**Network Fundamentals Lecture 4 Notes**

**IP (Internet Protocol)**

* Connectionless, best effort delivery, no built in recovery
* Uses IP addressing system
* Sends data via datagrams

*Performs certain tasks during sending and receiving*

**Sending**

* Determines if the destination is on the same or a remote network
* This is done with the ARP protocol
* ARP will translate an IP address to a MAC address if the destination is on the same network

**Receiving**

* Datagram is received by the network access layer and check for corruption and destination
* Data is extracted and passed to the next protocol

*An address of IPv4 is 32 bits long and is assigned to a node on a network*

**Sending Data**

First determine if the address is in the same domain or not. This is done with the ARP protocol. If it is on the same network then the node direct connects via the MAC address. Otherwise the communication must be via a gateway. Once the datagram is prepared it is passed to the network layer (network access layer). The network access layer transmits the datagram to the media to begin its journey to its destination.

**Receiving Data**

* The datagram is received by the network access layer
* The datagram is error checked
* The instruction set is checked to determine the next course of action

**Inside Datagrams (packets)**

Header Fields

* The header contains information used by protocols
* It has several different units of information known as fields
* Each datagram contains a header and data
* The header is constructed on the sending node

**The IP Header**

The header contains

* IP of sending node
* IP of receiving node
* A set of instructions

*As the datagram travels through the routers the header is examined and updated*

Header contents

* Versions (IP)
* Internet Header Length (IHL) in 32 bit words
* Type of service, special routing information requirements e.g. delay, throughput, reliability
* Total length, includes IP header and data, identifies in octets
* Identification number to make the correction
* Flags, indicates fragment possibilities
* Fragment offset, numeric value assigned to each fragment, used to reassemble fragments
* Time to live, time in seconds/router hops, decrements by 1 or the number of seconds that its delayed, when it reaches 0 it is discarded
* Protocol, holds protocol address where the data is to be delivered
* Header check sum, verifies the validity of the header
* Source IP address, is used by destination IP to verify delivery
* IP data payload, the data to be delivered, size varies

**IP addressing**

* Similar to postal address
* Divided in to 2 areas, network ID and host ID
* Network ID is like a street name
* Host ID is like a house number

**Host ID and Network ID**

* Every node has a unique IP address
* Every node on a LAN has the same ID
* Within a network each node will have a unique host ID
* When these two are combined, they create the IP address

**Servers**

* Can have multiple ID addresses as they can have multiple network adapters
* Each network adapter (network card) is a point of contact
* Each host ID corresponds to a node

**Octets**

* An IP address is 32 bits long
* Broken down into 4 octets 128|000|000|001
* Each octet contains 8 binary bits connected into decimal

**Address classes**

* A 32 bit binary number can represent 4 billion different numbers
* TCP/IP doesn’t quite support that number
* The addresses have been broken down into smaller groups known as classes
* These refer to different types of network ID’s

**Classes of IP Address**

*Class A*

* Contains 8 network ID bits and 24 host ID bits
* Class A can support 16,777,216 computers
* The left most bit is always 0
* The left most 8 bits make the Network ID
* The right most 24 bit contain the host ID
* A subnet is used to differentiate the network ID and host ID
* Assigned to networks that support large number of hosts

*Class B*

* Contains 16 network ID bits and 16 host bits
* Supports 65,536 computers
* Left most bit is always 1
* The next bit is always 0
* Assigned to medium sized networks
* Subnet mask = 255.255.0.0

*Class C*

* Contains 24 network bits and 8 host bits
* Supports 256 computers
* Left most two bits are 1 and the third bit is 0
* Assigned top small network
* Subnet mask = 255.255.0.0

*Class D and Class E*

* Class D

1. Four left most bits start with 1110
2. Used for multitasking

* Class E

1. Experimental
2. Five left most bits start with the pattern 11110

**Classes**

* IP address are assigned based on a companies’ needs
* They are based on classes A-C generally
* Class D is for multicasting
* Class E is still experimental