

VII Jornada de Innovación Docente - FdI

GNS3 y contenedores para asignaturas de Redes

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et al.*



Prácticas de Redes

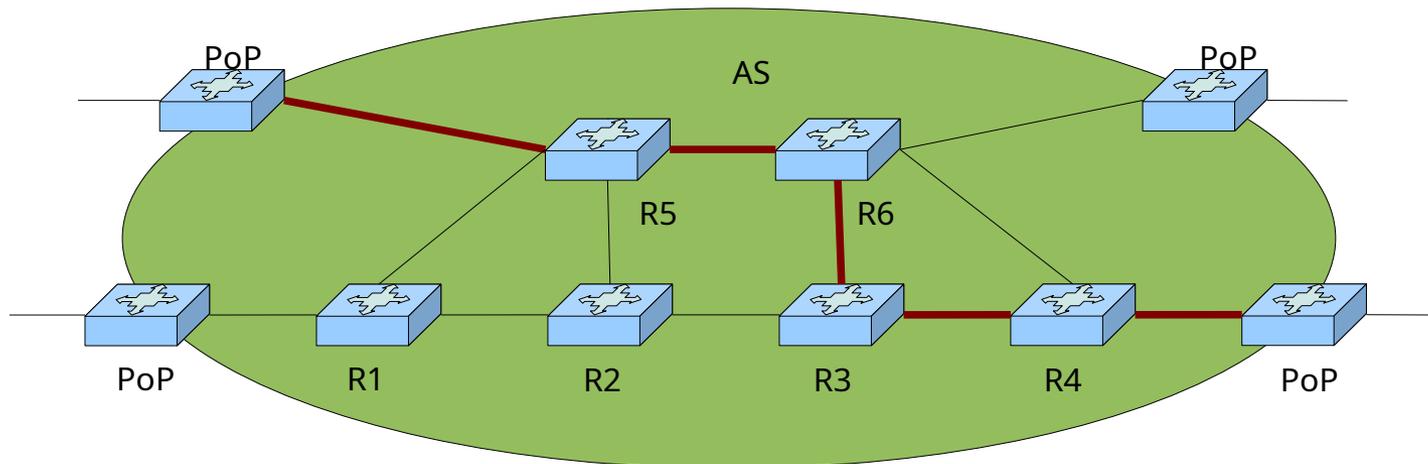


El Problema

El Problema

■ Asignaturas de Redes:

- Se necesitan “muchas” (varias) máquinas.
 - Virtualización.
- El entorno no debe ser un obstáculo.
 - Bastante enredo hay con las redes.
- Soluciones
 - VirtualBox y topologías virtuales.
 - Máquinas UML.



Prácticas de Redes

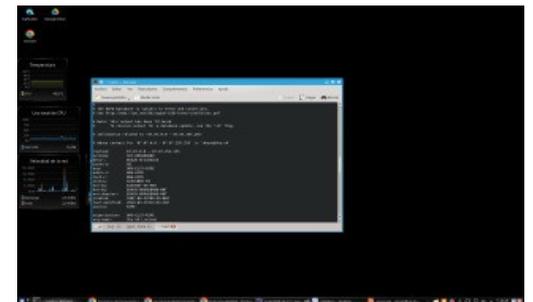
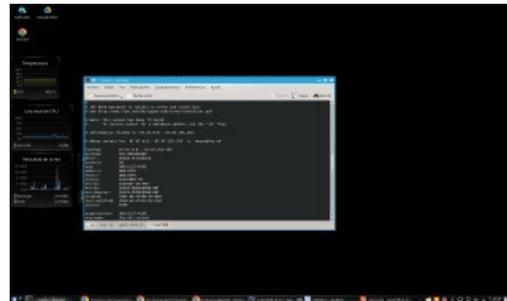
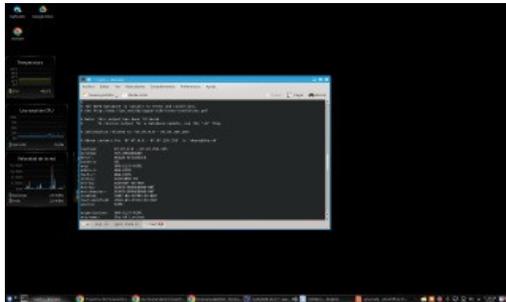
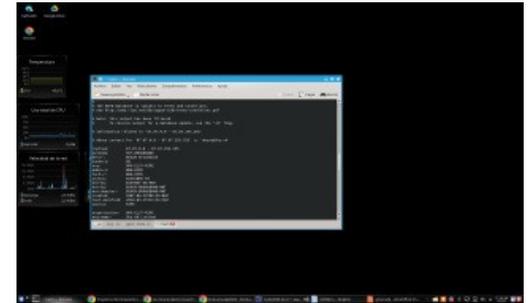


Solución I

Solución I

■ VirtualBox:

- Máquinas pesadas (en todos los sentidos).
- Topologías virtuales.
 - Simple para Redes.
 - Complejas para ASOR y AR.
 - Definición en un archivo de texto.
- Difícil de llevar a casa.



Prácticas de Redes

Solución II

Solución II

■ Máquinas User-Mode-Linux:

- Máquinas ligeras.
 - Espacio en disco: <512MB. Copy-On-Write (COW).
 - Memoria RAM: 64MB/máquina.
- Sin entorno gráfico.
- Topologías virtuales.
 - SDN para RNG y AR.
 - Scripts de apoyo para la definición.
- Se puede empaquetar en una máquina virtual para llevar a casa.

Solución II

■ Máquinas UML. Topologías:

defsw br12 uml1.1 uml2.0

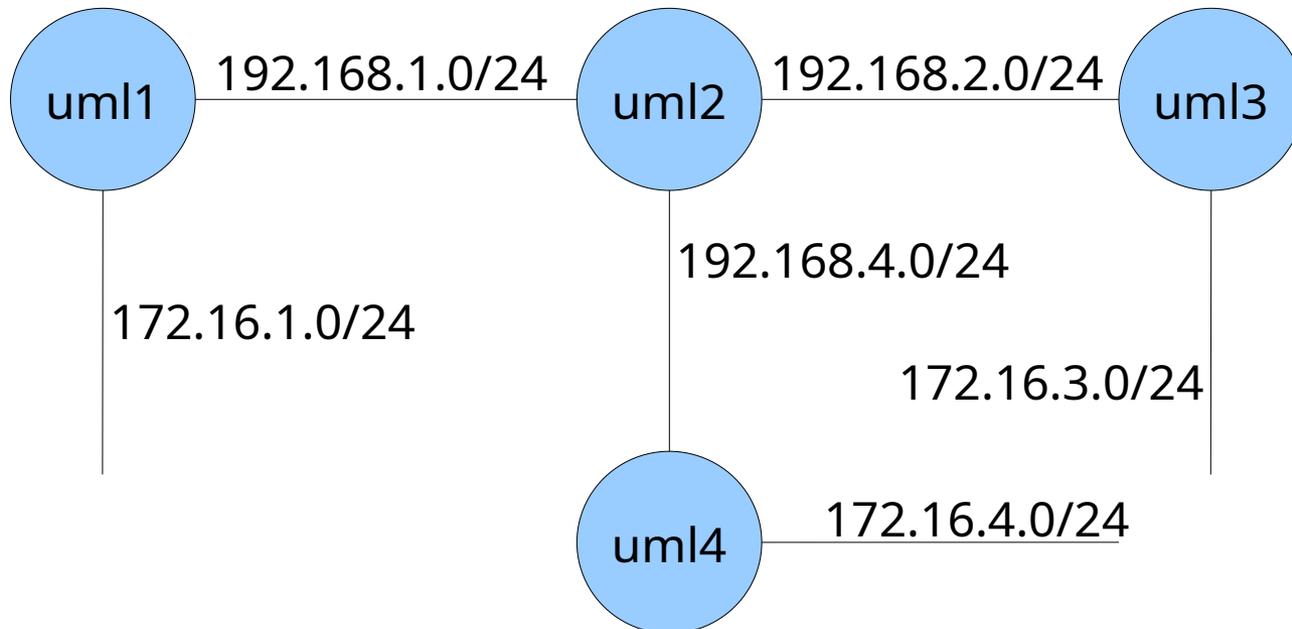
defsw br23 uml2.1 uml3.0

defsw br24 uml2.2 uml4.0

defsw net1 uml1.0

defsw net3 uml3.0

defsw net4 uml4.1



Solución II

■ Máquinas User-Mode-Linux:

The image shows a Linux desktop environment with three virtual consoles (uml1, uml2, uml3) running Debian GNU/Linux 8. The desktop includes icons for KMail, Google Chrome, Firefox, and various .odp files. A system monitor shows CPU usage at 8.1% and RAM usage. The virtual consoles display the process of starting the system, including network configuration and service management.

```
tmp : bash - Konsole
Archivo Editar Ver Marcadores Preferencias Ayuda
Se va a lanzar uml1 con:
NAME=uml1
UPATH=/tmp/uml1
ROOTFS=/usr/local/etc/uml/root_fs
COWFS=/tmp/uml1/uml1_fs
SWAP=/tmp/uml1/swap
HOSTIP=192.168.254.254
Interfaces= eth0=tuntap,uml1.0,02:00:00:00:01:f0 eth1=tuntap,uml1.1,02:00:00:00:01:f1 eth2=tuntap,uml1.2,02:00:00:00:01:f2 eth3=tuntap,uml1.3,02:00:00:00:01:f3 eth4=tuntap,uml1.4,02:00:00:00:01:f4 eth5=tuntap,uml1.5,02:00:00:00:01:f5 eth6=tuntap,uml1.6,02:00:00:00:01:f6 eth7=tuntap,uml1.7,02:00:00:00:01:f7
Se va a lanzar uml2 con:
NAME=uml2
UPATH=/tmp/uml2
ROOTFS=/usr/local/etc/uml/root_fs
COWFS=/tmp/uml2/uml2_fs
SWAP=/tmp/uml2/swap
HOSTIP=192.168.254.254
Interfaces= eth0=tuntap,uml2.0,02:00:00:00:02:f0 eth1=tuntap,uml2.1,02:00:00:00:02:f1 eth2=tuntap,uml2.2,02:00:00:00:02:f2 eth3=tuntap,uml2.3,02:00:00:00:02:f3 eth4=tuntap,uml2.4,02:00:00:00:02:f4 eth5=tuntap,uml2.5,02:00:00:00:02:f5 eth6=tuntap,uml2.6,02:00:00:00:02:f6 eth7=tuntap,uml2.7,02:00:00:00:02:f7
Se va a lanzar uml3 con:
NAME=uml3
UPATH=/tmp/uml3
ROOTFS=/usr/local/etc/uml/root_fs
COWFS=/tmp/uml3/uml3_fs
SWAP=/tmp/uml3/swap
HOSTIP=192.168.254.254
Interfaces= eth0=tuntap,uml3.0,02:00:00:00:03:f0 eth1=tuntap,uml3.1,02:00:00:00:03:f1 eth2=tuntap,uml3.2,02:00:00:00:03:f2 eth3=tuntap,uml3.3,02:00:00:00:03:f3 eth4=tuntap,uml3.4,02:00:00:00:03:f4 eth5=tuntap,uml3.5,02:00:00:00:03:f5 eth6=tuntap,uml3.6,02:00:00:00:03:f6 eth7=tuntap,uml3.7,02:00:00:00:03:f7
juan@x220:~$ /tmp$ vi net.conf
juan@x220:~$ /tmp$ sudo ifovparse net.conf
[sudo] password for juan:
juan@x220:~$ /tmp$
```

```
Virtual Console #0 (uml1)
Starting Console Getty...
[ OK ] Started Console Getty.
[ OK ] Reached target Login Prompts.
[ OK ] Started System Logging Service.
[ OK ] Started LSB: start and stop the Quagga routing suite.
[FAILED] Failed to start LSB: DHCP server.
See 'systemctl status isc-dhcp-server.service' for details.
[ OK ] Reached target Multi-User System.
[ OK ] Reached target Graphical Interface.
Starting Update UTMP about System Runlevel Changes...
[ OK ] Started Update UTMP about System Runlevel Changes.

Debian GNU/Linux 8 uml1 console

uml1 login: root
Linux uml1 3.16.7-ckt20 #2 Sun Jan 24 16:47:11 UTC 2016 x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@uml1:~#
```

```
Virtual Console #0 (uml2)
Starting LSB: DHCP server...
Starting LSB: start and stop the Quagga routing suite...
Starting System Logging Service...
Starting Permit User Sessions...
[ OK ] Started Restore /etc/resolv.conf if the system crash...was shut down..
[ OK ] Started LSB: IPv6 Multicast Routing Daemon.
[ OK ] Started LSB: Multicast Beacon.
[ OK ] Started Permit User Sessions.
[ OK ] Started /etc/rc.local Compatibility.
Starting Console Getty...
[ OK ] Started Console Getty.
[ OK ] Reached target Login Prompts.
[ OK ] Started System Logging Service.
[ OK ] Started LSB: start and stop the Quagga routing suite.
[FAILED] Failed to start LSB: DHCP server.
See 'systemctl status isc-dhcp-server.service' for details.
[ OK ] Reached target Multi-User System.
[ OK ] Reached target Graphical Interface.
Starting Update UTMP about System Runlevel Changes...
[ OK ] Started Update UTMP about System Runlevel Changes.

Debian GNU/Linux 8 uml2 console

uml2 login: 
```

```
Virtual Console #0 (uml3)
Starting LSB: DHCP server...
Starting LSB: start and stop the Quagga routing suite...
Starting System Logging Service...
Starting Permit User Sessions...
[ OK ] Started Restore /etc/resolv.conf if the system crash...was shut down..
[ OK ] Started LSB: IPv6 Multicast Routing Daemon.
[ OK ] Started LSB: Multicast Beacon.
[ OK ] Started Permit User Sessions.
[ OK ] Started /etc/rc.local Compatibility.
Starting Console Getty...
[ OK ] Started Console Getty.
[ OK ] Reached target Login Prompts.
[ OK ] Started System Logging Service.
[ OK ] Started LSB: start and stop the Quagga routing suite.
[FAILED] Failed to start LSB: DHCP server.
See 'systemctl status isc-dhcp-server.service' for details.
[ OK ] Reached target Multi-User System.
[ OK ] Reached target Graphical Interface.
Starting Update UTMP about System Runlevel Changes...
[ OK ] Started Update UTMP about System Runlevel Changes.

Debian GNU/Linux 8 uml3 console

uml3 login: 
```

Prácticas de Redes

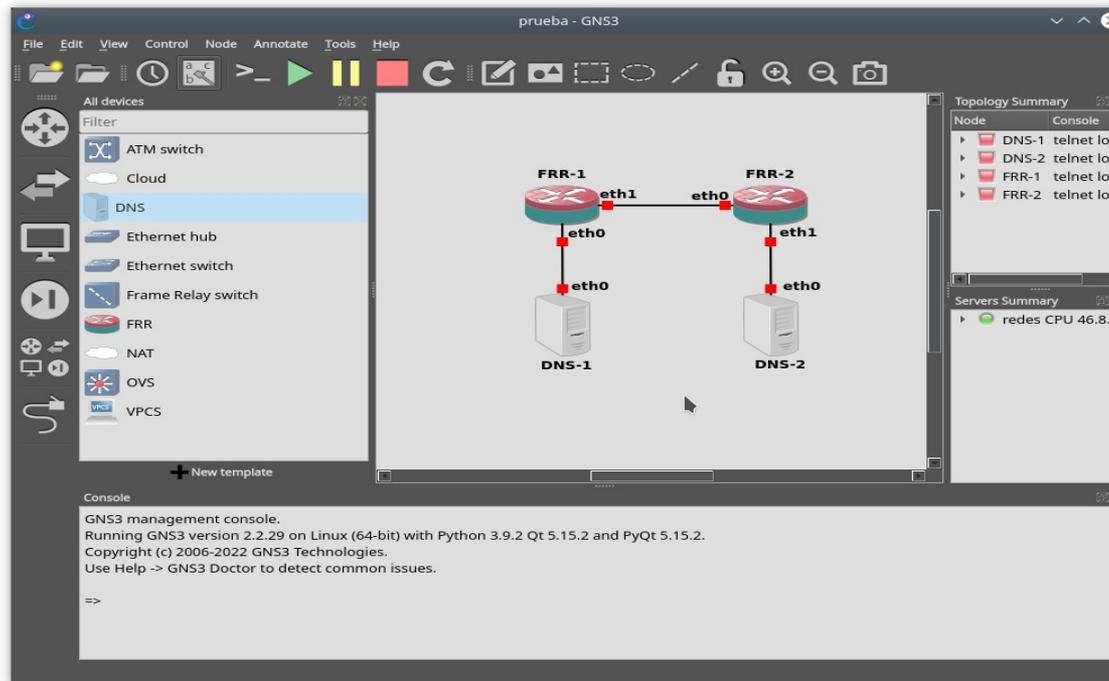
Solución III

Solución III (y ahora sí)

■ GNS3 + contenedores.

■ GNS3: Graphic Network Simulator.

- ¡Gráfico!
- Ideado para usar con chismes Cisco, pero ampliado a Vbox, VMWare, Qemu y contenedores.
- Visualización de los dispositivos y la topología

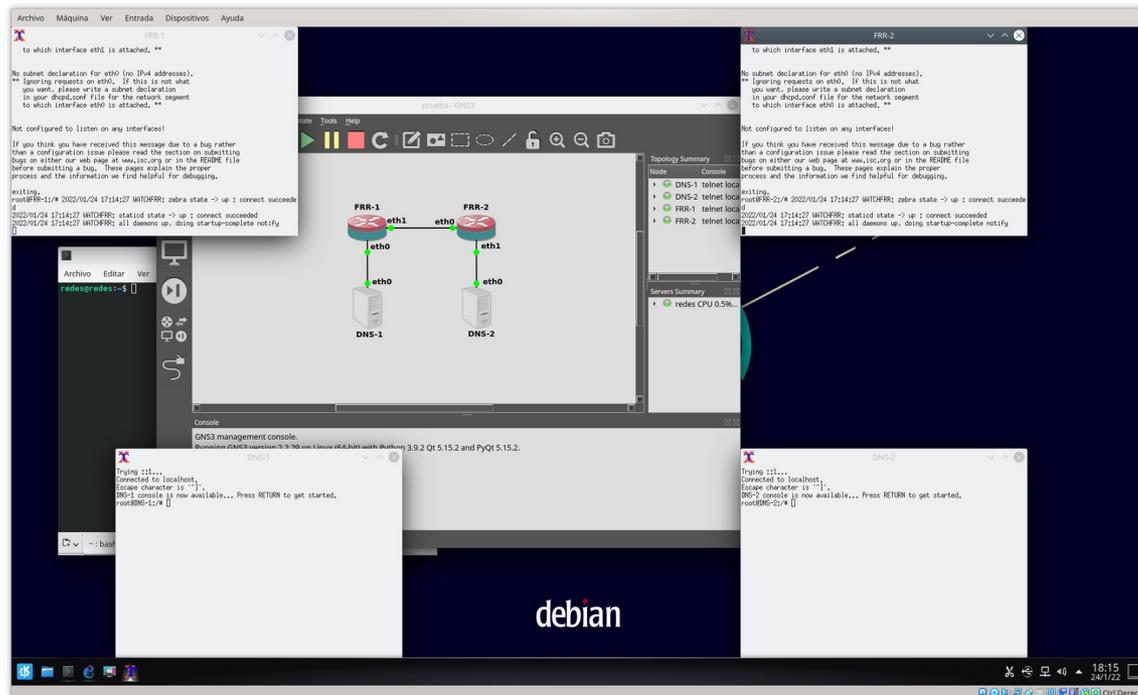


Solución III (y ahora sí)

■ GNS3 + contenedores.

■ Contenedores.

- Bloquean la WiFi.
- Creados ad-hoc.
- Tres modelos de cachivaches: FRR, DNS, OVS.



Solución III

■ Captura de tráfico

- Directamente desde los enlaces.

The screenshot shows the Wireshark interface with a capture filter set to 'icmp'. The packet list pane displays five ICMP packets:

No.	Time	Source	Destination	Protocol	Length	Info
100	34.103948	172.16.5.2	172.16.1.2	ICMP	102	Echo (ping) reply id=0x000b, se
101	35.104447	172.16.1.2	172.16.5.2	ICMP	102	Echo (ping) request id=0x000b, se
102	35.104745	172.16.5.2	172.16.1.2	ICMP	102	Echo (ping) reply id=0x000b, se
103	36.110521	172.16.1.2	172.16.5.2	ICMP	102	Echo (ping) request id=0x000b, se
104	36.111043	172.16.5.2	172.16.1.2	ICMP	102	Echo (ping) reply id=0x000b, se

The packet details pane for the selected packet (Frame 27) shows the following structure:

- Ethernet II, Src: 56:c5:53:5b:77:bc (56:c5:53:5b:77:bc), Dst: 02:f1:2f:f1:48:2d (02:f1:2f:f1:48:2d)
- MultiProtocol Label Switching Header, Label: 17, Exp: 0, S: 1, TTL: 61
 - 0000 0000 0000 0001 0001 = MPLS Label: 17
 - 000. = MPLS Experimental Bits: 0
 - 1 = MPLS Bottom Of Label Stack: 1
 - 0011 1101 = MPLS TTL: 61
- Internet Protocol Version 4, Src: 172.16.1.2, Dst: 172.16.5.2

The packet bytes pane shows the raw data in hexadecimal and ASCII:

```
0000 02 f1 2f f1 48 2d 56 c5 53 5b 77 bc 88 47 00 01  ..../H-V·S[w·G·
0010 11 3d 45 00 00 54 e7 d2 40 00 3f 01 f5 b1 ac 10  =E·T· @·?·
0020 01 02 ac 10 05 02 08 00 3e 05 00 0b 00 5c b4 8c  >···\·
0030 eb 62 00 00 00 00 52 d1 08 00 00 00 00 10 11  ·b···R·
0040 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21  ······ !
0050 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31  "#$%&'()*+,-./01
0060 32 33 34 35 36 37 234567
```

Prácticas de Redes

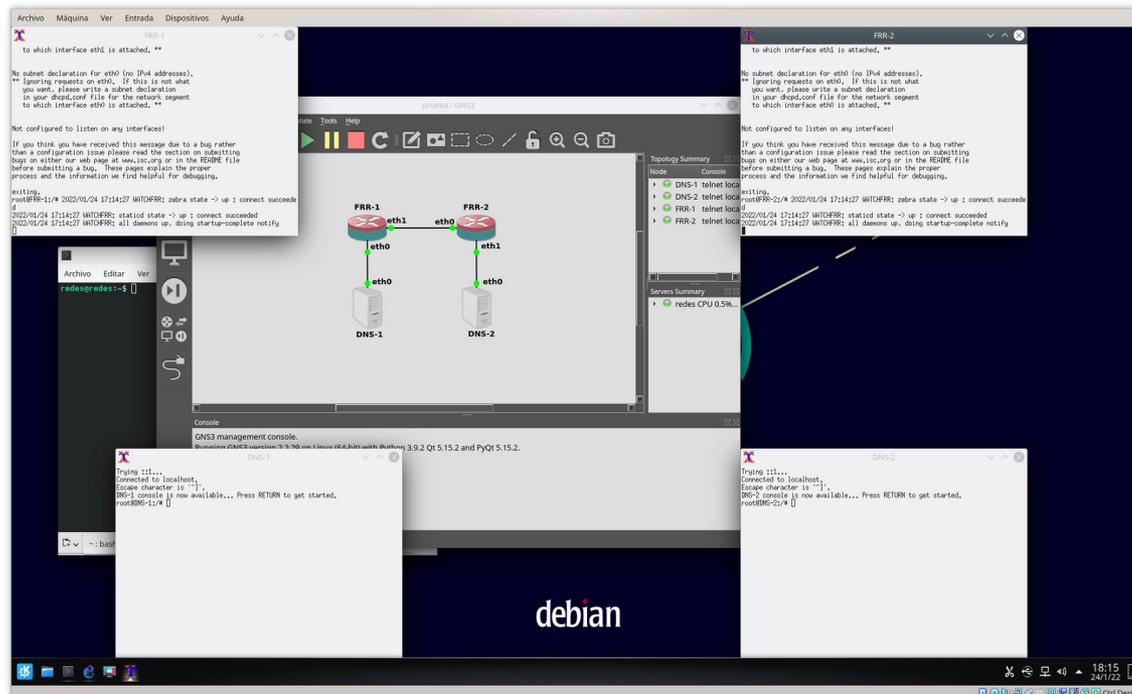


Resultados

Resultados

■ GNS3 + contenedores.

- El entorno no es un obstáculo, sino una ayuda.
- Definición gráfica de las topologías.
- Posibilidad de crear dispositivos personalizados.
 - Contenedor (.tar) y appliance (.gns3a).



Prácticas de Redes

Y Fin (no eran 34)