C H A P T E R

8

PROCESS MODELING

Models: Logical and Physical

A **model** is a representation of reality. Just as a picture is worth a thousand words, most models are pictorial representations of reality.

Logical models show *what* a system is or does. They are implementation *in*dependent; that is, they depict the system independent of any technical implementation.

Physical models show not only what a system is or does, but also *how* the system is (to be) physically and technically implemented. They are implementation *de*pendent because they reflect technology choices.

Process Modeling and DFDs

Process modeling is a technique for organizing and documenting the structure and flow of data through a system's processes, and/or the logic, policies, and procedures to be implemented by a system's processes.

A data flow diagram (DFD) is a tool (and type of process model) that depicts the flow of data through a system and the work or processing performed by that system.

DFDs have become a popular tool for business process redesign.

External Agents

- An external agent defines a person, organization unit, or other organization that lies outside of the scope of the project but that interacts with the system being studied.

  - External agents define the "boundary" or scope of a system being modeled.

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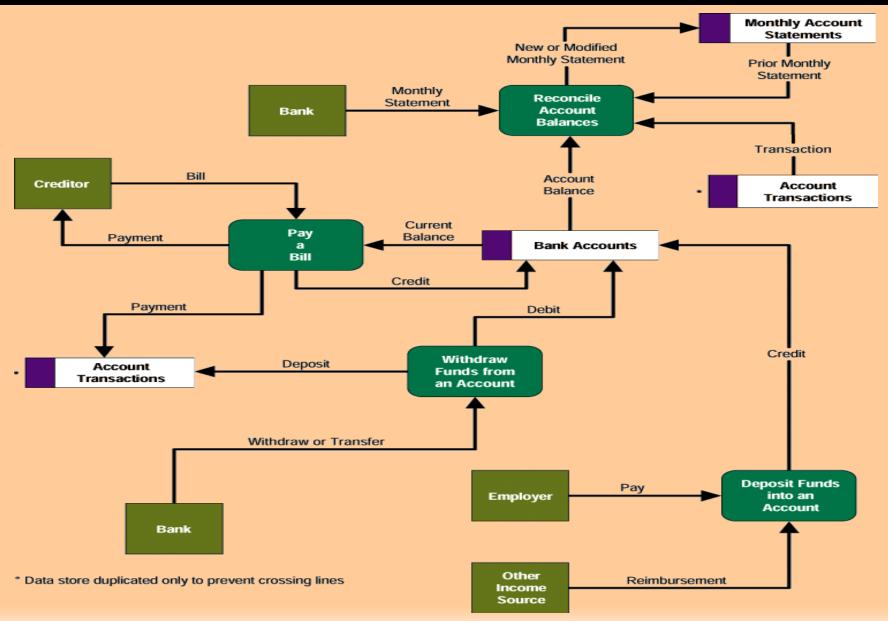
External Agent

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Data Stores

- A data store is an inventory of data.

    - 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)

	Data Store

DFD

- Three symbols and one connection:
  - Round rectangles represent processes or work to be done-process color
  - Square represents external agents-interface color
  - Open ended boxes represent data stores (sometimes called files or databases)
  - Arrows represent data flows, i/p and o/p to and from the process

Simple Data Flow Diagram

Monthly Account Statements

New or Modified Monthly Statement

Prior Monthly Statement

Bank → Monthly Statement → **Reconcile Account Balances**

Transaction

Creditor → Bill

Payment

Pay a Bill

Account Balance

Current Balance

* **Account Transactions**

Bank Accounts

Credit

Payment

Debit

* **Account Transactions**

Deposit ← **Withdraw Funds from an Account**

Credit

Withdraw or Transfer

Bank

Employer → Pay → **Deposit Funds into an Account**

Other Income Source → Reimbursement

* Data store duplicated only to prevent crossing lines

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 one DFD can have dramatically different timing

  – Processes on flowcharts are part of a single program with consistent (regular) timing
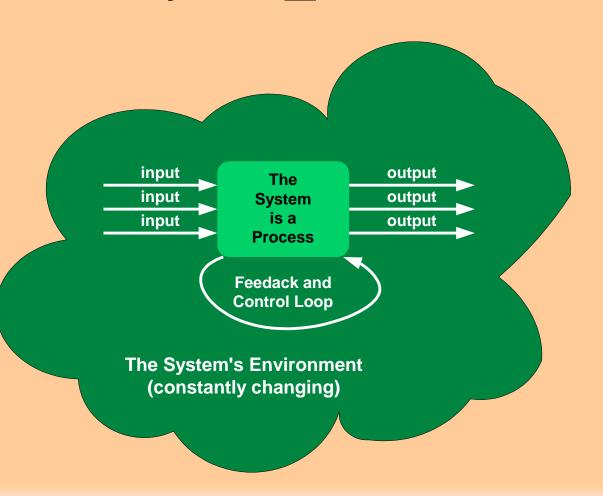
Systems Thinking

Systems thinking is the application of formal systems theory and concepts to systems problem solving.

DFDs are a tool that supports systems thinking.

Process Concepts

A **process** is work performed on, or in response to, incoming data flows or conditions.

A Process

A System <u>is</u> a Process

input
input
input

The System is a Process

output
output
output

Feedack and Control Loop

The System's Environment (constantly changing)

Decomposition
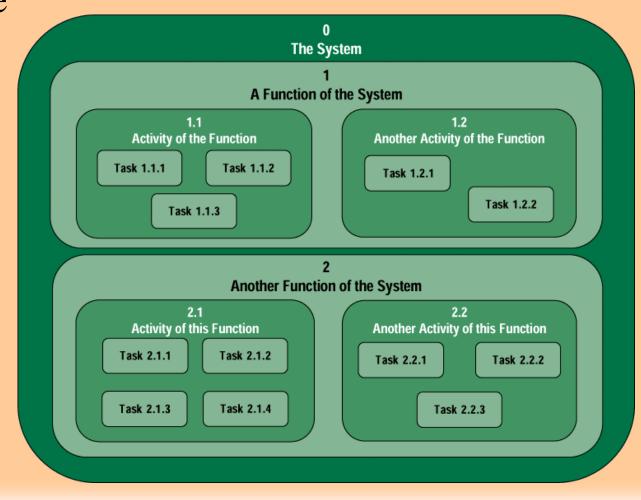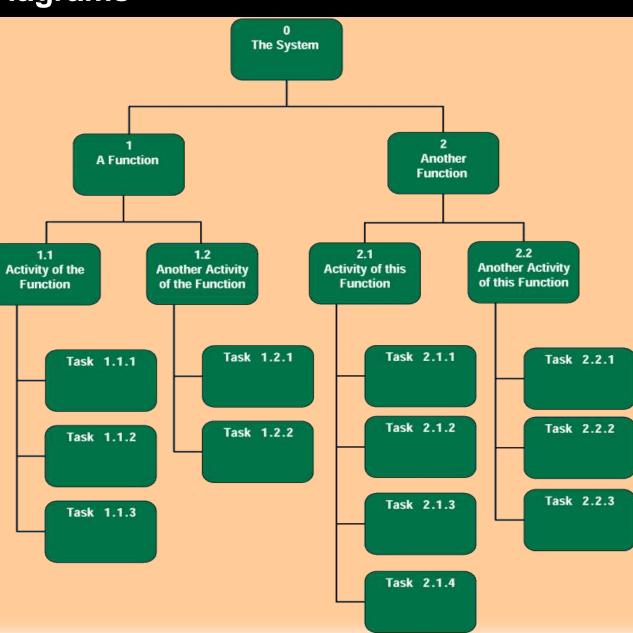
Decomposition is the act of breaking a system into its component subsystems, processes, and subprocesses.

System Decomposition

Decomposition Diagrams

A decomposition diagram or hierarchy chart shows the top-down, functional decomposition of a system.

```
                          0
                      The System
                          |
          +---------------+---------------+
          1                               2
      A Function                      Another
                                      Function
          |                               |
     +----+----+                     +-----+-----+
    1.1        1.2                  2.1          2.2
 Activity of  Another Activity   Activity of   Another Activity
 the Function of the Function    this Function of this Function
    |          |                    |            |
 Task 1.1.1  Task 1.2.1          Task 2.1.1    Task 2.2.1
    |          |                    |            |
 Task 1.1.2  Task 1.2.2          Task 2.1.2    Task 2.2.2
    |                               |            |
 Task 1.1.3                       Task 2.1.3    Task 2.2.3
                                    |
                                  Task 2.1.4
```
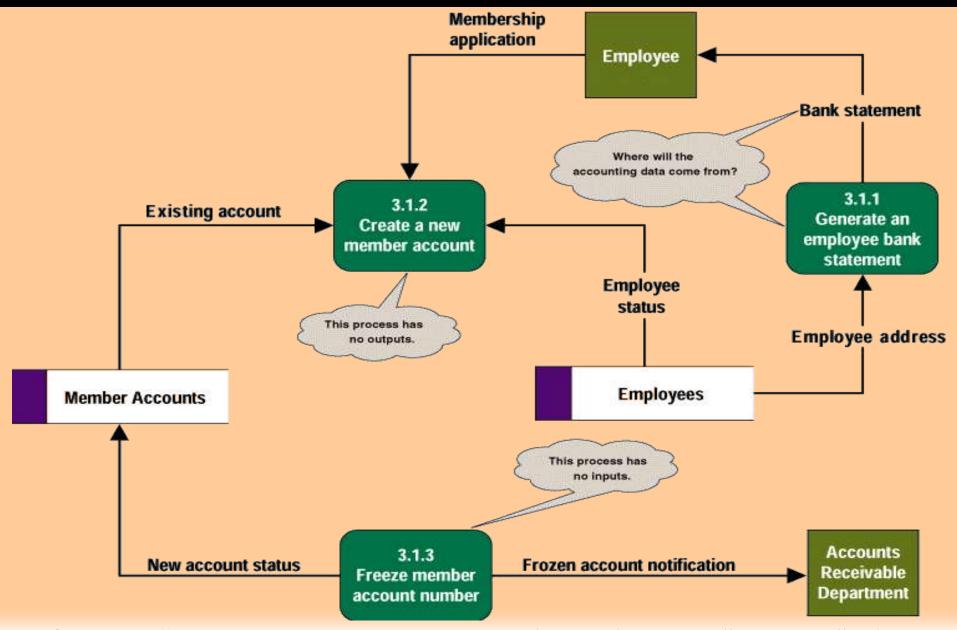
Types of Logical Processes

- A function is set of related and ongoing activities of a business.

- An event (or transaction) is a logical unit of work that must be completed as a whole (as part of a function).

- An elementary process (or primitive process) is a discrete, detailed activity or task required to respond to an event. Usually, several such tasks must be completed to respond to an event.

Common Process Errors on DFDs

- 3.1.2 has inputs but no outputs (it is called black hole because data enter the process and then disappear). In most cases the modeler simply forgot the output

- 3.1.3 has outputs but no inputs. Unless you are David Copperfield (most commercially successful magician in history) it's a miracle. In most cases the input flows were likely forgotten.

- 3.1.1 the inputs are insufficient to produce the o/p (it is called gray hole because
  - Misnamed process
  - Misnamed inputs and/or outputs
  - Incomplete facts

- gray holes are most common errors

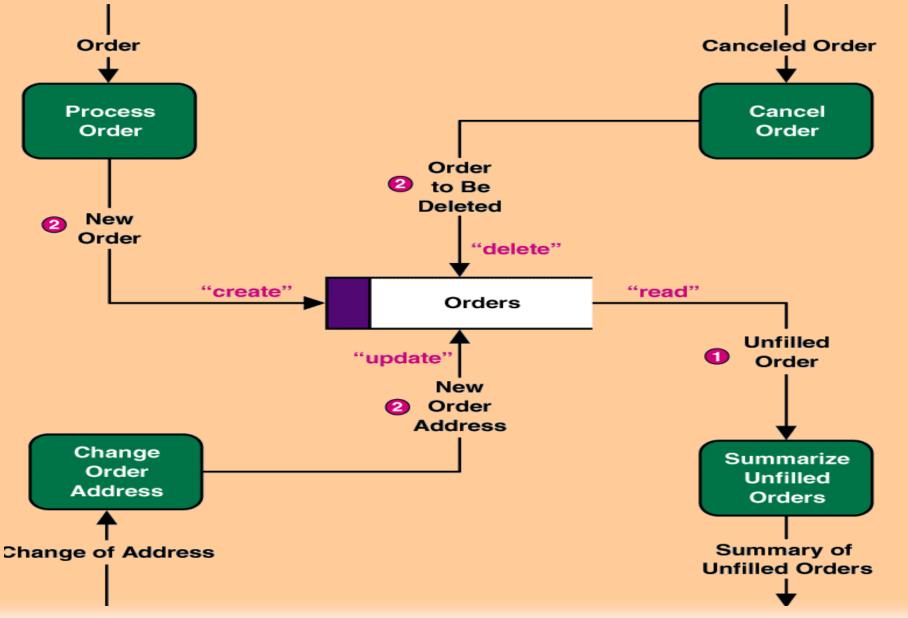# Common Process Errors on DFDs
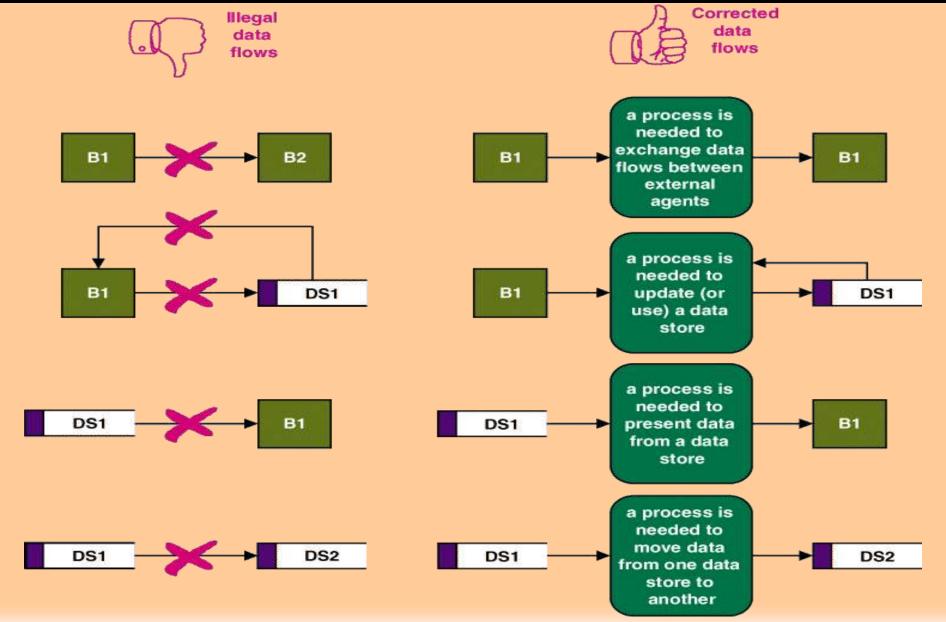
Data Flows & Control Flows

- A data flow represents an input of data to a process, or the output of data from a process.

  – 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).

  ←————————————

  – A composite data flow is a data flow that consists of other data flows.

- A control flow represents a condition or nondata event that triggers a process.

  – Used sparingly (carefully) on DFDs.

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Data Flows to and from Data Stores

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Illegal Data Flows

Data Types and Domains

Data attributes should be defined by data types and domains.

A data type defines what class of data can be stored in an attribute (e.g., character, integers, real numbers, dates, pictures, etc.).

A domain defines what values or range of values an attribute can legitimately (legally) take on.

Diverging and Converging Data Flows

- A diverging data flow is one that splits into multiple data flows.

  – Useful for illustrating data that starts out naturally as one flow, but needs to be routed to parallel processes.

  – Also useful for illustrating multiple copies of the same output going to different destinations.

- A converging data flow is the merger of multiple data flows into a single packet.

  – Useful for illustrating data from multiple sources that must come back together for some subsequent (consequent)processing

Diverging and Converging Data Flows