Compact Dynamics

Measurement and Calibration

Systems

Measurement
29.6.2006

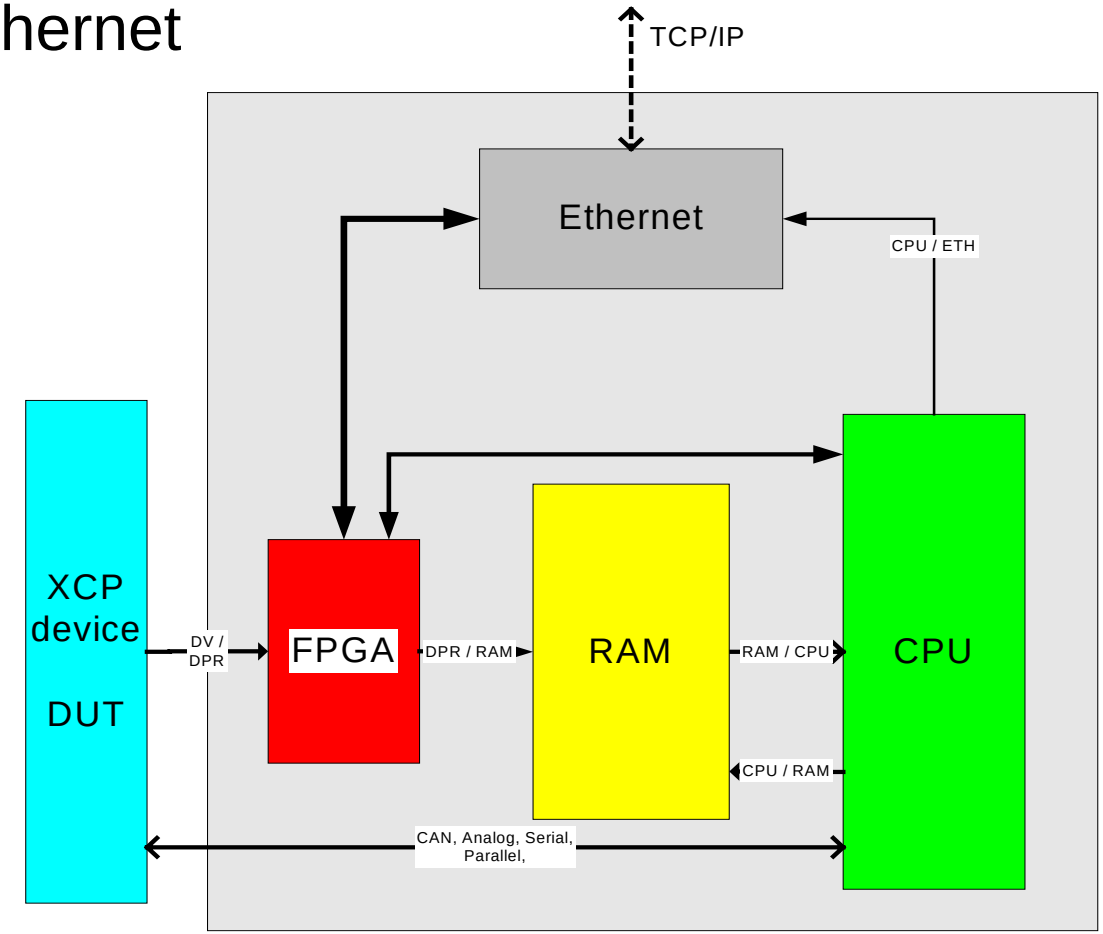
Compact Dynamics

Measurement in general

- Designed for automotive -40…+125°
- Mechanical design for engine compartment
- Ethernet with 100MBit, full TCP/IP
- XCP 1.0 on Ethernet standard protocol
- Small size
- High data rates up to 6MByte/s
- Timestamp with 10µs resolution for all measured signals
- Diagnostic software supports more measurement units at one time.
- Data logger available
- Any connection to measured signal (SPI, CAN...) or FPGA with protocol adjustment

Measurement in general

- Connection to any external protocol
- Additional inputs and outputs
- 100MBit Ethernet



Technical details hardware

- MTA specified for automotive temperature range, (-40...+105°C)
- CPU: Motorola Power PC® MPC 5xx, Flash, NVM
- FPGA for any connections to DUT, up to 150MByte/s
- Implemented connections:
  - TMS470 Nexus or data bus
  - MPC5xx / MPC555x data bus
  - EDP / IPD, multiple SPI
- RAM on Board up to 8MByte
- Available MTAs with 90*60 mm^2
- Additional connections for example CAN, SPI or A/D

Technical details software

- Real time operating system with TCP/IP-Stack
- Based on MPC5xx
- CPU load less than 50% on a continuous data rate of 4 MByte/s
- Standard XCP1.0 Interface
- PC-SW:
  - CANape 5.6 von Vector Informatik or
  - INCA 3.0 von ETAS
- Auf 100Mbit Ethernet up to 6 MByte/s
- Download and flashing of the MTA by XCP
- Sample rate and time stamps for measurement 10 µs.

Measurement system EMMA

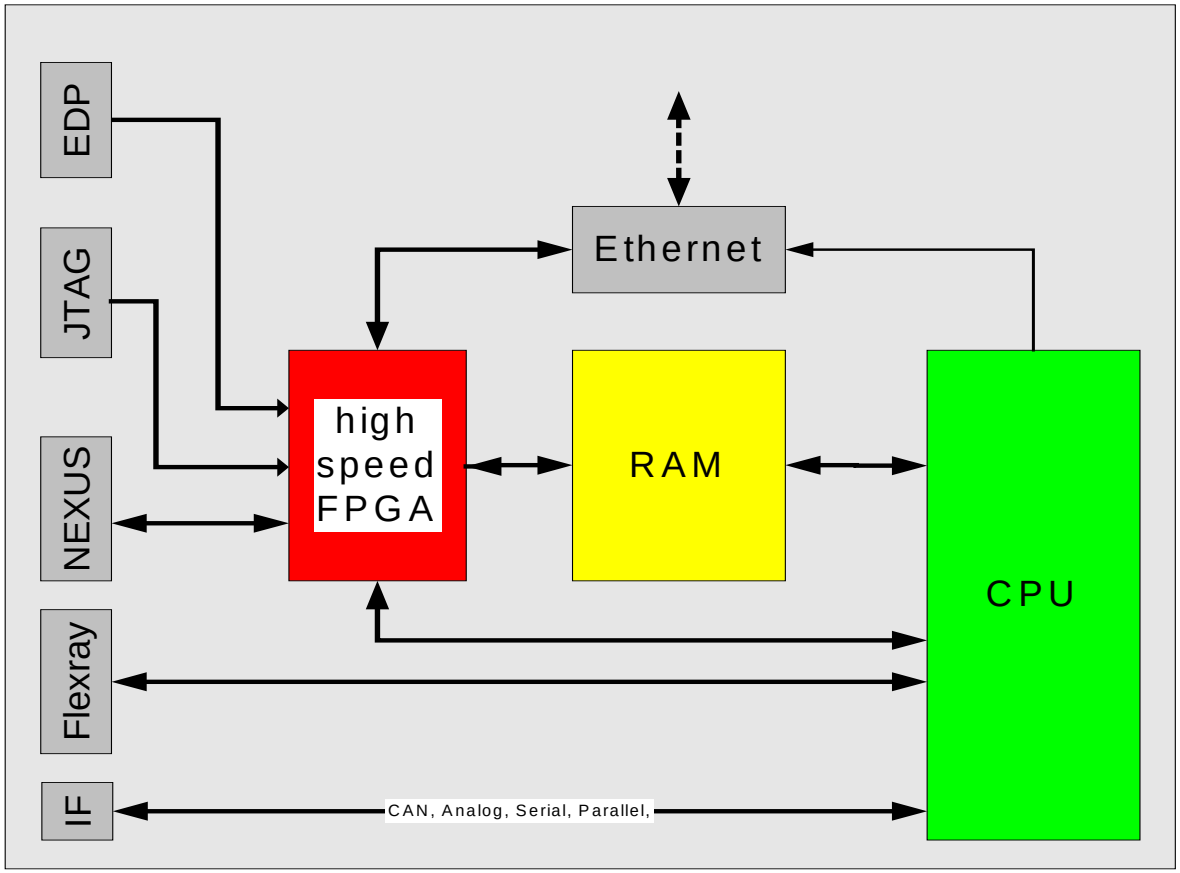
- EMMA based on a modular frame
- DPRAM connection 32bit data / 17bit addr.
- Contains development platform for customer

Measurement system IMA

- IMA 60*90 mm² for engine compartment
- 8 high speed SPI inputs + CAN and A/D
- 60 MByte/s burst input

Measurement system NMA

- New connection e.g. Flexray, Nexus,...
- Higher CPU power (development of algorithms...)



Measurement system NMA

- High data rates on input up to 150MByte/s burst
- FIFO and RAM up to 256KByte
- Continuous data measurement during data transfer
- Data rate up to 6MByte/s for measurement and up to 500KByte/s for calibration
- Standard Nexus Data-Trace und JTAG-connector
- FPGA-Interface adaptable to other connections
- Additional CAN, A/D und digital I/O with common timestamp available

Compact Dynamics

Measurement and Calibration

with OS-9

Measurement
29.6.2006

Automotive measurement

- **CAN**
  - Protocol CCP
  - Layer CAN

- **Ethernet**
  - Protocol XCP 1.0
  - Layer CAN - SPI - USB - Ethernet UDP, TCP/IP

- **ASAM**
  - A2L file for device description
  - XCP 1.0 Draft Standard from 2003-04-08

XCP main features

- ***X*CP provides the following basic features:**

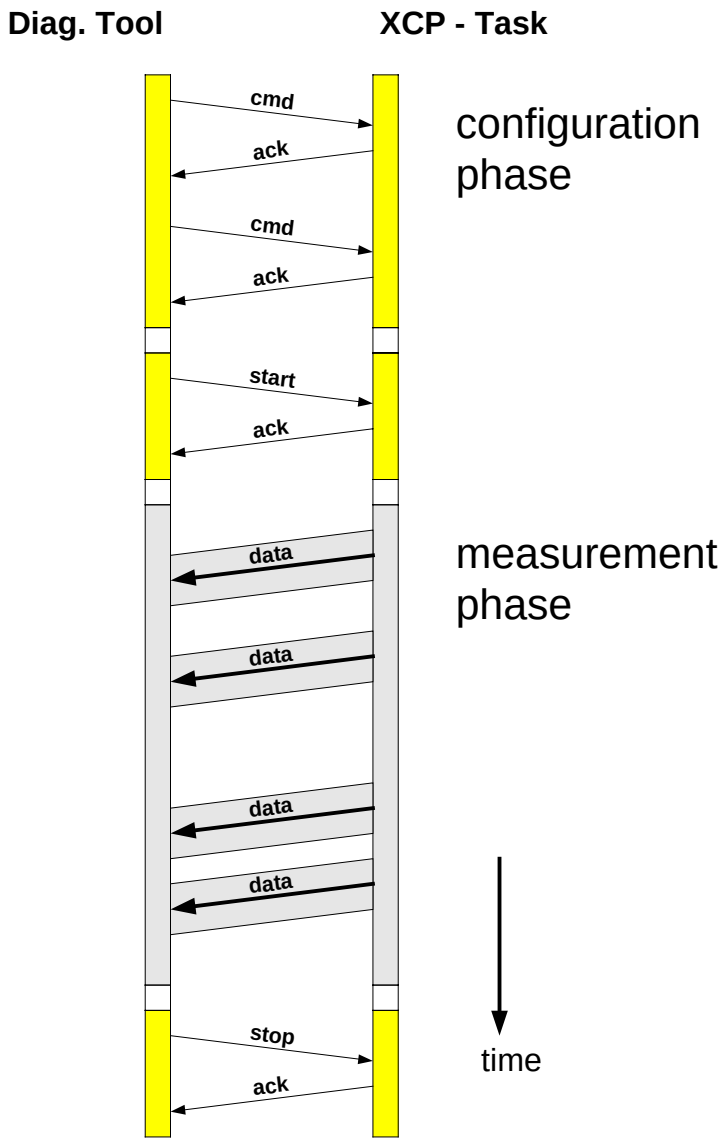
- Synchronous data acquisition
- Synchronous data stimulation
- Online memory calibration (read / write access)
- Calibration data page initialization and switching
- Flash Programming for ECU development purposes

- ***X*CP provides the following new features:**

- Various transportation layers (CAN, Ethernet, USB, …)
- Block communication mode
- Interleaved communication mode
- Dynamic data transfer configuration
- Time stamped data transfer
- Synchronization of data transfer
- Prioritization of data transfer
- Atomic bit modification
- Bitwise data stimulation

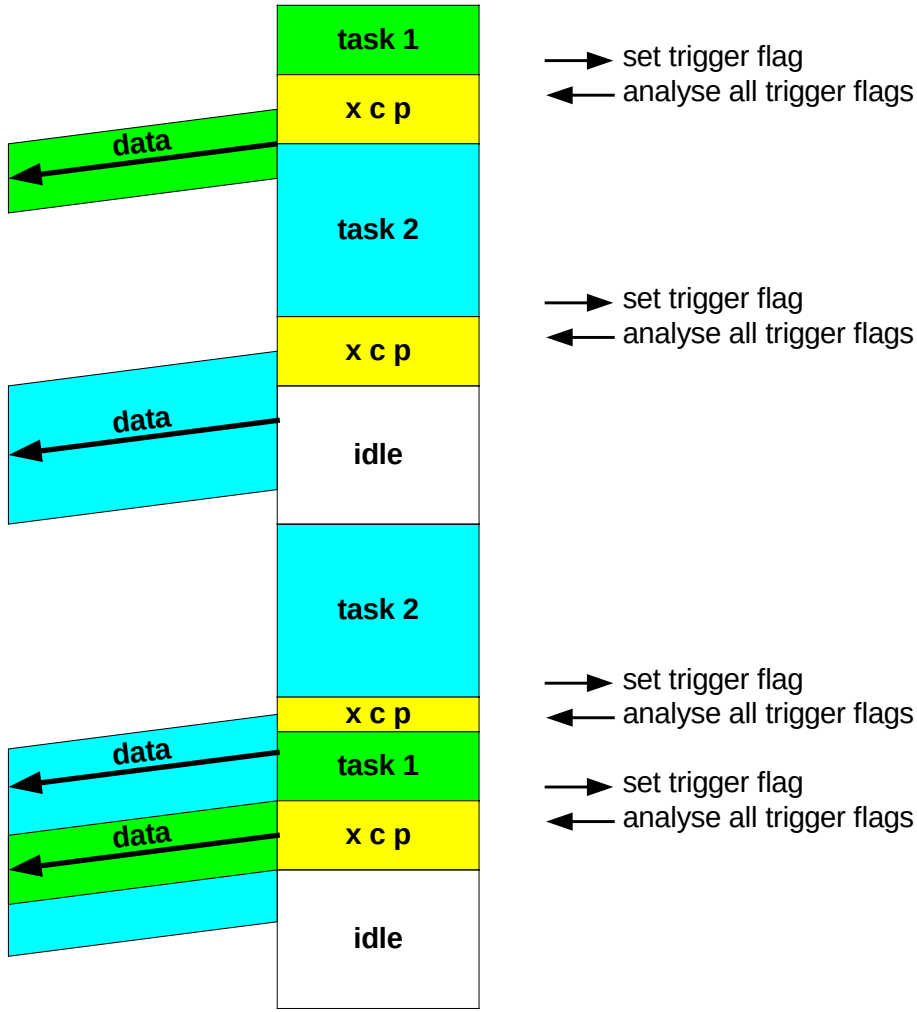
XCP communication

- **Configuration phase**
  - Install connection
  - Config measurement data
  - Start Measurement
  - Commands are acknowledged
- **Measurement phase**
  - DUT sends data - Tool captures data.
  - No communication handshake



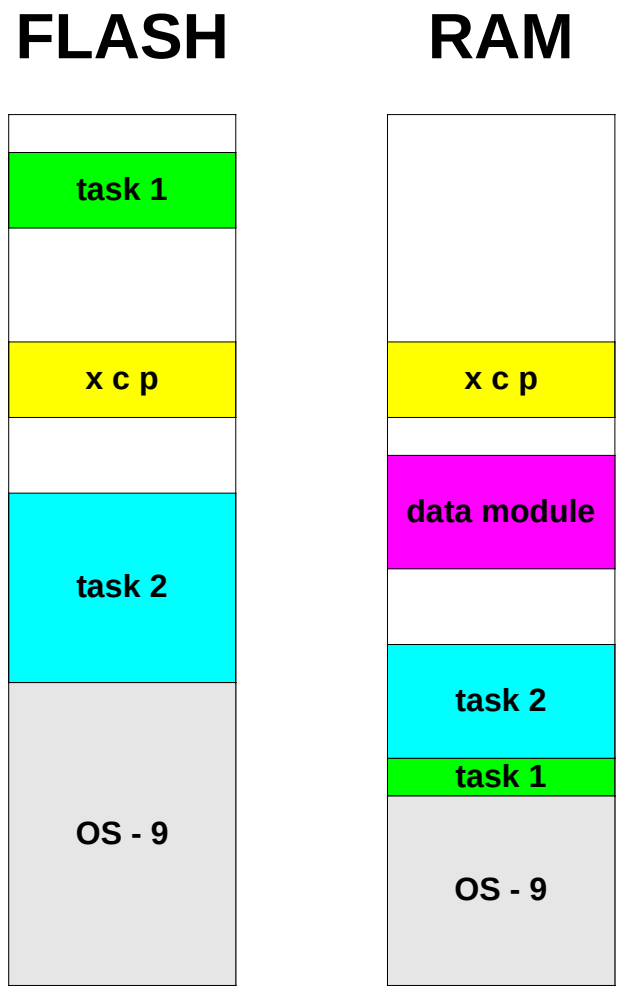
XCP com. details

- **Application tasks**
  - Running in real time
  - Manipulating data
  - Setting trigger at end of task
- **XCP task**
  - Runs at lower priority
  - Checks trigger of application tasks
  - Sends configured data according to trigger
  - Trigger are prioritized.



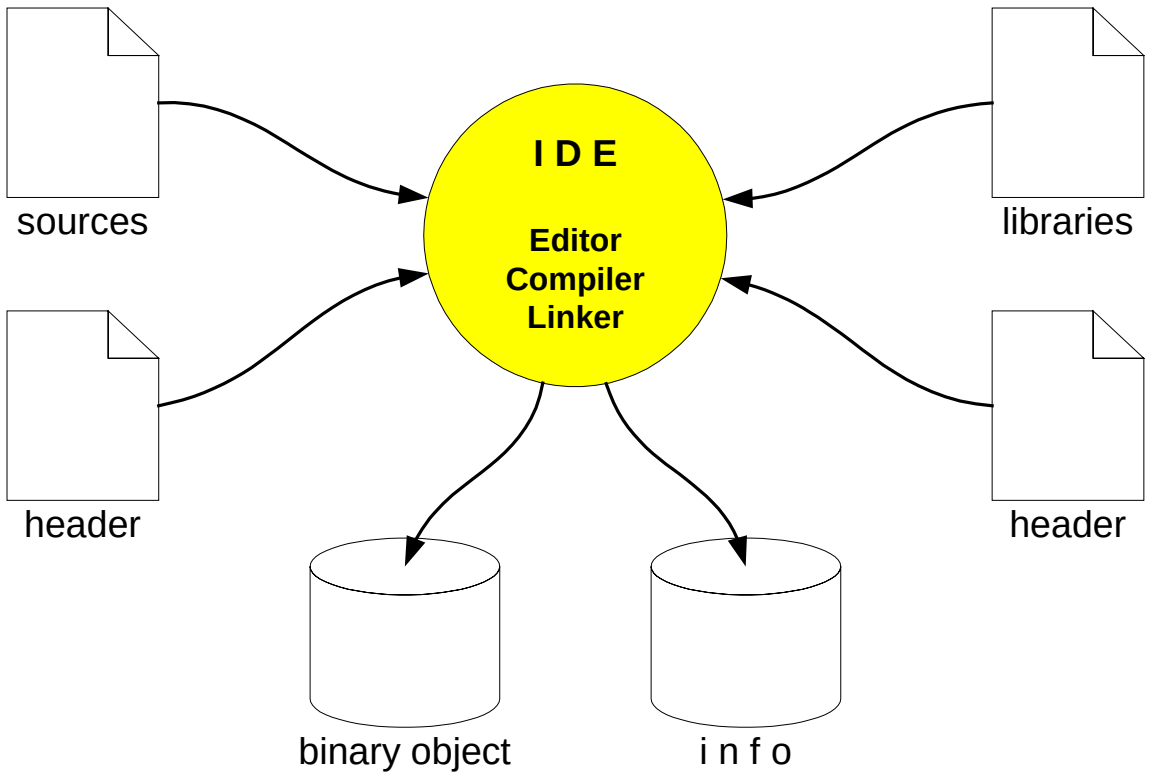
OS-9 address space

- **FLASH contains**
  - Task code
  - Static data module
  - Location is **NOT** known at time of compilation
- **RAM contains**
  - Static storage area of each task
  - Dynamic data module
  - Location is **NOT** known at time of compilation
- **Startup**
  - Tasks are loaded (forked) at run time
  - RAM is allocated at run time



OS-9 tool chain

Application **OS - 9**



- **map file**
- **symbol file**

XCP and OS-9

- **Implementation**

- Use the XCP feature ‘address extension’ to distinguish tasks
- Dynamically synchronize tool and DUT

- **OS-9: During startup**

- Allocate table for address translation
- Each task adds its absolute start address to the table
- The data start address of a data module can be added too

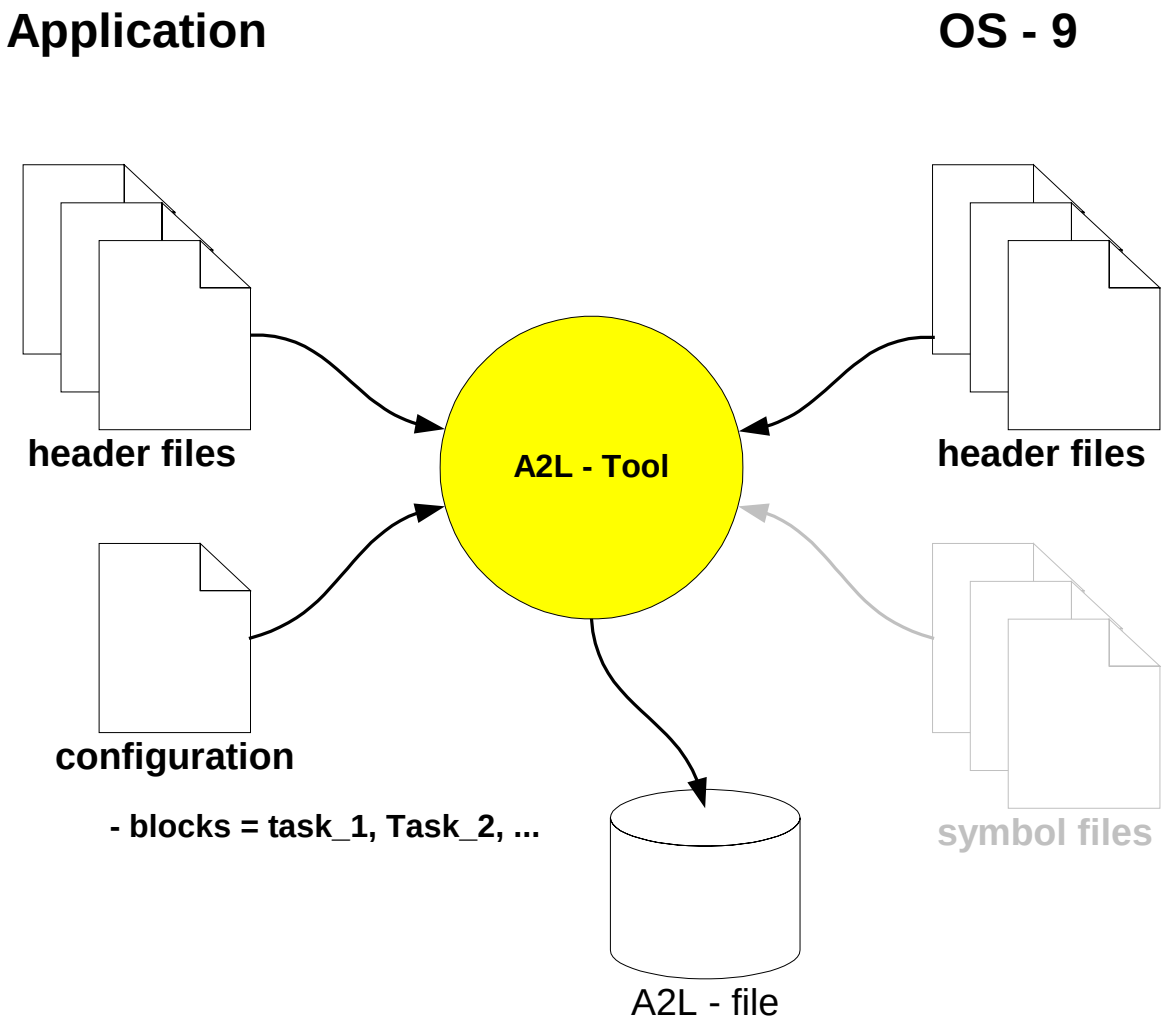
- **Tool: During configuration**

- Tool sends relative address and address extension
- XCP task translates relative address and address extension into absolute address

- **Tool: During run time**

- XCP task takes absolute addresses from DAQ lists
- Tool takes passed data according to configured DAQ list into its memory

A2L tool chain



Diagnostic Tool