White Rabbit Switch

status and plans

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10th White Rabbit Workshop
6 October 2018
CERN
Outline

• WR Switch overview and status
  • Hardware
  • Gateware
  • Software
• Main features of firmware v5.0.1
• Plans for firmware release v5.1
White Rabbit network

In this presentation we focus on WR Switches
WR Switch - overview

- Central element of WR network
- 18-port GbE switch with WR features
Hardware

Xilinx Virtex6 FPGA

Power supply 12V DC 80W

10 MHz in
62.5 MHz out
1-PPS in/out
Management ports

Front panel

Cooling FANs
Debug ports

Back panel

18 SFP cages

64MB DDR2
256MB NAND
8MB boot flash

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Hardware - variants

- Low jitter daughterboard

Reduces jitter (1Hz-100kHz) from 9ps RMS to <2ps RMS
Hardware - variants

• Low jitter daughterboard
• WRS Fan-less – by Tsinghua University
WR Switch - new hardware

Call for ideas tomorrow 11h30
Gateware

Virtex-6 FPGA

- Timestamps FIFO
- GbE Endpoint 1..18
- Switching Core
- Watchdog
- Routing Table
- CPU/Wishbone bridge
- Stats Counters
- Timing Subsystem
- Network Interface

Optical transceiver 1..18
Xilinx SerDes 1..18

GbE Endpoint 1..18

1-PPS 10MHz
Software

FPGA
- SoftPLL

ARM
- HAL
- PPSi
- RTUd
- shmem

Userspace
- minipc
- SNMP
- LLDP
- Web interface
- Other SW

Linux Kernel

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Main features of v5.0.1 gateware

- Bandwidth throttling for ARM
- More efficient linked-list to handle switching core paged memory
  - Replaces round-robin based linked-list
Bandwidth throttling for ARM

• Makes sure Linux is not overwhelmed with traffic
• Configurable required maximum bandwidth
• Random Early Detection algorithm
  • Calculate current b/w
  • If b/w reaches half of the configured max b/w, start dropping frames randomly
  • Dropping probability grows with measured b/w
  • LSFR-based pseudo-random number generator
More efficient Swcore linked-list

- LVT-based multi-port memory
Main features of v5.0.1 software

- Rename network interfaces from wr0..17 to wri1..18
- Improve LED support
- VLANs configuration in dot-config
- Add wrs_menuconfig on switch
- Add a tool to dump (and write) SFP's memory on the switch
- More verbose information about errors in SNMP via syslog
- Verify firmware before updating
- Support p2p in ppsi
- Uplift Buildroot
- Uplift Linux kernel
SNMP status tree

- wrsMainSystemStatus
  - wrsOSStatus
    - wrsBootSuccessful
      - wrsTemperatureWarning
      - wrsMemoryFreeLow
      - wrsCpuLoadHigh
      - wrsDiskSpaceLow
  - wrsTimingStatus
    - wrsPTPStatus
      - wrsSoftPLLStatus
      - wrsSlaveLinksStatus
      - wrsPTPFramesFlowing
  - wrsNetworkingStatus
    - wrsSFPsStatus
    - wrsEndpointStatus
    - wrsSwcoreStatus
    - wrsRTUStatus
WR Switch: Failures and Diagnostics

- Document published with WR Switch firmware release
- Lists various errors reported by a switch
- Analyses problems that cause the error
- Proposes actions to mitigate problems
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Plans for v5.1 - gateware

• Fix problems when switch boots under heavy traffic
• Add port mirroring
• Add 1-PPS in/out alignment
• Fix handling Ethernet preamble shrinkage
• Improve GTX determinism
Plans for v5.1 - software

• LLDP (Link Layer Discovery Protocol)

• LDAP+Kerberos for authentication and authorization
  • Username and password validated in the central data base
  • Currently available solutions (password, ssh keys) are not scalable

• Option to disable web-interface
Plans for v5.1 - software

- Monitoring of WRS lifetime
  - What is MTTF of WRS?
  - Why? Replace aging device in advance
  - Data collection centralized and distributed
  - Also for SFPs

- Export SFP’s monitoring data
  - RX/TX power
  - Temperature
  - Why? Replace aging units in advance
  - Data collection centralized

- Improve syslog handling
  - Store in one file
  - Logrotate

- A tool to gather switch status (a.k.a. crash reporter)
Thank you!

Need more information?
https://www.ohwr.org/projects/white-rabbit/wiki/switch