chapter 1

Understanding ArcGIS products and extensions

**ArcGIS products**  
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ArcGIS for Server  
ArcGIS Online  
ArcGIS for Mobile  
ArcGIS Explorer  
Challenge 1

**ArcGIS for Desktop extensions**  
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ArcGIS Geostatistical Analyst  
ArcGIS 3D Analyst  
ArcGIS Network Analyst  
ArcGIS Schematics  
ArcGIS Tracking Analyst  
ArcGIS Publisher  
Challenge 2

**Answers to challenge questions**  

**Key terms**  

**Resources**
Welcome to the ArcGIS platform. The ArcGIS products complement each other to create a complete geographic information platform that lets you author, serve, and use geographic information (figure 1.1). In this chapter, you will get an overview of ArcGIS products that will help you identify the right product for a given task.

Skills measured
Given a task, identify the necessary ArcGIS products and/or resources to complete the task.

ArcGIS products
ArcGIS is a complete platform that includes several products for managing, integrating, and sharing geographic data, performing spatial analysis, and displaying your results as professional-quality maps. To determine the correct product to complete a given task, you need to know what each of the different products is used for. Below you will find a brief description of the main products in the ArcGIS platform and some examples of when to use them.

ArcGIS for Desktop
ArcGIS for Desktop is used to author and edit maps and geospatial content. It includes two applications: ArcMap and ArcCatalog. ArcCatalog is also integrated into ArcMap as a Catalog window. Use these two applications for the following:

- Use ArcMap for visualizing and editing geographic data, performing GIS analysis, and creating professional-quality map products.
- Use ArcCatalog (or the ArcMap Catalog window) for browsing, managing, and documenting geographic data.

Examples:
- An analyst could use ArcGIS for Desktop geoprocessing tools to analyze the spatial distribution of 911 calls and visualize the results as a series of maps and graphs. The analyst could then run the analysis repeatedly on different data by building a geoprocessing model.
- You could use the ArcGIS for Desktop predefined templates and simple wizards to create quality maps (figure 1.2).
- A technician could use ArcGIS for Desktop to create and edit roads and highways. For new roads, the technician could use Coordinate Geometry (COGO) tools to create features based on survey measurements.
- As part of the GIS department in a larger organization, you could use ArcGIS for Desktop to prepare maps for publishing and share them as map services and map packages in ArcGIS Online.
ArcGIS for Server

ArcGIS for Server is used to create and distribute maps and geospatial services over the web. Use ArcGIS Server for the following:

- Publishing GIS information and maps as web services
- Accessing GIS services through web applications
- Managing data in an enterprise geodatabase

Examples:
- An employee of a city GIS department could use ArcGIS for Server to publish city map layers as GIS services and make them available to the general public via a web application.
- An employee of a weather agency could use ArcGIS for Desktop to create an animation showing the progression of hurricane paths from time-enabled data and then use ArcGIS for Server to publish the map as a GIS service that can be accessed through a web application.
- A Department of Emergency Management employee could use ArcGIS for Server to integrate statewide hazmat, transportation, and shelter status from several GIS services, along with a weather data feed into one central web application to support decisions that involve hazardous materials.
- A city employee could store city spatial data holdings in a central enterprise geodatabase that employees from different city departments could access and use to edit and maintain the data. Enterprise geodatabase functionality is part of the ArcGIS for Server license.

ArcGIS Online

ArcGIS Online helps organizations collaborate and manage maps and geospatial content in the cloud (figure 1.3). Organizations can set up their own custom ArcGIS Online website. Members of the organization use ArcGIS Online for the following:

- Creating and sharing maps that can be accessed by anyone through a browser, a mobile device, ArcGIS for Desktop, or a custom application
- Accessing maps, datasets, services, tools, and other geospatial content shared by others
- Managing geospatial content
- Sharing content publicly, with specific groups, or keeping it private within the organization
Examples:
• You could use the World Street Map basemap from ArcGIS Online as a background for displaying analysis results in ArcMap.
• You could create a map of median household income in different parts of the county, and then create a map package and post it to ArcGIS Online.
• A web developer could create an application that combines ArcGIS Online map services of renewable energy projects and solar radiation potential with an ArcGIS Online basemap, allowing users to calculate the solar energy potential of a building or area. The developer could then share the application on ArcGIS Online.
• A public health initiative employee could create a web map of health-food supermarkets using the ArcGIS Online built-in map viewer. Then the employee could share the web map by distributing the URL to members of the initiative’s ArcGIS Online group.

ArcGIS for Mobile
ArcGIS for Mobile is used to access maps and geospatial content on mobile devices, including tablets and smartphones. It consists of ready-to-deploy applications for field data collection and inspections, plus Software Development Kits (SDK) for creating custom applications.

ArcGIS for Mobile consists of the following product suite:

• **ArcPad:** ArcPad is designed for GIS professionals who need mobile field mapping and advanced data collection software. ArcPad includes key GIS and GPS (Global Positioning Systems) capabilities for capturing, editing, and displaying geographic information quickly and easily.

• **ArcGIS for Windows Mobile:** ArcGIS for Windows Mobile helps organizations deliver GIS capabilities and data from centralized servers to a range of Windows-based mobile devices. You can use ArcGIS for Windows Mobile to deploy intuitive GIS applications to increase the accuracy and improve the currency of GIS data across your organization. Easy-to-use ArcGIS for Windows Mobile applications enable field crews who do not necessarily have any GIS experience to do field mapping, GIS editing, spatial queries, sketching, and GPS integration.

• **Apps for Smartphones and Tablets:** ArcGIS for Smartphones and Tablets is used for navigating maps, data collection, reporting and analysis using iOS, Android, or Windows Phone devices. It includes a free application that you can download from the Apple App Store, Google Play/Android Market, or Windows Store. Also provided are developer-focused SDKs that you can use to build custom applications.
Use ArcGIS for Mobile to do the following:

- Provide simple-to-use data collection applications for smartphone and tablet devices
- Synchronize directly with ArcGIS for Server to make data and map updates available to field staff and desktop users both in the office and in the field

Examples:
- You could use ArcPad on a Windows-based mobile device in the field to collect and edit spatial and attribute data for water and sewer mains, manholes, fire hydrants, pole inspections, and so on, using various customization tools such as scripts and applets. Back in the office, you could quickly check new data into a geodatabase to update the city’s data holdings.
- City field workers who are not trained in GIS could use the out-of-the-box ArcGIS for Windows Mobile application to collect information about city street signs via a map service that accesses the GIS features of the map.
- A water department employee could use an ArcGIS for Windows Mobile application to view work orders, find the water valves to shut off for servicing water features, add notes for the user to the map about updates in the water features, and synchronize the information with the database in the office twice a day.
- You could use the ArcGIS for Windows Mobile SDK to create a data collection application to be used on a Windows 7 tablet or laptop PC and distribute it to field crews.
- A city resident without any GIS knowledge could use the city’s custom reporting smartphone or tablet application that leverages ArcGIS technology to report civic issues and make service requests to the different city departments using your mobile phones.

**ArcGIS Explorer**

ArcGIS Explorer is a free viewer that can be used to do the following:

- View, query, and analyze spatial data
- Deliver authoritative data to a broad audience

ArcGIS Explorer includes two applications: ArcGIS Explorer Desktop and ArcGIS Explorer Online (figure 1.4).

- Use **ArcGIS Explorer Desktop** (downloadable) for exploring, visualizing, and sharing geographic information and author presentations.
- Use **ArcGIS Explorer Online**, a browser-based viewer, for creating web maps, performing queries, and creating dashboards and author presentations.

![Figure 1.4 With ArcGIS Explorer Desktop you can access ready-to-use ArcGIS Online basemaps and layers, perform spatial analysis (e.g., visibility analysis, modeling, proximity search), fuse your local data with map services to create custom maps, and add photos, reports, videos, and other information to your maps. Esri.](image-url)
Examples:
- An employee in the department of transportation could use ArcGIS Explorer Desktop to view and query data about road construction projects, query traffic data, and integrate external map services and basemaps to create presentations for a public meeting.
- A real-estate agent could use ArcGIS Explorer Online to show available properties to clients, along with socio-economic, transportation, school, and other family resource information in a one-mile buffer area.
- A group of disc golf enthusiasts could use ArcGIS Explorer Online to create a web map of disc golf courses in a county along with a description and driving directions to the individual courses. Then, they could share their web map with others using ArcGIS Online.
- A geography teacher could use ArcGIS Explorer Desktop in the classroom to view, query, and analyze maps as part of geography education.

**Challenge 1**
For each of the following scenarios, pick the right products to complete the task.

1. Which two ArcGIS products or applications should you use to create a new geoprocessing model? (Choose two.)
   a. ArcGIS Explorer Desktop
   b. ArcCatalog
   c. ArcGIS Mobile
   d. ArcMap
   e. ArcGIS for Server

2. Which ArcGIS product should you use to share GIS maps so they can be accessed from within a web browser?
   a. ArcGIS Explorer Online
   b. ArcPad
   c. ArcGIS for Server
   d. ArcGIS for Desktop

3. You need to add imagery to a map document so that it displays in the background of some analysis results. Which product should you use to find the imagery?
   a. ArcGIS for Desktop
   b. ArcGIS Online
   c. ArcGIS Explorer Online
   d. ArcGIS Mobile

4. You need to use advanced labeling tools for fitting the maximum number of labels on a map without conflict. Which product or application will provide this functionality?
   a. ArcMap
   b. ArcGIS Online
   c. ArcPad
   d. ArcGIS Explorer Online
   e. ArcGIS Mobile

**ArcGIS for Desktop extensions**
Let’s briefly talk about special products that extend the functionality of ArcGIS for Desktop. ArcGIS for Desktop extensions are products that add specialized capabilities for advanced analysis and enhanced productivity to ArcGIS for Desktop. They give you tools for performing sophisticated tasks such as raster geoprocessing, 3D analysis, and network analysis. Below, you will find a summarized description of the most commonly used ArcGIS for Desktop extensions.
**ArcGIS Spatial Analyst**

ArcGIS Spatial Analyst is used for creating, querying, mapping, and analyzing cell-based raster data (figure 1.5). Examples:

- You could use an elevation raster to calculate surfaces, for example, slope, aspect, and hillshade.
- You could find suitable locations for a new ski resort by reclassifying different input rasters according to their suitability and then combining them in a weighted overlay.
- You could derive a crime density surface from a point layer of crime incidents. Since some point locations represent more than one crime incident, a density surface will present a different pattern than the point layer.
- You could perform a cost-of-travel analysis between two locations by creating a cost-weighted distance raster and identifying the best path based on travel cost.

**ArcGIS Geostatistical Analyst**

ArcGIS Geostatistical Analyst complements the functionality of Spatial Analyst. Most of the interpolation methods available in Spatial Analyst are represented in ArcGIS Geostatistical Analyst as well, but in Geostatistical Analyst there are many more statistical models and tools, and all their parameters can be manipulated to derive optimum surfaces.

Examples:

- A California Health Department employee could use the kriging interpolation method from Geostatistical Analyst to create a raster surface of ozone concentrations for the state of California from point measurements at different ozone monitoring stations (figure 1.6).

![Figure 1.5 ArcGIS Spatial Analyst provides tools to derive slope, aspect, or hillshade rasters from an elevation raster. Esri.](image1)

![Figure 1.6 There are 193 ozone monitoring stations in California. The prediction map shows a predicted ozone value for every location in the state. Esri.](image2)
• From the same data, you could create a standard error map that quantifies the uncertainty of the predictions (figure 1.7).

Figure 1.7 An error map quantifies the uncertainty of the predictions. The larger the standard error, the more uncertain the predictions. Esri.

• A scientist working for an environmental science university lab could use Geostatistical Analyst to determine radioactive soil contamination after the Chernobyl reactor accident based on point measurements of rainfall within a few days after the accident.

ArcGIS 3D Analyst
ArcGIS 3D Analyst is used for creating, visualizing, and analyzing three-dimensional data. ArcGIS 3D Analyst extends the functionality of ArcMap and ArcCatalog but also includes two viewing applications: ArcGlobe and ArcScene (figure 1.8).

• Use ArcGlobe for viewing and navigating large amounts of data on a globe surface.
• Use ArcScene for 3D viewing and analyzing datasets in a local area.

Figure 1.8 You can visualize very large amounts of 3D data in a global view using the ArcGlobe application, or you can view site-level data in a local coordinate system using the ArcScene application. Map by Esri; data from Esri Data & Maps, 2010, courtesy of Esri, i-cubed, USDA FSA, USGS, AEX, GeoEye, AeroGRID, Getmapping, IGP, DeLorme, NAVTEQ, TomTom, Intermap, AND, NRCAN, Kadaster NL, and the GIS User Community.

Examples:
• You could visualize data in 3D to enhance understanding of spatial relationships and build a 3D animation to share in a public meeting.
• You could use interactive tools in a 3D view to determine line of sight, measure heights in 3D, calculate 3D volumes, and determine the steepest path.
• You could use ArcGIS 3D Analyst to analyze how the shadow of a proposed building will affect the neighboring buildings.
• You could build surfaces of tree heights and crown cover from light detection and ranging (lidar) data to estimate the biomass in a forest area.

**ArcGIS Network Analyst**

ArcGIS Network Analyst is used for spatial analysis of transportation networks, such as street, pedestrian, and railroad networks that allow for travel in multiple directions.

Examples:
• A truck driver in a fleet of delivery vehicles could use ArcGIS Network Analyst to find the quickest route for a vehicle to drive from location A to location B and print travel directions.
• A fleet manager could create the most efficient routes for a fleet of vehicles for multiple customer locations, optimizing travel time and minimizing transportation costs (figure 1.9).

![Figure 1.9](image1.png) Three food delivery trucks at a distribution center are assigned grocery stores and routes to the stores that minimize transportation costs. Vehicle capacities, lunch breaks, and maximum travel time constraints are included in the analysis. Esri.

• A 911 dispatcher could determine which ambulances or patrol cars can respond quickest to an accident and locate the closest hospital from an accident location.
• A marketing analyst of a department store chain could define the service area that is covered by a department store and determine the optimal location for a new department store.

**ArcGIS Schematics**

ArcGIS Schematics is used for creating a representation of a network in a schematic diagram.

Examples:
• An electrical company employee could use ArcGIS Schematics to create a simplified representation of an electrical power network, intended to explain its structure and the way it operates (figure 1.10).

![Figure 1.10](image2.png) Schematic representation of an electrical network showing how three outside stations are connected to the network inside a substation. From the position of the switches, you can tell how electricity flows through this network. Esri.
A system administrator could use ArcGIS Schematics to visualize a computer network in a schematic diagram.

An airline could use ArcGIS Schematics to visualize resource dependencies of a flight schedule and the cockpit crew, the cabin crew, and the plane (figure 1.11).

An employee of an organic food brand could use ArcGIS Schematics to visualize the path of food, for example, from the farm where it’s grown, to the packing facility, to the distribution facility, to a warehouse, and finally, to the store and the customer.

ArcGIS Tracking Analyst

ArcGIS Tracking Analyst is used for visualizing, analyzing, and understanding spatial patterns and trends in your data in the context of time (figure 1.12).

Examples:

- A fleet manager could track the positions of a fleet of delivery trucks in real time. ArcGIS Tracking Analyst supports network connections to GPS units and other tracking devices so the fleet manager could create a connection to a tracking service or GPS device that can stream real-time temporal data.

- A National Weather Service employee could create a time-series animation of a hurricane, with the hurricane’s center symbolized by wind speed and with a special symbol for the most current speed.

- An airport employee could analyze patterns in airplane delays by creating and summarizing charts that display the temporal distribution of the data.

- An employee of the Center for Disease Control could analyze the spread of a highly infectious disease to come up with the best strategy to stop it.
ArcGIS Publisher

ArcGIS Publisher is used by ArcGIS Desktop users to share and distribute their maps, globes, and data. ArcGIS Publisher creates Published Map Files (PMFs) (figure 1.13). PMF files are viewable through ArcGIS for Desktop products, including ArcReader, a free downloadable and customizable application that supports collaboration via markup tools. Since ArcGIS Publisher does not require an Internet connection, it is frequently used for distributing content inside and outside of an organization with secure control over data sources and viewer access. It's a cost-effective way to distribute maps and data to many different people.

Examples:
- A government agency could use ArcGIS Publisher to share an interactive parcel map, protect it with a password, and package the required data for distribution to the public.
- The GIS manager in a large organization could use ArcGIS Publisher to distribute maps to all GIS groups within the company.
- A GIS consultant could use ArcGIS Publisher to distribute preauthored maps to their customers.
- A GIS developer in a consulting firm could use ArcGIS Publisher to distribute custom map viewers to their customers.

For a complete list of Esri products, refer to the product pages at http://www.esri.com/products and click the Alphabetical List of All Products link at the bottom of the page.

Challenge 2

For each of the following scenarios, pick the extension or product to complete the task.

1. Which ArcGIS for Desktop extension should you use to find the best location for a new ski resort based on the following criteria?
   - Must be on intermediate slopes, 15%–35%
   - Must be in deeper snow; over 23 inches is best
   - Must be in an area that gets more shade (so snow doesn’t melt quickly)
   a. ArcGIS 3D Analyst
   b. ArcGIS Spatial Analyst
   c. ArcGIS Geostatistical Analyst
   d. ArcGIS Tracking Analyst
   e. ArcMap
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2. Which extension product should you use to find the shortest route for driving your car from home to the closest train station, taking the train to the central station downtown, and then walking to your workplace?
   a. ArcGIS Spatial Analyst
   b. ArcGIS Tracking Analyst
   c. ArcGIS Network Analyst
   d. ArcGIS Mobile

3. Which product should you use to visualize data with a time component?
   a. ArcGIS Network Analyst
   b. ArcGIS Spatial Analyst
   c. ArcGIS Tracking Analyst
   d. ArcGIS Publisher

Answers to challenge questions

Challenge 1
Correct answers shown in bold.

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   d. ArcMap
   e. ArcGIS for Server

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   d. ArcGIS for Desktop

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Key terms

ArcSDE geodatabase: A geodatabase stored in an RDBMS served to client applications using ArcSDE technology. An ArcSDE geodatabase can support long transactions and versioned workflows, be used as a workspace for geoprocessing tasks, and provide the benefits of a relational database such as security, scalability, backup and recovery, and SQL access.

Geoprocessing tool: An ArcGIS tool that can create or modify spatial data, including analysis functions (overlay, buffer, slope), data management functions (add field, copy, rename), or data conversion functions.

Map service: A type of web service that generates maps.

Web service: A software component accessible over the World Wide Web for use in other applications.

Web map: In ArcGIS Online, a web-based, interactive map that allows you to display and query the layers on the map. A web map contains one or more ArcGIS Server map services that are referenced to ArcGIS Online.

Resources

- ArcGIS Help 10.1 > ArcGIS Tutorials
  - ArcGIS Spatial Analyst
  - Geostatistical Analyst
  - ArcGIS Network Analyst
  - ArcGIS Tracking Analyst
  - Schematics
Chapter 1: Understanding ArcGIS products and extensions

- ArcGIS Help 10.1 Help > Extensions
  - Spatial Analyst > Introduction
    - What is the Spatial Analyst extension?
    - A quick tour of Spatial Analyst
  - 3D Analyst
    - What is the ArcGIS 3D Analyst extension?
    - A quick tour of the ArcGIS 3D Analyst extension
  - Geostatistical Analyst > Introduction to Geostatistical Analyst
    - What is the ArcGIS Geostatistical Analyst extension?
    - A quick tour of Geostatistical Analyst
  - Network Analyst
    - What is the ArcGIS Network Analyst extension?
    - A quick tour of the ArcGIS Network Analyst extension
  - Schematics > Basics
    - What is Schematics?
    - A quick tour of Schematics
  - Tracking Analyst
    - What is Tracking Analyst?
    - A quick tour of Tracking Analyst
  - Publisher > Getting started with Publisher
    - An overview of ArcGIS Publisher

- ArcGIS Help 10.1 Help > Professional Library > ArcGIS Server
  - What is ArcGIS Server?

- Virtual Campus courses
  - 3D Visualization Techniques Using ArcGIS 10
  - 3D Analysis of Surfaces and Features Using ArcGIS 10
  - Using Lidar Data in ArcGIS 10
  - Learning ArcGIS Spatial Analyst
  - Introduction to ArcGIS 9 Geostatistical Analyst
- Recorded training seminars (free)
  - ArcGIS Explorer Desktop Quick Start Tutorial
  - Getting the Most Out of ArcGIS Explorer Online
  - Introduction to ArcGIS Schematics
  - Making and Sharing Maps with ArcGIS Online
  - Using Network Analyst in ArcGIS 10
  - Introduction to the ArcGIS API for iOS