Chapter 1
Introduction to the Internet

https://www.youtube.com/watch?v=N4znQDyz038
https://www.youtube.com/watch?v=f7_4QoZwH54
https://www.youtube.com/watch?v=nVTUi6wWN3M

1.1 Introduction

- The Internet and web programming technologies you'll learn in this course are designed to be *portable*, allowing you to design web pages and applications that run across an enormous range of Internet-enabled devices.
- *Client-side programming* technologies are used to build web pages and applications that are run on the *client* (i.e., in the browser on the user's device).
- *Server-side programming*—the applications that respond to requests from client-side web browsers, such as searching the Internet, checking your bank-account balance, ordering a book from Amazon, bidding on an eBay auction and ordering concert tickets.

1.1 Introduction (cont.)

Moore's Law

- Every year or two, the capacities of computers have approximately *doubled* inexpensively.
- Moore's Law and related observations apply especially to the amount of memory that computers have for programs, the amount of secondary storage (such as disk storage) they have to hold programs and data over longer periods of time, and their processor speeds—the speeds at which computers execute their programs (i.e., do their work).
- Similar growth has occurred in the communications field, in which costs have plummeted as enormous demand for communications bandwidth (i.e., information-carrying capacity) has attracted intense competition.

Name	Description
Cloud computing	**Cloud computing** allows you to use software, hardware and information stored in the "cloud"—i.e., accessed on remote computers via the Internet and available on demand—rather than having it stored on your personal computer. Amazon is one of the leading providers of public cloud computing services. You can rent extra storage capacity using the Amazon Simple Storage Service (Amazon S3), or augment processing capabilities with Amazon's EC2 (Amazon Elastic Compute Cloud). These services, allowing you to increase or decrease resources to meet your needs at any given time, are generally more cost effective than purchasing expensive hardware to ensure that you have enough storage and processing power to meet your needs at their peak levels. Business applications (such as CRM software) are often expensive, require significant hardware to run them and knowledgeable support staff to ensure that they're running properly and securely. Using cloud computing services shifts the burden of managing these applications from the business to the service provider, saving businesses money.

Fig. 1.3 | Examples of computers and the Internet in infrastructure. (Part 1 of 3.)

Name	Description
GPS	Global Positioning System (GPS) devices use a network of satellites to retrieve location-based information. Multiple satellites send time-stamped signals to the GPS device, which calculates the distance to each satellite based on the time the signal left the satellite and the time the signal arrived. This information is used to determine the exact location of the device. GPS devices can provide step-by-step directions and help you easily find nearby businesses (restaurants, gas stations, etc.) and points of interest. GPS is used in numerous location-based Internet services such as check-in apps to help you find your friends (e.g., Foursquare and Facebook), exercise apps such as RunKeeper that track the time, distance and average speed of your outdoor jog, dating apps that help you find a match nearby and apps that dynamically update changing traffic conditions.
Robots	Robots can be used for day-to-day tasks (e.g., iRobot's Roomba vacuum), entertainment (e.g., robotic pets), military combat, deep sea and space exploration (e.g., NASA's Mars rover) and more. RoboEarth (`www.roboearth.org`) is "a World Wide Web for robots." It allows robots to learn from each other by sharing information and thus improving their abilities to perform tasks, navigate, recognize objects and more.

Fig. 1.3 | Examples of computers and the Internet in infrastructure. (Part 2 of 3.)

Name	Description
E-mail, Instant Messaging, Video Chat and FTP	Internet-based servers support all of your online messaging. E-mail messages go through a mail server that also stores the messages. Instant messaging (IM) and Video Chat apps, such as AIM, Skype, Yahoo! Messenger and others allow you to communicate with others in real time by sending your messages and live video through servers. FTP (file transfer protocol) allows you to exchange files between multiple computers (e.g., a client computer such as your desktop and a file server) over the Internet using the TCP/IP protocols for transferring data.

Fig. 1.3 | Examples of computers and the Internet in infrastructure. (Part 3 of 3.)

Name	Description
iTunes and the App Store	iTunes is Apple's media store where you can buy and download digital music, movies, television shows, e-books, ringtones and apps (for iPhone, iPod and iPad) over the Internet. Apple's iCloud service allows you to store your media purchases "in the cloud" and access them from any iOS (Apple's mobile operating system) device. In June 2011, Apple announced at their World Wide Developer Conference (WWDC) that 15 billion songs had been downloaded through iTunes, making Apple the leading music retailer. As of July 2011, 15 billion apps had been downloaded from the App Store (`www.apple.com/pr/library/2011/07/07Apples-App-Store-Downloads-Top-15-Billion.html`).
Internet TV	Internet TV set-top boxes (such as Apple TV and Google TV) allow you to access an enormous amount of content on demand, such as games, news, movies, television shows and more.

Fig. 1.4 | Examples of computers and the Internet in entertainment. (Part 1 of 2.)

Name	Description
Game programming	Global video game revenues are expected to reach $65 billion in 2011 (uk.reuters.com/article/2011/06/06/us-videogames-factbox-idUKTRE7552I20110606). The most sophisticated games can cost as much as $100 million to develop. Activision's *Call of Duty 2: Modern Warfare*, released in 2009, earned $310 million in just one day in North America and the U.K. (news.cnet.com/8301-13772_3-10396593-52.html?tag=mncol;txt)! Online *social gaming*, which enables users worldwide to compete with one another over the Internet, is growing rapidly. Zynga—creator of popular online games such as *Farmville* and *Mafia Wars*—was founded in 2007 and already has over 265 million monthly users. To accommodate the growth in traffic, Zynga is adding nearly 1,000 servers each week (techcrunch.com/2010/09/22/zynga-moves-1-petabyte-of-data-daily-adds-1000-servers-a-week/)!

Fig. 1.4 | Examples of computers and the Internet in entertainment. (Part 2 of 2.)

1.3 HTML5, CSS3, JavaScript, Canvas and jQuery

HTML5

- HTML (HyperText Markup Language) is a special type of computer language called a *markup language* designed to specify the *content* and *structure* of web pages (also called documents) in a portable manner.
- HTML5, now under development, is the emerging version of HTML.
- HTML enables you to create content that will render appropriately across the extraordinary range of devices connected to the Internet—including smartphones, tablet computers, notebook computers, desktop computers, special-purpose devices such as large-screen displays at concert arenas and sports stadiums, and more.

1.3 HTML5, CSS3, JavaScript, Canvas and (cont.)

- A “stricter” version of HTML called *XHTML (Extensible HyperText Markup Language)*, which is based on XML (eXtensible Markup Language), is still used frequently today.
- Many of the server-side technologies we cover later in the book produce web pages as XHTML documents, by default, but the trend is clearly to HTML5.

1.3 HTML5, CSS3, JavaScript, Canvas and (cont.)

Cascading Style Sheets (CSS)

- Although HTML5 provides some capabilities for controlling a document's presentation, *it's better not to mix presentation with content*.
- Cascading Style Sheets (CSS) are used to specify the *presentation*, or styling, of elements on a web page (e.g., fonts, spacing, sizes, colors, positioning).
- CSS was designed to style portable web pages *independently* of their content and structure.
- By separating page styling from page content and structure, you can easily change the look and feel of the pages on an *entire* website, or a portion of a website, simply by swapping out one style sheet for another.
- CSS3 is the current version of CSS under development.

1.3 HTML5, CSS3, JavaScript, Canvas and (cont.)

JavaScript

- JavaScript helps you build *dynamic* web pages (i.e., pages that can be modified "on the fly" in response to *events*, such as user input, time changes and more) and computer applications.
- It enables you to do the client-side programming of web applications.
- JavaScript was created by Netscape.
- Both Netscape and Microsoft have been instrumental in the standardization of JavaScript by ECMA International (formerly the European Computer Manufacturers Association) as ECMAScript.
- ECMAScript 5, the latest version of the standard, corresponds to the version of JavaScript we use in this book.
- JavaScript is a portable scripting language. Programs written in JavaScript can run in web browsers across a wide range of devices.

1.3 HTML5, CSS3, JavaScript, Canvas and (cont.)

Web Browsers and Web-Browser Portability

- Ensuring a consistent look and feel on client-side browsers is one of the great challenges of developing web-based applications.
- Currently, a standard does not exist to which software vendors must adhere when creating web browsers.
- Although browsers share a common set of features, each browser might render pages differently.

1.3 HTML5, CSS3, JavaScript, Canvas and (cont.)

- Browsers are available in many versions and on many different platforms (Microsoft Windows, Apple Macintosh, Linux, UNIX, etc.).
- Vendors add features to each new version that sometimes result in cross-platform incompatibility issues.
- It's difficult to develop web pages that render correctly on all versions of each browser.

1.3 HTML5, CSS3, JavaScript, Canvas and (cont.)

jQuery

- jQuery (`jQuery.org`) is currently the most popular of hundreds of *JavaScript libraries*.
  - www.activoinc.com/blog/2008/11/03/jquery-emerges-as-most-popular-javascript-library-for-web-development/.
- jQuery simplifies JavaScript programming by making it easier to manipulate a web page's elements and interact with servers in a portable manner across various web browsers.
- It provides a library of custom graphical user interface (GUI) controls (beyond the basic GUI controls provided by HTML5) that can be used to enhance the look and feel of your web pages.

1.5 Evolution of the Internet and World Wide Web

- The Internet—a global network of computers—was made possible by the *convergence of computing and communications technologies*.
- In the late 1960s, ARPA (the Advanced Research Projects Agency) rolled out blueprints for networking the main computer systems of about a dozen ARPA-funded universities and research institutions.
- They were to be connected with communications lines operating at a then-stunning 56 Kbps (i.e., 56,000 bits per second)—this at a time when most people (of the few who could) were connecting over telephone lines to computers at a rate of 110 bits per second.

1.5 Evolution of the Internet and World Wide Web (cont.)

- A bit (short for “binary digit”) is the smallest data item in a computer; it can assume the value 0 or 1.
- ARPA proceeded to implement the ARPANET, which eventually evolved into today’s Internet.
- Rather than enabling researchers to share each other’s computers, it rapidly became clear that communicating quickly and easily via electronic mail was the key early benefit of the ARPANET.
- This is true even today on the Internet, which facilitates communications of all kinds among the world’s Internet users.

1.5 Evolution of the Internet and World Wide Web (cont.)

Packet Switching

- One of the primary goals for ARPANET was to allow *multiple* users to send and receive information simultaneously over the *same* communications paths (e.g., phone lines).
- The network operated with a technique called packet switching, in which digital data was sent in small bundles called packets.
- The packets contained *address*, *error-control* and *sequencing* information.
- The address information allowed packets to be *routed* to their destinations.

1.5 Evolution of the Internet and World Wide Web (cont.)

- The sequencing information helped in reassembling the packets—which, because of complex routing mechanisms, could actually arrive out of order—into their original order for presentation to the recipient.
- Packets from different senders were intermixed on the same lines to efficiently use the available bandwidth.
- The network was designed to operate without centralized control.
- If a portion of the network failed, the remaining working portions would still route packets from senders to receivers over alternative paths for reliability.

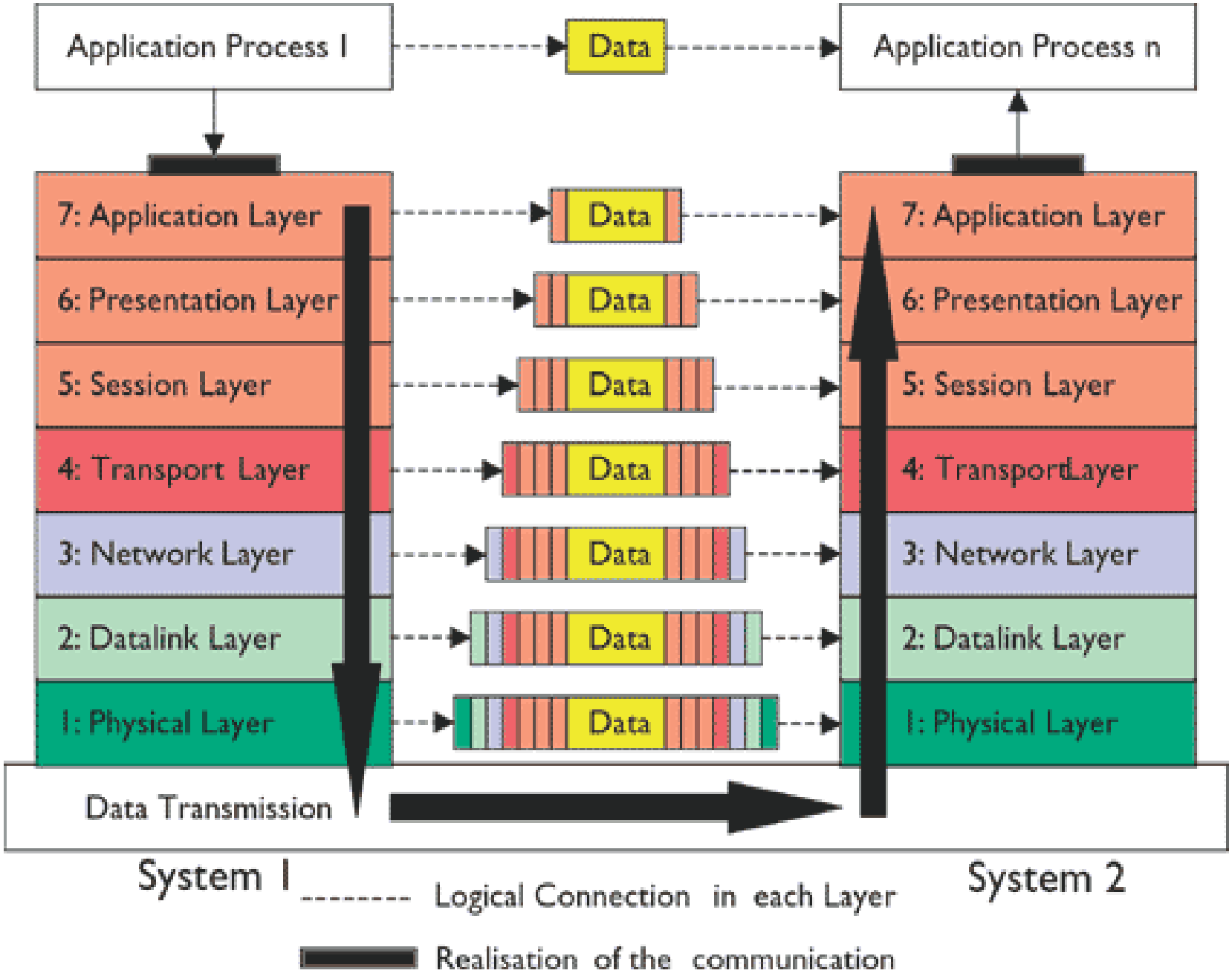
1.5 Evolution of the Internet and World Wide Web (cont.)

TCP/IP

- The protocol (i.e., set of rules) for communicating over the ARPANET became known as TCP—the Transmission Control Protocol.
- TCP ensured that messages were properly routed from sender to receiver and that they arrived intact.
- As the Internet evolved, organizations worldwide were implementing their own networks for both intraorganization (i.e., within the organization) and interorganization (i.e., between organizations) communications.
- One challenge was to get these different networks to communicate.

1.5 Evolution of the Internet and World Wide Web (cont.)

- ARPA accomplished this with the development of IP—the Internet Protocol, truly creating a network of networks, the current architecture of the Internet.
- The combined set of protocols is now commonly called TCP/IP.
- Each computer on the Internet has a unique IP address.
- The current IP standard, Internet Protocol version 4 (IPv4), has been in use since 1984 and will soon run out of possible addresses.
- IPv6 is just starting to be deployed. It features enhanced security and a new addressing scheme, hugely expanding the number of IP addresses available so that we will not run out of IP addresses in the forseeable future.


Application Process I
Data
Application Process n
7: Application Layer
6: Presentation Layer
5: Session Layer
4: Transport Layer
3: Network Layer
2: Datalink Layer
1: Physical Layer
Data
Data
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Data
7: Application Layer
6: Presentation Layer
5: Session Layer
4: TransportLayer
3: Network Layer
2: Datalink Layer
1: Physical Layer
Data Transmission
System 1
System 2
Logical Connection in each Layer
Realisation of the communication

Potential Internet roadblocks

- The basic IP forwarding paradigm: All traffic from a given source to a given destination always follows the same path
- The forwarding table in a router only contains one entry for a given destination

Is it possible to perform “traffic engineering” where paths can be controlled for individual flows?

Traffic Engineering Paradigm

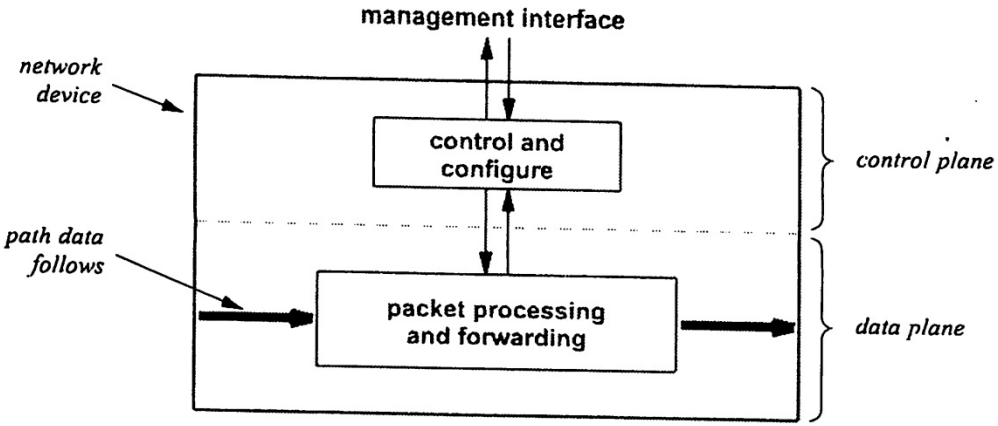
Old routing paradigm: Find shortest paths that all datagrams must follow

New paradigm: Network manager has control of the paths that datagrams follow

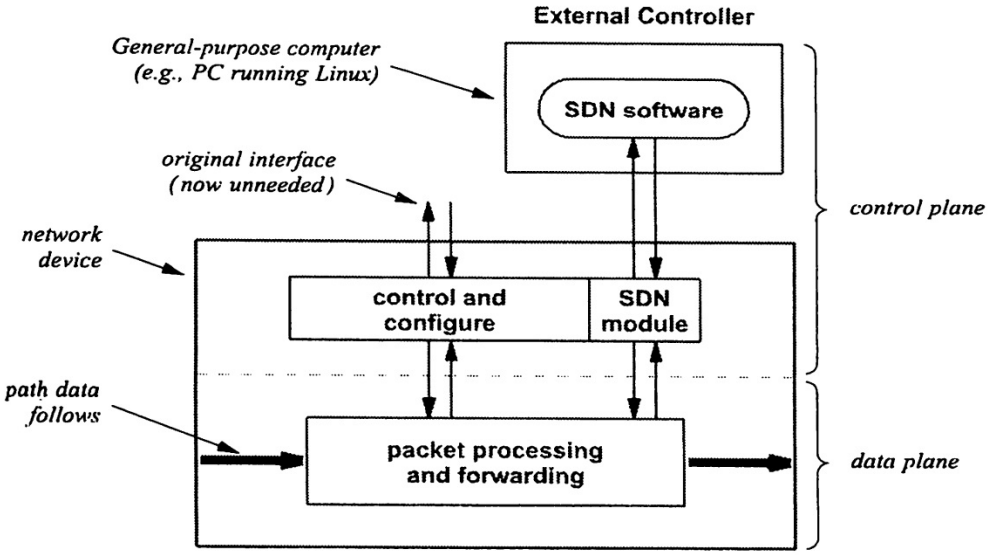
Motivation: Priority packets, “first-class” service, economic considerations

Software Defined Networking

- Avoid overhead from performing classification in software
- Avoid bottleneck of performing packet forwarding in software
- Avoid using routing protocols to set the routes for all traffic
- To scale to Internet, have management applications configure and control network devices



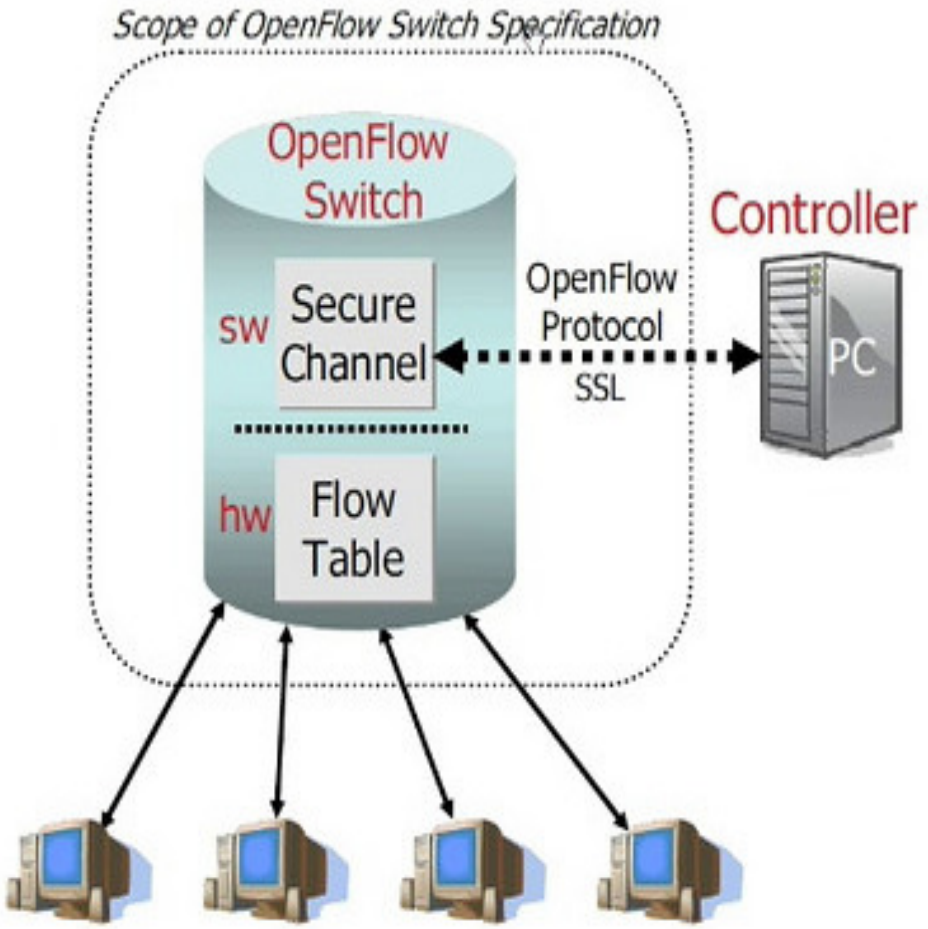
Network Device: Control and Data Plane

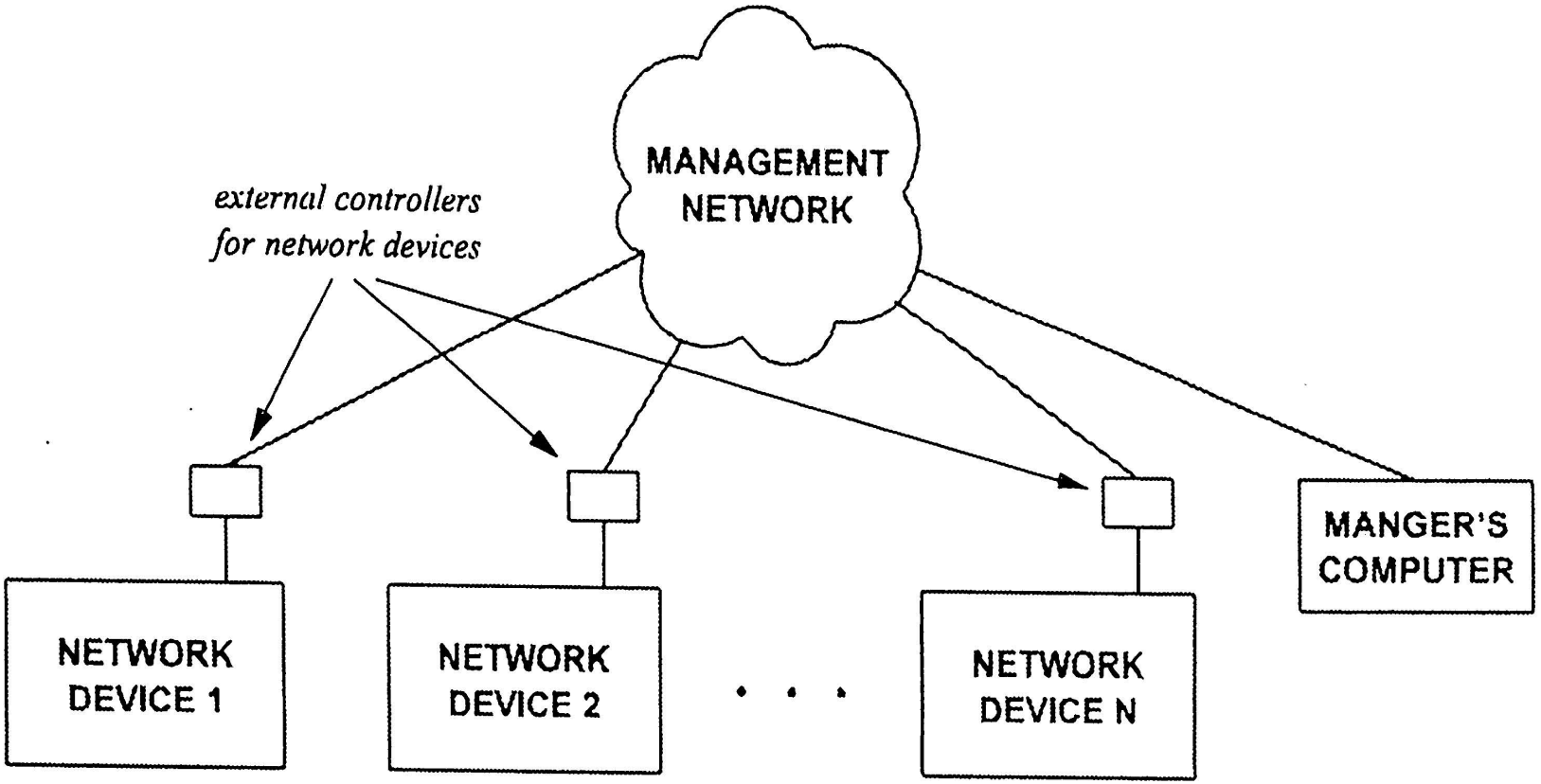


Network Device: SDN Architecture

Figures courtesy D. Comer, Computer Networks and Internets, 6th Edition

What is OpenFlow?



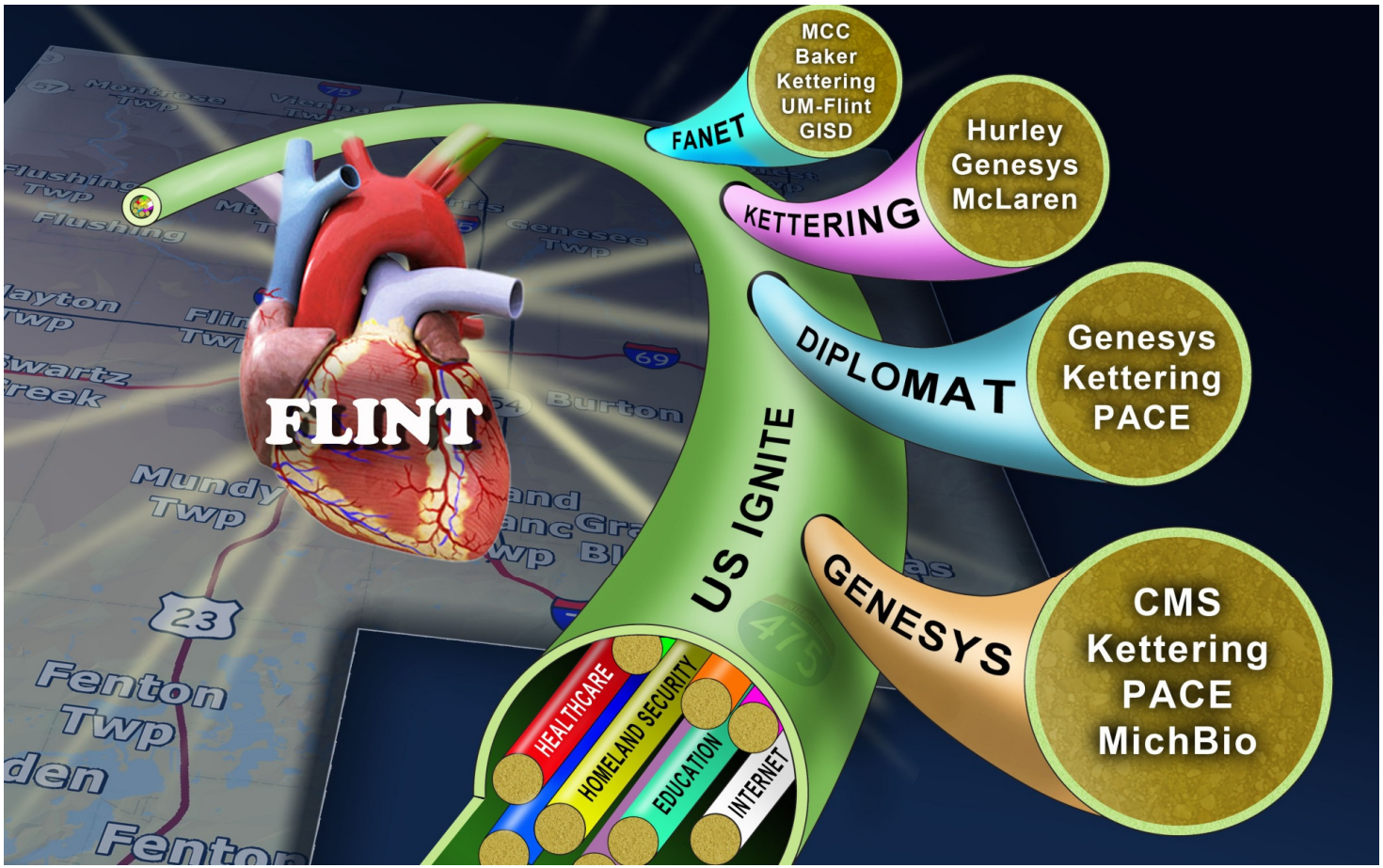


An idealized interconnection of SDN controllers by a management network. Management applications on the controllers use the network to coordinate with one another.

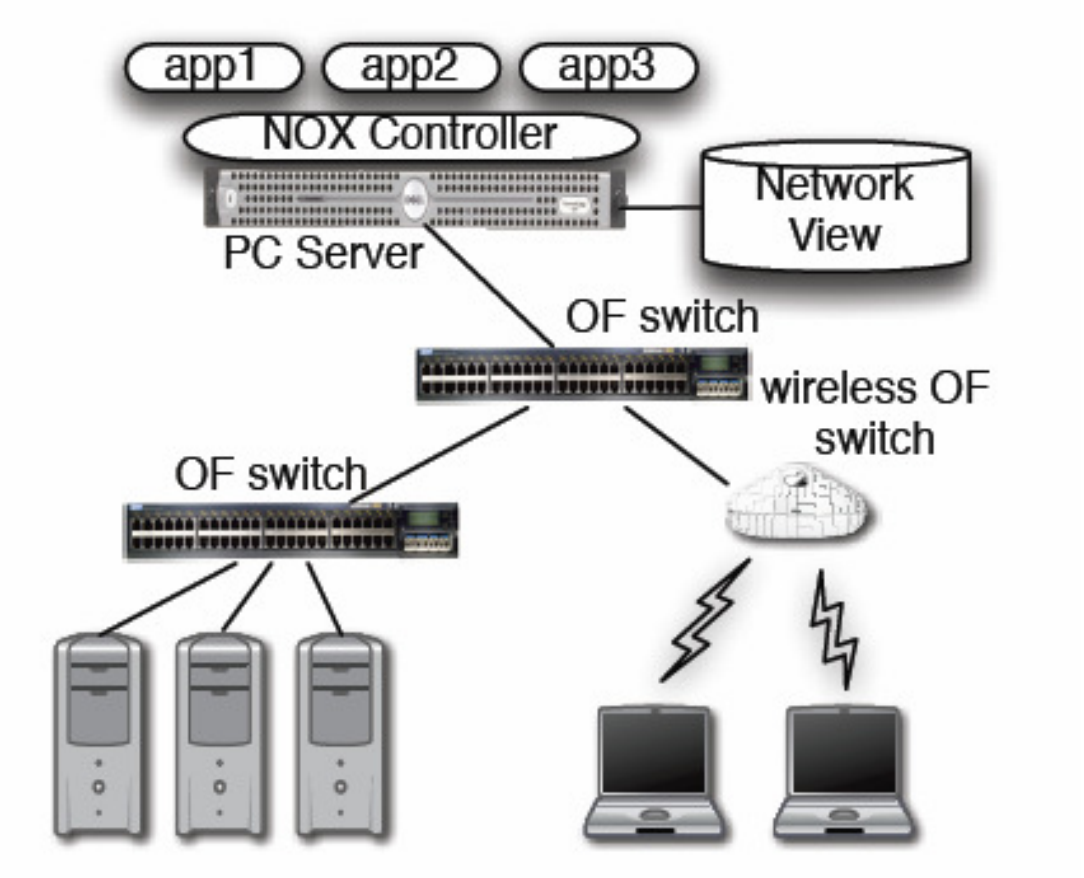
Network Virtualization

- Network virtualization: multiple isolated logical networks each with potentially different addressing and forwarding mechanisms share the same physical infrastructure.
- Software Defined Networking / OpenFlow provide the mechanism to achieve this

Net Virtualization (Regional)



NOX – Network Operating System



1.5 Evolution of the Internet and World Wide Web (cont.)

Explosive Growth

- Initially, Internet use was limited to universities and research institutions; then the military began using it intensively.
- Eventually, the government decided to allow access to the Internet for commercial purposes.
- Bandwidth (i.e., the information-carrying capacity) on the Internet's is increasing rapidly as costs dramatically decline.

1.5 Evolution of the Internet and World Wide Web (cont.)

World Wide Web, HTML, HTTP

- The World Wide Web allows computer users to execute web-based applications and to locate and view multimedia-based documents on almost any subject over the Internet.
- In 1989, Tim Berners-Lee of CERN (the European Organization for Nuclear Research) began to develop a technology for sharing information via hyperlinked text documents.
- Berners-Lee called his invention the HyperText Markup Language (HTML).
- He also wrote communication protocols to form the backbone of his new information system, which he called the World Wide Web.
- In particular, he wrote the Hypertext Transfer Protocol (HTTP)—a communications protocol used to send information over the web.
- The URL (Uniform Resource Locator) specifies the address (i.e., location) of the web page displayed in the browser window.
- Each web page on the Internet is associated with a unique URL.
- URLs usually begin with http://.

1.5 Evolution of the Internet and World Wide Web (cont.)

HTTPS

- URLs of websites that handle private information, such as credit card numbers, often begin with https://, the abbreviation for Hypertext Transfer Protocol Secure (HTTPS).
- HTTPS is the standard for transferring encrypted data on the web.
- It combines HTTP with the Secure Sockets Layer (SSL) and the more recent Transport Layer Security (TLS) cryptographic schemes for securing communications and identification information over the web.

1.5 Evolution of the Internet and World Wide Web (cont.)

Mosaic, Netscape, Emergence of Web 2.0

- Web use exploded with the availability in 1993 of the Mosaic browser, which featured a user-friendly graphical interface.
- Marc Andreessen, whose team at the National Center for Supercomputing Applications (NCSA) developed Mosaic, went on to found Netscape, the company that many people credit with igniting the explosive Internet economy of the late 1990s.
- But the "dot com" economic bust brought hard times in the early 2000s.
- The resurgence that began in 2004 or so has been named Web 2.0.

1.6 Web Basics

- In its simplest form, a *web page* is nothing more than an HTML (HyperText Markup Language) document (with the extension .html or .htm) that describes to a web browser the document's content and structure.

Hyperlinks

- HTML documents normally contain hyperlinks, which, when clicked, load a specified web document.
- Both images and text may be hyperlinked.
- When the user clicks a hyperlink, a web server locates the requested web page and sends it to the user's web browser.
- Similarly, the user can type the *address of a web page* into the browser's *address field* and press *Enter* to view the specified page.

1.6 Web Basics (cont.)

- Hyperlinks can reference other web pages, e-mail addresses, files and more.
- If a hyperlink's URL is in the form mailto:*emailAddress*, clicking the link loads your default e-mail program and opens a message window addressed to the specified e-mail address.
- If a hyperlink references a file that the browser is incapable of displaying, the browser prepares to download the file, and generally prompts the user for information about how the file should be stored.

1.6 Web Basics (cont.)

URIs and URLs

- *URIs (Uniform Resource Identifiers)* identify resources on the Internet.
- URIs that start with `http://` are called *URLs (Uniform Resource Locators)*.

Parts of a URL

- A URL contains information that directs a browser to the resource that the user wishes to access.
- Web servers make such resources available to web clients.
- Popular web servers include Apache's HTTP Server and Microsoft's Internet Information Services (IIS).

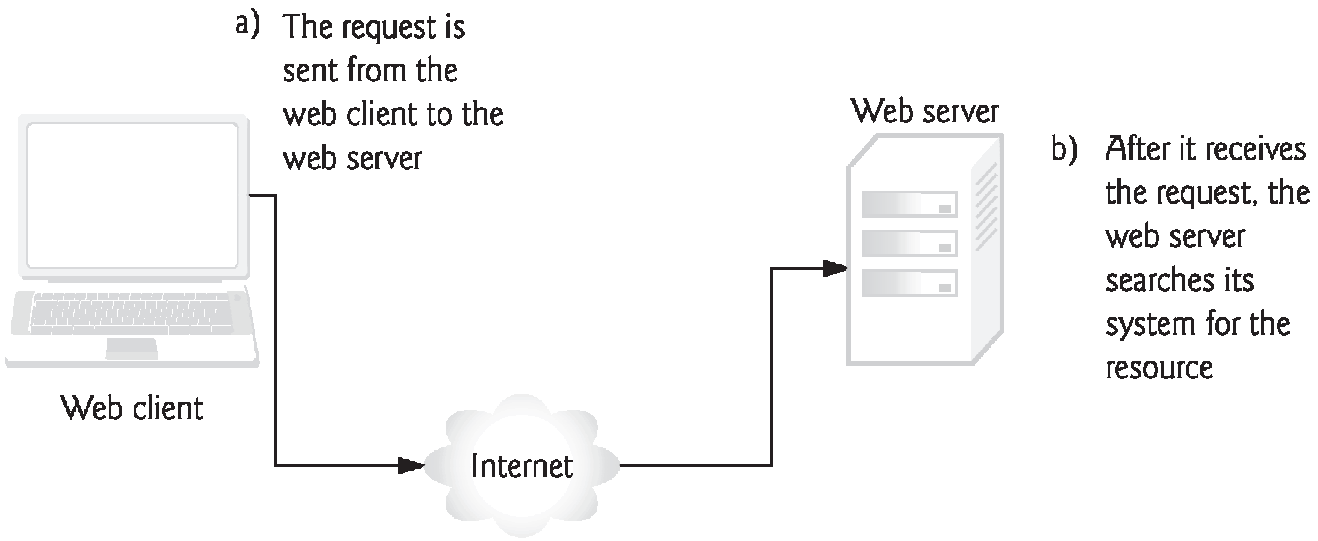


Fig. 1.8 | Client requesting a resource from a web server.

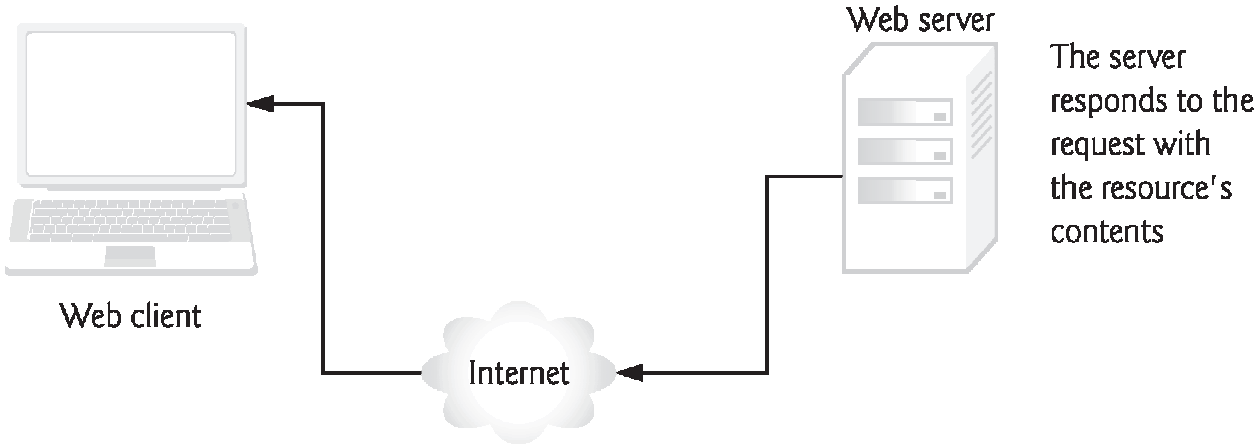


Fig. 1.9 | Client receiving a response from the web server.

1.6 Web Basics (cont.)

- The server first sends a line of text that indicates the HTTP version, followed by a numeric code and a phrase describing the status of the transaction. For example,
    - `HTTP/1.1 200 OK`
- indicates success, whereas
    - `HTTP/1.1 404 Not found`
- informs the client that the web server could not locate the requested resource.

HTTP Headers

- Next, the server sends one or more HTTP headers, which provide additional information about the data that will be sent.
- In this case, the server is sending an HTML5 text document, so one HTTP header for this example would read:
    - `Content-type: text/html`

1.6 Web Basics (cont.)

- The information provided in this header specifies the Multipurpose Internet Mail Extensions (MIME) type of the content that the server is transmitting to the browser.
- The MIME standard specifies data formats, which programs can use to interpret data correctly.
- For example, the MIME type text/plain indicates that the sent information is text that can be displayed directly.
- Similarly, the MIME type image/jpeg indicates that the content is a JPEG image.
- When the browser receives this MIME type, it attempts to display the image.

1.6 Web Basics (cont.)

- The header or set of headers is followed by a blank line, which indicates to the client browser that the server is finished sending HTTP headers.
- Finally, the server sends the contents of the requested document (`downloads.html`).
- The client-side browser then renders (or displays) the document, which may involve additional HTTP requests to obtain associated CSS and images.

1.6 Web Basics (cont.)

HTTP get and post Requests

- The two most common HTTP request types (also known as request methods) are get and post.
- A get request typically gets (or retrieves) information from a server, such as an HTML document, an image or search results based on a user-submitted search term.
- A post request typically posts (or sends) data to a server.
- Common uses of post requests are to send form data or documents to a server.
- An HTTP request often posts data to a server-side form handler that processes the data.
- For example, when a user performs a search or participates in a web-based survey, the web server receives the information specified in the HTML form as part of the request. Get requests and post requests can both be used to send data to a web server, but each request type sends the information differently.

1.6 Web Basics (cont.)

- A get request appends data to the URL, e.g., www.google.com/search?q=deitel.
- In this case search is the name of Google's server-side form handler, q is the name of a variable in Google's search form and deitel is the search term.
- The ? in the preceding URL separates the query string from the rest of the URL in a request.
- A *name/value* pair is passed to the server with the *name* and the *value* separated by an equals sign (=).
- If more than one *name/value* pair is submitted, each pair is separated by an ampersand (&).
- The server uses data passed in a query string to retrieve an appropriate resource from the server.
- The server then sends a response to the client. A get request may be initiated by submitting an HTML form whose method attribute is set to "get", or by typing the URL (possibly containing a query string) directly into the browser's address bar.

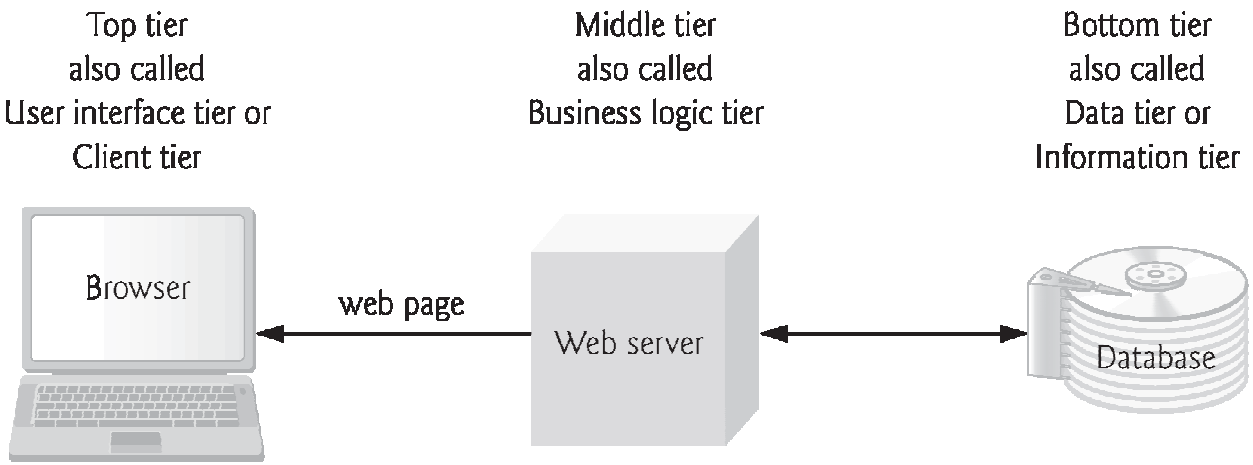


Fig. 1.10 | Three-tier architecture.

1.8 Client-Side Scripting versus Server-Side Scripting

- Client-side scripting with JavaScript can be used to validate user input, to interact with the browser, to enhance web pages, and to add client/server communication between a browser and a web server.
- Client-side scripting does have limitations, such as browser dependency; the browser or scripting host must support the scripting language and capabilities.
- Scripts are restricted from arbitrarily accessing the local hardware and file system for security reasons.
- Another issue is that client-side scripts can be viewed by the client by using the browser's source-viewing capability.
- Sensitive information, such as passwords or other personally identifiable data, should not be on the client.
- All client-side data validation should be mirrored on the server. Also, placing certain operations in JavaScript on the client can open web applications to security issues.

1.9 World Wide Web Consortium (W3C)

- In October 1994, Tim Berners-Lee founded an organization—the World Wide Web Consortium (W3C)—devoted to developing nonproprietary, interoperable technologies for the World Wide Web.
- One of the W3C's primary goals is to make the web universally *accessible*—regardless of disability, language or culture.
- The W3C is also a standards organization.
- Web technologies standardized by the W3C are called Recommendations.
- Current and forthcoming W3C Recommendations include the HyperText Markup Language 5 (HTML5), Cascading Style Sheets 3 (CSS3) and the Extensible Markup Language (XML).

1.10 Web 2.0: Going Social

- In 2003 there was a noticeable shift in how people and businesses were using the web and developing web-based applications.
- The term Web 2.0 was coined by Dale Dougherty of O'Reilly Media in 2003 to describe this trend.
  - T. OReilly, ôWhat is Web 2.0: Design Patterns and Business Models for the Next Generation of Software.ö September 2005 <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html?page=1>.
- Generally, Web 2.0 companies use the web as a platform to create collaborative, community-based sites (e.g., social networking sites, blogs, wikis).

1.10 Web 2.0: Going Social (cont.)

Web 1.0 versus Web 2.0

- Web 1.0 (the state of the web through the 1990s and early 2000s) was focused on a relatively small number of companies and advertisers producing content for users to access (some people called it the "brochure web").
- Web 2.0 *involves* the users—not only do they often create content, but they help organize it, share it, remix it, critique it, update it, etc.
- One way to look at Web 1.0 is as a *lecture*, a small number of professors informing a large audience of students. In comparison, Web 2.0 is a *conversation*, with everyone having the opportunity to speak and share views.

1.10 Web 2.0: Going Social (cont.)

Architecture of Participation

- Web 2.0 embraces an architecture of participation—a design that encourages user interaction and community contributions.
- The architecture of participation has influenced software development as well.
- Opensource software is available for anyone to use and modify with few or no restrictions (we'll say more about open source in Section 1.12).
- Using collective intelligence—the concept that a large diverse group of people will create smart ideas—communities collaborate to develop software that many people believe is better and more robust than proprietary software.
- Rich Internet Applications (RIAs) are being developed using technologies (such as Ajax) that have the look and feel of desktop software, enhancing a user's overall experience.

1.10 Web 2.0: Going Social (cont.)

Search Engines and Social Media

- The way we find the information on these sites is also changing—people are tagging (i.e., labeling) web content by subject or keyword in a way that helps anyone locate information more effectively.
  - ***Semantic Web***
- In the future, computers will learn to understand the meaning of the data on the web—the beginnings of the Semantic Web are already appearing.

1.10 Web 2.0: Going Social (cont.)

Google

- In 1996, Stanford computer science Ph.D. candidates Larry Page and Sergey Brin began collaborating on a new search engine.
- In 1997, they chose the name Google—a play on the mathematical term *googol*, a quantity represented by the number "one" followed by 100 "zeros" (or 10^{100})—a staggeringly large number.
- Google's ability to return extremely accurate search results quickly helped it become the most widely used search engine and one of the most popular websites in the world.

1.10 Web 2.0: Going Social (cont.)

Web Services and Mashups

- We include in this book a substantial treatment of web services and introduce the applications-development methodology of *mashups*, in which you can rapidly develop powerful and intriguing applications by combining (often free) complementary web services and other forms of information feeds (Fig. 1.11).

Web services source	How it's used
Google Maps	Mapping services
Facebook	Social networking
Foursquare	Mobile check-in
LinkedIn	Social networking for business
YouTube	Video search
Twitter	Microblogging
Groupon	Social commerce
Netflix	Movie rentals
eBay	Internet auctions
Wikipedia	Collaborative encyclopedia
PayPal	Payments
Last.fm	Internet radio

Fig. 1.11 | Some popular web services that you can use to build web applications (`www.programmableweb.com/apis/directory/1?sort=mashups`). (Part 1 of 2.)

Web services source	How it's used
Amazon eCommerce	Shopping for books and more
Salesforce.com	Customer Relationship Management (CRM)
Skype	Internet telephony
Microsoft Bing	Search
Flickr	Photo sharing
Zillow	Real estate pricing
Yahoo Search	Search
WeatherBug	Weather

Fig. 1.11 | Some popular web services that you can use to build web applications (`www.programmableweb.com/apis/directory/1?sort=mashups`). (Part 2 of 2.)

1.10 Web 2.0: Going Social (cont.)

- Web services, inexpensive computers, abundant high-speed Internet access, open source software and many other elements have inspired new, exciting, *lightweight business models* that people can launch with only a small investment.
- Some types of websites with rich and robust functionality that might have required hundreds of thousands or even millions of dollars to build in the 1990s can now be built for nominal sums.

1.10 Web 2.0: Going Social (cont.)

Ajax

- Ajax is one of the premier Web 2.0 software technologies (Fig. 1.12).
- Ajax helps Internet-based applications perform like desktop applications—a difficult task, given that such applications suffer transmission delays as data is shuttled back and forth between your computer and servers on the Internet.

Company	Description
Facebook	Facebook was launched in 2004 and is already worth an estimated $100 billion. By January 2011, Facebook was the most active site on the Internet with more than 750 million users who were spending 700 billion minutes on Facebook per month (`www.facebook.com/press/info.php?statistics`). At its current growth rate (about 5% per month), Facebook will reach one billion users in 2012, out of two billion Internet users! The activity on the site makes it extremely attractive for application developers. Each day, over 20 million applications are installed by Facebook users (`www.facebook.com/press/info.php?statistics`).
Twitter	Twitter (founded in 2006) has revolutionized *microblogging*. Users post tweets—messages up to 140 characters long. Approximately 140 million tweets are posted per day. You can follow the tweets of friends, celebrities, businesses, government representatives (including Barack Obama, who has 10 million followers), and so on, or you can follow tweets by subject to track news, trends and more. At the time of this writing, Lady Gaga had the most followers (over 13 million). Twitter has become the point of origin for many breaking news stories worldwide.

Fig. 1.13 | Social applications. (Part 1 of 4.)

Publication	URL
IEEE Internet Computing	www.computer.org/portal/web/internet/home
InfoWorld	www.infoworld.com
Mashable	mashable.com
PCWorld	www.pcworld.com
SD Times	www.sdtimes.com
Slashdot	slashdot.org/
Smarter Technology	www.smartertechnology.com
Technology Review	technologyreview.com
Techcrunch	techcrunch.com
Wired	www.wired.com

Fig. 1.17 | Technical and business publications. (Part 2 of 2.)