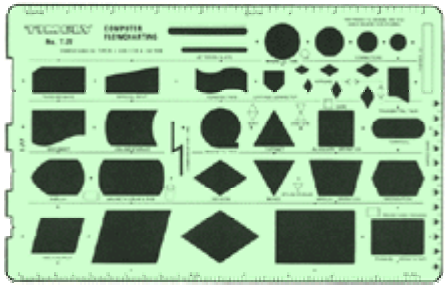
Guide to Flowcharting



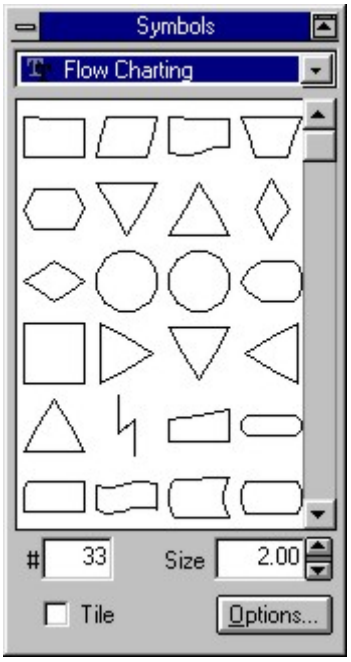


TABLE OF CONTENTS

INTRODUCTION 3
OVERVIEW OF FLOWCHARTING 3
FLOWCHARTING SYMBOLS & THEIR USES 5
TYPES OF FLOWCHARTS 6
FLOW CHARTING USES 8
  Benefits 8
  Limitations 8
FLOWCHARTING FOR AUDITORS 9
FLOWCHARTING SOFTWARE 9
FLOWCHARTING GUIDELINES AND STANDARDS 9
DOCUMENTATION TECHNIQUES 10
  Interviewing Employees 10
  Selecting Employees to Interview 10
  Cradle to Grave Approach 11
  Avoiding the Common Pitfalls of Detailed Flowcharting 11
  Drawing a Flowchart 11
  Limitations of Flowcharts 12
  Tips for Preparing Flowcharts 12
HISTORY OF PROGRAM FLOW CHARTING SOFTWARE 14
  Historical Importance 15
DECISION TREES & TABLES 16
DECISION TREES 16
  Decision Tables 16
  Limitations of Decision Tables 16
DATA FLOW DIAGRAM (DFD) 17
  DFD Conventions 17
  Drawing a DFD 17
  Limitations of DFD's 17

INTRODUCTION

One Picture Is Worth A Thousand Words

Definition

A flowchart is a graphical representation of the definition, analysis, or solution of a problem in which symbols are used to represent operations, data, flow, equipment, etc.

Flowcharting is a tool originally developed in the computer industry, for showing the steps involved in a process. Flowcharting is probably the oldest method of diagrammatically representing system processes (or sequence of activities). A flow chart is a pictorial description of how accounting transactions flow through a system. Flowcharts clearly and graphically convey work processes, process controls, decision flows, time flows and paper flows. A flowchart is a diagram made up of boxes, diamonds and other shapes, connected by arrows - each shape represents a step in the process, and the arrows show the order in which they occur. They are frequently used to visually document how a job is being done and compare it to how it should be done. Because there is no better way to illustrate a process, flowcharts are no longer the domain of engineers and auditors. Flowcharts are to managers and business owners what spreadsheets are to accountants.

OVERVIEW OF FLOWCHARTING

A flowchart is a method for documenting and understanding the flow of a system. A flowchart is a pictorial description of how transactions flow through a system. Flow charting help to ensure documentation of important aspects of the accounting system and recognition of system control points. Flow charts conveniently describe complex relationships because they reduce narrative explanations to a picture of the system. They visually communicate attributes and procedures, and the sequence in which they occur. Flow charts provide a comprehensive system description and, therefore, can be used effectively in (1) orienting new personnel, (2) defining areas of responsibility, (3) identifying key accounting controls, and (4) evaluating the efficiency of system procedures. The auditors primary purpose for preparing a flow chart is to understand the system in order to identify the key control attributes--those attributes that achieve control objectives. As an audit tool, the flow chart is an excellent tool that helps internal auditors perform the study and evaluation of the organization's systems of internal accounting control. This can efficiently point out cases of under/over control and processing redundancy. A flowchart can visually communicate procedures, controls and the sequence in which they occur.

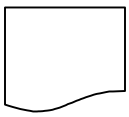
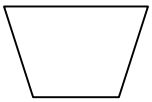
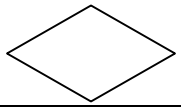
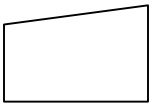
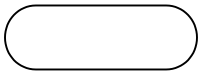
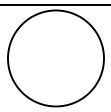
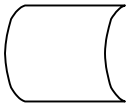
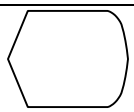
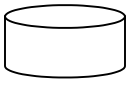
The advantages of using a flowchart to document a system are as follows:

1. Flowcharts are easier and less time consuming to understand than a narrative.

2. Flowcharts make it easier to represent flow of transactions using standardized symbols.
3. Flowcharts are easier to update.

FLOWCHARTING SYMBOLS & THEIR USES

In computing, there are dozens of different symbols used in flowcharting (there are even national and international flowcharting symbol standards). In business process analysis, a couple of symbols are sufficient. A box with text inside indicates a step in the process, while a diamond with text represents a decision point.

DOCUMENT 	Indicates the use of a document in the process; Name of document should be placed in the symbol
MANUAL OPERATION 	Indicates a manual procedure which should be described on the flowchart and referenced to an operation
PROCESS 	Indicates an automated procedure which should be described on the flowchart and referenced to an operation
DECISION 	Used to denote a decision point where alternate paths are possible
MANUAL INPUT 	Indicates manual input of data into the system under review
START/END 	Used to indicate the beginning or ending of a flowchart
CONNECTOR 	Used to represent continuity when the flow is broken by the limitations of the flowchart
FILE 	Indicates that information is stored (filed)
MAGNETIC TAPE 	Indicates files stored on Magnetic Tape
DISPLAY 	Indicates a computer display screen (CRT or PC) used for input, output, or inquiry purposes
DISK STORAGE 	Indicates files stored on Magnetic Disks (for online access)

TYPES OF FLOWCHARTS

A Flowchart is defined by the Miriam Webster Online Dictionary at http://www.m-w.com/ as *a diagram that shows step-by-step progression through a procedure or system especially using connecting lines and a set of conventional symbols*. A flowchart then is essentially a picture of a process. Auditors have been using flowcharts for decades as a tool to detail management processes in order to evaluate internal controls. The following types of flowcharts may be used by auditors:

Systems flowchart - Depicts overall or broad flow of operations (minimal detail). They may show the flow of data or the sequence of operations of a system. Sometimes they include all steps to process data into information.

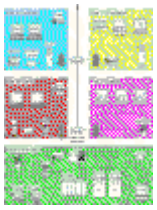
Procedures flowchart - presents the steps in a process.

Document flowchart - depicts the flow of documents through specific processing steps.

Program flowchart - A more detailed flowchart that illustrates specific steps in a computer run.

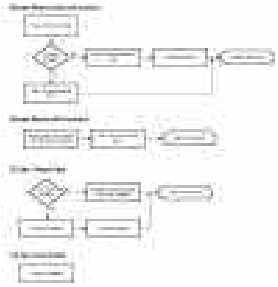
Network Diagram

A network diagram can show the layout of anything from a small network to a world-wide network. You can use hyperlinks between charts to show the overview (organized by region, department, or office) and then the finer details to show the actual hardware and connections.



Process Flowchart

A process flowchart is the most common type of business diagram, and it is used to communicate any idea that consists of a series of steps. These types of diagrams truly demonstrate that a picture is worth a thousand words. It is so much easier to learn a new task by following a process flowchart than it is to understand 10 or 15 paragraphs of text that describe the same thing.



Data Flow Diagram

A Data Flow Diagram, or DFD chart, shows the relationship between data. The data could represent a database or anything else that is important for you to document.

Deployment Flowchart

A Deployment chart is used to show a process or procedure as it flows through different departments or uses different resources.

FLOW CHARTING USES

Flow charts produce a model displaying tasks in their sequential relationship. This means that process tasks will be detailed to the level at which and in what order they will be performed will be known. Although there are a variety of different types of flow charting techniques, most will employ simple geometric shapes that will represent starting points, individual tasks, decision points, and ending points. In addition, the direction of "flow" from one task to the next will be represented by arrows. In such a way, individual process tasks will be ordered and their sequential relationship will be detailed.

Benefits

- Portrays the logical "flow" between tasks
- Visually successful in communicating the sequence of tasks
- Easy to know the sequential impact of changes
- Easy to spot redundant operations & other inefficiencies
- Training tool for new employees
- Spot internal control weaknesses
- Helps the auditor see the “whole picture”

Limitations

- Task start and finish dates are not known.
- The duration of tasks are not known.
- Resources needed are not known.
- Lacks the incorporation of resource constraints.
- Physical locations of tasks are not known.
- Difficult to distinguish importance of tasks.

FLOWCHARTING FOR AUDITORS

For decades, accountants and auditors have used flowcharting as an audit tool to understand and evaluate systems for their clients. When I graduated from college, a flowcharting template was considered as important to the accounting profession as slide rules were for engineers. We would painstakingly interview employees, write-up narratives of the interviews and then flowchart the process. Subsequent interviews and follow-ups would result in adjustments to the original flow chart. We would eventually produce a revised detailed flowchart of the process as explained by employees and confirmed by management. We would then obtain management's signature attesting to the accuracy of the flow chart and the process under review. From that flowchart, we could identify where the controls were weak and the processes required changes. The flowchart analysis of controls helped up to design an audit work program that would test those controls to ensure that they were operating as designed. If the controls were not working, we could recommend changes to the process for management's consideration. As a by-product of the evaluation of internal control, we found that management usually requested a copy of the flowchart for use in orientation training for new employees.

In the 1980's new flowcharting tools were introduced which made the standard flowcharting template a dinosaur. The software was easy to use and made modifications as easy as the click of the mouse. While the software made it easier, it was clear that management was finding that flowcharting was not only a science but a combination of science and art.

FLOWCHARTING SOFTWARE

A survey of Patton & Patton Software Corp.'s registered user base indicates that flowcharts are used by managers/supervisors (14.2 percent), business owners/ partners/presidents/CEOs (10.7 percent) and project managers/group leaders (8.1 percent).

1. It takes 50 percent less time to create flowcharts on computer than by hand. Updating an existing chart takes 60 to 90 percent less time depending on the complexity of the chart
2. The demand for flowcharting software has steadily increased.

Flow Charting 5 - Patton & Patton http://www.patton-patton.com
IGrafx Flowcharter Professional – Micrografx http://www.micrografx.com
AllClear – Proquis Incorporated http://www.allclearonline.com

FLOWCHARTING GUIDELINES AND STANDARDS

Clarity and simplicity in presentation are essential. Mistaken use of extreme detail may tend to conceal rather than expose key points. Complexities such as exception controls

can be better explained in attached memoranda. However, narrative explanations should be kept brief. In most cases, the combination of the flow chart and a narrative description tends to be far superior to either document alone.

Only transactions/documents with control significance should be shown (i.e., control over authorization, recording, safeguarding, reconciliation, and valuation). This can generally be accomplished by including only those activities within an application where data is initialized, changed, or transferred to other departments. For a process to be flow charted, it must be broken down into its component parts, namely actions and decisions. Also, the name(s) and position(s) of the people performing the transactions should be indicated for each action. The names of each document should also be included within the document symbols.

The auditor usually obtains information necessary for preparing or updating flow charts by interviewing personnel at each site about procedures followed, and by reviewing procedure manuals, existing flow charts and other system documentation. Sample documents are collected and each department involved is questioned about its specific duties. Inquiries can be made concurrently with the performance of transaction reviews, particularly when flow charts are being updated. If possible, the auditor should observe the process.

DOCUMENTATION TECHNIQUES

The first step in flowcharting involves obtaining an understanding of the system. This involves documenting how transactions are processed and assets are safeguarded. The documentation process involves understanding how the system works and the nature of the transactions processed. Typically, auditors prepare an overview which may come from the following sources:

1. Narrative descriptions of the system
2. Interviews with employees responsible for the system
3. Accounting and administrative policy and procedure manuals, charts of accounts
4. Policies
5. Laws and regulations
6. Prior audit working papers

Interviewing Employees

Interviewing responsible personnel is a productive way to obtain information about how the system or process operates. Strong interviewing techniques are important.

Selecting Employees to Interview

It is important to select the right employees to interview. If an employee is responsible for an entire function, questions should be directed exclusively to him.

Cradle to Grave Approach

It is best to document the system from the beginning of the process. It is much easier if employees begin at the beginning. The interviewer should clearly explain the objectives of the interview before asking any questions. It is important that the interviewer control the interview and not allow the employee to wander "off track."

Use the following guide for obtaining the necessary information:

1. Ask each employee:
    a. What procedures are performed?
    b. What records they maintain, including unofficial records
    c. What documents are processed and what documents are prepared?
    d. From whom are the documents received?
    e. What information is recorded on the documents, and what is the source of the information?
    f. To whom are the documents sent?
    g. What error detection methods are used?
    h. What is done when errors are found?
    i. When was an error last found and describe the type of error?

2. Follow one procedure at a time to a logical conclusion.

3. Ask to see documents described by the employee, and relate them to information received. This may help to identify inaccuracies or incomplete answers.

4. Ask about the impact of changes in routine during slack or busy periods, vacations or sickness.

5. Be careful not to oversimplify or over-elaborate.

Avoiding the Common Pitfalls of Detailed Flowcharting

- Develop a detailed flowchart only when it is required.
- Complicated detailed flowcharts cannot be drawn accurately on a first attempt. Rough out an initial draft. Eliminate all irrelevant, confusing information.
- Too little detail may not provide a meaningful analysis. Clearly understand how the flowchart will be used before preparing.
- Large complex systems cannot be presented in a single flowchart. Prepare separate flowcharts tied together by an overview flowchart.
- Do not assume that someone else can immediately understand a detailed flowchart. Include an explanation of the method and symbols used and an overview of the highlights of processing and flow.
- Provide an overview flowchart for complex detailed flowcharts. This provides the reader an opportunity to understand the overall process before attempting to understand the detailed process and flow.

Drawing a Flowchart

Decide what activities are to be shown and the purpose of drawing the flowchart.
Obtain the information needed to draw the flowchart

A flowchart proceeds from top to bottom and from left to right.
Use arrow heads to show the direction of flow and improve clarity.
A flowchart may be any size but keep dimensions and be as neat and tidy as possible.
The flowchart should be identified with a title, the date and name of the author.

Limitations of Flowcharts

Different levels of detail can easily become confused. As flowcharts become more complex they can resemble 'spaghetti.'
There is no obvious mechanism for proceeding from one level to the next.
The essential story of what is done can easily get lost in the detail of how it is done.
Flowcharts are best used in relatively simple process sequences such as system overview diagrams or user procedures.

Tips for Preparing Flowcharts

Create a flow chart beginning at a high level on the first draft. As you look at each of the operations or processes, fill in the detail.

Do not be concerned about getting all the detail on the first draft (this is an iterative process).

Refrain from trying to analyze and fix a process until it is completely flow charted.

Review your chart. Does it show the proper flow of information or operations? Does it reflect sequential and simultaneous events? Does it accurately capture what really happens? Are all major decisions reflected?

When the operations and decisions are charted as they actually happen, analyze the process to determine possible improvements. You should concentrate on eliminating unnecessary or inefficient steps or highlight major control weaknesses such as lack of segregation of incompatible duties, no approval of key events, lack of accountability.

Involve all people actually involved in the process in order to get accurate perceptions.

Have a manager or supervisor of the actual operations review and attest to the accuracy of the completed flow chart.

Flowcharting Commandments

1. Know your symbols

2. Create charts that flow form the top to the bottom of the page

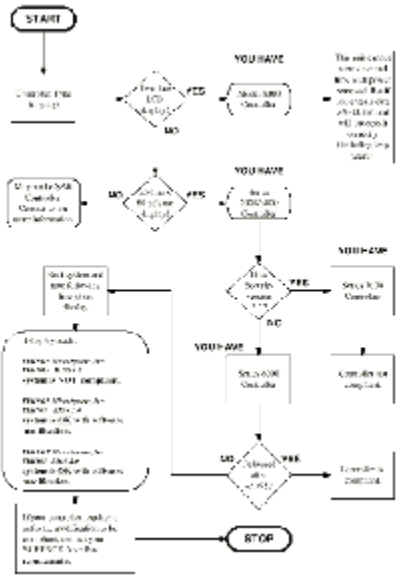
3. Navigational lines should not intersect

4. Try to fit flowcharts on as few pages as possible

5. KISS or use the simplest method when flowcharting

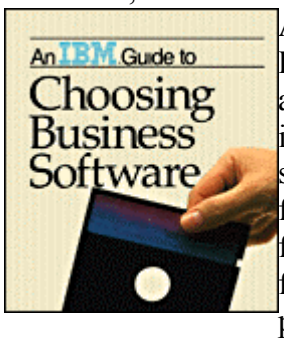
HISTORY OF PROGRAM FLOW CHARTING SOFTWARE

In 1964, one of Applied Data Research's larger customers, RCA, expressed interest in a flowcharting program. Such a program would print the logical flow of instructions in a program, aiding their growing computer development. Flowcharting was first developed in the 1940s as a way for a programmer to keep track of the machine address where an instruction was stored in memory. Inserting a new instruction would change the addresses of all the instructions that would follow, so this graphical method was quick to catch on. By the time RCA wanted a flowcharting program, however, most programmers were not writing in machine language, anymore, so keeping track of the machine addresses was not important. The practice of drawing a flowchart before writing a program was still part of the programmers' routine, though, so a flowcharting program would be a nice diagnostic tool. At this point, ADR had invested a considerable sum in the project, so they tried to license it to users of the RCA 501 computer. Goetz named the program Autoflow, and priced it at $2,400. Of the 100 users of the 501, only two were interested. Disappointed, Goetz reflected that only 100 companies used the RCA 501, while thousands used the competing IBM 1401; the decision was made to port Autoflow to work on the IBM.



After ten months of reprogramming, ADR finished the new version of Autoflow, which could produce flowcharts for Autocoder programs. There was more interest this time, but few bought the program. The main problem was that the programmer had to add a one-digit code to each instruction in the program to tell Autoflow what type of instruction it was, whether it accessed a file, performed a calculation, or tested a condition for branching to another instruction. This was not a major inconvenience when a program was written from scratch, but it was typical for programmers in this era to modify a similar program instead of writing a new one every time they wanted the machine to perform a certain function. While only some customers would want a program to flowchart new programs, most of them wanted a way to flowchart the existing programs they were using as templates.

ADR redesigned Autoflow yet again, and in the new version the program did not rely on hand-coding to define the functions; it was designed to reference the instructions in the Autocoder program to determine what flowchart symbol to draw. Because of this, the source code for any existing Autocoder program could be processed, and if the program was changed, it merely had to be run through Autoflow again to generate an updated flowchart would print out; the programmer would not have to re-examine the program to add codes to the ends of the lines. This function was widely embraced, and Autoflow sold very well.



At the same time, IBM had a flowcharting program called Flowcharter, which was available to IBM customers for free (as was all IBM software). The program was far different than Autoflow--it was not automatic, and it required the programmer to prepare a separate set of coding sheets that the program would use to draw the flowchart. It essentially allowed the programmer to write a flowchart in shorthand, and the program would convert it into a flowchart. This was much different than the functions Autoflow performed; however, potential customers felt that IBM would soon modify their software to do similar functions. Since IBM software was free, it would be cheaper for them to wait for such a program.

Historical Importance

As Autoflow grew in popularity, the likelihood that IBM would make a competing program—and put ADR out of business-- rose. Goetz decided to act first, and applied for a patent on Autoflow: in 1968 he became the first person to receive a patent on software. He served notice on IBM that it might be violating ADR's patent application if it produced an automatic flowcharting program. This was an historic moment, as it was official recognition that software was a product in itself, not just a service to be provided with a computer purchase.

DECISION TREES & TABLES

Decision Trees and Tables are useful for the analysis and design of multiple choice decision environments.

Decision Trees and Tables are also useful in highlighting deficiencies in existing methods and information systems.

Decision Trees and Tables should be used to supplement other charting methods, nor replace them.

DECISION TREES

A decision tree breaks down systematically the decision making process, showing all possible options.
Identify the range of decisions, which have common input, processing or output.
Relate each group of decisions to a specific user group.
Identify decision-making inputs and outputs.
Identify the decision rules which users use to make decisions.

Decision Tables

Decision Tables are an effective way of expressing the relationship between data, actions and people.
Identify the general conditions and list them in the upper left-hand part of the table.
Identify the general actions and list them in the lower left-hand part of the table.
Examine each required combination of general conditions marking them with Y, N, or a dash - if not applicable.
For each set of conditions the corresponding actions are indicated by an X.

Decision tables becomes more comprehensive if combinations of general actions are shown which satisfy combinations of general conditions.
Decision tables can represent more than logical relationships. They can be used as a check on the consistency, accuracy and completeness of the analysis.
Decision tables can be converted directly into machine code, thus reducing systems development effort.

Limitations of Decision Tables

Decision tables are not good at expressing sequence or procedure. This is best left to graphical techniques such as flowcharting.
Multiple decision environments can quickly produce very large decision tables. These can be split into a number of smaller tables but interrelating these tables can be difficult.
Nevertheless, decision tables are a useful tool for the analyst throughout the systems development process.

DATA FLOW DIAGRAM (DFD)

The DFD shows the logical relationships between processes and the way in which data moves to support those processes.
A powerful feature of DFD's is that they can be decomposed or exploded to provide increasing levels of detail.
DFD's are a widely used technique in structured methodologies

DFD Conventions

A process represents an activity which happens to data (calculate). Processes are described using an action verb followed by a description of the data being processed.
A data store represents data at rest. (stored for any length of time, in whatever format.)
Data flow represents data in motion (the flow of data between processes or data stores)
An external entity represents the point of origin of inputs or the point of destination of outputs from the system being diagrammed.

Drawing a DFD

Identify the aspect or the extent of the system to be diagrammed.
List and draw all processes involved.
List and draw the outputs or data flows produced by each process and connect them to their appropriate destination.
List and draw the inputs or data flows and connect them to their point of origin.
Label and name each data flow, external entity, data store and process.
Restructure the DFD to give the clearest possible graphical representation.

Limitations of DFD's

They also can become over-complex (although not as bad as conventional flowcharts)
They are not good at showing error handling or exceptional situations.
They are data oriented. Although this is fine for applications which emphasis data (such as banking or insurance) DFD's are not as appropriate for applications where there is less emphasis on data (for example in manufacturing applications, we are more concerned with the flow of goods and services, not data.)
However these are minor criticisms, DFD is a powerful and widely used technique.
Source: http://www.qub.ac.uk/mgt/staff/brian/flowch~1.htm

Internet Resources and Links for Flowcharting

Flowcharting Toolkit http://www.hci.com.au/hcisite/toolkit/flowchar.htm