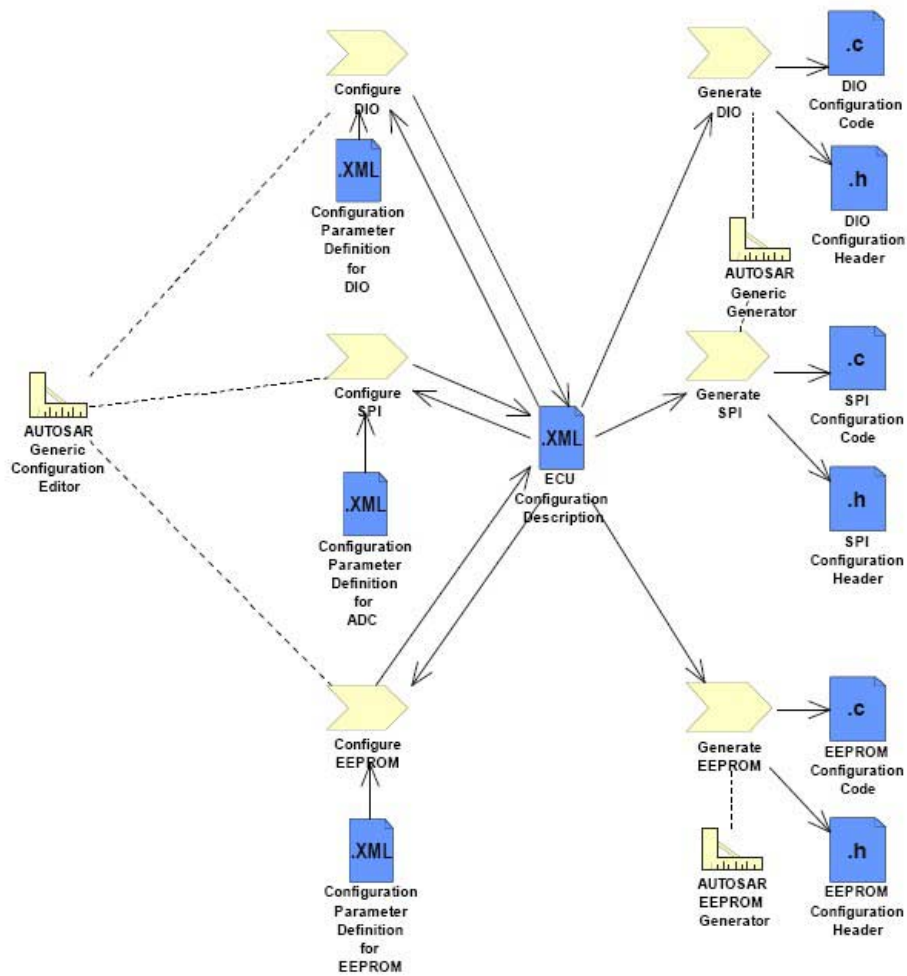


## Tool-Supported Integration of Microcontroller-Specific Modules

The development of ECU-specific software is taking a new path. The AUTOSAR development partnership has defined a software architecture resulting in standardized base software to be used as a foundation for development of reusable applications. This places special requirements on semiconductor producers.

Now that AUTOSAR specification Version 2.1 has been released just recently, the first semiconductor producers are offering implementations of AUTOSAR SPAL (Standard Peripheral Abstraction Layer) modules for their microcontrollers. The AUTOSAR specification defines the behavior of any given module in the AUTOSAR architecture, regardless of whether it is a hardware-dependent module from the SPAL layer or a hardware-independent module from the Service Layer. Reusability and interchangeability of individual modules must be assured. Implementations of SPAL modules and hardware-independent modules only differ in the cost and effort involved. Hardware-independent modules are usually only implemented once, while SPAL modules must be re-designed for each microcontroller.

This means that semiconductor producers are treading in unfamiliar terrain, because - in addition to implementation of the SPAL modules - the AUTOSAR specification requires that a suitable configuration tool have to be provided. The tool should support these AUTOSAR-specified interfaces: The "AUTOSAR Parameter Definition" and the "AUTOSAR ECU Configuration Description" (Figure 1).



[Figure 1: AUTOSAR ECU configuration process.]

### Configuration tool for AUTOSAR architecture

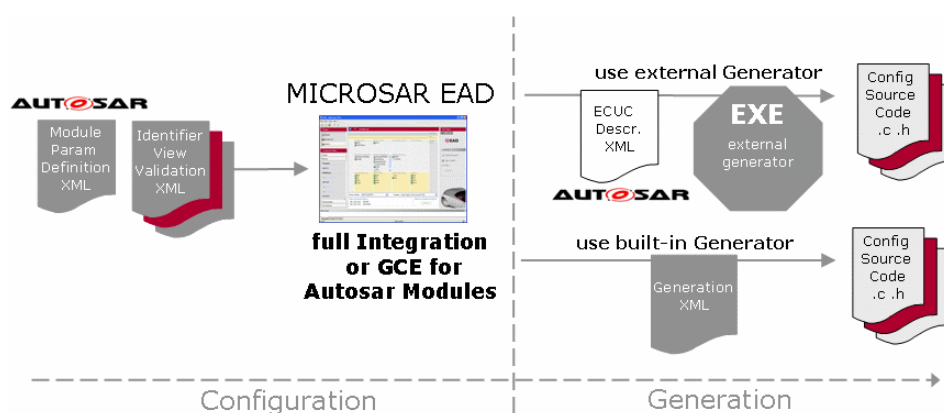
The AUTOSAR specification leaves the tool question open: All components can be configured either with a generic tool or a number of different tools. Neither alternative offers a comprehensive solution for guaranteeing a correct, consistent and yet easy-to-manage configuration process.

A tool chain with products from various producers does not guarantee error-free configuration, since the tools are not perfectly tuned to one another. The concept of utilizing a generic configuration tool that can read in the AUTOSAR

Parameter Definition File for any AUTOSAR module, and can therefore master the entire ECU configuration, is in principle desirable. But the whole system will only work if parameters are queried throughout the process and are found to be consistent, so that optimal and valid results are obtained.

## Valid and open approach to configuration

A total solution for configuration, which goes beyond a purely generic approach and contains the necessary validity check, is offered by the tool MICROSAR EAD (Embedded Architecture Designer) from Vector Informatik. First, the tool performs the role of a Generic Configuration Editor and represents a module in an AUTOSAR Standard GUI based on the AUTOSAR Parameter Definition File. This functionality might indeed be sufficient for some less complex modules. For more difficult configuration concepts the XML Interface Description can be accessed, which enables a very detailed description of the configuration parameters and contains an innovative validation concept (Figure 2).



[Figure 2: MICROSAR EAD - Integration concept.]

MICROSAR EAD offers an optimal foundation for integrating external components by implementing XML technology. Each integrated module is described by a set of XML files. External components may include: AUTOSAR SPAL modules from semiconductor producers, complex customized drivers or existing solutions that are not yet AUTOSAR-conformant. Vector offers integration of external components as a service. Vector acquired the necessary expertise from development experience with all types of AUTOSAR components and associated tools for configuring the base software and the overall system.

### **SPAL modules require hardware expertise**

Since each SPAL module contains the specific properties of the microcontroller, it is especially important here to provide a configuration tool with hardware know-how. To optimally assist the user in the startup of a new microcontroller, as early as configuration time Vector gives the user a lot of decision-making assistance. Defining parameter values in MICROSAR.EAD prevents invalid data input and invalid data import. Creation of one intelligent GUI per module enables a simplified, smooth configuration process for the user. Optimal data consistency is assured by a three-stage validation concept. This customizes the validation process, and qualification of the data is guaranteed before the files are generated.

After successful configuration and validation the generation process is started, in which files are generated according to the settings. It does not matter whether the generator used is the built-in generator of MICROSAR.EAD,

which is also controlled by XML file, or an external generator is called. In this connection it is really important that a generation process may only occur after successful validation.

### **Integration solutions proven in practice**

Technical implementation and integration of the configuration have been established and undergone trials at Vector. With regard to the business model, certain questions arise: What form might integration of the SPAL modules of a semiconductor producer take in the MICROSAR EAD? Who assumes responsibility for distribution, maintenance and support? Many different scenarios are conceivable here. Vector Informatik is currently conducting discussions on individual solutions with various OEMs and semiconductor producers.

The advantages of an integration solution are obvious:

Microcontrollers and SPAL modules from a single source shorten development times and increase consistency. The MICROSAR EAD configuration tool with integrated SPAL modules supports the user optimally with easy handling and openness in integration. The extensive validation process detects configuration errors early on and improves quality. The capability of integrating additional modules and even external components in MICROSAR.EAD makes it unnecessary to seek out a coherent tool chain. That is because configuration of an entire architecture can be guaranteed with just one tool. In porting existing projects to new controllers or derivatives the data transfer runs smoothly.

There remains the question of the practical feasibility of the modularity prescribed by the AUTOSAR architecture. The well-coordinated Vector product line, and its interconnection to external products, shows that this modularity can operate properly. Integration of the SPAL modules from semiconductor producers targets another AUTOSAR commandment: Interchangeability. Vector Informatik is up to the challenge here. With a full product lineup of AUTOSAR software architecture, Vector offers support in all project development phases: From design to implementation to integration. In this process, it does not matter whether what is being used are Vector products, in-house developments or third-party components.

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### **Figures:**

Figure 1: AUTOSAR ECU configuration process (Source: AUTOSAR\_ECU\_Configuration.pdf, Section 2.3.3.2 Generic Tools)

Figure 2: MICROSAR EAD - Integration concept (Source: Vector Informatik GmbH)

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