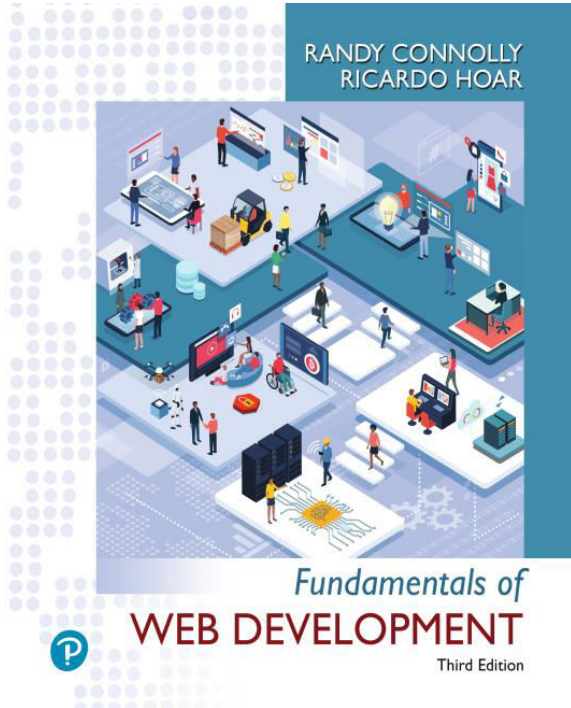


# Fundamentals of Web Development

Third Edition by Randy Connolly and Ricardo Hoar



## Chapter 1

### Introduction to Web Development

# In this chapter you will learn . . .

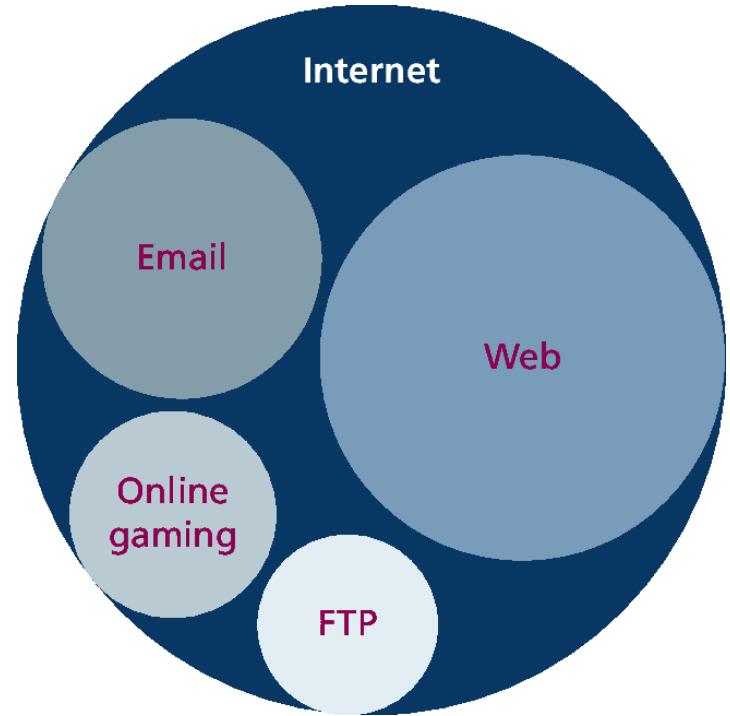
- **About web development in general**
- **The history of the Internet and World Wide Web**
- **Fundamental concepts that form the foundation of the Internet**
- **About the hardware and software that support the Internet**
- **The range of careers and companies in web development**

# A Complicated Ecosystem



# A Short History of the Internet

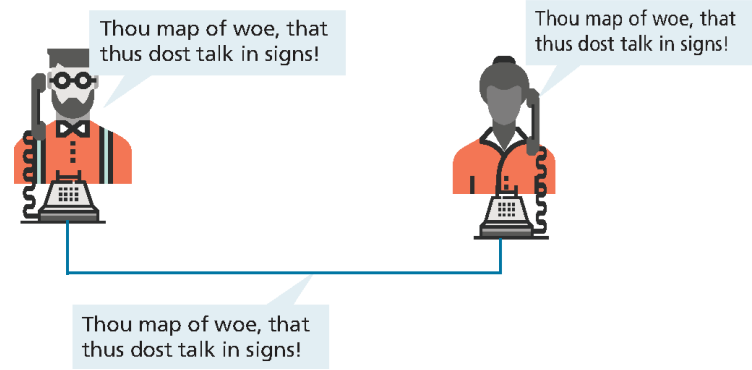
- Know the difference between “Internet” and “WWW”
- While this book is focused on the web, part of this chapter is also devoted to a broad understanding of that larger circle labeled the “Internet.”
- **Protocols** define different kinds of interactions/services on the Internet



# 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

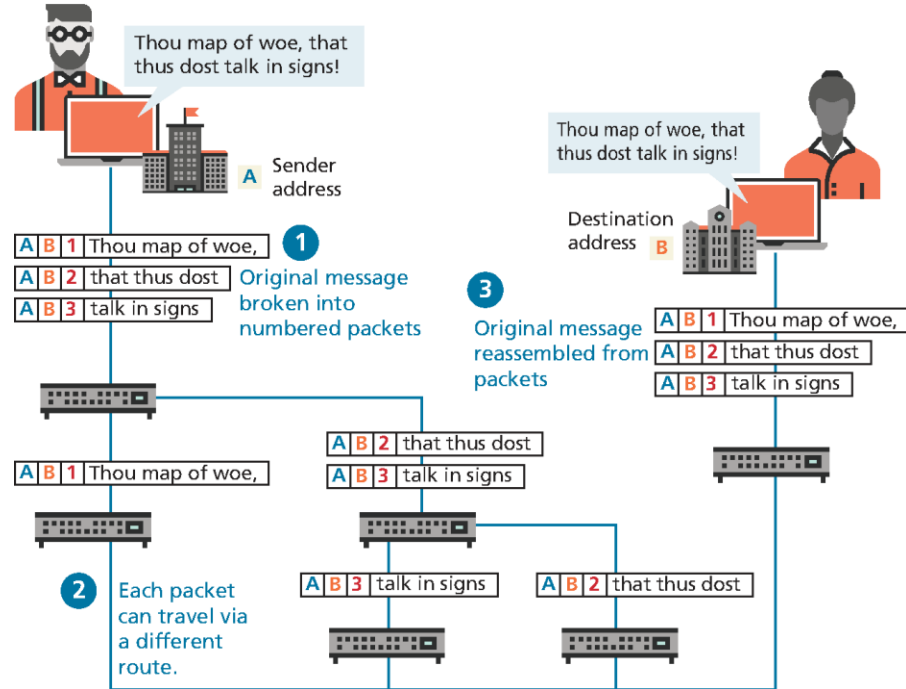


# Packet Switched Networks

**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).

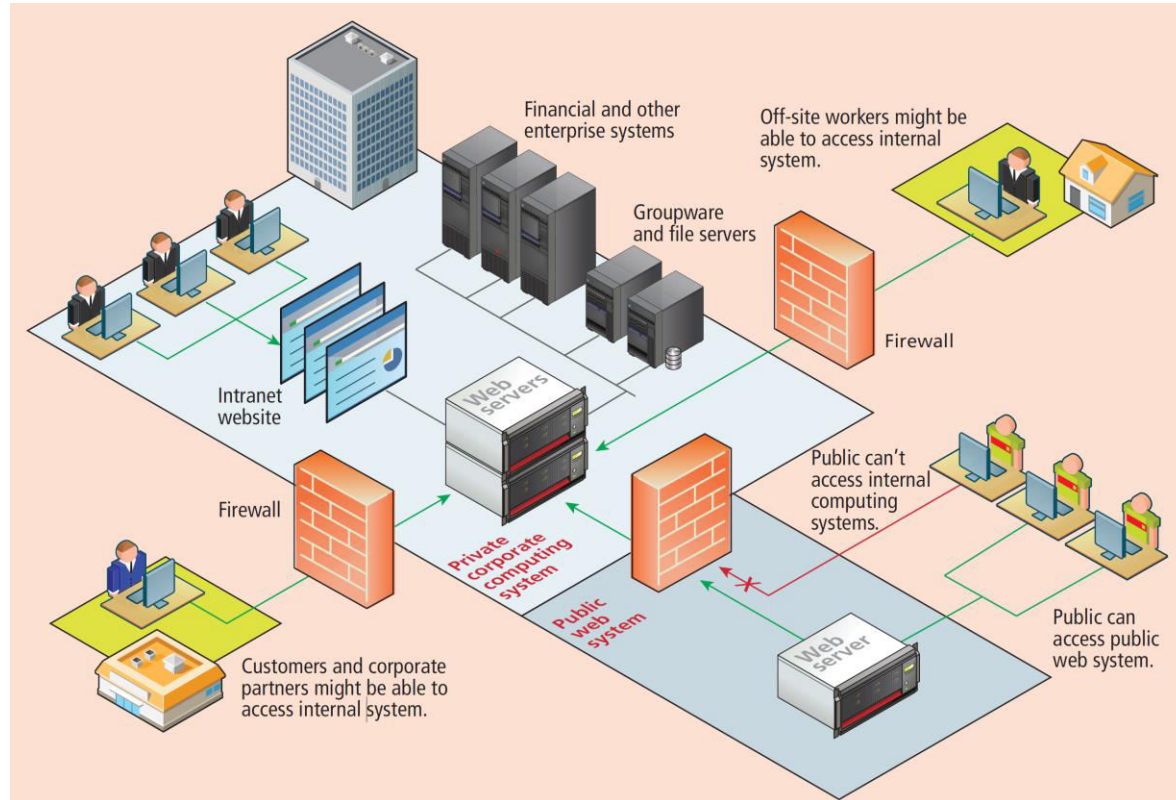


# Web Applications in Comparison to Desktop Applications (2 of 2)

## Disadvantages

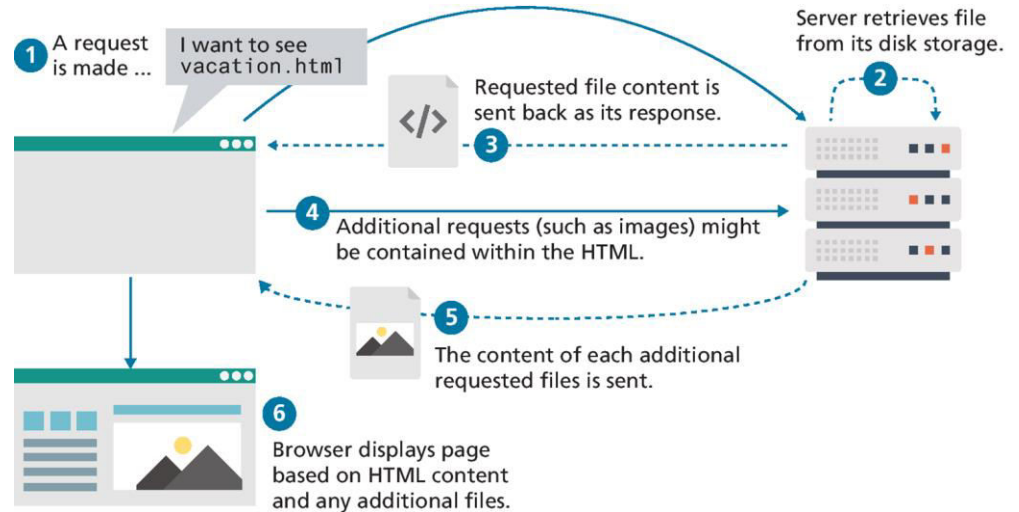
- Requirement to have an active Internet connection
- Security concerns about sensitive private data being transmitted over the Internet.
- Concerns over the storage, licensing, and use of uploaded data.
- Problems with certain websites not having an identical appearance across all browsers.
- Restrictions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

# Intranet vs. Internet



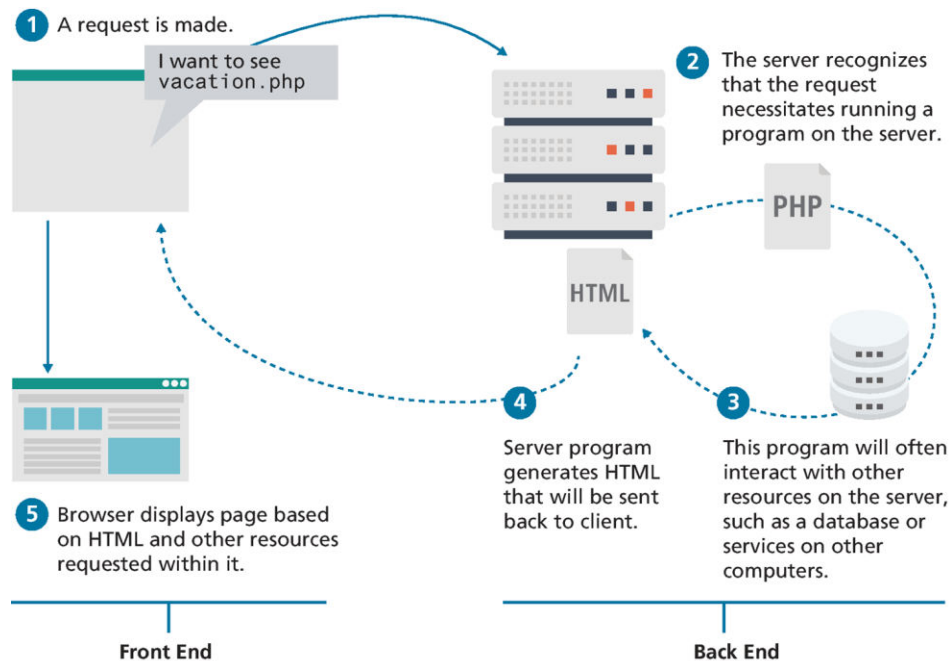
# From Static to Dynamic (and Back to Static)

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**

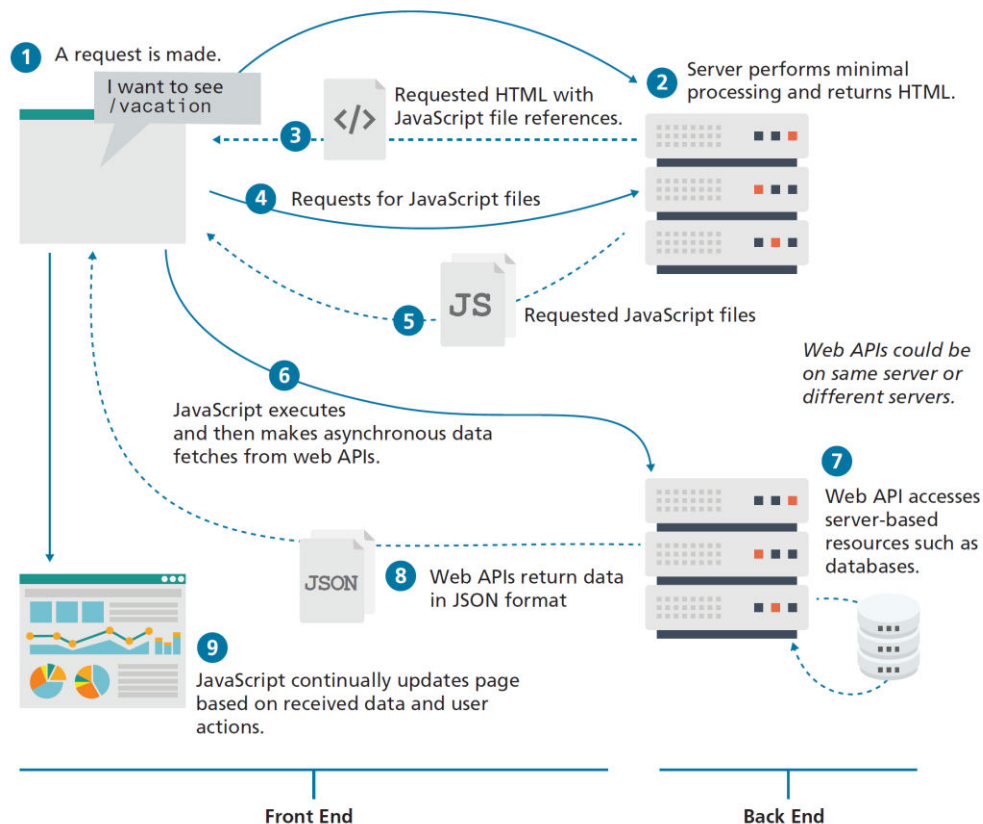


# Web 2.0

- **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**

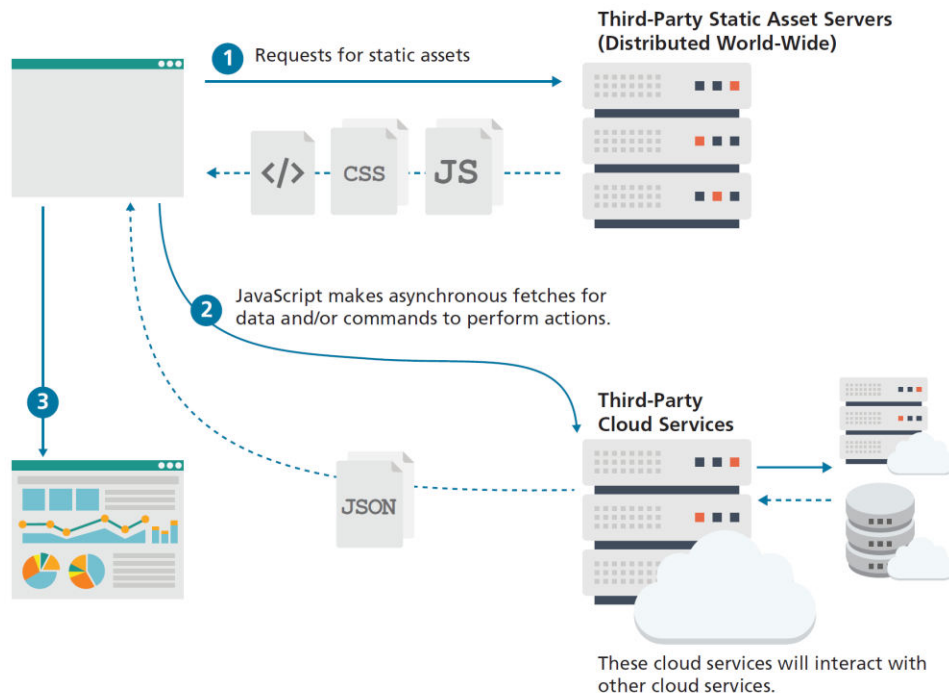
# From Static to Dynamic (and Back to Static) III

By the late 2010s, servers often performed minimal processing outside of authentication and data provision. The back end became “thinner”.



# From Static to Dynamic (and Back to Static) IV

This trend towards thinner and thinner back ends is still continuing. Thanks to innovations in cloud-based services, static websites are back, albeit in a new form.



# Why are programs needed? (1 of 2)

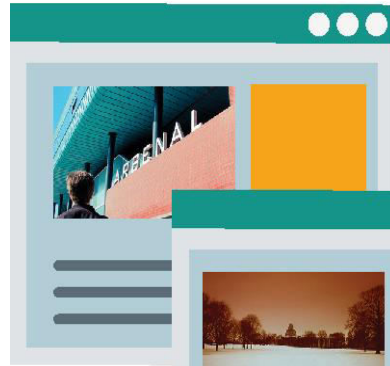


photo1.html

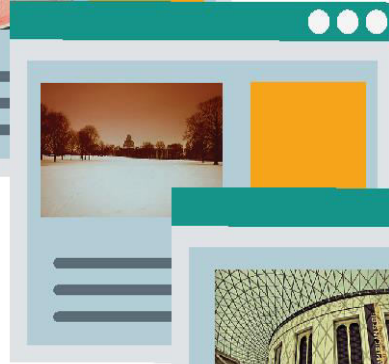


photo2.html

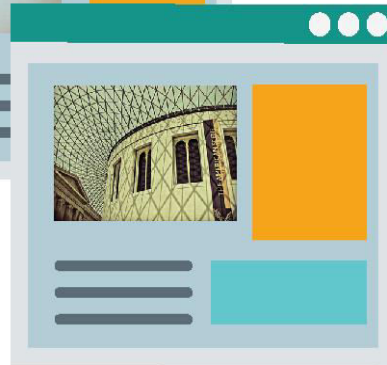


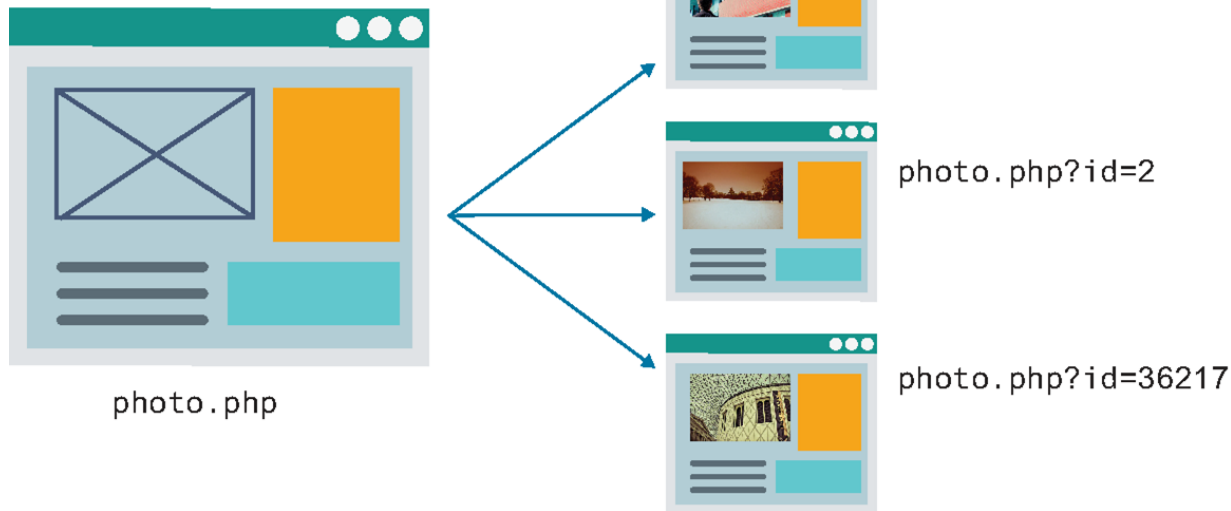
photo36217.html

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.



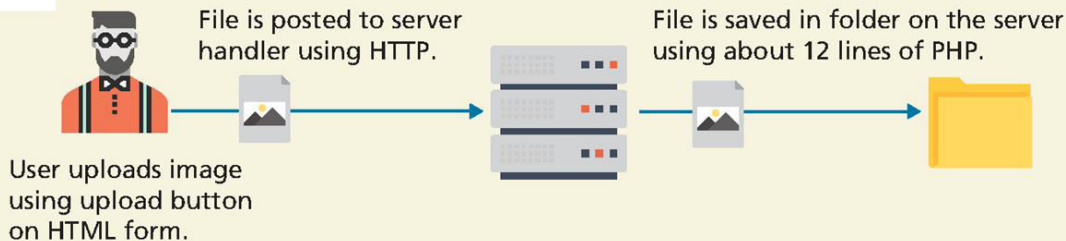
# The evolution continues

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

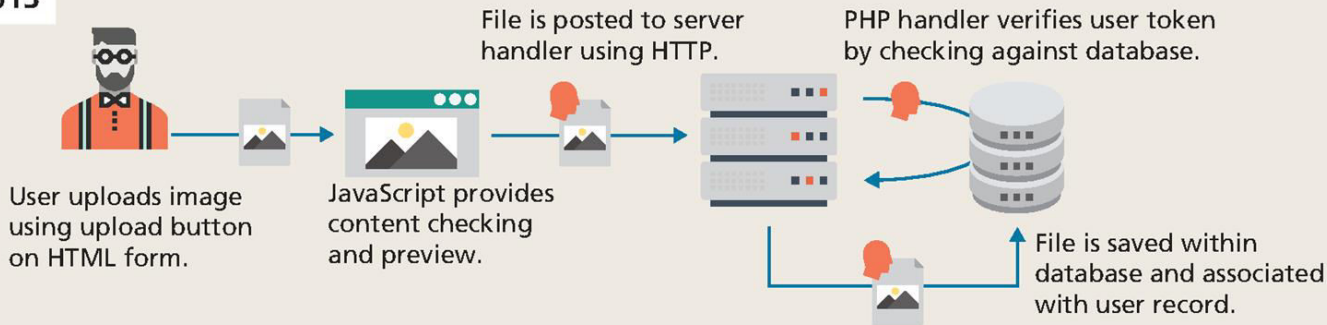
- Early chapters on **HTML** and **CSS** teach layout and structural foundations.
- **JavaScript** chapters focus on the fundamentals of the language and its usage within the browser.
- While back-ends are thinner than they once were, **server-side technologies** are still essential.
- Databases, state 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

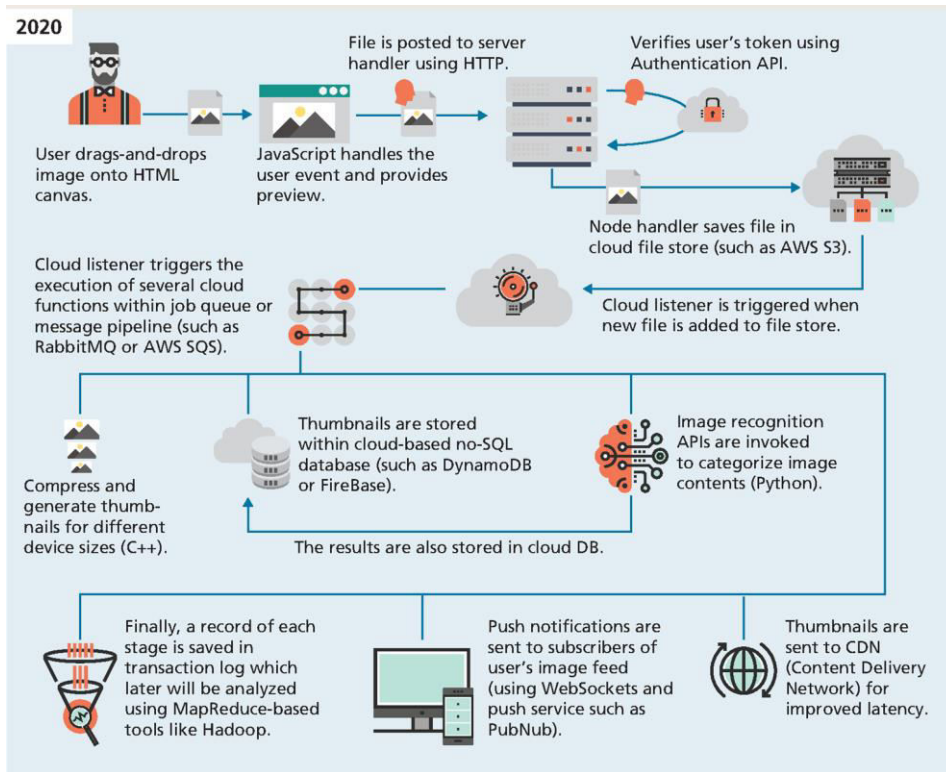
2006



2013



# 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

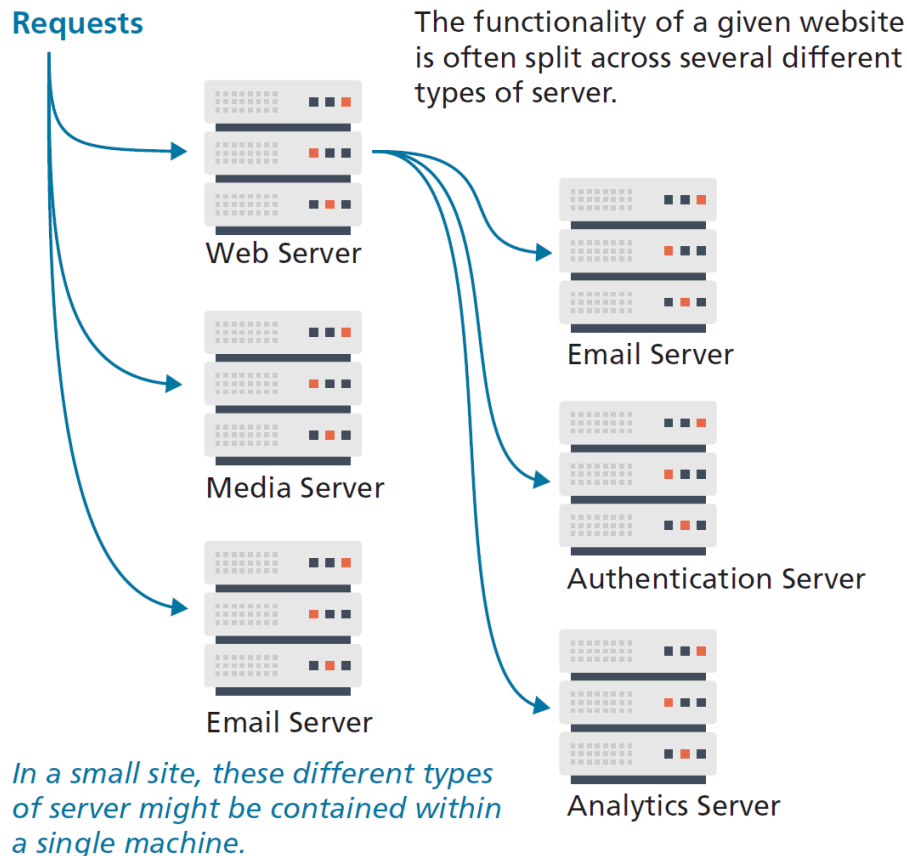
**Server machines** hosts web applications, stores user and program data, and performs security authorization tasks

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

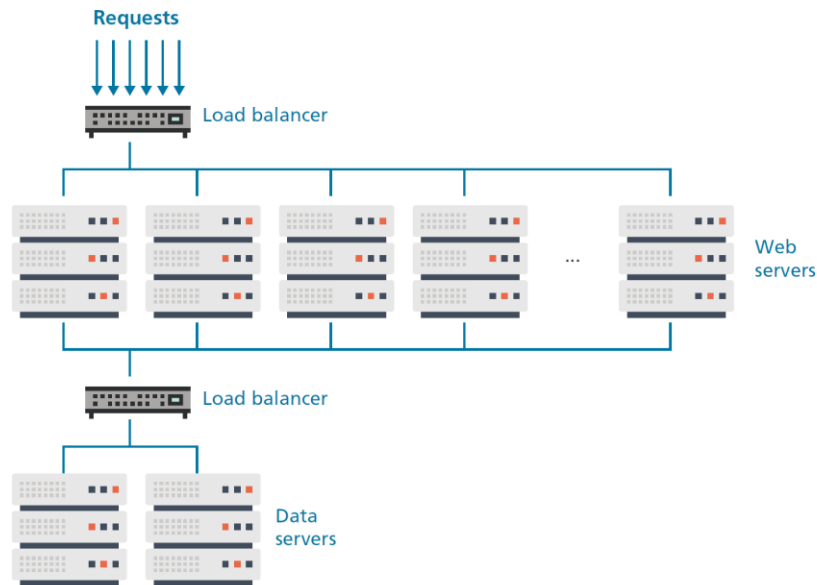
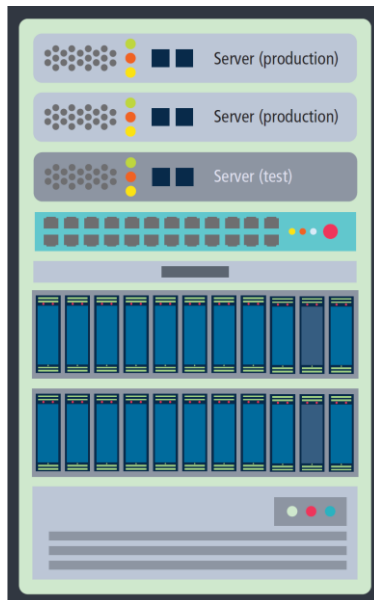
- Web servers.
- Application servers.
- Database servers.
- Mail servers.
- Media servers.
- Authentication servers.



# Real World Server Installations

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

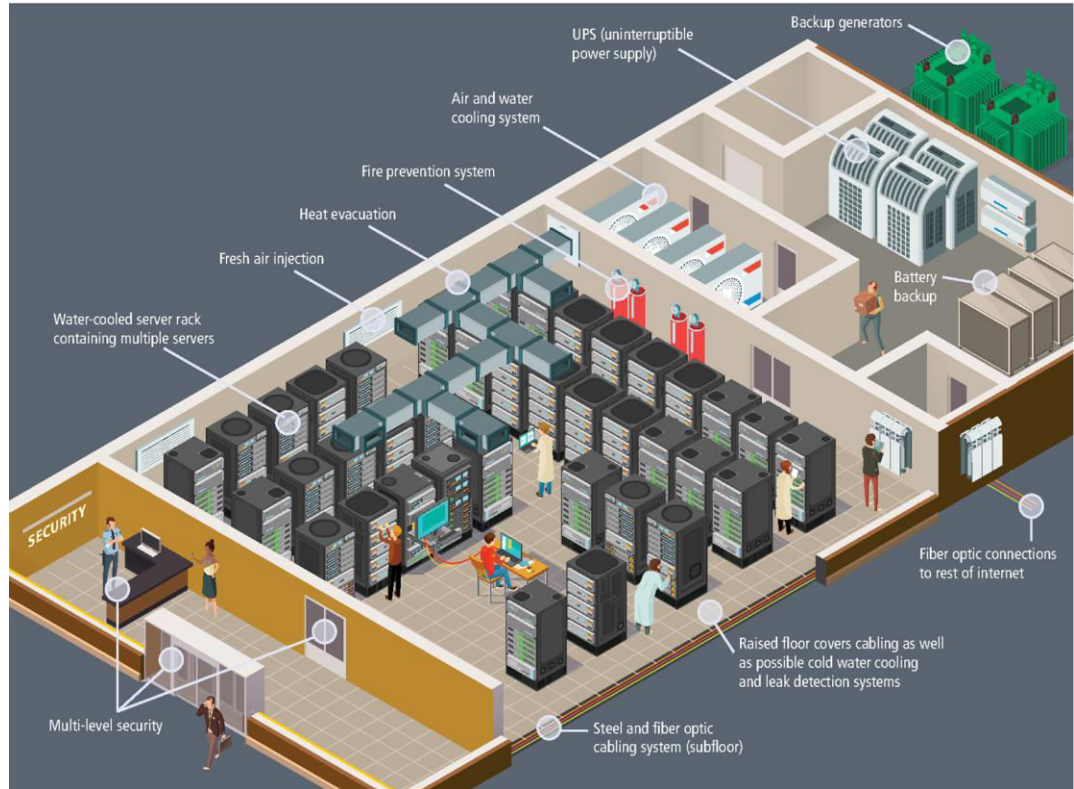
- Server Farm
- Load Balancers
- Failover
- Redundancy
- Server Racks
- Data Centers
- Cloud Services



# Hypothetical data center

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

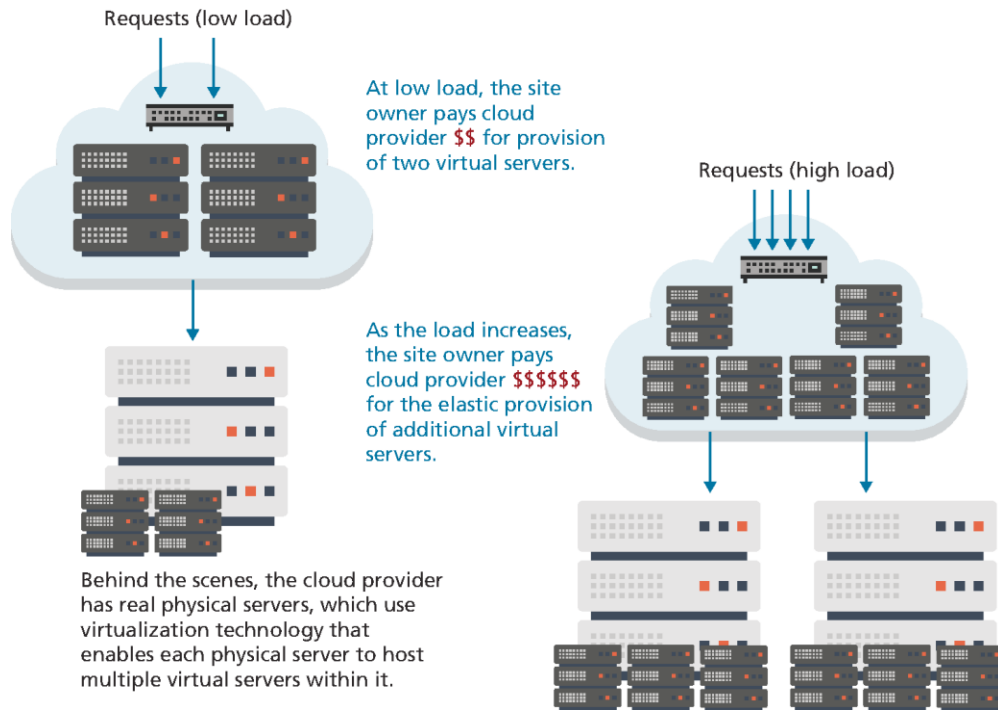
- Fire suppression,
- Biometric security,
- Failover data
- Redundant power
- and more!





# 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

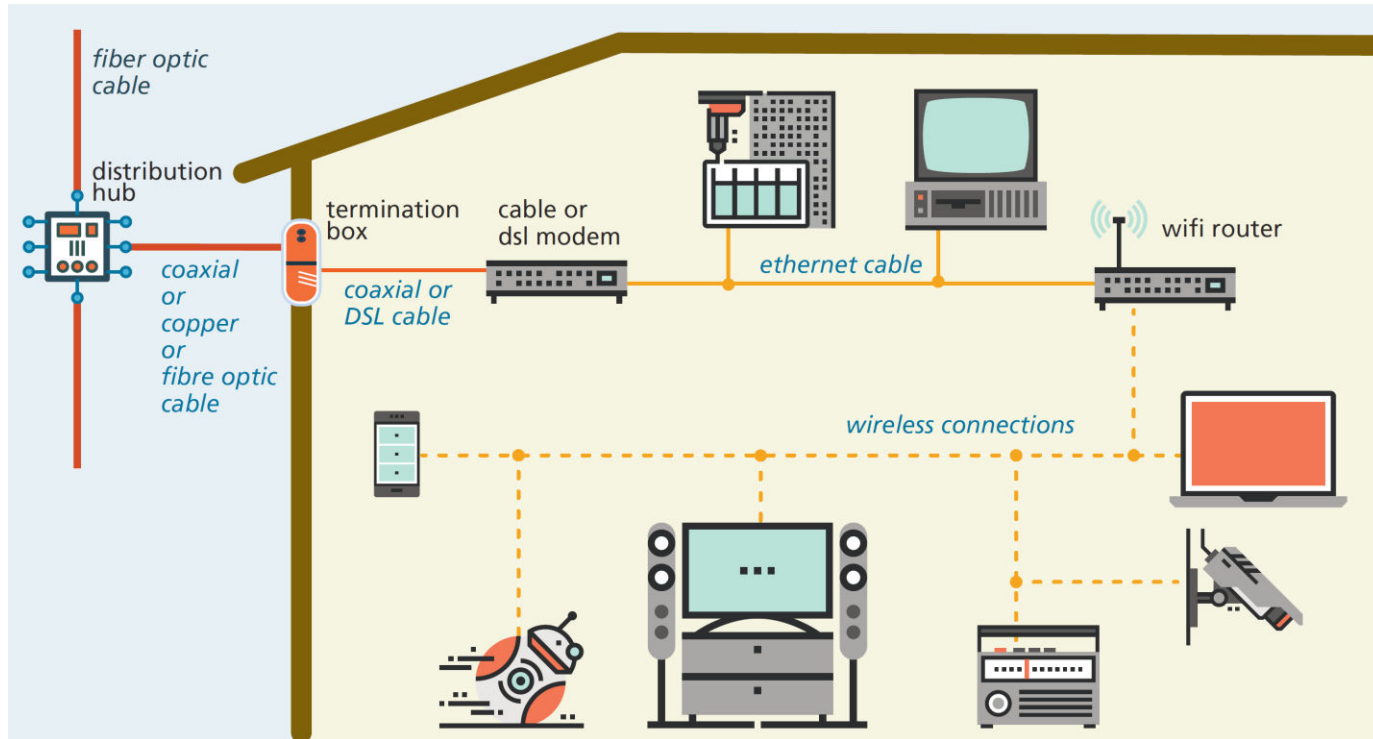


# Where Is the Internet?

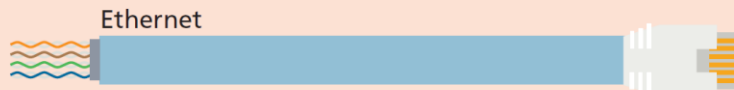
It is quite common for the Internet to be visually represented as a cloud

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



# From the Computer to Outside the Home



Ethernet

Ethernet cables use four twisted pairs and are typically used to connect computer devices on a network.



DSL

DSL cables also use twisted pairs to transmit digital information using standard telephone lines.



Coaxial

A coaxial cable is a copper cable surrounded by insulation that was initially used for TV cable and is still used for internet provision.



Fiber Optic

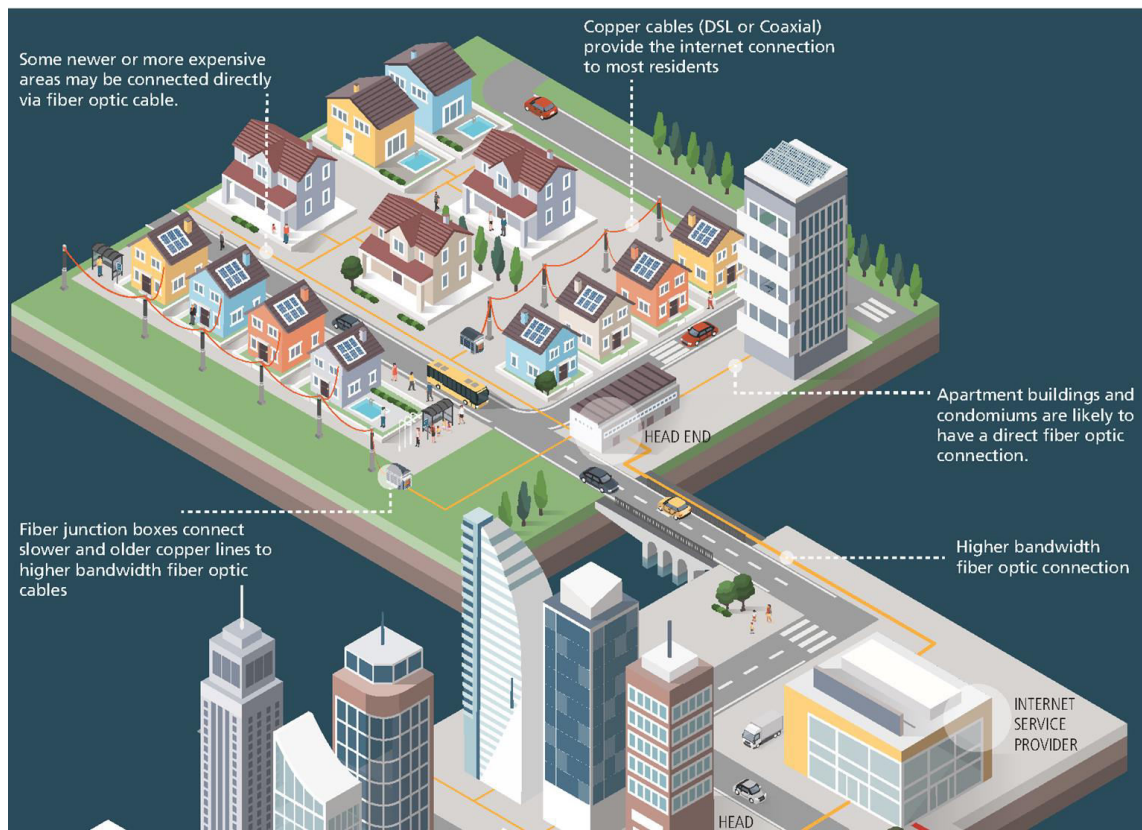
A fiber optic cable uses light pulses within flexible transparent fibers to pass data with a greater bandwidth and speed in comparison to metal cables.

# 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.

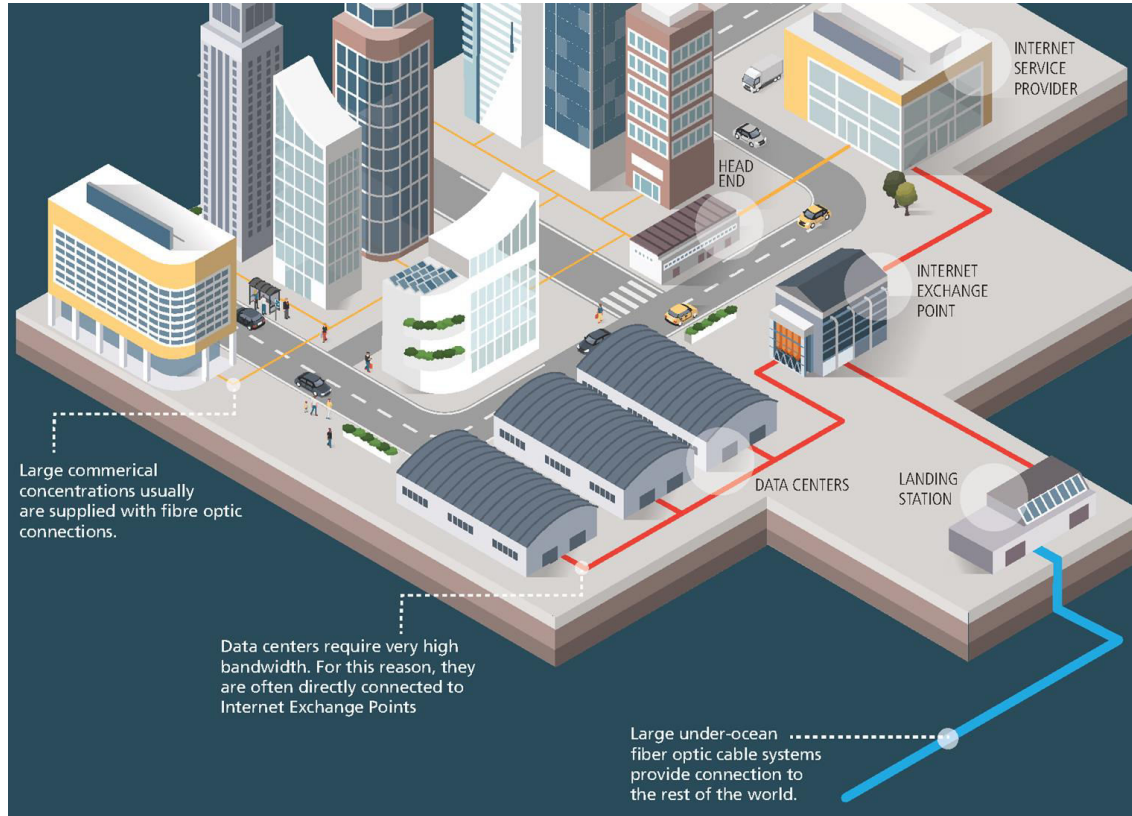
The **wireless router** is perhaps the most visible manifestation of the Internet in one's home. At its simplest, a router is a hardware device that forwards data packets from one network to another network.

# From the Home to the Ocean's Edge

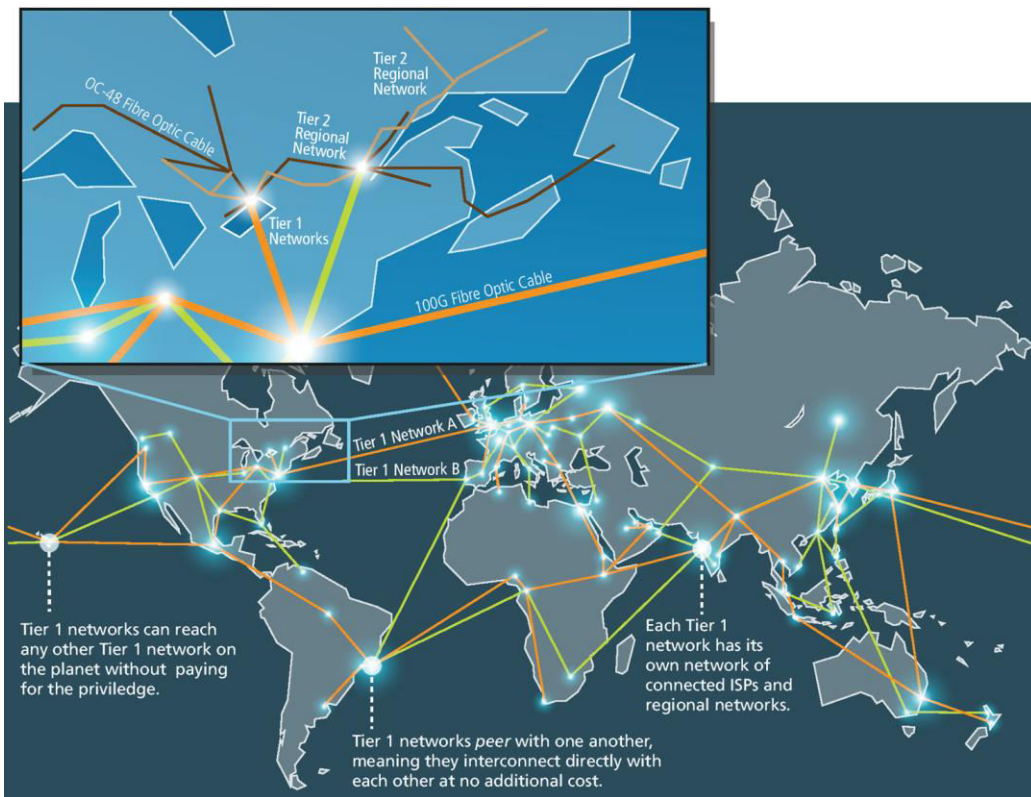


# From the Home to the Ocean's Edge

## (2)



# How the Internet Is Organized Today



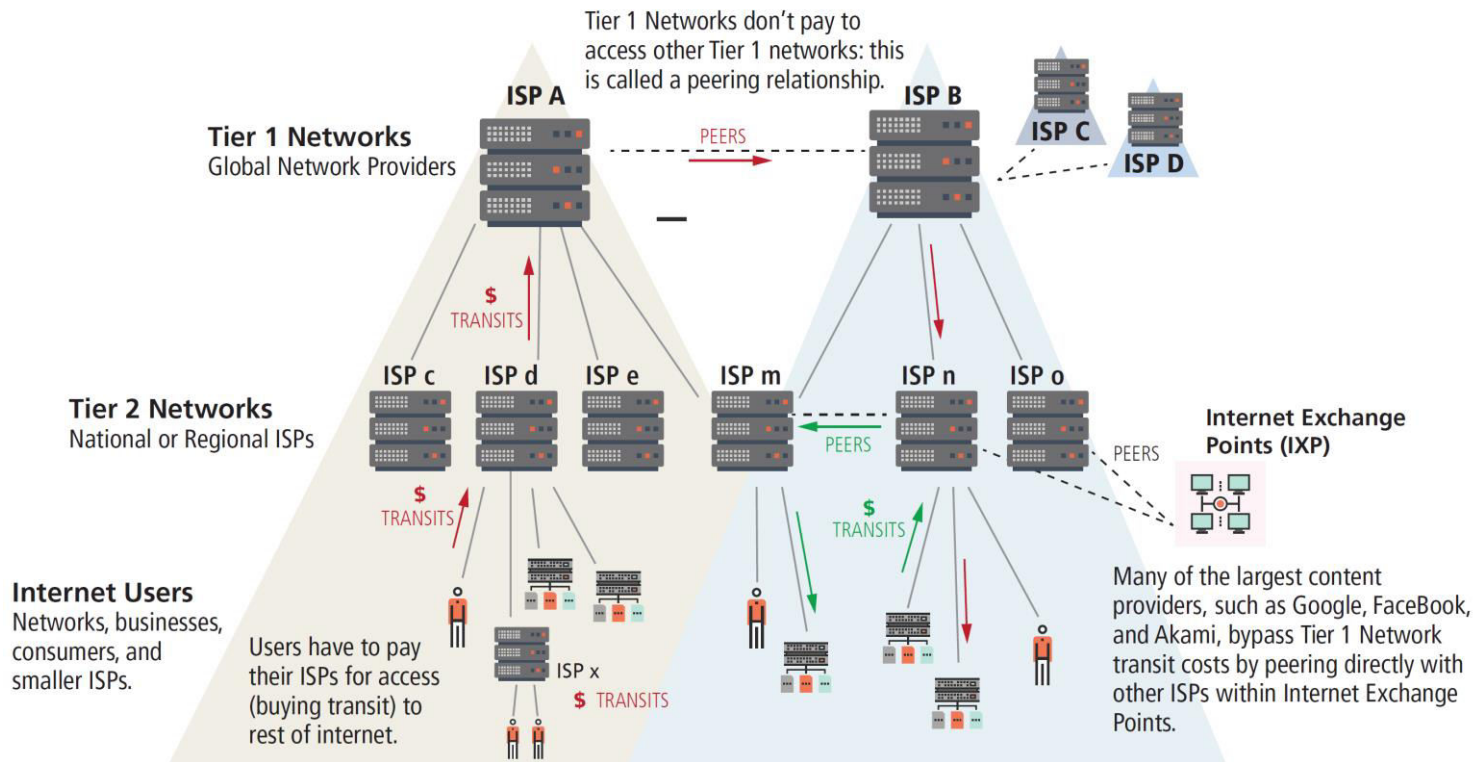
When someone talks about the “Internet Backbone” they are talking about Tier 1 networks.

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

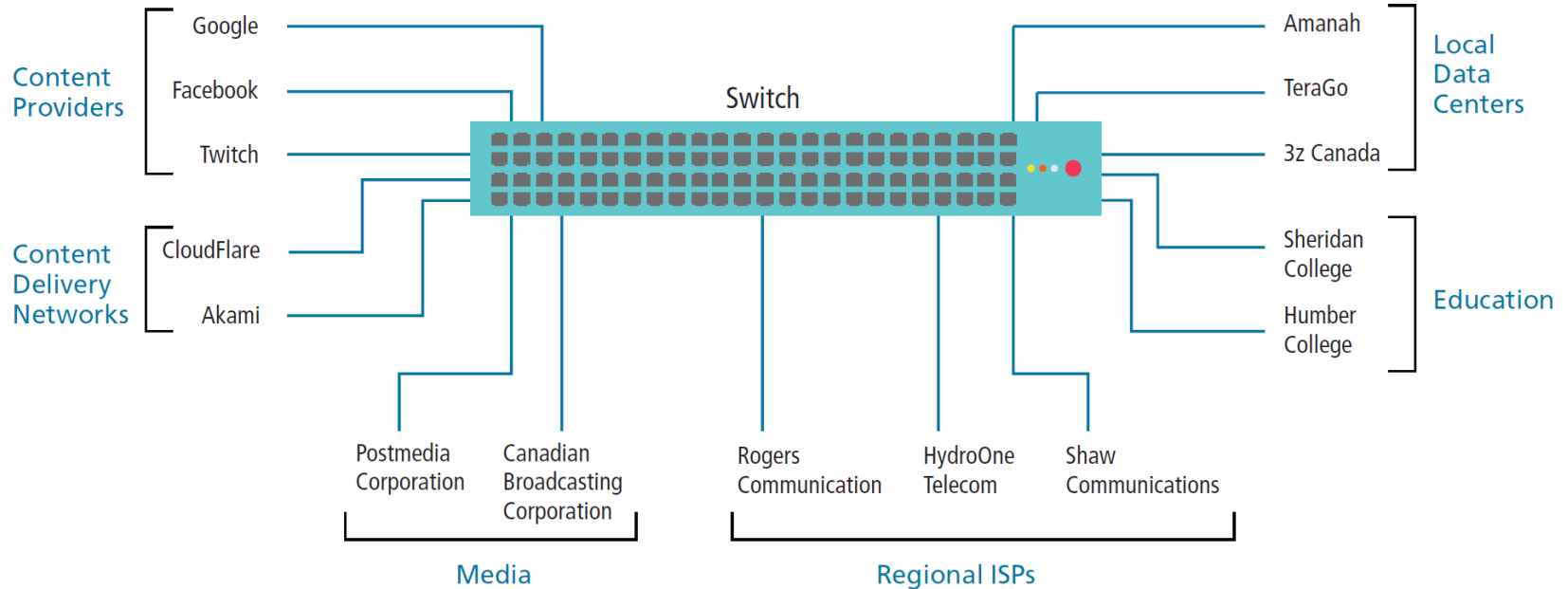
Regional networks have traditionally used less speedy infrastructure, though this is rapidly changing as prices of optical hardware decreases.



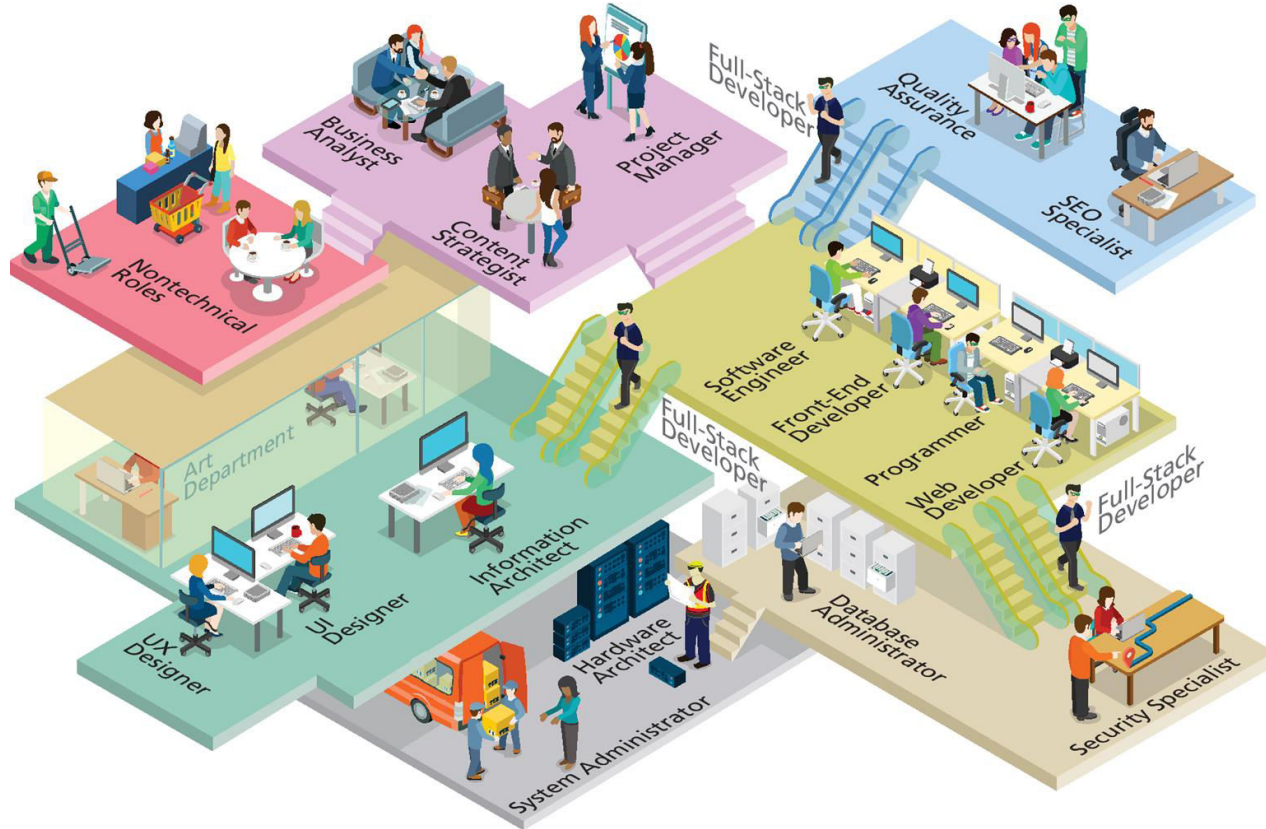
# How the Internet Is Organized Today



# How the Internet Is Organized Today



# 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)