

# Introduction

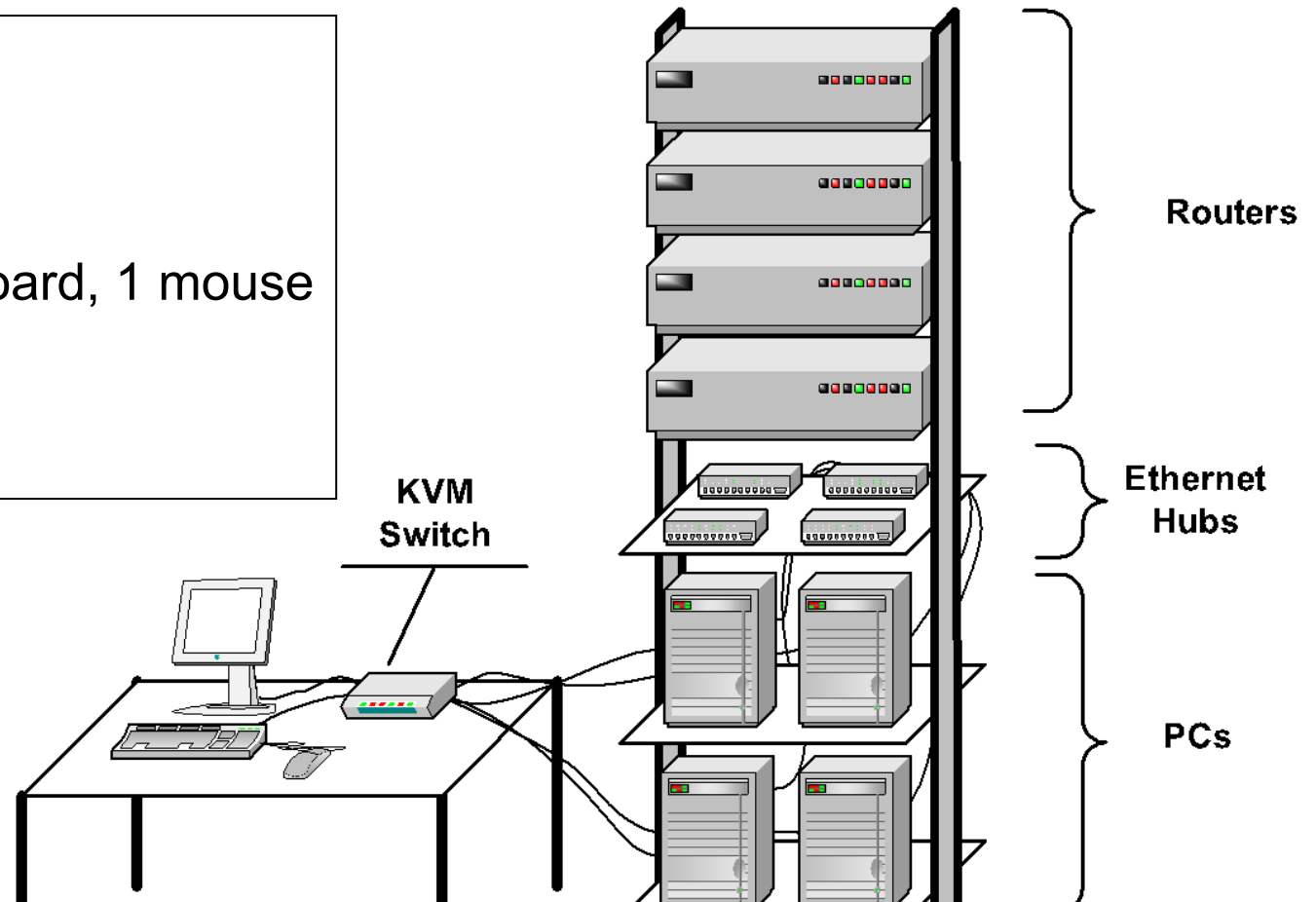
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An introduction to the equipment and organization of the Internet Lab.

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# Internet Lab Equipment

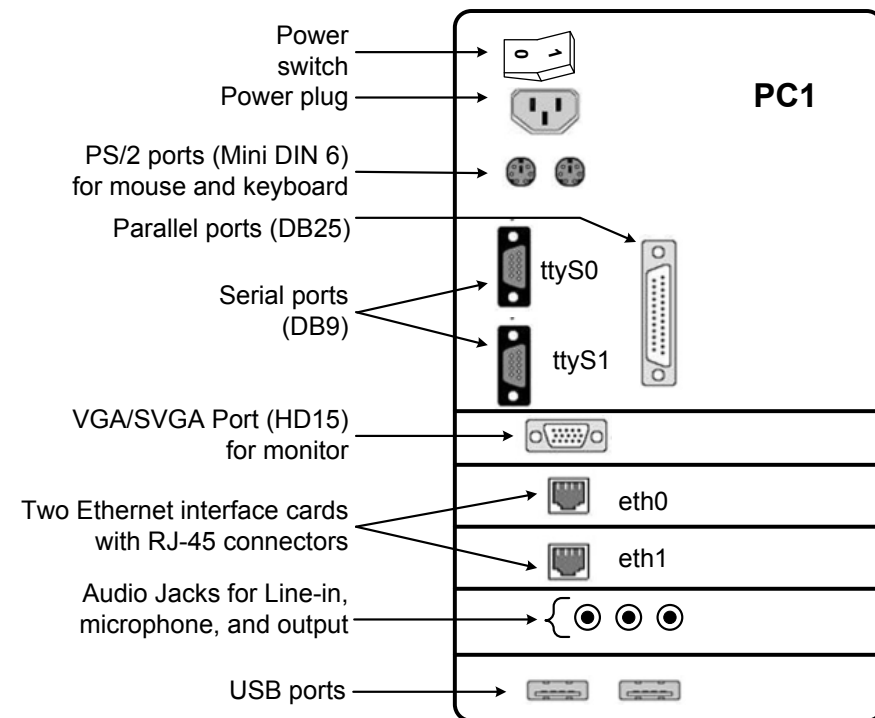
- 4 Linux PCs
- 4 Cisco Routers
- 4 Ethernet hubs
- 1 monitor, 1 keyboard, 1 mouse
- 1 KVM switch
- Cables



New: Software-defined networking (SDN) routers (pica8 and Juniper MX104) this semester!

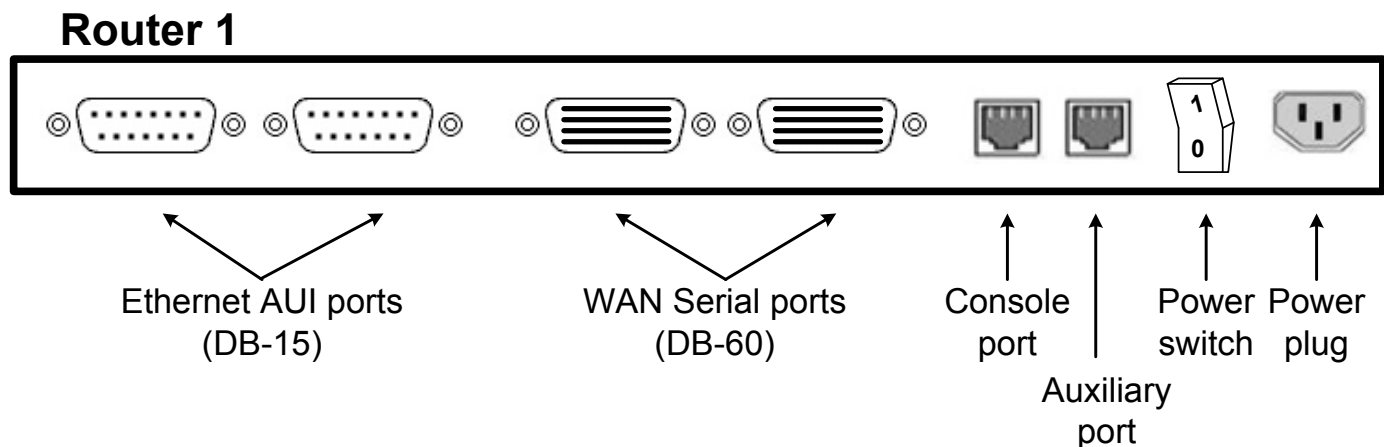
# Linux PC

- PCs are labeled as: *PC1*, *PC2*, *PC3*, *PC4*.
- PCs Linux Red Hat 8.0 or a later version installed
- Each PC has:
  - a USB port,
  - a serial port,
  - two 10/100 Mbps Ethernet interface cards (*NICs*).



# Cisco Router

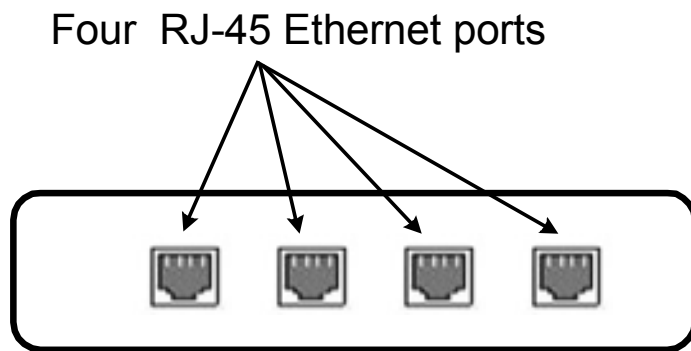
- Routers are labeled: Router1, Router2, Router3, Router4.
- Routers run Cisco IOS 12.0 or a later version
- Each router has:
  - a console port
  - two 10 or 100 Mbps Ethernet interfaces
  - two WAN serial interfaces



# Ethernet Hubs

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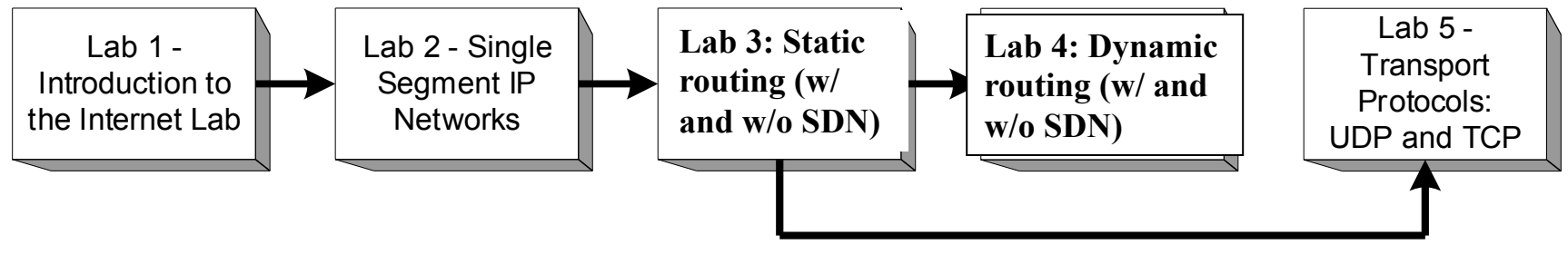
- Each hub has 4 or more RJ-45 ports
- Ports operate at 10 Mbps, 100 Mbps or both



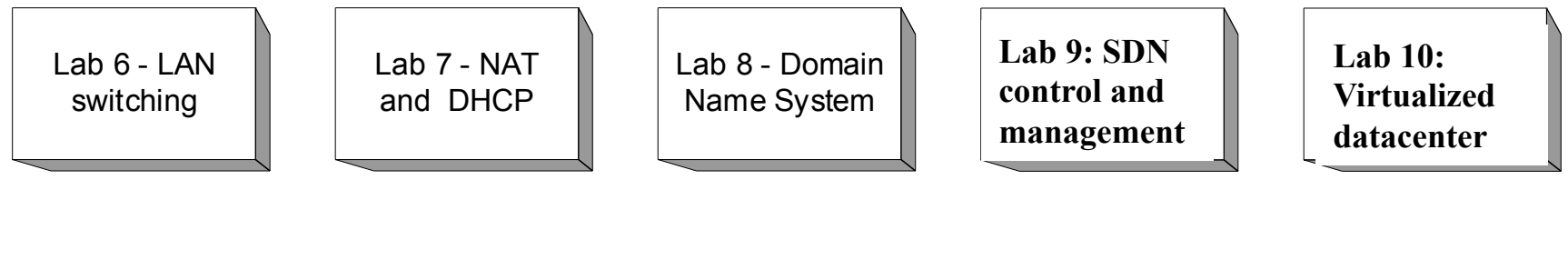
# Lab Sequence

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## Core Labs:



## Advanced Labs:



# Core Labs

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- **Lab 1 – Introduction to the Internet Lab**  
Overview of the Internet Lab equipment; introduction to *ethereal* and *tcpdump*.
- **Lab 2 – Single Segment IP Networks**  
Configuring a network interface for IP networking; address resolution with ARP; security problems of common Internet applications.
- **Lab 3 – Static routing (w/ and w/o SDN)**  
IP forwarding and routing between IP networks; setup a Linux PC and a Cisco router as an IP router; manual configuration of routing tables.
- **Lab 4 – Dynamic Routing Protocols (w/ and w/o SDN)**  
Routing protocols RIP, OSPF and BGP; count-to-infinity problem in RIP; hierarchical routing in OSPF; setup of autonomous systems in BGP.
- **Lab 5 – Transport Protocols: UDP and TCP**  
Data transmissions with TCP and UDP; TCP connection management; TCP flow control; retransmissions in TCP; TCP congestion control.

# Advanced Labs

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## **Lab 6 – LAN switching**

LAN switching in Ethernet networks; forwarding of Ethernet frames between LAN switches/bridges; spanning tree protocol for loop free routing between interconnected LANs.

## **Lab 7 - NAT and DHCP**

Setup of a private network; dynamic assignment of IP addresses with DHCP.

## **Lab 8 – Domain Name System**

Domain name resolution with DNS; name server hierarchy; setup of a DNS root server.

## **Lab 9: SDN: Firewalling and Traffic engineering**

Engineering routes to traffic matrices; setting up firewalling rules; using SDN control and management

## **Lab X: SDN: Virtualized datacenters**

Controlling a virtualized datacenter using SDN and OpenStack platforms.



# Structure of the Labs

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- Each lab has three phases:
  - 1.Prelab**
  - 2.Lab session**
  - 3.Lab report.**
- **Pre-laboratory Assignment (Prelab).** Exercises to be completed in advance of the associated lab session. The prelabs ask you to acquire background knowledge that is needed during the lab exercises. Each prelab has a question sheet that must be completed before the corresponding lab session. The answers to the prelab questions are graded.

# Structure of the Labs

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- **Lab Session.** Lab exercises that are performed on the equipment of the Internet lab. All lab exercises can be completed without supervision. The time to complete a lab session should be three hours on the average, but may vary. Complete the laboratory activities to the extent that you can. The activities during the lab session are not graded, however, data collected during the lab session are needed to complete a lab report.

# Structure of the Labs

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- **Lab Reports.** After each lab session, you prepare a lab report that summarizes and analyzes the findings from the lab session. A notepad symbol indicates an assignment for the lab report. The lab reports should be submitted as a typewritten document.
  - Report due dates on class website
- **Note:** Saved data should be included in the report only if it is requested in the lab report, and if it is used to answer a question. Filtering the relevant measurements for the answers of the lab report is part of the analysis.

# Info on the Lab Sessions

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- In the Internet lab:
  - Bring USB drives, the lab manual, and prelab solutions
  - Reboot Linux PCs
  - Complete exercises as described in the lab manual
  - Take measurements as instructed
  - Save data to your drive
- The equipment of the Internet Lab is not connected to the Internet.
- Each lab has an anonymous feedback sheet. The feedback is used to improve the setup and organization of the labs.
- Since you have administrative (root) privileges on the Internet Lab equipment, exercise caution when modifying the configuration of the Internet Lab equipment.