Chapter 7

- **Data** are **raw facts** that describe the characteristics of an event.
- **Information** is **data converted into** a meaningful and **useful context**.
- **Information granularity** – refers to the **extent of detail within** the **information** (fine and detailed or coarse and abstract)

Levels, Formats & Granularities of Information

- **Levels**
  - Individual, department, enterprise
- **Formats**
  - Document, presentation, spreadsheet, database
- **Granularities**
  - Detail (fine), Summary, Aggregate (Coarse)

Characteristics of HQ Information

- Accuracy
- Completeness
- Consistency
- Uniqueness
- Timeliness
  - **Real-time information** – Immediate, up-to-date information
  - **Real-time system** – Provides real-time information in response to requests
- **Transactional Data (TD)**
  - Stored in databases (collection of records pertaining to various business categories)
    - Resources
    - Events
    - People
    - Places
  - Operational IS (like SCM/CRM) maintain and access the TD
  - **Hierarchical database model** – information is organized into a tree-like structure (using parent/child relationships) in such a way that it cannot have too many relationships.
  - **Network database model** – a flexible way of representing objects and their relationships.
  - **Relational database model** – stores information in the form of logically related two-dimensional tables. The most common business databases today are relational databases
  - **Entity class** – a category of person, place, thing or event about which information is stored.
  - **Entity** – an individual person, place, thing or an individual occurrence of an event about which information is stored.
  - In a relational database each **Table** collects the data for an **entity class.** For example: One table is for Customers, another for Orders, another for Products.

        - In each table (entity class) each row or **Record**, contains the data for each **entity** belonging to that class.
        - **Attributes** – characteristics or properties of an entity class for which we collect data. In a DBMS, these are columns in the table called fields.
        - **Advantages**
            - Increased flexibility.
            - Increased scalability and performance.
            - Reduced redundancy.
            - Increased integrity (quality).
            - Increased security.
    - **Relating Data through Keys**
        - **Primary key** – A field (or group of fields) contain values that uniquely identify a given record in a table.
        - **Foreign key** – A primary key of one table that appears a field in another table. A value in the foreign key of one table corresponds to the value in the primary key of another table.
        - **Relationships** – The data from one table is linked to another when the computer finds a match between the values in a primary key to the values in the foreign key of another table.
- **Integration** – allows separate systems to communicate directly with each other.
    - **Forward integration** – takes information entered into a given system and sends it automatically to all downstream systems and processes.
    - **Backward integration** – takes information entered into a given system and sends it automatically to all upstream systems and processes.
- **Data warehouse** – a logical collection of information – gathered from many different operational databases – that supports business analysis activities and decision-making tasks.
- **Extraction, transformation, and loading (ETL)** – a process that extracts information from internal and external databases, transforms the information using a common set of enterprise definitions, and loads the information into a data warehouse.
- **Data mart** – contains a subset of data warehouse information extracted to be analyzed for specific units or objectives.
- **Information cleansing or scrubbing** – a process that weeds out and fixes or discards inconsistent, incorrect, or incomplete information.
- **Business intelligence (BI)** – applications and technologies used to gather, provide access to, and analyze information to support decision-making.
- **Characteristics of BI Systems**
    - Reliable
    - Consistent
    - Understandable
    - Easily manipulated
- **Data mining** – the process of analyzing data to extract information not offered by the raw data alone.
    - **Drilling Down –**increasing levels of detail.
    - **Drilling Up**—increasing summarization.

    - **Data-mining tool** – uses a variety of techniques to find patterns and relationships in large volumes of information and infers rules that predict future behaviour and guide decision making
- **Association detection** – Reveals the relationship between variables along with the nature and frequency of the relationships
- **Business Benefits of BI**
    - Single Point of Access for all Users.
    - BI across Organizational Departments.
    - Up-to-the-Minute Information for Everyone.
- **Categories of BI benefits:**
    - Direct quantifiable benefits.
    - Indirect quantifiable benefits.
    - Unpredictable benefits.
    - Intangible benefits

Chapter 8

- **Information—**Meaningful data
- **Knowledge—**Actionable information
    - To be knowledgeable, a person must understand the information, to make inferences between various tidbits of information presented, and, be able to apply that knowledge into action.
- **Knowledge management (KM)** – involves capturing, classifying, evaluating, retrieving, and sharing information assets in a way that provides context for effective decisions and actions
- **Knowledge management system (KMS)** – supports the capturing, organization, and dissemination of knowledge ("know-how") throughout an organization
    - **Explicit knowledge –** Consists of anything that can be documented, achieved, and codified, often with the help of IT
    - **Tacit knowledge –** Knowledge contained in people's heads. Shadowing and joint problem solving are the best practices for transferring or recreating tacit knowledge.
        - **Shadowing** – less experienced staff observe more experienced staff to learn how their more experienced counterparts approach their work
        - **Joint problem solving** – a novice and expert work together on a project
- **Crowdsourcing** – the wisdom of the crowd
    - **Asynchronous communication -** is transmission of data, that can occur at anytime and at irregular levels
    - **Synchronous communication -** Occurring at regular intervals
- **Social media** – Websites that rely on user participation and user-contributed content.
- **Social network** – An application that connects people by matching profile information.
- **Social networking** – The practice of expanding your business and/or social contacts by a personal network.

- **Social networking analysis (SNA)** – Mapping a groups contacts.
  - **Core competency** – an organization's key strength, a business function that it does better than any of its competitors.
  - **Core competency strategy** – organization chooses to focus specifically on its core competency and forms partnerships with other organizations to handle nonstrategic business processes.
- **Information partnership** – occurs when two or more organizations cooperate by integrating their IT systems, thereby providing customers with the best of what each can offer
  - **Unstructured collaboration (information collaboration)** - includes document exchange, shared whiteboards, discussion forums, and e-mail. Generally ad hoc.
  - **Structured collaboration (process collaboration)** - involves shared participation in business processes such as workflow in which knowledge is hardcoded as rules.
  - None of the factors affecting the degree to which enterprise portals would be used were technical in nature.
    - The **Information Politics** surrounding design and development of the portal.
    - The **System Development process** by which the portal was maintained.
    - The **Information Culture** of the organization.
    - Information Sharing, Information Overload, Information Access, Information Control and Attitudes towards using the Portal
- **Collaboration system:** An IT-based set of tools that supports the work of teams by facilitating the sharing and flow of information.
- **Content management system (CMS)** – provides tools to manage the creation, storage, editing, and publication of information in a collaborative environment
  - **Document management system (DMS)**
  - **Digital asset management system (DAM)**
  - **Web content management system (WCM)**
- **Wikis** – Collaborative Web pages that allows users to add, remove, and change content, which can be easily organization and reorganized as required.
- **Workflow** – defines all the steps or business rules, from beginning to end, required for a business process.
- **Workflow management system** – facilitates the automation and management of business processes and controls the movement of work through the business process.
- **Groupware System Advantages**
  - Facilitating communication (faster, easier, clearer, more persuasive
  - Enabling telecommuting
  - Reducing travel costs
  - Sharing expertise
  - Forming groups with common interests where it would not be possible to gather a sufficient number of people face-to-face
  - Saving time and cost in coordinating group work

    - Facilitating group problem solving
- **Videoconferencing**—is a set of interactive telecommunications technologies that allow two or more locations to interact via two-way video and audio simultaneous transmissions.
- **Web Conferencing**—blends audio, video and document-sharing technologies to create virtual meeting rooms.
- **M-learning**—uses portable computing devices with wireless capability to enable mobility and mobile learning expanding learning beyond the classroom.
- **Enterprise Portals**—Are single-point Web browser interfaces used within an organization to promote the gathering, sharing, and dissemination of information throughout an enterprise.
- **Enterprise taxonomy**—a classification of information categories that help organize information retrieval.
- **Search engine**—to facilitate more specific and exact information requests.
- **Hypertext links**—to both internal and external Web sites and information sources.
- **Vertical Enterprise Portals**—specific applications or business functions
- **Horizontal Enterprise Portals**—aggregate cross-functional information
- None of the factors affecting the degree to which enterprise portals would be used were technical in nature.
    - The **Information Politics** surrounding design and development of the portal.
    - The **System Development process** by which the portal was maintained.
    - The **Information Culture** of the organization.
        - Information Sharing, Information Overload, Information Access, Information Control and Attitudes towards using the Portal
- **Insights from Computer Supported Cooperative Work (CSCW) on adoption and use of Enterprise Portals**
    - Ensure that everyone benefits.
    - Create incentives for use.
    - Promote multiple perspectives.
    - Understand current work practice.

Chapter 9

- **Ethics** – the principles and standards that guide our behaviour towards other people
- Privacy is a major ethical issue
    - **Privacy** – The right to be left alone when you want to be, to have control over your own personal possessions, and not to be observed without your consent
    - **Confidentiality** – the assurance that messages and information are available only to those who are authorized to view them
- **Individuals form the only ethical component of MIS**
    - Individuals copy, use, and distribute software.
    - Search organizational databases for sensitive and personal information.
    - Individuals create and spread viruses.
    - Individuals hack into computer systems to steal information.

    - Employees destroy and steal information.
- **Effects of Employee Monitoring**
    - **Employee Absenteeism**
        - Taking care of personal business. Give them a few hours instead of losing whole days?
    - **Lower Job Satisfaction**
        - People believe the quantity of work is more important than the quality.
    - **"Psychological Resistance"**
        - If employees are told they can't do something, they will want to even more.
- **Information privacy -** concerns the legal right or general expectation of individuals, groups, or institutions to determine for themselves when, and to what extent, information about them is communicated to others.
- **Personal Information Protection and Electronic Documents Act (PIPEDA)** - a Federal act that sets out ground rules for how private sector organizations may collect, use or disclose personal information in the course of commercial activities.
    - **Exceptions to PIPEDA:**
        - Journalistic, artistic, or literary use.
        - Actions clearly of benefit to the individual, or if obtaining permission could infringe on the information's accuracy.
        - Information, or the disclosure of information aids a legal investigation, or an emergency where lives and safety are at stake.
        - Information disclosure facilitates the conservation of historically important records.
- **ePolicies**--Organizations strive to build a corporate culture based on ethical principles that employees can understand and implement.
- **Ethical computer use policy** – contains general principles to guide computer user behaviour.
- The **ethical computer user policy** ensures all users are **informed** of the rules and, by agreeing to use the system on that basis, **consent** to abide by the rules
- **Information privacy policy** - contains general principles regarding information privacy
- Information privacy policy guidelines for creating an Information Privacy Policy:
    - Adoption and implementation of a privacy policy
    - Notice and disclosure
    - Choice and consent
    - Information security
    - Information quality and access
- **Acceptable use policy (AUP)** – a policy that a user must agree to follow in order to be provided access to a network or to the Internet
- **Nonrepudiation Clause** – a contractual stipulation to ensure that e-business participants do not deny (repudiate) their online actions.

- **Information security** – the protection of information from accidental or intentional misuse by persons inside or outside an organization.
- The greatest threat to a business information system are **insiders,** employees and authorized users of the IS:
  - Negligence, mistakes and ignorance of the consequences of risky behaviour.
  - Victims of **social engineering,** the use, by hackers, of social skills to acquire passwords and personal data.
- **Information security policies** – identify the rules required to maintain information security.
- **Information security plan** – how an organization will implement the information security policies.
- There are three primary information technology security areas
  - Authentication and authorization
  - Prevention and resistance
  - Detection and response
- **Authentication** – A method for confirming users' identities
- **Authorization –** The process of giving someone permission to do or have something
- **Identity theft** – the forging of someone's identity for the purpose of fraud
- **Phishing** – a technique to gain personal information for the purpose of identity theft, usually by means of fraudulent e-mail
- **Tokens** – Small electronic devices that change user passwords automatically.
- **Smart card** – A device that is around the same size as a credit card, containing embedded technologies that can store information and small amounts of software to perform some limited processing.
- **Biometrics** – The identification of a user based on a physical characteristic, such as a fingerprint, iris, face, voice, or handwriting. Unfortunately, this method can be costly and intrusive. (This is by far the best and most effective way to manage authentication)
- Technologies available to help prevent and build resistance to attacks include
  - Content filtering
  - Encryption
  - Firewalls
- **Content filtering** - prevents emails containing sensitive information from transmitting and stops spam and viruses from spreading.
- **Spam –** is a form of unsolicited email.
- **Encryption—**is a method of transforming a message into an alternative form that requires a key or password to make it readable.
- **Public key encryption (PKE)—**is a method where the key to scramble the message is known to everyone but the key to unscramble it is held by the recipient only.
- **Firewall** – Hardware and/or software that guards a private network by analyzing the information leaving and entering the network

- **Hackers**—are experts in technology who use their knowledge to break into computers and computer networks, either for profit or just motivated by the challenge
  - Black-hat hacker
  - Cracker
  - Cyberterrorist
  - Hactivist
  - Script kiddies or script bunnies
  - White-hat hacker
- **Virus**—malicious software that spreads from computer to computer by a user activating the file in which it resides.
  - Backdoor program
  - Denial-of-service (DoS)
  - Distributed denial-of-service(DDoS)
  - Polymorphic virus
  - Trojan-horse virus
- **Worm**—a type of malicious software that spreads across networks and does not need a user to activate it.

Chapter 10

- Information systems that are built correctly can transform as the organization and its business transform.
- Information systems that effectively meet employee needs will help an organization become more productive and enhance decision-making.
- Information systems that do not meet employee needs may have a damaging effect on productivity and can even cause a business to fail.
- **Systems development life cycle (SDLC)**—The overall process for developing information systems from planning and analysis through implementation and maintenance
  - **SDLC Phases**
    a. **Planning phase** – Establishes a high-level plan of the intended project and determines project goals.
    b. **Analysis phase** – Involves analyzing end-user business requirements and refining project goals into defined functions and operations of the intended system.
       - **Business requirement** – Specific business requests the system must meet to be successful
    c. **Design phase** – Establishes descriptions of the desired features and operations of the system including screen layouts, business rules, process diagrams, pseudo code, and other documentation.
    d. **Development phase** – Involves taking all of the detailed design documents from the design phase and transforming them into the actual system.
    e. **Testing phase** – Involves bringing all the project pieces together into a special testing environment to eliminate errors and bugs, and verify that

the system meets all of the business requirements defined in the analysis phase.

f. **Implementation phase** – Involves placing the system into production so users can begin to perform actual business operations with it.
g. **Maintenance phase** – Involves performing changes, corrections, additions, and upgrades to ensure the system continues to meet its business goals

- **Methodology**—is a set of policies, procedures, standards, processes, practices, tools, techniques and tasks that people apply to technical and management challenges.
- **Systems Development Methodologies include**:
  - **Waterfall**– a sequential, activity-based process in which each phase in the SDLC is performed sequentially from planning through implementation and maintenance.
  - **Agile** —aims for customer satisfaction with early and continuous delivery of useful system or software components meeting bare minimum requirements.
  - **Iterative Development**—consists of a series of fast, efficient, short, lower cost projects that achieve rapid feedback and acceptance. It's speed, size and focus account for end user satisfaction.
  - **Rapid application development (RAD)** —emphasizes extensive user involvement in the rapid and evolutionary construction of working prototypes.
  - **Extreme programming methodology** - Software project is broken down into small phases. Four parts: planning, designing, coding, testing, which advance rapidly one after another.
  - **Rational unified process (RUP) methodology** – Provides a framework for breaking down the development of software into four gates
    - Gate One: Inception
    - Gate Two: Elaboration
    - Gate Three: Construction
    - Gate Four: Transition
- **Scrum methodology** – Uses small teams to produce small pieces of deliverable software using sprints, or 30-day intervals, to achieve an appointed goal
- **Participatory design methodology** —views the users, not the developers as experts:
  - Create opportunities for mutual learning.
  - Utilize design tools familiar to users.
  - Use language familiar to users.
  - Start the design with current practice.
  - Encourage users to envision future situations of working with the final system
- **Prototype** – a smaller-scale representation or working model of the users' requirements, or a proposed design.
- **Primary principles for successful agile software development include**:
  - Slash the budget
  - If it doesn't work, kill it
  - Keep requirements to a minimum
  - Test and deliver frequently

    - Assign non-IT executives to software projects
- **The consequences of failed projects include**
    - **Damaged brand**
    - **Lost goodwill**
    - **Dissolution of partnerships**
    - **Lost investment opportunities**
    - **Low morale**
- **Three primary project variables**
    - **Time**
    - **Cost**
    - **Scope**
- **Project**—Temporary activities undertaken to create a unique product or service.
- **Project management—**The application of knowledge, skills, tools, and techniques to project activities to meet project requirements.
- **Project manager –** An individual who is an expert in project planning and management, defines and develops the project plan, and tracks the plan to ensure the project is completed on time and on budget.
- **Project deliverable**—Any measurable, tangible, verifiable outcome, result, or item that is produced to complete a project or part of a project.
- **Project milestone—**Represents key dates when a certain group of activities must be performed.
- Techniques for Choosing Strategic Projects:
    - Focus on organizational goals.
    - Categorize projects.
    - Perform a financial analysis.
- **Project charter**—is a document issued by the project initiator or sponsor that formally authorizes the existence of a project and typically includes:
    - Project scope that defines the work to be done.
    - Project objectives are the quantifiable criteria that must be met.
    - Project constraints are the factors that can limit the projects options.
    - Project assumptions are factors believed to be true that impact the project.
- **Project plan** – a formal, approved document that manages and controls project execution.
- A well-defined project plan should have:
    - Description of project scope.
    - A list of activities
    - A schedule
    - Time and Cost estimates
    - Risk factors
    - Assignments & Responsibly
    - Kill Switch
- **Project scope** – defines the work that must be completed to deliver a product with the specified features and functions
- Two diagrams that provide visual support to a project:

    - **PERT (Program Evaluation and Review Technique) chart**—is a graphical network model that depicts a project's tasks and the relationships between those tasks.
    - **Gantt chart**—is a simple bar chart that depicts project tasks against a calendar.
- **Project managers must focus on managing three primary areas** to **ensure success**:
    - People
    - Communications
    - Change
- **Why Change Occurs**
    - Omissions/misunderstandings in the initial scope
    - External
    - Organizational change such as M&A
    - Technological breakthrough
    - Scope creep
    - Budget reduction
- **Insourcing (in-house-development)**—a common approach using the professional expertise within an organization to develop and maintain the organization's information technology systems.
- **Outsourcing**—is an arrangement by which one organization provides a service or services for another organization that chooses not to perform them in-house.
- **Onshore outsourcing** – engaging another company within the same country for services
- **Nearshore outsourcing** – contracting an outsourcing arrangement with a company in a nearby country
- **Offshore outsourcing** – using organizations from developing countries to write code and develop systems
- **Challenges to outsourcing**
    - Contract Length:
    - Difficulties in getting out of a contract.
    - Problems in foreseeing future needs.
    - Problems in reforming an internal IS department after the contract is finished.
    - Competitive edge.
    - Confidentiality.
    - Scope definition.

Chapter 11

- **Enterprise architecture (EA)—**refers to the plans for how an organization will build, deploy, use, and share its data, processes, and IT assets
- **Enterprise architect—**a person grounded in technology, fluent in business, a patient diplomat, and provides the important bridge between IT and the business
- **Data Architecture—**identifies where and how important data, like customer records, are maintained and secured.
- **Backup** - an exact copy of a system's information.

- **Recovery** - the ability to get a system up and running in the event of a system crash or failure and includes restoring the information backup.
- **Fault tolerance** – the ability of a system to continue with no loss of service in case of a failure
- **Failover** - a backup operational mode in which the functions of a computer component is assumed by another when the first becomes unavailable.
- **Disaster recovery plan** - a detailed process for recovering information or an IT system in case of a disaster such as a fire or flood.
- **Disaster recovery cost curve** - charts the cost of the unavailability of information and technology, and, the cost of recovering from a disaster over time.
- **Hot Site** – a separate, fully equipped facility that the company moves into after a disaster.
- **Cold Site**- a separate, facility lacking computer equipment where employees can move after a disaster.
- **Business Continuity Planning—**indicates how an organization will restore interrupted critical functions within a pre-determined time.
- **Security:** Preventing unauthorized access, copying, deletion and modification of data, ensuring continuity of operations, and managing user access.
- **Managing User Access—**preventing unauthorized access to the information system and its data. Weakest link in securing an IS.
- **Anti-virus software and patches—**applications that prevent hackers, spammers and other malcontents from entering the network. Constantly updated and changed.
- **Application architecture—**determines how applications integrate and relate to each other.
- **Web Services**—contain Web-based data and procedures that use the same standards permitting different applications to relate to each other.
- **Interoperability—**means that two or more systems share data and resources even though they were made by different manufacturers.
- **Service-oriented architecture (SOA)** is an approach to IT architecture which creates connections among a variety of applications and information sources so that the system can adapt quickly and easily.
- **SOA service—**is not merely a piece of software but a business task that is part of a business process. IT can be coupled and uncoupled with others as needed providing flexibility and agility.
- **Interoperability—**is a key characteristic of SOA allowing component software to be used across platforms and applications.
- **Loose coupling—**applications are built from numerous services that are distinct/well-defined units that can be disconnected and replaced or reused elsewhere as needed.
- **Types of Web Services**
    - **Event**—the type of application that monitors a business process for threats and opportunities and alerts those who can act on the information.
    - **Service**—a software component that, not only provides code to be used by developers to create specific functionality in a larger program being

developed, but also can be used by other applications to perform a task across a wide range of clients.

- **Open system** - a broad, general term that describes nonproprietary IT hardware and software where the standards and procedures by which the products work is made publicly available.
- **Open Source** – refers to any program whose source code is made available for use or modification.
- **Virtualization** - creates multiple "virtual machines" on a single computer
- **Grid computing** - A collection of computers, often geographically dispersed, that are coordinated to solve a common problem
- **Cloud computing** - Refers to the use of resources and applications hosted remotely on the Internet
  - **Advantages**:
    - Convenient access to application programs and data.
    - Cost savings for data storage and software and client computers.
    - "Pay as you go" rather than large capital expenditures.
  - **Disadvantages**:
    - No control over applications, lack of customization.
    - Must trust a 3rd party with confidential information.
    - Possible data access issues.
- **Goals of Enterprise Architecture**
  - Reduce costs/improve productivity
  - Improve customer satisfaction
  - Create competitive advantages
  - Generate growth
  - Optimize the supply chain

Chapter 12

- **Telecommunication system**—enables the transmission of data over public or private networks.
- **Network**—a system created by linking two or more computers and establishing standards, or protocols, so that they can work together.
- The three types of networks include:
  - Local area network (LAN)
  - Metropolitan area network (MAN)
  - Wide area network (WAN)
- **Voice over IP (VoIP)**—uses TCP/IP technology to transmit voice calls over long-distance telephone lines.
- **Virtual private network (VPN)**—a way to use the public telecommunication infrastructure (e.g., Internet) to provide secure access to an organization's network
- **Valued-added network (VAN)**—a private network, provided by a third party, for exchanging information through a high capacity, secure connection.
- **Mobile technology**—means the technology can travel with the user, but it is not necessarily in real-time.

- **Wireless technology**—refers to any type of electrical or electronic operation that is accomplished without the use of a "hard wired" connection via satellite or radio transmitters. The signal is carried on radio waves, microwaves and satellites
    - **Mobile Applications can**:
        - Help track materials and shipments from suppliers and distributors to customers.
        - Manage inventory.
        - Support Point of Sale.
        - Collect data in an automated fashion.
        - Immediate data analysis.
- **Personal digital assistants (PDA)**—are small, handheld computers capable of entirely digital communications transmission.
- **Smartphone**—combines the functions of a cellular phone and a PDA in a single device.
- **Tablets**—is a mobile computer that is larger than a mobile phone, with an integrated flat touch screen. Recent improvements in memory and functionality have seen tablet sales sky-rocket.
- **Bluetooth** is a telecommunications industry specification that describes how mobile phones, computers, and PDAs can be easily interconnected using a short-range wireless connection.
- **Satellite**--A space station that orbits the Earth receiving and transmitting signals from Earth-based stations over a wide area.
    - **Location based services (LBS)** are wireless mobile content services that provide location-specific data to mobile users moving from location to location.
    - **Global position systems (GPS)** is a constellation of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographical location.
    - **Geographic information system (GIS)** is designed to work with data that can be shown on a map
        - Consists of hardware, software, and data that provide location information for display on a multidimensional map.
- **Wireless LAN (WLAN) -** A local area network that uses radio signals to transmit and receive data over distances of a few hundred feet
- **Wireless fidelity (Wi-Fi) -** A means by which portable devices can connect wirelessly to a local area network, using access points that send and receive data via radio waves
- **Wireless MAN (WMAN) -** A metropolitan area network that uses radio signals to transmit and receive data
- **Worldwide Interoperability for Microwave Access (WiMAX) -** A communications technology aimed at providing high-speed wireless data over metropolitan area networks
- **Radio frequency identification (RFID)**—uses active or passive tags in the form of chips or smart labels that can store unique identifiers and relay this information to electronic readers
    - **RFID tag**—contains a microchip and an antenna, and typically works by transmitting a serial number via radio waves to an electronic reader, which confirms the identity of a person or object bearing the tag