Train the Trainers

Kigali, Rwanda

Network Startup Resource Center

Capacity Building and Virtual Technologies

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Virtualization Technologies

They are everywhere…

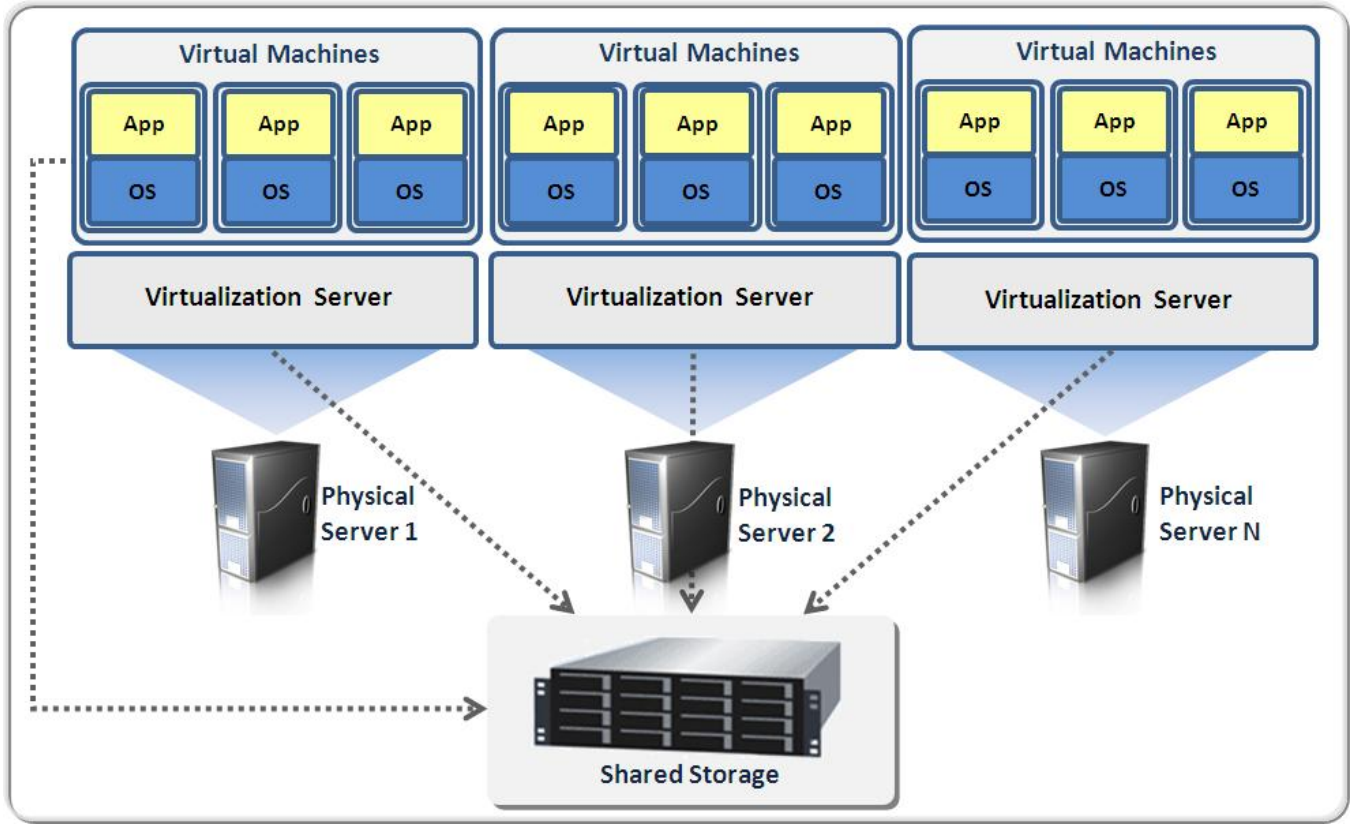
By abstracting functionality away from hardware we gain

- Improved capacity usage
- Lower power consumption
- Reduced system administration overhead
- Better reliability (uptime, data loss)
- Possibilities that we are still thinking of…

- Run many services and servers onto fewer physical machines: increases ***efficiency***

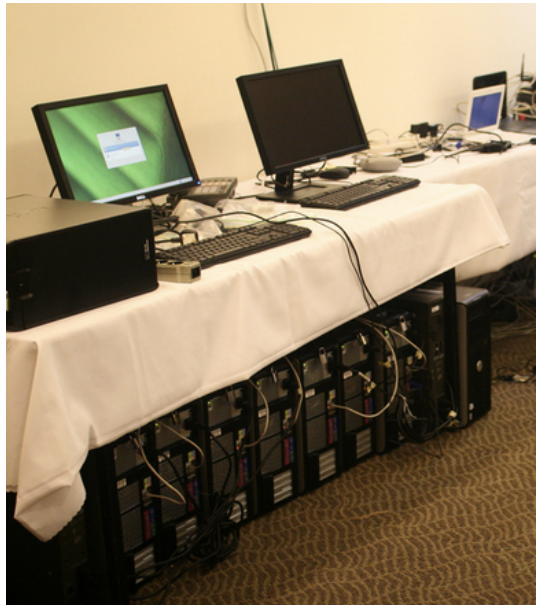
Some virtualization benefits

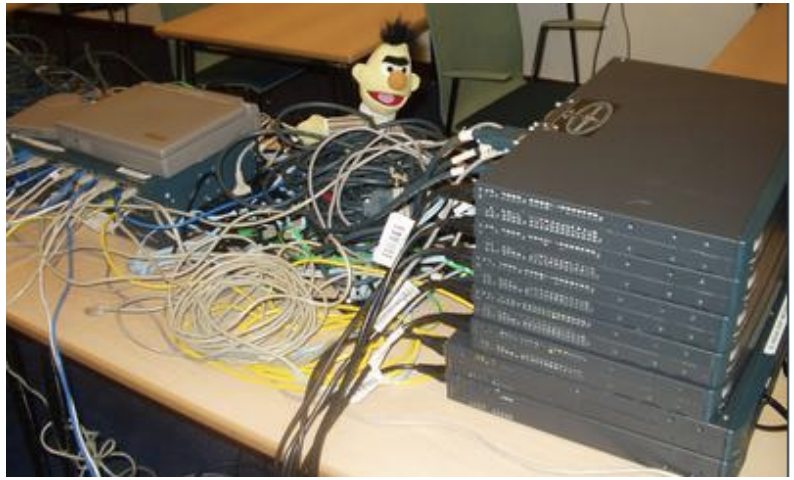
Reduced power use and better use of resources through **consolidation**



AfNOG Trainings 2000-2010…

…lots of setup





Logistical benefits are obvious

In the context of regional and local training:

- "Virtualizing" = less hardware (better use)
- Reduced shipping costs
- Reduced Logistics
  - Customs / import
    - Network equipment is often considered to be "telecommunications" – taxation issues, licensing
  - Small footprint – fits in a backpack or carry-on
  - Peripheral infrastructure (access points, desktop switches) are very small

Virtual AfNOG 2013

- This represents ***significant overkill*** (2x or more).
- Much more could be virtualized…

Motivations and benefits

Other benefits than logistics are well aligned with the needs of regional / decentralized training:

- Adaptability
- Educational

We will cover these in the next slides

A smorgasbord of choices!

Full virtualization

- KVM (Linux and Solaris only)
- Parallels (Mac OS X only)
- QEmu
- VirtualBox (Windows, Linux, Mac, FreeBSD)
- Virtual PC (Windows only)
- VMware (Workstation/Fusion, ESX)
- Windows Hyper-V
- Xen

Lightweight/pseudo

- FreeBSD / Linux Jails/LXC/OpenVZ

Network Simulation

- Marionnet
- Navy CORE

Network Emulation

- Dynamips / Dynagen / GNS3
- Olive (Juniper)
- Cisco IOU (private)

What do we use?

Hardware

- MacMini Server, 16GB RAM, 2x256 SSD, i7 quad core
- (Optional) fanless, Gigabit, managed 8-port switch
- Ubiquiti UniFi Pro AP or Netgear AP

Software

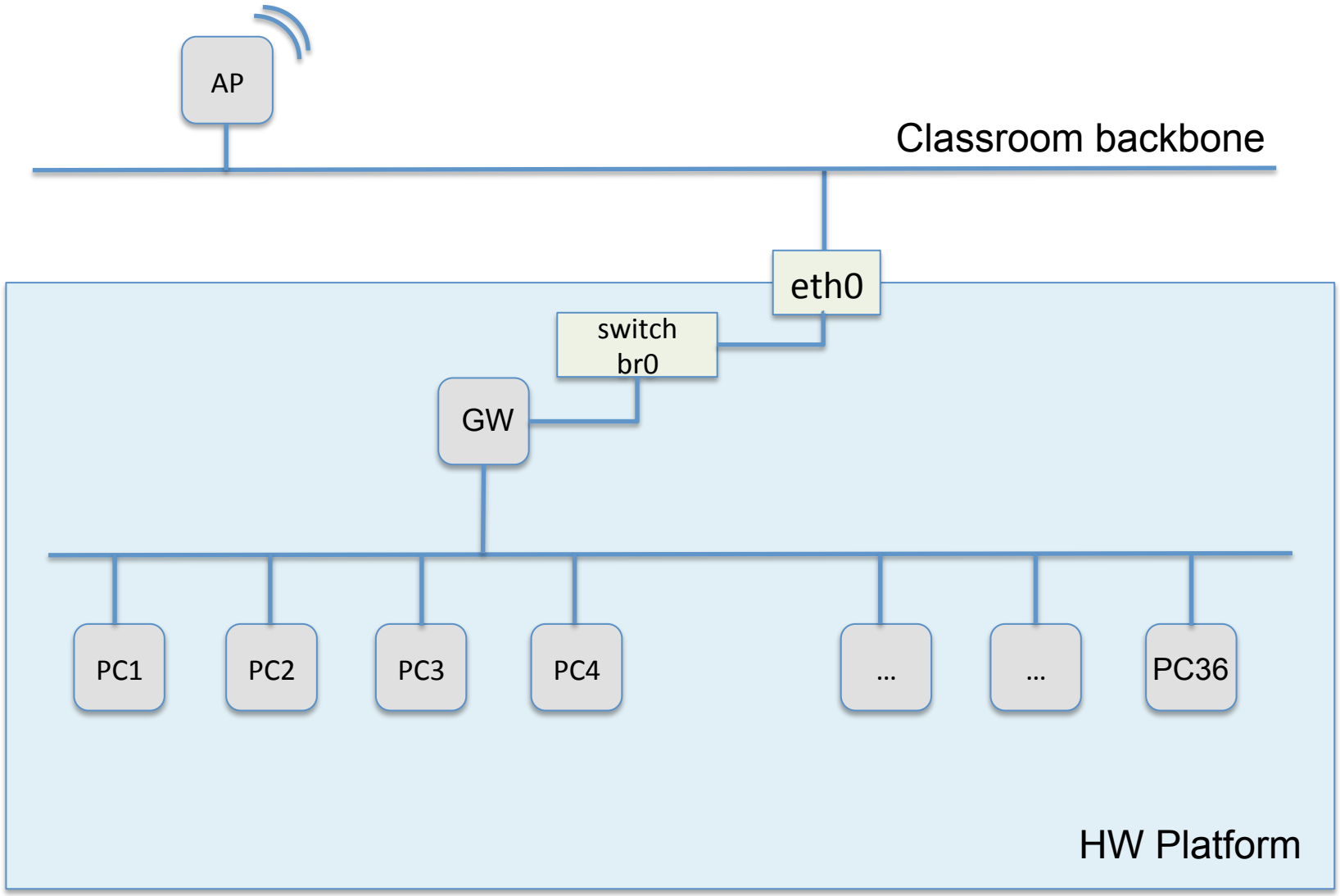
- Ubuntu Linux 12.04 LTS 64-bit
- KVM (Kernel based Virtual Machine)
- dynamips/dynagen
- Ansible

What do we use?

Hardware

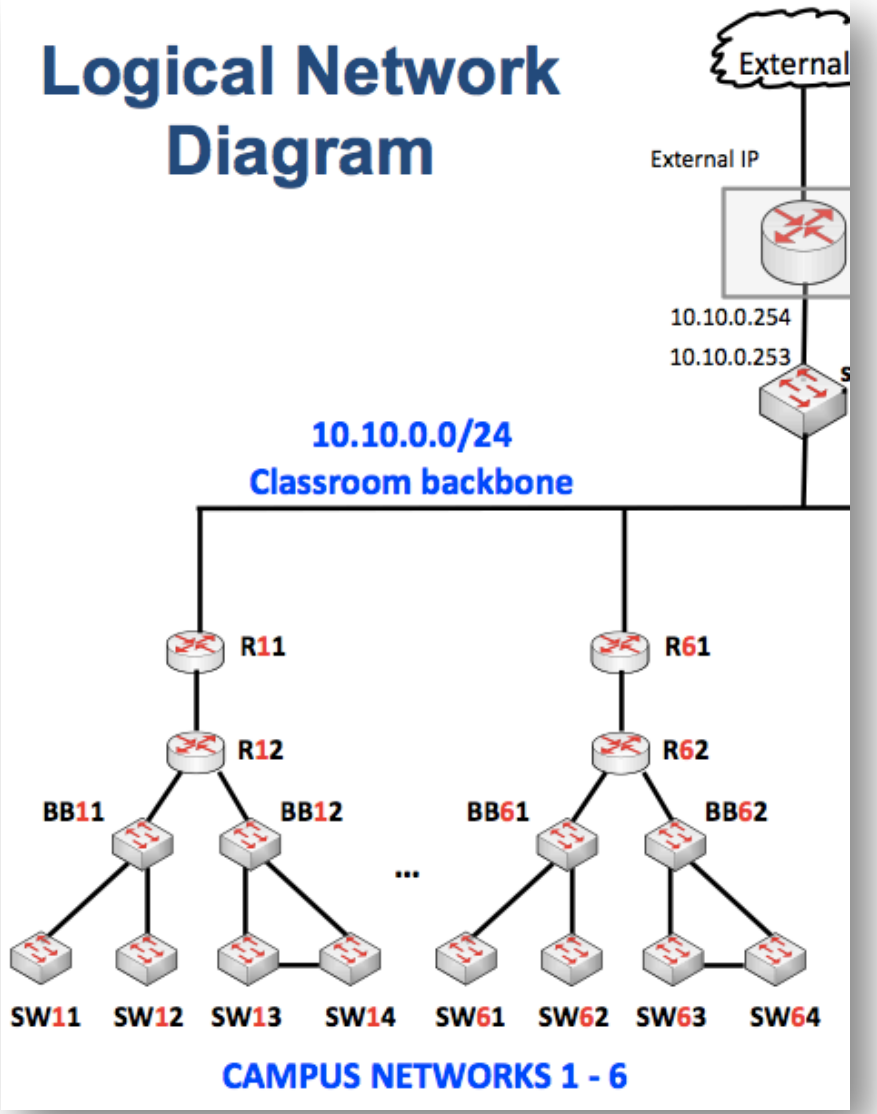
- We use the MacMini for convenience (power / size ration = very good)
- Can use any reasonably modern machine with virtualization extensions (VT-x/VT-d) in the CPU
- Tower PC with Core i7, 7200 RPM disks
- Rackmount server, Xeon/Opteron, faster disks
- SSD disks are very nice, but not critical
- RAM is a big factor

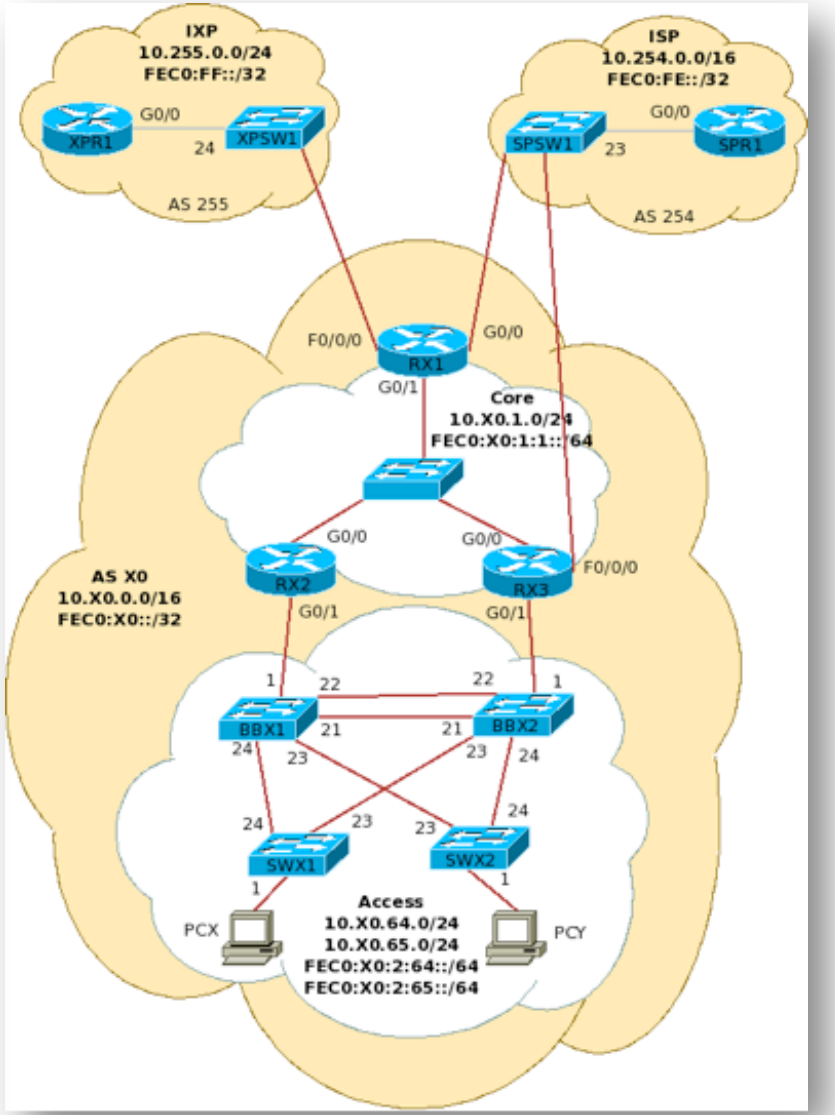
UNIX / Linux Introduction



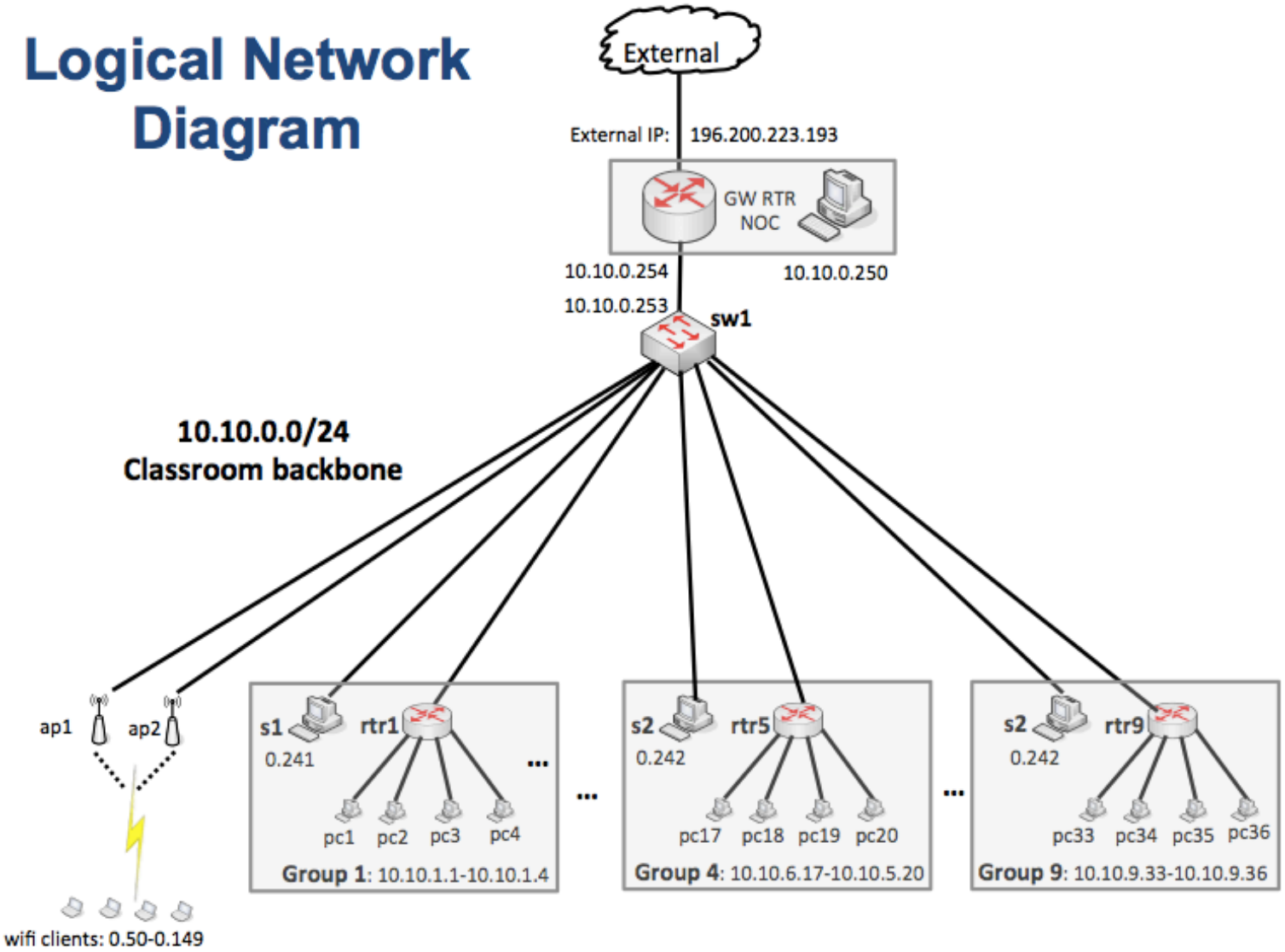
36+ virtual machines on one server

Campus Network Design (CND)

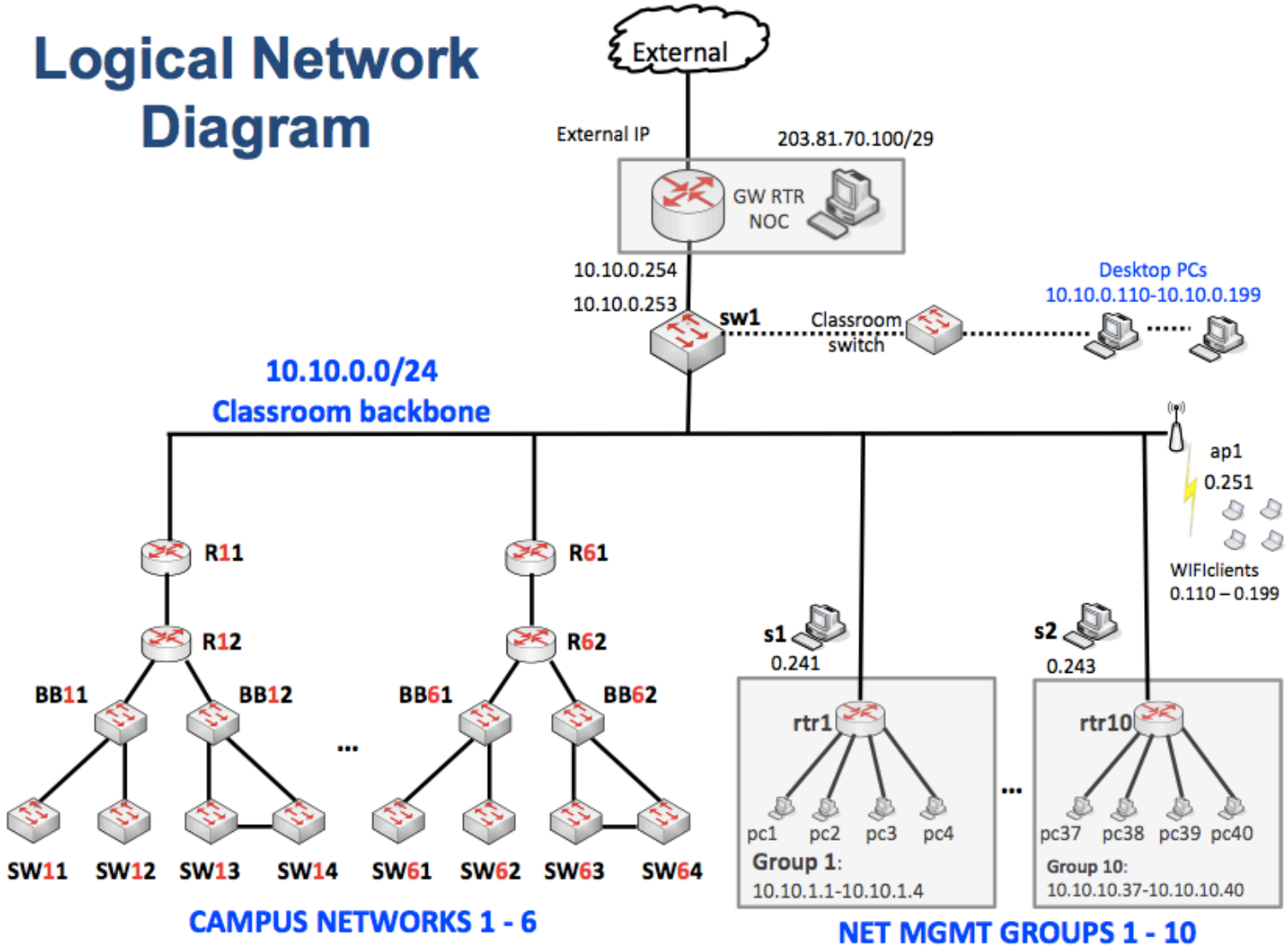




Network Management (NMM)



CND and NMM over 2-3 Machines

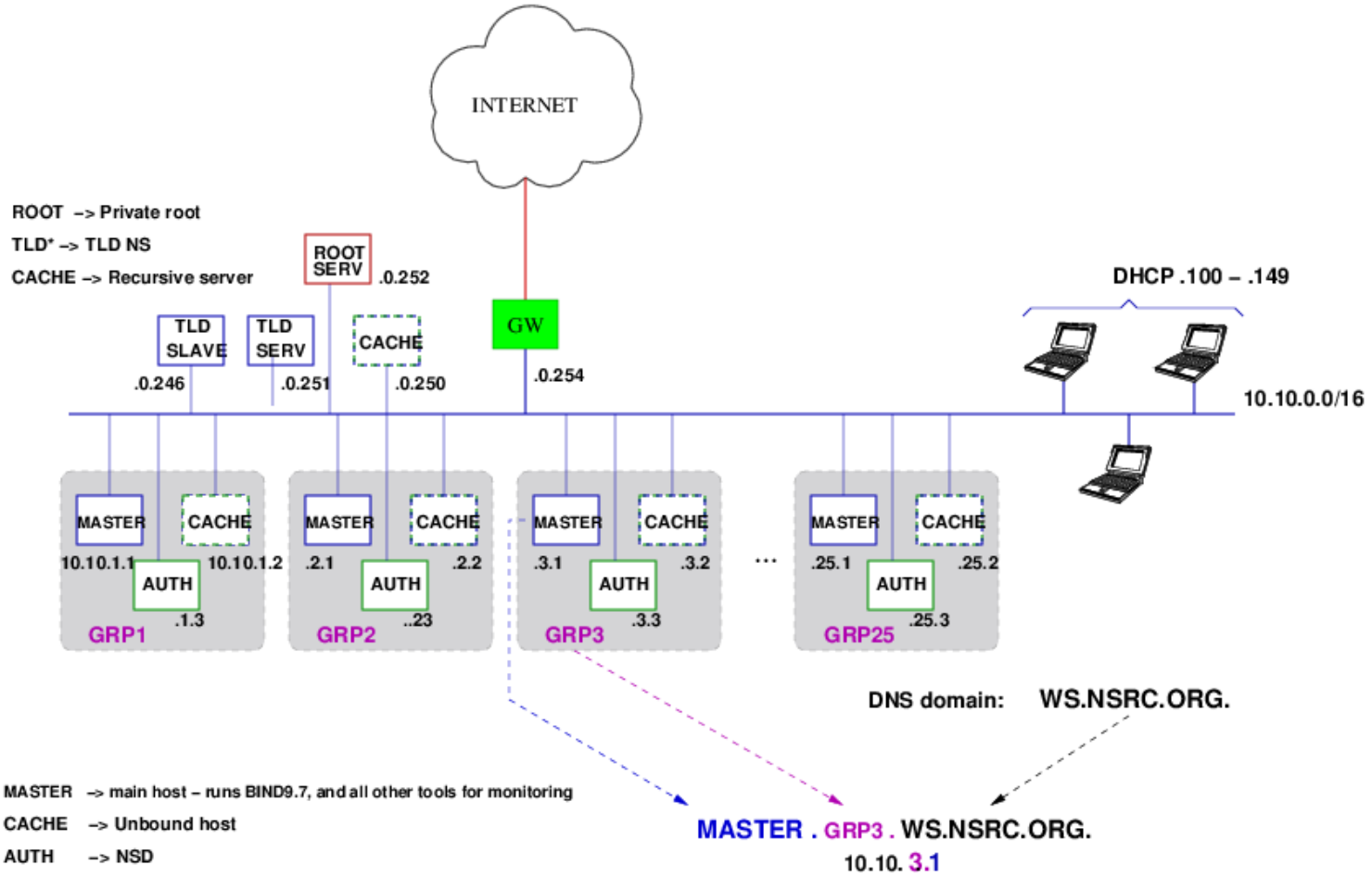


DNS/DNSSEC workshop

NETWORK LAYOUT

login: adm
pass: *given in class*

WiFI SSID: DNS or DNS2
WiFi pass: 8888888888



Benefits: Educational

- Shipping small CPUs much less expensive.
- Other benefits not tied to simple cost benefit or logistics
- Virtualization technologies part of modern IT infrastructure
  - Not just for training
    - Virtualized OS (“hypervisors”)
    - Virtualized network (VLANs, virtual switches, routers, SDN)
    - Virtualized storage (iSCSI, disk images)

Benefits: Educational (con't)

- Clear benefits for institutions offering applications and services to staff and faculty
- Professionally relevant for students and instructors
- Participants can easily re-create lab environments on laptops
- Much simpler to provide network and systems training.

Limitations…

There are, of course, some tradeoffs:

Hands-on is limited

- No manipulation of “real hardware”
  - Some people grasp concepts better
  - Cables vs VLANs
  - Reality for present-day networks and systems
- Not always possible to virtualize all hardware

What tool(s) to use?

… and new possibilities

All this simplifies capacity building…

- Lower cost, better outreach
- Increased adaptability
- More can be done
- Easy to adjust to new topics / themes

Questions?