Software for development and communication with FPGA based hardware

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Agenda

- General idea
- System scheme
- Embedded systems
- Development tools
- Future plans

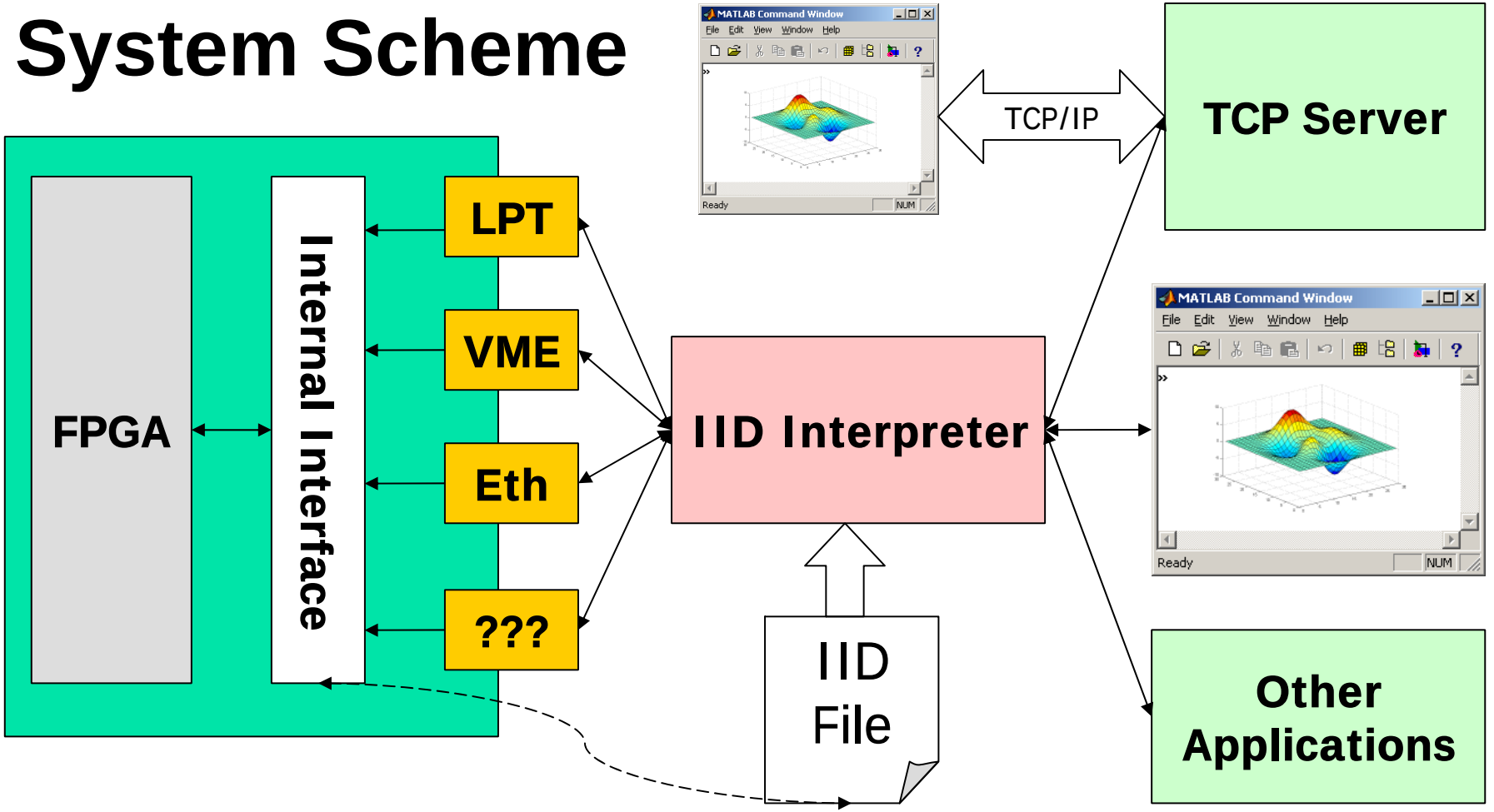
FPGA features

- Functionality of the FPGA is flexible, and can be changed very often.
- Hardware interface (protocols, buses' widths, etc) may be changed.
- Software must handle all this flexibility.

Guidelines for software

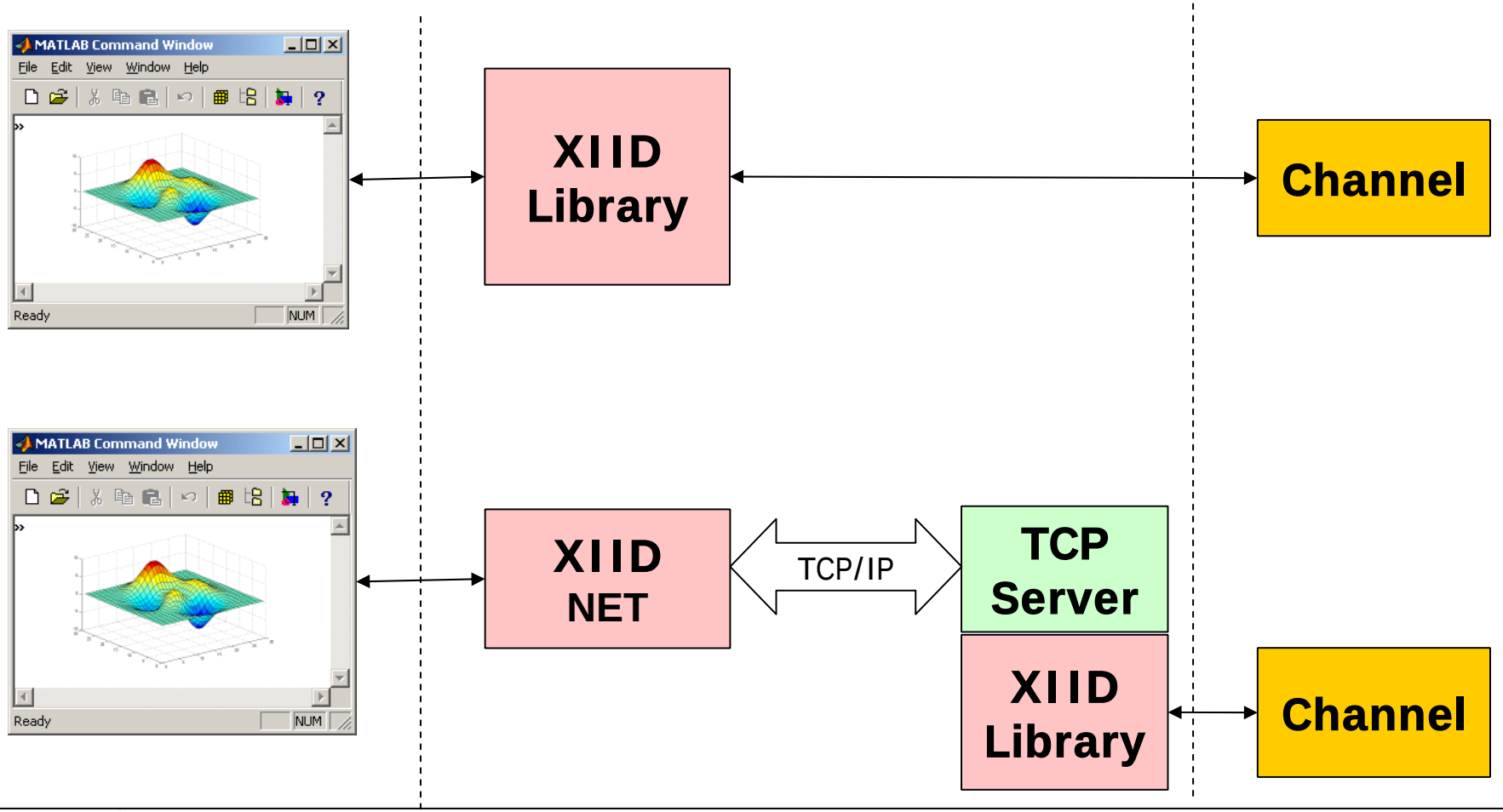
- Using configuration files when possible (recompilation only in the last resort)
- Modularity:
  - Division into the layers
  - Interfaces defined between layers
  - Implementation as Dynamic Link Libraries (DLL) or Shared Objects (SO)

System Scheme



Hardware | Channels | Engine | User Applications

TCP/IP Connection



Control Systems

Using these hardware access interfaces two control systems has been set up:

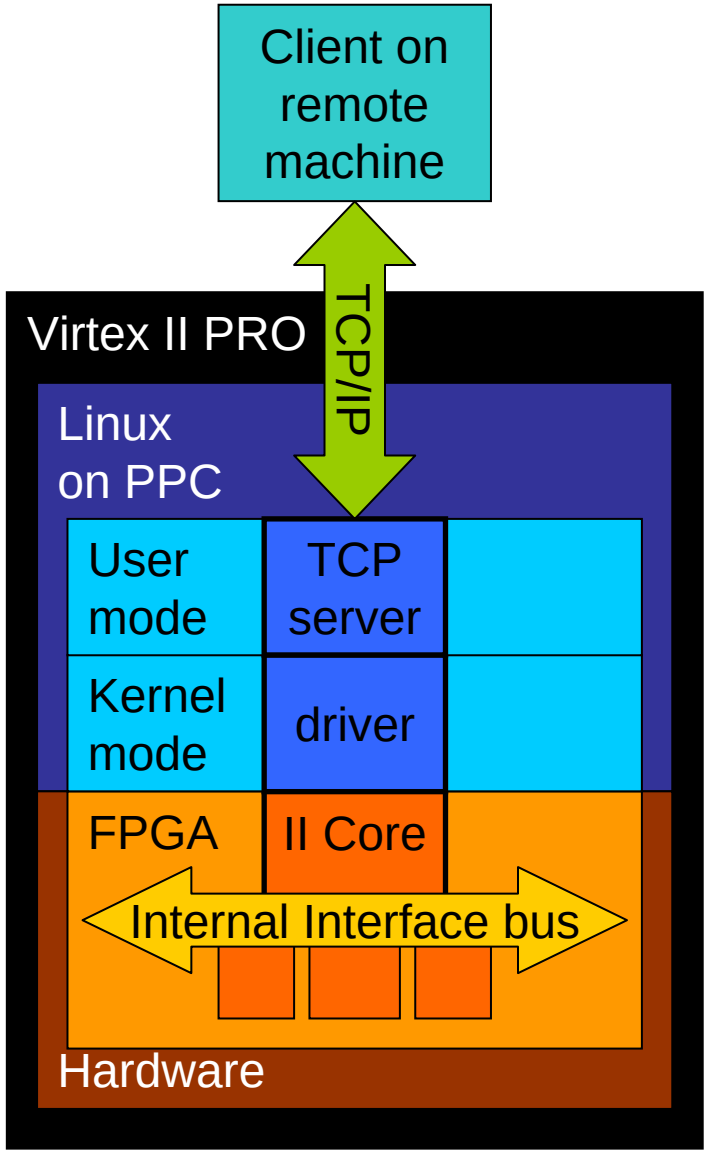
- DOOCS – Distributed Object Oriented Control System developed at DESY
- Our own Matlab based toolset (used mostly for laboratory development)

Embedded Systems

- External RISC CPU - Axis Etrax
- FPGA chip with CPU - Xilinx Virtex II Pro
- Soft processors (described in VHDL) implemented in programmable logic – NIOS, MicroBlaze and others
- Dedicated Linux distributions are available for all examples listed above

Linux on PowerPC

- User applications access hardware through the driver
- Kernel mode driver has access to the FPGA
- FPGA has defined hardware interface



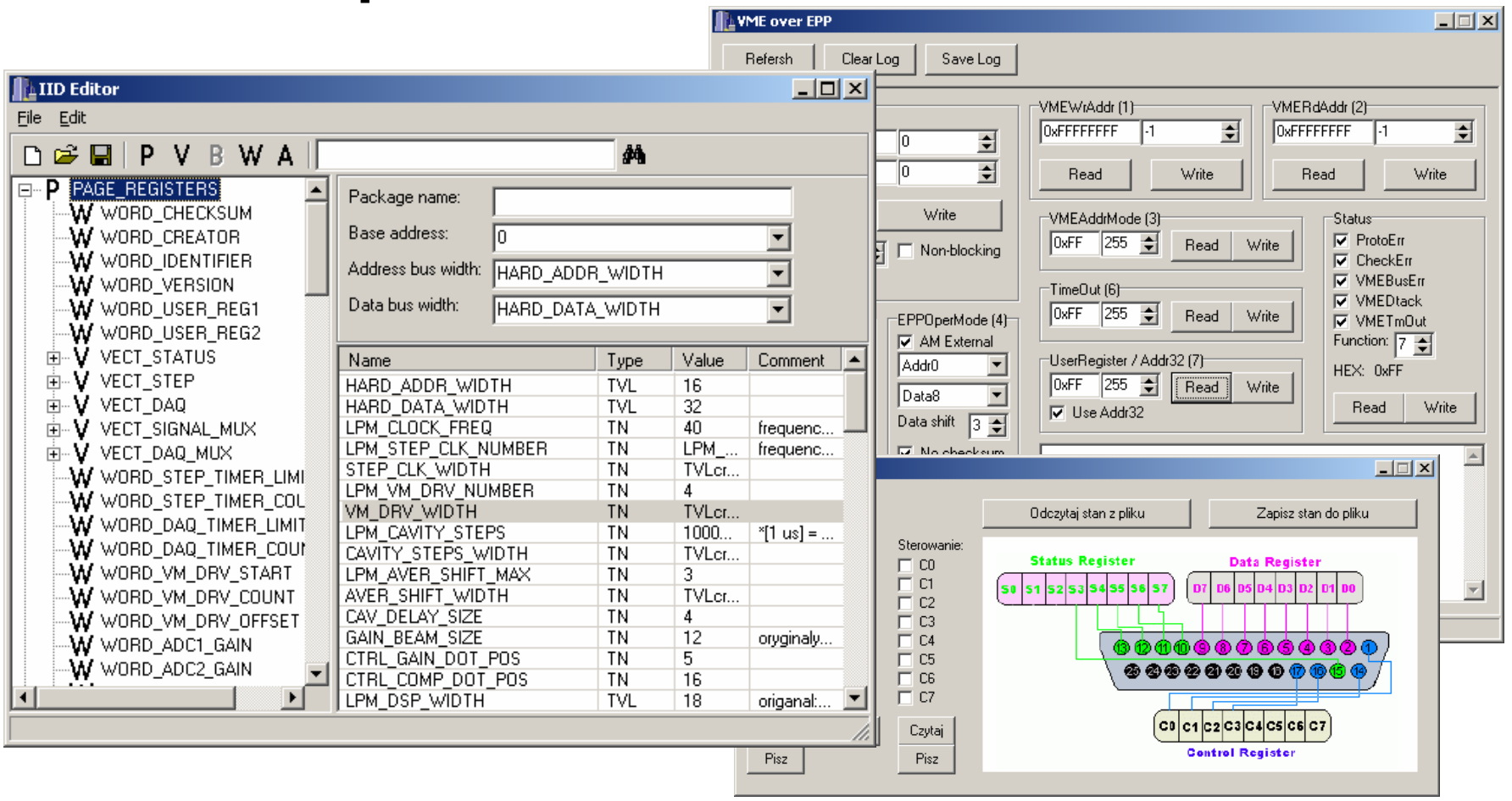
Common usage

- Calculations
  - non time critical algorithms
  - post processing
- Communication
  - trough the VME bus
  - Standalone, using Ethernet and TCP/IP

Currently available software

- X11 window system
- DOOCS server libraries
- Scripting languages: perl, tcl
- Secure shell (ssh)
- Apache web server
- Our custom tools (drivers, servers, etc)

Development Tools



Future Plans

- Porting EPICS to our Linux distribution
- Running VxWorks on PowerPC
- Research on Altera's NIOS processor
- Completing full communication layer for the VUV-FEL experiment