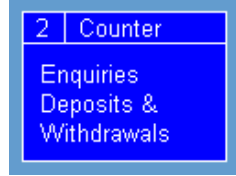


An external entity is a source or destination of a data flow which is outside the area of study. Only those entities which originate or receive data are represented on a business process diagram. The symbol used is an oval containing a meaningful and unique identifier.

Process



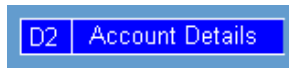
A process shows a transformation or manipulation of data flows within the system. The symbol used is a rectangular box which contains 3 descriptive elements: Firstly an identification number appears in the upper left hand corner. This is allocated arbitrarily at the top level and serves as a unique reference. Secondly, a location appears to the right of the identifier and describes where in the system the process takes place. This may, for example, be a department or a piece of hardware. Finally, a descriptive title is placed in the centre of the box. This should be a simple imperative sentence with a specific verb, for example 'maintain customer records' or 'find driver'.

Data Flow



A data flow shows the flow of information from its source to its destination. A data flow is represented by a line, with arrowheads showing the direction of flow. Information always flows to or from a process and may be written, verbal or electronic. Each data flow may be referenced by the processes or data stores at its head and tail, or by a description of its contents.

Data Store



A data store is a holding place for information within the system:

It is represented by an open ended narrow rectangle.

Data stores may be long-term files such as sales ledgers, or may be short-term accumulations: for example batches of documents that are waiting to be processed. Each data store should be given a reference followed by an arbitrary number.

Resource Flow



A resource flow shows the flow of any physical material from its source to its destination. For this reason they are sometimes referred to as physical flows.

The physical material in question should be given a meaningful name. Resource flows are usually restricted to early, high-level diagrams and are used when a description of the physical flow of materials is considered to be important to help the analysis.

Data Flow Diagrams – The Rules

External Entities

It is normal for all the information represented within a system to have been obtained from, and/or to be passed onto, an external source or recipient. These external entities may be duplicated on a diagram, to avoid crossing data flow lines. Where they are duplicated a stripe is drawn across the left hand corner, like this.

The addition of a lowercase letter to each entity on the diagram is a good way to uniquely identify them.

Processes

When naming processes, avoid glossing over them, without really understanding their role. Indications that this has been done are the use of vague terms in the descriptive title area - like 'process' or 'update'.

The most important thing to remember is that the description must be meaningful to whoever will be using the diagram.

Data Flows

Double headed arrows can be used (to show two-way flows) on all but bottom level diagrams. Furthermore, in

common with most of the other symbols used, a data flow at a particular level of a diagram may be decomposed to multiple data flows at lower levels.

Data Stores

Each store should be given a reference letter, followed by an arbitrary number. These reference letters are allocated as follows:

- 'D' - indicates a permanent computer file
- 'M' - indicates a manual file
- 'T' - indicates a transient store, one that is deleted after processing.

In order to avoid complex flows, the same data store may be drawn several times on a diagram. Multiple instances of the same data store are indicated by a double vertical bar on their left hand edge.

Data Flow Diagrams – Relationship Grid

	External Entity	Process	Data Store
External Entity	✓	✓	✗
Process		✓	✓
Data Store			✓

There are rules governing various aspects of the diagram components and how they can relate to one another.

Data Flows

For data flows the rules are as follows:

Data flows and resource flows are allowed between external entities and processes. Data flows are also allowed between different external entities. However, data flows and resource flows are not allowed between external entities and data stores.

Processes

For processes the data flow rules are as follows:

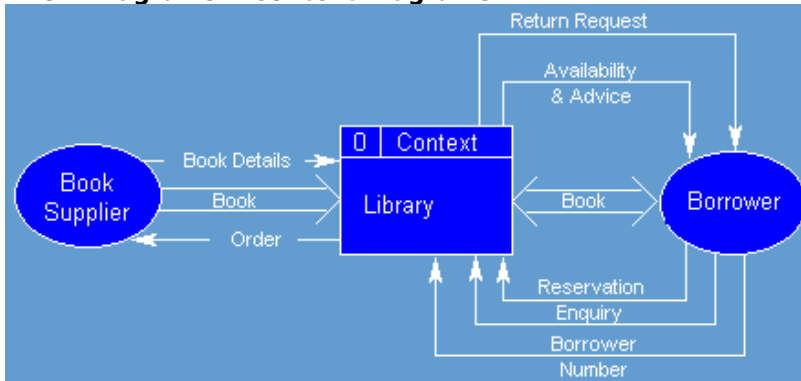
Data flows and resource flows are allowed between processes and external entities and between processes and data stores. They are also allowed between different processes. In other words processes can communicate with all other areas of the business process diagram.

Data Stores

For data stores the data flow rules are as follows:

Data flows and resource flows are allowed between data stores and processes. However, these flows are not allowed between data stores and external entities or between one data store and another. In practice this means that data stores cannot initiate a communication of information, they require a process to do this.

Data Flow Diagrams – Context Diagrams



The context diagram represents the entire system under investigation. This diagram should be drawn first, and used to clarify and agree the scope of the investigation.

The components of a context diagram are clearly shown on this screen. The system under investigation is represented as a single process, connected to external entities by data flows and resource flows.

The context diagram clearly shows the interfaces between the system under investigation and the external entities with which it communicates. Therefore, whilst it is often conceptually trivial, a context diagram serves to focus attention on the system boundary and can help in clarifying the precise scope of the analysis.

The context diagram shown on this screen represents a book lending library. The library receives details of books, and orders books from one or more book suppliers.

Books may be reserved and borrowed by members of the public, who are required to give a borrower number. The library will notify borrowers when a reserved book becomes available or when a borrowed book becomes overdue.

In addition to supplying books, a book supplier will furnish details of specific books in response to library enquiries.

Note, that communications involving external entities are only included where they involve the 'system' process. Whilst a book supplier would communicate with various agencies, for example, publishers and other suppliers - these data flow are remote from the 'system' process and so this is not included on the context diagram.

Data Flow Diagrams – Context Diagram Guidelines

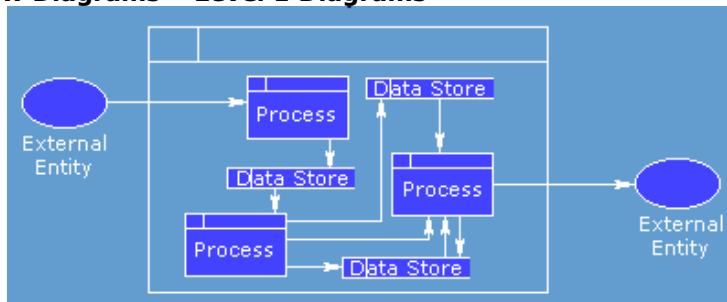
Firstly, draw and name a single process box that represents the entire system.

Next, identify and add the external entities that communicate directly with the process box. Do this by considering origin and destination of the resource flows and data flows.

Finally, add the resource flows and data flows to the diagram.

In drawing the context diagram you should only be concerned with the most important information flows. These will be concerned with issues such as: how orders are received and checked, with providing good customer service and with the paying of invoices. Remember that no business process diagram is the definitive solution - there is no absolute right or wrong.

Data Flow Diagrams – Level 1 Diagrams



The level 1 diagram shows the main functional areas of the system under investigation. As with the context diagram, any system under investigation should be represented by only one level 1 diagram.

There is no formula that can be applied in deciding what is, and what is not, a level 1 process. Level 1 processes should describe only the main functional areas of the system, and you should avoid the temptation of including lower level processes on this diagram. As a general rule no business process diagram should contain more than 12 process boxes.

The level 1 diagram is surrounded by the outline of a process box that represents the boundaries of the system. Because the level 1 diagram depicts the whole of the system under investigation, it can be difficult to know where to start.

There are three different methods, which provide a practical way to start the analysis. These are explained in the following section and any one of them, or a combination, may prove to be the most helpful in any given investigation.

There are three different methods, which provide a practical way to start the analysis. These are introduced below and any one of them, or a combination, may prove to be the most helpful in any given investigation:

Data Flow Diagrams – Resource Flow Analysis

Resource flow analysis may be a useful method for starting the analysis if the current system consists largely of the flow of goods, as this approach concentrates on following the flow of physical objects.

Resource flow analysis may be a useful method for developing diagrams if the current system consists largely of the flow of goods. Physical resources are traced from when they arrive within the boundaries of the system, through the points at which some action occurs, to their exit from the system. The rationale behind this method is that information will normally flow around the same paths as the physical objects.

Data Flow Diagrams – Organizational Structure Analysis

The organizational structure approach starts from an analysis of the main roles that exist within the organization, rather than the goods or information that is flowing around the system.

Identification of the key processes results from looking at the organizational structure and deciding which functional areas are relevant to the current investigation. By looking at these areas in more detail, and analyzing what staff actually do, discrete processes can be identified.

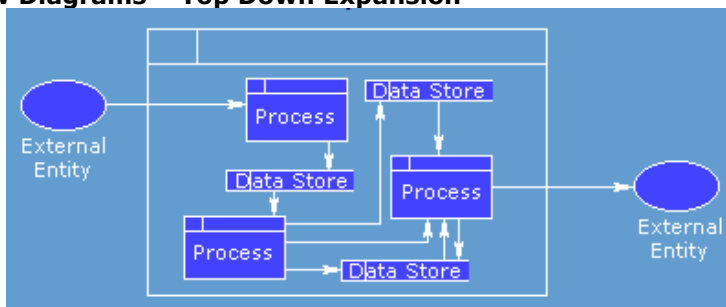
Starting with these processes, the information flows between them and between these processes and external entities are then identified and added to the diagram.

Data Flow Diagrams – Document Flow Analysis

The document flow analysis approach is appropriate if the part of the business under investigation consists principally of flows of information in the form of documents or computer input and output.

Document flow analysis is particularly useful where information flows are of special interest. The first step is to list the major documents and their sources and recipients. This is followed by the identification of other major information flows such as telephone and computer transactions. Once the document flow diagram has been drawn the system boundary should be added.

Data Flow Diagrams – Top Down Expansion

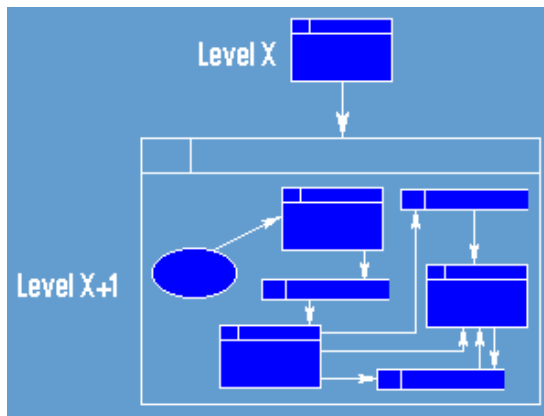


The section explains the process of top down expansion, or leveling. Furthermore, it illustrates that whilst there can only be one context and one level 1 diagram for a given system, these normally give rise to numerous lower level diagrams.

Each process within a given business process diagram may be the subject of further analysis. This involves identifying the lower level processes that together constitute the process as it was originally identified. This procedure is known as top-down expansion or leveling.

As a business process diagram is decomposed, each process box becomes a boundary for the next, lower level, diagram.

Data Flow Diagrams – Top Down Expansion Illustrated



In order to illustrate the process of top-down expansion, consider the three processes shown within this business process drawing. No detail is shown, only the outline of the process boxes, which have been identified during the drawing of a level 1 diagram.

Any area of a level 1 diagram is likely to require further analysis, as the level 1 diagram itself only provides a functional overview of the business system.

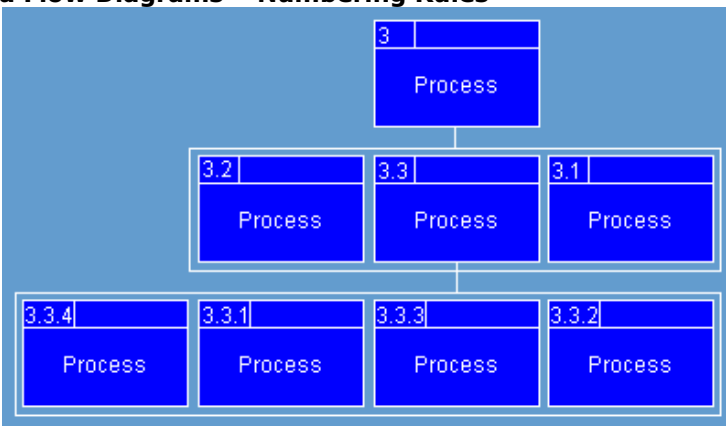
Therefore, below the level 1 diagram there will be a series of lower level diagrams. These are referred to as level 2, level 3, etcetera. In practice, level 2 is usually sufficient and it is unusual to carry out an analysis beyond level 3.

In this example the process numbered 3, at level 1, will be investigated further thereby giving rise to a level 2 diagram.

In the level 2 diagram four processes of interest have been identified and the numbering of these processes must reflect the parent process. Therefore the level 2 processes are numbered 3.1, 3.2, 3.3 and 3.4

Suppose that of these four level 2 processes, one was of sufficient interest and complexity to justify further analysis. This process, let's say 3.3, could then be further analyzed resulting in a corresponding level 3 diagram. Once again the numbering of these processes must reflect the parent process. Therefore these three level 3 processes are numbered 3.3.1, 3.3.2 and 3.3.3.

Data Flow Diagrams – Numbering Rules



The process boxes on the level 1 diagram should be numbered arbitrarily, so that no priority is implied. Even where data from one process flows directly into another process, this does not necessarily mean that the first one has to finish before the second one can begin.

Therefore the processes on a level 1 diagram could be re-numbered without affecting the meaning of the diagram. This is true within any business process diagram - as these diagrams do not imply time, sequence or repetition.

However, as the analysis continues beyond level 1 it is important that a strict numbering convention is followed. The processes on level 2 diagrams must indicate their parent process within the level 1 diagram. This convention should continue through level 3 diagrams, and beyond, should that level of analysis ever be required.

The diagram on this screen clearly illustrates how processes on lower level diagrams identify their ancestral path.

Data Flow Diagrams - When to Stop

It is important to know when to stop the process of top-down expansion. Usually this will be at level 2 or level 3.

There are 3 useful guidelines to help you to decide when to stop the analysis:

Firstly, if a process has a single input data flow or a single output data flow then it should be apparent that there is little point in analyzing it any further.

Secondly, when a process can be accurately described by a single active verb with a singular object, this also indicates that the analysis has been carried out to a sufficiently low level. For example, the process named validate enquiry contains a single discrete task.

Finally, ask yourself if anything useful will be gained by further analysis of a process. Would any more detail influence your decisions?

If the answer is no, then there is little point in taking the analysis further.

Data Flow Diagrams – Keeping the Diagrams Clear

In this section a variety of simple techniques are introduced to show how a business process diagram can be clarified. The examples used do not relate to any specific scenario but are hypothetical abstracts used for the purpose of illustration.

Combining Processes

Firstly, where a diagram is considered to contain too many processes, those that are related can often be combined. As a general rule no business process diagram should contain more than 12 process boxes.

In some examples multiple process boxes can be identified as being related and can be combined into a single process box with a collective description.

Exclude Minor Data Flows

Where information is being retrieved from a data store, it is not necessary to show the selection criteria, or key, that is being used to retrieve it.

In the banking example, the customer details are shown being retrieved from the data store but the key used to retrieve this information is not shown.

Where a data store is being updated, only the data flow representing the update needs to be shown. The fact that the information must first be retrieved does not need to be shown.

Only the most important reports, enquiries, etcetera should be shown on the diagram. Communications that are of less significance can, if necessary, be detailed in support documentation.

Combining External Entities

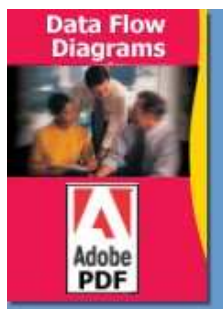
Another way to reduce the complexity of a business process diagram is to combine any related external entities.

For example, a business system will often be dealing with different units from within the same external organization, and these can be combined into a single external entity. Where these units are uniquely identified a number should follow the entity identification letter. However, when they are combined the numbers placed after the identifying alphabetic character are not shown.

Combining Data Stores

In a similar way, data stores that are holding related information should be suffixed with a lower case letter.

Related data stores can also be combined, and where this is the case the numbers placed after the identifying alphabetic character are not shown.

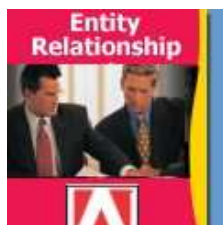


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