Why system architecture?

An innovative and optimized electrical / electronic (E/E) architecture helps to improve vehicle performance, safety and reliability. It also reduces vehicle weight thus resulting in lower overall system costs.

With rising demands for vehicle functionalities the complexity of system architecture is significantly increased. That’s why the potential for cross influences has grown and full testing of all possible application scenarios has become a real challenge.

Continental as a system supplier provides technical and advisory support, functional safety management and complete traceability throughout the whole development process, following Automotive Standards.
Tailor-made system architecture.

Continental offers a wide range of different services regarding system architecture: everything from extensive functional safety consultation to complete development and integration of E/E architecture.

Our experts have profound knowledge of the commonly used software tools for creating system architecture (like PREvision). This guarantees the development of target-oriented organized E/E architectures that are ready to meet even the most sophisticated requirements.

Besides, Continental as one of the world’s leading automotive suppliers can offer a wide range of additional off-the-shelf products, e.g. a variety of powerful instrument clusters. Naturally our development team is also able to create customer-specific solutions for individual requirements.

We provide our customers with on-site support for every step of the development and integration process.

Example of a future-oriented, decentralized E/E architecture.

Interdomain Backbone (High-Speed CAN, 500 kbit/s), CAN FD [Flexible Datarate], Ethernet

- Individual service-packages for every demand
- State-of-the-art knowledge and technology
- Development process concurrent to Standard Automotive Process Landscape
- On-site support through Continental experts
The development process of an automotive system architecture consists of a series of steps, that are all influencing each other. Continental as a system supplier can offer the realization of every step with complete traceability while fulfilling Automotive Standards.
System architecture development process.

**Step 1 – Requirements analysis and engineering**

The first step in developing a system architecture is the evaluation of the range of requirements that the system needs to fulfill. These can be legal requirements, functional/non-functional safety requirements, market, cost and modularity requirements.

After evaluating, these requirements will then be transformed into a Performance Specification and imported into our standard tool PREEvision. This guarantees that every design decision can later be tracked back to the corresponding requirements (traceability).

**Step 2 – Logical architecture**

**Functional analysis**

In a second step a functional vehicle design model is established, still independent of the functional distribution. Therefore the types of inputs and outputs as well as the essential factors for processing, quality and safety are evaluated.

**Function distribution**

Based on the functional vehicle model that is created during the functional analysis process, different scenarios can be evaluated to find an optimized vehicle architecture. The evaluation process includes:

- Costs for the implementation
- Resource usage: RAM/ROM/CPU, Network
- Wiring harness

Based on the different requirements, like harness optimization and extensibility, the system scenarios are weighted and the matching functions are assigned to the corresponding control units.
Step 3 - Software architecture
In this step typically a modular software architecture (for example AUTOSAR based) is designed. A base definition of the functionality and the interface to other modules is established. Based on this architecture also the network management (wake up behaviour, shutdown etc.) concept is selected (like AUTOSAR NM, OSEK NM or proprietary). A basic concept for diagnostics that is refined in the network topology / communication design phase is also developed.

Step 4 - Communication technologies
Optimally designed communication technologies are important to create the functional requirements. From the concept to the on-board and off-board diagnostics, we offer a wide service field:
- Design of the bus systems (Flexray / CAN / LIN / Ethernet): topology design, bus system optimization, extensibility analysis etc.
- Analysis and qualification of the existing bus systems and their applications
- Specification and standardization of communication software modules (transport protocol, bus driver, network management)
- Support for system developer in applying the communication technologies
- Validation of the network design: simulation, EMC research
- Diagnostic concept refinement

Process Flow

Functional Safety Management >>
Requirements Analysis / Engineering
- Customer Requirements
- Safety
- Legal
 Logical Architecture
- Functional Analysis
- Function Distribution
 Software Architecture
 Communication Technologies
 Project Management >>
Step 5 - Component definition and selection
When function distribution and communication are settled, the detailed definition and selection of the components take place. Continental can offer a wide range of different off-the-shelf products as well as the development of customer specific ECUs (engine control unit) and instrumentation. This way a fitting solution can be found for every range of production volume. The integration of already existing third party components is also in any case possible.

Step 6 - Electrical connection design
The electrical connections of the wiring harnesses system implements the entire architecture design and is one of the most important steps converting the designs from the previous step to the next:
- Structured implementation of the entire wiring systems
- Connections between all components (pinning)
- Power distribution / simulation
- Optimization in electrical connections, costs and weight
Step 7 - Wiring harness design
In this step the wiring harnesses will be further refined, the construction of the wiring harness in a 3D model will be completed and the production data and mounting supports will also be prepared.
- Wire definition and pin attribution
- Definition of logical harness modules
- 3D integration (cable laying and location of other accessories)
- Generation of 2D scaled drawing
- Generation of production data

With our comprehensive services, an optimized harness with reduced costs and weight will be released to the manufacturer.

Step 8 - Integration and validation support
We provide on-site support to our customers for the physical integration and validation of the complete E/E system architecture on vehicle level. We support our customers at:
- Localizing mounting points
- Building up and integrating a prototype vehicle
- Residual bus simulation
- Network logging and analysis
- Sub-system and system testing
- Vehicle validation

Process Flow

Functional Safety Management >>

Requirements Analysis / Engineering
- Customer Requirements
- Safety
- Legal

Logical Architecture
- Functional Analysis
- Function Distribution

Software Architecture

Communication Technologies

Project Management >>
Our standard software tool offers a unified multi-layered design environment with complete traceability between every step of the development process. This ensures that every design decision can be traced back to the corresponding requirements.

The logical architecture layer and software function network layers allow the development of data flow.

The geometric topology layer provides the capability to position hardware components into physical installation locations in the vehicle.

The network architecture layer defines physical connections between hardware components. Virtual functions from the previous layers can be mapped onto hardware components and signals routed over the physical connections.
Functional Safety.

Functional safety management is an essential part throughout the whole system development process.

**Functional safety as system approach**
Before starting with the development of a system architecture a detailed functional safety concept is developed based on the Hazard and Risk Analysis. Safety relevant parts of every phase are identified and documented. Each safety goal/requirement can be traced through the complete development process. This approach ensures, that the resulting system architecture complies with Automotive Safety Standards.

**Continental services regarding safety management**
We provide the know-how and resources to also handle functional safety management for special vehicles and agricultural vehicles. Additionally we offer support for safety management activities like hazard and risk analysis, FMEDA (failure modes effects and diagnostic analysis) etc. during all steps of the design chain. For customers with existing E/E architecture Continental offers extensive consulting and support.
### Project sketch

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<th>Relevant process steps (please select)</th>
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