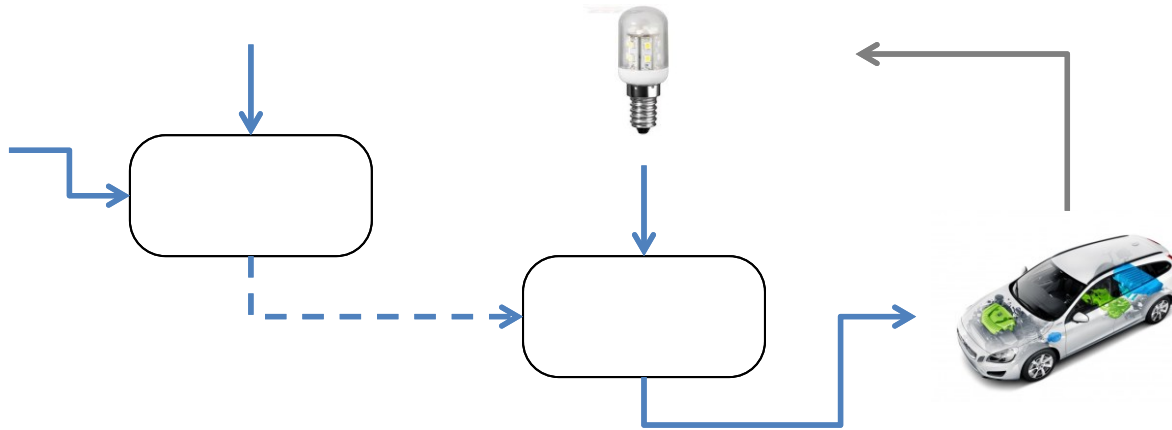


Agile Model-Driven Engineering



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University of Gothenburg Volvo Cars Corporation

*In collaboration with **Jon Whittle** and **Rogardt Haldal***

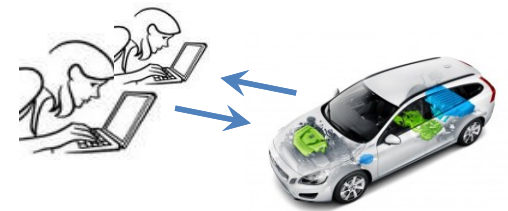
Challenges

Exponential growth of software!

- maximized in e-vehicles



Difficult to be *innovative* with external sw suppliers



- requires tight, robust and well-defined APIs!
- very very slow feedback loops, if not!

Off-the-shelf \neq plug-and-play

- due to complex dependencies



Increase in-house development

+ Control of software development
+ Speed

- Volvo Cars is not a **C** organization



www.need4speed.ws



www.womenworking.com

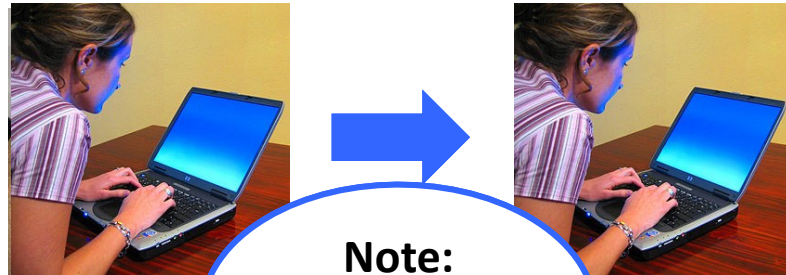
The challenge is to create **VCC++**

- keeping the domain expertise
- not getting too large

MDE - Model-Driven Engineering

Let domain experts develop SW!

- Quality
- Reuse
- Speed



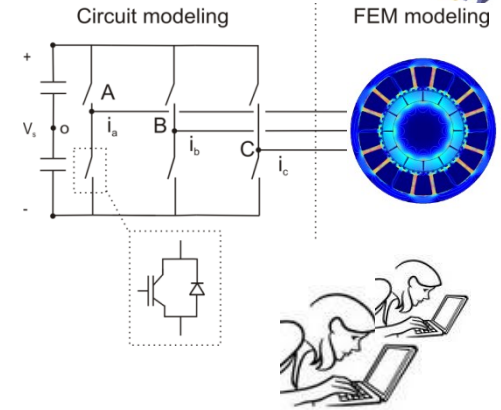
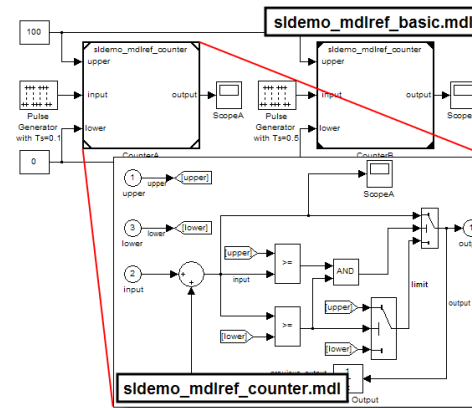
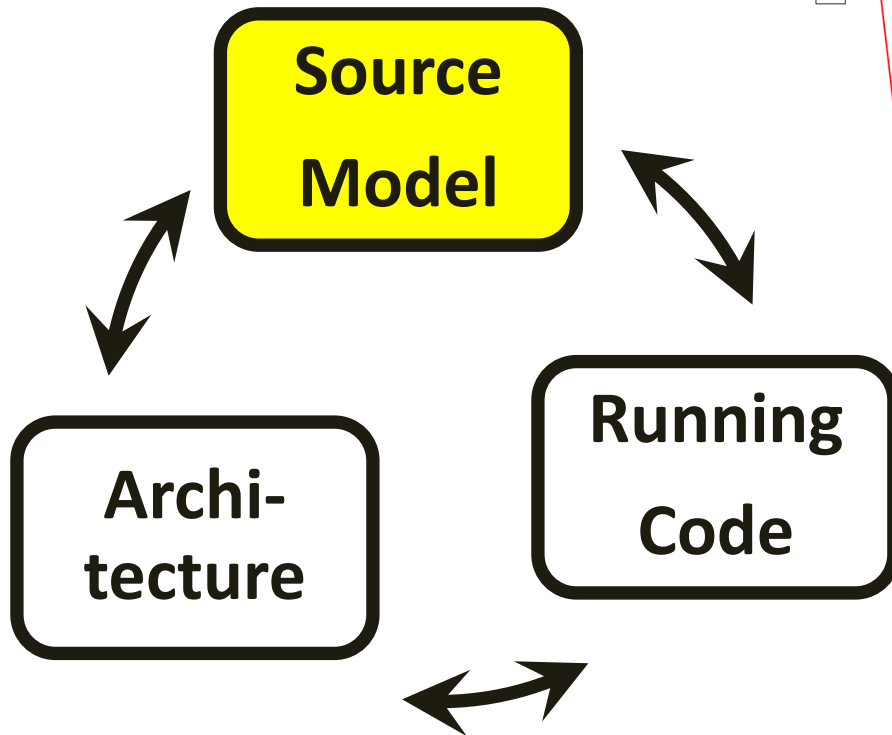
Forbes.com

MDE is a *strategy* to utilize

Abstraction – Simulation – Automation
to *facilitate* sw-development and test

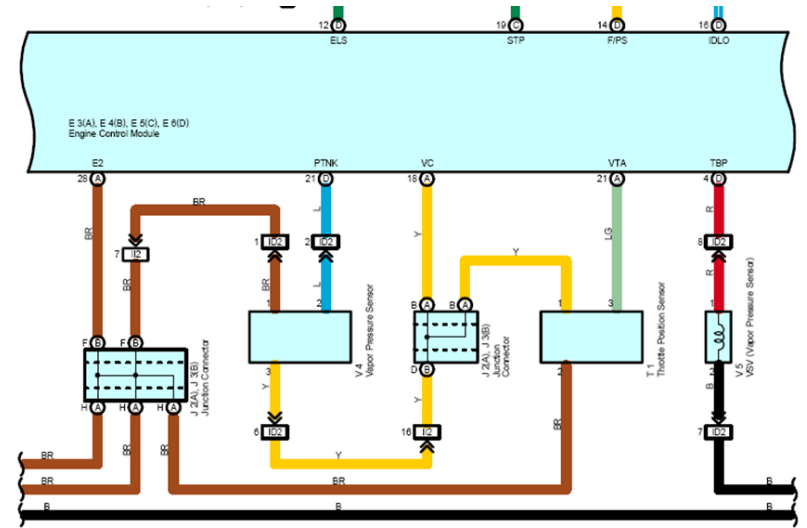
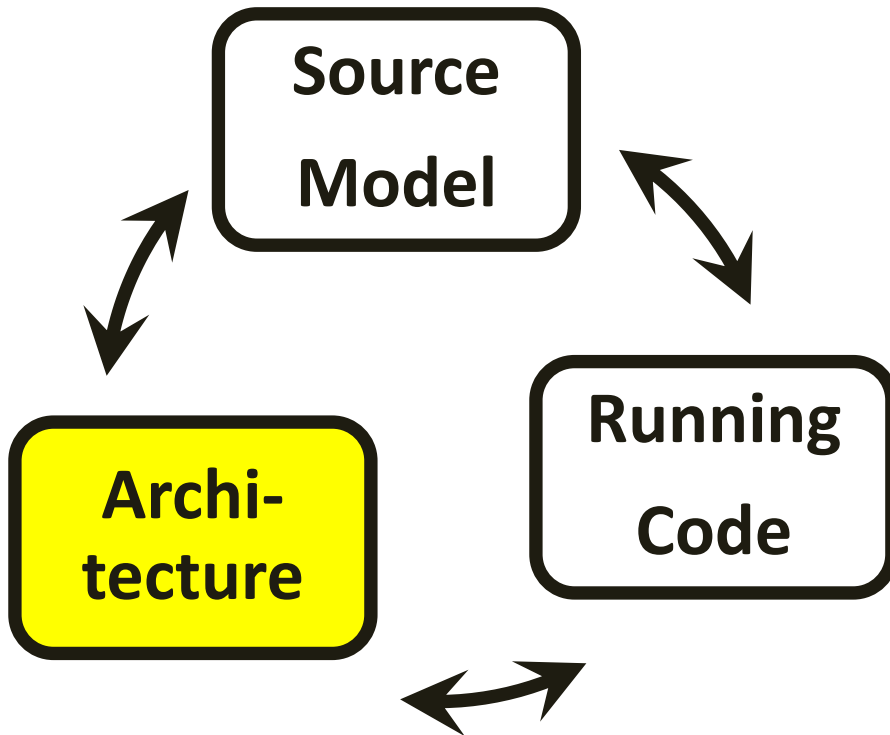
Note also:
Next step is
agile!

Implementation



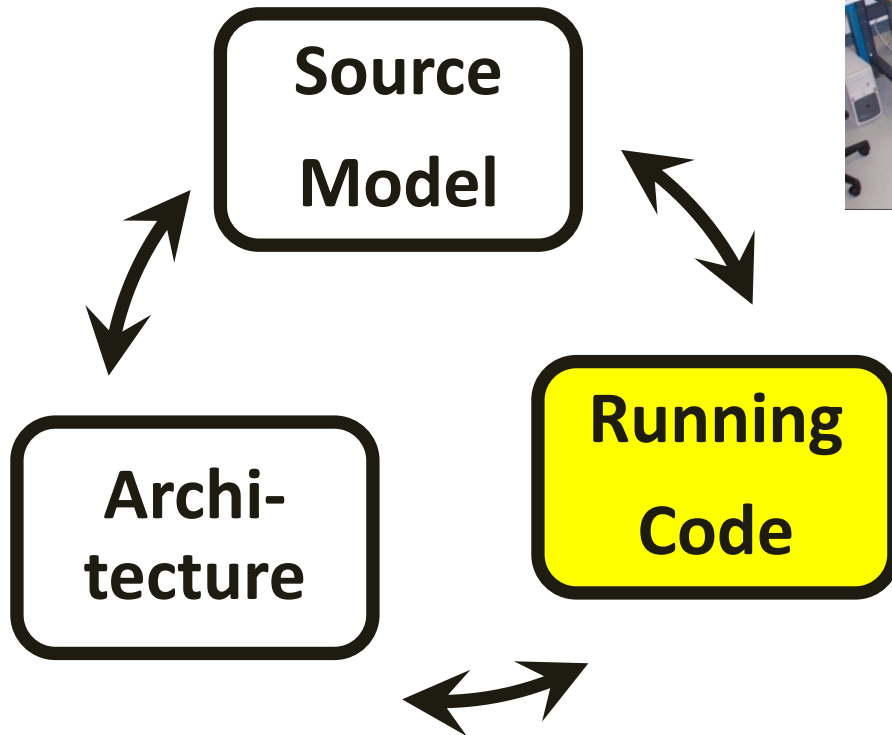
- **SW abstraction** using Simulink
- **Simulation** using an executable environment
- **Automation** of code generation and integration

Specification



- System design **abstraction**
- Source model **automation** (prepare models)

Integration



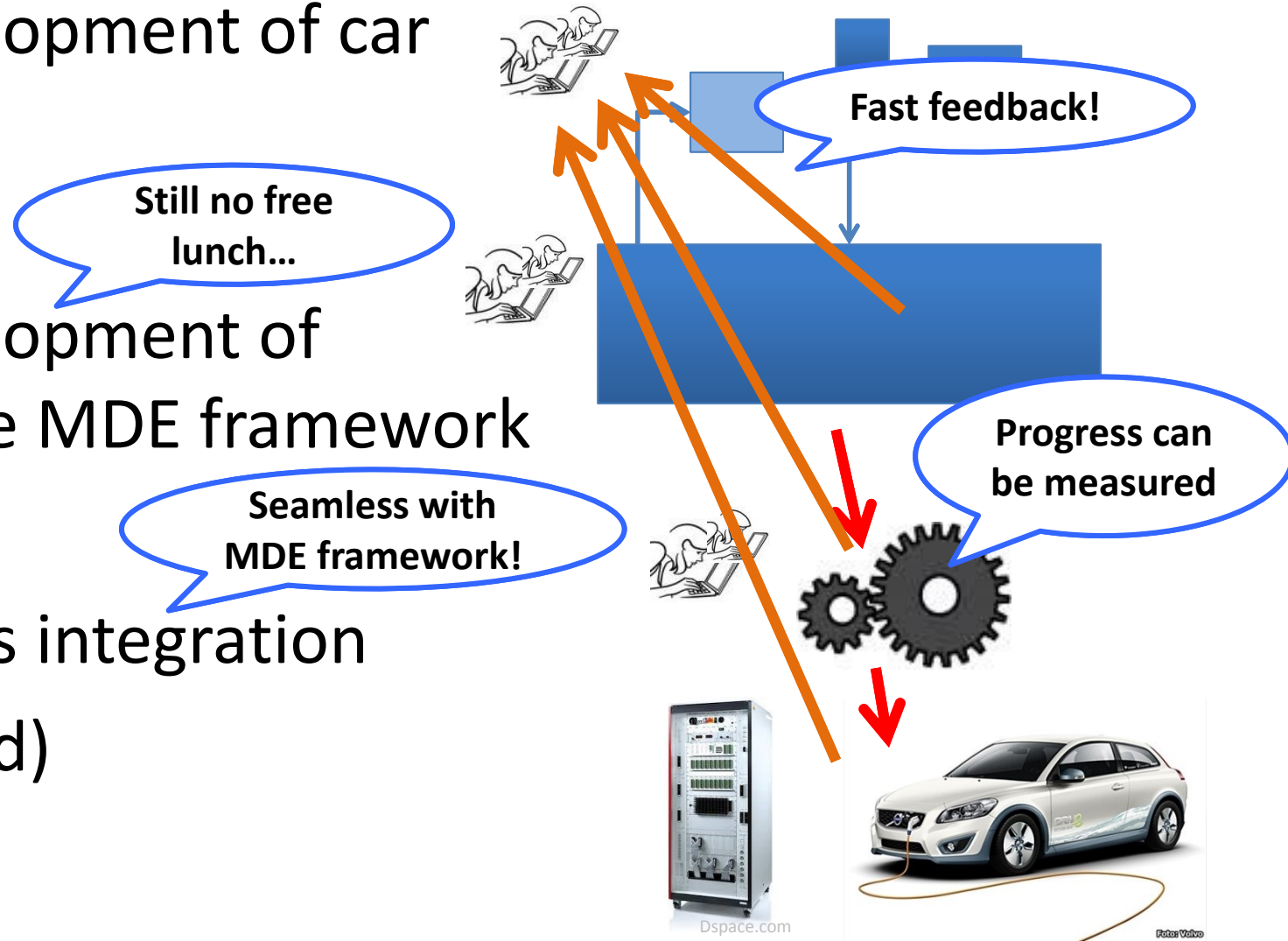
- HIL (test rig) test using environment **simulation**
- **Automation** of regression test and data feedback

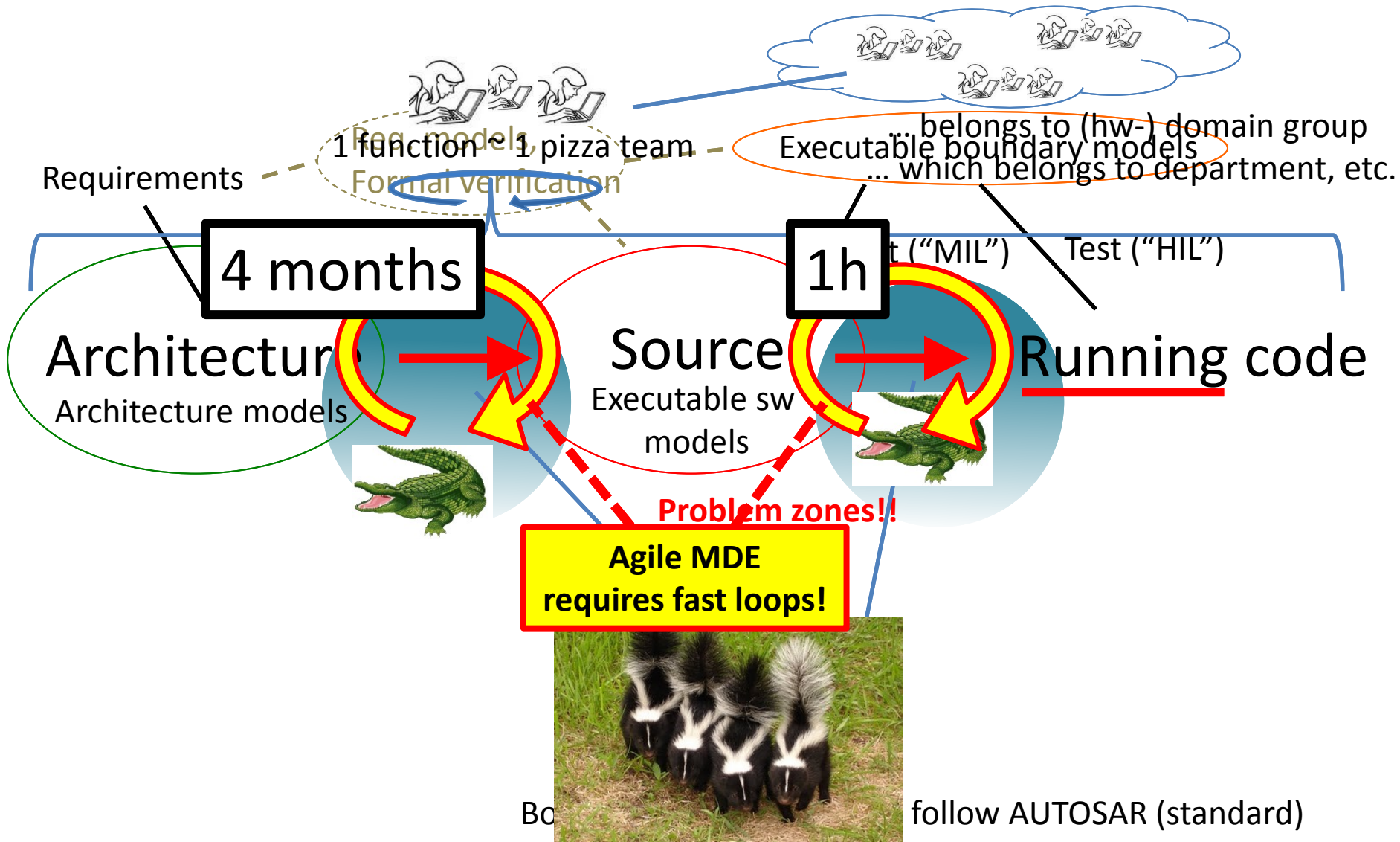
Agile MDE:

Agile development of car features

Agile development of taylormade MDE framework

Continuous integration
(automated)





Bo
 Several(!) not in-house parts of these transformations cause trouble

For agile MDE
external organizations are both



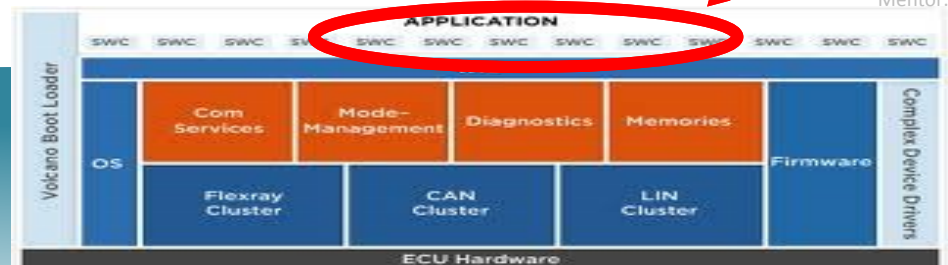
The CPU load

- Quality of generated code is no longer a problem
- Quality and efficiency of AUTOSAR system software is a serious problem

Running code → Limping code 😞

- Complicated and undeveloped AUTOSAR meta model.
- Non robust interfaces & services.
- “Basic SW” (system) modules can be faster? Or?

Here we are



Wishlist



MDE for embedded software:

1. Hide the complexity behind tight APIs
(like in web development)
 2. Hide the model transformations
(like html to browser)
- Better and open-source tools
 - kill-your-darlings standards!