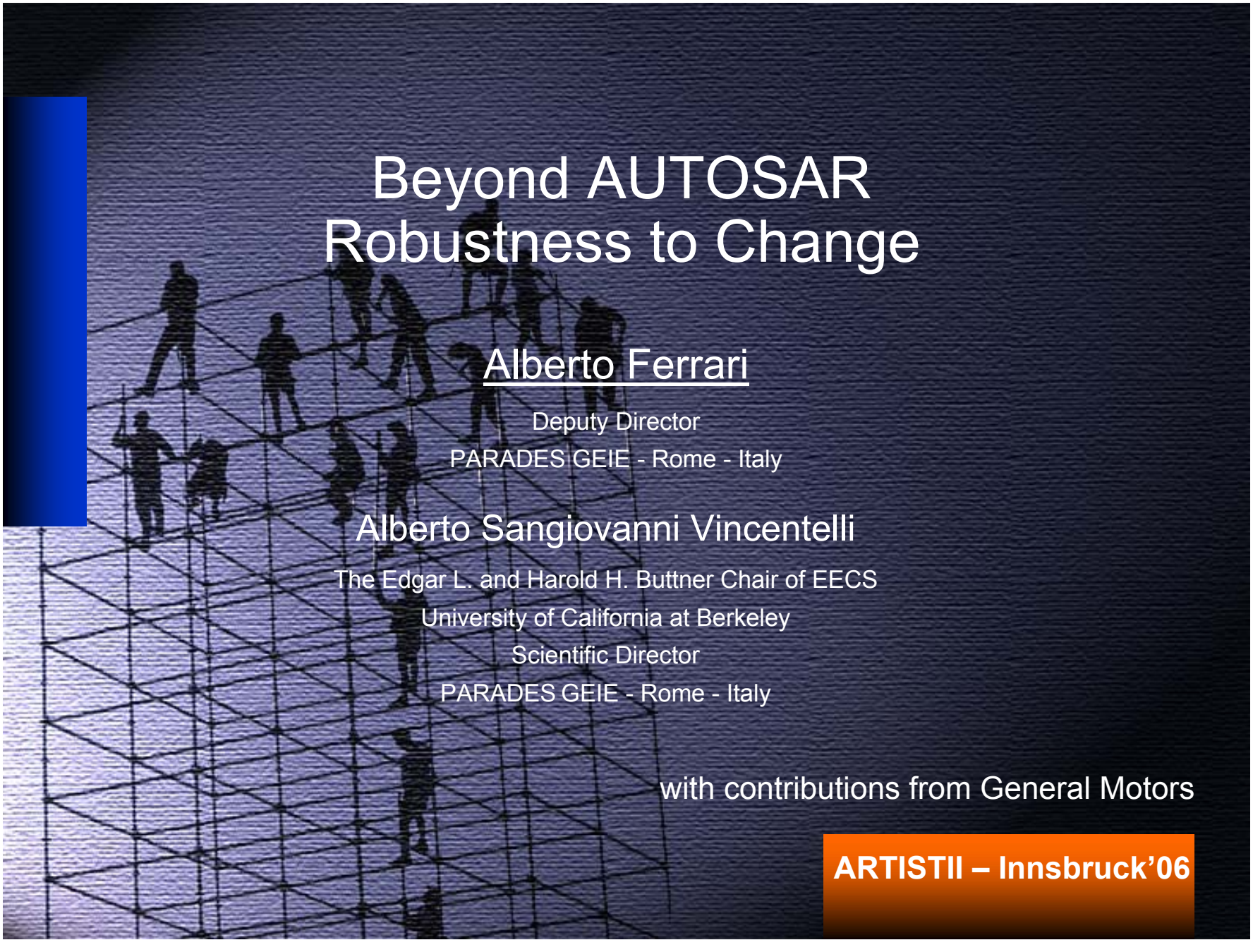

Beyond AUTOSAR
Robustness to Change

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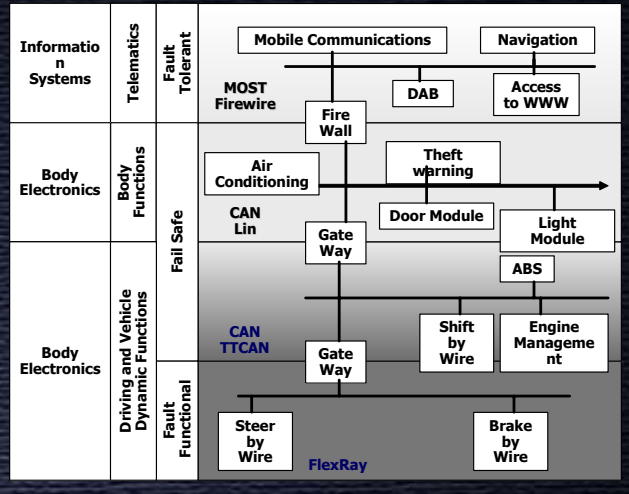
Key Issues

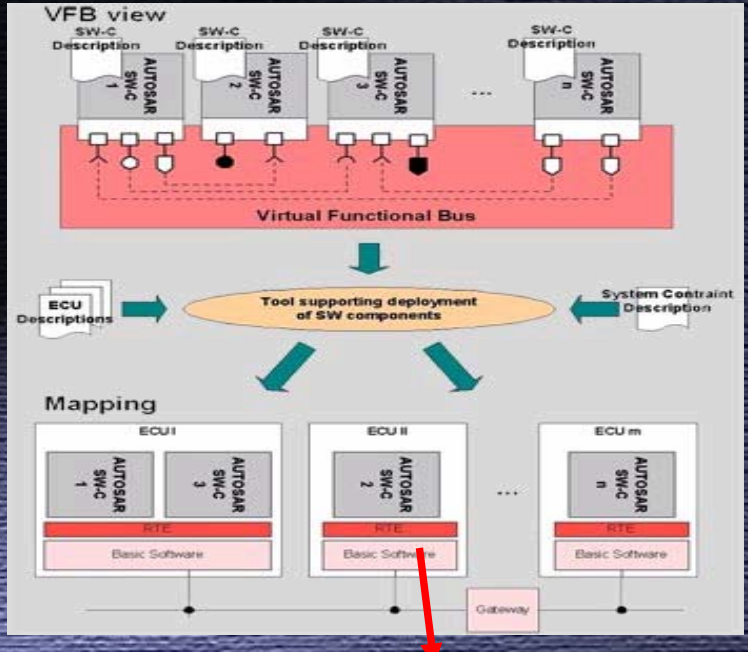
- Commonize as much as possible electronic platforms
- Optimization and integration
- Robustness to change
  - Include fail-safe, fail-soft issues
- Need for a virtual integration environment that allows the architect to take advantage of the architectural degrees of freedom and efficiently analyze the impact of the changes.

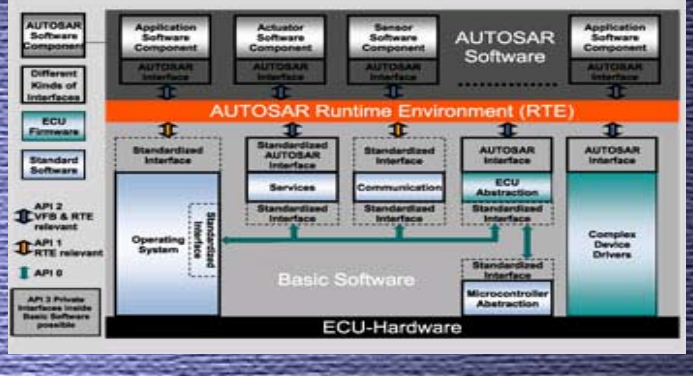


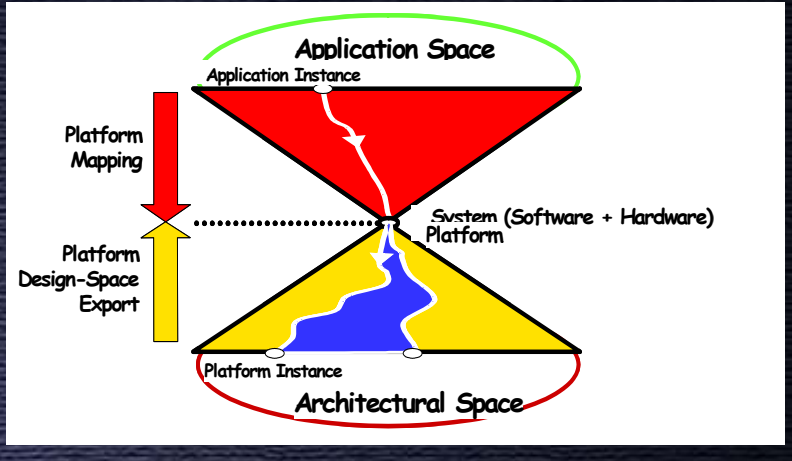
Strategy for Commonization

- Potential areas of commonization
  - Process
    - Development and deployment
  - Architectures
    - Functional architecture
    - Subsystem architectures
    - Hardware architecture
    - Software architecture
  - Components
    - ECU components
    - Software components
    - Sensor/Actuator components

AUTOSAR: decoupling functionality from platform







- Mapping performed at design time:
  - Require non functional information
  - Optimize solutions for known application/architectural space
- Control architecture not addressed

Rich component models: decorate components with non functional views

- Time views:
  - WCET, state based ET
  - WCCT
- Safety views:
  - Fault masking & detection
  - Fail silent, fail operational behavior
- Power views:
- …

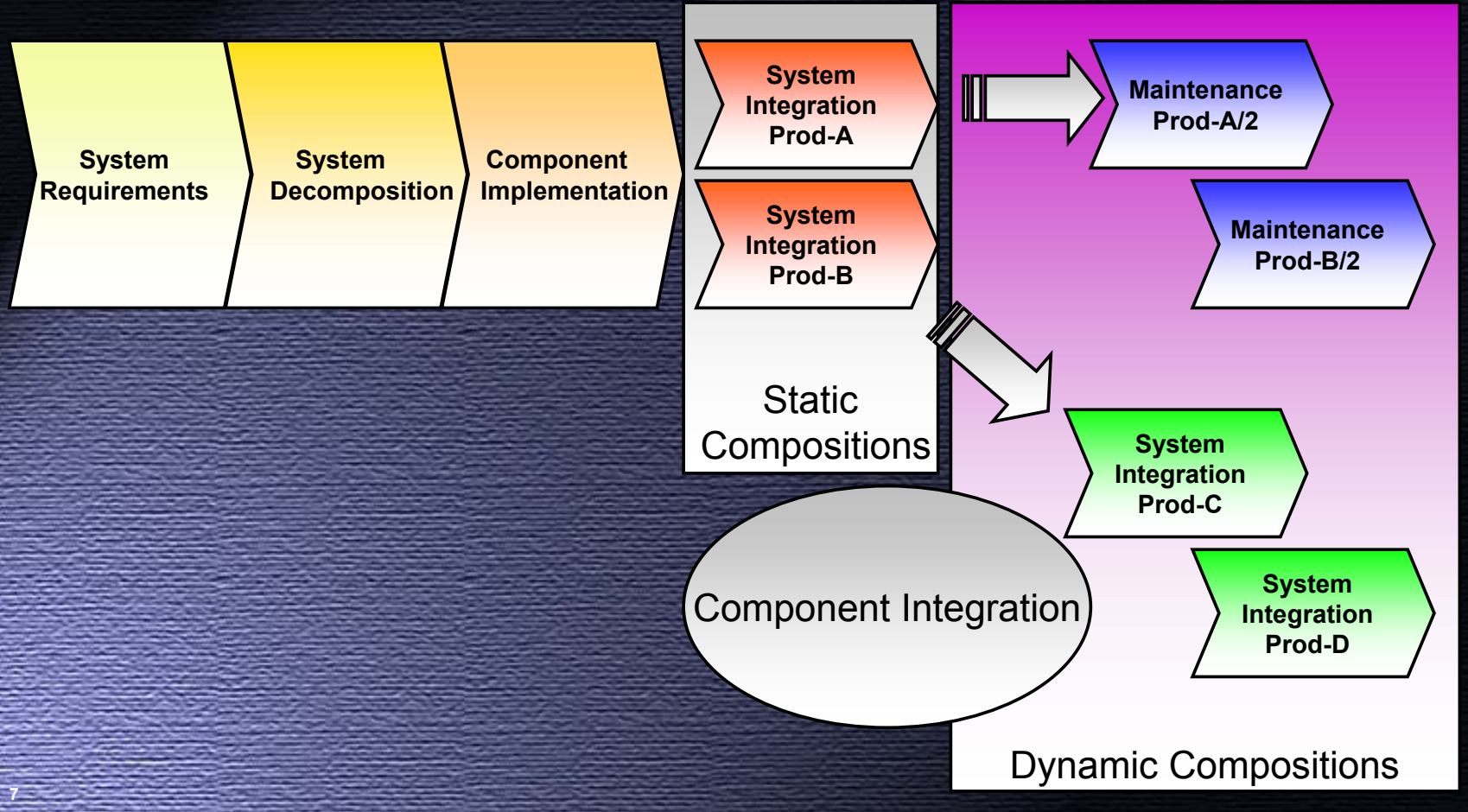
Beyond AUTOSAR: Robustness to change

- Capability to adapt to changing conditions
  - Changing conditions known at design time,
    - Solved at design-time
      - E.g. product variants
    - solved at run-time

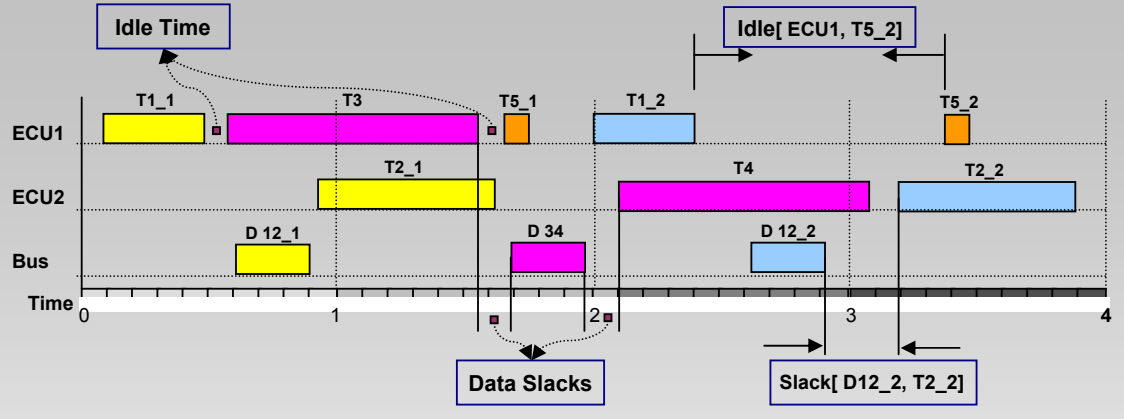
  - Changing conditions unpredictable at design time:
    - minimize sensitivity at design time
      - Extensibility, scalability (incremental mapping)
    - solved at run-time
      - Run-time adaptability

Beyond AUTOS@R

Robustness to change: designing for dynamic integration



Communication robustness



- **Focus on optimally utilize redundancies in schedules for extensibility and scalability**
  - Idle time and slacks are traditionally incorporated in hard real time embedded systems schedules to increase system robustness
- **We should utilize these redundancies to:**
  - Tolerate incremental design changes

Capture the Metrics

Extensibility		Scalability
• Tolerate changes of Task WCET • Tolerate changes of Data WCTT	Motivation	• Accommodate NEW tasks by statically scheduling them on a legacy system
• Maintain Bus Schedule • Maintain non-involved ECU schedules • Maintain involved ECU schedules without reconfiguration	Implementation	• Provide blocks of computation time for future computation intensive tasks • Provide porosity in schedules to allow for future tasks with tight deadlines

• Message left & Right slack
  • Max Sum of all slacks
  • Min Variance of all slacks
	Approach	• ECU idle time distribution
		• Bus idle time distribution
		  • Evenly distribute all idle time

Adapting to change

- Reconfiguration of software (hardware) and communication mapping
  - At Initialization: components agree on the software task and communication mapping
  - Maintenance and component reuse
- Run-time adaptability:
  - Components agree on new mode of computation and communication at run-time
  - Robustness to faults

Thanks