▶ video case

chapter 3   E-commerce Infrastructure: The Internet, Web, and Mobile Platform

case 3.3   Facebook's Data Centers

watch the video at   https://www.youtube.com/watch?v=_r97qdyQtlk

summary   Businesses today run on the Internet, and the Internet runs on data centers. Today, data centers might be more accurately called business centers. Data centers drive nearly every aspect of many businesses, especially ones with a significant online presence like Facebook. But data centers are significant users of expensive electricity to cool their servers, and they make a significant contribution to pollution and global warming. Cloud data center operators are using a variety of new techniques to become more efficient in their use of electricity. L: 8:20

case   Consumers of technology constantly demand devices that are smaller, more efficient, and more powerful than the ones they have. But most consumers don't understand the massive back-end infrastructure that powers their "front end" devices, like mobile phones, smartphones, tablets, and desktop computers.

Take, for example, smartphones and tablet computers. iPhones, Androids, BlackBerrys, iPads, and other tablets represent a trend in all forms of mobile technology towards smaller devices that perform an increasingly large number of functions. But every time a smartphone or tablet user connects to the Internet, places a call, or sends an instant message, it uses power not only on their phone, but at every step of the infrastructure used to perform that function. More often than not, data centers are intimately involved in any Internetbased communication.

In 2018, there are approximately 3 million data centers in the United States and around 9 million data centers of all sizes worldwide. The total number of data centers had been growing at around 15% a year but will likely begin to decline starting in 2018 due to the growth of very large cloud mega-data centers. Currently US data centers consume about 100 billion kilowatt hours of electricity, about 2% of all electricity generated in the United States. Because most data centers use air conditioning of one sort or another to keep operating temperatures of microprocessor chips within a safe range, they are significant contributors to pollution and global warming . Most data centers do not practice energy management, and waste approximately 20 billion kilowatt hours annually. The growth of cloud computing, in particular streaming of music, television, and movies, is expected to accelerate data center power consumption in the next ten years even as the number of data centers decline. Due to these increasing power demands, by 2020, the world's computer servers will likely match or exceed the carbon emissions of the airline industry.

Data centers are growing not only in number, but also in sheer size. IBM has a data center which covers approximately 40,000 square feet (three football fields) and contains 10,000 servers. The cost of running large data centers is a significant component of the overall IT budget of firms. There are two components to the energy cost of data centers: the cost of running the computers, and the cost of cooling them. For this reason, large-scale data center operators are seeking a variety of new ways to cool their servers.

Of all the Web sites in the world, Google and YouTube may get the most hits per day, but no site can top Facebook as far as raw traffic. Facebook is by far the "stickiest" of the top sites, meaning its users spend more time per visit there, so it's reasonable to argue that no site has a greater need for a robust infrastructure than the social networking giant. With a mind-boggling 2 billion monthly active users as of June 2017, Facebook faces computing demands that no other company has ever faced. Not only is their site traffic unparalleled, but users are contributing 100 petabytes of photos and videos on Facebook each day, and that data requires storage.

To manage this demand, Facebook has built 300,000 square foot data centers in Oregon, North Carolina, Iowa, and Texas. They are also planning more international data centers to complement their data center in Lulea, Sweden. They also lease server space across the United States and worldwide. Facebook has chosen locations that allow them to use environmental factors (such as cooling water from rivers, and cooler northern climates) to reduce the costs of cooling computers, and to minimize their carbon footprint. Each location consumes roughly 30 megawatts of electricity. To ensure 100% uptime of the flagship Facebook site, each site has backup power. For example, the Oregon location has 14 diesel generators capable of 3 megawatts apiece in case of a power generation.

video case questions

1. Why does Facebook's data center specialist argue that "The Internet is not a cloud?"

2. What are some of the techniques Facebook uses to cool its data centers?

3. Facebook had over 2 billion users as of June 2017. If Facebook continues to employ engineers at the same rate as stated in the video, how many engineers does Facebook have?