Large Scale Systems Design
G52LSS

Lecture 14 – Process Modelling With DFDs

- Data Flow Diagrams
- Multi-Level DFDs
- Examples of DFDs

Learning outcomes: describe the purpose of DFDs; interpret DFDs; understand multi-level DFDs; appreciate importance of DFDs to analyse and design information systems.

Data Flow Diagrams

Once system requirements are well defined:

Process modelling and Data modelling

Process modelling aims to describe the logic for the flow of information in the system and is perhaps the most important element of systems analysis and design.

Process models can be of two types:

Logical process models – describe processes with no details about specific implementation.

Physical process models – produced in the design phase, provide further information necessary to build the system.

Data Flow Diagram (DFD)

- Structured analysis technique for constructing a graphical representation of processes
- Method to model the logic of data oriented systems
- Simple diagram to model processes and represent flow of information
- Contains four elements: process, data flow, data store, external entity

Advantages of DFDs

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

Process

Manual or computerised activity or function that is performed for some specific business reason. A process always denotes changes in data.

Represented as a rectangle with rounded corners.

Has a name (verb applied to noun), an identification number and a description (simple statement).

Processes can create a child DFD. Complex processes might require the use of process specification techniques such as structured English (pseudo-code), decision tables or decision trees.

Data Flow

Single piece of data or a logical collection of several pieces of information.

Represented as an arrow and the direction of the arrow indicates destination of data.

Has a name (noun) and maybe a description (simple statement).

Data flows hold processes together and one end of the data flow will always come from or go to a process.

Simultaneous data flow is shown using parallel arrows.

Data flow joins and splits can occur in DFDs.

Data Store

Collection of data stored in some way. Denotes long-term storage.

Represented as a rectangle with an open right side. The same entity data store symbol can be used several times for clarity of the diagram.

Has a name (noun), an identification number and maybe a description (simple statement).

Data stores are the basis for the data model and are the link between the process model and the data model.

Must have at least one input data flow and at least one output data flow.

External Entity

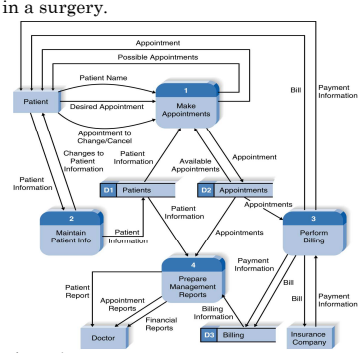
Person, organisation, or system that is external to the system but interacts with it. Also known as source or destination of data.

Represented as an square. The same entity symbol can be used several times for clarity of the diagram.

Has a name (noun) and maybe a description (simple statement).

People that are part of the system are not considered as external entities because if they execute a process, then they are part of the process (not external to the system).

Example 14.1 The following is a DFD for the appointments system in a surgery.



The previous DFD can be interpreted as follows:

Patients can make, change and cancel appointments according to their preferences. The system maintains an updated database of allocated and available appointments.

Only the patient's name is required for the system to create, change, or cancel appointments. However, full information for each patient is also maintained up to date by the system according to the updates given by the patients.

The system also generates billing information based on appointments and payment information which is obtained from the patient's insurance company. The insurance company receives the bill for each patient's appointment to determine the patient's payment information. The system sends bill and payment information to the patient.

The system also maintains an updated record of billing details. When management reports are required by the doctor, the system generates these reports containing patient, appointments and financial reports from the system's databases.

Multi-Level DFDs

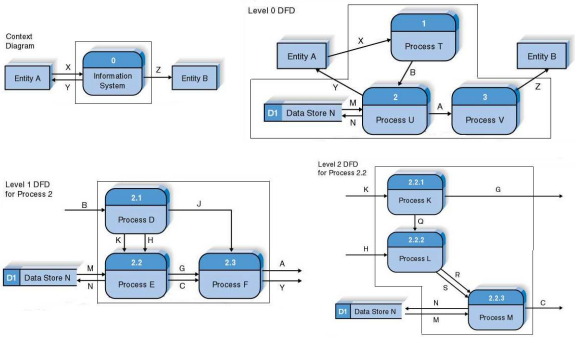
Most complex systems cannot be shown on a single DFD. Then, a hierarchy of data flow diagrams is required.

Lower level diagrams (child diagrams) show a portion of an upper level diagram (parent diagram) in more detail.

A multi-level DFD has one context diagram, one Level 0 DFD and perhaps one or more DFDs at Levels 1, 2, etc.

Balancing means that information presented at one level of a DFD must be accurately represented in the next level DFD.

Example 14.2 Illustration of a multi-level DFD.



Important Issues in Multi-Level DFDs

Only one context diagram showing the overall business process.

Only one Level 0 DFD with no more than 10 processes.

One Level 1 DFD for each process in the Level 0 DFD.

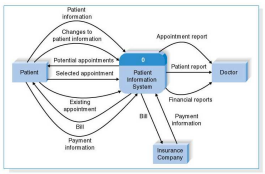
Correspondence between parent process and its child processes.

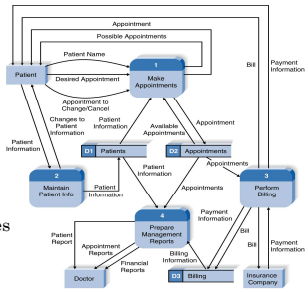
Correct numbering for better understanding.

Alternative data flows, data flow splits and data flow joins might be shown.

Users and analysts should verify the correctness of a DFD.

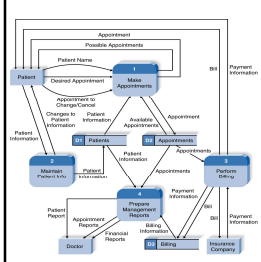
Example 14.3 Context diagram and Level 0 DFD for the appointments system in a surgery.

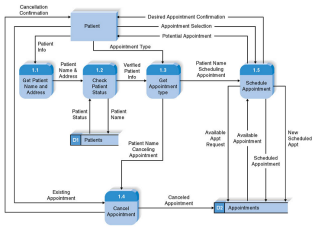




There are some inconsistencies between the context and the Level 0 DFD

Example 14.3 (cont.) Level 0 and Level 1 DFDs for the appointments system in a surgery.

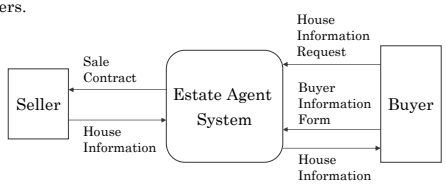


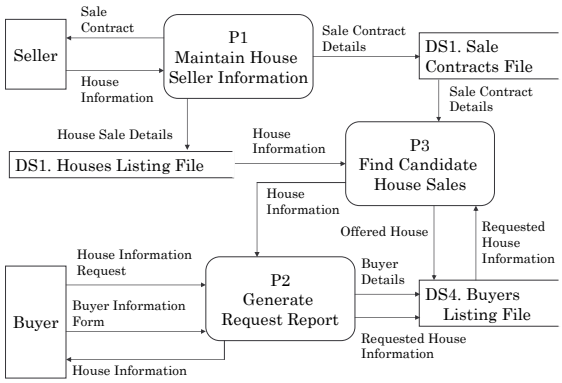


There are some inconsistencies between the Level 0 and Level 1 DFDs

Examples of DFDs

A state agent system (exercise D, Dennis et al. chapter 6). People who want to sell their houses sign a contract with the agent and provide information on their house which is kept in a database. Some potential buyers have an interest on a specific house while others ask the agent to advise them in finding a house that meet their needs. The estate agent prints the information about houses from the database and uses it to shows houses to the potential buyers.





Additional Reading

Chapter 6 of (Dennis et al., 2006)

Chapter 7 of (Kendall and Kendall, 2005)