

How It Works

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Acknowledgement: Original slides provided courtesy of Dr. Lawrence.

Key Points

1) Use our knowledge to understand how popular applications and systems work: Amazon, Facebook, Twitter, BitTorrent, iPhone.

COSC 122 - Page 2

Amazon.com

Amazon.com is America's largest online retailer and sells books, DVDs, software, and other products.

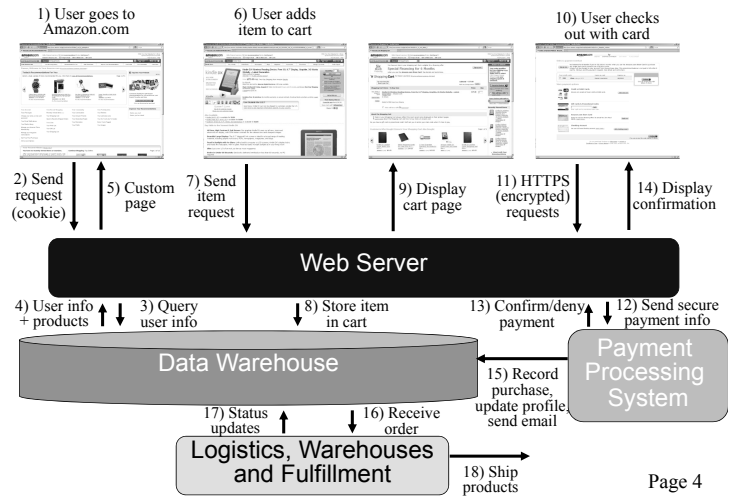
- ◆ Headquartered in Seattle, Washington.
- ◆ Founded by Jeff Bezos in 1994.
- ◆ "Amazon" is named after the world's largest river. Since 2000, Amazon's logo has an arrow from A to Z, representing customer satisfaction (as it forms a smile).

Amazon's Canadian site comes from the US, as it was legally prevented until March 2010 of operating any fulfillment centers in Canada. Products ship from Canada Post's Mississauga, ON.

Amazon provides technology and online hosting and services for many other retailers. Affiliates can sell through Amazon's system and link to Amazon's product database.

COSC 122 - Page 3

Amazon.com – How it Works



Page 4

Facebook Overview

Facebook is a social networking site with over 1.1 billion active users as of June 2013.

- ◆ Allows users to create personal profiles, add people as friends and send messages and updates to them.
- ◆ Founded by Mark Zuckerberg in 2004.
- ◆ Revenue (\$5B+) from advertising (banner ads, news feed).
- ◆ Accessible directly or through applications on smartphones.
- ◆ 250+ billion user photos taking up more than 8 petabytes
 - ⇒ 350 million photos added each day (50 terabytes)
- ◆ 4.5 billion likes per day
- ◆ Facebook Platform is an API (application programming interface) allowing developers to write own applications.
 - ⇒ Currently more than 10 million applications with games being extremely popular.

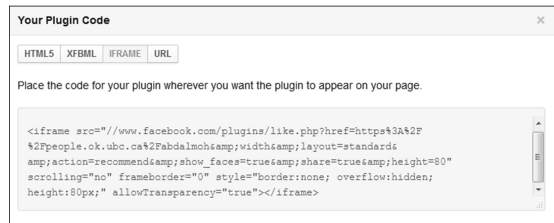
COSC 122 - Page 5

Facebook.com – Like Button

User adds Like button to page

 Like  31,532 people like this. Be the first of your friends.

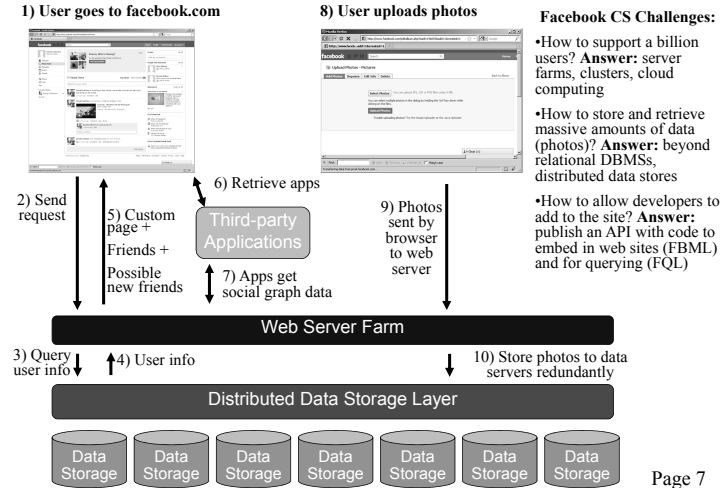
Added Code



When user clicks on Like request is sent to Facebook servers.

Build your own at:
<http://developers.facebook.com/docs/reference/plugins/like>

Facebook.com – Applications



How do they make money?

Facebook and Google make billions of dollars of revenue from advertising.

Facebook advertising

- ◆ primarily **banner advertising** (display ads) and advertising in **news feed**.
- ◆ A company gets paid for banner advertising based on the **number of displays ("impressions")** and the **number of user clicks ("click throughs")**.
 - ⇒ "Click through" rates may be as low as 0.05% (Facebook). Each click may only represent \$0.10 to \$0.50 of revenue.

Google advertising

- ◆ primarily as **sponsored results**.
- ◆ Google gets paid each time a user clicks on a sponsored link.
 - ⇒ A user clicks these ads an average of 8% of the time

Companies make money due to the billions of page views and clicks.

COSC 122 - Page 8

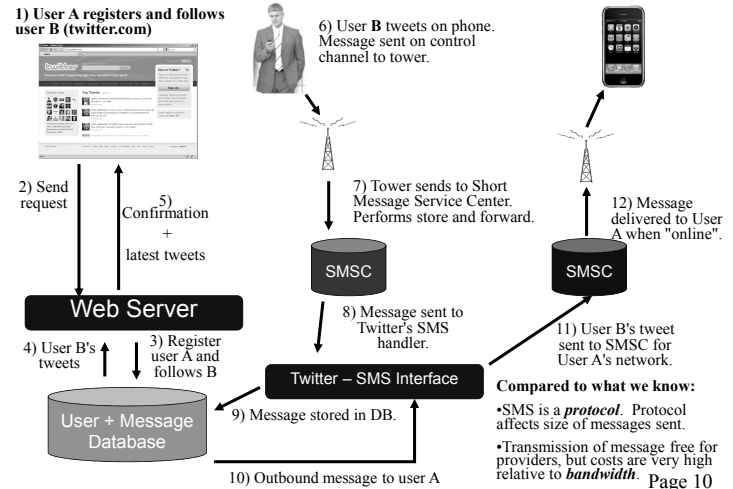
Twitter Overview

Twitter is a social networking and blogging service that allows users to send and read user messages called tweets.

- ◆ **Tweets** are displayed on an user's page and can be up to 140 characters long (due to SMS compatibility).
- ◆ Users may subscribe (*followers*) to other user tweets.
- ◆ Tweets can be sent via the website, external applications (for smartphones/PCs), and the Short Message Service (SMS).
- ◆ Service is free but may be charged to use SMS or phone fees.
- ◆ Created in 2006 by Jack Dorsey.
- ◆ Currently has more than 500 million users and over 350 million tweets per day.

COSC 122 - Page 9

Twitter – How it Works



BitTorrent Overview

BitTorrent is a peer-to-peer file sharing protocol for data distribution. It is estimated to be the majority of Internet traffic.

Basic idea: Instead of downloading a large file from one source, the file is downloaded in pieces from many sources and re-assembled. This improves performance and reliability.

How it works:

- ◆ 1) A user creates a torrent descriptor file of the file to be shared. The file itself is put on a BitTorrent "seed" node and divided into pieces.
- ◆ 2) Another user downloads the torrent descriptor file and begins to download the file pieces. It may acquire pieces from other peers that had previously downloaded the file. Once a peer has the complete file, it can function as a seed.

COSC 122 - Page 11

iPhone Overview

The **iPhone** is a **smartphone** manufactured by Apple that supports voice, text, browsing, email, and Wi-Fi. Distinctive features include its multi-touch screen, virtual keyboard, and thousands of third-party applications ("apps").

Smartphones are mini-computers that have an operating system capable of running programs both within and outside of a web browser.

- ◆ A major battle for market share between operating systems: Android, iPhone, Microsoft, Blackberry.

These devices are chosen more for their program capabilities and user interface features than phone service provider plans.

COSC 122 - Page 12

iPhone

How it Works – Apps

1) An iPhone application is built by a developer in the Objective-C programming language and compiled into a binary.

- ◆ Each smartphone platform supports a different language:
RIM/Android – Java

2) The application is verified by Apple, and if it passes, is loaded onto the App store.

3) Users search the store for applications and download and run the binary file on their device. An App runs on the device directly rather than in the browser.

What we have learned:

- ◆ Basic programming skills (can be extended to develop apps)
⇒ By 3rd year CS (or time on your own), you could do it.
- ◆ Hardware components and how computer works/run programs
- ◆ Components of applications and user interfaces

COSC 122 - Page 13

Conclusion

We have investigated how some of the most popular systems and applications work. Each system requires ***creativity*** and a significant software ***engineering effort*** to design and build it.

We saw how the concepts ***we have learned*** in programming, computer systems, and networking/Internet are used in these systems and the research/technical challenges being faced.

Operational systems are continually improved, fixed for errors, and must remain working all the time. It takes considerable resources and people to operate.

The popular systems typically started from basic ideas and were expanded over time. It has never been easier to create a system and scale it up to millions of users.

COSC 122 - Page 14

Objectives

- ◆ Understand some of the ideas behind common applications and systems and how it relates to the concepts discussed in the course.

COSC 122 - Page 15