Dr. Günther Heling
Vector Informatik

AUTOSAR Adaptive Platform –
Now it’s Time to get on Board
At the first glance Adaptive and Classic don’t have too much in common.

A second glance reveals even more differences:

<table>
<thead>
<tr>
<th>Classic</th>
<th>harmonize, optimize</th>
<th>terminology, functions, and interfaces, development methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive</td>
<td>utilize, connect</td>
<td>existing IT methods and solutions, vehicles to the internet</td>
</tr>
</tbody>
</table>

Nevertheless: it’s worth to have a look at Classic.
Adaptive – now it’s time to get on board

1. What can we learn from Classic?

2. Where to use Adaptive?

3. How to benefit best?
AUTOSAR grows continuously – but full exploitation takes a while

1. What can we learn from Classic?

Source: Vector’s evaluation based on number of projects
1. What can we learn from Classic?

Development methods change slower than technology

- Usage of the AUTOSAR methodology can be derived from **usage of RTE**

  ![](chart.png)

  **RTE Share of AUTOSAR Classic Projects**

  - 80%

- … and from **usage of ARXML System Description**: **1/3 of our OEM programs** use ARXLM

To benefit from a new technology it takes

1. a good reason,
2. a good opportunity and
3. the will to change

Source: Vector’s evaluation based on number of projects
## 1. What can we learn from Classic?

**AUTOSAR Classic - many variants for many OEMs**

<table>
<thead>
<tr>
<th>Program</th>
<th>AUTOSAR version</th>
<th>Configuration</th>
<th>Bus System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.2.1</td>
<td>Legacy LDF + DBC + Fibex</td>
<td>CAN, LIN, FlexRay</td>
</tr>
<tr>
<td>2</td>
<td>3.2.2</td>
<td>AUTOSAR SD</td>
<td>CAN, LIN, FlexRay</td>
</tr>
<tr>
<td>3</td>
<td>3.2.x</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>4</td>
<td>3.2.x</td>
<td>Legacy Fibex</td>
<td>CAN, LIN, FlexRay</td>
</tr>
<tr>
<td>5</td>
<td>3.2.x</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>6</td>
<td>3.x</td>
<td>Legacy LDF, DBC + Fibex</td>
<td>CAN, LIN, FlexRay</td>
</tr>
<tr>
<td>7</td>
<td>3.x</td>
<td>Legacy LDF, Fibex</td>
<td>CAN, LIN, FlexRay</td>
</tr>
<tr>
<td>8</td>
<td>3.X</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>9</td>
<td>3.X</td>
<td>Legacy LDF + DBC + J1939</td>
<td>CAN, LIN, Eth</td>
</tr>
<tr>
<td>10</td>
<td>4.0.1</td>
<td>Legacy DBC</td>
<td>CAN, CAN-FD, LIN, FlexRay, Eth</td>
</tr>
<tr>
<td>11</td>
<td>4.0.3 + RFCs</td>
<td>AUTOSAR SD</td>
<td>CAN, LIN, FlexRay, Eth</td>
</tr>
<tr>
<td>12</td>
<td>4.0.3 + RFCs</td>
<td>AUTOSAR SD + DEXT</td>
<td>CAN, LIN, FlexRay, Eth</td>
</tr>
<tr>
<td>13</td>
<td>4.0.3 + RFCs / 4.2.2</td>
<td>AUTOSAR SD + DEXT</td>
<td>CAN, CAN-FD, FlexRay, Eth, LIN</td>
</tr>
<tr>
<td>14</td>
<td>4.0.3, 4.2.1 (Eth)</td>
<td>AUTOSAR SD</td>
<td>CAN, LIN, Eth</td>
</tr>
<tr>
<td>15</td>
<td>4.2.1</td>
<td>SD 4.2.1</td>
<td>CAN, CAN-FD, Lin, FlexRay, Eth</td>
</tr>
<tr>
<td>16</td>
<td>4.2.2</td>
<td>AUTOSAR SD</td>
<td>CAN, LIN, FlexRay, Eth</td>
</tr>
<tr>
<td>17</td>
<td>4.2.2</td>
<td>AUTOSAR SD + DEXT</td>
<td>CAN, LIN, FlexRay, Eth</td>
</tr>
<tr>
<td>18</td>
<td>4.2.2</td>
<td>AUTOSAR SD</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>19</td>
<td>4.2.2 + 4.3 features</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN, Eth, J1939</td>
</tr>
<tr>
<td>20</td>
<td>4.2.2 + 4.3 features</td>
<td>AUTOSAR SD + DEXT</td>
<td>CAN, CAN-FD, FlexRay, Eth, LIN</td>
</tr>
<tr>
<td>21</td>
<td>4.2.2 + 4.3 features</td>
<td>AUTOSAR SD + DEXT</td>
<td>CAN, CAN-FD, FlexRay, Eth</td>
</tr>
<tr>
<td>22</td>
<td>4.2.x</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN, Eth</td>
</tr>
<tr>
<td>23</td>
<td>4.X</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>24</td>
<td>4.X</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN, Eth</td>
</tr>
<tr>
<td>25</td>
<td>4.X</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>26</td>
<td>4.X</td>
<td>Legacy LDF + DBC</td>
<td>CAN, LIN</td>
</tr>
<tr>
<td>27</td>
<td>4.x</td>
<td>Legacy LDF + DBC, ARXML</td>
<td>CAN, LIN</td>
</tr>
</tbody>
</table>

→ success requires adaptation to specific needs
1. What can we learn from Classic?

AUTOSAR Classic – **many versions** with growing functionality

**Specification:**

- **Changes in 4.3**
  - Ethernet
    - traffic shaping
    - queue optimization
    - SOMEIP-TP
  - Security
    - new crypto interfaces
    - SecOC freshness handling
    - secured TP/diagnostics
  - V2X
  - Diagnostics
    - DEXT: J1939, OBD, FIM
    - DEM: multiclient
    - virtual ECUs

→ **success requires extension of functionality**

**Implementation:**

<table>
<thead>
<tr>
<th></th>
<th>AUTOSAR 3</th>
<th>AUTOSAR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of BSW Modules</td>
<td>68</td>
<td>104</td>
</tr>
<tr>
<td>Lines of Code</td>
<td>100%</td>
<td>271%</td>
</tr>
</tbody>
</table>
1. What can we learn from Classic?

What else can we learn?

| keep! | - use the power of the **AUTOSAR community**
|       | - support **automotive specifics**
|       | - benefit from **competition**
|       | diagnostics; workflows in implementation |

| improve! | - **one solution** for one problem
|          | - use the **complete methodology**
|          | - be open for **new business models**
|          | incl. integration to Classic |

| drop! | - specification of **all details**
|       | - focus on **minimum footprint** |
Adaptive – now it’s time to get on board

1. What can we learn from Classic?

2. Where to use Adaptive?

3. How to benefit best?
2. Where to use Adaptive?

"Automotive goes IT"

- CAN published: 1986
- First SOP with CAN: 1990
- First release of AUTOSAR Classic: 2005
- AUTOSAR 4: 2010
- AUTOSAR Adaptive started: 2015
- Ethernet becomes ISO standard: 1985
- First WWW browser: 1990
- JAVA published: 1995
- REST published: 2000
Adaptive – best of two worlds

2. Where to use Adaptive?

**Cloud / Backend**
- support of high performance processors
- high bandwidth
- service based architectures
- open source
- dynamic and updatable
- internet

**Embedded Systems**
- safe
- secure
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

**AUTOSAR Classic**
2. Where to use Adaptive?

Adaptive – best of two worlds

**Cloud / Backend**
- system and mobility strategies
- deep learning

**On board HP Computing**
- multipurpose computing servers
- connectivity, gateways, HMI
- automated driving

**AUTOSAR Adaptive**
- safe
- secure
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

**AUTOSAR Classic**
- safe
- secure
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

Adaptive AUTOSAR
- high bandwidth
- service based architectures
- open source
- dynamic and updatable
- internet
2. Where to use Adaptive?

Adaptive – best of two worlds

**Cloud / Backend**
- system and mobility strategies
- deep learning

**On board HP Computing**
- multipurpose computing servers
- connectivity, gateways, HMI
- automated driving

**Adaptive AUTOSAR**
- support of high performance processors
- high bandwidth
- service based architectures
- open source
- **dynamic and updatable**
- **internet**
- **safe**
- **secure**
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

**AUTOSAR Adaptive**
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

**AUTOSAR Classic**
2. Where to use Adaptive?

There are more reasons to use Adaptive!

Let’s have a look at the development process:

**Classic AUTOSAR**
- static
- monolithic / top-down
- model-based
- configuration at compile time

→ maximal efficiency
→ quick local changes not supported

**AUTOSAR Adaptive**
- dynamic
- modular / parallel
- model-based and software-based
- configuration at runtime

→ maximal flexibility
→ quick local changes well supported

- Good software design is more important than small footprint → good fit to AUTOSAR Adaptive
- Software is developed by computer scientist → good fit to AUTOSAR Adaptive

AUTOSAR Adaptive may be the right choice even for smaller ECUs
2. Where to use Adaptive?

There are more reasons to use Adaptive!

- Seamless link between on-board and off-board computing
- Parts of a safety related function can be calculated off-board
- Flexible mapping of functions
  - on-board and off-board
  - even at runtime

Vehicle becomes a part of IoT

What about using Adaptive for non-automotive applications?
## Adaptive – now it’s time to get on board

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What can we learn from Classic?</td>
</tr>
<tr>
<td>2</td>
<td>Where to use Adaptive?</td>
</tr>
<tr>
<td>3</td>
<td>How to benefit best?</td>
</tr>
</tbody>
</table>
3. What should you do to benefit best?

**Now it’s time to get on board**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Execution Management</td>
<td>&gt; Platform Health Management</td>
<td>&gt; Container Support</td>
<td>&gt; tbd</td>
</tr>
<tr>
<td>&gt; Communication/Middleware</td>
<td>&gt; RESTful Services</td>
<td>&gt; Package Management</td>
<td></td>
</tr>
<tr>
<td>&gt; DLT</td>
<td>&gt; Signal based communication</td>
<td>&gt; E2E Protection</td>
<td></td>
</tr>
<tr>
<td>&gt; Diagnostics</td>
<td>&gt; Security Features</td>
<td>&gt; SW-Lockstep</td>
<td></td>
</tr>
<tr>
<td>&gt; Persistency</td>
<td>&gt; Time Synchronization</td>
<td>&gt; Crypto Hardware</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; E2E Protection (Draft)</td>
<td>&gt; Network Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Package Management (Draft)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
</table>

1. let’s define **one** powerful standard
   ➔ Contribute to the specification

2. gain experience early
   ➔ Start evaluation projects now

3. combination of automotive embedded & IT is challenging
   ➔ Care for skilled staff
Thank you for your attention!

Dr. Günther Heling
Vector Informatik GmbH
Ingersheimer Str. 24
70499 Stuttgart
Germany

guenther.heling@vector.com