Operations Manual

WanRaptor™ Network Emulator

6/8/2020

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Introduction

The **WanRaptor**™ Network Emulator is an easy to use, economical test solution to validate your network applications in a lab environment by emulating Ethernet Bandwidth, Latency, Loss, Re-Ordering and Jitter of wide area networks. The **WanRaptor**™ is a COTS embedded hardware system supporting 10/100/1000, 10G, 25G and 40G optional interfaces provided on Intel Server PCIe NIC Cards. The product has an easy to use Graphical User Interface(GUI) and allows changes on-the-fly for real time test and result monitoring. Packet throughput is line rate for 10/100/1000 and 10G interfaces by use of user space drivers embedded in the product. The **WanRaptor**™ Network Emulator supports bridge or routing.

Configuration and control of the **WanRaptor**™ Network Emulator is accomplished from a Personal Computer(PC) and a web browser supporting Google Chrome(preferred) or Firefox.

The **WanRaptor**™ has a handy visual bar at the top of the GUI indicating each LAN port current status.

Figure 1 - Status of LAN Ports

Figure 2 - Typical Application

Hardware Installation

Select a location that allows ventilation around the **WanRaptor**™. Plug in straight CAT-5 LAN cables for MGMT 1 to your local PC LAN Port. You may also connect MGMT 2 to configure a static IP Address for your local LAN access. Connect the power cord to the **WanRaptor**™ and depending on the model turn on the Power Supply Switch. Now, press the **WanRaptor**™ power ON button on the front panel. Allow the **WanRaptor**™ 3-4 minutes to boot and you should hear a small beep. Now, you may access the GUI from your PC.

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GUI Access from a Web Browser

GUI Access via MGMT 1 LAN Port

1) Set your PC Ethernet Port to 192.168.1.90 and subnet 255.255.255.0

2) WanRaptor™ GUI supports: Google Chrome(best) or Firefox

3) Open your browser on your PC and type in the top address bar: **192.168.1.100:8080**

The GUI web login page will appear and the user should enter as follows:

       User ID: admin **Password:** golf

4) After successful connection to the **WanRaptor™**, click on the **SYSTEM SETTINGS** tab, then click on the **MANAGEMENT PORT SETTINGS** tab to change MGMT 2 IP Address as required for your local network. In the event you cannot access MGMT 2, MGMT 1 IP Address is hard coded and is always reachable.
NOTICE:
MGMT 1 & MGMT 2 may not be on the SAME IP ADDRESS RANGE

Overview / Basic Operation

1) . The **WanRaptor™** is installed between two LAN segments and will emulate your Wide Area Network(WAN). Simply connect the LAN cables as desired to the available emulation ports.

EXAMPLE: Router----LAN Cable---- **WanRaptor™**----LAN Cable----Router

2) From the user's PC, access the **WanRaptor™** via MGMT 1 or MGMT 2 LAN Ports to your PC. Then, from your PC Web Browser, Login with username and password to access the **WanRaptor™** operation menu's

2) Select **Emulation Tab**, enter a test name, then select the LAN ports available for testing in the LAN port pull down bar

3) Select **Bridge / Route Tab** and enter your selection

4) Select **Default Rules Tab** and you will see left and right side emulation settings. Enter the emulation profile settings on the left hand entries. If you want both LAN ports to have the same emulation settings you can simply leave the "Set different configuration" without a check mark. When all emulation rules are entered, click **SAVE at the bottom right of the GUI**.

5) Monitor your results on the **Logs Tab** which has real-time counters for TX/RX Packets/Bytes, Dropped Frames/Bytes, Reordered Frames/Bytes, Bit Rate/Frame Rate and Loss shown in Bytes/Packets. The log screen shows each LAN segment and also has a button for **Reset Counters** for each LAN port.

6) **Changes-On-The-Fly** are supported while an emulation is running. Simply click **Edit** on the emulation profile and the user may change the set Delays, Loss or other impairments. When changing delay Types such as **Constant** to **Exponential Delay**, the user must stop the running profile. It is recommended to change only the base settings you have entered in the profile, ie...delay, loss % ect.... So, if the user has delay and loss as impairments, you may freely change them. But if adding other impairments it is recommended to stop the profile and change impairment types. *If testing **Inter Packet Gap** the user must **stop and start** the emulation if changing delays in the current software release.*

Emulation Tab

The **WanRaptor**™ allows data entry in whole numbers such as 10 or 25, 100ms of constant delay. The **WanRaptor**™ also allows decimal inputs such as 10.2 or 25.5 or 100.8ms of constant delay. The delay accuracy is within 50µ worst case for frame sizes 2000 and under. Larger frames such as 9000 may be slightly higher tolerances.
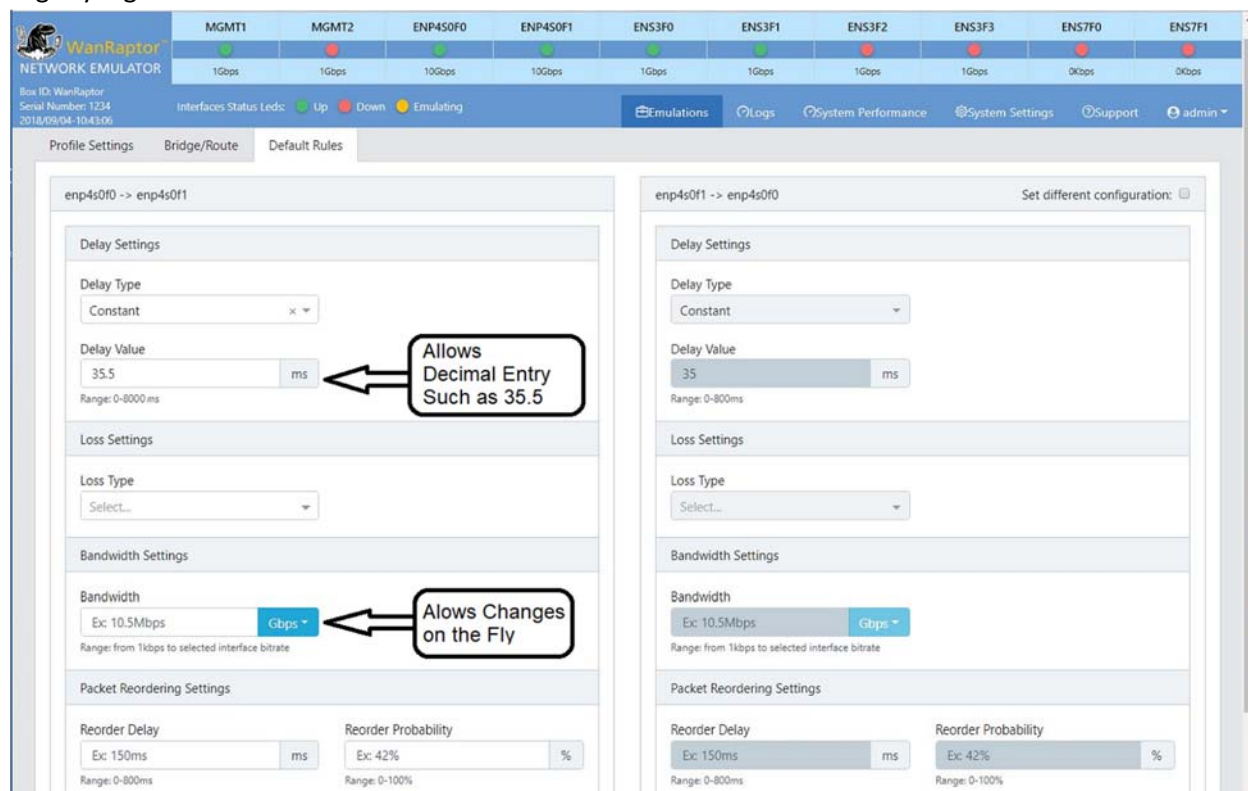

Figure 3 - Emulation Tab

Data Entry and Impairment Direction

It is important to understand the direction when applying impairment on the **WanRaptor**™ Emulation data entry screen. If the user has for example Ethernet Port 0 and Ethernet Port 1. The entry on the Emulation screen on the left is Ethernet 0. If the user adds Loss , then the loss will be data flowing BACK to Ethernet Port 0.   Port 0 Loss Direction ←---- Port 1--→No Loss

Types of Latency Emulation Supported

The **WanRaptor**™ supports four different types of latency in the current software release.

1) Constant Latency – Allows the user to set a fixed constant latency. The constant latency may be the same for each LAN port, or the latency on each port may be set for split delays.

2) Uniform Delay – each incoming packet is first assigned a random delay drawn from the selected distribution; then, the packet is enqueued for transmission.
At low packet rates(70% of the LAN Bandwidth, you should observe the following:
- uniform distribution with min= m and max= M:
- min delay = m
- max delay = M
- avg delay = (M-m)/2

3) Exponential Delay – each incoming packet is first assigned a random delay drawn from the selected distribution; then, the packet is enqueued for transmission.

At low packet rates(70% of the LAN Bandwidth, you should observe the following:

- exp delay with min= m and avg= a

- min delay = m

- max delay = 4 a

- avg delay = a

4) Inter Packet Gap – Applies a random inter-packet gap between Min Gap and Max Gap milliseconds.
Parameters: Min Gap; Max Gap; Delay.

Primarily directed at creating Jitter in high speed packet streams by specifying an inter-packet gap. Ideal for emulating flows being held up and then bunching which can be very useful for certain streaming video tests. **NOTE:** *Inter Packet Gap currently does not support Changes-On-The-Fly*

Packet Loss Types and Setting

The **WanRaptor**™ supports two different types of packet loss in the current software release. This is generally useful to emulate random loss.

1) Loss Percentage(%) – Allows the user to set a fixed packet loss by whole number entries or decimal entries: examples: 1, 2, 5, 10 or 0.0001, 0.001, 0.01, 1.5

2) Loss BERT – Allows the user to set a fixed packet loss by Bit Error Rate(BERT) entries:
example: 10E-3

Bandwidth Setting

The **WanRaptor**™ supports bandwidth throttling via this setting and the entry is whole numbers or decimal. The bandwidth may match each port or the unit supports split speeds. It is important to understand that a bandwidth pipe set smaller than your traffic pipe may result in packet loss.

1) Bandwidth Settings – Gbps, Mbps or Kbps
Examples: 1 Gbps, 500 Mbps, 100, Mbps
NOTE: Use **Kbps** setting when the LAN Link Bandwidth is below 10 megabits for best accuracy.

Packet Reordering

The **WanRaptor**™ supports packet reordering in a unique design method over competing products for packet reordering. Most products will drop packets in reordering which will dilute testing results. The **WanRaptor**™ will not drop packets during testing until the user fills the available LAN bandwidth past 80% capacity.

This option enables the emulation of packet reordering and it requires two parameters:
- a reordering probability, p
- a packet hold delay, h
The reordering is performed *before* the delay emulation, by selecting the incoming packets at random, with probability p, and pushing them to a "hold back" queue, where they remain for the chosen h amount of time, after which they are inserted in the output queue. While

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they are kept in the hold-back queue they can be overcome by later packets, thus emulating packet reordering in the network.

Note that no further reordering goes on in the hold-back queue. Moreover, packets selected for reordering are never selected for reordering again, once they come out of the hold-back queue . Therefore, in a sufficiently long test, the parameter p directly translates into the fraction of reordered packets.

Since the reordering is operated before, and independently of, the delay emulation, the reordered packets will experience the h delay in addition to any configured delay. At low packet rates, you should observe the following:

- **constant delay** d

- min delay: d

- max delay: $d + h$

- avg delay: $d + ph$

- **uniform delay** with minimum m and maximum M

- min delay: m

- max delay: $M + h$

- avg delay: $(M + m)/2 + ph$

- **exp delay** with average a and minimum m

- min delay: m

- max delay: $4\, a + h$

- avg delay: $a + ph$

Log Tab

The **WanRaptor**™ supports real time statistics for TX/RX Packets/Bytes, Dropped Frames/Bytes, Reordered Frames/Bytes, Bit Rate/Frame Rate and Loss shown in Bytes/Packets. The log screen shows each LAN segment and also has a button for **Reset Counters** for each LAN port.
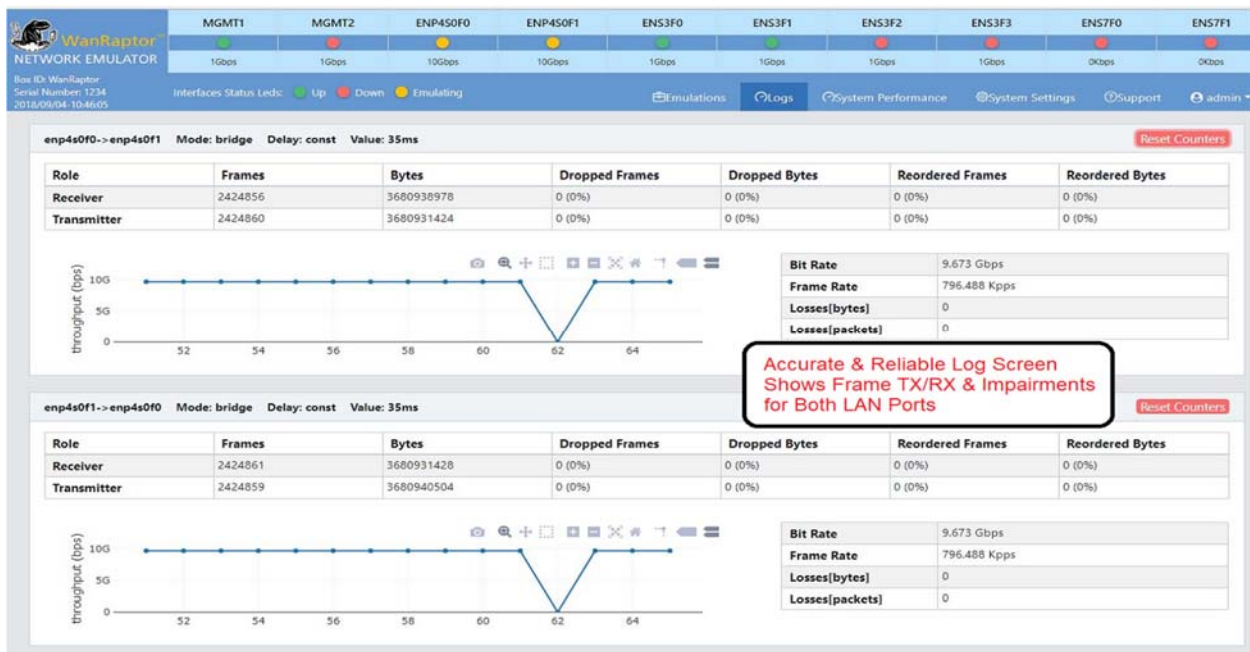

Figure 4 - Log Tab of Emulation Stats

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Output Log File Data

The **WanRaptor™** supports two methods of exporting log files. The pre-formatted text(.txt) for the user shows all emulation name, date and all data and useful for test report retention. The unit supports Excel(.xls) or compatible that allows the user to format the data to your preference.

System Performance Tab

The **WanRaptor™** supports a useful feature in the Performance Tab for monitoring the system resources at a fundamental entry level, yet important to users for reference. When the user clicks START of an emulation, the **WanRaptor™** software will bind threads to processor cores for running an emulation. Each system sold has INTEL XEON processors with a defined number of cores. The **WanRaptor™** runs the GUI system on 2-cores and the rest are for the emulations. The System Performance Tab is an easy way to monitor the core usage and how hard the **WanRaptor™** is working.

Figure 5 - System Performance Tab

System Settings Screen Tab

WanRaptor™ supports three items of interest to the user in this tab.

Box Info Tab – Time Set / Time NTP Sync

Allows the user to set the BOX Name, the box Date and Time. **Note:** To change the local time just select the location as desired, then _**MANUALLY**_ set the time and click SAVE. After save you will need to log-out and back in to reset the user token. The unit also supports NTP time sync to a local or web site based NTP Time source. Select the NTP Time and location allow 2-4 minutes for time sync. The NTP time sync is very handy for timed tests. You must have the local IP Address for INET Access for a NTP remote time server of your local address for NTP time with the correct gateway for NTP time sync.

Management Port Settings Tab

The **WanRaptor™** supports two MGMT ports that are 10/100/1000. MGMT 1 port is an assigned factory address of 192.168.1.100. The user can set MGMT 2 port to your local network IP Network. **However, do**

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not use the same address range as the 192.168.1.100 as this will cause IP conflict. Any address range outside of this will work fine such as 10.10.20.1, 172.71.17.1 ect…..

System License Types, Updates and Security Tab

The **WanRaptor**™ supports two license types, **Temporary** or **Permanent**. A Temporary License is issued for demo units and rental units. A Permanent License is issued for The **WanRaptor**™ purchases. Without a license the user cannot operate the **WanRaptor**™.

The **WanRaptor**™ supports a **System Reset** feature that will erase all user data profiles and logs of data. This feature is handy when you have completed your test project and the **WanRaptor**™ is moved to another project or personnel. **NOTE: Please STOP all Emulations before applying System Reset**

The **WanRaptor**™ supports a means to **upgrade the system software** from the GUI interface. In order to upgrade the **WanRaptor**™ the user is required to obtain the update file from East Coast Datacom, Inc. and save the **Update File** to the computer you are using to access the **WanRaptor**™ GUI interface. Simply click the upgrade, select the file and upload, save and wait for the spinning update wheel to complete…4-5 minutes…**NEVER STOP THE SYSTEM DURING AN UPDATE**. After SYSTEM REBOOT: The User MUST perform Browser Refresh before Login(e.g. pressing CTRL+R or F5) .
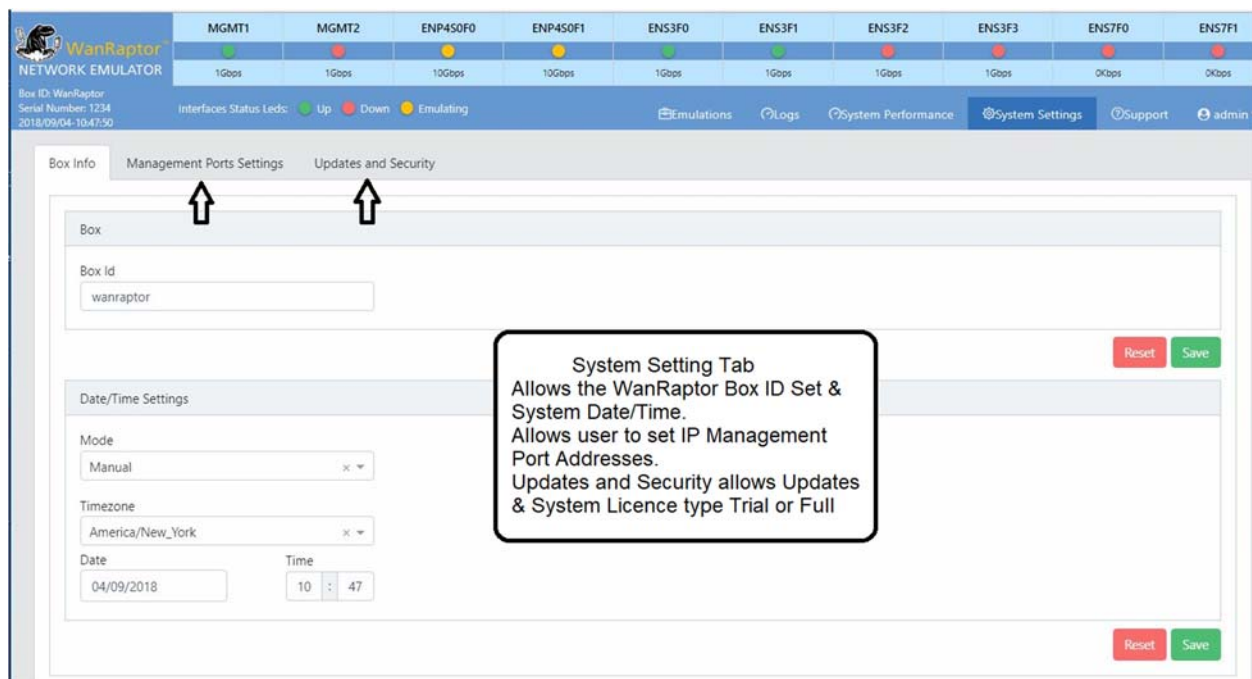

Figure 6 - System Settings Tab

Support Tab

The **WanRaptor**™ has a Support Tab that has the User Manual, License Statement and East Coast Datacom, Inc Support Information for telephone and email support.

Admin Tab

The **WanRaptor**™ has a handy Admin Tab that is used for GUI Log Out, System Power Reset and System Power Down.

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VLAN Emulation - Overview / Basic Operation

The new VLAN software release allows users to create multiple VLAN tags on two LAN Ports that form a trunk during emulation. Each VLAN Tag on this trunk allows its own emulation settings for impairments such as Latency, Loss, Jitter and Re-Ordering. The user can create a maximum of 10 VLAN's on a given LAN-to-LAN paired connection.

VLAN network latency emulation is supported in *Bridge Mode* and not in Route Mode.

Note: The user must be aware that when creating VLAN's, the total bandwidth of all VLAN's cannot exceed the bandwidth of the given LAN-to-LAN link.
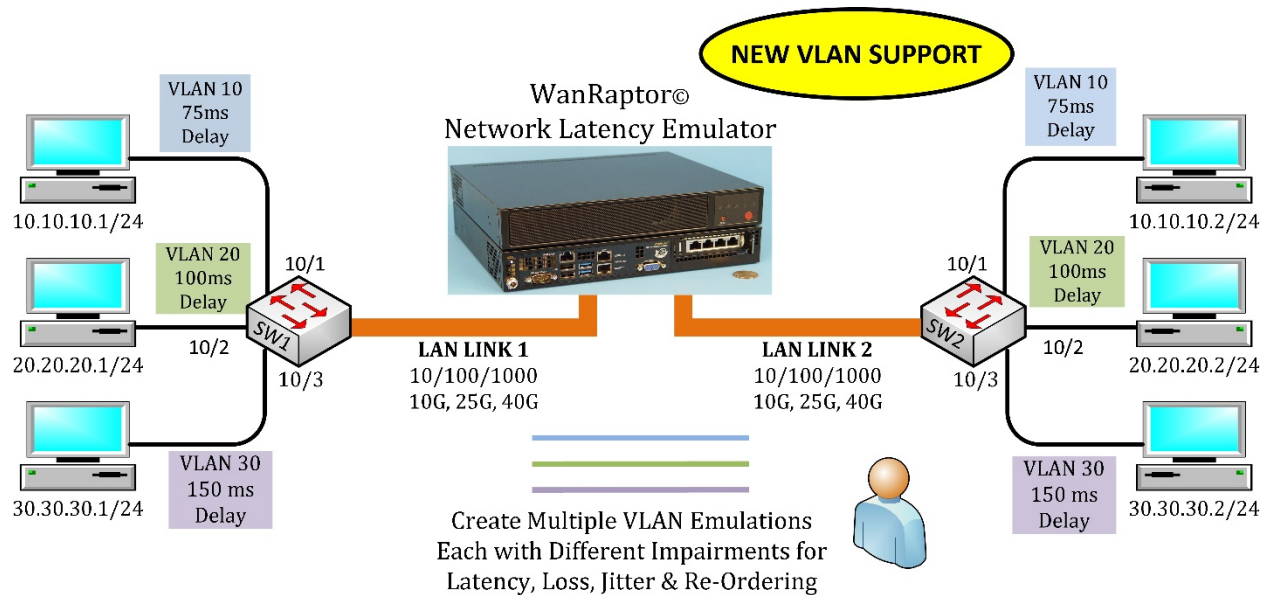

Figure 7 - Example of VLAN Application

1) . The **WanRaptor**™ is installed between two LAN segments and will emulate your Wide Area Network(WAN). Simply connect the LAN cables as desired to the available emulation ports.

EXAMPLE: Router----LAN Cable---- **WanRaptor**™----LAN Cable----Router

2) From the user's PC, access the **WanRaptor**™ via MGMT 1 or MGMT 2 LAN Ports to your PC. Then, from your PC Web Browser, Login with username and password to access the **WanRaptor**™ operation menu's

2) Select **Emulation Tab**, enter a test name, then select the LAN ports available for testing in the LAN port pull down bar

3) Then select **VLAN on the GUI slide bar** located under the LAN port selection area

4) Now Select **Default Rules Tab** and you will see left and right side emulation settings. Each VLAN will have a Tag Number. You can use the VLAN Tag numbers we create, or enter your own numerical value. If you want both LAN ports to have the same emulation settings you can simply leave the "Set different

configuration" without a check mark. When all emulation rules are entered, click **SAVE at the bottom right of the GUI**.

5) Monitor your results on the **Logs Tab** which has real-time counters for TX/RX Packets/Bytes, Dropped Frames/Bytes, Reordered Frames/Bytes, Bit Rate/Frame Rate and Loss shown in Bytes/Packets. The log screen shows each LAN segment and also has a button for **Reset Counters** for each LAN port. NOTE: Log must be enabled on the emulation name screen.

NOTE: In VLAN Emulation, the user must use the same delay method type on both LAN pair. Such as Constant and Constant for both LAN ports. Each VLAN does support different delay types, but not mixed delay types such as Constant and Exponential.

CPU Cores – Core Count, Utilization During Emulations

The **WanRaptor**™ Network Emulator standard system ships from the factory with a XEON 6-Core processor. You can order the system with more cores, or the user can increase the number of cores by upgrading the hardware from East Coast Datacom, or by replacing the XEON processor with the same model – only with a higher core count(Requires software Upgrade file). The XEON processor core count determines several things the user should be aware of, such as when increasing the system LAN port count or the number of emulations that the system runs in concurrent emulations. A large 18-Core CPU is capable of many emulations at one time in the system, such as 20 ports of 10/100/1000 or 10 ports of 10G. In all instances, 10/100/1000 emulations will always support full line rate thru-put for any packet sizes. 10G traffic is line rate at all times with the 6-Core standard system. Higher core count CPU's may lower the overall full line rate capabilities, because the CPU frequency will be a bit lower. However, it should be noted that slightly lower thru-put will only be affected when full duplex small packets sizes are run at the same time on both ports, which is very rare in a typical user environment.

NOTE: If a **WanRaptor**™ Network Emulator system has a system of mixed interfaces such as 10G and 1G, the system utilization of cores is best served by selecting 10G emulations first and then the 1G emulations 2nd. The system software always tries to look for best performance first. So, if binding 10/100/1000 emulations before 10G, the system will use full free cores. If you start 10G emulations first and then 1G emulations, the system will reserve best performance for the 10G and then can share cores for the 10/100/1000 because the PCI slot is not heavily utilized.

NOTE 2: The following is an example of core utilization

GUI Web User Interface – 2-cores are always reserved for the GUI and Linux operating system

10/100/1000 - If you have a 6-core cpu: 2 cores are taken for the gui, 4-cores are available for emulations. Each 1G emulation takes 0.66 cores, so you can have 4/0.66 or 6/ 1G emulations.

10G Emulation: Each emulation consumes 2-Cores/4-threads

25G & 40G Emulation: Each emulation consumes 2-Cores/4-threads

For support:

East Coast Datacom, Inc.
245 Gus Hipp Blvd., STE 300
Rockledge, FL 32955
Web: www.ecdata.com
Email: support@ecdata.com
Tel: (321).637.9922 ext: 2

SPECIFICATIONS

Application
An embedded box appliance that will mimic the behavior of a WAN/LAN network, inserted between LAN segments supporting Bridge or Routing functions with network impairments such as bandwidth, delay, loss & re-ordering

Configuration Management Ports – GUI Access
Two Independent fixed 10/100/1000 Ethernet Ports

Bridge or Routing Support
All emulations support Bridge or Subnet Routing

VLAN Emulation Support
Create up to ten VLAN emulations within a single LAN, each with its own impairments

Emulation Interfaces
10/100/1000 Copper or Fiber, Optional SFP
10G, 25G and 40G SFP+ Inserts

Emulation Bandwidth Link Rates
Up to 40GbE bi-directional or split speeds, Kbps, Mbps or Gbps

Emulated Latency Settings
Constant: 0 to 10 Seconds, Decimal Format Supported, Also Supports Uniform, Exponential & Inter-Packet

Other Emulation Impairments
Packet Loss: 0 to 100%, Decimal Inputs
Packet Re-Ordering: 0 to 100%, Decimal Inputs
Jitter: By use of different delay options

Link Throughput
Full Line Rate for 10/100/1000 & 10G (64-9000byte Packets)
25G and 40G Consult Factory

Emulation Statistics
Each link is capable of real-time statistics via GUI

Login Password Protection
Implemented via the user LAN Management Port

Power Source
AC Mains: 90-240VAC @ 10%, 50/60Hz, Auto Range

Environmental
Operating Temperature....32º to 104º F (0º to 40º C)
Relative Humidity.............5 to 85% Non-Condensing
Altitude...........................0 to 10,000 feet

Warranty
3 - Years hardware, includes software support and software feature upgrades/improvements

Software Upgrades
Administered via the LAN User Management Ports

Web Browser Security & Compatibility
Google Chrome and FireFox

Regulatory Approvals
UL, CSA, CE, CCC, FCC and RoHS

ORDERING INFORMATION, 3-MODELS

PT # 210000
Model: WanRaptor, 2U
Description: WanRaptor WAN Emulator 2U, 6-Slot Chassis
Dimensions: H x W x D
3.50(88.9mm) x 17.20(436.9mm) x 14.50(368.3mm)
Weight: 30 Pounds, 13.6Kg

10/100/1000 NIC CARDS
Ecdata# 226000
Desc: 4-Port 10/100/1000 Copper NIC Card

Ecdata# 226001
Desc: 2-Port 10/100/1000GbE Fiber SFP NIC Card

10GbE SFP+ NIC CARD
Ecdata# 226007
Desc: 2-Port 10G NIC Card

SFP+ Optics for ECDATA PT# 226007
Ecdata# 226004 = 10G Pluggable Optic(SR)
Ecdata# 226006 = 10G Pluggable Optic(LR)

25GbE SFP+ NIC CARD (Also Supports 10G)
Ecdata# 226016
Desc: 1-Port 25G NIC Card

Ecdata# 226018
Desc: 2-Port 25G NIC Card

SFP+ Optics for ECDATA PT# 226016
Ecdata# 226004 = 10G Pluggable Optic(SR)
Ecdata# 226006 = 10G Pluggable Optic(LR)
Ecdata# 226011 = 25G Pluggable Optic(SR)

40G QSFP+ NIC CARD
Ecdata# 226005
Desc: 1-Port 40GbE QSFP+ NIC Card

QSFP+ Pluggable Optic for PT# 226006
Ecdata# 226011 = QSFP+ SR Optic
Ecdata# 226012 = QSFP+ LR Optic

**PORTABLE EMULATOR or 1U RACKMOUNT
PT # 234000
Model: PDS-1/10G
Description: Portable Delay Simulator 1U, 1-Slot Chassis