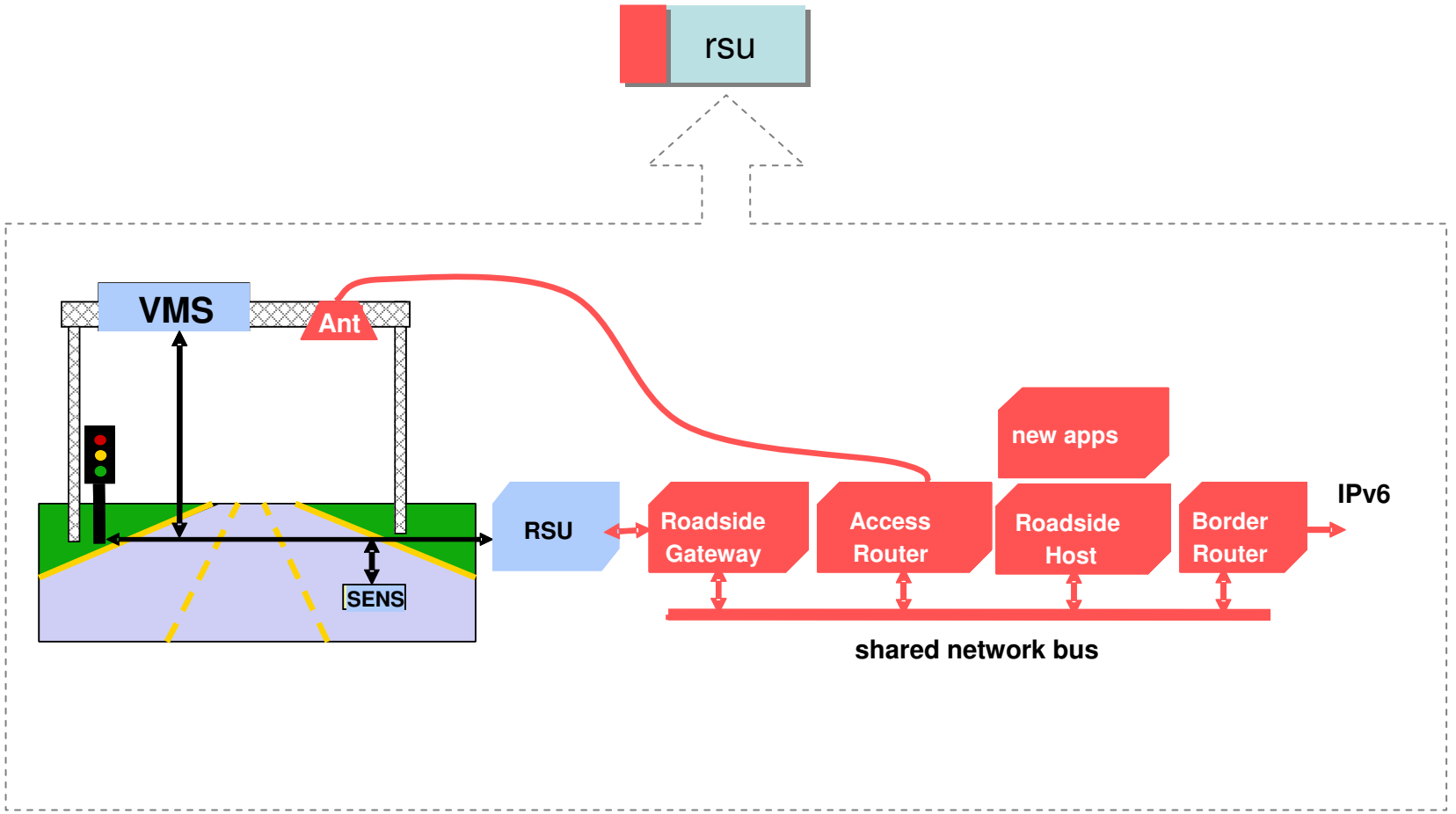
CURB innovation

1. Communication with vehicles (continuously)
2. Sharing the data and making it useful



RSU Architecture

bottom up approach



Core Technologies

- Technologies enabling Cooperative URBAN Applications:
  - COMM communication (previous slide)
  - POMA positioning and mapping
  - FOAM software platform (platform and manage apps)
  - COMO traffic data

Applications

- Role of the applications
  - Drive technology design
  - Showcase key application concepts
- Application framework
  - Host, update and manage applications on
    - Vehicle
    - RSU
    - Central
  - Open interface, between vehicle and roadside

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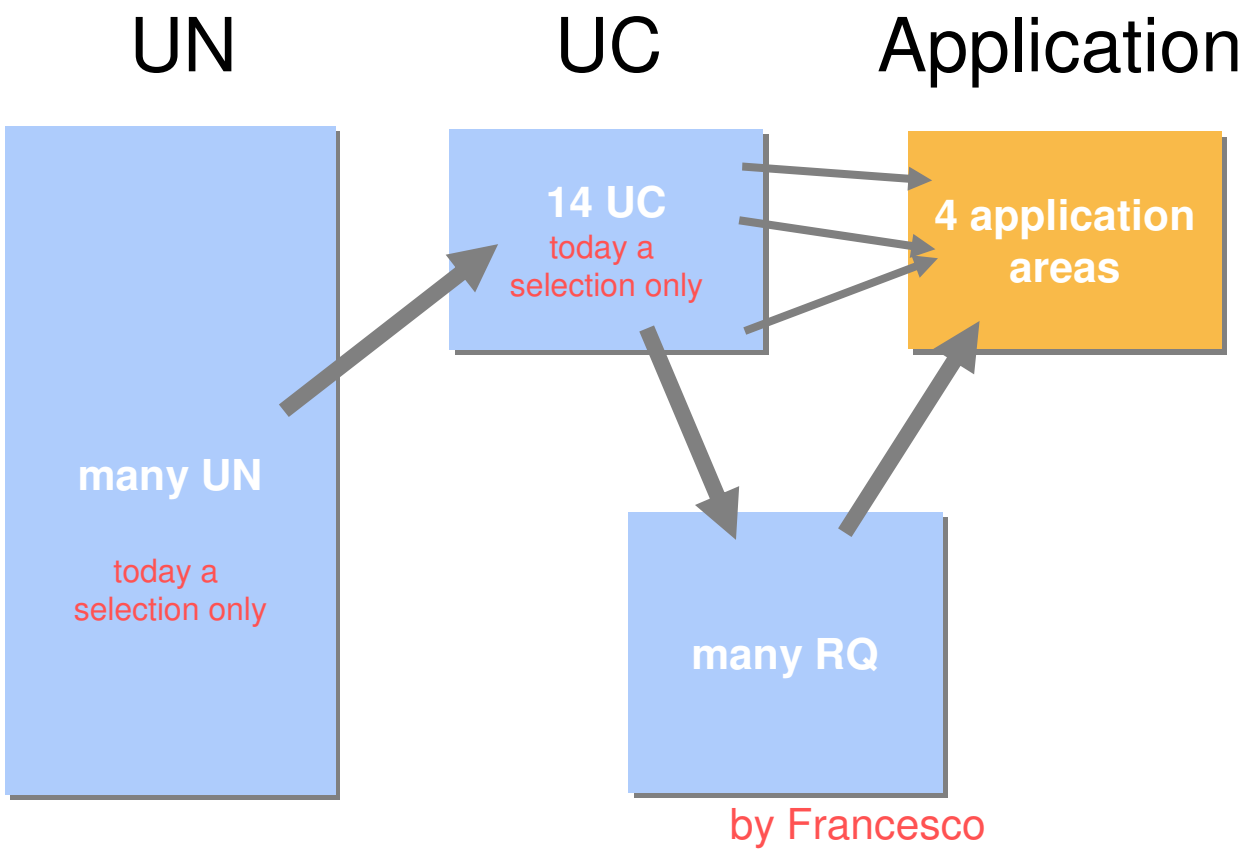
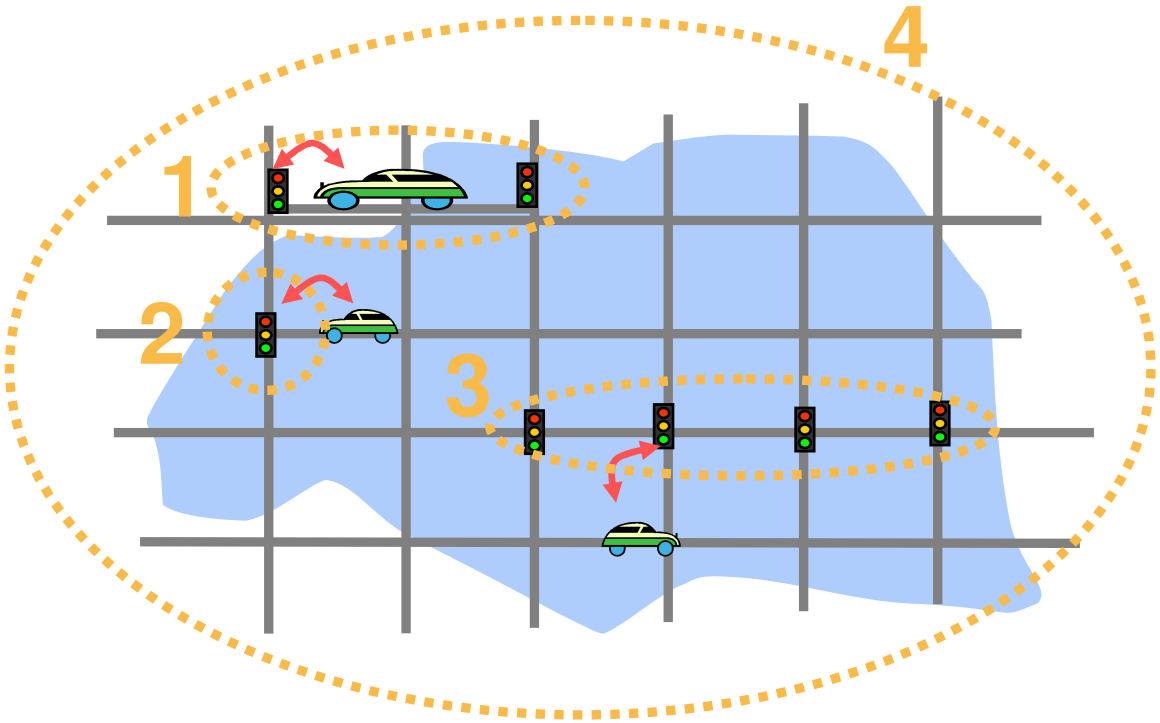
Process summary



CURB areas

Providing a bit of a structure



User Needs 1/3

dynamic bus lane

0018 - Capacity enhancement

Road operators want to use remaining/additional capacity potential (i.e. PT-lanes) to increase efficiency in special situations

0024 - No disturbance of Public Transport

In case that PT-lane usage is occasionally offered to other vehicles, these vehicles should not disturb / delay PT-vehicles

User Needs 2/3

intersection level

0026 - Dynamic vehicle priority on a intersection

Authorities should be able to configure dynamic priority to certain user groups (i.e. emergency vehicles, dangerous goods)

0028 - More fluid (and relaxed) intersection approach

Improving efficiency and safety on an intersection by sending out acceleration and deceleration advice to the drivers.

0049 - Optimize efficiency of road use

Optimize efficiency merging FCD with traditional detection data and feeding the information into a cooperative (master) controller

User Needs 3/3

urban area and network level

0048 - Provide routing service for small urban sub areas

Provide a fast reacting routing service to offer alternative partial routes based on local traffic state and incident detection

0050 - Implementation of cooperative traffic management strategies

Possibility to implement cooperative traffic management scenarios referring to the current traffic state, in order to optimize traffic flow and reduce congestion

0051 - Driver to receive optimal routing advices and route updates

Optimal routing advices based on high quality traffic information. In case of incidents the driver wants to receive updated routing advice and information why the intended route has changed

Full list Use Cases

AREA 1 - Flexible Lane Allocation

1. Provision of licences for CVIS vehicles
2. Opening the lane seamlessly when public transport arrives

AREA 2 - Local Traffic Control

3. Dynamic prioritised green (based on vehicle category)
4. Better control by better detection (single intersection)
5. Providing Speed Profiles to CVIS vehicles

AREA 3 - Area Routing and Control

6. Better control by better detection (multiple intersections)
7. Local rerouting advise generation and elaboration
8. Area level rerouting communication
9. Area level rerouting of special vehicle category
10. Area level traffic information distribution and enrichment (harmonisation of info)

AREA 4 - Co-operative Network Management

11. Generate and provide traffic state (incidents - for drivers that are well known in city)
12. Routing advise to individual vehicles to support the network wide scenarios
13. Selection and implementation of traffic management scenarios
    a. predictive network management, using online simulation
    b. reactive network management, using user equilibrium
14. Evaluate traffic management scenarios

Detail Use Case 1/2

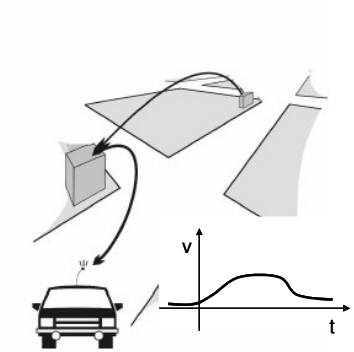
0013 Speed profiles

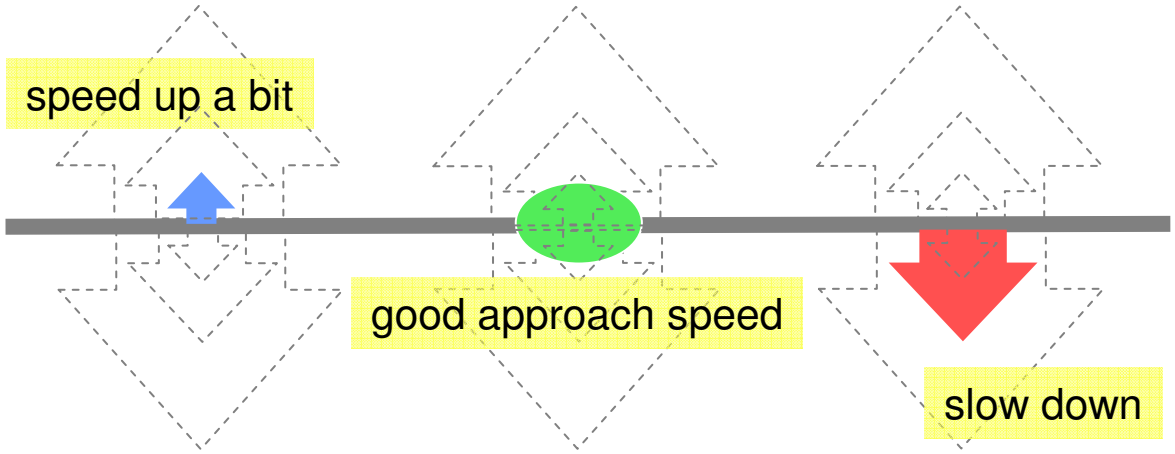
GOAL: increase efficiency of an intersection, and combining that with optimal comfort for the driver

- Local controller receives relevant data from all approaching CVIS vehicles
- Controller calculates speed profiles
  - Speed profile is a prediction of the green window (per direction)
- Controller broadcasts speeds profiles to approaching CVIS equipped vehicles.
- Speed profile is interpreted by the vehicles' on-board unit
- Speed profile is presented to the driver

Example

In-vehicle speed profile presentation





Detail Use Case 2/2

0035 Selection and implementation of cooperative traffic management scenarios

GOAL: Improving the current traffic situation by implementing the optimal cooperative urban traffic management scenario

- COMO data
- Scenario selection
  - performed by a CVIS control model and an on-line simulation model
- Scenarios consist of:
  - control rules
  - information (i.e. on incidents)
  - routes or corridors prioritised by the road operator to be provided to certain road user groups
- Implementation of scenario (RSU / Vehicles)

DISCUSSION 1

Questions for discussion

1. Are they valuable as they are?
2. Are we missing important ones?
   - **UC**
   - RQ

Role of the applications
- Drive technology design
- Showcase and prove key application concepts

Reminder: the list of cooperative application areas
- Dedicated Lanes
- Local
- Area
- Network

System Requirements Classes

Functional
What the system shall do

Communication
Communication channels, channel performances, channel bandwidth and latency time

Information
Which information, where, between who

Performance
On traffic management, on system scalability

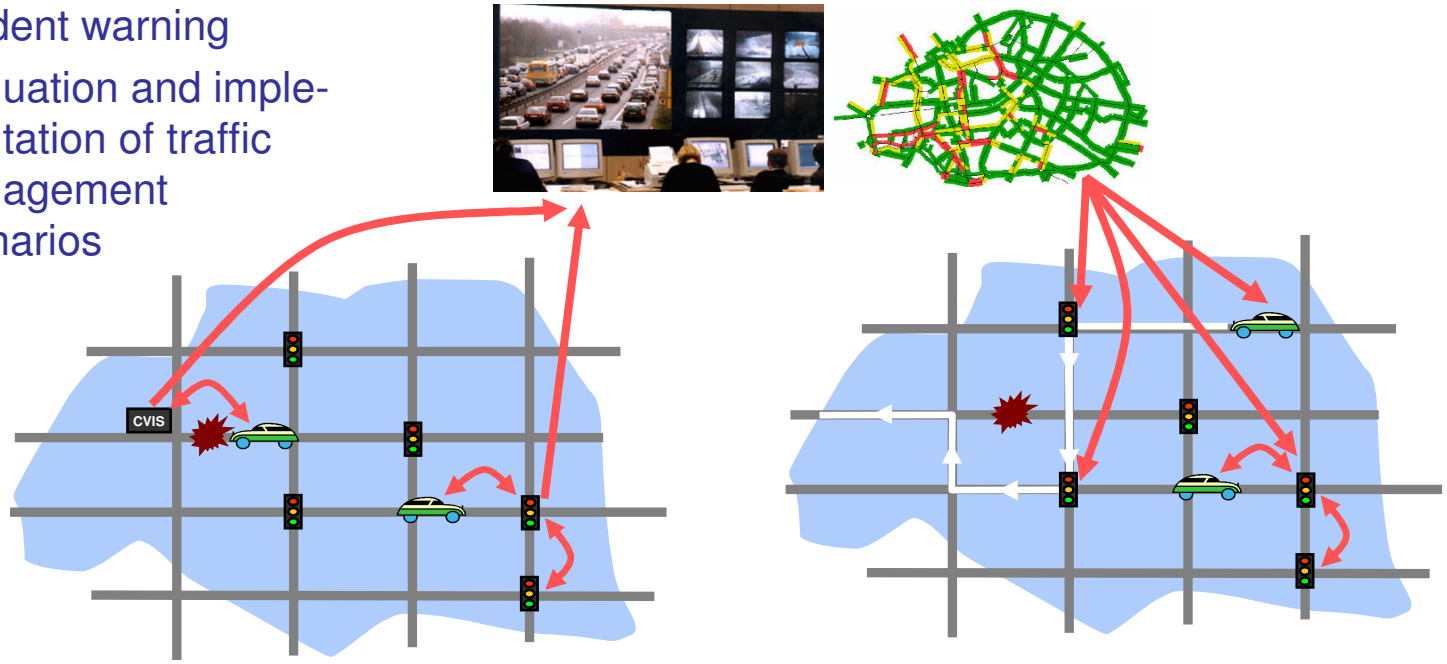
Driver Interaction
Requirement on the interaction with the driver

User Acceptability
Road user and road operator

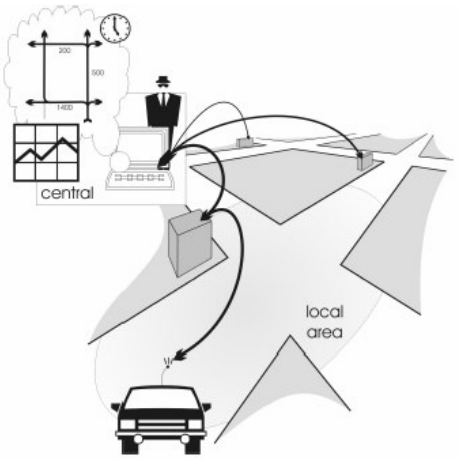
Network

Cooperative Network Management

- **Goal: optimize network wide traffic conditions**
  - Network routing
  - Incident warning
  - Evaluation and imple-mentation of traffic management scenarios

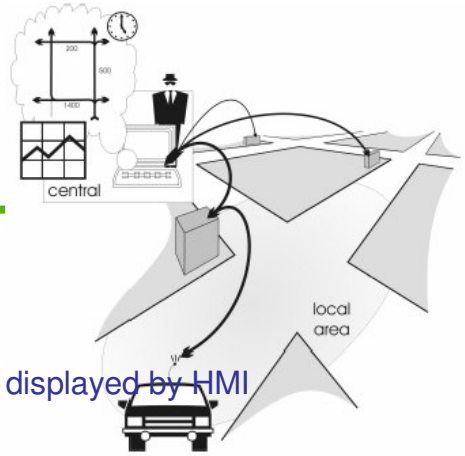


Network



- Main Concepts
  - Network Routing
  - Generate traffic status and incident, inform vehicle
  - Implement Traffic Management
- Main Requirements
  - Traffic information,
    - The driver shall be able to select the time window, the area and duration of information
    - The information shall be displayed to the traffic status and the incident data, on selected area
    - TMC shall provide Traffic Status and Incident data, on request and update on regular basis 5min
    - Local collected traffic information shall be propagated at network level
    - Traffic Information content is: congestion, road surface condition, road works, accidents, blockages
    - Each incident warning message is associated with a geographical region
    - Warning shall be distributed to profiled user

Network

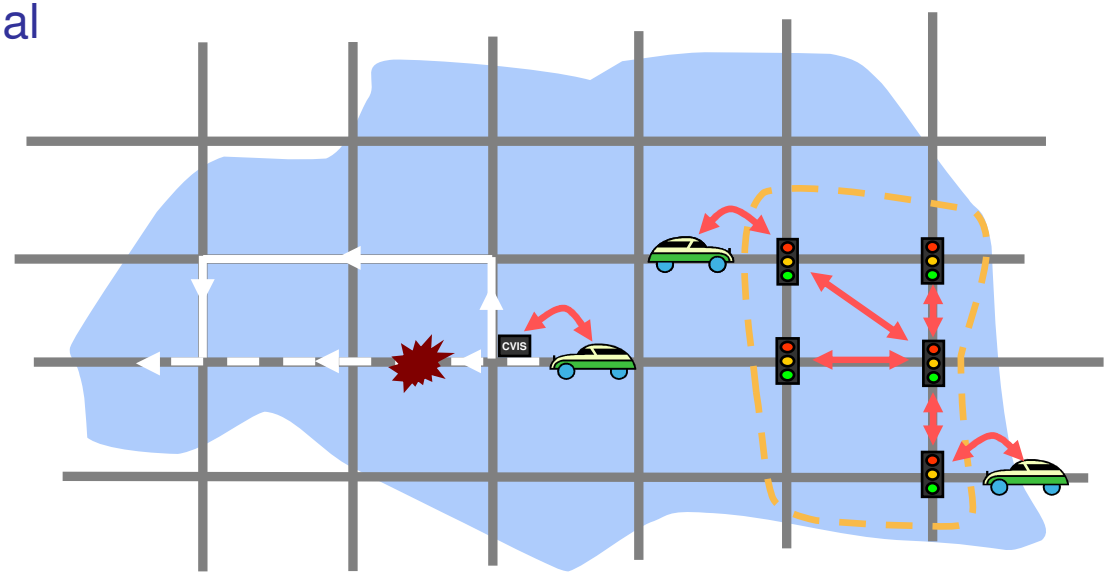


- Main Requirements
  - Routing
    - The vehicle shall communicate its destination, which is entered and displayed by HMI
    - Route options are compute and provided to the driver
    - When leaving chosen route, the system shall inform the driver and the routing system
    - When congestion event occur, the driver shall be informed and new route update provided
    - The discovery of the routing service shall be initiated by the on-board system and be automatic
    - Vehicle shall be localised and information provided to the routing system, when requesting a route
    - Request shall contains vehicle characteristics, position and destination
    - The request can pass through the RSU or directly to the network centre
    - The vehicle shall be addressable by the routing system
    - Route selection, by driver, shall be reported back to the routing system
    - Route options are elaborated by the onboard subsystem
    - Route requests are generated by the vehicle
    - Vehicle characteristics shall be considered when defining the route options
    - Routing system shall be fed with current traffic status and with the traffic strategy
    - Route description shall include flexible bus lane information
  - Traffic Management
    - Set of requirements …
- Risk and consideration
  - missing information

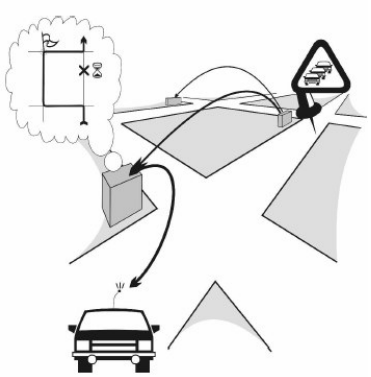
Area

Cooperative Area Routing and Control

- **Goal: provide alternative routes and optimize traffic flow in urban areas**
  - Route computation and dynamic routing
    - small disturbances
  - Determination of optimal control measures based on XFCD (and traditional data sources)



Area

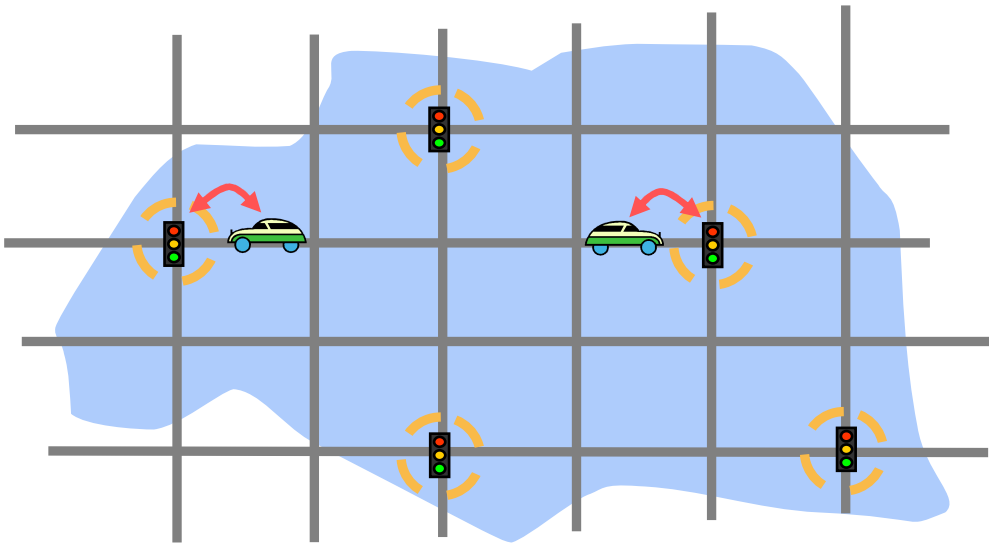


- Main Concepts
  - Area routing elaboration
  - Area routing communication
  - Area routing for special road community
  - Traffic information distribution and enrichment
  - Cooperative traffic control
- Main Requirements
  - RSU shall be able to communicate with each other.
  - RSU shall harmonise the message prior to deliver to the vehicle
  - RSU and vehicle shall be identifiable, at least temporary, for all the journey
  - Vehicle shall transmit position, destination, waypoints, turning sign and FCD, on regular base or on request
  - The vehicle shall interact with the driver to derive destination and potentially way point or preferable route, e.g. via user profiling
  - The vehicle shall be able to communicate with nearby RSU
  - RSU shall be able to merge detection data and FCD at local level
  - The RSU and area status shall be updated every 2 minutes
  - Positional data and FCD are provided from the vehicle to the RSU in real-time
  - It shall be possible to share the temporary id of the vehicle between handover cells
  - Navigation system shall provide route, waypoints and partial route on request
- Risk and consideration
  - Conflicting information to the RSU
  - Vehicle may receive information from not-synchronised sources

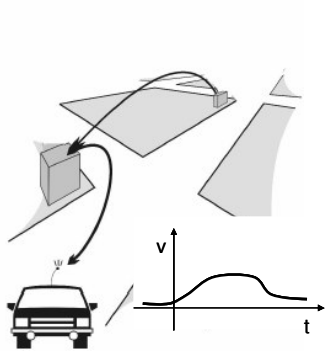
Local

Local Traffic Control

- **Goal: Improving efficiency and safety at an intersection**
  - Better detection → Better control
  - Priority to single vehicles of certain user groups
  - Speed advice to approaching CVIS vehicles



Local

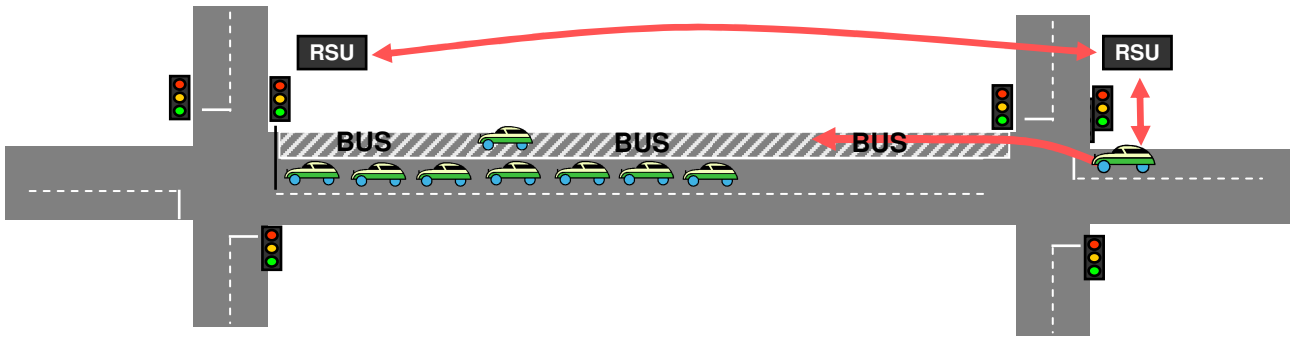


- Main Concepts
  - Green request
  - Speed profile
- Main Requirements
  - Green requests are generated by the vehicle and are sent to the RSU/LTC
  - Driver shall able to set a request to the onboard unit for green, on pre-trip or on trip stages
  - Vehicle knows its position with respects to the RSU
  - The vehicle characteristics is considered when processing green request
  - The request can be rejected by the LTC and acknowledge reported back
  - The onboard system shall be able to convey speed profile advice, on regular basis
  - The RSU is able to communicate to vehicle on a specified road link and direction
  - Real-time information on approaching vehicles (type of vehicle, direction, link, speed, weight)
- Risk and consideration
  - Conflicting request shall be handled
  - Reliability of information is to be considered

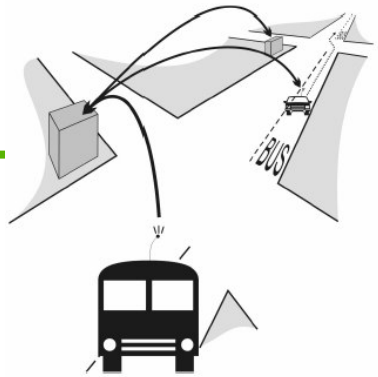
Dedicated lanes

Flexible Lane Allocation

- **Goal: Improving capacity on certain road sections**
  - Providing bus lane use to other road users
  - Avoiding disturbances to PT



Dedicated lanes



- Main Concepts
  - Prevent disturbances to public transport vehicles.
  - Provision of licenses to use the bus lane
- Main Requirements
  - Bus allocation system shall know the current position of Public Transport vehicles, with long range communication and in real-time
  - The arrival time of the bus vehicle on the flexible lane shall be extracted, with suitable advance and integrating traffic status
  - A short range communication system along road side infrastructure must recognise PT vehicles entrance in the Bus Lane
  - The HMI of the on-board system must provide the ability of entering the CVIS vehicle's destination (vehicle's position and speed are transmitted automatically without the driver's intervention)
  - The TMC & PTMC systems should have the details (kind of vehicle, transport company of the vehicle, driver data, PT route & schedule …) of the CVIS vehicles within the monitored area (i.e. the Bus Lane surroundings)
  - The RSU supported by legacy systems should detect vehicles (CVIS and non CVIS) without license (including expired license) driving on the Bus Lane
  - RSU must be able to release licenses to the pre-registered vehicles, over encrypted communication channel
  - …
- Risk and consideration
  - Fit with heavily congested scenario

DISCUSSION 2

Resume for discussion

Are they valuable as they are/ are we missing important ones

- UC
- **RQ**

Reminder: the list of cooperative application areas

- Dedicated Lanes
- Local
- Area
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Thank you for your attention

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