

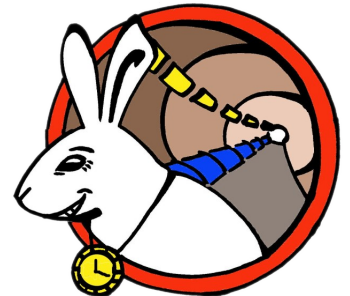
White Rabbit PTP Core

Greg Daniluk

4th White Rabbit Workshop

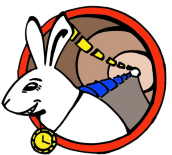
Darmstadt, 14 April 2011

ELPROMA  ELECTRONICS



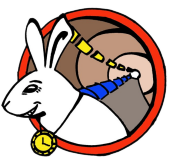
Outline

- What is WRPC?
- HDL design
- Software
 - WR PTP daemon
 - SoftPLL
- Future development
- WRPC demo

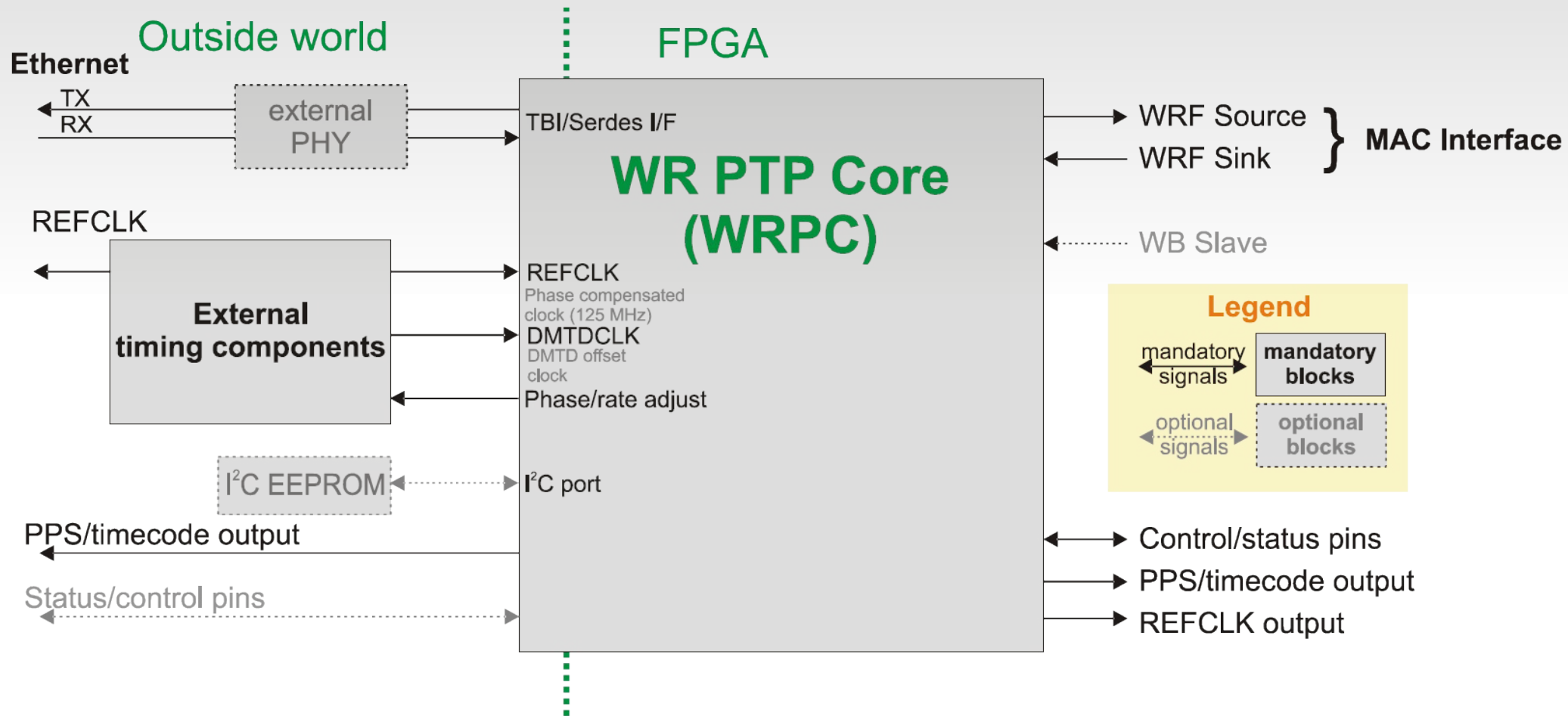


What is WRPC ?

- HDL module implementing a WR Slave
- PTP Slave ordinary clock
- Performs sub-nanosecond clock synchronization using WR protocol
- Outputs 1PPS and UTC timecode
- Ethernet "gateway", passing packets other than PTP to the user's cores



WRPC and its interfaces



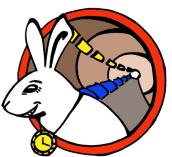
WRPC HDL

- shares numerous HDL modules with the WR Switch
- based on a soft-core CPU (Lattice Mico32)
- dual-port RAM shared between the CPU and miNIC
- software PLL controller
- small peripherals integrated into a single WB Slave
- Wishbone interconnect

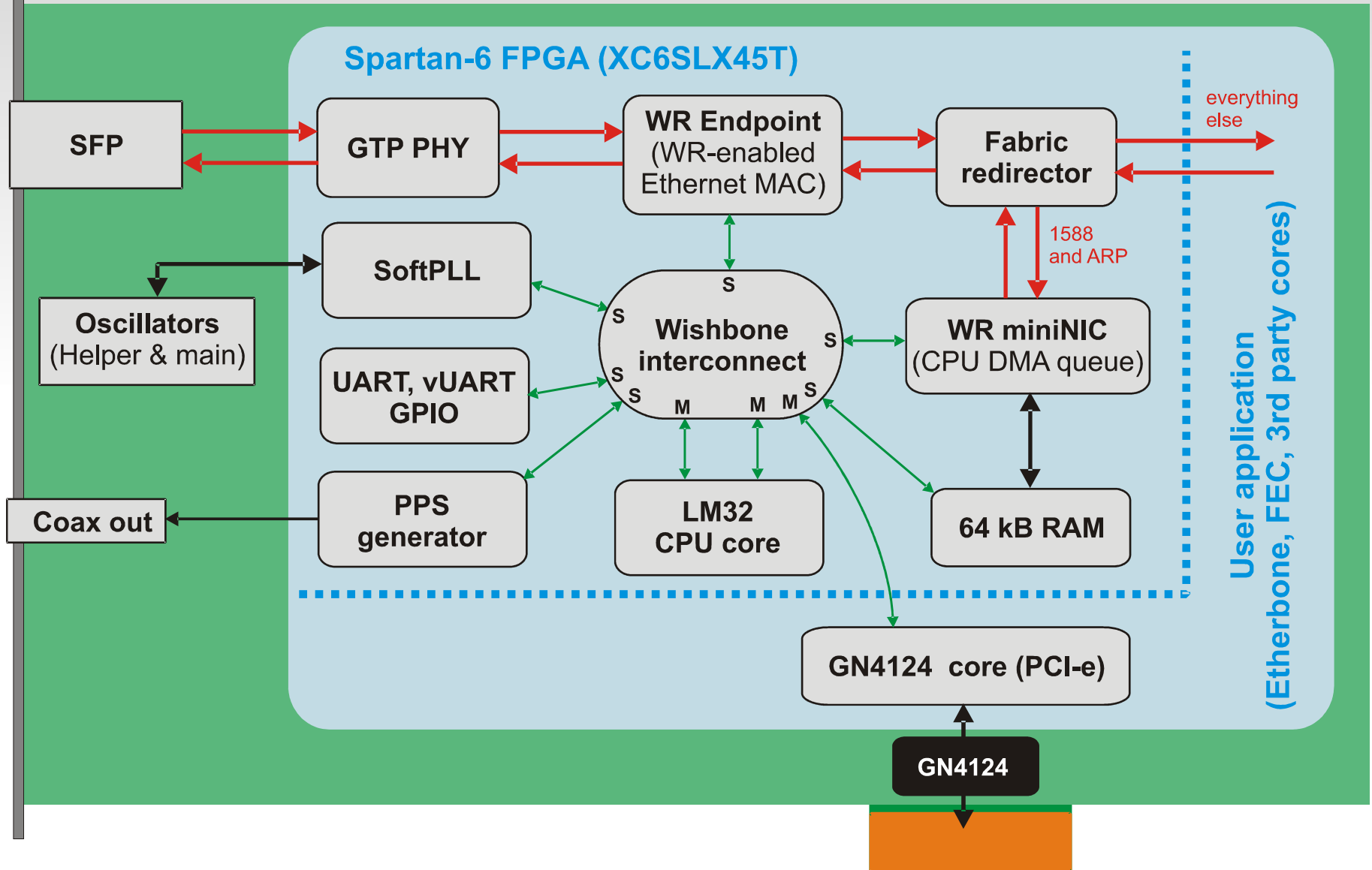


... and extra stuff

- Gennum GN4124 PCI-Express bridge core - programming and debugging via PCIe
- Virtual UART – debugging console via PCIe
- I2C EEPROM for storing configuration

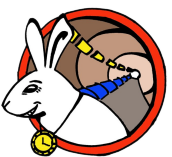


Block diagram



WR PTP daemon

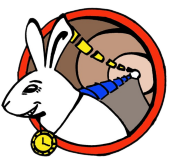
- Based on WR-PTPd daemon made for WR Switch, which went on a diet
- removed floating point math
- removed or rewritten some standard library routines
- externalized OS-dependent code
- wrote functions to talk with WRPC hardware



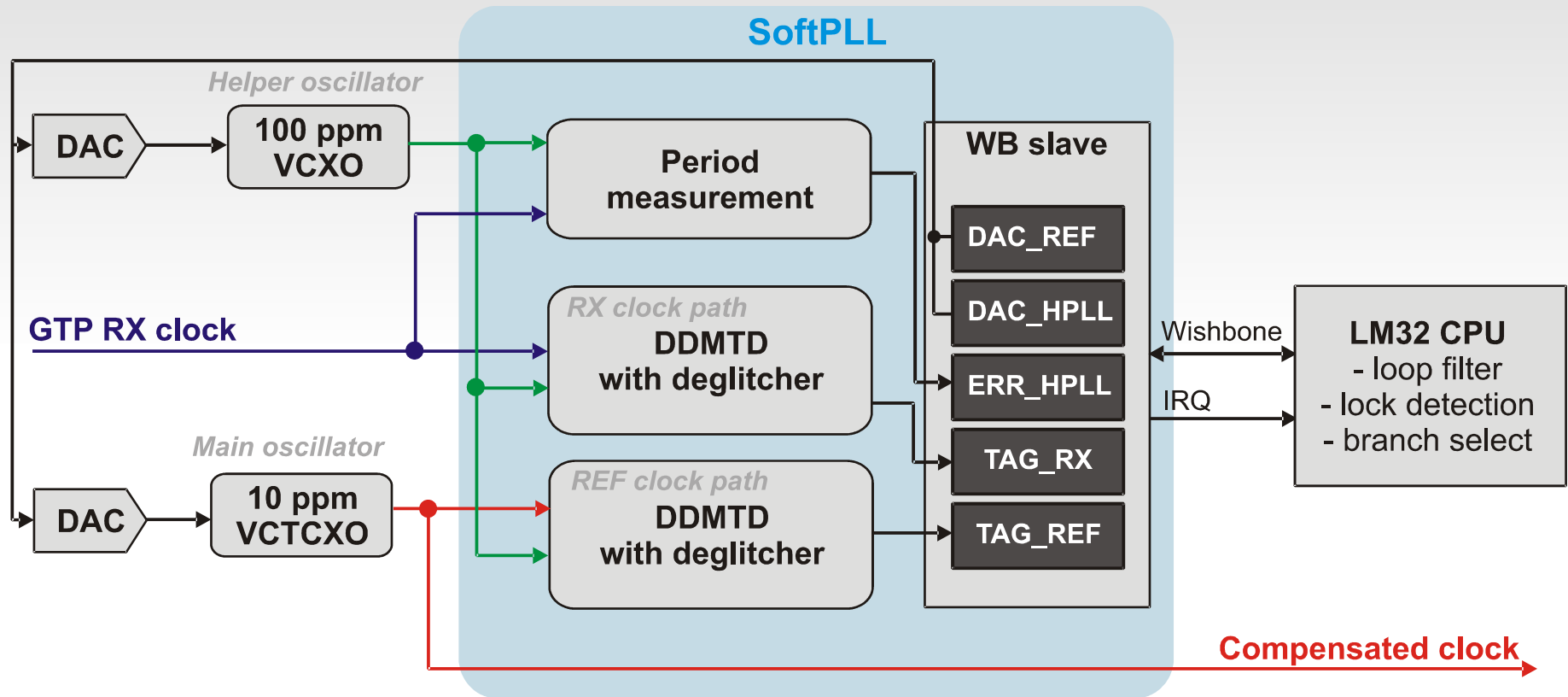
SoftPLL

The PLL system in the WR Switch is nice and works very well, but it also....

- takes a lot of FPGA resources
- is difficult to modify the loop response, since it's in VHDL
- works with a relatively low sampling rate (7.62 kHz), so the calculations can be performed by the CPU
- ZPU + WR PLL > LM32 + SoftPLL

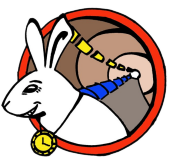


SoftPLL



Extra stuff

- *cpu-loader*: initialize DPRAM with CPU firmware
no need to re-synthesize the project just to change the firmware
- *vuart-console*: look what is going on inside the PTP daemon using PCIe
- both use Alessandro's GNU *Urabbit*



In the nearest future...

- add packet redirector and external MAC interface
- replace WRF with pipelined Wishbone interface
- simplify the WB interconnect
- use the new standalone PTP daemon from Alessandro
- test external PHYs using TBI and copper PHYs



Time for a little demo

- WR PTP Core running on SPEC board
- WR Switch as White Rabbit Master
- monitoring console and oscilloscope for observing the PPS skew
- our famous hot-air gun to check if fiber delay compensation works correctly

