

# An open source FPGA firmware framework (FWK) by DESY

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12th MT ARD ST3 Meeting 2024 in Darmstadt 3 to 5 July



- Currently it is used to provide firmware for:
  - LLRF Regulation of many facilities in and outside of DESY:
    - EuXFEL: e.g. Laser Synchronization, Cavity Tuning, Special Diagnostics
    - FLASH: e.g. Special Diagnostics
    - TARLA, HZDR, HZB, MYRRHA,...
- Motivation: everything in mono repository – initially easy to maintain but difficult to share, reuse and distribute
  - Decouple framework from the code base and make it open source
  - Restructure, improve and make more modular

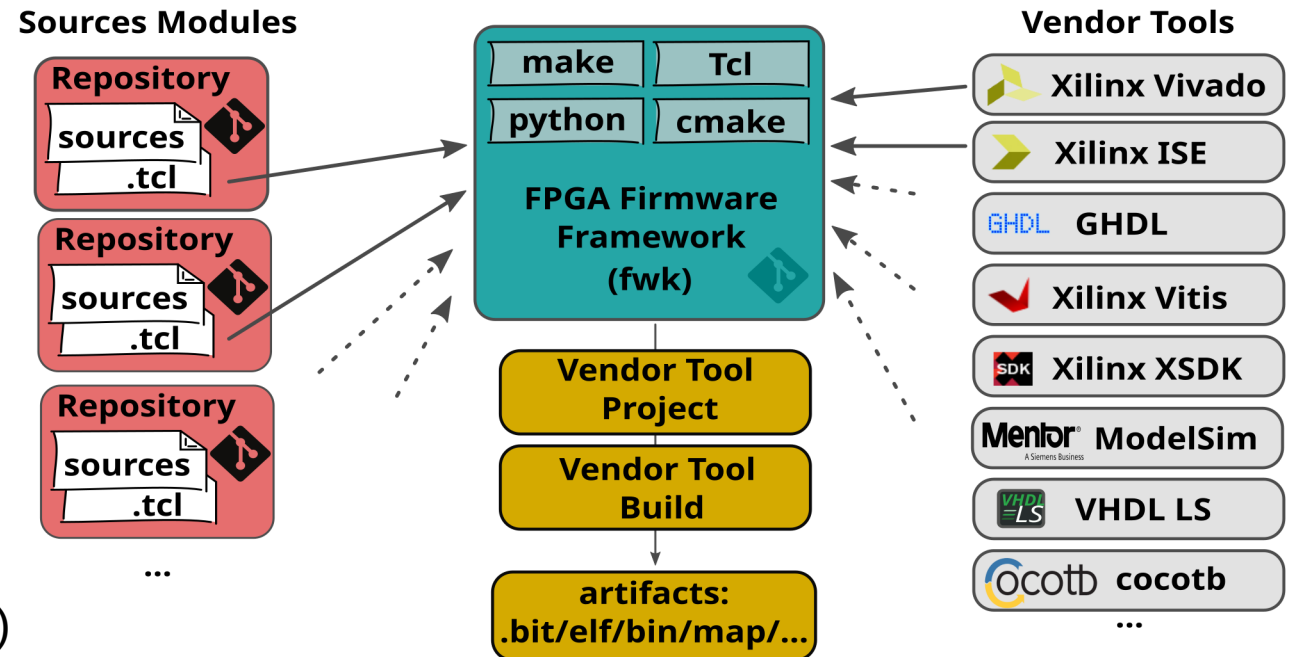
# FPGA firmware framework (FWK) Structure

- FWK is a set of rules, structures, script and tools that give an abstraction layer.
- It is based on Tcl scripts with backend for each vendor => Makefile as a start point => Python as extensions
- Each source module is a separate git repository with source files and FWK defined Tcl script.

The main features of the framework :

- Multiple vendor tools support
- Allows easy regeneration of projects (Generic)
- Constructs an address space for the SW (also link with software : ChimeraTK\*)
- Generates documentation
- Integrates HW and SW part of the FPGAs
- Automated versioning
- Continuous integration ready (Jenkins, Gitlab CI)

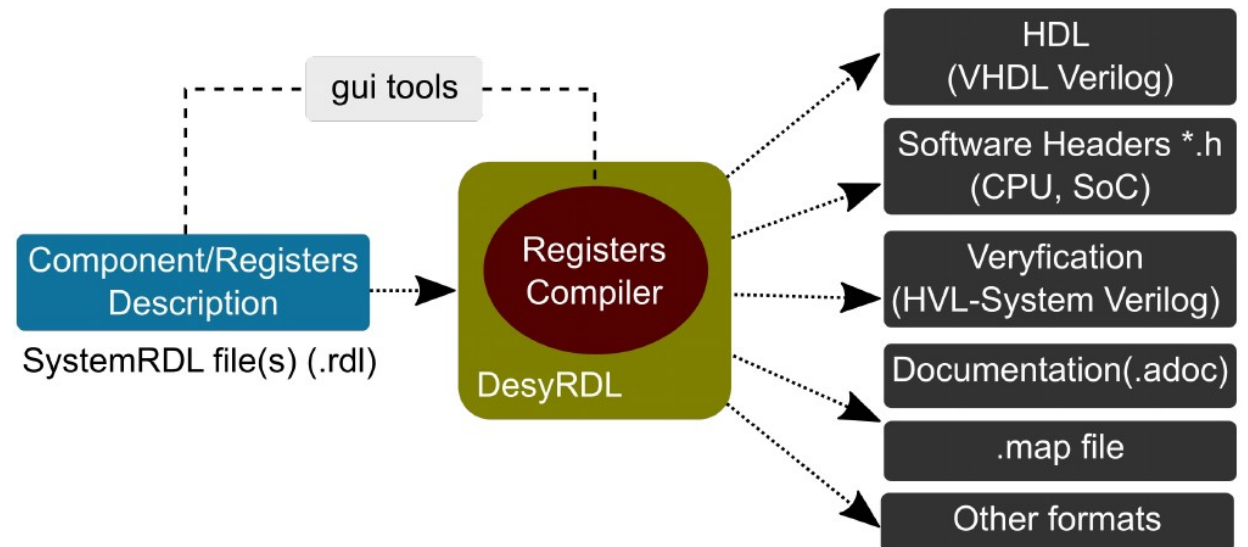
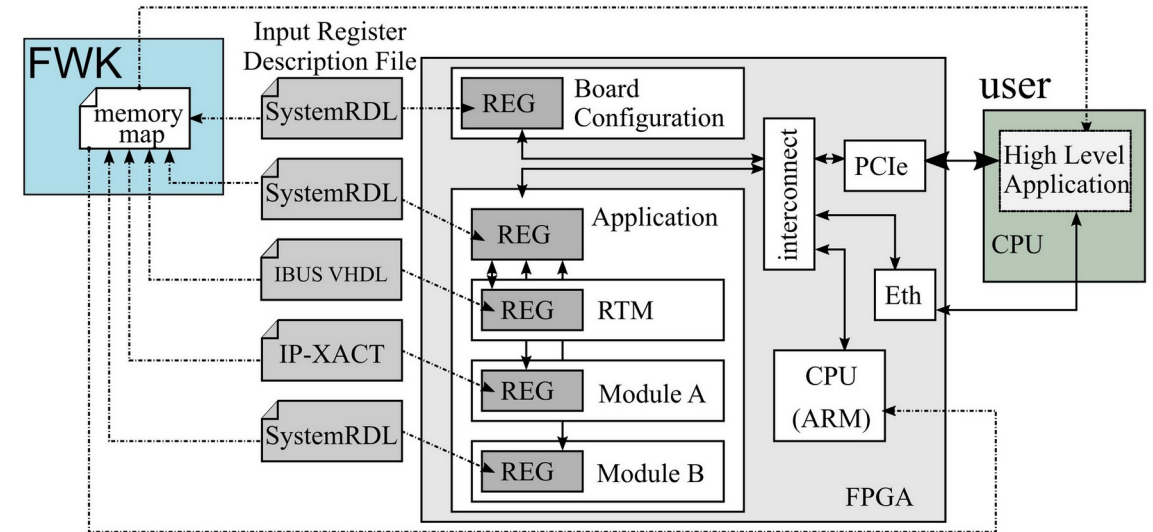
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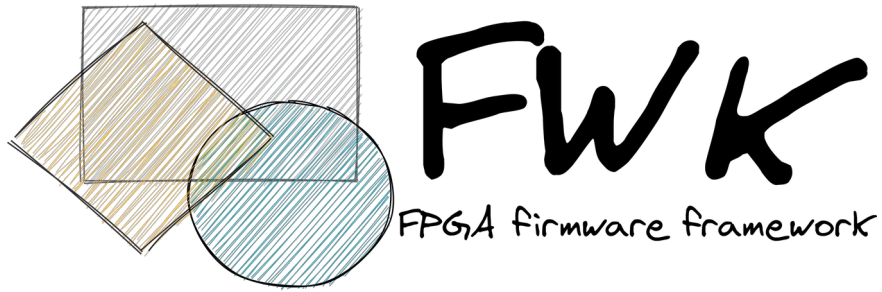
\* Georg, Jens, et al. "Board Bring-up with FPGA Framework and ChimeraTK on Yocto.", ICALEPCS 2023

# FWK Address Space Generation

- **SystemRDL** is an open source industry standard for register description. It is the main register and address space description format in framework.
- **SystemRDL-compiler** open source compiler written in python (available on pip)
- **DesyRDL** is the open source tool that uses SystemRDL compiler to produce the output artifacts such as VHDL code, documentation, map file. (available on pip)
- It is possible to use other address space tool backend



# Thank you



## Contact

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