Charting Your Course: Charts and Graphs for IT Projects

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ABSTRACT

This paper describes the most common types of charts and graphs used for IT project management.   If "a picture is worth a thousand words," then the most effective and efficient way to describe the details of an IT project is with charts and graphs. Charts and graphs allow you to present an overall view of the project and system specification and to organize your data visually to further communication among the participants of the project. Among the popular charts include Gantt charts, PERT charts for project management; Entity Relationship Diagram, Data Flowchart for system specifications; Pie charts, Bar charts and Histograms for quick visual aid for communication. We will look at each chart closely by following the lifecycle of an IT project.

INTRODUCTION

Charts and graphs are frequently used in IT projects to visually assist in project management, define system specifications, and enhance communication among participants of the project. Structure charts, Gantt charts, PERT charts are for project management; Entity Relationship Diagram, Data/Process Flowchart for system specifications; Pie charts, bar charts for effective visual presentation of information. In terms of tools, Microsoft Office Suite – Word, PowerPoint, and Excel – are used for simpler charting; and Microsoft Project, Visio, ASAP, SmartDraw, Rational Rose, and others are for more sophisticated charting, some of which allow automatic generation of charts based on code.

CHARTING YOUR COURSE

There are five major steps in project lifecycle: Analysis, Design, Code, Test and Implement. In Analysis Stage, we use structure chart to designate the hierarchy of resources, WBS (Work Breakdown Structure), Gantt charts and PERT charts for project planning and scheduling. In Design and Code Stages, we use Entity Relationship Diagram and Data Flowchart to relationships of data objects and specify system specifications.   In Test and Implement Stages, we may use a combination of both. Pie charts, bar charts and histograms may be used throughout the lifecycle to convey message instantly. The following table lists the charts that correspond to the IT stages.
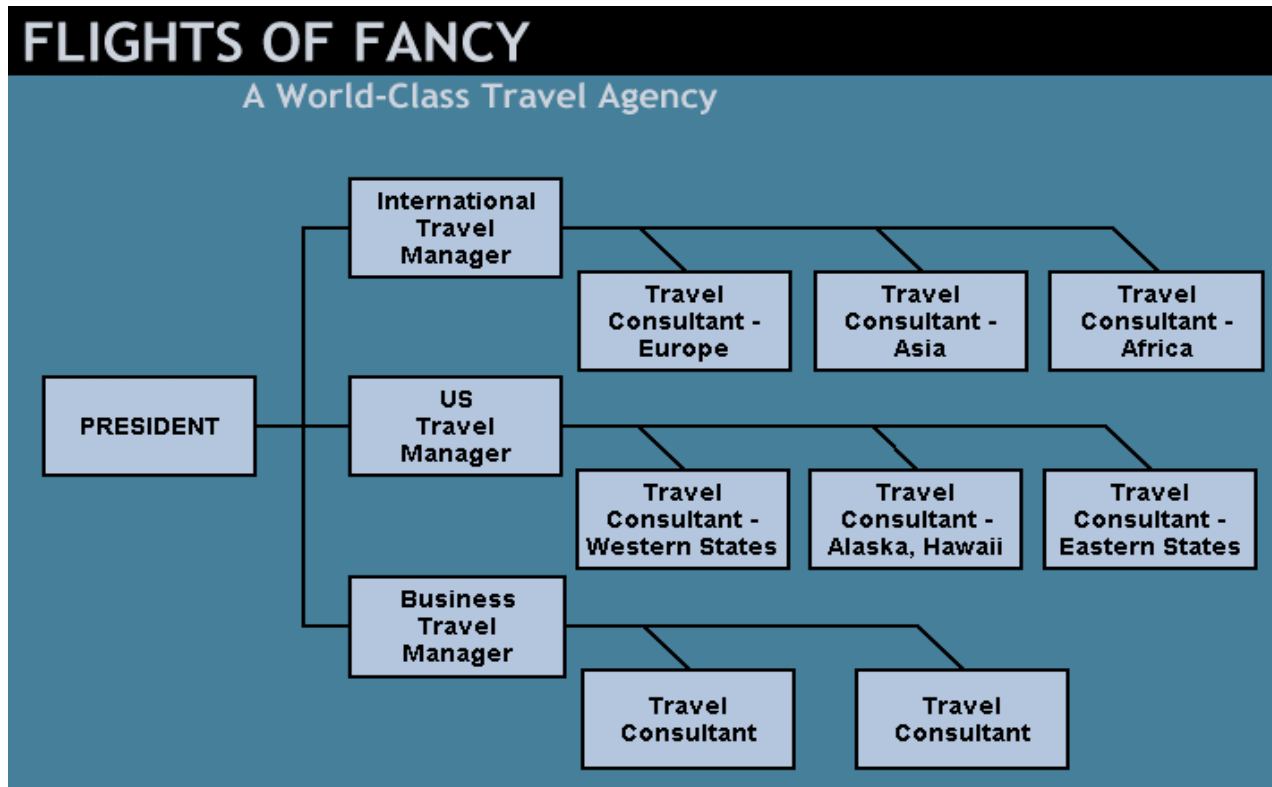
Figure 1: Charts and Their Use in the Project Lifecycle

	Analysis	Design	Code	Test	Implement
Organization Chart	X				
WBS	X				
Gantt Chart	X				
PERT Chart	X				
Entity Relationship Diagram (ERD)		X			
Data Flowchart (PFC)		X	X		
Pie Chart	X	X		X	
Bar Chart	X	X			X
Histogram	X	X		X	X

Organization Chart
At the start of the project, we may use a structure chart to describe the hierarchy of the resources involved in the project. It is the designation of the "Chain of Command." The Organization chart details the general tasks involved in the project and assigned them to either individuals or groups. With this chart, one can immediately determine who is responsible in certain office for certain tasks.

Figure 2: Organization Chart

Source: http://www.smartdraw.com/resources/examples/business/orgchart7.htm

Work Breakdown Structure (WBS), Gantt Chart, PERT Chart
Next a project plan needs to be created to ensure the timely completion of the project. As part of the project analysis, we break the project down to a number of stages (see table below for an example of this process) and use a Gantt chart and a PERT chart to describe specific tasks and status. PERT chart shows task dependencies while Gantt chart does not.

WBS
Figure 3: A simple example of WBS:

WBS number	Task Description
1.0	Project initiation
1.1	Draft project plan
2.0	Analysis phase
2.1	Plan user interviews

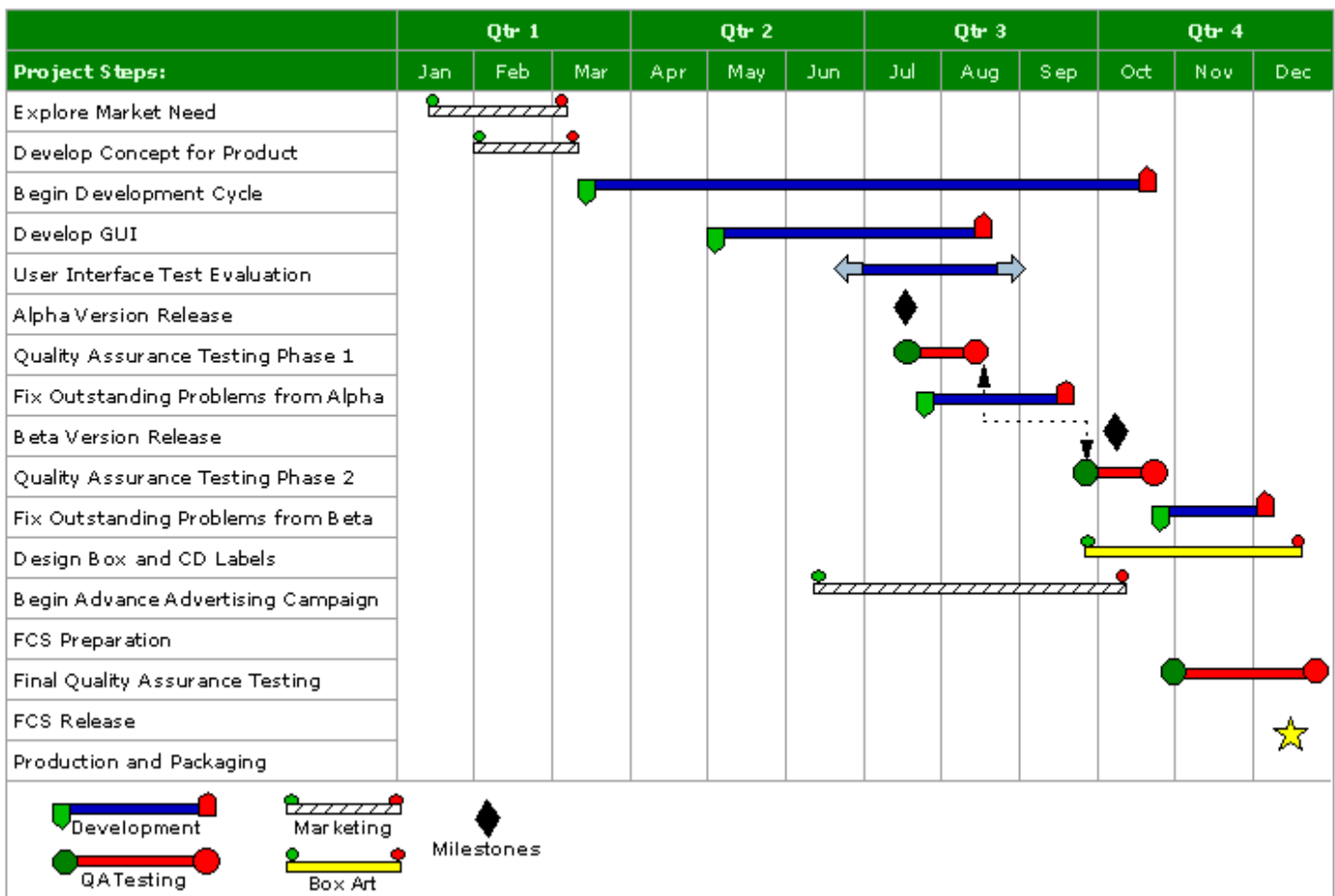| 2.2	Schedule users interviews
3.0	Examination and test
4.0	Design
5.0	Test
6.0	Implementation
7.0	Post-implementation review

Source: http://studentweb.tulane.edu/~mtruill/dev-pert.html

Gantt Chart
A Gantt chart provides the illustration of a schedule that helps to plan, coordinate, and track specific tasks in a project. It is a horizontal bar chart developed as a production control tool in 1917 by Henry L. Gantt, an American engineer and social scientist.   It usually consists of two parts: the project tasks on the left and the time allocation for each task on the right. Milestones are specially marked as important dates for deliverables. Below is an example of a project Gantt chart.

Figure 4: Project Development Schedule

PERT Chart
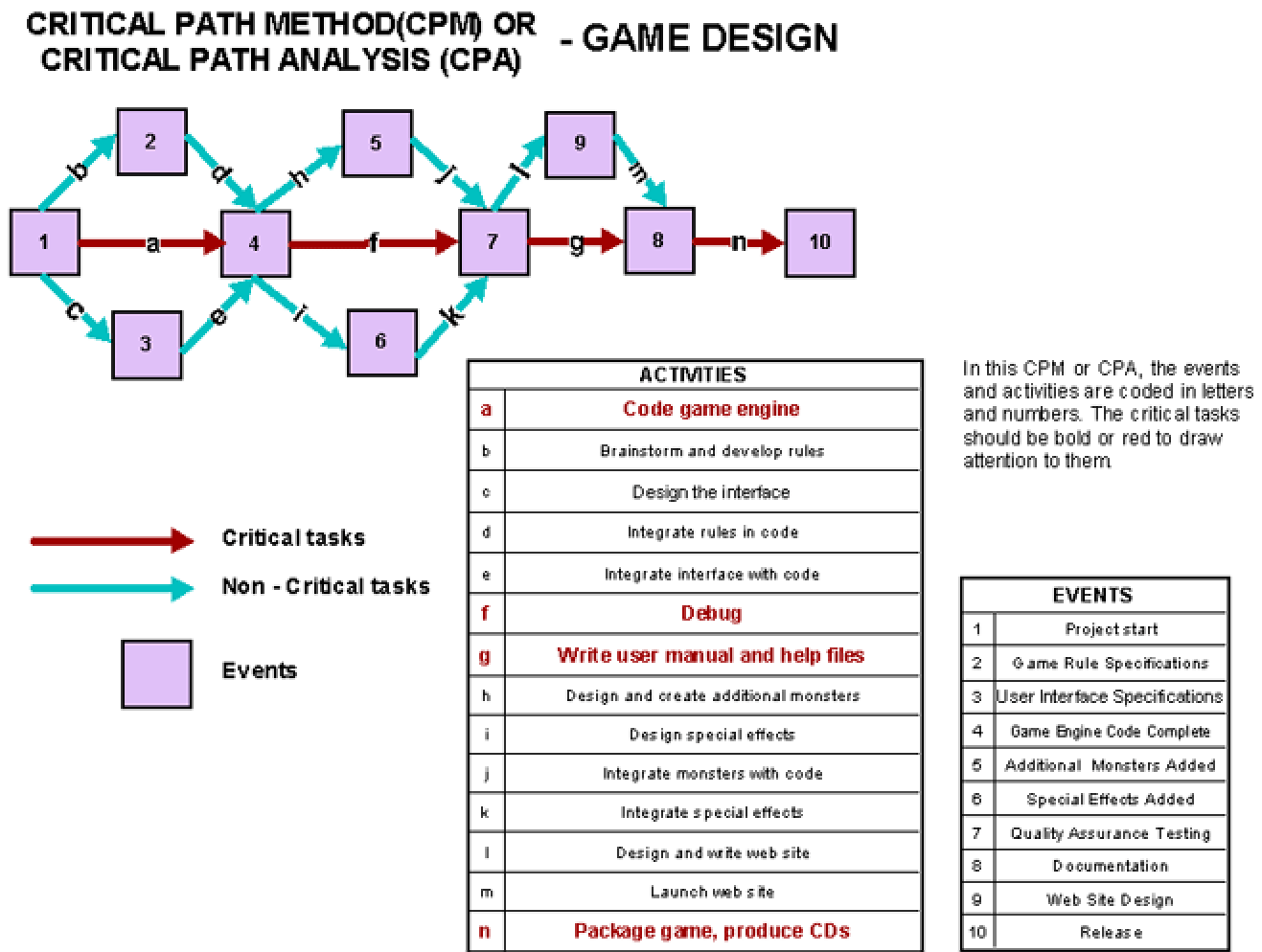Program Evaluation Review Technique (PERT) charts depict task, duration, and dependency information. PERT charts are very similar to Gantt charts except that Gantt charts do not indicate task dependencies – if some tasks get delayed, we do not know how other tasks are impacted. PERT charts were developed by the U.S. Navy in the 1950s to manage the Polaris submarine missile program. PERT charts are very similar to Critical Path Methods and are sometimes called PERT/CPM. Below is an example of PERT/CPM.

Figure 5: PERT/CPM Chart

CRITICAL PATH METHOD(CPM) OR CRITICAL PATH ANALYSIS (CPA) - GAME DESIGN

Critical tasks

Non - Critical tasks

Events

In this CPM or CPA, the events and activities are coded in letters and numbers. The critical tasks should be bold or red to draw attention to them

ACTIVITIES	
a	Code game engine
b	Brainstorm and develop rules
c	Design the interface
d	Integrate rules in code
e	Integrate interface with code
f	Debug
g	Write user manual and help files
h	Design and create additional monsters
i	Design special effects
j	Integrate monsters with code
k	Integrate special effects
l	Design and write web site
m	Launch web site
n	Package game, produce CDs

EVENTS	
1	Project start
2	Game Rule Specifications
3	User Interface Specifications
4	Game Engine Code Complete
5	Additional Monsters Added
6	Special Effects Added
7	Quality Assurance Testing
8	Documentation
9	Web Site Design
10	Release

The PERT chart is sometimes preferred over the Gantt Chart, because it clearly illustrates task dependencies. On the other hand, the PERT chart can be much more difficult to interpret, especially on complex projects. Frequently, project managers use both techniques.

Automated Gantt charts store more information about tasks, such as the individuals assigned to specific tasks, and notes about the procedures. They also offer the benefit of being easy to change, which is helpful. Charts may be adjusted frequently to reflect the actual status of project tasks as, almost inevitably, they diverge from the original plan.
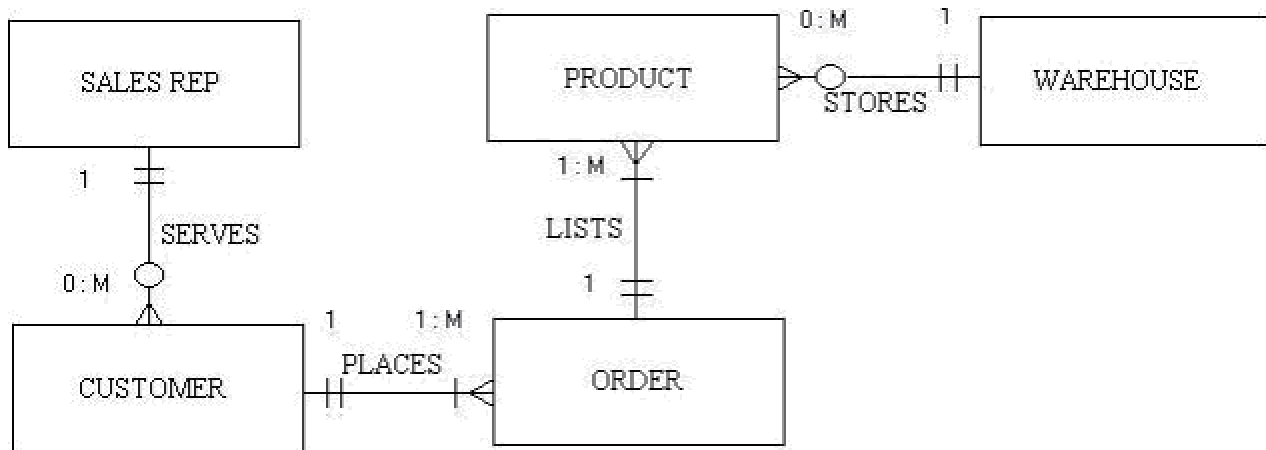
Entity Relationship Diagram (ERD) and Data Flowchart (DFC)
With a project plan in place, we come to the Design stage where we develop system specifications and data or process flow. ERD charts the entities and their relationships and DFC designates the process or data flow. Both are techniques developed for data modeling, a method for the analysis of data objects in a business or other context.

Entity Relationship Diagram (ERD)
ERD depicts entities (people, person, place, or event) and relationships between them within an information system. As a notation we use to conduct data modeling activity, an ERD includes all entities within the domain of the project and their relationships to one another. The entity is represented by a rectangle and labeled with a singular noun. A relationship may be represented by a diamond shape, or more simply, by the line connecting the entities. Verbs are used to label the relationships. Identification of the entities and the determination of all significant interactions between them are some of the important steps in creating an ERD.

Figure 6: Entity Relationship Diagram

* 1 INSTANCE OF A SALES REP SERVES 1 TO MANY CUSTOMERS
* 1 INSTANCE OF A CUSTOMER PLACES 1 TO MANY ORDERS
* 1 INSTANCE OF AN ORDER LISTS 1 TO MANY PRODUCTS
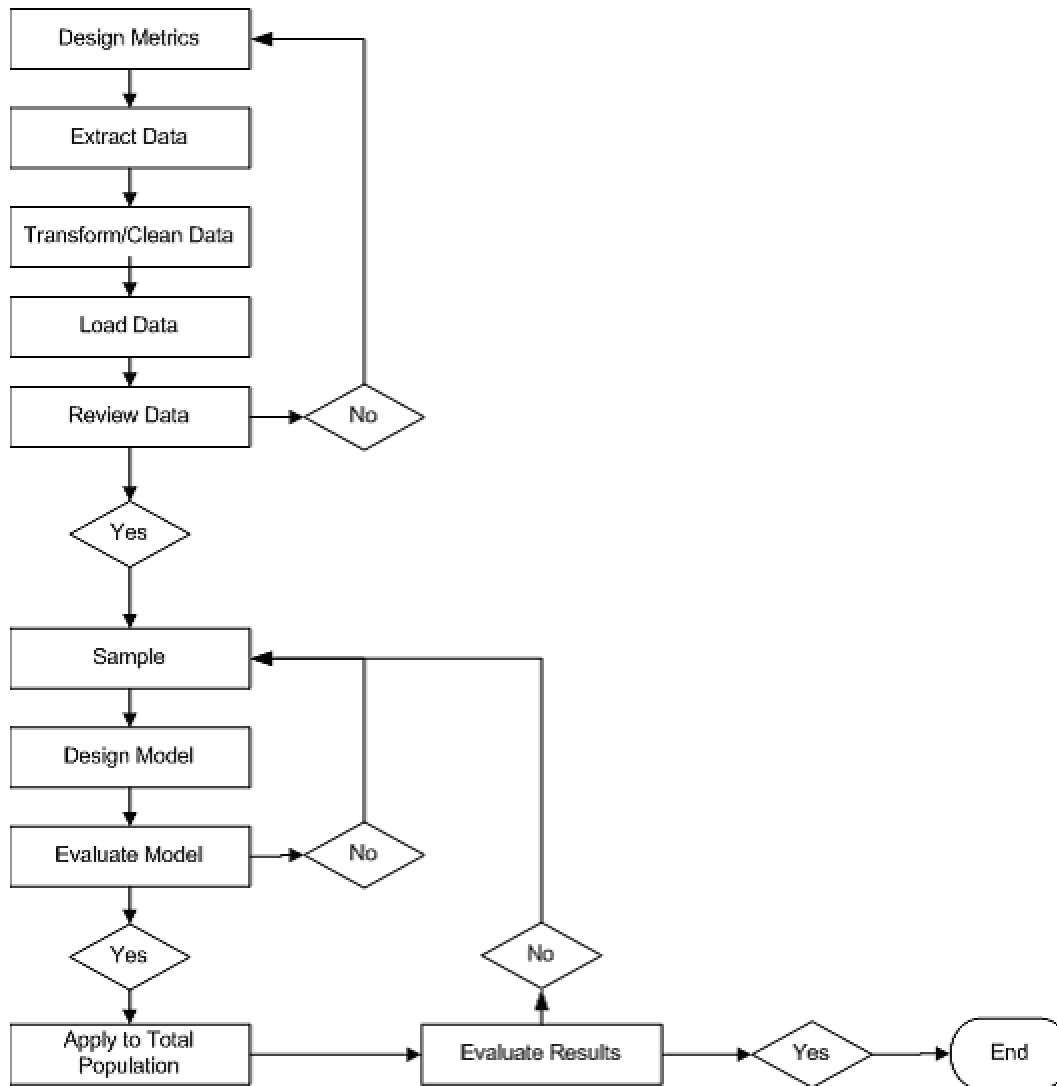* 1 INSTANCE OF A WAREHOUSE STORES 0 TO MANY PRODUCTS

Source: http://searchdatabase.techtarget.com/sDefinition/0,,sid13_gci333128,00.html

Data Flowchart
DFC organizes information about a process in a graphical manner thus making it clear who is impacted. DFC serves two purposes: 1) to provide an indication of how data is transformed as they move through the system, and 2) to depict the functions and sub-functions that transform the data flow.
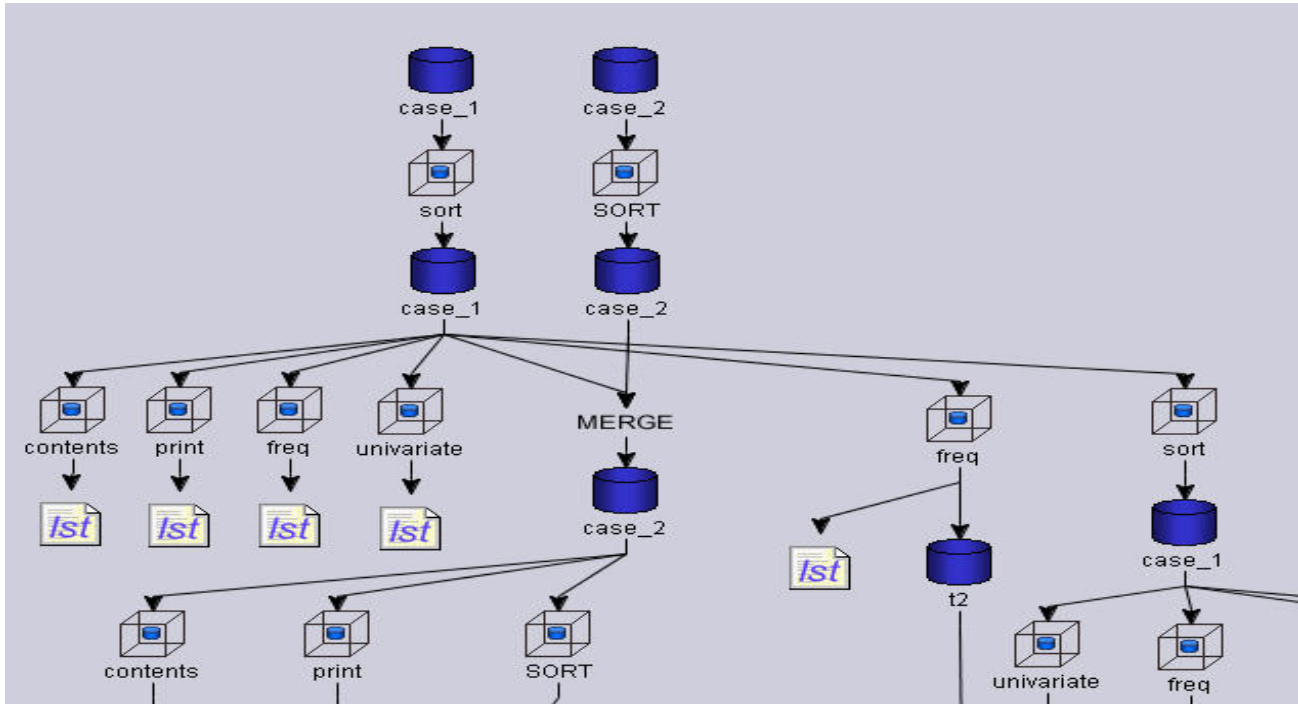
Below is an example drawn for a Student Graduation Prediction Model developed by Gary McQuown for a project for Ohio State University. He used it to chart the design process from data ETL manipulation to model metrics design and acceptance.

Figure 7: Design Process Flowchart

An effective SAS third party tool ASAP developed by complementSoft has a visualizing componentr that can generate charts automatically from the SAS code.   Below is a screenshot of the automatically generated code from ASAP.

Figure 8: ASAP's Visualizer for SAS code
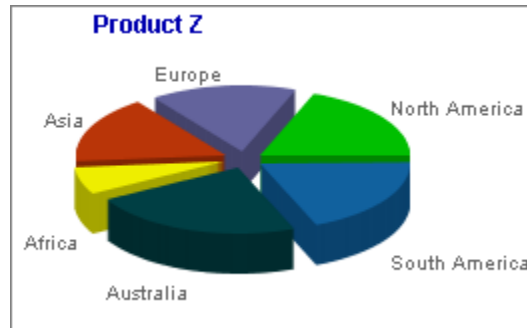

Source: A Screenshot from ASAP's Visualizer

Pie Chart, Bar Chart, and Histograms

Finally we'd like to briefly discuss Pie charts, Bar charts, and histograms that may be used throughout the project lifecycle. These charts, though not indispensable like ERD and DFC, help convey information instantly through often colorful visual illustrations.

Pie Chart
A pie chart is a specialized graph used in statistics. The independent variable is plotted around a circle in either a clockwise direction or a counterclockwise direction. The dependent variable (usually a percentage) is rendered as an arc whose measure is proportional to the magnitude of the quantity. Each arc is depicted by constructing radial lines from its ends to the center of the circle, creating a wedge-shaped "slice." The independent variable can attain a finite number of discrete values (for example, five). The dependent variable can attain any value from zero to 100 percent.
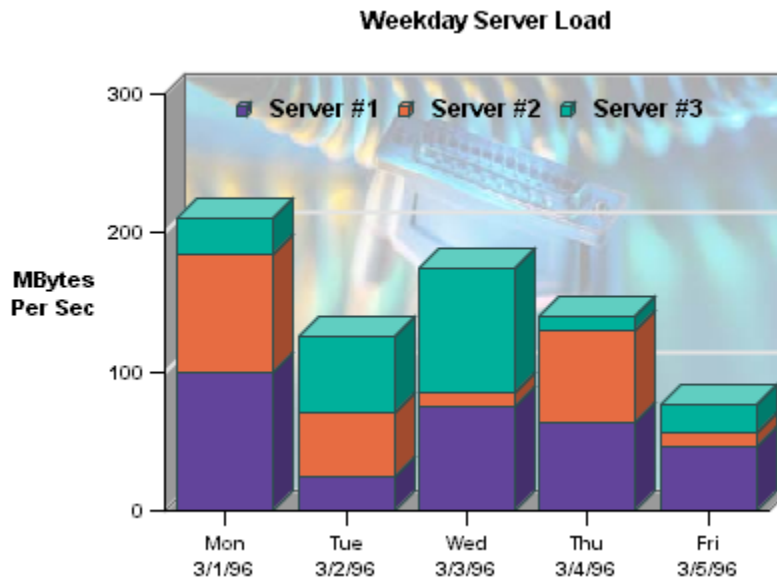
Figure 9: Pie Chart

Bar Chart
Bar graphs are useful for comparing a number of discontinuous events (or values) against the same scale. Bar charts allow you to see the differences between events rather than trends. Stacking and grouping bar graphs can also serve to show relationships between data sets.

Figure 10: Example of Vertical Bar Chart

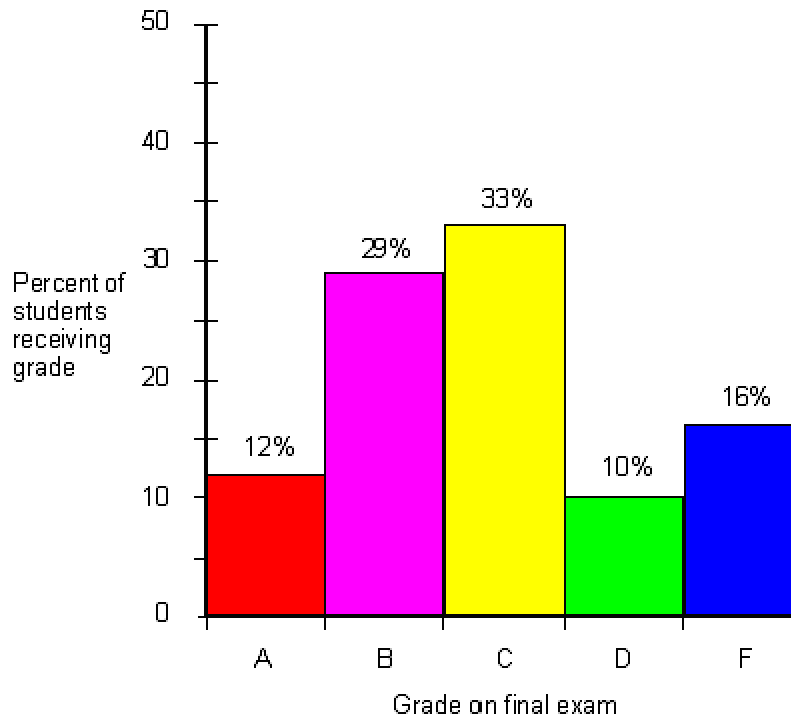http://www.visualmining.com/examples/styles/bar-graphs.html?source=gaws1

Histograms
A histogram is a specialized graph or plot used in statistics. In its most common form, the independent variable is plotted along the horizontal axis, and the dependent variable (usually a percentage) is plotted along the vertical axis. The independent variable can attain only a finite number of discrete values (for example, five) rather than a continuous range of values. The dependent variable can span a continuous range. The illustration is a histogram depicting the results of a final exam given to a hypothetical class of students. Each grade is denoted by a vertical bar of a certain color. The total of the percentages is equal to 100 (this is important; if it were not, the accuracy of the graph would be suspect).

Figure 11: Example of a Histogram

Source: http://whatis.techtarget.com/definition/0,,sid9_gci330729,00.html

The difference between a bar chart and a histogram is that in a bar chart, the classification variables are usually nominal or ordinal scale while histograms are typically constructed for interval or ratio scaled variables.

CONCLUSION

Since the early days of software development, IT managers and programmers have depended on charts and graphs for project planning and system specification mapping. The more complex a project is, the more important it is to chart. The charging tools have become more sophisticated in recent decades, but the tasks remain the same. In a world where over 70% IT projects cannot be delivered on time and within budget, the effective use of charts and graphs will definitely offer us an advantage and increase our chance of success.

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About the Authors:

Dawn Li, Ph.D. and Gary McQuown are co-owners of Data and Analytic Solutions, Inc, a SAS Alliance Partner, located in Fairfax, Virginia (http://www.dasconsultants.com). Dawn has worked in numerous IT projects using Software Development Lifecycle Methodologies to ensure the success of those projects. Charts and graphs are a norm for these projects, with some flowcharts as long as 20 pages. She can be reached at dawnli@dasconsultants.com. Gary has programmed in SAS long enough to learn the difference between a programmer and a developer. He provides SAS solutions for large and small firms in the US and Europe. Previous presentations have been made at NESUG, SESUG, SSU and MWSUG. He can be contacted at gmcquown@dasconsultants.com.