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PRAXIS



THE CENTRE FOR EMBEDDED AND CRITICAL SYSTEMS

Dealing with the Driver

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Reminder: The Driver in the Loop

Constrained Physics versus Unconstrained Agents

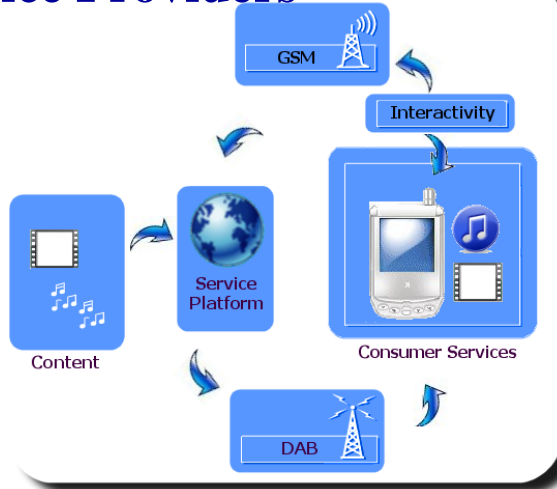


The New Car Myth

- Automotive market has been driven by the “Myth of speed”. While not every car is bought for performance, the market drive is clearly aspiration to a performance car targeting drivers (as opposed to passengers)
- Several factors are eating away at this myth:
 - Environmental awareness
 - Safety awareness and regulation
- The move to electric vehicles will strengthen this trend
- It is likely that the new “Myth” will be connectivity and service delivery or “on-board life” as some OEM marketing departments see it. But all this will be modulated by an increasing concern for professional levels of safety.

Key Players

Infotainment Service Providers



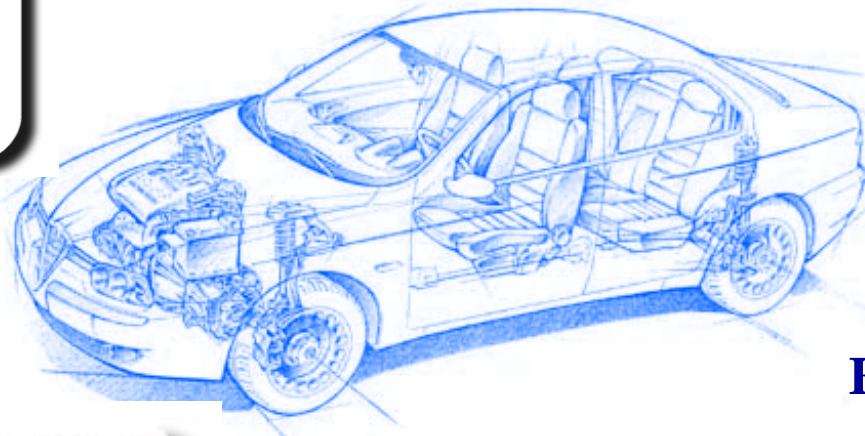
Road agencies



Emergency Services



Public Transport



Operators



OEMs



Insurance companies



Fleet operators



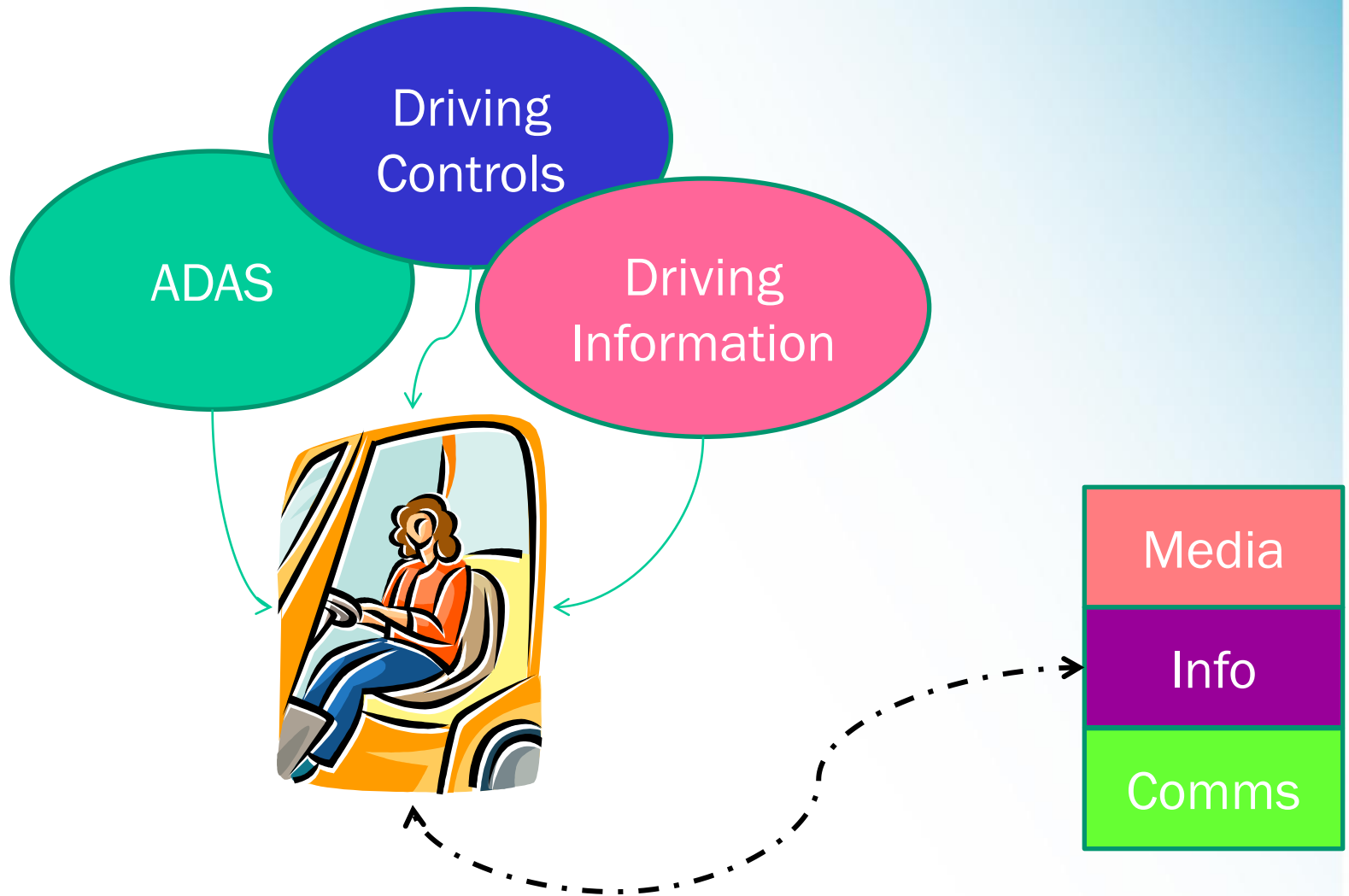
Driver Assistance

- In parallel to the move towards a new form of car marketing based on services, society is placing higher expectations on safety levels. Today this is shown by:
 - Car design effort around safety
 - Regulation (telephone restrictions for instance)
 - Increased number of speed cameras and the appearance of average speed detection
- The next step is likely to be a major effort in driver assistance and driver management

Driver Assistance Systems

- Today, driver assistance systems are isolated one-task systems such as cruise control, parking distance meters and such like.
- New systems such as forward looking braking are appearing, which will also have an increasing impact on the dynamics of the car
- The use cases and the economics mean that the current model will change towards integrated ADAS including sensor fusion and situation awareness to deal with potential conflict in the ADAS systems.
- Connectivity (car-to-car and car-to-infrastructure) will impact ADAS. Intelligent junctions for instance.
- Driver will be impacted by new information flows and, potentially, automated dynamics control.
- In addition to pure safety assistance, economy and journey management will be integrated. This will also allow position-based safety assistance

Driver Information Sources



Overview: Legal Background

- As technology possibilities increase governments are paying more attention to the impact on the driver. Notably there are discussions and, potentially, legislation around the following areas:
 - Use of hands-free telephone kits by the driver
 - Video playback in front while the car is moving
 - Use of visual maps within navigation systems
 - Speech input/output mechanisms for the driver
- Aiming infotainment at the driver may be a dead end!



So What Gets To the Driver and How?

- The reality is that a driver is occupied with a safety critical task. This implies that a driver can only have a controlled and prioritized interaction with the information flows. We could envisage:
 - Drive controls
 - ADAS
 - Navigation and traffic information
 - Basic audio media control
 - Pre-scheduled information updates
- This will be imposed by the in-car systems in the same manner as video is disabled in the front seat today.

There are Good Ways and Bad Ways to Present Information



Current Thinking

- Currently there are many ideas about restyling the driver/front passenger area:
 - Large area touch/gesture displays (the whole dashboard?) supporting a full windowing platform
 - Localised audio
 - Increased use of head-up displays
 - Increased use of voice (but probably no hands-free telephony)

There are Good Ways and Bad Ways to Deliver Information



Timing is Everything

- Information delivery to a driver needs to be done in a time positioned manner which reflects:
 - Driver load
 - Relevance to the driver's need within a time window
- Existing example – Navigation advice window
 - Perceived quality of a navigation system is strongly dependent on the management of advice with respect to the time around a required manoeuvre. Much effort in fine tuning this is performed by navigation suppliers
 - Tuned by position, speed and nature of manoeuvre to be communicated: Motorway exit slipway as opposed to a town roundabout.

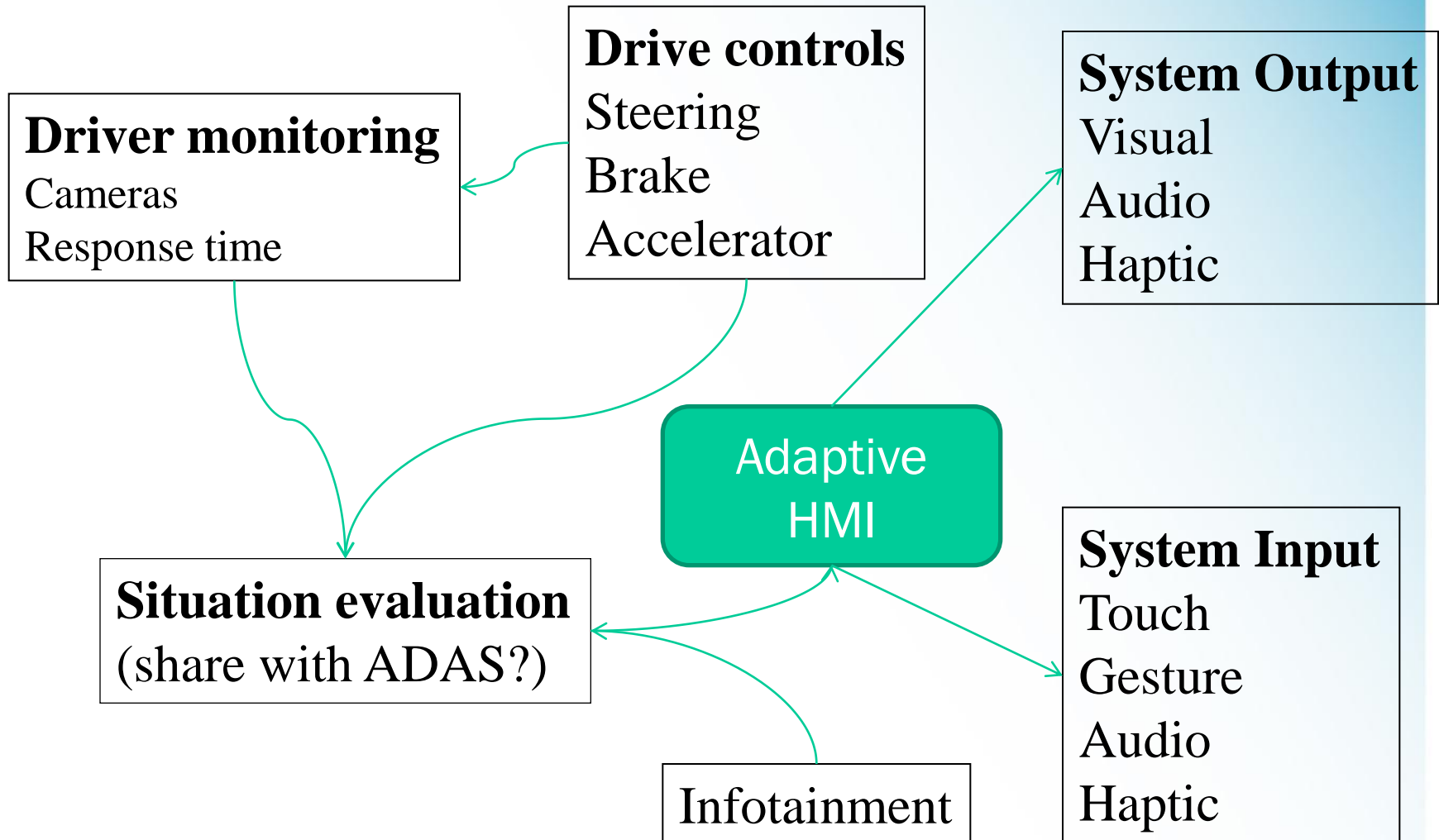
Information Competition – Driver Limitations

- Timing the information delivery needs also to take into account the driver limitations and the current load. A driver dealing with a difficult driving task (multi-way junction) can not comfortably deal with an email being read to him (one of the most common popular use cases promoted by OEMs at the moment).
- In particular it is essential to avoid the ‘hot potato syndrome’ i.e. making a radical switch in information urgency, style and required reaction (originally discovered in the aerospace industry).

Driver Workspace for the Future

- Bottom line – NOT A SOLVED PROBLEM
- Current discussions are around adaptive HMI: HMI displays which adapt to the driving situation. The HMI will automatically reconfigure based on the driver tasks and external situation. This will be a major add-on to the current technology addressing the driving task. Basic paradigm is likely to be the driver and the driving situation monitored by the system

Potential Development of the Driver Workspace



Adaptive HMI Actions (Potential)

- Adaptive HMI is the collective term for HMI which provides information in the best manner (mode), timing and urgency indication based on an assessment of:
 - Driving situation
 - Driver load/awareness
 - Basic human capacities
- Adaptive HMI will be a sophisticated function which will use its data sources to allocate display space, audio signals and even haptic feedback to present the information considered to be the priority at any given moment.

Examples

- Dangerous junctions could be indicated by a combination of a focus on a map coupled with an audio signal or even a relay from the forward looking camera. Typically this would come with a speed warning – perhaps in the HUD.
- The presence of black ice (information obtained from car-to-car communication) could be signaled by gentle vibration in the steering wheel at the appropriate moment.
- A car braking ahead could be indicated by an appropriate signal in the HUD or vibration in the brake pedal
- During a quiet moment (cruising on the motorway) the system can read emails – if such functionality is allowed in the future.

The work to be done

- Serious ergonomics studies of the appropriate modes and signals for communicating to the driver in the various use cases.
- Creation of high-integrity components to support predictable and safe HMI behaviour at all moments
- System integration of HMI, ADAS, Driver controls and connectivity
- A recognition that the connected model envisaged for the future car may be seriously restricted for the driver – at least during motion of the car.

Some Useful References

- <http://www.gstforum.org/GST> Open Telematics standards EU project
- <http://prevent-ip.org/en/home.htm> Preventive safety Applications EU Project
- <http://www.safespot-eu.org> Intelligent vehicles and Intelligent roads for safety
- <http://www.car-2-car.org/> Communication standards and use cases for controlled car2car and car2infrastructure communication
- <http://www.esafetysupport.org/en/welcome.htm> European initiative to support technology support for safety
- <http://www.eimpact.info/> Socio-economic evaluation of Intelligent Safety Systems in vehicles
- <http://www.inro.ca/en/index.php> Traffic planning software company
- <http://www.itu.int/ITU-T/lighthouse/articles/car.html> ITU article on Networked car
- <http://www.thecarthatstopsitself.com/> Article on Volvo active braking
- http://www.westernsystems-inc.com/localintersection_software.htm Site dealing with intelligent intersection management in the US