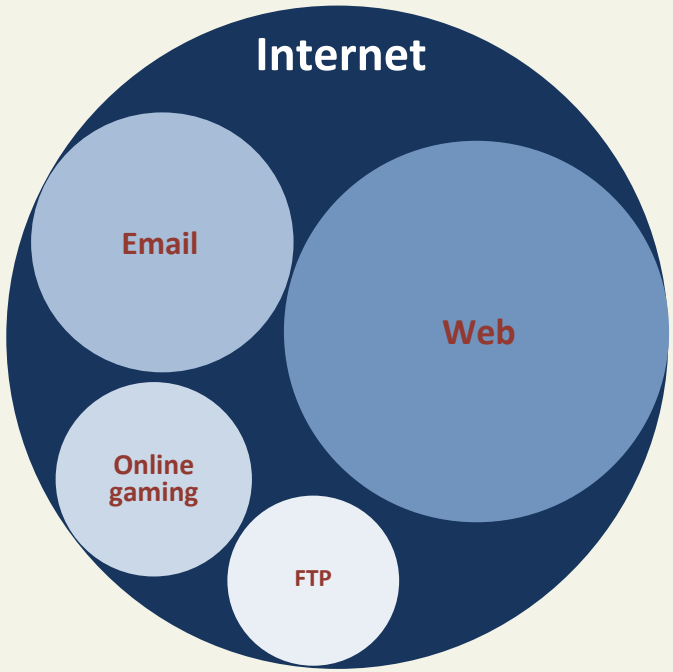
How the Web Works

Chapter 1

Randy Connolly and Ricardo Hoar

Internet = Web?

The World-Wide Web (WWW or simply the Web) is certainly what most people think of when they see the word “internet.”



The answer is no

Internet

is a vast, international network of computers.

Consists of computers around the world and the communication links that connect them.

the physical connections between computers vary, but the overall effect is that computers around the world can communicate and share resources

The World Wide Web

World Wide Web (WWW)
Software consists of web pages, images, sound files,..etc and the software that stores and retrieves these files

Checkpoint

- Could the web exist without the internet?
- Could the internet exist without the web?

Internet could exist without the Web

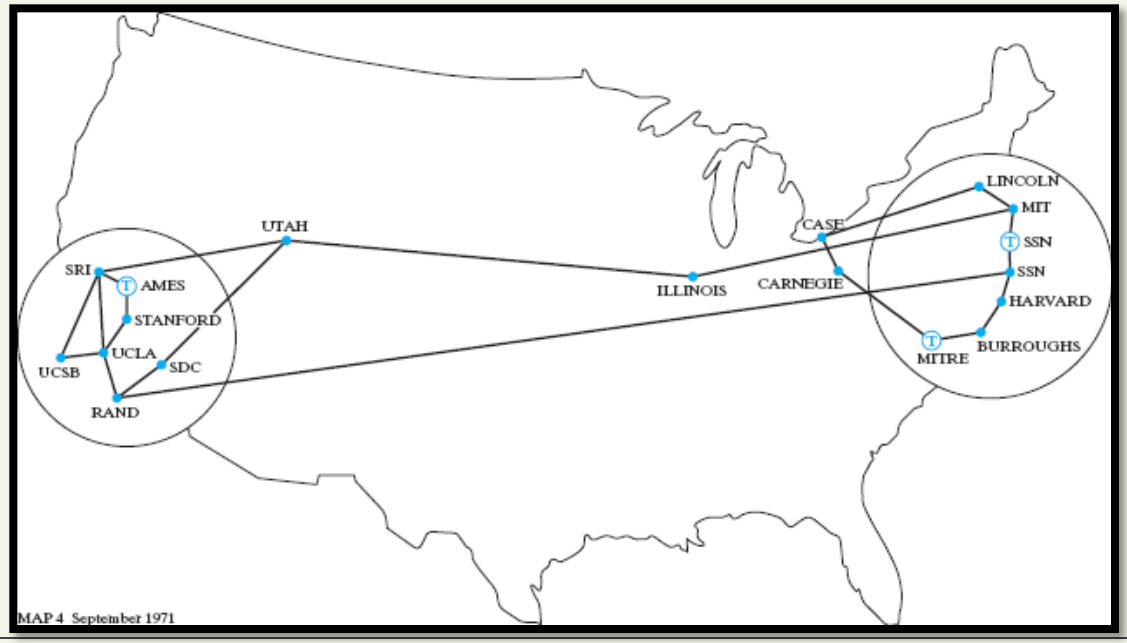
Web couldn't exist without the Internet
Internet is the hardware that stores and executes the Web software

Short History of the Internet

Perhaps not short enough

The early ARPANET network was funded and controlled by the United States government, and was used exclusively for academic and scientific purposes.

The early network started small with just a handful of connected campuses in 1969 and grew to a few hundred by the early 1980s.



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.

W3C

The World Wide Web Consortium (W3C) is an international organization committed to improving the web

W3C sets standards for the World Wide Web (WWW)

Standards developed by the Consortium include:

- CSS
- DOM
- HTML
- HTTP
- XHTML
- XML
- …

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.

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What is an "Intranet"?

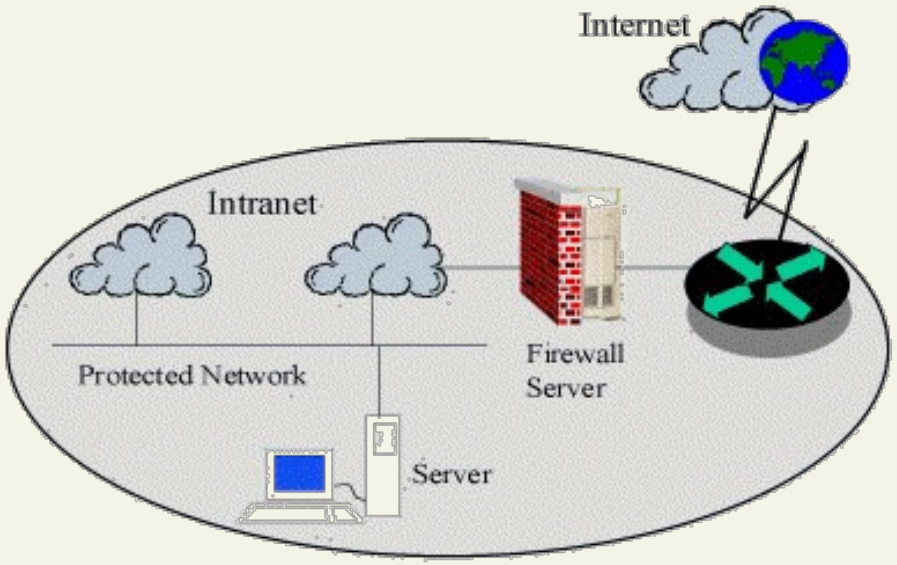
One of the more common terms you might encounter in web development is the term "**intranet**" which refers to an internet network that is local to an organization or business.

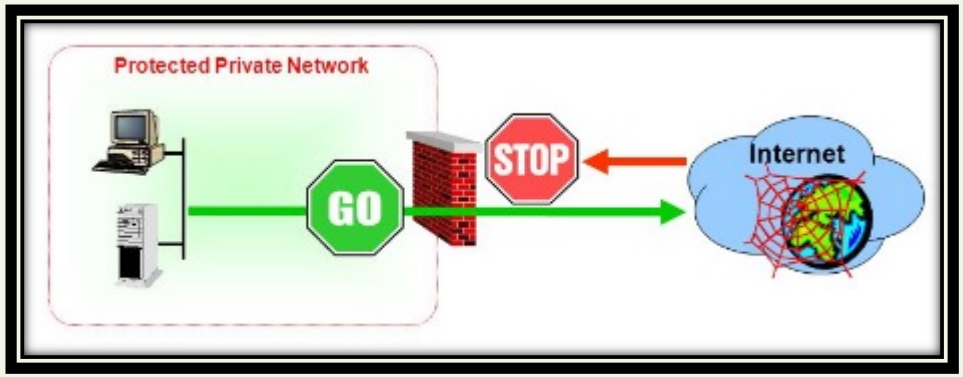
Intranet resources are often private, meaning that only employees (or authorized external parties such as customers or suppliers) have access to those resources.

Thus **Internet** is a broader term that encompasses both private (intranet) and public networked resources.

What is an "Intranet"?

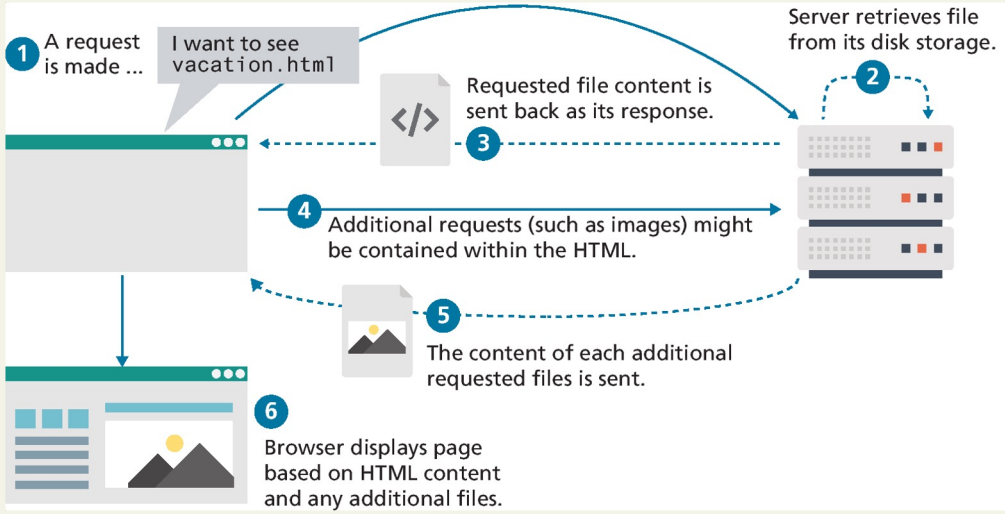
Intranets are typically protected from unauthorized external access via security features such as firewalls.





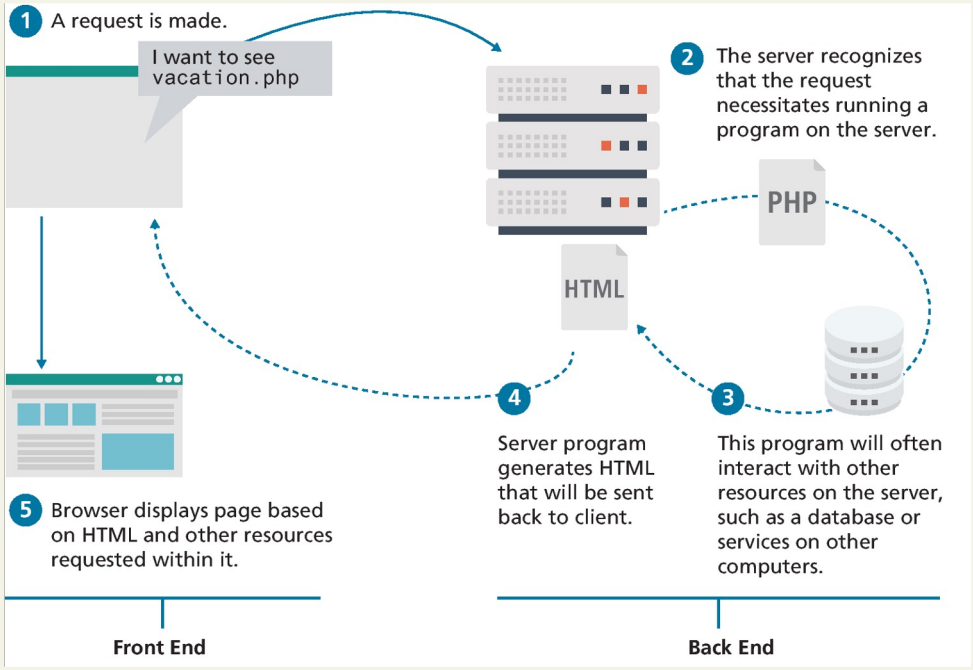
From Static to Dynamic

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



From Static to Dynamic

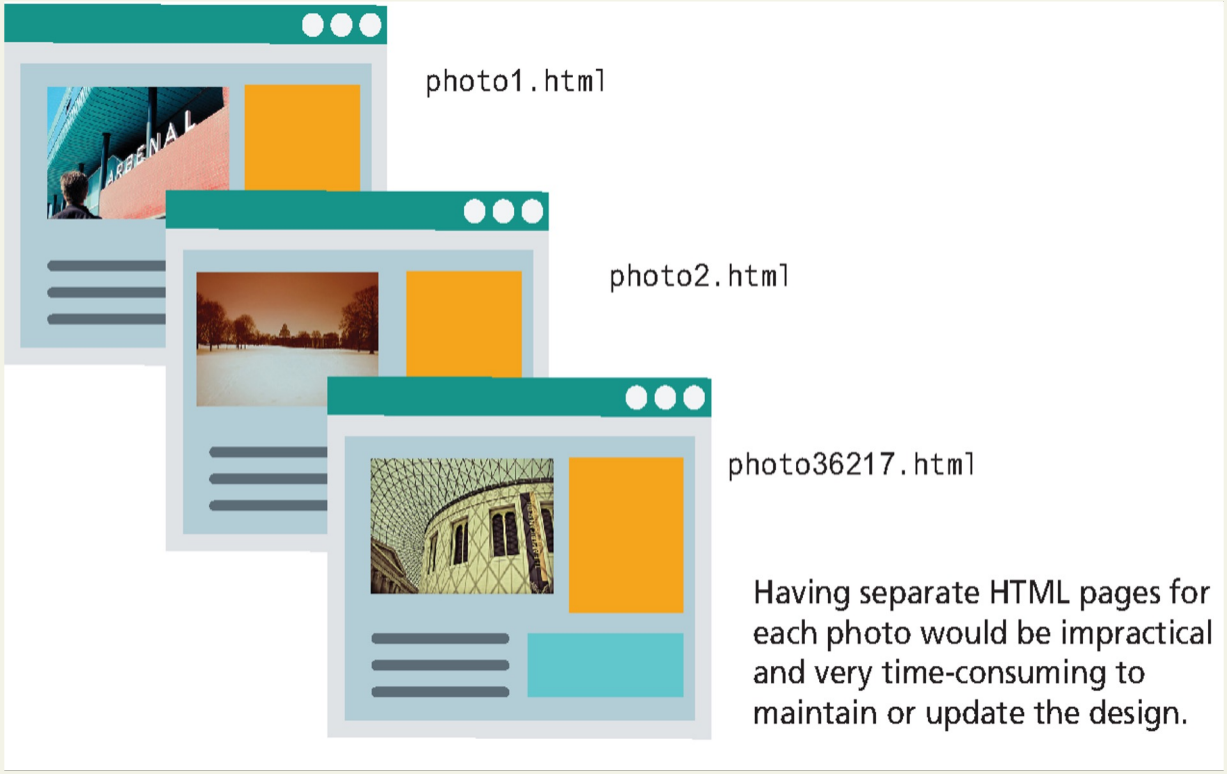
Later, programs running on web servers let websites generate content dynamically. This type of website is called a **dynamic server-side website**



Why are programs needed?

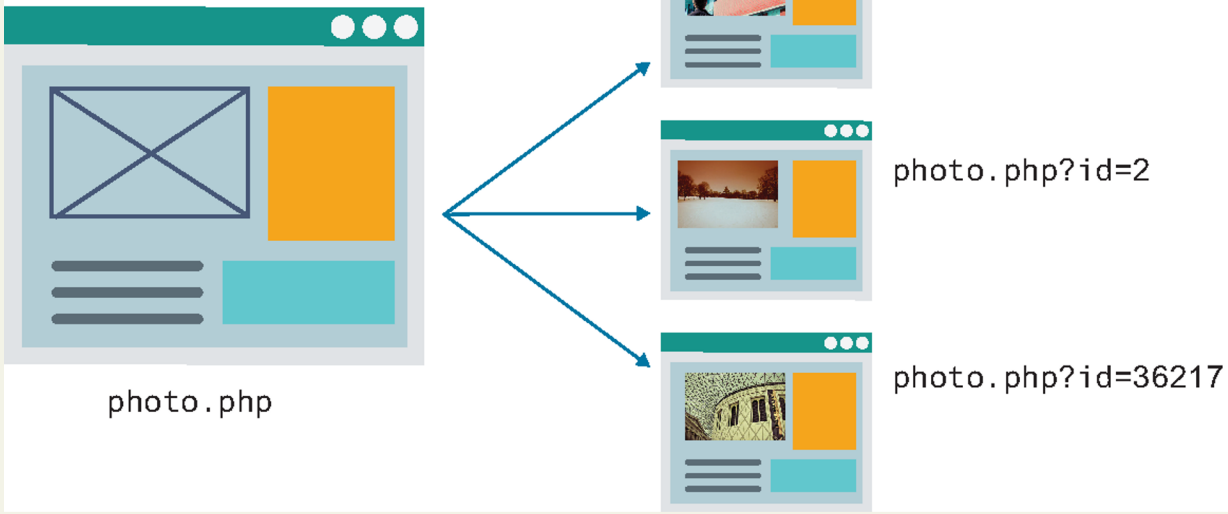
If HTML can be used to describe content on the web, why then are programs necessary?

Why are programs needed? (1 of 2)



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.



Web 2.0

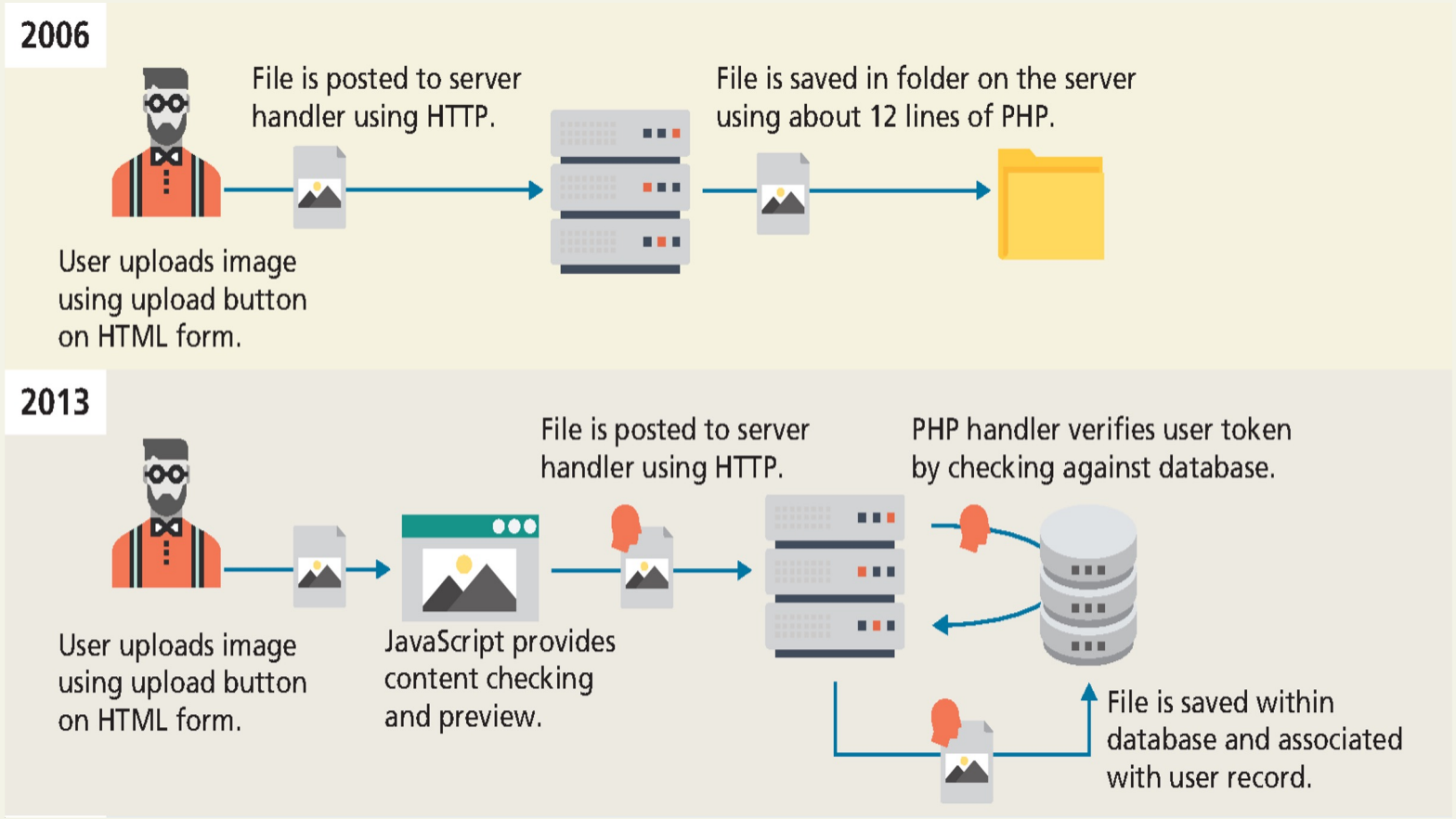
- **Web 2.0** referred to an interactive experience where users could contribute and consume web content, thus creating a more user-driven web experience.
- For software developers, Web 2.0 also referred to a change in the paradigm. Programming logic, which previously existed only on the server, began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

The evolution continues

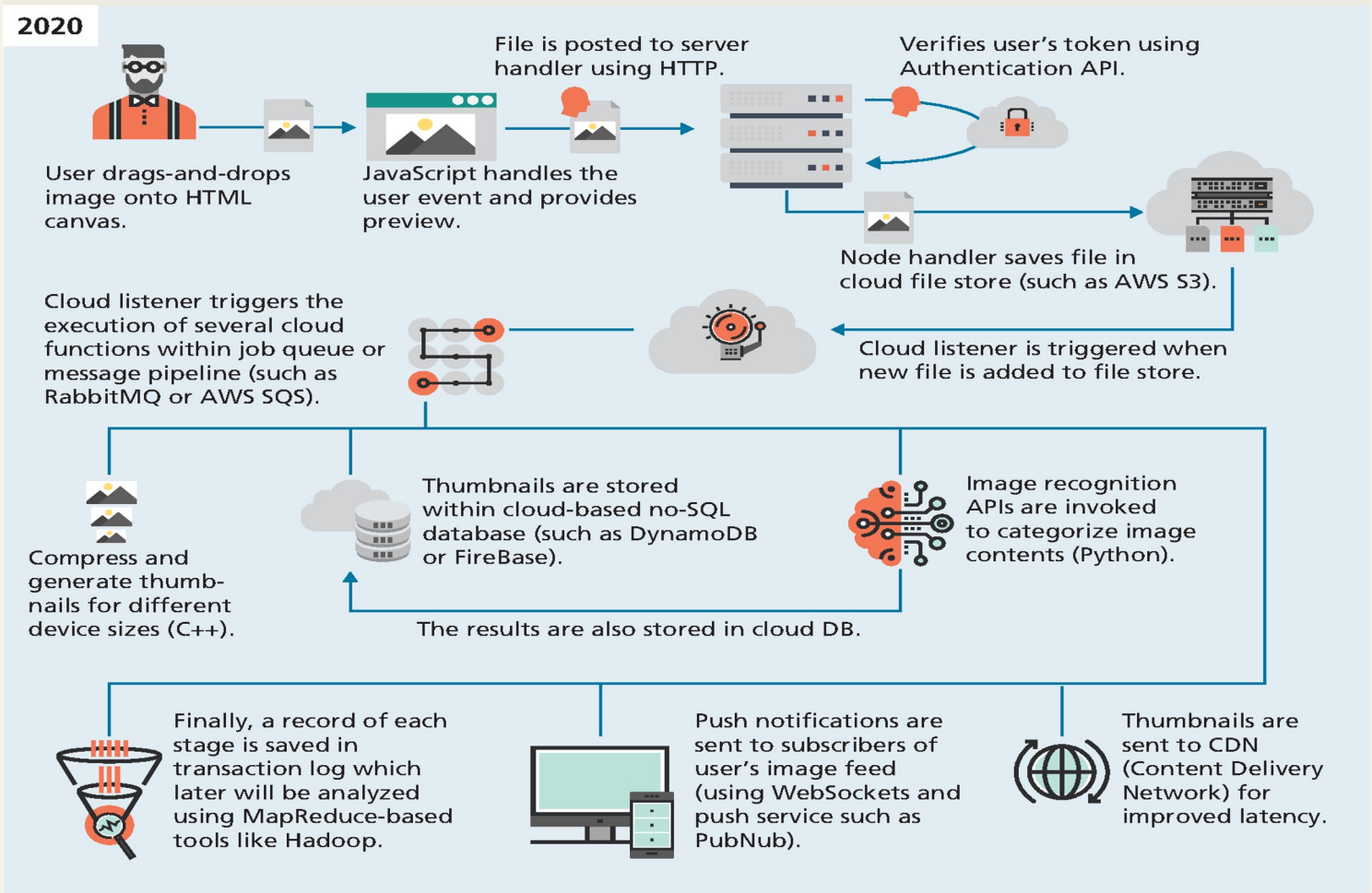
Web development today is thus more complicated than it was a decade before.

- **HTML** and **CSS** to create layout and structural foundations.
- **JavaScript** focuses on user interaction and 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.

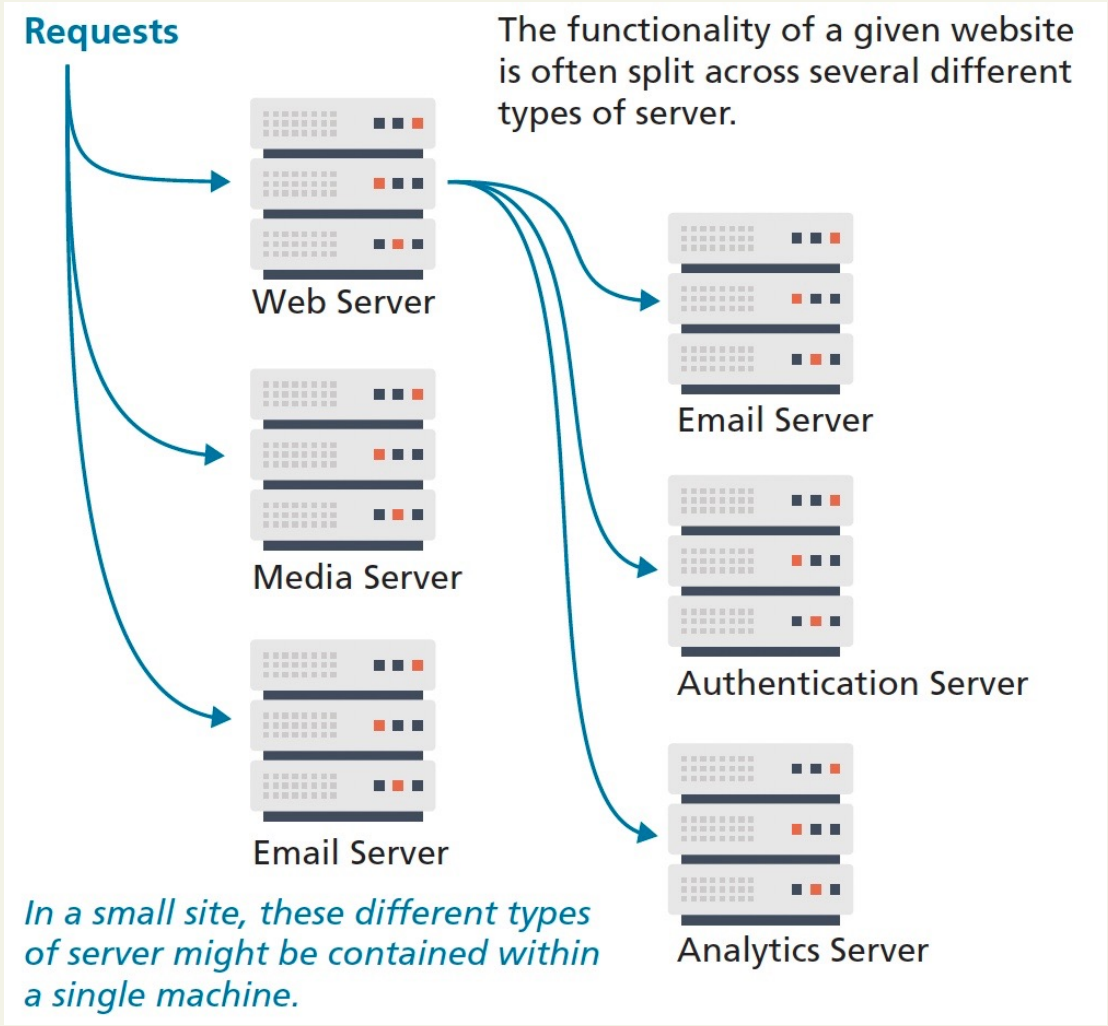
Broad range of specifications regarding

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

Server machines host web applications, store user and program data, and perform 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

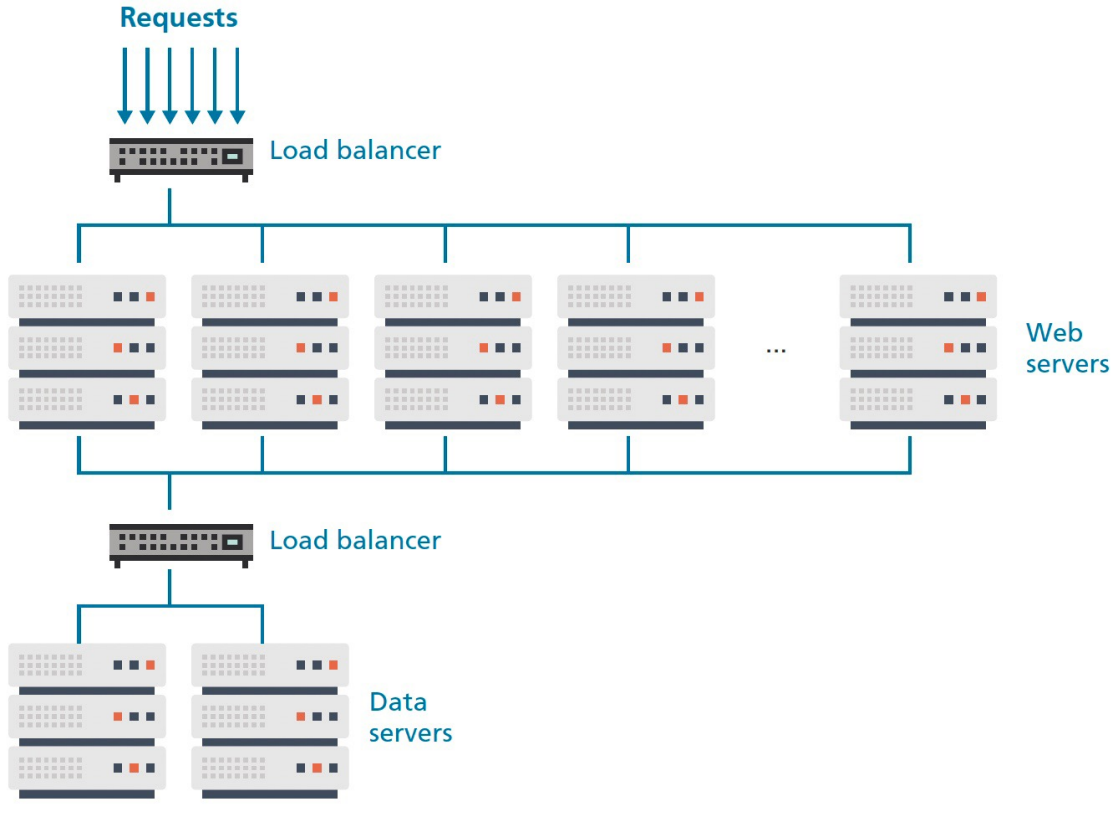
- Web servers.
- Application servers.
- Database servers.
- Mail servers.
- Media servers.
- Authentication servers.



Real World Server Installations

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

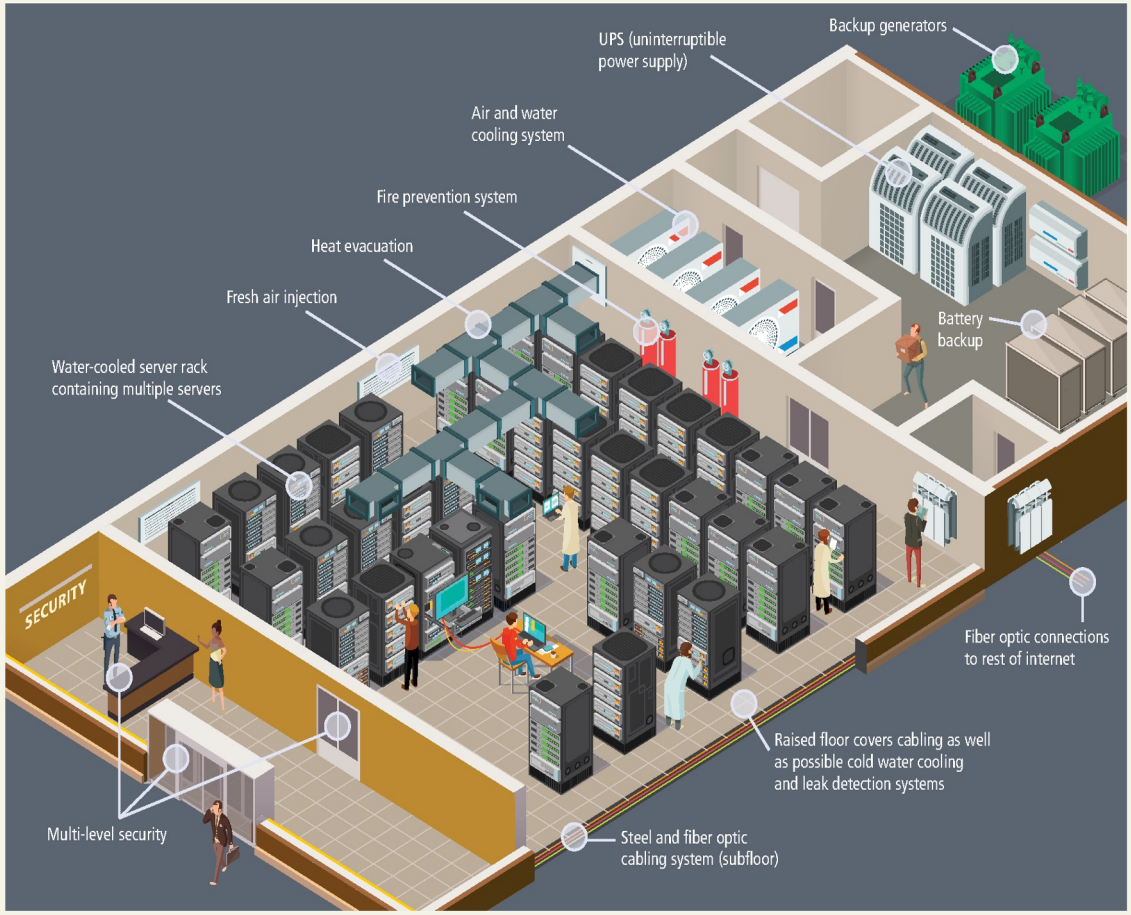
- Server Farm
- Load Balancers
- Failover Redundancy
- Server Racks
- Data Centers
- Cloud Services



Hypothetical data center

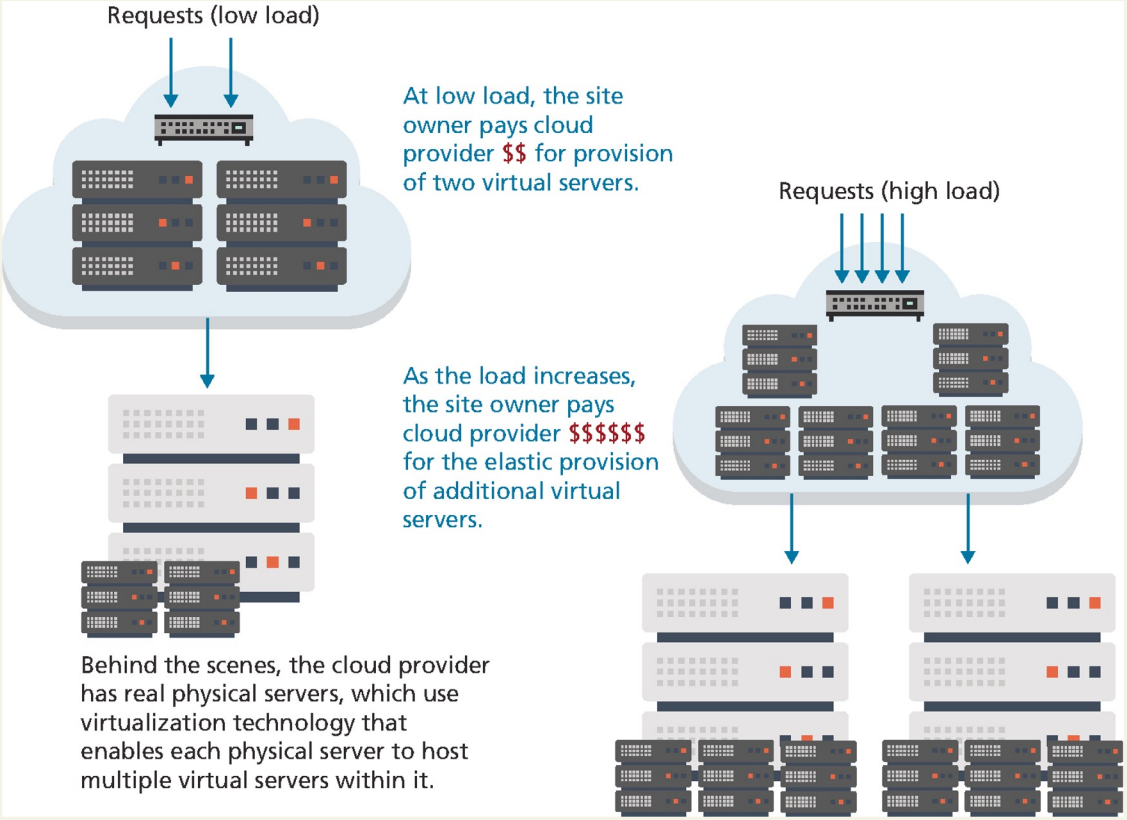
Many additional considerations can be handled at a data center including:

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



Cloud Servers

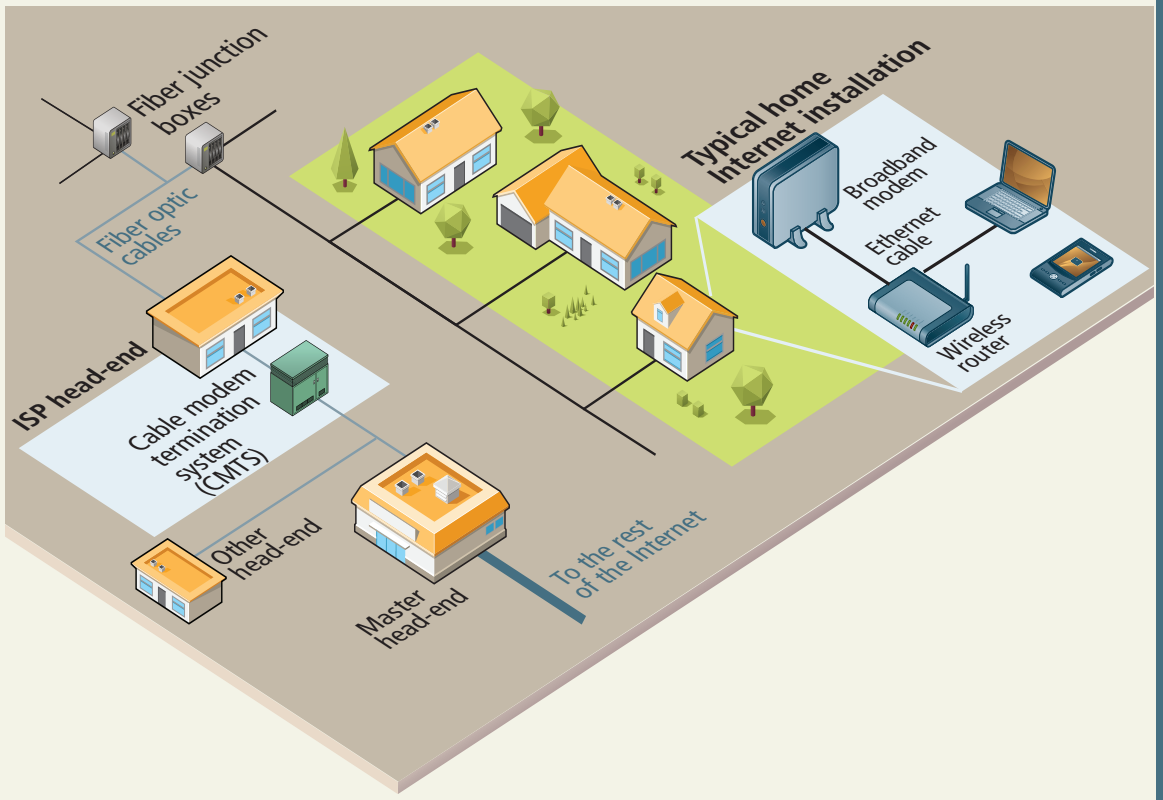
Instead of spending too much or spending too little to handle peak loads, cloud providers offer **elastic provisioning** of virtual servers, which scales costs and hardware to the demand



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!

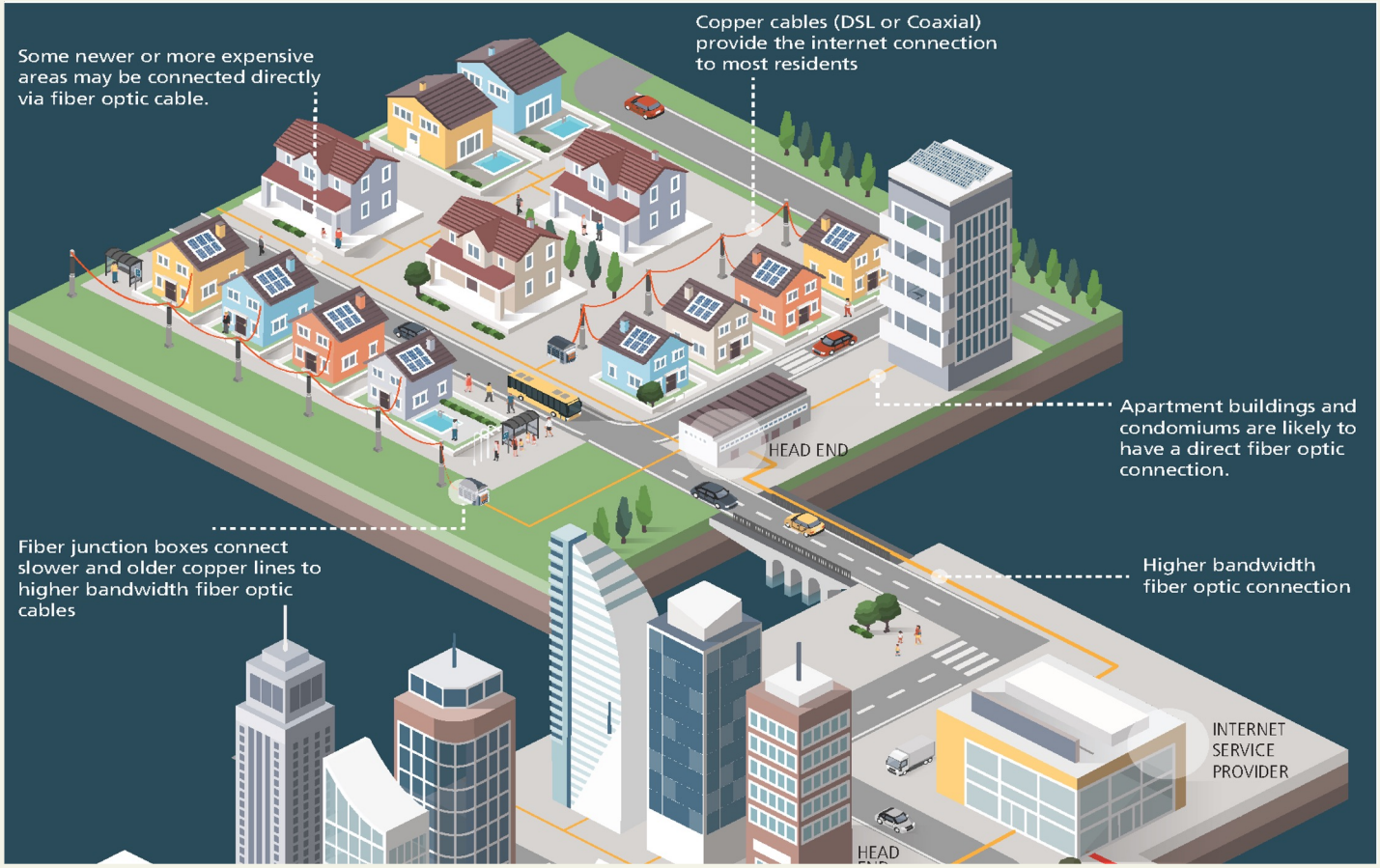


From the Computer to Outside the Home

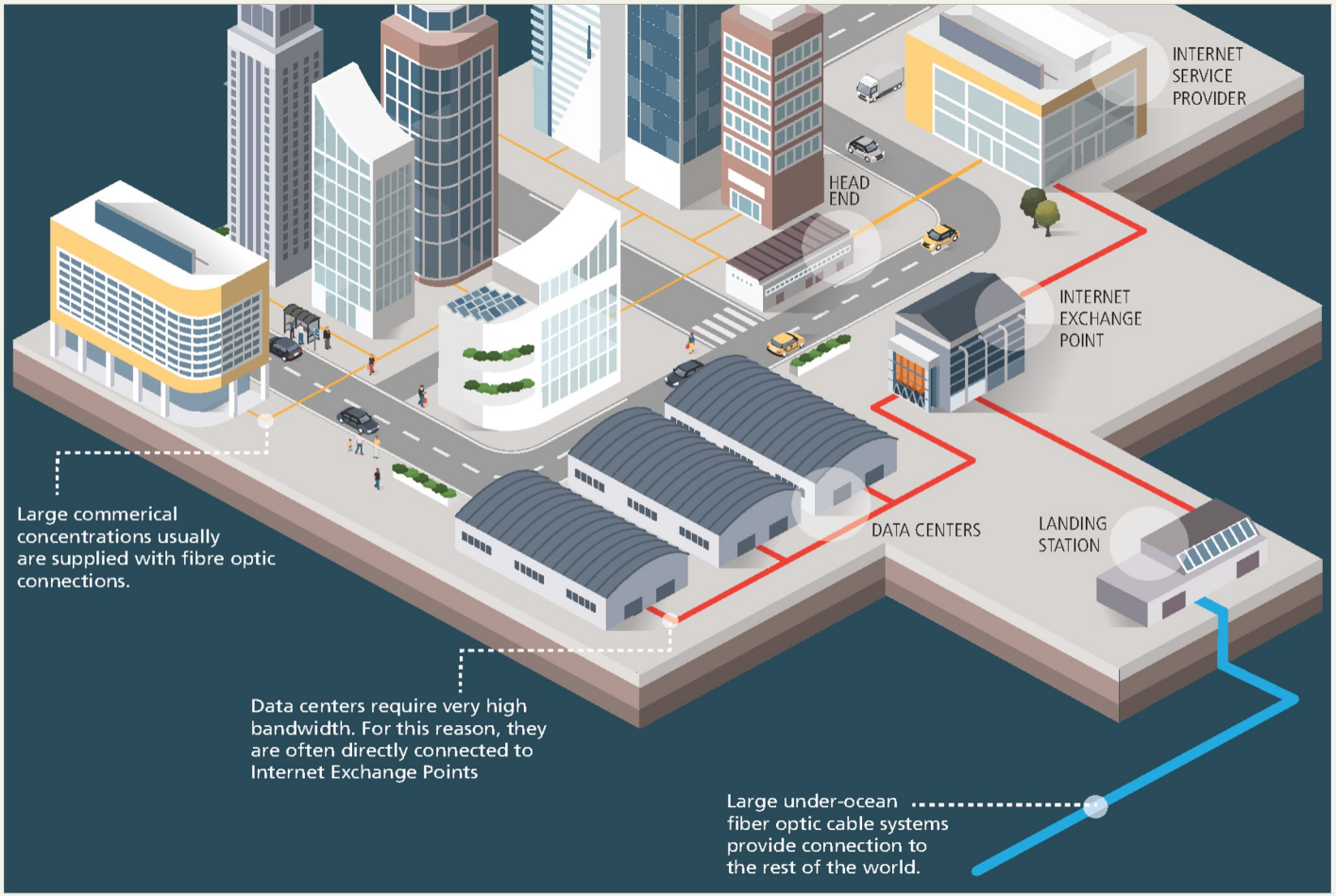
The **broadband modem** is a bridge between the network hardware outside the house and the network hardware inside the house. These devices are often supplied by the ISP.

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.

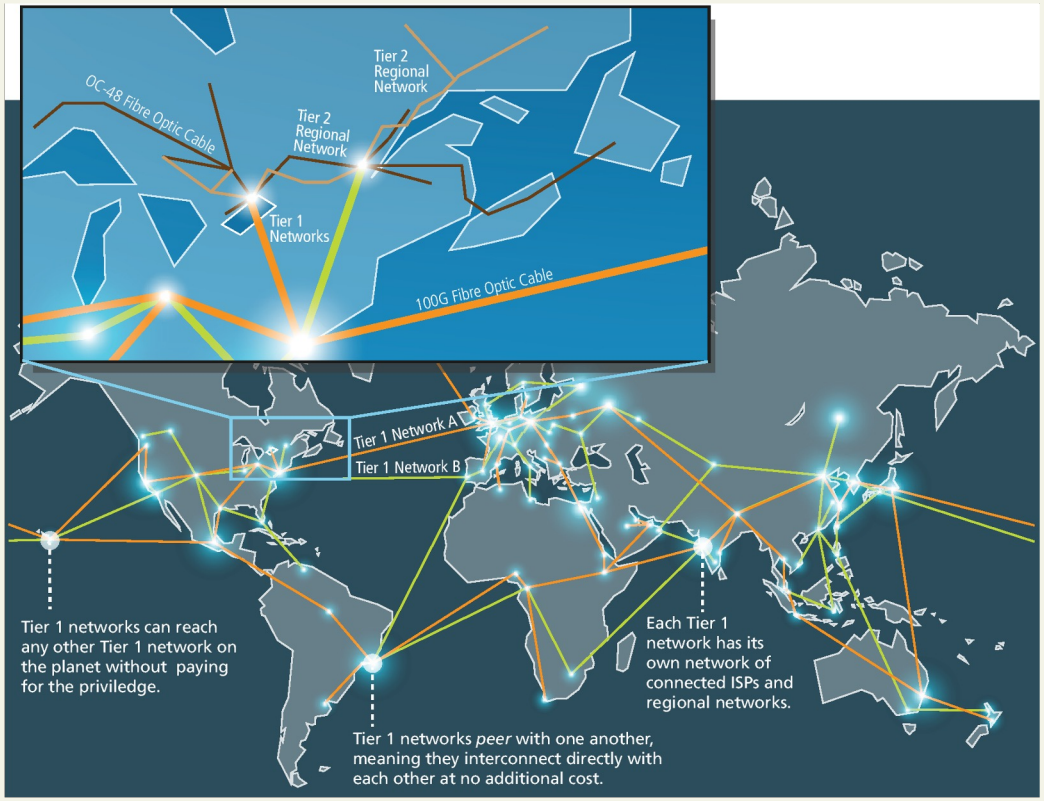
From the Home to the Ocean's Edge



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



How the Internet Is Organized Today

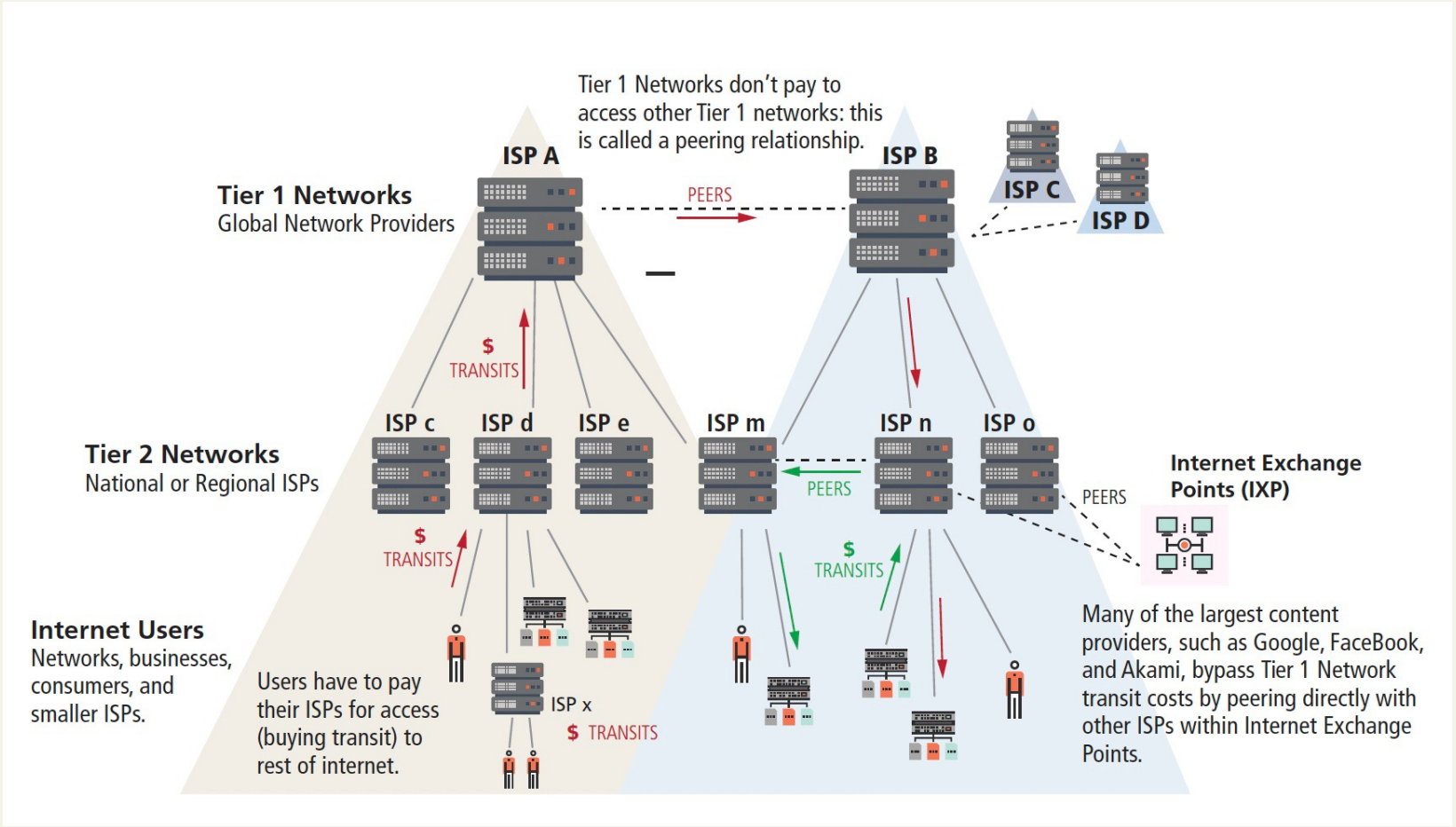


When someone talks about the "Internet Backbone" they are talking about Tier 1 networks.

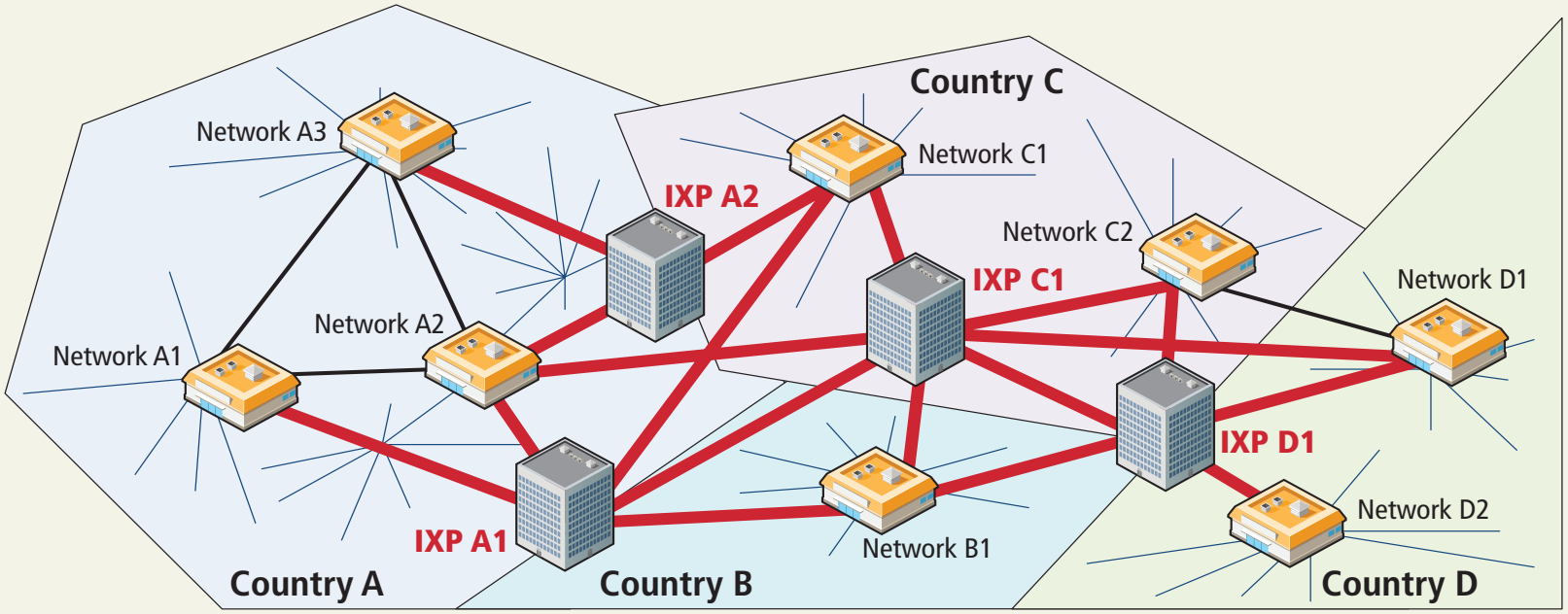
Tier 1 Networks make use of very fast fiber optic cable.

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

How the Internet Is Organized Today

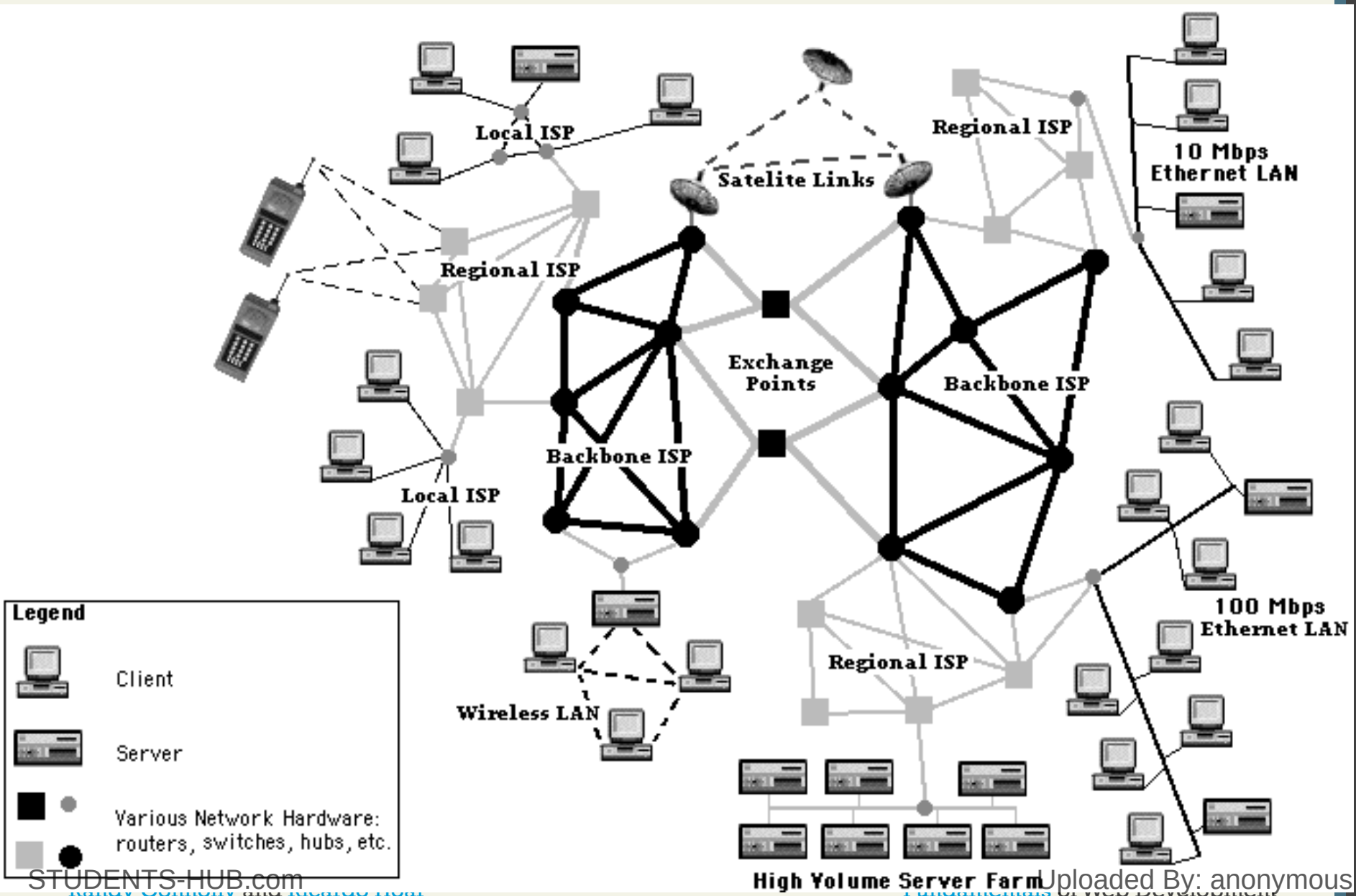


Where Is the Internet?

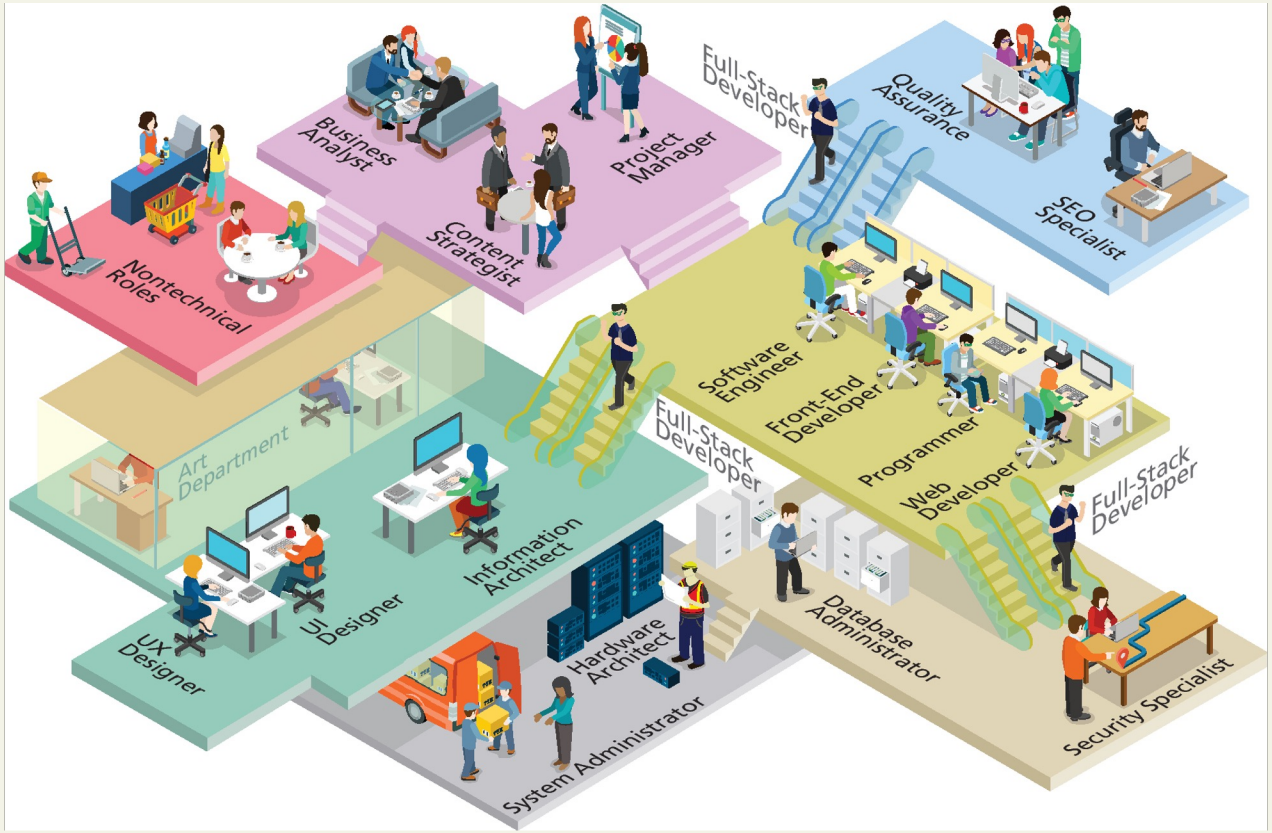


National and Regional networks using Internet exchange points (IXP)

The Inter-network is a big network of networks.



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

Where Is the Internet?

(Simplified) Routing Tables