Information Technology for Management

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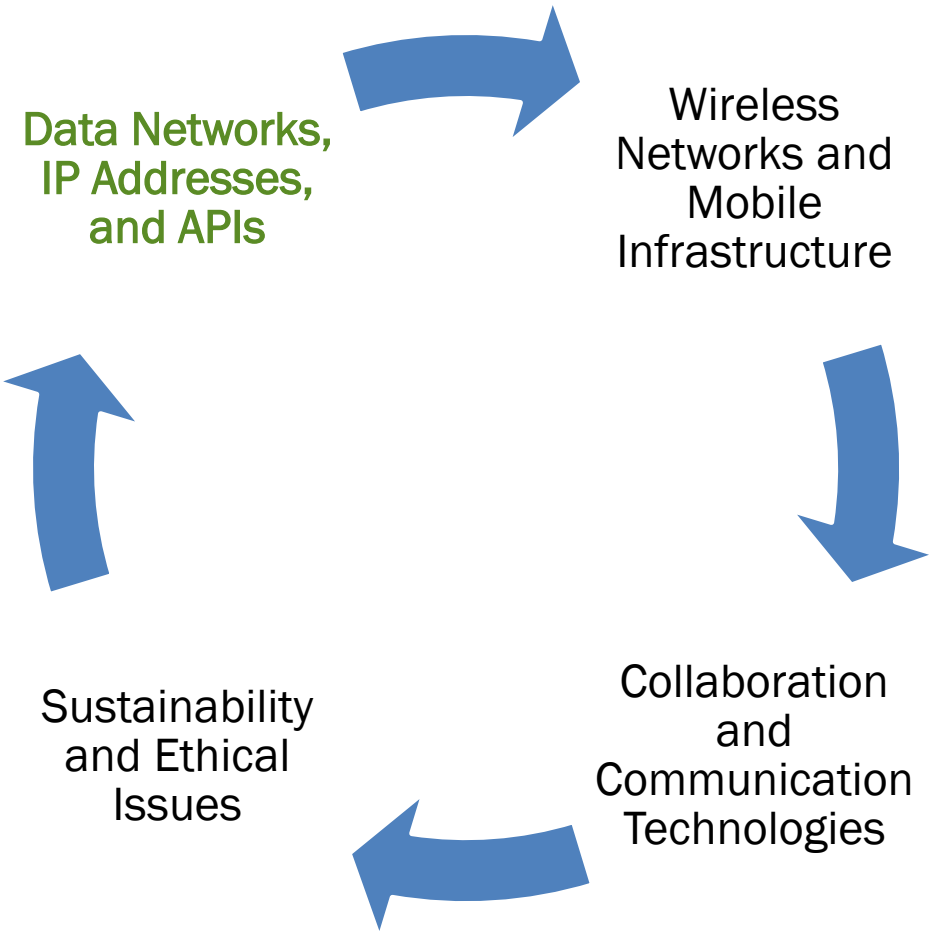
- Chapter 4: Digital Networks and the Triple Bottom Line

Learning Objectives



Data Networks, IP Addresses, and APIs

- Network Fundamentals
  - **Bandwidth:** the capacity or throughput per second of a network measured in **bits per second** (bps).
  - **Protocol:** rules and standards that **govern device** functionality.
  - **TCP/IP:** Basic communication **protocol of the Internet supported by every major network operating system**.
  - **Network Speed:** data flowing that depends on the **amount of traffic**.
  - Commonly referred to by generation (**2G, 3G**, 4G, etc.)
  - Data **transferred over guided** (**wired/ fixed-line broadband**) or **unguided (wireless and mobile broadband) media**.

Data Networks, IP Addresses, and APIs

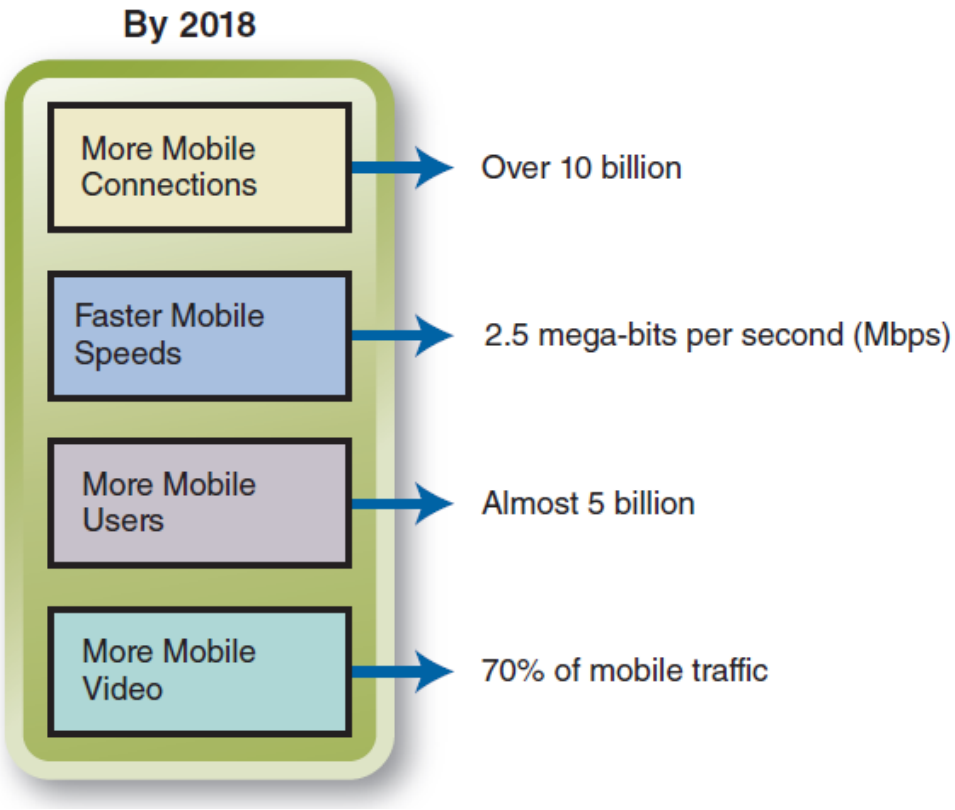


Figure 4.4 Four drivers of global mobile traffic through 2018.

Data Networks, IP Addresses, and APIs

- High Demand for High-Capacity Networks
  - **Voice over IP (VoIP):** voice calls (analog) converted to digital signals.
  - VoIP voice and data transmissions travel in **packets over telephone wires.**
  - Rely on 5 basic functions through **switches and routers**:
    - **Communication**
    - **Mobility**
    - **Collaboration**
    - **Relationships**
    - **Search**

Data Networks, IP Addresses, and APIs

- Quality of Service (QoS)
  - ***Latent-sensitivity***: data such as **real-time voice and high-quality video.**
  - ***Prioritized Traffic***: data and apps that are time-delay-sensitive or latency-sensitive apps.
  - ***Throttle (Control) Traffic***: gives latency-sensitive apps priority, other types of traffic need to be held back (throttled).
  - ***Traffic Shaping***: the ability to prioritize and throttle network traffic.

Data Networks, IP Addresses, and APIs

- Pure IP Networks
  - WiMAX
    - IEEE 802.16
    - 30 miles range
    - 70 Megabits per second (Mbps)
    - Line-of-site not required
    - Same principles as WiFi
  - Long-Term Evolution (LTE)
    - GSM deployed by Verizon, AT&T, and T-Mobile
    - 100 Mbps download, 50Mbps upload

Data Networks, IP Addresses, and APIs

- Near-Field Communication (NFC)
  - **Close proximity radio waves** more **secure** than other wireless technologies
    - **Apple iWatch**
    - **Digital tickets providing access to concerts**
    - Kiosks to transmit moves in Supermarkets
    - Transmit **public transport payment** through phones

Data Networks, IP Addresses, and APIs

- **Mashup**
  - General term referring to the **integration of two or more technologies such as Bluetooth and Wi-Fi**
    - Provide intelligence
    - Inter-Automobile collision avoidance

Data Networks, IP Addresses, and APIs

- Application Program Interface (API)
  - **Boundary where two separate systems meet.**
  - Consists of a **set of functions, commands**, and **protocols** used by programmers for **OS-interactivity** without having to write a program from scratch.
  - Can be automated for simplified usability.
    - **Twitter**
    - **Facebook**
    - **Amazon**

Data Networks, IP Addresses, and APIs

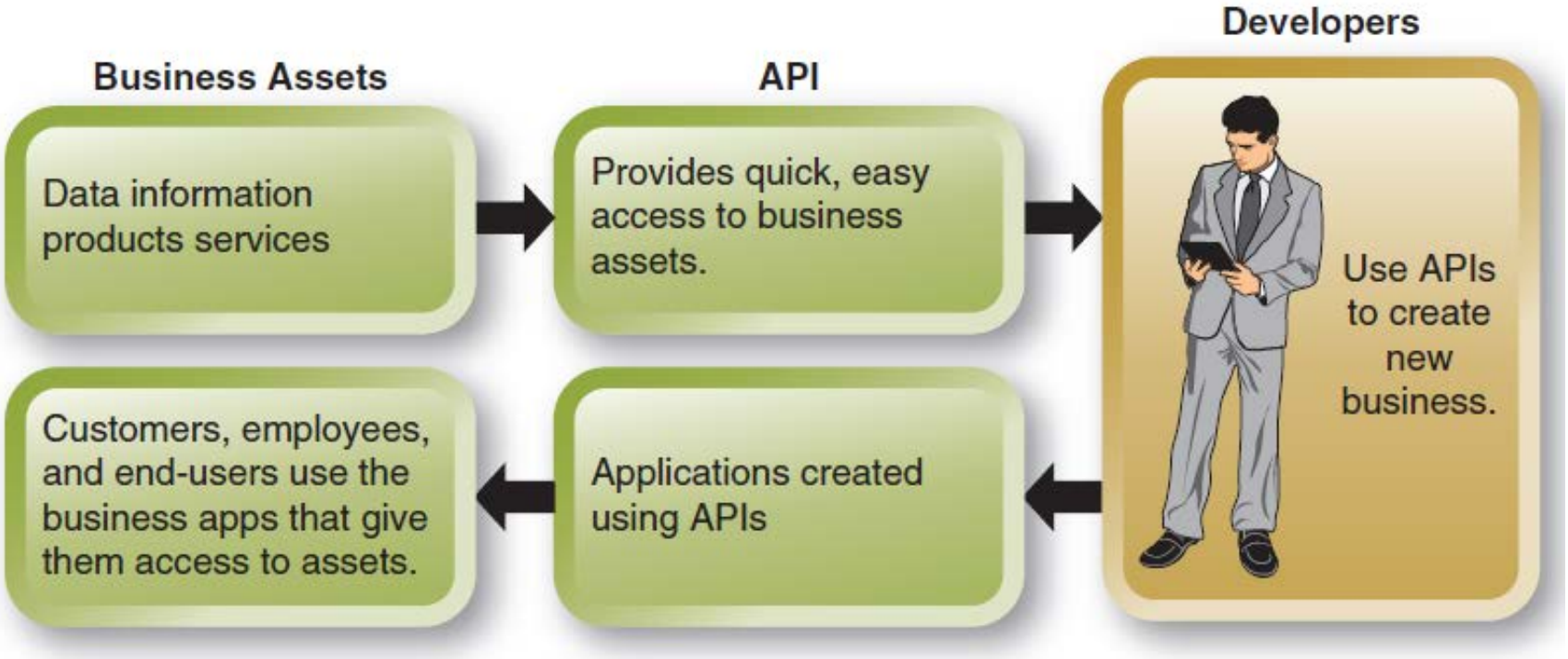


Figure 4.8 API value chain in business.

Data Networks, IP Addresses, and APIs

1. Why has IPv6 become increasingly important?

IPv4 can support roughly 4.3 billion unique IP address. IPv6 can support 340 trillion, trillion, trillion addresses. IPv6 offers also enhanced quality of service that is needed by the latest in video, interactive games, and e-commerce. In April 2014 ARIN, the group that oversees Internet addresses, reported that IPv4 addresses were running out—making it urgent that enterprises move to the newer IPv6

2. What is an IP address?

Every device that communicates with a network must have a unique identifying IP address. An IP address is comparable to a telephone number or home address.

3. What are bandwidth and broadband?

Bandwidth is the communication capacity of a network. Bandwidth is the amount of data that passes through a network connection over time as measured in bits per second (bps). For an analogy to bandwidth, consider a pipe used to transport water. The larger the diameter of the pipe, the greater the throughput (volume) of water that flows through it and the faster water is transferred through it.

Broadband is short for broad bandwidth and means high capacity.

Data Networks, IP Addresses, and APIs

4. Briefly described the basic network functions.

- Business networks support basic functions including: communication, mobility, collaboration, relationships, and search.
- Communication: Provides sufficient capacity for human and machine generated transmissions, such as being able to talk, text, tweet, fax, send messages, etc.
- Mobility: Provides secure, trusted, and reliable access from any mobile device anywhere at satisfactory download (DL) and upload (UL) speeds.
- Collaboration: Supports teamwork activities that may be synchronous or asynchronous; brain storming; and knowledge and document sharing.
- Relationships: Manages interaction with customers, supply chain partners, shareholders, employees, regulatory agencies, etc.
- Search: Able to locate data, contracts, documents, spreadsheets, and other knowledge within an organization easily and efficiently.

5. What is the difference between circuit switching and packet switching?

The two types of switching are:

- Circuit switching: A circuit is a dedicated connection between a source and a destination. Circuit switching is older technology that was used for telephone calls. The distinguishing characteristic is that the circuit cannot be used by any other call until the session (connection) is ended. It is inefficient for digital transmission.
- Packet switching: Packet switching transfers data or voice in packets. Files are broken into packets, numbered sequentially, and routed individually to their destination. When received at the destination, the packets are reassembled into their proper sequence.
- The astute student may realize: The path of the signal is digital, and is neither dedicated nor exclusive. That is, the networks are shared. When packets are transmitted over a shared network, such as the Internet, they may follow different paths to the destination, where they are reassembled into the original message once all of them have arrived.

Data Networks, IP Addresses, and APIs

6. What is the difference between 3G and 4G?

- 4G delivers average download rates of 3Mbps or higher. In contrast, today's 3G networks typically deliver average download speeds about one-tenth of that rate. Even though individual networks, ranging from 2G to 3G, started separately with their own purposes, soon they will be converted to the 4G network. 4G is based purely on the packet-based Internet Protocol (IP) – unlike current 2G and 3G networks that have a circuit-switched subsystem. Users can get 4G wireless connectivity through one of the following standards:

1. WiMAX is based on the IEEE 802.16 standard and the metropolitan area network (MAN) access standard. IEEE 802.16 specifications are:

- Range: 30 miles (50 km) from base station
- Speed: 70 megabits per second (Mbps)
- Line-of-sight not needed between user and base station

- WiMAX operates on the same basic principles as Wi-Fi in that it transmits data from one device to another via radio signals.
- 2. LTE (Long-Term Evolution) is a GSM-based technology that is deployed by Verizon, AT&T, and T-Mobile. LTE has download data rates of 100 Mbps and upload data rates of 50 Mbps.

7. What are the mobile network standards?

- Mobile broadband: Describes various types of wireless high-speed Internet access through a portable modem, telephone or other device. Various network standards may be used, such as GPRS, 4G, 3G, WiMAX, LTE UMTS/HSPA, EV-DO, and some portable satellite-based systems.
- The textbook discusses 4G standards, so students' answers will probably be focused along this line. In general, users can get 4G wireless connectivity through one of two standards: WiMAX or LTE (Long-Term Evolution).

Data Networks, IP Addresses, and APIs

8. Define bandwidth and broadband.

- In January 2014 an appeals court struck down the FCC's 2010 decision (providing a Net "semi-neutrality".) The court allowed ISPs to create a two-tiered Internet but to avoid anticompetitive practices, and banned "unreasonable" discrimination against providers. However, the rules do not explicitly forbid "paid prioritization," which would allow a company to pay an ISP for faster data transmission.
- Those in favor of Net neutrality. They want a one-tier system in which all Internet data packets are treated the same, regardless of their content, destination, or source. In contrast, those who favor the two-tiered system argue that there have always been different levels of Internet service and that a two-tiered system would enable more freedom of choice and promote Internet-based commerce.

9. What are two applications of NFC?

- NFC enables two devices within close proximity to establish a communication channel and transfer data through radio waves. NFC is location-aware technologies that are more secure than other wireless technologies like Bluetooth and Wi-Fi. Unlike RFID, NFC is a two-way communication tool.

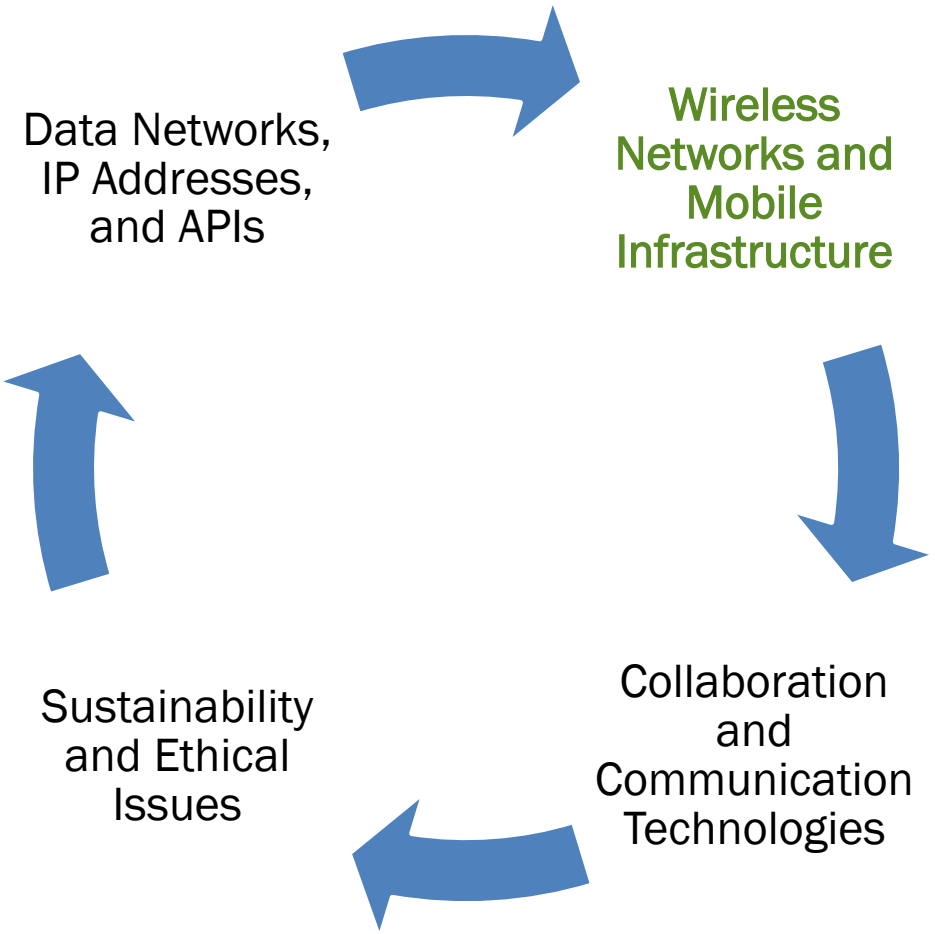
- *Answers may vary.* Location-aware NFC technology, such as smartphones, can be used to make purchases in restaurants, resorts, hotels, theme parks and theaters, at gas stations, and on buses and trains. They also can provide consumers with content to complement their current activity, such as recipe or idea videos when shopping at a supermarket having proper NFC tag-equipped units.

Data Networks, IP Addresses, and APIs

10. What are the benefits of APIs?

- For programmers: The benefits of APIs are that they simplify the programmer's job and ensure that all programs using the same API use that resource in the same manner. APIs are the common method for accessing information, websites, and databases.
- Business benefits of APIs include:
- APIs are channels to new customers and markets: APIs enable partners to use business assets to extend the reach of a company's products or services to customers and markets they might not reach easily.
- APIs promote innovation: Through an API, people who are committed to a challenge or problem can solve it themselves.
- APIs are a better way to organize IT: APIs promote innovation by allowing everyone in a company to use each other's assets without delay.
- APIs create a path to lots of Apps: Apps are going to be a crucial channel in the next 10 years. Apps are powered by APIs. Developers use APIs and combinations of APIs to create new user experiences.

Learning Objectives



Wireless Networks and Mobile Infrastructure

- Modern Mobile Communications
  - 2Mbps per mobile device by 2016
  - 66% of traffic through smartphones by 2018
  - Mobile traffic surpasses 2.5EB*/month by 2018
  - Greater than 15% all traffic through tablets by 2016
  - Greater than 50% mobile traffic is 4G by 2018

* Exabyte = 1 billion Gigabytes

Wireless Networks and Mobile Infrastructure

- Mobile Networks
  - **Bluetooth: short-range wireless** communication technology **allowing device pairing.**
  - **Wi-Fi:** standard way to **wirelessly connect computing devices** through routers commonly connected to the Internet.
  - **WiMax:** transmits **voice, data, and video over high-frequency radio signals** designed as alternative to cable and DSL.

Wireless Networks and Mobile Infrastructure

- **Mobile Networks Evaluation Factors**
  1. Simple
  2. Connected
  3. Intelligent
  4. Trusted

Data Networks, IP Addresses, and APIs

1. What factors are contributing to mobility?

- ***Answers may vary.*** **Factors contributing to mobility can include the following:**
  - New wireless technologies such as WiMAX-Wireless Broadband and standards such as 8.11n
  - High-speed wireless networks such as 4G
  - Multitasking mobile devices
  - More robust mobile OSs and their applications
  - Increased competitive pressure as others start adopting mobile technology for strategic applications

2. Why is strategic planning of mobile networks important?

Organizations are recognizing the strategic value of mobile technology. So, organizations are moving away from ad hoc adoption of mobile devices and network infrastructure to a more strategic planning build-out of their mobile capabilities. As technologies that make up the mobile infrastructure evolve, identifying strategic technologies and avoiding wasted investments require more extensive planning and forecasting.

Data Networks, IP Addresses, and APIs

3. How does Wi-Fi work?

- Wi-Fi is a technology that allows computers to share a network or internet connection wirelessly without the need to connect to a commercial network. Wi-Fi networks beam packets over short distances using part of the radio spectrum, or they can extend over larger areas, such as municipal Wi-Fi networks. Municipal networks are not common because of huge costs.
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- Wi-Fi is the standard way computers connect to wireless networks. Nearly all computers have built-in Wi-Fi chips that allow users to find and connect to wireless routers. The router must be connected to the Internet in order to provide Internet access to connected devices. Wi-Fi networking standards are:
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- 802.11b. This standard shares spectrum with 2.4 GHz cordless phones, microwave ovens, and many Bluetooth products. Data are transferred at distances up to 100 meters or 328 feet.
- 802.11a. This standard runs on 12 channels in the 5 GHz spectrum in North America, which reduces interference issues. Data are transferred about 5 times faster than 802.11b, improving the quality of streaming media. It has extra bandwidth for large files. Since the 802.11a and b standards are not interoperable, data sent from an 802.11b network cannot be accessed by 802.11a networks.
- 802.11g. This standard runs on three channels in 2.4 GHz spectrum, but at the speed of 802.11a. It is compatible with the 802.11b standard.
- 802.11n. This standard improves upon prior 802.11 standards by adding multiple-input multiple-output (MIMO) and other newer features. Frequency ranges from 2.4 GHz to 5GHz with a data rate of about 22 Mbps, but perhaps as high as 100 Mbps.

4. What is a WLAN?

A WLAN (Wireless Local Area Network) is a type of local area network that uses high-frequency radio waves to communicate between computers or devices such as printers, which are referred to as nodes on the network. A WLAN typically extends an existing wired LAN by attaching a wireless access point (AP) to a wired network.

Data Networks, IP Addresses, and APIs

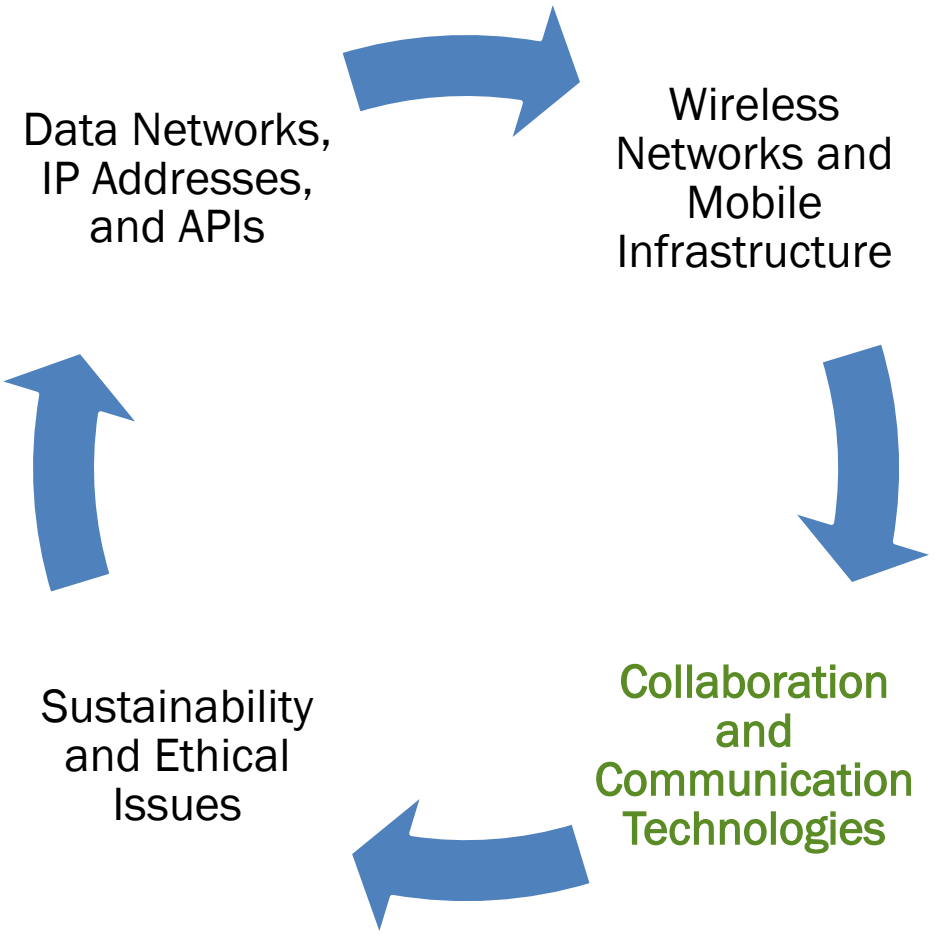
5. Why is WiMAX important?

Wireless broadband WiMAX transmits voice, data, and video over high-frequency radio signals to businesses, homes, and mobile devices. It was designed to bypass traditional telephone lines and is an alternative to cable and DSL. WiMAX is based on the IEEE 802.16 set of standards and the metropolitan area network (MAN) access standard. Its range is 20 to 30 miles and it does not require a clear line of sight to function.

6. What factors should be considered when selecting a mobile network?

- When evaluating mobile network solutions, four factors to consider are:
- 1. Simple: Easy to deploy, manage and use.
- 2. Connected: Always makes the best connection possible.
- 3. Intelligent: Works behind the scenes, easily integrating with other systems.
- 4. Trusted: Enables secure and reliable communications.

Learning Objectives



Collaboration and Communication Technologies

- Working in Modern Groups
  - **Group workers** can be **located in different places** or work at different times.
  - Group members **may work for the same or different organizations**.
  - Data, information, or knowledge may be located in many sources that may be external to the organization.
  - Create group dynamics – group processes by design or default.

Collaboration and Communication Technologies

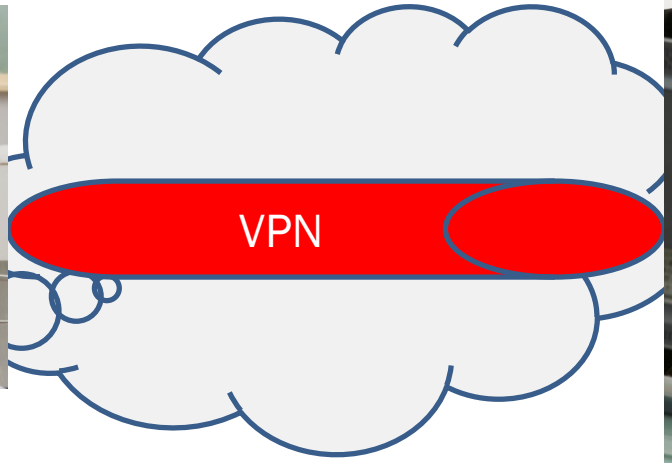
- Virtual Collaboration
  - Avoid **travel expenses**
  - Increase **numbers of sessions**
  - Record and **store data in real-time**
  - **Streamline** work processes, **minimize information overload, generate new ideas, and boost innovation through** online software.

Collaboration and Communication Technologies

- Virtual Collaboration Continued…
  - Improved **retailer-supplier collaboration** through web-based **electronic data interchange (EDI)**.
  - Intranets provide inter-company data access, **sharing, and collaboration through portals or gateways.**
  - **Extranets are private, company-owned networks remotely accessible via the Internet.**
  - Online brainstorming through the Internet
    - **Evernote**
    - **iMindmap Online**

Collaboration and Communication Technologies

- Virtual Private Networks
  - Virtual tunnel routed through the Internet with software and hardware encryption.



Collaboration and Communication Technologies

1. Why is group work challenging?

- Group work involves processes that can be quite complex depending on the following factors:
- Group members may be located in different places or work at different times.
- Group members may work for the same or for different organizations.
- Some of the needed data, information, or knowledge may be located in many sources, several of which are external to the organization.
- Despite the long history and benefits of collaborative work, groups are not always successful.

2. What are the benefits of working in groups?

Answers may vary. In-person brainstorming can be limited by travel expense if members are geographically dispersed. Other limiting factors, such as schedules, time zones, and available resources, such as an available meeting place, may limit in-person brainstorming.

Collaboration and Communication Technologies

3. How can online brainstorming tools overcome those limits?

Online brainstorming tools can be accessed virtually from anywhere Internet access is available. Many of these tools allow users to post comments on their own time rather than having to meet at a particular time, however, virtual meetings may be necessary as well.

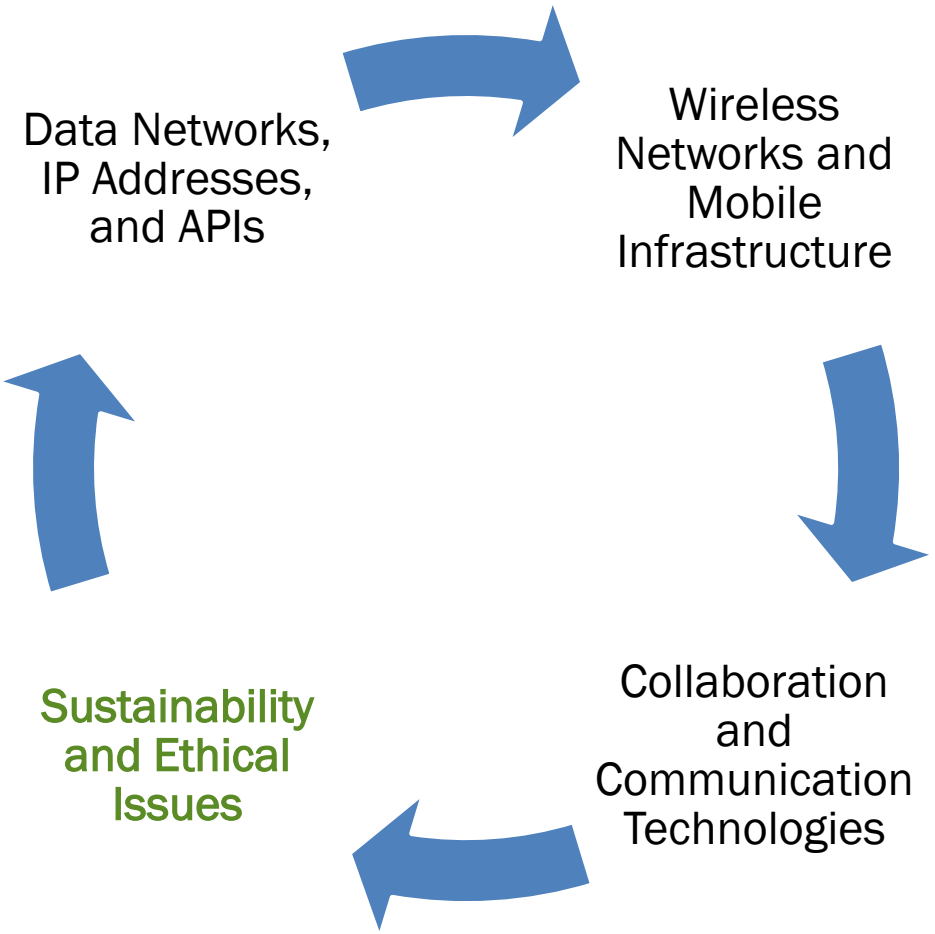
4. What is the difference between an intranet and an extranet?

- Intranets are used within a company for data access, sharing, and collaboration.
- An extranet is a private, company-owned network that can be accessed remotely via the Internet. It connects two or more companies, suppliers, vendors, partners, or customers, so they can securely share information.

5. How does a virtual private network (VPN) provide security?

Virtual private networks (VPNs) encrypt the data packets before they are transferred over the network and decrypt at the receiving end.

Learning Objectives



Sustainability and Ethical Issues

- Global Warming
  - Upward trend in global mean temperature (GMT) rising more than **2^0C since preindustrial times**.
  - **Damages** include **water and food** scarcity, rising sea levels, and greater incidence and severity of disease.
- Unsustainability
  - Profit-motivated **without concern for damage to the environment** contributing to climate change threatening quality of life.
  - Conduct that is **unethical, socially irresponsible**, and/or environmentally damaging.
- Sustainability
  - **Reduce**
  - **Reuse**
  - **Recycle**
  - **Recover**

Collaboration and Communication Technologies

1. Why do some experts warn that carbon emission reductions between 50 percent and 85 percent are necessary by 2050?

The Prince of Wales' Corporate Leaders Group on Climate Change holds that carbon emission reductions between 50 percent and 85 percent are necessary by 2050 to prevent the global temperature from rising too much too fast because of the greenhouse effect.

2. What contributes to the rise of global mean temperature?

Scientists have concluded that increases in CO2 resulting from human activities have thrown the earth's natural carbon cycle off balance, increasing global temperatures.

3. What is the greenhouse effect?

The greenhouse effect is the holding of heat within the earth's atmosphere.

4. How does the use of mobile devices contribute to the level of greenhouse gases?

Almost all of these devices are powered by the burning of fossil fuels.

Collaboration and Communication Technologies

5. What is ICT's role in global warming?

Climate Group found that ICT plays a key role in reducing global warming by transforming the way people and businesses use IT. The role of IT includes emission reduction and energy savings not only in the sector itself, but also by transforming how and where people work. The most obvious ways are by substituting digital formats—telework, video-conferencing, e-paper, and mobile and e-commerce—for physical formats.

6. Why is global warming hotly debated?

Many scientists and experts are extremely alarmed by global warming and climate change, but other experts outright deny that they are occurring.

7. Explain the goal of sustainability.

Answers may vary. The goal is to preserve the earth's capacity to support human life by curbing emissions and reducing environmental impact, yet preserving the ability of businesses to show a return on investment (ROI) through the use of four factors essential to preserving the environment: reduce, reuse, recycle, and recover.

8. Explain the characteristics of a life out of control.

IT keeps people connected with no real off switch. Tools that are meant to improve the productivity and quality of life in general can also intrude on personal time. In our hyper-connected world, people are always on, collaborating, communicating, and creating—and not always aware of how technology impacts them. Downtime has given way to filling every moment with bite-sized chunks of information, education, and entertainment—seemingly packing our lives with productivity.

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