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# INFORMATION MANAGEMENT AND TECHNOLOGY

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## LEARNING OBJECTIVES AND ACTIVITIES

- Document how technology has changed in the workplace and at home.
- Discuss data management and the difference between data mining and data cleansing in health care.
- Discuss computer networking and identify ways the Internet can support nursing.
- Identify personal skills and skills necessary for high-tech environments.
- Identify and discuss the purpose of various information systems.
- Illustrate uses of application software.
- Define concepts such as confidentiality, security, and privacy.



## CONCEPTS

Confidentiality, data, database, information, Internet, intranet, multimedia, network, security, spreadsheet, technology, word processing, informatics, information systems.

### Q U O T E

***The hardest thing is not to get people to accept new ideas; it is to get them to forget old ones.***

—John Maynard Keynes



## NURSE MANAGER BEHAVIORS

Advocates, supports, and uses computer technology that enhances nursing operations.



## NURSE EXECUTIVE BEHAVIORS

Plans, develops, and evaluates information technology that improves nursing operations, including management, education, research, and clinical practice with input from representative nurses.

## Introduction

The information and technology revolution is thought to be one of three fundamental changes that have taken place in society. In the classic work, *The Third Wave*, Toffler observed those three fundamental changes to be the agricultural revolution, the industrial revolution, and the information and technology revolution.<sup>1</sup> The information and technology revolution has redefined how we live and work, what values we place on health care and education, and our family structure.<sup>1</sup> Technology has made rapid progress throughout the past two centuries, revolutionizing and redefining many aspects of human life: steam engines, electricity, printing machines, vaccines, automobiles, airplanes, telephones, radio, weapons of mass destruction, satellites, television, computers, genetic engineering, cloning, and so on. The impact of technology continues with technological innovations daily. Computers are the major technological breakthrough of the past 25 to 30 years. Computers, once thought to be for business use only, now exist in many households, becoming a common part of life. Nearly every aspect of our lives has become automated with computers enhancing the process.

Although technical tools, especially computers, continue to be invented and rapidly placed in industry, the ability of organizations to accept, accommodate, and even embrace technology is moving at a varied pace. The healthcare industry has been one of the slowest businesses to embrace the computer revolution in regards to patient care even though many healthcare organizations have had their business departments functioning on computers for years. With technology creating constant transition from old to new, the healthcare industry will need to advocate education and training. "As the business world changes at an ever increasing rate, many of us are finding that our jobs require us to constantly

enhance our skills and develop new ones—possibly some we never thought we'd need. Today, staying in place means falling behind, and no one can afford to do that in our technology-driven world.<sup>2</sup> Nursing, being one of the slowest to embrace technology to its fullest, must meet the challenges of using new technology in all aspects of information management. New skills need to be taught and learned to assimilate and use the technology involved in information management. Nurse leaders need to embrace technology, advocating and supporting its use in all nursing operations to meet the demand for high-quality care.

Health care involves the use and management of an abundance of information that must be collected, managed, reviewed, processed, and mined. High-quality patient care relies on careful documentation of every patient's medical and family history, health status, current medical conditions, and treatment plans. A clinical decision based on information that has been efficiently managed and processed lends itself to quality care outcomes. Specialty roles for nurses have developed over the past 10 to 15 years, and many nurses have found themselves in nursing informatics roles. In 1992, the American Nurses Association declared nursing informatics a specialty, and, currently, master level-prepared nurses with a certification in informatics may sit for the national exam.<sup>3</sup> Nursing informatics is a specialty area that integrates nursing science, computer science, and information science. This specialty area provides expertise in developing and implementing information management systems that can be used by nursing to enhance daily tasks and integrate various aspects of patient care.

Today, there are abundant resources available for healthcare environments. Multimedia that interacts with the user through text, sight, sound, and voice are commonly used. These techniques are used to seamlessly integrate technology and information that may be located within a geographical area or even across international boundaries. The use of the Internet has tooled the healthcare industry with an avenue to provide continuity of care. With advancement of technology and integration across boundaries, concerns of security and privacy continue to loom over the healthcare industry. Management must continue addressing ethical and legal issues with regard to control of information.

## **NURSING INFORMATICS ROLE IN HEALTH CARE**

Healthcare informatics is a board term involving the application of computer and information science in all basic and biomedical sciences. Medical informatics refers to the application of informatics to all healthcare disciplines as well as to the practice of medicine.<sup>4</sup> Nursing informatics is the use of information and computer technology to support all aspects of nursing practice. This may include direct delivery of care, education, research, and management. Nursing informatics facilitates the integration of data, information, and knowledge to support patients, nurses, and other providers involved in the decision-making process.<sup>4</sup>

Managers need to collaborate with the Information Systems (IS) department in design, development, and implementation of management and clinical applications. Nurses filling roles as nursing informaticists will act as a liaison between management, staff, and the IS department. Although informatics nurses may be removed from bedside care, they remain focused on patient care while working toward improved clinical outcomes and quality care. These nurses can communicate how tasks are completed each day providing an understanding of the work flow for IS staff. Often, nurse managers may fill this role as well. The informatics nurse may fill a variety of roles. Figure 13-1 lists various roles of an informatics nurse.

## **DATA MANAGEMENT IN HEALTH CARE**

Nurses and nursing management handle large amounts of data and information during any given day. Data are a collection of numbers, characters, or facts. These are usually gathered because they are needed for analysis or some other action at a later time. Information is a set of data that has been in-

**FIGURE 13-1** ROLES OF INFORMATICS NURSES

Project manager	Informatics nurses analyze, design, develop, select, test, implement, and evaluate new or modified informatics projects that support optimal data and delivery of quality patient care.
Consultant	Consultants may take on a variety of roles, including project manager, market research, planning conferences, strategic information technology planning, reviewing clinical software, redesigning the workplace, and others. They may work for an organization or with a consulting firm.
Educator	Informatics nurses may educate staff nurses, managers, and others in using the healthcare information system. Their role would include educating all staff on confidentiality and security matters as well.
Researcher	As a researcher, the informatics nurse may research clinical situations that arise, help implement evidence-based practice, evaluate the current system for improved outcomes, and conduct research to improve clinical information systems and clinical outcomes.
Product developer	The informatics nurse may develop software applications for clinical and nonclinical healthcare environments.
Decision support/ outcomes manager	Nurses in this role use technology and other systems tools to maintain data integrity and reliability, identify outcomes, and develop performance measurements. Aggregate data are used by these nurses.
Policy developer	Nurses in this role help to develop policies for clinical and administrative health care information systems.
Chief information officer (CIO)	This role provides leadership and management at the executive level for both the organization and vendors.
Entrepreneurs/Innovator	Entrepreneurs emerge every day and informatics nurses may fit here by managing their own practice, developing applications, or owning their own healthcare information systems business.
Other	Many other roles exist and will emerge as health care continues to embrace the technology that expands.

**Source:** Author.

American Nurses Association (2006). *Scope and standards of nursing informatics practice*. Nursesbooks.org.: Silver Spring, MD.

Hebda, T., Czar, P., & Mascara, C. (2005). *Handbook of informatics for nurses & health care professionals*. Pearson Education, Inc.: Upper Saddle River, New Jersey.

terpreted covering some aspect of time, such as over the course of a day. Figure 13-2 shows examples of data and information.

Knowledge can be defined as applying facts or ideas acquired by study, investigation, observation, or experience.<sup>5</sup> It is the synthesis of information that may have been derived from several sources producing a concept or idea. Nurses acquire knowledge over time and use it extensively in their daily task of direct patient care. Data collection, with the aid of computer and information technology, helps to provide evidence of best practices supported by research. This collection of evidence-based information provides a substantial database of knowledge that can be applied to everyday practice situations. See Evidence-Based Practice 13-1 for an evidence-based practice example.

## Data Integrity

It is not enough to collect data, interpret it, and build a database of knowledge. Data that make up the database of information must be maintained with optimal assurance that quality data exist. Data

FIGURE 13-2

## EXAMPLES OF DATA AND INFORMATION

Time	Temperature	Pulse	Respirations
0730	99.2 F	66	18
1130	99.8 F	69	20
0400	101.4 F	74	22
0800	102.2 F	82	24

*Source:* Author.

Each single value in the table represents data, and the entire table represents a collection of data over a course of a day. The trend of the data represents information. Trends are more useful than single data to the healthcare provider.

Fictitious data, for illustration purposes only.

### Evidence-Based Practice 13-1

Knowledge can be seen when nurses use the most effective nursing interventions for the prevention of skin breakdown. Quality care aimed at preventing skin breakdown has been identified as a nursing priority and evidence-based research drives the interventions when appropriately implemented. Studies such as that of Harrison, Logan, Joseph, and Graham<sup>6</sup> provide interventions that address prevention of skin breakdown.

integrity must be maintained so that current data are available when needed. If data integrity is less than optimal, it could result in inappropriate decisions that could possibly harm a patient. Quality data have characteristics that can be identified. Data must be timely, accurate, rapidly and easily available, precise, clear, comprehensive, reliable regardless of whom collects it, easy to interpret, current, and appropriate for the user's needs.<sup>4,7</sup> Following policies that identify procedures for collection, validation, storage, management, and retrieval of data results in quality data. Quality data are needed for nurses to make sound clinical decisions and potentially impacts patient care.

Several techniques exist to help alleviate erroneous data. These techniques include educating staff, system prompts, various verification techniques, data mining, and data cleansing.

### Educating Staff

Today, most nurses lack skills that enable them to integrate information technology into practice. The Institute of Medicine has strongly emphasized that informatics is a core competency required of health-care professions, including nursing. It is time for nursing to embrace technology with care and become a part of the information and technology revolution. Educating staff is vital to having quality data and reducing erroneous data. Nurses should have a general understanding of how to use software, enter data, extract data, print reports, and evaluate data to make good clinical decisions. Nurses need to be taught for the future. They need to know how to find information and procedures rather than know,

they need to learn to question rather than answer, they need to achieve rather than accomplish, and they need to inspire rather than inform.<sup>9</sup>

**“On any given day, documenting care consumes from 13% to 28% of a nurse’s time.”<sup>10</sup>**

## System Prompts

Managers, staff, and informatics nurses can work with the IS department to develop system prompts that alert the user to recheck the data, enter data in a field that has been left blank, check that the data fall in a specific range, or confirm that data have been entered correctly. These system prompts are embedded in the application software that is developed by the IS department or a vendor of the information systems software. For example, a system prompt may display on the screen to inform the nurse that the allergy field on the assessment screen has been left blank. This display would prompt the nurse to fill in the allergy field.

## Verification Techniques

Verifying data is very crucial to having quality data that can be utilized for clinical decision making. System prompts certainly help, but other techniques may be used to check and recheck data that are being entered at the point of care. Many verification techniques may exist, including verbal questioning and visual verification. Both techniques are very effective in the right environment. However, there are some things to think about when applying these techniques to verify data. It is important to be sure that patients understand what is being asked of them and understand what they are reading. Consideration should be given to hearing, language barriers, reading, and comprehension of the material. If a patient presents with any of the mentioned issues, then the nurse must accommodate, whether by getting an interpreter, a family member to help, or explaining the material in a simpler form, so that the patient understands what is being asked.

## Data Mining

Technology has aided in rapid advances in data capture and storage, resulting in large databases of data. These data are stored internally in what is called “relational databases” that consist of rows and columns of data. Relational databases provide an easy method for internal storage, retrieval, and analysis.

The traditional method of analyzing data manually is no longer feasible. Extracting data from these databases is known as data mining. The process of data mining has become known as knowledge discovery and data mining or data to knowledge.<sup>8</sup> Data to knowledge usually begins by answering questions that are being asked. Assessing the question gives managers and others an advantage toward filtering through numerous large databases. Without a clear objective of what is being asked or needed, data overload may occur instead of gaining knowledge. Once the data are gathered, then the data must be prepared for data mining by selecting and formatting the data for use. Clinical data must be defined appropriately to identify like items when data mining. For example, “CABG” and “coronary artery bypass graft” must be identified as the same.

Data-mining processes may begin after the formatting has been completed by evaluating and analyzing for trends and predictive attributes. Trends that may be identified can then be interpreted and finally used within nursing environments. For data mining to be successful, nurse managers as well as staff nurses must be proficient in understanding current issues in managing data. Nurse managers, especially, should be aware of the uses of techniques such as data mining that allows them to extract, predict, evaluate, and apply knowledge to daily task.

## Data Cleansing

Data cleansing is another technique used to clean up erroneous data that have been captured and stored in databases. Software is used that flags the erroneous data and generates a report. After reviewing the

report, the files or records that have been flagged may be deleted or corrected. This process should be conducted on a routine basis to keep electronic records free from errors.

## COMPUTER NETWORKING

Networks have become the infrastructure of today's electronic world and are the media for transfer of information from one location to another. Networks can be any computer devices that are attached, providing a conduit for information to be passed. There are two main types of computer networks: local area networks (LANs) and wide area networks (WANs). LANs are just what their name implies. All the computers in this type of network are local, meaning they all exist in a common geographical location and have a common owner. A WAN is two or more computers that are remote, meaning they are over a large geographical area from each other and they are connected by leased telecommunications equipment. LANs and WANs have largely given way to intranets and extranets, discussed below.

Designing networks is a crucial part of the design, development, and implementation of any health-care information system. Organization size, needs, and willingness to spend money need to be considered and may range from very simple to very complex. Unfortunately, many organizations spend less money and end up with less than desirable systems.

Networks require management from the time the process starts, to the planning and design phase, and continues as an ongoing process. IS department staff may be involved in the management process, especially when troubleshooting network problems. Routine monitoring to evaluate capacity and performance should be done. A network administrator manages the server and users. Server administration includes the maintenance of daily backups and any shared resources. Management of users includes the maintenance of user identification and passwords and security-related issues between users.

When considering networks and design of systems, organizations should take into account budget and spending expenses, growth of the company and future needs, the healthcare information systems to be implemented, number of employees using the system, and the amount of data to be stored, retrieved, and transferred, among other things. One of the most important things is to plan for the future. Nursing leaders should become involved in planning, designing, developing, implementing, and evaluating networks that will be used by nurses.

### Intranets, Extranets, and Virtual Private Networks

Examples of networks include intranets, extranets, and virtual private networks. Each of these forms of networks is used widely today by many organizations. These networks use Internet/World Wide Web technologies for information transfer and distribution.

Intranets are used by organizations for internal use and use a variety of communication technologies. Intranets usually are not geographically limited but do have a common owner. Employees generally have access to intranets for organizational information and applications that are easily accessible when using web browsers. Portals into the site are developed and maintained providing centralized access by employees. Because information can be kept more current and accurate, organizations use this method of network to aid in reduction of errors and improve quality health care.

Extranets extend beyond intranets and an organization's information providing access to anywhere in the world. They generally use multiple types of communication technologies and are not geographically limited just as intranets. Extranets are used to connect different parties that have common interests. With extranets, staff has access to information from almost anywhere, including patients' homes, their own homes, while at conferences, or even on vacation. Nurse leaders have access to this information for evaluating staffing conditions, monitoring staff ratios, and patient care. Those outside the organizations may also have access through some portal or gateway that allows them to provide or obtain information to or from the organization.

Virtual private networks are just what the name implies: They are private networks that provide stronger security with flexible remote access. Well-designed virtual private networks are secure, reliable, and easy to administer. For organizations to have these networks, software may need to be purchased and installed so connection to the organization's intranet can occur. This software interacts with software on the organization's intranet to manage authentication and encryption.<sup>10</sup>

## Wireless Networking

Wireless networking has rapidly become the norm for most computer users. Wireless access points are available in most areas such as academic areas, shopping malls, coffee shops, and neighborhoods. There are some cities that are connecting their entire city with a network.

Wireless technology is suited for the healthcare environment where providers are mobile and dependent on current data generated and captured continuously during daily tasks and activities. Many technologies used today include wireless technology. Handheld wireless devices continuously download data, including laboratory, pharmacy, and radiographic data, saving many hours of time specially dedicated to searching for this information. Bedside infusion pumps, blood glucose machines, blood pressure machines, ultrasound machines, EEG and ECG machines, and other equipment can store and download information into the electronic records, saving valuable time in patient care.

This technology is rapidly changing, as are other technologies: Radiofrequency identification tags, monitoring devices to locate staff, and voice-over technology are being used. As wireless capabilities increase, technology will continue to enhance the way nursing performs task, providing quality care at the bedside.

## Internet

The largest wide area global network is the Internet. The Internet allows us the ability to connect and communicate with any computer. When connected, the user can function on the Internet with simple point-and-click techniques, creating an interactive environment. The Internet has provided an opportunity for health care to reinvent the way medicine and health care is delivered. This transformation of health care has great potential to provide access to health care to many individuals that once had none.

***“The arrival of the Internet offers the opportunity to fundamentally reinvent medicine and healthcare delivery.... Internet technology may rank with antibiotics, genetics, and computers as among the most important changes for medical care delivery.”<sup>11</sup>***

Patients have access to vast amounts of information that provides education related to their diagnosis and care. However, patients should be told to beware of information found on the Internet. There have been systematic evaluations of medical content on the web that have been found to be inconsistent or the reading level too high for the average consumer. There are several key points to remember when searching for information on the Internet:

- Reading level of material found on the Internet may be too high for the average consumer to understand.
- Medical information may be inaccurate or inconsistent.
- Internet medical information can come from reputable, other providers, drug companies, practitioners looking to sell their “product,” or even from other groups.
- It is crucial to evaluate the credentials of the content providers to determine their qualifications and if the information on the site might be biased.<sup>12</sup>

More and more physician's offices, hospitals, clinics, and other healthcare provider organizations are creating Web sites that patients can access for information that is current and accurate concerning

various diseases and treatment options. Many nurses have begun to work in areas such as creating and maintaining Web sites, consulting over the Internet, and reviewing cases, and some nurse practitioners are even providing care across the Internet via telemedicine.

As healthcare organizations continue to transition into the electronic world, many changes are occurring. Electronic medical records are mandated to be completed by 2014, and many organizations are working toward this goal. Data can be captured and stored, providing access to information that is readily available. As this movement continues, patients will be able to access their electronic records, complete medical forms before admissions or appointments, list their medications and allergies themselves, fill out their medical history, and provide insurance information and select payment options. Self-scheduling is beginning to be used, and patients will soon have the opportunity to schedule appointments as needed over the Internet.

Patients are already being assessed, diagnosed, and treated via the Internet, and as telemedicine continues to grow this effort will continue and expand. Opportunities for consultations, primary visits, and research are growing as expansion of health care to the Internet grows. Capturing data in real-time or point-of-care environments creates large databases of data for research, providing evidence-based data that can be translated into practice fairly quickly. Video conferencing is being used to consult with colleagues concerning evaluation of diagnoses and treatments. Available resources are being used as well to improve the clinical decision-making process.

### Evidence-Based Practice 13-2

More than 75% of the patients who participated in an online-based communication system with their doctors said the service was easy, convenient to use, and better than a phone call or actual office visit.<sup>13</sup> Physicians were satisfied with the service, and over half of the physicians preferred it to an actual visit from the patient.<sup>14</sup>

The Internet has changed the way education is provided to nurses, patients, and students and has become the ideal vehicle for multimedia instruction and education on demand. Continuing and higher education for nurses is available online, providing convenient times for learning. Continuing education programs are available over the Internet, and many organizations use the Internet for yearly education requirements and updating skills information. Even policy and procedures are found on organizations' intranets today. Higher education programs can be found online, and many institutions are using technology to enhance traditional classrooms. There are many programs available that are completely offered online. These programs provide classroom environments on demand and offer convenient education for individuals needing flexibility.

The Internet has changed the way healthcare organizations are doing business with many aspects of business involving electronic transfer of information between parties. Healthcare organizations market their products and services, their facilities, and recruit for employees and patients via the Internet. Current employees can access personnel records and communicate with others through e-mail over the Internet.

Finally, privacy and security are concerns when using the Internet. As Internet and technology use increase and change, privacy and security issues will continue to be a concern. The Health Insurance Portability and Accountability Act (HIPAA) addressed many issues related to privacy and security. However, the ever-increasing demand for technology implementation in health care will create new issues as this ranks as one of the top issues related to technology.

## HEALTHCARE INFORMATION SYSTEMS

There are several types of healthcare information systems. Some of these systems help to manage the daily operations of general healthcare organizations and others are classified as hospital information systems. For the purposes of this text, hospital information systems are discussed.

Hospital information systems consist of two types, administrative information systems and clinical information systems. Each of these systems plays a major role in the operations of an organization providing health care to consumers such as hospitals. As the demand for automation and data management increases in nursing, nurses will become more involved with evaluating, selecting, designing, and implementing information systems. They are becoming the norm for the clinical areas and have been used in administrative activities for years.

### Hospital Information Systems

Hospital information systems are large complex computer systems designed to help manage information needs of a hospital. Hospital information systems are tools that can be used interdepartmentally or intradepartmentally. These large systems are composed of smaller systems that are used for the daily operations of a hospital. Figure 13-3 lists some examples of administrative and clinical information systems that may be found in a hospital.

#### *Implementing Hospital Information Systems*

Nurse leaders need to become more and more involved in implementing hospital information systems, both in the administrative and clinical areas. Implementing information systems requires more than just installing and using the systems. A management plan should be devised by the nurse leader that incorporates input for selection, design and development, implementation, and evaluation of the information system being considered (Figure 13-4). Nurse leaders should work closely with the IS department or the nursing informatics nurse in obtaining the optimal system that will enhance the delivery of quality care.

**FIGURE 13-3**

### HOSPITAL INFORMATION SYSTEMS

<b>Administrative Systems</b>	<b>Clinical Systems</b>
Nursing administrative systems	Nursing information systems
Payroll / human resource systems	Order entry systems
Patient registration systems	Radiology systems
Quality improvement and assurance systems	Laboratory systems
Scheduling systems	Pharmacy systems
Billing and payment systems	Dietary systems
Financial systems	Surgical and other department specific systems
Other business operations systems	Other ancillary department systems

Source: Author.

FIGURE 13-4

EXAMPLE OF A PROJECT IMPLEMENTATION PLAN<sup>10</sup>

ID	Activity	Duration	Start	Finish
1	UNIVERSITY HOSPITALS RESULTS REPOSITORY PROJECT STARTUP	2.5d	9/11/00	9/13/00
4	ADMINISTRATIVE	120d	9/13/00	2/28/01
5	Project Status Meetings	115.25d	9/15/00	2/23/01
13	Project Steering Committee Meetings	95.25d	9/20/00	1/31/01
19	Quality Assurance Review Visit	2d	9/13/00	9/15/00
20	Project Supervision	120d	9/13/00	2/28/01
21	PROJECT INITIATION	10d	9/14/00	9/27/00
22	Pre-Implementation Planning	1d	9/14/00	9/14/00
24	Project Planning	2d	9/15/00	9/18/00
28	Adapt Network	5d	9/18/00	9/22/00
30	Project Kickoff	7d	9/19/00	9/27/00
35	HARDWARE AND SOFTWARE	12.5d	9/13/00	9/29/00
36	Hardware/Software Installation	12.5d	9/13/00	9/29/00
39	Software Delivery Validation	9d	9/13/00	9/26/00
43	ANALYSIS	58d	9/28/00	12/18/00
44	Results Repository Surveys/Process Flow/Tables	15d	9/28/00	10/18/00
48	Results Repository Interfaces	20d	10/19/00	11/15/00
51	Results Repository Profiles/Procedures	11d	11/16/00	11/30/00
59	Nursing Assessment Surveys/Process Flow/Procedures	11d	11/27/00	12/11/00
63	Nursing Assessment Master Files	3d	12/12/00	12/14/00
65	Nursing Assessment Reports/Project Scope	2d	12/15/00	12/18/00
68	TRAINING	42d	12/18/00	2/13/01
69	Training Preparation	12d	12/18/00	1/2/01
73	Educate Users	30d	1/3/01	2/13/01
77	LIVE EVENT	28d	1/22/01	2/28/01
78	Live Event Preparation	22d	1/22/01	2/20/01
83	Results Repository Live Event	4d	2/23/01	2/28/01
86	Nursing Assessment Live Event	5d	2/22/01	2/28/01
88	Live Event Support	5d	2/22/01	2/28/01
90	POST-LIVE	10d	3/1/01	3/14/01
91	Evaluation and Feedback to Management	10d	3/01/01	3/14/01
92	Monitor Production System			
95				

Source: Author.

Several processes must be completed when an organization has committed to implementing technologies. Nurse leaders and other appointed or volunteer staff nurses along with multidisciplinary team members should determine the needs of the unit, department, or division within the organization. First, a thorough assessment should be conducted that involves looking at the current system for capturing and analyzing data for delivery of care. Determining weakness and strengths of the current system provides insight into what works and does not work for daily operations. The needs of the organization are determined during the assessment phase. Nurse leaders should evaluate what is needed currently and what will be needed in the future.

Second, nurse leaders along with IS staff and administrative personnel need to evaluate and select a hospital information system that meets the needs found. Several information systems should be evaluated for the closest fit to the organization's budgetary guidelines, goals, and the needs that were determined earlier.

Third, the implementation phase begins once the selection has been made. This phase involves intensive training of employees, both administrative and staff, over some period of time. Timelines need to be developed for completing training, installation of equipment and software, and testing of the new system. Once training and installation have been completed, the systems are brought online for the users to use. Multiple support personnel should be available the day the system is started to help with problems that may arise or to guide employees through the process of computerized daily tasks.

Finally, the systems should be evaluated. Mechanisms should be developed during the planning phases that provide methods for support and evaluation of the system. These methods may include but are not limited to a call-in help desk, support technicians that are available on demand as questions and problems arise, request for help forms that can be submitted online, and suggestion boxes.

### *Administrative Information Systems*

Administrative information systems include a wide variety of systems that work to maintain information used in the daily operations of an organization. These include financial systems, human resource systems, nonclinical patient systems such as registration and scheduling systems, and even nursing administrative systems that nurse leaders use.

Information systems that are classified as administrative systems involve any operation that is not directly linked to hands-on patient care. Operations may include nonclinical patient activities, medical records activities, business and accounting activities, and some nursing management tasks. Nonclinical patient activities may involve such tasks as patient scheduling, admissions, discharges, transfers, census functions, bed assignments, and other nonclinical activities association with the patient. Medical records procedures include master patient index functions, abstracting (diagnosis/procedure/and coding), transcription, and correspondence. Business and accounting functions may include patient insurance verification, billing, accounts payable, accounts receivable, cash processing, maintenance activities, and other business operations. Nursing management tasks may involve budget projections, employee records (annual skills and educational updates, evaluations, staffing), and other management activities required for daily operations by nurse leaders.

### *Clinical Information Systems*

Clinical information systems involve any system that is used in patient care and may not be nursing information systems. However, these systems are generally associated with the nursing information system in hospitals, such as a laboratory or medication administration system. Refer back to Figure 13-3 for a list of examples of clinical information systems. Each of the systems shown provides support to the care of patients. They may be general support systems or explicit to a specific nursing area. Many nursing areas benefit from unique information systems. Some of these areas include surgery, infection

control, labor and delivery, enterostomal therapy, oncology, mental health, orthopedics, neonatology, and intensive care. Clinical information systems can be used to improve the quality of care while enhancing the environment and reducing cost long term.

Many clinical information systems are designed in modular form, providing flexibility to the organization. General nursing information systems have multiple programs comprising a module that is used to perform various clinical tasks, educational, and management functions. The modules may vary between vendors and software developers but may include medical history, patient assessment documentation, nursing care plan, medication administration, dietary information, patient education, ongoing daily care, vital signs and graphic sheet information, reports, nursing progress notes, discharge planning, and other tasks that nurses perform on a daily basis.

Clinical nurses can use clinical information systems to provide quality patient care. These systems provide a mechanism for capturing data that can be used to formulate treatment plans and evaluate trends. Technology along with clinical information systems continues to change the work environment and improve the quality of work life for nursing.

## GENERAL APPLICATIONS SOFTWARE FOR THE NURSE LEADER

General applications software includes such software as communications, database management, word processing and desktop publishing, spreadsheet, personal information managers, graphics programs, and other software information nurse leaders may need on a daily basis. Nurses use computers to perform many aspects of their daily jobs in areas such as budgeting, documentation, policy and procedures, research, inventory, scheduling, patient and staff education, maintaining personnel records, and other tasks as needed. Because of this, nurse leaders should be prepared to encourage and support the increased use of technology in clinical and nonclinical areas of nursing. Fundamental concepts related to computers and the use of applications software is important to the nurse manager and other nurses. Computer literacy is important and will be required more and more as computers continue to be a tool of the profession.

### Communications

Communications software is what provides a link for access between computers. Links may be dedicated or nondedicated. Dedicated links remain open even when not in use. Nondedicated links are open only when being used. Organizations tend to use dedicated links to have direct access to the organization's information resources typically through a LAN connection. Small business or home environments tend to use nondedicated links and access information only when needed. However, dedicated links have become the norm with integrated services digital network and digital subscriber lines.

Nurse leaders are not normally involved in communications software selection and installation. The IS department personnel should take care of this portion of implementation. Communications software to support LANs is generally taken for granted and is provided as part of the operating system that comes installed on the equipment. At work, most employees have a dedicated connection, and at home, they can dial in or connect through a portal to the remote access server and perform as if they are at work.

### Database Management

Computer databases are much like filing cabinets, only electronic. There are files and contents in those files. Databases are used to store data and can be manipulated to view information based on query options. Database management systems virtually take the place of a filing cabinet to handle many information and record-keeping needs.

Typically, relational tables are used in databases. These tables contain rows and columns where data can be stored that relate to each other. A table is considered a collection of records where one row is a record. The rows and columns consist of cells, and these cells are given data field names. Data fields are defined with length and type of data that will be placed in the field. The fields are defined in a table definition. A database may consist of several relational tables that data can be pulled from to form reports. Reports may be printed or displayed on the computer screen for review. This process of storing and retrieving data provides ease of information management, the timely retrieval of information, and the concurrent access of information to individuals from different locations.

## Word Processing and Desktop Publishing

Word processing software is used to produce documents such as memos, letters, signs, books, and resumes. Desktop publishing software generally incorporates graphics into the text and is used for newsletters, posters and signs, books, and other documents that require graphics. Today, both types of software have incorporated aspects of each other, enabling a variety of documents to be produced from either type. Figure 13-6 shows an example of a poster/sign produced with desktop publishing software.

**“The arrival of the Internet offers the opportunity to fundamentally reinvent medicine and healthcare delivery. . . . Internet technology may rank with antibiotics, genetics, and computers as among the most important changes for medical care delivery.”<sup>11</sup>**

Word processing and desktop publishing software applications have tools that help to manage the information placed in the document. There are various styles of formatting and, depending on the software, unique styles may exist. Styles can establish the following in a document<sup>15</sup>:

- Font type, size, and style
- Spacing (between lines and paragraphs)
- Page headers and footers and page numbering
- Orientation of the page (portrait or landscape)
- Margins, tabs, and text alignment
- Outline formats (bullets with symbols or numbering)

Many other tools are available in word processing and desktop publishing software. Some of these include but are not limited to spell checkers, thesaurus, word counts, and translators. You can add footnotes, endnotes, change the writing style of the paper, insert objects and captions, and edit, replace, and

### FIGURE 13-5

### KEY POINTS TO REMEMBER

#### **Key Points to Remember:**

Reading level of material found on the Internet may be too high for the average consumer to understand.

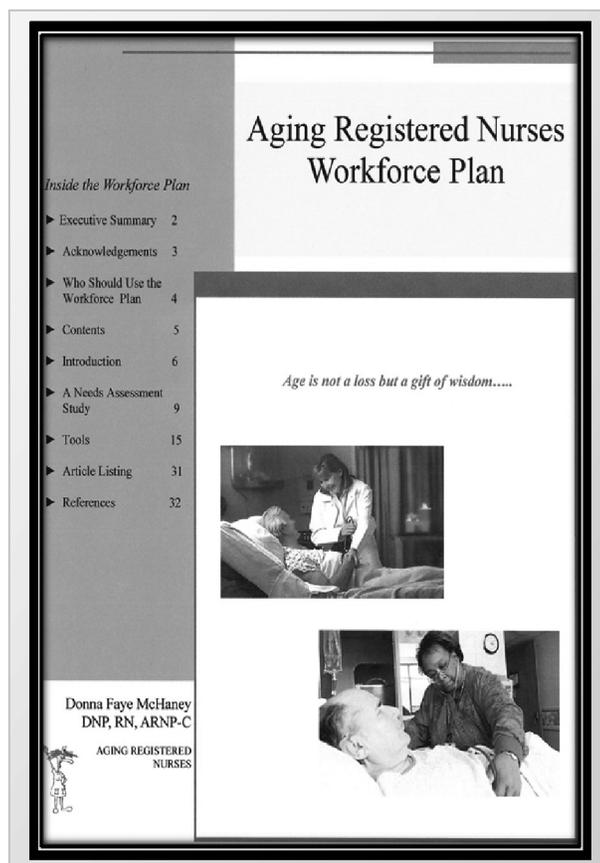
Medical information may be inaccurate or inconsistent.

Internet medical information can come from reputable, other providers, drug companies, practitioners looking to sell their “product” or even from other groups.

It is crucial to evaluate the credentials of the content providers to determine their qualifications and if the information on the site might be biased.<sup>12</sup>

*Source:* Author.

FIGURE 13-6

EXAMPLE OF A BROCHURE CREATED WITH  
DESKTOP PUBLISHING

**Source:** Courtesy of Donna Faye McHaney, DNP, BSCS, RN, ARNP-C; University of South Alabama, Mobile, AL.

add or delete. Standard templates can be used or templates can be defined for use. Both word processing and desktop publishing software provide nurse leaders with software to aid them in producing a variety of documents.

## Spreadsheets

Spreadsheets are computer software applications that can be used to manipulate data. Spreadsheets contain multiple cells and rows that make up a grid-type form. The cells may contain alphanumeric text, numeric values, or formulas that define the contents of the cell. Calculations can be performed, graphs can be produced, and statistical abilities are built in most spreadsheets. They have the ability to recalculate an entire spreadsheet automatically after changing a single cell. Spreadsheets can contain large numbers of rows and columns and make handling data easy.<sup>15</sup> Often, spreadsheets are used for creating budgets and handling numerous amounts of data.

Nurse leaders can use spreadsheets for developing budgets, maintaining staff records, calculating and tracking, and creating graphs on statistics pertaining to staffing and patient data. Items can be imported and exported to and from other software applications as well.

## Personal Information Manager

Personal information manager (PIM) applications are electronic versions of an appointment book or day planner. It contains an address book, a calendar, e-mail, a journal, notes, and tasks. Today, PIMs work with desktop computers, laptop computers, and personal digital assistants (PDAs). Even cellular phones have some capabilities to support PIM applications. A PDA is a small computing device that offers the same PIM capabilities as a PIM does on a desktop computer. Calendar or contact information can be interchanged between these devices through synchronization.

There are many capabilities of these devices. Some are as powerful and have the same applications available as desktop or laptop computers. Today, e-mail services and Internet access are available from PDAs, providing greater flexibility with technology. PDAs are frequently being used in the clinical setting not only by nurse leaders but by staff as well. Advances in this area continue to progress and can only be refined to produce more efficient devices.

## NURSING MANAGEMENT APPLICATIONS

Nursing management must be ready for the technology that is being implemented in administrative and clinical areas. Many applications are available for nursing management that can aid in daily tasks. Computer applications for nursing administration may include patient classification systems, acuity systems, staffing and scheduling systems, unit activity reports, utilization review, census, error reports, drug and allergy reactions, incident reports, shift summary reports, budgeting and payroll, and other systems as well. Nurse executives may also use application software for forecasting and planning, hospital expansion, regulatory reporting, risk pooling, surveys, preventive maintenance, and financial planning.

Today's nurse administrator has moved into the role of executive officer with obligations to report to the institution, to society, and to national accrediting agencies. These responsibilities and others come with the professional practice of nursing. Today's nurse administrator needs more than a basic understanding of e-mail and word processing; they need to have sufficient knowledge about computer technology to help improve health care and healthcare costs by better managing nursing information.<sup>8</sup>

The applications for nursing management include the nursing management minimum data set (NMMDS), calendar of events, general application software as discussed earlier in this chapter, and human resource information systems that support nursing management tasks. Calendars are useful for scheduling meetings, conferences, and educational events. Many nurse managers use PDAs or some general application software for this or use an Internet browser-based application available on the organization's intranet. The advantage to using the Internet browser-based application is that employees and managers can schedule appoints and events such as educational opportunities and their names are added to the class role and automatic notifications can be sent to nursing management.

The NMMDS is available from the American Organization of Nurse Executives and is a research-based management data set. It works in conjunction with the nursing minimum data set. The NMMDS contains 17 elements that fall into three board categories: environment, nurse resources, and financial resources. Nurse executives need hard data to make the difficult quality decisions occurring in today's healthcare operating environment.<sup>16</sup> Having quality data to answer difficult questions such as outcomes of critical pathways, retention and turnover rates of personnel, nursing and patient satisfaction rates, personnel ratings, budgets, and productivity are essential to the nurse manager. Having NMMDS provides a tool for nurse managers to answer these difficult questions.<sup>17</sup>

Although most human resources applications support activities required for the human resource departments, nurse managers find themselves in situations where these data are most helpful. Management of human resources is a huge task for most organizations, requiring significant time and personnel. These applications can be very informative and supportive to the nurse manager. Reports can be

obtained that supply such things as the number of individuals who apply for available positions, how many employees there are with a breakdown by rank, educational reports that show what educational programs have been completed, retention and turnover rates, information on credentials and special skills, time and attendance, and much more. Figure 13-7 shows an example of an employee termination report that may be used by nursing management.

With appropriate integration of the overall hospital information systems, these data can be exported and imported into other hospital information systems, nursing information systems, and other general applications software.

## ETHICAL, LEGAL, AND SECURITY ISSUES

Ethical, legal, and security issues go hand in hand when using technology. These concepts have been the top issues for IS departments and healthcare organizations for many years. *Webster* defines ethics as a system of conduct or behavior.<sup>18</sup> Ethics is conforming to professional standards that are defined by an organization or group of individuals such as nursing. Security can be defined as being safe and free from danger.<sup>18</sup> Terms related to security are privacy and confidentiality. Privacy is defined by Romano as “control over exposure of self or information about oneself and freedom from intrusion. Privacy denotes the right of an individual to decide how much personal information to share. It includes a right to secrecy of information and protection against the misuse or release of this information.”<sup>19</sup> Confidentiality means being entrusted with information that is held secret or secure.<sup>18</sup> Each of these concepts shares a relationship with each other when discussing patient information.

Many legal issues can arise from using technology and should be addressed by organizations. HIPAA of 1996 was originally designed to protect workers from losing their right to insurance coverage when leaving a job (portability) and to protect integrity, confidentiality, and availability of electronic health information (accountability). Key components of HIPAA can be found in Figure 13-8. Components that relate to the development of electronic data, security, and privacy standards play a major role in healthcare delivery. HIPAA has placed attention on the implications on computerized electronic records as they relate to patient’s rights.<sup>12</sup> The HIPAA privacy component gives patients access to and control over their medical data and who has access to it. Health plans, healthcare clearing-

**FIGURE 13-7**

### EXAMPLE OF AN EMPLOYEE TERMINATION REPORT

Employee Termination Report for the Month of September 200X				
position	name	title	date	reason
00356	Johnson, Mary J.	Registered nurse	09/26/xx	Q
10234	Armstrong, Helen M.	Licensed practical nurse	09/08/xx	Q
16212	Mims, Janet K.	Registered nurse	09/13/xx	F
17335	Baker, Donald M.	Registered nurse	09/05/xx	Q
17366	Smitherman, Carolyn S.	Registered nurse	09/22/xx	R
18549	Jackson, Melanie J.	Unit secretary	09/01/xx	Q
18675	Hanson, Marcus K.	Respiratory therapist	09/29/xx	Q

Source: Author.

houses, and healthcare providers must obtain prospective approval from a patient before sharing protected health information.

As a result of the privacy act, security issues concerning electronic health information arose. Security provisions must be made and cover policies, procedures, physical safeguards, and technical aspects of the management of protected health information. Security rules ensure the confidentiality, integrity, and availability of electronic protected health information. The current version of HIPAA legislation represents a relatively flexible set of rules that anticipates future changes in technology but remains achievable by healthcare organizations.<sup>12</sup>

Nursing management needs to be aware of the legal issues surrounding patient information and employees. There are guidelines and strategies (Figure 13-9) available from the American Nurses Association, the American Health Information Management Association, and the Canadian Nurses Association that help to minimize legal risk associated with computerized documentation and technology.<sup>20</sup>

## FUTURE TRENDS

It is unclear what the future holds for nursing when thinking about technology and what it can do to enhance the daily work flow involved in producing quality care. Transforming care into quality care is the essence of the clinical environment, and nurse leaders need to recognize the importance of emerging technologies. Two such technologies are virtual reality (simulation) and ubiquitous computing. Both these technologies are emerging and being used in education and other areas of health care.

**FIGURE 13-8**

### KEY COMPONENTS OF HIPAA

There are three aspects that relate to computerized medical information and patient's rights.

1. Privacy: The requirement for healthcare providers to obtain consent from patients about protected health information
2. Security: Administrative, physical, and technical safeguards used to protect patient data
3. Code sets: Tags and labels used in identification of patient specific data, including definitions, billing codes, and patient identifiers

*Source:* Author.

**FIGURE 13-9**

### GUIDELINES AND STRATEGIES TO MINIMIZE RISK

1. Never give out your computer password.
2. Always log off when you leave a computer terminal.
3. Follow procedures for correcting mistakes because computer entries are permanent.
4. Do not leave patient information displayed on a screen; keep track of printed information and dispose of it properly.
5. Follow your institution's confidentiality policies and procedures.

*Source:* Author.

Virtual reality allows an individual the ability to interact in a computer-stimulated environment. Most virtual reality environments are primarily visual, displayed either on a computer screen or through some special or stereoscopic display, but some offer additional sensory information such as sound. Others offer tactile information forcing feedback in medical and gaming applications. Users can interact with the computer-driven devices, which have become known as simulation technology. It has been used for years in pilot training and combat training. Currently, simulation is being experimented with and used in the medical industry. Nursing schools, medical schools, and other discipline schools are using simulation technology to train students with hands-on computer-simulated scenarios to replace the demand for clinical environments provided by healthcare organizations. It is unclear at this time where future virtual reality technology will lead the healthcare industry.<sup>21,22</sup>

Ubiquitous computing is a model of human computer interaction where information processing has been integrated into everyday objects and activities. Nurse leaders engaging in ubiquitous computing use many computational devices and systems simultaneously in the course of ordinary activities, and most of the time they may not be aware of it. All models of ubiquitous computing share a vision of small, inexpensive, robust networked processing devices. This natural interaction between humans and computers has yet to emerge, although there is recognition in the computer field that we are already living in a ubiquitous computing world.<sup>23</sup>

## SUMMARY

New and emerging technologies will continue to have an effect on the healthcare delivery system. Nursing, as a major player in health care, will be part of this ever-growing era of technology. Having access to learning environments that support this new technology will be a challenge for academia and healthcare organizations. Providing learning that simulates these environments requires a commitment from administrators in both areas. As the nursing shortage, improved quality care, and the push for electronic health records continue to drive technology in health care, nurse leaders will need to be more and more involved in information system technology.

Nurse leaders, both managers and executives, need to be conscious of new emerging technologies and how they can enhance clinical and nonclinical areas of nursing. Understanding the fundamental elements of computing is no longer sufficient. Nurse leaders must have learned knowledge to help lead nursing to a new age of electronic processing. Engaging in collaboration with information systems departments to select, design, develop, implement, and evaluation information systems is essential to the success of fully computer-automated environments.

## APPLICATION EXERCISES

### Exercise 13-1

Think back 5 to 10 years and consider how technology has changed in your workplace. Consider how technology has affected you and your family. Write down the changes you have seen as technology has advanced.

### Exercise 13-2

Think about your skills. Do you have the technology skills needed to perform efficiently in a high-tech environment? What training would you benefit from? What skills do you see as necessary for nurses as it relates to technology?

**Exercise 13-3**

Visit Vital Health Statistics Web site and search the site. Numerous databases of information are available.

1. List some interesting information that you found.
2. List ways nursing uses data, information, and knowledge specific to your job.

**Exercise 13-4**

How have you used the Internet in your practice? How do you see the Internet being used in the future? List ways the Internet can enhance healthcare delivery that is different from what is going on today.

**Exercise 13-5**

1. Considering healthcare information systems, what systems have you used?
2. List healthcare information systems you use or have used and categorize them into administrative and clinical healthcare information systems.
3. What systems would benefit nursing leaders the most? List them.
4. Identify and list information technology used by personnel (unit secretary, nurse technicians, nurses, nurse leaders). Include personal computer applications and information systems.

**Exercise 13-6**

Gain access to a computer and look for the word processing program. Open the program and experiment with the options that the word processing software has available. Experiment with inserting pictures and graphics. Produce a fact sheet with facts about the word processing software listed.

**Exercise 13-7**

1. Discuss your views on ethical, legal, and security issues.
2. What security measures do you interact with in your environment? List them.
3. What security measures do you see as needing improvements?
4. How can you contribute to confidentiality and privacy efforts?

**Exercise 13-8**

List examples where simulation technology would be beneficial for nursing in clinical areas. Think of examples of ubiquitous computing in health care.

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**APPENDIX 13-1****Computer Technology Terms**

**Central processing unit (CPU):** The part of the computer that controls all other parts. It consists of a control unit, an arithmetic and logic unit, and memory (registers and cache).

**Character:** A letter, digit, or other symbol that is used as part of the representation of data. A byte.

**Compact disc (CD):** A type of disk storage that uses magneto-optical recording and lasers.

**Data:** A representation of numbers or characters in the form suitable for processing by a computer.

**Database:** A collection of files or tables.

**Database management system:** A specialized type of software used for the organization, storage, and retrieval of data in a database.

**Disk (or disc):** Round, flat magnetic media used for the storage of data.

**Downtime:** The elapsed time when a computer is not available for use. It may be scheduled for maintenance or unscheduled because of machine or program problems.

**Expert system:** An application that contains a knowledge base and a set of algorithms or rules that have been derived from human expertise to provide assistance in decision making.

**Extranet:** An extension of an organization's intranet, over the Internet, enabling communication between the institution and people with whom it deals.

**Field:** A unit of data within a record.

**File:** A collection of related data with a given structure.

**Forecasting:** Predicting the future by an analysis of data.

**GUI (graphical user interface):** A user interface to a computer based on graphics.

**Hard copy:** Printed computer output in the form of reports and documents.

**Hardware:** Physical computer equipment.

**Information systems:** Computer systems designed to store and manipulate information for communication and decision support.

**Input/output (I/O):** Transfer of data between an external source and internal storage.

**Interface:** Point at which independent systems or computers interact.

**Internet:** A worldwide network of computer networks that use the TCP/IP network protocols to facilitate data transmission and exchange.

**Intranet:** A privately maintained computer network that can be accessed only by authorized persons, especially members or employees of the organization that owns it.

**Key:** A field or fields within a record that makes that record unique with respect to other records in a file.

**Kilobyte (KB):** 1,024 bytes.

**Local area network (LAN):** Two or more computers connected for local resource sharing.

**Mainframe computer:** A powerful computer capable of being used and interacted with by hundreds of users, simultaneously.

**Megabyte (MB):** 1,024 kilobytes.

**Microcomputer:** A small computer built around a microprocessor.

**Minicomputer:** A midsize computer, smaller and less powerful than a mainframe but larger and more powerful than a microcomputer.

**Modeling:** Representation of a complex system used as a basis for simulation to allow for the prediction and understanding of the system's behavior.

**Modem:** Device that converts digital data from a computer to an analog signal that can be transmitted on a telecommunications line and that converts received analog transmissions to digital data.

**Multimedia:** Combination of different elements of media, such as text, graphics, audio, video, animation, and sound.

**Multitasking:** Mode of operation that provides for the concurrent execution of two or more tasks.

**Online processing:** System that provides for the immediate, interactive input and processing of data.

**Operating system:** Software designed to control the hardware of a specific computer system to allow users and application programs to use it.

**Printer:** Terminal or peripheral that produces hard copy or printed output.

**Program:** A set of computer instructions directing the computer to perform some operation.

**Random access:** A storage technique whereby a file can be addressed and accessed directly at its location on the media or a record can be addressed and accessed directly within a file.

**Record:** A group of related fields of data treated as a unit.

**Robotics:** Science or study of mechanical devices designed to perform tasks that might be otherwise done by humans.

**Sequential access:** Storage technique whereby a file can be addressed and accessed only after all those before it on the media have been or a record can be addressed and accessed only after all those before it in the file have been.

Simulation: Attempting to predict aspects of the behavior of some system by creating an approximate model of it.

Software: A program or set of programs written to tell the computer hardware how to do something.

Spreadsheet: Specialized type of software for manipulation of numbers.

Table: Collection of related records in a database management system.

Trend: Systematic pattern of change over time.

Ubiquitous computing: Human–computer interaction that involves sharing of computer technology with everyday activities and objects.

User friendly: Software considered easier to use for novices.

Virtual reality: Simulation of real environments.

Voice communication: Interaction with a computer by voice recognition.

Wide area network (WAN): A network of two or more groups of computers or computing devices that are remote from each other and connected by telecommunication equipment.

Word processor: Specialized type of software for the manipulation of words to produce printed material.

