

## Chapter 1

# Getting Started with Digital Maps

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### *In This Chapter*

- ▶ Discovering digital maps
  - ▶ Using digital maps
  - ▶ Discovering types of map programs
  - ▶ Understanding the differences between Geographic Information System (GIS) and consumer mapping programs
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**T**his chapter introduces you to the fundamentals of digital maps. You find out what a digital map is, the differences between static and smart digital maps, and the different types of programs available for using digital maps.

## *What Is a Digital Map?*

Any *map* is a picture of where things are, generally associated with our planet and its geographic or man-made features. Road maps, hiking maps, maps to Hollywood stars, and all sorts of other maps provide a sense of place and often help you get from one place to another.

Most maps are printed on paper. That's pretty convenient. They can be folded into a lightweight, compact bundle (if you've had a little practice). *Digital maps* (maps made on a computer or meant to be used with a computer) serve the same purpose as their paper cousins. It's just more difficult to fold a CD.

Digital mapmaking is a significant leap forward from traditional paper maps.

✔ **Maps can be made faster, cheaper, and more accurately.**

This is important because of how quickly new roads, subdivisions, and development projects pop up in fast-growing urban areas. An old street map isn't much help in a new subdivision with a couple of hundred homes. The same problem affects political maps; an example is the change in national names and borders after the end of the Soviet Union.

✔ **Digital map data can be used with mapping software to make digital maps on your personal computer.**

## Making maps

*Cartography* is the art and science of making maps. Until the 1960s, maps were made the time-honored, traditional way:

1. Draw an original map by hand, based on land survey measurements and other information.

2. Print as many copies as you need.

That changed with the advent of computers, satellite imagery, and Global Positioning System (GPS), which made making maps much easier. Most paper maps now are generated or produced on a computer.

Read on to discover the many types of digital maps.

### *Static map*

A *static map* is the simplest form of digital map. Often it's a paper map that's been scanned and turned into a BMP (bitmap) or JPG (graphic) file. Aside from displaying it, printing it, and perhaps making a few edits, what you can do with the map is limited.

Static maps used to be the only type; often, a static map is all you need.

### *Smart map*

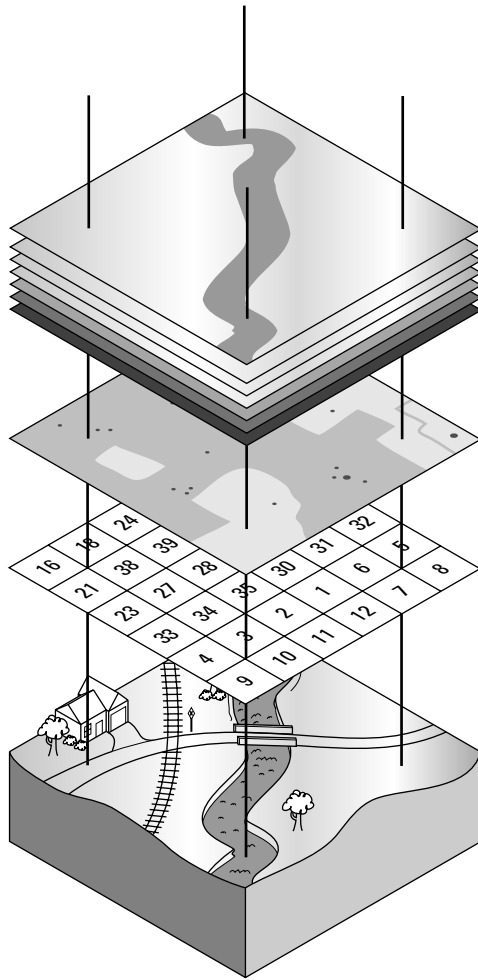
*Smart* digital maps (as shown in Figure 1-1) may look like static maps, but data is associated with map locations. The data can be as basic as the latitude and longitude of a point, or as detailed about vegetation, soil type, and slope.

*Spatial* or *geospatial* data is associated with a place. The place can be smaller than a meter or as large as a country. Spatial data can be stored two ways:

- ✓ Embedded in a map graphic file
- ✓ Separate files with references to the locations



*TIFF* (Tagged Image File Format) is a popular format for storing graphics files. The *GeoTIFF* extension embeds geographic tags into map images. If you view a *GeoTIFF* file with a standard graphics program, it looks like an ordinary map. A program that uses the data tags can access the spatial data associated with each pixel in the image.



**Figure 1-1:**  
A smart  
map has  
associated  
data.

## Mapping Programs

Although many different kinds of mapping programs are available, you can classify map programs in two types: consumer programs and Geographic Information System (GIS) software. Here is a quick look at each type.

### Consumer programs

A *consumer* mapping program is software that displays street maps, topographic maps, marine charts, or aeronautical charts. Such mapping programs

are easier to use (and much less expensive) than their professional counterparts, meeting most computer users' mapping needs.

This book focuses on mapping programs available to consumers.

## GIS (Geographic Information System)

A *Geographic Information System* (GIS) is an information system that analyzes, inputs, manipulates, outputs, retrieves, and stores spatial data. GIS is mostly used by governments; large corporations; and engineering and GIS consulting firms for land, natural resources, transportation, environmental, and urban planning and management.



Some people use the terms *digital map* and *GIS* interchangeably. This really isn't correct. GIS isn't just about making maps. GIS involves using computers and special software to help people make decisions by using spatial data.

Distinguishing between consumer mapping programs and GIS programs is important:

- ✔ **GIS software**, which is sold primarily to governments, corporations, and consulting firms, is flexible, powerful, and relatively expensive.
- ✔ **Consumer mapping programs** target the needs of average computer users. These programs are much more limited in scope and functionality — and a lot less expensive — than GIS programs.



GIS software typically has a steep learning curve; you can earn advanced degrees in GIS. Consumer mapping programs can mostly be used right out of the box and can be mastered in a relatively short period of time.

A typical consumer mapping program is a road map program that costs about \$30 and provides exact routing directions to get from one location to another. This isn't a static map because it has underlying data (such as street names, distances, and gas stations), which can lead you to think it's a GIS program. Not so. A true GIS program has built-in precision tools that can (for example) let you input data about traffic flow and vehicle speeds, and then display every street where traffic volume exceeds 500 cars per hour and vehicle speeds are .5 miles an hour over the speed limit. The price tag for such a GIS program would be at least \$1,000, not to mention the costs of training people to use it and gathering all the traffic data to input into the system.



Of course, if you have a burning need for high-end precision and complexity, it's still possible to get into GIS on the cheap. A growing community is developing open source and free GIS programs. Although many of these programs lack the polish of a commercial product, they do get the job done. The <http://opensourcegis.org> and [www.freegis.org](http://www.freegis.org) Web sites are two excellent resources for finding out more about free GIS programs.

## Using Digital Maps

There's an old song that goes, "Anything you can do, I can do better." If digital maps could sing that tune to their paper counterparts, they'd be right (for the most part). Digital mapping software offers all sorts of enhancements over paper maps, including these capabilities:

- ✓ Finding street addresses quickly
- ✓ Interfacing with GPS receivers to see where you are or where you were
- ✓ Showing driving directions to just about anywhere
- ✓ Displaying terrain three-dimensionally
- ✓ Annotating maps with pop-up information
- ✓ Creating custom maps
- ✓ Printing a hard copy map (which is sometimes the most important)

Digital maps do have a few drawbacks, including these:



✓ **You need a computer.**

If you have a laptop or personal digital assistant (PDA), you can take mapping software on the road with you.

✓ **You need software.**

This book helps you select and use software packages, particularly mapping programs in the free–\$100 price range.

✓ **You have to spend time mastering the software.**

Most mapping software is readily usable, but all programs have nuances that sometimes make their features and user interfaces a little tricky.

## Mapping Software: The Essentials

The first step for digital mapping is to understand the available types of mapping programs and their capabilities and limitations; that's what this part of the book is all about.

After you know what software is available, you can match it to your needs. An invitation to a birthday party may consist only of displaying a screen capture of a street map on a Web site, editing and saving the map in Paint, and then e-mailing it to friends. A week-long backpacking expedition would require a *topographic* mapping program (showing land features) to plan your route, view elevation profiles, and upload location data to your GPS receiver.

Before you can select the right tool for the right job, you need a general handle on the options that you can include in your digital-mapping tool chest. This section of the book organizes mapping programs into three categories:

- ✓ Standalone programs
- ✓ Programs bundled with maps
- ✓ Web-hosted mapping services

## *Standalone programs*

A *standalone program* is a program that can open and use digital maps. These programs typically don't come with map data, and you'll need to download or purchase the maps you're interested in using.

Like with a word processor or a spreadsheet, a mapping program needs someone to input data before it can be useful. In this case, the data is bits and bytes that describe how a map should be displayed. Fortunately, an amazing amount of map data is freely available on the Internet, most of it already collected by the government and in the public domain.

A big market exists for commercial map data. People buy data to use with their mapping programs because

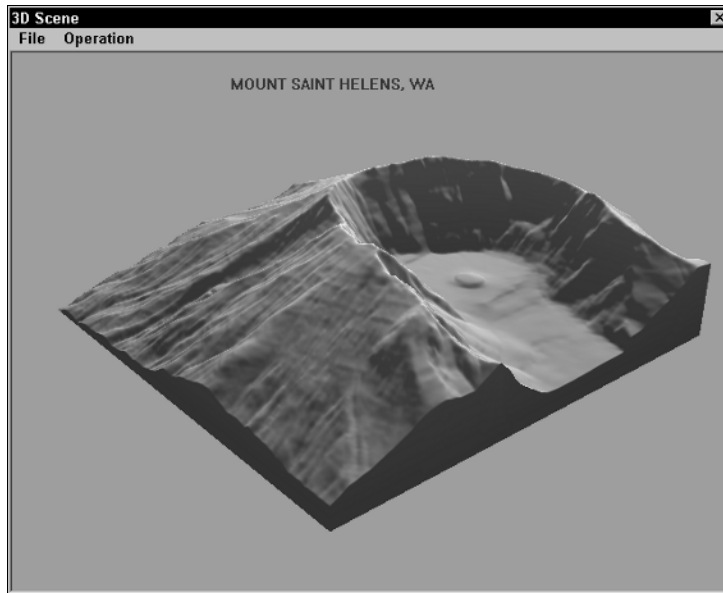
- ✓ Free data may not be available for an area or a specific need.
- ✓ Commercial data may be enhanced with information unavailable in the free versions.
- ✓ Firing up a CD filled with data is more convenient than searching for free data and then downloading it.

Many standalone mapping programs aren't tied to one data type. (Chapter 2 shows which types of digital map data are commonly used.) Figure 1-2 shows a three-dimensional map of Mount St. Helens created with 3DEM from free U.S. Geological Survey (USGS) digital elevation map (DEM) data. (Mount St. Helens, an active volcano in Washington State, erupted in 1980.) The elevation map shows the crater and how the volcano blew out its side.

Map programs are viewers, editors, or both:

- ✓ **Viewers** show only maps.
- ✓ **Editors** can make changes.

Usually you can't change a base map you've opened from a data file, but you can add text and draw shapes on top of the map.



**Figure 1-2:**  
A 3-D map  
created with  
a free map  
program  
and free  
map data.

Many standalone programs are either free or shareware. Two aspects of such programs are especially worth noting:

- ✓ Some manufacturers offer free (or cheap) limited-feature versions of their products that are otherwise available as pricy commercial software.
- ✓ Standalone mapping programs are mostly suited to a user who has intermediate to advanced computer skills and experience.

Examples of standalone mapping programs include OziExplorer ([www.ozexplorer.com](http://www.ozexplorer.com)), USAPhotoMaps (<http://jdmcox.com>), and 3DEM ([www.visualizationsoftware.com/3dem.html](http://www.visualizationsoftware.com/3dem.html)). Don't forget that you can also make maps with Paint or any other general-purpose graphics program. This book shows how to use these programs and others.



TIP

Some free, noncommercial mapping programs have advanced features that are normally more suited to professional users. Don't be intimidated by every feature and option. You can use some commands and features to make maps for your needs. And you can master those other features if you ever need to.



WARNING!

One big disadvantage to standalone mapping programs is that you need to search the Internet for the data you need, find and download it, and then open it with the map program. This process sometimes involves *registering* a map so that the coordinates all line up. Also, even with a high-speed Internet connection, downloading can still be a hassle. And after all that, you still have to find the map data for an area that you want to view, and then successfully load all that stuff into the mapping program.

## Programs with bundled maps

Mapping companies bundle software with digital maps. The program comes with the map data and is distributed on CDs or DVDs; static or smart maps that have a lot of detail can be quite large in size. You install the mapping program, and you're immediately ready to start using the data on the CD.

Data files bundled with software are often in a proprietary file format, which can be read and used only with the software that comes with the product. The same usually holds true for maps that you can upload to a GPS receiver; only maps from the manufacturer can be used.

Sometimes you don't have much choice between using a standalone program or one bundled with maps.

- ✓ Topographic map data of the United States is widely available for free. You can use a number of free or shareware programs to view maps.
- ✓ Only outdated Census Bureau map data is available for United States streets and roads. Most free or shareware programs don't match the features in commercial products.

Software that comes with bundled maps has gotten incredibly cheap over the years. With discounts and rebates, you can often find road atlas software for around \$20 that covers the entire United States. For a little under \$100, you can buy programs that come with a full set of detailed digital topographic maps for an entire state. Considering that a single paper USGS 1:24,000 map costs around \$7 — and there can easily be over a thousand maps per state — that's a pretty decent value. Figure 1-3 shows a map made by Terrain Navigator ([www.maptech.com/land/TerrainNavigator](http://www.maptech.com/land/TerrainNavigator)), which is a topographic mapping program that comes bundled with map data.



Manufacturers that sell bundled map programs (particularly those with street and road data) usually come out with a new release of their product every year or so. In addition to enhancements in the software, the map data contains new roads and updated services information (such as gas stations, restaurants, and hotels, called *POIs*, or *Points of Interest*). Whether you buy an updated copy of the software every year depends on your circumstances. If you usually travel on major roads, or in areas that haven't experienced much development and growth, you probably don't need to update every year. On the other hand, road atlas software is fairly inexpensive, so if you travel a lot and rely on the program, it can be a cheap investment.

If you have beginning to intermediate computer skills and experience, you can come up to speed quickly with bundled map programs. The user interfaces are generally simpler than those found in feature-rich, standalone programs.

Examples of programs that come bundled with maps are DeLorme's Street Atlas USA ([www.delorme.com](http://www.delorme.com)), National Geographic's TOPO! (<http://>



maps.nationalgeographic.com/topo), and mapping software from GPS manufacturers that interfaces with their receivers. These programs and others like them are discussed in following chapters.



**Figure 1-3:**  
A 1:100,000  
scale topo-  
graphic map  
displayed  
with  
Maptech's  
Terrain  
Navigator.

## Web-hosted mapping services

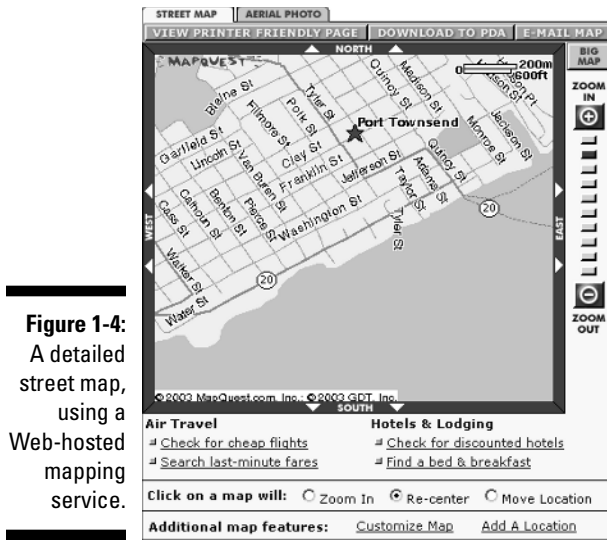
A *Web-hosted mapping service* is a Web site that displays a map. You just need Internet access and a browser to view street maps, topographic maps, aerial maps, satellite imagery, and many other types of maps. This eliminates purchasing and installing specialized programs and map data on your hard drive, swapping CDs to access new map data, and mastering a new program. (Figure 1-4 is a detailed street map of downtown Port Townsend, Washington, using [www.mapquest.com](http://www.mapquest.com), a Web-hosted mapping service.)



If a map isn't displayed, check your browser's Java settings first. A number of Web-hosted mapping services, in particular the U.S. government sites that all share the same mapping engine, require Java and/or JavaScript enabled in your browser before maps can be correctly displayed.

Most Web-hosted mapping services are extremely easy to use. Anyone who can use an Internet browser should be navigating through maps in no time.

Examples of Web-hosted mapping services include MapQuest ([www.mapquest.com](http://www.mapquest.com)), TerraServer-USA (<http://terraserver-usa.com>), and TopoZone ([www.topozone.com](http://www.topozone.com)). You discover how to use these mapping Web sites and others in other chapters of this book.



**Figure 1-4:**  
A detailed  
street map,  
using a  
Web-hosted  
mapping  
service.

Although most of these free Web sites don't have all the features of a map program that you install on your hard drive, they offer a surprising amount of capability, especially considering their cost. (Some mapping sites on the Web charge for advanced services, such as color aerial photographs, larger map sizes, and enhanced searching.)

## A few words on commercial GIS software

This book doesn't dwell overmuch on commercial GIS software packages. If your mapping needs get complex enough to require GIS (or you just want to find out more about these high-end mapping systems), check out the Web sites of the top three GIS companies:

- ✓ **ESRI:** Environmental Systems Research Institute is the largest GIS company in the marketplace. Its Arc products (such as ArcInfo and ArcView) are standards in the GIS field. For more information about ESRI, go to [www.esri.com](http://www.esri.com).
- ✓ **MapInfo:** MapInfo develops and sells a wide array of GIS products. For more information

on the company and its products, see [www.mapinfo.com](http://www.mapinfo.com).

- ✓ **Autodesk:** Autodesk is the developer of AutoCAD, a widely used computer-aided design program. Autodesk add-ons and standalone GIS programs are used throughout the world. You can find out about the Autodesk mapping applications at [www.autodesk.com](http://www.autodesk.com).

The GIS Lounge is a great Web resource that isn't tied to a specific manufacturer. This site provides information on all aspects of GIS, and has informative and educational content for novices to professionals. For more information, go to [www.gislounge.com](http://www.gislounge.com).