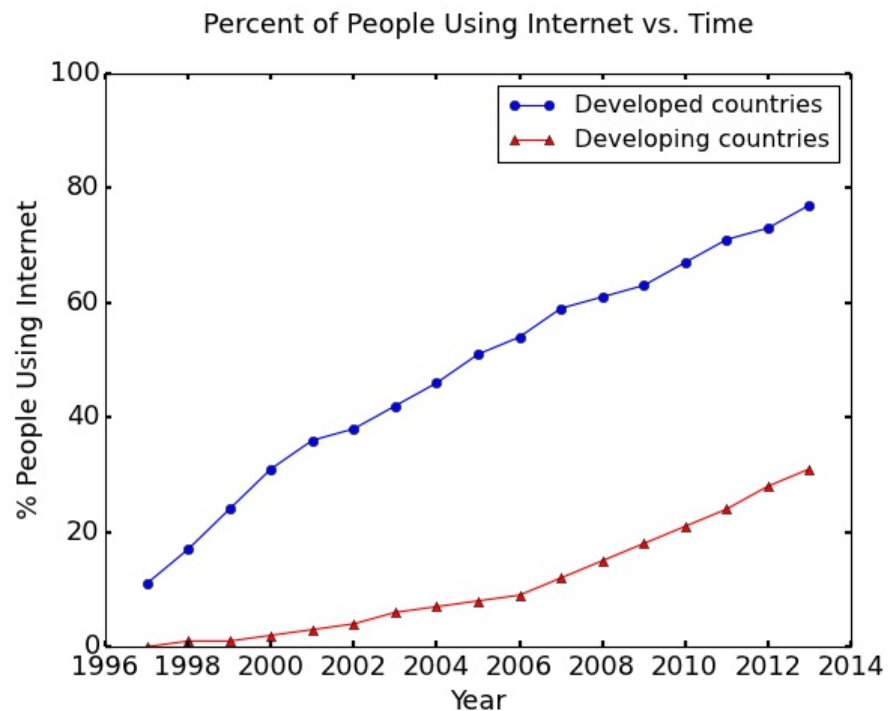


The Rise of the Internet

Introduction

The Internet has grown steadily since 1969, when the first message was sent between UCLA and Stanford. Then known as ARPANET, the network grew to 13 computers by 1970. Public use of the Internet grew rapidly with the introduction of the World Wide Web in 1991 and the legalization of ecommerce in 1995.

The Internet has, alongside computing power, grown faster than most people ever anticipated. How has it/will it continue to change and shape your world?



Materials

- Paper and a writing utensil
- Computers with Internet access for research

Resources

[The Pledge](#)

[Evaluating Sources of Information](#)

Procedure

1. Form pairs for the duration of the lesson, as directed by your teacher. Greet your partner to practice professional skills. Set team norms, including the following:
 - How will you handle any imbalance in participation?
 - How will you store information for the research and presentation components of this

activity?

2. Direct a web browser to the link <http://news.bbc.co.uk/2/hi/8552410.stm>. Use the slider on the page to “watch the Internet spread around the world.” (You may have to enable the Flash Player in your browser.) In 1998, about what percentage of the world's population would you say lived in a country with 0-5% of that country's population online?
3. In the ten years that passed between 1998 and 2008, in what countries did the percent of people using the Internet change the most?
4. One system with some similarities to the Internet is the postal service. Although the Internet and the postal service have many differences, they share many of the same concerns. Both rely on many components and protocols.
 - What is the primary purpose of the postal service?
 - What is the primary purpose of the Internet?
5. List four items that would be ridiculous to attempt to send through the mail. Explain to your partner why it would be bizarre to attempt to send each item through the mail.

Part I: Packets

6. The founders of the Internet had some great ideas that have contributed to its success. One key idea allowed computers to send arbitrarily large amounts of data by breaking the data up into **packets**. A packet is a small amount of data with a specific format. Smaller packets are less prone to error but then have to be reassembled by the recipient's computer. The postal service could do the same thing. For example, if Cyndy wants to mail a book to Biff, she could tear the book apart and mail each page individually. Biff could use the page numbers as a guide to reconstruct the book. Are there any items on your list from the previous question that could not be sent this way? Why can't they?
7. Because digital data can always be represented as bits, they can always be separated into packets and reassembled. Packets are used to send messages like email and texts, but they are also for sending web pages, images, music, or any other kind of data. To simulate how the Internet passes data between devices using packets, you will send a message using handout “2.1.1Aa PacketTemplate.”
 - The handout has eight packets. Your teacher has listed the recipient of your message on one packet. Copy the recipient's name to each packet on the handout.
 - Beginning with packet 1, write your message using 1 character per slot, up to five characters per packet. Recall that a blank space is a character.
 - On the first packet, record how many total packets are in your message.
 - Cut or tear along the dotted lines to separate your packets.
8. It is your goal to get all of your packets to your intended recipient as quickly as possible. Wait for your instructor to direct you to begin. Follow these rules.
 - You may not leave your seat and may only pass packets to people seated adjacent to you in any direction.
 - Four students in the center of the room will play a special role. Only these students can send or receive packets across the center line of the room.
 - Each person can only pass one packet at a time. Each person must silently count quickly to ten between handing off a packet and accepting a new one. If someone hands you a packet before you are done counting, accept it but keep it. This simulates the loss of packets when machines are overloaded.

9. A **router** is a piece of equipment that passes data packets between networks. One pair of students in your class served as the main router for the left half of the class, and another pair for the right. Why do you think routers might be necessary in the architecture of the Internet?
10. An **ISP (Internet Service Provider)** is a company that provides users access to the Internet. These companies may own routers, cell towers, and other hardware. What makes the Internet work is that all stakeholders agree to cooperate to exchange data following established protocols. A **protocol** is a set of rules governing an interaction of any variety. In this activity we focus on communications protocols. For example, all Internet packets begin with “0100” or “0110” to indicate whether they will follow IPv4 or IPv6, the two versions of the Internet Protocol currently being used for exchanging packets. Describe the protocol people followed during Step 8.

Did the message that you received in Step 8 read as intended? How do you know for sure?

11. Today we used first names to direct packets. What happened or would happen if two students have the same first name?

Part II: Scalable Systems: IP and DNS

12. The Internet uses a protocol to ensure that packets reach the correct destination. As of 2013, **IPv4** (standing for Internet Protocol version 4) was still the dominant carrier of most Internet traffic. IPv4 uses a 32-bit address for each unique device. These addresses are usually written in **dotted decimal** notation, like 213.45.75.36, where each of the four decimal numbers ranges from 0 to 255 and represents one byte. Since each bit can be 0 or 1, each bit doubles the number of unique values. How many devices can have unique addresses in IPv4?
13. **IPv6** uses 128 bits for each address. How many unique addresses can IPv6 support?
14. IP addresses are not very human friendly. Fortunately, the **Domain Name System (DNS)** provides a more human-friendly address for a device. Some domain names that you're familiar with probably end in `.com`, `.net`, or `.org`. Each of these is an example of a top-level domain. The owner of a top-level domain like `.us` can create second-level domains like `ky.us`. DNS is hierarchical, with `southhs.k12.hi.us` able to create a new subdomain `music.southhs.k12.hi.us`. Which domain would have the authority to create the domain `clerk.house.gov` ?
15. IP addresses are also hierarchical, and they are assigned in blocks of sequential addresses. If an organization is allocated 12.65.124.x, then they are able to assign the IP address 12.65.124.34 to a particular computer. Who gets to decide what computer is addressed by 208.64.123.4?
16. **Name servers** keep track of the IP addresses that correspond to a given domain name. Records about which IP numbers go with a domain name are maintained one level up from the domain name in the domain name hierarchy. For example, the `cnn.com` name server's IP address can be found on the `.com` name server. What name server would contain the IP address for the `en.wikipedia.org` name server?
17. Delegation and autonomy allow systems to grow. Both the IP and domain name systems are hierarchical and delegate autonomous authority to lower levels in the hierarchy. This is a strategy for letting the system scale. How well a system scales is how well it works as it grows. These two systems work in parallel with each other and have worked well even as the Internet has grown so quickly. Delegation of authority lets the Internet scale without becoming bogged down because domain owners can each create and keep track of their own subdomains.

To understand this important concept about how computing systems can grow, think about an

imaginary school that can build new corridors and rooms as it enrolls more students and hires teachers. However, as the school grows, it maintains only one main office. The school can grow by delegating certain responsibilities to teachers or to students. Some responsibilities are retained by the main office.

- Give an example of a responsibility that is delegated to teachers or students in your school.
- Give an example of a responsibility that is retained by the main office in your school.
- Discuss the impact of these two responsibilities if the school grew to 1,000 times its current size.

Part III: Impact of the Internet

Refer to your downloadable resources for this material. Interactive content may not be available in the PDF edition of this course.

The Internet has had and continues to have a wide-reaching impact on almost every aspect of our lives. For the remainder of this activity, you will explore and share information about that impact. Research one of the following topics as directed by your teacher.

1. The impact of social Internet technologies such as email, Facebook, Listserv, IRC, blogs, and others on the way that people interact with one another, contrasted with social interactions before services like these existed
2. How the Internet is making it possible for Americans with and without disabilities to extend their personal abilities
3. Ways that Internet services such as eBay, Amazon, online banking, tax filing sites, and others have changed how people conduct business
4. How the Internet has allowed for more effective utilization of the capabilities of parallel computing and the impact of parallel computing on other fields and industries. For some starter examples, check out http://en.wikipedia.org/wiki/List_of_distributed_computing_projects
5. Ways that the Internet has allowed for the collaborative collection of data and the impact that data sharing has had on academic disciplines
6. The interdependence of the Internet and commercial and governmental agencies/entities, past and present

Use the Internet as a resource while gathering information for your presentation.

While you are learning about your topic, reflect on how you are evaluating the usefulness of the pages you visit. Also reflect on how you would cite the pages. Deciding who wrote an article and what they titled it is a significant part of evaluating the usefulness of a source of information.

To facilitate discussion about evaluating sources of information, you will record information about some of the sources while you are gathering information. Use the table in [Evaluating Sources of Information](#).

to describe three of the web pages you visit: one that helped the most, one that you didn't

trust, and one that didn't approach the information in a way that was helpful.

For each of these three web pages, record the URL, the source (title/author), and comment on the target audience and the reliability of the web page.

Note that the source may be different than the domain name. For example, you could find an article on `uvm.edu`, but the source would be the author and the article's title.

18. Prepare a collaborative presentation that will last 2- 5 minutes. Present your summary to a portion of the class. Your best references can be displayed at the end of the presentation but do not need to be discussed.
19. Summarize the presentations made by your classmates here.
 - Impact on social interaction
 - Impact on extending human ability
 - Impact on economic exchange
 - Impact on parallel computing
 - Impact on data collaboration
 - Impact from and on organizations
20. Read one of the following two excerpts from *Blown to Bits*, as directed by your teacher.
 - Read pages 237-238. Consider how the Internet has affected our constitutional right to the freedom of speech. Briefly describe your thoughts about whether and how the interpretation of the Constitution is or should be affected by our changing technology.
 - Read pages 244-245. Consider how the Internet affected our constitutional right to the freedom of the press. Briefly describe your thoughts about whether and how the interpretation of the Constitution is or should be affected by our changing technology.

Conclusion

1. In what ways have social interactions amongst people changed as a result of technologies that rely on or build upon the Internet?
2. The IPv4 protocol did not have enough addresses for all computers to use, even though it seemed nearly infinite when the protocol was created. Will IPv6 eventually run out of addresses? Explain.
3. How does the autonomous nature of domain name allocation facilitate the growth of the Internet?
4. Why do we break up data into packets to pass information through the Internet?
5. Describe one positive and one negative effect of the Internet on society.

The Pledge: Do the Right Thing

2.1.1 ThePledge.docx

Introduction

To safely use the tools and knowledge that you will acquire in your study of computer science requires good judgement and a commitment to do the right thing.

Read the following contract. By signing below, you are indicating that you have read, understood, and agreed to all of the following statements. If you choose to sign the form, return the form to your teacher.

1. I will never use my knowledge of programming and computer science to access data or computing resources that I am not authorized to access.
2. I understand that accessing computing resources without permission can be a felony-level crime under the Computer Fraud and Abuse Act and other federal and state laws.
3. I understand that penalties even for minors have included felony conviction, prison, and large fines to pay computing professionals to attend to a company's entire computing network on the basis of small interruptions in the company's service.
4. I understand that a single instance of penetration testing without permission is sufficient for a lifetime ban from professional cybersecurity positions.

<input type="text"/>	<input type="text"/>
Date	Student signature

Student name, printed

Activity 2.1.1 Supplement B: Evaluating Sources of Information

2.1.1.Ab EvaluatingSourcesOfInformation.docx

Category of source:	<ul style="list-style-type: none">• Source is most credible• I am in the intended audience	<ul style="list-style-type: none">• I am not in the author's intended audience for my task	<ul style="list-style-type: none">• Source is not the most credible
URL			
Author, Title			
Comment on Audience			
Comment on Reliability			