

Virtual Training Platform

Overview



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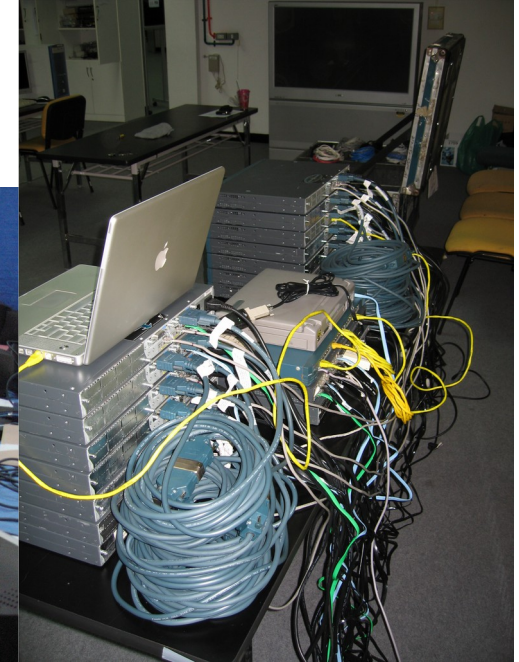
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Why are we doing this?

- Early 2000s, our workshops looked like this:



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Why are we doing this?

- Shipping 150kg crates of routers, switches, cables,...
 - Cost! Time! Customs! Setup! Power! Cabling!
- Desktop computers
 - Cabling (power and ethernet)
 - Laptops were still a luxury item
- Fast forward to early 2010s:
 - Dynamips for running router labs (and simple switches)
 - Laptops and Wi-Fi more common
- Today (mid-2020s):
 - Mini-PCs with GNS3 and router software running in Linux environment



What is the NSRC VTP?

- A software environment for students to experience hands-on labs for configuring routers, switches and servers
 - Developed over many iterations and years of training
- Supports the NSRC training courses
 - Multiple lab environments for different training courses
 - Labs encourage collaboration between students, in groups or in pairs
- If you're an NREN delivering training, **we will share all the configs and help you build this!**



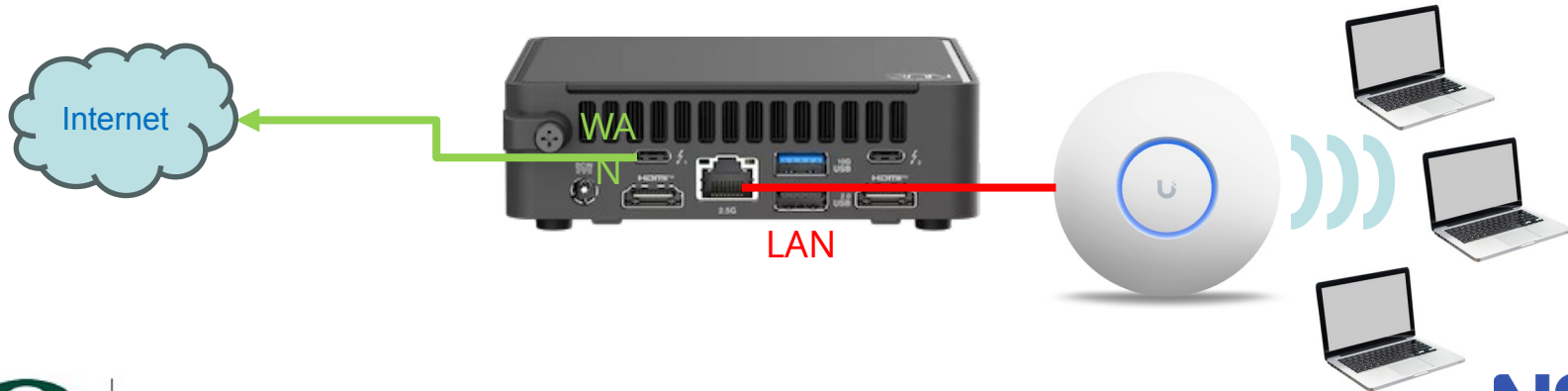
Hardware requirements

- Quad-core i7 or better
- 32GiB RAM minimum (64GiB or 96GiB required for some labs)
- 500GB SSD minimum (1TB+ better)
- Preferably on a dedicated server
 - Running inside a VM is not ideal, but *might* work OK
 - Note that student Linux servers inside the labs are themselves VMs
 - VMs inside a VM = nested virtualization
 - Can perform poorly and/or have reliability issues
 - However, Cisco IOL routers/switches are not VMs



Option 1: Portable server

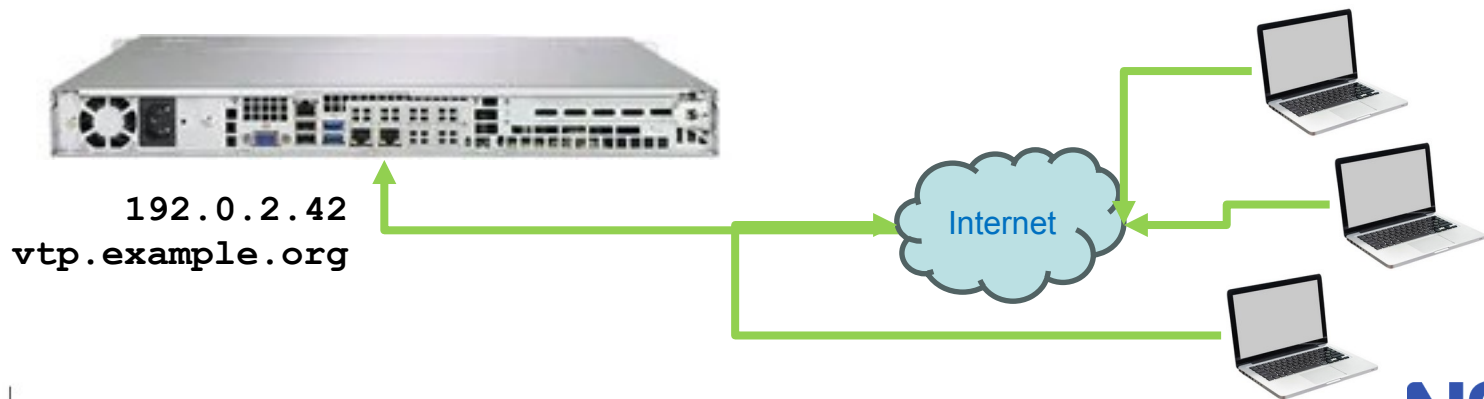
- Students connect to local Wi-Fi access point
 - They get a private IP address from local DHCP server
 - Connect to private domain `local.nsrc.org`
 - Server also acts as NAT gateway (*but most labs work if Internet is down*)



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Option 2: Hosted server

- Students connect over the Internet
 - Server needs a public IP address and public DNS name
 - Access is authenticated (student login required)
 - HTTPS certificate obtained from LetsEncrypt



The students' point of view: web interface



Campus Network Design and Operations

Serial
Consoles

web ssh (no laptop ssh client
required)

A screenshot of the NSRC web interface. At the top, there is a navigation bar with links: Agenda, Downloads, Monitoring, Archived Labs & News, Admin, and Logout. Below this, the interface is divided into sections for different campuses: Campus 1, Campus 2, Campus 3, Campus 5, and Campus 6. Each campus section contains three buttons: Console, SSH, and Web. A dropdown menu is open under the 'Console' button for Campus 1, showing a list of network devices: bdr1, core1, dist1-b1, edge1-b1, edge2-b1, dist1-b2, edge1-b2, edge2-b2, and srv1. Blue arrows point from the text labels to the 'Console' button and the 'SSH' button in the Campus 1 section.

Access to web servers
inside lab



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Virtual routers and switches (IOL, IOL-L2)

```
Router>ena
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname bdr1-campus1
bdr1-campus1(config)#end
bdr1-campus1#sh ip i
*Aug 6 12:37:45.299: %SYS-5-CONFIG_I: Configured from console by console
bdr1-campus1#sh ip int br
Interface                IP-Address      OK? Method Status                Protocol
Ethernet0/0              unassigned      YES unset  administratively down down
Ethernet0/1              unassigned      YES unset  administratively down down
Ethernet0/2              unassigned      YES unset  administratively down down
Ethernet0/3              unassigned      YES unset  administratively down down
bdr1-campus1#
```



Virtual machines

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

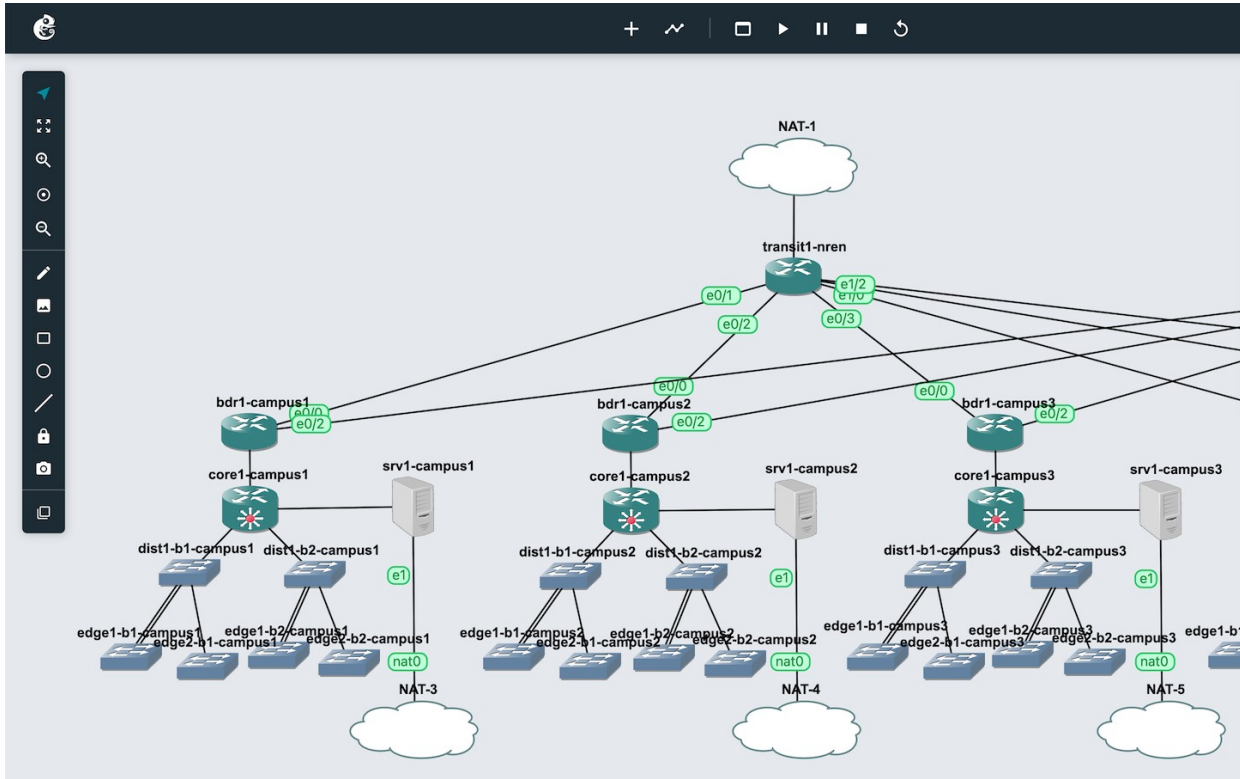
```
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by  
applicable law.
```

```
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.
```

```
sysadm@srv1-campus1:~$ sudo -s  
root@srv1-campus1:/home/sysadm# apt-get update  
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]  
Hit:2 http://archive.ubuntu.com/ubuntu jammy InRelease  
Get:3 http://HTTPS//ppa.launchpadcontent.net/cz.nic-labs/bird/ubuntu jammy InRelease [24.6 kB]  
Get:4 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]  
Get:5 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [3445 kB]  
Get:6 http://HTTPS//ppa.launchpadcontent.net/cz.nic-labs/bird/ubuntu jammy/main amd64 Packages [712 B]  
Get:7 http://HTTPS//ppa.launchpadcontent.net/cz.nic-labs/bird/ubuntu jammy/main Translation-en [536 B]
```



The instructors' point of view: GNS3 topology



Topology management

- GNS3 snapshots: restore the entire lab to a known state
- Our custom "gns3man" admin tool
 - Restore individual devices from snapshot
 - Edit the stored NVRAM settings
 - especially useful if a student forgets what password they configured!



Demo

Virtual training platform – web interface



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