DAIMLER

Cooperative Systems

- An Overview of WILLWARN and German National projects

Gerhard Noecker

Group Research and Advanced Engineering

Infotainment and Telematics

GR/ET

Stuttgart

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History

PROMETHEUS

Cooperative driving has its roots in the Prometheus Project!

First work 1988-1989 in the subprojects PRO-COM, PRO-NET and in Copdrive CED4

Technology: Radio location/orientation and communication

The Mercedes-Benz demo vehicle!

Photo taken at the Munich Test Track in preparation for the first board meeting

CED4 presentation: radio location and communication. Exchange of the intention of maneuvers and exchange of actual maneuvers. Display of the state for external observers through 2 lamps on the roof. The vehicles were driven by the drivers, no GPS!

During the course of the project, the focus shifted towards registration and communication of warning messages.

However, technology in location and communication has changed dramatically since then!

Applications for Vehicle Communication

On the road

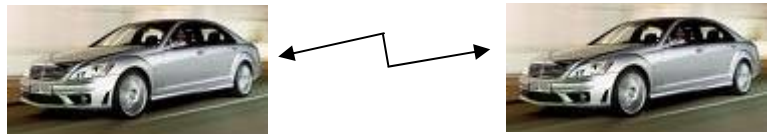
At intersections

- **Safety**
  - Hazard Warning
  - Maneuvering Assistance
- **Traffic efficiency**
  - Floating Car Data
  - Traffic Preview / Adaptive Driving
  - Green Wave Organization

Danger Warning

Traffic Preview

Intersection Assistance



Vehicle – Vehicle - Communication

Warning Beacons

FCD

Communication

with traffic lights

Vehicle – Infrastructure - Communication

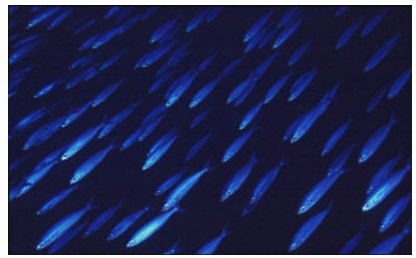
Cooperative Systems

Advance Information:
Sensing and communicating to get information ahead of time

- Drivers / cars get to know everything going on around them, even things they cannot sense themselves, and can condition themselves to react more quickly and in a better way.

Harmonious Driving:
Acting coordinated to avoid detrimental behavior

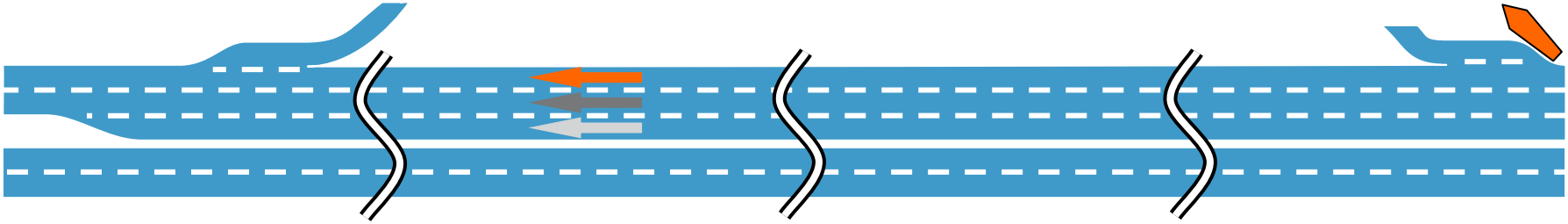
- Drivers / cars adapt their driving for higher traffic efficiency, better fuel economy, or avoidance of safety-critical situations.

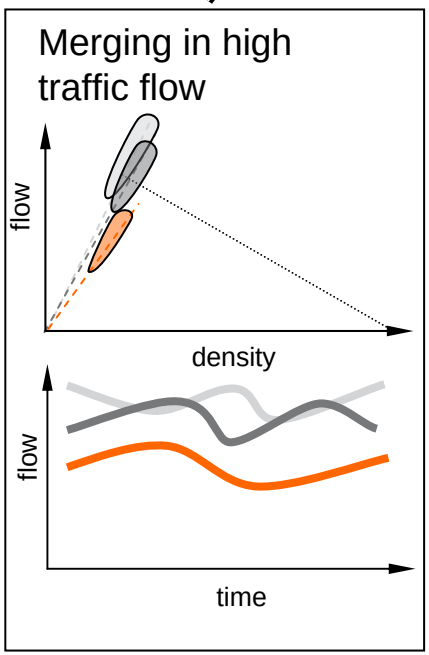


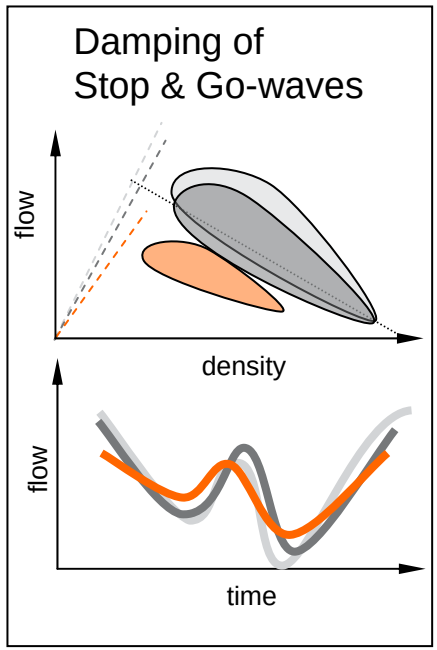
Cooperative Maneuvering:
Bringing it all together

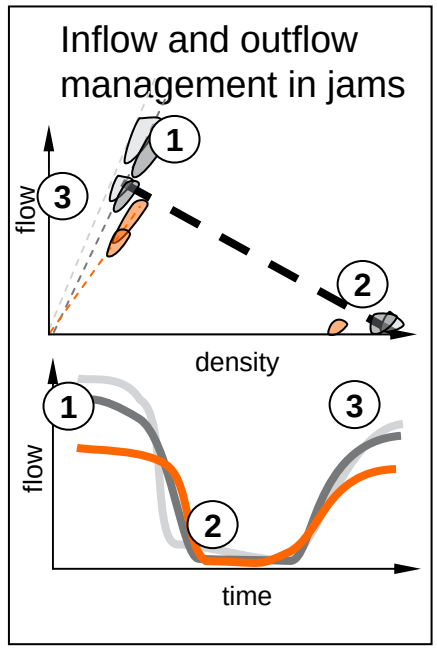
- Drivers / cars negotiate their driving maneuvers for higher road safety and road efficiency. Traffic lights communicate their status and phases.

Methods for Traffic Moderation









Driver-Recommendations and ADAS-Parameters for:
distance and speed behavior, lane choice, usage of gaps, merging assistance

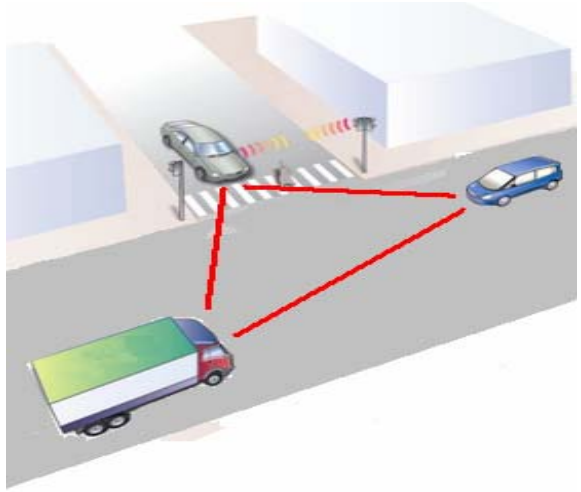
Intersection Assistance

Communication with Infrastructure

- State of traffic light
- State of phase

Inter-vehicle Communication

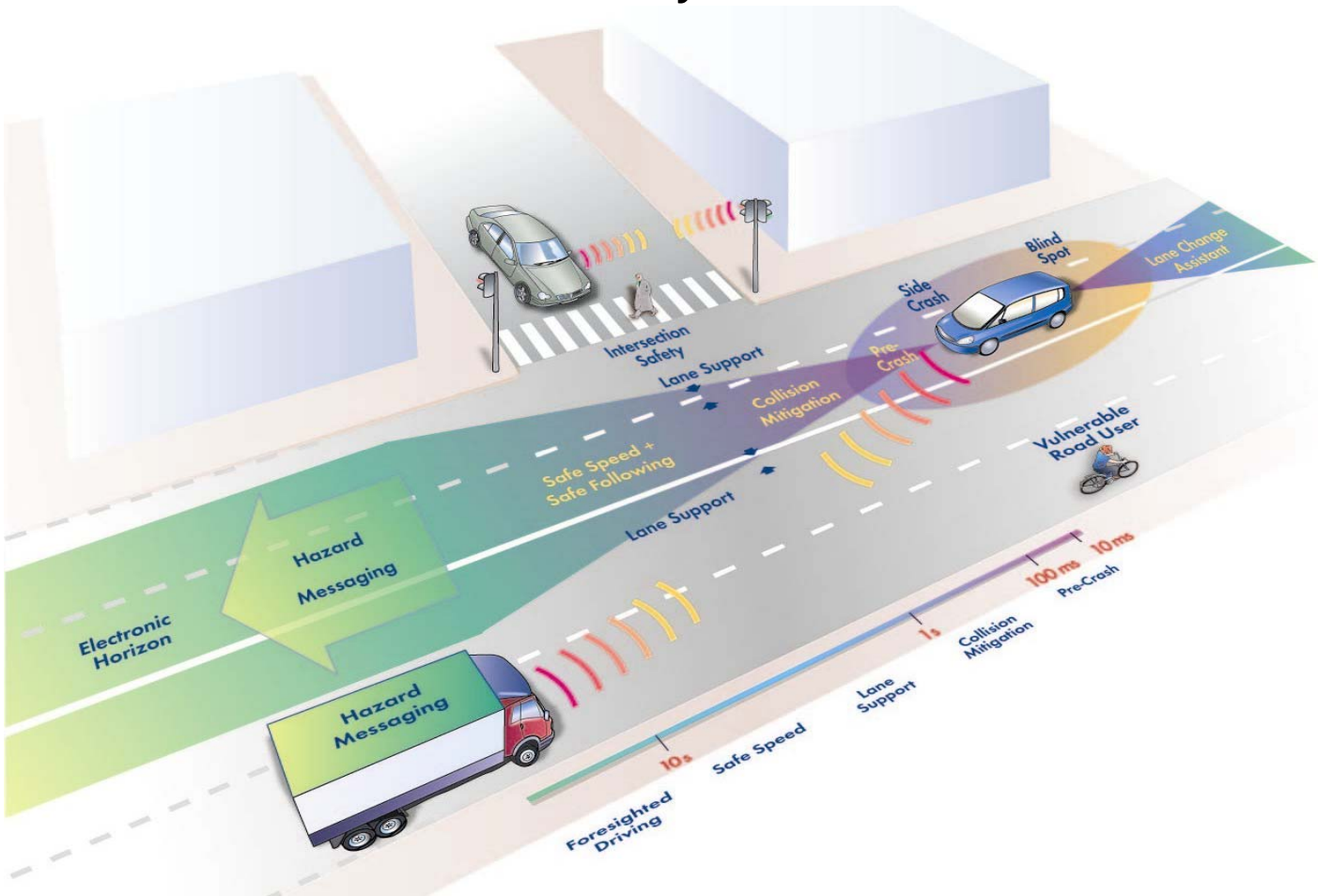
- Collision trajectories



Avoidance of red-light conflicts and collisions!

PReVENT - Cooperative Systems

WILLWARN - Wireless Local Danger Warning
INTERSAFE – Intersection Safety



PReVENT WILLWARN – Wireless Local Danger Warning

Supports the driver in safe driving by inter-vehicle communication. The electronic horizon enables foresighted driving.

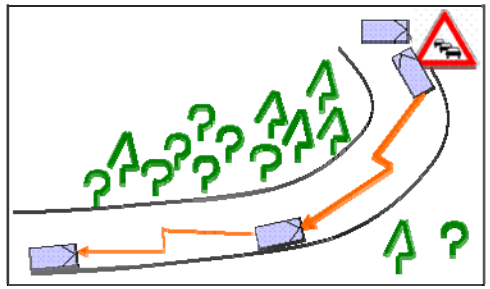
WILLWARN developed

- on-board hazard detection
- in-car warning management
- decentralized warning distribution by communication

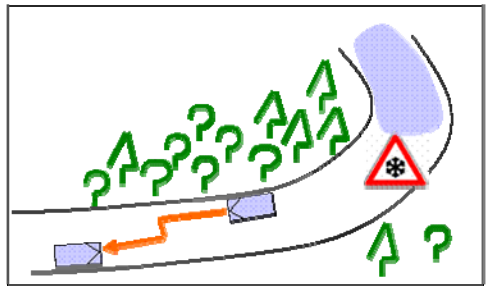
WILLWARN enables

- rural road and highway scenarios
- high benefit for the driver even at low equipment rates
- use of available low cost communication equipment

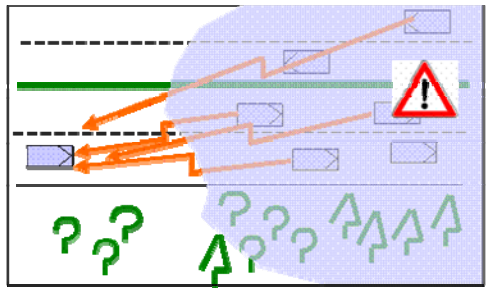
Obstacle behind a curve



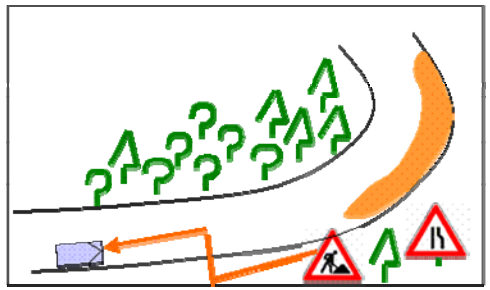
Low friction on rural road



Low visibility



Construction area

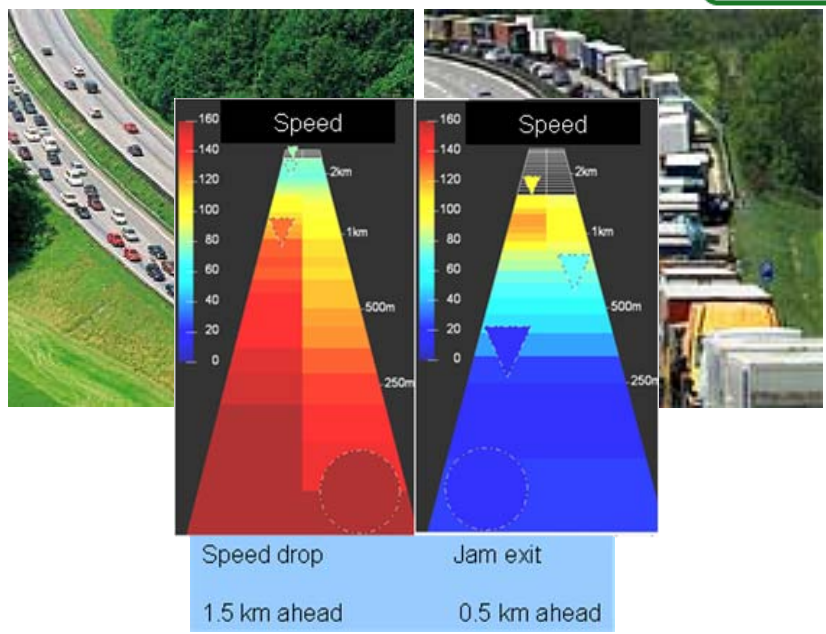


Project duration: 06/2004 - 05/2008
Partners: BMW, Daimler, Philips, CNRS, HTW, NTUA, TNO,
Funded by: EU

INVENT
Traffic Performance Assistance

Speed horizon through vehicle Communication

- Fast dissolving of traffic jams by inflow and outflow management
- Damping of Stop&Go waves trough foresighted and traffic adaptive driving
- Stabilization of high traffic flows in merging zones
- Increased safety by optimized traffic flow

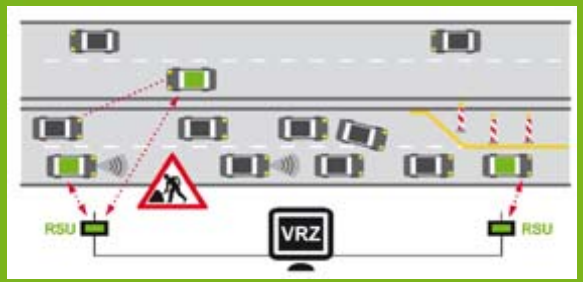


Project duration: 05/2001 - 05/2005
Partners: BMW, Daimler, Volkswagen, MAN, BOSCH
Funded by: German BMBF

aktiv – Cooperative Functions

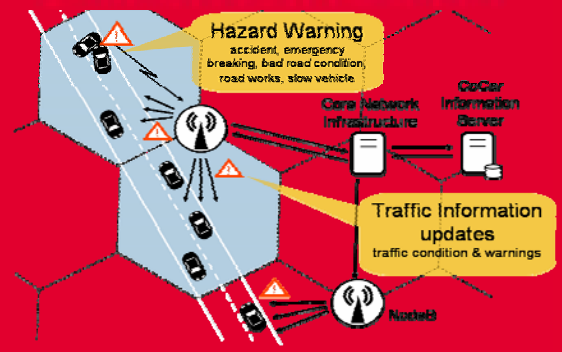
aktiv

Traffic Management



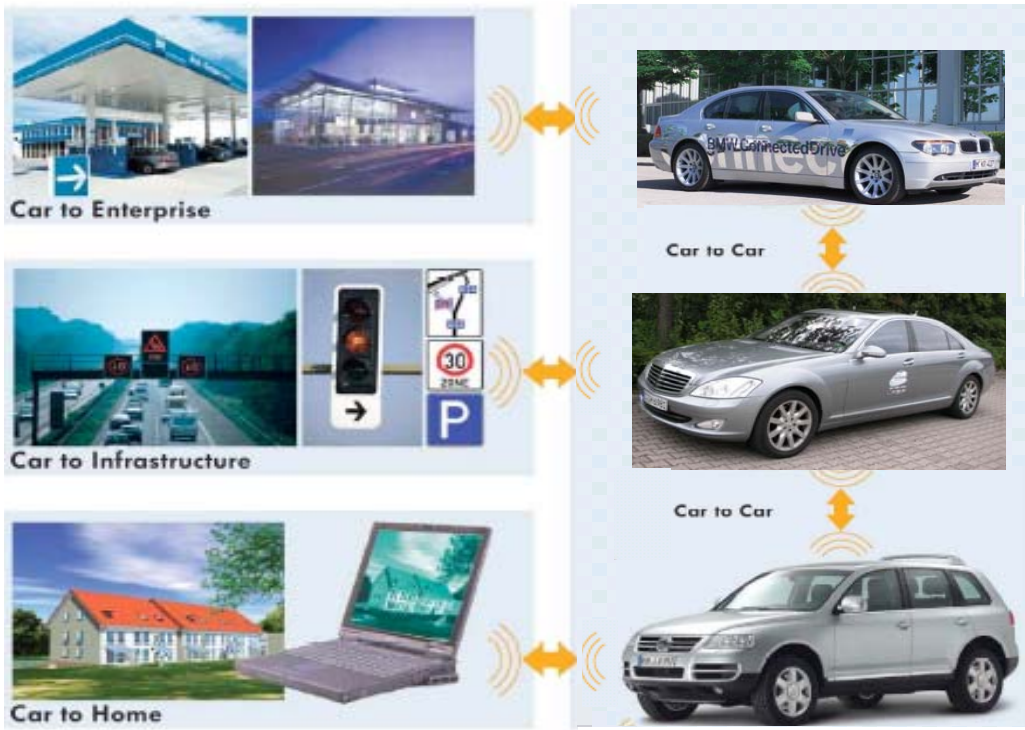
Active Safety

Cooperative Cars



Project duration: 09/2006 - 08/2010
Partners: 29 (automotive, supplier, research)
Funded by: German BMBF

NOW Network on Wheels



Objectives

– Development & specification of communication protocols based on WLAN technology
– Submission of results to C2C-CC
– Support of EU frequency allocation

Technical challenges

– Scalable and reliable communication system
– Active safety and deployment apps
– Security concept and protocols
– Strategies for market introduction

Project duration: 06/2004 - 05/2008
Partners: BMW, Daimler, Volkswagen, NEC, Fraunhofer, embedded wireless, IMST
Funded by: German BMBF

Planned Field Operational Tests
SIM-TD - Sichere Intelligente Mobilität

Demonstration and evaluation of applications in 3 categories

- Safety / hazard warning
- Mobility / traffic management
- Commercial applications / services

Validation of communications protocols

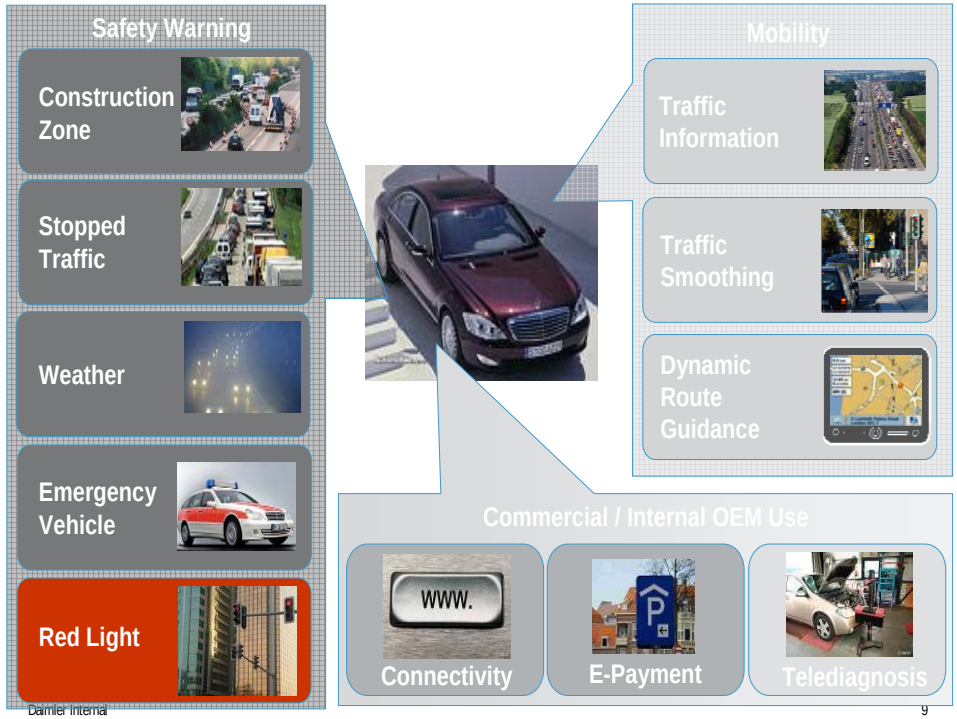
- Support for envisioned applications
- Scalability

Prototype communications infrastructure

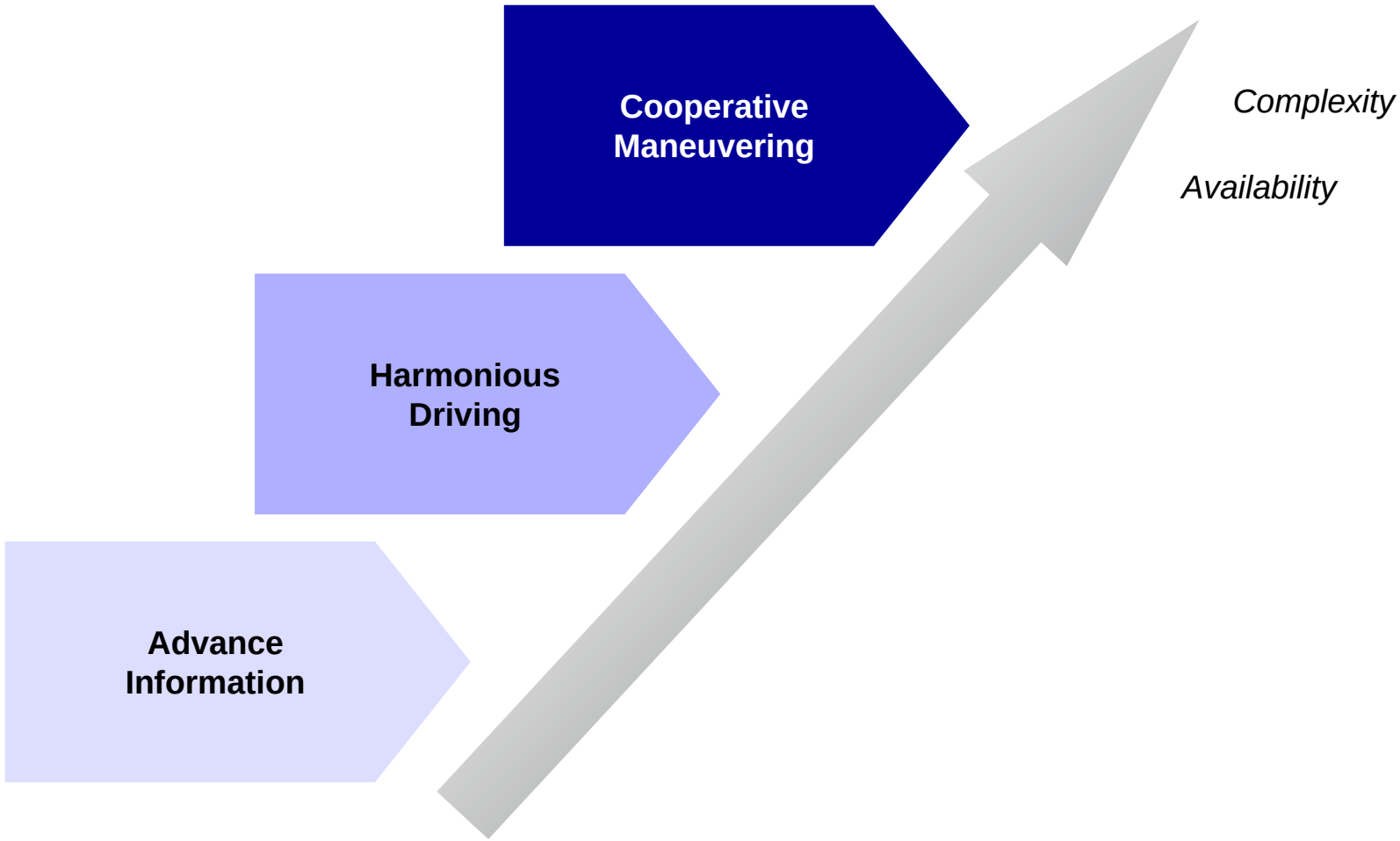
- Roadside Units (RSU)
- Networking of RSU and relevant servers

Prototype vehicle on-board unit (OBU)

Economic implications and deployment strategy



Timeline


Cooperative Maneuvering
Harmonious Driving
Advance Information
Complexity
Availability