

# Constructions from Dots and Lines

by Marko A. Rodriguez and Peter Neubauer

A graph is a data structure composed of dots (i.e., vertices) and lines (i.e., edges). The dots and lines of a graph can be organized into intricate arrangements. A graph's ability to denote objects and their relationships to one another allows for a surprisingly large number of things to be modeled as graphs. From the dependencies that link software packages to the wood beams that provide the framing to a house, most anything has a corresponding graph representation. However, just because it is possible to represent something as a graph does not necessarily mean that its graph representation will be useful. If a modeler can leverage the plethora of tools and algorithms that store and process graphs, then such a mapping is worthwhile. This article explores the world of graphs in computing and exposes situations in which graphical models are beneficial.

## The Bits and Pieces of the Dots and Lines

A model is a representation of some aspect of reality. Many models can be thought of as a collection of objects, such as people or concepts, and the relationships that exist between them, such as friendships or subclasses. Such objects and relations form a network. Graphically, an object in a network can be denoted by a dot, and a relationship can be denoted by a line. A structure formed by dots and lines is known as a graph – the mathematical term for a network [1]. The most common type of graph is the simple graph. An example

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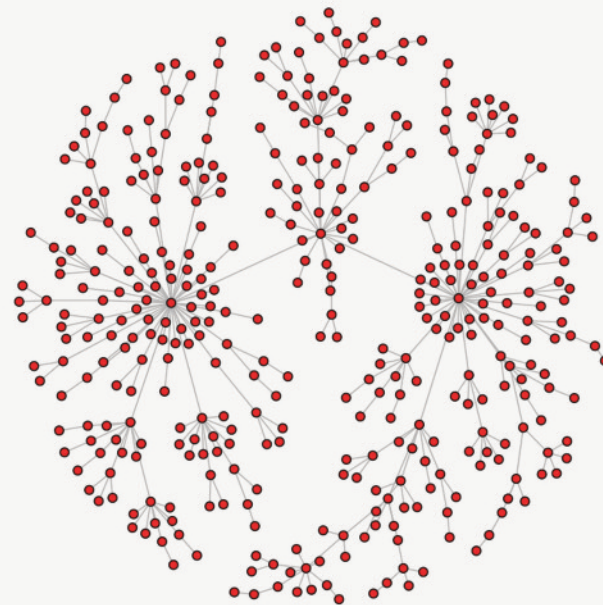


FIGURE 1. The prototypical graph is the simple graph. In this structure, dots (vertices) and lines (edges) exist. While the primitives are simple, their amalgamation can yield great complexity.

is diagrammed in Figure 1. In a simple graph there are a set of vertices (dots) and a set of edges (lines), where edges are undirected and connect two unique vertices (that is, there are no loops), and no two edges exist between the same pair of vertices.

Despite the title of this article, dots and lines are not the only components in a graph modeler's toolkit. There are many more bits and pieces in the world of graphs. In practice, rarely are vertices and edges the only data











