



Auto generated Remaining Bus Simulations based on a Fibex description file

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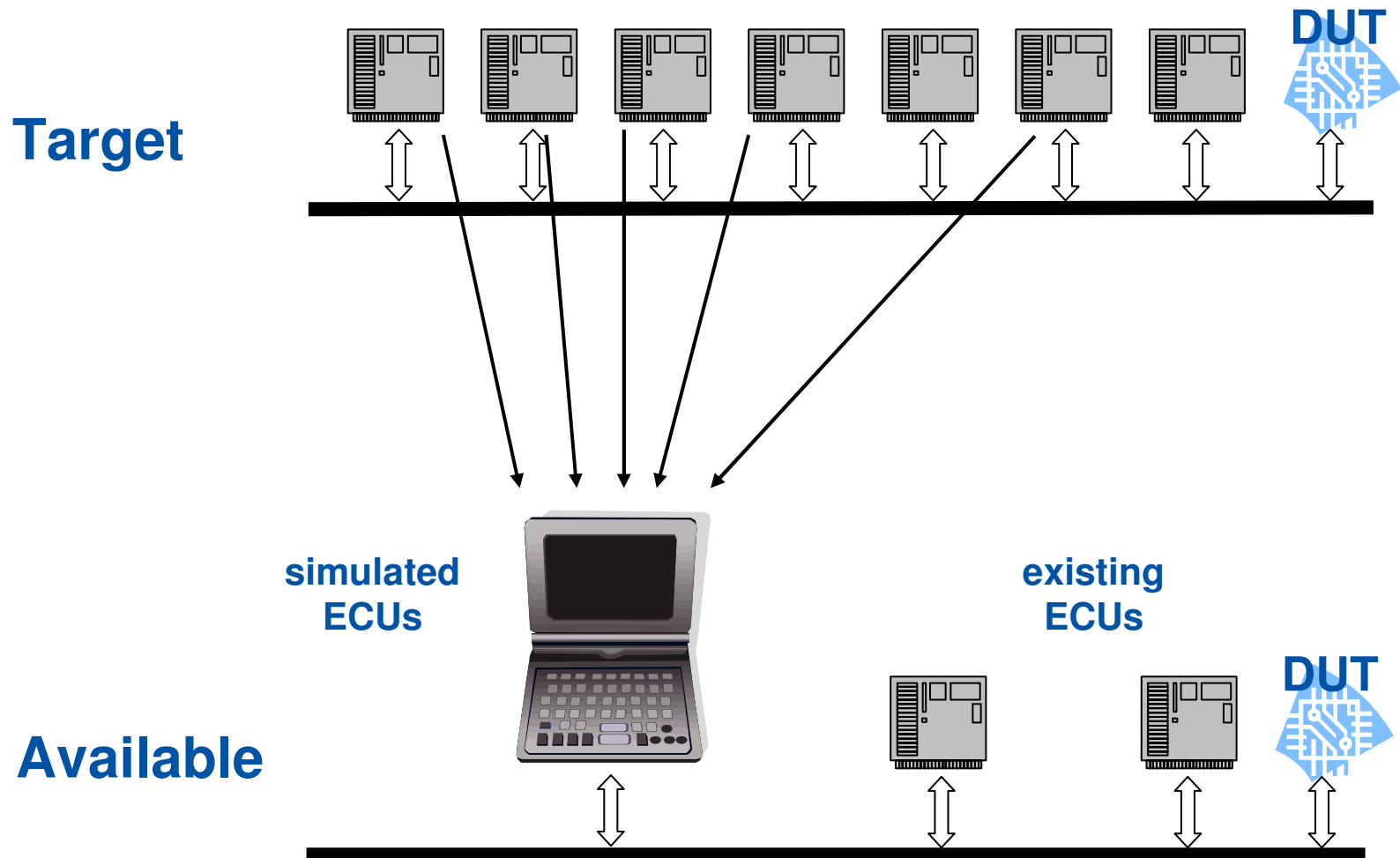
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Contents



- What is a RBS?
- RBS - Why?
- Needed features
- Fibex as database
- Concept
- Implementation
- RBS vs. HIL
- Example

What is a RBS?

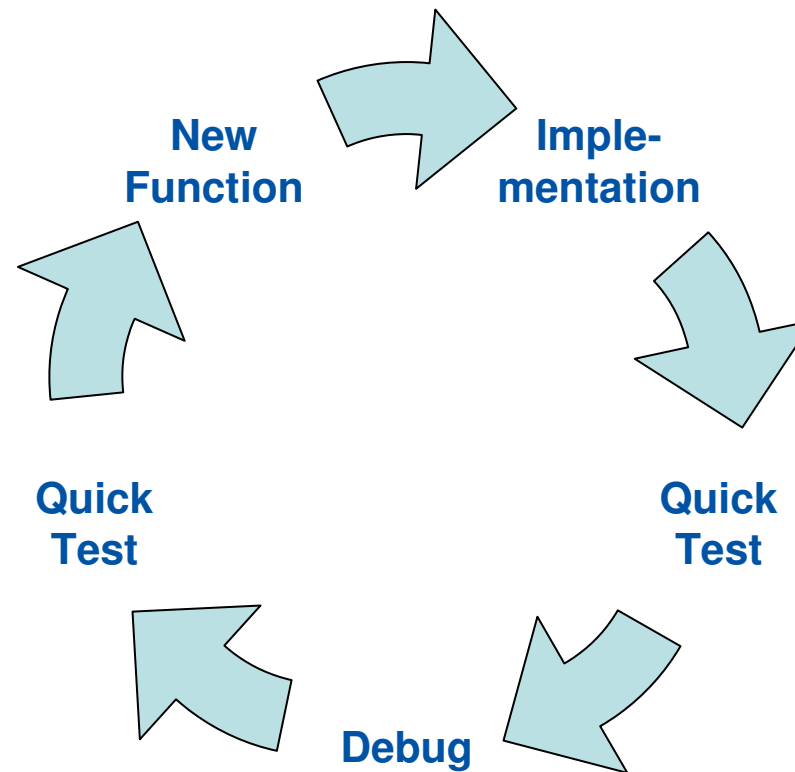


RBS – Why?



- **Testing**

During Development: Verify new implemented functions



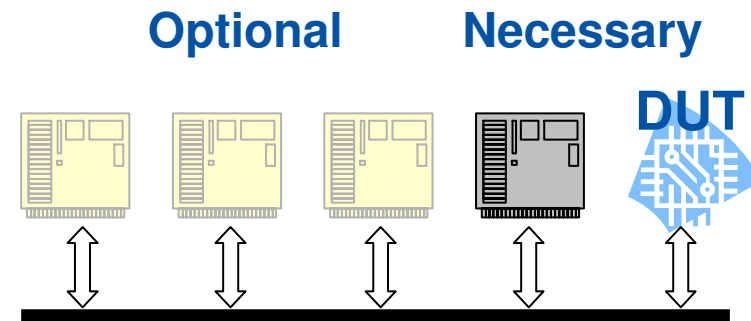
RBS – Why?



■ Keep Bus Alive

Two Nodes necessary

- Startup
- Synchronization



■ Device under test needs correct bus data

Dataflow control in real-time

- Alive counter
- CRC



- **Behavior verification**

- Startup
- Shutdown

- **Verification of FlexRay Parameter**

Configuration quite complex

- DUT synchronizes
- DUT sends Frames
- DUT does not cause errors

Needed Features



- **Fast generation of the RBS (5-10 min)**

Complete auto generation of the RBS out of a description file (FIBEX)

- **Application CRC calculation**

Application CRCs must be included on certain positions.

CRC algorithm defined by the user.

- **Alive counter calculation**

Alive counter must be included on certain positions.


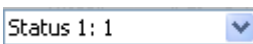

Algorithm defined by the user.

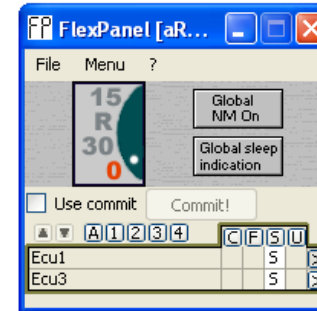
Needed Features



■ Manipulable Signals

Change signal values

- Scroll bar 
- Drop down menu 
- Binary values 



Application_Data_7 (*)	12	
CRC_1 (*)	0	
Application_Data_1 (*)	4259	
Application_Data_4 (*)	655	
Application_Data_6 (*)	0	

- Show "All transmitted signals"
- Show "S_Ecu1 - Frame7"
- Show "S_Ecu1 - Frame1"
- Show "S_Ecu1 - Frame4"
- Show "S_Ecu1 - Frame6"

- Show all panels of Ecu1
- Hide all panels of Ecu1

BMW
Flexpanels

■ Adaptation to the integration process

Exclude already existing frames / ECUs

Needed Features



- **Monitor bus traffic**

In error cases it is helpful to be able to have a look at the bus traffic.

- **Includable User defined code**

An user interface should be provided to define user code which shall be included during code generation.

- **Deadline-/Overload-Monitoring**

Insurance that the simulation works correct

- Deadline violations
- Losing Frames
- CPU too weak (User code)

Needed Features



- **NM support**

Network management functionality must be supported.

- **Control / error indication / special functions**

Diagnose functions beside normal operation mode

- Alive Counter manipulation
- Application CRC manipulation
- Header CRC manipulation
- Calculation stop
- Defined and repeatable synchronization and shut down



Advantages of FIBEX

- **Standard format in the automotive section**

Nearly every firm uses FIBEX to describe their busses.
FIBEX is supported by many tools.

- **Nearly everything is describable**

- Bus parameters
- Bus topology
- ECUs
- Signals
- Frames



Disadvantages of FIBEX

- **NM not supported**
 - Payload-Preamble-Bit not supported.
 - Autosar NM planed in Fibex 3.0.1

- **Fast update rate**

Short intervals between new FIBEX version

→ A lot of work to keep the tools / database up to date.

Roots



**The following remain bus simulation
is based on a concept of**

BMW AG

**Forschungs- und Innovationszentrum
80788 München**

Dr.-Ing. Robert von Häfen

Dipl.-Ing. Georg Fries (Reliatec GmbH)

A patent is pending

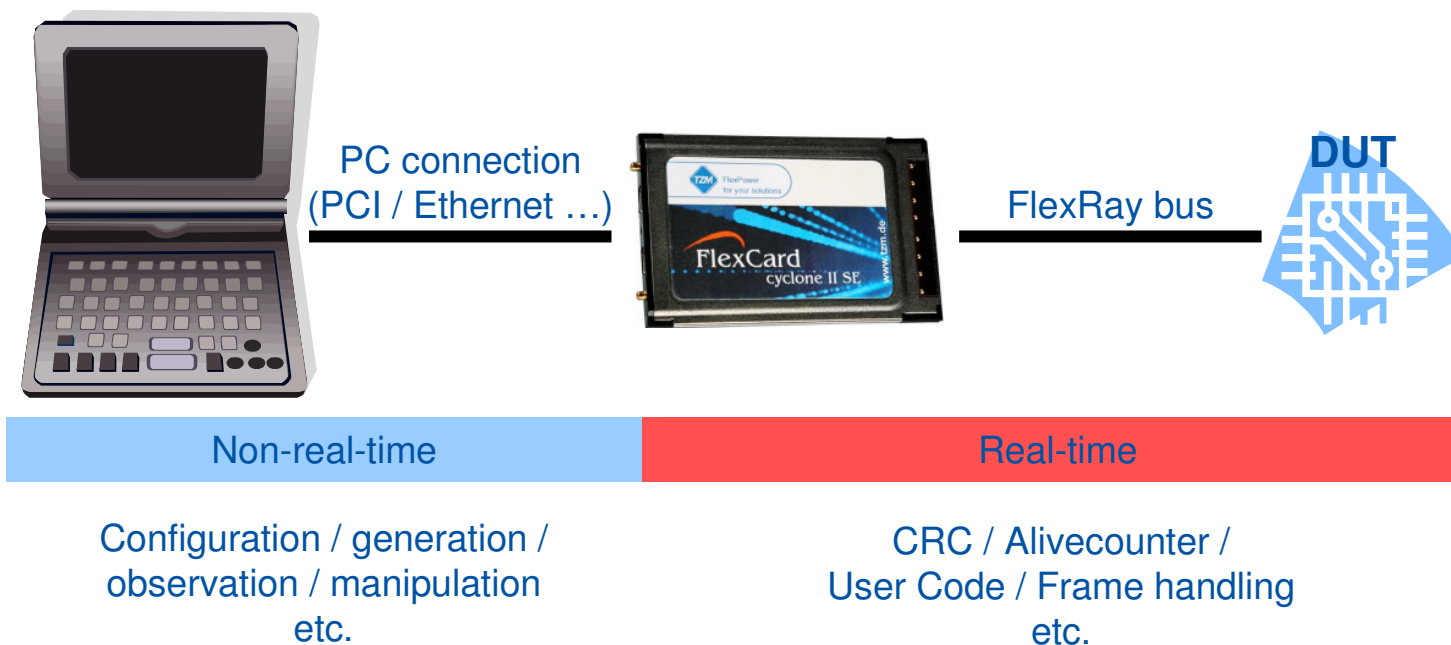
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Concept



Principle:

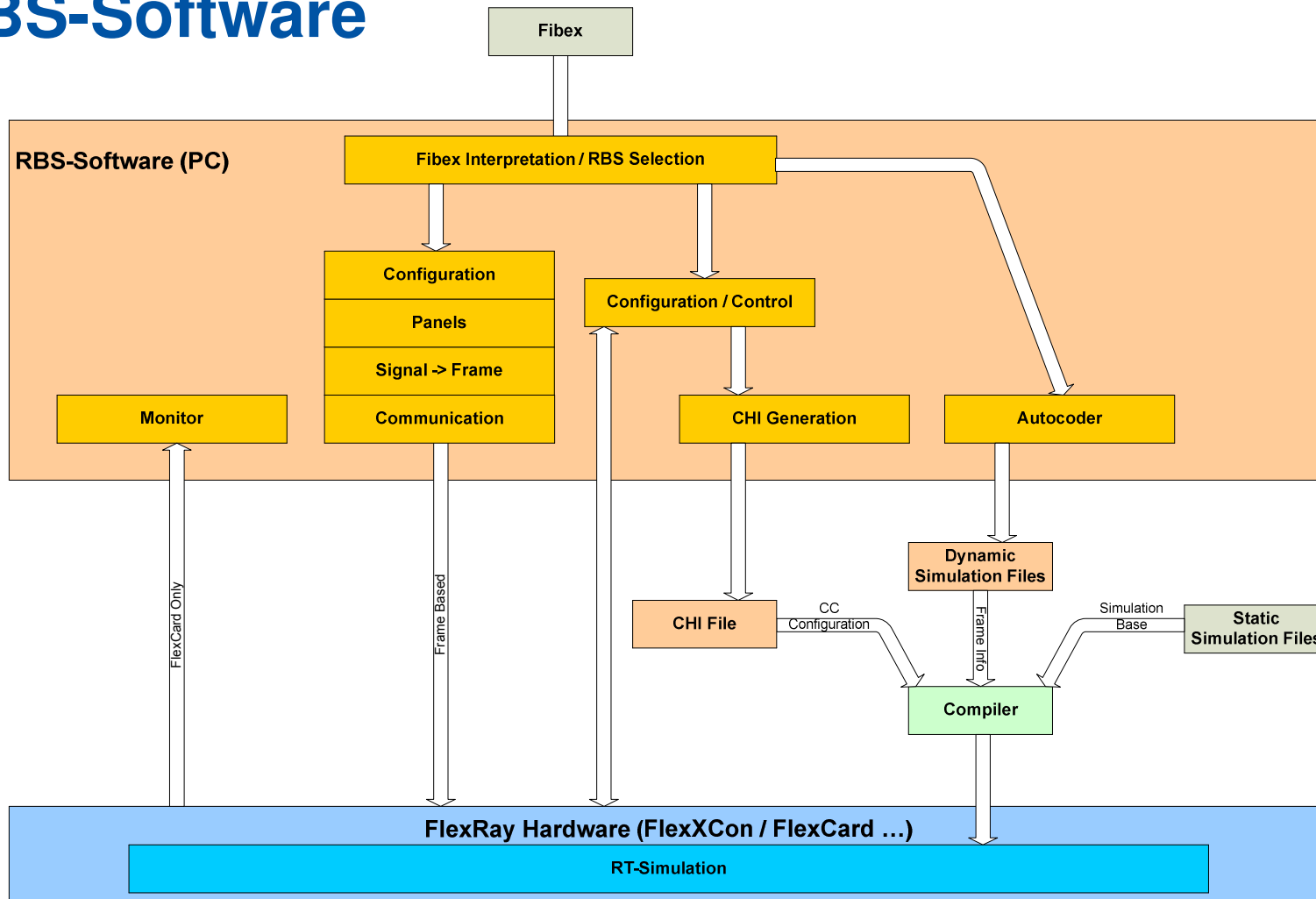
- Separating the software in a real-time and a non-real-time part
- Use a real-time platform and PC for corresponding software parts
- Make an intelligent simulation of the remaining bus communication



Concept



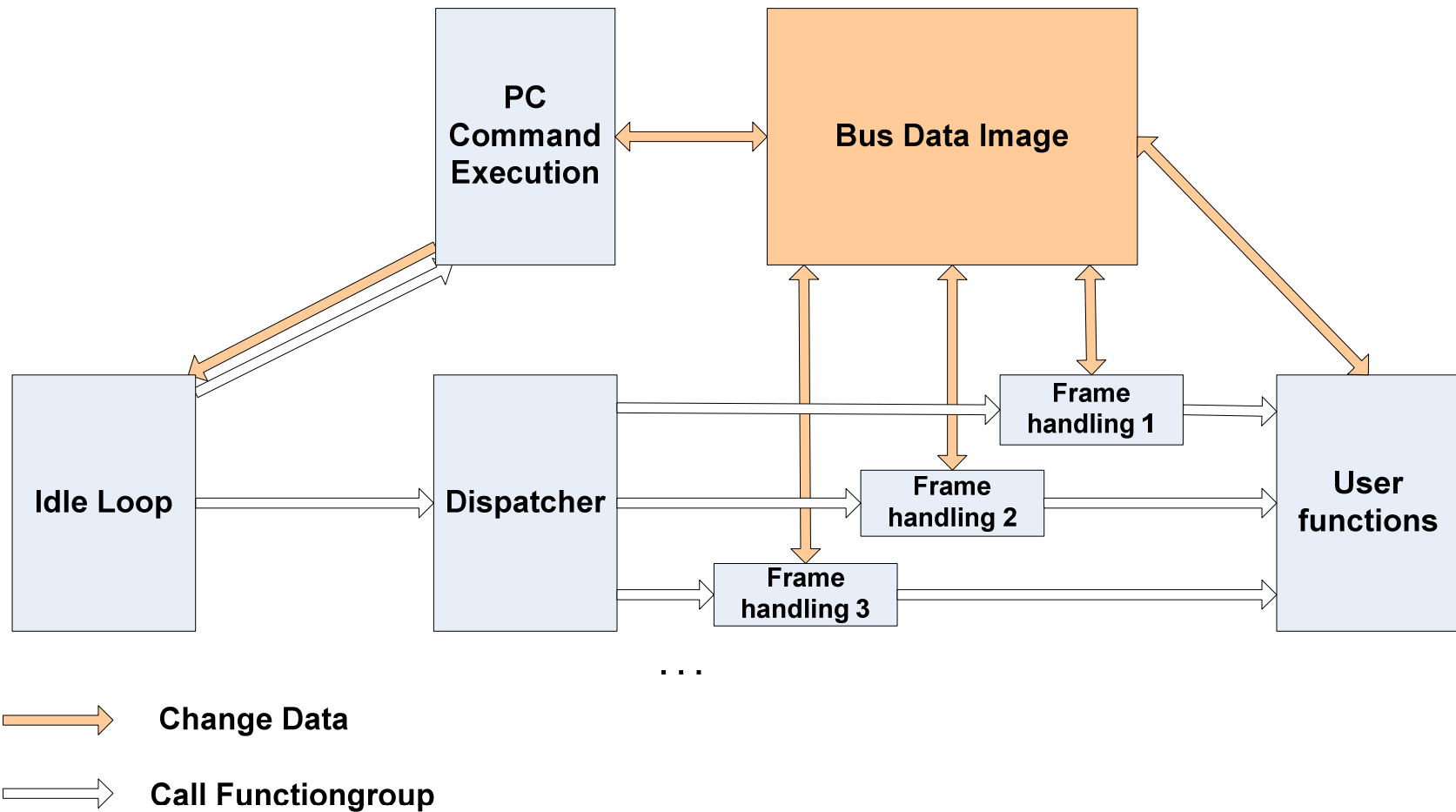
RBS-Software



TZM FlexXCon Implementation



RBS-Firmware



RBS vs HIL



RBS:

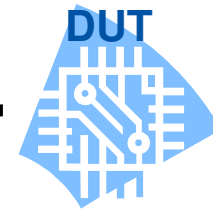
Human controlled



PC connection
(PCI / Ethernet ...)



FR bus



Non-real-time

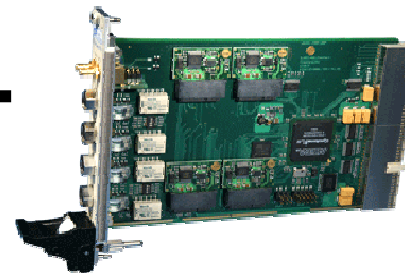
Real-time

HIL:

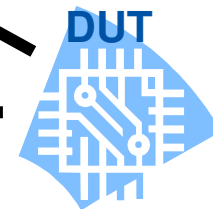
Model controlled



PC connection
(PCI, ...)



FR bus



Real-time

RBS vs HIL



RBS

- Elementary / Cheap
- Real-time at lower level
- Short generation time
- Human controlled test
- Step by Step Testing
- Less error-prone since auto generated

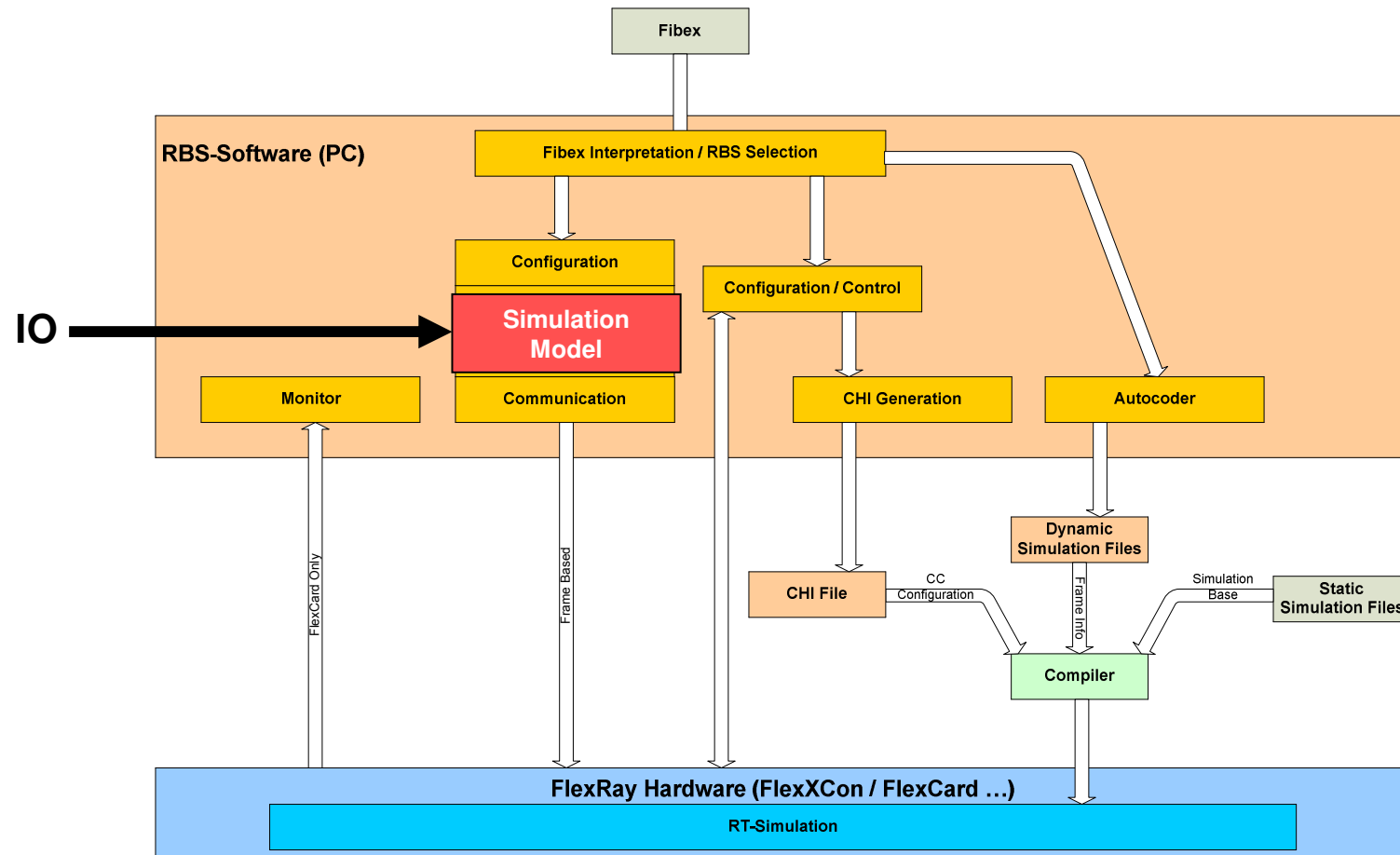
HIL

- Complex / Expensive
- Real-time at every level
- Time intensive model generation
- Automated test (model, parameter controlled)
- Test normally not interruptible
- If an error appears, is the error in the DUT or in the simulation model?

RBS vs HIL



Transform the RBS into a HIL



Example



FlexRBS

The screenshot displays the RbsGui software interface. The main window is titled "RbsGui - Demo_Stufe1_FlexCon_compact_A02.rbs". It features a menu bar (Datei, RBS, Ansicht, ?) and a toolbar. The main area is divided into several sections:

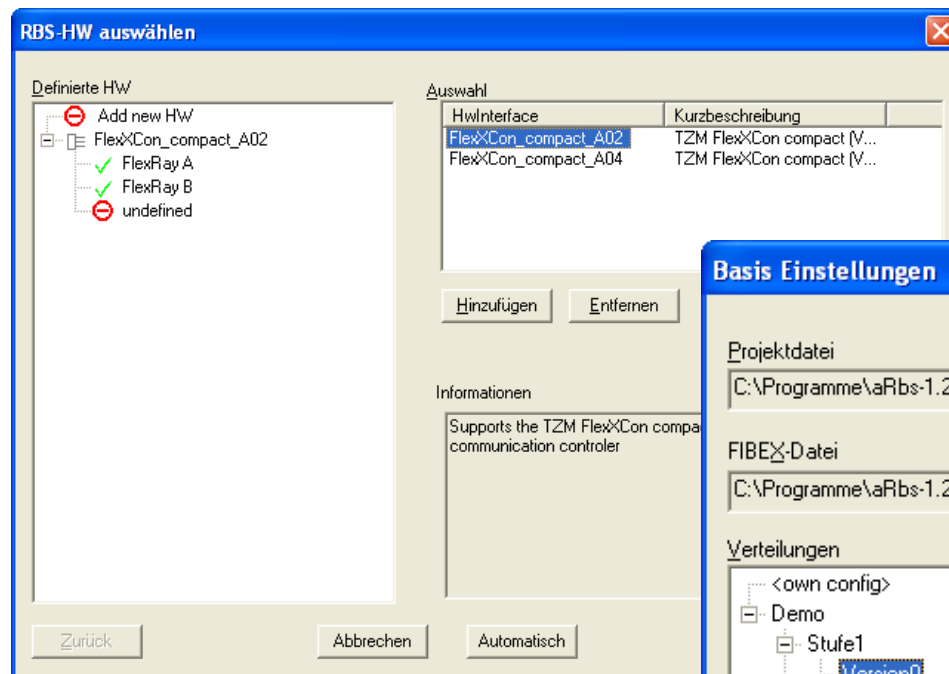
- Strukturansicht (Structural View):** A tree view showing the system hierarchy. Under "ChanneA", there are "Ecu1" and "Ecu2". "Ecu1" has a "send" action with a red "not supported" icon and several frames (Frame7, Frame1, Frame5, Frame4, Frame6). "Ecu2" has "send" and "receive" actions. A "Dummy" component is also listed.
- simulierte Frames (Simulated Frames):** A panel for managing simulated frames, with buttons for "Simuliere ECU", "RBS for ECU", "(Not) real ECU", "Simuliere", and "Don't simulate".
- Legende (Legend):** A key for symbols used in the tree view:
 - E: ECU alle Empfangsframes vorhanden
 - F: ECU alle Frames simuliert
 - E: ECU teilweise simuliert
 - E: ECU nicht simuliert
 - F: Frame simuliert
 - F: Frame nicht simuliert
- Status:** A panel with indicator lights for "Logging gestartet" (yellow), "RBS gestartet" (red), "RBS-Version" (0.0.0), "Bus Status" (red), and "Signalanzeige" (green).
- Statistik:** A section for "Deadline-Verletzungen" (Deadline violations) with a value of 0.
- FlexRay:** A panel with dropdown menus for "Kanal", "Frame", and "Daten", and a "Senden" button.
- CAN:** A section for CAN bus configuration.
- Ecu1 - Common Panel:** A panel with input fields for "Application_Data_7 (*)", "CRC_1 (*)", "Application_Data_1 (*)", "Application_Data_4 (*)", and "Application_Data_6 (*)".
- S_Ecu3 - Frame:3:** A panel with input fields for "Alive_Counter_1 (*)" and "Application_Data_3 (*)".
- Log Console:** A scrollable area at the bottom left showing system messages and logs.
- Table:** A table at the bottom right with columns: Time, Shortname, Frame, Cyc, Dir, Data.

BMW GUI

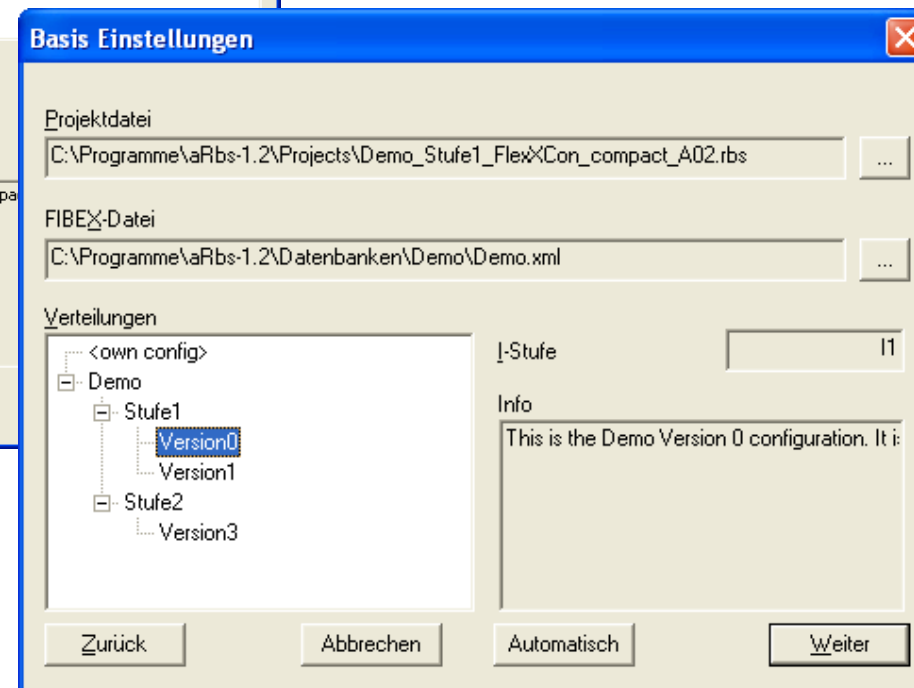
Example



FlexRBS - Workflow



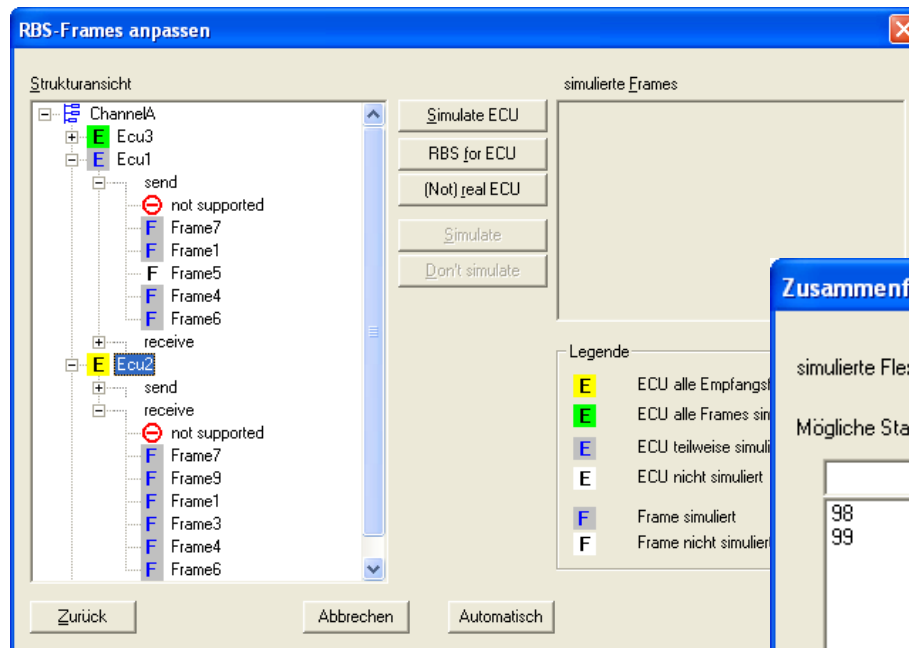
Select pre defined simulation configuration



Example

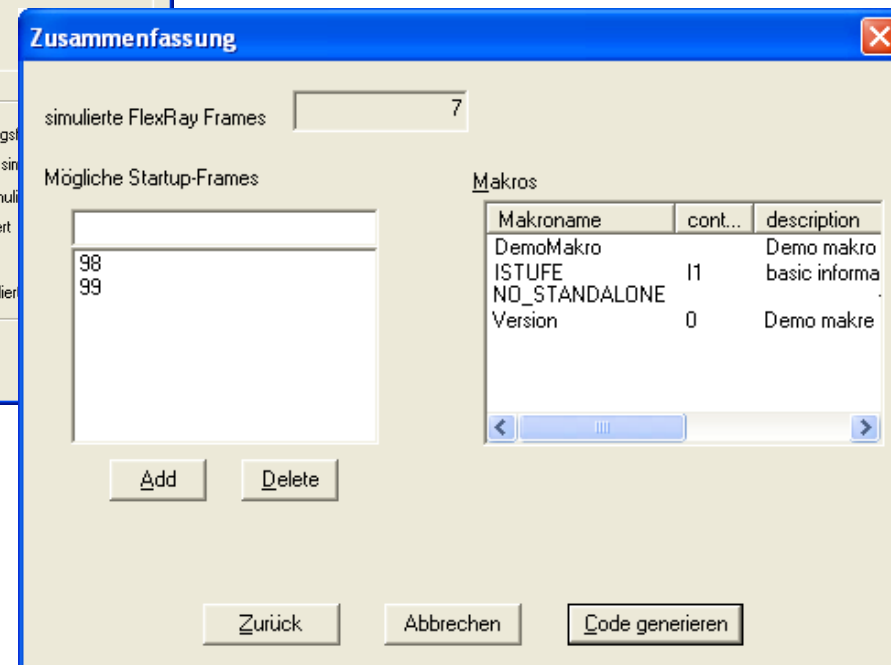


FlexRBS - Workflow



Edit the
configuration

Generate RBS



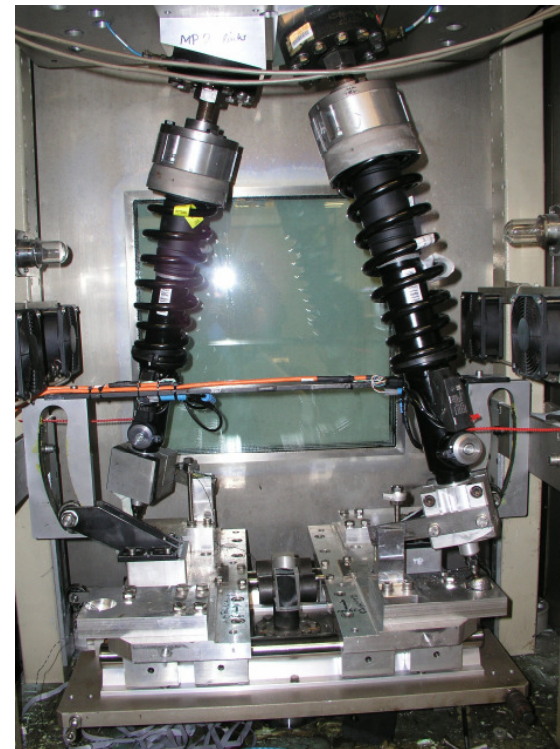
Example



Restbussimulation at BMW



Test bench for dampers

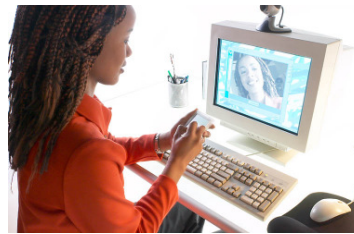


Example



Restbussimulation used for pre-verification

Reference
Traffic



FR bus

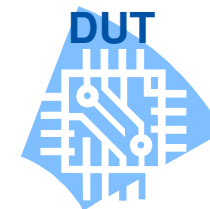


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Produced
Traffic



FR bus



Conclusion



- Can not replace a HIL system, but is a cheap test alternative to minimize the test time at the HIL system
- Quick creation
- Useful test tool during development



Thank you for your attention

Questions?

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