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# Setting-up WAN Emulation using WAN-Bridge Live-CD v1.09

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## Contents

Document version 0.2

Overview .....	2
Software Installed on the CD .....	2
License.....	3
Sample Lab Configurations .....	4
Lab Configurations Explained.....	4
Software Pre-requisites .....	5
Hardware Pre-requisites .....	5
Using WAN-Bridge Live-CD .....	6
Step-by-Step Instructions.....	6
Access using a Serial Console.....	8
Access using SSH .....	8

## Overview

With WAN emulation, the user can recreate different WAN link scenarios in a lab environment without the need to physically change the lab layout.

This document provides instructions for setting-up and using WAN-Bridge Live-CD v1.09 as a WAN emulation solution in your lab. The WAN-Bridge Live-CD is a bootable CD-ROM containing software required to set up basic WAN emulation. This WAN emulator is set up as an Ethernet bridge, and uses network bandwidth control along with latency and packet loss injection to network traffic flows across bridged networks to emulate the behavior of simple WAN links.

## Software Installed on the CD

- Linux 2.6.x Kernel
- Knoppix Live-CD
- Ethernet bridge set-up and control utilities
- ntop - a network traffic probe to show network usage
- wanbridge script – used to set-up and control simple WAN emulation functions using Linux netem for latency and loss injection and Linux TC for bandwidth control.

## License

WAN-Bridge Live-CD contains a variant of KNOPPIX. If not otherwise specified, the software on the CD falls under the GNU GENERAL PUBLIC LICENSE. Similar to other Open Source licenses, this means that you can copy, modify, redistribute and even resell the CD without restrictions, as long as the recipient receives the same license.

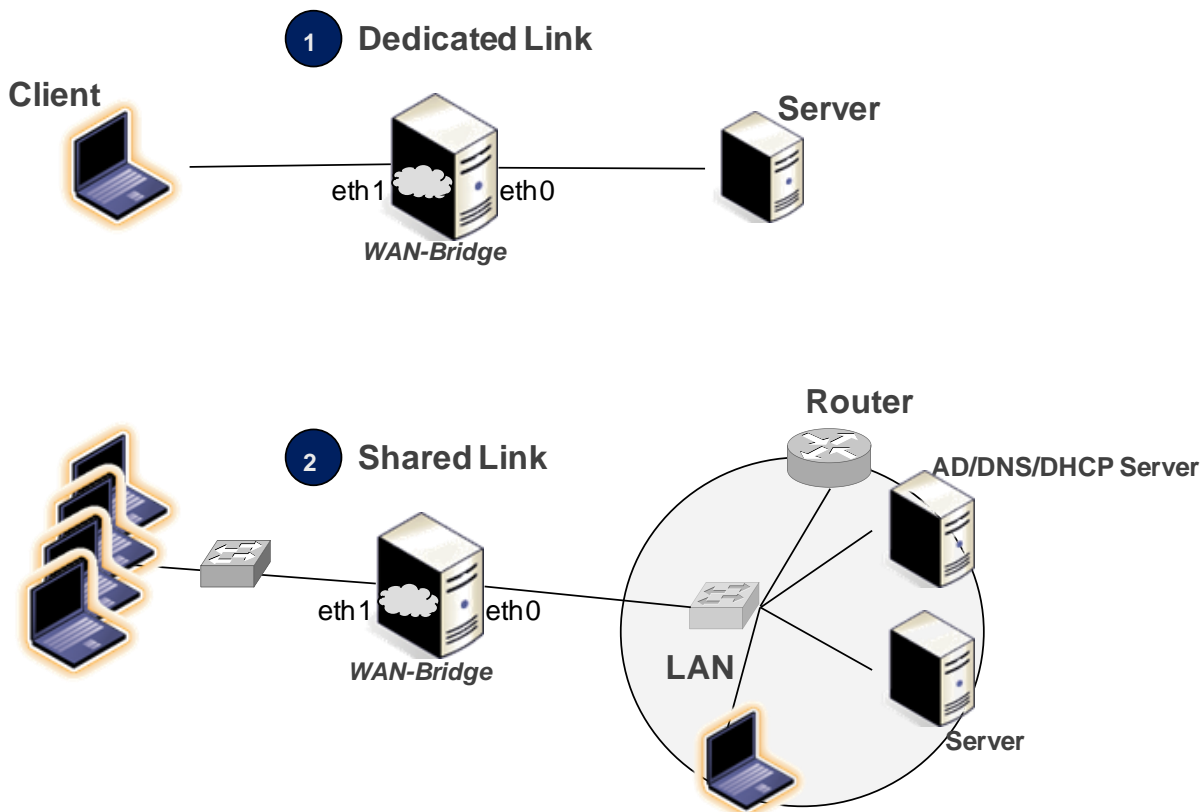
The source-code of the standard packages on the CD is available from their respective original providers (for example on the FTP servers at Debian, RedHat, Mandrake). Special components such as the KNOPPIX kernel or the automatic hardware detection source code can be downloaded from <http://www.knopper.net/download/knoppix/> if not already available in the */usr/src* directory on the CD. Individual packages, as specified by the GPL, may fall under another license (for example Netscape). If in doubt, the licenses can be found in the help sections or the DEB-database (*dpkg -p package-name*) of each software package.

The WAN emulation set-up and control script and source code is available in the CD at */usr/bin/wanbridge*

**DISCLAIMER: THIS IS EXPERIMENTAL SOFTWARE. USE AT YOUR OWN RISK. IN SOME COUNTRIES THE CRYPTOGRAPHIC SOFTWARE AND OTHER COMPONENTS ON THE CD ARE GOVERNED BY EXPORT REGULATIONS OR SOFTWARE PATENTS, WHICH MAY FORBID DISTRIBUTION OR DOWNLOAD. YOU ARE RESPONSIBLE FOR YOUR OWN COMPLIANCE WITH ALL APPLICABLE LAWS. IF YOU PLAN TO COMMERCIALY USE OR DISTRIBUTE (AND SELL) THE SOFTWARE, YOU HAVE TO ACQUIRE THE NECESSARY LICENSES AND PERMISSIONS FROM ALL SOFTWARE COPYRIGHT HOLDERS OF NON-FREE SOFTWARE COMPONENTS, OR REMOVE THESE COMPONENTS BEFORE DISTRIBUTING THE SOFTWARE.**

## Sample Lab Configurations

Two typical lab configurations are provided below. Emulating mobile users and branch populations is achieved by using WAN link emulation and link sharing.



### Lab Configurations Explained

Configuration	Description
1	<ul style="list-style-type: none"><li>• This is a simple, ad-hoc configuration.</li><li>• The server and the client Ethernet ports are connected directly to the WAN-Bridge Ethernet ports.</li><li>• The use of Ethernet cross-over cables is required for 10/100Mbps ports.</li><li>• Static IP address assignment is required on all hosts (client, server, WAN-Bridge) unless the server functions as a DHCP server.</li><li>• All hosts share the same IP subnet as there is no router in place.</li></ul>
2	<ul style="list-style-type: none"><li>• This configuration allows sharing an emulated WAN link across multiple clients and servers.</li><li>• The clients and servers are connected to their respective switches (or VLANs if sharing a physical switch).</li><li>• Each switch is connected to a port on the WAN-Bridge.</li><li>• The DHCP server assigns IP addresses to the hosts (client, server, WAN-Bridge). Static IPs can be assigned as needed.</li></ul>

	<ul style="list-style-type: none"> <li>• All hosts share the same IP subnet as there is no router in place between the server side and the client side.</li> <li>• A router is available for outside access (e.g. to access the internet) and serves as the default gateway.</li> </ul>
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### Software Pre-requisites

Component	Description
WAN Emulator	<ul style="list-style-type: none"> <li>• Bootable CD media with WAN-Bridge Live-CD v1.09.</li> </ul>

### Hardware Pre-requisites

Component	Description
WAN Emulator	<ul style="list-style-type: none"> <li>• An Intel PC with: <ul style="list-style-type: none"> <li>○ Minimum RAM: 512MB</li> <li>○ 2x Ethernet NICs, 100/1000 Mbps</li> </ul> </li> <li>• 2x Ethernet Switches (100/1000 Mbps), one for client side and one for server side, OR a managed switch with 2 VLANs set up.</li> <li>• The WAN Emulator will act as a bridge between the two switches (or two VLANs on a single switch)</li> </ul>

# Using WAN-Bridge Live-CD

## Step-by-Step Instructions

**Step 1.** Insert the WAN-Bridge Live-CD into the CD-drive of the PC you wish to turn into a WAN emulation bridge

**Step 2.** Boot the PC from the CD-drive

**Step 3.** Upon boot, the system will present the status of the bridge creation. If a DHCP server is available, an IP address will be assigned automatically. When done, a Linux shell prompt will appear following usage instructions for the **wanbridge** script.

```
Welcome to Knoppix 6 based on MICROKNOPPIX!

Linux Kernel 2.6.28.4, 502 MB RAM.
CPU 0: Intel(R) Core(TM)2 Duo CPU E4600 @ 2.40GHz @ 2393MHz, 2048 KB Cache
Knoppix 6 found at: /dev/hda
>>> Starting in Live-Mode. <<<
>>> Please do not remove medium until shutdown! <<<
INIT: version 2.86 booting

System Setup... OK.
INIT: Entering runlevel: 5
Checking for bridge...FAILED
Creating bridge: br0...OK
Network device eth0 detected, adding to bridge br0.
Network device eth1 detected, adding to bridge br0.
Requesting DHCP IP for bridge br0...OK
Stopping network top daemon: No ntop found running; none killed.
ntop
Starting network top daemon: Wed May 27 23:43:36 2009 NOTE: Interface merge enabled by default
Wed May 27 23:43:36 2009 Initializing gdbm databases
ntop
Restarting OpenBSD Secure Shell server: sshd.
Interface info: inet addr:192.168.16.3 Bcast:192.168.16.255 Mask:255.255.255.0
Default route: default via 192.168.16.1 dev br0

Usage: wanbridge {option}
Options:
  menu
  status
  set <bandwidth (kbps)> <round-trip latency (ms)> <packet loss (%)>
  stop
  ip {show|dhcp|static} <ip address> <subnet> <default gw>
root@WANBridge:/# _
```

BRIDGE CREATION

SCRIPT USAGE

**Important:** WAN-Bridge Live-CD does not retain any configuration across reboots.

**Step 4.** Type: **wanbridge** menu and press Enter; the system will present a menu allowing you to choose from a pre-defined WAN setting – options 1-6.

```
WAN-Bridge Live-CD v1.09

Please select one of the following options:
-----
1: 40ms round-trip delay, 1544Kbps, 0.1% packet loss
2: 60ms round-trip delay, 1544Kbps, 0.1% packet loss
3: 80ms round-trip delay, 1544Kbps, 0.1% packet loss
4: 100ms round-trip delay, 1544Kbps, 0.5% packet loss
5: 120ms round-trip delay, 1544Kbps, 0.5% packet loss
6: 120ms round-trip delay, 768Kbps, 0.5% packet loss

status: Show Current settings
custom: Custom WAN Settings
dhcp: Get DHCP Address
static: Set Static Address
ip: Show IP Address
tz: Set Time Zone
stop: Stop WAN Emulation
q: Exit

Selection? _
```

**Step 5.** If you require other settings, you may type **custom**. You will need to enter the desired bandwidth in Kbits per second (Kbps), the desired round-trip latency (delay), and the packet loss percentage.

```
Selection? custom
Custom WAN Settings:
-----
Enter bandwidth [kbits/sec]: 512
Enter round-trip delay [millisec]: 120
Enter packet-loss [percent]: 0.1
Emulation settings for eth0:
qdisc htb 1: root r2q 10 default 1 direct_packets_stat 0
Sent 0 bytes 0 pkt (dropped 0, overlimits 0 requeues 0)
rate 0bit 0pps backlog 0b 0p requeues 0
qdisc netem 2: parent 1:1 limit 1000 delay 60.0ms loss 0.1%
Sent 0 bytes 0 pkt (dropped 0, overlimits 0 requeues 0)
rate 0bit 0pps backlog 0b 0p requeues 0
class htb 1:1 root leaf 2: prio 0 rate 512000bit ceil 512000bit burst 1023b cburst 1023b
Sent 0 bytes 0 pkt (dropped 0, overlimits 0 requeues 0)
rate 0bit 0pps backlog 0b 0p requeues 0
lended: 0 borrowed: 0 giants: 0
tokens: 15624 ctokens: 15624

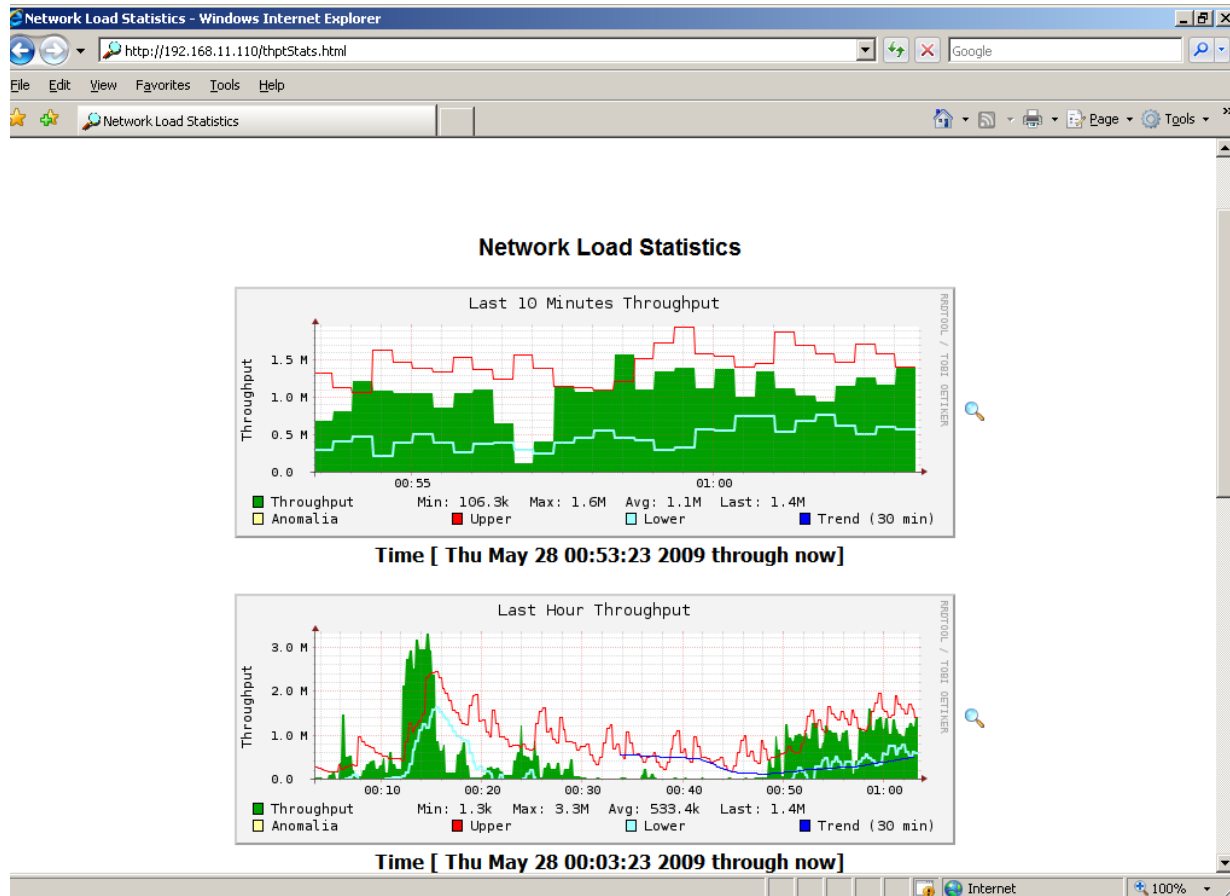
class netem 2:1 parent 2:

Emulation settings for eth1:
qdisc htb 1: root r2q 10 default 1 direct_packets_stat 0
Sent 0 bytes 0 pkt (dropped 0, overlimits 0 requeues 0)
rate 0bit 0pps backlog 0b 0p requeues 0
qdisc netem 2: parent 1:1 limit 1000 delay 60.0ms loss 0.1%
Sent 0 bytes 0 pkt (dropped 0, overlimits 0 requeues 0)
rate 0bit 0pps backlog 0b 0p requeues 0
class htb 1:1 root leaf 2: prio 0 rate 512000bit ceil 512000bit burst 1023b cburst 1023b
Sent 0 bytes 0 pkt (dropped 0, overlimits 0 requeues 0)
rate 0bit 0pps backlog 0b 0p requeues 0
lended: 0 borrowed: 0 giants: 0
tokens: 15624 ctokens: 15624

class netem 2:1 parent 2:
```

#### CUSTOM SETTINGS

**Step 6.** If the bridge is assigned an IP address (either through DHCP or Static configuration), you may access the network traffic probe (ntop) web interface by browsing to <http://WANBRIDGE-IP>.



## Access using a Serial Console

To access WAN-Bridge by serial console, configure your terminal emulation software (such as Hyperterm) to:

bps: **9600**, data bits: **8**, parity: **none**, stop bits: **1**, flow control: **none**

Log on using the following credentials:

Username: **root**

Password: **default**

## Access using SSH

Once configured with an IP address, WAN-Bridge is also accessible using SSH.

Log on using the following credentials:

Username: **root**

Password: **default**