**Computer Applications**

**The Internet – Summary of Notes**

**Day 01 (The Internet)**

The Internet didn’t always have millions of web pages, games, and videos. The original reason for the Internet was to create a communication network for the US. They wanted a network of computers that could share information across the entire country. This would be useful for research, and also useful in creating a communication system that was more reliable and useful than standard telephone lines. While it is true that the network would be useful in the event of a war, it wasn’t the main reason it was made. They wanted the network to continue to work even when certain ‘paths’ were not working. They also wanted a single computer to be able to talk to several other computers at once, unlike a phone conversation where you are only talking to one person at a time (they didn’t have party chat back then!). So a few universities on the west coast of the US in the 1960’s started working on this.

They eventually made a network in which data is sent in small chunks called *packets*. Each packet has the address of the sender, and the destination address, and a piece number. Packets travel around the Internet passing through *routers* until the packet reaches its destination. Routers are now found all over the country, and there could be many paths that a packet could take to get to its destination. Routers are connected by wires, satellite, underwater cables, radio and microwave towers, etc.

Routers are all connected to other routers to form a web like network. Each router is constantly asking the router/s next to it who they are connected to and how good/fast the connection is. By doing this, each router quickly learns and remembers the overall map of the Internet. The routers can quickly calculate the possible paths to go from Vancouver to Hong Kong, and which pathways will be the quickest. If one router breaks down, the routers figure this very fast because they keep talking and they will not send packets to this router.

When you send messages and files across the Internet, they are broken down in packets. The packets may or may not take the same pathway to their destination. They might even arrive in a different order. That’s why they are numbered when they are sent out. When they arrive, they can be put back into the correct order to make the message. Sending data in small chunks is good because it allows for different pieces to take different pathways to make sending as fast as possible. It also makes it easy to re-send data that doesn’t make it properly to the destination – the router just has to resend a tiny packet instead of the entire message (which could be large if it’s a big file like a movie!).

To make sure that data makes it to the destination safely, routers will send a ‘Got it!’ message back to the router that sent the packet. This lets the sending router know everything went well. If it doesn’t get the ‘Got it!’ message, it must resend the packet again.

How does your computer connect to the Internet’s routers? You pay money to an ISP (Internet Service Provider). These are companies like Shaw, Telus, etc. Signals go from your computer to the ISP using phone or cable lines. The ISP is connected to the larger routers of the Internet.

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**Day 02 (Finding out where you stuff is going - IP Addresses)**

You’re going to send a message, video, song, or visit a webpage. How do the packets know where to go?

Every computer directly connected to the Internet has an address called an IP address (Internet Protocol Address). This address is made up of 4 numbers in the range 0-255. Example: 135.85.203.42 . While this allows for many different addresses, the world has actually used up all the possible addresses! They are now switching to a 6 number address system to create more addresses.

You don’t type the IP address into a browser when going to a website like *www.janetka.com*. You just type www.janetka.com. Somehow your browser figures out what the IP address is. But how? Your computer connects to your ISP (Internet Service Provided) and requests the address for www.janetka.com. Your ISP has a special program/computer running called a DNS (Domain Name Server). It keeps a list of all website domain names and their IP address. So, in your ISP’s Domain Name Server, it knows that www.janetka.com is really 66.147.244.239. The packets leaving your computer are now sent off towards that address. That simple! This way your don’t have to remember IP addresses.

But how does the ISP’s DNS know the IP address of www.janetka.com? Good question. Thousands of website are being created every day, so there must be a system for finding out their IP address. Here is how it works. Every website that has a domain name that ends in *.com* must pay about $10 a year to own and register the name with a company called ‘The Dot Com People’. They have their own big DNS and record your name *www.janetka.com* and asks you for the address of your website (when you pay for a website, you are told the address). If anyone needs to know the address of www.janetka.com, they know they can ask the .com people since it’s stored in their DNS! So when the Domain Name Server at your ISP doesn’t have any record of www.janetka.com (like on the first week or two of it being created), it quickly contacts the .com DNS server. Every major domain name like .ca, .us, .net, .org, etc. will have a DNS that stores the name and address of the Internet sites.

How do you get your own domain name? You can Google a ‘domain name check’ website that will allow you to type in the name you are curious about. After you type in *janetkaIsTheBest.ca*, it will tell you if that address is available or not. It typically costs about $10 a year to own a domain name. Remember that in addition to a domain name, you will have to pay to have your website hosted somewhere. This costs between $5-10 a month for a small business website.

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**Day 03 (Digital Communications – all 0’s and 1’s)**

You’ve heard of the digital age. But what does ‘digital’ really mean in relation to computers, communications, and the Internet? It means that everything sent (text, sound, images, video) is sent as numbers. Everything saved on your computer, sent over the Internet, put on CD/DVD’s, etc. is saved as lots of 0’s and 1’s. Using only 0’s and 1’s for numbers is how *binary* works. In binary, you can only use 0’s and 1’s. You’ll can look for a longer explanation of binary on the Internet, but here’s a basic explanation:

 7 2 5 8 In our number system, 7258 means 7 thousands, 2 hundreds, 5 tens, and 8 ones.

1000 100 10 1

 0 0 1 0 0 1 0 1 In binary, the number 00100101 really means that you have 1 one, 1 four, and

128 64 32 16 8 4 2 1 1 thirty two. This adds up to 1+4+32 = 37! You can see how you can send any number

 you want using just 0’s and 1’s.

000000111 would be 1+2+4=7 in decimal. 11111111 would be 128+64+32+16+8+4+2+1=255 in decimal.

**But why use 0’s and 1’s?**
Computer chips are made up of tiny little transistors (millions on your fingernail!). Each transistor can be electrically charged ( 1 ) or not electrically charged ( 0 ). This works great for binary.

Fibre optics cable could send light on (1) or no light (0). Great for binary.

Internet wires can send electrical signals that represent (0) or (1). Great for binary.
CD and DVD’s have little pits in the surface. When the laser scans it, it either detects a pit (0), or detects no pit (1).

**How is music sent in binary?**

Music is just a quickly changing level of sound hitting our ears. The changing level can be recorded as a sequence of numbers like 180, 152, 75, 132, 184, 43, 65, 180, etc. These numbers are then converted to binary and then sent in packets. When they reach the destination, the binary is converted back to numbers, and then to sound levels again.

**How is a picture sent in binary?**

Every picture is made of pixels. Each pixel has a certain amount of Red, Green, and Blue in it. For every pixel in the picture, send the amount of Red, Green, and Blue as a number. For example, if the first pixel has the RGB values of 200,50,75, then you should convert these numbers to binary and then send them. When the person gets the binary, they convert it back to 200,50,75 and draw that pixel. You have to do this for every pixel. That’s why pictures can take up a lot of space.

**How is a video sent?**
A video is just thousands of pictures and sound put together. So combine the ideas above.

**How is text sent – they are not numbers!**

There is a code called ASCII that assigns every character on your keyboard to a number. The letter “A” is 65, the letter “B” is 66, the “\*” is 42. So when you send a text message, each letter is converted to it’s ASCII number, then this number is converted to binary. The computer that receives the binary converts it back to numbers and then looks on the ASCII table to see what letter was sent. “A” 🡪 65 🡪 01000001 🡪 sent received 🡪01000001 🡪 65 🡪 “A”

**Data Size**

A single zero or one is called a *bit*. A group of 8 zero’s or one’s is called a *byte*. 8 bits make a byte.
1 Megabyte (MB) is 1 000 000 bytes. 1 Gigabyte is 1 000 000 000 bytes. How many 0’s and 1’s in a 4 GB movie? Lots!

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**Day 04 (Email – What is going on)**

Everyone here sends email. The way that email works is very similar to the way that many ‘things’ are send and saved on the Internet. Use the picture on the handout to help you along here.

Jane@shaw.ca is sending an email to Bob@hotmail.com

Jane types the email. Her email *client* program sends the email to Shaw’s SMTP (Simple Mail Transfer Protocol) server.

The job of the SMPT is to try to send the mail until successful. If it encounters problems, it will send Jane an email telling her that there were problems.

The SMTP server looks at the email and sees that it is going to hotmail.com. It asks Shaw’s DNS (Domain Name Server) to check for the IP address of this site. Once it gets the address, it sends the email on it’s way in packets.

When Hotmail gets the email, it passes it to it’s SMTP. It’s SMTP talks to the POP (Post Office Protocol Server) to see if there is a user called Bob. If there is, the SMTP gives the message to the POP server for safe storage and sends a message back to the Shaw SMTP that everything has gone well. If there is no user called Bob, the email is thrown away and the SMTP sends the Shaw SMTP a message telling it that Bob does not exist.

To get the mail, Bob must sign in with a name and password at hotmail.com. When he checks his mail, hotmail checks the POP server to see if Bob has any emails being stored. There is one from Jane! It must be about the party on Saturday night. He clicks on it and the POP server sends the email to hotmail and then hotmail shows it on the screen.

**Some key things to remember here are:**
The SMTP server’s job is to send the mail, wait to see if it made it there properly, and try to resend again if it never gets a response from the destination. It also gives incoming emails to the POP server for storage.

The POP server’s job is to check to see if the user exists and store the email. When the proper name and password are provided, the email’s for that user can be read.

Notice how the SMTP’s always tell each other whether or not things went well. This is really important in all computer communications. You must know that things went well so that you know whether to resend or not.