Integration of Vehicular Communication Gateway and Car-to-Car Communication for Future Vehicular Applications

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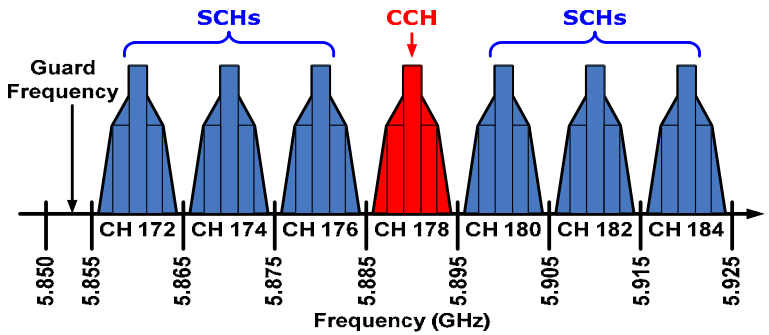
Geneva, 7-9 March 2007

Outline

- Overview on wireless vehicular communications
- Inter-vehicle communication for safety services
- The vehicular communication gateway for MYCAREVENT project
- Integrated vehicular communication gateway with C2C communications
- Conclusion and outlook

Overview on wireless vehicular communications

- Vehicular Communication of Intelligent Transportation System (ITS)
  - Safety applications
  - Non-safety and comfort oriented applications
- Regulations worldwide
  - ETSI 5.8GHz for CEN DSRC, ETSI ERM TG37 5.9GHz for European ITS
  - U.S. FCC 75MHz @5.9GHz for ITS
  - Japan 5.8GHz ITS
- Standardization
  - CEN DSRC, ISO/ETSI CALM
  - IEEE 1609/ 802.11p (WAVE)
  - Car2Car Communication Consortium
- Projects
  - Crash Avoidance Metrics Partnership (CAMP)
  - Vehicle Infrastructure Integration (VII)
  - CarTalk2000, PReVENT, e-Safety
  - Fleetnet, Network-on-Wheels (NoW)



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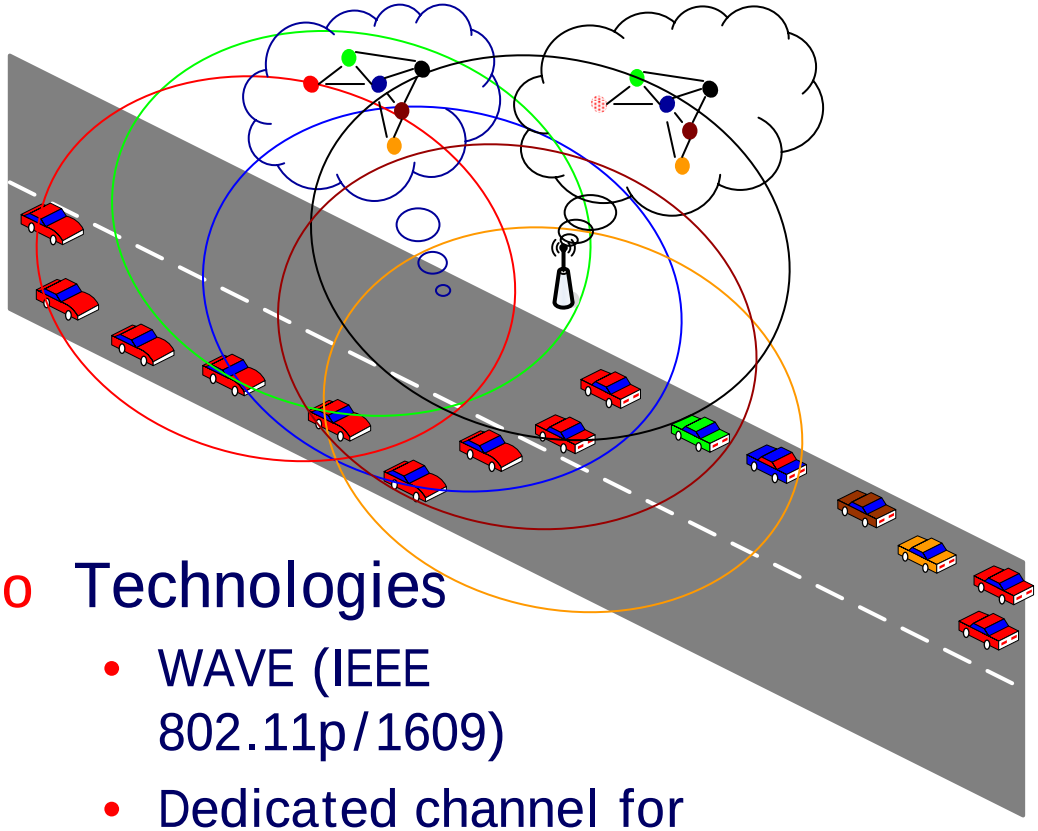
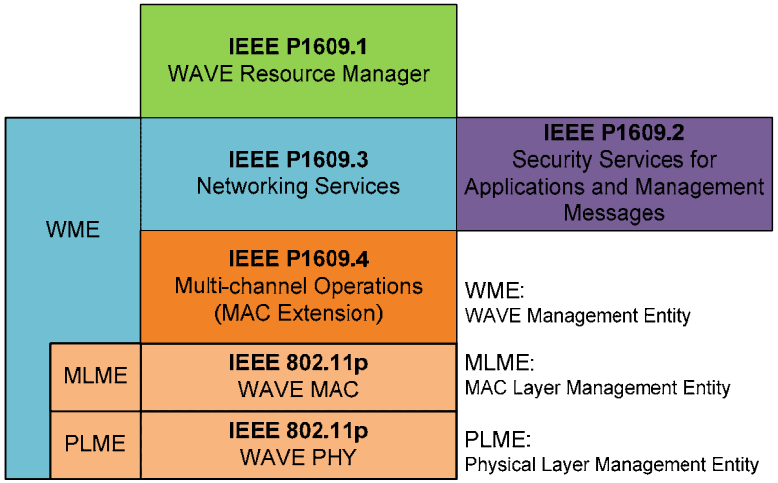
Car-2-Car (C2C) Communications

C2C is meant to be a complement to cellular communications by providing very high data transfer rates in circumstances where minimizing latency in the communication link and isolating relatively small communication zones are important.*

- Applications
  - Safety: public safety, danger warning, cooperative driving
  - Non-safety: telematic, infotainment, on-board internet





- Technologies
  - WAVE (IEEE 802.11p/1609)
  - Dedicated channel for vehicle safety and commercial applications

*IEEE Magazine on Wireless Comm.

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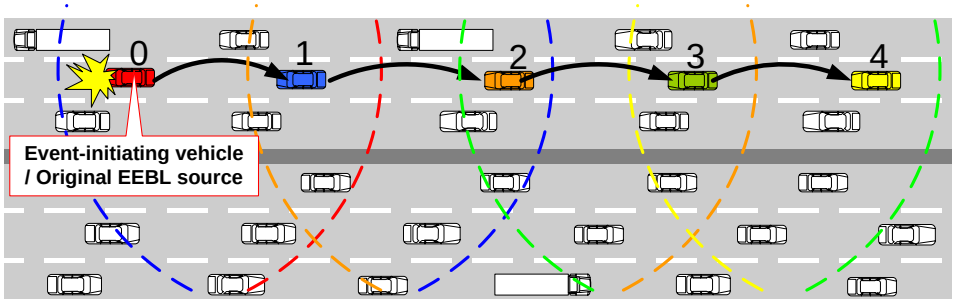
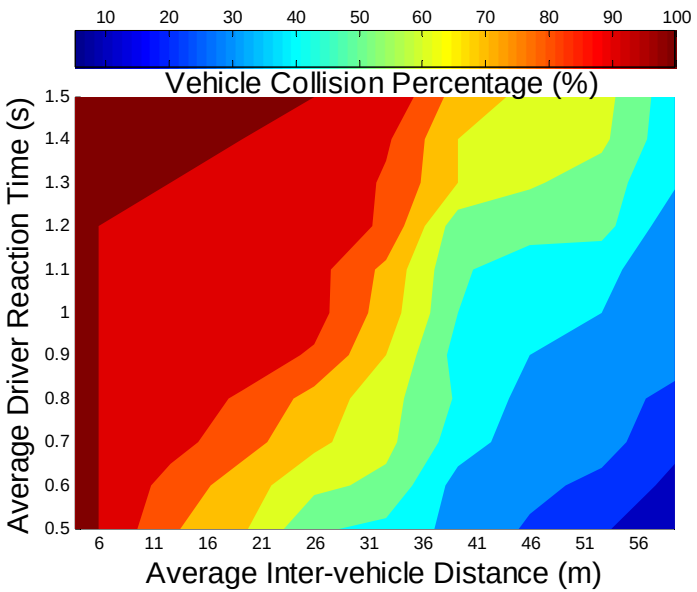
Car-2-Car communication for safety applications

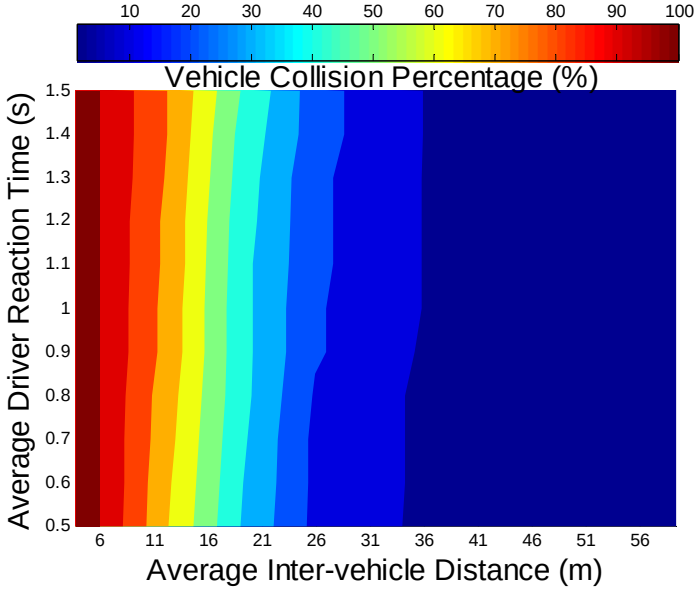
- Emergency Electronic Brake Light (EEBL) using WAVE system
- Effective in reducing vehicle collision probability



Optical Brake Light



Emergency Electronic Brake Light



*Data source: European PreVENT/WILLWARN Project Report

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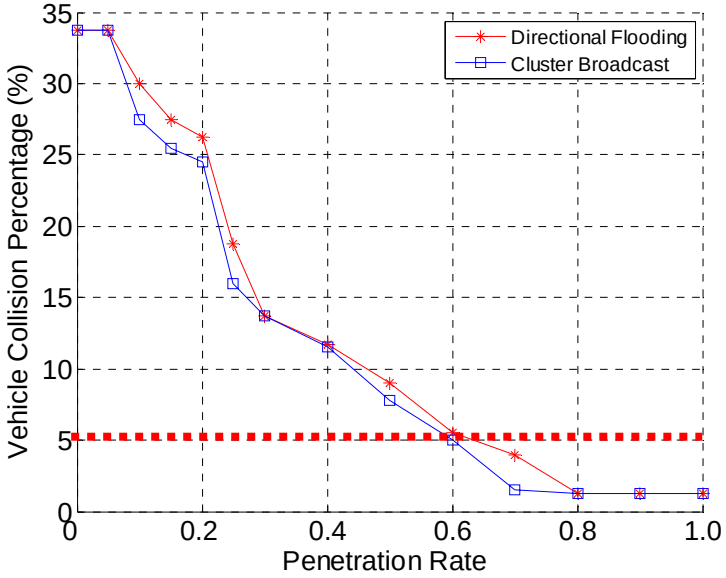
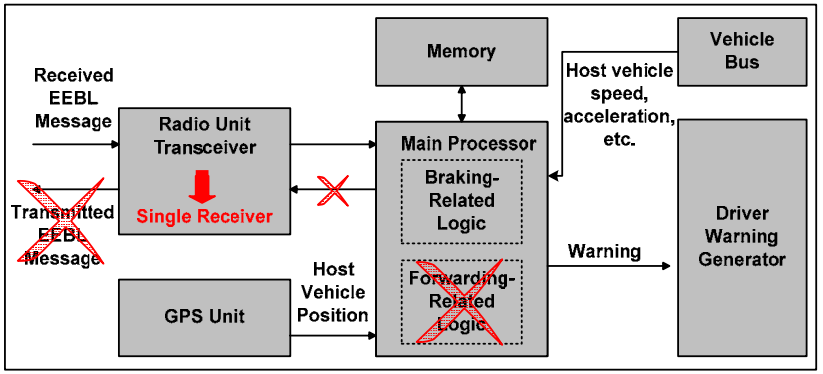
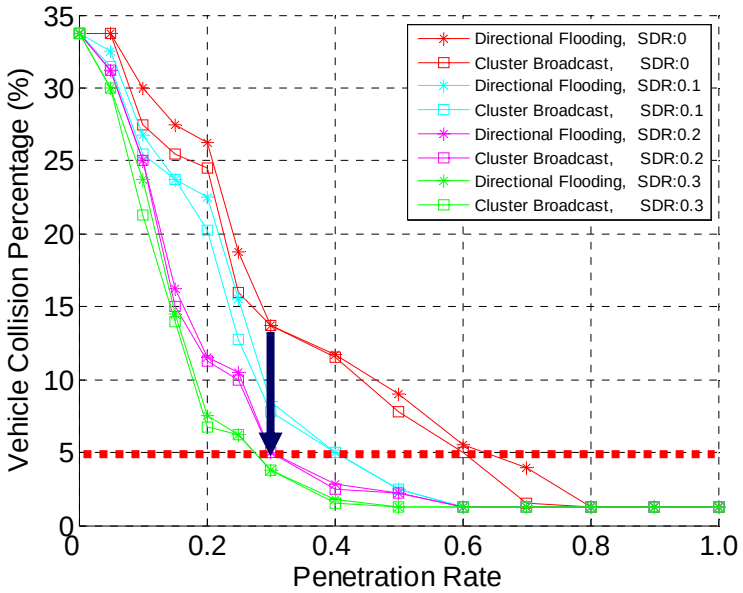
Market penetration rate and system performance



- EEBL performance (51m, 1s)
  - min. penetration rate 20%
  - Collision free: 70%
- Solutions
  - Devices for legacy vehicles
  - "Light" WAVE device



Emergency Electronic Brake Light Block Diagram



*Data source: European PreVENT/WILLWARN Project Report

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Summary on the C2C

- Effective on enhancing the safety of transportation system
- The performance depends on the market penetration rate
- There are ways to speed up the market penetration rate
- For non-safety applications:
  - Broadband, low latency
  - Limited communication range, RSU deployment
  - Restricted access to Internet and general services

MobilitY and CollAboRative work in European Vehicle Emergency NeTworks (MYCAREVENT)

Mobile Service Providers
- Location based Services
- Diagnostic Tools & Apps
- Long-/ Short Range Comm
- ...

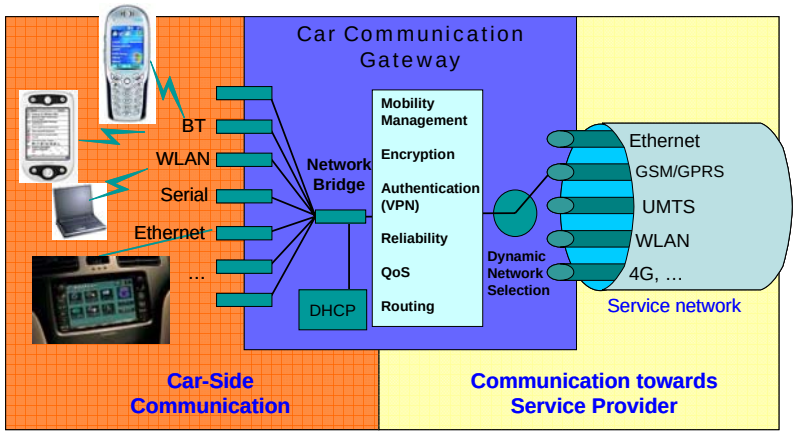
Vehicle
- On-board diagnostics
- Long-/ Short Range Comm
- Sensors
- Location based info
- ...

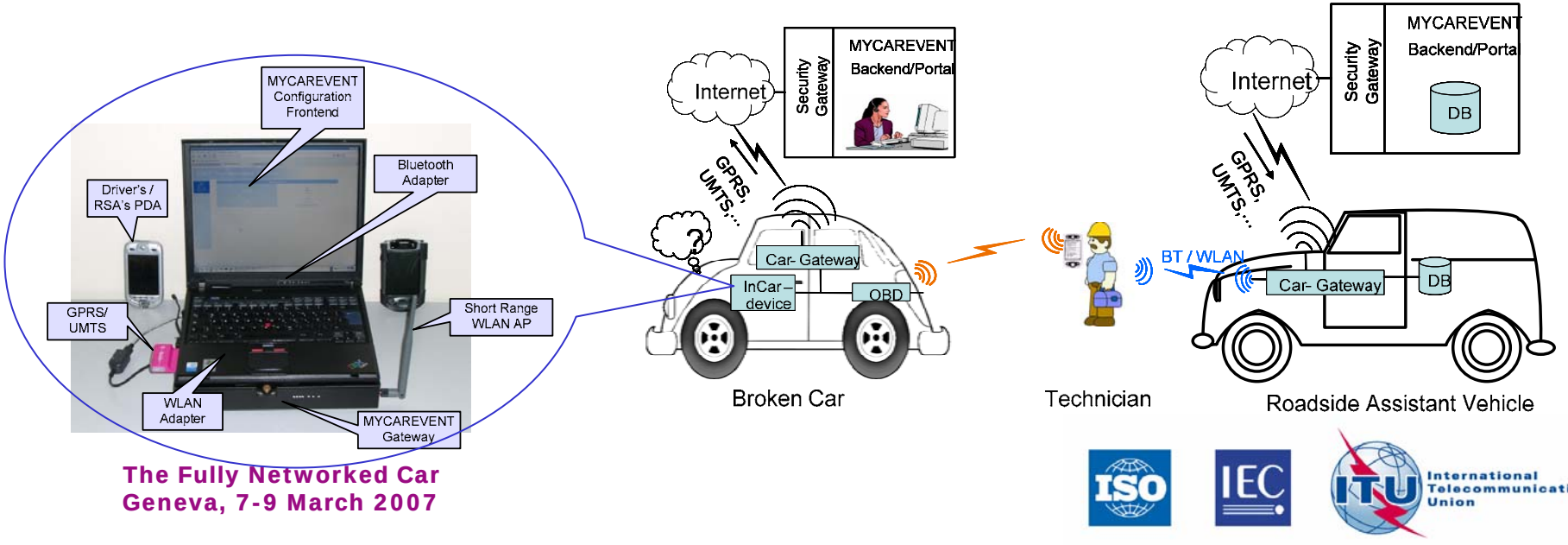
Workshops
- Stationary Services
- Long-/ Short Range Comm
- (Spare Parts Warehouse)
- Enhanced Diagnose Tools
- Enhanced Repair Tools & Devices
- ...

Service Portals & Service Applications
- 1st & 2nd Level Diagnose
- Data Communication over IP
- Long Range Communication (LRC)
- ...

Vehicular Communication Gateway for MYCAREVENT

- Always Best Connected
  - UMTS/GPRS, WLAN, Bluetooth, etc.
- Secure transmission
- Reliable transmission





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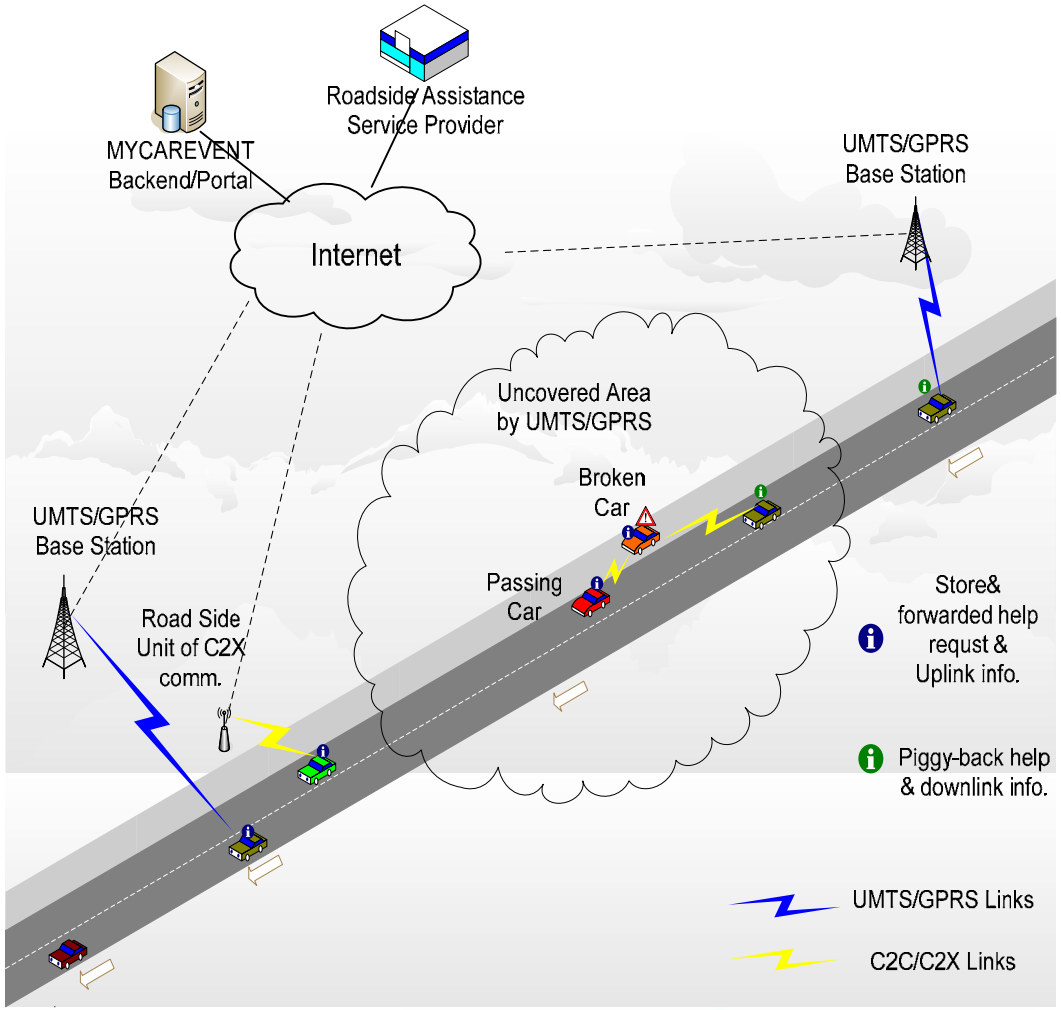
Integrated solution for vehicular communication gateway and car-2-car communications

- Limitations of Vehicular Communication Gateway (VCG)
  - Cost
  - Dependence on cellular system
- Integration of the VCG and C2C communications
  - VANET based on C2C comm.
  - VCG as the VANET gateway

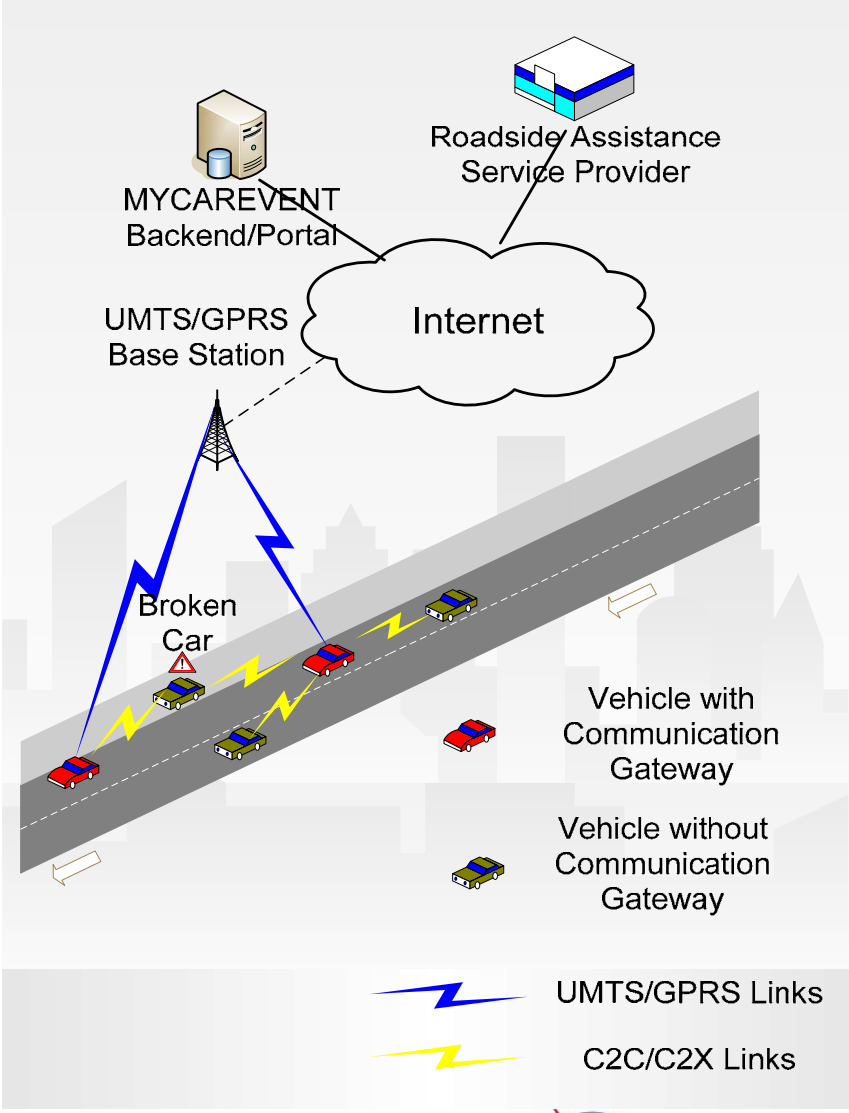
Scenario 1 of the integrated solution

- Service range extension of VCG via C2C
  - The broken car located out the range of UMTS/GPRS
  - Help request / emergency message picked by passing by vehicles via C2C link
  - Store and forward when the VCG is back in the UMTS/GPRS range
  - Message dissemination / forwarding via multi-hop C2C or mobility prediction



Scenario 2 of the integrated solution

- Internet access to C2C user via VCG
  - Cars with VCG act as Internet gateways
  - Through the VCG other C2C users can
    - Use MYCAREVENT service
    - Access internet
  - Additional services than danger warning may stimulate the C2C market



Conclusions and outlooks

- C2C communication is an promising technology
- Vehicular Communication Gateway is the solution for secure, reliable and always best vehicular connection
- The integrated solution extends the service range of VCG and provides the C2C user Internet access and general services
- Challenges foreseen:
  - Self-organized VANET
  - Service discovery and routing
  - Resource management in cellular system
  - Business case and billing issue

Thanks for your attention!

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