ITS
Car to Car Communications at 5,9 GHz

Workshop on Spectrum Requirement
For Road Safety

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CAR 2 CAR
COMMUNICATION CONSORTIUM

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The C2C-Commuication Consortium

The Car2Car Communication Consortium is a non-profit organisation initiated by European vehicle manufacturers

Goals and Missions

- Bring out the idea of working together for more safety on the road
- Establish an open European industry standard for a Car2Car communication system
- Promote the allocation of royalty-free European-wide frequency band for Car2Car applications
- Enable the development of an open system supporting active safety applications as well as a broad range of information services
- Take into consideration worldwide related activities
- Develop realistic deployment strategies and business models to speed-up the market penetration

C2C-CC Members

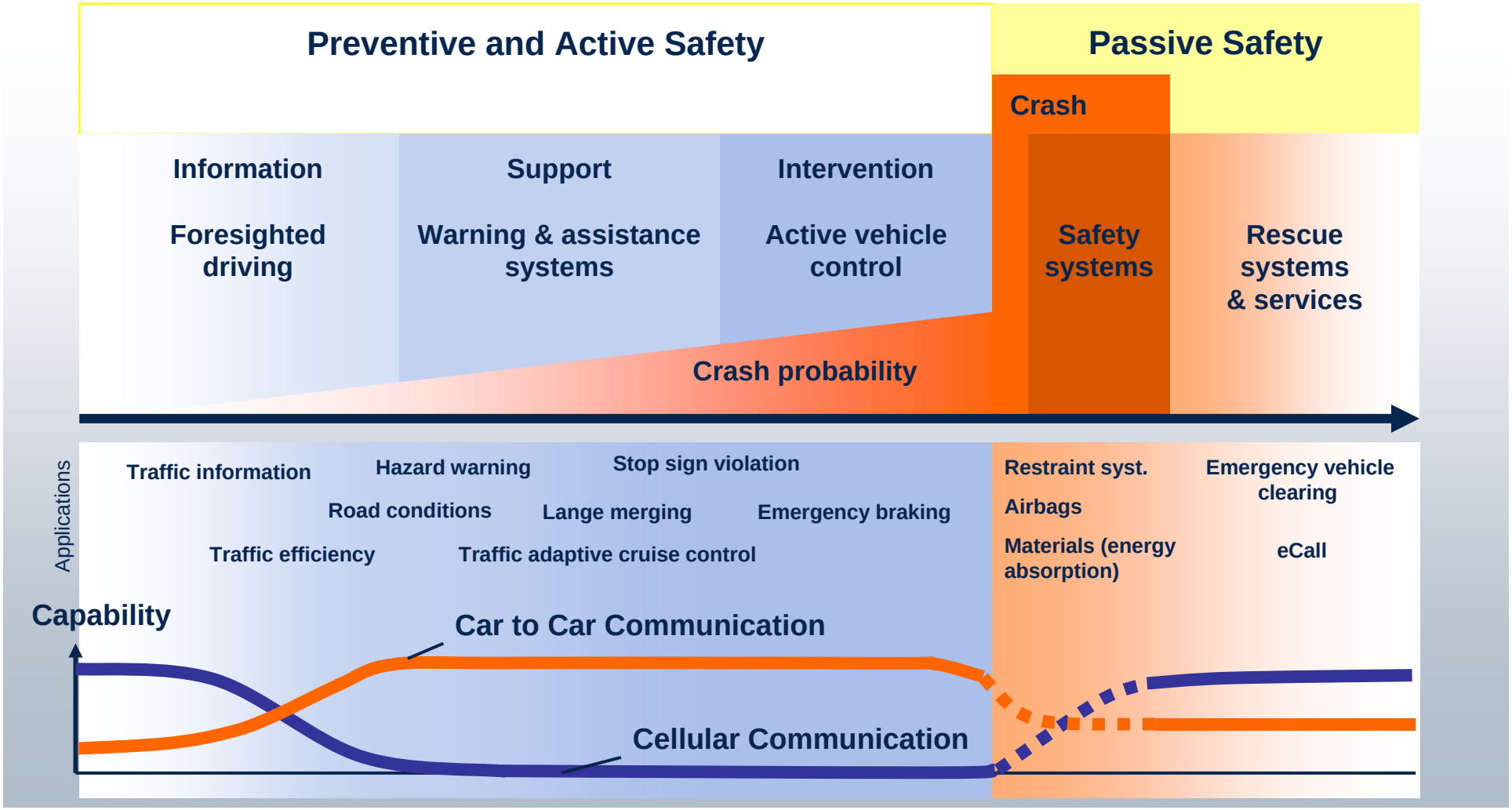
- open for suppliers, research organisations and other partners
- different levels of membership

More Information

- www.car-2-car.org

Video illustrating active safety system on the road.

Active Safety with C2C Communication



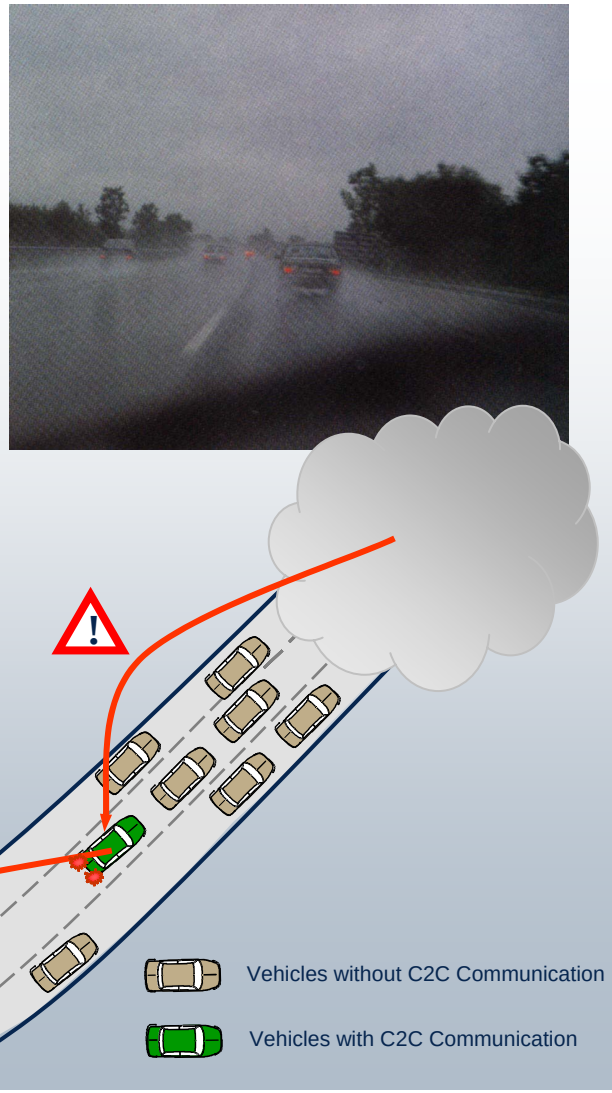
Hazardous Situations

Problem

- Rear end collisions are caused by carelessness, poor visibility, unexpected slippery roads or breaking maneuvers, etc.

Solution

- Immediate hazard warning via direct car to car communication helps to avoid or at least to reduce the consequences of accidents.
- The information distribution could be triggered by the airbag-sensor, friction-sensor or switching on the warning flashers.
- This information reaches the upcoming traffic much faster than conventional methods.



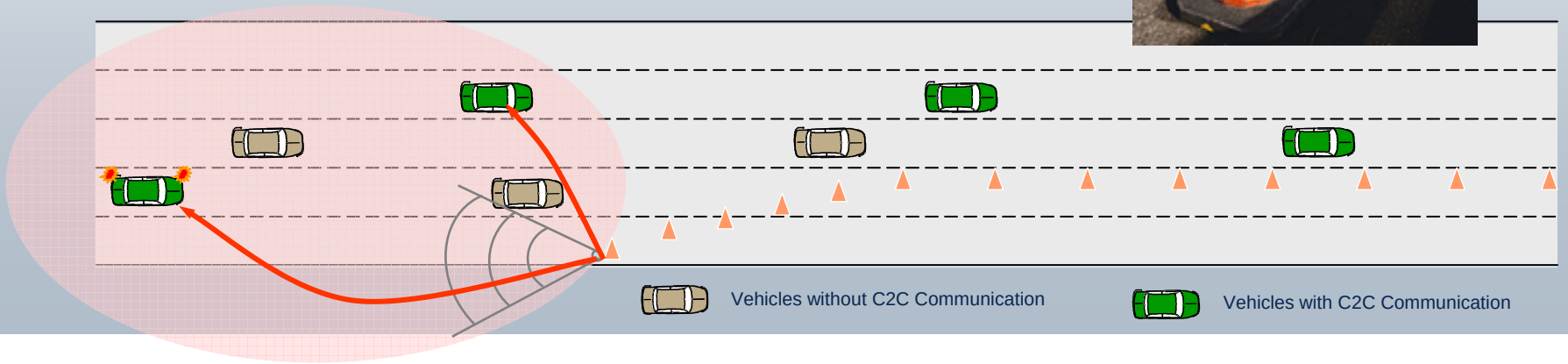
Road Works

Problem

- Construction sites and temporary maintenance work are accident black spots, because traffic signs are ignored or realized too late.

Solution

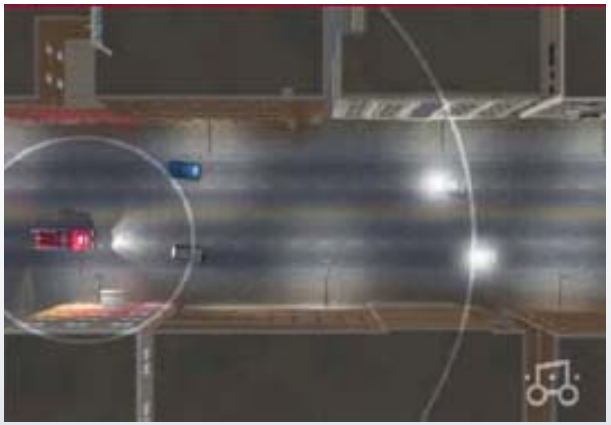
- Road maintenance vehicles and special cones in road construction sites should be equipped with a communication unit and send out information about lane closures or speed limits.
- The Car2Car Communication System receives this information and assists the driver.



Emergency Vehicles in Operation

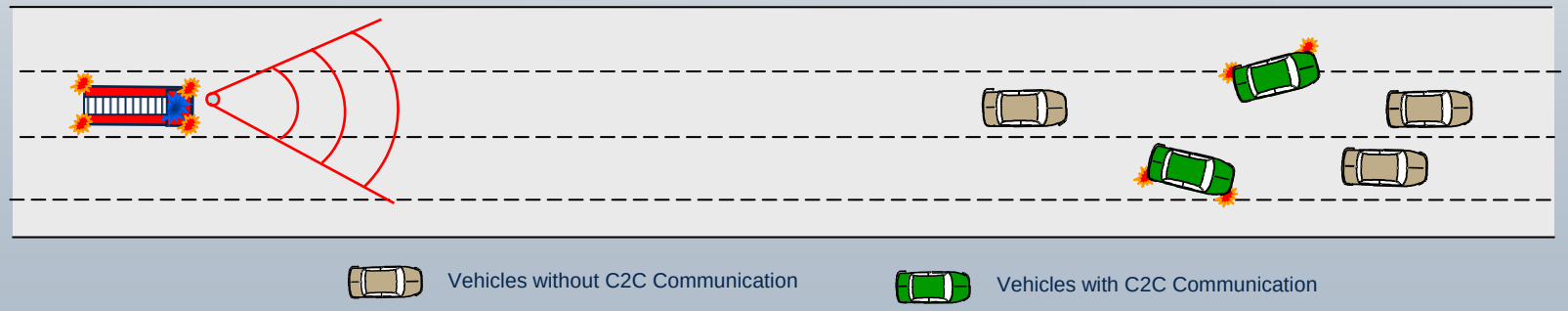
Problem

- Emergency vehicles in operation are often obstructed by other road users
- In urban areas it is difficult to identify from which direction the sound is coming



Solution

- Early warning when an emergency vehicle is approaching for clearing the road



Infrastructure to Car Communication

At Intersections

- Communication of information about stop signs or traffic lights
- Acoustic or visual warning will prevent the driver missing stop signs or red traffic lights

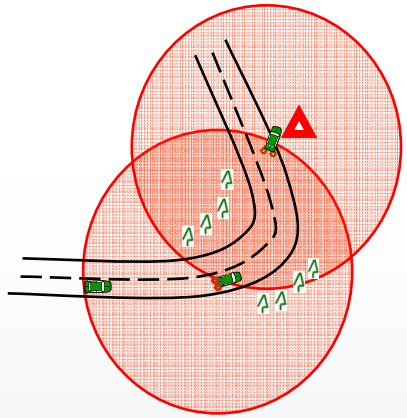
Along Roads

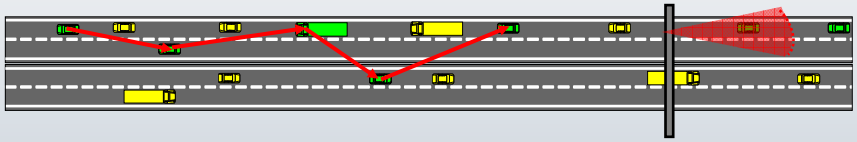
- Communication of the traffic sign information to allow traffic sign violation warnings
- The knowledge of speed limits might be used as input for automatic cruise control
- Provision of by-pass information
- Provision of parking information

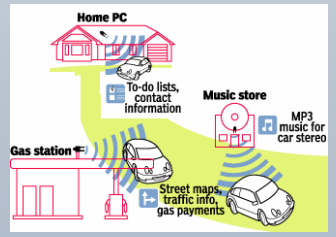
The Car2Car Communication System receives information and assists the driver if needed.

Features of the C2C System

- Broadcast with message forwarding
- Multi hop communication
- Geobased routing, considering the ongoing traffic
- Car to roadside unit communication
- Ad hoc networking
- Scalability
- Fast medium access
- Time critical safety related services
- Non time critical IP-communication

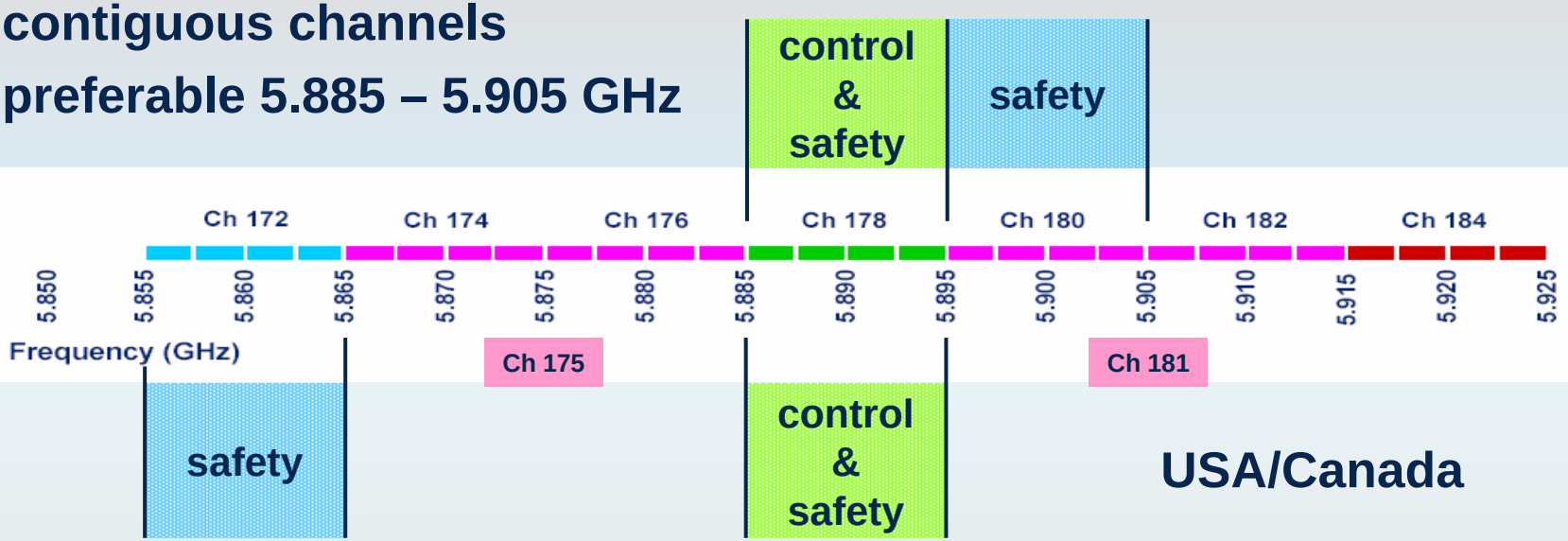






Required spectrum for critical safety applications

For Europe 2 x 10 MHz contiguous channels preferable 5.885 – 5.905 GHz



- In 1999 the Federal Communication Commission (FCC) allocated **75 MHz** of spectrum at **5.9 GHz** to be used for **v2v** and i2v communications.
- Prioritized public safety applications and private applications
- Standardization is in progress: **IEEE 802.11p, IEEE 1609 (WAVE)**

Worldwide harmonization

- European OEM's vehicles are marketed in the global marketplace.
- Direct use of WAVE[1)] / IEEE802.11p hardware used in US.
- Modification and adaptation of the software according to the European regulations.
- Avoiding additional product diversity and enabling economy of scale effects.
- Having different types of emergency communications systems may hinder safety.

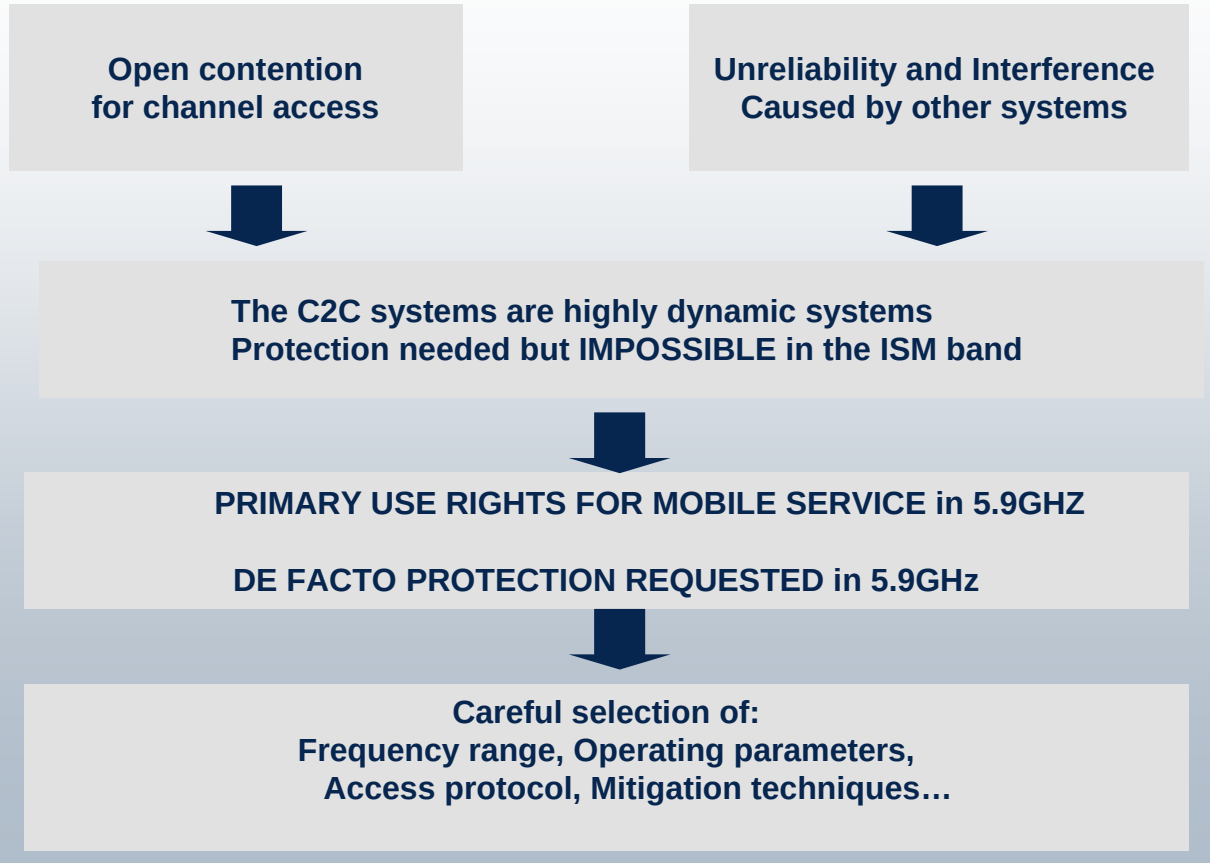
1) WAVE: Wireless **A**ccess for the **V**ehicular **E**nvironment

Requested licensing conditions

- The C2C system is a **Safety** priority measure of **Public interest.**
  - the spectrum for safety related ITS services must be individual license free.
  - The practical problems of licensing in a global car market are immense,
  - Drivers / Car holders are NOT willing to pay for the operation of safety systems, e.g. data transmission fees,
  - Safety applications are expected to have a very slow take-off if there are costly licensing policies.

Effective protection of C2C communications

- Road safety related car to car applications require **fast and reliable data communication.**



Infrastructure to Car Communication

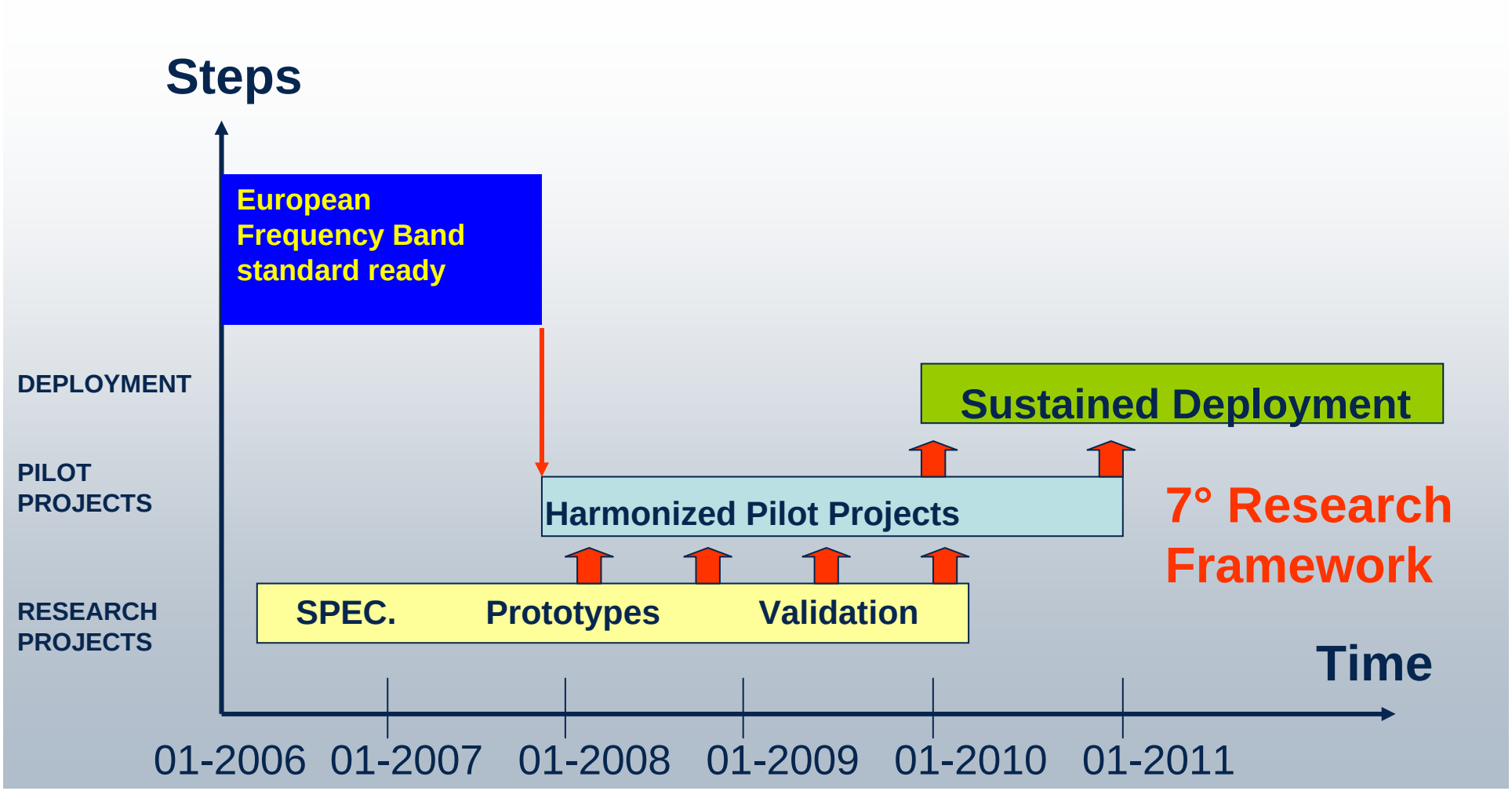
For non time critical i2v communication WLAN spectrum for outdoor usage in the range from 5.470 – 5.725 GHz is available:

- **in compliance with the existing regulations (DFS, TPC, max. TP 30 dBm e.i.r.p) defined in the decision ECC/DEC (04)08.**
- **IP based communications between vehicles and roadside units or at hotspots**
- **same hardware as for safety applications**
- **beneficial for market introduction due to broad range of applications**

Safety relevant applications must have the highest priority and should not be influenced by the hotspot communication.

Timescales for operational implementation

Deployment Roadmap



Summary

- Further reduction of the number of accidents and their severeness will be achieved with preventive road safety systems based on C2C communications.
- For economies of scale and for the international trade of the same vehicles on the major markets, spectrum should be available in the 5 GHz band.
- Spectrum with at least “effective” protection is required for safety relevant applications to provide quality of service, preferably 2 x 10 MHz at 5.885 – 5.905 GHz. This protection is not possible in the ISM band.
- For non time critical I2V communications WLAN spectrum for outdoor usage in the range from 5.470 – 5.725 GHz is available and should be used for market introduction, in compliance the current regulations .