WR Switch v4

On behalf of
the WRSv4 CERN team

13th White Rabbit Workshop
21st March 2024

WRSv4 CERN Team

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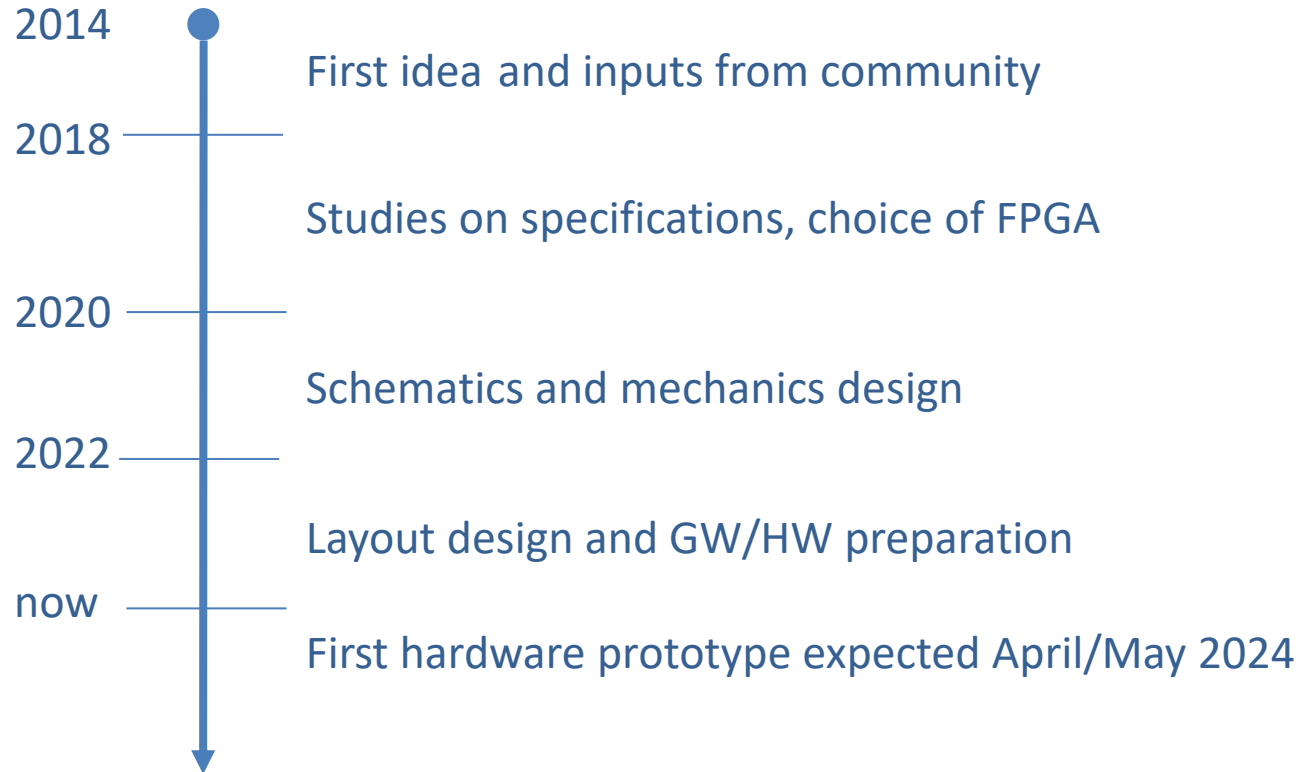
Maciej
Consultant

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Software Developer

WRSv4 project - goal

Create a new WR Switch that:

- Supports 10 Gbps (data and timing)

- Serves as drop-in replacement for WRS-v3 (obsolescence)

- Provides industry-level reliability features

- Meets needs of the WR Community

WRSv4 – project history

2014 ● First idea and inputs from community

2018 Studies on specifications, choice of FPGA

2020 Schematics and mechanics design

2022 Layout design and GW/HW preparation

now First hardware prototype expected April/May 2024

Main Board architecture

- One single Main Board (possibility of Expansion Board)

- Based on a SoC: Xilinx Zynq Ultrascale+ XCZU17EG-1FFVC1760E
  - 32 GTH 16.3Gb/s and 16 GTY 32.75Gb/s
  - Footprint compatible with ZU11EG and ZU19EG

- Clocking architecture
  - Flexibility with multiple options using multiplexers, fanout buffers and the expansion board
  - Already tested in FCWR Board (FMC mezzanine)
  - Possibility to have mixed scenario for simultaneous 1G and 10G

- On board memory
  - 4GB SO-DIMM DDR4, SD memory card, 4GB eMMC, NOR flash QSPI, EEPROM, m.2 SATA SSD


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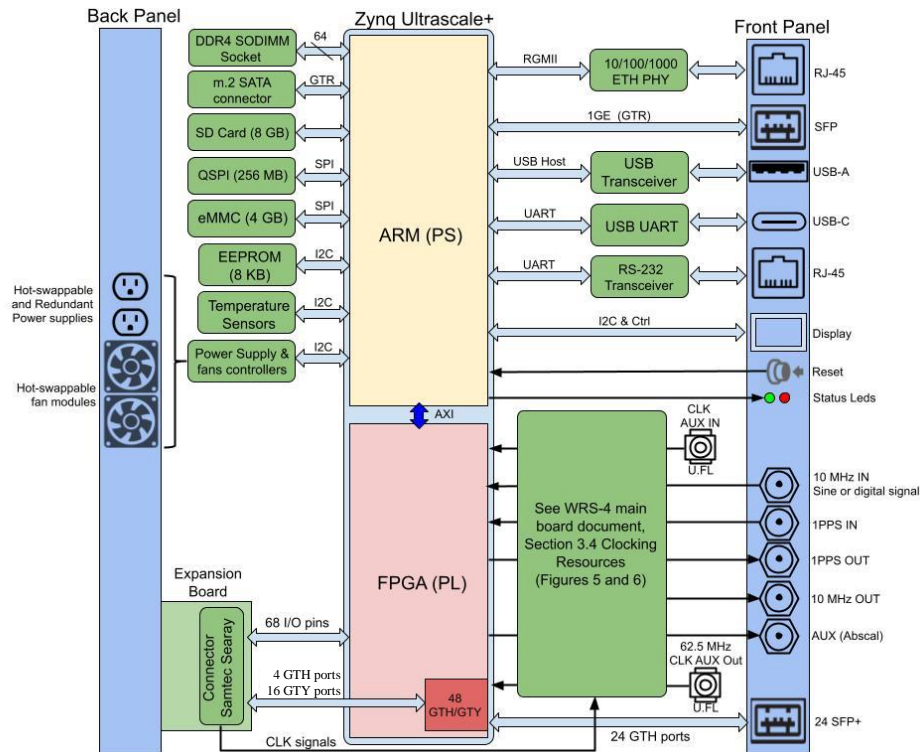
PCB

- Main board layout finished in December 2023, sent to production in February, expected in April

- 5 prototypes

- 16 layers, blind vias, megtron substrate

- Technological check (PCB difficult in production)

Enclosure

- 19" rack-mountable 1U (height: 44.45 mm, wide: 482.6 mm, depth: 310 mm)
- Separate airflow for Main Board and PSU (and optionally expansion board)
- Simple design for hot-swappable elements (fans and power supply) and expansion board

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Mockup
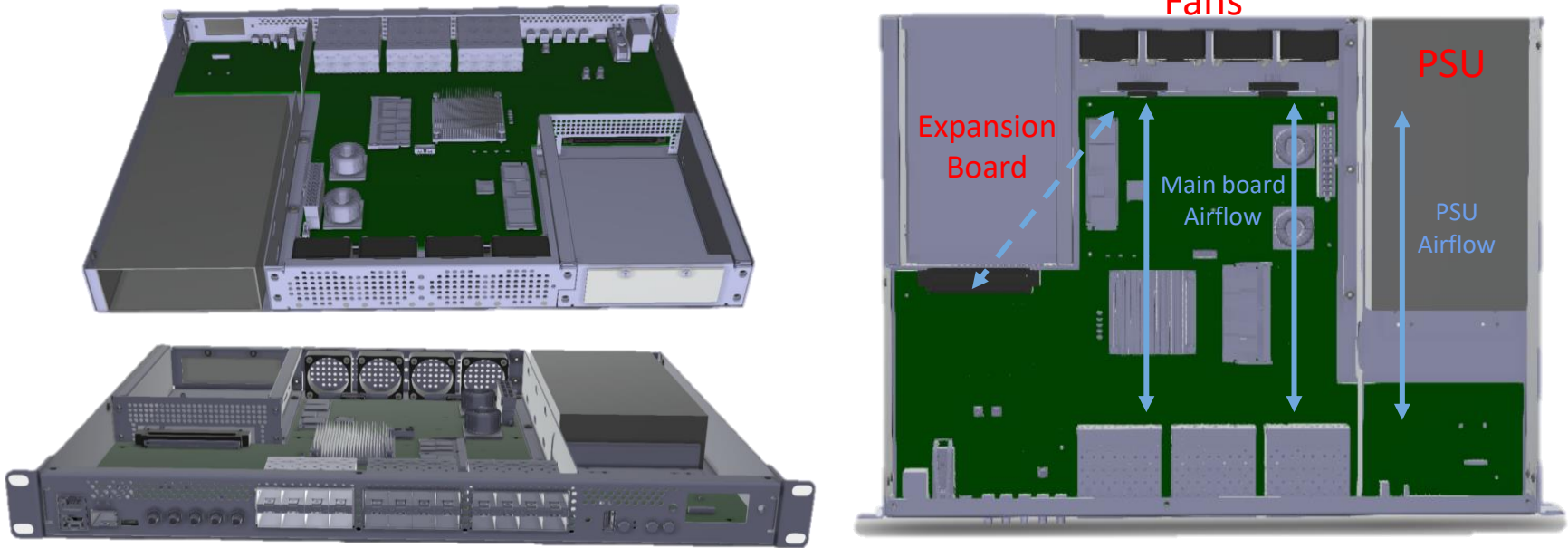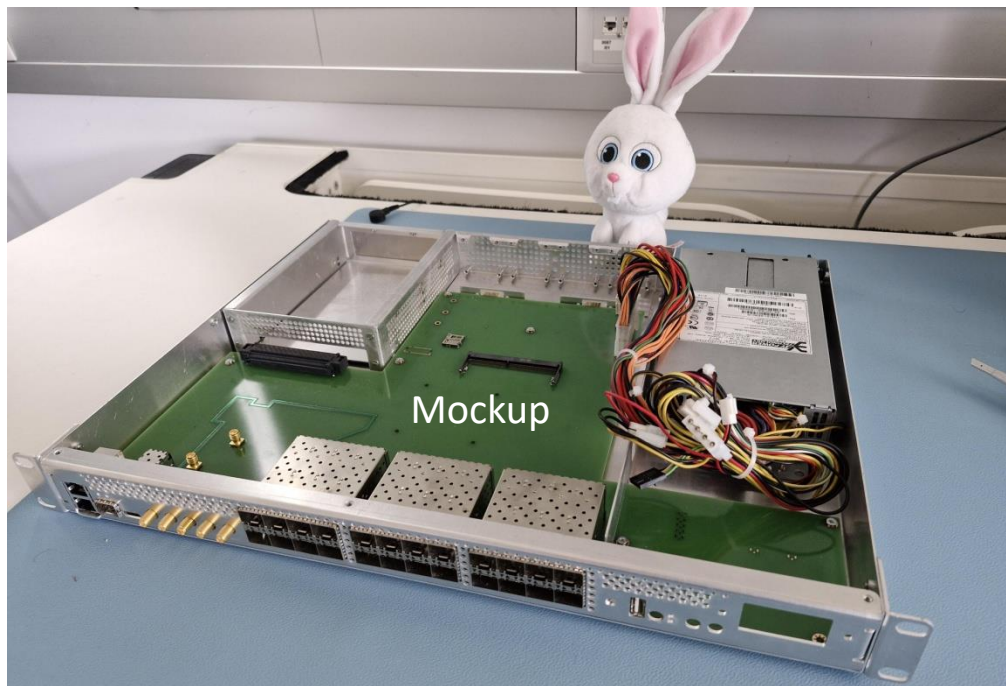
Fans

- Hot-swappable and self-docking module with a simple bracket
- 4 fans per module
- Configurable airflow direction (mechanical adjustment)
- Adjustable speed controller
- Broken rotor protection
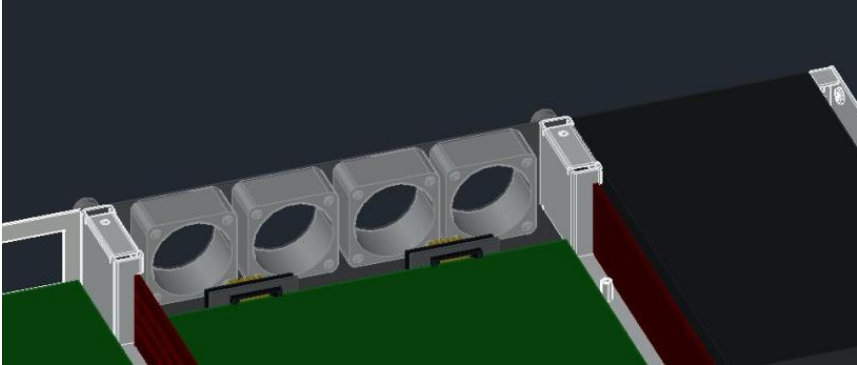
Power Supply

- Redundant and hot-swappable

- ATX standard compliant connectors

- Size allowed: 215 x 106 x 42 mm (accommodates units from different vendors)

- PMBus included

- The selected power supply unit is the YH5151-1EBR or similar

Front Panel

- Clocking connectors:
  - 5 SMA connectors - inputs: PPS, 10 MHz; outputs: PPS, 10 MHz, AUX (abscal)
- WR SFP ports:
  - 24 stacked SFP+ connectors
  - Hardware supports 1G and 10G
- Management:
  - 1 SFP Port
  - 2 USB: 1 x Type C and Type A connector
  - 2 RJ45: 1 x Ethernet port and 1 x RS-232
  - 3 buttons: 1 x reset and 2 x next to the OLED display
  - 2 status LEDs: Red and Green status
  - 1 OLED display

Expansion board

- Provide further functionalities
(e.g. holdover capabilities or high-performance oscillators).

- Expansion board characteristics
  - Size: 85 x 235 mm, overhead space: 32 mm
  - Pluggable from the rear panel
  - By default, airflow circulation ensured by the main fans via air guide; optionally, separate airflow circulation can be implemented
  - It can work as an FMC carrier at the same level as the main board

- Expansion connector
  - Single connector with 300 pins (up to 28+ Gbps support)
  - FMC LPC compatible (Ansi Vita 57.1)
(68 user-defined pins + other as required by FMC)
  - High speed data I/Fs: 4 GTH and 16 GTY ports
(45 diff-pairs to GTH/GTY quads)
  - SEAF-SEAM connector from Samtec
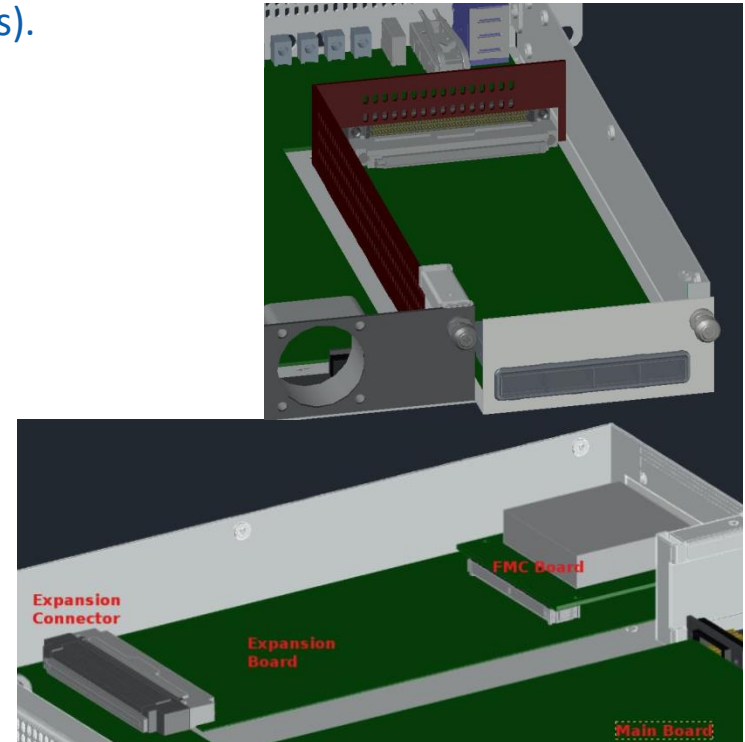
WRSv4 – Status and plans

- April 2024: prototype WRSv4.0

- May 2024: smoke test & Linux boot, peripheral tests

- September 2024: WRSv3 functionality (18 port x 1G)

- December 2024: Pre-release of firmware

- Spring 2025: Prototype WRSv4.1

Strategy for WRS-4 dev. and WRS-3 support

- Long-term support for WRS-3 (large installed base)
    - No foreseen end-date for support but production depends on components availability
    - Lock HW/GW of WRS-v3 – no new features added
    - Very likely, the SW (PTP, RTU, etc daemons) will be common to WRS-3 and WRS-4
        - SW new features for WRS-3 only in common SW, if HW/GW support available
        - Bug-fixes for WRS-v3
- Incremental GW/SW design of WRS-4
    - **First:**   1G time and   1G data
    - **Second:** 10G time and   1G data
    - **Third:**   10G time and 10G data
      (10G support schedule depending on availbility of resources)