

CASE STUDY

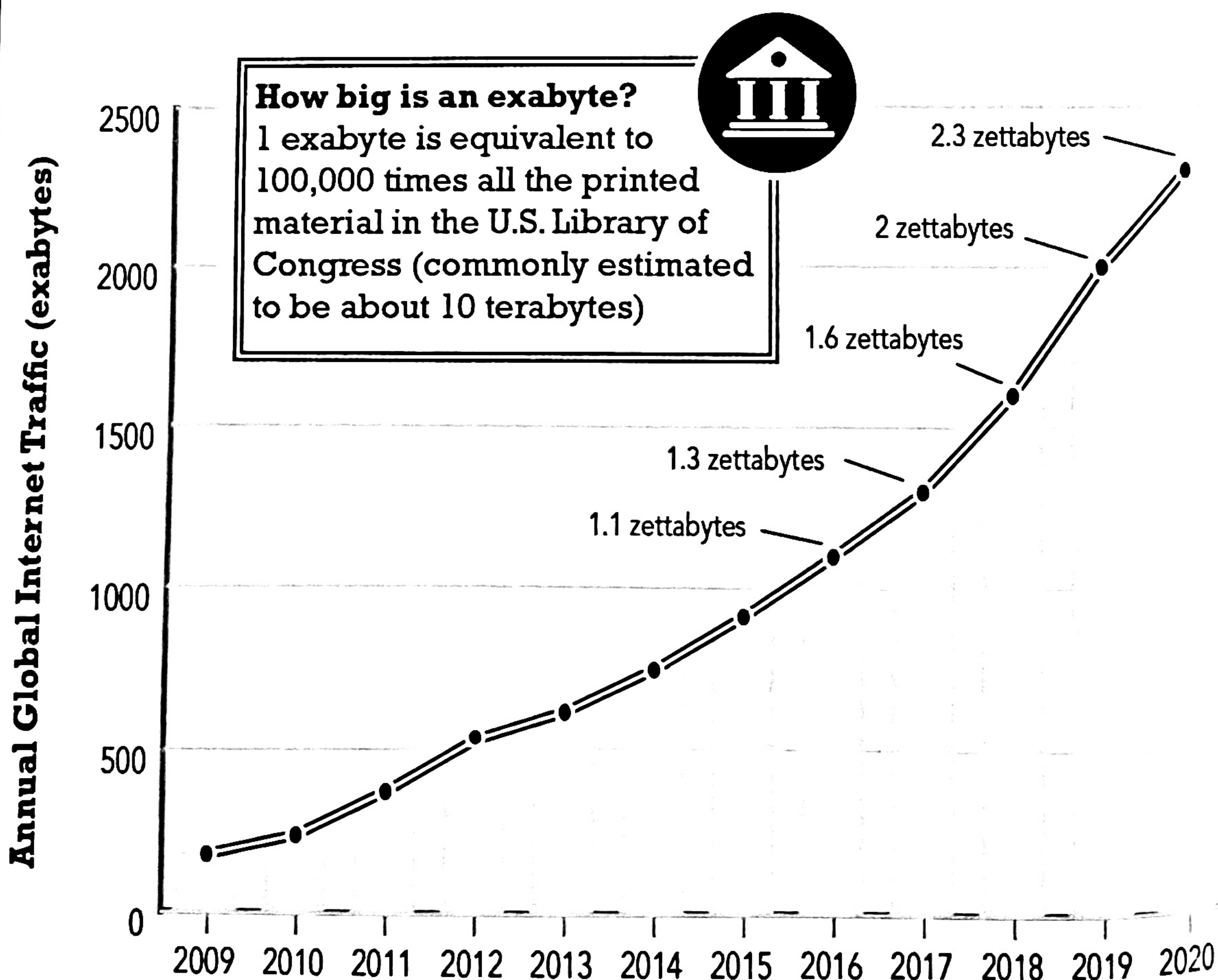
Akamai Technologies:

Attempting to Keep Supply Ahead of Demand

In 2016, the amount of Internet traffic generated by YouTube alone is greater than the amount of traffic on the entire Internet in 2000. Because of video streaming and the explosion in mobile devices demanding high-bandwidth applications, Internet traffic has increased over 500% since 2010 and is predicted to nearly triple by 2019 (see **Figure 3.19**). Internet video is now a majority of Internet traffic and will reach 82% by 2020, according to Cisco. Experts call services like YouTube, Netflix, and high definition streaming video “net bombs” because they threaten the effective operation of the Internet. Mobile platform traffic grew by almost 75% in 2015 and may soon push cellular networks and the Internet to their capacities.

FIGURE 3.19

THE GROWTH OF INTERNET TRAFFIC



Cisco estimates that annual global Internet traffic will be around 2.3 zettabytes in 2020: that's 2,300 exabytes, or, in other words, 23 with 19 zeroes behind it!

In today's broadband environment, the threshold of patience is very low. Increased video and audio customer expectations are bad news for anyone seeking to use the Web for delivery of high-quality multimedia content and high definition video. Akamai is one of the Web's major helpers, and an overwhelming majority of the Web's top companies use Akamai's services to speed the delivery of content. Akamai serves more than 30 terabits of web traffic per second.

Slow-loading web pages and content sometimes result from poor design, but more often than not, the problem stems from the underlying infrastructure of the Internet. The Internet is a collection of networks that has to pass information from one network to another. Sometimes the handoff is not smooth. Every 1,500-byte packet of information sent over the Internet must be verified by the receiving server and an acknowledgment sent to the sender. This slows down not only the distribution of content such as music, but also slows down interactive requests, such as purchases, that require the client computer to interact with an online shopping cart. Moreover, each packet may go through many different servers on its way to its final destination, multiplying by several orders of magnitude the number of acknowledgments required to move a packet from New York to San Francisco. The Internet today spends much of its time and capacity verifying packets, contributing to a problem called "latency" or delay. For this reason, a single e-mail with a 1-megabyte attached PDF file can create more than 50 megabytes of Internet traffic and data storage on servers, client hard drives, and network backup drives.

Akamai Technologies was founded by Tom Leighton, an MIT professor of applied mathematics, and Daniel Lewin, an MIT grad student, with the idea of expediting Internet traffic to overcome these limitations. Lewin's master's thesis was the theoretical starting point for the company. It described storing copies of web content such as pictures or video clips at many different locations around the Internet so that one could always retrieve a nearby copy, making web pages load faster.

Officially launched in August 1998, Akamai's current products are based on the Akamai Intelligent Platform, a cloud platform made up of over 216,000 servers in 120 countries within over 1,500 networks around the world, and all within a single network hop of 85% of all Internet users. Akamai software on these servers allows the platform to identify and block security threats and provide comprehensive knowledge of network conditions, as well as instant device-level detection and optimization. Akamai's site performance products allow customers to move their online content closer to end users so a user in New York City, for instance, will be served L.L.Bean pages from the New York Metro area Akamai servers, while users of the L.L.Bean site in San Francisco will be served pages from Akamai servers in San Francisco. Akamai has a wide range of large corporate and government clients: 1 out of every 3 global Fortune 500 companies, the top 30 media and entertainment companies, 96 of the top 100 online U.S. retailers, all branches of the U.S. military, all the major U.S. sports leagues, and so on. In 2015, Akamai delivers between 15% and 30% of all web traffic, and over 3 trillion daily Internet interactions. Other competitors in the content delivery network (CDN) industry include Limelight Networks, Level 3 Communications, and Mirror Image Internet.

Accomplishing this daunting task requires that Akamai monitor the entire Internet, locating potential sluggish areas and devising faster routes for information to travel. Frequently used portions of a client's website, or large video or audio files that would be difficult to send to users quickly, are stored on Akamai's servers. When a user requests a song or a video file, his or her request is redirected to an Akamai server nearby and the content is served from this local server. Akamai's servers are placed in Tier 1 backbone supplier networks, large ISPs, universities, and other networks. Akamai's software determines which server is optimal for the user and then transmits the "Akamaized" content locally. Web sites that are "Akamaized" can be delivered anywhere from 4 to 10 times as fast as non-Akamaized content. Akamai has developed a number of other business services based on its Internet savvy, including targeted advertising based on user location and zip code, content security, business intelligence, disaster recovery, on-demand bandwidth and computing capacity during spikes in Internet traffic, storage, global traffic management, and streaming services. You can see several interesting visualizations of the Internet that log basic real-time online activity by visiting the Akamai website.

The shift toward cloud computing and the mobile platform as well as the growing popularity of streaming video have provided Akamai with new growth opportunities. As more businesses and business models are moving to the Web, Akamai has seen its client base continue to grow beyond the most powerful Internet retailers and online content providers. In 2014, Akamai made a push to encourage Hollywood studios to use the cloud for feature films, touting its ability to handle uploads and downloads of large video files, to quickly convert files from one format to another, and to apply DRM protections. Establishing partnerships with movie studios represented big business for Akamai, with an increasing amount of media consumption taking place on mobile devices through the cloud. Akamai has also made agreements to become the primary content delivery platform for cloud service providers like Microsoft Azure and Google Cloud Platform.

However, the growth of streaming video has also created new challenges for Akamai, including increased competition from Comcast and Amazon, which have built competing content delivery services. Amazon's Cloudfront content delivery network is already bringing in \$1.8 billion in revenues. Larger clients like Apple and Facebook are also increasingly shifting their content delivery operations away from Akamai's platforms and onto in-house content delivery networks. Reducing carbon emissions and energy expenditure as demand grows has been another challenge for Akamai. In response, the company has undertaken sweeping efforts to reduce its greenhouse gas emissions to below 2015 levels by 2020 despite significantly higher demand.

Akamai is also acutely aware of the increase in cybercrime as more traffic migrates to the Internet. Growth in Internet traffic is good news for Akamai, but the company must also now deal with politically motivated cyberattacks, organized crime online, and state-sponsored cyberwarfare. Akamai has continued to improve its Kona Site Defender tool, which offers a variety of security measures for Akamai clients. The tool protects against Distributed Denial of Service (DDoS) attacks and includes a firewall for web applications. In 2016, Akamai rolled out new improvements to Kona's web application firewall and analytics features. Akamai also upgraded Site Defender's Web Application Firewall feature and developed modifications to the tool that make it easier

for its users to use. With so many businesses now dependent on the uninterrupted flow of content over the Internet, Akamai is in a very strong position to sell security services to its customers. In 2015, Akamai partnered with top information security firm Trustwave to cross-sell each other's services and products, expanding their offerings and reaching even further. Akamai made a similar agreement with China Unicom, a provider of cloud services in the fast-growing Chinese market. Akamai has also set itself up for future growth by moving into areas of the world with less developed broadband infrastructure, such as the Middle East. In 2015, Akamai opened an office in Dubai, hoping to bolster its presence in an area where the adoption rate for broadband is skyrocketing.

In 2016, experiencing rapidly increasing demand from its clients for security tools, Akamai announced it would restructure its business into two distinct units, one focusing on content delivery and media, and the other on website security. The improvements in Akamai's security businesses have offset any slowdown in their content delivery business, as the company registered earnings well above analyst estimates in 2016 despite increased competition in content delivery. Akamai has plans to increase its suite of security tools going forward, with tools designed to protect employees from phishing and malware due to be released in 2017. While the future of its content delivery business is cloudier due to increased competition and the challenges of Internet growth, the company is still very profitable.

Case Study Questions

1. Why does Akamai need to geographically disperse its servers to deliver its customers' web content?
2. If you wanted to deliver software content over the Internet, would you sign up for Akamai's service? Why or why not?
3. Do you think Internet users should be charged based on the amount of bandwidth they consume, or on a tiered plan where users would pay in rough proportion to their usage?

3.8 REVIEW

KEY CONCEPTS

- Discuss the origins of, and the key technology concepts behind, the Internet.
- The Internet has evolved from a collection of mainframe computers located on a single campus to an interconnected network of thousands of networks and millions of computers.
- The history of the Internet can be divided into three phases: the Innovation Phase (1960s–1975), the Institutionalization Phase (1975–1995), and the Commercialization Phase (1995 to the present).