King Saud University

College of Engineering

IE – 462: "Industrial Information Systems"

Fall – 2022 (1st Sem. 1444H)

Chapter 4:

Structured Analysis and Functional Architecture Design – p2 – DFD – i - Fundamentals

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Lesson Overview

- Modeling IIS – (p1)
- Integrated Computer-Aided Manufacturing Definition 0 (IDEF0) – (p1)
- **Data Flow Diagram (DFD) – (p2)**
  i. **Fundamentals**
  ii. Diagramming Rules
  iii. Case Studies

DFD – part i – Fundamentals

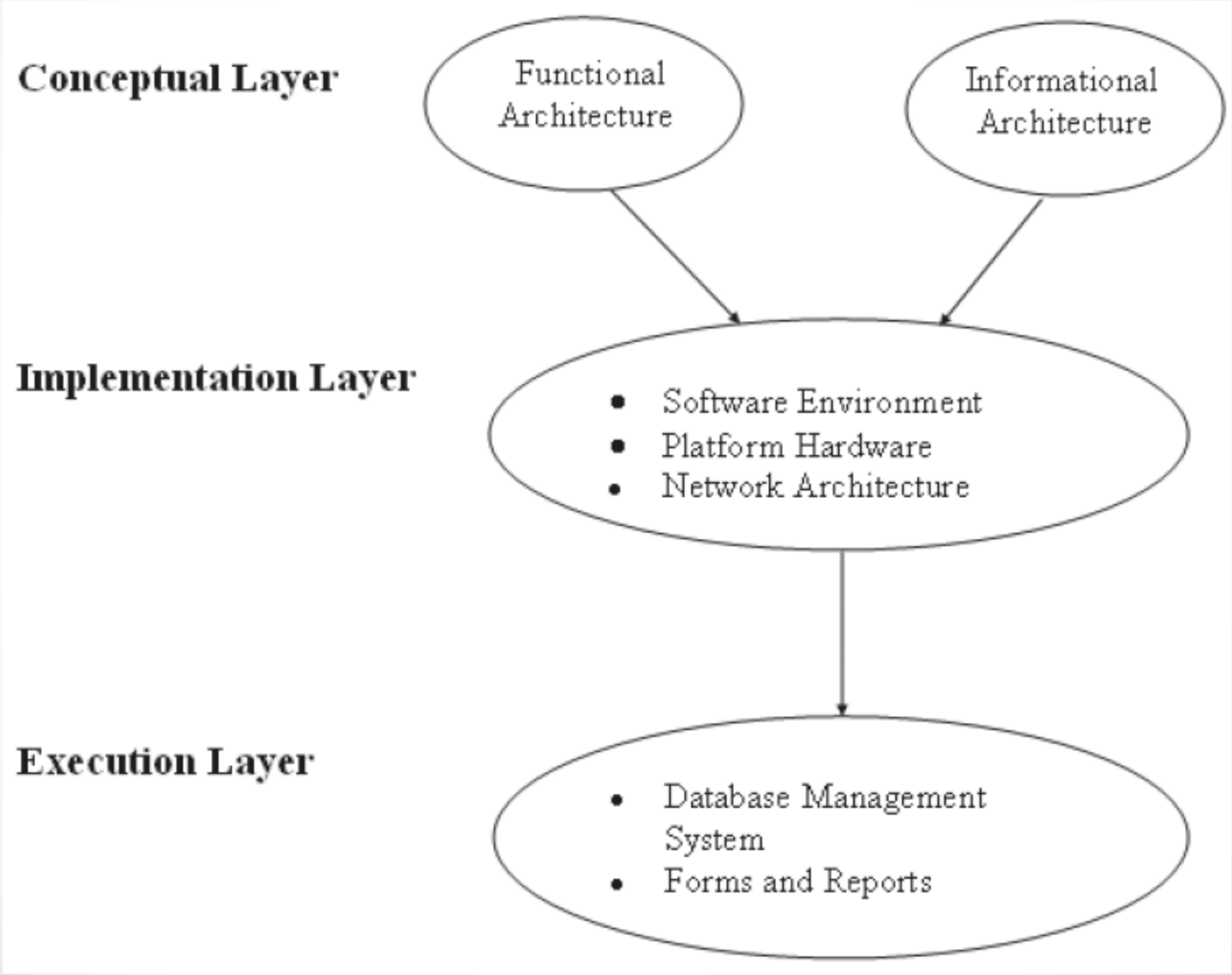
- Introduction to DFD
- DFA/DFD Modeling Primitives

Functional/Process Modeling:

2. Data Flow Diagram (DFD)

Introduction to DFD

Layers of IS Design Process



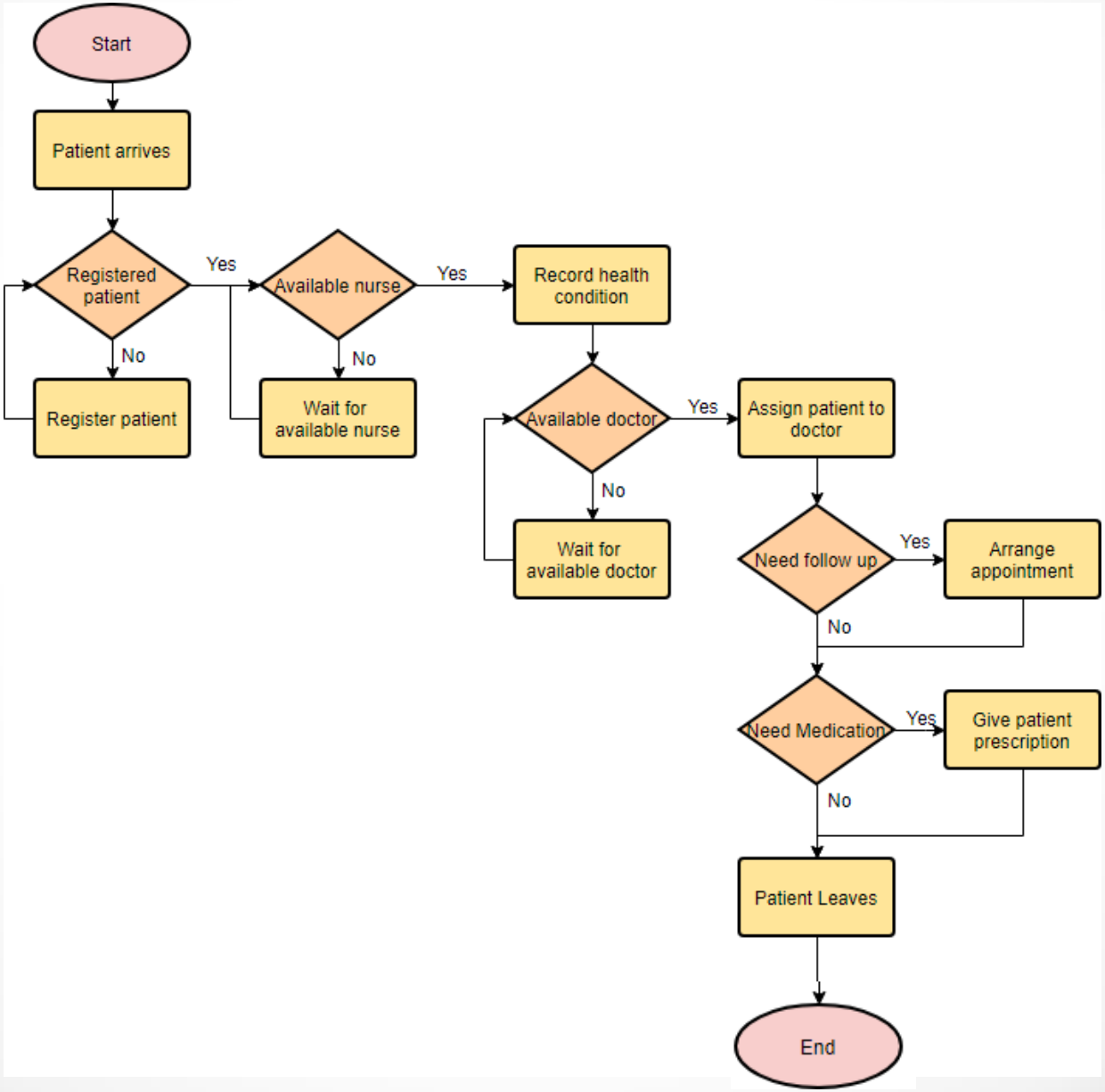
Functional/Process Modeling

- *Remember*: two methodologies for designing a functional architecture, known as "structured analysis" techniques:
  - ***data flow diagrams*** (1979), widely used by information system professionals in all industries
  - ***structured analysis and design technique*** (SADT) (1988), adapted for manufacturing enterprises under the name ***integrated computer-aided manufacturing definition 0*** (IDEF0)
  - Both methodologies are based on graphical notations used to describe information flows among processes of the enterprise being documented

Functional/Process Modeling

- Graphically represent the processes that capture, manipulate, store, and distribute data:
  - between a system and its environment
  - and among system components
- Useful for depicting purely *logical* information flows
- DFDs differ from system flowcharts which depict a *procedure* (see next slide)

System Flowchart (example)



DFDs vs. IDEF0

- **Data Flow Diagrams** (DFD), aka **Data Flow Analysis** (DFA) is an alternative to IDEF0 that is widely used in all industries, both in modeling:
  - manufacturing, and
  - service processes and operations
- It differs from IDEF0 in that it focuses exclusively on business *processes* and the *information that flows* among processes, *ignoring* (unlike IDEF0):
  - material flows
  - mechanisms, and
  - controls

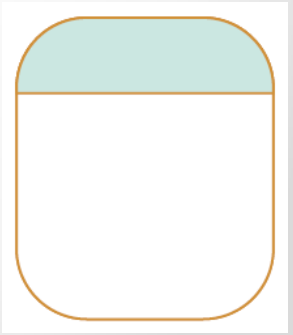
DFA/DFD Modeling Primitives

Components of DFD

- Data flow diagrams are constructed using four symbols:
  - **Process**
  - **Data Flow**
  - **Data Store**
  - **Sources and Sinks**

Components of DFD (cont.)

- **Process**:
  - work or actions performed on data (inside the system) so that they are transformed, stored, or distributed
  - represents people/procedures that transform data
  - each process *must* have data entering it and exiting it (otherwise, it does not belong in a DFD)
  - *Gane and Sarson* symbol:
    - upper portion is used to indicate the number of the process
    - lower portion is a name for the process (e.g. Generate Paycheck, Calculate Overtime Pay)



Components of DFD (cont.)

- **Data flow**:
  - arrows indicate the direction in which the data move (i.e. "*data in motion,*" from one place in a system to another)
  - "data" is a general concept; e.g. data sent to a computer file, or information given from one process to another process
  - remember, arrows are *not* used to indicate physical flow of materials (as in IDEF0)
  - arrow is labeled with a meaningful name for data in motion (e.g. Customer Order, Sales Receipt, or Paycheck)

Components of DFD (cont.)

- **Data store**:
  - place where data are preserved as a record inside the system ("*data at rest*")
  - e.g. computer file or paper filing cabinet
  - note, there is *no* explicit construct in IDEF0 that is analogous to a data store
  - *Gane and Sarson* symbol:
    - left end: a small box used to number the data store
    - inside the main part of the rectangle is a meaningful label for the data store (e.g. Student File, Transcripts, or Roster of Classes)

Components of DFD (cont.)

- **Sources and sinks**:
  - external entity that is origin –source– or destination –sink– of data (outside the system)
  - it represents how at the boundaries, DFA system interacts with outside people, processes, organizations, other information systems (note, this is similar to IDEF0 model)
  - **Sources**: entities outside the system that provide data input to the system (usually trigger events in the system); e.g. customer
  - **Sinks**: entities outside the system that receive data
  - note, same entity may be both a source and a sink if it both sends data to and receives data from the system
  - sources/sinks have a name that states what the external agent is (e.g. Customer, Teller, Inventory Control System)

Components of DFD (cont.)

Sources and sinks (cont.):

- Sources and sinks, *do not* consider the following:
  - Interactions that occur between sources and sinks
  - What a source or sink does with information (i.e. source or sink is a "black box")
  - How to control or redesign a source or sink (assumed to be fixed)
  - How to provide sources and sinks direct access to stored data (since they cannot directly access or manipulate data stored within the system)

DFD Symbols/Notation

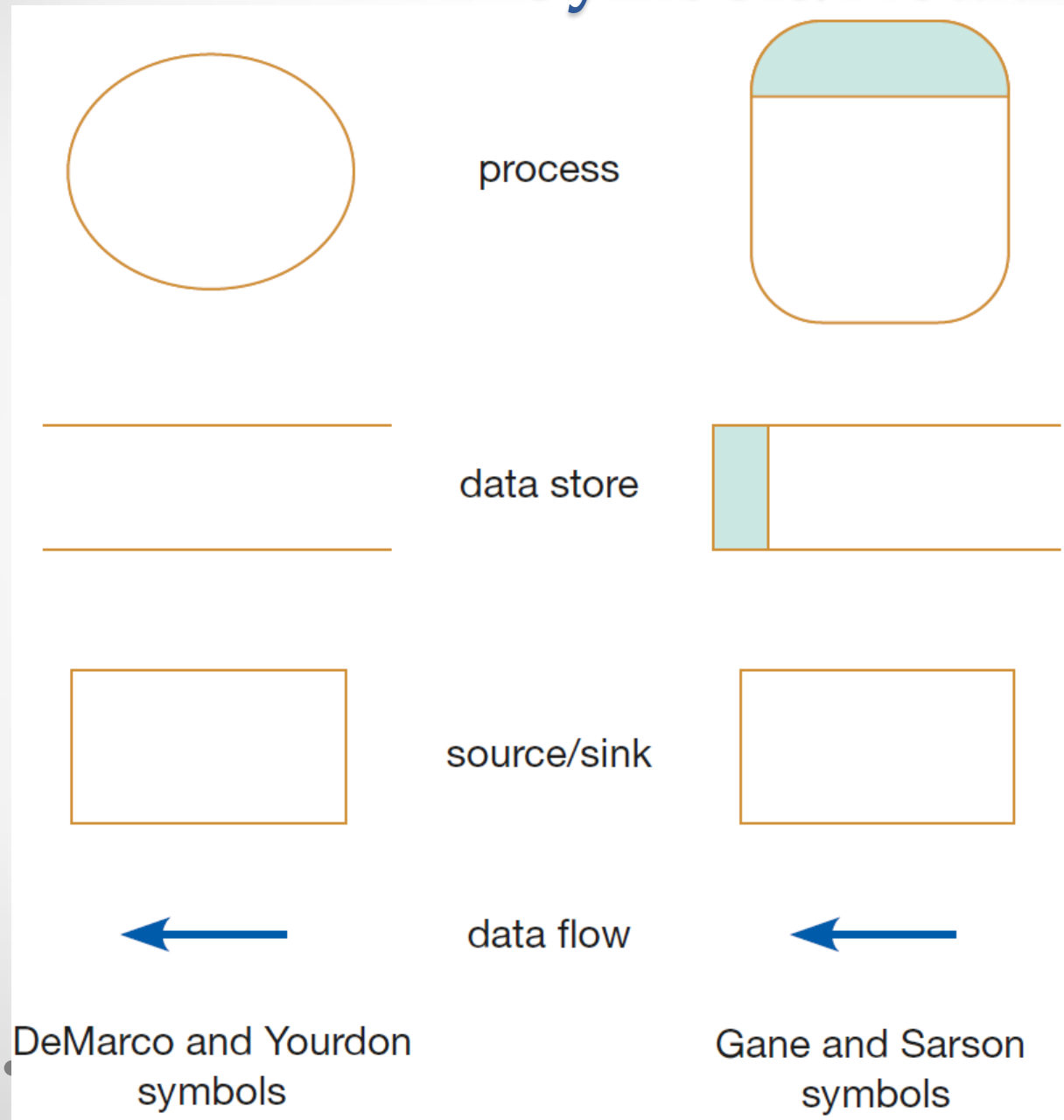


FIGURE 7-2
Comparison of DeMarco and Yourdon and Gane and Sarson DFD symbol sets

DFD Symbols/Notation (contd.)

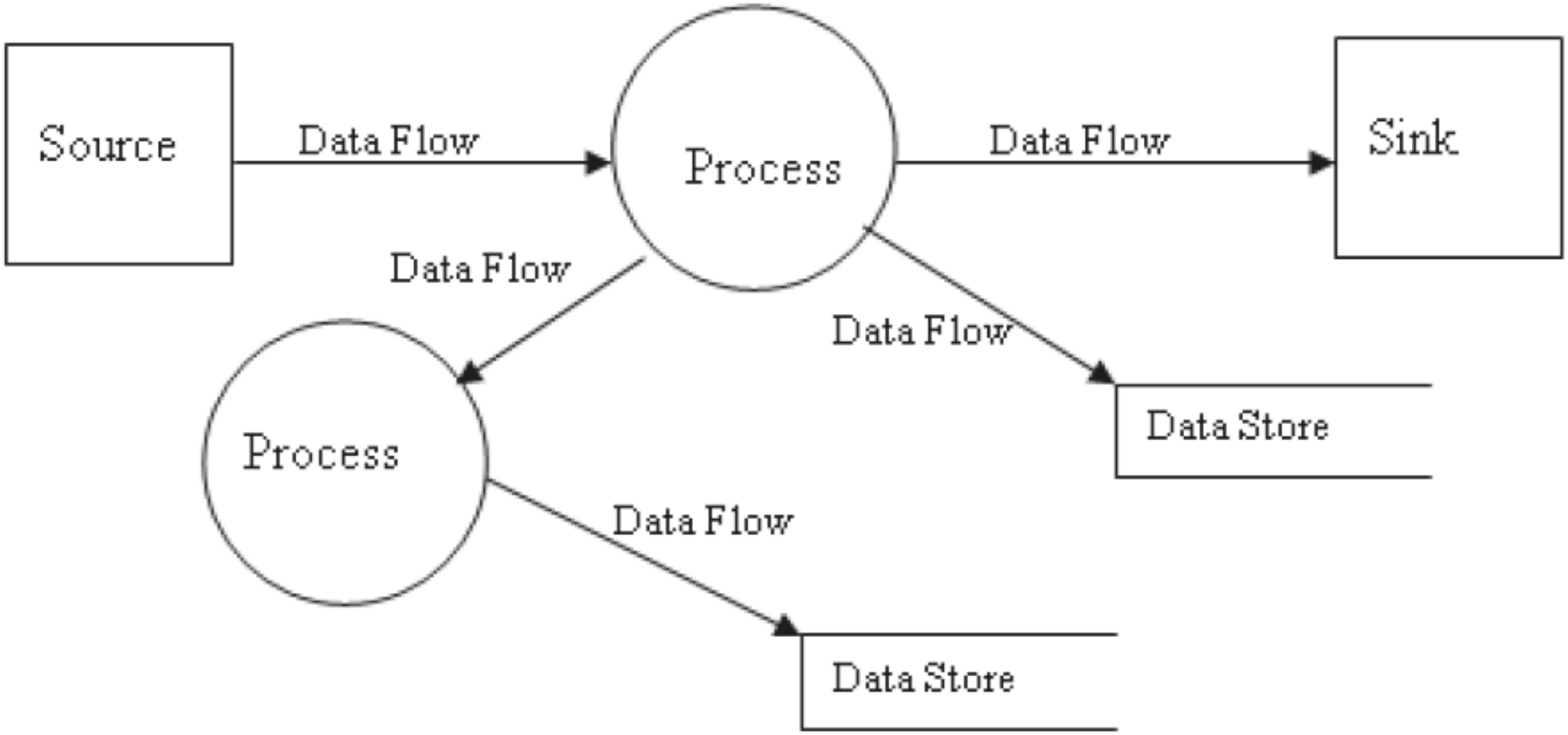


Figure 4.14 Generic data flow diagram.

Components of DFD (cont.)

Sources and sinks (cont.):

- Careful not to *confuse* whether something is a source/sink or a process within a system:
  - occurs most often when the data flows in a system cross office or departmental boundaries (see e.g.)
  - students are then tempted to identify the second office as a source/sink (to emphasize that data moved from one physical location to another)
  - we are not concerned with *where* the data are physically located, rather *how* they are moving through the system and how they are being processed
  - if the other office is *controlled* by your system ⇒ then you should represent the second office as one or more processes

Components of DFD (cont.)

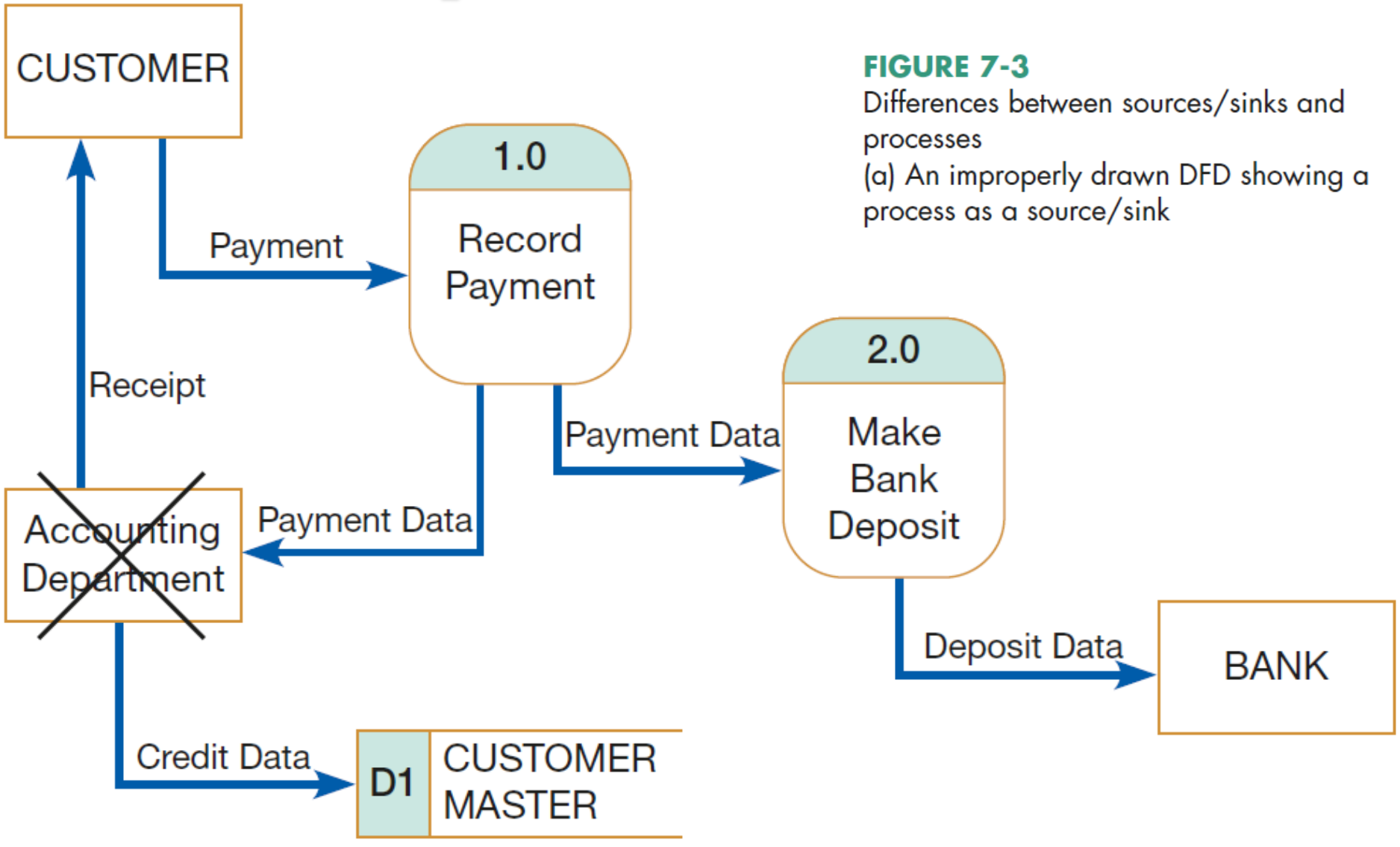


FIGURE 7-3
Differences between sources/sinks and processes
(a) An improperly drawn DFD showing a process as a source/sink

Components of DFD (cont.)

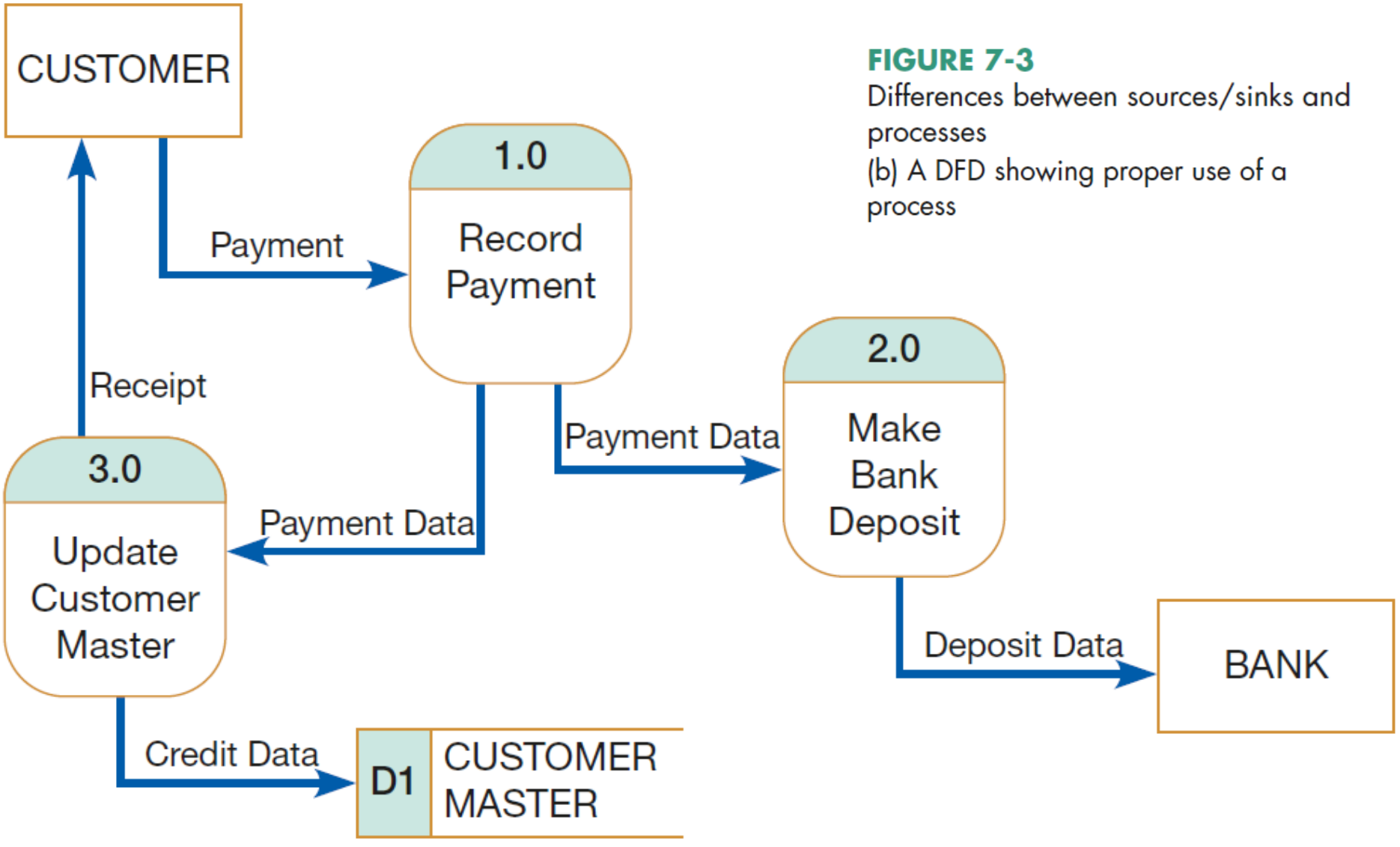


FIGURE 7-3
Differences between sources/sinks and processes
(b) A DFD showing proper use of a process

Videos to Watch

- **What is DFD? Data Flow Diagram Symbols and More**
  https://youtu.be/6VGTvgaJIIM (*Smartdraw*)

- **How to Draw Data Flow Diagram?**
  https://youtu.be/ztZsEI6C-mI (*Visual Paradigm*)

- **DFD Diagram 0**
  https://youtu.be/Ik85hZkyYPA (*Visible Analyst*)

Sources

- **Design of Industrial Information Systems**. Thomas Boucher, and Ali Yalcin. Academic Press. First Ed. 2006. Chapter 4.

- **Modern Systems Analysis and Design**. Joseph S. Valacich and Joey F. George. Pearson. Eighth Ed. 2017. Chapter 7.