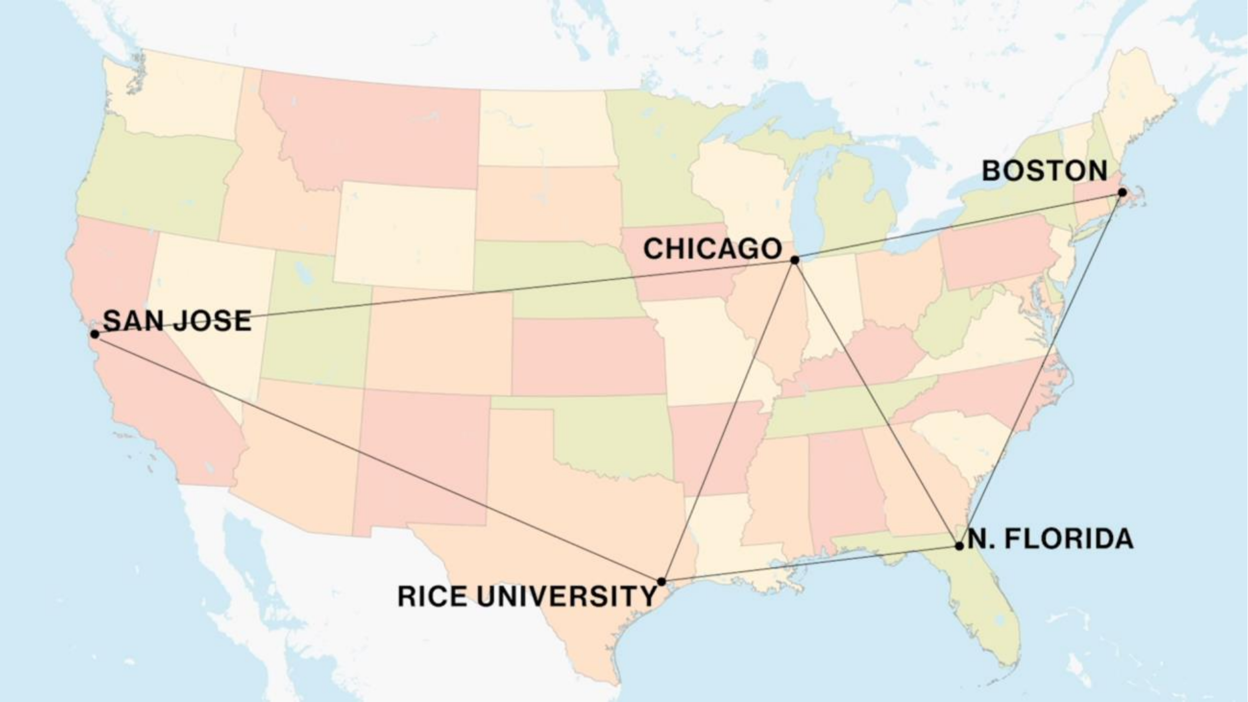
Introduction to TCP/IP

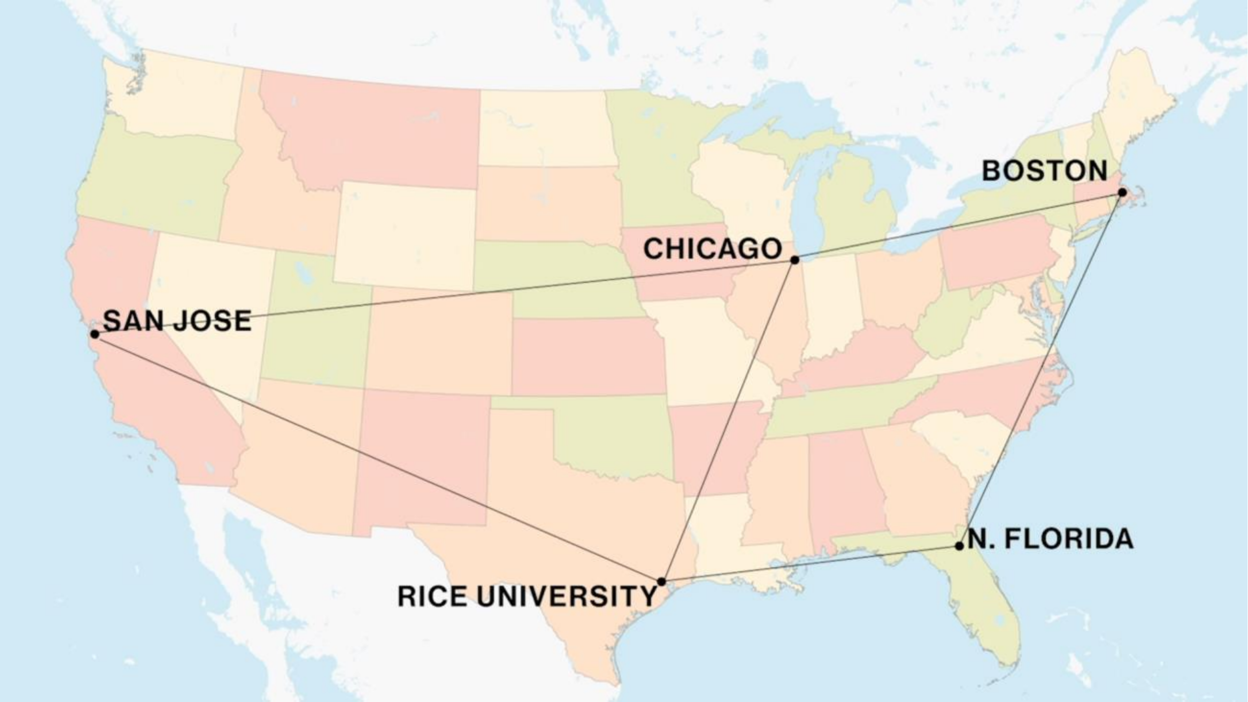
- ARPANET formed (basis for Internet)
- TCP/IP adopted as protocol for ARPANET/the Internet
- IP addresses have four octets between 0-255
- Classful address scheme for locations and sublocations

A typical IP Address - 192.168.5.10 (4 digits separated by 3 dots)

All across the US there are Military Installations and a lot of Universities
1000's of LAN's. We wanted to interconnect these LAN's (late 1970's/early 80's)



LAN's connected through Telephone Lines



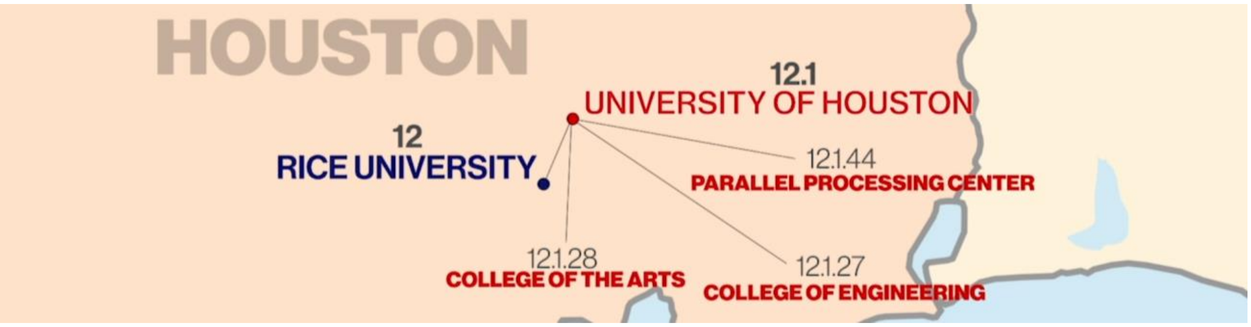
If one of these nodes went down, we could still reroute to get to everyone!

Each one of these 4 numbers in the IP is called an Octet, and can range from 1-255, resulting in being able to have about 4 Billion IP Addresses

Remember every computer has its own IP Address

This IP -

1) Identifies which LAN you're a part of
2) Gives you a Unique Host ID (unique only to you)



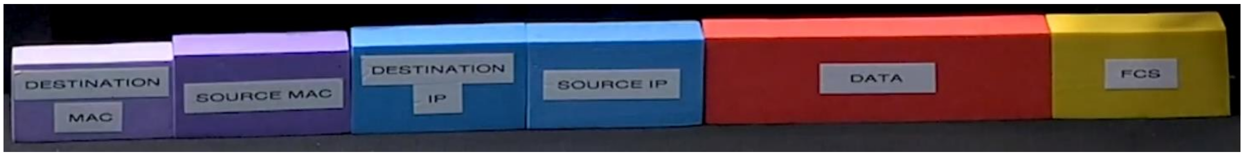
1st digit (12) - Rice University AREA
2nd digit (1) - University of Houston
3rd digit - each Area of Study at UoH
4th digit - Individual Computers

These Block of Addresses are given by Rice University

Class C - First 3 Numbers are Set, and Last is Variable (max 254 Hosts in LAN)
210.11.12.x
Class B - First 2 Numbers are Set, and Last 2 are Variable (max 65,534 Hosts in LAN)
172.16.x.x
Class A - First Number is Set, and Last 3 are Variable (max Millions of Hosts in LAN)
6.x.x.x

IP Addresses are always no more than 4 Routers away from the Top of the Internet
Major Mistake!

IP Address -
4 Characters 3 dots in between them
from 0-255 Never end in 0 or 255



Destination IP and Source IP added to our Frame!
Allows us to jump from LAN-to-LAN

These LAN’s end in a 0 (ending in 0 is only for Network ID’s!)
Router’s typically end in a 1

Sending from 1 computer to another within a LAN will have 3 digits matching in the IP, which will be recognized and the info will stay & be sent/received within the LAN

If wanting to send from 1 computer to another with 1st, 2nd, or 3rd digit not matching,
we know this is for a different LAN,
so the info is sent to the Router, which acts like a gateway to the internet
(often called a Default Gateway)

If you want a computer to be on the internet, you need to give it….
1) IP Address
2) Subnet Mask - lets computer know if it’s local/long distance
3) Default Gateway

Dynamic IP Addressing

- Dynamic Host Configuration Protocol (DHCP)
automatically assigns IP information to hosts
- Gateway routers commonly are DHCP servers for their internal LANS
- If a DHCP client can't find the DHCP server, it will use an APIPA address.
- Use the ipconfig/renew command to force a new connection to the DHCP server

DHCP (Dynamic Host Configuration Protocol) -
Your home Router will also act as a DHCP Server.
Your computers in your LAN will shout out requesting an IP Address.
The Router/DHCP Server will hand out this information automatically!

This is the reason why we don't have to ask for a new IP Address
when we enter a new LAN in a coffee shop!

Just boot your computer, connect to the wireless network,
and the IP Address automatically configured for us!

If our DHCP Server goes down, you'd think that we wouldn't be auto configured with an IP Address, but this isn't right because our OS has APIPA

APIPA (Automatic Private IP Addressing) "Ah-Pip-Ah" - This is a fallback
for if we can't find a DHCP Server

Will always give a Class B Address 169.254.X.X

You'll still be able to access computers within your own LAN,
which at this time will all have 169.254.X.X IP Addresses,
but not the Internet because your Router doesn't use APIPA

If you're connecting to your Printer, and other devices in the office,
but not the Internet,
Check Command Prompt and type ipconfig
If you're showing Autoconfiguration IPv4 Address 169.254.X.X
you have a DHCP Server issue!
It's either down, someone unplugged you, or unplugged DHCP Server

Once you think you've solved the issue,

Command Prompt

ipconfig /renew   Connects you to a DHCP Server

ipconfig /release   Disconnects you from a DHCP Server

Right click on your Connection & run the Troubleshooter

The built in Troubleshooter works great!

IPv6

- IPv6 addresses use a 128-bit addressing scheme
- IPv6 addresses use a hexadecimal notation
- Link-local addresses are used for local connections
- Global unicast addresses are used to connect to the Internet

IPv4 Address - 172.16.254.1   4 Values from 1-254 separated by 3 dots

4 Billion Addresses...and we ran out!

IPv6 Address - 2001:0db8:85a3:0000:0000:8a2e:0370:7334

3.4 x 10^{38} Addresses   8 groups separated by 7 colons

Long-hand - 2001:0000:0000:0001:0000:0000:0000:8a2e
Short-hand - 2001:0:0:1:0:0:0:8a2e   ← Takes away all leading zero's

Shorter-hand - 2001:0:0:1::8a2e   ← Replaces (3) zero's in a row with ::
(Notice it looks like there's only 5 numbers)

IPv4 - you only had 1 IP Address (and a Subnet Mask)
IPv6 - 2 IP Addresses (prefix length fixed at /64 - this prefix acts like a Subnet Mask)

Link-Local Address - this always starts with "fe80:0000:0000:0000"
followed by 4 other values auto generated

Internet Address (Global Unicast Address) -
Titled "IPv6 Address" or "Temporary IPv6 Address"

Port Numbers

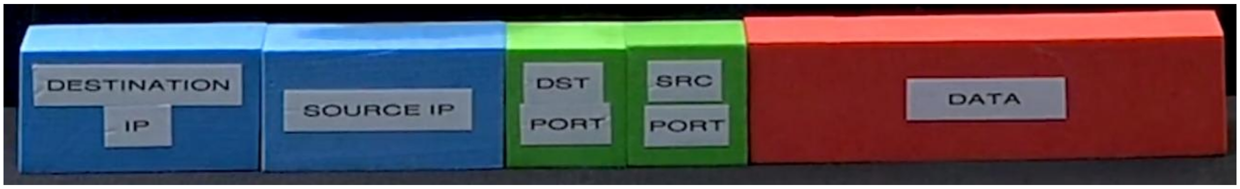
- Port numbers get data to the correct application
- There is always a source and destination port number
- Resource Monitor shows the connections on a system
- Memorize all ports numbers listed on the CompTIA A+ 1001 objectives

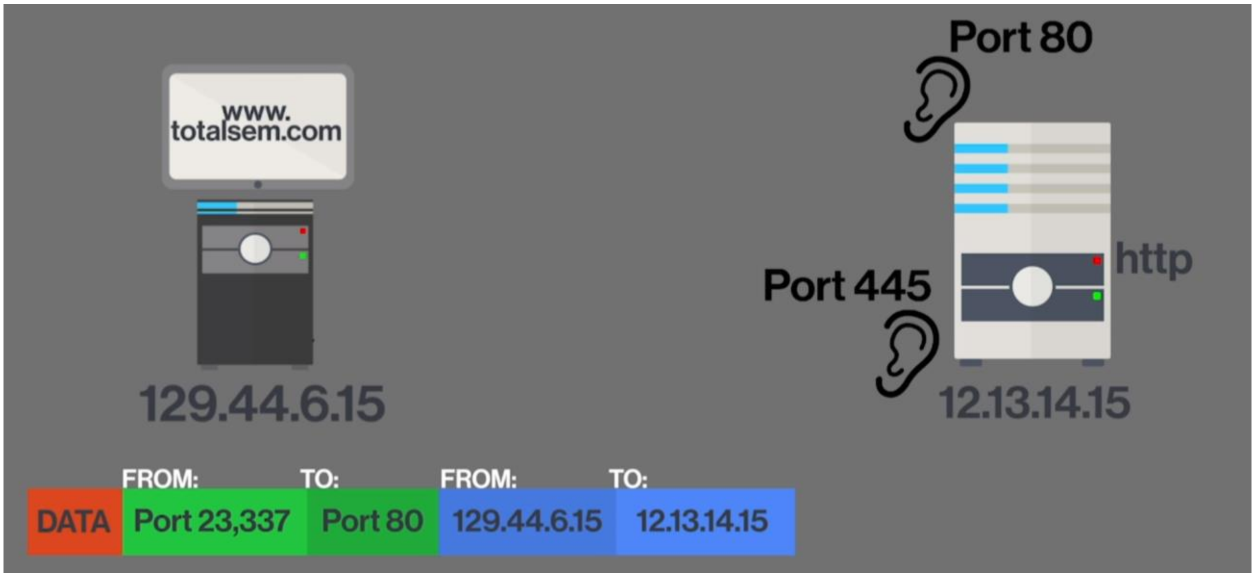
Your Web Browser is a Web Client designed to be used by you, to query these things called Web Servers, to get Information (the Internet)

Everything on the Internet is a Client, and a Server.

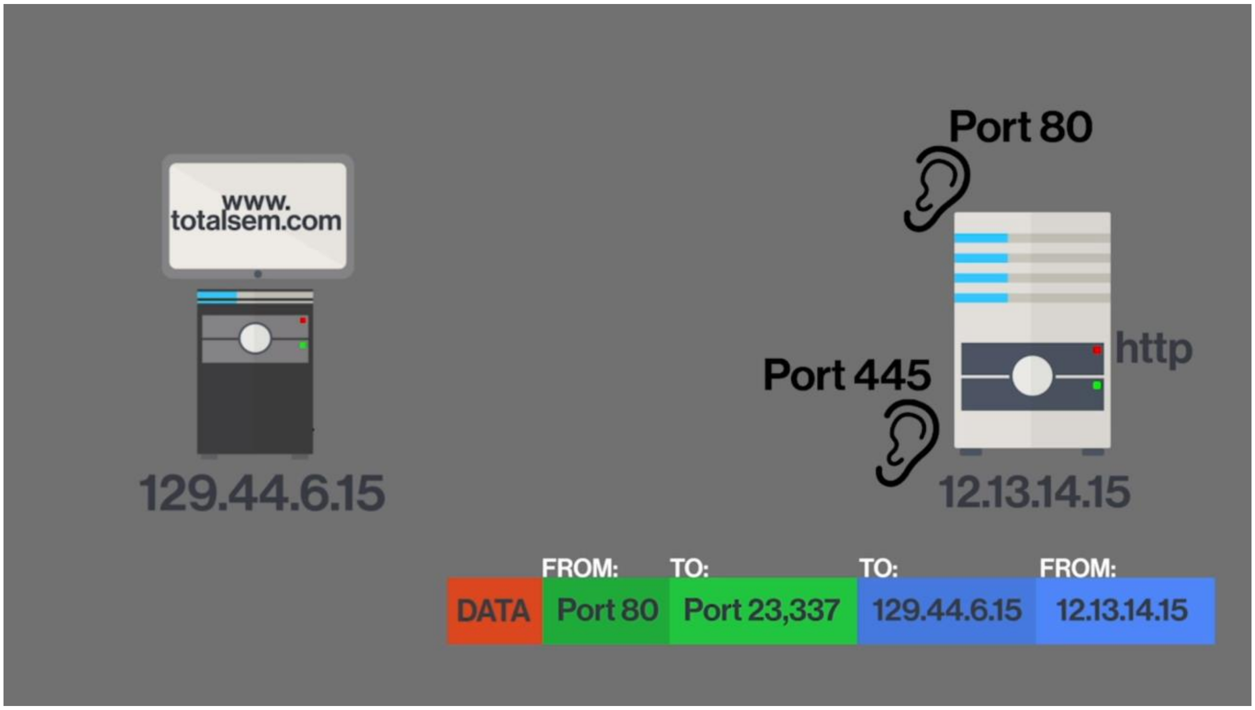
DNS (Domain Name System) - basically a speed dialer

IP Address - gets the data to the right computer
Port Number - gets the data to the right application on that computer
You'll always have a Source & Destination Port Number (from 0 to 65,535)

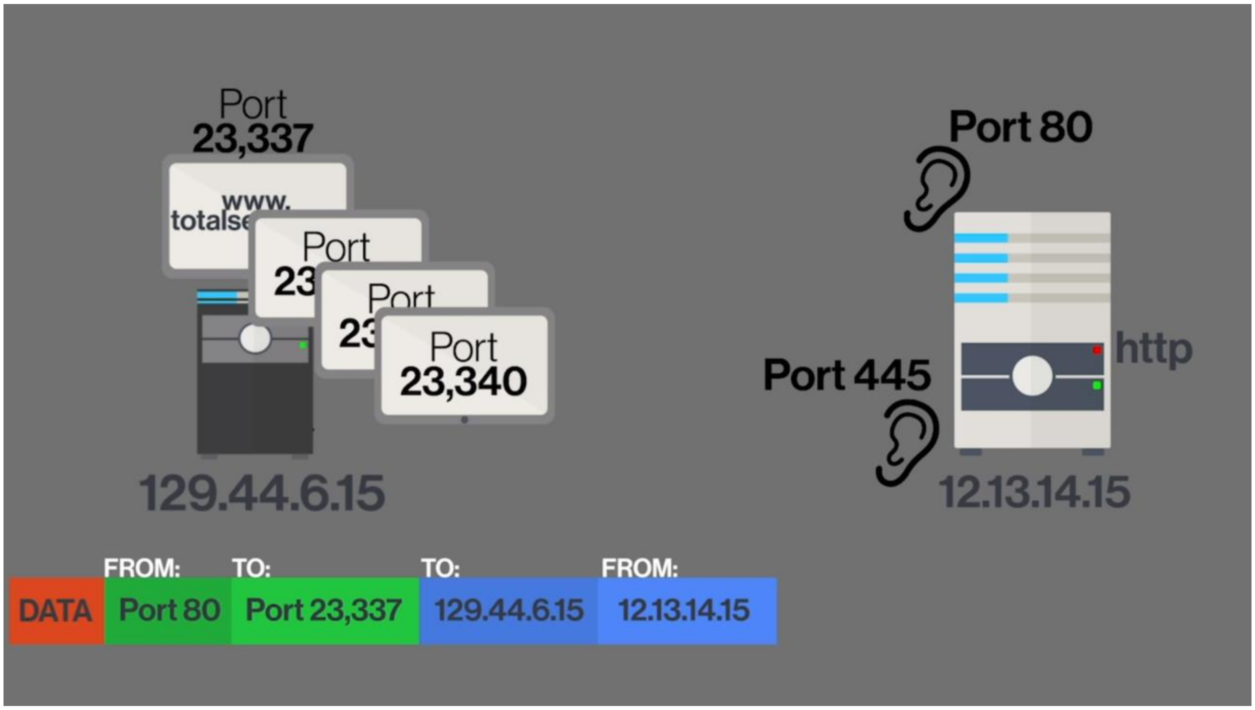




This is a Request for the computer to visit a website



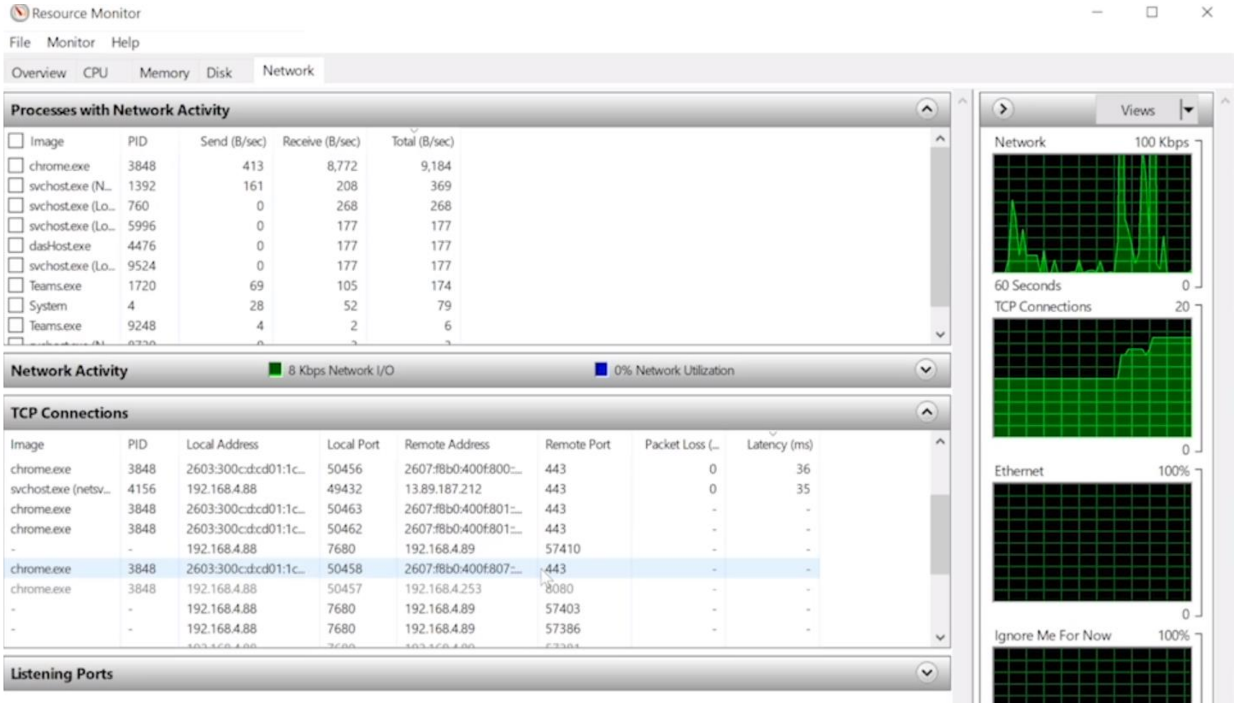
Web Server acknowledges the computer's request, and is ready to send the Website



Website is received (along with other websites that are loaded - different Port numbers) and displays the website with the matching Port Number.

We can see all these connections with Resource Monitor!

Resource Monitor → Network (tab) → TCP Connections



Processes with Network Activity

☐ Image	PID	Send (B/sec)	Receive (B/sec)	Total (B/sec)
☐ chrome.exe	3848	413	8,772	9,184
☐ svchost.exe (N...	1392	161	208	369
☐ svchost.exe (Lo...	760	0	268	268
☐ svchost.exe (Lo...	5996	0	177	177
☐ dasHost.exe	4476	0	177	177
☐ svchost.exe (Lo...	9524	0	177	177
☐ Teams.exe	1720	69	105	174
☐ System	4	28	52	79
☐ Teams.exe	9248	4	2	6

Network Activity 🟩 8 Kbps Network I/O 🟦 0% Network Utilization

TCP Connections

Image	PID	Local Address	Local Port	Remote Address	Remote Port	Packet Loss (...	Latency (ms)
chrome.exe	3848	2603:300c:d:cd01:1c...	50456	2607:f8b0:400f:800:...	443	0	36
svchost.exe (netsv...	4156	192.168.4.88	49432	13.89.187.212	443	0	35
chrome.exe	3848	2603:300c:d:cd01:1c...	50463	2607:f8b0:400f:801:...	443	-	-
chrome.exe	3848	2603:300c:d:cd01:1c...	50462	2607:f8b0:400f:801:...	443	-	-
-	-	192.168.4.88	7680	192.168.4.89	57410	-	-
chrome.exe	3848	2603:300c:d:cd01:1c...	50458	2607:f8b0:400f:807:...	443	-	-
chrome.exe	3848	192.168.4.88	50457	192.168.4.253	8080	-	-
-	-	192.168.4.88	7680	192.168.4.89	57403	-	-
-	-	192.168.4.88	7680	192.168.4.89	57386	-	-

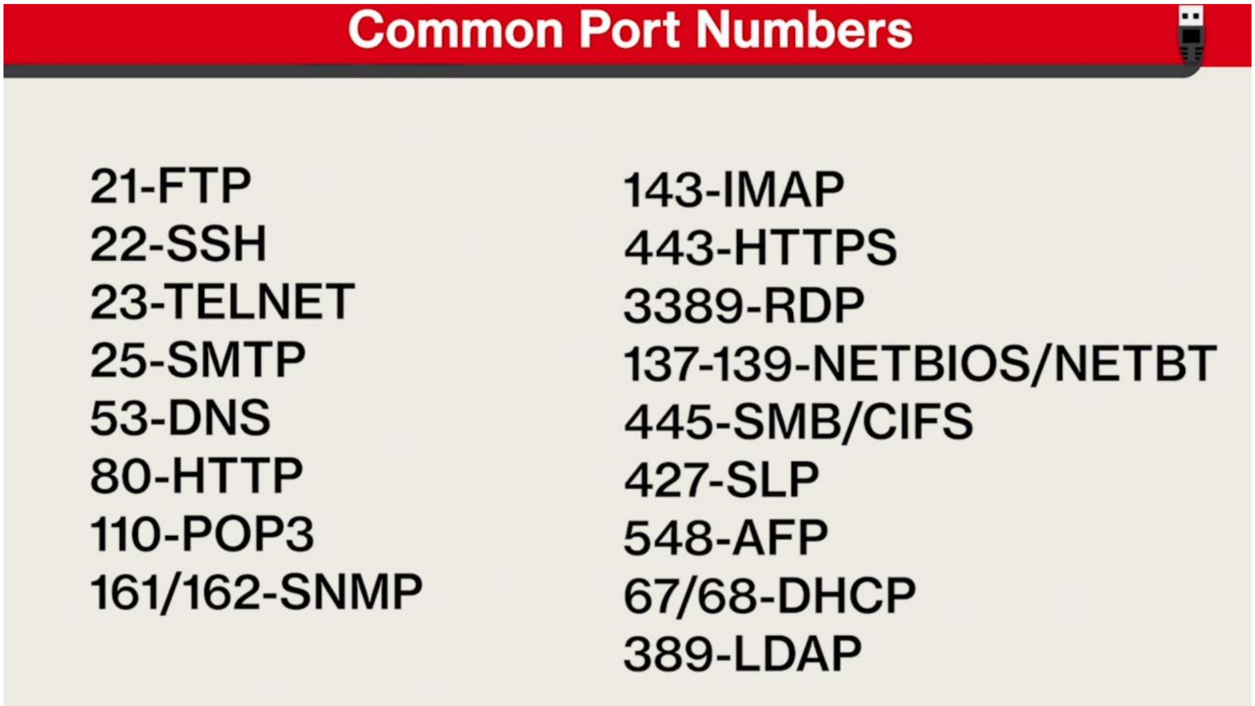
Listening Ports

Port Numbers -

Well Known Ports (0 - 1023) - The Web, and other very well known ports we wouldn’t want anyone else to use

Registered Ports (1024 - 49,151) - Came out after Well Known Ports, but still people that want their own ports.
Also well known & registered, and we don’t want anyone else to use these either

Dynamic/Ephemeral (49,152 - 65,535) -
generated by your system every time it makes a connection
to give a return Port Number for whatever Server you might be connecting to



Common Port Numbers

21-FTP
22-SSH
23-TELNET
25-SMTP
53-DNS
80-HTTP
110-POP3
161/162-SNMP

143-IMAP
443-HTTPS
3389-RDP
137-139-NETBIOS/NETBT
445-SMB/CIFS
427-SLP
548-AFP
67/68-DHCP
389-LDAP

HTTP 80 - Unprotected Webpage (no encryption)
HTTPS 443 - Encrypted Webpage

TCP, UDP, and ICMP

- **Transmission Control Protocol (TCP) is connection-oriented, and sends multiple packets**
- **User Datagram Protocol (UDP) is connectionless, and sends multiple packets**
- **Internet Control Message Protocol (ICMP) is connectionless, and always sends a single packet**
- **We organize packets by protocol data units (PDUs)**

Protocol - set of rules that allow different things to work together
such as working with an IP Protocol

TCP/IP (Transmission Control Protocol/Internet Protocol) - 2 different Protocols
working together to make the Internet work (get the data between the systems)

TCP - Connection-Oriented Protocol
A Client talks to the Server, says hello, waits till Server acknowledges the Client
with a Handshake, and continue from there.

UDP - Connectionless Protocol

A Client gives the order the Server, and the Server just does it. No Handshake

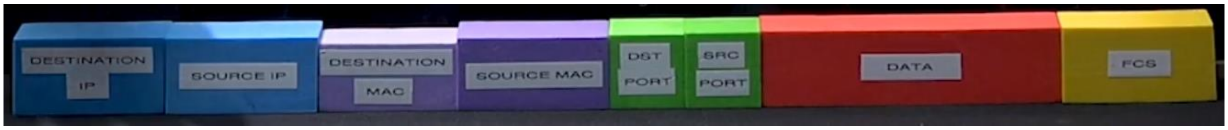
ICMP - Single Packet Only (TCP & UDP can be 1000’s of Packets)

Single Packet, like sending out a single ping, and that’s it

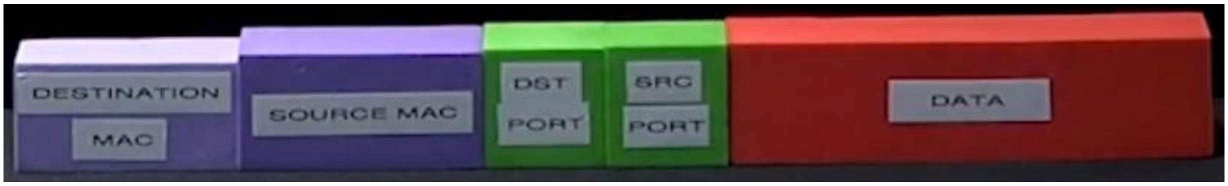
The Internet really is a combination of TCP, UDP, ICMP, and IP,
but for simplicity, we shorten it to just TCP/IP

PDU (Protocol Data Unit) - It looks at the entire Frame,
and determines what part it’s actually interested in

If we’re talking about Switches, we’re really interested in MAC Addresses



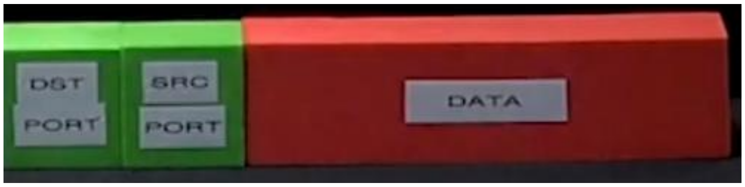
Ethernet Frame - image above describes an Ethernet Frame



When we’re in a system, and IP Addresses & FCS are no longer interesting to us, most the time we’re just talking about this part of the Packet.

This PDU is called the IP Packet

We can have the full Ethernet Frame, but when talking about the IP part,
this is how we make the separations.



TCP Segment/UDP Datagram - when we’re in our system

This could also be for ICMP

It’s important to know these 3 different PDU’s based on what we’re interested in

Understanding DNS

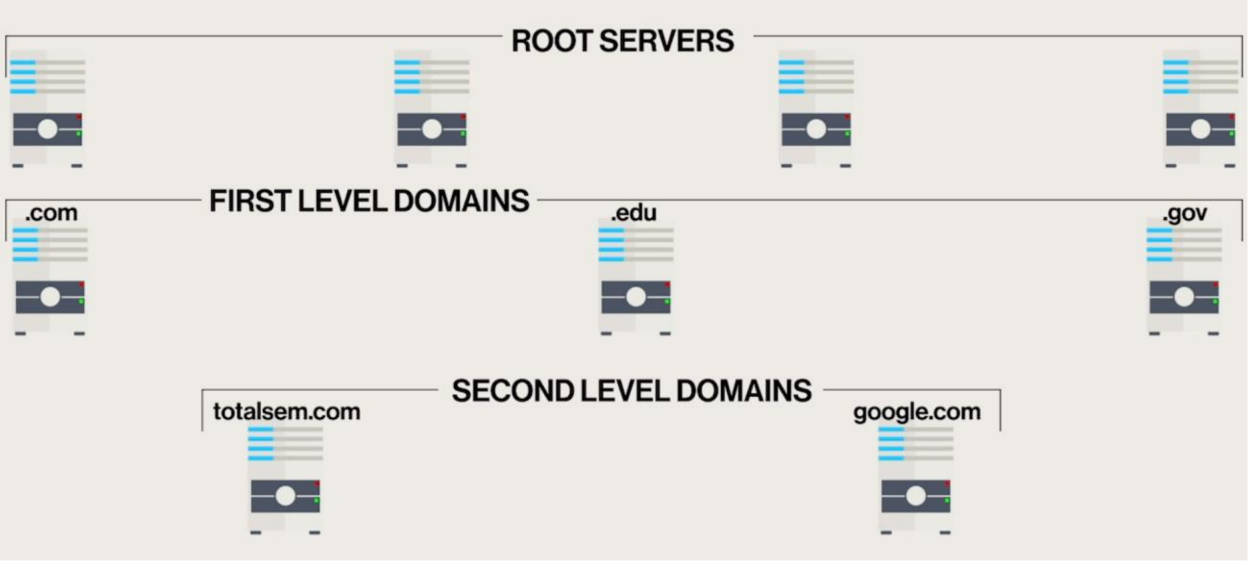
- Domain Name System (DNS) resolves fully-qualified domain names (FQDN) to IP addresses
- DNS replaced hosts files
- DNS uses a hierarchical organization to resolve FQDNs to IP addresses
- All Internet-connected hosts have a DNS server

DNS (Domain Name System) - acts like a contact list you have in your cell phone, which allows you to not have to memorize all of your contacts phone numbers

We type in website addresses, because we'd be bad at having to type in IP Addresses.

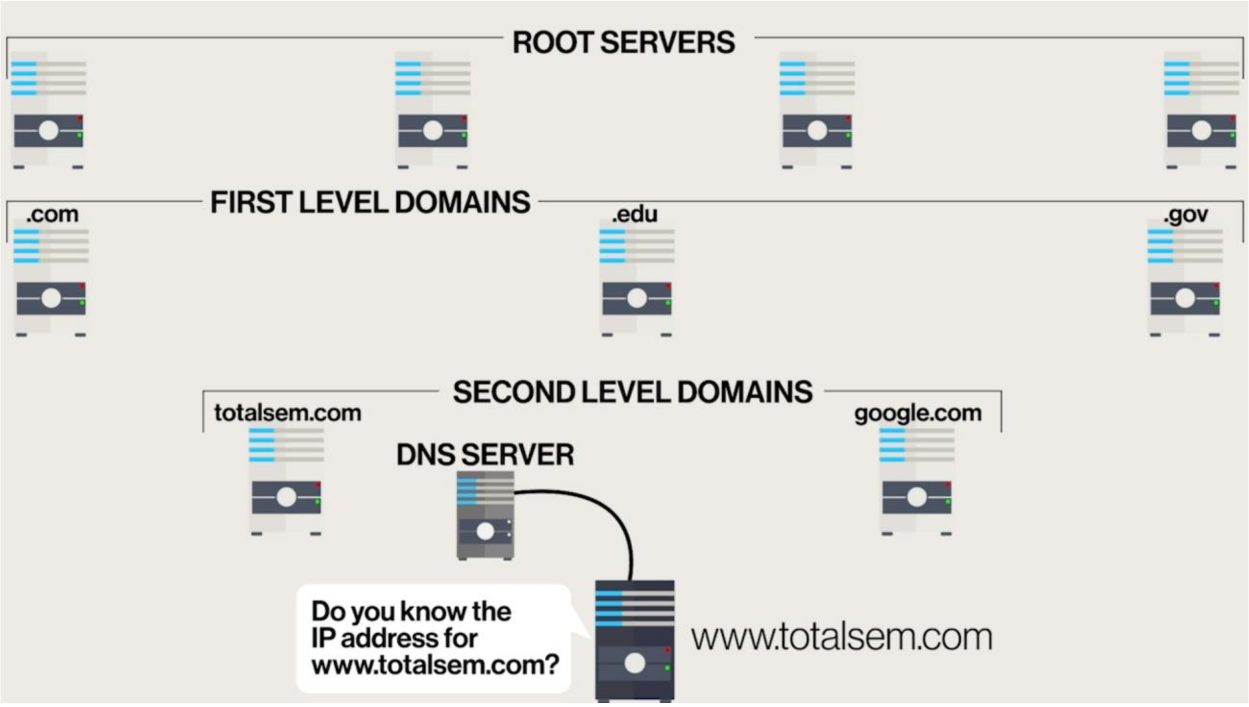
DNS associates these websites with the correct IP Address, then it sends out the Packet

DNS replaced the Hosts File, which would distribute your IP Address every day to every computer to make the Internet work.



There are DNS Servers spread all around the world, called the Root Servers.
Under this are Servers that control First Level Domains - .com .edu .gov
Under this are Servers that control Second Level Domains - google.com totalsem.com
There might be hundreds of Servers that handle google.com

These are all Authoritative Servers



DNS Server will just help us find stuff

Let’s say we open a web browser & type in www.totalsem.com.

We have a DNS Server entered in our computer

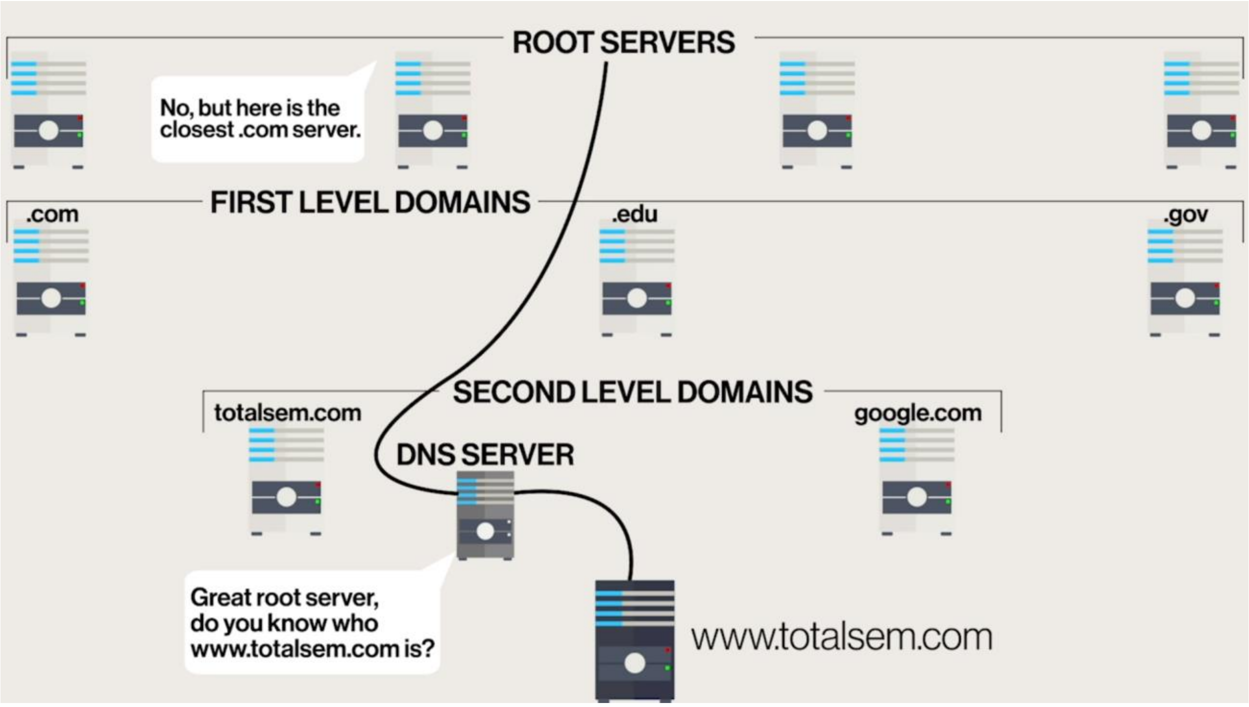
(has to be typed in, or provided by DHCP).

When we hit Enter after typing in the web address,

we query the DNS Server, “Do you know the IP Address for this website?”

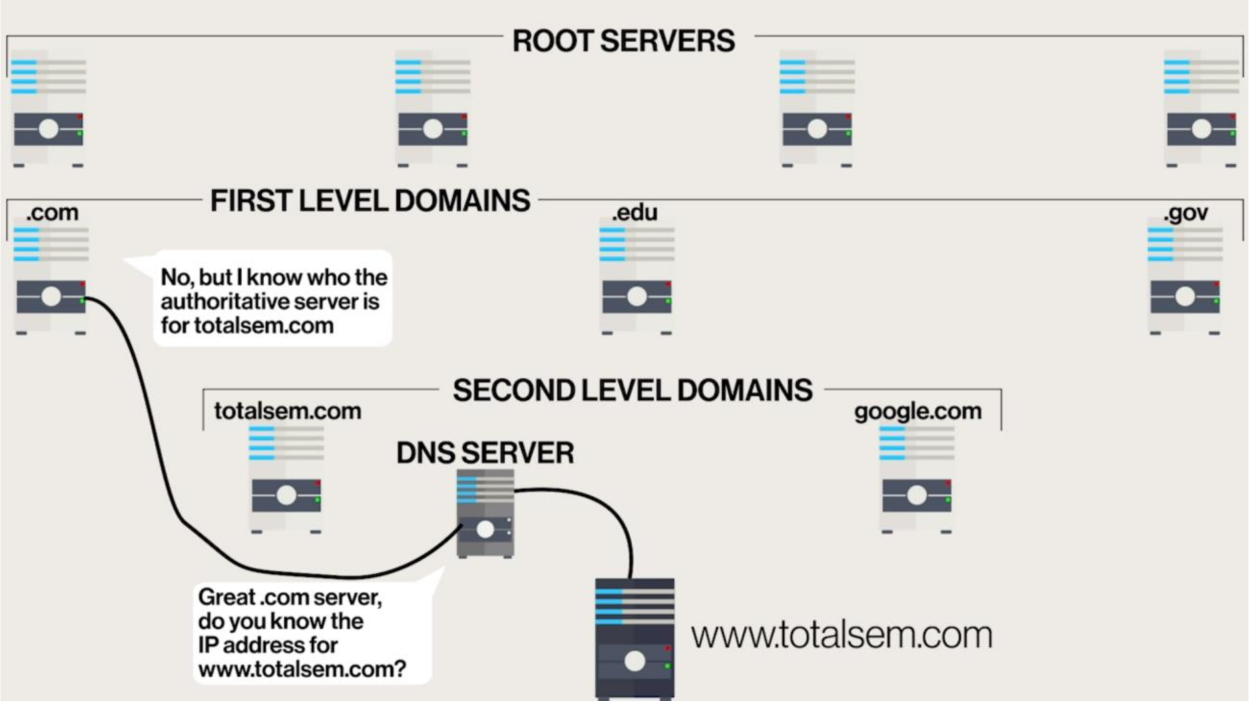
This DNS Server has a list of all the IP Addresses of all the Root Servers

all around the world!

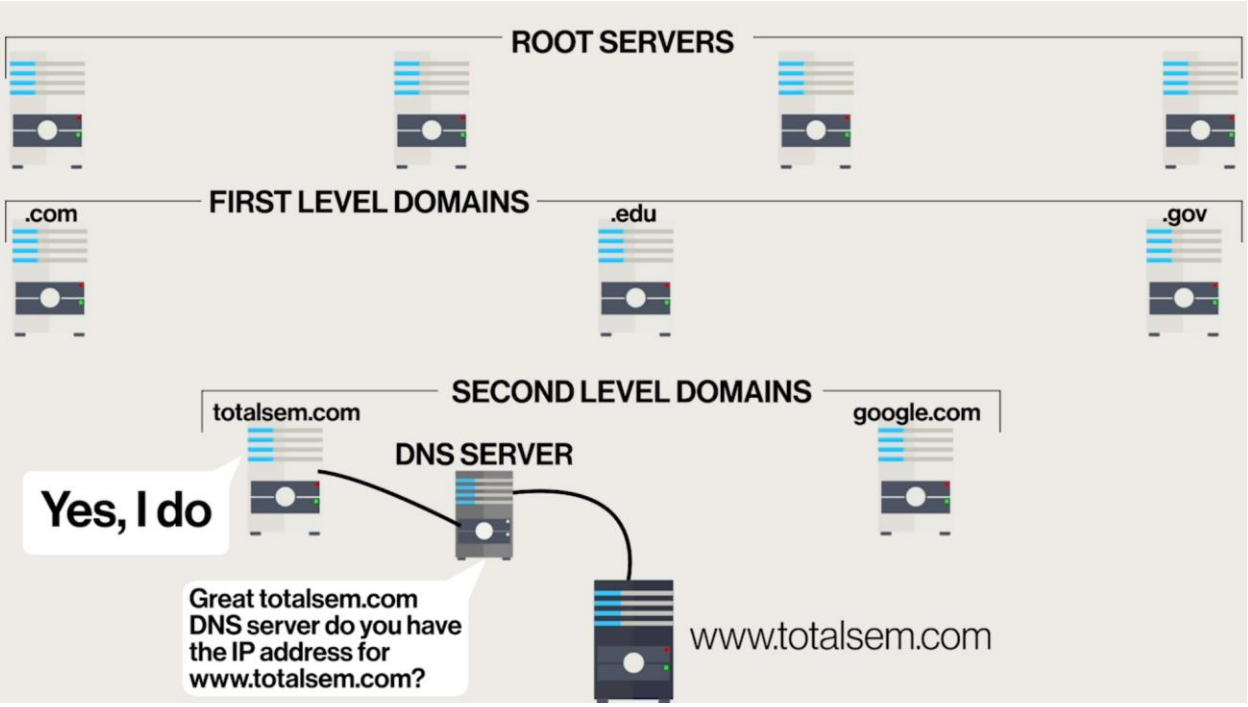


DNS Server will pick a Root Server based on geography,
and ask it who this website is

If the Root Server doesn't know, it does know where the closest .com Server is


ROOT SERVERS
FIRST LEVEL DOMAINS
.com
.edu
.gov
No, but I know who the authoritative server is for totalsem.com
SECOND LEVEL DOMAINS
totalsem.com
google.com
DNS SERVER
Great .com server, do you know the IP address for www.totalsem.com?
www.totalsem.com

So, the DNS Server asks if the .com Server knows the IP Address for the website
If the .com Server doesn't know, it'll redirect the DNS Server to its Authoritative Server



The DNS Server will ask the Authoritative Server of the website for the IP Address.

That Server will send the IP Address to the DNS Server,

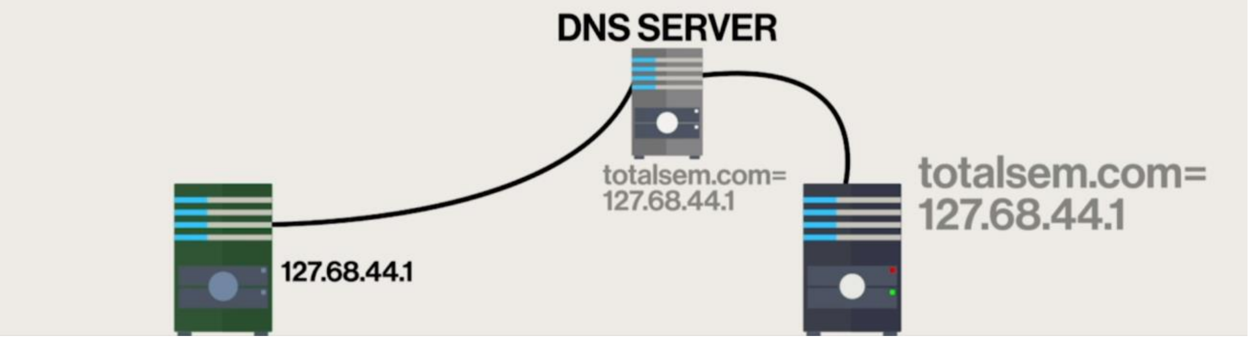
then the IP Address will be sent to you, which enables you to view the website!

You see this process happening when you go to a website you've never been to before.

Look on the bottom left of your web browser when loading a new website,

and you'll see "Waiting for…"

This is the DNS Process at work!



If you've gone to a website before, your computer will keep a copy of that website in itself (Caching), and your DNS Server will keep a copy as well (for a certain amt of time)

Someone else using a computer with the same DNS Server

will also be able to access that website quicker using this Caching

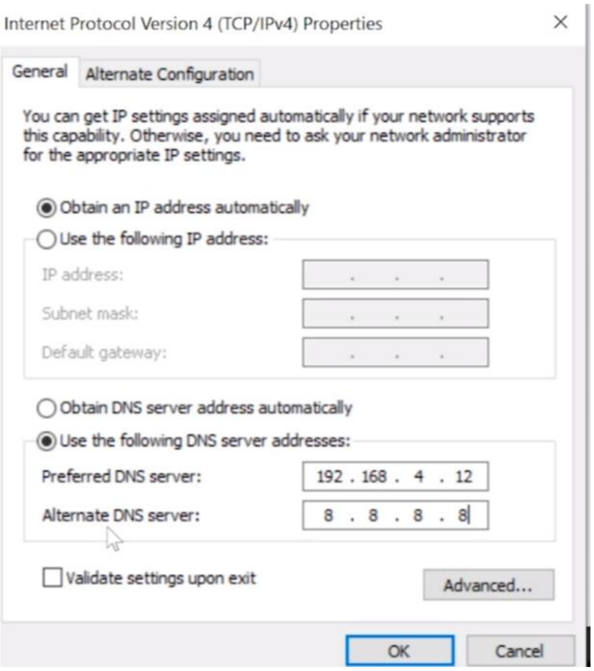
FQDN (Fully Qualified Domain Name) - come from a Registration Process to register
a unique name, once it’s verified it’s unique it is now yours (after paying some $$)

Once you have it, you assign it to a DNS Server!

FQDN’s have a 256 Character limit (including the dots)

Working with DNS

- Use ipconfig /all to see a system's DNS servers
- You can statically configure DNS and still use DHCP for IP addressing
- Have an alternative public DNS server in case your DNS server is down
- Use nslookup to verify a DNS server is running



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

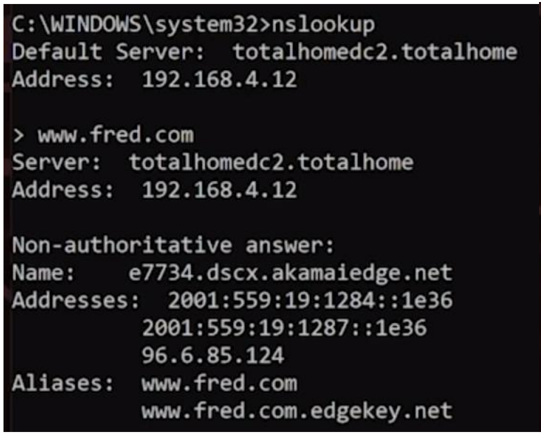
● Obtain an IP address automatically
○ Use the following IP address:
IP address: . . .
Subnet mask: . . .
Default gateway: . . .

○ Obtain DNS server address automatically
● Use the following DNS server addresses:
Preferred DNS server: 192 . 168 . 4 . 12
Alternate DNS server: 8 . 8 . 8 . 8

□ Validate settings upon exit

If DNS Servers are down/DNS Connections are acting up, we can
1) Manually Configure DNS (with 2 DNS Servers)
Popular Public DNS Servers 8.8.8.8 or 8.8.4.4 (from Google)
2) nslookup - Built in to OS’s (this is a Command Prompt)
This answers if the DNS Server is a Good Server

If we get timed out when using nslookup,
we know we don’t have a functioning DNS Server!

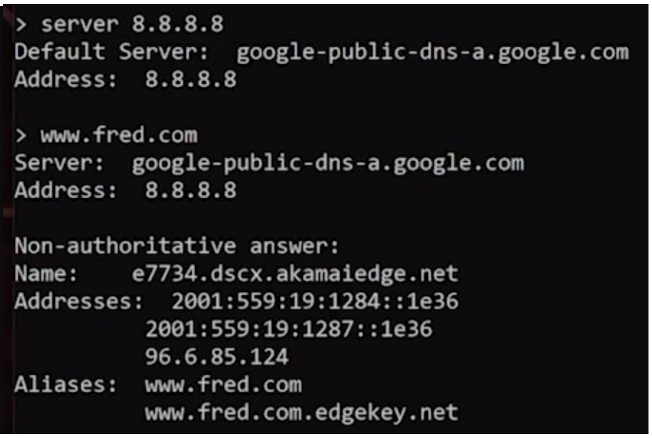


```
C:\WINDOWS\system32>nslookup
Default Server:  totalhomedc2.totalhome
Address:  192.168.4.12

> www.fred.com
Server:  totalhomedc2.totalhome
Address:  192.168.4.12

Non-authoritative answer:
Name:    e7734.dscx.akamaiedge.net
Addresses:  2001:559:19:1284::1e36
          2001:559:19:1287::1e36
          96.6.85.124
Aliases:  www.fred.com
          www.fred.com.edgekey.net
```

Good DNS Server

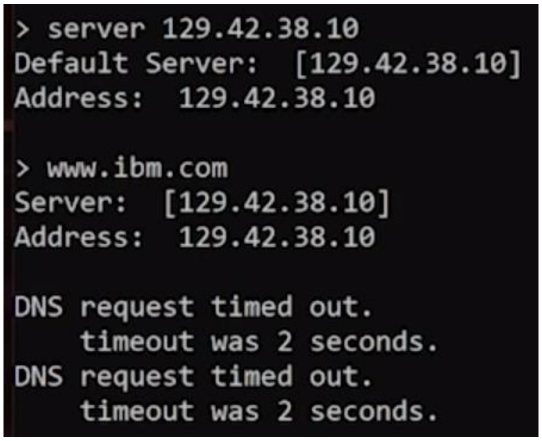


```
> server 8.8.8.8
Default Server:  google-public-dns-a.google.com
Address:  8.8.8.8

> www.fred.com
Server:  google-public-dns-a.google.com
Address:  8.8.8.8

Non-authoritative answer:
Name:    e7734.dscx.akamaiedge.net
Addresses:  2001:559:19:1284::1e36
          2001:559:19:1287::1e36
          96.6.85.124
Aliases:  www.fred.com
          www.fred.com.edgekey.net
```

Good DNS Server



```
> server 129.42.38.10
Default Server:  [129.42.38.10]
Address:  129.42.38.10

> www.ibm.com
Server:  [129.42.38.10]
Address:  129.42.38.10

DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
```

Bad DNS Server

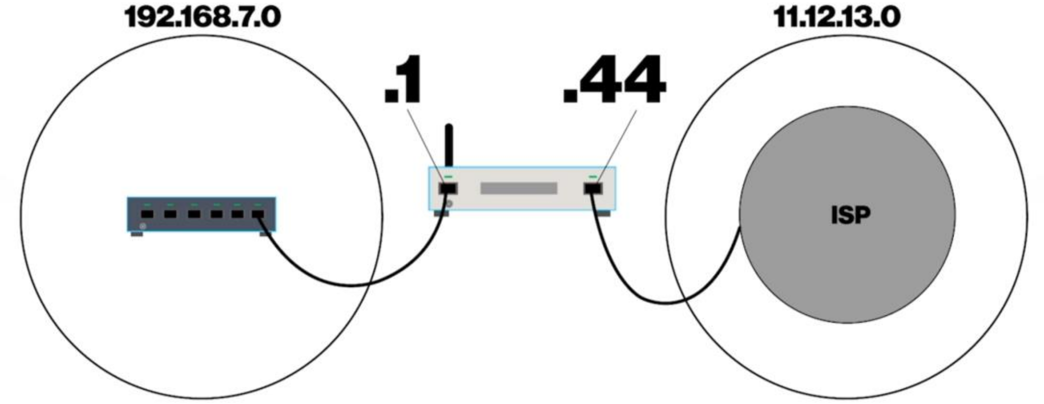
DNS Servers store

- A Records - Web Addresses & IP Addresses
- MX Records - used by Mail Servers to get to the right spot
- Cname - used if there's more than 1 name for an IP Address

Routers

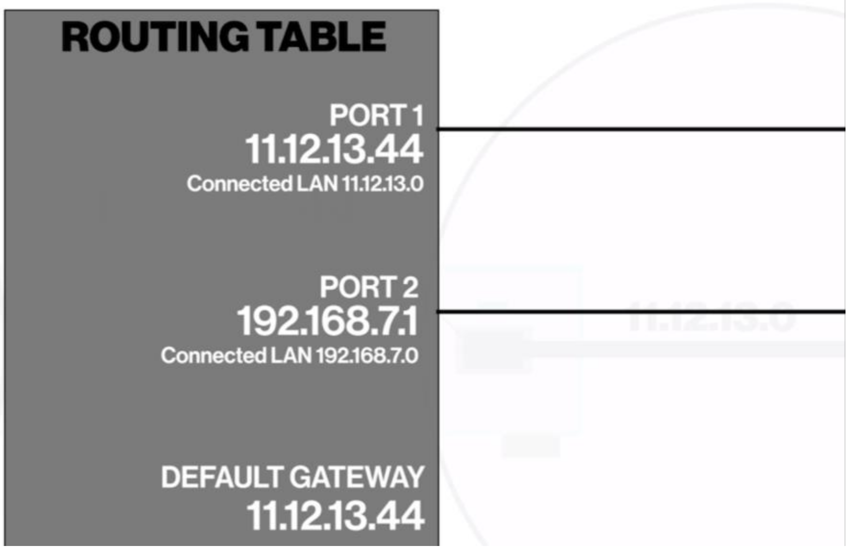
- Routers filter and forward traffic based on IP addresses
- A routing table determines where to filter or forward IP packets
- Every routing table has a default gateway that sends all data unless otherwise specified
- A SOHO router is usually far more than a router
- Some routers use web connections, some use console ports

Routers - Devices that Filter & Forward Traffic based on IP Addresses.
They're the tools we use to connect LAN's



Router connects to a Network and an Internet Service Provider

Routers don't care where any Packets come from.



ROUTING TABLE

PORT 1
11.12.13.44
Connected LAN 11.12.13.0

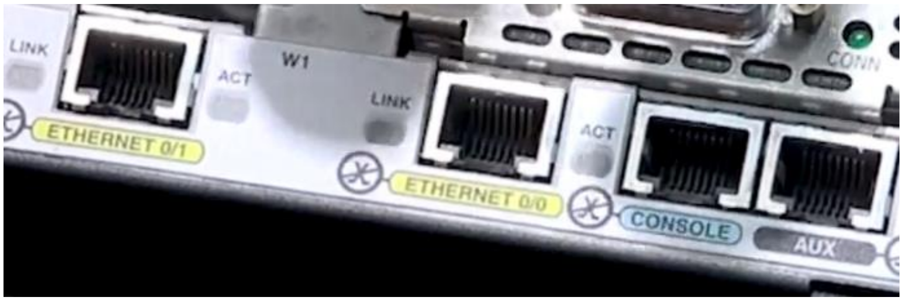
PORT 2
192.168.7.1
Connected LAN 192.168.7.0

DEFAULT GATEWAY
11.12.13.44

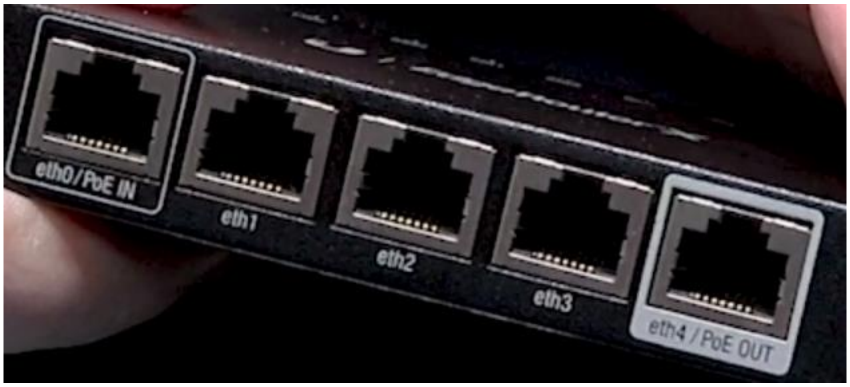
There's a built-in Routing Table tells the Router where to send stuff

They look at the Destination of incoming IP Packets,
and send it out to some other Port.

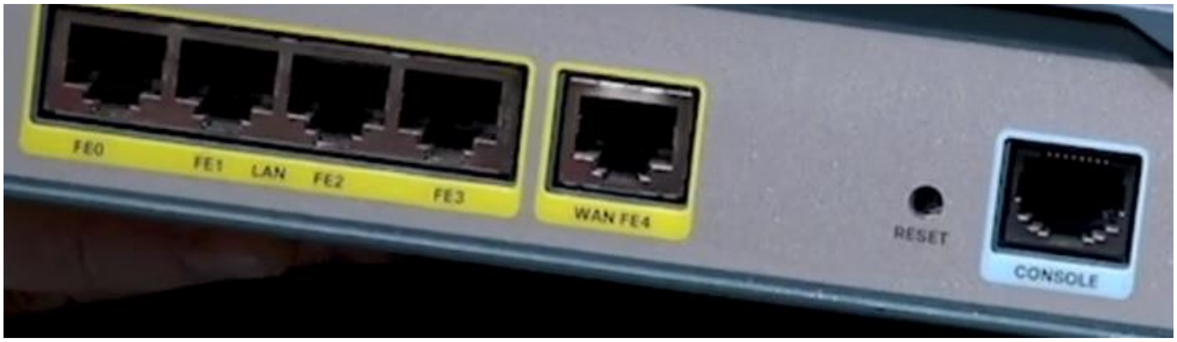
Routers make the Internet work!
Without them, we wouldn’t have a way to separate our different LAN’s



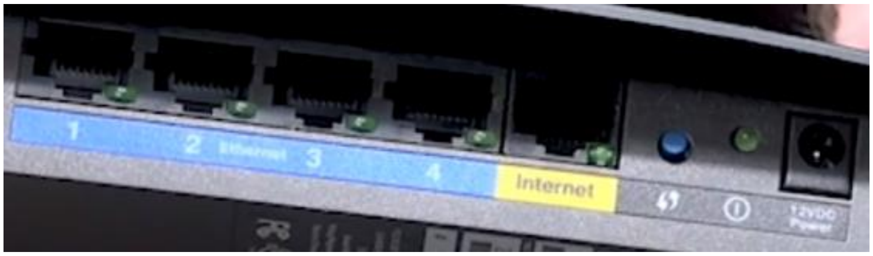
Very Old Router - 2 Connection Router (Ethernet 0/1 and Ethernet 0/0)



5 Connections (et0, eth1, eth2, eth3, eth4)
Can connect to 5 LAN’s. Or, 4 LAN’s and 1 ISP

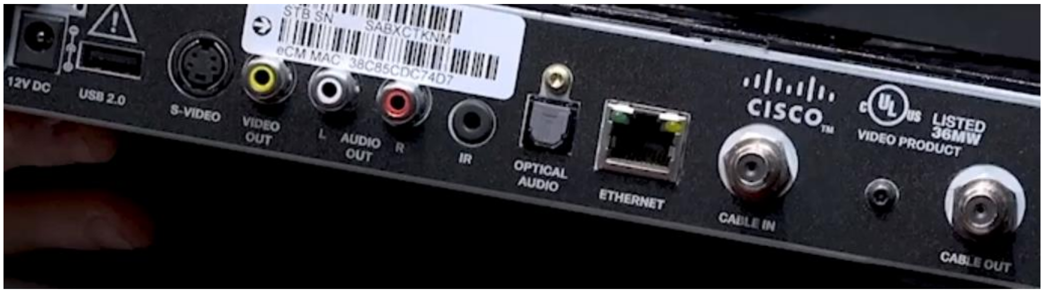


Especially in Small Offices, and Home Offices, we combine Routers with other Devices
2 Port Router (WAN FE4) with a 4 Port Switch



2 Port Router with a 4 Port Switch
Router/Switch with WAP - This device is a Router, a Switch,
and a WAP (Wireless Access Point) built in 1 box

Not all Routers have Wireless.
The Home ones do,
but in an Enterprise, if you need Wireless, you get a WAP,
and if you need a Router, you get a Router!



We have 1 Connection to our LAN (plugs into a Switch),
then the Upstream Connection is using DOCSIS (Cable Modem)

Routers can connect using Ethernet, or Cable Modem DOCSIS
These will always keep the IP Packet in good shape

Some Routers have a Console Port, which is a Serial Port
using RS-232 Language to act as a connection
This will require you to use a Terminal Program to talk to the Router

uses a DB-9 Connector to connect to your laptop
and the other end has a RJ-45 Connector
This is a Yost/Rollover Cable

SOHO (Small Office/Home Office) Router - 4 Port Switch and WAP (has antennas)

Initially Connecting these devices

1) passing out by DHCP within a DHCP Range
2) Default Username and Password

ipconfig should be showing a 192.168 IPv4 Address

If we were getting an APIPA Address 169.254 Address,
we know the Router is NOT passing out DHCP

If this is the case, we need to go into the User Manual,
find out what the Default IP Address is,
then go into our system and Statically Set the IP Address that Matches its Range

The Default Gateway is your Router!

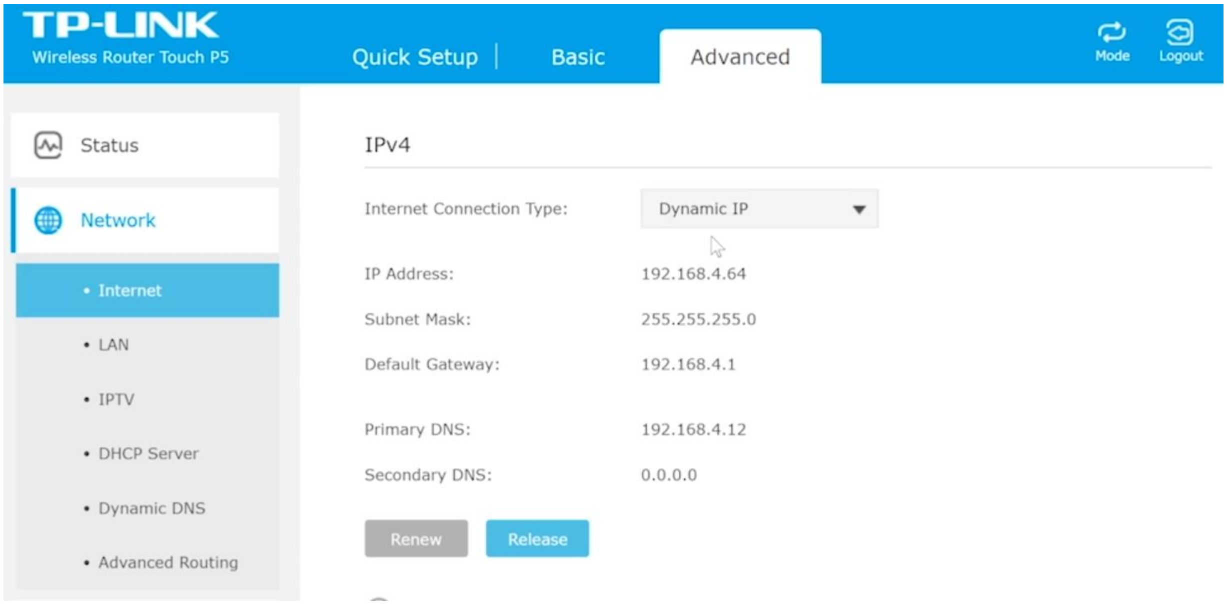
Basic Router Configuration

- Configure both the WAN and LAN connections on your router
- Avoid default settings for basic configurations (IP, SSID, password, etc.)
- Don't create too large of a DHCP pool
- DHCP reservations set aside IP addresses in the DHCP pool

Router is wire connected to ISP (Modem) and the other is connected to the computer

If you plug a SOHO Router in the right way, you'll get the Internet,which sounds great,
but there may be a lot of Security & Configuration issues we need to deal with

Type your Router/Default Gateway Address into a Browser, hit Enter & log in
This web interface will look different for each company



IPv4

Internet Connection Type: Dynamic IP

IP Address: 192.168.4.64

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.4.1

Primary DNS: 192.168.4.12

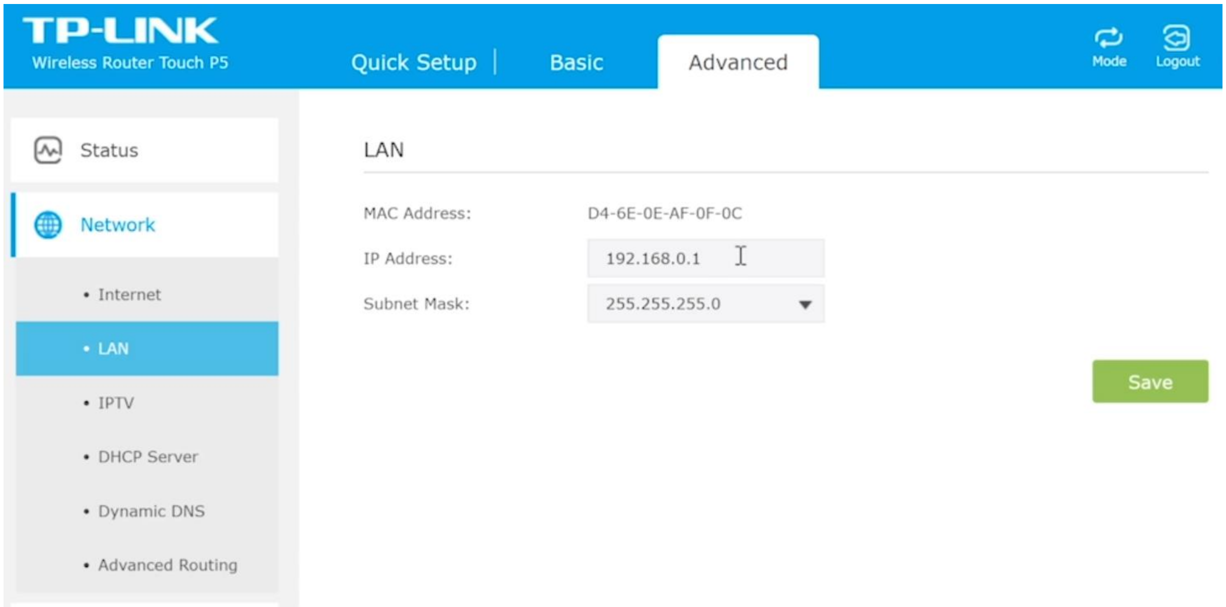
Secondary DNS: 0.0.0.0

WAN Connection - try to find this in your web interface (look under Network → Internet)

Shows you how to configure your Connection up to your ISP

Most Routers are DHCP Clients

Can be changed to Static IP -if your ISP requires it Otherwise, keep it Dynamic



LAN

MAC Address: D4-6E-0E-AF-0F-0C

IP Address: 192.168.0.1

Subnet Mask: 255.255.255.0

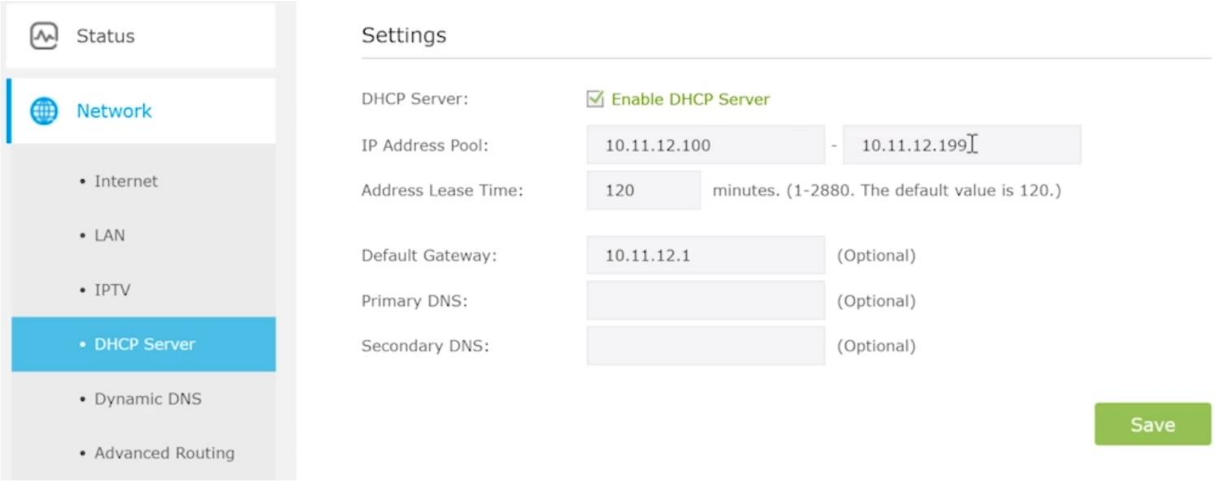
For LAN, Mike likes to change his Internal Network ID

From the IP Address given 192.168.0.1 to 10.11.12.1

then hit Save. This will take a little while. And, will need to Reboot.

After the Reboot, try to go to the Web Interface for 10.11.12.1
and see if the new IP Address is present in ipconfig

The DHCP will also rename your computer IPv4 Address to 10.11.12.X



Settings

DHCP Server:	☑ Enable DHCP Server	
IP Address Pool:	10.11.12.100 - 10.11.12.199	
Address Lease Time:	120	minutes. (1-2880. The default value is 120.)
Default Gateway:	10.11.12.1	(Optional)
Primary DNS:		(Optional)
Secondary DNS:		(Optional)

Save

DHCP Server

- This IP Address Pool is allowing up to 100 computers to connect (100-199)
- Reduce this number so it ranges from 100-120 (change the 199 → 120)
- DHCP Reservation (scroll down to see this) - This reserves an IP in the Pool
  - Mike doesn’t like the idea of these Reservations -don’t use them

Go into your Web Interface to make sure you have

- Time Settings - set this to automatic

- Diagnostics - If you’re having an issue, this can be handy

- Firmware Upgrades - check for these upgrades
  - At times, you might have to go to the manufacturer’s site for this

- Administration - Use this for typing in New Usernames & Passwords
  - Local Management -
  - Remote Management - Don’t turn this on!!!

VLANs

- VLANs enable network segmentation without adding hardware
- Configure VLAN-capable switches via IP address and Web browser
- Use firmware interface for managing VLANs
- Firmware interface also enable features such as port security

VLAN (Virtual Local Area Network) - takes 1 physical Switch,
and electronically turns it into 2 or more Switches.

It separates the LAN, into multiple LAN's

This allows you to separate your Voice-Over IP Phones onto their own Network,
without having to buy an extra Switch!

VLAN's are extremely popular -see them all the time!

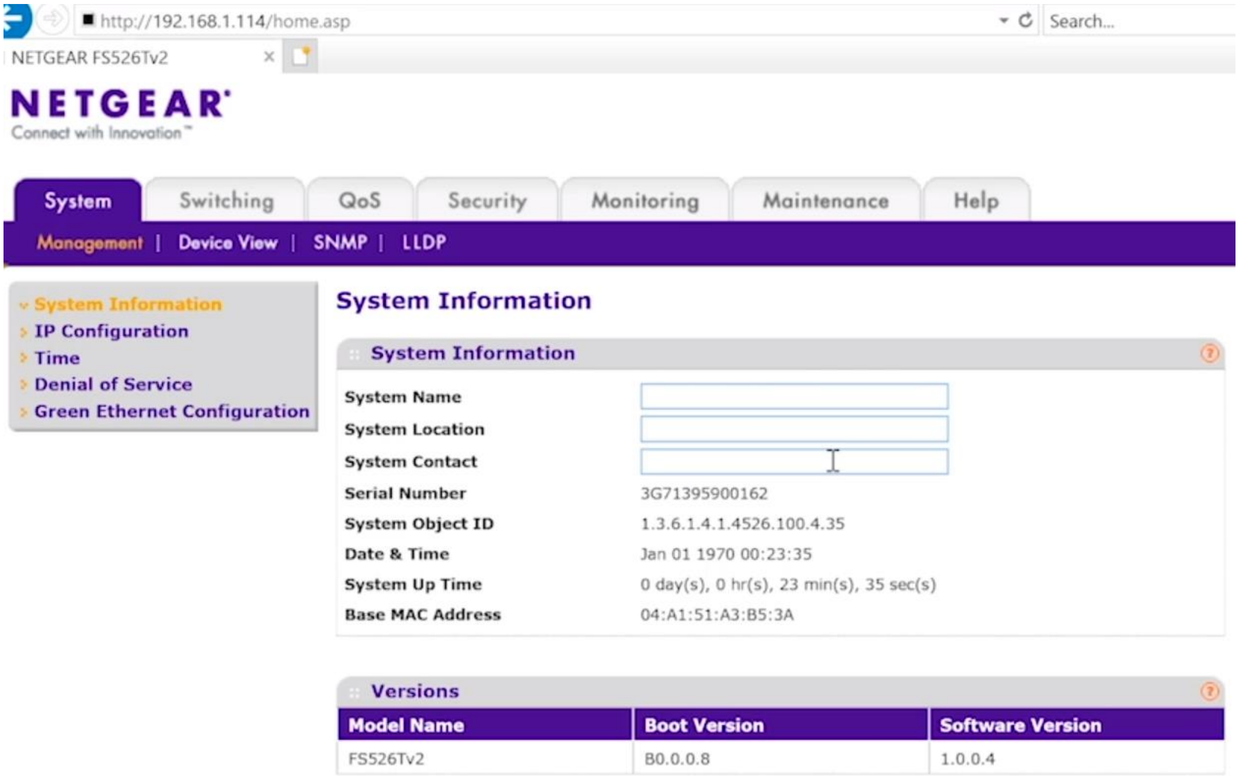
We need to configure this Switch into a VLAN

Keep in mind, Switches don't need IP Addresses -they use MAC Addresses.
We're going to give this Switch an IP Address,
because it gives us a way to get to the Switch so we can configure it!
This is called a Managed Switch
-comes with additional features, but it's more expensive

It will get it's IP Address through DHCP, so connect the Switch to the Router.

Then, go into the Status of your Router.
You'll see that there's something there.
Go into a Web Browser & type in that IP Address.

Anytime you configure these devices (Switches or Routers), use Internet Explorer!
IE has features that are compatible with these older devices.



System Information

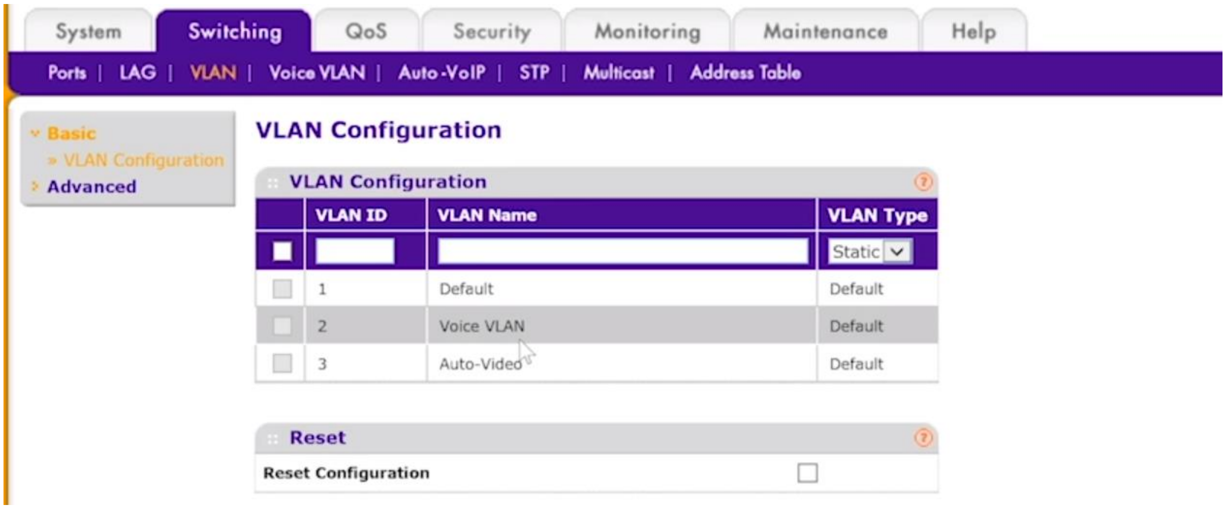
System Information

System Name	
System Location	
System Contact	
Serial Number	3G71395900162
System Object ID	1.3.6.1.4.1.4526.100.4.35
Date & Time	Jan 01 1970 00:23:35
System Up Time	0 day(s), 0 hr(s), 23 min(s), 35 sec(s)
Base MAC Address	04:A1:51:A3:B5:3A

Versions

Model Name	Boot Version	Software Version
FS526Tv2	B0.0.0.8	1.0.0.4

Type the IP of the Switch in Internet Explorer



VLAN Configuration

VLAN Configuration

	VLAN ID	VLAN Name	VLAN Type
□			Static
□	1	Default	Default
□	2	Voice VLAN	Default
□	3	Auto-Video	Default

Reset

Reset Configuration □

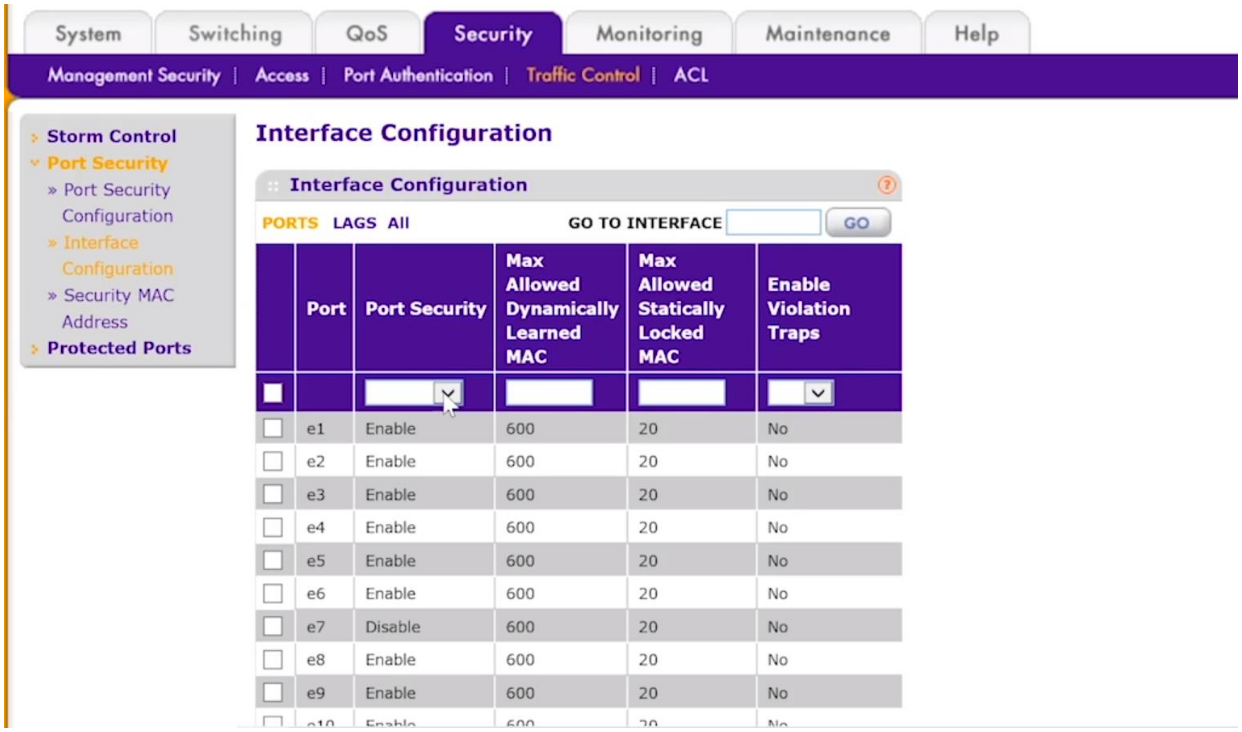
VLAN’s get a Number, such as 1, 2, 3 like we see in the image above

Use this to Define your VLAN’s!!

You need to assign the Ports on the Switch to each VLAN you create/configure

Once again, these are separate LAN’s, so plugging in 2 computers
might not be able to talk to each other, depending on how you assign the Ports!

If you're plugging computers into a Switch,
and they're not able to communicate with each other,
there's a good chance you have a VLAN configurations!



Interface Configuration

Interface Configuration

	Port	Port Security	Max Allowed Dynamically Learned MAC	Max Allowed Statically Locked MAC	Enable Violation Traps
□					
□	e1	Enable	600	20	No
□	e2	Enable	600	20	No
□	e3	Enable	600	20	No
□	e4	Enable	600	20	No
□	e5	Enable	600	20	No
□	e6	Enable	600	20	No
□	e7	Disable	600	20	No
□	e8	Enable	600	20	No
□	e9	Enable	600	20	No
□	e10	Enable	600	20	No

Port Security -

We can tell the Switch, "whatever computers are plugged into you right now,
memorize those MAC Addresses..." (we are telling the Switch to do this)
"...and, if any other computers try to plug in, other than the ones
with these MAC Addresses, disable/turn off that Port, and/or Notify me!"
There are devices on this switch that are playing that shouldn't be here!

Network Troubleshooting

- Connectivity problems caused by physical or software faults
- External interference can create network problems
- Lack of or slow access to resources point to problems as well

No Connectivity - can't get to whatever resource you want to get to

Are you Physically Connected
Is your Patch Cable plugged into the back of your Computer?
Do you have good link lights?

If yes to the both of these,
then look at your IP Addressing
If you're a DHCP Client, this shouldn't be an issue.
If you have Static Devices in your Network,
you might have IP Conflicts (2 devices with same IP)

Ping by IP Address!

Limited Connectivity - some stuff I could get to, and some stuff I can't.

This is a DHCP issue. Look for an APIPA Address
If you start seeing a 169.254. Address when running ipconfig,
there's a problem with your DHCP Server.

Also look for any changes in your IP Address.
This can be due to a Rogue DHCP Server. Somebody has plugged in
a DHCP Server, and is passing out bad information.
You need to trace and find whatever box is doing this.

Intermittent Connectivity - rare in a Wire Network. Problem with the cabling itself,
where it may be too close to a running motor.

Just have to move the cabling.

Unavailable Resources - resources you can’t access (folders)

Folder I used to be able to access, but now I can’t!

Can you get to the system itself? If yes,
then we might have an issue with the shared resource itself.

With NTFS, or Network Share Permission, it’s not that difficult to unplug you from a resource you used to get to in the past.

Slow Transfer Speeds - more of a Wireless Issue, but can happen in a Wire Network

Task Manager - how hard is your Network Card being used?

If there’s spikes, go through the Processes
that are eating up your Bandwidth and end them.

This is where QoS can really be of great help!