

Introduction

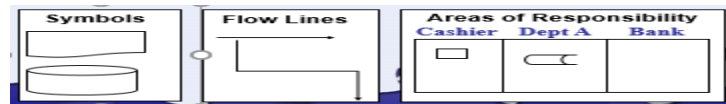
- Tasks are the individual steps involved in accomplishing events in an enterprise
- Events are tasks; however, not all tasks should be represented as events
- Tasks that are activities that may be changed or eliminated without substantially changing the nature of the enterprise should not serve as foundational elements in an enterprise information system database
- The purpose of task level models is NOT to design a database; rather, it is to document the flow of data through an enterprise
- No pattern has yet been identified at the task level

System Flowcharts

- Graphically document information systems
- Summarize pages of narrative in diagrammatic format
- Focus on the physical aspects of information flows

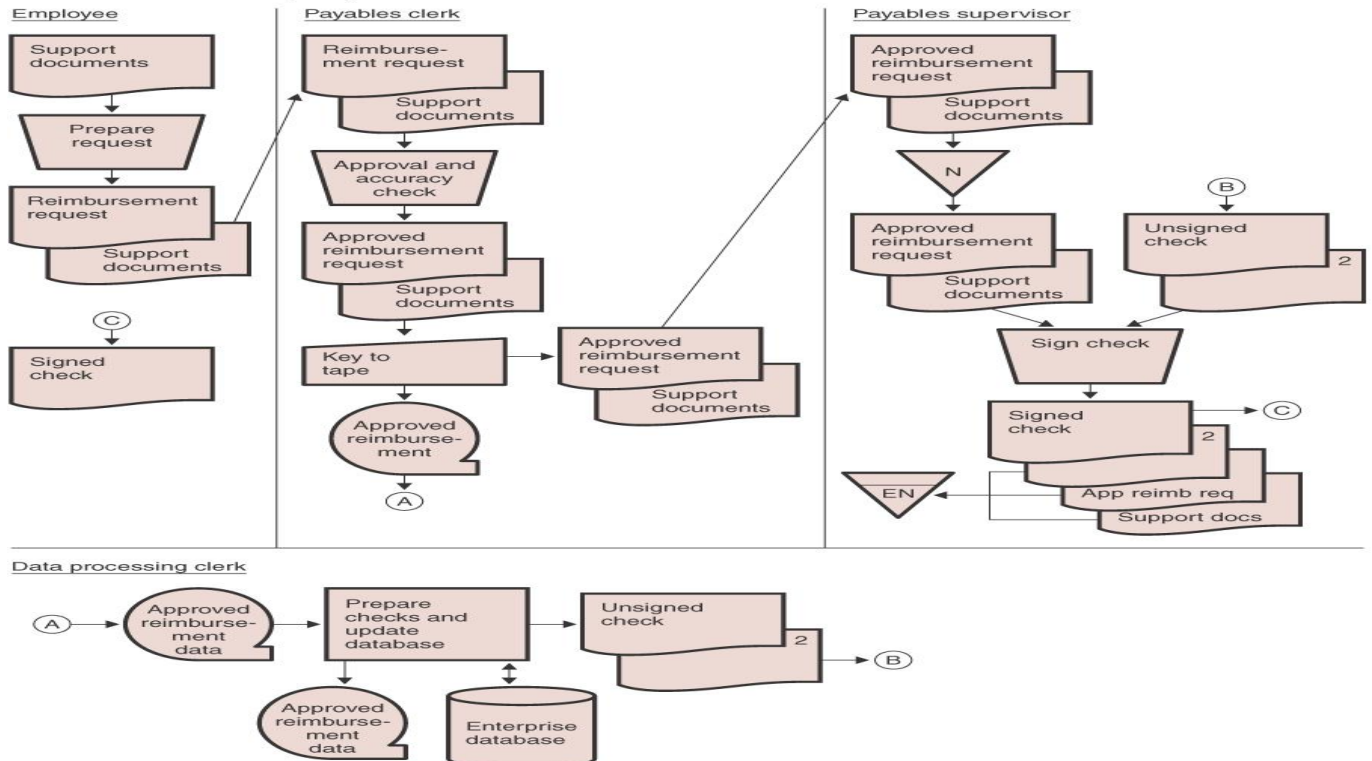
System Flowcharts: Basic Elements

- System flowcharts may be drawn freehand or with a plastic flowchart template/stencil tool.
- System flowcharts may be prepared using software created for that purpose.
 - E.g. SmartDraw, Visio, ABC Flowcharter
 - Microsoft Word and Powerpoint (but they are not as automated)
- System flowcharts combine three simple graphical elements to represent various types of physical information flows and processes



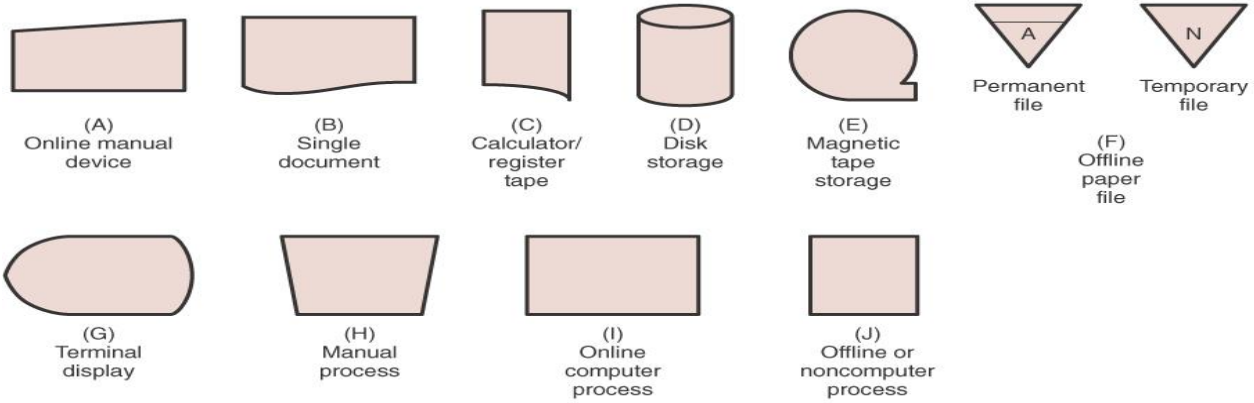
Example System Flowchart

EXHIBIT 5-1 Example System Flowchart



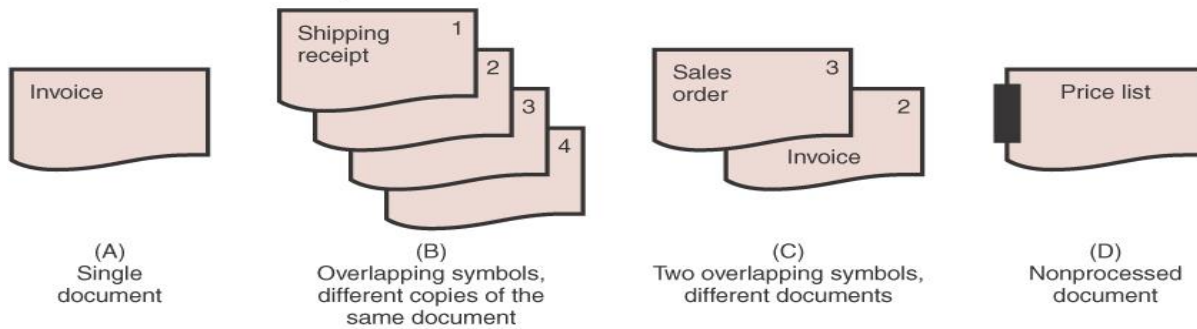
Flowchart Symbols

EXHIBIT 5-2 Flowchart Symbols



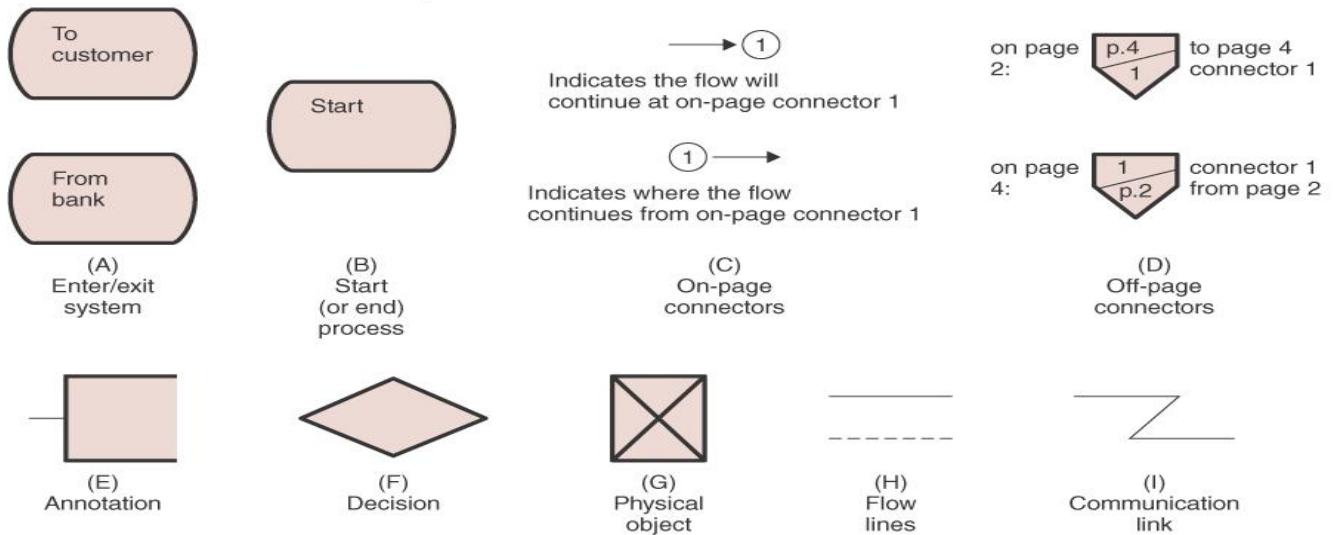
Flowchart Symbols: Documents

EXHIBIT 5-3 Flowchart Symbols: Documents



More Flowchart Symbols

EXHIBIT 5-4 More Flowchart Symbols



Flow Lines

- Flow lines are used to connect the symbols on the document flow chart.
- A solid line indicates the flow of a document or object
- A dotted or dashed symbol indicates a flow of information rather than the physical document
- Some flowcharts also show communication flows such as by telephone modem or satellite
- Arrows are used when the documents or information flow is not left-to-right or top-to-bottom

Areas of Responsibility

- Areas of responsibility are displayed to enable the flowchart reader to clearly identify changes in responsibility as the documents flow through the system.
- They are represented on flowcharts by segmenting and labeling columns.
- Areas of responsibility may be departments, sections within a department, or individual employees within a department.
- Judgment must be used in choosing the level of subdivision that one column should represent.

Flowchart Preparation Conventions

- Left-to-right, Top-to-bottom
- All documents must have an origin and termination ("cradle to grave documentation")
 - each copy of the document must flow to
 - a permanent file symbol
 - a symbol denoting an exit from the system, or
 - an off-page connector
 - a document destruction symbol (small black box)
 - Corner of originating symbol may be darkened to indicate its introduction to the system
- Keep flowcharts uncluttered
 - Place responsibility areas with frequent interchange in adjacent columns
 - Enter narrative only within symbols
 - Avoid unnecessary explanation with narrative
- Make sure progress of each document is clear.
 - Diagram a document
 - before and after each process
 - entering or leaving a file
 - entering or leaving a page or area of responsibility
- Ensure flowchart is complete

System Flowchart Summary

The Good	The Not-So-Good
<ul style="list-style-type: none"> – Flowcharts are relatively easy for information customers and managers to understand – Flowcharts help auditors understand business and systems controls 	<ul style="list-style-type: none"> – Flowcharts are tied to physical information flows and system characteristics that hide procedural essence of – Flowcharts may be artifactual and tied to outdated information technology

File Types

- Master files
 - Contain the balance or status of entities
 - E.g. vendors, credit customers, inventory, assets, employees
- Transaction files
 - Contain activity data
 - E.g. orders, sales, payments
- History or archive files
 - Contain inactive past or historical data
- Reference files
 - Contain information needed for reference purposes
 - e.g., rates, prices, zip codes, chart of accounts
- Suspense files
 - Contain items awaiting action, errors, missing information

PROJECT GUIDELINES

To eliminate communication issues, guidelines must be established. The following are components of a quality project guideline:

- Daily meetings
- Idea sharing
- Keep project managers informed
- Complaint resolution

COMMUNICATION PLANNING PRINCIPALS

- Define and understand quality
- Define goals and objectives
- Establish a set of managers who:
 - Understand the technical practices that support systems and software engineering
 - Can clearly define and provide a scope for the team defining the development stages
 - Provide a scope for the team to know what is ahead
 - Involve systems and software teams to help with delivery schedules
 - Can accommodate change and identify potential risks that impact on program and project planning
 - Track the progress daily and adjusting if needed

Storage and Access of Data

- **Sequential Storage and Sequential Access**
 - Records are stored in order
 - To access a record, the access device must read through all records that are stored previous to the desired record
 - Tape cartridges and open reel tapes require sequential storage and sequential access of data
- **Random Storage and Direct Access**
 - Records are stored in any order
 - Any record can be retrieved directly regardless of physical position on the media; the access device need not read all the records prior to the desired record
 - Computer hard disks, floppy disks, zip disks, CD-ROMs, and DVD-ROMs allow random storage and direct access of data

Media

- **Paper**
 - Most common form of media
 - Most easily used by people
 - Doesn't depend on electricity to access
 - Disadvantages
 - Bulk (for storage)
 - Lack of search and automated processing capability
 - Susceptibility to destruction
 - Sequential storage (may be indexed for indexed-sequential access)
 - May update on same physical input media
 - Add information to existing document
- **Magnetic tape**
 - Audiocassette tapes, VHS videotapes, and 8mm video camera cassettes use magnetic tape
 - Sequential storage and sequential access

- Sorting is important for processing (transaction file must be sorted to match the order of the master file)
- Separate physical media must be used for input and output in an update process
 - Old master file, new master file
- Easy backups
- Dependent on electricity and on hardware
 - Cannot be read or processed directly by a person
- **Digital (Disk) media**
 - Computer hard disks, floppy disks, zip disks, CDs, DVDs, and memory cards
 - Random storage
 - Information may be stored anywhere on the media; may be broken up (fragmented) and stored in multiple places
 - "Defragging" a hard drive is the process of sorting the data to re-connect all the fragments for more efficient processing
 - Direct access
 - From index, hardware can jump directly to the desired information and proceed with processing
 - Same physical media may be used for input and output in an update process (unless disk is full)
 - Easy backups
 - Dependent on electricity and on hardware
 - Cannot be read or processed directly by a person

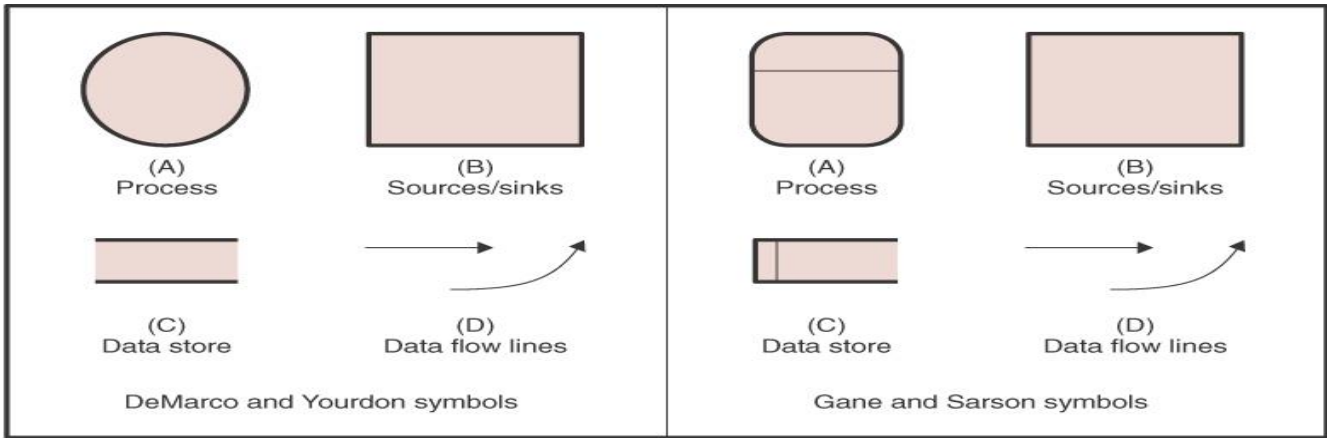
Processing Methods

- **Batch:** accumulates transaction data for a period of time. Then all of the transactions in the transaction file are posted to the master file in one processing run. (Tape processing is always batch)
- **Online:** means the computer-input device is connected to the CPU so that master files are updated as transaction data are entered
- **Real-time:** denotes immediate response to an information user; transaction data are entered and processed to update the relevant master files and a response is provided to the person conducting the business event fast enough to affect the outcome of the event
- **Report-time:** the data used to generate the requested report is processed as the report is created



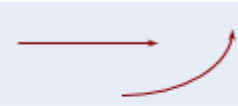

Data Flow Diagrams (DFD)

- DFD symbols are used for a variety of system analysis purposes, including graphically displaying the logical flows of data through a process.
- Unlike flowcharts which represent the physical components of an information system, DFDs can provide a more conceptual, nonphysical display of the movement of data through a system.
- DFDs disregard such things as organizational units, the computer on which the data are processed, and the media on which the data are stored.
- Movements of data across offices or departments within a particular system are not represented.

Data Flow Diagram Symbols



Dunn, Cherrington, and Hollander, 3e uses the Demarco and Yourdon symbols

<p>Process</p> <ul style="list-style-type: none"> – Circles are used to represent processes that take data inflows and transform them to information outflows – Each circle contains two labels <ul style="list-style-type: none"> • a process number • a process name – Alternate notation is rectangular box with rounded corners <div style="text-align: center;">  <p>(A) Process</p> </div>	<p>Data Sources and Sinks</p> <ul style="list-style-type: none"> – Rectangles (or squares) represent data (inflow) sources and (information outflow) sinks – Rectangle is labeled with the name of the data source or sink/destination (e.g. Customer, Vendors, Government Agency). – Sources and sinks are agents external to (i.e. outside the scope of) the system represented on the diagram <ul style="list-style-type: none"> • Delineate the boundaries of the system <div style="text-align: center;">  <p>(B) Data inflow sources, information outflow destinations</p> </div>
<p>Data Flow Lines</p> <ul style="list-style-type: none"> – Data flow lines display the route of data inflow and information outflow – Lines can be straight or curved – Data flows are generally labeled with the name of the data (e.g. a customer order, a bill, a financial analysis) – Arrow indicates the direction of the data flow <div style="text-align: center;">  <p>(D) Data flow lines</p> </div>	<p>Data Stores</p> <ul style="list-style-type: none"> – Two parallel straight lines are used to display a store or collection of data – Some people refer to data stores as data at rest – A description of the data store contents is entered on the symbol – Data stores are used anytime it is necessary to store the output from a process before sending it on to the next process – Alternative notation uses a rectangular box that is open at one end <div style="text-align: center;">  <p>(C) Data store</p> </div>

THE THREE CRITICAL FACTORS

<p>1) All processes should have unique names If two data flow lines (or data stores) have the same label, they should both refer to the exact same data flow (or data store)</p>	<p>2) The inputs to a process should differ from the outputs of a process</p>
<p>3) Any single DFD should not have more than about seven processes</p>	<p>4) No process can have only outputs. (This would imply that the process is making information from nothing.) If an object has only outputs, then it must be a source.</p>  
<p>5) No process can have only inputs (referred to as a "black hole") - If an object has only inputs, then it must be a sink</p> <p>6) Process should be labeled with a verb phrase</p>  	<p>7) Data must be moved by a process; data cannot move directly from one data store to another</p>  
<p>8) Data must be moved by a process that receives data from the source and places the data in the data store; data cannot move directly from an outside source to a data store</p>  	<p>9) Data must be moved by a process; cannot move directly to an outside sink from a data store</p>  
<p>10) Data store should be labeled with a noun phrase</p>  <p>12) A source/sink has a noun phrase label.</p>	<p>11) Data cannot move directly from a source to a sink. It must be moved by a process if the data are of any concern to the system. If data flows directly from a source to a sink (and does not involved processing) then it is outside the scope of the system and is not shown on the system data flow diagram DFD.</p>  
<p>13) A data flow has only one direction between symbols. It may flow in both directions between a process and a data store to show a read before an update. To effectively show a read before an update, draw two separate arrows because the two steps (reading and updating) occur at separate times.</p>  	<p>14) A fork in a data flow means exactly the same data (e.g. different copies of an invoice) goes from a common location to two or more different processes, data stores, or sources/sinks</p>  

15) A join in a data flow means exactly the same data comes from two or more different processes, data stores, or sources/sinks, to a common location.	16) A data flow cannot go directly back to the same process it leaves. At least one other process must handle the data flow, produce some other data flow, and return the original data flow to the originating process.
17) A data flow to a data store means update (i.e., delete, add, or change). 18) A data flow from a data store means retrieve or use.	19) A data flow has a noun phrase label. More than one data flow noun phrase can appear on a single arrow as long as all of the flows on the same arrow move together as one package.

DFD Levels

- DFDs are divided into levels to keep their size and complexity manageable
- Context level shows least detail
- Each subsequent level (Level Zero, Level One, Level Two, etc.) subdivides one process on the previous diagram into more detail
- Balance must be maintained between levels
 - All inflows from and outflows to external sources/sinks must be the same from one level to the next

Context Level DFD

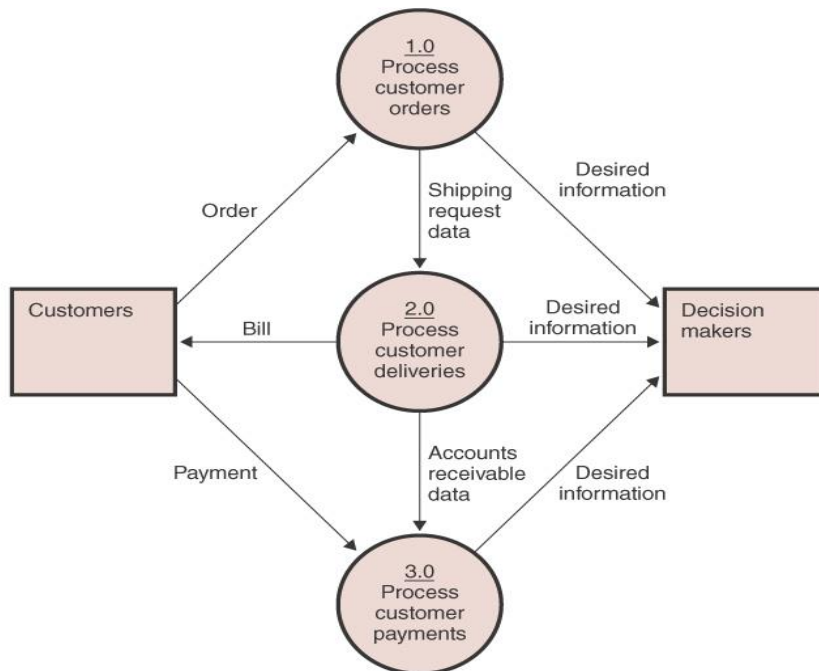
- The context diagram shows **one process** (representing the entire system) and the **sources/sinks** that represent the boundaries of the system.

EXHIBIT 5-7
Context Level DFD



Level Zero DFD Example

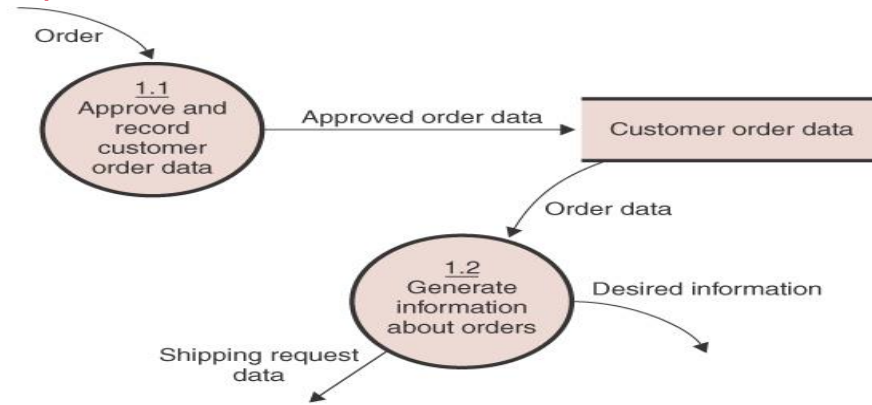
EXHIBIT 5-8
Level-Zero DFD



Level One DFD Example

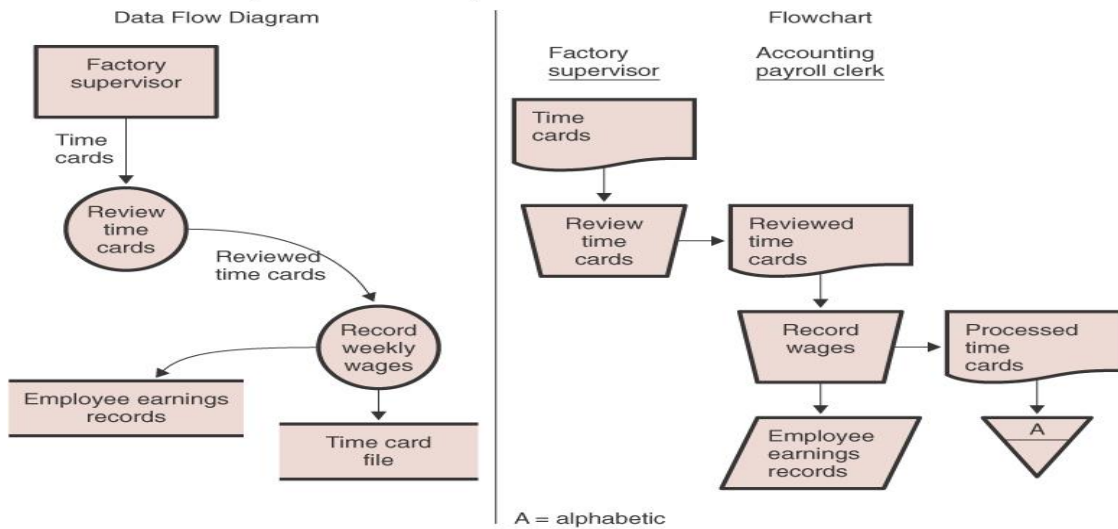
EXHIBIT 5-9

Level-One DFD



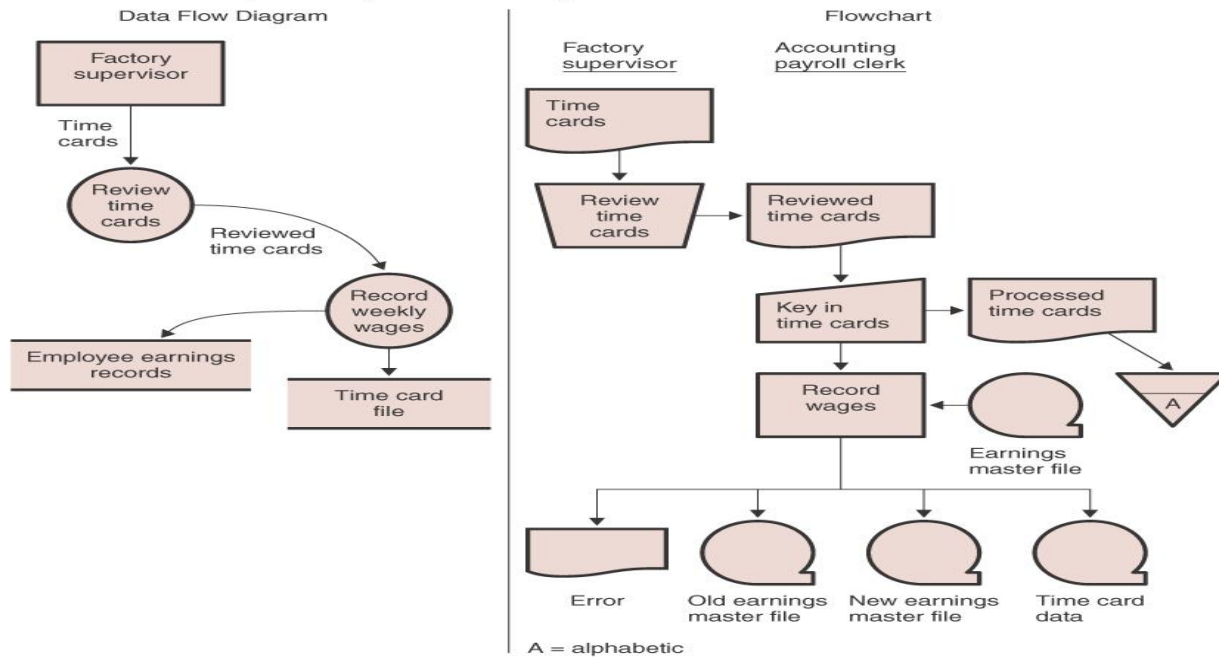
Comparing DFDs and Flowcharts

EXHIBIT 5-11 Payroll DFD versus System Flowchart



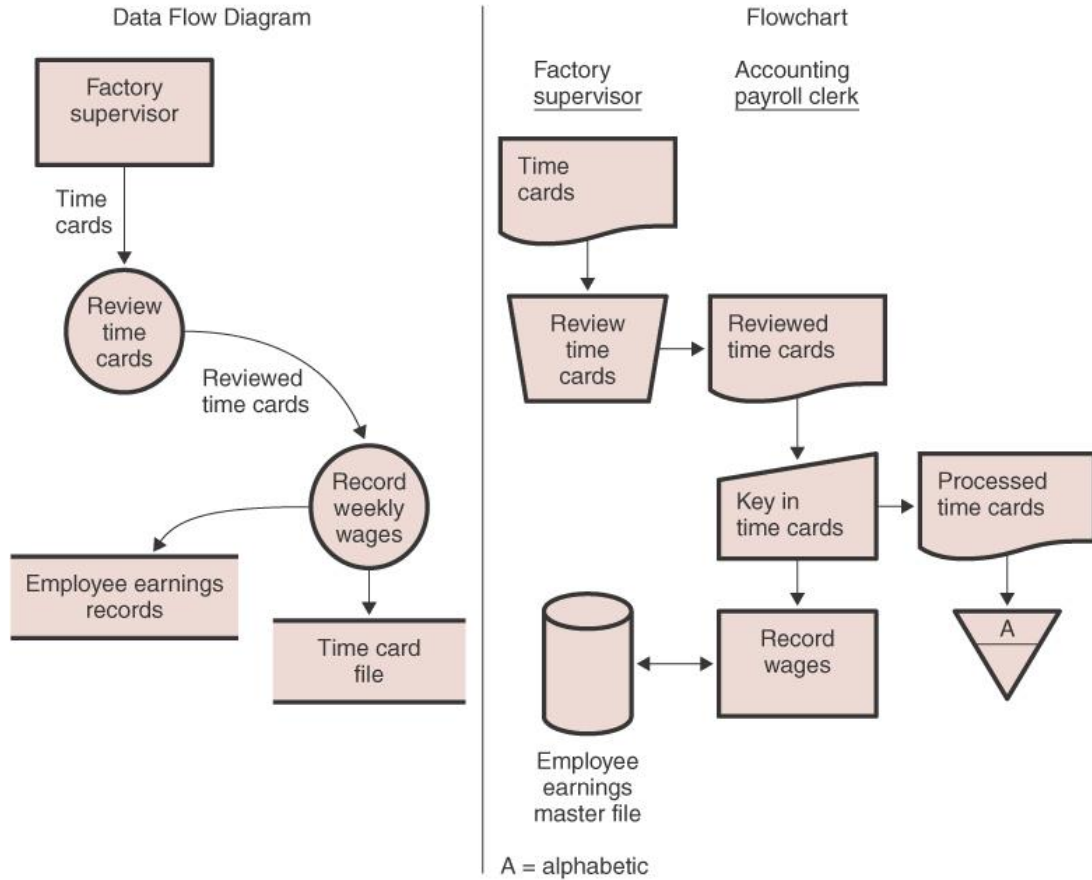
Comparing DFDs and Flowcharts

EXHIBIT 5-12 Updated Payroll DFD and System Flowcharts



Comparing DFDs and Flowcharts

EXHIBIT 5-13 Second Update to Payroll DFD and System Flowcharts



SUMMARY

- Task level modeling represents workflow activities within enterprise information systems
- Task level modeling is useful for representing the individual steps that make up events but which are subject to change and therefore should not serve as foundational elements in the enterprise database architecture
- System flowcharts and data flow diagrams are alternative means for representing task level models
 - Each has advantages and disadvantages
- To create task level models, one must understand physical media, file types, and processing methods