APPLIED COMPUTING 1P01
Fluency with Technology
The Internet and The Web

APCO/IASC 1P01

Brock University
Introduction to the Internet

Terms and Concepts

Before we begin, we first need to understand what the internet is, and how it fits into our digital lives. For that, we first need to define a few things:

- Protocol
- Network
  - Internet
- Connection
- Stream
- Server and Client
  - Server-side and client-side
- Spoofing
- Address
  - Email address
  - IP address
  - Mac address
  - URL
Introduction to the Internet

So, what is the internet?

Techie answer:

- The collection of connections (both literal and virtual), communications, protocols, services, and designations that allow for discrete packets of information to be transported between devices, along with the addressing and routing schemes necessary to facilitate that (just off the top of my head; don’t quote me on it).

Practical answer:

- It’s what lets different computers — whether yours, your friends’, or businesses’ — to talk to each other. It lets you use a program on one computer to talk to another program on a distant computer.
Introduction to the Internet

Can I get just semi-techie?

Like most things in computers, internet-facilitated communication is typically *abstracted* into multiple *layers*.

- Refer to the diagrams I should be drawing on the board

It is this abstraction that lets you *not* have to worry about everything that’s going on under the hood.

- To that end, from here on, we’re going to primarily focus on *what* you can do, rather than *why*
Getting Online

ISPs

You connect to the internet through a *gateway* — a connection between one network and another. But, what and where is that gateway?

- A typical gateway is your *Internet Service Provider (ISP)*
  - Your home network has a modem (or very fancy router) that connects to the ISP
  - All of your internet traffic then goes from that home network, and through that gateway, before getting to the rest of the internet
  - The ‘quality’ on your connection will depend greatly on the service you’re getting from your ISP
Getting Online
Types of Connections

Of course, there are numerous options, but common home connections include:

- Fibre optic
- Cable internet
- DSL
- 56k Dial-up

The most appropriate option for you will depend largely on your needs, including:

- "Speed"
- Total allowable downloads within a unit of time (i.e. monthly caps)
- Usage (obviously this is related to speed)
- Cost

That said, not all options are available in every area.
Getting Online

Cellphone Tethering

Most cellphones these days have some form of internet connectivity

- Whether 2G/EDGE, 3G, 4G LTE, etc., what matters is that it can ‘talk’ to the internet

Since cellphones are also typically capable of some other form of communication (wireless, via a cable, etc), they can act as a bridge to provide internet capability to other devices

- This is called tethering
- Most service providers that allow it at all charge extra
- Note that, for myriad reasons, this tends to be less responsive than other connections

For those who can’t (or don’t wish to) do this with their phones, mobile hotspots may be a viable alternative

- It’s generally easier to get them up and running; especially to act as an access point
- They typically require a separate plan
Getting Online
Clearing Up Terminology

To be clear, let’s just make sure we understand each of these terms:

- Modem
- Router
- Wireless Access Point

We’ll be revisiting some of these in a few weeks
Everybody wants a “fast” connection, but what does that really mean?

- **Throughput?**
  - *Downstream* or *Upstream*?  
    - *(Downloading or uploading)*

- **Latency?**

- What the heck is “bandwidth”?  

Additionally, some customers might benefit from a *static IP address*, while others are fine with *dynamic*  

- What’s the difference?  

- Are there additional options?
Measuring the Speed of Your Connection

Take a quick trip to http://www.speedtest.net

How did your connection fare?
How did the upload rate compare to download?
What does your ‘ping’ mean?
Back to Protocols

As mentioned earlier, communication requires that both ends be using the same protocol.

- This means that different types of service can be identified by the protocol they use
  - For example, can you guess what the File Transfer Protocol (FTP) is used for?
- One interesting protocol is the Hypertext Transfer Protocol (HTTP)
  - Hypertext is basically just a text document that includes references to other documents and files
  - The HTTP protocol delineates precisely how such files may be requested by a client and how that information is to be transmitted, as well as information about the client program making the request
  - Each of these documents may also be called a web page, because they are simply pages with links to each other (spanning out like a web)
  - The World Wide Web is effectively just the totality of these web pages, and the underlying service for retrieving them!
    - This means that the web is built on top of the net!
The World Wide Web

As mentioned, the web is basically just a collection of documents, hosted on *web servers*, offered up to requesting clients

- Those requesting clients are called *web browsers*
- Web traffic is actually bidirectional. The client sends information, in addition to receiving it
  - This is obvious from the fact that it must be able to make requests
  - What are other examples of a web browser *sending* information to a server?
- Note that, because the web follows a *Client-Server model*, web clients do not *directly* interact with each other
  - e.g. The last time you sent a private message to someone, you weren’t sending it *to them*
Web Browsers

Common Browsers

- Internet Explorer
  - Still an important compatibility target for developers
    - Its ubiquitousness also makes it a frequent target for exploits/malware
- Google Chrome
  - Redefined the process model
    - Wants all of your computing resources! omnomnom!
  - Introduced a far more powerful JavaScript engine for web apps
  - Growing support for extensions
- Mozilla Firefox
  - Popularized tabbed browsing
  - Amazing support for extensions
  - Has a long storied history of memory leaks
- Opera
  - Inspired features in other browsers, including layout of home screen
  - Good adherence to standards
    - Which is good, because nobody develops with Opera in mind
- Safari
  - Included with OS X
  - It’s a thing
Browser Profiles

Your web browser (by default) collects quite a bit of information as you browse:

- Your browsing history
- Your logins and passwords
- Your searches
- Terms you fill out in forms

It also stores a *cache* of files (both documents and images) you’ve viewed, so it can more quickly bring them back up when next you return.
Browser Profiles

What does that mean?

- The next person who uses your computer (or a public computer after you) can see what sites you were on
  - If you forgot to log out, they may even be able to “be you” online
  - If more than one person commonly uses the same computer, you can keep accidentally being each other
- Websites can more easily build up a profile of you, for targeted ads
- Searches may start being more helpful (which is good!)
  - But can also keep leading to ads trying to sell you golf clubs just because you went shopping for a gift once two years ago (which is bad/annoying)
- The browser can keep track of all of your bookmarks for you
  - Neither here nor there, but some browsers like Chrome can actually store this profile information online, so you can have your bookmarks on different devices

The point is, oftentimes, it can be good that your browser just “remembers” things about you. But, what about when you *don’t* want it to remember you? You can always clear private information from a browser, but you must remember to do this each time, after the fact
Privacy Mode

Privacy Mode — AKA Incognito Mode or InPrivate — is simply a way to tell the browser to not remember things about you.

- Since it will actually retain cookies for as long as it’s active, it may be more accurate to say that it creates a temporary profile that’s automatically deleted when you leave the mode.

There are lots of legitimate uses for it:

- Shopping for gifts
- Using someone else’s computer (or a public computer)
- Quickly checking a site (while logged in under your profile, and without having to log off)
- Discouraging the connection of browsing habits to identity

However, since it only affects your end, DON’T RELY ON IT FOR PRIVACY OR SECURITY!
Web Page

Or webpage

Like we said, a web page is really just a document, retrieved from a web server

- We request a specific document via its *Uniform Resource Locator (URL)*
- e.g. http://www.cosc.brocku.ca/offerings/apco1p01
  - The *scheme* (http) indicates the protocol
  - The *server name* (including the *domain name*) is how we identify the server to which we are making the request
  - A *folder name* (e.g. /offerings/) specifies the relative path
  - The *file name* (e.g. apco1p01) is the actual document we're requesting
    - Usually the file name includes an *extension* (e.g. .htm, .html, .jpg) that also acts as a hint to the server as to how the media should be handled
HyperText Markup Language
i.e. HTML

Web pages (HTML documents) are typically just plaintext files that include both text to display and notes to the browser that additional components should be retrieved/displayed

- e.g. a web page could include a ‘tag’ to include an image
  - The browser, upon seeing this, would then re-contact the web server to request that image, and then display it in the rendered document
- HTML contains many tags for numerous types of referencing of resources and formatting
  - We'll devote a couple lectures solely to this topic later!
- HTML can also include instructions to run scripts — small snippets of code — to perform different actions within the document
  - This is the foundation of “web 2.0” and web apps
- If appropriate plugins are included with the browser, the document may also embed different forms of media (e.g. a flash-based video player)
HyperText Markup Language

HTML Authoring

There are different ways to create webpages. Some involve explicitly writing out HTML, while others are no more complicated to use than a word processor.

Later in the course, we’ll learn a bit of the process of manually creating webpages, which should also make it slightlier easier to do things the “easy way”
Web Pages

Mobile Sites

It’s outside the scope of this course, but when requests are made for files, the browser actually includes several additional pieces of information along with the request

- One of these tidbits is the *User Agent*: an identifier of your platform/browser
  - It’s how a website knows you’re on a phone or tablet
- Many sites offer a *mobile version* (some offer more than one!)
  - Mobile sites often expect a smaller screen size, and typically include larger buttons and/or simpler UI elements
    - Some sneakier services also pump in more ads, because ad-blocking software is harder to set up for mobile platforms
- Though your user agent may be what causes you to get redirected to a mobile site, you can often get there manually on a desktop/laptop if you wish
  - Similarly, many mobile sites include links to their desktop versions
Domain Name System

i.e. DNS

We’ve already said that we identify a computer on the internet by an IP address. However, *humans* identify services based on easy-to-remember names

- A *DNS server* is a special server that, when queried about a domain name, returns an IP address
- e.g. www.cosc.brocku.ca is actually 139.57.100.6

Wait, wait, wait… we were only going to talk about things that might matter, right?

- Would you recognize if your DNS server went down?
- Have you ever wanted to access a computer from home?
- Are you interested in VPN or tunneling?
- Would you like to set up a webcam for security reasons when you’re on vacation?

Then you need to know a bit about DNS!

http://www.vladstudio.com/wallpaper/?how_internet_works
HTTP vs HTTPS

Who knows what evil lurks in the hearts of man?

- Suppose someone walks up to you and tells you they’re the queen of England (and I guess Canada). Would you believe him or her?
  - Establishing identity can be a bit trickier than that online...
- Do you remember anything about *packet sniffing*?
  - Perhaps we should revisit that...

Let’s have a chat, shall we?
Search Engines

Search engines aren’t nearly as old as the web

- That’s a scary thought, eh?

Let’s have another chat, shall we?
Common Websites

Of course, you already know that the world wide web has quite a bit of content on it.

Once one provider realizes that there’s a particular appetite for a type of service, it isn’t long before others start offering their own similar services.

Sometimes these directly compete; other times they happily coexist.

Examples include:

- Forums
- Wikis
- News services
- Social media
A Note on Social Media and Broadcasting

Always make sure that you know your rights

- Social media services almost always retain at least non-exclusive rights to everything you say and do on their service
  - i.e. Even after you stop using the service, they still *can* use your words or likeness
  - This also includes sharing your information with *affiliates*
- For broadcasting services (e.g. YouTube, Twitch), there can be numerous legal snags for licensing and monetization
  - I won’t bore you here, because it won’t apply to most of you; just make sure that you do your homework if you’re doing something that really matters to you
Cookies

*C is for introducing state information to an otherwise stateless protocol,*
*that’s good enough for me...*

I imagine most of us have a rough idea of what cookies are, but first let’s just make sure we’re all up to speed.

... (are we done talking yet? Yes? Good!)

We should also know about:
- Using them to track identity and build up marketing profiles
- Third party cookies
- Other similar tracking techniques
  - e.g. “Flash cookies”
Ads and Ad-Blocking

How much do we know about this, and how much have we thought about both sides of the subject?
Electronic Mail (E-Mail) is not, intrinsically, a web service. Rather, it’s another internet-enabled service, parallel to HTTP. It allows us to compose and send text messages to each other, without having to worry about how to physically deliver them.

Let’s have quick chats about:

- Email clients and POP
- Web-based clients (and IMAP)
*ahem* STOP BEING A JERK ONLINE! (sorry)

- Always include a *meaningful* subject line with your emails
  - This not only helps the recipient to realize the email isn’t spam; it also helps them find the message again later if they need it for future reference
- Always start your messages with a salutation!
- End with a proper sign-off
- Actually use complete words
  - ‘U’ is not a word
- Only use smilies/emoticons in an informal setting
- Humour and sarcasm do not convey well; assume words will be taken the worst way possible
- Be careful when using CC and BCC
  - Only CC someone to remind the recipient that a request is formal
  - BCC is only ever appropriate for sending a copy to yourself
- Never send an email while angry
  - If this is not possible, sleep on it to see if you’re still angry
Email

Security Concerns

- Privacy
  - Assume everything not encrypted is being read

- Identity
  - Email addresses are pretty easy to spoof
  - Even “legitimate” email can come from a compromised computer

- No service will ever ask you for your password, or pre-emptively provide you with a password reset link because of compromised security
  - If any service ever *does* actually do that, stop using that service
  - In other words, beware of *phishing*

- Most email services are decent at identifying spam, but sometimes they’re overzealous

- What should you do when you receive an unexpected attachment “from a friend”? 
  - Just open it if you believe the address is legitimate?
  - Delete it immediately?
  - Something else?
Speaking of Passwords...

- Do we know how they work?
- Do we know how websites use them?
- Do we know when not to reuse passwords?
- Do we know when to *really not* reuse passwords?
- Should a website know your password?
- Most operating systems either include a tool, or have a popular tool, for managing passwords.
  - If you use one, it should be guarded by your most secure password ever.
Online Payments

There are two reasons a credit card number could become compromised:

- The act of entering it could be monitored
- The company at the other end could be reckless with it

Treat both seriously, but the latter is the bigger concern.

- Alternatives include PayPal, Amazon Payments, and Google Wallet
- You’re still trusting someone else with your information, but it’s still generally safer this way
Additional Security Concerns

- Pharming (and simply relying on common typos)
- Firewalls
- Network Address Translation (NATs)
- Open WiFi hotspots
- Your online identity and presence
  - Besides the information you consciously share with companies, consider how much information about you may be available online
    - Could anyone who read your facebook page answer security questions about your school, first pet, etc.?
    - Let’s see a different example
Bits and Bobs

Obviously there are numerous other uses for the internet; it’d take weeks to scratch the surface.

Other common uses include:

- **Backups**
  - The chances are good that *some* storage device in your life will fail eventually
  - Automated backups are usually the most reliable, since they don’t rely on memory
  - Remote backups (on the internet) might compromise security, but local backups may miss the point

- **Filesharing and Torrents**
Questions?