Foreword by Michael T. Jones, Chief Technology Advocate, Google

The KML HANDBOOK

Geographic Visualization for the Web

JOSIE WERNECKE

Google

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Foreword

If you have ever hiked a ridge or climbed an Alpine peak, you know that magic moment when your view rises above what's immediately around you to reveal the new and distant land beyond. This is my sense as I write this foreword. I look back at a decade-long climb to advance Earth browsing technology from an idea to a patent to a start-up business and finally into the everyday lives of hundreds of millions of people. I look ahead to those further peaks—the greater good that you and other KML developers work by building on what we have done. But most of all, I look inward to see how a decade of virtually exploring our planet has raised my own perception, tolerance, and respect for spaceship Earth and its crew.

Experience has vividly demonstrated that geographic browsing has the power of personal exploration—so much so that users of products Google Earth and Google Maps often remark after seeing their homes and locations of their lives that, as T. S. Eliot wrote in *Little Gidding*, they now "know the place for the first time."

World-spanning, detailed imagery and terrain make the geobrowsing experience real. Smooth motion and the freedom of exploration make it engaging. Brought together in a geobrowser, these attributes give the age-old complaint "if you were there, you would understand" a solution. You can now easily "go there" any time, using your personal computer or mobile phone, and when you "get there" you will see the relevant information in its natural geospatial context and have the ability to browse the area at will. For the first time, all people can know, feel, and understand in the deep ways that formerly only travel could teach.

This understanding is the ambition of the Open Geospatial Consortium's KML—to provide a popular, pervasive, and international standard for the "what" that is embedded in the "where" and "when" of Earth browsers. The chapters of this book detail many forms for this "what," including points on, above, or below the Earth or even in outer space, lines for roads, paths, and boundaries, filled and outlined regions, text, images, 3D objects like buildings and boats, and various mechanisms and encodings for sharing each of these.

Together these elements form a comprehensive markup language and publishing framework annotating the Earth and other planets with the unbounded diversity of humanity's information. This role is like the relationship between page-oriented web browsers and HTML, the difference being that a page browser without an HTML file is just a blank page, while an Earth browser without a KML file will still offer a richly detailed world to explore and enjoy—it will lack only the annotation information that would turn the planet into a storytelling mechanism.

If this idea of a planet lacking the critical annotations to make a point—say real-time traffic and weather, the locations of your bank's ATMs, the trend of sea temperature rise near coral reefs, the story of Shackleton's voyage, the details of every location mentioned in a Jane Austen novel or Shakespeare play, or the spread of the H5N1 virus—troubles you and moves you to action, then KML and this book are for you. For in that case, you are one who will use the power of geobrowsing and the geoweb to create the distant land we see beyond today's mountaintop, a land where information has the power to save our planet, reshape politics, educate people, and improve life. For your role in using the virtual world to change the real one, I salute you.

Michael T. Jones
Chief Technology Advocate
Google

Preface

"Learning to 'see geographically' means grasping an ever-changing world in an integrated way. It means getting to the heart of environmental and human problems. It involves balancing global and local understandings. It opens an opportunity to encompass themes vital to today's world: the working of the earth's natural systems, the increasingly problematic interaction between people and the physical environment, the nature of human social organisation with all its inequalities and struggles for power over people and nature."

From "Why Choose Geography?"
Geography Department, University of Liverpool

I took my only formal geography class in the eighth grade from Mr. Granger, and I loved it. I'm intrigued by the different graphical styles of maps and continue to be amazed by the variety of information that can be shown geographically. By luck, two years ago I was assigned to a project at Google called "KML," which has been as much fun as any work can be and as instructive as a year-long series of college seminars, lectures, and personal tutorials. **KML** stands for **Keyhole Markup Language** and is a simple, human-readable format originally used by Google Earth (and now by a host of other Earth browsers).

This book is an attempt to share the knowledge I've gained from the experts at Google. When I joined it, the KML team consisted of two engineers: Bent Hagemark and Michael Ashbridge ("Mash"). Bent and Mash's mission was to corral the existing KML into a formal XML schema, to create compelling examples that would represent good coding style, and to shepherd the language to its new and deserved status as an international standard. I was to create a website for KML and expand the existing documentation. I managed to complete that task, but it always felt as though I'd exposed only the tip of the iceberg. Well, here's The Iceberg.

The *KML Handbook* is also an effort to publicize some of the inspirational KML work by brilliant thinkers around the world—many of them technical experts in their own fields but completely new to XML, KML, and even to the basics of computer programming. They've discovered that KML brings raw numbers, arbitrary place names, and flat maps to life, and they've struggled and experimented to discover the hidden logic behind Google Earth's data format. I hope that, with this book at your side, there will be no more struggles.

Audience

This book is written for people who are curious about how to create customized presentations for an Earth browser such as Google Earth but have little or no experience with computer programming. It also contains information primarily of interest for "power users" who want to use the more advanced features of the language. The text suggests the level of complexity for each general topic, and the chapters follow a basic flow from relatively simple to more complex topics.

What You Should Know Before Reading This Book

This book assumes you are somewhat familiar with creating, storing, and loading files onto a computer and into a web browser and that you're connected to the Internet. Although it describes a few elements of HTML that are used in a placemark balloon, it does not attempt to provide an in-depth explanation of HTML. If you're new to HTML, you'll probably want to consult some additional resources on that subject. You do not need to know XML in order to use KML; this book teaches you the XML basics required to use KML.

If you want to set up a server to host KML files referenced in network links (Chapter 6), you'll also need to select a web server software package such as Apache or lighttpd and then install and configure the server according to the specific instructions for that product. Chapter 6 offers some basic information on this topic, but the details are best left to the individual product documentation.

What This Book Contains

Chapter 1, A Quick Tour, provides an overview of the many different uses of KML, ranging from simple sets of placemarks to elaborate blogs and websites that use KML to make attractive, informative presentations of geographic data. This chapter describes a simple "Hello, Earth" example that illustrates the basic parts of a KML file.

Chapter 2, Placemarks and Balloons, describes how to create custom icons and attractive balloon styles. It contains detailed information on how to specify colors in KML and how to create KMZ archives.

Chapter 3, Geometry, goes into detail on specifying coordinates and altitude modes and also explains concepts related to geometry such as tessellation and extrusion. It includes examples and explanations of all geometry elements, including Models. It also shows you how to add elements describing the author and source of a KML file.

Chapter 4, Styles and Icons, explains how to use shared styles and how to create all types of substyles: icon, label, line, polygon, balloon, and list substyles.

Chapter 5, Overlays, describes how to create screen, ground, and photo overlays. Other topics covered here include the special processing required to add very large (gigapixel) photos to a photo overlay and how to specify a viewpoint using the Camera element.

Chapter 6, Network Links, covers how to host KML files on a web server, where they can be refreshed periodically or processed by user-written scripts. It also introduces network link controls, which control certain aspects of the fetching network link.

Chapter 7, Dynamic KML, provides detailed examples of the Update feature, which allows you to create, modify, and delete elements in KML files that have been previously fetched by a network link. This chapter also describes the time elements, which allow you to animate geometry in a KML file.

Chapter 8, Dealing with Large Data Sets, contains important information on regions and custom data types. Regions are a powerful mechanism that allow you to control the conditions under which a given feature comes into view. If you're interested in creating a custom balloon-style template for use throughout a KML presentation, be sure to read the section Entity Replacement for Extended Data Elements.

Appendix A, KML Reference, is an alphabetical reference that contains a brief description of every element and type in the KML standard, with syntax sections for all complex elements. This appendix describes the basic structure of a KML file and conventions of the language.

Appendix B, Sky Data in KML, describes how to display astronomical data in an Earth browser. It includes the syntax for the "hint" used at the beginning of the KML file to alert the browser that the file contains sky data and also describes how to convert celestial coordinates for display in Google Earth and other Earth browsers.

Trying the Examples

The complete set of examples for *The KML Handbook* is available at informit.com/title/0321525590. Click the link for any example to launch Google Earth and view the presentation. Then use the copy-and-paste trick (Chapter 1) to view the KML code.

Formatting Conventions

Code examples are set in `Courier` font. Syntax sections for complex elements are also set in `Courier` font, and they have a shaded background that distinguishes them from the examples. Elements discussed in the chapter are set in **boldface type**.

This special icon indicates that the code example can also be found online at informit.com/title/0321525590.

KML element names are set in the normal text font and enclosed in angled brackets (for example: <Placemark>, <NetworkLink>, <GroundOverlay>). For readability, element names also appear as simple lowercased words when no ambiguity results from this more casual usage (for example: placemark, network link, ground overlay).

Acknowledgments

It's been a privilege to work with members of the Google Earth team: intelligent, creative, and generous people. This book is the result of patient teaching, helpful criticism, and enthusiastic coaching from many people at Google.

At the very top of the list is Bent Hagemark. His easygoing, friendly demeanor and soft-spoken style belie a rigorously demanding technical intelligence of the highest caliber. He taught me most of what I know about KML, and he's been willing to read and reread my prose as many times as I've had the energy to write and rewrite it. Similarly, Michael Ashbridge has provided endless and cheerful assistance every time I've requested it, along with a great sense of humor. Mano Marks, who joined the KML team soon after me to support external developers, has promptly reviewed all drafts and helped me understand the needs of our audience. I would never have attempted this book, and I certainly could never have completed the project, without the support of Bent, Mash, and Mano.

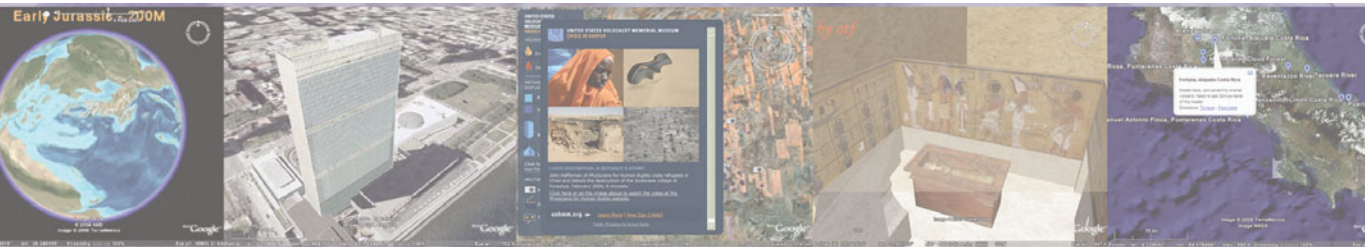
Many thanks, too, to the members of the Google Earth team, especially John Rohlf, Francois Bailly, Brent Austin, Greg Coombe, Ryan Scranton, Peter Birch, Michael Weiss-Malik, Brian McClendon, and Michael T. Jones. I also appreciate the assistance of the Google Earth Outreach team, especially Rebecca Moore and Jenifer Foulkes, who helped me track down some great examples of KML in the wild.

One of the most delightful parts of this project was searching the web for interesting applications of KML technology. Special thanks to all of the KML authors who so graciously granted permission to include their code and examples. Although space here is limited, I'd like to highlight the creators of some of the key examples used in this book (in order of appearance): Pamela Fox; Mano Marks; John Bailey, Peter Webley, and the Alaska Volcano Observatory; the Jane Goodall Institute; the United States Holocaust Memorial Museum; Angel Tello; Jerome Burg; Brian Flood; Stefan Geens; Declan Butler; Valery Hronusov and Ron Blakey; James Stafford; Bent Hagemark; Michael Ashbridge; the David Rumsey Map Collection; and Antonio Rocha Graca.

Writing is hard work, and it helped to have the support and understanding of the Google EngDocs writing team. Special thanks to Tina Ornduff, who shared an office cubicle with me for the duration of this project and provided frequent encouragement. We often reminded ourselves of Anne Lamott's book, *Bird by Bird*, as we tackled our seemingly endless writing tasks.

Addison-Wesley recruited a dedicated group of reviewers: Warren Kelly, Stephen Kemp, Daniel McKinnon, Jennifer Minnick, and Bob Yewchuk. I appreciate your conscientiousness in promptly reading every chapter and sending me such helpful criticism. Thanks to my editor, Greg Doench, for keeping the faith when I fell behind schedule at the start of the project, and to Michelle Housley and Elizabeth Ryan for keeping us all on track.

And finally, hugs and a toast to my friends, especially Priscilla Hospers and Judy Coughlin, and my family: my sons Jeff and Evan, my daughter-in-law Caryn, my sister Ruth—you have all been patient and interested, and I needed your help. Lastly, and from the bottom of my heart, thanks to Byron for sharing this journey.



Chapter 1

A Quick Tour

After reading this chapter, you'll be able to do the following:

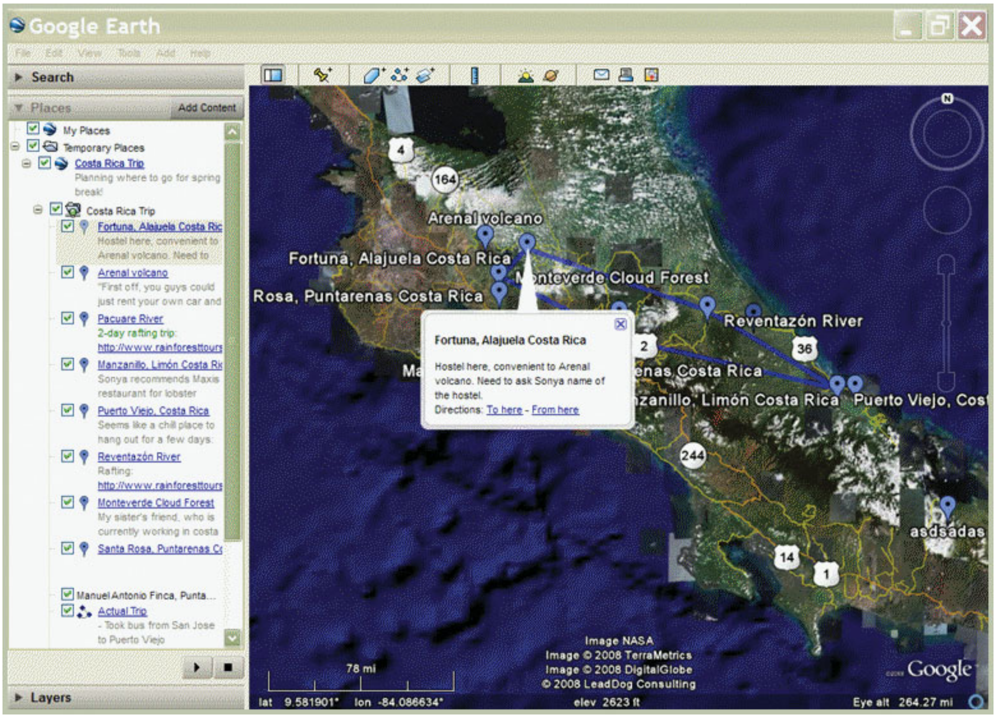
- Give a simple definition of KML in layman's terms.
- List four possible use cases for a KML presentation.
- Search for KML files on the web on a topic that interests you, and then view them with an Earth browser.
- Create a simple KML file and share it with your friends.

KML (Keyhole Markup Language) is an XML data format used to display information in a geographic context. Just as web browsers read and display HTML files, Earth browsers such as Google Earth read and display KML files. KML is a human-readable language composed of text and punctuation. It can be created and edited with a basic text editor, saved, and then viewed in an Earth browser. You don't need to be a technical wizard to master the basics of KML, and you'll find that this knowledge will enable you to create powerful presentations that paint your own geographic data and imagery over the global palette provided by many popular (and free) Earth browsers.

KML: An International Standard

As Michael T. Jones describes in his foreword to this book, KML was originally created in 2001 by a company called Keyhole as the data format for its Earth browser named Earth Viewer. Since that time, KML has evolved to its status as an international standard for presenting geographic information visually. Its official name is the *OpenGIS KML 2.2 Encoding Standard* (OGC KML), which is controlled by the Open Geospatial Consortium (www.opengeospatial.org/standards/kml/). At present, tens of millions of KML files are shared on the World Wide Web.

For consistency and simplicity, this book displays most KML examples using Google Earth, as shown in Figure 1-1. However, KML is now widely supported by a variety of applications, including Microsoft Virtual Earth, Microsoft WorldWide Telescope, NASA WorldWind, ESRI ArcGIS Explorer, Google Maps, Google Maps for mobile, Adobe PhotoShop, Autodesk AutoCAD, and Yahoo! Pipes. And the list of Earth browsers, mapping applications, and mobile devices that support KML is growing daily. Not all platforms support all features of KML 2.2, so be sure to test your work on the target system or software application if you have a special use in mind. There may be slight variations across browsers, but the KML basics are the same. KML is a 3D system: *Length*, *width*, and *depth* are the typical three dimensions in 3D, but in this context, it's *longitude*, *latitude*, and *altitude* that form the three dimensions. However, 2D mapping applications such as Google Maps and Google Maps for mobile also support a subset of KML.



☑ My Places
☑ Temporary Places
☑ Costa Rica Trip
Planning where to go for spring break!
☑ Costa Rica Trip
☑ Fortuna, Alajuela Costa Ric
Hostel here, convenient to Arenal volcano. Need to
☑ Arenal volcano
"First off, you guys could just rent your own car and
☑ Pacuare River
2-day rafting trip: http://www.rainforesttours
☑ Manzanillo, Limón Costa Ri
Sonya recommends Maxis restaurant for lobster
☑ Puerto Viejo, Costa Rica
Seems like a chill place to hang out for a few days:
☑ Reventazón River
Rafting: http://www.rainforesttours
☑ Monteverde Cloud Forest
My sister's friend, who is currently working in costa
☑ Santa Rosa, Puntarenas C
☑ Manuel Antonio Finca, Punta...
☑ Actual Trip
- Took bus from San Jose to Puerto Viejo

Fortuna, Alajuela Costa Rica

Hostel here, convenient to Arenal volcano. Need to ask Sonya name of the hostel.
Directions: To here - From here

4
164
Arenal volcano
Fortuna, Alajuela Costa Rica
Monteverde Cloud Forest
Rosa, Puntarenas Costa Rica
Reventazón River
2
36
enas Costa Rica
Ma
nzanillo, Limón Costa Rica
Puerto Viejo, Cost
244
asdsadas
14
1
N
78 mi
Image NASA
Image © 2008 TerraMetrics
Image © 2008 DigitalGlobe
© 2008 LeadDog Consulting
Google
lat 9.581901° lon -84.086634°
elev 2623 ft
Eye alt 264.27 mi

Figure 1-1 Share your experiences: your travels around town or around the world, places you've lived, photos you've taken. Blue icons indicate planned stops on a tour of Costa Rica. Balloons include travel tips and links to other trip resources. This file was originally created using Google's My Maps, a collaborative 2D mapping application, and was then imported into Google Earth. (KML created by Pamela Fox.)

Is the KML Specification Complete?

KML version 2.2 is complete, but the KML specification is evolving and will be expanded under control of the Open Geospatial Consortium (OGC). Version numbers for KML have a double numbering system in the form of *majorVersion.minorVersion*. KML versions that have the same major version are guaranteed to be compatible with each other. The official definition of the KML syntax is contained in the KML *schema*, a formal XML definition of the language (see www.opengeospatial.org/standards/kml/). KML 2.2, the current version, is guaranteed to be supported by the schema for KML 2.3 when it is developed. See Appendix A for more information on KML versioning.

The best place to check for progress on future versions of KML is the OCG website (www.opengeospatial.org/standards/kml/). Companies such as Google and Microsoft, which offer free Earth browsers, also provide documentation on KML. The website for this book (www.informit.com/title/9780321525598) is updated periodically to provide you with current information on recent developments in KML.

A Wealth of Resources

In addition to official OGC and various corporate websites, you'll want to check out the enthusiastic and informative KML blogging community. You'll find great tips, late-breaking news, and fabulous examples of using KML in the real world that will both educate and inspire you. Frank Taylor's long-running Google Earth Blog (www.gearthblog.com) and Stefan Geens' Ogle Earth (www.ogleearth.com) are two examples of blogs that offer a wealth of information on KML topics.

Creating and Sharing KML

You can create KML files with the Google Earth user interface, or you can use an XML or simple text editor to enter raw KML from scratch. KML files and their related images can be packaged up into KMZ archives so that all related image and model files are contained in one KMZ container (described in detail in Chapter 2). To share your KML and KMZ files, you can e-mail them as attachments, host them locally for sharing on a private home or corporate network, or host them publicly on a web server. Once you've properly configured your server and shared the web address of your KML files, anyone who's installed Google Earth (or other compatible application) can view the KML files you create.

Tell Your Story with KML

The KML community includes people with a broad range of interests and skills:

- Casual users create KML files to placemark their homes, to document journeys, and to plan cross-country hikes and cycling adventures.

- Students and teachers use KML to explore people, places, and events, both historical and current.
- Real estate professionals, architects, and city development agencies use KML to propose construction and visualize plans.
- Scientists use KML to provide detailed mappings of resources, models, and trends such as volcanic eruptions, weather patterns, earthquake activity, and mineral deposits (Figure 1-2).
- Organizations such as National Geographic, UNESCO, and the Smithsonian have all used KML to display their rich sets of global data.

You can use KML to add your own placemarks, geometry, annotations, and images on top of the base imagery of Google Earth. If you host the KML files on a server, you can

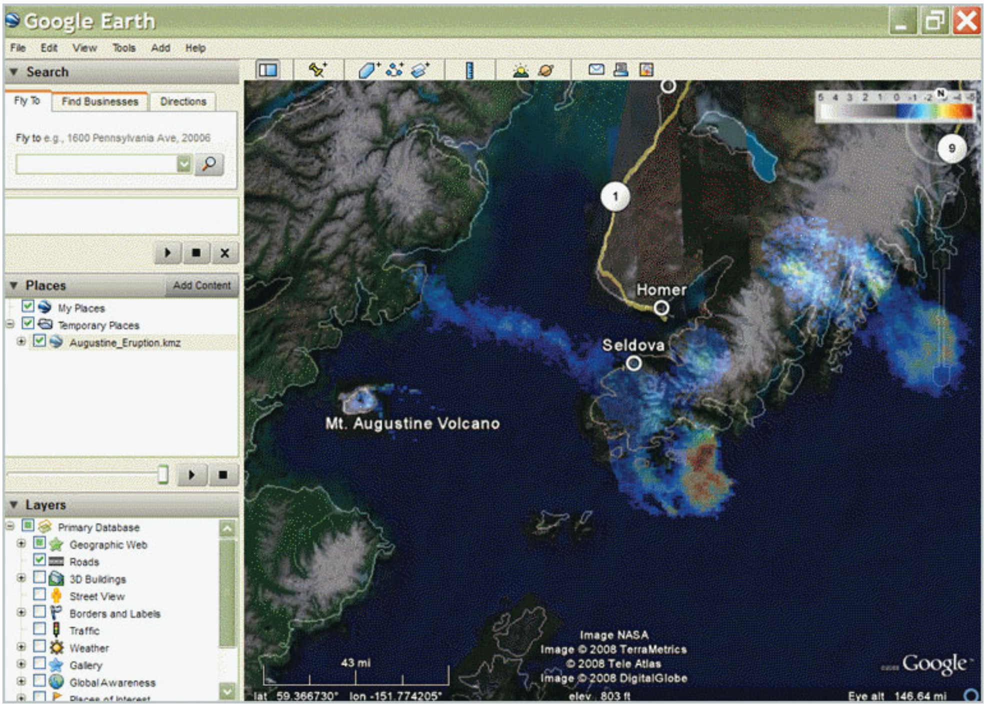
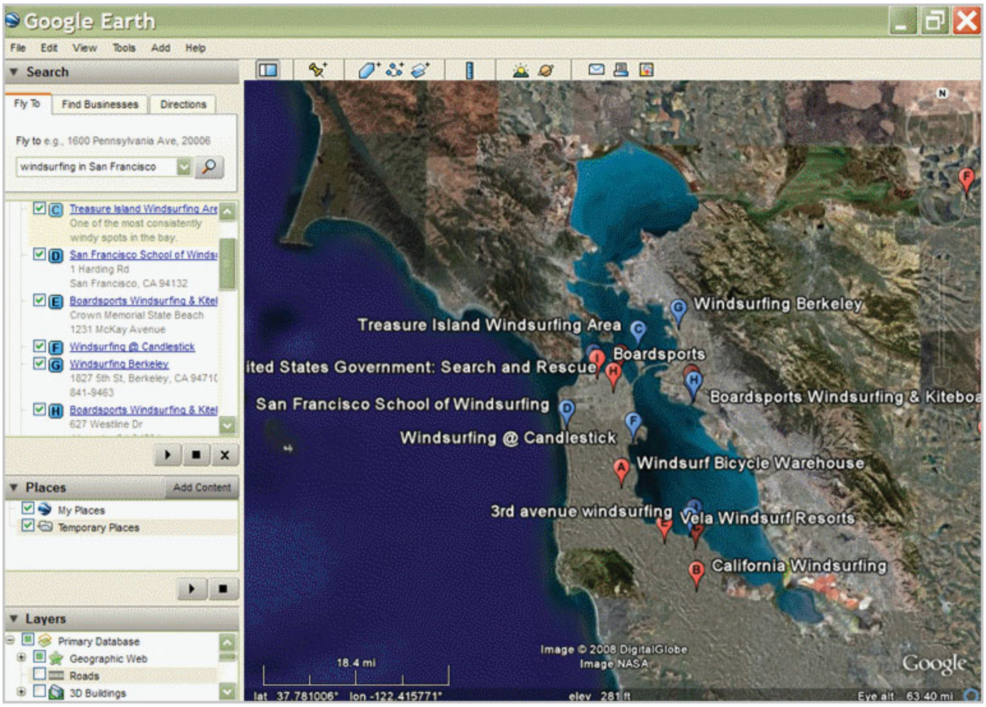


Figure 1-2 Display data in a meaningful way. Here, a team at the Alaska Volcano Observatory uses Google Earth to show an overlay of ash plumes created by an explosive eruption of Mt. Augustine Volcano. The colors represent temperature data. (Photo courtesy of John E. Bailey, Arctic Region Supercomputing Center, Fairbanks, Alaska.)



Fly to e.g., 1600 Pennsylvania Ave, 20006

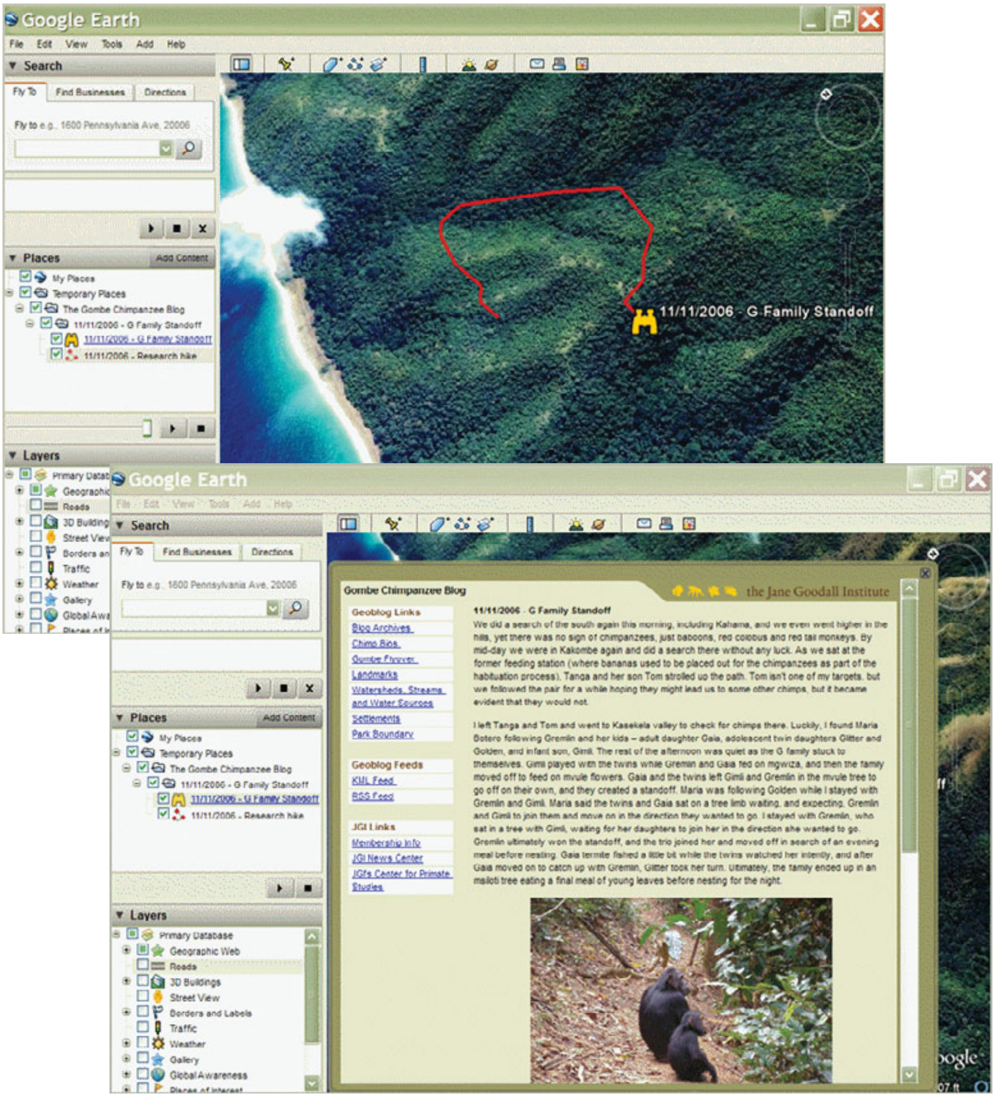
windsurfing in San Francisco

- ☑ C Treasure Island Windsurfing Are
  One of the most consistently windy spots in the bay.
- ☑ D San Francisco School of Windsu
  1 Harding Rd
  San Francisco, CA 94132
- ☑ E Boardsports Windsurfing & Kitel
  Crown Memorial State Beach
  1231 McKay Avenue
- ☑ F Windsurfing @ Candlestick
- ☑ G Windsurfing Berkeley
  1827 5th St, Berkeley, CA 9471(
  841-9463
- ☑ H Boardsports Windsurfing & Kitel
  627 Westline Dr

Figure 1-3 Search for information on a particular topic or place. Here, a search in Google Earth produces information on windsurfing spots near San Francisco.

even update your presentation on the user's system at regular intervals or whenever your data changes (see the discussion of network links in Chapter 6). Publicly hosted files are indexed by web search engines for easy access by all web users (Figure 1-3).

Personalizing your KML presentations is easy, through the use of custom styles for icons, information balloons, colors, lines, shapes, and labels. KML allows you to display features according to specific times within a given time range and to change the display according to the user's zoom level, with increasing levels of detail shown as the user flies in closer (Figure 1-4 and Figure 1-5).

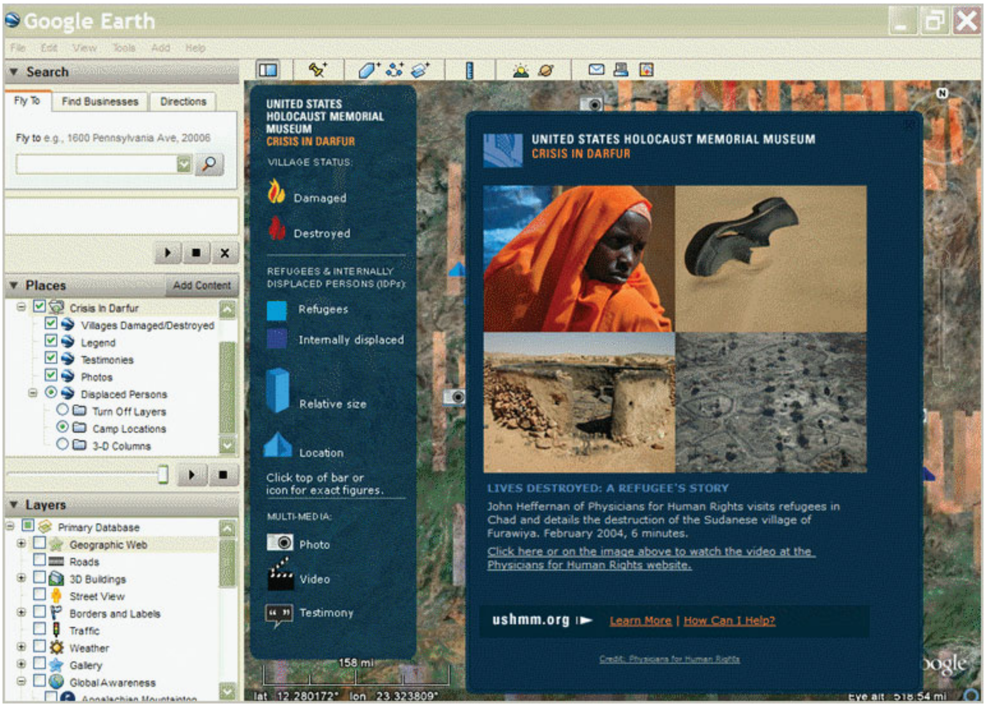


11/11/2006 - G Family Standoff

We did a search of the south again this morning, including Kahama, and we even went higher in the hills, yet there was no sign of chimpanzees, just baboons, red colobus and red tail monkeys. By mid-day we were in Kakombe again and did a search there without any luck. As we sat at the former feeding station (where bananas used to be placed out for the chimpanzees as part of the habituation process). Tanga and her son Tom strolled up the path. Tom isn't one of my targets, but we followed the pair for a while hoping they might lead us to some other chimps, but it became evident that they would not.

I left Tanga and Tom and went to Kasekela valley to check for chimps there. Luckily, I found Maria Botero following Gremlin and her kids – adult daughter Gaia, adolescent twin daughters Glitter and Golden, and infant son, Gimli. The rest of the afternoon was quiet as the G family stuck to themselves. Gimli played with the twins while Gremlin and Gaia fed on mgwiza, and then the family moved off to feed on mvule flowers. Gaia and the twins left Gimli and Gremlin in the mvule tree to go off on their own, and they created a standoff. Maria was following Golden while I stayed with Gremlin and Gimli. Maria said the twins and Gaia sat on a tree limb waiting, and expecting, Gremlin and Gimli to join them and move on in the direction they wanted to go. I stayed with Gremlin, who sat in a tree with Gimli, waiting for her daughters to join her in the direction she wanted to go. Gremlin ultimately won the standoff, and the trio joined her and moved off in search of an evening meal before nesting. Gaia termite fished a little bit while the twins watched her intently, and after Gaia moved on to catch up with Gremlin, Glitter took her turn. Ultimately, the family ended up in an msiloti tree eating a final meal of young leaves before nesting for the night.

Figure 1-4 Explore the world . . . without leaving your armchair. Top image shows the path of a chimpanzee family studied by the Jane Goodall Institute in Gombe, Africa. Clicking the title opens the description balloon, which provides detailed information about the animals' behavior that day. (Images courtesy of the Jane Goodall Institute: http://gombeblog.janegoodall.org.)



Click top of bar or icon for exact figures.

LIVES DESTROYED: A REFUGEE'S STORY

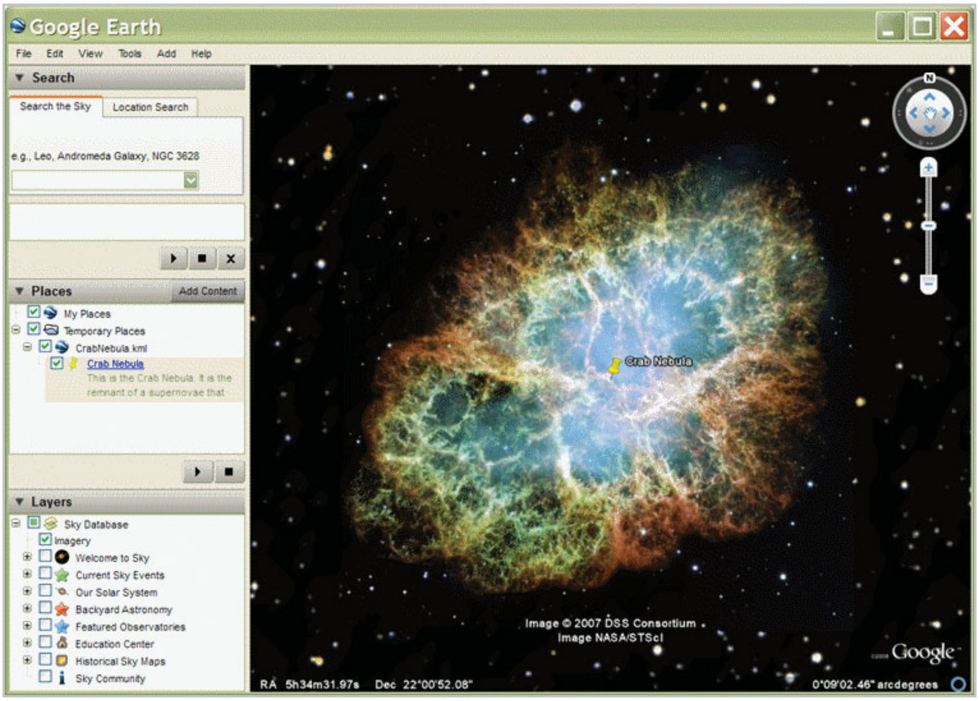
John Heffernan of Physicians for Human Rights visits refugees in Chad and details the destruction of the Sudanese village of Furawiya. February 2004, 6 minutes.

Click here or on the image above to watch the video at the Physicians for Human Rights website.

Figure 1-5 Deepen your understanding. Special projects like the United States Holocaust Memorial Museum's *Crisis in Darfur* initiative focus the world's attention on tragedies both personal and global by presenting photos, first-person narratives, and links to videos, all within a geographic context. (Image courtesy of United States Holocaust Memorial Museum: www.ushmm.org.)

Sky in KML

KML 2.2 supports presentation of astronomical as well as terrestrial data (as shown in Figure 1-6). When you include a special hint (`hint="target=sky"`) at the start of a KML file, the browser interprets the data in a different way and projects it onto a virtual celestial sphere that surrounds the Earth. In Sky mode, the Google Earth camera looks up at the heavens rather than down at the Earth. The main difference from the KML creator's point of view is that you need to perform some arithmetic to convert astronomical coordinates (*right ascension* and *declination*) into terrestrial coordinates (*longitude* and *latitude*). Everything else in KML works the same in both Sky and Earth modes.



This is the Crab Nebula. It is the remnant of a supernovae that

Figure 1-6 Travel through space. This KML file contains a placemark and balloon for a famous planetary nebula. To display sky data in an Earth browser, include the special KML hint, and convert astronomical coordinates to Earth coordinates (see Appendix B).

If you're primarily interested in using KML to show Sky data, read Appendix B, "Sky Data in KML," first.

"Hello, Earth"

A standard placemark in Google Earth uses a yellow pushpin icon to point to a particular spot on the Earth's surface. A placemark usually has a *name* that identifies the location. It's a good practice to include a *description* as well. The description is displayed by web search results and will help users decide if they want to view your KML files.

The following KML example creates a simple placemark with the name "Hello, Earth." The description provides additional information about this place (Figure 1-7).

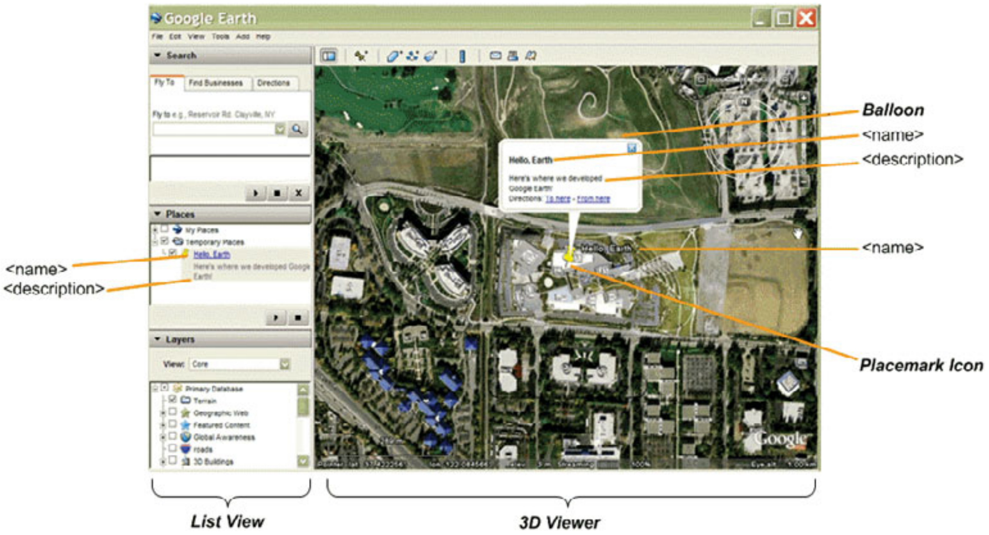


Figure 1-7 Anatomy of a placemark. You will usually create a *name* and a *description* for a placemark. If you have a lot to say, description balloons provide related text, images, and links to other places on the web.

HelloEarth.kml

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Placemark>
    <name>Hello, Earth</name>
    <description>Here's where we developed Google Earth!</description>
    <Point>
      <coordinates>-122.084583,37.42227,0</coordinates>
    </Point>
  </Placemark>
</kml>
```

Viewing the Examples in This Book

To view this example in Google Earth, first download and install Google Earth. You can obtain a free copy of Google Earth from the Google website http://earth.google.com. A complete listing of examples is provided on this book's website at www.informit.com/title/9780321525598. Click the title of any example to view it in Google Earth.

Experiment!

If you'd like some hands-on experience, you can enter this example text into any basic text editor that saves text without adding any formatting information, such as Notepad. Save the file with a filename that ends in *.kml* and open the file in Google Earth on your computer. Once you've saved the file in this manner, you can also edit it. For example, try changing the <name>, save the file again, and then open it in Google Earth. Next, try modifying the values for the <coordinates> element, save the file, and watch where the new placemark appears.

The best way to learn KML is to experiment with sample files, changing values and viewing the results in your favorite Earth browser. If you make a mistake, you may not see anything in the browser, but that's your clue that something's amiss. Google Earth provides a feature for error checking that you may find helpful. (Select Options > General, and under the heading KML Error Handling, select Show Prompts for All Errors.) You can also use a KML validator to check your KML code. For example, see the KML validator by Galdos Systems at www. kmlvalidator.com.

Structure of a KML File

Every KML file begins with the two lines shown in this example.

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
```

If you're creating a KML file from scratch, be sure to copy these two lines verbatim into the beginning of the file. A KML file can contain only one <kml> element. Don't forget the closing </kml> tag at the end of the file.

The file contains a <Placemark> element that has three children. The angled brackets < > indicate KML element names:

Children of <Placemark>

<name>	Label for the placemark.
<description>	Text (and optional images) providing additional information about the placemark. The <description> appears in the information *balloon*. This balloon pops up when the user clicks the placemark name in the Places panel or the placemark icon in the 3D viewer of Google Earth).
<Point>	Contains the <coordinates> element. The <coordinates> element contains values for the *longitude*, *latitude*, and *altitude* of the <Placemark>. See the section in Chapter 3 on "Coordinates" for more detail.

Figure 1-7 shows how the name and the description appear in both the 3D viewer and the Places panel of Google Earth.

Because KML is an XML data format, it has a consistent structure that observes certain patterns. An element begins with its name in angled brackets (<Placemark>). An element ends with an angled bracket and a slash preceding the element name (</Placemark>). The element's *value* is contained within these delimiters.

Definition of Simple/Complex Elements

In KML, any word contained in angled brackets < > is an *element*. When an element name begins with a capital letter, it is a *complex element,* which means that it can contain other elements. For example, in this code excerpt, <Point> is a complex element that *contains* the <coordinates> element:

```
<Point>
  <coordinates>-122.084583,37.42227,0</coordinates>
</Point>
```

Names of *simple elements* begin with a lowercase letter. Simple elements cannot contain other elements. A simple element contains only *character data* (in XML terms: letters, digits, and symbols that are not used for XML markup purposes). In the *HelloEarth.kml* example, <name>, <description>, and <coordinates> are examples of simple elements.

Complex elements are also called *parents* because they contain other elements. Simple elements are called *children*. In a KML file, the children are indented several spaces from their parent's position in the file, but this convention is simply for readability. The Earth browser does not pay attention to the different levels of indentation (white space).

General Rules in KML

Here are some general rules to keep in mind when authoring KML files:

- Case is significant. Each element name must be spelled exactly as shown in the KML 2.2 Reference, and with the same capitalization (see Appendix A).
- Order is significant. KML child elements must be listed in the same order as listed within their parent element in the KML 2.2 Reference. You can omit child elements, but you cannot rearrange them.
- Child elements can belong only to the allowed parent elements. Again, if you follow the ordering within the individual syntax sections in the KML 2.2 Reference, you'll be doing things correctly.

The Copy-and-Paste Trick

If you want to view the KML for a particular Google Earth folder or placemark, you can easily copy the feature from Google Earth and paste it into a text editor such as NotePad. (It's somewhat counterintuitive that you can copy a graphical feature from Google Earth's 3D viewer and, when you paste it into a text editor, it's converted to its corresponding KML textual format, but try it—it works!) Follow these steps to view the KML for a visible feature such as a Placemark, GroundOverlay (image laid on top of the basic Earth terrain), Polygon (shape), or LineString (path) in Google Earth.

1. In the 3D viewer (or Places panel) of Google Earth, place your cursor over the feature to highlight it.
2. Right-click and select Copy from the drop-down menu that appears.
3. Open a simple text editor and paste the contents of the clipboard; for example, by selecting Edit > Paste from the text editor menu.

   The KML for the selected feature appears in the text editor. (Be sure to use a text editor that does not add extra formatting or information to the text file.)
4. Save the file with a *.kml* extension in the filename (for example, *myHouseInPhila.kml*).

What's Next?

In the next chapter, you'll learn about two of the most basic KML elements, <Placemark> and <description>. Although you can create placemarks and balloon descriptions using an Earth browser graphical user interface, Chapter 2 explains how to modify the KML file to achieve custom effects and paves the way for you to efficiently create entire websites with a custom look and feel. The next chapter also explains how to package KML files into KMZ archives so that you can conveniently share them and post them on the web as one entity.

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