



EMERGING TRENDS IN AUTOMOTIVE ACTIVE-SAFETY APPLICATIONS

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OUTLINE OF THE TALK

- Introduction
- Landscape of Safety Features
- Recent Trends
 - Electronics, Software
 - System Architectures
 - System Integration
- Research Challenges
- Conclusion

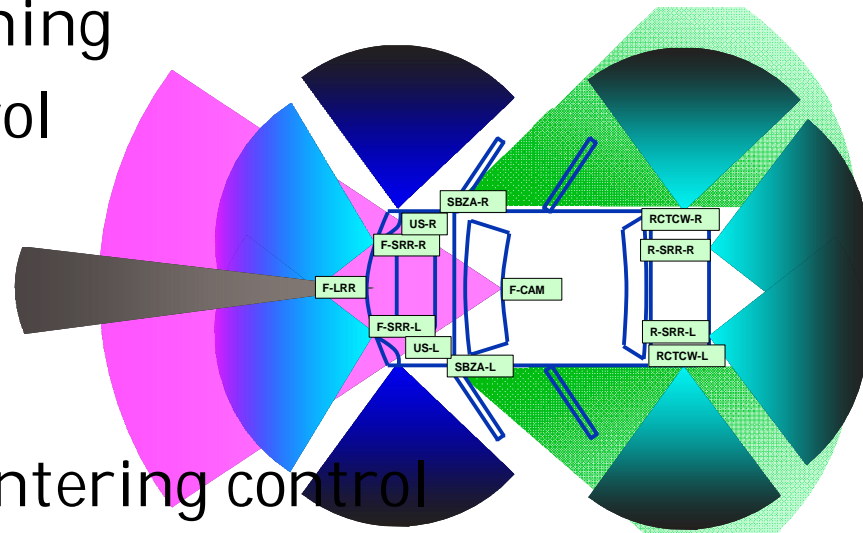
ACTIVE SAFETY AND DRIVER ASSISTANCE SYSTEMS

○ Goals

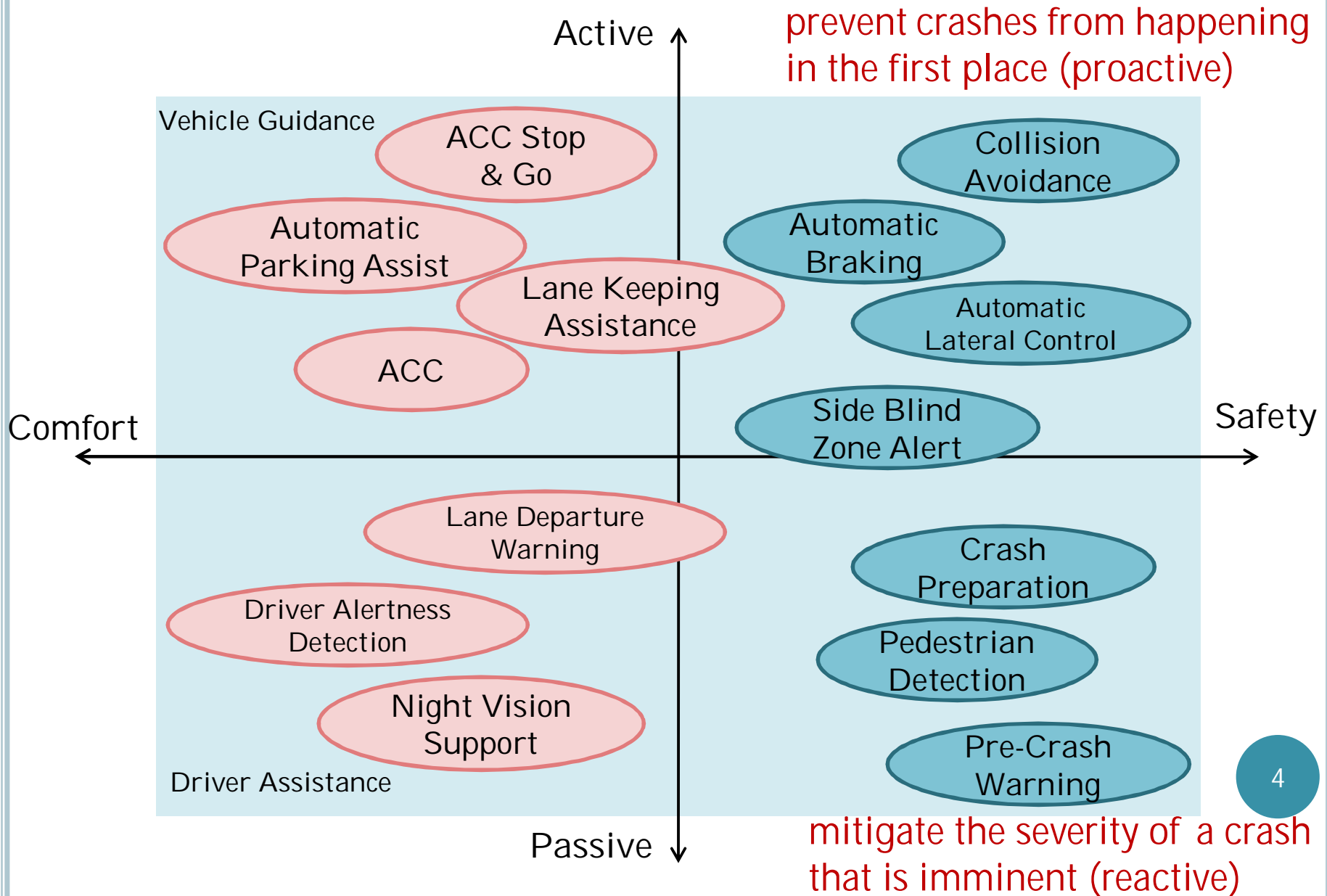
- Enhance safety of vehicle and occupants during various driving maneuvers; avoid crashes
- Enhance convenience of driver of the vehicle

○ Examples

- Forward collision warning
- Adaptive Cruise Control
- Curve speed control
- Side blind zone alert
- Lane change assist
- Lane keeping / lane centering control
- Cross traffic collision avoidance
- Parking assist

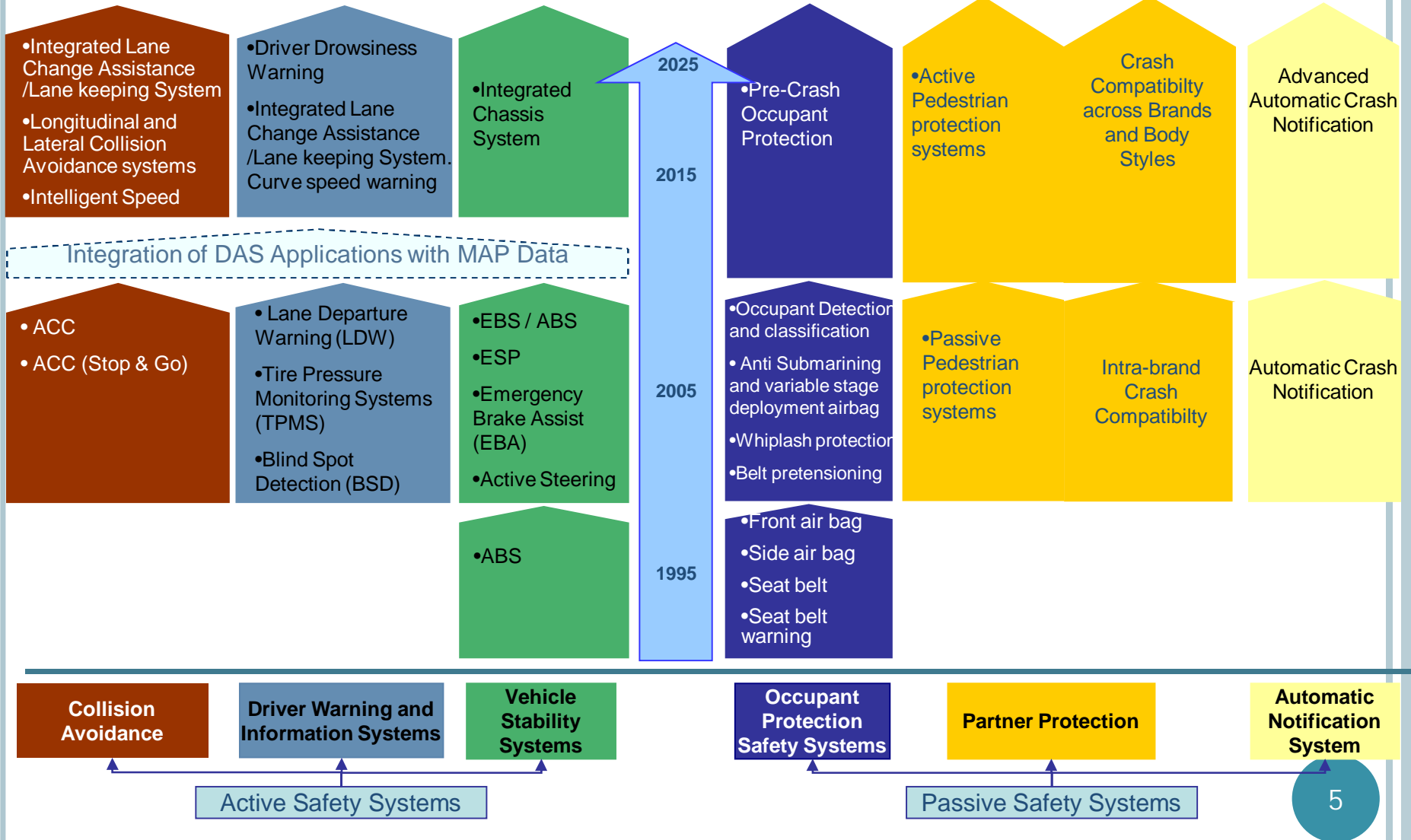


LANDSCAPING OF SAFETY FEATURES



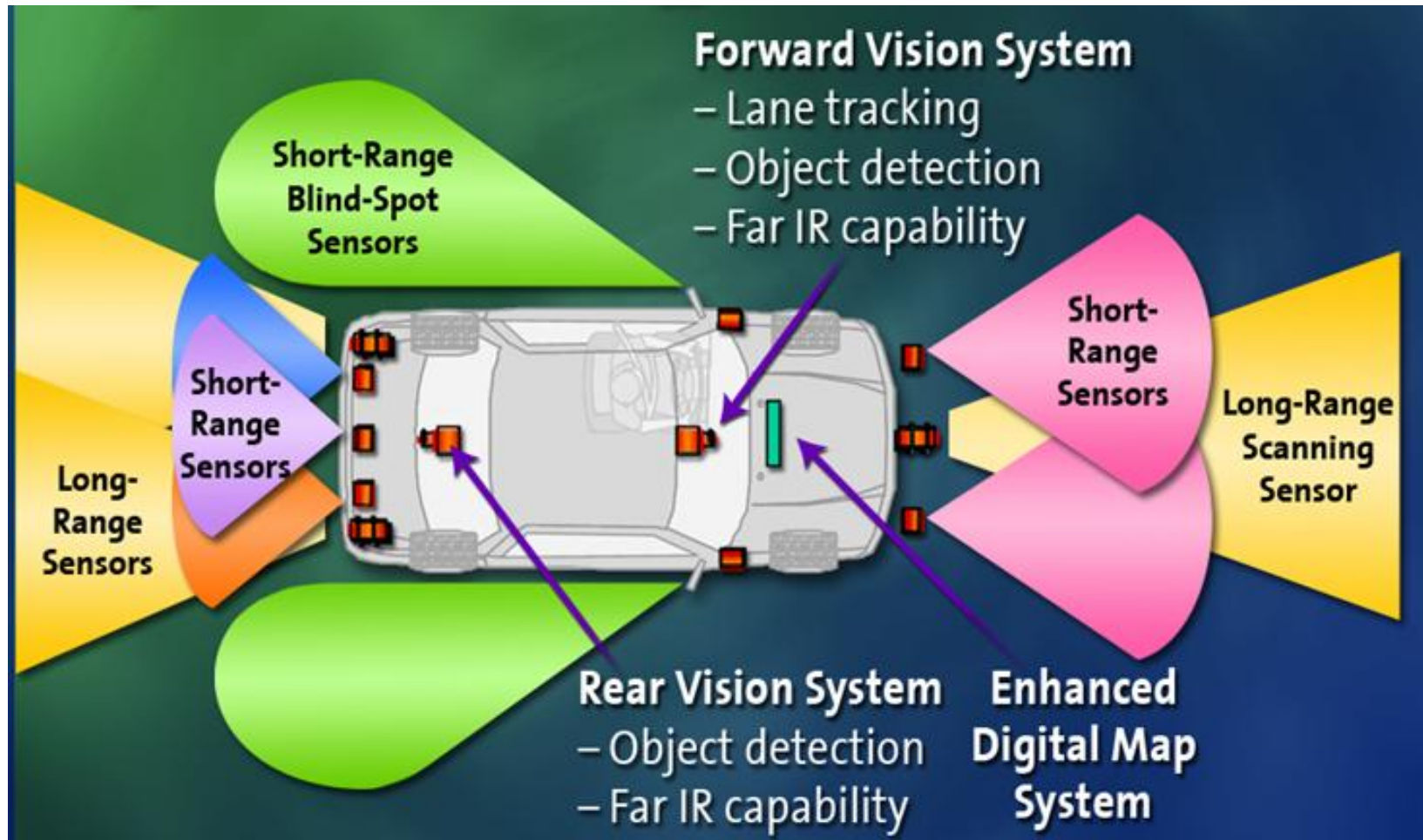
SAFETY SYSTEM EVOLUTION 1995-2025

Inter-section support, Urban Driving Assistance, Rural Driving Assistance

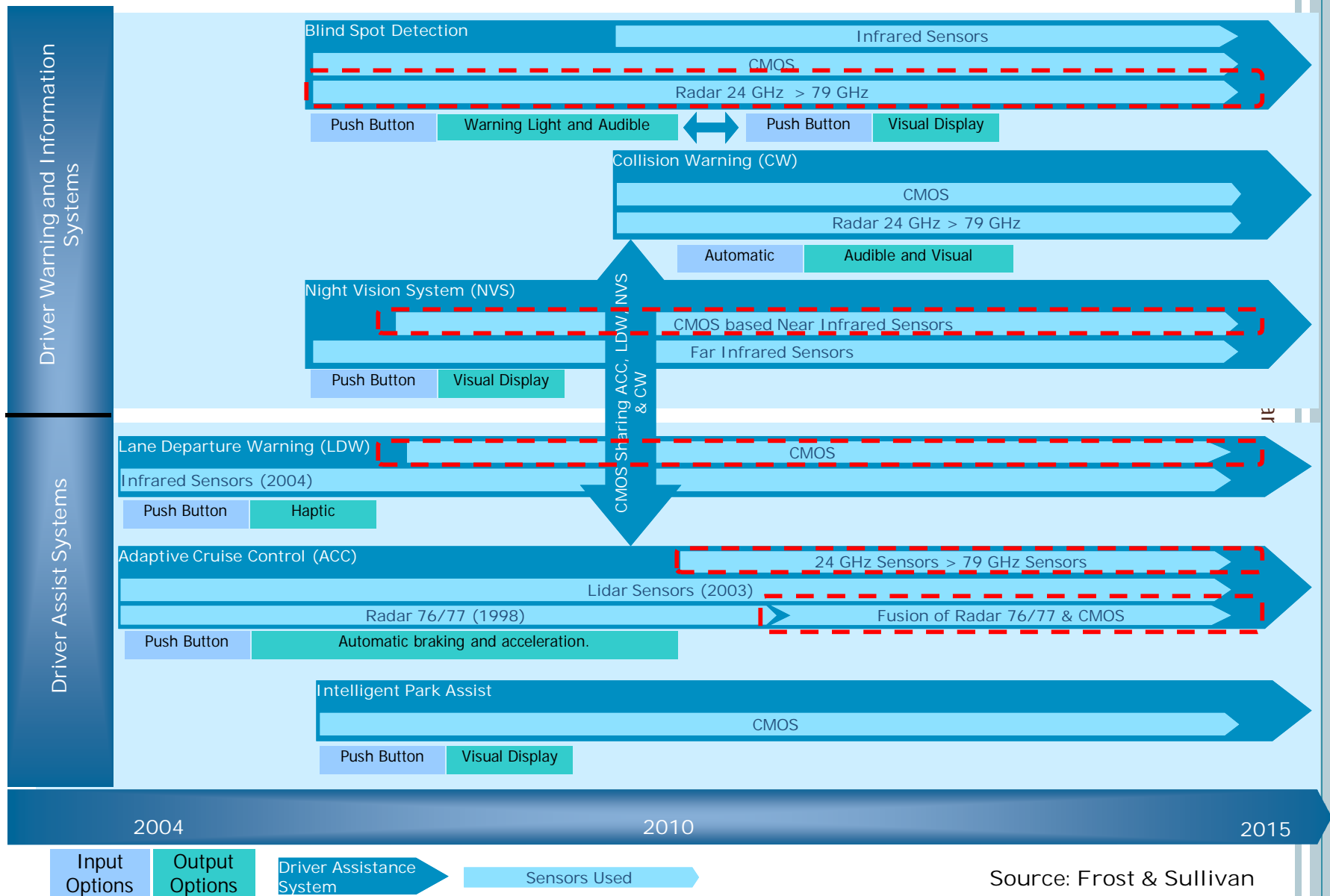


Source: Frost & Sullivan

360° SAFETY WITH INTEGRATED SENSOR STRATEGY

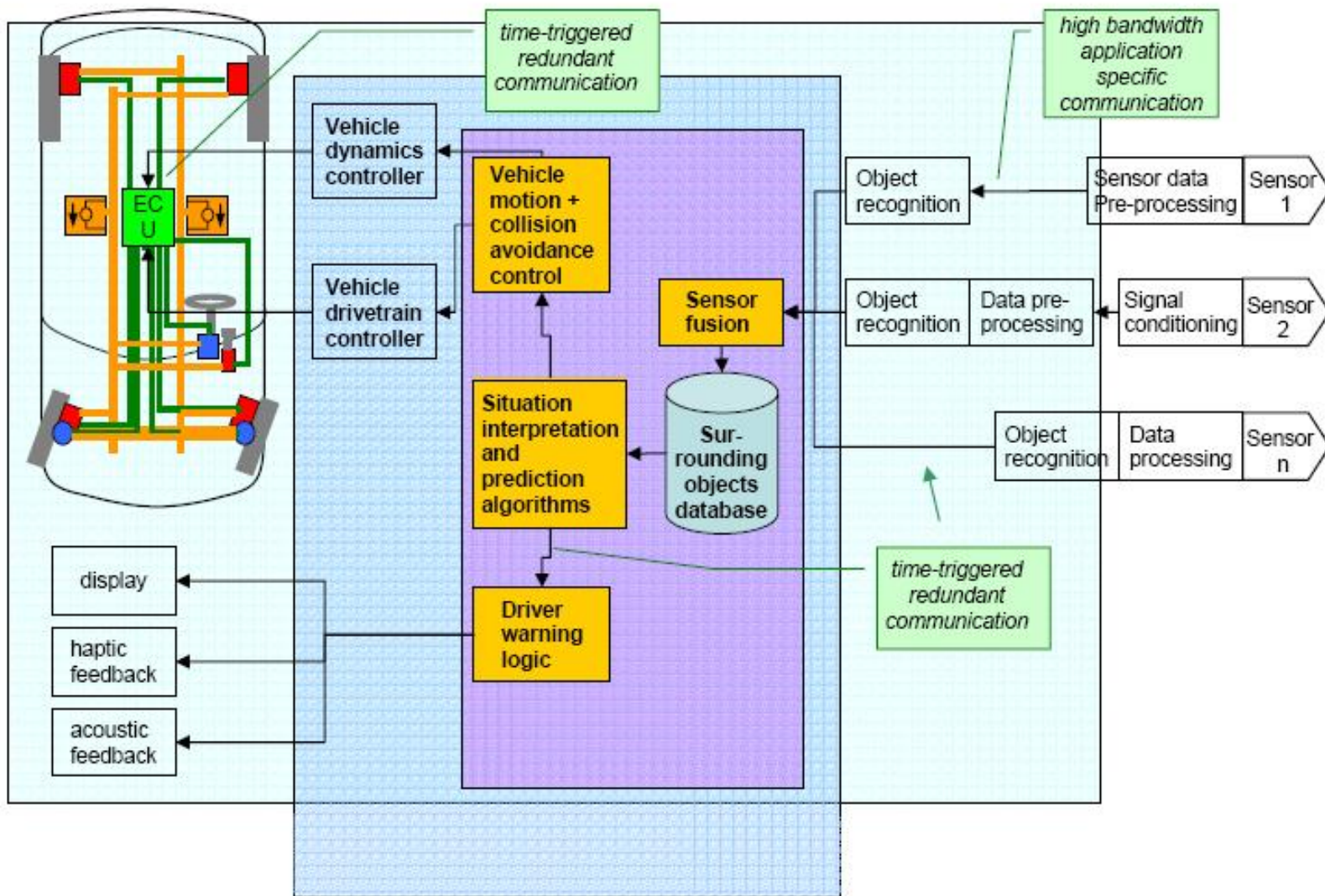


KEY DIMENSIONS – SYSTEMS, SENSORS, HMI

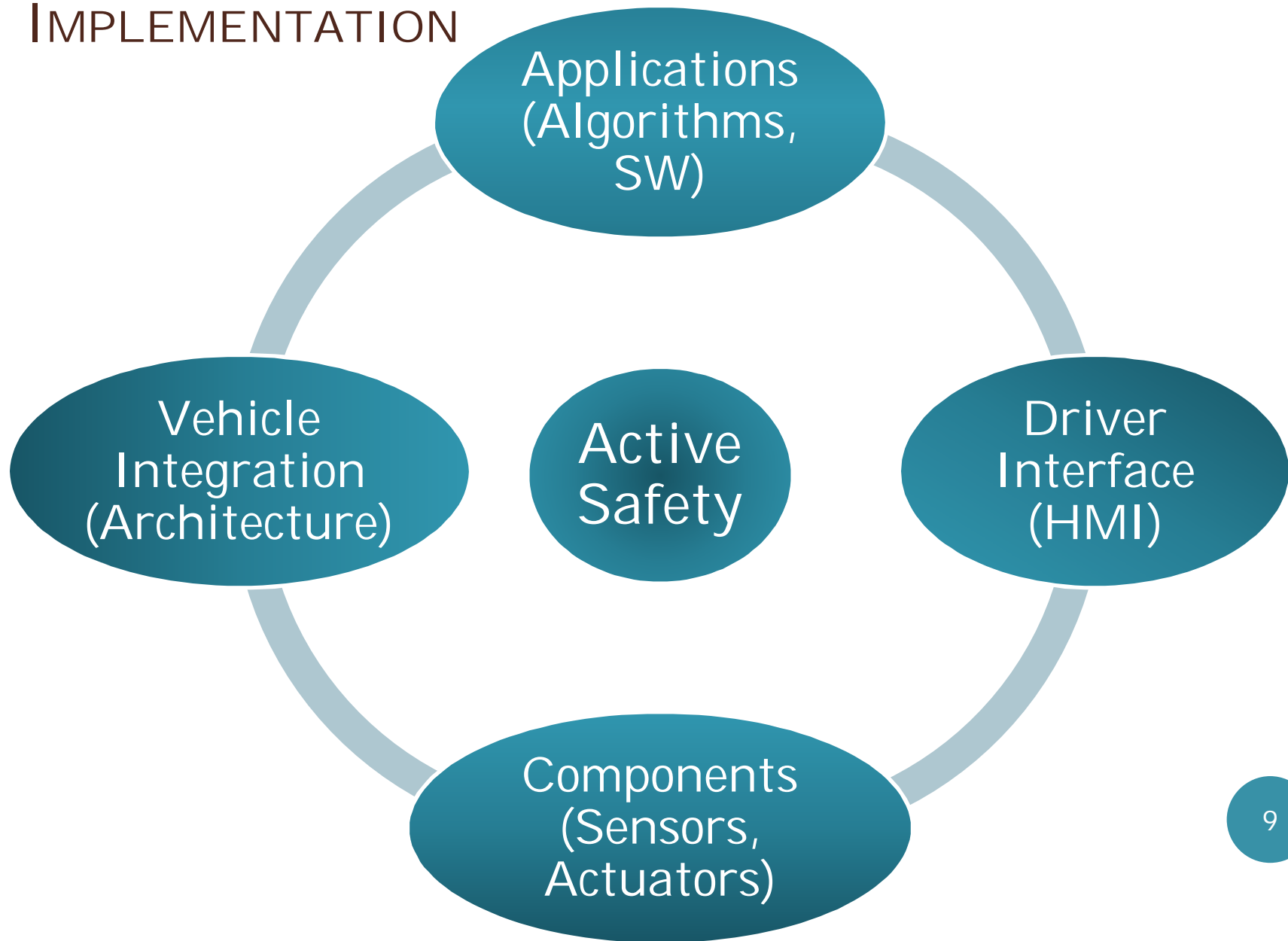


Source: Frost & Sullivan

COLLISION AVOIDANCE SYSTEM - ARCHITECTURE



PERSPECTIVES ON ACTIVE SAFETY FEATURE IMPLEMENTATION



LANE DEPARTURE WARNING - EXAMPLE

Components

- CMOS sensors (e.g., camera)
- Image processing ECU
- Electronic steering actuator for steering wheel vibration

Algorithms



- Lane recognition based on lane-markings
- Consideration of curves
- Monitoring of vehicle dynamics and driver actions

Vehicle Integration

- HW integration
- Serial communication bus interfaces
- Sensor fusion



Driver Interface

- Vibration warning via steering wheel
- System warning strategy
- System status via icons in instrument panel

CHALLENGES WITH ACTIVE SAFETY SYSTEMS

- 360° sensing via vision, radar, infrared, sonar
- Sensor fusion for higher level situational awareness
- Robustness: how should the vehicle behave in anticipation of every possible real-world driving scenario, in the presence of variability in:
 - Driver experience, skill level, and mental state (e.g., age, drowsiness, inattentiveness, impairment)
 - Vehicle state of health / maintenance / repair
 - External environmental factors (weather conditions, road conditions, traffic conditions)

CONCLUSION

- There is a lot of activities going on in this space...
- Future “sensor-dependent” systems will be the key differentiator in active and passive safety features.
- Consumers are becoming increasingly comfortable with “driver-aids” and demand more relief from the tedium of driving.
- Active safety, by-wire technologies, cooperative driving, drive-train powered by electric motors, etc.
 - will help us inch towards “autonomous driving”

Thank
You