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INTERACTIVE TESTING OF AUTOMOTIVE FUNCTIONS

UCAAT 2014

**BMW
GROUP**



Rolls-Royce
Motor Cars Limited

SOFTWARE IN THE CAR. INNOVATION.



SOFTWARE IN THE CAR. CHALLENGES.

Connected Drive

Nahlose Vernetzung digitaler Lebenswelten

Individuelle Unterhaltung - Always online

CE Devices perfekt ins Fahrzeug integriert

Steuerung und Anzeige von Inhalten über Fahrzeug MMI.

Infotainment

Direkte Kundenbeziehung ohne Umwege

Kontinuierliche Aktualität und exklusiver Kundenzugang

Neue Kundenfeatures durch pfiffige Apps schnell umgesetzt.

Fahrzeug und App verschmelzen zu einer Einheit.

Mobility

Intelligente Fahrerunterstützung durch Car-to-x Communication

Immer die richtige Information zur richtigen Zeit

Immer stressfrei ans Ziel

Automatisiertes Fahren im fließenden Verkehr

Driver Assistance

Wesentliche Informationen jederzeit im Blick

Head Up Display und FPK

vom Fahrzeughersteller zum Mobilitätsdienstleister

Lückenlose Mobilitätskonzepte

Electric Mobility

Cleveres Energiemanagement

Häblierung elektrischer Energieverbrauch

Intelligente Lade-Kommunikation

PLC-CP: Lastlast-empfindliche V2X-Kommunikation
PLC: Power Line Communication

Innovative Kundenfeatures

CO2 Free Lades, Vehicle-to-Grid, Vehicle-to-Grid

Skalierbares Energiebordnetz

Für alle Antriebsstypen: Klassisch, Hybrid, Elektro

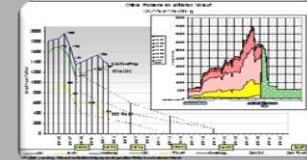
➤ In-vehicle software becoming more and more important.

➤ Rapid cycles in hardware technology.

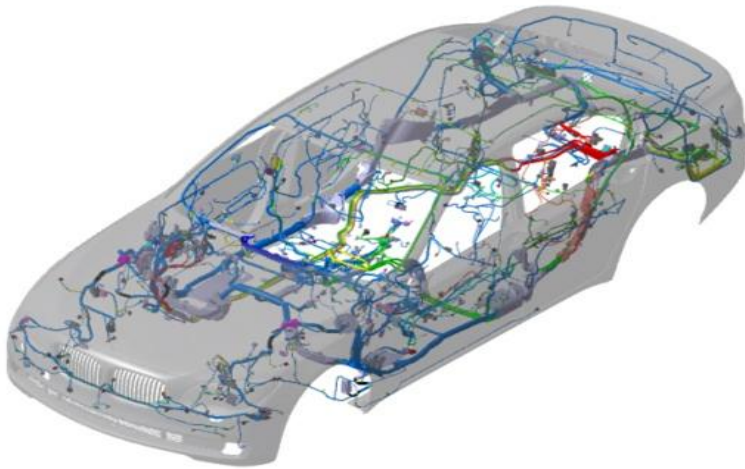
➤ Increasing connectivity.

➤ Rising consumption of electricity.

➤ Ensure product quality.



SOFTWARE IN THE CAR. BMW 7 SERIES.

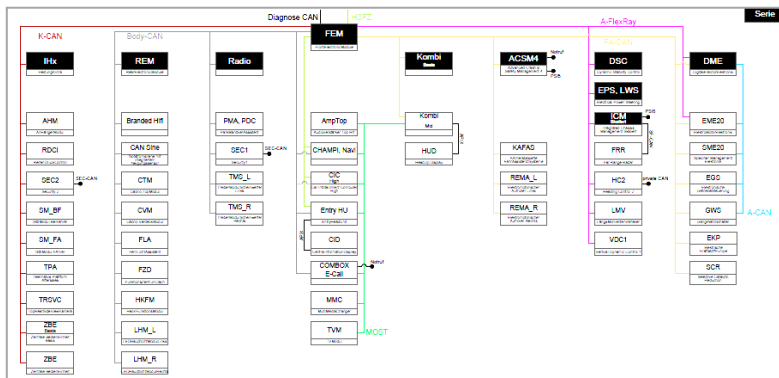


7 series wiring harness

No. of electric pins	3490
Total length of wiring	2751 m
No. of electric plugs	570
Wiring channels	16
Total weight	43 kg

On-board network

ECUs	35 ... 70
CPUs	ca. 180
GPUs	> 5
Buses	CAN, LIN, MOST, FlexRay, Ethernet

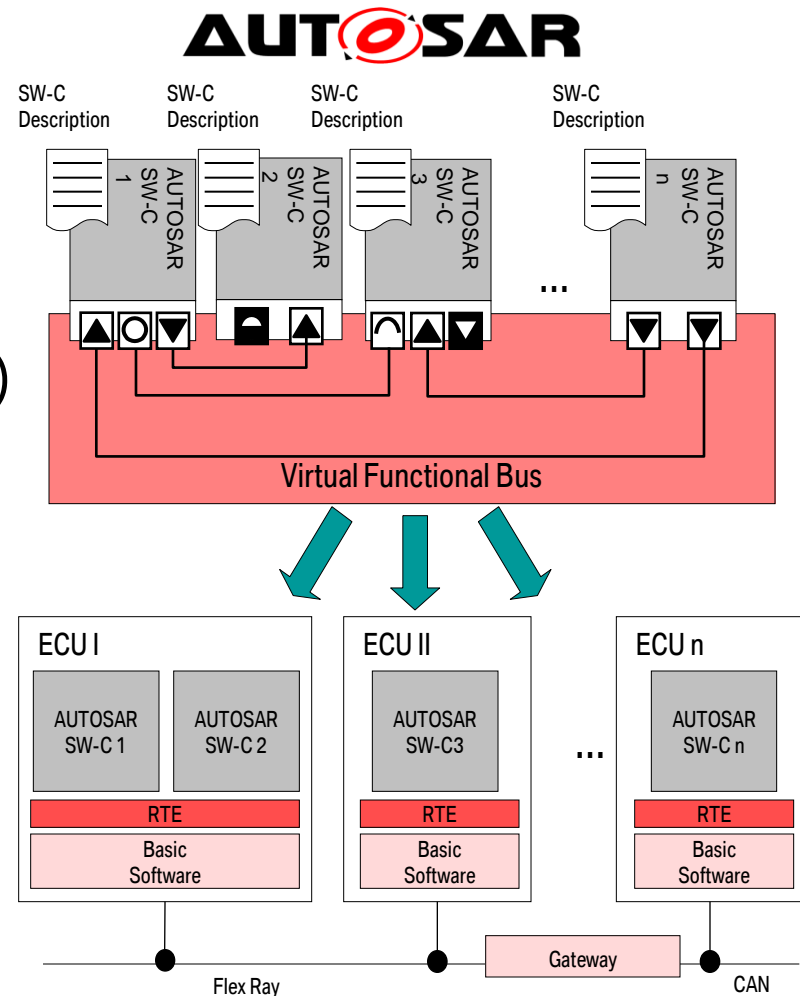


Miscellaneous

Software	ca. 1 GB
Operating systems	Standard Core AUTOSAR GENIVI

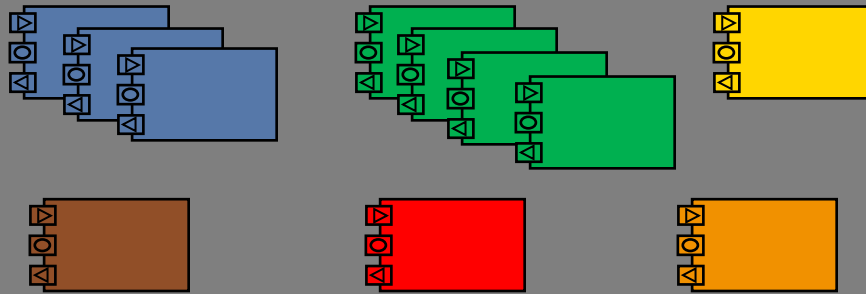
SOFTWARE BUILDING BLOCKS. AUTOSAR.

- Standard Basic Software.
- Software Components as hardware-independent building blocks.
- Standard description format for interfaces (sender/receiver, client/server) and lifecycle events.
- Well-defined SW-C communication via generated RTE.



BUILDING BLOCKS. SOFTWARE LIBRARIES FOR PRODUCT FAMILIES.

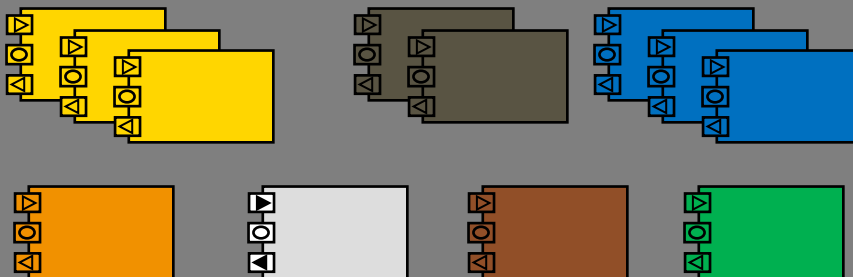
SW Library Driver Assistance



- Cruise Control.
- Traffic Jam Assistant.
- Speed Limit Info.
- Lane Departure Warning.

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SW Library Basic Functions

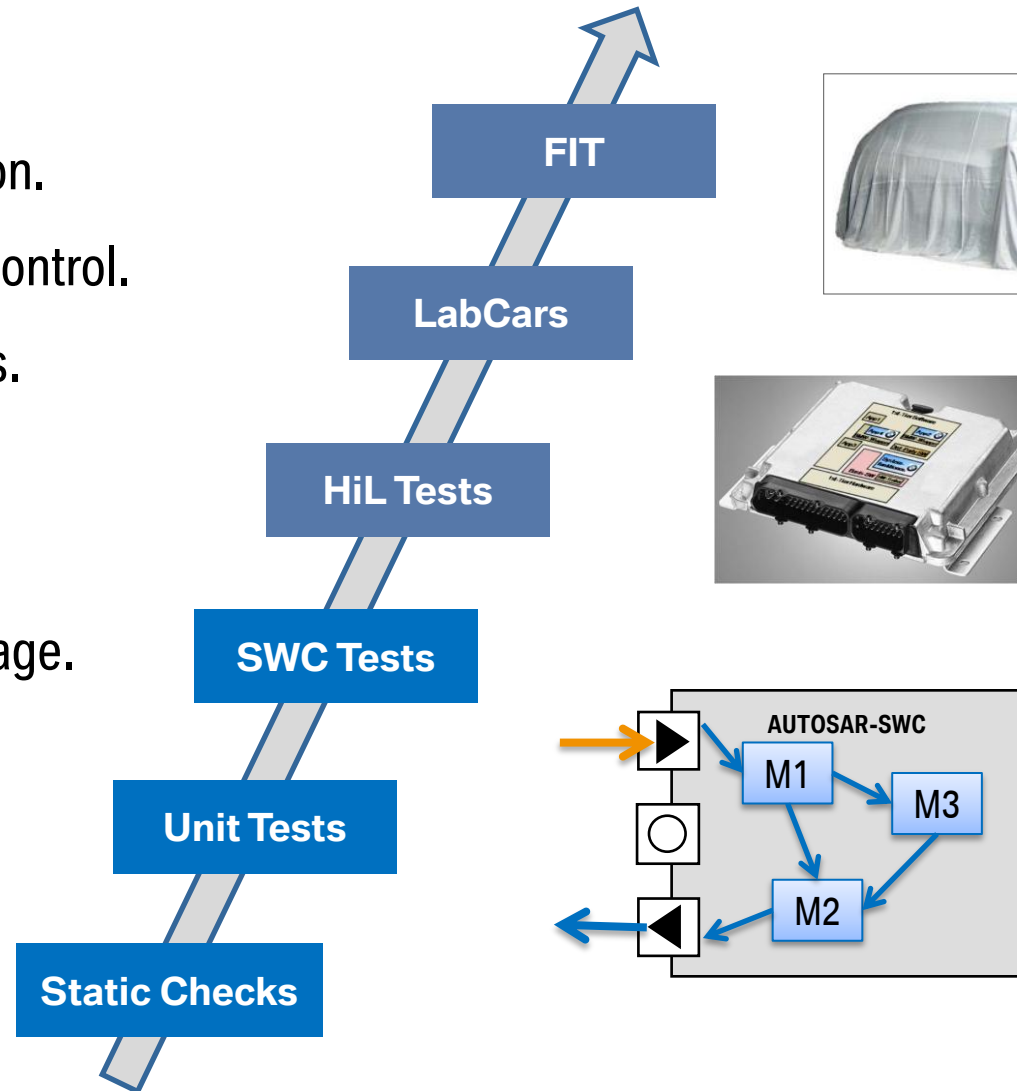


- Power Windows.
- Light: Xenon, LED, Laser.
- Wiper.
- Comfort Access.

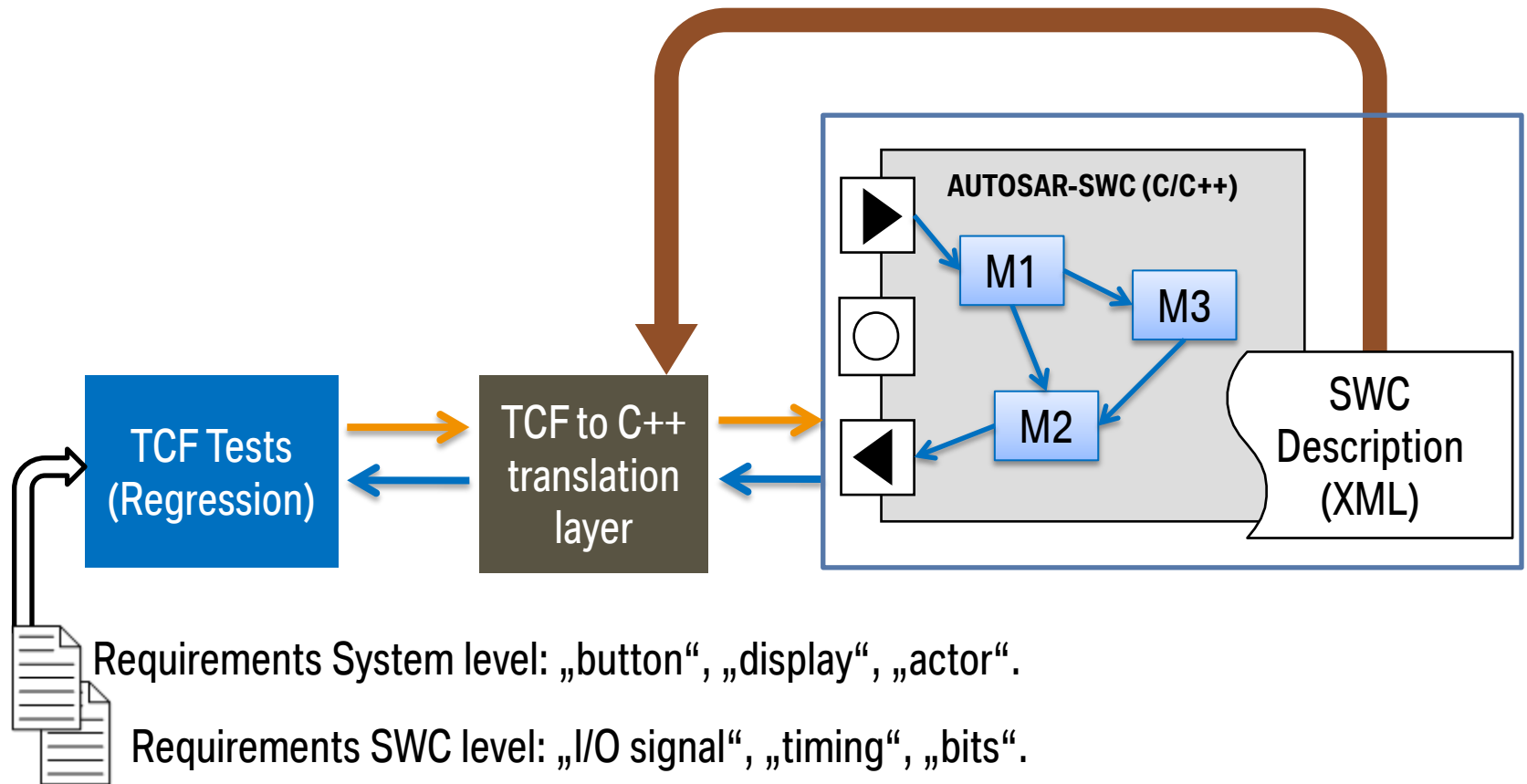
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QUALITY.

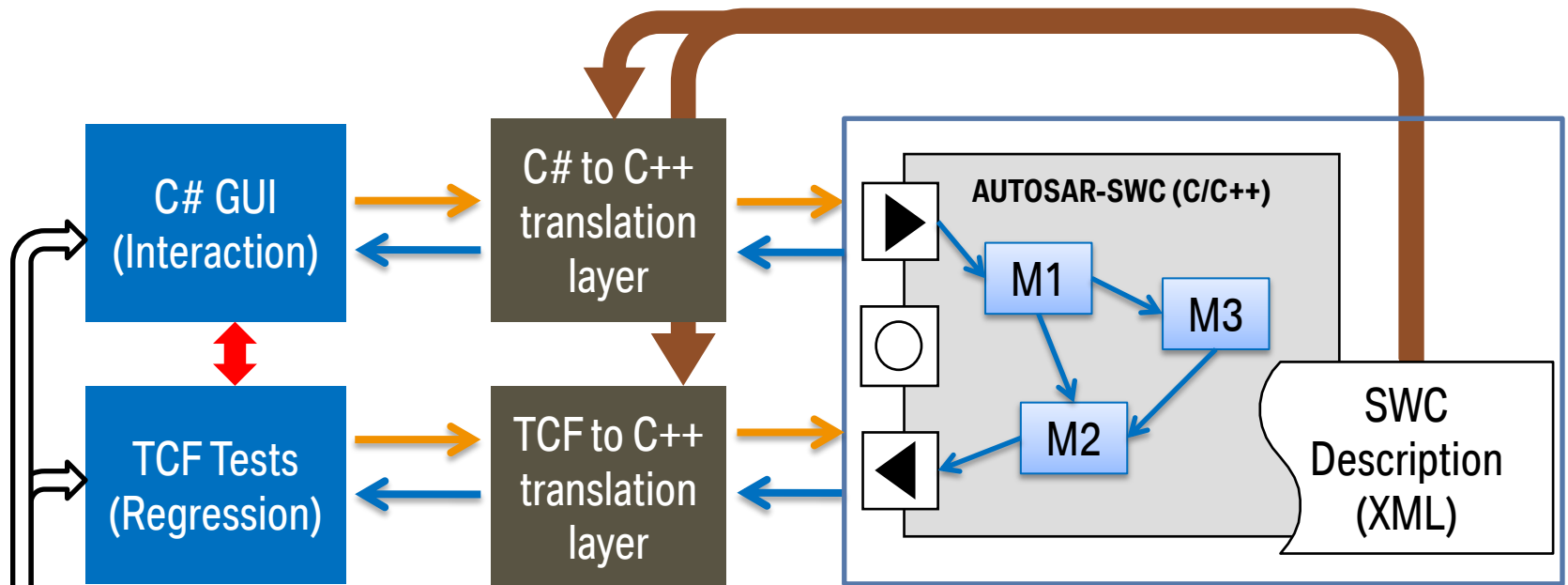
- Continuous Integration.
- Continuous Quality Control.
- Static Code Analysis.
- Resource Tracking.
- Code Coverage.
- Requirement Coverage.
- Code Reviews.



SWC TESTS. TESTING AGAINST REQUIREMENTS ON THE PC.



SWC TESTS. DRIVING THE SWC ON THE PC.



Requirements System level: „button“, „display“, „actor“.

Requirements SWC level: „I/O signal“, „timing“, „bits“.

THE GUI. YOU GET THE IDEA.

- Provides user controls and in-car displays.
- Simulates missing partners: other SWCs and required Basic SW.
- Provides fine-grain lifecycle control, error injection.
- Early demonstration/validation.
- Experience functions before in-car tests are possible.
- Execute high-level test scenarios.
- No hardware required.



**THANK YOU.
QUESTIONS...**

