Chapter 10
Global Communications

The rapid increase in capacity of communication technologies has produced a revolutionary change in the relationships between the people and cultures of the world.

In this chapter, you will learn about the technologies that connect us at the speed of light and how we interact with cultures of India and Japan.

Why Do I Need to Know This?

The world has become a global market place where jobs that can be done on a computer can be done anywhere. This affects the cost of goods that you buy and the wages that you get at your job. It also creates opportunities for those who perceive them and who are prepared to live in a connected world. To prepare for your future, you need to be aware of the competition and what great advantages you already have.

1 Communication Technologies

Learning Objectives

1. Identify the communication method used by the telegraph. [10.1.1]
2. Identify examples of analog communication technologies. [10.1.2]
3. Identify how binary switches are used to represent letters and numbers. [10.1.3]
4. Identify the types of letters and languages that can be represented by ASCII and Unicode. [10.1.4]
5. Identify the elements of a data packet and how it is used to transfer data on the internet. [10.1.5]
6. Identify the difference between data transmission and streaming video or audio and the role of a CODEC. [10.1.6]
7. Identify the role of a router and a domain name server on the Internet. [10.1.7]
8. Identify the characteristics of laser diodes and fiber optic cables and their role in world-wide communications. [10.1.8]
9. Identify the ways that electromagnetic waves are used for communications. [10.1.9]

Modern communication systems combine the technologies of computers, fiber optics, and satellite relays.

Communicating with Electricity

Shortly after the properties of electricity were discovered in the early 1800s, technologies appeared that used these properties for communication. For example, scientists discovered that an electric current in a wire

created a magnetic field that would attract a piece of iron. Electricity has the advantage of speed. Its energy moves along wires at almost the speed of light (186,000 miles per second). It has the disadvantage of being silent and invisible. To take advantage of its speed for communication, we have to use technology to make it audible and visible.

A few years later, the telegraph was invented that allowed people to communicate even though they were miles apart. One person could connect or disconnect a source of electricity to a wire that would make an electromagnet at the other end of the wire attract an iron bar that moved and made an audible click. The current was either on or off depending on the position of a special switch that could be moved rapidly like the one shown in Figure 10.1. The people at both ends of the circuit had to know the same code so they could interpret the series of clicks which required training and limited its usefulness.

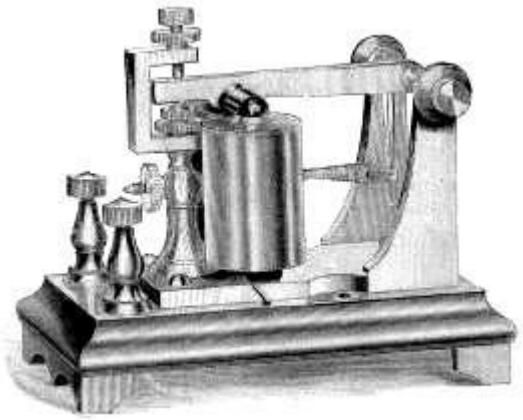

Figure 10.1.Morse telegraph key

Electricity and Analog Communications

The telegraph was a major step forward in communication but it took training to learn the code and translation of messages took time. What was needed was a technology that could transform voices directly into electricity and then back into recognizable speech. Instead of using the electromagnet to pull an iron bar that made a clicking noise, the electromagnet was attached to a cone of paper. This arrangement was duplicated at the other end of the circuit. At the speaker's end, someone spoke into the paper cone and the pressure vibrations of the sound waves moved a magnet past a coil of wire producing a change in the electric current that corresponded to the air pressure patterns of the speaker's voice. A wire transmitted this changing electric current to the electromagnet at the other end which caused a similar paper cone to move with the same pattern of vibrations. The first diagram for this system was drawn by Alexander Graham Bell, as shown in Figure 10.2. His name is still part of many telephone company names that used his patent. The electric

energy in the circuit varies in strength the same way the air pressure changes when we speak. When two systems behave similarly, we say they are analogous and this type of communication using electricity is an analog system.

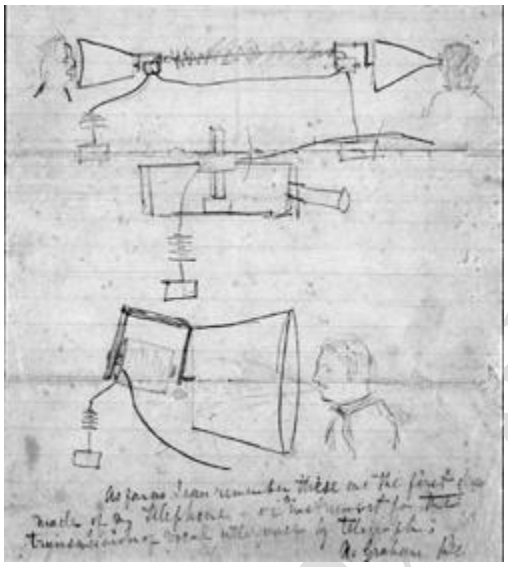

Figure 10.2. Sketch of the first telephone by Alexander Graham Bell

Another analog device called a phonograph was used to record sounds. A needle was attached to a disk. The sound waves caused the needle to swing side-to-side matching the variations in air pressure from the sound waves. The needle scratched a groove in a disk where the width of the groove was analogous to the air pressure waves of the music or voice. If a similar needle on a playback device was passed through the scratch, it would vibrate in the same pattern. The playback needle was attached to a paper cone that converted its motion into audible sounds.

Circuit Switching

When you make a call with an older telephone system, an automated set of switches connects a series of wires until you have a direct connection between your phone and the phone at the other end. This type of connection is called circuit switching. This method works fairly well for simple connections and voice communications and it is still the basis for some local telephone services in the U.S. However, it gets much more complicated when you try to connect millions of people using the same set of wires. The farther apart the two phones are, the more wires that have to be used to make the connection. Tying up more resources for one phone call is why long distance phone calls traditionally cost extra.

Transistors

The limiting factor of the telegraph was the operator's hand speed. Twenty words per minute was a pretty good speed in the 1800s. The telegraph used a simple device that turned the electric current either on or off. If a device has only two states, such as on or off, we say it is a binary device where *bi* stands for two. We can represent the two states of binary devices with just two numbers, zero and one. Binary devices like the telegraph were left behind by analog devices like the telephone, phonograph, radio and television until a much faster binary device was created. In 1947, scientists discovered a way to make a switch with no moving parts. It is a three-layer sandwich of silicon called a transistor**.** Transistors can be very small and millions of them can be combined to perform complicated tasks. The key factor is their speed. Instead of a few hundred switches back and forth per minute like a human operating a telegraph key, transistors can switch on and off billions of times per second. Transistors are at the heart of modern computers and we use their tremendous switching speed to make computers do complicated tasks by simply turning circuits on or off very rapidly.

Bytes and Languages

Telegraph operators used a simple code called the Morse code. For example, the code for the letter S in Morse code is three dots which are pairs of on then off motions. If we represented this with the numbers one and zero, it would be 10 10 10. The Morse code also uses dashes which are three Ones in a row followed by an Off. For example, Morse code for the letter B is dash dot dot which would be 1110 10 10.

The code used with transistors and computers can be represented with ones and zeros but it is not the Morse code. The code is named the American Standard Code for Information Interchange (ASCII). It uses a group of eight zeros or ones for each character, symbol or operation (see the glossary for a more exact definition).

There are 127 different ASCII codes. A sample of the codes is shown in Figure 10.3.

Binary Code	Abbreviation	Description
0000 0000	NUL	Null character
0000 0001	SOH	Start of Header
0000 0010	STX	Start of Text
0000 0011	ETX	End of Text
0011 0000	0	Zero
0011 0001	1	One
0011 0010	2	Two
0011 0011	3	Three
0100 0001	A	Capital Letter A
0100 0010	B	Capital Letter B
0100 0011	C	Capital Letter C
0110 0001	a	Lower case A
0110 0010	b	Lower case B
0110 0011	c	Lower case C

Figure 10.3. Sample of ASCII codes

The ASCII code uses a different value for capital and lower case letters. This is why correct capitalization makes a difference when you provide a password to a computer. A group of eight binary digits is called a byte and a single zero or one is a bit.

Because lengthy numbers consisting of zeros and ones are hard for humans to read, the binary numbers are represented by a shorter numbering method. A group of four binary digits can represent sixteen numbers from zero to fifteen. The hexadecimal system uses numerals from 0 to 9 plus the letters A to F to represent zero to fifteen. The eight digits of the binary system can be separated into two groups of four and then each group can be replaced by a hexadecimal numeral. For example, the binary code for the letter A is 0100 0001 in binary and 41 in hexadecimal. A table of the first 127 ASCII characters in Figure 10.4 uses the hexadecimal numerals as row and column labels. The code for capital A is 41 and the code for capital M is 4D.

	0	1	2	3	4	5	6	7
0	NUL	DLE	space	0	@	P	`	p
1	SOH	DC1 XON	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3 XOFF	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	del

Figure 10.4. Hexadecimal numerals for ASCII codes

The ASCII code only has 256 possible codes (16 x 16) and is sufficient for the English language and other languages that use the same alphabet but it doesn't have characters for the special punctuation marks

used in other languages and it does not include the thousands of drawn characters like those used in Chinese, Korean, and Japanese. For many years, all computer programming was done in English because English was assumed by the very code used to program the computers. This was a huge advantage for the U.S. and other English-speaking countries. Even now, most computer programs are written in English but if the programmer is from another country, the explanatory notes might be in another language.

To make computers useable in different languages, the code had to be expanded. The Unicode standard was created that uses two bytes of code per character (four hexadecimal numerals). Unicode can represent any character including complex drawn characters like those used in Chinese, Korean, or Japanese. For example, the Chinese character for water, is 水, and its Unicode number is 328C.

To display characters in languages other than English on a Web page, the Web browser program must have a set of instructions that show how to display the characters for each code in that language. This feature may have to be installed or turned on to show the characters.

The Internet

Personal computers were introduced in the 1970s and became commonplace in the U.S. in the 1980s and 1990s. Each computer could manage documents, spreadsheets, and data but they weren't very good at communicating with each other. Communication between computers was a major concern of the U.S. military. The military needed to coordinate its missile defense system even if parts of the communication system were destroyed by a nuclear attack and they wanted to link the computers at national research centers so they could exchange data. The circuit switching method used by the telephone system was unreliable for transmitting data where a single burst of static caused by a spark in a mechanical switch could wipe out vital data or cutting a single line could interrupt the message; so the military devised a completely different system that took advantage of the computer's ability to work with bytes.

Packet Switching

The Internet is a network of connections with many optional pathways between any two points. The junctions of connecting lines are called nodes. To take advantage of this network that provides many alternate paths, a message is broken up into small packets of data. Each packet has five parts:

1. Address of the destination
2. Address of the origin
3. Contents
4. Checksum
5. Sequence number

This system is called the Internet Protocol (IP) and each computer on the Internet has a unique IP address. The sequence number is used to reconstruct the entire message when it arrives. The checksum is the sum of all the zeros and ones in the contents. If the some of the content is lost or garbled, the sum of its zeros and ones won't match the checksum. When a message travels across the Internet it goes through the following steps:

1. A computer divides the message into packets, calculates the checksum for each packet, and then attaches the addresses, sequence number and checksum.
2. The packets are sent to a special computer called a router that is at a node on the Internet with several communication lines to choose from.
3. The router compares the domain name in the address to a directory of computers to see which computer on the Internet handles that domain name and looks up its IP address. If it doesn't have the domain name on its list, it sends a request to a domain name server that keeps a master list of all domain names and the IP addresses of the computers that handle them. For example, the IP address of the computer that handles the emich.edu domain name is 164.76.250.120.
4. The router chooses a communication line that is available and starts to send the packets along their way to the destination computer. If a shorter route becomes available during transmission of the message, the computer will send the rest of the packets along the shorter route. If the destination is very far away, the packets will go through several routers. At each router, the zeros and ones that make up the content are summed and compared to the checksum. If they don't match, the router refers to the address of origin and requests that the previous router send another copy of the packet.
5. Routers make the optimum use of available connections by routing packets along lines that are not in use at the moment. This method makes this form of communication far cheaper than circuit switching because it makes much more efficient use of the lines.

6. When the packets arrive at the destination address, the computer that hosts the domain name organizes the packets using the sequence number and then reassembles the original message from the contents of the packets.

Analog to Digital

Analog information such as the air pressure waves of your voice or the brightness of colors that comprise each element of a picture can be converted into zeros and ones by sampling the analog information thousands of times per second and assigning a digital number to each sample, as shown in Figure 10.5.

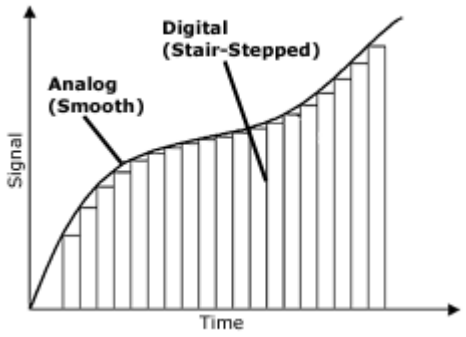

Figure 10.5. Analog to digital conversion

Once the sound or image is converted into digital form, a computer can manipulate it. If a conversation is sampled thousands of times per second, we find that many of those samples represent silence or the same sounds. Similarly, if we examine the samples of a picture, many of the elements of the picture like the background do not change often. A computer can be programmed to replace the repeated information with a code that indicates which samples are the same. This process is called data compression and the program used for **co**mpressing and **dec**ompressing the data is a CODEC. By compressing audio and video files using a codec and then using the packet switching method of transmitting them, the same wires or fibers that could only carry one conversation can now carry thousands. This technology reduced the cost of communication dramatically.

Streaming Audio and Video

The packet method is designed to assure that all of the packets arrive and are assembled correctly. If a packet is lost or damaged, the router can request a replacement. This process is very accurate but it might not be fast enough to handle the large amounts of data in a video. The size of the video data file depends on several

factors including the detail of the picture and how much of it changes from moment to moment. Accuracy is less important than keeping up with the action on the screen so a different method is used that is called streaming. Special software can encode the data file to make it much smaller and can adjust the quality of the video to match the speed of the connection. If the data connection is slow, the video image might be smaller, grainier, or have fewer images per second making motion look jerky. Matching software must be installed on the recipient's computer or player to decode the file and display it on the screen. The data is discarded as soon as the image is displayed. With streaming, quality is sacrificed as necessary to avoid interrupting the audio or video file.

Domain Names

The Internet works because all of the computers use the same directory of computers and domain names. Assigning domain names and keeping this international directory up to date is the responsibility of the Internet Corporation for Assigned Names and Numbers (ICANN). ICANN was created when the U.S. Government turned over responsibility for this task to ICANN. Domain names have two levels. The top level domain name is a broad category such as .edu for education, .mil for military, or .com for commercial sites. The midlevel name is the name of an organization. For example emich.edu is the domain name for Eastern Michigan University. ICANN has the authority to open up new top level domains such as .jobs and .travel.

One of the challenges to ICANN is creation of domain names in languages that aren't supported by the old ASCII character set. (Internationalized Domain Names 2008) [Link] China and Russia have threatened to set up their own domain servers that might not be compatible with the rest of the world. (The Internets 2008) [Link] ICANN is now independent of the U.S. government and is controlled by a board that has representatives from many other countries. On June 2010, ICANN announced that it would create three new top-level domains that use Chinese characters with English equivalents. They are:

CNNIC (China Internet Network Information Center)
HKIRC (Hong Kong Internet Registration Corporation Limited)
TWNIC (Taiwan Network Information Center)

(ICANN Approves Chinese Internationalized Domain Names 2010) [Link]

ICANN receives input from governments through the Government Advisory Committee (GAC) but "is not an arm of any government." (ICANN 2010) [Link]

The system developed by ICANN created the first set of unique worldwide addresses. Each domain name is unique in the world and each user name within the domain is unique so each computer and each user can have an address that is unique and understandable worldwide. For example, the domain name for a

university might be emich.edu. The system administrator at the school would assign a unique name to each student composed of their first name initial and their last name. For example, jpreston@emich.edu would be a unique e-mail address. There might be another jpreston at a different school, such as jpreston@umich.edu but because the schools have different domain names, the addresses are different. If there are two prestons with a first name that starts with J, the administrator has to make them different, e.g. jpreston01 and jpreston02.

Communicating with EM Waves

Electromagnetic (EM) waves are created by moving electrons back and forth in a conductor. They radiate from the source at the speed of light and when they pass through another conductor, they induce its electrons to move back and forth. By imposing an analog or digital pattern on the EM waves, that pattern can be transmitted through air or space at the speed of light. The length of EM waves varies greatly.

Broadcast

EM waves can be used for one-way communication that is called broadcasting. Radio and television stations use this technique. The station uses an antenna—conductor used to emit or receive EM waves—that is often placed on a hill or tower so that its EM waves will cover the maximum distance and its EM waves have as much power as the government will allow. The stations are assigned a range of wavelengths to use because the same wavelengths can be used by different stations if they are far enough apart and their power is limited. EM waves used for radio and television vary from hundreds of meters to about one meter. Receivers use much smaller antennas that can fit into portable devices.

Figure 10.6 TV broadcast antenna

Microwave

Smaller EM waves that are a few centimeters long are called microwaves. They can be focused into a beam using a dish-shaped reflector and pointed at a receiving antenna. A similar reflector can be used to focus the EM waves onto a small antenna at the receiving end to increase the amount of EM wave energy. This method is used to transmit data and video but it requires a series of towers that are in direct sight of each other a few miles apart.

Figure 10.7 Microwave antennas with reflectors on a tower

Satellite

To overcome the limitations of using microwave towers and to send data across oceans, satellites are used. A satellite receives an EM microwave from the ground and retransmits it to an antenna at another location. Satellites that are near the earth circle the globe in about an hour and a half. Satellites that are further away take longer to circle the earth. At a distance of 22,236 miles, it takes a satellite 24 hours to circle the earth. Because this is the same time it takes the earth to rotate once, the satellite appears to remain in the same place in the sky if it is directly above the earth's equator. This makes it much easier to keep antennas pointed in the right direction but even at the speed of light (186,000 miles per second) it adds a delay of 0.24 seconds to a

communication between two places on earth. This delay becomes noticeable when someone is being interviewed on live television from another country and they use several satellites to communicate between the interviewer and the guest.

Figure 10.8 Satellite relay

Cell Phones

Cell phones use low power microwave EM waves to communicate between portable phones and an antenna on a tower. They use low power so the same EM wavelengths can be used by many different people if they are not near the same tower. The area around a tower is called a cell. If a portable cell phone is moving, computers compare the signal strength received at nearby towers and determine which one is closest and then use that tower to send data and voice to the phone. The approximate position of the phone can be determined by the location of the tower to which it is closest.

Figure 10.9 Cell tower system

GPS

Precise location of a place on earth can be determined by using EM waves that are broadcast from a network of satellites. Pulses of EM waves are emitted by the satellites at exactly the same time and each EM wave has a code that identifies the satellite from which it came. The EM waves will arrive at different times at each place on earth depending on the distance from each satellite to that point. A computer in a portable device can determine the exact position on earth from this information. This system is called the global positioning system (GPS). It was developed by the military for guiding missiles to targets but it is now available for use in cell phones, golf range finders, boat navigation, and surveying equipment.

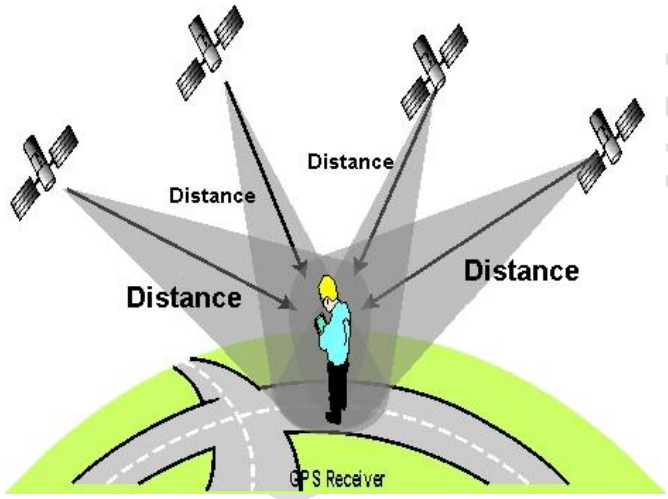

Figure 10.10 GPS satellite system

Fiber Optic Cable

The development of the Internet allowed people to communicate between computers effectively within a network. The connections that make up the network can be traditional copper telephone lines or EM waves that are transmitted between towers or relayed by satellites. These transmission technologies have limits on how much traffic they can handle and were the limiting factor to high-speed connections between countries across oceans.

The answer to the limitations of copper wire and radio waves was the use of light. Light waves are also EM waves but they are a million times shorter than microwave EM waves used for other communications. Because they are so much shorter, there are millions of individual waves per second that can be turned on and off to carry binary data. A device called a light emitting diode (LED) has no moving parts but it emits a flash of light when electricity flows through it. An LED can flash on and off billions of times per second. A special type of LED—a laser diode—can create a laser beam. The flashing light from a

laser diode can be transmitted for miles through thin glass strands called fibers. These strands are bundled together into fiber optic cables, as shown in Figure 10.11.

Figure 10.11 Fiber optic cable

Fiber optic cable can transmit data much faster than copper wire and many tiny strands can fit into one cable. Researchers in Germany transmitted data at a rate of 2.56 terabits per second over a fiber optic cable which is fast enough to transmit 60 DVDs per second. (Fiber-optic network sets world record 2006) [Link] Underwater fiber optic cables have been laid between the major countries and continents. This is the technology that has changed the world since the beginning of the new century. Now, sending data to India is as cheap and as fast as sending it across town. Anything that can be done on a computer can be done anywhere in the world because the cost of communications is so low that it is no longer the limiting factor. (Freundenrich 2008) [Link] A map of the undersea cables shows links between all the continents and large islands. (Optical fibre submarine networks 2007) [Link] See Figure 10.12.

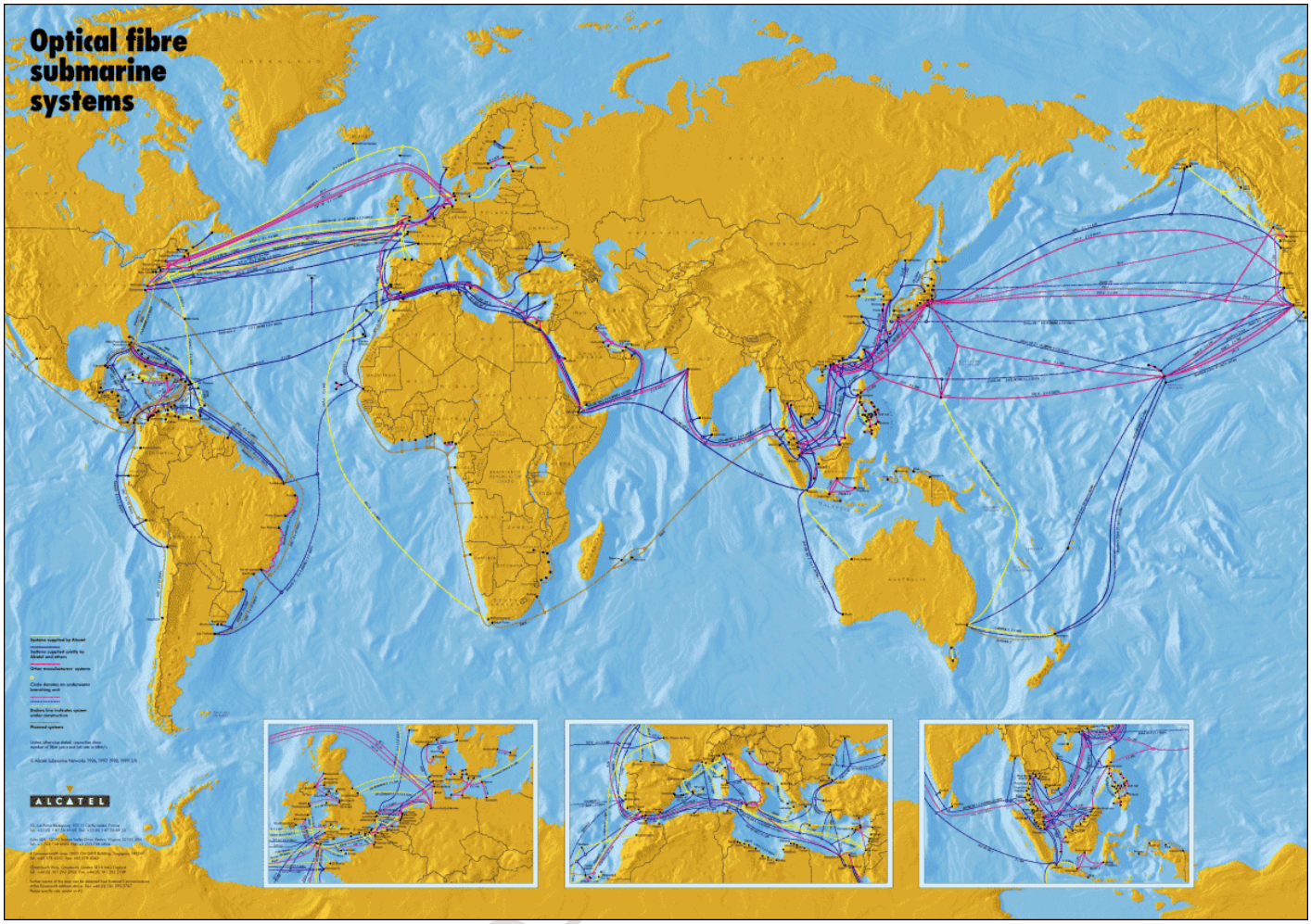

Figure 10.12.Undersea fiber optic cable network

Key Takeaways

The telegraph uses a source of electricity and a wire to send electric current to an electromagnet that pulls an arm against a spring. A switch or telegraph key completes or interrupts the current resulting in motion of the arm and an audible click. A code like Morse code is used to translate the clicks into letters and numbers in a message. [10.1.1]

Sound waves vary smoothly in air pressure. An electric signal that varies the same way (analogous) in voltage is an analog signal. The grooves in a vinyl record vary in width in an analog of the variation of sound pressure waves. [10.1.2]

Switches that can be on or off (binary) can be used to represent numbers and letters by using a code that uses just two numerals, 0 and 1. [10.1.3]

ASCII code uses binary numbers that consist of eight zeros and ones—one byte. There are 256 ASCII codes which are enough for all the capital and lower case English letters, Arabic numerals, control codes and some graphic characters but not enough to include many other languages. Unicode uses two or sometimes three bytes per character to represent all of the characters of all the languages, including those that use symbols for whole words such as those used in Chinese, Korean, or Japanese languages. [10.1.4]

A data packet has a destination address, the address of the sender, the message, a checksum, and a sequence number. A router uses the destination address to choose the best available path. At each node in the network, a computer confirms the integrity of the data by summing the content of the packet and comparing it to a checksum. At the destination, the sequence number is used to reassemble the original message from packets that might have arrived out of order along different paths. [10.1.5]

Data transmission is accurate but relatively slow. Streaming files discard some of the data to keep up with the action of the video or audio file without stopping. The data is discarded after it is displayed in a streaming video. A CODEC is a program that compresses and decompresses an audio or video signal to make it smaller for transmission. [10.1.6]

A router chooses the best route available moment by moment and distributes packets accordingly. A domain name server keeps a list of the domain names and their Internet addresses. [10.1.7]

A laser diode is a solid state device that emits laser light in pulses that can carry binary codes. The light from the laser diodes travels through the glass fibers in a fiber optic cable. Undersea fiber optic cables carry data very quickly and cheaply around the world. [10.1.8]

Electromagnetic (EM) waves can be used to broadcast television and radio signals, to communicate data, audio, and video data directly between antennas or satellites. They can be used at low power in cell phones. They can be used to locate a position on earth. [10.1.9]

2 Global Business Communications

Learning Objectives

1. Identify the advantages of VIOP over the older telephone technology that used circuit switching. [10.2.1]
2. Identify the method that lets workers connect to a company's main computer over the Internet securely. [10.2.2]
3. Identify the method used for secure communication between a company and its customers. [10.2.3]
4. Identify an advantage of outsourcing image analysis to a country that is twelve time zones away. [10.2.4]
5. Identify communication technologies that allow employees to work from home. [10.2.5]

Businesses use the global network of satellites and fiber optic cable to manage operations around the world.

The network can be used with several different communication technologies.

Telephone

Before the widespread use of fast, cheap computers, a telephone wire could only handle a few calls at a time.

To make a long distance call, a series of wires between the callers had to be reserved for their exclusive use.

The further apart the people were, the more wires had to be used for the call and there was a direct

relationship between the distance and the amount of resources dedicated to complete the call. For this reason,

a long-distance call was more expensive and a call between continents was very expensive. Most businesses have replaced the old circuit switched system with a computerized system that uses a CODEC and the Internet Protocol (IP). These systems are called voice over IP (VOIP). They make it much easier and cheaper to make international telephone calls and to include several people at once in the same call.

Computer Connections

Most businesses keep their data on a central computer that they can control and safeguard. They need to allow their workers to use the data and usually restrict the connections between the central computers and the computers on employee desktops by using wires within the same building called a local area network (LAN).

When businesses operate in several different countries around the world, they use a secret code to scramble the data so that it cannot be read by competitors. A salesperson can connect to the Internet and activate the secrecy program to encode the data so they can work on the central computer as if they are connected to the company's LAN. This system is called a virtual private network (VPN). The company's computer has the same program and uses the same secret code to unscramble the message or to create a scrambled message to send to the salesperson. This secret code is called a private key.

Like VOIP, video images can be compressed by a CODEC and combined with a virtual private network to allow companies to have live video conferences that include sharing data on their computers. By using this technology, businesses can conduct meetings as if the people around the world were in the same building.

Public Key Encryption

To conduct business over the Internet, a secure method was needed that allowed anyone to place an order with the company and provide private information like their credit card number and address. This problem was solved by using a pair of codes. One code is called the public key and it is available from a computer on the Internet that verifies the authenticity of public keys. For example, if you log into a website like Amazon.com and log into your account, the browser automatically sends a request to the special server and asks for Amazon's public key. The browser uses the public key to scramble a message that it sends to Amazon's server. Amazon uses a private key that works with the public key to unscramble the request. Amazon's computer generates a new private key just for this conversation and sends it to your computer where the new private key is used to scramble messages in both directions. This security system is used for most commercial activity between public customers and businesses to take orders and sell items online. You know when it is in use because the browser changes the beginning part of the Web address from http to https.

Some browsers change the color of the Web address or show a lock to indicate the connection is secure, as shown in Figure 10.13.

Figure 10.13. Secure connection using public key security

Time Zones

High speed and low cost transmission of detailed images like x-rays make it possible to consult doctors anywhere in the world. Many hospitals accumulate many diagnostic images from x-rays and medical scanners that must be interpreted by a specialist. The hospitals often use specialists in other countries that are on the other side of the world to interpret the images. Because the doctors are in a time zone that is 12 hours different, their work day is opposite to ours. At the end of our workday, the images can be sent to another country where their workday is just beginning and they can have the analysis done by the start of business the next morning. This type of international teamwork across time zones allows companies to work on projects 24 hours a day.

Advances in communication technology have fundamentally changed the way businesses work. Geographic distance is much less important so certain types of work can be done anywhere by the people who offer the greatest value. Value is a combination of cost, quality, and timeliness.

Outsourcing

A company might determine that some of its functions can be performed by other people or companies faster, better, or at a lower cost. For example, many companies hire someone to prepare their tax statements or payroll checks who is knowledgeable about the details of the tax code and various benefits packages. Using another person or company to perform one of the functions of the business is called outsourcing. Some companies have chosen to have their products manufactured in other countries. To coordinate the activities of the manufacturing facilities with the parent company that determines the design, sales, and marketing of those goods requires fast, cheap, reliable, and accurate communications.

Flex-time

Because many people own their own computers and have high-speed connections to the Internet in their homes, they can work at home as effectively as they can in the office for certain tasks. Salespeople often work from home offices because the value of their work is easily determined by the amount they sell. Other

tasks are not easy to measure and might not be suitable for work at a location where a manager cannot see what is going on. Many companies allow some of their workers to do their work from home at least part of the time. Other companies assume that they can ask employees to spend their nights and weekends working for the company without additional pay. Working from home can be a great saving of time and energy but it can also take up personal and family time.

Key Takeaways

Digitizing analog voice signals allows them to be compressed by a CODEC and using IP packets allows them to be transmitted efficiently over available lines. The system is called voice over IP or VIOP. Its advantages are lower cost and easier conference calling. [10.2.1]

Communication between a remote worker and the company computer can be accomplished over the public Internet if the signals are scrambled using a secrecy program called virtual private network (VPN). [10.2.2]

Computers can use a public key to scramble communications with a company computer to create a secure connection where the customer can send private information over the Internet. The browser shows this secure connection by changing the web address to https. [10.2.3]

In a country that is twelve time zones away, they start their work day at the end of ours. They can work on a project while we sleep and have the results when we come to work the next day. [10.2.4]

Employees can use their own computers and Internet connections to work from home using VIOP and VPN. They can audio and video conference with people from the main office or from anywhere in the world. [10.2.5]

3 Japan

Learning Objectives

1. Identify the source of Japan's name and the symbol on its flag. [10.3.1]
2. Identify the two main religions of Japan, how they complement each other, and the relationship between the religion and the emperor. [10.3.2]
3. Identify the event that happened in Nanking China in 1937 that involved the Japanese army. [10.3.3]
4. Compare the size of the U.S. carrier fleet at the beginning and end of WWII. [10.3.4]
5. Identify who was in charge of Japan after WWII and the reforms he instituted. [10.3.5]
6. Identify how Japan changed its reputation for quality manufacturing and who they credit for the ideas. [10.3.6]
7. Identify the four types of characters and the type of numerals used in writing Japanese. [10.3.7]
8. Identify a location outside of Japan where there are many people who speak Japanese and

where Japan outsources customer service calls and engineering design work. [10.3.8]

During World War II, Japan's industries were severely damaged by U.S. bombing and they had to rebuild. With help from the U.S., they became one of the top economies in the world.

In this section, we review Japan's history and how it became known for quality manufacturing and the role of language in its business relations with the U.S.

Short History of Japan

Japan is an island nation near Russia, China, and Korea, as shown in Figure 10.14. It is near a geological fault zone in the ocean to the East and it has frequent earthquakes.

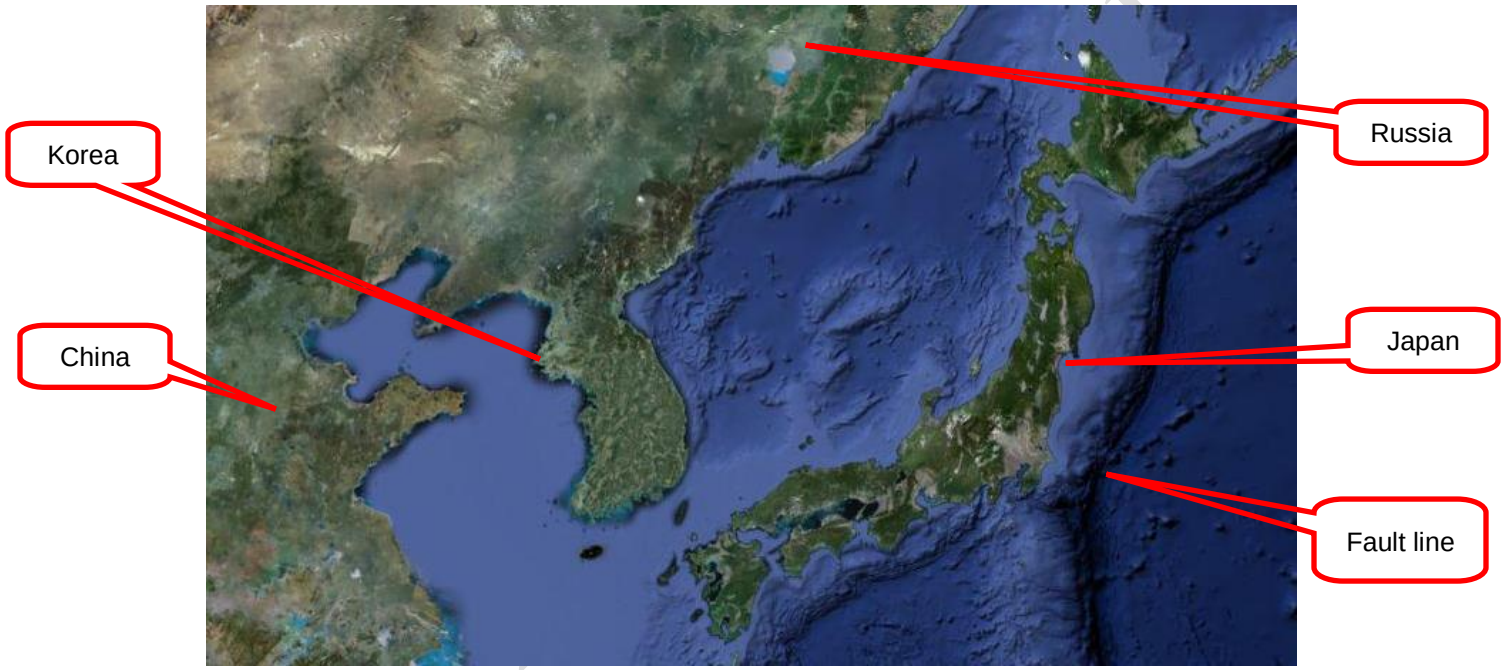

Figure 10.14.Japan, Russia, Korea, and China

Early History

The islands of Japan have been inhabited for more than 30,000 years and it has been influenced by Chinese culture at different times in its history. For example, Japan's name is 日本 or Nippon in English. The two characters mean *sun origin* which was the name given to it by the Chinese because Japan is to the East of China where the sun rises. Japan's flag is a red ball that symbolizes the sun as shown in Figure 10.15.

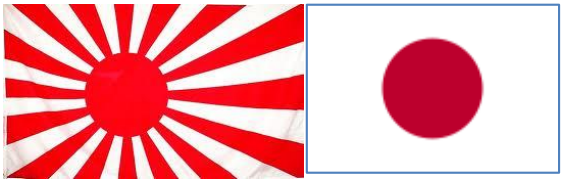

Figure 10.15. Japan's flag during WWII and its present flag

Japan developed a feudal culture much like Europe during its dark ages with local rulers called Shoguns that had their own armies. The warriors were called Samurai and fought with swords and bows, as shown in Figure 10.16.

Figure 10.16. Samurai warrior

The Samurai has a position in Japanese culture that is similar to the cowboy in American culture as a symbol of strength, courage, and toughness. Samurai lived by a code of conduct and philosophy called Bushido that stressed honor unto death. An honorable death, even if self-inflicted, was valued above surrender or dishonor. Bushido values seven virtues:

- Rectitude
- Courage
- Benevolence
- Respect
- Honesty
- Honor
- Loyalty

Japan was relatively isolated from the rest of the world until Westerners made contact. In 1854, the U.S. Navy forced Japan to open its ports to trade. The U.S. had warships with cannon that were superior to anything the Japanese had at the time and they agreed to the U.S. demands. This demonstration of Japan's weakness compared to the West prompted it to reform its society and technology. By 1890, Japan had

adopted the Meiji Constitution which created a constitutional monarchy and had begun modernizing its military.

Religion

The Shinto religion is integral to Japan. According to the Shinto creation story, the islands of Japan were created when the Sky Father dipped his spear into the sea and drops from the spear became the islands of Japan. The Sky Father created other gods including the Sun Goddess, whose grandson became the first emperor of Japan. (Time Magazine U.S. 1945)

Shinto has the following characteristics and beliefs: (Japan-guide 2008)

- It is not based upon a particular founder or book
- Sacred spirits are called kami
- Kami take the form of things and concepts that are important to life such as wind, rain, mountains, trees, rivers, and fertility
- Humans become kami after they die and are revered by their surviving children
- Shrines are placed in many areas where people worship the kami of that location
- People pray and perform rituals to keep evil kami away

Buddhism was introduced in the 1500s and the two religions complement each other. The Buddhists view the kami as manifestations of Buddha. Most Japanese use Shinto ceremonies for birth and marriages and use Buddhist ceremonies for dealing with death. Funerals and cemeteries are typically Buddhist.

World War II

Japan adopted western military methods and technologies and became a power in Asia. The military gained control of the country and convinced many people that the Japanese were the rightful rulers of the earth according to their Shinto beliefs and they incorporated aspects of the warrior's Bushido code to teach that dying in battle was the ultimate good. Japan fought China over control of Korea in 1894 and kept control of Korea until the end of WWII. In 1899, Japan joined Western powers in occupying China. Japan occupied a large area of northern China called Manchuria in 1931. China responded by boycotting trade with Japan. To break the boycott, Japan invaded Shanghai—a major seaport in central China. The Japanese army expanded their control of the area and occupied the nearby capitol city of Nanking, shown in Figure 10.17.

Figure 10.17. Nanking

The Japanese army brutalized the people of Nanking in 1937, murdering and raping for six weeks. Chinese officials estimate there were 300,000 people killed and 20,000-80,000 women raped.

Japan joined Germany and Italy as allies in 1940. Germany was at war with Great Britain at that time but not with the U.S. The U.S. tried to influence Japan's behavior in China by using its economic power. The U.S. imposed restrictions on trade and finally stopped shipping oil to Japan in July 1941. The Japanese military needed oil for its planes and ships so they decided to invade Borneo to seize its oil fields. To give them a free hand in the area, they attacked the U.S. fleet at Pearl Harbor which was the largest naval fleet in the Pacific.

According to the Bushido code, it is dishonorable to kill a sleeping opponent so the Japanese sent a formal declaration of war to the U.S. by way of the Japanese embassy in Washington. The intent was to deliver the declaration just before the attack began on Sunday morning, December 7, 1941. Due to a delay in translating the document, it was not delivered in time and the U.S. used this surprise attack without a declaration of war as a rallying cry to mobilize U.S. citizens into an all-out war effort against Japan. Because Japan was an ally of Germany and for other obscure reasons, Germany declared war on the U.S. and then the U.S. declared war on Germany which made the conflict world-wide.

The Japanese were very successful in the first years of the war and they expanded their control into China, Southeast Asia, many islands of the Pacific, the Philippines, and the Dutch East Indies which included

the oil fields of Borneo, as shown in Figures 10.18 and 10.19. They took control of former French colonies in Vietnam, British colonies in Siam and Burma, and Dutch colonies in the Dutch East Indies.

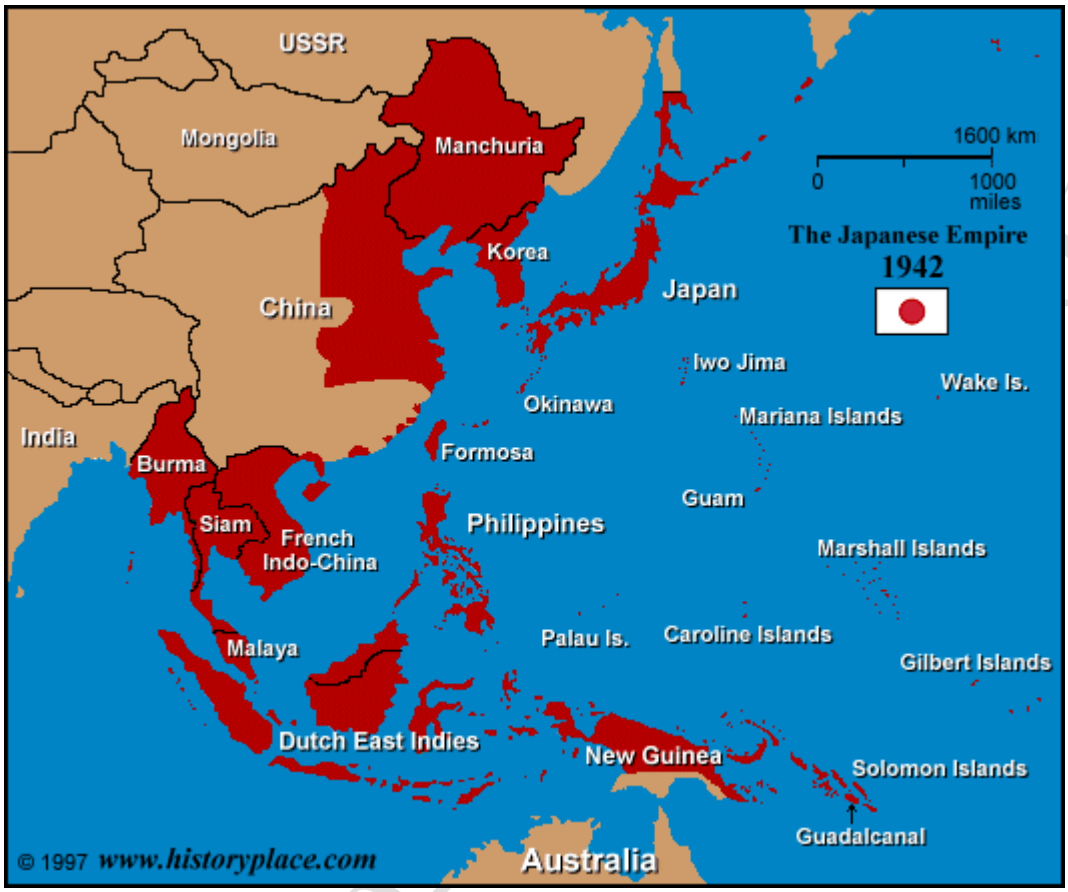

Figure 10.18.Japanese Empire

Figure 10.19. Japanese soldiers in Borneo

After the attack on Pearl Harbor, the U.S. converted its manufacturing plants from making automobiles and consumer goods to making ships, planes, and other weapons. The much greater wealth in natural resources of the U.S. and its high quality manufacturing facilities that were safe from attack proved decisive. For example, in 1941 at the time the Japanese bombed Pearl Harbor, there were eight aircraft carriers in the U.S. navy. By the end of the war in the Pacific four years later, the U.S. had thirty-five new carriers. (Gormley 2003)

The end of WWII for the Japanese marked a dramatic change in their culture. Germany surrendered in May of 1945 and the Soviet army was prepared to turn its efforts toward Japan and invade the northern Japanese islands. The U.S. used its new atomic bombs to destroy two cities in Japan. Following the second bombing, the emperor of Japan used the radio to address his people directly for the first time and told them to surrender. Because many considered him to be the divine descendent of the Sun Goddess, he was obeyed and the Japanese cooperated with the U.S. occupation force, which also prevented permanent loss of territory to the Soviets.

Post WWII

The commander of U.S. forces in the Pacific was General Douglas MacArthur. After Japan surrendered, he was in charge of the country for three years during which time he instituted major changes, including:

- new constitution that outlawed war and a standing army
- elected government
- emperor's powers were limited
- women were given the right to vote
- guaranteed human rights and outlawed racial discrimination
- purchased 38% of the cultivated land and resold to tenant farmers
- established trade unions

In 1951, MacArthur addressed the U.S. congress where he said;

I know of no nation more serene, orderly and industrious, nor in which higher hopes can be entertained for future constructive service in the advance of the human race. (MacArthur 1951).

Japan began to rebuild its industrial base under the protection of the U.S. military without the economic burden of supporting an army, navy, or air force. Transistors had just been invented in 1947 and Japan applied this discovery to the production of small portable radios called transistor radios, shown in Figure 10.20, that became popular world-wide.

Figure 10.20. Japanese transistor radio

The quality of Japanese goods was initially poor. They sought the advice of experts from the U.S. who had produced so many quality weapons in such a short time. The most significant of those experts was W. Edwards Deming. He lectured in Japan on the importance of quality and how to achieve it. His ideas were widely adopted by Japanese manufacturers and Japan became known for the high quality of its products. (Leadership Institute 2005) Deming is highly regarded in Japan and each year they award the Deming prize for high quality manufacturing.

Japan formed alliances called keiretsu between companies and banks in the same business sector to protect them from individual failure so they could take risks and pursue long-term strategic goals. Two of these goals were to produce a large share of the world's automobiles and electronics. They applied the quality methods of Deming to the manufacturing of automobiles, televisions, radios, and audio players and eventually became one of the world leaders in manufacturing. Japan has the third largest economy in the world.

Language

Japan has a single language—Japanese—but its written version is a combination of several methods. Japanese uses many Chinese characters known collectively as Kanji that are slightly modified. For example, the symbol for water in Kanji is 水 and in Chinese it is 水. Herigana is used to write words that do not have

Kanji symbols or in combination with Kanji symbols to give additional meaning. Katakana is used primarily to translate foreign words into Japanese syllables. Japanese also use the Latin alphabet for words like DVD or company names like Sony and Arabic numerals for numbers. The Latin alphabet characters are called Romaji. A document in Japanese might contain a mixture of all four types of characters.

Language has been a significant barrier for Japanese companies doing business internationally. Several Japanese automobile companies built factories in the U.S. and they use video conferencing and fiber optic cable connections to maintain relationships with the home offices in Japan but language is still a significant barrier. Japanese students study English along with Japanese so they can do business in the U.S. and in many other countries that do not speak Japanese.

Because labor costs are relatively high in Japan compared to other Asian countries, some of the work that is done on computers could be done in other countries but their languages are different. Ironically, the area of Asia that does speak Japanese is the area of China that was occupied prior to WWII. The city of Dalian in Manchuria was occupied by the Japanese for forty years from 1905 to 1945. Now there are an estimated 100,000 Chinese there who speak Japanese. Japanese companies like Sony and Hitachi have call centers located there to handle inquiries from Japanese customers. Dalian has 22 universities and 26,000 software engineers and they provide engineering and technical services to Japanese companies.

Key Takeaways

Japan's name is Nippon with means sun origin or land of the rising sun. The name comes from China because Japan is to the East where the sun rises. The flag is a red ball that represents the sun [10.3.1]

The two main religions of Japan are Shintoism and Buddhism. Shintoism teaches that people become spirits—Kami—when they die. Their creation story says that the emperor is a direct descendent of the Sun Goddess. Buddhism was added in the 1500s. People often believe both and use Buddhism for rituals related to death and dying and Shinto ceremonies for birth and marriage. [10.3.2]

The Japanese army killed and raped uncontrolled for six weeks in the Chinese city of Nanking in 1937. [10.3.3]

When the U.S. joined WWII, it had eight carriers. By the end of the war it had 35 new carriers. [10.3.4]

Douglas MacArthur was in control of Japan after WWII for three years. He instituted the following changes: [10.3.5]

- new constitution that outlawed war and a standing army
- elected government
- emperor's powers were limited

- women were given the right to vote
- guaranteed human rights and outlawed racial discrimination
- purchased 38% of the cultivated land and resold to tenant farmers
- established trade unions

After WWII, Japan's reputation for quality manufacturing was poor. They adopted the practices suggested by an American, W. Edwards Deming, and became a world leader in manufacturing. [10.3.6]

Japanese writing consists of four types of characters; Kanji—Chinese characters, Hiragana—characters that modify the Kanji characters, Katakana—characters used to translate foreign words, Romaji—Latin letters like DVD, and Arabic numerals. [10.3.7]

Because of the occupation of Manchuria for forty years, many people in that part of China speak and write Japanese. The people in the city of Dalian provide services like customer support and engineering design in Japanese at a lower cost so Japanese companies outsource work to them. [10.3.8]

4 India

Learning Objectives

1. Identify the characteristics and primary beliefs of Hinduism. [10.4.1]
2. Identify the percentages on Hinduism, Islam, and Christianity in India. [10.4.2]
3. Identify the methods of achieving independence from the British and India's present relationship to Great Britain and Pakistan. [10.4.3]
4. Identify the two most common languages of India and the language used in its national parliament. [10.4.4]
5. Identify the characteristics of the nuclear weapons and energy programs in India and Pakistan. [10.4.5]
6. Identify examples of tasks that can be performed in India using the Internet. [10.4.6]
7. Identify advantages to U.S. companies of outsourcing work to India. [10.4.7]

Technology overcame the limitations of distance and made it possible for countries on opposite sides of the earth to communicate as cheaply and conveniently as next door neighbors. This made the barriers of language and culture even more important and they are the reason that India became an important communication partner before other Asian countries.

In this section, we explore the new world that emerged as a result of computer and communications technologies. India plays a key role historically, presently, and in the future. It is important that we know more about this emerging world power.

Short History of India

India has more than one billion people and it has more English-speaking citizens than the U.S. or the U.K. To

understand how this came about and India's importance in today's world, we need some background knowledge.

India is bordered by the highest mountain range on earth to the north, the Indian Ocean to the south, Pakistan to the west, and Bangladesh to the east, as shown in Figure 10.21.

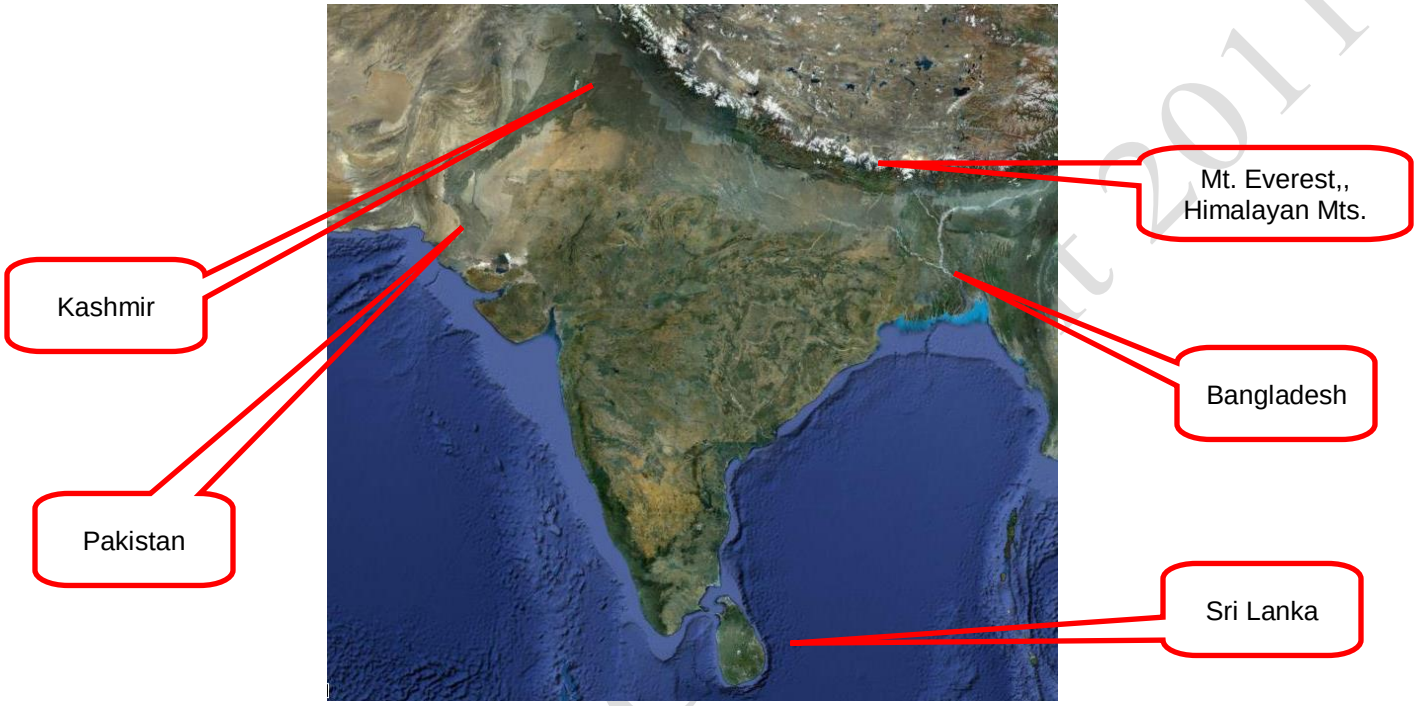

Figure 10.21. India, Pakistan, Bangladesh, and Sri Lanka

Early History

India is one of the oldest civilizations on Earth. India is home to the religions of Hinduism, Buddhism, Jainism, and Sikhism. Part of this rich cultural heritage is its leadership in mathematics. Early counting systems in different civilizations have different methods of dealing with the concept of counting *nothing* but the idea of using a zero as a number in a mathematical system was developed in India in the 6th century CE.

Hinduism

Hinduism began in India about 2500 BCE (some say 8000 BCE) and it is the World's oldest major religion that is currently practiced. Hinduism is not a typical religion:

- It is not based upon a particular founder.
- It is not based upon a particular book.
- It is not controlled by a central institution or authority such as a church or an association.

- It is not averse to examine and assimilate fundamentally diverse thoughts and beliefs into its system.
- It accepts other religions as various paths to salvation and does not favor organized attempts to convert people.
- It has been evolving continuously, through internal reforms and as a reaction to the threats and challenges.

(Hinduism: The world's third largest religion 2010) [Link]

Prominent themes in Hindu beliefs include Dharma (ethics/duties), Samsāra (The continuing cycle of birth, life, death and rebirth), Karma (action and subsequent reaction), Moksha (liberation from samsara), and the various Yogas (paths or practices)." (Hinduism 2008) [Link]

Christianity

European Christians were cut off from direct trade with India and the Far East due to the crusades against the Muslims of the Middle East. In an attempt to reach the spice islands of Southeast Asia, Christopher Columbus sailed west from Europe across the Atlantic Ocean. When he arrived in the Caribbean islands, he refused to believe he had failed and mistakenly dubbed the natives Indians. When European Christians arrived in India in the 1500s after sailing east around Africa, they found an established Christian church that had been there for 1500 years! The Christians of India trace their church back to St. Thomas who was one of the original disciples of Jesus. (Missick 2000) [Link] About 2.3% of the population is Christian and most of them live in the South and East of the country (see Figure 10.22).

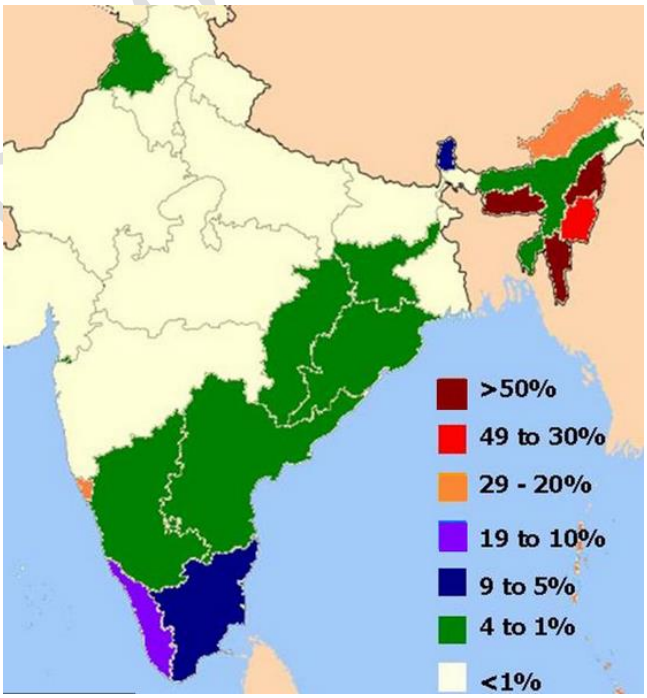

Figure 10.22.Christians in India

Islam

When Islam was expanding into the Middle East and fighting the European Christians, it also expanded into India. India had a long tradition of trading with Arabs and Arab traders introduced the religion to the area. The first Indian mosque was built in 612 CE during Muhammad's lifetime. Many Hindus converted to Islam and it became the second most popular religion in India

British Rule

Merchants from Great Britain set up trading centers in India that were run by the East India Company (EIC)—a stockholder owned company—that was founded in 1600. It traded in cotton, silk, tea, and opium. The British government gave the company broad powers and a monopoly on trade with India. The company started taking control of the areas in which it traded using hired military force when necessary until it ruled most of India. Robert Clive, known as Clive of India (shown in Figure 10.23) was a British officer who consolidated control of India for the British.

Figure 10.23 Robert Clive, First British Governor of Bengal

The people of India rebelled against the company's control in 1857 after which the British government nationalized the company and assumed direct control of the troops that had been hired by the EIC and expanded the force. This unsuccessful rebellion is known as the First War of Indian Independence. (Indians mark revolt anniversary 2007) [Link]

Independence

The trade between India and Great Britain was very profitable for Great Britain and was a major source of

the British Empire's wealth. In the early 1900s following World War I, India wanted independence but Great Britain was reluctant to end such a profitable relationship. In spite of the potential loss of revenue and in recognition of India's support in WW I, the British proposed a process that would begin with power sharing and lead to self-rule.

Unfortunately, fears of German and Bolshevik influence resulted in rules that gave the local military commanders wide powers to put down demonstrations. In 1919, during a demonstration, an over-zealous British commander ordered his troops to fire on a crowd of 5,000 unarmed demonstrators killing or wounding about half of them. This is known as the Jallianwala Bagh massacre and part of the site is preserved, as shown in Figure 10.24.

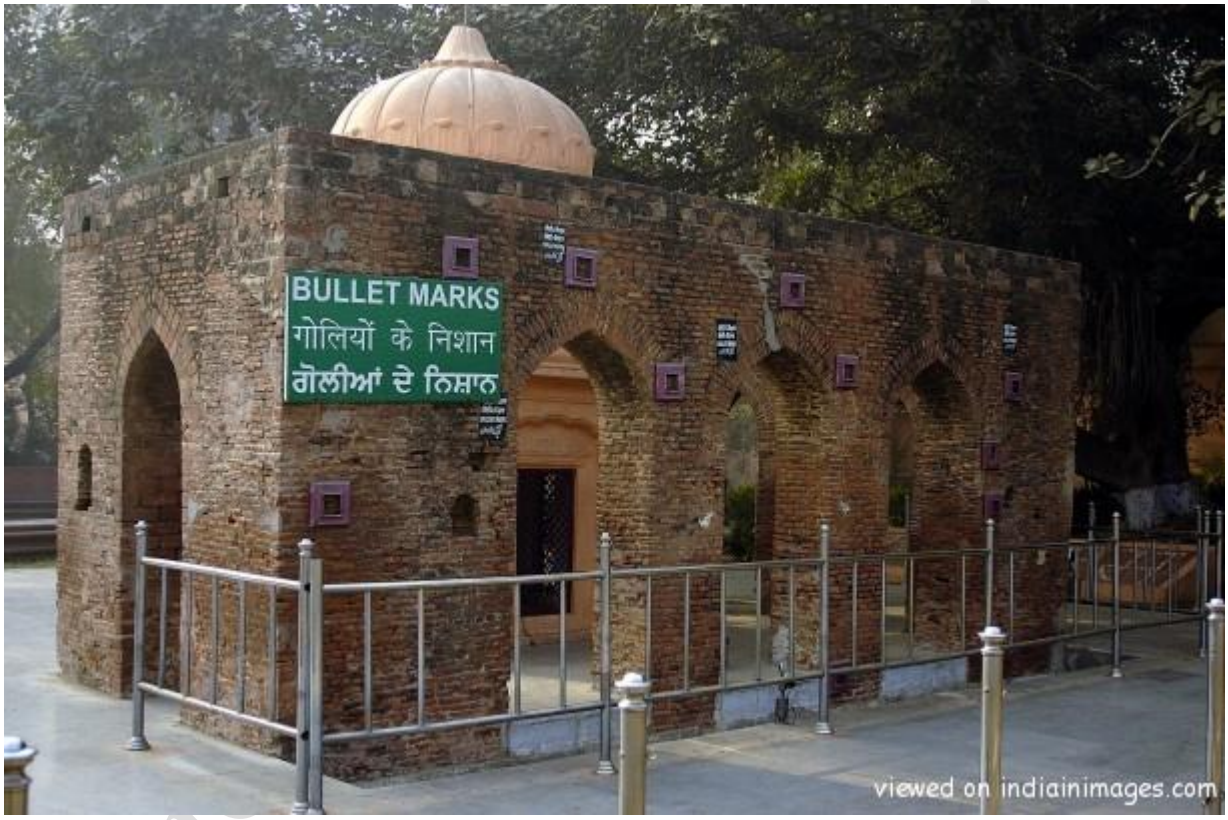

Figure 10.24. Site of British massacre of Indian protestors

The public in India and in Great Britain were shocked. The nation was saved from open rebellion by use of the philosophy of satyagraha that espouses non-violence and civil disobedience to bring about change by appealing to the conscience of the rulers. The leader of this movement was Mahatma Gandhi. (History: Indian Freedom Struggle (1857-1947) 2005) [Link]

Martin Luther King used Gandhi's methods in the civil rights movement in the U.S. in the 1960s that led to significant changes in U.S. laws and practices.

In spite of their differences, Indians volunteered to fight on the side of the allies in World War II. The Indian army became the largest all-volunteer force in history with 2.5 million men. The Indian army fought in North Africa, Italy, and Burma and lost 87,000 men. Following World War II, Great Britain granted India its independence in August, 1947.

India retains many of the governmental and military organizations that were set up by the British.

Pakistan

The large number of Muslims in India wanted to have their own country and in August of 1947 they formed Pakistan that consisted of two parts—one on the East and the other on the West. Millions of Muslims moved to Pakistan and millions of Hindus and Sikhs moved to India. The disagreements over borders and the violent clashes between displaced people resulted in between 500,000 and 1 million deaths. (Chester 2002) [Link]

Initially, there were two parts of Pakistan, as shown in Figure 10.25, but the eastern part declared its independence from Pakistan in 1971 to form the country of Bangladesh. The border between India and Pakistan in the region of Kashmir is still not agreed upon.

Figure 10.25.Early Pakistan

The large island off the coast of India is Sri Lanka. The majority religion in Sri Lanka is Buddhist. The mix of religions in India, Pakistan, Bangladesh, and Sri Lanka are shown in Figure 10.26

Country	Muslim	Hindu	Buddhist	Christian	Sikh
India	13%	80%		2%	2%
Pakistan	97%	2%		1%	
Bangladesh	83%	16%			
Sri Lanka	7%	15%	70%	7%	

Figure 10.26. Religions in India, Pakistan, Bangladesh, and Sri Lanka

The Commonwealth of Nations

India became independent in 1947 but is a member of *The Commonwealth of Nations* which is a group of

Great Britain's former colonies. (Harare Commonwealth Declaration, 1991 1991) [Link] They subscribe to the following principles:

- International peace and order, global economic development and the rule of international law are essential to the security and prosperity of mankind;
- Liberty of the individual under the law, in equal rights for all citizens regardless of gender, race, colour, creed or political belief, and in the individual's inalienable right to participate by means of free and democratic political processes in framing the society in which he or she lives;
- Recognize racial prejudice and intolerance is a dangerous sickness and a threat to healthy development, and racial discrimination as an unmitigated evil;
- Opposition to all forms of racial oppression, and we are committed to the principles of human dignity and equality;
- Recognition of the importance and urgency of economic and social development to satisfy the basic needs and aspirations of the vast majority of the peoples of the world, and seek the progressive removal of the wide disparities in living standards amongst our members.

There are 53 countries in the organization with a total population of almost two billion (see Figure 10.27). (Commonwealth of Nations 2008) [Link]

Country	Population	Country	Population
Antigua and Barbuda	81,000	Mozambique	19,424,000
Australia	21,134,563	Namibia	2,009,000
Bahamas	319,000	Nauru[2]	13,000
Bangladesh	139,215,000	New Zealand	4,109,000
Barbados	269,000	Nigeria[3]	128,709,000
Belize	264,000	Pakistan[4]	161,488,000
Botswana	1,769,000	Papua New Guinea	5,772,000
Brunei	366,000	Saint Kitts and Nevis	42,000
Cameroon	16,038,000	Saint Lucia	159,000
Canada	33,039,967	Saint Vincent and the Grenadines	118,000
Cyprus	826,000	Samoa	184,000
Dominica	79,000	Seychelles	80,000
Fiji[1]	841,000	Sierra Leone	5,336,000
Gambia	1,478,000	Singapore	4,680,600
Ghana	21,664,000	Solomon Islands	466,000
Grenada	102,000	South Africa[5]	47,208,000
Guyana	750,000	Sri Lanka	20,570,000
India	1,087,124,000	Swaziland	1,034,000
Jamaica	2,639,000	Tanzania	37,627,000
Kenya	33,467,000	Tonga	102,000
Kiribati	97,000	Trinidad and Tobago	1,301,000
Lesotho	1,798,000	Tuvalu	10,000
Malawi	12,608,000	Uganda	25,827,000
Malaysia	27,356,000	United Kingdom	60,609,155
Maldives	321,000	Vanuatu	207,000
Malta	400,000	Zambia	11,479,000

Mauritius	1,233,000	***Total Population***	***1,921,974,000***

Figure 10.27. Members of the Commonwealth of Nations

The countries of the commonwealth all use English. The influence of Great Britain and subsequently the United States has made English a commonly used language around the world.

Language in India

There are several hundred languages spoken in India and over twenty of them are spoken by at least a million people. (Distribution of the 22 Scheduled Languages 2007) [Link] During British rule, English was the official language. After independence, the original Indian constitution called for a conversion from English to Hindi within 15 years which is spoken by about a third of the population. The non-Hindi speaking groups did not want this so Indian parliament passed the Official Languages Act in 1963 that allowed individual states to have an official language while the national parliament used English for its own communications and for communications with the states. English is a second language to approximately a third of the people in India. (English Speakers 2008) [Link] Because of its large population, this implies that India has more English speaking people than the U.S. This is a big advantage for India when it comes to working with English-speaking countries.

Because India was controlled by the British for almost 300 years and many of its people speak English, it was one of the first Asian nations to benefit from the world-wide communications network. Its people were educated in English and had many of the same values as Westerners.

Education

India has 113 universities and 2,088 colleges. In 2005 they produced 464,743 graduates with engineering degrees, 35% of which were computer engineers. (Iype 2006) [Link] These numbers include categories that would be described as technology or engineering technology so it is difficult to make a direct comparison to the U.S. colleges that produce 70,000 engineers per year but it is still significantly more. The U.S. college statistics do not indicate how many of its 70,000 students are Indian students who are studying in the U.S., but anecdotal evidence is that this number is significant. In the past, most of these Indian students remained in the U.S. but many of them are now returning to India where there are more opportunities than previously.

Nuclear Energy and Weapons in India and Pakistan

Relations between India and Pakistan have been tense since the millions of people died following the British

pull-out and the division of the country. India and Pakistan have gone to war four times in 1947, 1965, 1971, and 1999. Chinese support of Pakistan encouraged India to develop its own nuclear weapons capability in 1974. India has not signed the nuclear non-proliferation treaty or the nuclear test-ban treaty. India has developed its military with help from Russia. India has produced enough plutonium for between 40 and 120 bombs.

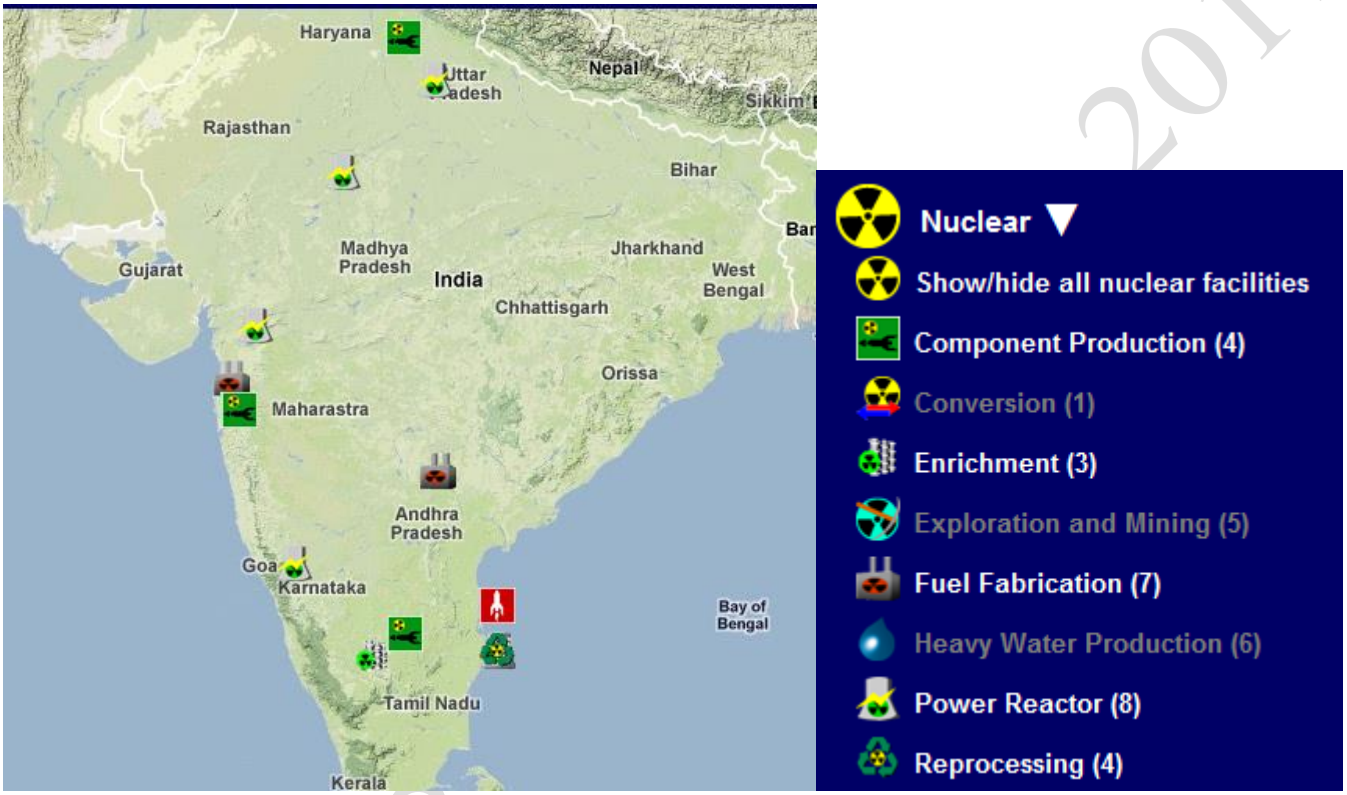

Figure 10.28. Nuclear weapons in India

India has indicated that it wants to buy several nuclear power plants but because they have not signed the NPT, the U.S. has had to get congress' approval to provide them with the technology. Pakistan has reactors that produce plutonium and is thought to have enough for about 100 bombs. Pakistan, India, and Israel are the three nuclear powers that have never signed the NPT.

U.S. Companies in India

Many companies that rely on engineering have opened offices in India. For example, IBM employs about 400,000 people in 170 countries (Chandra 2011) with 120,000 in India. (John 2011) Few U.S. companies were operating in India before 1992 but now there are more than 300. Some of them are shown in Figure 10.28. (Business Maps of India 2010)

U.S. Companies in India	
American Express	JPMorgan
Amway	Kellogg India
Caterpillar	Kimberly Clark
Cisco	Kodak
Citigroup	McDonalds
Coca Cola	Metlife India
Colgate Palmolive	Microsoft
Cummins	Morgan Stanley
Discovery	New York Life
Dupont	Oracle
EDS	Pepsico
Eli Lilly	Pfizer
Emerson Electric	Pizza Hut
Federal Express	Sun Microsystems
Ford	Tecumseh
GE	Timex
General Motors	Tyco
Gillette	UPS India
Honeywell India I	Visteon
Intel	Whirlpool
Johnson & Johnson	Xerox Modicorp

Figure 10.28. U.S. Companies in India

Reasons for rapid development of U.S. businesses in India include:

- common language
- rapid and reliable communications via the fiber optic network
- growing Indian economy
- large population of India represents a large market for goods and services
- skilled but relatively cheap labor

Key Takeaways

Hinduism is not based on a particular person or book. It does not have a central authority. It can adopt other beliefs and it accepts other religions as valid paths to salvation. Its beliefs are Dharma (ethics/duties), Samsāra (The continuing cycle of birth, life, death and rebirth), Karma (action and subsequent reaction), Moksha (liberation from samsara), and the various Yogas (paths or practices). [10.4.1]

India is 80% Hindu, 13% Muslim, 2% Christian, and 2% Sikh. [10.4.2]

The Indians practiced peaceful resistance as taught by Mahatma Gandhi. They volunteered to serve in the British army and were promised independence which they got after WWII. India is part of the Commonwealth. Muslims chose to create their own country of Pakistan. Initially it was two separate parts but the eastern part later became the separate country of Bangladesh. Many people were displaced or killed during the separation. The two countries still fight over control of the region of Kashmir. Because of the division, millions of people moved or were displaced resulting in hundreds of thousands of deaths. [10.4.3]

There are hundreds of languages; more than twenty of them have at least a million speakers. English is the language of the Indian Parliament and is used for communication between states. About a third of the population speaks Hindi. [10.4.4]

India has not signed the non-proliferation treaty or the test-ban treaty. It has between 40-120 bombs. Pakistan has material for about 100 bombs. [10.4.5]

Because India's people speak English, they can provide customer support in call centers. They also have many schools that teach engineering and computer science so companies use their people for engineering design projects. [10.4.6]

Reasons given for outsourcing to India are: [10.4.7]

- common language
- rapid and reliable communications via the fiber optic network
- growing Indian economy
- large population of India represents a large market for goods and services
- skilled but relatively cheap labor

Key Terms

American Standard Code for Information Interchange (ASCII)

standard code that uses groups of eight zeros or ones to represent letters and codes

analog

method of encoding information where the medium varies similarly to the information

antenna

conductor used to emit or detect EM waves

binary

two states such as on or off

bit

a single zero or one

broadcasting

one-way communication over a large area

byte

a group of eight zeros or ones

cell

area near a low-power transmitter used for wireless telephone communications

checksum

a total of the zeros and ones in the packet contents used to check for transmission errors

circuit switching

connecting a series of wires to make a continuous connection between to points

CODEC

software or hardware used to compress or decompress a digital signal

Dharma

ethics and duty in Hinduism

domain name server

computer that keeps a directory of domain names and the computers that host those names

electromagnetic (EM) waves

self-generating combination of electric and magnetic fields created by accelerating charged particals

fiber optic cable

bundle of glass fibers used for transmitting data

global positioning system (GPS)

combination of satellites and local receivers that determine position on the earth

Herigana

Japanese method of writing words that do not have Kanji characters or to add meaning to Kanji characters

hexadecimal

base sixteen numbering system with numerals from 0-9 plus A-F for numbers 10-15.

Hinduism

most common religion of India

Indians

people of India, also the name given to native Americans by Columbus in error

Internet Corporation for Assigned Names and Numbers (ICANN)

organization that manages domain names

Internet protocol (IP)

rules for transferring data over the Internet

kami

sacred spirits in the Shinto religion

Kanji

Japanese method of writing syllables

Karma

action and subsequent reaction in Hinduism

Katakana

Japanese method of writing foreign words

keiretsu

collaboration of Japanese companies and a bank in a business sector

laser diode

solid state device that emits laser light

light emitting diode (LED)

solid transistor-like device that emits light when an electric current passes through it

local area network (LAN)

group of connected computers that are in one locale

microwaves

electromagnetic waves that are a few centimeters long

Moksha

liberation from samsara in Hinduism

Morse code

code for letters represented by dots and dashes

Nippon

name of Japan

node

a junction of communication lines

outsourcing

contracting an outside company to perform a business function

packet

a group of structured data used for data transmission

phonograph

device that transferred sound waves into grooves on a disk that could be used to reproduce the sounds

private key

code shared by two computers to scramble and unscramble messages

public key

code that can be used to send a secure message to a particular company's computer

Romaji

Latin letters used in Japanese writing

router

computer that manages communication between nodes

Samsara

continuing cycle of life, death, and rebirth in Hinduism

samurai

Japanese warrior

satyagraha

policy of non-violent resistance

shogun

local ruler in Japan

streaming

data transfer method that adjusts the quality to match the transmission speed so voice or video does not stop

transistor

electronic switch with no moving parts

Unicode

the successor to the ASCII code that can represent all the known letters and characters in all languages

virtual private network (VPN)

encoded data communication over the Internet provides similar security to working directly on a LAN

voice over IP (VOIP)

audio communication using data packets and the Internet protocol

Yoga

path or practice in Hinduism

Works Cited

Business Maps of India. *American Companies in India.* 2010. http://business.mapsofindia.com/india-company/america.html (accessed October 16, 2011).

Chandra, Nimesh. *Careers 360.* September 11, 2011. http://www.careers360.com/news/6909-How-to-get-a-job-at-IBM (accessed October 16, 2011).

Chester, Lucy. *The 1947 Partition: Drawing the Indo-Pakistani Boundary.* February 15, 2002. http://www.unc.edu/depts/diplomat/archives_roll/2002_01-03/chester_partition/chester_partition.html (accessed July 25, 2010).

Commonwealth of Nations. March 28, 2008. http://en.wikipedia.org/wiki/British_Commonwealth (accessed March 30, 2008).

Distribution of the 22 Scheduled Languages. 2007. http://www.censusindia.gov.in/Census_Data_2001/Census_Data_Online/Language/parta.htm (accessed March 30, 2008).

English Speakers. 2008. http://www.abc.net.au/newsradio/txt/s1363471.htm (accessed March 30, 2008).

Fiber-optic network sets world record. March 28, 2006. http://www.physorg.com/news62776076.html (accessed April 8, 2008).

Freundenrich, Craig. *How Fiber Optics Work.* 2008. http://electronics.howstuffworks.com/fiber-optic.htm (accessed April 6, 2008).

Gormley, Larry. *eHistory archive.* 2003. http://ehistory.osu.edu/wwii/usncv.cfm (accessed October 21, 2011).

Harare Commonwealth Declaration, 1991. October 20, 1991. http://www.thecommonwealth.org/Templates/Internal.asp?NodeID=34457 (accessed March 30, 2008).

Hinduism. March 28, 2008. http://en.wikipedia.org/wiki/Hinduism#CITEREFWeightman1998 (accessed April 1, 2008).

Hinduism: The world's third largest religion. June 17, 2010. http://www.religioustolerance.org/hinduism.htm (accessed July 25, 2010).

History: Indian Freedom Struggle (1857-1947). 2005. http://india.gov.in/knowindia/history_indiannationalcongress.php (accessed March 30, 2008).

ICANN Approves Chinese Internationalized Domain Names. June 25, 2010. http://www.icann.org/en/news/releases/release-25jun10-en.pdf (accessed July 26, 2010).

ICANN. *ICANN Factsheet.* August 13, 2010. http://www.icann.org/en/factsheets/fact-sheet.html (accessed December 5, 2010).

Indians mark revolt anniversary. May 11, 2007. http://news.bbc.co.uk/2/hi/south_asia/6645457.stm (accessed March 30, 2008).

Internationalized Domain Names. March 19, 2008. http://www.icann.org/topics/idn/ (accessed April 6, 2008).

Iype, George. *Engineering education: Can India overtake China?* June 9, 2006. http://www.rediff.com/money/2006/jun/09bspec.htm (accessed July 25, 2010).

Japan-guide. *Shinto.* May 31, 2008. http://www.japan-guide.com/e/e2056.html (accessed October 21, 2011).

John, Jujit. *The Times of India.* June 16, 2011. http://articles.timesofindia.indiatimes.com/2011-06-16/india-business/29664876_1_ibm-india-ibm-technology-model (accessed October 16, 2011).

Leadership Institute. *Who is Dr. W. Edwards Deming.* May 26, 2005. http://www.lii.net/deming.html (accessed October 23, 2011).

MacArthur, Douglas. *MacArthur's Speeches.* April 19, 1951. http://www.pbs.org/wgbh/amex/macarthur/filmmore/reference/primary/macspeech05.html (accessed October 23, 2011).

Missick, Stephen Andrew. "Mar Thoma: The Apostolic Foundation of the Assyrian Church and the Christians of St. Thomas in India." *Journal of Assyrian Academic Studies* XIV, no. 2 (2000).

Optical fibre submarine networks. 2007. http://www1.alcatel-lucent.com/submarine/refs/World_Map_2007_LR.pdf (accessed April 6, 2008).

The Internets. January 11, 2008. http://www.onthemedia.org/transcripts/2008/01/11/04 (accessed April 6, 2008).

Time Magazine U.S. *Japan: The God-Emporor.* May 21, 1945. http://www.time.com/time/magazine/article/0,9171,852228-1,00.html (accessed October 22, 2011).

Last edited on October 27, 2011