Networking Hardware 101

GAME 311
Network Programming

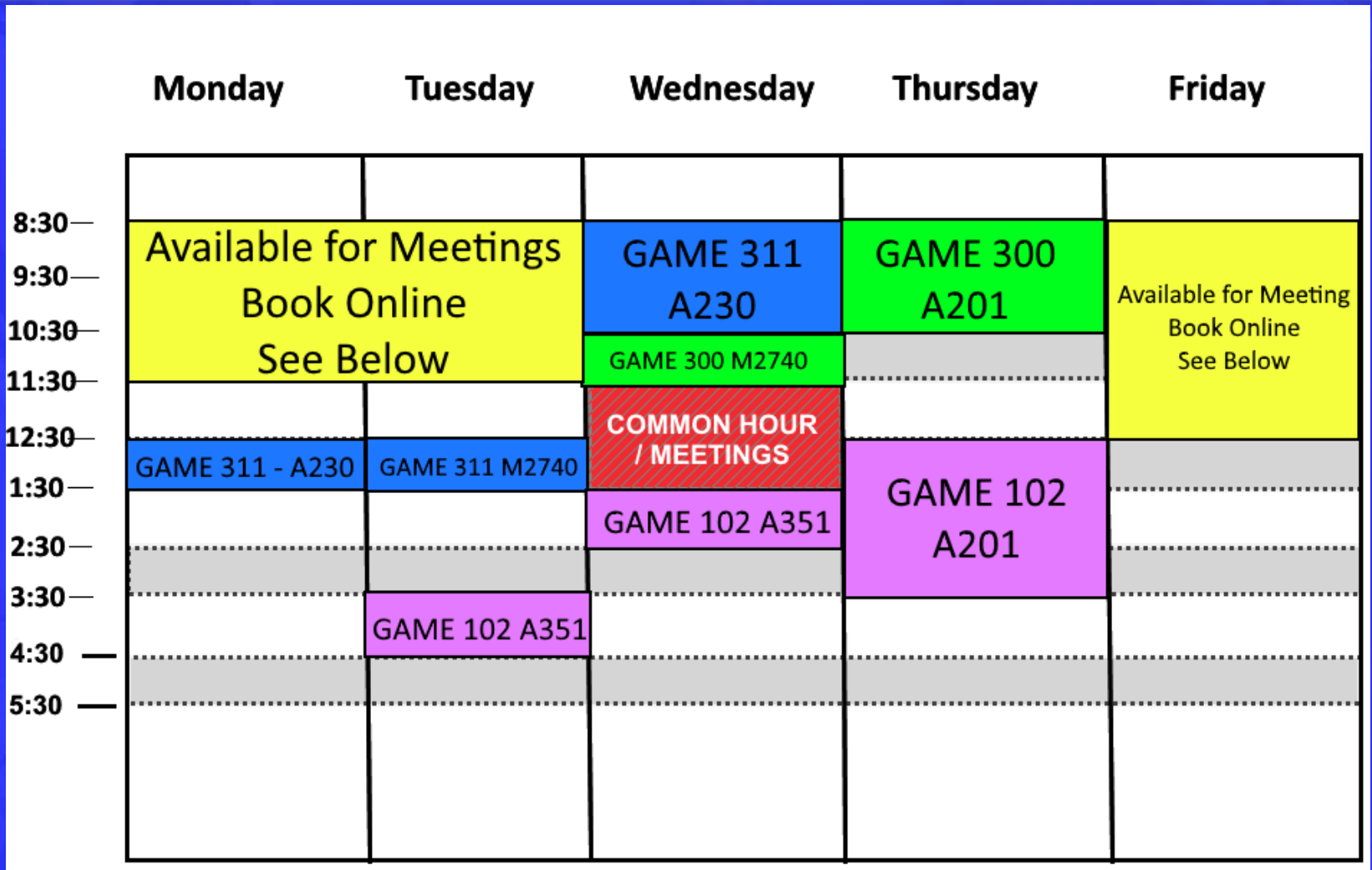
Lecture 1
Objectives

- **Review the Course Outline and Learning Plan**

- **Changes**
  - Timetables
  - Appointments

- **Basic Networking Concepts and components**
  - Hardware

SCHEDULE



*BOOK MEETINGS ONLINE AT: doopwee.com/students

Networking 101

- Concept of transferring data
- Communicating from one electronic device to another
- Can be short or long distanced.
- Requirements:
  - Hardware
  - Software
  - Collection of important information:

Who?	What?	Where?	How?	When?
Is sending data	To send	To send it to	To send the data	To send it (usually immediately)

Hardware

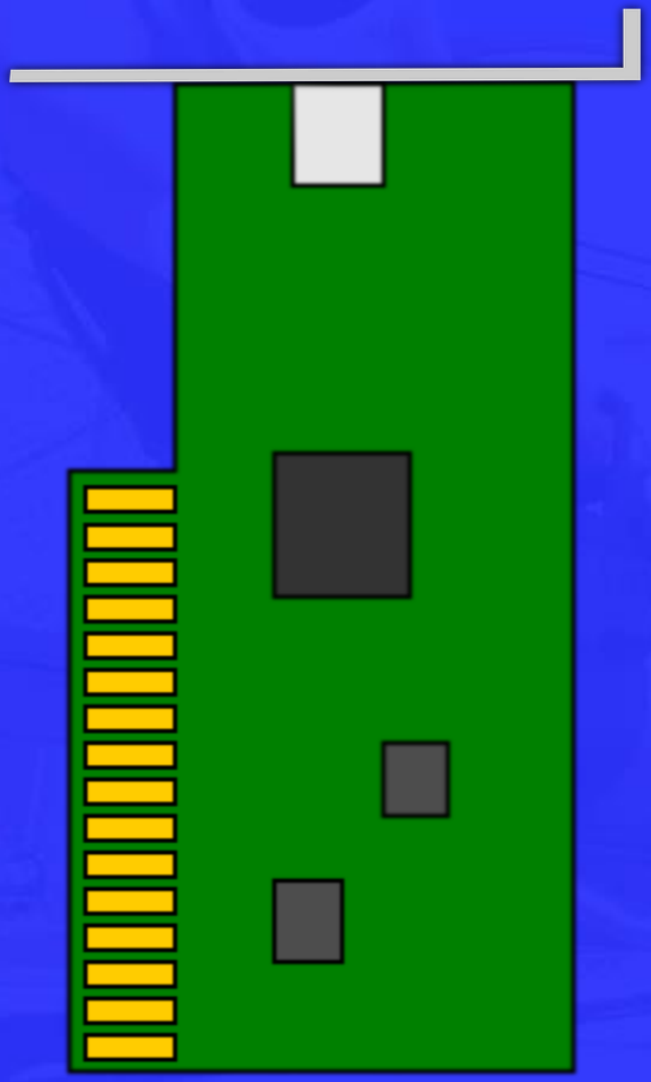
- Requirements for Networking:
  - Two Devices
  - Mediums for transmission:
    - Cables and cords used for the signal to be sent along.
  - Network card

- Additional Hardware:
  - Routing Devices
  - Modem
  - wireless NIC, Access Point, repeater

Mediums

- Electrical pulses of information are sent at high speeds to represent bits of data over a connection medium.
- Ethernet cables:
  - Often used within household or business networks
  - Two main types based on how the wires within the cable are ordered
    - Straight through:
      - both ends of cable wires are ordered are the same
      - Most commonly used Ethernet cable
      - Used for connecting PC's to other devices like routers or modems
    - Cross over:
      - Used to connect two PC's together or two hubs together.
- Other mediums:
  - coax, cable, fiber-optic, electrical, wireless

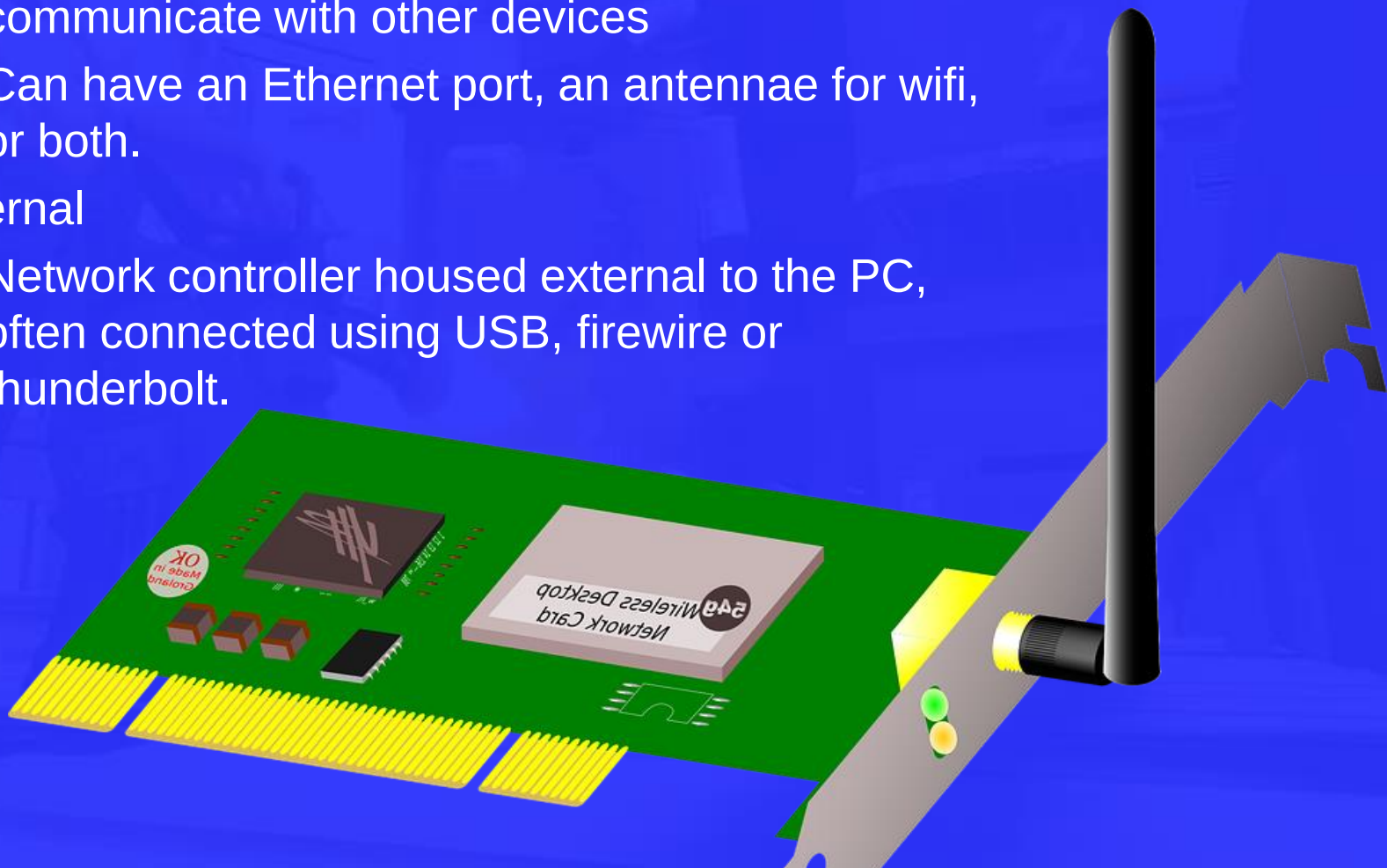
NIC's



- Network Interface Controller (NIC) allow the device to connect to another external device.
  - A component of a computer system or device.
  - Has outbound hardware connections for data transfer.
  - Typically Embedded in motherboards
    - Visibly identifiable by locating an Ethernet port on the motherboard.

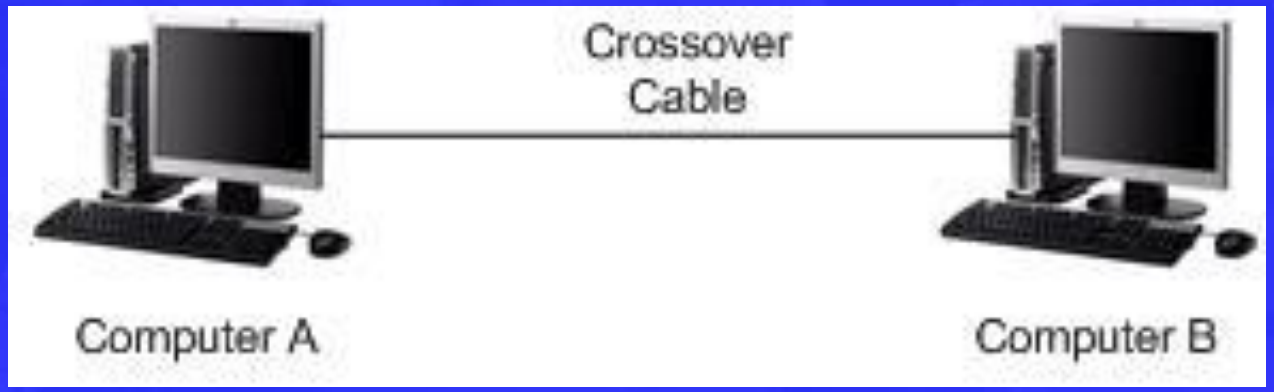
NIC's

- Network Card
  - A PCI or PCI-e connected board that connects into a motherboard to allow a PC to externally communicate with other devices
  - Can have an Ethernet port, an antennae for wifi, or both.
- External
  - Network controller housed external to the PC, often connected using USB, firewire or thunderbolt.



Basic Network

- The most basic network is a 1 to 1 peer to peer direct connection from one device to another.
- This can be visualized as two PC's connected together using a single crossover cable with each having network controller.



https://www.home-network-help.com/crossover.html

Routing Devices

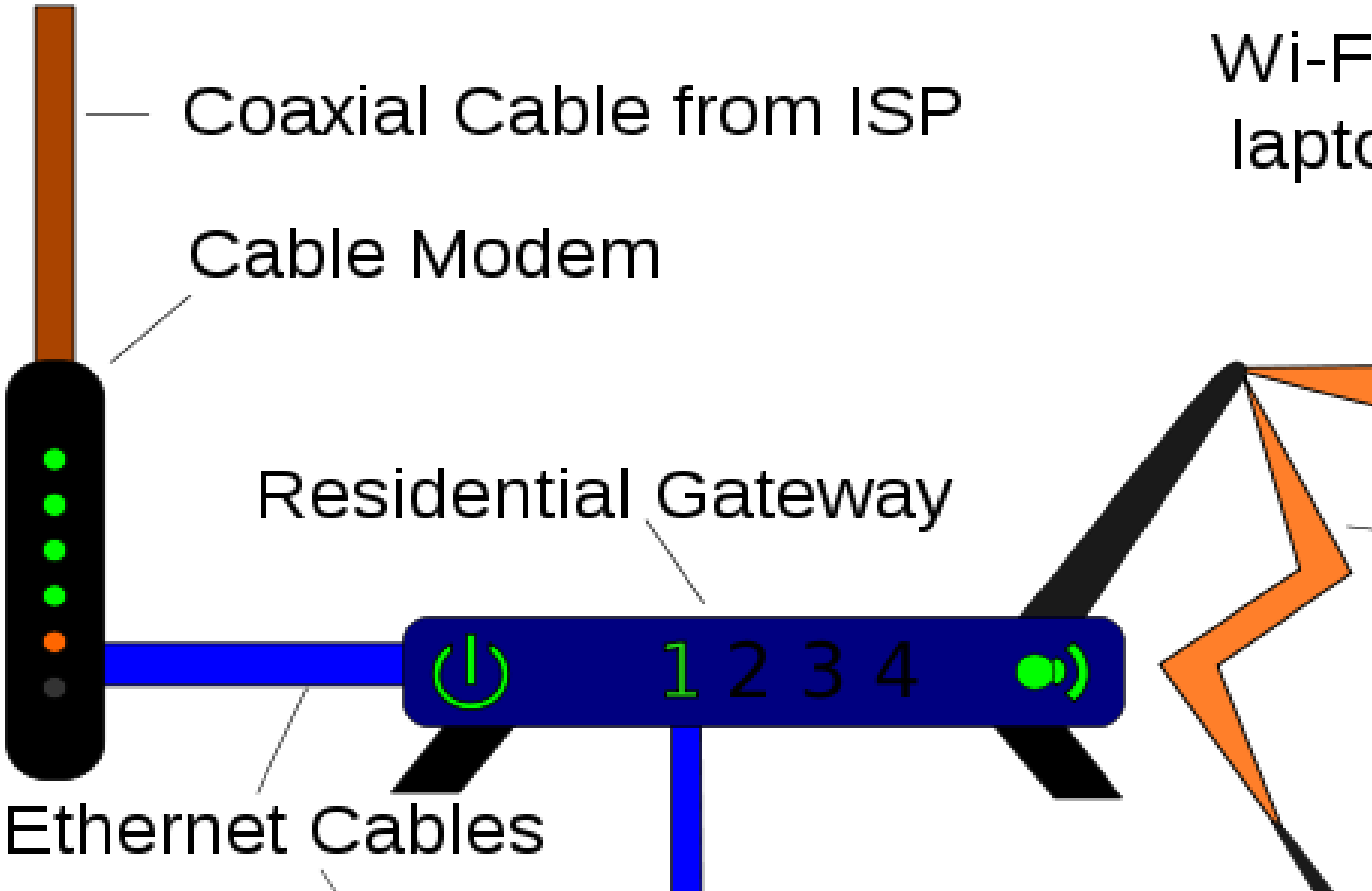
- In order to connect more than two devices together on a network, and share outbound connections, routing devices were created.
  - Prior to routing devices, a network of ring topology were used to communicate data.
    - Which slowed data transfer as more PC's connected.

- There are 3 main devices used to route data within a network.
  - Hub
  - Bridge / Switch
  - Router

Modems

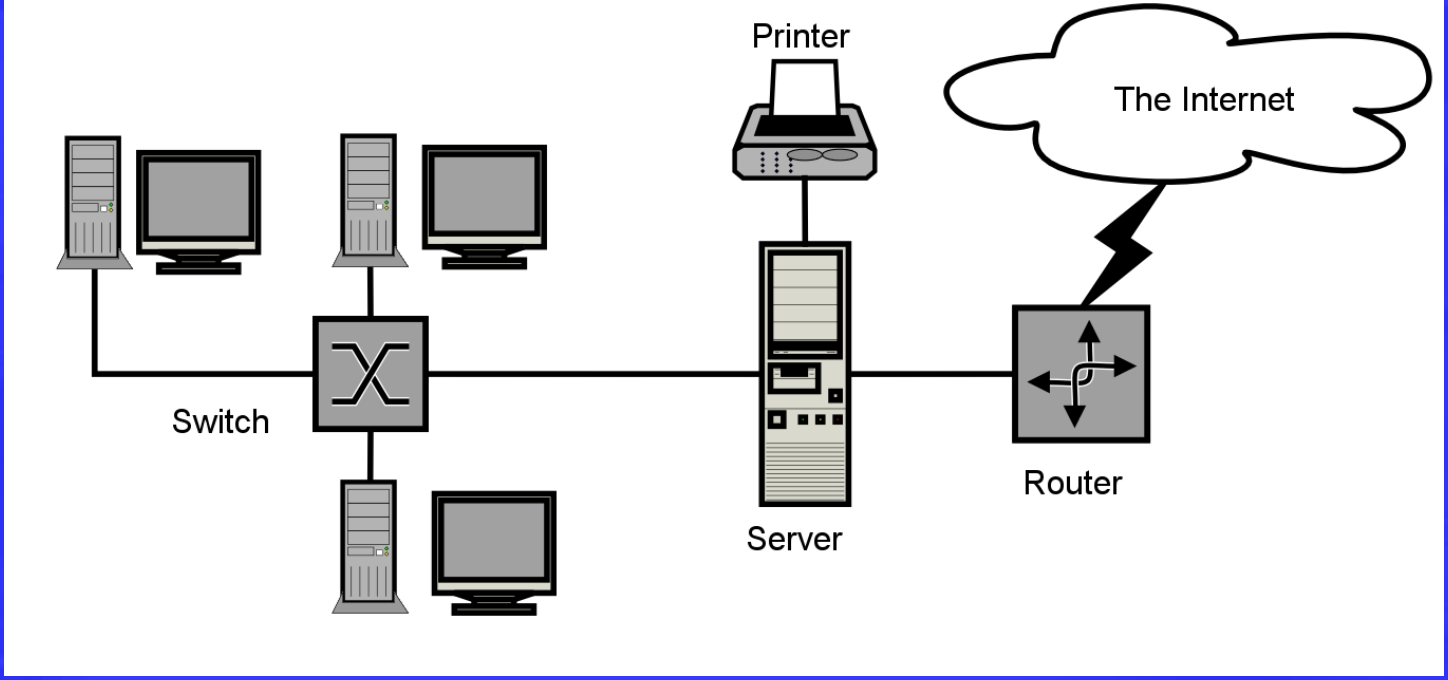
- When you connect to an internet source provider (ISP) like Bell, you are assigned a global IP.
  - Your network then uses that single IP for all the devices inside your home.
  - Some types of modems you might see are fiber optic, DSL, or cable modems.
    - Use either a connection of the existing phone or cable lines into the home or business.
  - Most modems have a built in wireless router included in them now.
- The Modem, takes in the designated IP from the ISP for the devices to use.
  - Typically only one IP address is given and must be shared.

Modems


Coaxial Cable from ISP
Cable Modem
Residential Gateway
1 2 3 4
Ethernet Cables

Hub, Bridge/Switch

- Used to bind multiple devices to a single shared connection.
- Each PC connects to the HUB, Bridge or Switch and shares a single common outbound connection.



Hub, Bridge/Switch

- HUB:
  - When data is sent to the HUBs main line, all devices connected into the HUB are sent the data and only the expected computer uses the data.
  - Slowest and cheapest of Routing Devices

- Bridge/Switch:
  - Forwards data to the specific computer which requested the data using ports.
  - Quicker but more expensive than a simple HUB.

Router

- A router is another routing device, which is even more powerful and expensive than a HUB, bridge or switch.
- The router comes with built in software which controls the traffic flowing through to the connected network devices.
  - Has it’s own IP
  - Can be logged in by an administrator.
  - Has software (firmware) which can be updated.

Configuring Routers

- To connect to a router or Access point you must first establish a physical connection to the device usually through an Ethernet cable.
- Once a connection has been established you can access the router through the IP address assigned to the device using a web browser of your choosing.
  - Typically this is defaulted to 192.168.0.1,or 10.0.0.1 or similar and is usually listed through a sticker on the device.
  - http://www.techspot.com/guides/287-default-router-ip-addresses/
- Upon successfully connecting you will be presented with a login page for the device.
- If the default username, password or IP do not seem to work you should factory reset the device using the external reset switch following the documentation provided with the device.

FIRMWARE

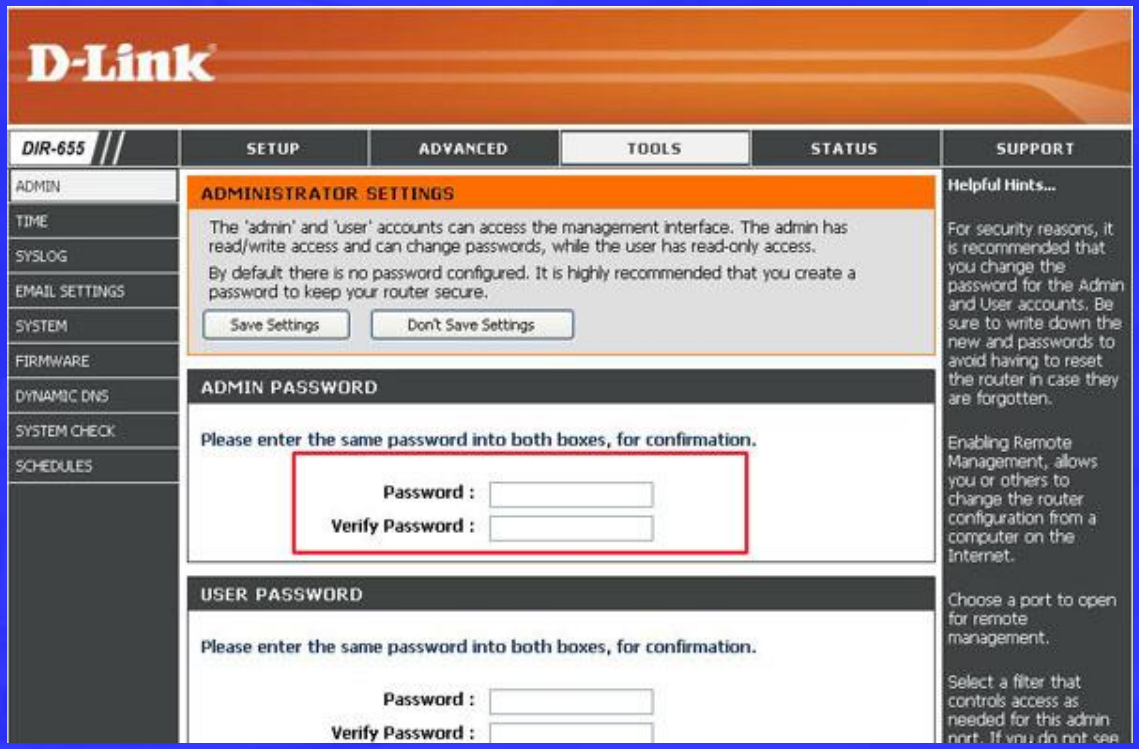
- **Firmware** is the preinstalled software which comes by default on the device.
- Similar to the **OS** of the device.
- Typically devices with firmware **do not permit the installation of other software**.
- Firmware **updates** are released by the **hardware manufacturer**.
  - Important to keep firmware up to date to address new **exploits / bugs** found since manufacturing
  - Usually able to determine **firmware version** from a wireless **router / repeater / access point** from logging into the device through it's available IP.

FIRMWARE UPDATES

- Firmware can be updated by **downloading a new firmware from the manufactures website and uploading it to the device**.
  - This is typically done through the devices web portal.
- This process is **sensitive** and should be done with care and proper power sources.
  - Failure during firmware upgrades on device **could render them useless**.

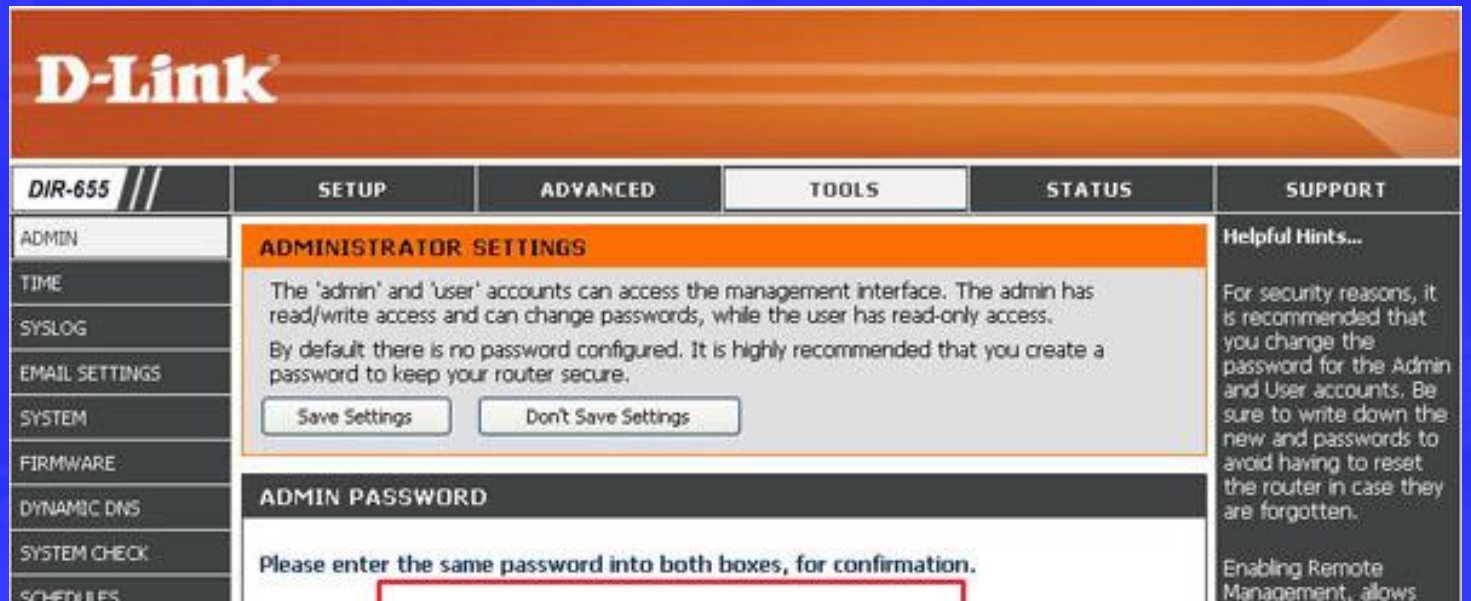
Web Portal

- Upon initial login to a new device it is important to immediately update the login password for the device.



Web Portal

- Each company and device may have it's own unique web portal and configuration settings specific to their devices and often times these can be radically different.
- Some consumer routers include both a simple and advanced setup mode.
  - We will go through some of the settings now.



Basic Settings

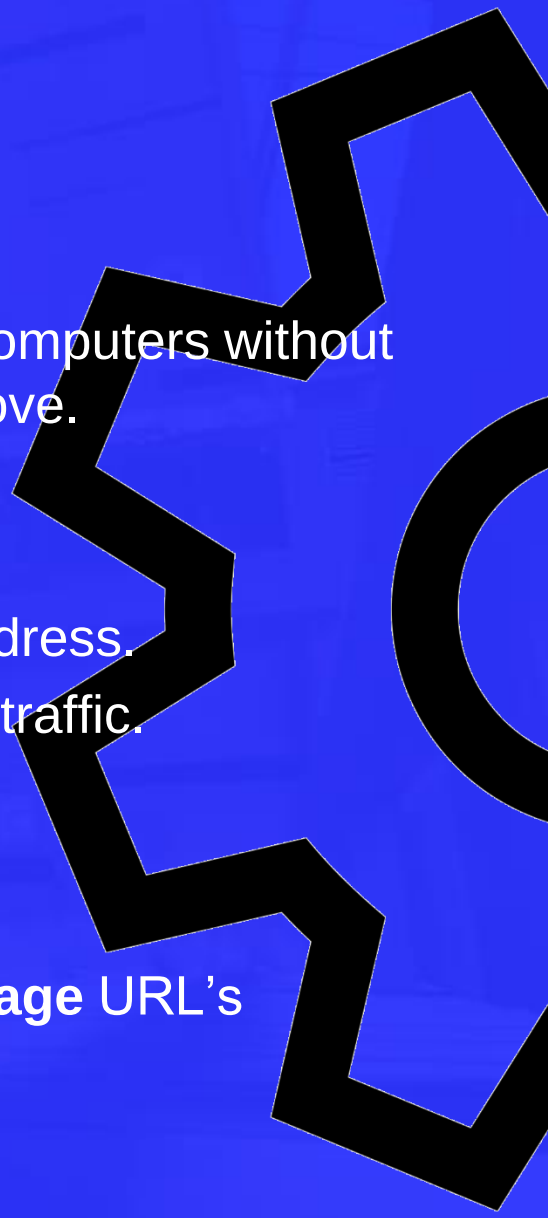
- Internet Settings
  - These settings will be used to configure the **WAN** connection of the router and define the **incoming connection**.
- Network Settings
  - Here you'll find **DHCP settings** regarding the **limitations and specifications of IP's assigned** to devices connected to the router.
  - http://www.voiproblem.com/emulators/DLink/wbr2310/lan.html
- Wireless Settings
  - This will host options regarding your wireless network for things like the **SSID** used, which **channel** the signal is being broadcasted on, **security/encryption** used on the connection.
  - http://www.voiproblem.com/emulators/DLink/wbr2310/wireless.html

Advanced Settings

- Port Forwarding
  - This allows the admin to redirect connections coming in on a specific port to a specific IP within the network using a different port.
  - http://www.voiproblem.com/emulators/DLink/wbr2310/adv_portforward.html
  - Games sometimes require port forwarding to allow traffic to consistently be assigned and flow continuously without being regulated.
- Application Rules
  - Exposes or protects specific port ranges required for applications uses.

Advanced Settings

- Firewall Settings
  - Routers typically act as a basic firewall.
  - No traffic is permitted through to individual computers without being granted access through one of the above.
- Network Filter
  - **Allow or deny network access** by MAC address.
  - You could theoretically deny all iOS devices traffic.
    - http://www.coffer.com/mac_find/?string=apple
- Website Filter
  - Specifically **block or allow access** to **webpage** URL's



Lecture 1
Summary

- **Review the Course Outline and Learning Plan**
- **Changes**
  - Timetables
  - Appointments

- **Basic Networking components**
  - **Mediums**
  - NICS
  - Modems
  - Routing devices

- References / supporting information:
  - https://study-ccna.com/what-is-a-network/