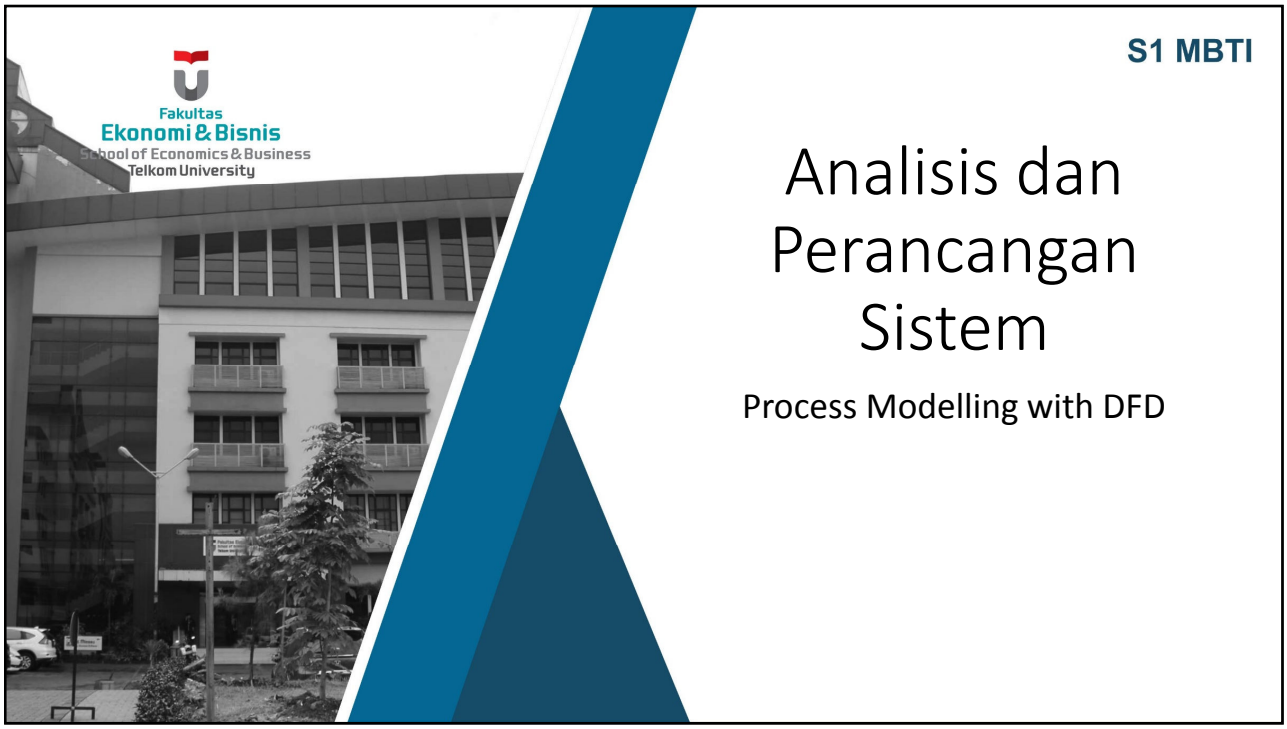


Process Modeling and DFDs

Process modeling – a technique used to organize and document a system's processes.

- Flow of data through processes
- Logic
- Policies
- Procedures

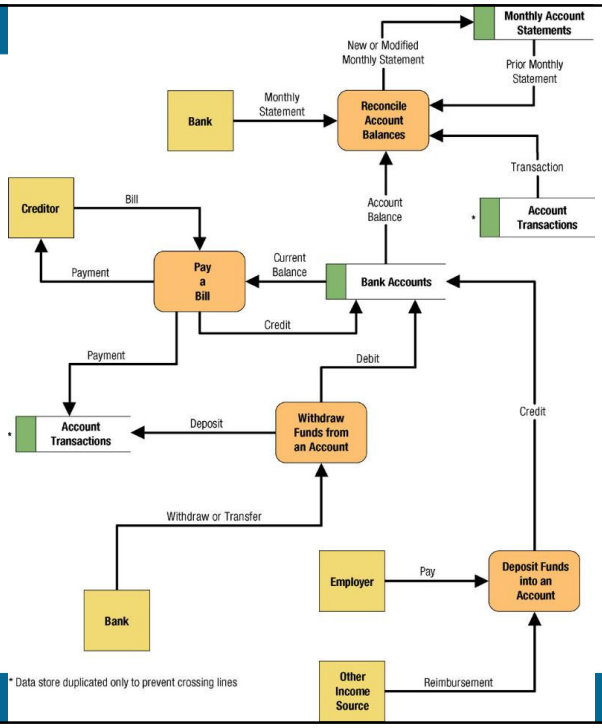
Data flow diagram (DFD) – a process model used to depict the flow of data through a system and the work or processing performed by the system. Synonyms are bubble chart, transformation graph, and process model.

DFDs have become a popular tool for business process redesign.

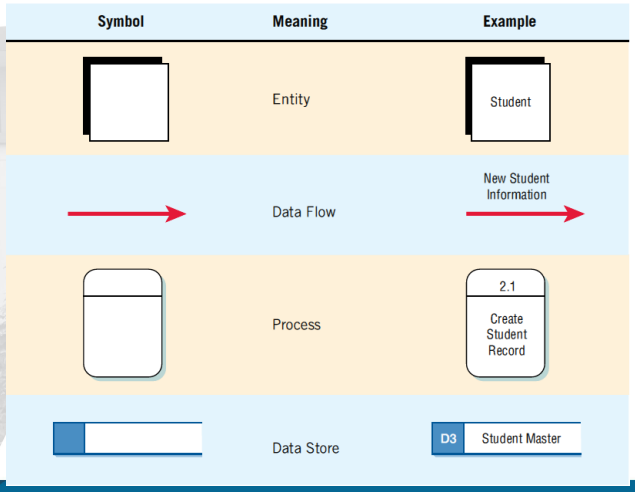
Advantages of the Data Flow Approach

- Freedom from committing to the technical implementation too early
- Understanding of the interrelatedness of systems and subsystems
- Communicating current system knowledge to users
- Analysis of the proposed system

Simple Data Flow Diagram



The Four Basic Symbols Used in Data Flow Diagrams, Their Meanings, and Examples (Figure 7.1)



Symbols for DFD

Yourdon notations (source: www.yourdon.com)

External Interactor	***External Entity:*** Source or destination of data
Process name	***Process:*** Action on data
Data store	***Data Store:*** Storage of data
	Data Flow: Data Transfer

Source: www.yourdon.com
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Differences Between DFDs and Flowcharts

- Processes on DFDs can operate in parallel (at-the-same-time)
  - Processes on flowcharts execute one at a time
- DFDs show the flow of data through a system
  - Flowcharts show the flow of control (sequence and transfer of control)
- Processes on a DFD can have dramatically different timing (daily, weekly, on demand)
  - Processes on flowcharts are part of a single program with consistent timing

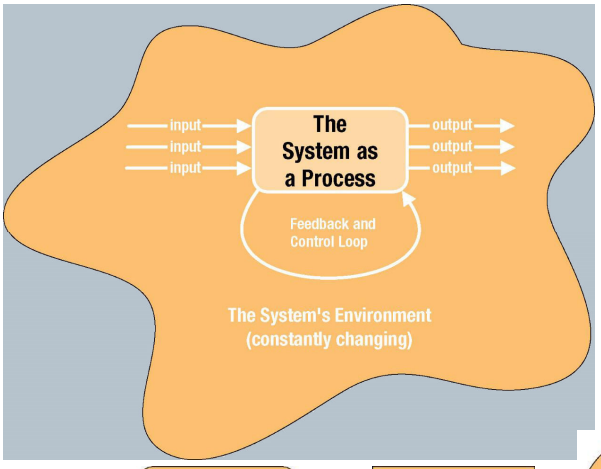
S1 MBTI

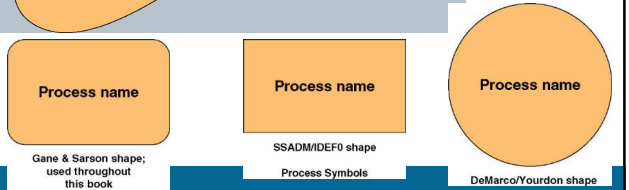
Process Concepts

Process – work performed by a system in response to incoming data flows or conditions. A synonym is *transform*.

Naming convention:

- Assign the name of the whole system when naming a high-level process
- To name a major subsystem attach the word subsystem to the name
- Use the form verb-adjective-noun for detailed processes

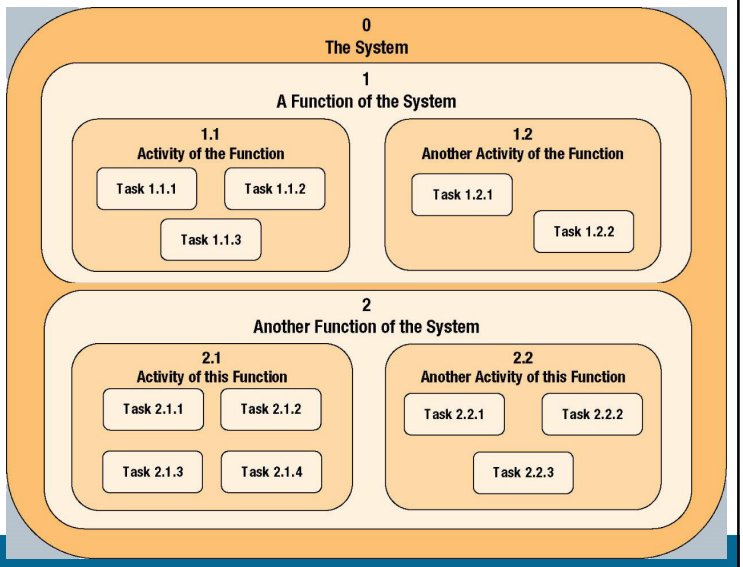




S1 MBTI

Process Decomposition

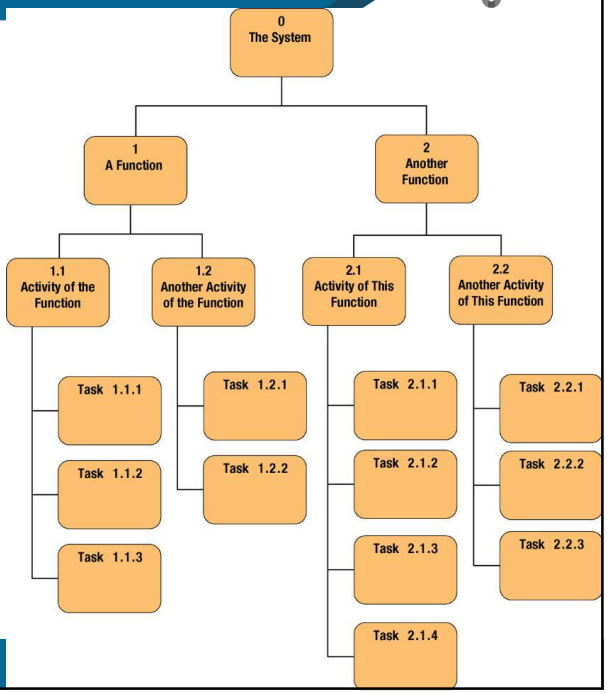
Decomposition – the act of breaking a system into sub-components. Each level of abstraction reveals more or less detail.



S1 MBTI

Decomposition Diagrams

Decomposition diagram – a tool used to depict the decomposition of a system. Also called hierarchy chart.



S1 MBTI

Types of Logical Processes

Function – a set of related and ongoing activities of a business.

- A function has no start or end.

Event – a logical unit of work that must be completed as a whole. Sometimes called a *transaction*.

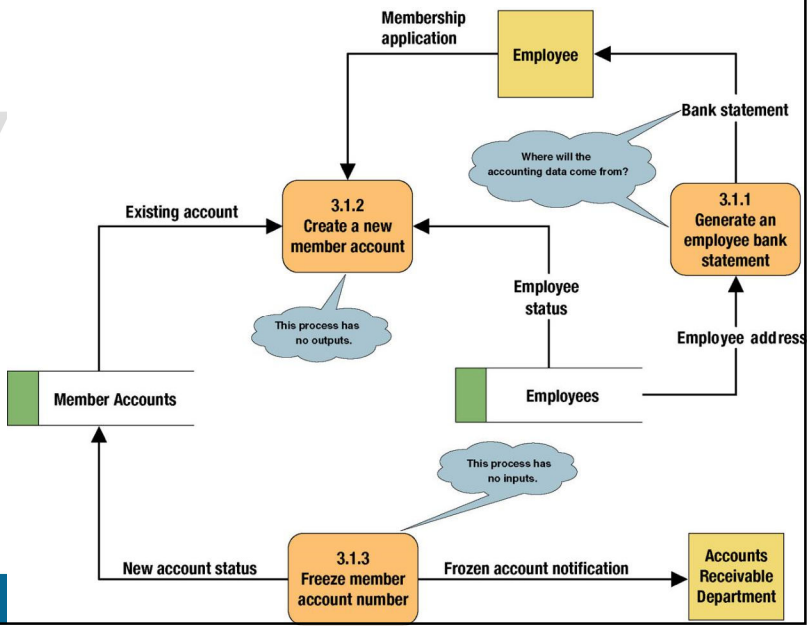
- An event is triggered by a discrete input and is completed when the process has responded with appropriate outputs.
- Functions consist of processes that respond to events.

Elementary process – a discrete, detailed activity or task required to complete the response to an event. Also called a *primitive process*.

- The lowest level of detail depicted in a process model.
- Should be names with a strong action verb followed by an object clause that describes what the work is perform on (or for).

S1 MBTI

Common Process Errors on DFDs



S1 MBTI

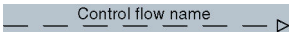
Data Flows & Control Flows

Data flow – data that is input to or output from a process.

- A data flow is data in motion
- Described with a noun
- A data flow may also be used to represent the creation, reading, deletion, or updating of data in a file or database (called a data store).

Control flow – a condition or nondata event that triggers a process.

- Used sparingly on DFDs.



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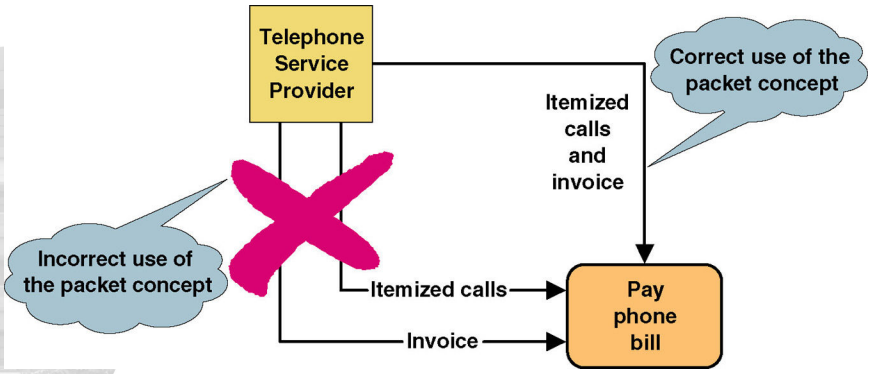
Data Flow Packet Concept



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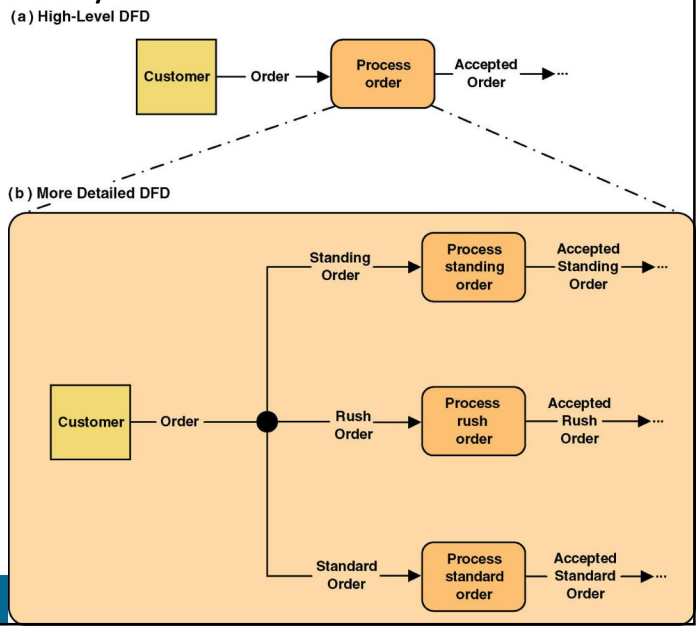
Composite and Elementary Data Flows



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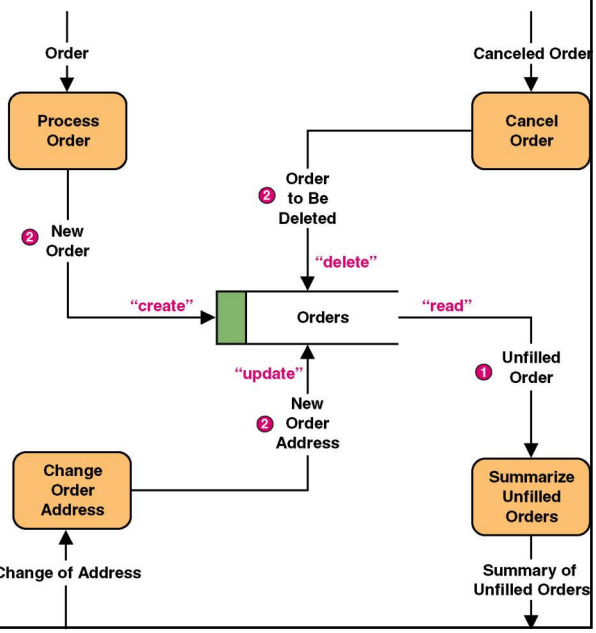
Data Flows to and from Data Stores



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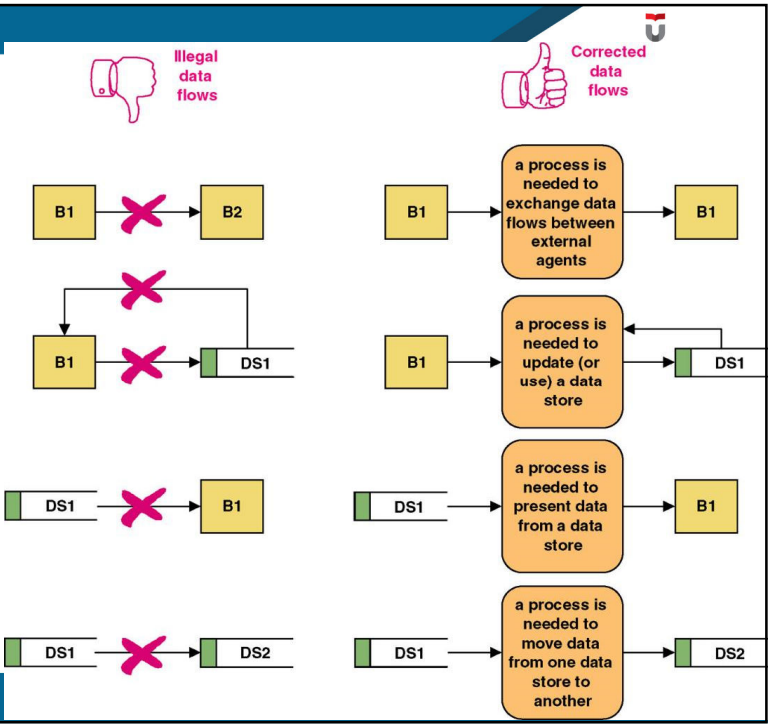
Illegal Data Flows



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Diverging and Converging Data Flows

Diverging data flow – a data flow that splits into multiple data flows.

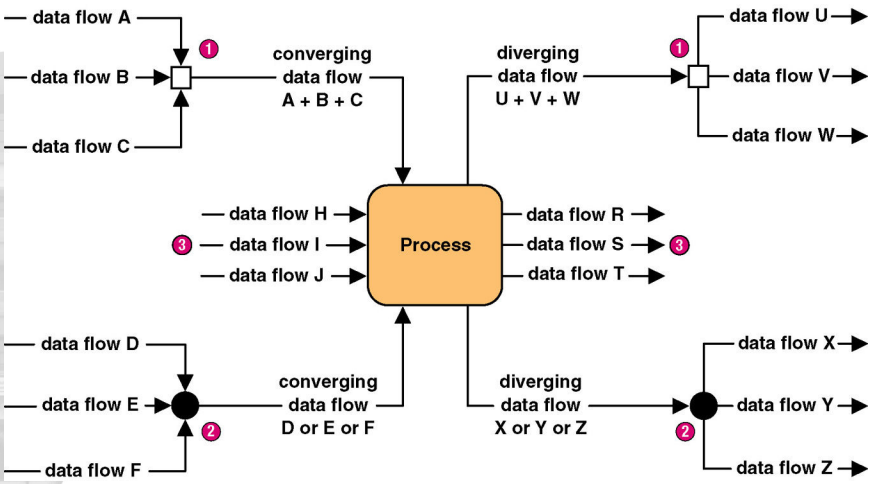
- Indicates data that starts out naturally as one flow, but is routed to different destinations.
- Also useful to indicate multiple copies of the same output going to different destinations.

Converging data flow – the merger of multiple data flows into a single packet.

- Indicates data from multiple sources that can (must) come together as a single packet for subsequent processing.

S1 MBTI

Diverging and Converging Data Flows



External Agents

External agent – an outside person, organization unit, system, or organization that interacts with a system. Also called an *external entity*.

- External agents define the "boundary" or scope of a system being modeled.
- As scope changes, external agents can become processes, and vice versa.
- Almost always one of the following:
  - Office, department, division.
  - An external organization or agency.
  - Another business or another information system.
  - One of your system's end-users or managers
- Named with descriptive, singular noun

Gane and Sarson shape

DeMarco/Yourdon shape

Data Stores

Data store – stored data intended for later use.
Synonyms are *file* and *database*.

- Frequently implemented as a file or database.
- A data store is "data at rest" compared to a data flow that is "data in motion."
- Almost always one of the following:
  - Persons (or groups of persons)
  - Places
  - Objects
  - Events (about which data is captured)
  - Concepts (about which data is important)
- Data stores depicted on a DFD store all instances of data entities (depicted on an ERD)
- Named with plural noun

Gane and Sarson shape

Data Store

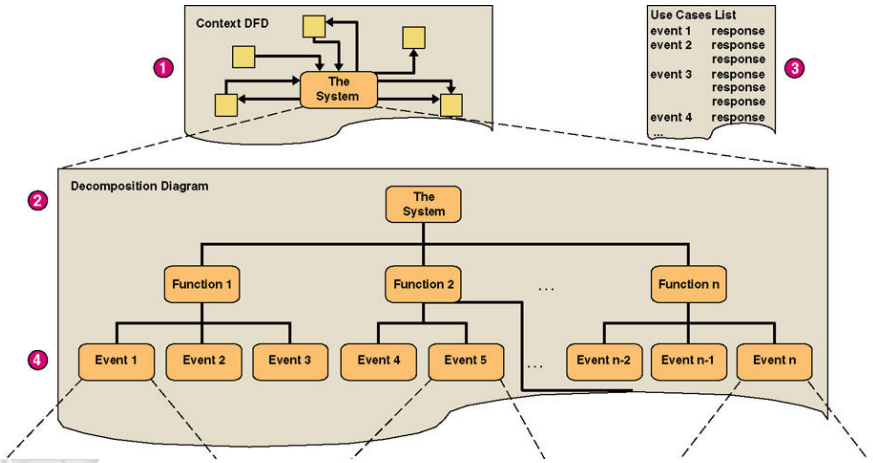
DeMarco/Yourdon shape

Modern Structured Analysis

1. Draw a context DFD to establish initial project scope.
2. Draw a functional decomposition diagram to partition the system into subsystems.
3. Create an event-response or use-case list for the system to define events for which the system must have a response.
4. Draw an event DFD (or event handler) for each event.
5. Merge event DFDs into a system diagram (or, for larger systems, subsystem diagrams).
6. Draw detailed, primitive DFDs for the more complex event handlers.
7. Document data flows and processes in the data dictionary.

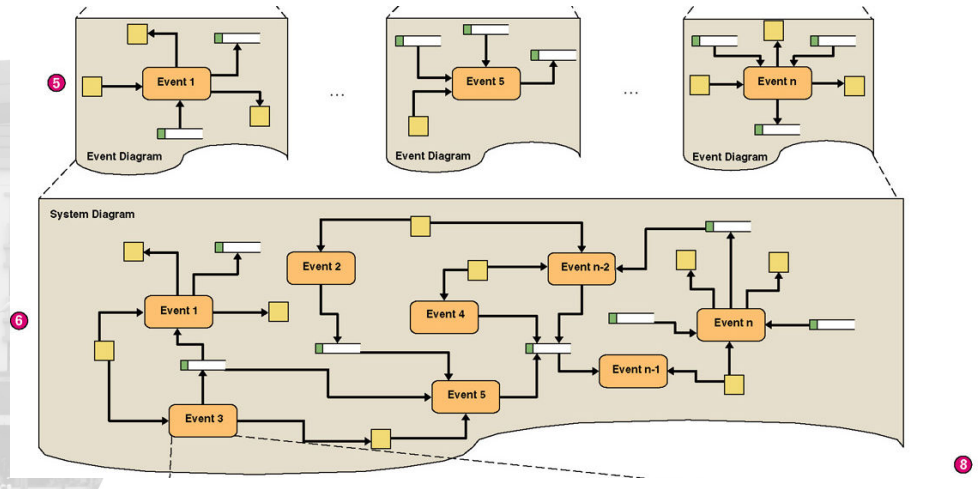
THE ABOVE METHODOLOGY, BASED ON EVENT PARTITIONING, IS MORE COMMONLY PRACTICED.

Structured Analysis Diagram Progression (1 of 3)



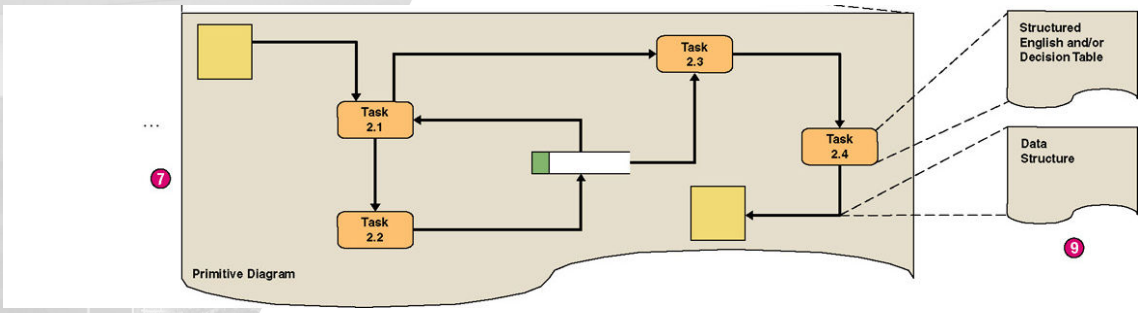
S1 MBTI

Structured Analysis Diagram Progression (2 of 3)



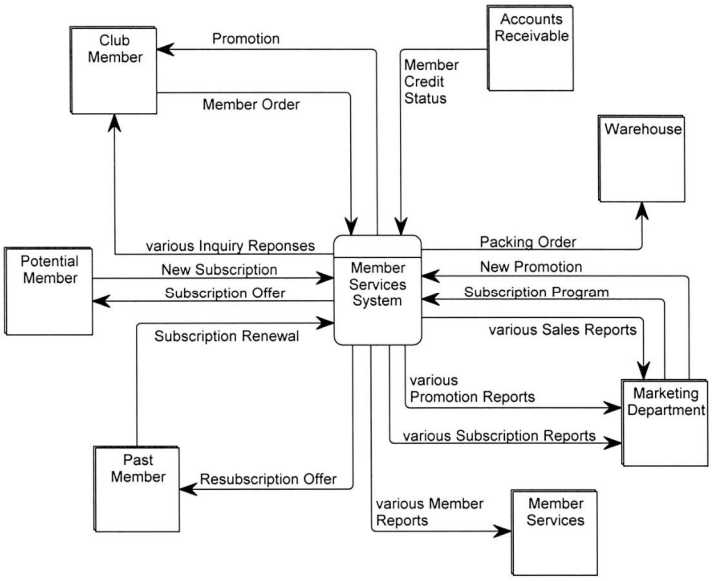
S1 MBTI

Structured Analysis Diagram Progression (3 of 3)



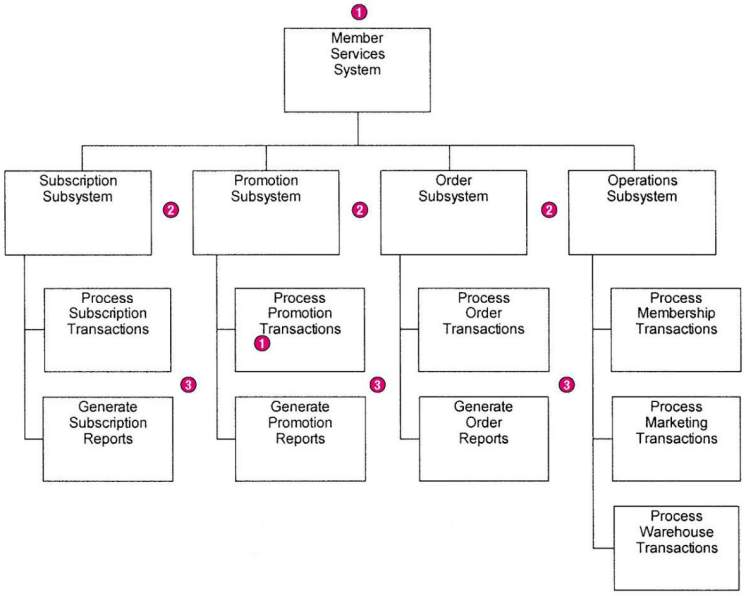
S1 MBTI

SoundStage Context DFD



S1 MBTI

SoundStage Functional Decomposition Diagram



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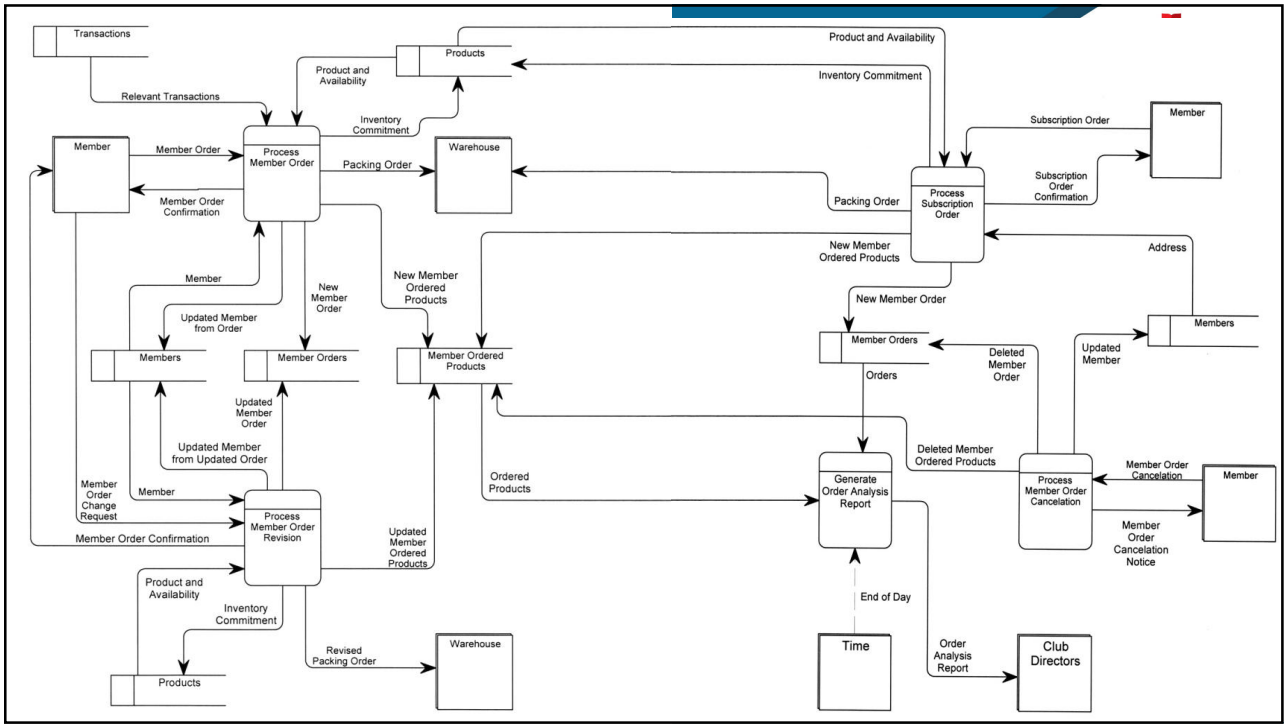


Another approach in developing DFD….

Steps in Developing Data Flow Diagrams

(Figure 7.2)

Developing Data Flow Diagrams Using a Top-Down Approach

1. Make a list of business activities and use it to determine various
   - External entities
   - Data flows
   - Processes
   - Data stores
2. Create a context diagram that shows external entities and data flows to and from the system. Do not show any detailed processes or data stores.
3. Draw Diagram 0, the next level. Show processes, but keep them general. Show data stores at this level.
4. Create a child diagram for each of the processes in Diagram 0.
5. Check for errors and make sure the labels you assign to each process and data flow are meaningful.
6. Develop a physical data flow diagram from the logical data flow diagram. Distinguish between manual and automated processes, describe actual files and reports by name, and add controls to indicate when processes are complete or errors occur.
7. Partition the physical data flow diagram by separating or grouping parts of the diagram in order to facilitate programming and implementation.

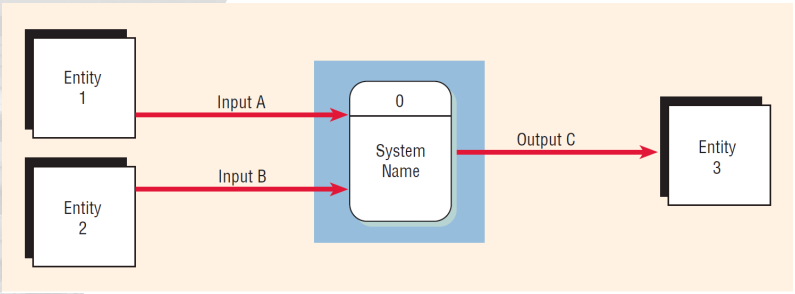
Creating the Context Diagram

- The highest level in a data flow diagram
- Contains only one process, representing the entire system
- The process is given the number 0
- All external entities, as well as major data flows are shown

Basic Rules

- The data flow diagram must have one process
- Must not be any freestanding objects
- A process must have both an input and output data flow
- A data store must be connected to at least one process
- External entities should not be connected to one another

Context Diagram (Figure 7.3)



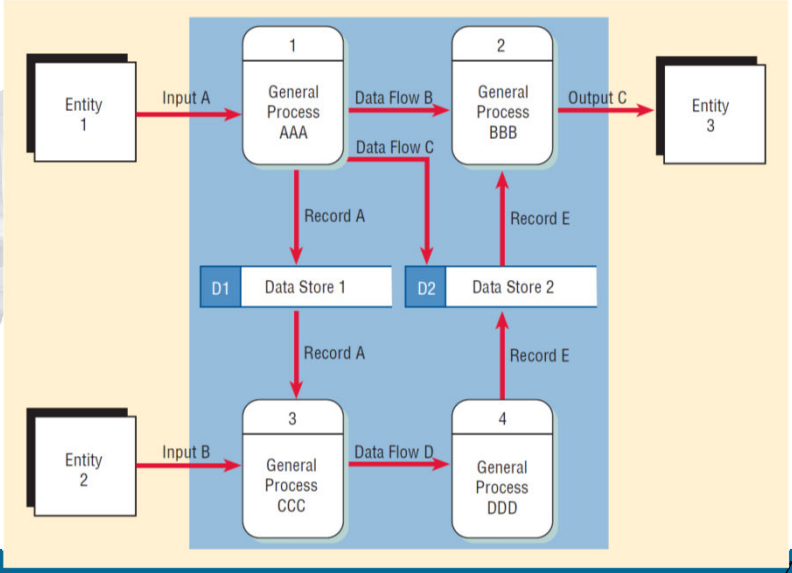
Drawing Diagram 0

- The explosion of the context diagram
- May include up to nine processes
- Each process is numbered
- Major data stores and all external entities are included

Drawing Diagram 0 (continued)

- Start with the data flow from an entity on the input side
- Work backward from an output data flow
- Examine the data flow to or from a data store
- Analyze a well-defined process
- Take note of any fuzzy areas

Note Greater Detail in Diagram 0 (Figure 7.3)



Data Flow Diagram Levels

- Data flow diagrams are built in layers
- The top level is the context level
- Each process may explode to a lower level
- The lower level diagram number is the same as the parent process number
- Processes that do not create a child diagram are called primitive

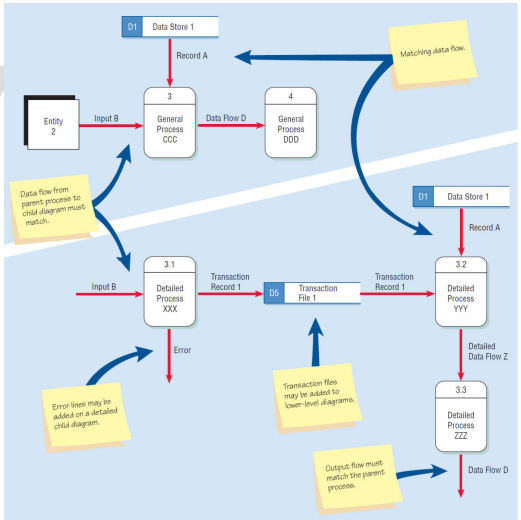
Creating Child Diagrams

- Each process on diagram 0 may be exploded to create a child diagram
- A child diagram cannot produce output or receive input that the parent process does not also produce or receive
- The child process is given the same number as the parent process
  - Process 3 would explode to Diagram 3

Creating Child Diagrams (continued)

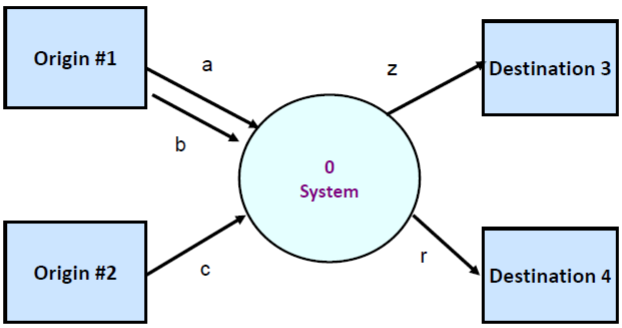
- Entities are usually not shown on the child diagrams below Diagram 0
- If the parent process has data flow connecting to a data store, the child diagram may include the data store as well
- When a process is not exploded, it is called a primitive process

Differences between the Parent Diagram (above) and the Child Diagram (below) (Figure 7.4)



Another Example…

Level 0 CD



Explanation:
a: .....
b: .....
c: ..... Etc

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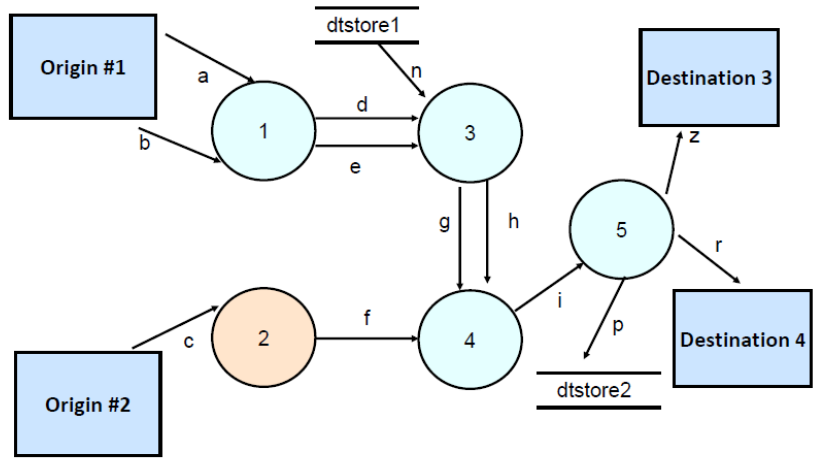
Level 1 DFD



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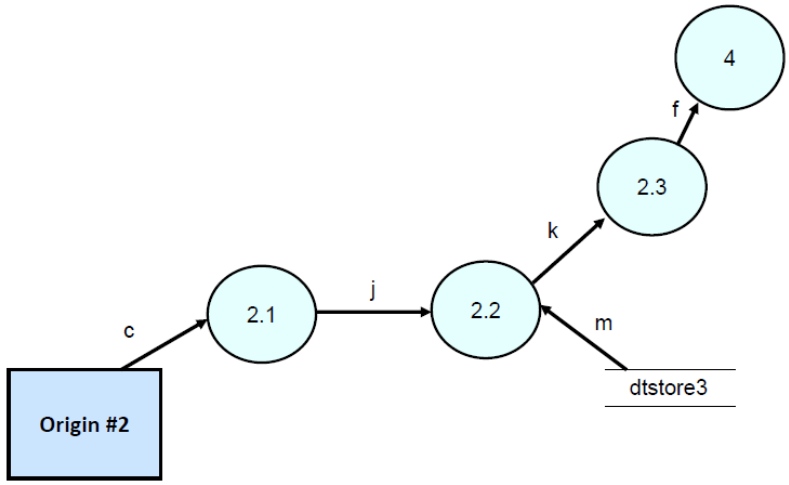
Level 2 DFD



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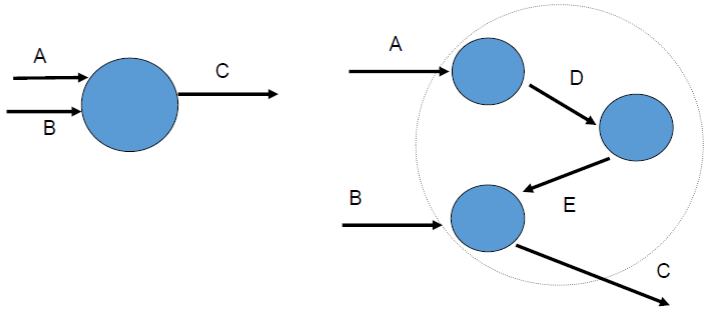
THE IMPORTANT IS….

Balancing ➢ **The conservation of input and output flows through different levels**



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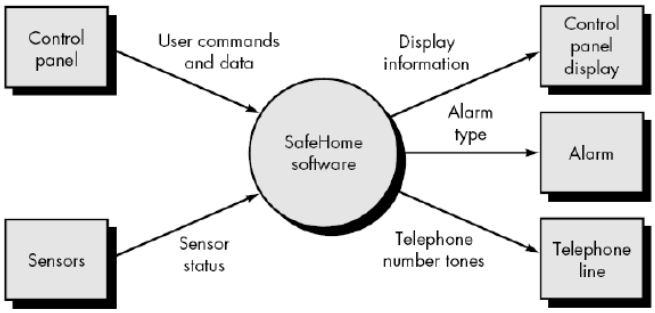
Example of Context Diagram

(Let's check with the rules together ^^ …)



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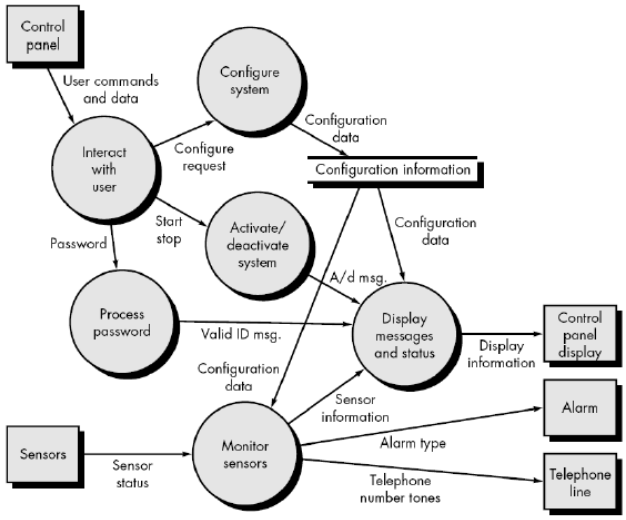
Example of DFD Level 1

(Let's check with the rules together ^^ ...)



Level 1 DFD for SafeHome

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S1 MBTI

Logical and Physical Data Flow Diagrams

- Logical
  - Focuses on the business and how the business operates
  - Not concerned with how the system will be constructed
  - Describes the business events that take place and the data required and produced by each event

S1 MBTI

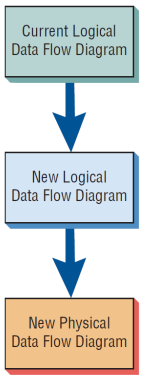
Logical and Physical Data Flow Diagrams

- Physical
  - Shows how the system will be implemented
  - Depicts the system

Features Common of Logical and Physical Data Flow Diagrams (Figure 7.7)

Design Feature	Logical	Physical
What the model depicts	How the business operates.	How the system will be implemented (or how the current system operates).
What the processes represent	Business activities.	Programs, program modules, and manual procedures.
What the data stores represent	Collections of data regardless of how the data are stored.	Physical files and databases, manual files.
Type of data stores	Show data stores representing permanent data collections.	Master files, transition files. Any processes that operate at two different times must be connected by a data store.
System controls	Show business controls.	Show controls for validating input data, for obtaining a record (record found status), for ensuring successful completion of a process, and for system security (example: journal records).

The Progression of Models from Logical to Physical
(Figure 7.8)

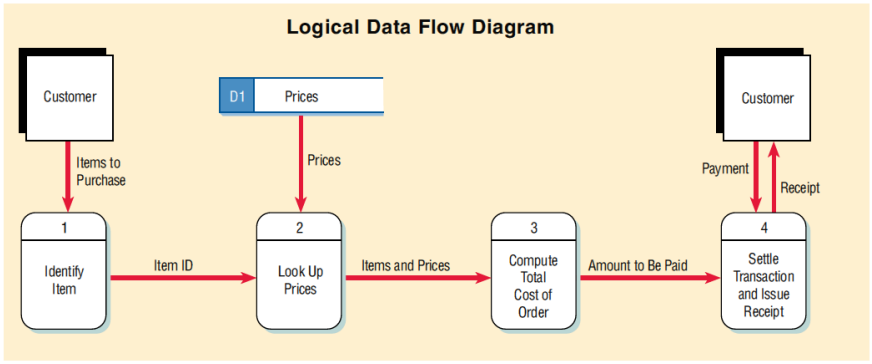


Derive the logical data flow diagram for the current system by examining the physical data flow diagram and isolating unique business activities.

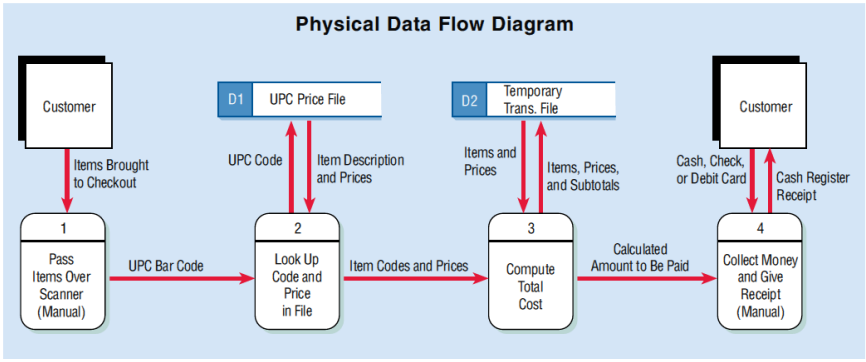
Create the logical data flow diagram for the new system by adding the input, output, and processes required in the new system to the logical data flow diagram for the current system.

Derive the physical data flow diagram by examining processes on the new logical diagram. Determine where the user interfaces should exist, the nature of the processes, and necessary data stores.

Logical Data Flow Diagram Example (Figure 7.9)



Physical Data Flow Diagram Example (Figure 7.9)



CRUD Matrix

- The acronym CRUD is often used for
  - Create
  - Read
  - Update
  - Delete
- These are the activities that must be present in a system for each master file
- A CRUD matrix is a tool to represent where each of these processes occurs in a system

CRUD Matrix (Figure 7.11)

Activity	Customer	Item	Order	Order Detail
Customer Logon	R			
Item Inquiry		R		
Item Selection		R	C	C
Order Checkout	U	U	U	R
Add Account	C			
Add Item		C		
Close Customer Account	D			
Remove Obsolete Item		D		
Change Customer Demographics	RU			
Change Customer Order	RU	RU	RU	CRUD
Order Inquiry	R	R	R	R

Sample Data to Process CRUD Matrix

Data-to-Process-CRUD Matrix

Entity . Attribute	Process Customer Application	Process Customer Credit Application	Process Customer Change of Address	Process Internal Customer Credit Change	Process New Customer Order	Process Customer Order Cancellation	Process Customer Change to Outstanding Order	Process Internal Change to Customer Order	Process New Product Addition	Process Product Withdrawal from Market	Process Product Price Change	Process Change to Product Specification	Process Product Inventory Adjustment
Customer	C	C			R	R	R	R					
.Customer Number	C	C			R	R	R	R					
.Customer Name	C	C	U		R		R	R					
.Customer Address	C	C	U		RU		RU	RU					
.Customer Credit Rating		C		U	R		R	R					
.Customer Balance Due					RU	U	R	R					
Order					C	D	RU	RU					
.Order Number					C		R	R					
.Order Date					C		U	U					
.Order Amount					C		U	U					
Ordered Product					C	D	CRUD	CRUD		RU			
.Quantity Ordered					C		CRUD	CRUD					
.Ordered Item Unit Price					C		CRUD	CRUD					
Product					R	R	R	R	C	D	RU	RU	RU
.Product Number					R	R	R	R	C			R	
.Product Name					R		R	R	C			RU	
.Product Description					R		R	R	C			RU	
.Product Unit of Measure					R		R	R	C		RU	RU	
.Product Current Unit Price					R		R	R			U		
.Product Quantity on Hand					RU	U	RU	RU					RU

C = create R = read U = update D = delete