Advanced diagnostics in a White Rabbit network

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How to diagnose WR network

• White Rabbit is an extension of Ethernet
• It can be diagnosed using standard protocols and tools:
  • Simple Network Management Protocol (SNMP)
  • Syslog
  • Link Layer Discovery Protocol (LLDP)
  • Wireshark
What is SNMP

• Standard for monitoring off-the-shelf switches, routers, time servers, etc.
• Request-response architecture
• SNMP manager queries SNMP agents
• SNMP agents export information as Object IDs (OIDs)

• SNMP agents: WR Switches, WR Nodes
• SNMP manager: regular computer with monitoring software
  • e.g. open source Nagios or Icinga
White Rabbit test network

GM – Grand Master
BC – Boundary Clock

GM
BC1
BC2

SNMP agent

SNMP agent

SNMP agent

SNMP agent

SNMP manager

Nagios

Node
WR Switch agent

• Provides collective status for operators
• SNMP status tree

• Exports raw values for White Rabbit experts
WR Switch 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
WR Switch: Failures and Diagnostics

• Example:

* wrsSFPsStatus
  
  Description: Reports the status of SFP transceivers inserted to the switch.
  Error when any of the SFPs reports an error. To find out which SFP caused the problem check `wrsPortStatusSfpError.<n>`.
  
  On error:
  1. Check `wrsPortStatusSfpError.<n>` SNMP objects or Syslog messages to determine the WR port on which the problem is reported. In case of Syslog, you should see a message similar to this one:
     Unknown SFP vn="AVAGO" pn="ABCU-5710RZ" vs="AN1151PD8A"
on port wri2
  2. If the reported port is intended to be used with WR not compatible equipment (e.g. using a copper SFP module), to avoid SNMP errors set this port to `non-wr`. To disable PTP traffic on this port set it to `none`.
  3. Otherwise, you should use a WR-supported SFP module and make sure it is declared together with calibration values in the WRS configuration.

Related problems: [3.1.10], [3.3.9]
WR PTP Core SNMP agent

- Very minimalistic SNMP implementation
- SNMP agent does not analyze errors
- There is no status tree like for the WR Switch

- Exports only raw values
- SNMP manager has to analyze errors according to the instructions in: “WR PTP Core: Failures and Diagnostics”
Syslog

- Computing standard for message logging
- WR devices send text messages to a configured server
  - Should be used with SNMP for WR network diagnostics
  - Provides more information about the problem cause
SNMP and Syslog demo

GM – Grand Master
BC – Boundary Clock

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SNMP manager

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Link Layer Discovery Protocol (LLDP)

• Layer 2 protocol defined in IEEE 802.1ab
• Used to discover neighbors
  – Only directly connected
• All information is sent in one packet with information like:
  – System name
  – Chassis ID and description
  – Port ID and description
  – Time To Live
• Possible to discover a network topology
  – Starting from a device/switch
  – Traverse a network via SNMP to get all LLDP stored data
Link Layer Discovery Protocol (LLDP)

MON: GM, Any Neighbors?
GM: Yes, BC1 on port 7 and BC2 on port 8
MON: BC1, Any Neighbors?
BC1: Yes, GM on port 1
MON: BC2, Any Neighbors?
BC2: Yes, GM on port 1 and Node on port 5
Demo network topology

GM

BC1

BC2

Node
Analyzing a traffic in a WR network

Running sniffer on a WR node

• Not enough resources on WRPC
• Possible to forward traffic to the host
  (refer to the WR-NIC project)
  – But not possible to mirror WR and SNMP traffic to the host
Analyzing a traffic in a WR network

Connect a host with a sniffer to another WR port

- Good for broadcast traffic
- ... but not for WR traffic (which is link local)
- ... or requires port mirroring on a switch (not implemented yet)
Analyzing a traffic in a WR network

"Men in the middle" sniffing

- Good for sniffing data streams
- WR synchronization disturbed
Analyzing a traffic in a WR network

Intercept WR traffic on a switch

- Good for WR traffic
- Not for sniffing data streams
Wireshark

• Wireshark is the world's foremost and widely-used network protocol analyzer since 1998
• It lets you see what’s happening on your network at a microscopic level
• Live capture and offline analysis
• Deep inspection of hundreds of protocols, with more being added all the time
• Capable to dissect WR messages (not official)
• Multi-platform: Runs on Windows, Linux, macOS, Solaris, FreeBSD, NetBSD, and many others

https://www.wireshark.org/
Wireshark Demo

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Summary

• White Rabbit is an extension of Ethernet
• ... thus can benefit from many existing standard tools
• WR network can be managed by an IT department
• Using standard protocols like SNMP and LLDP reduces new developments and the risk of vendor lock-in
• Introducing new users to WR network technology is much easier