



Project example: HiL test systems



- **Overview realised projects**
- **Workflow HiL Project**
- **Specification HiL test system**
- **Setting up a HiL test system**
- **Starting up a HiL test system**
- **Operation**



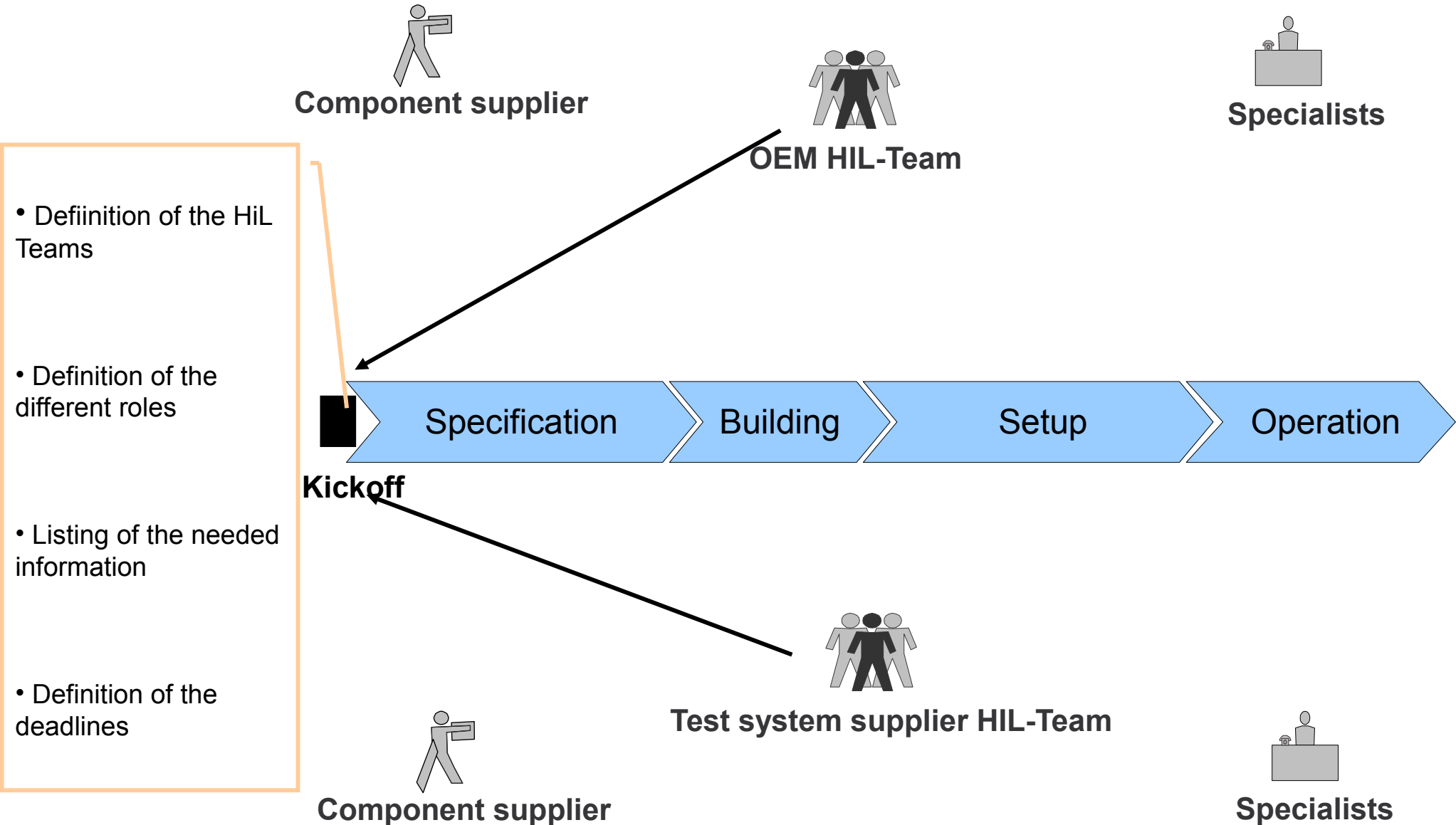
Project example: HiL test systems Overview realised projects

- **HiL-Simulator for a 6HP gier ecu on a dSPACE Platform**
- **HiL-Simulator for an EDC17 and a MED17 engine ecu on a dSPACE Platform**
- **HiL-Simulator for an ABS ecu on a xPC-Target Platform**
- **HiL-Simulator for a DELPHI engine ecu on a xPC-Target Platform**
- **HiL-Simulator for an AISIN gier ecu on a dSPACE Platform**
- **Multiple Openloop test systems for the EDC17 and MED17 engine ecu**



Project example: HiL test systems

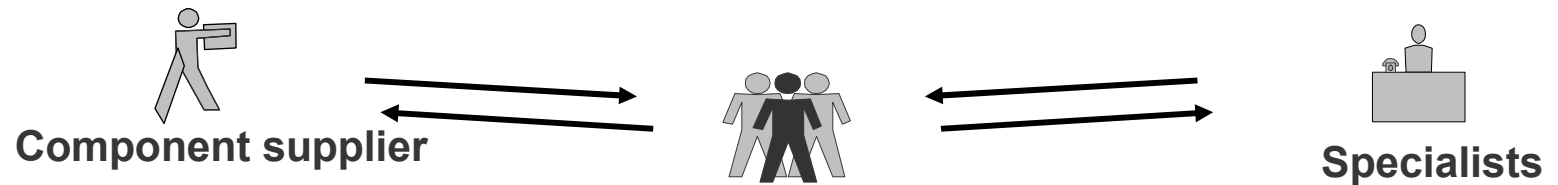
Workflow HiL Project



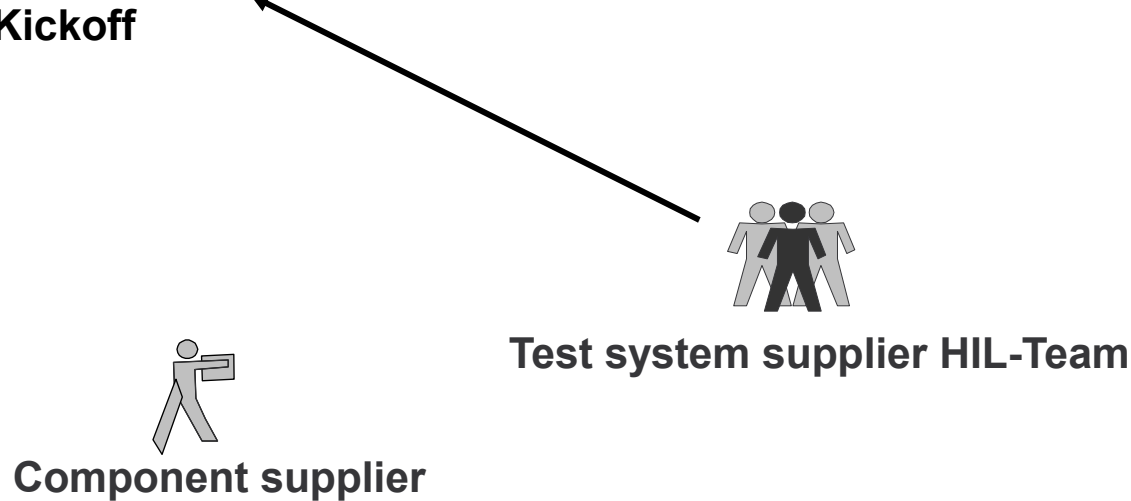
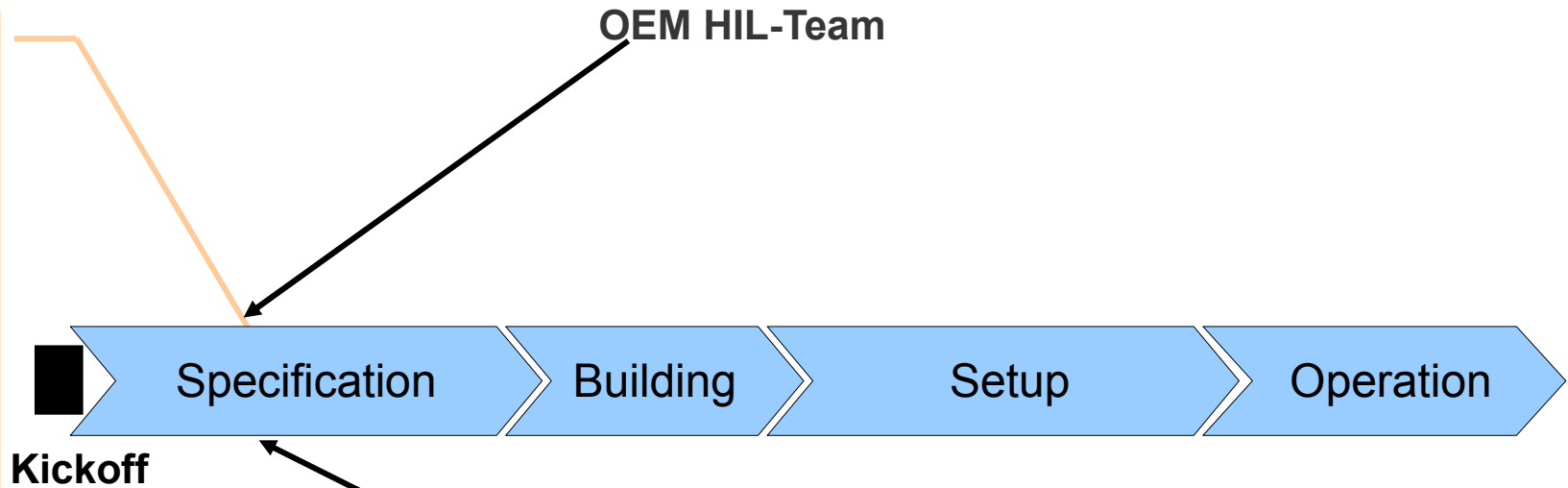


Project example: HiL test systems

Overview Workflow

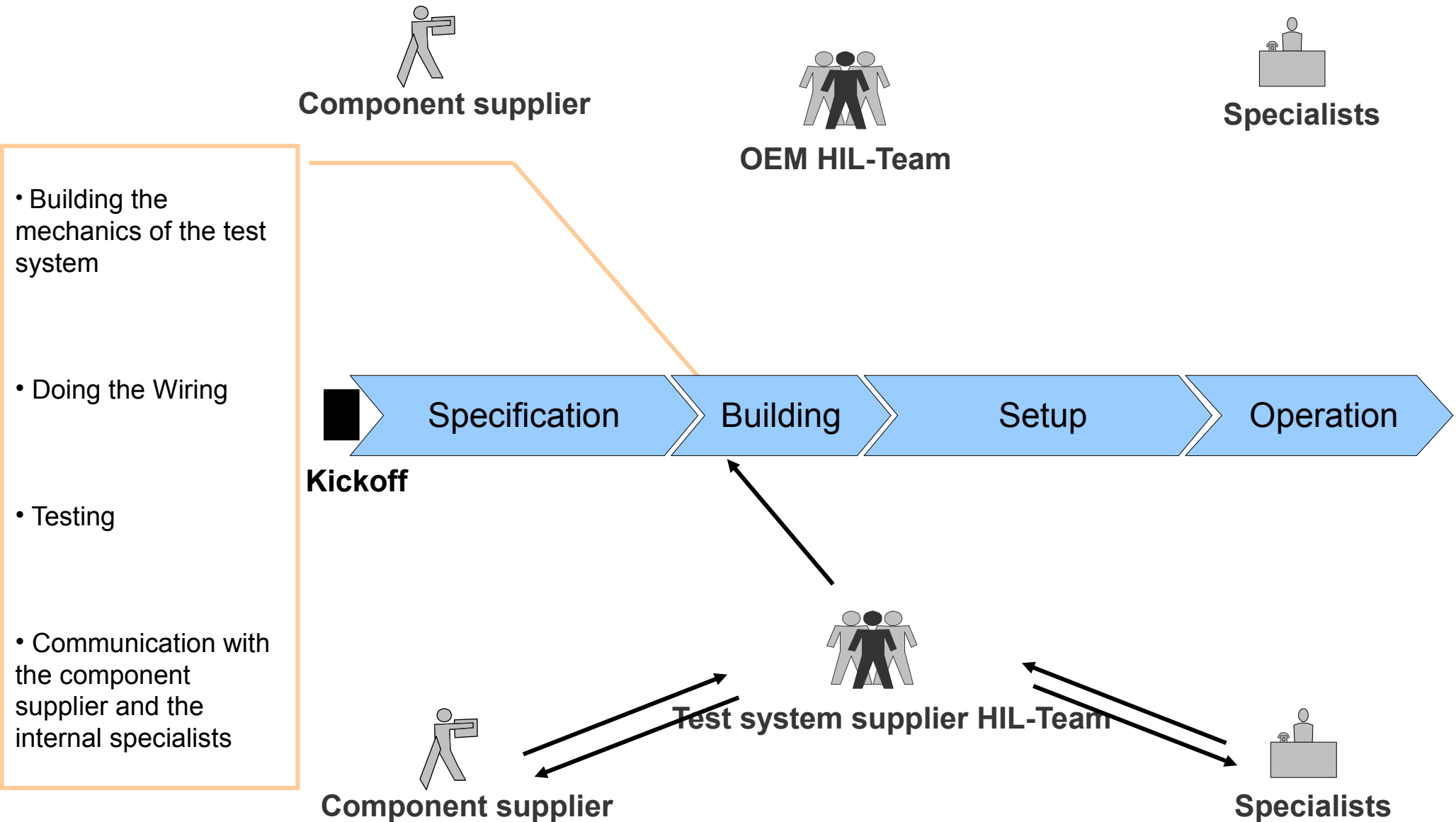


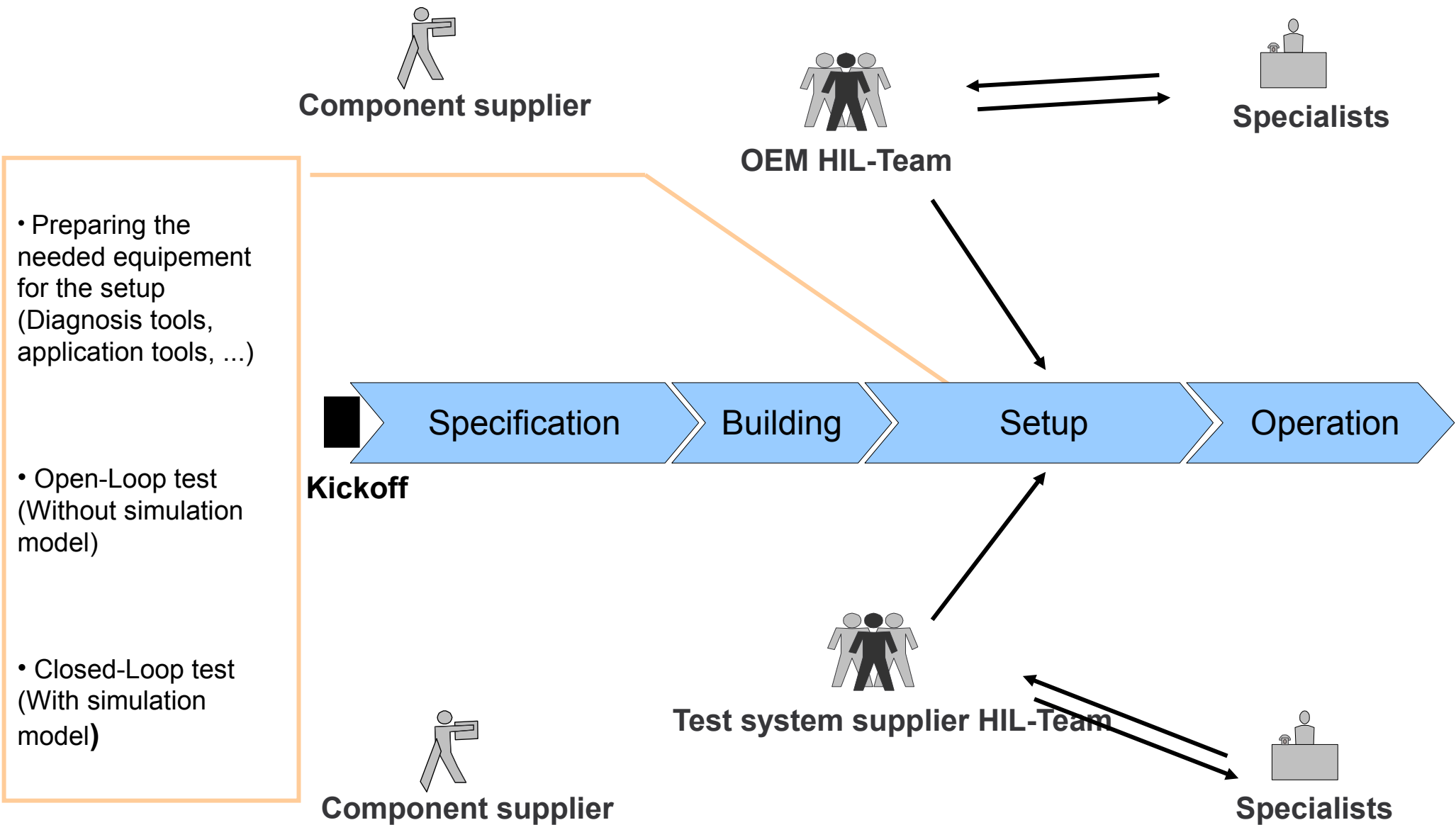
- Choosing the suitable Hardware and Software
- Working out the signallist
- Working out the control Software and the simulation model
- OEM HiL-Team looks for the needed information





Project example: HiL test systems Overview Workflow







Project example: HiL test systems

Overview Workflow


Component supplier

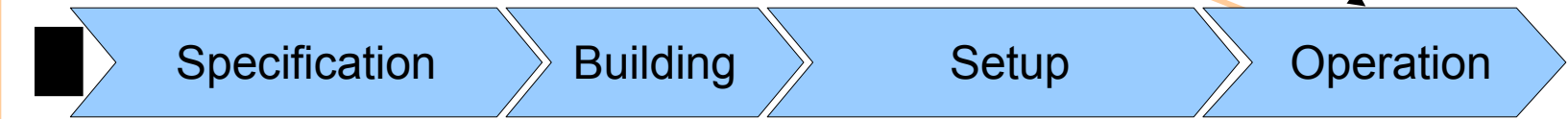

OEM HIL-Team


Specialists

• Functional tests,
communication tests,
diagnosis tests, ...

• Manual and
automated testing

• Component testing
or multiple ecu testing



Kickoff



Component supplier


Test system supplier HIL-Team

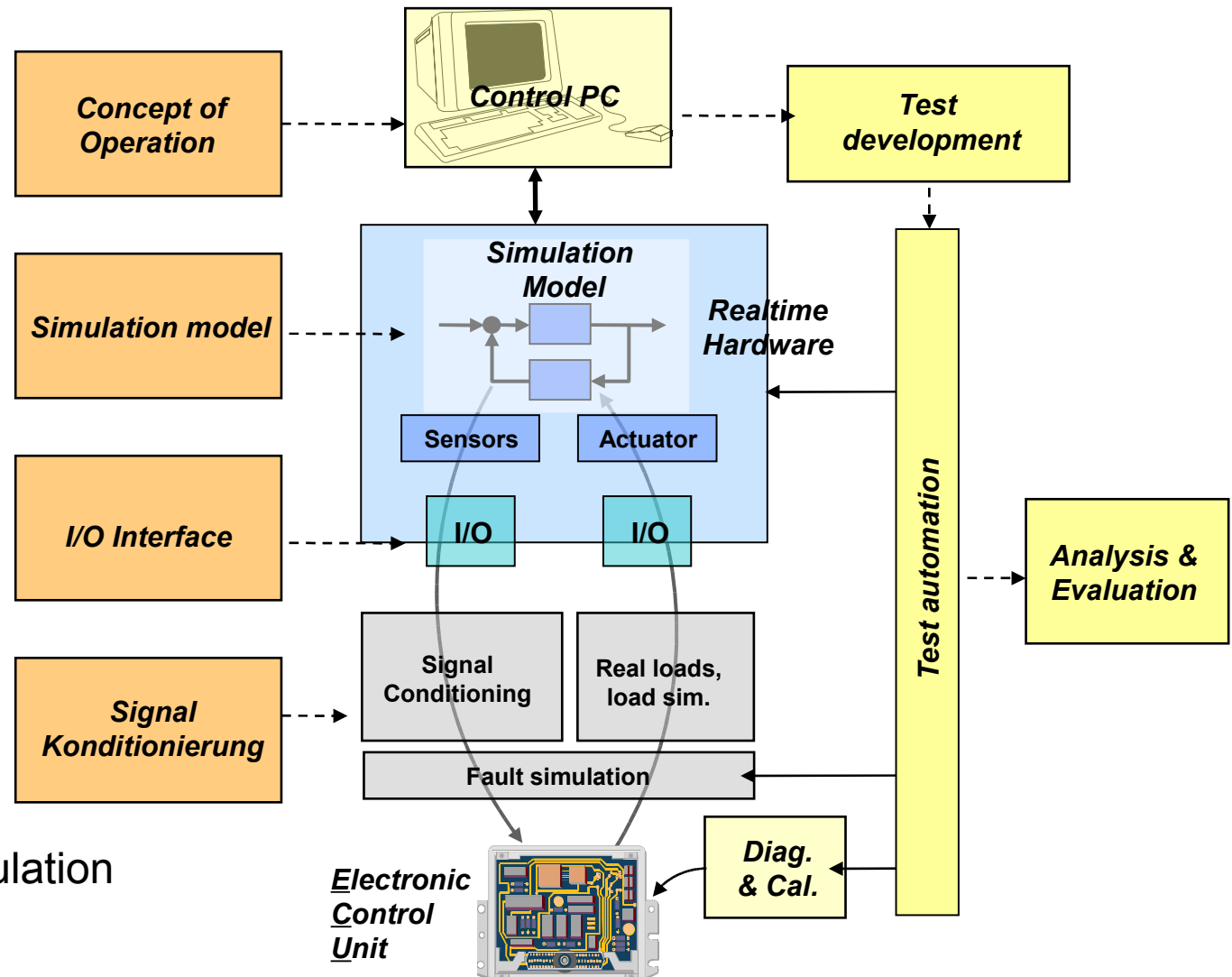

Specialists

Software

- Simulation model
- Concept for the operation
- Concept for test automation
- I/O Driver

Hardware

- Realtime processor and I/O cards
- Scaling modules
- Fault simulation
- Real loads and load simulation



Concept for the Operation:

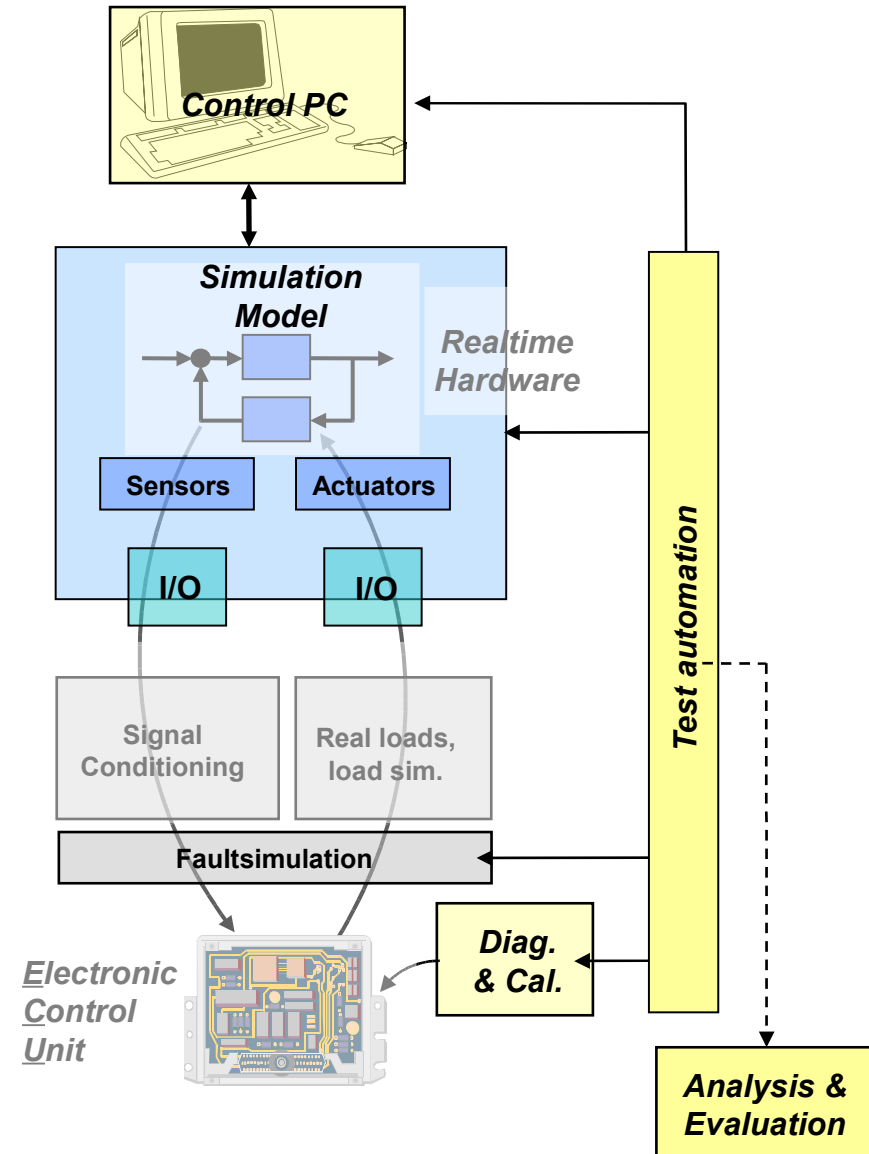
- Definition of the Cockpits
- Visualisation of the communication signals (CAN, LIN, ...)
- Visualisation of the informations to faultsimulation and diagnosis
- Choosing of the suitable controls and layouts

Simulation model:

- Choosing the needed model components (engine, gear, ...)
- Concept for the parametrisation of the model (e.g. m-Files)
- Simulation of the remaining bus
- I/O Driver, characteristic curves of sensors and actuators

Test automation:

- Access to ...
 - ... Control layouts
 - ... Real time application
 - ... external interfaces: diagnosis, calibration, ...
- Choosing of the suitable tools
- Definition of the structure of the test projects
- Analysis and evaluation of the test results (Documentation)



ECU Interfaces:

- Pinout of the ecu, terminal diagram
- Signals of the ecu: Name, Type (Voltage, Current, Resistance, ...)
- Mapping of the ecu signals to the I/O

Sensors and Actuators:

- Sensors: type (temp., pressure), pins (voltage, resistance), characteristic curves
- Actuators: type (resistance or Inductive load), real load or load sim.

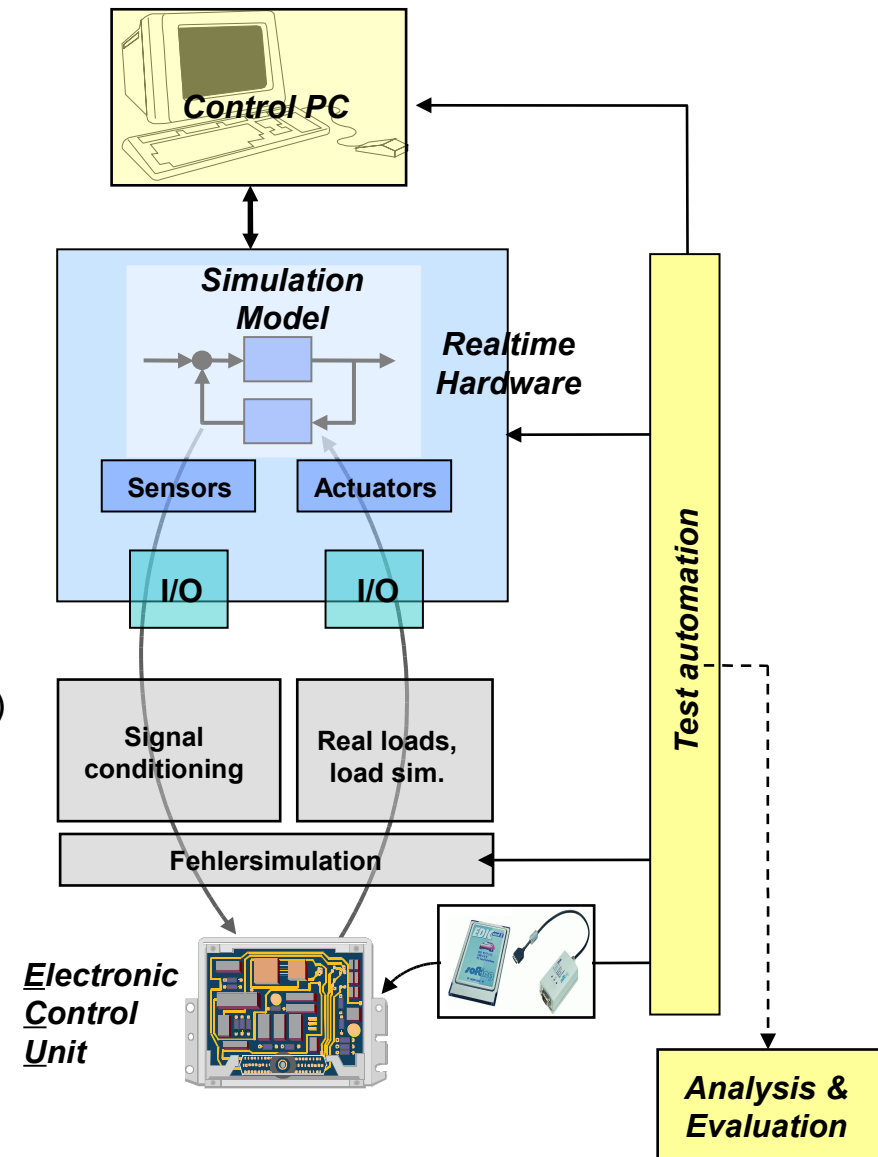
Realtime processor and I/O cards:

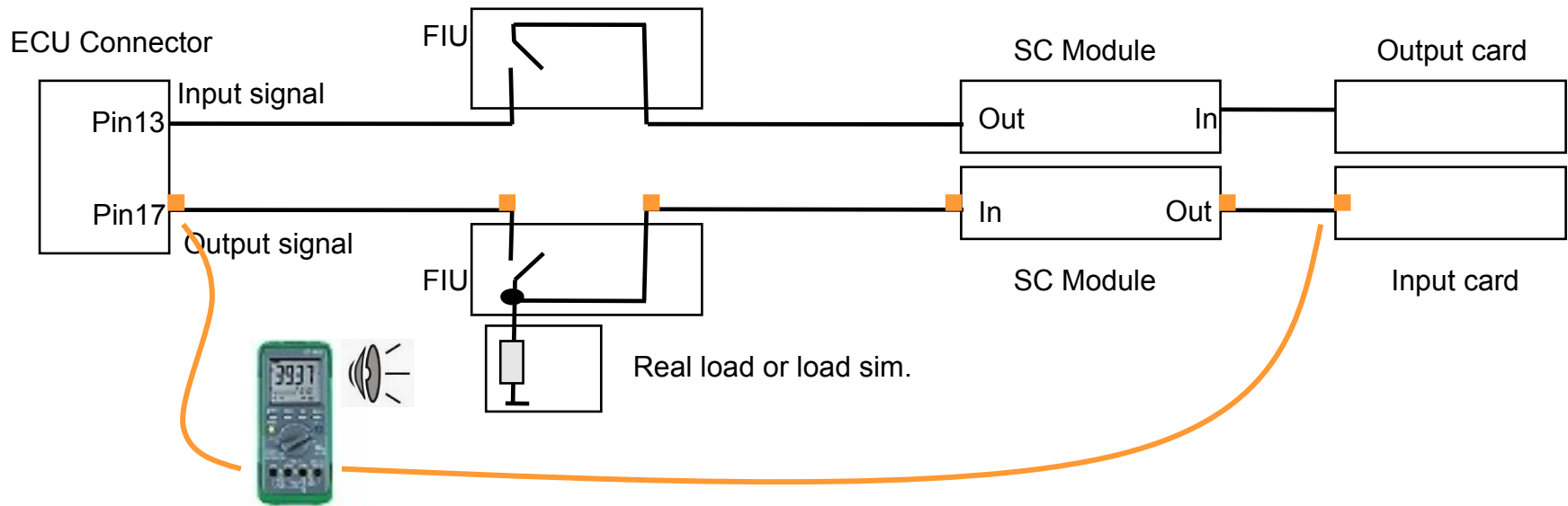
- Single- or Multiprocessor (Depending on the complexity of the model)
- I/O cards depending on the pinout of the ecu: Analog and Digital I/O, PWM I/O, Special I/O cards ...

Fault simulation:

- Choosing the desired signals with faultsimulation
- Type: Shortcircuit, breakout, ...

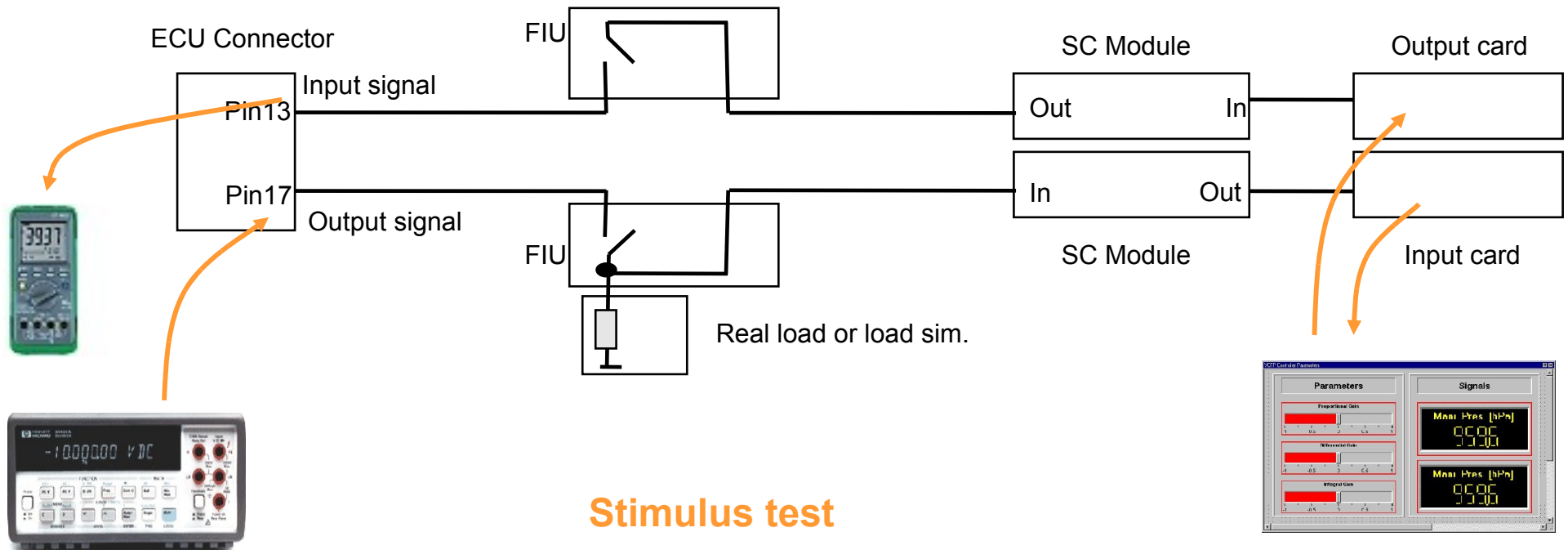
➤ **The result is a signal list with all needed information**



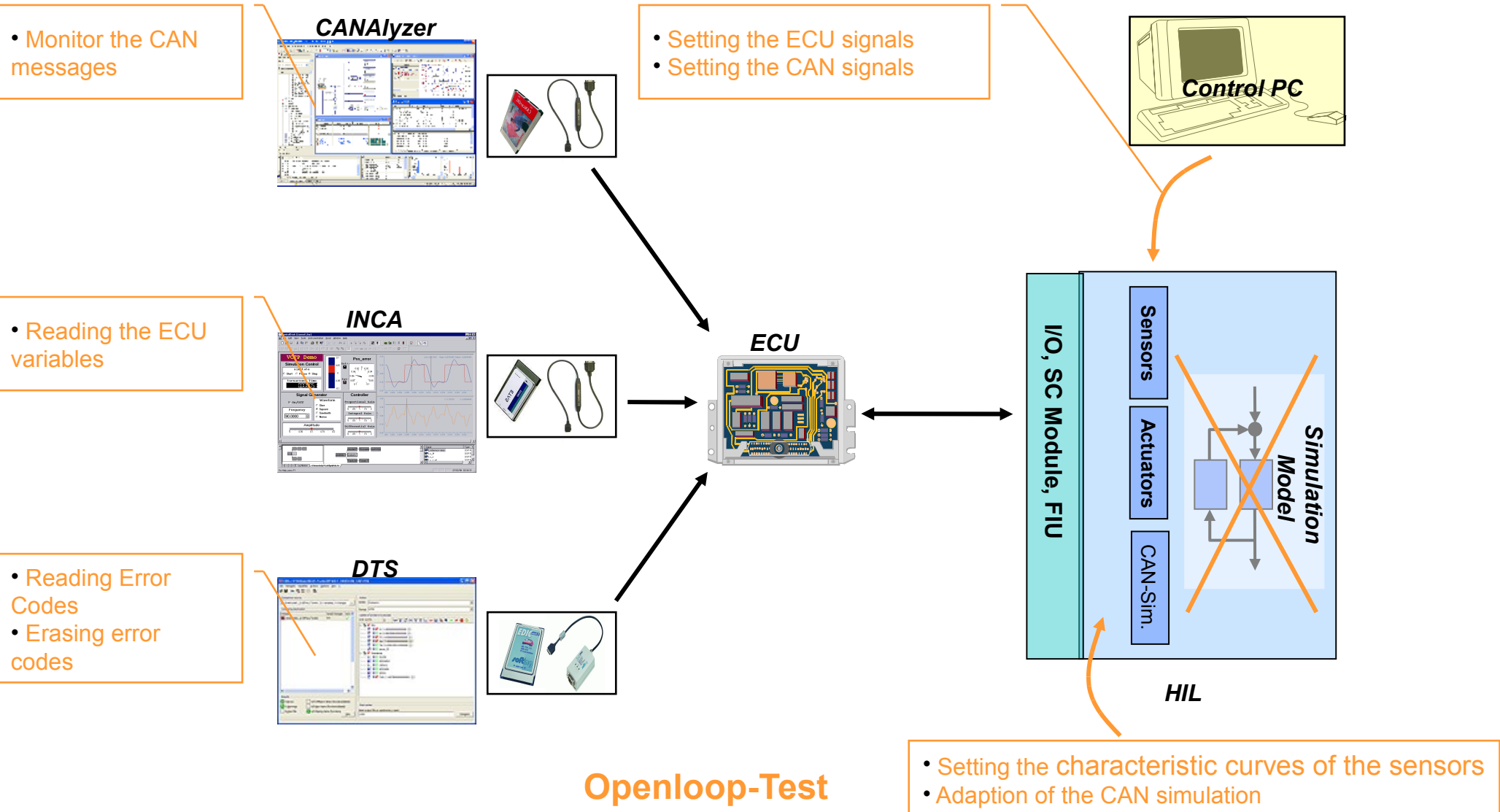


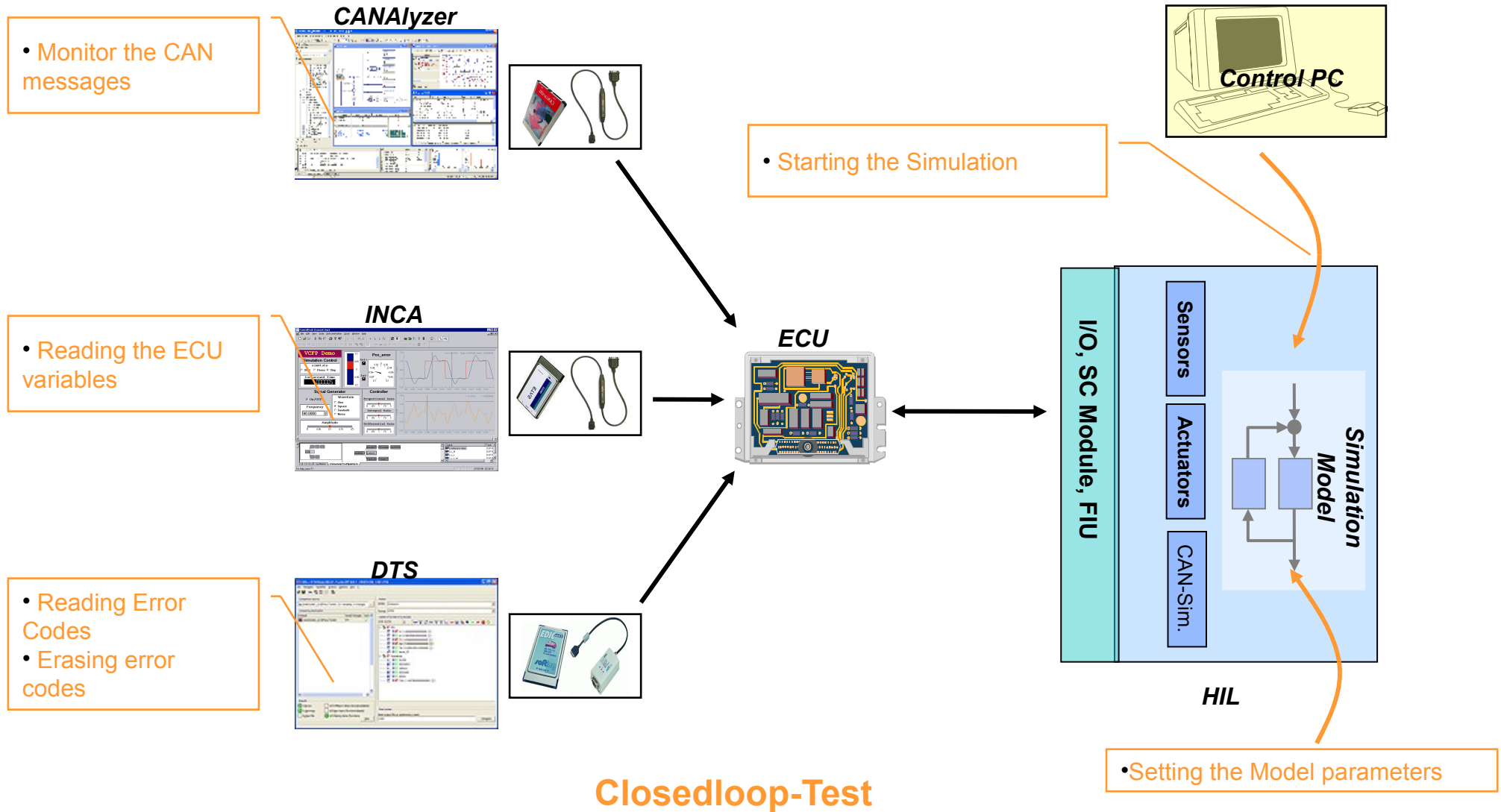
Test of the wiring

signal name in the sim. model	I/O card			SC Module			FIU			ECU	
	Nr. & Type	channel	Pin	Nr. & Type	Pin In	Pin Out	Nr. & Type	Pin In	Pin Out	Pin	signal name
HFM	Analogout 1	1	16	Analogout 2	3	7	FIU card 2	6	5	13	HFM +
...
DK Poti 1	Analogin 2	3	27	Analogin 1	4	6	FIU card 4	3	4	17	EGAS 1 +



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- ✓ **Wiring test**
- ✓ **Stimulus test**
- ✓ **Open-Loop test**
- ✓ **Closed-Loop test**



Component test

- Focus on functional tests
- Simulation of the remaining bus (CAN, LIN, Flexray), Diagnosis tests
- Fault simulation
- Electrical tests (e.g. Overvoltage, Undervoltage)
- Used by the development department at OEM and tier one supplier

Sub-System test

- Focus on integration tests by sub-systems
- Network management (e.g. Wake up and Sleep behavior)
- Simulation of the remaining bus (CAN, LIN, Flexray)
- Test of distributed functions
- Used by testing teams at the OEM

Integration tests, release tests

- focus on custom functions.
- Network tests

