

WANem 1.1
Wide Area Network Emulator
Setup Guide
Performance Engineering Research Centre

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Revision History

Date	Document Version	Tool Version	Description	Author
27-Apr-2007	1.1	1.1	WANem Setup Guide	M K Nambiar
22-May-2007	1.2	1.1	Updates with bug fixes on DHCP and introduction of Basic mode in WANem	M.K.Nambiar

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1 Setting up WANem

WANem is distributed in the form of a bootable CD with Linux Knoppix O/S. This CD comes with WANem pre-installed. No there are no installation steps. When an i386 architecture based PC is booted with the PC WANem is ready for use.

1.1 How to start WANem

The distribution is in the form of a bootable CD. No installation is required. Just insert the CD into any i386 PC/Server and reboot using the CD. The PC will boot up in the Knoppix Linux OS. We will call this the WANem PC. After the PC boots up, it automatically starts the IP address configuration screen

Following are the general steps to be followed after WANem boots up

- 1 You get a Knoppix screen with a prompt in the bottom left called "boot:" Just press "Enter"
- 2 After Knoppix boots up a question is prompted if you want to configure all the network interfaces of the PC using dhcp. If the PC is connected to a dhcp network, then it is recommended to enter "y" and move on to step 5.
- 3 Otherwise you will be automatically taken to a network setup screen.
- 4 Set up the IP address for the Ethernet interface (most likely eth0). Call this "**wanemip**". You have to select this interface and set up the ip address, network mask and default gateway. This screen is part of the reset command available in the WANem PC console. Details on this command can be found in section 1.3.1
- 5 WANem will prompt you to enter the password for user "perc". It will also prompt you to re-enter the password. Using this userid and password will allow you to remote login to the WANem PC with programs like putty or ssh.
- 6 Setup the routes between the two endpoints (say client and server) such that their packets are routed via the WANem PC when the two communicate with each other. For more details refer to section 1.4 "How to make packets go via WAN emulator".
- 7 From another Windows PC on the network open Internet Explorer and type the URL <http://wanemip/WANem>. [Ensure that your screen resolution is set to 1024 x 765 for best viewing.]
- 8 Now, WANem is ready for use.

1.2 Using WANem Graphical user interface

In the WANem start page you will see 2 boxes -

- a) Enter Basic Mode
- b) Enter Advanced Mode. In this box you will also see a drop down selection of network interfaces.

1.2.1 Basic Mode

If the basic mode is selected then only 1 set of network characteristics can be applied for each network interface. Each such set is called a rule set. In the basic mode each rule set will allow the user to specify only the following network characteristics

- Bandwidth
- Latency

These characteristics are explained in more detail in chapter WANem user guide. Illustrated in Figure 4-1 is a screenshot of the WANem GUI in basic mode with one network interface.

[Help](#)

TCS WANem GUI

TCSWANemGUI [homepage](#)

Interface: eth0

Bandwidth	Delay
Bandwidth(Kb/s) 0	Delay time(ms) 0

[< Return to index page](#)

Apply settingsReset settingsRefresh settings

☐ Display commands only, do not execute them

Check current status

Figure 4-1 – WANem GUI Basic Mode

1.2.2 Advanced Mode Operation

If you want to use the advanced mode select the correct network interface in advanced mode and click the “Start” button. Typically eth0 is the default Ethernet network interface you want to use. You can confirm this with your system/network administrator. You get a screen as shown in Figure 4-2.

[Help](#)
TCS WANem GUI
[TCSWANemGUI homepage](#)

Interface: eth0

Limit(Packets) 1000
Default=1000
Symmetrical Network Yes ▾

Bandwidth		Delay		Loss		Duplication		Packet reordering		Corruption	
Bandwidth (Kb/s)	0	Delay time (ms)	0	Loss(%)	0	Duplication (%)	0	Reordering (%)	0	Corruption (%)	0
		Jitter(ms)	0	Correlation (%)	0	Correlation (%)	0	Correlation (%)	0		
		Correlation (%)	0					Gap (packets)	0		
		Distribution	-N/A-								

IDLE Timer Disconnect
 Type: none ▾
 Random Disconnect Type: none ▾
 Random Connection Disconnect Type: none ▾

none ▾
 Low
 Low

Idle Timer
 High
 High

Disconnect Timer
 Low
 Low

MTTR
 High
 High

IP source addr: any
 IP source subnet:

IP destination addr: any
 IP destination subnet:

Application port if any: any

[< Return to index page](#)

Add a rule set

Apply settings

Reset settings

Refresh settings

☐ Display commands only, do not execute them

Check current status

Figure 4-2 – WANem GUI Advanced Mode

- 1) The above screen shows the form for one rule set. All fields barring the ones in the last row represent various network characteristics. So a rule set identifies a set of network characteristics or a Private WAN. Fill in the relevant network characteristics. These characteristics are explained in more detail in chapter WANem user guide.
- 2) The last row (circled in the figure) in the form starting with “IP source addr” determines the packets to which the rules apply. There are 3 possibilities here
 - a) You want the same rule set to apply to any packet that passes via WANem. In this case you can leave this row as it is.
 - b) You want the rule set to apply to all traffic between 2 end hosts (regardless of whether they are client or server). Then fill in the specific IP addresses or the 2 hosts. You can set the subnets to 32. Leave the “Application port” to “any”.
 - c) You want the rule set to apply to all traffic between 2 end hosts which are client and server for a given application. Then fill in the specific IP addresses of the client in “IP source addr”. And the address of the server in “IP destination addr”. You can set the subnets to 32. Set the “Application port” to the server port.
- 3) To add one more rule set then click “Add a rule set” and repeat from step 2..

-
- 4) Click “Apply Settings” to start WANem.
 - 5) Click “Refresh Settings” immediately to ensure that the settings have taken effect.

Saving all your network characteristics for later reuse is a useful feature to have. This will be supported in the next release of WANem.

1.3 WANem Console commands

Following commands are available in the WANem Console

- reset
- wanemreset
- status
- assign
- clear
- restart
- shutdown

The WANem PC can be either operated from the console. Or you can connect to the WANem PC with “putty” or ssh utilities. For remote login you can use the user id perc and the password set during the WANem boot setup. Either way all the listed commands will be available.

1.3.1 reset

The “reset” command allows the user to specify IP addresses and other details for each network interface on the WANem PC.

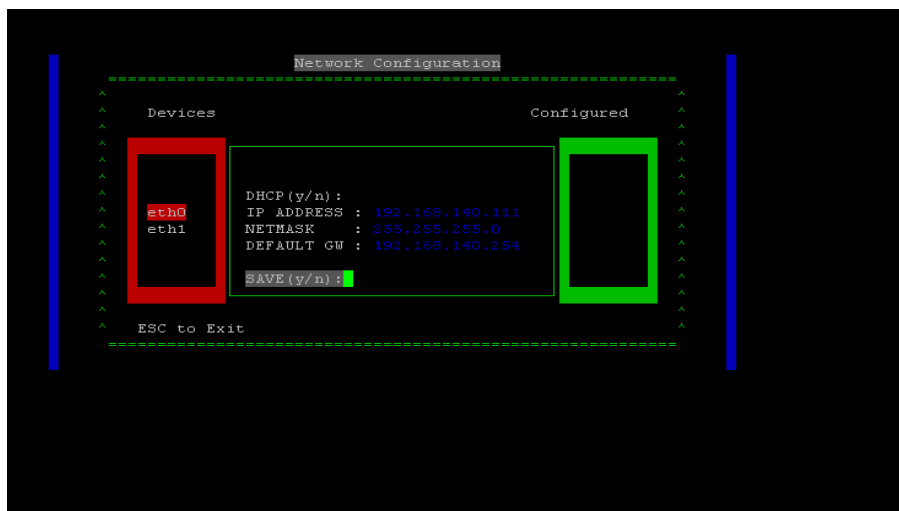


Figure 5 – Network setup screen

This screen allows the user to configure the ip address for each and every interface in the PC. In the above figure there are two interfaces eth0 and eth1. The current selected interface is eth1 and the IP ADDRESS and other parameters relate to eth1. After the parameters are entered entering “y” saves the settings and returns control to the WANem prompt which looks like “**WANemControl@PERC>**”. If dhcp is to be used for network address the please enter yes when the DHCP question is popped for the interface.

If in case you do not want to add or change any settings hit “Enter” key till “SAVE(y/n)” is displayed on the screen. Enter ‘n’. Then enter ‘C’ for cancelling the changes.

If you want to add or change any settings fill in the values and hit “Enter” key till “SAVE(y/n)” is displayed on the screen. Enter y. Then type ‘S’ for saving the changes.

One limitation in this program is that the previous values will not be displayed. For knowing the previous values use the “status” command described in section [1.3.2](#).

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Pls note that if you change the IP address over a remote login session then your session will be disconnected. In such a case you will have to relogin to WANem using the new ip address.

1.3.2 status

This command will list the network settings of all the network interfaces. IP addresses and other settings are displayed. The status will also display the routing table entries within the WANem PC. In case there are multiple network cards in the WANem PC, these entries will be useful to see the distribution of end hosts across network interfaces. In the end the command requests the user to enter an IP address to check connectivity. It is an optional step and it can be used to test network connectivity of the WANem PC itself.

1.3.3 assign

The assign command is used to assign an end host to a specific network interface in the WANem PC. It is useful if there are multiple network cards in the WANem PC. No need to use this command if there is only one network interface. The syntax of this command is **assign <end host ip> <interface>**. For e.g. if we want to assign host 192.168.140.34 to interface eth0 run “**assign 192.168.140.34 eth0**”.

1.3.4 wanemreset

This command can be used to reset all the WANem settings previously set using the WANem GUI. This can be done in case the user is facing trouble accessing the WANem GUI using Internet Explorer. More details regarding why this happens can be found in section 2.

1.3.5 clear

This command is used to clear the WANem console screen

1.3.6 restart

This command is used to restart the WANem PC

1.3.7 shutdown

This command is used to shutdown the WANem PC

1.4 How to make packets go via WAN emulator

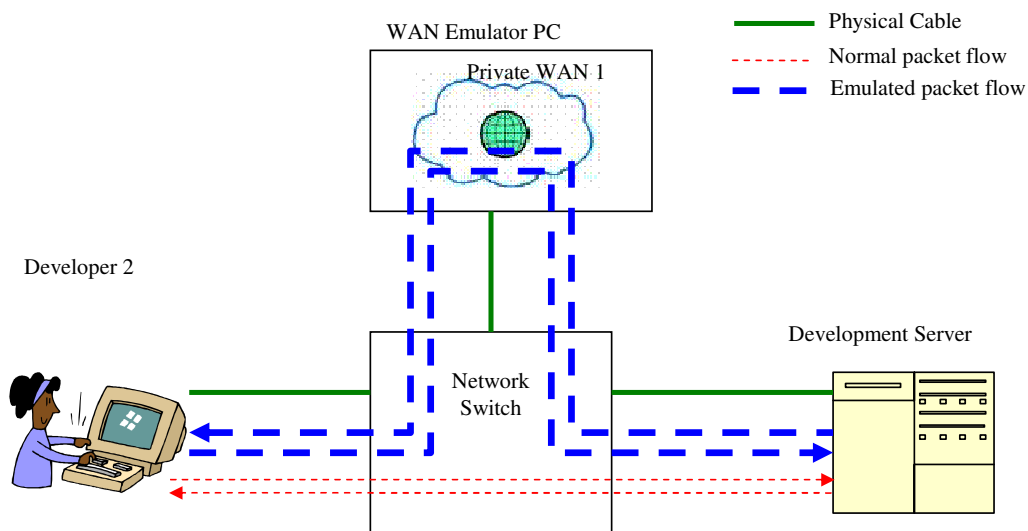


Figure 6 – Routing packets thru WANem

A WAN emulator emulates a wide area network between any two hosts. In order for a wide area network conditions to be emulated between hosts their communication should flow via the WAN emulator. In other words the packets from one host to another and vice versa should be routed via WANem. This is illustrated in the figure above in which the two hosts are the Developer's PC and the Development Server. Under normal situations the packets between 2 hosts flow directly via the switch. In order to introduce emulation the routing tables in the hosts need to be changed.

Please note that in order to use WANem it is not necessary that both the hosts are connected to the same switch. They just need to be in the same local area network or in the same Ethernet broadcast domain. One way to check this is ping one host from another. The ping response should be less than 10 ms. Another method to check this is using traceroute utility (tracert on Windows). The traceroute from 1 host to another should ideally show only 1 hop.

1.4.1 Changing Routes

In the following examples we will setup the network traffic between two hosts to flow via WANem. Following rules will be used for illustrating routing change examples.

1. IP address of host 1 is 192.168.140.12
2. IP address of host 2 is 192.168.140.14
3. IP address of WANem PC is 192.168.140.20

It is assumed that the user is logged in to the machines using Administrator or root privileges.

Example 1: Both host1 and host 2 run the Windows O/S

1. Run this command host 1 “route add **192.168.140.14** mask 255.255.255.255 **192.168.140.20**”
2. Run this command host 2 “route add **192.168.140.12** mask 255.255.255.255 **192.168.140.20**”

Following table gives a listing of commands for changing routes where the end hosts run different combinations operating systems

Example Scenario	Host 1 operating system	Change route to WANem command on Host 1	Host 2 operating system	Change route to WANem command on Host 2
Two Windows hosts communicate via WANem	Windows	route add 192.168.140.14 mask 255.255.255.255 192.168.140.20	Windows	route add 192.168.140.12 mask 255.255.255.255 192.168.140.20
Windows and Linux communication via WANem	Windows	route add 192.168.140.14 mask 255.255.255.255 192.168.140.20	Linux	route add –host 192.168.140.12 netmask 0.0.0.0 gw 192.168.140.20
Linux and IBM AIX communicate via WANem	Linux	route add –host 192.168.140.14 netmask 0.0.0.0 gw 192.168.140.20	IBM AIX	route add 192.168.140.12 192.168.140.20
IBM AIX and Solaris communicate via WANem	IBM AIX	route add 192.168.140.12 192.168.140.20	Solaris	route add 192.168.140.12 192.168.140.20

1.4.2 How do you know change of routing table is working?

For checking this we need to use the command traceroute. In Windows O/S use the command tracert.

1. From host 1 run the command “traceroute <ip2>” - ip2 is the IP address of host 2. In the output you should be able to see the route passing thru “wanemip”, the IP address of the WANem PC.
2. From host 2 run the command “traceroute <ip1>” - ip1 is the IP address of host 1. In the output you should be able to see the route passing thru “wanemip”, the IP address of the WANem PC.

1.4.3 How to check if WANem works between the two hosts

We are assuming that by now you have sorted the routing of packets via WAN emulator.
Using the WANem GUI enter a delay of 100 ms and click on “Apply settings”.

If you are using multiple rule sets - then you will have to first add a new rule set and set the Source IP address and Destination IP address with Symmetrical network set to yes. For this testing purpose please leave port = “any” even if your project needs to specify a real port. You can do that later once you confirm that WANem works between the host 1 and host 2.

Run the following commands

1. From host 1 run the command “ping <ip2>” - In the output you should be able to see a ping response equal to or above 200 ms.
2. From host 2 run the command “traceroute <ip1>” - In the output you should be able to see a ping response equal to or above 200 ms.

2 Frequently Asked Questions

1. What are the requirements for using WANem?

Ans: You will need minimum an i386 based PC with 1 CPU, 512 MB RAM and 1 Network interface card – 100 Mbps (preferably 1 Gbps)

2. How easy is it to install?

Ans: There is nothing to install. WANem is distributed in the form of a bootable CD. Just insert this CD in you CD ROM drive and restart the PC. While restarting, ensure that the PC is booted using the CD ROM.

3. What after restarting the PC with WANem?

Ans: Just 2 more steps before using it

- a. Add an IP address to the Network interface. This is explained in section 1.1 in more detail.
- b. Make the packets between your communicating hosts (mos probably between your client and server) to pass through WANem. This is explained in section 1.4.

4. OK done – Now how do I start using WANem?

Ans: This is the simplest part. Use the WANem GUI. It is self explanatory. Check out section 1.2 for more details.