Chapter 14

Global Ecology, Ethics, and Social Responsibility

Learning Objectives

1. Understand how IT and users can reduce carbon emissions and hence global warming, which harms the planet, through green business practices and data center designs that conserve natural resources.
2. Understand the trade-offs associated with the conveniences and competitive advantages that IT offers.
3. Recognize the impacts of *constant connectivity* and distractions on quality of life, business, safety, and interpersonal relationships.
4. Understand the key trends and forecasts for IT.

Integrating *IT*

CHAPTER 14 LINK LIBRARY

Internet World Stats *internetworldstats.com/stats.htm*
Green IT *greenit.net/*
Nicholas Institute for Environmental Policy Solutions at Duke University, June 2010 Report *nicholas.duke.edu/institute/about.html*
SMART 2020, enabling the low-carbon economy in the information age *smart2020.org/*
Internet statistics, trends, and demographics *isoc.org/internet/stats/*
Green Student U *greenstudentu.com/*
National Research Council *americasclimatechoices.org/*
Green Power for Mobile (GPM) of the GSMA *gsmworld.com/our-work/mobile_planet/green_power_for_mobile/index.htm*
3-D view of mobile green power deployments/solutions *wirelessintelligence.com/green-power/*
Google Earth plug-in earth.google.com/plugin/
ENERGY STAR ratings *energystar.gov/*
Information Commissioner's Office, United Kingdom *ico.gov.uk/*
Stop Climate Change, European Free Alliance *stopclimatechange.net/*
U.S. Global Change Research Program *globalchange.gov/*

QUICK LOOK at Chapter 14, Global Ecology, Ethics, and Social Responsibility

This section introduces you to the business issues, challenges, and IT solutions in Chapter 14. Topics and issues mentioned in the Quick Look are explained in the chapter.

Tackling global warming by reducing emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs) is high on the list of global challenges. **Carbon footprint** refers to the amount of CO_2 and other GHGs emitted by a particular activity (e.g., driving cars), industry (e.g., auto manufacturing), or value chain (e.g., telecom value chain). Roughly 72 percent of GHGs are made up of CO_2. A carbon footprint is typically measured in **MtCO2e,** which stands for **metric tonne (ton) carbon dioxide equivalent.** Annual emissions are generally measured in gigatonnes (billions of tonnes) of carbon dioxide equivalent per year (GtCO2e/y).

A carbon footprint is a way to measure the impact of the carbon-producing activities of an individual, organization, or industry sector on the environment via climate change and global warming. All carbon emissions worldwide make up the *global carbon footprint*.

The IT sector, including computing and telecommunications, is responsible for an estimated 2 to 3 percent of the global carbon footprint as a result of emissions from the energy used to run servers, computers, and other hardware. That 2 to 3 percent can be cut in half by switching to low-emission data centers, placing them in cold climates to reduce the energy needed to cool the heat-generating hardware, and buying ecofriendly hard drives with considerably reduced power consumption, as shown in Figure 14.1.

Figure 14.1 Ecofriendly computing. Computer hard drive with considerably reduced power consumption by manufacturer Western Digital. (© *Olaf Kowalzik-editorial collection/Alamy*)

IT can play a greater role by helping reduce the remaining 97 to 98 percent of the GtCO2e/y from other industries. One example is replacing commuting and long-distance travel, when feasible, with collaboration and telework tools, Web-based meetings, and other IT applications to significantly reduce transportation carbon emissions. Innovative IT solutions can both provide a better quality of life and contribute to dramatically reduced emissions. That is, quality of life and reduced emissions do not involve a trade-off.

Governments and industry associations have introduced a range of programs on IT and the environment to address global warming and energy use. And business associations continue to develop initiatives to reduce energy consumption and to demonstrate corporate social responsibility.

In this chapter, we examine the greening of computing and IT's role in reducing global warming. We take a closer look at IT ethical responsibilities and impacts on people's lives. Social media has negative consequences, as "reporting" of personal text messages and activities becomes more invasive, abusive, engineered (faked), and sensational. The Internet, real-time data analysis, mobile communications, automated decision making, and social media create capabilities, which carry ethical responsibilities.

IT's Carbon Hot Spots

Global warming is the upward trend in global mean temperature (GMT) and one of the most complicated issues facing world leaders. Warnings from the scientific community point to dangers from the ongoing buildup of CO_2 and greenhouse gases, mostly from the burning of fossil fuels and forests (U.S. Global Change Research Program, *globalchange.gov/*). Global warming is the theory that the earth's atmosphere is warming because of the release of greenhouse gases (GHGs) from burning gas, oil, coal, wood, and other resources, which then holds heat in similar to the walls of a greenhouse. The **greenhouse effect** refers to the holding of heat within the earth's atmosphere by certain GHGs—such as CO_2, methane (CH_4), and nitrous oxide (N_2O)—that absorb infrared radiation (IR), as diagrammed in Figure 14.2. Scientists predict that the increased temperature and sea level rise from global warming will adversely affect the earth's biodiversity.

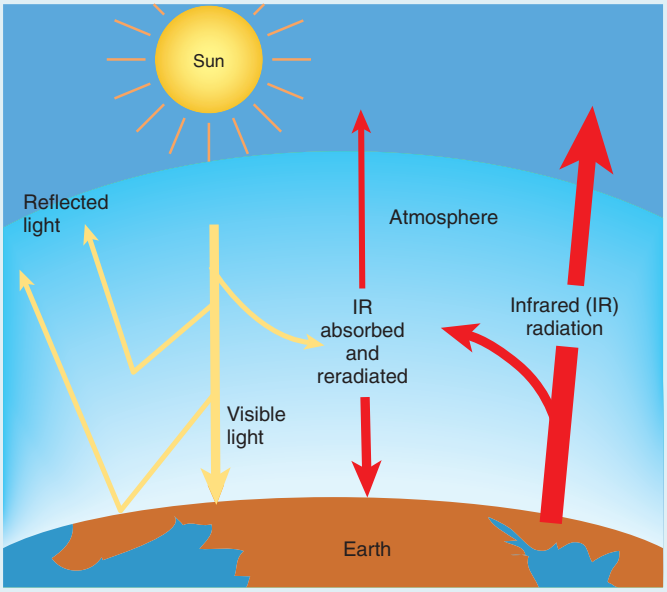

Figure 14.2 Earth's greenhouse effect. Greenhouse gases absorb infrared radiation (IR) emitted from the earth and reradiate it back, thus contributing to the greenhouse effect.

Keeling Curve

The rise of CO_2 gas in our atmosphere has been measured continuously since 1958 and follows an oscillating (squiggle) and upward line known as the **Keeling curve,** named after Dr. Charles David Keeling, professor at Scripps Institution of Oceanography. An expert on the way carbon moves through the ecosystem, Keeling was the first to measure CO_2 in the atmosphere on a continuous basis, rather than on a monthly or yearly basis. Figure 14.3 shows the upward movement of the Keeling curve of increasing CO_2 concentration. The measurements are made at a station on top of Mauna Loa in Hawai'i. Note carefully the magnitude of the increase from 1958 through 2010. The most recent data can be found at

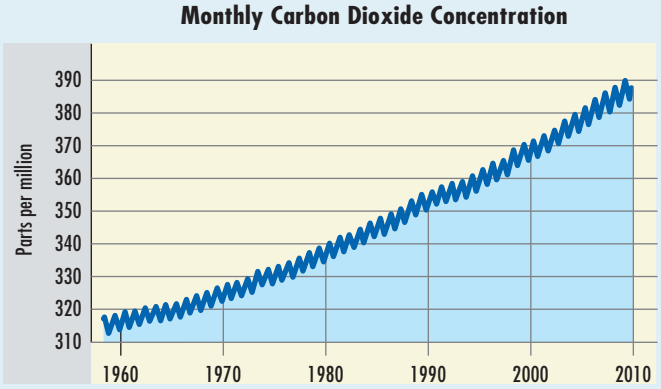

Figure 14.3 The Keeling curve tracks changes in the concentration of CO_2 in the earth's atmosphere at a Mauna Loa research station. (*Courtesy of Scripps CO_2 Program, 2010, and National Oceanic and Atmospheric Administration (NOAA.gov/).*

scrippsco2.ucsd.edu. The Keeling curve has become the symbol of the ever-changing chemistry of the earth's atmosphere and the associated warming of the planet.

Scientists have determined that we should aim to stabilize the concentration of GHGs in the atmosphere in the range 450 to 550 parts per million (ppm). This is higher than the present level of roughly 400 ppm, which in turn is higher than the level of only 228 ppm before the Industrial Revolution. To stabilize, emissions per year must peak within the next 10 to 20 years and then fall at a rate of 2 percent a year. By 2050, GHG emissions must be about a quarter less than they are now. What is more, because the world economy is expected to expand, the rate per unit of GDP (gross domestic product) will have to be much lower, perhaps only a quarter of the current level.

For Class Discussion and Debate

1. ***Scenario for Brainstorming and Discussion:*** Investments in energy-conserving data centers or other computing facilities can reduce the long-term costs of ownership and maintenance. But organizations need to pay upfront premiums to invest in green computers that are both energy efficient and environmentally responsible. Organizations that have invested in green hardware find that the energy savings, extended product life cycle, positive public image, and other benefits have exceeded the additional costs of that hardware—improving net profit.

a. Given this situation, in your opinion, why wouldn't companies invest in energy-saving IT and business practices?

b. In your opinion, why aren't managers more concerned with global warming and the greenhouse effect? That is, why aren't all levels of management concerned enough about the health of current and future generations and the planet to make investments to reduce GHGs?

c. What can you do to reduce your carbon footprint and still meet your responsibilities? (Skipping class to reduce driving would not meet both those criteria.) What would motivate you to take those actions? Why is reducing your carbon footprint so difficult?

2. ***Debate:*** To increase payback from its green initiatives, customers would have to learn that the company was *green*, and they'd also need to be concerned about the dangers of global warming. Debate the most effective and cost-effective ways for companies to promote their green public image and convince customers of the value of green efforts.

14.1 IT's Role in Reducing the Global Carbon Footprint

The IT industry sector (called *information and communications technology*, or ICT, in emission reports) has supported economic growth in developed and developing countries. But what impact does our expanding IT dependence have on global warming? And how can business processes be changed to make use of IT to reduce greenhouse gases? And what alternative energy sources can be used to power the increasing demands for telecommunications (telecom)? We examine several reports and initiatives to help answer these important questions.

GLOBAL E-SUSTAINABILITY INITIATIVE AND THE SMART 2020 REPORT

The Climate Group's **SMART 2020 Report** (*theclimategroup.org/programs/ict/*) is the world's first comprehensive global study of the IT sector's growing significance for the world's climate.

In 2008, **the Climate Group,** on behalf of the **Global e-Sustainability Initiative (**GeSI, *gesi.org/*), found that ICT is a key sector in the struggle to reduce climate warming. Transforming the way people and businesses use IT could reduce annual human-caused global emissions by 15 percent by 2020 and deliver energy-efficiency savings to global businesses of over 500 billion euros, or US $800 billion. And using social media, for example, to inform consumers of the grams (g) of carbon emissions associated with the products they buy could change buyer behavior and ultimately have a positive environmental effect. Like food items that display calories and grams of fat to help consumers make healthier food choices, product labels display grams of CO_2 emissions, as shown in Figure 14.4.

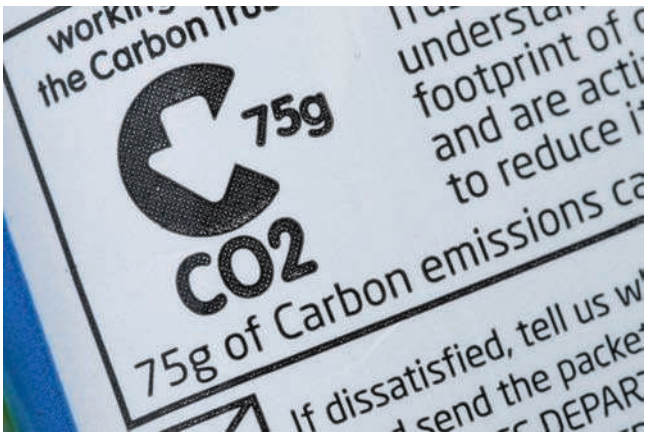

Figure 14.4 Label showing the amount of CO_2 emissions produced in the making of a bag of Walkers crisps in the United Kingdom.(*© Alex Segre/Alamy*)

According to analysis conducted by international management consultants McKinsey & Company, which were listed in the SMART 2020 Report:

- The IT sector's own footprint of 2 percent of global emissions could double by 2020 because of increased demand for smartphones and other hardware, software, and services. To help, rather than worsen, the fight against climate change, the IT sector must manage its own growing impact and continue to reduce emissions from data centers, telecom networks, and the manufacture and use of its products.
- IT has the unique ability to monitor and maximize energy efficiency both within and outside of its own industry sector and cut CO_2 emissions by 7.8 GtCO2e/y by 2020, which is greater than the 2010 annual emissions of either the United States or China.

TOWARD A LOW-CARBON ECONOMY IN THE INFORMATION AGE

At least 4 billion people are mobile phone users. By 2020, the number of users is expected to double to 8 billion. Not only will more people get connected, but things will, too: There could be 50 billion machine-to-machine connections in 2020. The good news is that information from these machines could help monitor our environmental impacts and emissions.

From smart meters to smart grids, the Climate Group is working with members and partners, such as Google and Cisco, to build on the enormous potential and economic opportunities of IT in the low-carbon economy. Fortunately, the IT industry has the potential to reduce global GHG emissions by up to 30 percent. Many industries can make use of the latest IT to move into higher-efficiency low-carbon markets. But better use of IT to shift away from existing energy-intensive work habits and lifestyles will depend on government policy innovations, incentives for companies, and the active participation of consumers.

The SMART 2020 Report gives a clear picture of the key role that the IT industry plays in addressing climate change globally and facilitating efficient and low-carbon development. The role of IT includes emission reduction and energy savings not only in the IT sector itself but also by transforming how and where people work. The most obvious ways are by substituting digital formats—telework, videoconferencing, e-paper, and mobile and e-commerce—for physical formats. Researchers estimate that replacing physical products/services with their digital equivalents would provide about 6 percent of the benefits the IT sector can deliver. But if IT is applied to other industries, then the benefits in terms of lower GHG emissions would be even greater. Examples of those industries include smart building design and use, smart logistics, smart electricity grids, and smart industrial motor systems.

"Smart" means that wasted energy and materials are minimized and that procurement, manufacturing, distribution, service, and recycling are done in an environmentally friendly manner.

GREEN IT AND MOBILE SOLUTIONS IN DEVELOPED AND DEVELOPING NATIONS

In this section, you read of several impressive green power initiatives and efforts at sustainability. **Sustainability,** whether applied to energy, technology, or consumption of resources in general, refers to the concept of using things at a rate that does not deplete their availability in future generations. In environmental terms, a process or industry is *unsustainable* when it uses up natural resources faster than they can be replenished.

These examples give you a wider perspective on how mobile initiatives and changes in behavior and business processes are reducing GHG and soot emissions worldwide, including on Vanuatu, a volcanic archipelago of 82 islands in the South Pacific.

- Isotrak's (*isotrak.com/*) fleet management system is designed to help U.K. businesses cut fuel costs and CO2e emissions, reduce fleet size, and save staff time. Isotrak's fleet management system combines satellite tracking and onboard telematics data sent over the Vodafone mobile network using standard SIM cards. This IS enables businesses to monitor their fleets remotely and plan more efficient logistics based on where vehicles travel, what they carry, and how they are driven. Isotrak estimates that by changing driving styles, for example, fuel efficiency is improved by up to 15 percent.
- Using Isotrak's system, the U.K. supermarket chain Asda's fleet saved 29 million road kilometers, or 28 KtCO2e, and cut fuel costs by 23 percent over three years. Asda drivers have changed their behavior to improve fuel efficiency by 6.6 percent, and the system is also enabling Asda to haul more waste and recyclable materials between stores and distribution centers, minimizing the number of trucks running without full loads.
- The **GSMA *Green Power for Mobile* (GPM) program** (*wirelessintelligence.com/green-power/*) was launched in September 2008 to advance the use of renewable energy sources by the mobile industry to power 118,000 new and existing *off-grid* base stations in developing countries by 2012. (*Off-grid* means that the base stations are not connected to the electricity grid.) Achieving this target will cut diesel fuel costs by $2.5 billion, cut carbon emissions by up to 6.8 million tons per year, and connect 118 million people in developing countries to mobile networks using green power. Using the Google Earth plugin (*earth.google.com/plugin/),* you can search and view in 3-D the global mobile deployments at *wirelessintelligence.com/green-power/.*

Figure 14.5 GSM cellular base station. (*© Tomislav Stajduhar/iStockphoto*)

The *GSMA Development Fund* (*gsmworld.com/*) has delivered mobile green projects in Namibia (Africa) and on Vanuatu through its GPM program, which has been established to promote the use of green power to achieve two commercial objectives.

1. To expand mobile networks into regions currently lacking coverage. The GSMA's Green Power for Mobile (GPM) program has the goal of helping the mobile industry use renewable energy sources, such as solar, wind, and sustainable biofuels to power 118,000 new and existing off-grid base stations in developing countries by 2012. Figure 14.5 shows a GSM base station.

2. To reduce diesel fuel consumption by telecom (telecommunications) operators. Solar, wind, and **sustainable biofuels** would replace diesel fuel. Although diesel emits less carbon dioxide than gasoline, diesel can emit 25 to 400 times more mass

IT at Work 14.1

Soybean Biofuel Used to Run Mobile Base Stations

MTN Group (*mtn.com/*) in South Africa is the leading mobile telecom company operating in Africa and the Middle East. As part of its network rollout, MTN has installed more power-efficient base stations. The new-generation network also uses 40 to 60 percent less power than its predecessor, helping reduce the cost of provisioning, while increasing the capacity of the network. In addition to these financial benefits, the new networks are reducing GHG emissions.

In Nigeria, MTN conducted research on biofuel-powered generators. Tests were completed using locally produced biofuels by the end of Q1 2007. Since then, three base stations in the Badagry region have been running on biodiesel produced from locally grown soybeans. The project has forged many local partnerships in preparation for the local growth and processing of crops, for the long-term solution. The use of soybean biofuel has, in turn, created local employment.

Karel Pienaar, chief technology and information officer of MTN Group, commented on the value of the program to the company, the local community, and the environment:

MTN regards the Biofuels Programme to be of great importance. We are working with our partners the GSMA and Ericsson to develop an environmentally friendly, self-sustainable, cost effective solution to extending mobile coverage into remote and rural parts of Nigeria, and potentially the rest of Africa where MTN is operating. I am personally excited that the Biofuels Programme could create employment for tens of thousands of agricultural workers, whose labour will bring communications to their villages for the first time, placing the mobile industry at the forefront of social development.

Sources: Compiled from MTN Group (2010), Biofuels Programme (2007), and *GSMWorld.com*.

Discussion Questions: What factors contributed to the success of the biofuels program in Nigeria? What payback did MTM expect and achieve from this program?

of particulate black carbon and associated organic matter (soot) per kilometer or mile. *IT at Work 14.1* explains biofuels.

The ecological importance of the vendor-neutral GPM program is not evident until you understand that many regions of the world don't have access to electricity grids. Since electricity is needed to power mobile networks, off-grid base stations are built to generate their own power. In Nigeria, for example, only 25 percent of mobile base stations are connected to the electricity grid, which means that telecom operators generate power using ecologically damaging diesel fuel to run the other 75 percent of the base stations. Africa alone consumes over 30 million liters of diesel fuel per year to power off-grid base stations. That's an average of 18,000 liters of diesel fuel per base station per year. As such, use of alternative energy sources (solar, wind, and sustainable biofuels) has successfully reduced harmful emissions and global warming. Note that these are commercial ventures of telecoms, which have improved the profitability of the telecoms in the long run. There are also green initiatives that companies can undertake, as well as partnerships sponsored by local, regional, and national government, which are discussed next.

WORLDWIDE TELECOM INDUSTRY CAN LEAD THE LOW-CARBON REVOLUTION

In 2010, the worldwide telecoms industry was responsible for 183 million MtCO2e/y, or 0.7 percent, a reasonable amount considering that it represents 2 percent of global GDP. The average European mobile phone user is responsible for around 17 kg of CO_2 emissions per year. The average fixed and Internet user will emit 44 kg. These performance statistics are only slightly influenced by the desire to be green because mobile phones are already very power-efficient in order to have longer battery life, and power savings in fixed networks are mainly driven by the desire to control costs. Given these levels of CO_2 emissions, the telecoms industry is relatively ecofriendly.

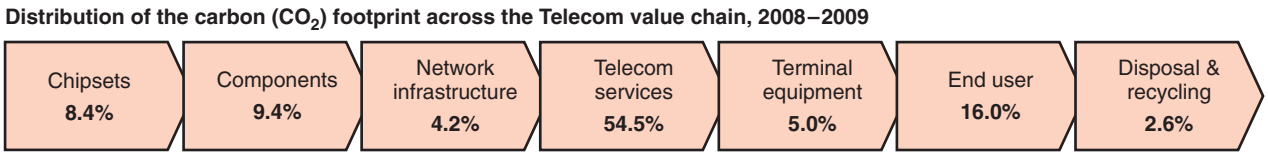

Figure 14.6 Telecom value chain's carbon footprint.

Each part of the telecom value chain, shown in Figure 14.6, is responsible for important CO_2 emissions, and reductions are possible in each part of that value chain. As the telecoms market grows, so will its emissions, unless specific measures are implemented by all players in the carbon chain.

There are four carbon hotspots where significant CO_2 savings can be achieved. The first two hotspots are under the control of telecom operators and vendors. The other two hotspots are under the control of users—and hopefully will motivate you to reduce your carbon emissions. End users account for a substantial 16 percent of the telecom footprint (see Figure 14.6).

1. **Data centers.** The numerous pieces of IT equipment needed to run networks effectively and manage their client bases are energy guzzlers. IT equipment vendors now offer much greener equipment; overall, data center management, cooling, and recycling can significantly reduce costs and CO_2 emissions. Data centers are discussed later in this chapter.
2. **Radio base stations.** Millions of mobile radio base stations have to run at full power 24/7/365 worldwide. Equipment vendors are developing smart solutions to reduce power consumption. As you read, off-grid solutions are using alternative fuels.
3. **Fixed network access equipment.** Routers, switches, and modems operated by end users are inefficient machines that could be significantly greener. Household broadband modems, built at the lowest possible cost, are power guzzlers. Users can invest in ecofriendly equipment and take the responsibility to switch off their equipment manually when it is not in use.
4. **Mobile handsets.** Mobiles consume very little electric power, but are a threat to the environment because millions of phones are produced and disposed of. Recycling practices are very poor, with only 5 percent of discarded handsets properly disposed of. If users slowed their renewal rates (tough with new iPhones and Sprint's 4G phones) or ensured that their old equipment was properly recycled, this carbon hotspot could be reduced.

FINANCIAL BENEFITS OF REDUCING IT POWER CONSUMPTION

The Internet is composed of huge numbers of power-consuming, heat-generating *servers* running 24/7/365 worldwide and *routers* that direct data packets over *networks* to their destination IP (Internet Protocol) addresses on *client machines*—computers and mobiles. Most servers are housed in data centers that must be cooled continuously. Harvard University physicist Alex Wissner-Gross (*CO2stats.com)* studied the Web overall and reported in 2009 that it takes on average about 20 milligrams of CO_2 per second to visit a Web site. Google's massive data centers around the world handle over 200 million searches daily; this power consumption has a definite environmental impact. And as you read, the global IT industry generates about 2 to 3 percent of global CO_2 emissions, or about as much greenhouse gas as the world's airlines.

Bottom Line of Green Computing High energy costs together with the growing power consumption of computing and communications technologies are having a direct negative impact on many businesses' bottom lines. There is also a growing desire among consumers to shrink their carbon consumption (like switching to vehicles that get more miles per gallon or kilometers per liter) and increase the use of recycled and recyclable materials. But the business case for green computing is not always compelling—or compelling enough for companies to invest in it and make the necessary process changes. *IT at Work 14.2* discusses the three biggest myths about green IT.

IT at Work 14.2

Three Myths About Green IT

All hardware manufacturers offer systems that meet stringent standards for efficiency and sustainable manufacturing. Lead and toxic materials are eliminated or minimized, and data centers are consuming less energy. While it may seem that going green is a common goal, it's the actual execution that matters. Here are three green IT myths managers need to understand.

Myth #1: The business case for green IT is clear. Trying to quantify the cost savings of green IT may be impossible or nonapplicable if cloud computing is used. The beneficiary of energy-efficient servers is not the company, but its outsourcer. For in-house servers and other hardware, energy costs may not be broken down enough for anyone to know what the savings would be. So the issue of who realizes the cost benefits is unclear, and that makes it tricky to pinpoint the real payback drivers for a given green project. Once a company can track the energy use of specific equipment, and break it down by business units, it becomes possible to incentivize and recognize those departments (like IT) that drive improvements.

Myth #2: Green IT is an achievable outcome. Green IT is an ongoing process and includes policies that define a way of operating over the long term. Companies don't achieve green and then quit. Energy efficiency and environmentally responsible manufacturing need to be made a part of hardware procurement policy. Industry standards like EPEAT and ENERGY STAR (discussed in this chapter) change. We're now on ENERGY STAR 5.0, which means the standards keep ramping up and will again. As green technology evolves, so do the standards, making green IT a continuous improvement process.

Myth #3: Everyone cares about green IT. The Society for Information Management (SIM) surveyed CIOs and IT executive leaders about their top priorities for 2010, based on a list of 20 IT and business concerns. Green IT wasn't one of them. The two top priorities were *cost reduction* because of the recession and alignment of IT and the business. Companies are concerned with costs—and so are the public and nonprofit sectors. To get management's attention, green IT initiatives should be described in terms of reducing waste and inefficiency. But even that tactic may be a tough sell if prior IT investments touted as reducing waste and inefficiency did not achieve those objectives.

Sources: Compiled from Alvares (2010) and Chickowski (2009).

Discussion Questions: Discuss the implications of these three myths. If you can't sell *green IT* as a concept to management, identify a way to package and present the concept. Viewing the slideshow *CIO Priorities for 2010* on *Baseline.com* at *baselinemag.com/c/a/IT-Management/CIO-Priorities-for-2010-706071/* may be helpful.

While not often recognized, there are financial benefits associated with becoming a sustainable company. Three leading benefits are:

- Cost savings by limiting waste and consumption of natural resources
- New business opportunities through environmentally friendly product innovations
- Enhanced brand value and reputation with customers, partners, and others.

Green computing, the study and practice of ecofriendly computing resources, may be in companies' best financial interests, as you read next.

VIRTUALIZATION IN DATA CENTERS

At the heart of the "Next Generation Data Center" strategy is the ability to deliver and support secure IT applications through **virtualization.** Virtualization is about efficient use of available resources. With energy and power costs increasing as the size of IT infrastructures grow, holding expenses to a minimum is a top priority for many CIOs. Data center virtualization means that servers are consolidated (integrated) so that they can be shared. Most stand-alone servers are highly underutilized. Virtualization technology optimizes the capacity and processing power of servers so that fewer servers are needed to provide the necessary processing power. Two examples are provided here:

1. Microsoft's commitment to green technology heavily leverages virtualization because of its massive data centers. Data centers are where virtualization can have the greatest impact, and that's where leading companies in the virtualization market are investing their resources. Virtualized, dynamic data centers lower energy consumption, reduce the number of servers needed, and extend server life. The benefits of longer server life are less manufacturing and less toxic materials in landfills.

2. By consolidating and moving to more efficient data centers, Sun increased processing power by over 450 percent with about one-half the servers and achieved an increase in storage capacity of over 240 percent with about one-third the storage devices.

GLOBAL GREEN REGULATIONS

Global regulations also are influencing green business practices. Sustainability regulations such as RoHS (*rohs.eu* and *rohs.gov.uk*) in the European Union (EU) will increasingly impact how supply chains function regardless of location. The RoHS directive stands for "the restriction of the use of certain hazardous substances in electrical and electronic equipment." For example, EU member states ensured that beginning in July 2006, new electrical and electronic equipment put on the market would not contain any of six banned substances—lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)—in quantities exceeding maximum concentration values. Moreover, China has passed its own RoHS legislation.

Similar legislation is developing elsewhere. For example, California's Electronic Waste Recycling Act (EWRA) prohibits the sale of electronic devices banned by the EU's RoHS, including CRTs, LCDs, and other products that contain the four heavy metals restricted by RoHS. In addition, many states have enacted mercury and PBDE bans, and several are considering bills similar to EWRA. For example, Seattle has issued many regulations related to eliminating paper-based manuals and mandating recycling.

Ecofriendly practices reduce costs and improve public relations in the long run. Not surprisingly, demand for green computers is on the rise. A tool to help companies find such hardware is the Electronic Product Environmental Assessment Tool, or EPEAT.

EPEAT and ENERGY STAR. Maintained by the Green Electronics Council (GEC), the **Electronic Product Environmental Assessment Tool (EPEAT)** is a searchable database of computer hardware that meets a strict set of environmental criteria. Among other criteria, products registered with EPEAT comply with the U.S. government's ENERGY STAR 5.0 rating (see *energystar.gov*); have reduced levels of cadmium, lead, and mercury; and are easier to upgrade and recycle. ENERGY STAR products use less energy. Depending on how many criteria they meet, products receive a gold, silver, or bronze certification rating.

The EPEAT rates computers and monitors on a number of environmental criteria, including energy efficiency, materials used, product longevity, takeback programs, and packaging.

Figure 14.7 ENERGY STAR label. (© *Art Directors & TRIP/Alamy*)

Stand-alone data centers and buildings that house large data centers can now earn the ENERGY STAR label (see Figure 14.7). To earn the label, data centers must be in the top 25 percent of their peers in energy efficiency according to the EPA's energy performance scale. By improving efficiency, centers can save energy and money and help fight climate change.

Traveling this summer? Check Into an ENERGY STAR Labeled Hotel. In May 2010, the EPA began this campaign to encourage travelers to bring their green on the road and choose hotels that have earned EPA's ENERGY STAR. Hotels that have earned the ENERGY STAR perform in the top 25 percent of hotels nationwide, use at least 35 percent less energy, and emit at least 35 percent less greenhouse gas emissions than their peers, making an environmentally friendly lodging choice a snap when planning a summer vacation.

TELEWORK

Telework can minimize damaging the environment or depleting natural resources by reducing pollution. Also called telecommuting or virtual work, it offers many green benefits, including reducing rush-hour traffic, improving air quality, improving highway safety, and even improving healthcare. See Table 14.1 for a list of potential benefits.

TABLE 14.1 Benefits of Telework

Individuals	Organizations	Community and Society
• Reduces or eliminates travel-related time and expenses • Improves health by reducing stress related to compromises made between family and work responsibilities • Allows closer proximity to and involvement with family • Allows closer bonds with the family and the community • Decreases involvement in office politics • Increases productivity despite distractions	• Reduces office space needed • Increases labor pool and competitive advantage in recruitment • Provides compliance with Americans with Disabilities Act • Decreases employee turnover, absenteeism, and sick leave usage • Improves job satisfaction and productivity	• Conserves energy and lessens dependence on foreign oil • Preserves the environment by reducing traffic-related pollution and congestion • Reduces traffic accidents and resulting injuries or deaths • Reduces the incidence of disrupted families because people do not have to quit their jobs if they need to move because of a spouse's new job or family obligations • Increases employment opportunities for the homebound • Allows the movement of job opportunities to areas of high unemployment

Review Questions

1. What is green computing?
2. Explain global warming and the greenhouse effect.
3. What does the Keeling curve track?
4. What are some low-carbon alternatives to fossil fuels, such as diesel?
5. What is the role of virtualization in green data centers?
6. How does RoHS in the European Union help protect the environment?
7. What are EPEAT and ENERGY STAR?
8. What are the benefits of telework?

14.2 IT Ethical Issues and Responsibility

Does the availability of information justify its use? Can shoppers keep their buying habits and online gaming and other legal activities private? Does the media have the right to publish or post highly private text messages of politicians, celebrities, or others in the news?

Questions about data access and capture, tracking and monitoring, privacy and profiling are examples of IT capabilities that have ethical considerations. And there are no easy or agreed-upon answers to these dilemmas. We look at a few of the most contentious ethical issues and what, if any, responsibility is associated with the use of information.

SOCIAL MEDIA MONITORING

Social media monitoring may be considered an integral component of social media strategies because it gives marketers the ability to discover public conversations about their brands and, if necessary, respond to posters directly or to their posts. Opponents of monitoring define it as spying and an intolerable invasion of privacy.

In mid-2010, the use of social media monitoring came under fire from the U.K.'s national *Daily Mail* newspaper over revelations that a number of large brands, including networking retailer BT, budget airline easyJet, mobile phone retailer Carphone Warehouse, and Lloyds TSB bank, were using the specialized software to spy on customers. These companies used specially developed software to scan for negative comments about their brands on the social media sites Twitter, Facebook, and YouTube. The companies then contacted some of the complainants in an attempt to solve their problems. While some customers and others were outraged, not all those contacted were offended. Companies defended their use of monitoring software by explaining that there was nothing sinister about the practice.

Why did companies risk angering customers by letting them know of the monitoring? Because research has found that negative comments by a frustrated customer on social media sites can lose a company as many as 30 other customers. Given that situation, you can see that the risk of not contacting the complaining customer to resolve the problem may be higher. General Motors, for example, doubled its team of social media agents in March 2010 to become more proactive in responding to customers' online complaints and repair its tarnished post-bankruptcy image. Privacy advocates were angered by the "outright spying," while legal experts claimed that firms making unsolicited approaches to customers could be violating the U.K.'s data protection laws. There are also fears that the software will be used to spam customers with sales pitches and advertising, or be used by political parties to exert pressure or control.

Privacy Sensitivity. Because of privacy scandals in 2010 surrounding **Facebook** and **Google,** the public in general is extremely sensitive to privacy. The *Daily Mail* has a history of attacks on social media and a reputation for stirring up moral outrage, for example, by publishing an article titled "How Using Facebook Could Raise Your Risk of Cancer" in February 2009. Campaigns against social media monitoring that incite privacy concerns could have huge implications for social media strategies.

Competing Responsibilities. There are competing interests and trade-offs at work when the issue is privacy. And there's not a clear-cut framework for deciding what is ethical and what's not. The personal privacy vs. public's security debate is a prime example. Typically, invasion of privacy is considered unethical. An ethically conscious corporate attitude sounds politically correct, but managers also have responsibility to stakeholders. Monitoring may be the responsible thing to do. And with intense competition, marketers naturally want to use every tool or technique to gain an edge or nullify a risk.

Globalization, the Internet, and connectivity have the power to undermine moral responsibility because it becomes relatively easy to ignore the harm that might be done to others. Despite the challenges and lack of clear answers, ethics is important because it has become clear that relying on the law alone to safeguard the community is insufficient. The law has its limits in large part because it changes so slowly.

URBAN PLANNING WITH WIRELESS SENSOR NETWORKS

Should IT be applied to social situations when it has the ability to provide benefits? If the answer is yes, the next question is: Who pays for it? The answer to the second question is tougher. In this section, we point out challenges more than we recommend solutions.

Traffic jams and parking problems in congested cities cause air and noise pollution, wasted fuel, stress, delays, and lost revenues. Studies of traffic congestion in New York and Los Angeles have found that drivers cruising for a parking space are a major source of gridlock. Disturbing results from studies conducted on behalf of urban planning efforts include the following:

- A study released in June 2008 by Transportation Alternatives *(transalt.org)*, a public transit advocacy group, reported that 28 to 45 percent of traffic on some streets in New York City is generated by people circling the block searching for parking. Drivers searching for parking within a 15-block area on Manhattan's Upper West Side drove 366,000 miles a year. Traffic congestion costs $13 billion in lost revenue and 50,000 jobs in the city annually for workers who are late for work once too often.
- Analysis conducted in Los Angeles by Donald Shoup, an urban planning professor at UCLA, found that over the course of a year, the search for curbside parking in a 15-block business district resulted in 950,000 excess vehicle miles of travel. Those wasted miles are the equivalent to 38 trips around the earth, and they consume

47,000 gallons of gas and produce 730 tons of the greenhouse gas carbon dioxide (CO_2) (Markoff, 2008).

These adverse effects can be reduced by implementing sensors and wireless networks—paid for by taxpayers who may not drive. In late 2008, the city of San Francisco initiated the most ambitious trial to date of a wireless sensor network that announces which parking spaces are free at any moment. The trial involved 6,000 of its 24,000 metered parking spaces. The system alerts drivers of empty parking places either by displays on street signs or via maps on their smartphone screens. In addition, the system can be extended so that drivers may even be able to pay for parking by cell phones and add funds to their parking meters from their phones without having to return to the meter. Solving the parking crisis takes on greater significance in San Francisco when you consider that a 19-year-old man was stabbed to death during a fight over a parking space—and calculate the GHG emissions due to all the excess driving around looking for parking.

Streetline (*streetlinenetworks.com*) is a company that provides city infrastructure technologies to improve urban operations through reliable information. Over the years, parking operations have become increasingly complex, and parking management has assumed a central role in the economic health of cities. But the quality of information to reduce their impacts has not kept up.

Streetline's product line includes *congestion management systems* that consist of parking sensors and wireless networked meters. The sensors, engineered using the same principles that make a compass operate, create a unique parking signature for each vehicle; they can determine, based on variations in parking angles and size of vehicles, when a parking space is filled, when a vehicle departs, and when a new vehicle replaces it. Wireless networked meters enable parking officials to instantly identify who has or has not paid as well as the total revenue for parking by meter and street, based on the time of day or the day of the week.

Presence, Location, and Privacy. Facebook enables users to know when friends are online. IBM Lotus also supports presence capabilities tied into "Connections," while Microsoft offers similar capabilities for SharePoint. iPhone has built-in location awareness capabilities.

What happens when LinkedIn, Facebook, or MySpace provides the ability for a GPS-enabled mobile device or iPhone to dynamically share its location status with others? Will—or how will—businesses begin to take advantage of these same capabilities to build applications to enable the tracking of field sales and support personnel by leveraging the location status capabilities already present in their mobile devices? With logs of location and presence, there will be an audit trail literally tracking people's movements. What are the privacy implications, assuming there would be any privacy remaining? Who will be held responsible or legally liable for unforeseen harm resulting from so much awareness and connectivity?

Free Speech via Wikis and Social Networks. Free speech and privacy rights collide in a world populated by anonymous critics, vengeful people, individuals with personal agendas, and malcontents. But the attacks are not always from competitors or others outside the company. The nature of the Internet ensures that we, at times, may become our own worst enemies personally and professionally, based on the content or images we post on blogs or the friends we keep on social networking pages. *IT at Work 14.3* describes what was irresponsible and illegal in the tactics of the CEO of Whole Foods. The lesson to be learned from this case is that companies need to make sure that when employees post in the blogosphere, they know what they can and cannot say about business information.

Companies victimized by online gossip and rumor have legal recourse, but against whom? What if the identity of the sender or poster is not known? Who is responsible for restricting troublesome content? Furthermore, companies face legal actions if they are found to be negligent for not restricting harmful content.

IT at Work 14.3

CEO's Blogging Is a Federal Crime

FIN ETHICS LESSONS FROM IT FAILURES

The CEO of Whole Foods Market, John Mackey, was blogging on the Yahoo! Finance message boards (*messages.yahoo.com*) anonymously as "Rahodeb." Whole Foods Market (*wholefoodsmarket.com*) is the world's largest retailer of natural and organic foods, with stores throughout North America and the United Kingdom. As "Rahodeb," the CEO told the world that "Whole Foods Is Hot, and Wild Oats is NOT." He did not disclose that he was hoping to purchase Wild Oats Market.

Whole Foods eventually completed the controversial $565 million purchase of Wild Oats, which closed in August 2007 after a six-month battle with the Federal Trade Commission (FTC). When the FTC audited Whole Foods, it discovered the CEO's deceptive blog posts. The blogging caused significant problems for the acquisition. Manipulating or influencing financial markets is a federal crime. Therefore, blogging to influence financial markets may be deemed by the FTC or the Securities and Exchange Commission (SEC) as a federal crime, particularly when done by the CEO posing as someone else. The takeover also led to an investigation by the SEC following the revelation that "Rahodeb" had been secretly promoting his company's stock and disparaging his rival's management team in postings in the Yahoo! stock message board. The investigation led to the suspension of Mackey's blogging privileges until the SEC and the Whole Foods board completed their investigations of Mackey's ill-considered blog outbursts.

Although the acquisition was eventually approved, Whole Foods and the CEO suffered damage to their reputations and huge legal fees and fines.

Review Questions

1. Why would a company engage in social media monitoring? What are objections to the monitoring?
2. How can wireless sensors improve urban planning efforts?
3. Distinguish between presence and location. Give an example of each.
4. Where and why do free speech and privacy rights collide?

14.3 Connectivity Overload and the Culture of Distraction

Consider your daily sources of information and what you check on your mobile or the Internet: tweets, texts, feeds, posts, voice messages, Facebook, LinkedIn, sport sites, Web cams, Skype, and dozens of apps. You probably haven't noticed the increase in the amount of information that you receive or check routinely. How many more things do you check today compared to a year ago? How long can you go without checking your mobile or computer without experiencing some anxiety? How many browser tabs do you have open right now, as you read? When do you put down your mobile and concentrate on one thing at a time? Your answers indicate information or connectivity overload and your tolerance for distractions, even if you're not aware of it.

People adapt to new ITs, many of which become *must have* and *can't function without* gadgets rather quickly. This situation is not limited to millennials or members of Generation Y—those born after 1982. Studies show that older adults are just as distracted as teenagers and 20-somethings, which can also be confirmed with a casual glance at offices, airports, cafes, and so on.

OVERLOADS AND DISTRACTIONS

IT's capability to introduce ever-growing amounts of data into our lives can exceed our capacity to keep up with the data, leading to **information overload.** Business users are more likely to suffer from too much data than from data scarcity. Finding the information they need in massive collections of documents can be complicated, time-consuming, frustrating, and expensive.

Maggie Jackson, author of *Distracted: The Erosion of Attention and the Coming Dark Age* (2009), suggested that: "We're really facing the limit of human ability to cope with stimuli in our environment." University of California–San Diego researchers found that on average, Americans hear, see, or read 34 gigabytes worth of information a day—about 100,000 words from TV, the Internet, books, radio,

newspapers, and other sources. And Bloomberg BusinessWeek (2008) reported that knowledge workers are distracted every three minutes at work—answering the phone, checking e-mail, responding to a text, or checking YouTube or Facebook. The consequence is that people are continuously paying *partial attention* to everything—skimming instead of being fully engaged. But there are also financial costs. According to Basex, a business research company in New York City, distractions take up to 28 percent of the average U.S. worker's day, including recovery time, and sap productivity to the cost of $650 billion a year.

To be effective at solving the problem of information overload, information systems must differentiate between the data that can be safely summarized and the data that should be viewed in its original form. This is a difficult problem to solve.

INFORMATION QUALITY

As organizations and societies continue to generate, process, and rely on rapidly increasing amounts of information, they begin to realize the importance of information quality. **Information quality** is a somewhat subjective measure of the utility, objectivity, and integrity of gathered information. To be valuable, both data and information must possess a number of essential characteristics, such as being complete, accurate, up-to-date, and consistent with the purpose for which they are used. The value and usability of data and information that do not satisfy these requirements are severely limited.

Information quality is mandated by several laws. The Data Quality Act of 2001 and the Sarbanes-Oxley Act of 2002 impose strict information quality requirements on government agencies and companies. For example, one of the provisions of the Sarbanes-Oxley Act makes CEOs and CFOs personally responsible and liable for the quality of financial information that firms release to stockholders or file with the Securities and Exchange Commission. This provision emphasizes the importance of controlling and measuring data quality and information quality in BI, corporate performance management, and record management systems.

Problems with information quality are not limited to corporate data. Millions of individuals face information quality issues on a daily basis as they try to find information online, whether on publicly available Web pages or in specialized research databases, wikis, blogs, and newsfeeds.

Among the most common problems that plague online information sources is omission of materials. A number of online "full-text" periodicals databases may omit certain items that appeared in the printed versions of their publications. In addition, online sources of information leave out older documents, which are not available in digital form. Thus, one cannot be assured of having access to a complete set of relevant materials. Even materials that are available from seemingly reputable sources present information quality concerns. Information may have been incorrectly reported, whether intentionally or unintentionally, or it may have become out of date. These and other information quality issues are contributing to the frustration and anxiety that for some people have become the unfortunate side effect of the information age.

IMPACTS ON INDIVIDUALS

Pervasive IT has caused changes in structure, authority, power, and job content, as well as personnel management and human resources management. Details of these changes are shown in Table 14.2. Together, the increasing amounts of information and IT use impact job satisfaction, dehumanization, and information anxiety as well as health and safety. Although many jobs may become substantially more enriched with IT, other jobs may become more routine and less satisfying.

Review Questions

1. What is information overload?
2. What are the consequences of connectivity or information overload?
3. What are the consequences of constant distractions?
4. What is information quality? Name one law that requires companies to ensure their information quality.
5. What are the impacts of pervasive IT?

TABLE 14.2 Impacts of IT on Structure, Authority, Power, and Job Content

Impact	Effect of IT
Flatter organizational hierarchies	IT increases *span of control* (more employees per supervisor), increases productivity, and reduces the need for technical experts (due to expert systems). Fewer managerial levels will result, with fewer staff and line managers. Reduction in the total number of employees, reengineering of business processes, and the ability of lower-level employees to perform higher-level jobs may result in flatter organizational hierarchies.
Change in blue-collar-to-white-collar staff ratio	The ratio of white- to blue-collar workers increases as computers replace clerical jobs and as the need for information systems specialists increases. However, the number of professionals and specialists could *decline* in relation to the total number of employees in some organizations as intelligent and knowledge-based systems grow.
Growth in number of special units	IT makes possible technology centers, e-commerce centers, decision support systems departments, and/or intelligent systems departments. Such units may have a major impact on organizational structure, especially when they are supported by or report directly to top management.
Centralization of authority	Centralization may become more popular because of the trend toward smaller and flatter organizations and the use of expert systems. On the other hand, the Web permits greater empowerment, allowing for more decentralization. Whether use of IT results in more centralization or in decentralization may depend on top management's philosophy.
Changes in power and status	Knowledge is power, and those who control information and knowledge are likely to gain power. The struggle over who controls the information resources has become a conflict in many organizations. In some countries, the fight may be between corporations that seek to use information for competitive advantage and the government (e.g., Microsoft vs. the Justice Department). Elsewhere, governments may seek to hold onto the reins of power by not letting private citizens access some information.
Changes in job content and skill sets	*Job content* is interrelated with employee satisfaction, compensation, status, and productivity. Resistance to changes in job skills is common and can lead to unpleasant confrontations between employees and management.

14.4 Future of IT in Business

The slideshow "Microsoft's Home of the Future: A Visual Tour" (*cio.com/article/597693/Microsoft_s_Home_of_the_Future_A_Visual_Tour*) shows a full-scale model home of the future. The Microsoft home seems like science fiction because of its interactive bedrooms, dishes that charge cell phones, sensors that notify you when plants need water, and kitchen counters that read your recipes. No wall or table in the home is safe from being a digital or information device. It's an exciting view of what homes could look like.

The future of IT in the organization may also bring about exciting changes. Here are seven IT trends that help define how the organization and business world are developing, as described in the report *Everything Elastic* from Accenture Technology Labs (Swaminathan, 2010).

1. Computing forecast: Into the clouds. ***A more flexible model that aligns better with business objectives.*** Cloud computing allows any part of the IT to be sourced from the Internet, ultimately offering a more flexible model that aligns better with business objectives. This new, adaptable IT framework may make it much easier to manage issues of cost, scale, and agility.

2. The new Web: ***The Web as a turning point.*** The Web is undergoing its most significant overhaul since the emergence of browsers and will emerge as an increasingly attractive enterprise platform. Because of the Web's reach (1.6 billion devices

connected, with this number expected to reach 2.7 billion by 2013), even small changes to its basic capabilities can have enormous potential—changing how people socialize, changing how societies link together, and changing how businesses operate. Right now, the Web is in the midst of its most significant overhaul since the first browsers emerged 15 years ago. Low-level engineering work—from networking protocols to browser optimization—is making the Web faster and more robust. New capabilities—such as location-awareness, online/offline modes, and social connectivity—are paving the way for new classes of Web apps. And a growing set of productivity, communication, and integration capabilities are making the Web increasingly attractive as an enterprise platform. It is a world that presents a new set of challenges—privacy, security, control of standards, interoperability—and requires a new set of technical and strategic skills.

3. **Devices as doorways.** ***User experience integrates over devices.*** With more data residing on the Web (cloud), users will increasingly access and manipulate this data using the devices that most suit their needs. Corporate IT will move away from hardware support to providing the secure transport layer for workers to access the information they need—using their own devices. We are now entering a world where any device can deliver any content.

4. **Fluid collaboration.** ***Seeking collaboration technology that pulls its weight.*** Collaboration across time zones and geographies is the new business norm. Given the realities of global workforces, carbon-reduction efforts, and the drive for greater productivity, these numbers are going up. Global—and thus virtual—collaboration will increasingly become the way business is done. Expect a wave of innovation to provide the technologies to enable collaboration across time zones and geographies.

5. **The conversation economy.** ***Social computing creates discontinuities in how we communicate and consume information.*** The rise of social networks is creating new ways of connecting with customers. Social computing has brought about change in how people connect, how they converse, and how they get and share information. The social network itself is fast becoming a primary information channel for many people. Any object of attention—rumors, novels, recipes, petitions—can explode in importance and visibility if it taps into the right social channels at the right time. But information can also travel in the opposite direction: Social networks are emerging as a rich source of information about consumer sentiment, preferences, and desires.

6. **Fourth-generation system development.** ***New architectures and new approaches.*** Technological and economic forces are prompting fresh approaches to systems development—as always, competitive advantage will go to those with the ability to spot technology hotspots and the skills to exploit them.

7. **Data + decisions = differentiation.** As analytics become a commodity, the real differentiators are the quality of the data—and the ability to use it to make productive decisions. Insightful analytics can help organizations discover patterns, detect anomalies, improve data quality, and ultimately take effective action. But as analytics tools have been incorporated into standard offerings from software vendors, it is becoming clear that the real advantage in analytics is gained before the analysis begins (in data collection) and after it ends (in decision making).

With IT creating organizations that have the characteristics of elasticity—scalable, infinitely flexible, and adaptive—companies and your job will be defined by IT.

Review Questions

1. Describe Microsoft's home of the future.
2. Describe the major IT trends influencing organizations.
3. What are the characteristics of elasticity as they apply to organizations?

Key Terms

computer cluster *436*
Electronic Product Environmental Assessment Tool (EPEAT) *426*
global warming *419*
green computing *425*
greenhouse effect *419*
information overload *430*
information quality *431*
Keeling curve *419*
MtCO2e, metric tonne (ton) carbon dioxide equivalent *418*
SMART 2020 Report *420*
social media monitoring *427*
sustainability *422*
sustainable biofuels *422*
virtualization *425*

Chapter Highlights and Insights

(Numbers refer to Learning Objectives)

1 Global warming is the upward trend in global mean temperature (GMT) and one of the most complicated issues facing world leaders.

1 The role of IT includes emission reduction and energy savings not only in the IT sector itself but also by transforming how and where people work. The most obvious ways are by substituting digital formats—telework, videoconferencing, e-paper, and mobile and e-commerce—for physical formats.

1 Organizations are paying premiums to invest in green computers that are both energy efficient and environmentally responsible. Organizations that invest in green hardware find that the energy savings, extended product life cycle, positive public image, and other benefits exceed the additional costs of that hardware.

1 Green computing is the study and practice of ecofriendly computing resources that is now a key concern of businesses in all industries and organizations. Now companies worry about their power consumption as well as the demand of physical space.

2 Social media monitoring may be considered an integral component of social media strategies because it gives marketers the ability to discover public conversations about their brands and, if necessary, respond to posters directly or to their posts. Opponents of monitoring define it as spying and an intolerable invasion of privacy.

2 Globalization, the Internet, and connectivity have the power to undermine moral responsibility because it becomes relatively easy to ignore the harm that might be done to others. Despite the challenges and lack of clear answers, ethics is important because it has become clear that relying on the law alone to safeguard the community is insufficient.

3 IT's capability to introduce ever-growing amounts of data into our lives can exceed our capacity to keep up with the data, leading to information overload. Business users are more likely to suffer from too much data than from data scarcity. Finding the information they need in massive collections of documents can be complicated, time-consuming, frustrating, and expensive.

4 Business executives and CIOs should consider reshaping their thinking in line with this concept. The idea of elasticity—scalable, infinitely flexible, adaptive—may be integrated into the very fabric of the business. Only then will high performance be achievable in this new marketplace.

Questions for Discussion

1. What is the relationship between GHG emissions and global warming?
2. How can carbon footprints be reduced by users and by organizations?
3. In your opinion, have mobiles, the Internet, and social media changed the way we communicate with each other and get news about our friends and family?
4. How has IT changed the way you communicate?
5. What changes do you predict in the way we communicate with each other in the future?
6. What are some communication casualties of IT?
7. If you were an employee in a company that offered telecommuting options, would you prefer to work from home, from the office, or some combination of both? Explain your answer.
8. Clerks at 7-Eleven stores enter data regarding customers' gender, approximate age, and so on into a computer system. However, names are not keyed in. These data are then aggregated and analyzed to improve corporate decision making. Customers are not informed about this, nor are they asked for permission. What problems do you see with this practice?
9. Discuss whether information overload is a problem in your work or education. Based on your experience, what personal and organizational solutions can you recommend for this problem?
10. Discuss how IT is expected to influence organizations in the future.

Exercises and Projects

1. List five opportunities to work remotely that are available at your workplace or educational institution. If you were to take advantage of these opportunities to telework, describe what potential impacts they could have on your life.
2. List three business applications or support for business activities available on the iPhone 3G or Sprint 4G phone.
3. Visit *wirelessintelligence.com/green-power/* and download the Google Earth plugin at *earth.google.com/plugin/*. Then look at the 3-D view of mobile green power deployments/solutions. Report what you learned.
4. Read *IT at Work 14.1.* Answer the questions at the end.

Group Assignments and Projects

1. The news that the U.S. Department of Justice (DOJ) has been seeking search data from Google, Yahoo, MSN, and America Online to track activities of "people or groups of interest" has struck fear into the hearts of Web surfers. Many users are concerned, not because they've done anything wrong, but because they wonder just how much personal information can be gleaned from their online searches. With the class divided into groups, debate the issues involved.
2. The state of California maintains a database of people who allegedly abuse children. (The database also includes names of the alleged victims.) The list is made available to dozens of public agencies, and it is considered in cases of child adoption and employment decisions. Because so many people have access to the list, its content is easily disclosed to outsiders. An alleged abuser and her child, whose case was dropped but whose names had remained on the list, sued the state of California for invasion of privacy. With the class divided into groups, debate the issues involved. Specifically:
   a. Who should make the decision or what criteria should guide the decision about what names should be included and what the criteria should be?
   b. What is the potential damage to the abusers (if any)?
   c. Should the state of California abolish the list? Why or why not?

Internet Exercises

1. Visit the U.S. Green Building Council at *usgbc.org/*. From the menu bar, select the Quick Link for *Case for Green Building (PowerPoint)*. Download the file about LEEDS and view the slides. Identify three buildings and their ecofriendly characteristics.
2. Assume that you read about a new nonprescription drug discovery called "Ace-the-Exam." This remarkable drug, being marketed to students for $19.99 plus shipping and handling, would keep the person awake and with perfect recall of what he or she had read in the textbook in preparation for the exam. How would you verify the truth about this drug—or any new drug treatment—before ordering it or ingesting it? Identify five sources of trusted health, medical, or drug information.

BUSINESS CASE

Energy Performance Management by Auto Manufacturers

The U.S. Environmental Protection Agency's ENERGY STAR program has helped the auto manufacturing industry increase its energy efficiency. As of mid-2010, the auto manufacturing industry had cut fossil fuel use by 12 percent and reduced GHG emissions by more than 700,000 MtCO2e/y, according to the June 2010 report by the Nicholas Institute for Environmental Policy Solutions at Duke University (Boyd, 2010). You can read the report at *nicholas.duke.edu/institute/Duke_EE_WP_10-01.pdf*.

The emissions reductions, which help to fight climate change, equal the emissions from the electricity use of more than 80,000 homes for a year.

The report, *Assessing Improvement in the Energy Efficiency of U.S. Auto Assembly Plants,* affirms the EPA's energy management strategy, particularly the importance of performance measurement and recognition for top performance. The report also demonstrates that the gap between top-performing plants and others has closed and the performance of the industry as a whole has improved.

Central to this energy management approach is the ENERGY STAR Energy Performance Indicator (EPI) for auto assembly plants, which enables industry to benchmark plant energy performance against peers and over time. ENERGY STAR EPIs exist or are under development for more than 20 other industries. Across these industries, the EPA has recognized nearly 60 manufacturing plants with the ENERGY STAR label, representing savings of more than $500 million and more than 6 million MtCO2e/y (metric tons of carbon dioxide equivalent annually).

The U.S. industrial sector accounts for more than 30 percent of energy use in the United States. If the energy efficiency of industrial facilities improved by 10 percent, the EPA estimates that Americans would save nearly $20 billion and

reduce GHG emissions equal to the emissions from the electricity use of more than 22 million homes for a year.

Hundreds of industrial companies across more than a dozen manufacturing industries are working with the EPA's ENERGY STAR program to develop strong energy management programs, earn the ENERGY STAR for their plants, and achieve breakthrough improvements in energy efficiency.

Sources: Compiled from Boyd (2010), EPA, ENERGY STAR (2010), and Nicholas Institute for Environmental Policy Solutions at Duke University.

Questions

1. Explain ENERGY STAR Energy Performance Indicators (EPIs).
2. What is the importance of cutting carbon emissions?
3. Why are companies in many industries motivated to earn the ENERGY STAR label?
4. What is energy management?
5. Global warming has been a known problem for over a decade. Why didn't the auto manufacturers undertake the ENERGY STAR program years ago?

PUBLIC SECTOR CASE

Green Computing at Argonne's Center for Nanoscale Materials

The U.S. Department of Energy's Argonne National Laboratory is renowned for its research centers in energy and environmental science, computation and biosciences, and national security. Argonne's Center for Nanoscale Materials (CNM) studies the behavior of nanoscale materials (*nano.anl.gov*). Nanoscale materials are slightly larger than the size of atoms and need to be studied with the CNM's nanoscope, the world's most powerful X-ray microscope (shown in Figure 14.8). The CNM's mission is to find new energy technologies and to understand and mitigate the environmental impacts of energy use. Researchers study nanoscale materials and devices to learn how to harvest solar energy more efficiently and to enable next-generation computing.

Minimizing Carbon Footprint

To achieve its mission, the CNM needed lab and computing facilities that could provide or accommodate extensive processing power, which would typically take up a lot of space—in other words, have a large **carbon footprint**—consume a huge amount of energy, and generate extreme heat that had to be controlled with air conditioning. The CNM had to be designed to conserve energy, space, and the environment and support future research missions.

Therefore, when research was just beginning at the CNM, the Department of Energy wanted to be sure that the center's infrastructure could accommodate not only current requirements but also future needs. Its ecofriendly plan was to deliver the computer processing performance required to support world-class scientific research on nanoscale materials in such a way that it would reduce the physical footprint of hardware while minimizing power consumption, cooling costs, and real estate costs.

Computer Cluster Solution

The CNM team built a high-performance computer cluster with Intel processors that delivered the extreme performance required with low power consumption and a small physical footprint. A **computer cluster** is a group of computers linked via a LAN (local area network) that work together to form the equivalent of a single computer. Using Intel software tools, CNM application developers have improved the efficiency of their research applications by 20 to 30 percent.

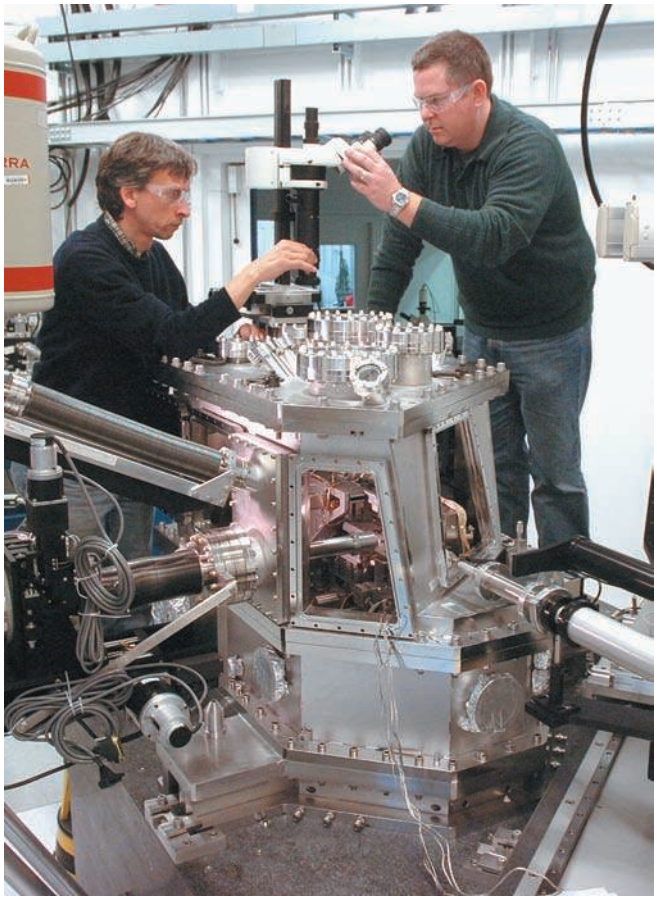

Figure 14.8 The Center for Nanoscale Materials' nanoscope, the world's most powerful X-ray microscope. (*Courtesy of U. S. Department of Energy's Argonne National Laboratory.*)

Built from the ground up, the new CNM facility enables scientists and engineers to conduct a wide variety of projects in a single location. The computing infrastructure delivers the computing power and data transfer rate required to capture and analyze large amounts of data in real time. Some experiments produce enormous amounts of data. Researchers are able to

analyze those data in real time so they can reposition samples, adjust instruments, and fine-tune their experiments. Research performed at the facility is contributing to advances in medicine, electronics, manufacturing, and alternative energy sources.

By providing a way to achieve fast results within a single facility, the CNM can accommodate more researchers in less time. Overall, it achieved its mission of providing a powerful computing infrastructure that enables researchers to produce better science while simultaneously protecting the environment.

Sources: Compiled from Argonne National Laboratory (2008), Center for Nanoscale Materials, (2010) and Intel Multi-Care Performance Accelerates Nanoscience Research (2008).

Questions

1. Explain the importance of nanoscale research.
2. Why is nanoscale research so power-intensive?
3. What is the advantage of a computer cluster over a single computer of comparable computing power?
4. In this chapter, you read many examples of companies, industry groups, and government agencies investing in IT infrastructure that ultimately reduced GHGs and CO_2 emissions. Compare and contrast the green initiatives at Argonne's CNM to the biofuel initiative in Nigeria discussed in *IT at Work 14.1*.

SIMULATION USING SPREADSHEETS

Global Warming Calculator

Visit *http://timeforchange.org/mitigation-global-warming-calculator* to download the Excel file attachment *Global-warming-calculator-Excel.xls*. The Global Warming Calculator is an Excel-based interactive simulation. Input data for three different scenarios in the section: *What would happen if everyone was like you?* Explain what you learned.

Resources on the Book's Web Site

More resources and study tools are located on the Student Web site and on WileyPLUS. You'll find additional chapter materials and useful Web links. In addition, self-quizzes that provide individualized feedback are available for each chapter.

References

Alvares, M., "The Three Biggest Myths About Green IT," Greenbiz.blog, June 22, 2010. *greenbiz.com/blog/2010/06/22/three-biggest-myths-about-green-it*

Argonne National Laboratory, 2008. *anl.gov*

Biofuels Programme, GSMA Development Fund, January 2007, *businessaction for africa.org*

Boyd, G., "Assessing Improvement in the Energy Efficiency of U.S. Auto Assembly Plants," *Duke University Environmental Economics Working Paper Series*, Working Paper EE 10-01, June 2010. *nicholas.duke.edu/institute/Duke_EE_WP_10-01.pdf*

Center for Nanoscale Materials 2010, *nano.anl.gov/index.html*

Chickowski, E., "CIO Priorities for 2010," *Baseline,* September 28, 2009. *baselinemag.com/c/a/IT-Management/CIO-Priorities-for-2010-706071/*

EPA, *epa.gov*

ENERGY STAR, *energystar.gov*

GSM World.com

"Intel® Multi-Core Performance Accelerates Nanoscience Research," April 9, 2008. *communities.intel.com/servlet/JiveServlet/previewBody/1489-102-1-1705/Intel_ESS_Argonne_LR.pdf*

Jackson, M., *Distracted: The Erosion of Attention and the Coming Dark Age,* Prometheus Books, 2009.

Markoff, J., "Can't Find a Parking Spot? Check Smartphone," *The New York Times*, July 12, 2008.

MTN Group, 2010. *mtn.com/*

Nicholas Institute for Environmental Policy Solutions, *nicholasinstitute.duke.edu*

Swaminathan, K. S., "Everything Elastic," 2010. a *ccenture.com*

U.S. Global Change Research Program, *globalchange.gov/*