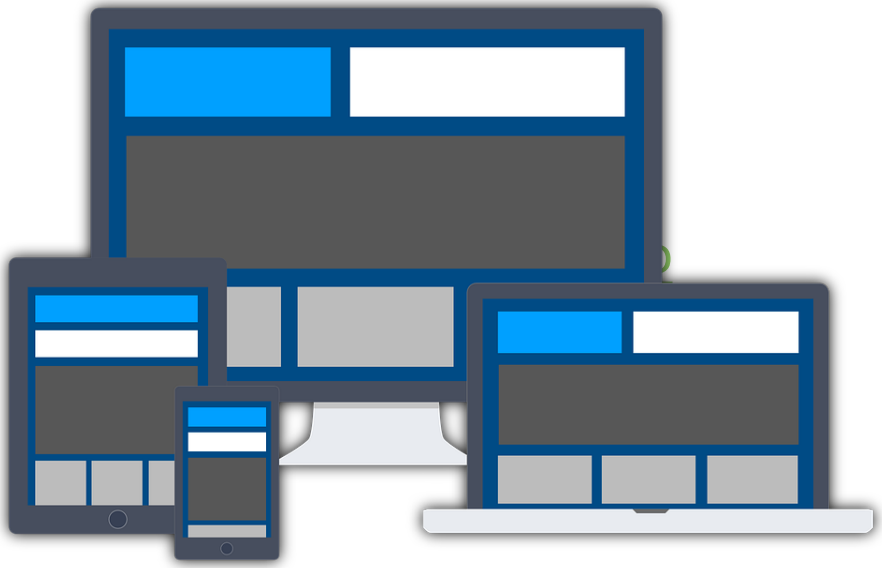
Computer Science 1033 – Week 5

HOW THE INTERNET WORKS



"The Internet: where men are men, women are men, and children are FBI agents." *Anonymous*

Overview of This Week's Topics

The Internet

IP addresses and Domain Names

Preparing to build a website

Good Website Design

What is a webpage ? Introduction to html

How to organize you files within your website, file extensions, types of web pages

Review

Textbook Readings for this Week

- Understanding Computers
  - Communications on the Internet
- Websites
  - Putting the Website Online

REQUIRED Homework

You MUST watch the video about Creative Commons on your OWN time:

- Creative Common Vimeo:
  - https://creativecommons.org/about/videos/creative-commons-kiwi/
  - Make sure you know all the symbols for Creative commons

Copyright

Copyright: your rights to control your works of creative expression

- Happens as soon as the pen leaves the paper!

If you created it, you OWN the copyright by default.

- You don’t have to do anything
- If you work for a company and you designed something while working for the company, then

What can you copyright?

Anything you created that is TANGIBLE (a tangible medium of expression)

Eg. drawing vs a song in your head

Photographs, drawings

Music

Sculptures

Non words nor name

Not ideas

Copyright continued

Myth: changing a design 20% means you can use it

Reality: if you created it, once your pen is off the paper you own!

You can agree with someone that they will pay you for your work (in reality this doesn't always happen).

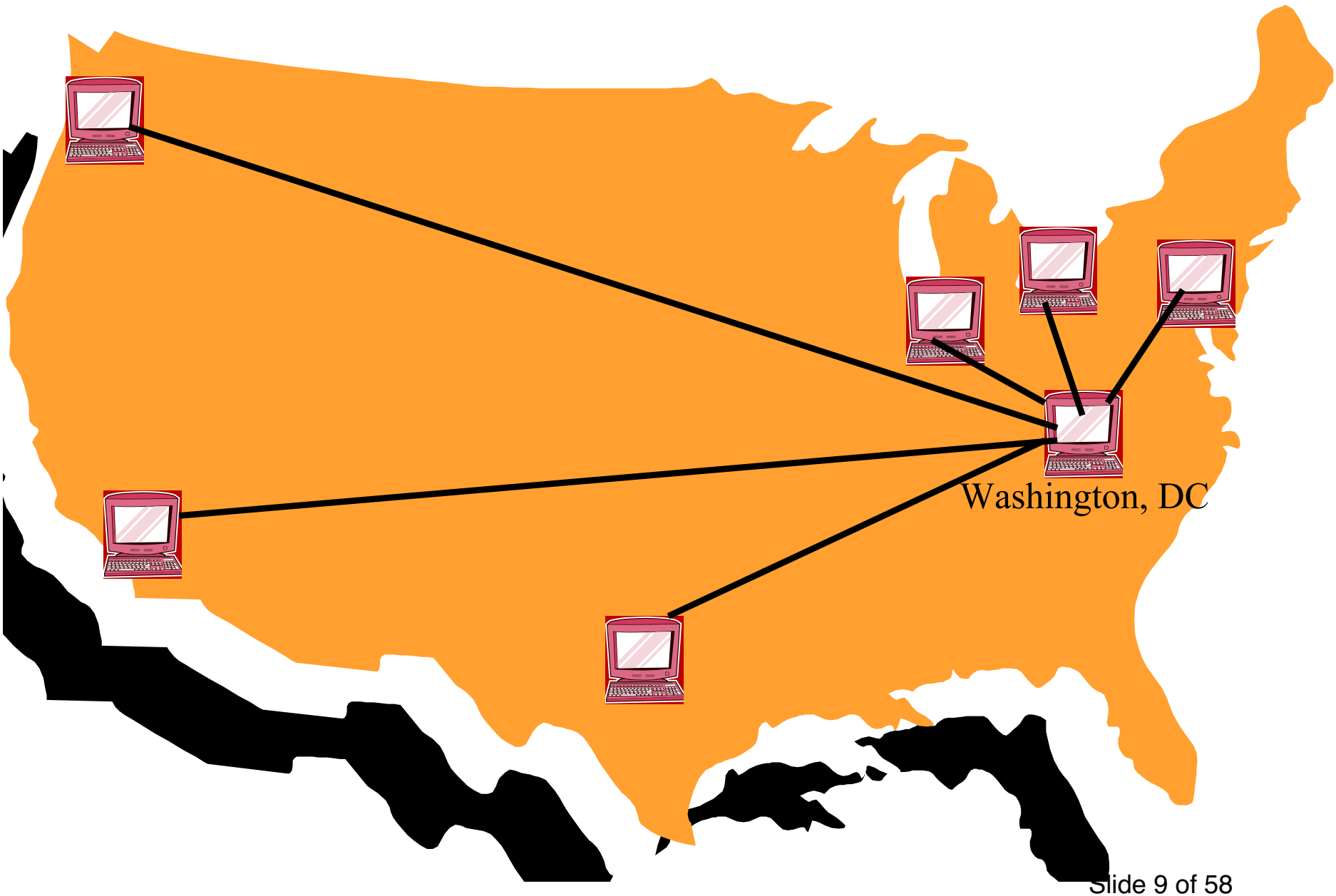
Computer Network

Network: a group of interconnected computers (could be connected with wires, wirelessly, satellites)

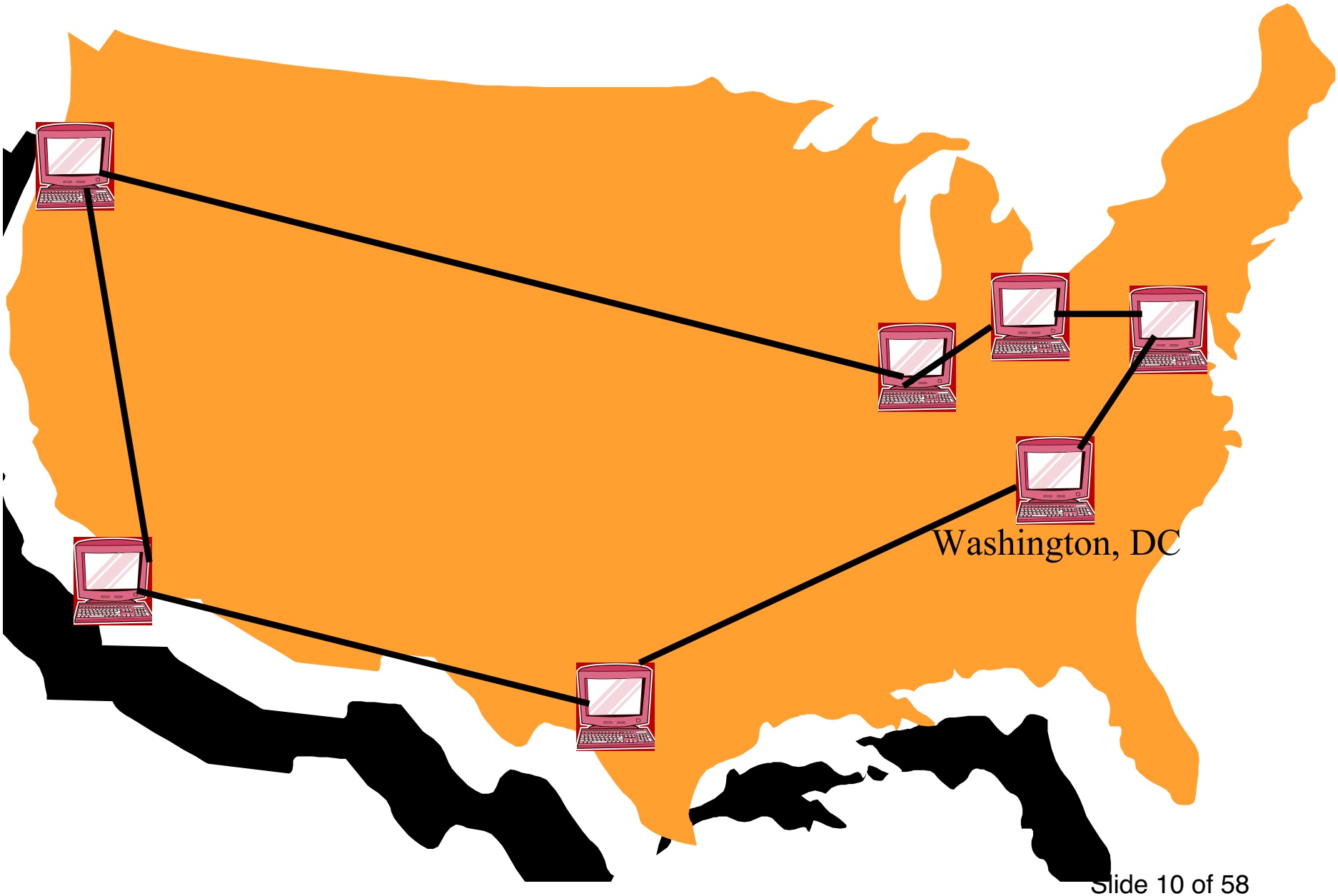
Let's look at some ways to configure a network and think about the pros and cons of each configuration.

Assume we have the following map of the United States:

What is good and bad about this layout?



How about this layout?



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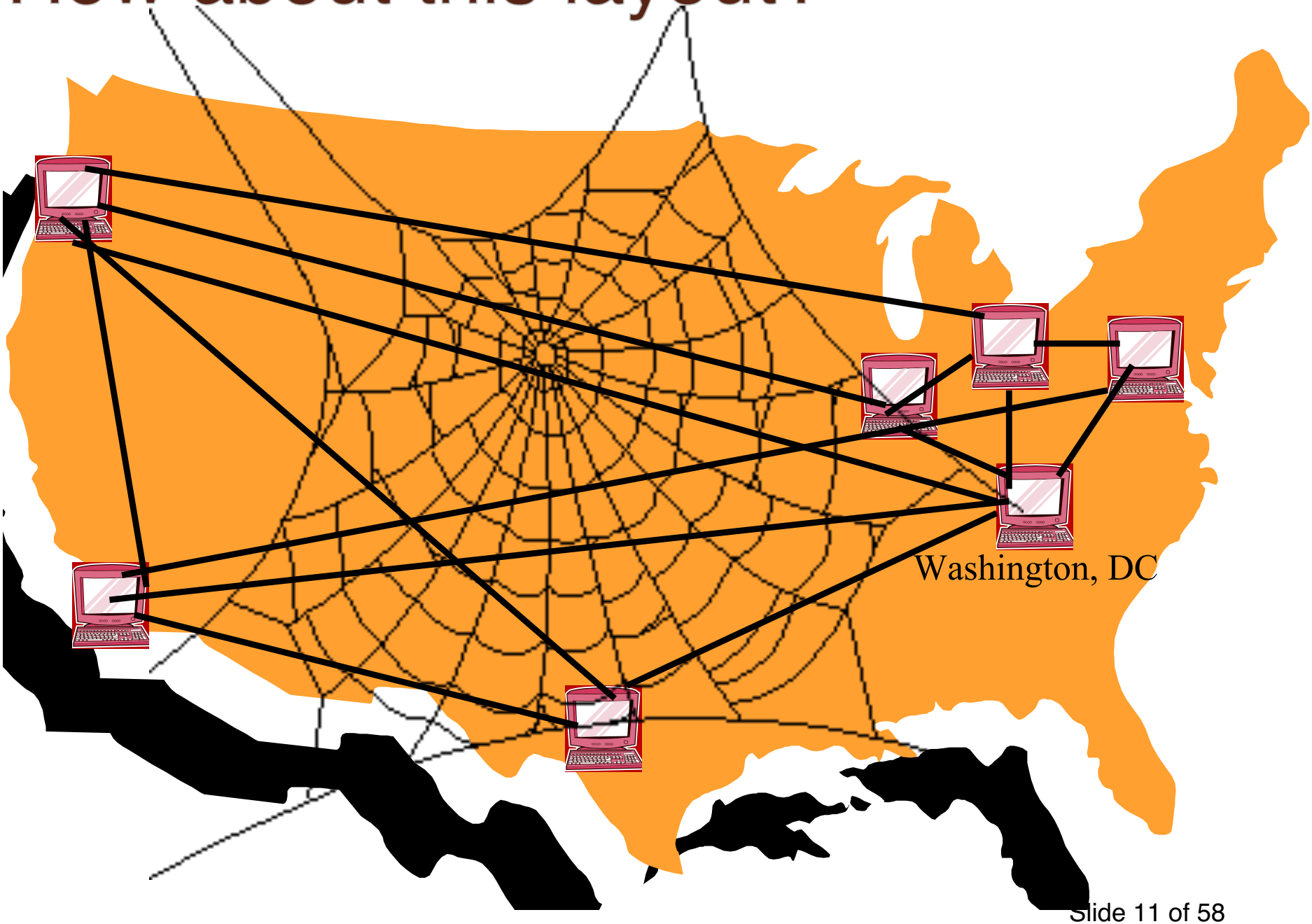


The Internet

Internet: a global system of interconnected computer networks that use the standardized Internet Protocol Suite (TCP/IP) to serve billions of users worldwide.

A network of networks

The Internet is hardware, not software! The World Wide Web is software that runs on the Internet!

How does the Internet work?

Uses **TCP/IP**

A standard protocol (way of communicating),

The ideas behind this protocol were funded by the Advanced Research Projects Agency (ARPA) of the US Department of Defence (DoD) (around 1969). Thus the Internet was originally call the ARPANET

Opposite of your home telephone where you get a direct line that only you and the person you are talking to can use.

TCP/IP has no direct line at the outset of the message! If a communication line is broken, another line is tried.

How does the Internet work?

Image that I had a written a manuscript, printed it but I had NOT stapled it together. I have to get it from our classroom to my publisher in Toronto at Bloor and Yonge. I could:

- **Idea 1:** Give the whole manuscript to **one** of you and tell you at the beginning to take the **whole** manuscript, drive down Western Road South, till it meets the 401, go east till you get to the cut off for Yonge Street, go south and stop at Bloor. AND I WILL STOP ALL TRAFFIC ON THESE ROADS WHILE YOU DO THIS. This is how a phone line work! (Like when Barak comes to town)

- Called ***Circuit Switching***

How does the Internet work

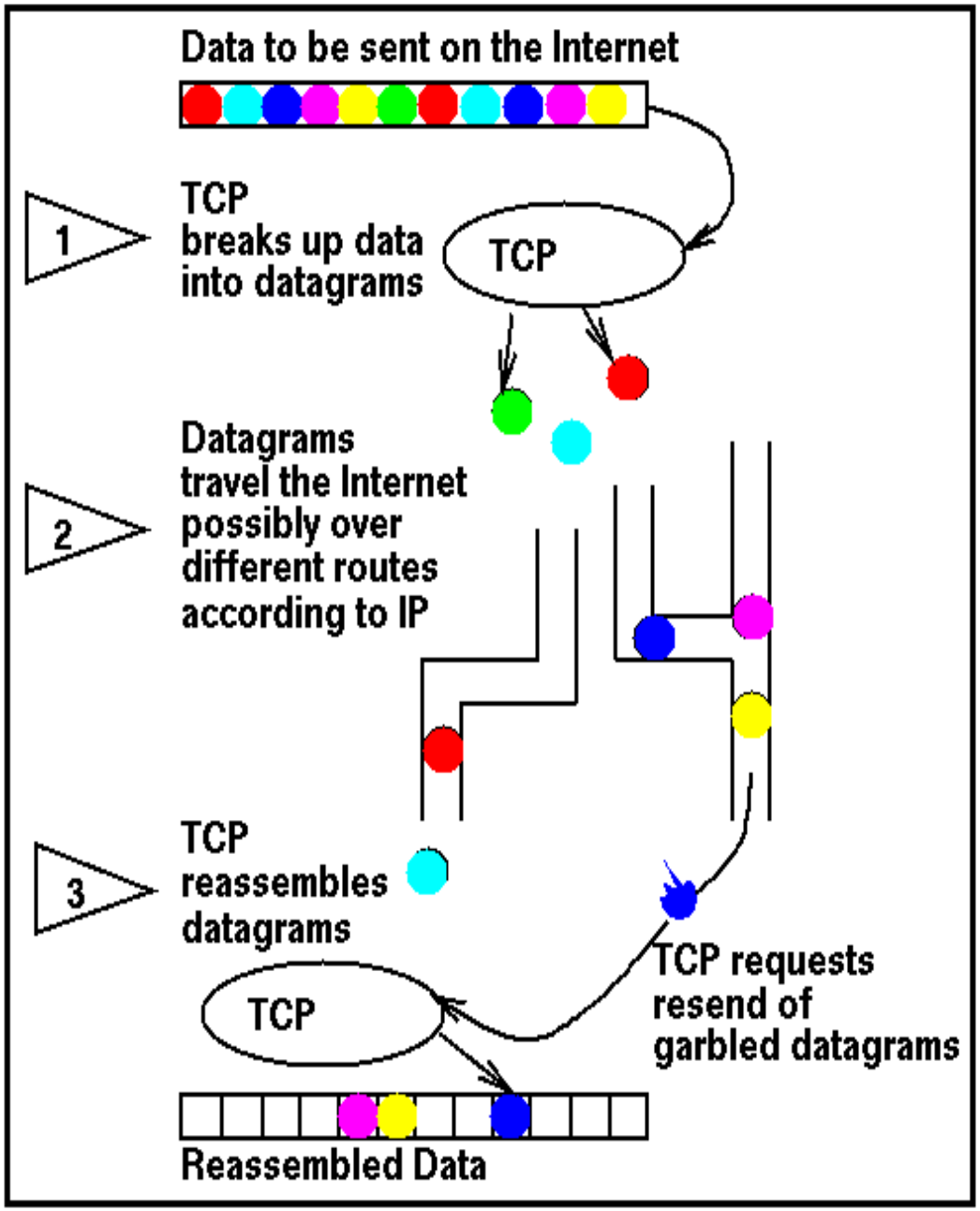
Each page in the manuscript is similar to a **packet**

Packet: a small group of bytes consisting of a header (tells where it is going: destination and where it came from: source) and the body. (Often 64 bytes for header and 512 bytes for body)

Protocol: rules for the format and transmission of data

How does the Internet work?

Idea 2: How else could I do it?



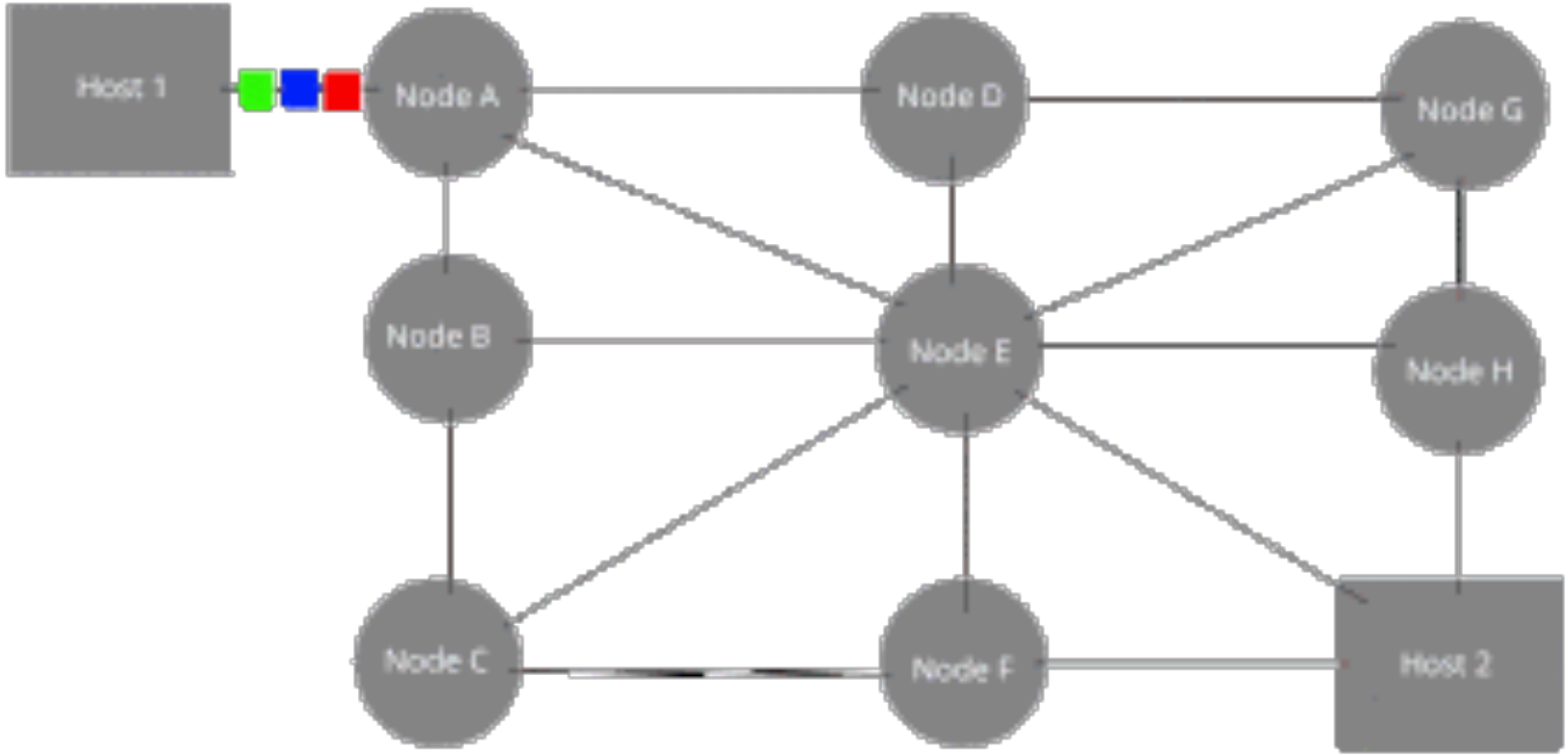
TCP

- Does a few things:
  - At the sending end:
    - Take a large chunk of data (such as a webpage, email message, etc) and breaks it into small packets
    - Sends the packets out on to the Internet
  - At the receiving end:
    - Detects lost packets, packets with errors because of network congestion, traffic load balancing, or other unpredictable network behaviour, and requests the packet to be resent from the source
    - Rearranges and reassembles the packets back into the webpage, email message, etc on the receivers machine

How to send the message, for example a webpage.

- TCP breaks webpage into packets of bytes
- TCP figures out IP address of where it wants to send the packets (destination)
- TCP figures out IP address of where the packet is coming from (source)
- Sends off each packet to first machine (IP Address) on the route (DOES NOT PREPLAN ROUTE!)
- Packet stops at first machine, likely a router, then the router sends it to the next machine on the journey (IP Address) and so on until it gets to the final IP Address (destination)
- Called **Packet Switching**

The original message is Green, Blue, Red.



IP

Like a GPS

Picks a route for a packet, stopping at routers which pick the next best machine/network to send the package to.

If a communication line is down or broken, sends the package back to TCP and TCP sends it again to try a different route.

Needs to be able to identify all the machines on the Internet, thus each machine has it's own unique address

Uses IP Addresses

IP Address

Just like your home address

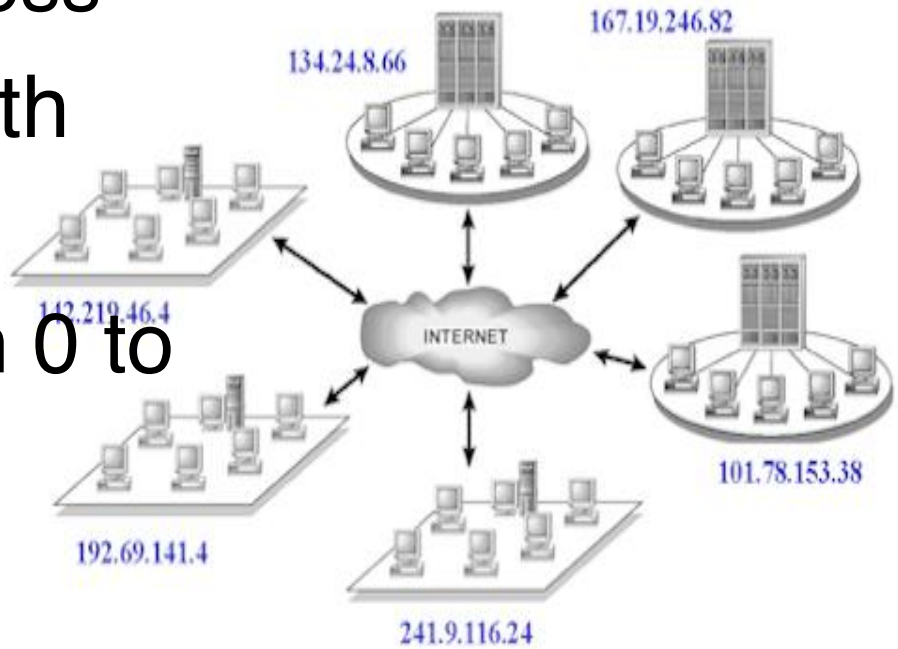
Each machine has its own address, called an IP Address

Consists of 4 numbers with dots between them.

Each number ranges from 0 to 255

Sample IP Address:

129.100.23.247



Home Address	Phone Number	IP Address
1151 Richmond Street, London, Ontario, Canada	1 (519) 679-2117	129.100.23.247
Canada	1	129
Ontario	519	100
London	679	23
1151 Richmond Street	2117	247

EXCEPT ⍰ IP addresses are NOT geographical so just think of this as an analogy not exactly done like this!

IP Addresses

IP Address ? Ways to Represent It

Is always 32 bits

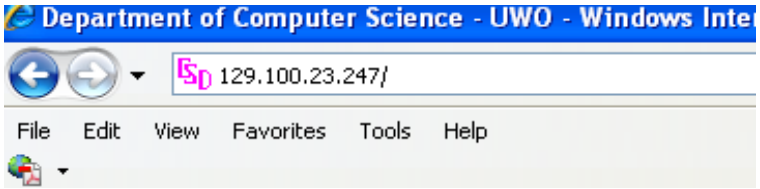
IP address can be expressed as:

Type	Example
Dotted Quad	**129.100.23.247 (most common)**
Binary	10000001 01100100 00010111 11110111
Hexadecimal	81 64 17 F7
Decimal	2,170,820,599

Newer ones are 128 bits (2^{128} different possible addresses) ? IPv6. We wont be looking at them!

Some Experiments with IP Addresses

If you have a laptop, type the following IP address into the address bar of your web browser: **98.158.91.201** and hit enter:



Give me 4 random numbers between 0 and 255 and I will try them on my machine ⍰

Another experiment

In Windows, go to Start>All Programs>Accessories>Command Prompt

Type the command: ***ping gate.csd.uwo.ca***

then type

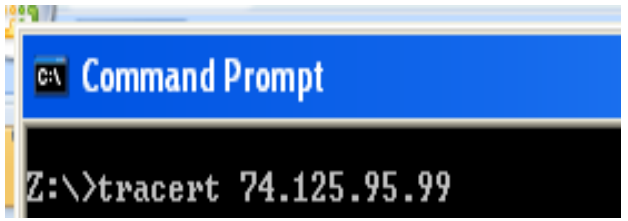
ping 123.123.123.123

then type

ping 129.100.22.120

Let's see an actual route: at the Command Prompt, type:

tracert 74.125.95.99



http://www.youtube.com/watch?v=tAv_eLm7DMk

Recap

Go to: http://www.hcidata.info/host2ip.htm

Go to: http://www.whatismyip.com/

Watch this movie: http://www.youtube.com/watch?v=RbY8Hb6abbg

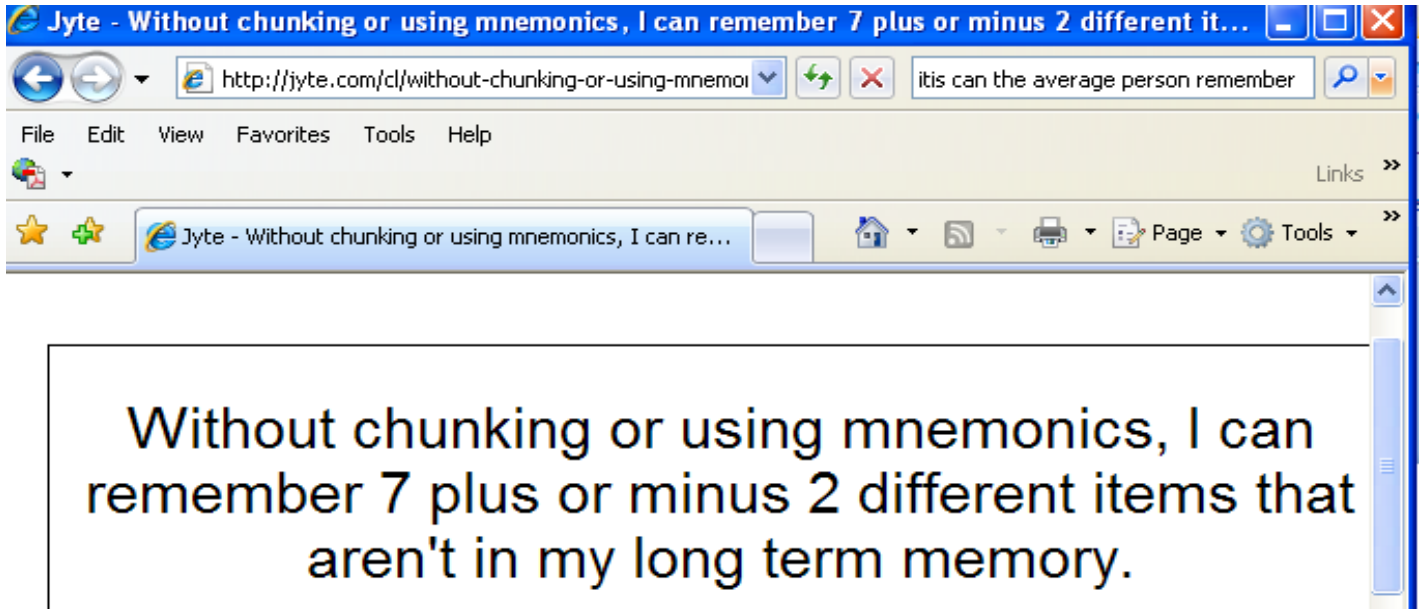
Why is this the first time you are hearing about IP Addresses?

Question: How come you don't just use IP addresses in your web browser? What do you use in your web browser?

IP Addresses and Domain Names

Numbers are hard for us to remember!

Phone numbers are 7 digits for a reason!



Domain Names to the Rescue

In 1973, IP Address became the standardized way to identify machines on the Internet.

In 1984, University of Wisconsin came up with a *name server*, that maps a name to an IP address.

In 1985, Domain Name System is established and the initial top level domain names are introduced.

Domain Name History

In 1990, the Internet moves beyond of the world of the government and universities and into the commercial society.

Up until 1995, you didn't have to pay for your domain name, 1995 to 1998 you paid the NSF (National Science Foundation) $100 US dollars for a 2 year registration for a domain name.

In 1998 the assignment of domain name is opened up to private companies to encourage competition.

How does a Domain Name work?

Every machine on the internet gets an IP Address

A **DNS** (Domain Name System) maps the domain name to the correct IP address.

In most cases there is a **one to one** mapping between an IP Address and a Domain Name:

- **129.100.23.247 maps to www.csd.uwo.ca**

Sometimes one IP Address might maps to more than one domain name:

- **155.12.12.12 might map to www.chapters.ca and www.indigo.ca**

Sometimes one domain name might map to more than one IP Address:

- **155.12.12.1 and 155.12.12.2 and … 155.12.12.77 might all be web server machines for www.msn.com**

- http://www.hcidata.info/host2ip.htm

Domain Names

Domain Names identify machines on the Internet, for example a web server machine.

A ***Web server*** contains all the web pages for a company or individual.

Web pages are stored on the ***web server*** machine (sometimes the machine is called a ***host)*** in folders or directories(web site)

A ***web site*** is really a folder

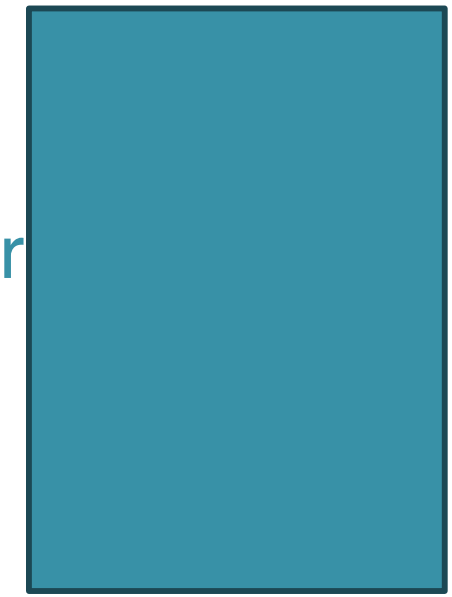
Web pages are just files, usually with the extension ***.html***, for example: *myhomepage.* ***html*** or *prices.****htm***

Question

Web Page

Web Site

Web Server



Machine/Host (usually called www)

File

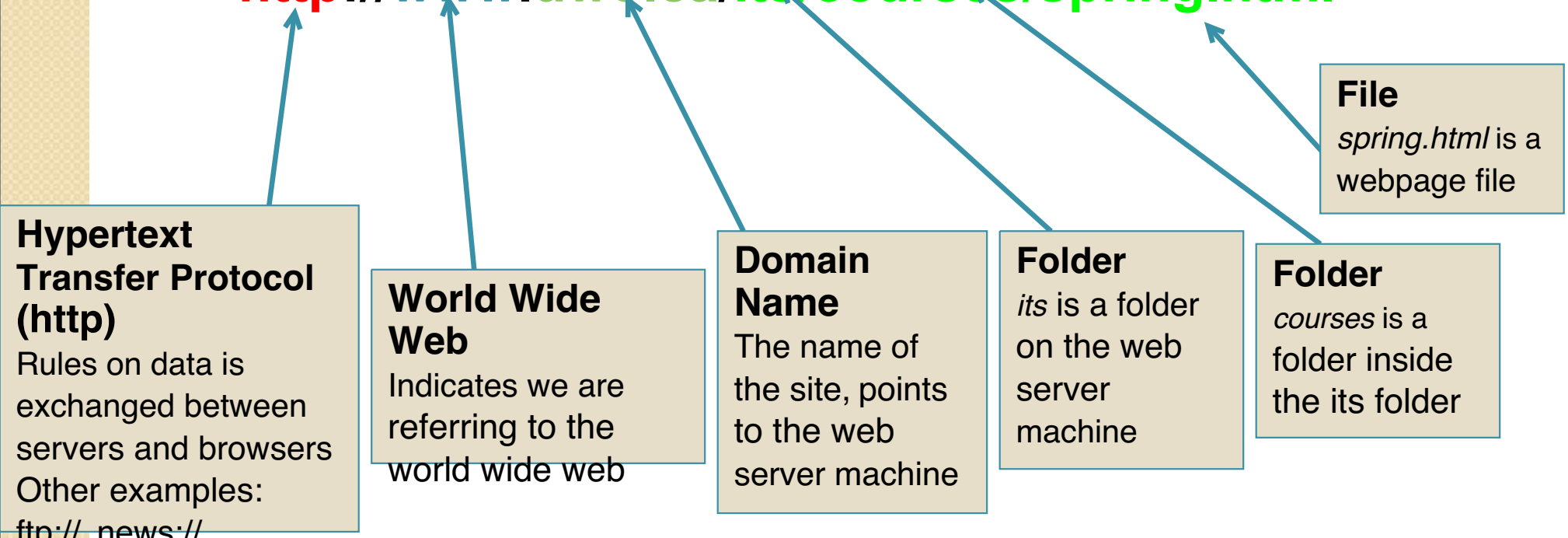
Folder/directory

URL

A URL (established by Tim Berners Lee in 1990) points at a web page on the internet.

For example:

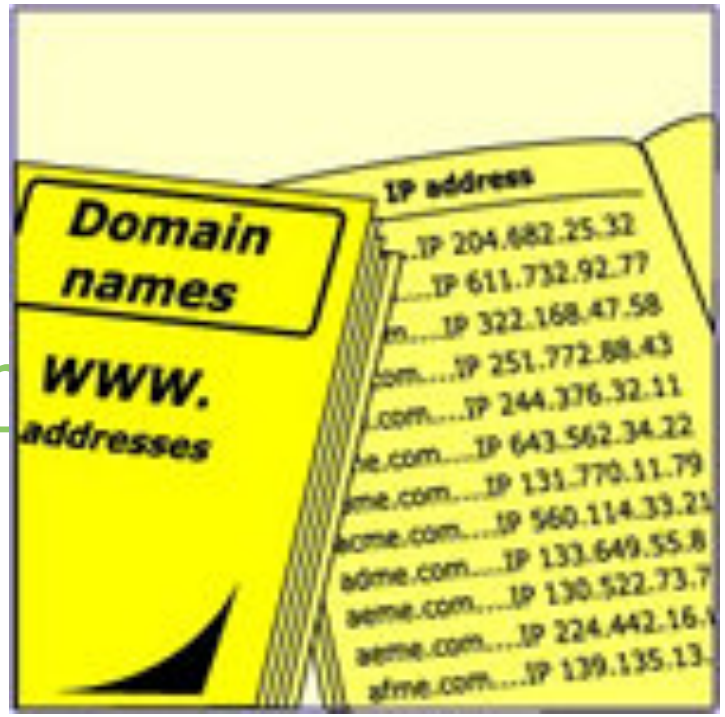
http://www.uwo.ca/its/courses/spring.html



Domain Names Systems (DNS)

A Domain Name System/Server (DNS) maps the domain name to the IP Address.

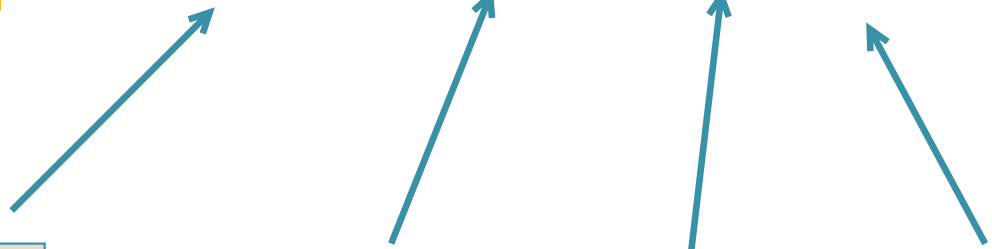
Like a big phone book of Domain Names and IP Addresses



http://www.youtube.com/watch?v=dE4rsNuG0aw

Let's break down the Domain Name!

http://www.csd.uwo.ca



World Wide Web
Not a part of the domain name, usually it is just the machine/host name that is the webserver

Third Level Domain
Also a Sub domain
csd is a subdomain of the domain uwo.ca

Second Level Domain

Top Level Domain (TLD)
Rules exist for what you can pick, only certain combinations of letters have been established as allowable top level domains

Things to note:

- the domain is *uwo.ca*
- *csd* is a sub domain of *uwo.ca*
- *www* is not part of the actual domain name but it will be stored in the DNS

Sub Domains

Used to organize your web server (just like folders and directories organize your computer)

Example:

- http://www.uwo.ca
- http://www.csd.uwo.ca
- http://www.brescia.uwo.ca

- csd is a sub domain of uwo.ca
- brescia is also a sub domain of uwo.ca

Rules for Domain Names

Each item between a dot is called a level.

You can have a maximum of 127 levels (thus the top level domain is 1 level and the second level is 1 level, that leaves room for 125 sub domains).

Each level can be up to 63 characters long

The entire domain name (including sub domains) can not be more than 255 characters.

http://www.abc.def.hij.com

Question: What is the above domain name?

Question: How many sub domains does the above domain name have?

Rules for Domain Names

Must use one of the approved TLDs.

Each level must consist of letters, digits and hyphens.

Each level cannot start with a hyphen or end with a hyphen.

Each level must not contain a space.

Domain names are case insensitive. Can cause confusion!

Question: Do these domain names represent the same domain?

dogsrus.com

DogsRUs.com

Question: Fill in the following table:

	Domain Name	Valid or Invalid
A	we are the world.org	Invalid
B	We-Are-The-World.org	Valid
C	We_Are_The_World.org	Invalid
D	WeAre99%OfTheWorld.org	Invalid
E	We.Are.The.World.org	Valid
F	-weare.theworld-.org	Invalid
G	Wearetheworld.werock	Unsure?

Top Level Domain Names

An International Internet committee has established the allowable top level domains:

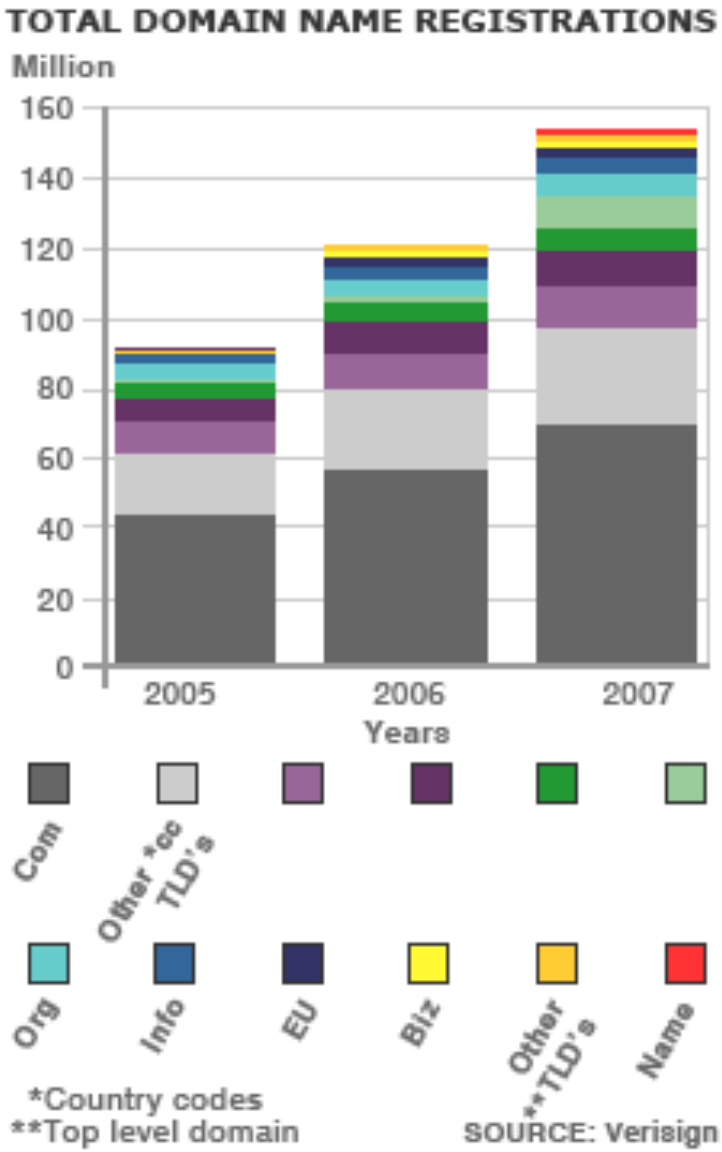
Question: Can you name at least 5 other top level domains? (E.G. .realty)

http://data.iana.org/TLD/tlds-alpha-by-domain.txt

https://www.apple.com/ca/legal/intellectual-property/tld/registration-policy/

- **Question:** after .***com*** what do you think is the most popular TLD was in 2007? Not what you might think ?

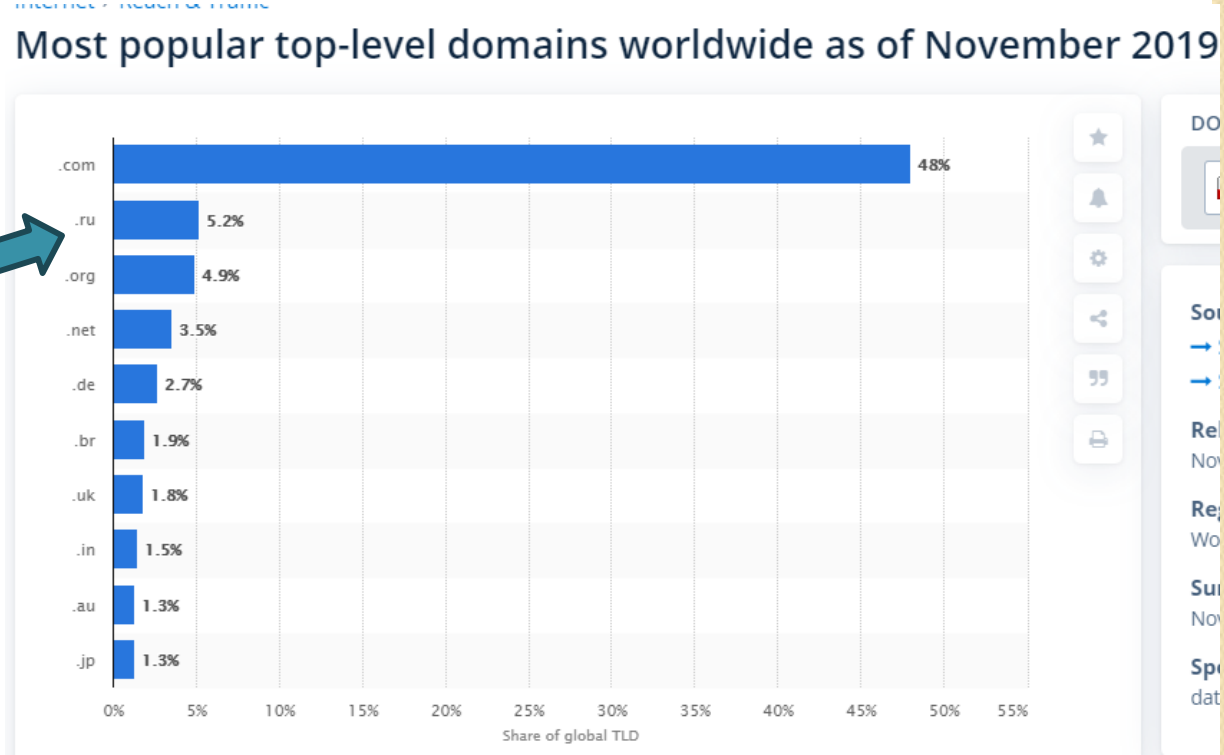
.



Usage as of 2019

Why do you think .ru is popular?

Answer



Top Level Domain names

Original ones were:

- .com, .org, .net, .int, .edu, .gov, .mil

Then country ones appeared (all 2 letters)

- .ca, .ae, .uk, .de

Then geographical ones:

- .asia, .berlin, .vegas

And now…Brand ones:

- .Bloomberg, .Barclays, .youtube

ICANN has now approved ones like:

- .adult, .apartments, .flowers, …

List of most expensive domain names

Tracing Routes Using Domain Names

Review:

https://www.youtube.com/watch?v=5o8CwafCxnU

Why should you care about Domain Names?

Let's assume you are about to start a new business:

Do you need a website?

- YES, YES, YES

Essential for competition!

Nowadays your customers don't just want a website from you, THEY EXPECT A WEBSITE!

Successful businesses take full advantage of the Internet:

- **Google** **Fact**: as of 2007, Google passes Microsoft as the most visited website in the world.
  - **Question**: Name some other sites that have now passed Microsoft https://en.wikipedia.org/wiki/List_of_most_popular_websites

Starting to think about your business

Perhaps you will need flyers/advertisements

You may need business cards

You might design a logo in Photoshop

You SHOULD have a website

You will legally need a company name.

Question: Why is the *company name* important in terms of your website?

"I'm one of the Top 100 dot.com companies who are actually making a profit!"

Picking a domain name: SOME SUGGESTIONS:

1. **Keywords, Keywords, Keywords-** Since our goal is to drive highly targeted traffic to our site; we need to pick a domain name with our keywords in it. Search engines give a lot of weight to domain names. If your domain name matches a keyword phrase that has traffic, you will get higher rankings. For example, if your site is called www.marketingcompany.com, this phrase gets tons of searches a day, so we will get free traffic coming to our site.

2. Be Memorable- Your domain name should be descriptive, memorable, and easy to spell and pronounce. For example, www.myspace.com

3. Avoid Hyphens- Most people won't remember the hyphen. However if you want to get www.joshfuller.com and it is taken, only then should you try www.josh-fuller.com.

4. .Com First- Buy a .com extension because it's the default extension in most people's mind. Many times a .com extension is going to be taken so you will need to try .net, .biz, .org, etc. Always try to get .com first.

More Suggestions

5. Keep it Short- Keep in mind that people need to be able to remember it, and type it. Focus on the shortest name that your customers and visitors will associate with your website. For example, www.pcworld.com, is much more effective than www.powercomputingworld.com

6. Kill Procrastination- Don't wait to register your domain name. If you are thinking about registering a domain name and it's available, what are you waiting for? Just like offline real estate, online real estate is being bought up fast. Register before you loose the opportunity to get the name you really want.

7. Get Creative- If your first choice is already taken. Add "e" or "i" or a number in front of a name, for example www.isurfing.com. Another secret is adding "web" or "net" in front or at the end of a name. Combine short, meaningful, catchy phrases or words that describe your business or site. For example if www.cheaptrips.com is taken, try www.webcheaptrips.com or www.cheaptrips4u.com

More Suggestions

8. Know the Rules- Remember that domain names can only use letters, numbers, and dashes. Spaces and symbols are not allowed. Also, domain names are not case sensitive.

9. Testing, Testing, 123- Before you purchase your domain name, spend a couple minutes testing them. See what your friends and family think of your choices. You may have a name you think is perfect, however it may be difficult for people to remember and/or hard to spell.

10. Learn from Monopoly- In the board game Monopoly, the person who usually wins, is the person who buys up the most real estate. Online real estate is no different. Purchase domain names similar in spelling to yours. The truth is, most people can't spell. Every day millions of people misspell domain names. Inevitably, they will still land on someone's web page. I have typed in www.utube.com, instead of www.youtube, a couple times and landed on some sort of tube manufacturing website. Utube is getting thousands of free hits to their site, just because they are similar in spelling to Youtube. If your website is www.cheaptrips.com, consider buying www.cheeptrips.com and www.cheeptrip.com.

11. Which Online Realtor to Use?- Go to www.GoDaddy.com. Start with The Domain Search Box and search for a name that is available. Once you find a name that works, go ahead and start the check out process. Your new domain name will only cost you $8 - $10. Skip all of the extra services they will try and sell you. No need for them. You only have to register domains for 1 year at a time to keep costs down. They will automatically renew each year or GoDaddy will notify you to do so.

From: http://billionairebythirty.com/2009/05/how-to-pick-a-domain-name-to-drive-traffic/comment-page-1/

How do you find out if the Domain Name you want is available?

Find out from a website that lets you purchase domain names such as:

- www.godaddy.com
- www.mydomain.com
- https://www.101domain.com/
- www.register.com

Pay per year, must reregister every year or every few years

To Host or Not To Host ? That is the Question!

You have:

- Picked a domain name
- Registered it and paid for it

Now you want to find a company that will hold/host your website (keep the files that make up your website) OR perhaps you can set up your own webserver in at your company or home?

Don't Host? That is the answer!

4 Reasons NOT to Host Your Own Website:

Expensive: Server and server software (web server, mail server, firewall, virus protection etc.) can be expensive.

Continual Connection: The server needs a 24/7 high speed connection to the internet, which is relatively costly.

Technical: Setting up all the configurations including mail server, FTP server and DNS server can be complicated.

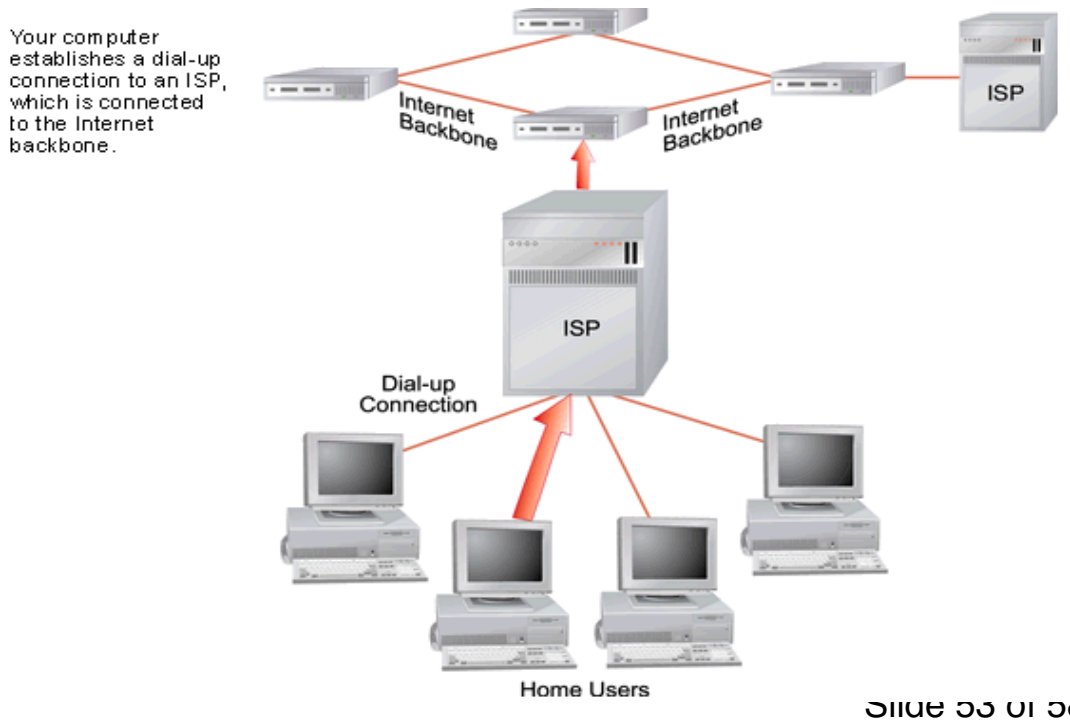
Support: Server maintenance requires 24 hour support, special skills and knowledge.

Find an ISP Internet Service Provider

ISP A company that provides access to the Internet

Maintains one or more machines that are permanently connected to the Internet

Offers connections via telephone lines, cable, satellite dishes.



ISP

Provide user with:

- User account for accessing the Internet
- Email access
- Web Space to host/hold your website

Some ISPs are:

- Rogers
- Bell
- Execulink
- Western (at least while you are a student here)

What to look for in an ISP

Top 10 Reasons to pick an ISP

Disk Space ? Always get more, Standard 5 GB – 10 GB

Bandwidth ? bandwidth is the amount of traffic that is allowed to occur between your web site and the rest of the internet in a given time period (static pages go with low; need for downloads go with high)

Web Site Speed ? Web site speed is a given… slow.. Poor service (ask for some websites and try it out yourself)

Database/Programming Language Support ? Needs for dynamic website – interact with customers. Perl, Java, PHP etc…

Technical Support ? Test by sending them an e-mail and see response time, Contact names, e-mails, phone numbers, hotlines

UpTime ? Look for 99% plus guaranteed

FTP Access ? Unlimited and unrestricted FTP access for easy maintenance

Web Statistics Summary: ? Traffic on your website- Easy access to your information… control

Scripts availability ? counters, forms support.

Web Provider ? Reliability? How long? Popular?

registration and renewals so you can focus on your business.

Our web hosting services include:

- Free domain registration and renewal management
- Email hosting using your domain name (ie. you@yourcompany.com)
- Spam and virus protection on every mailbox
- Secure web mail access
- No setup fees!

Package:	DNS Hosting	Emails	Web Container	Database	Monthly	Yearly Domain Rene Included
Standard Web Hosting	Yes	25	Yes	Yes	$30.00	Yes
Basic Web Hosting	Yes	5	Yes	No	$10.00	Yes
Domain Hosting	Yes	No	No	No	$5.00	No
Domain Redirection	No	No	No	No	$5.00	No
Domain Registration	No	No	No	No	$0.00	No

Web Container Features:

- Automatic daily backups.
- Includes an auto-renewing SSL certificate.
- SFTP for secure file transports.
- 30 TB of monthly data transfer.
- 20 Gigabytes of storage
- PHP 5.6 or PHP 7.X Support.

Okay, I have the Domain Name, what is next? **Stage 1: Planning and Design**

Define the Business Requirements

- Meet with the client:
  - Be prepared
  - Ask questions ? LISTEN TO THE ANSWERS
  - Learn as much as you can about their business
  - Ask for all the reports they generate, the forms they fill in, their printed brochures, etc…

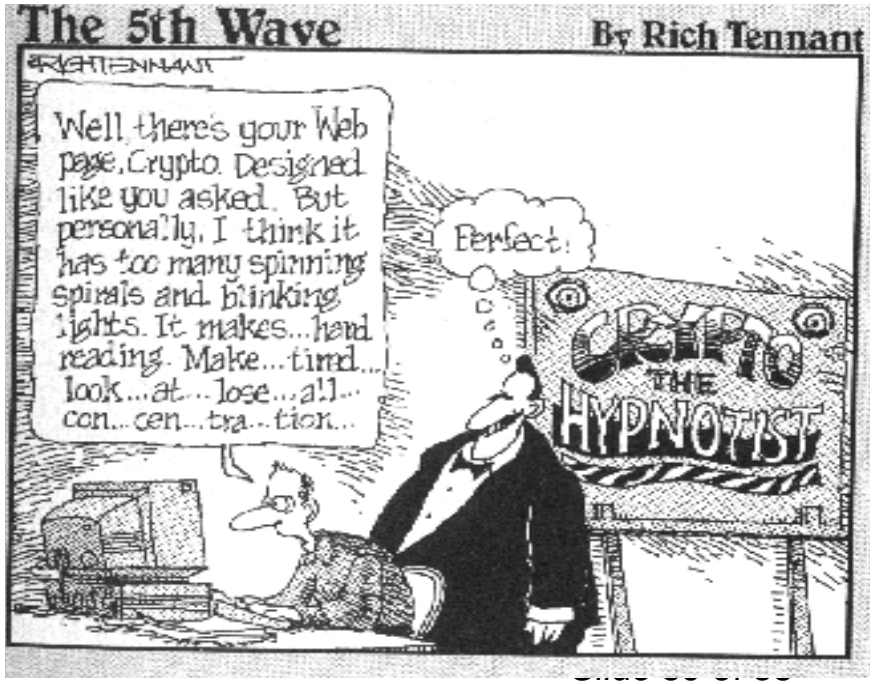
What questions should you ask your clients?

- Who will their primary audience be?
- What is the company's image?
- Do they have a company logo (this will help you with colours and a theme)? How about some other graphics/images?
- Will the company's focus change over the next year or so?
- What content will be on the page? This might help you figure out how to organize the material!

Questions:

Think of some of your favourite websites, what is it about those websites that you like?

Think of some websites you avoid, why do you avoid them?



What is the best thing you can do when designing a new website?

Review

- https://www.youtube.com/watch?v=AYdF7b3nMto