Fundamentals of Web Development

Third Edition by Randy Connolly and Ricardo Hoar

Chapter 1

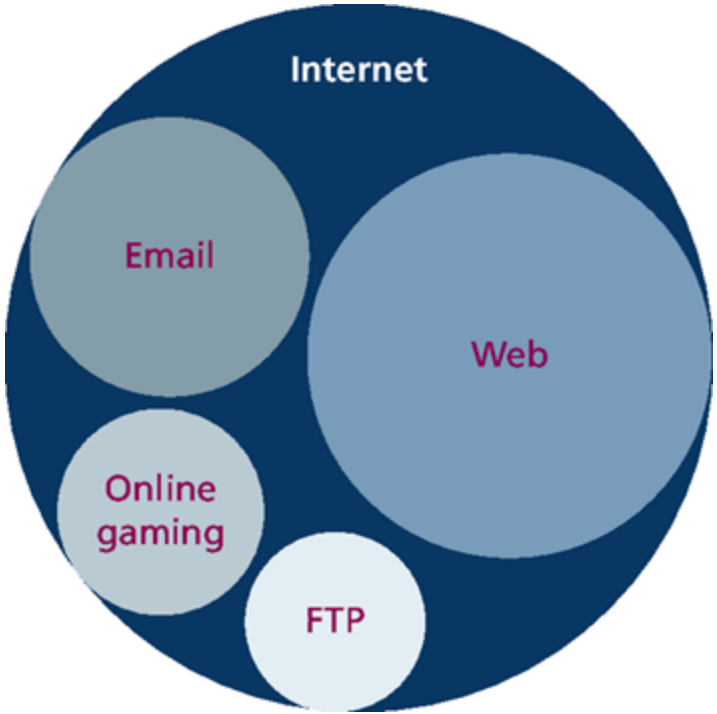
Introduction to Web Development

In this chapter you will learn . . .

- About web development in general
- The history of the Internet and World Wide Web
- Fundamental concepts that form the foundation of the Internet
- About the hardware and software that support the Internet
- The range of careers and companies in web development

A Short History of the Internet

- Know the difference between “Internet” and “WWW”
- While this book is focused on the web, part of this chapter is also devoted to a broad understanding of that larger circle labeled the “Internet.”
- **Protocols** define different kinds of interactions/services on the Internet



Circuit Switched Networks

Circuit switching in early networking

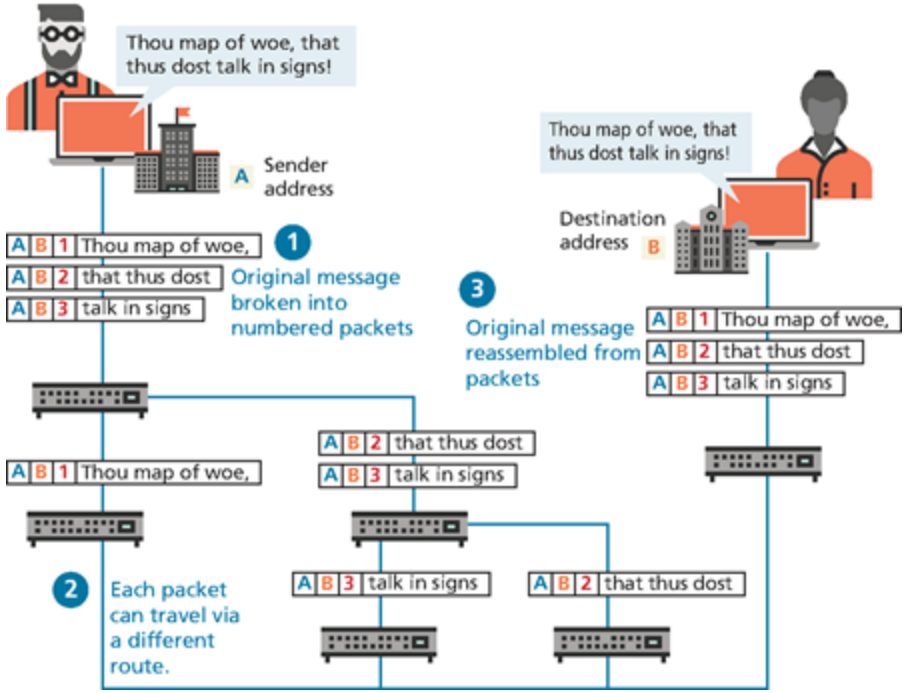
- In the past, telephone calls were routed through operators who **physically connected** the caller and the receiver by connecting a wire to a switchboard to complete a circuit.
- Inefficient use of **bandwidth**
- Difficult to scale

Packet Switched Networks

Packet switching came later, does not require a continuous connection

- 1960s ARPANET
- 1974 X.25
- 1979 USENET
- 1981 TCP/IP was introduced to unify disparate networks

On January 1, 1983, TCP/IP was adopted across all of ARPANET



The Birth of the Web

Sr. Tim Berners-Lee publishes the main features of the web we know today on 1992.

- A Uniform Resource Locator (**URL**) to uniquely identify a resource on the WWW.
- The Hypertext Transfer Protocol (**HTTP**) to describe how requests and responses operate
- A software program (**web server software**) that can respond to HTTP requests.
- Hypertext Markup Language (**HTML**) to publish documents.
- A program (**a browser**) that can make HTTP requests to URLs and that can display the HTML it receives.

Web Applications in Comparison to Desktop Applications (1 of 2)

Advantages

- They can be accessed from any Internet-enabled computer.
- They can be used with different operating systems and browser applications.
- They are easier to roll out program updates since only software on the server needs to be updated as opposed to every computer in the organization using the software.
- They have a centralized storage on the server, which means fewer security concerns about local storage (which is important for sensitive information such as health care data).

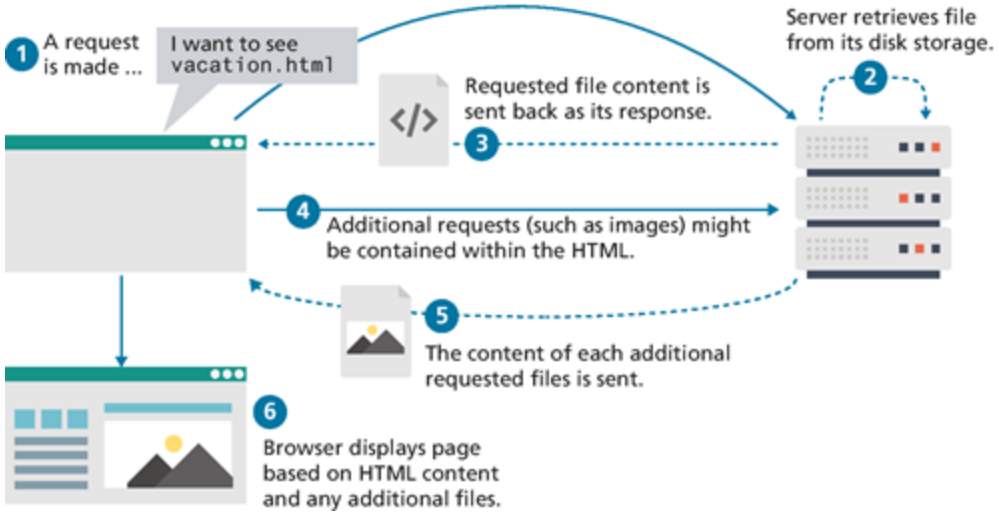
Web Applications in Comparison to Desktop Applications (2 of 2)

Disadvantages

- Requirement to have an active Internet connection
- Security concerns about sensitive private data being transmitted over the Internet.
- Concerns over the storage, licensing, and use of uploaded data.
- Problems with certain websites not having an identical appearance across all browsers.
- Restrictions on software from being installed and hardware from being accessed (like Adobe Flash on iOS).
- additional plugins might interfere with JavaScript, cookies, or advertisements.

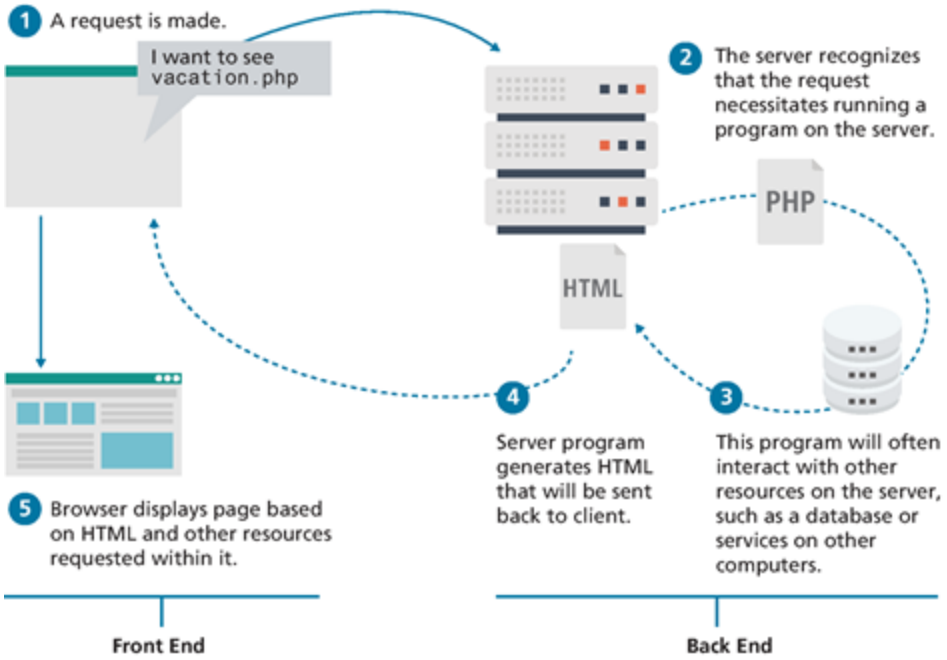
From Static to Dynamic (and Back to Static)

In the earliest days of the web, users could read the pages of a **static website**



From Static to Dynamic (and Back to Static) ii

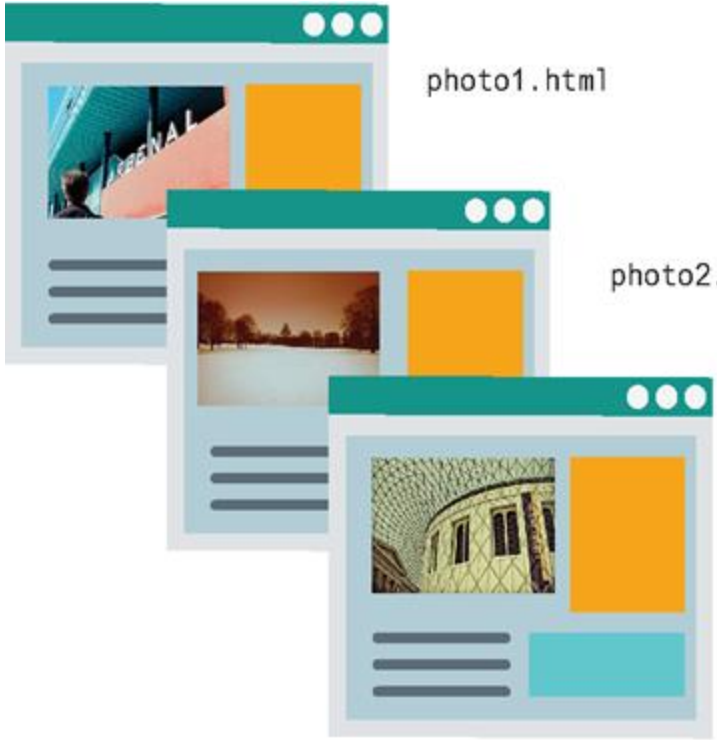
Later, programs running on web servers let websites generate content dynamically. This type of website is called a **dynamic server-side website**



Web 2.0

- **Web 2.0** referred to an interactive experience where users could contribute and consume web content, thus creating a more user-driven web experience.
- For software developers, Web 2.0 also referred to a change in the paradigm. Programming logic, which previously existed only on the server, began to migrate more and more to the browser, which required learning **JavaScript**

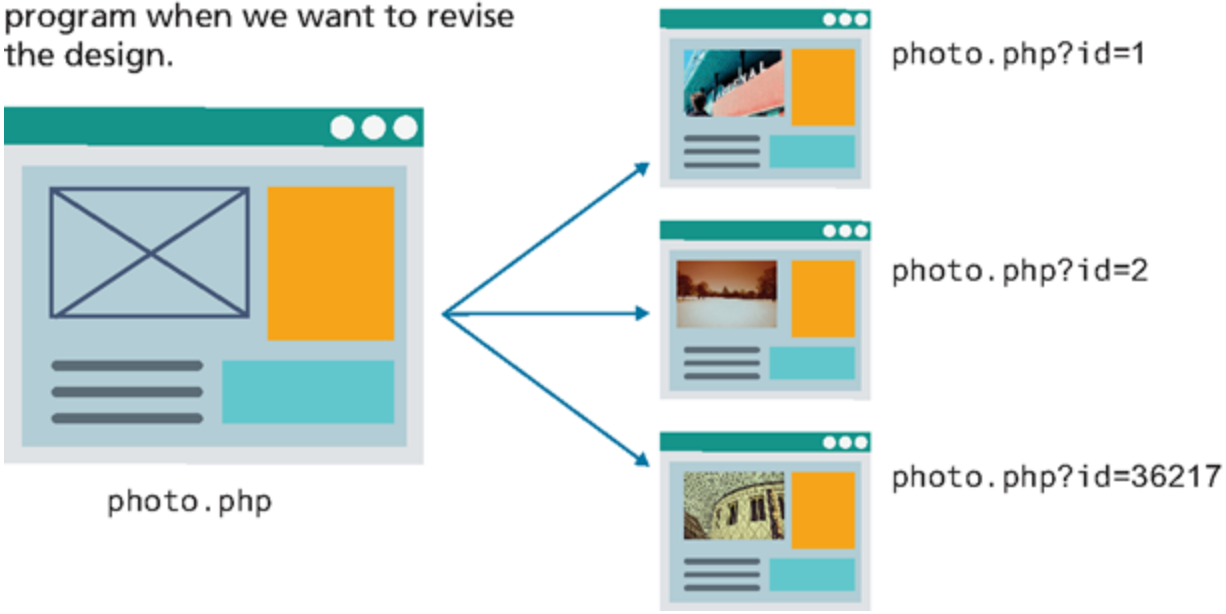
Why are programs needed? (1 of 2)



Having separate HTML pages for each photo would be impractical and very time-consuming to maintain or update the design.

Why are programs needed? (2 of 2)

Instead, using a single program, we can display any of our photos. We will only need to update a single program when we want to revise the design.

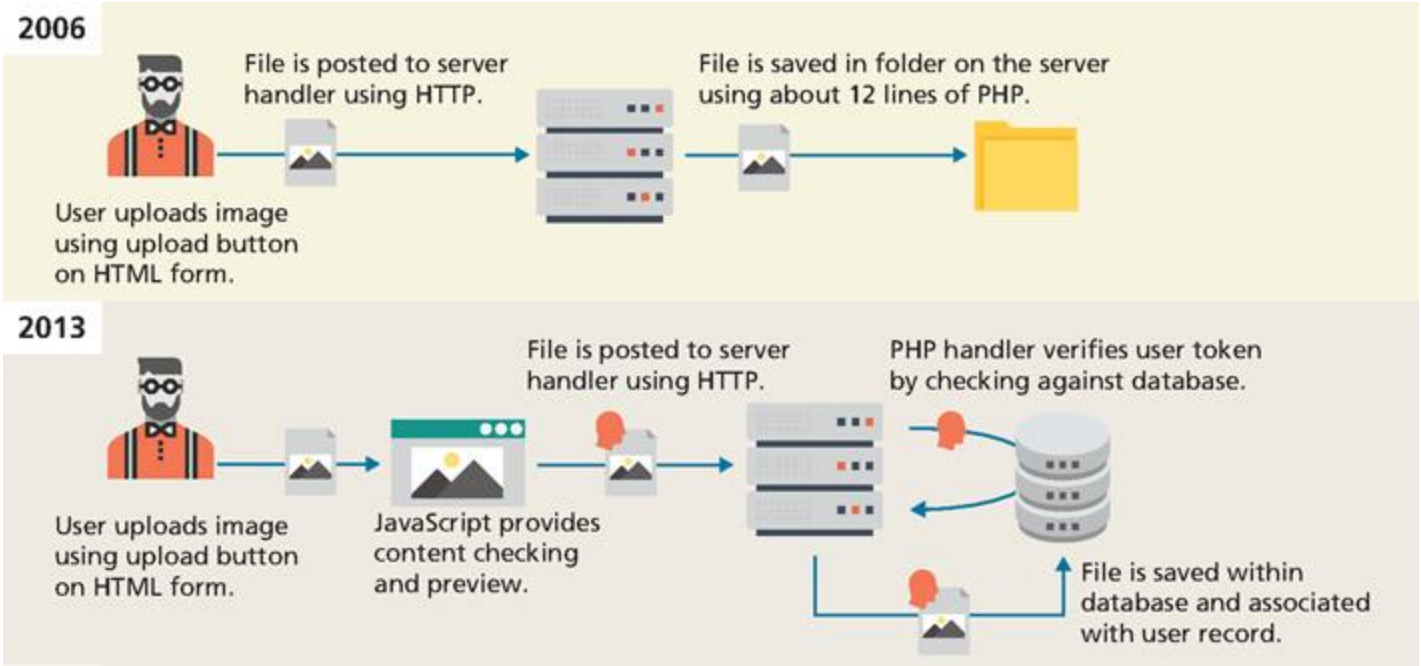


The evolution continues

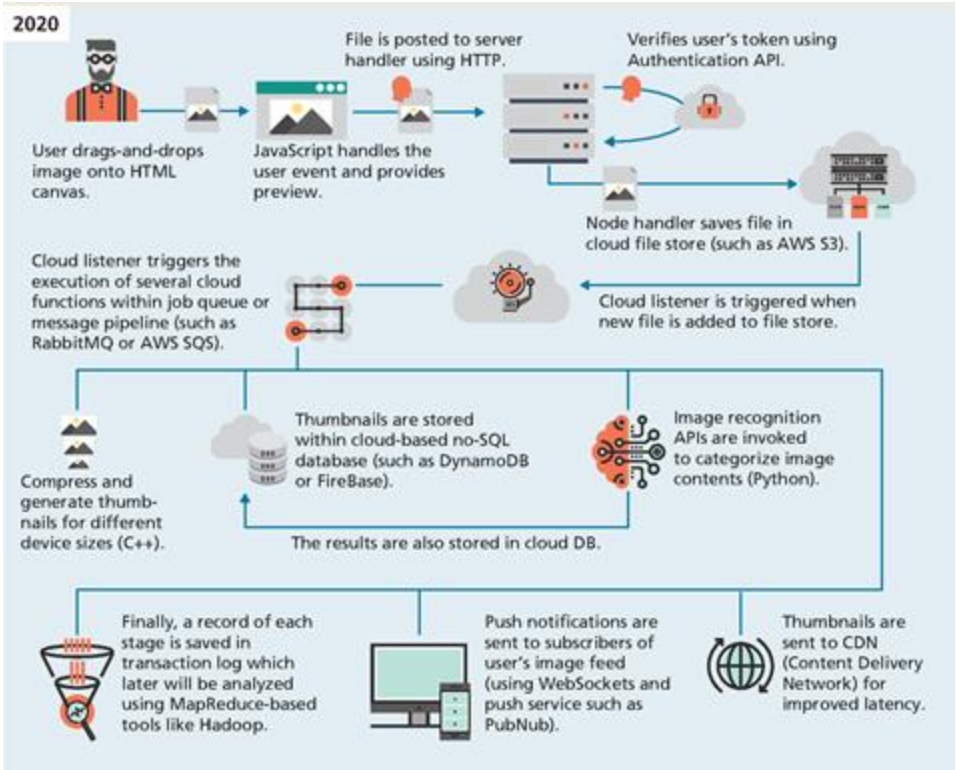
Web development today is thus more complicated than it was when the first edition of this textbook was written in 2012–2013.

- Early chapters on **HTML** and **CSS** teach layout and structural foundations.
- **JavaScript** chapters focus on the fundamentals of the language and its usage within the browser.
- While back-ends are thinner than they once were, **server-side technologies** are still essential.
- Databases, state management, and authentication are all covered.
- Management, security and configuration round out the advanced topics.
- The one constant in the history of web development has been change

Evolving complexity example. File upload



Evolving complexity example (cont.)



The Client-Server Model

Client machines are the desktops, laptops, smart phones, and tablets you see everywhere.

Broad range of specifications regarding

- operating system,
- processing speed,
- screen size,
- available memory, and
- storage

Server machines hosts web applications, stores user and program data, and performs security authorization tasks

Powerful machines to handle high traffic and bandwidth.

The essential characteristic of a server is that it is listening for requests, and upon getting one, responds with a message.

Server Types

- Web servers.
- Application servers.
- Database servers.
- Mail servers.
- Media servers.
- Authentication servers.

Real World Server Installations

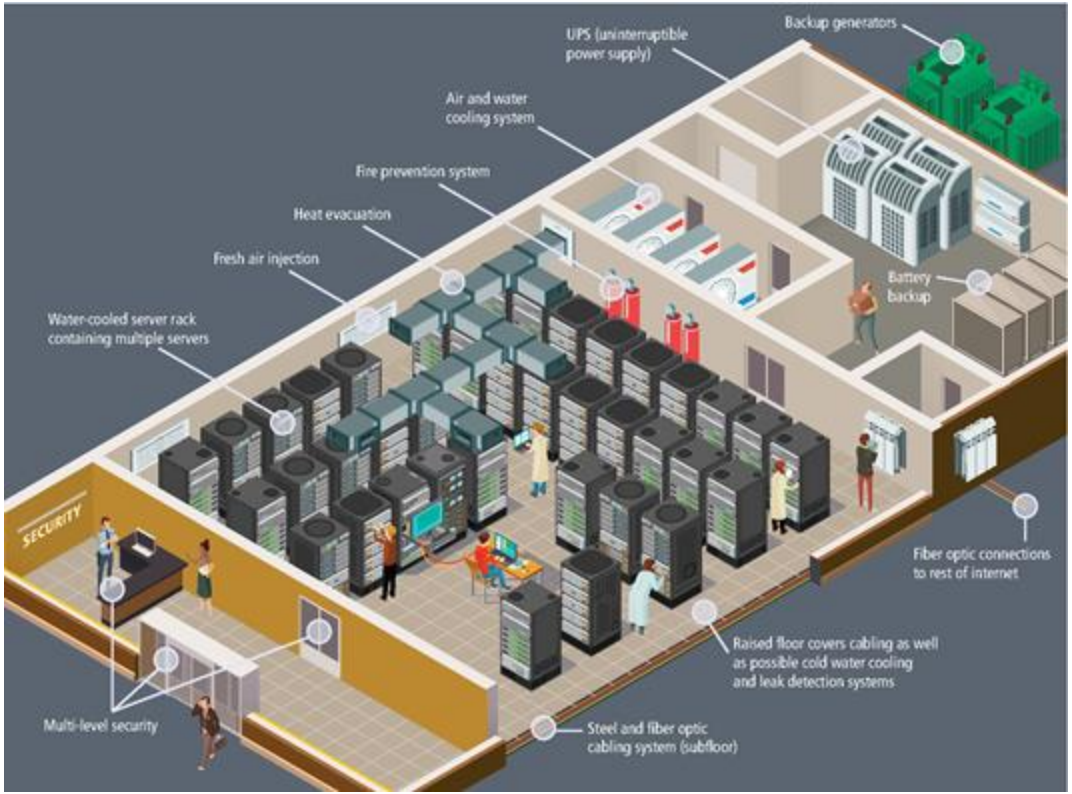
Not one server, but a cluster of multiple machines working together.

- Server Farm
- Load Balancers
- Failover Redundancy
- Server Racks
- Data Centers
- Cloud Services

Hypothetical data center

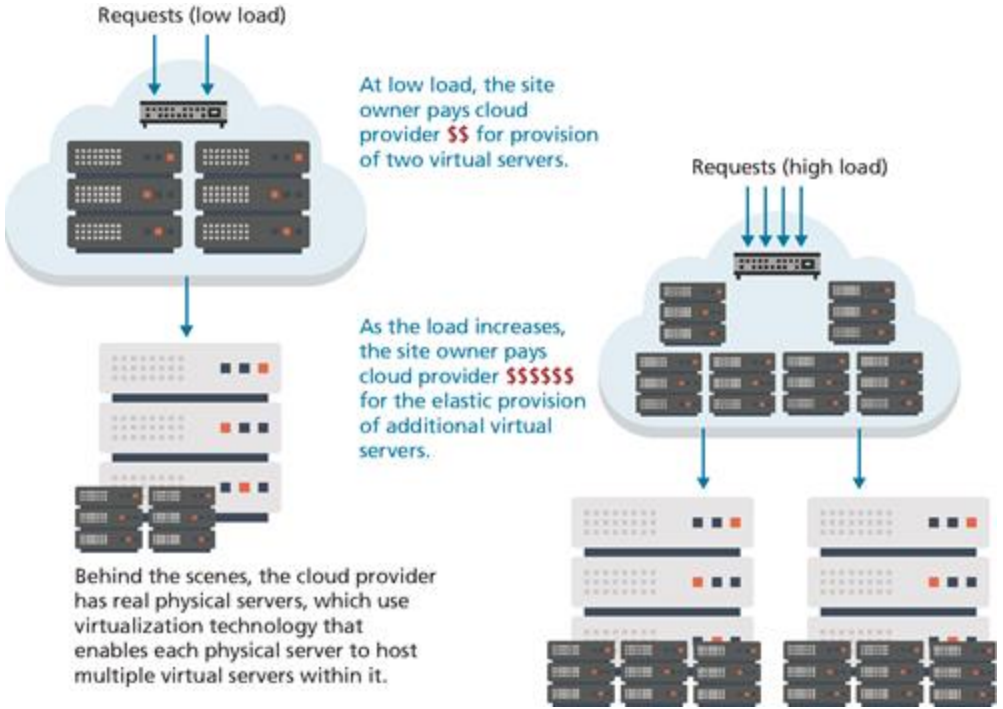
Many additional considerations can be handled at a data center including:

- Fire suppression,
- Biometric security,
- Failover data
- Redundant power
- and more!



Cloud Servers

Instead of spending too much or spending too little to handle peak loads, cloud providers offer **elastic provisioning** of virtual servers, which scales costs and hardware to the demand



Where Is the Internet?

It is quite common for the Internet to be visually represented as a cloud

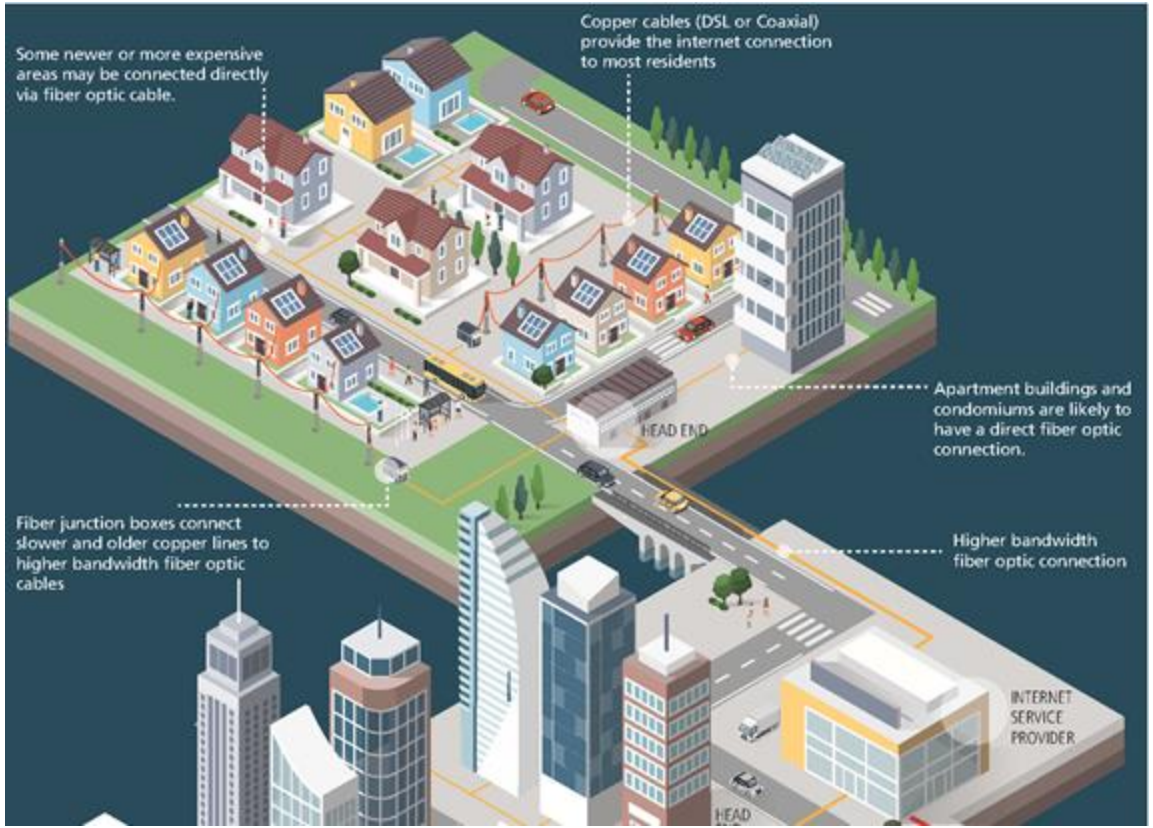
Actually implemented via millions of miles of copper wires and fiber optic cables connecting millions of server computers and other networked devices!

From the Computer to Outside the Home

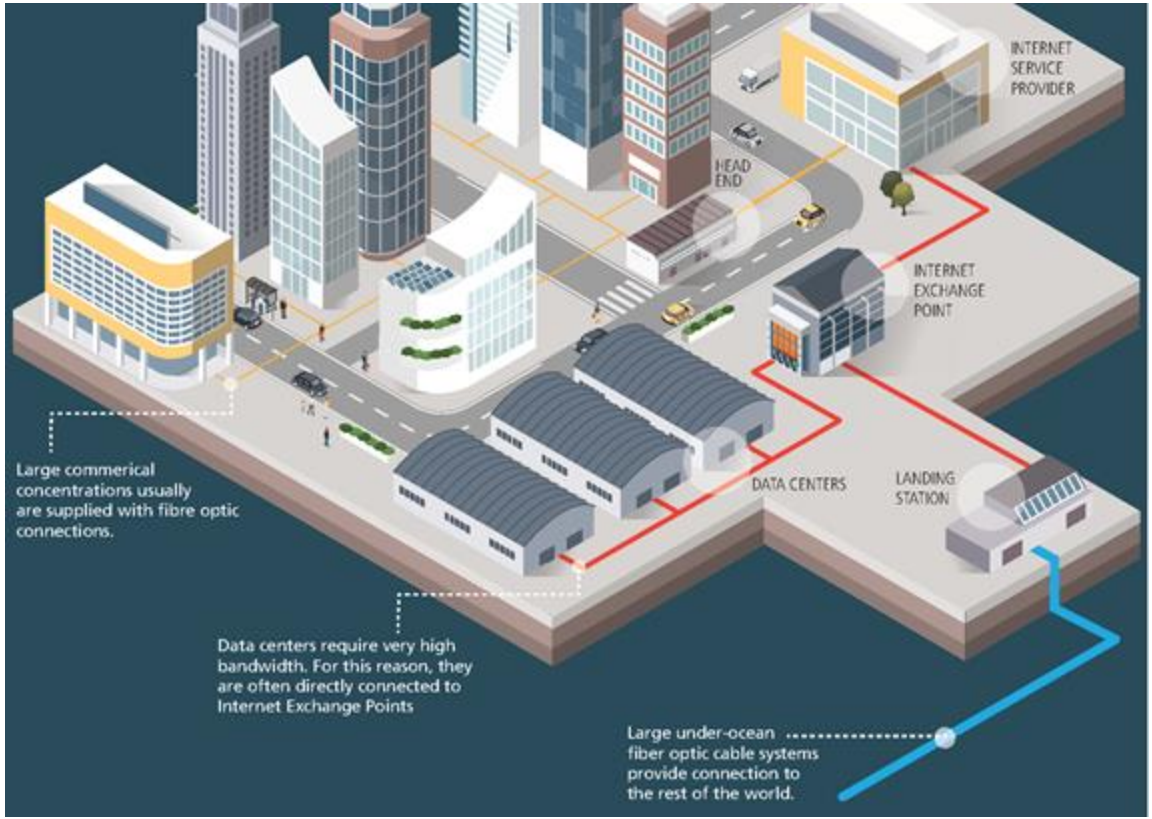
The **broadband modem** is a bridge between the network hardware outside the house and the network hardware inside the house. These devices are often supplied by the ISP.

The **wireless router** is perhaps the most visible manifestation of the Internet in one's home. At its simplest, a router is a hardware device that forwards data packets from one network to another network.

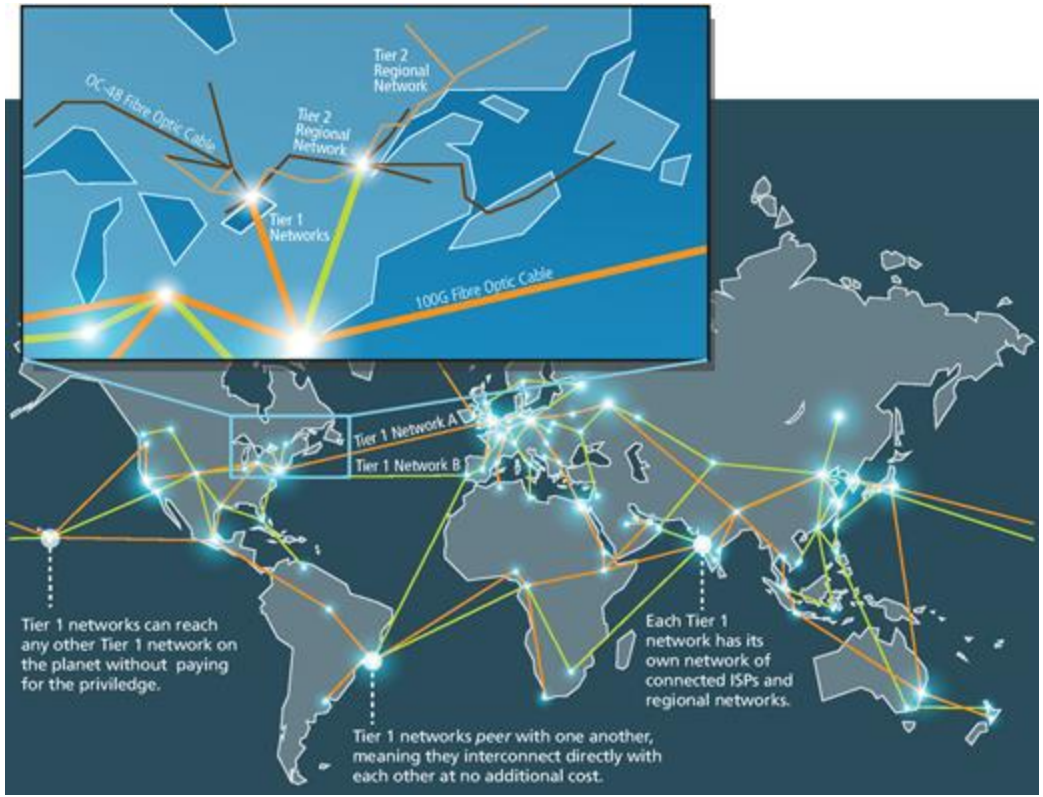
From the Home to the Ocean's Edge



From the Home to the Ocean's Edge (2)



How the Internet Is Organized Today

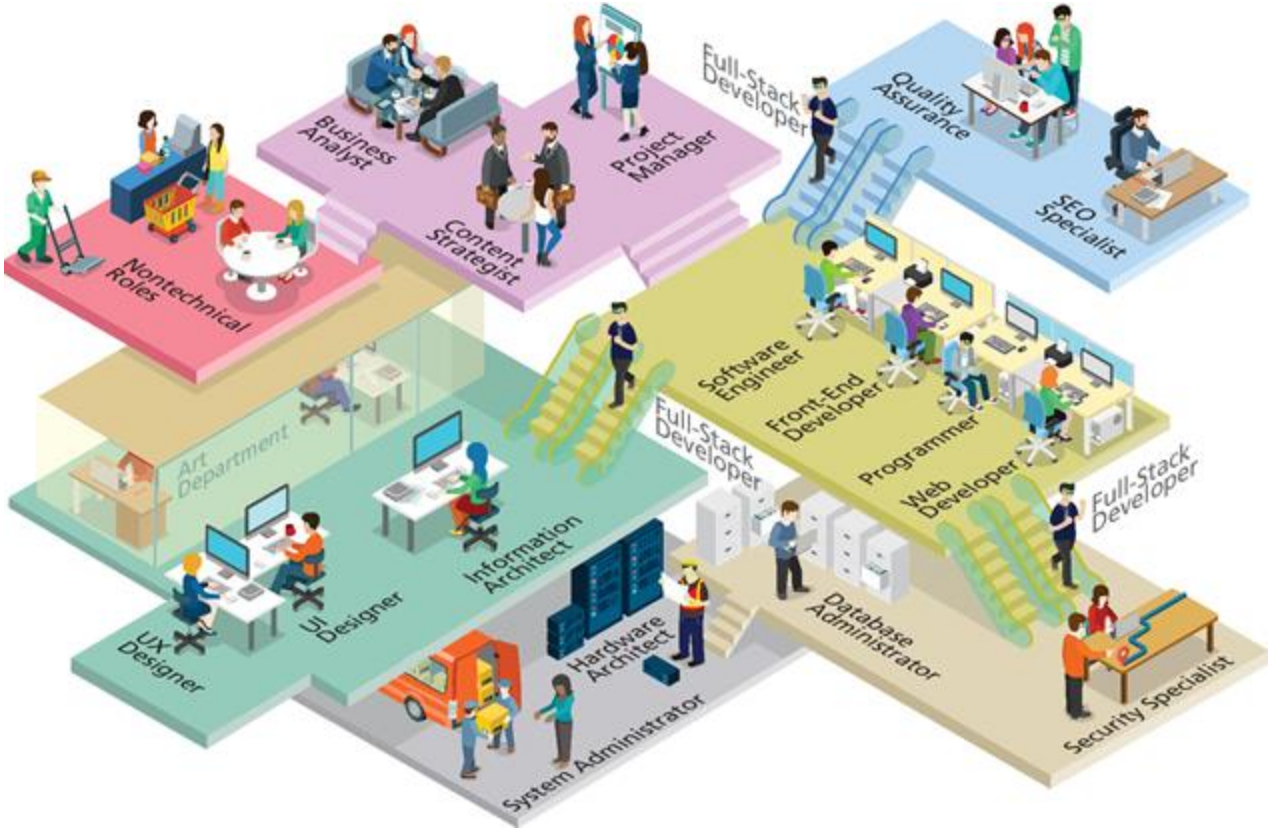


When someone talks about the "Internet Backbone" they are talking about Tier 1 networks.

Tier 1 Networks make use of very fast fiber optic cable.

Regional networks have traditionally used less speedy infrastructure, though this is rapidly changing as prices of optical hardware decreases.

Working in Web Development



Roles in Web Development

- Hardware Architect/Network Architect/Systems Engineer
- System Administrator
- Database Administrator/Data Architect
- Security Specialist/Consultant/Expert
- Developer/Programmer
- Front-End Developer/UX Developer
- Software Engineer
- UX Designer/UI Designer/Information Architect
- Tester/Quality Assurance
- SEO Specialist
- Content Strategists/Marketing Technologist
- Project Manager/Product Manager
- Business Analyst
- Nontechnical Roles
- Full-stack developer

Web Development Companies

- Hosting Companies
- Design Companies
- Website Solution Companies
- Vertically Integrated Companies
- Start-Up Companies
- Internal Web Development

Key Terms

application server
authentication server
back end
bandwidth
broadband modem
circuit switching
client
client-server model
Content Delivery Networks (CDN)
Content Delivery Networks (CDN)
data center
database server
DevOps (Development and Operations)
dynamic server-side website
elastic provisioning
failover redundancy
fiber optic cable
front end
full-stack developer
intranet
internet
Internet exchange point (IX or IXP)
Internet service provider (ISP)
latency
load balancers
mail server
media server
Mosaic
Netscape Navigator
Network Access Points (NAP)
next-hop routing
packet
packet switching
peer-to-peer model
request
protocols
Request for Comments (RFC)
request-response loop
response
router
routing table
semantic web
server
server farm
server racks
shared hosting
static website
TCP/IP (Transmission Control Protocol/ Internet Protocol)
user experience
virtual server
webmaster
web servers
Web 2.0
World Wide Web Consortium (W3C)

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