

# Network Design and Management

**Edo Biagioni**

[esb@hawaii.edu](mailto:esb@hawaii.edu)

Department of Information and Computer  
Sciences

# ICS 351: Today's plan

- \* introductions
- \* course overview
- \* overview of the Internet and routing
- \* initial lab visit

# Introductions

# ICS 351 Course Overview: Contents

practical, hands-on  
knowledge and  
understanding of  
networks and network  
equipment:

- end-systems (hosts, computers)
- switches
- routers
- cabling
- configuration

understanding of  
network parameters  
and design

- address assignment
- network monitoring
- protocol headers

# ICS 351 Course Overview: Structure

instructor: Edo Biagioni

Office: POST 311B

Office Hours: Tue 4pm, Wed 10:30am, Fri 11am

esb@hawaii.edu, 956-3891

instructor will open and monitor lab

the prelab must be completed individually **prior to** the scheduled lab time

the lab reports must be turned in the day after the lab

since the computers in the lab are not connected to the wider Internet, students must carry a personal USB drive and use it to save or transport data.

the course web page is at

<http://www2.ics.hawaii.edu/~esb/2012spring.ics351/index.html>

# The Internet

- \* at one level, a collection of boxes and cables
- \* boxes are called: routers, switches, hubs, hosts (and many variations)
- \* cables are called: serial, ethernet, fiber, wifi, etc.
- \* logically, cables and some of the boxes are grouped into networks
- \* the Internet has this name because it is designed to carry data across networks

# How the Internet works

- hosts originate data (routers may behave as hosts in this respect)
- data is grouped in limited-size packets (e.g. max size 576 or 1500)
- each packet's header carries a destination address and other information (e.g., what port, or application, this packet is for)
- the originating host sends the packet towards its destination
- each intermediate box must route the packet by selecting the next box

# Routing a packet, part I

- a host usually has a single network to which it is connected
- that network is usually connected to the Internet by a single router
- so a host can send all its non-local traffic to this **default router**
- in contrast, a router is usually connected to more than one network
- so a router needs a mechanism to decide where to send each packet

# Routing a packet, part II

- each router (and actually, almost every host) keeps a table of destinations to which each packet can be sent: a **routing table**
- one of those table entries can be a default route to another router which knows more about the Internet: the **default router**
- the collection of routers which have specific routing table entries to every part of the Internet is known as the **default-free zone**
- every other router in the Internet has a default route as well as more specific routes

# Routing protocols

- maintaining the routing tables is very labor-intensive if done manually
- so routing tables are maintained automatically
- after all, each router knows what networks it is connected to
- and can communicate that information to other routers
- the manner of communicating the information is standardized by a routing protocol, of which several are popular, including OSPF, BGP, RIP
- with the information from the routing protocol, each router can run a program to maintain its routing tables
- this is not a perfect process: sometimes the routing tables are inconsistent, because it takes time for a router to discover changes and it takes time to communicate the new information
- most of the time routing protocols maintain the routing tables correctly, and certainly much faster than with manual updates

# Router hardware and software

- big, expensive Cisco routers
- inexpensive Linux boxes with multiple network interfaces
- a Linux general-purpose computer can:
  - o use routing software to route packets
  - o just as the expensive Cisco router can
  - o but not as fast
  - o and perhaps not on the same media
- an expensive router should have hardware acceleration for
  - o looking up routes in a routing table, and
  - o forwarding packets from one interface to another
- the software to run the routing protocol might be very similar on a generic box and on an expensive specialized router