Chapter 1 — Exploring the Network

1.0.1.2 Class Activity — Draw Your Concept of the Internet

Objectives

Networks are made of many different components

In this activity, you will visualize how you are connected, through the Internet, to those places, people, or businesses with whom (or which) you interact on a daily basis. After reflection and sketching your home's or school's topology, you can draw conclusions about the Internet that you may not have thought of prior to this activity.

Background / Scenario

Draw and label a map of the Internet as you interpret it now. Include your home or school/university location and its respective cabling, equipment, devices, etc. Some items you may want to include:

- Devices or equipment

- Media (cabling)

- Link addresses or names

- Sources and destinations

- Internet service providers

Upon completion, save your work in a hard-copy format, it will be used for future reference at the end of this chapter. If it is an electronic document, save it to a server location provided by your instructor. Be prepared to share and explain your work in class.

For an example to get you started, please visit: http://www.kk.org/internet-mapping

Required Resources

- Internet access
- Paper and pencils or pens (if students are creating a hard copy)

Reflection

1. After reviewing your classmates drawings, were there computer devices that you could have included on your diagram? If so, which ones and why?

_____

2. After reviewing your classmates' drawings, how were some of the model designs the same or different? What modifications would you make to your drawing after reviewing the other drawings?

    _____

3. In what way could icons on a network drawing provide a streamlined thought process and facilitate your learning? Explain your answer.

    _____

1.1.1.8 Lab — Researching Network Collaboration Tools

Objectives

Part 1: Use Collaboration Tools

- Identify current awareness of collaboration tools.
- Identify key reasons for using collaboration tools.

Part 2: Share Documents with Google Drive

Part 3: Explore Conferencing and Web Meetings

Part 4: Create Wiki Pages

Background / Scenario

Network collaboration tools give people the opportunity to work together efficiently and productively without the constraints of location or time zone. Collaborative tool types include document sharing, web meetings, and wikis.

In Part 1, you will identify collaboration tools that you currently use. You will also research some popular collaborative tools used today. In Part 2, you will work with Google Drive. In Part 3, you will investigate Conferencing and Web meeting tools and, in Part 4, you will work with wikis.

Required Resources

Device with Internet access

Part 1:   Use Collaboration Tools

Step 1:   **List some collaboration tools that you currently use today.**

_____

_____

Step 2:   **List some reasons for using collaboration tools.**

_____

_____

Part 2:   **Share Documents with Google Drive**

In Part 2, you will explore the document sharing functions by using Google Drive to set up document sharing. Google Drive, formally Google Docs, is a web-based office suite and data storage service that allows users to create and edit documents online while collaborating in real-time with other users. Google Drive provides 5 GB of storage with every free Google account. You can purchase additional storage, if needed.
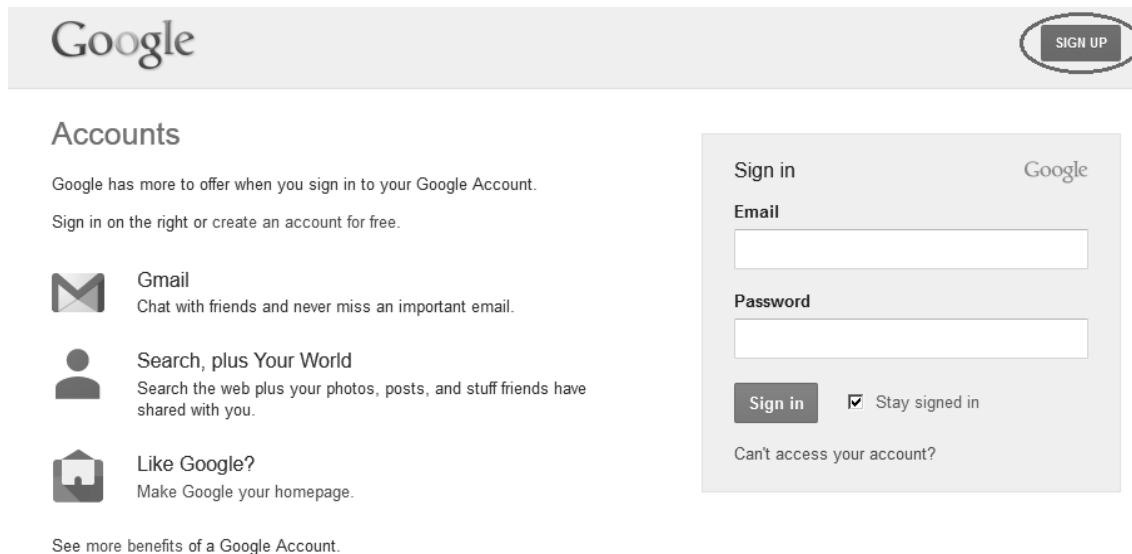
Step 1:   **Create a Google account.**

To use any of Google's services, you must first create a Google account. This account can be used with any of Google's services, including Gmail.

a.   Browse to www.google.com and click **Sign in** (located at the top-right corner of the web page).
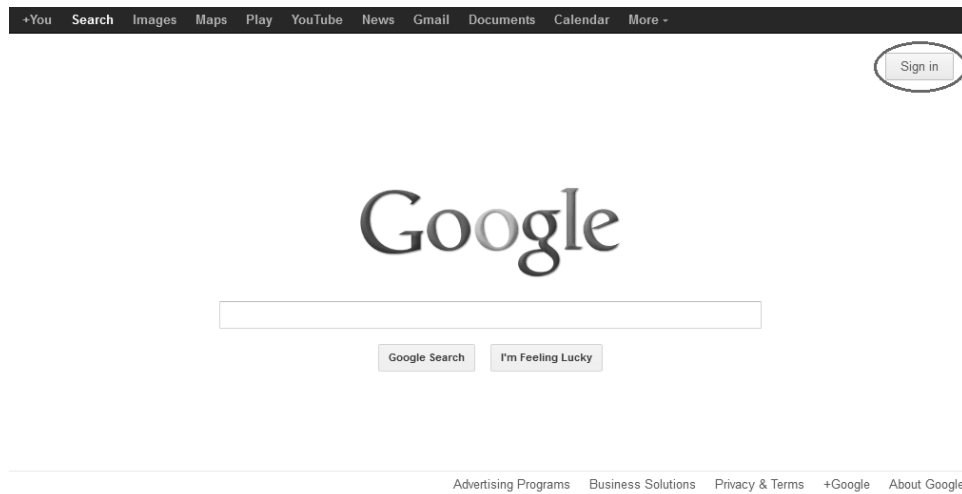
b.   On the Google Accounts web page, if you already have a Google account, you can sign in now; otherwise, click **SIGN UP**.

c.   On the Create a new Google Account web page, fill out the form to the right. The name you enter in the **Choose your username** field becomes the account name. It is not necessary to supply your mobile phone or current email address. You must agree to the Google Terms of Service and Privacy Policy before clicking **Next step**.

Google   Sign in

Create a new Google Account

Your Google Account is
more than just Search.

Talk, chat, share, schedule, store, organize,
collaborate, discover, and create. Use
Google products from Gmail to Google+ to
YouTube, view your search history, all with
one username and password, all backed up
all the time and easy to find at (you
guessed it) Google.com.

Take it all with you.

A Google Account lets you access all your
stuff — Gmail, photos, and more — from
any device. Search by taking pictures, or by
voice. Get free turn-by-turn navigation,
upload your pictures automatically, and
even buy things with your phone using
Google Wallet.

Share a little. Or share a lot.

Share selectively with friends, family
(maybe even your boss) on Google+. Start
a video hangout with friends, text a group all
at once, or just follow posts from people
who fascinate you. Your call.

Name

First   Last

You can't leave this empty.

Choose your username

@gmail.com

You can't leave this empty.

Create a password

Confirm your password

Birthday

Month   ⬍   4   1974

Gender

I am...   ⬍

Mobile phone

▦ ▾

Your current email address

Prove you're not a robot

d. The next web page allows you to add a profile photo if you would like. Click **Next Step** to complete the
    account creation process.

Step 2: **Create a new document.**

a. Sign in to Google using the access credentials you created in Step 1. Type **http://drive.google.com** in
    your browser and press Enter. This navigates you to Google Drive.

Google   SIGN UP

Drive
Welcome to Google Drive, the new home for Google Docs

📄 ▸   Access everywhere

🗄   Store files safely

📇   Collaborate with Google
      Docs

Learn more

Sign in   Google

Email

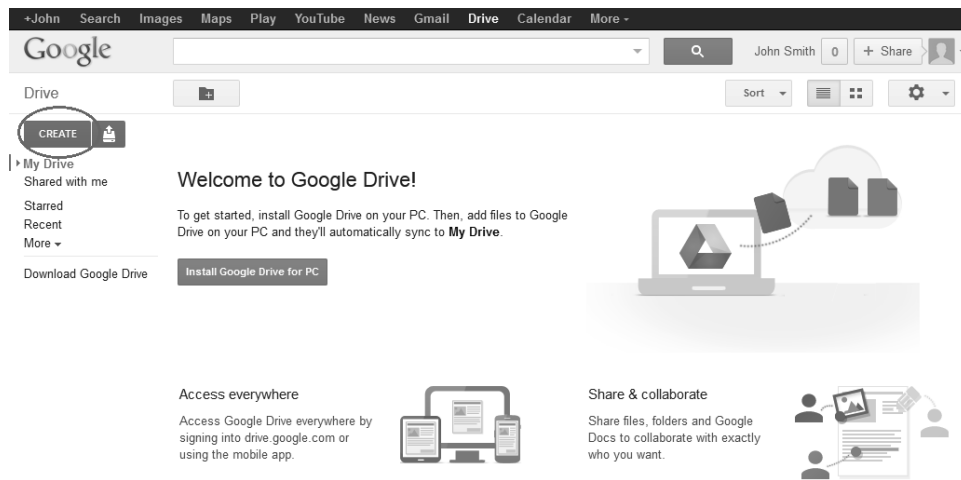**Password**

Sign in   ☑ Stay signed in

Can't access your account?

b. Click the **CREATE** button to display a drop-down menu that allows you to select the type of document to
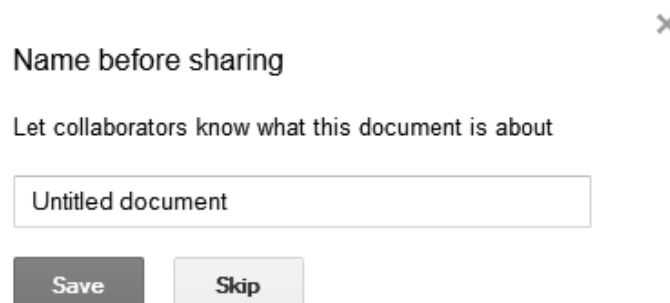   create. Choose **Document**.

The new document displays. Many of the functions of the Google editor work similarly to Microsoft Word.

Step 3:   **Share a Google document.**

a.   After the blank Google document opens, you can share it with others by clicking the **Share** button (at the top-right corner of the web page).
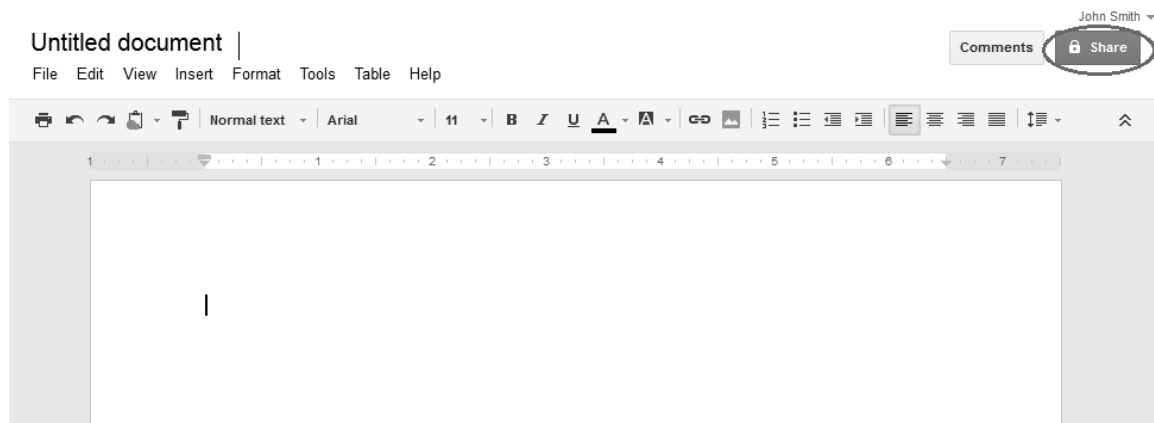
b.   Name your new document, then click the **Save** button.

c.   Here on the Sharing settings web page, in the **Add people** text field, you can enter Google email names, email addresses, or groups with whom to share this document.

d. As soon as you start entering information into the **Add people** box, the box provides more options. The **Can edit** drop-down menu allows you to choose the document privileges (Can edit, Can comment, Can view) for the people you add. You can also specify how to notify these people of this document (**Send a copy to myself** or **Paste the item itself into the email**). Click **Share & save**.

e. Click the **Done** button. This will navigate you back to the open document.

f. All users with share privileges can view this document at the same time. Users with edit privileges can edit this document while others view it.

g. If the document is being viewed by someone while you are in it, you can see who they are by clicking the **other viewer(s)** drop-down menu (in the upper-right corner of the document).
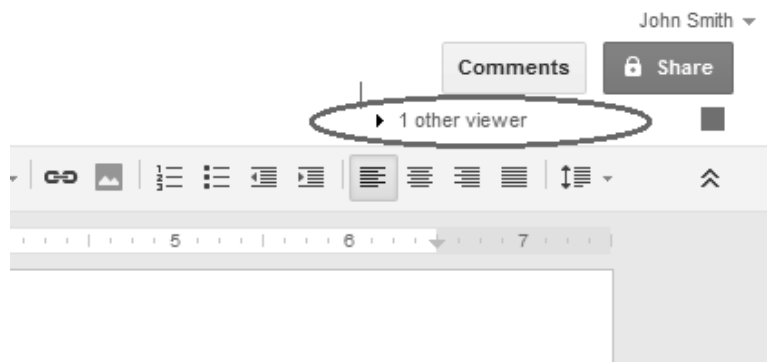
Step 4:   **Close a Google document.**

To close a Google document, move your cursor to the document name at the top of the screen and a left arrow will appear to the left of the name. Click that arrow to return to your Google Drive home page. The document is automatically saved.

The new document will appear at the top of your documents list under My Drive.
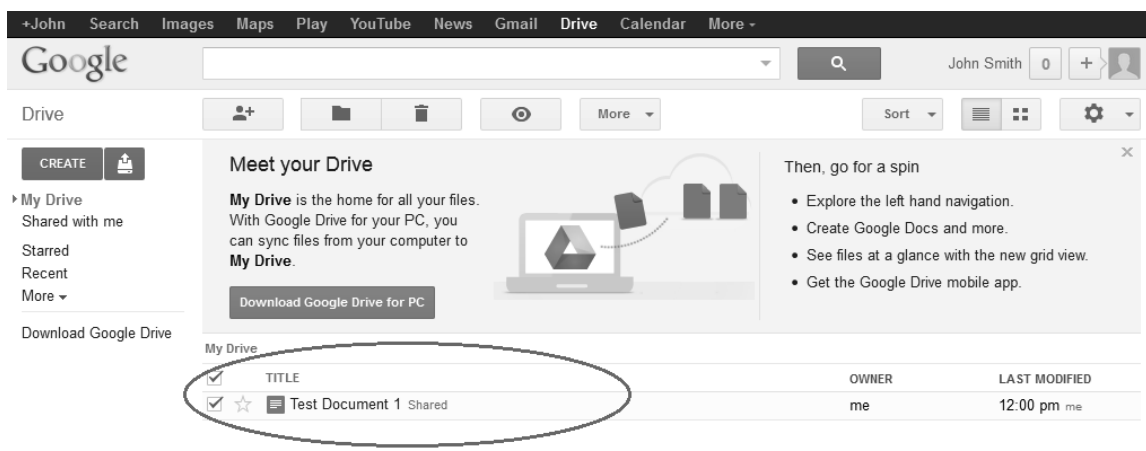
Step 5:   **Additional Information**

Google has developed apps for PCs and Smart phones. For more information about Google Drive, go to http://drive.google.com. YouTube is also a viable source of Google Drive tutorials.

Part 3:   **Explore Conferencing and Web Meetings**

Web meetings combine file and presentation sharing with voice, video, and desktop sharing. Cisco WebEx Meeting Center is one of the leading web meeting products available today.

In Part 3 of this lab, you will watch a video produced by Cisco that reviews the features contained within WebEx Meeting Center. The video is located on YouTube at the following link: http://www.youtube.com/watch?v=fyaWHEF_aWg

Part 4:   **Create Wiki Pages**

"Wiki" is a Hawaiian-language word that means fast. In networking terms, a wiki is a web-based collaboration tool that permits almost anyone to immediately post information, files, or graphics to a common site for other users to read and modify. A wiki provides access to a home page that has a search tool to assist you in locating the articles that interest you. A wiki can be installed for the Internet community or behind a corporate firewall for employee use. The user not only reads wiki contents, but also participates by creating content within a web browser.

Although many different wiki servers are available, the following common features have been formalized into every wiki:

- Any web browser can be used to view or edit pages or create new content.
- Edit and auto links are available to edit a page and automatically link pages. Text formatting is similar to creating an email.
- A search engine is used for quick content location.
- Access control can be set by the topic creator, defining who is permitted to edit content.
- A wiki is a grouping of web pages with different collaboration groups.

In this part of the lab, you will use the Google account that you created in Part 2 and create a wiki page in Google Sites.

Step 1:   **Sign in to Google Sites.**

Go to http://sites.google.com and sign in using the Google account that you created in Part 2 of this lab.
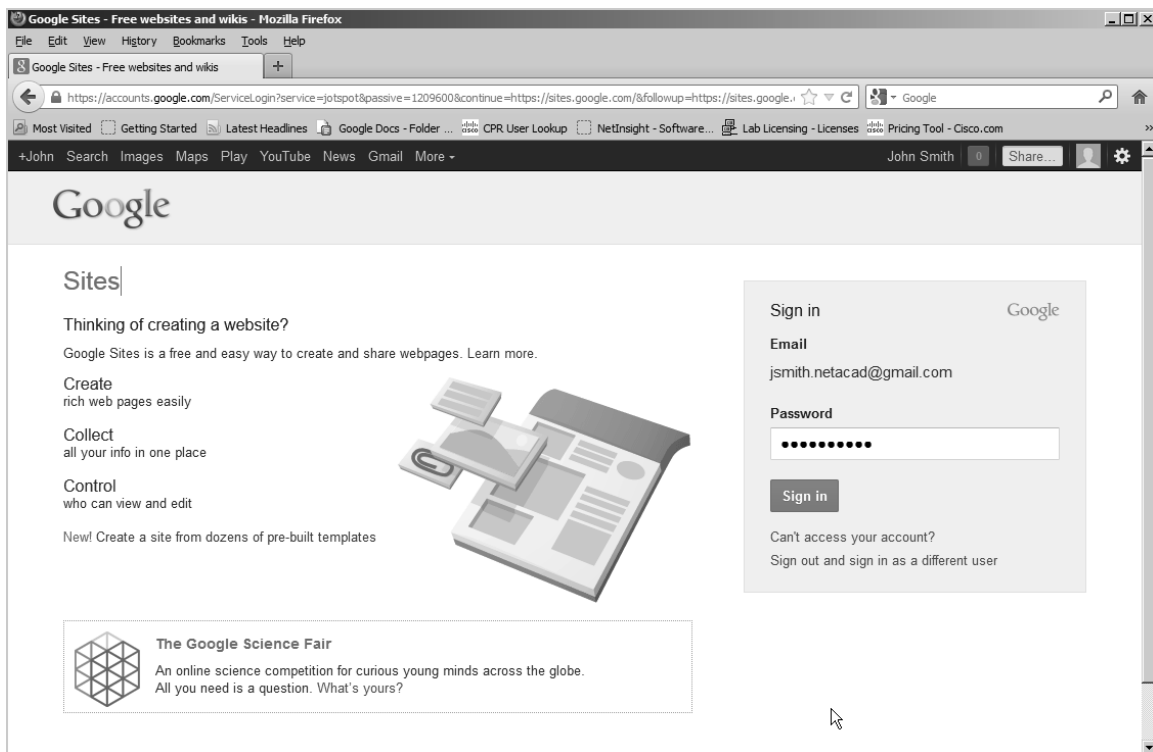
Step 2:   **Click CREATE.**
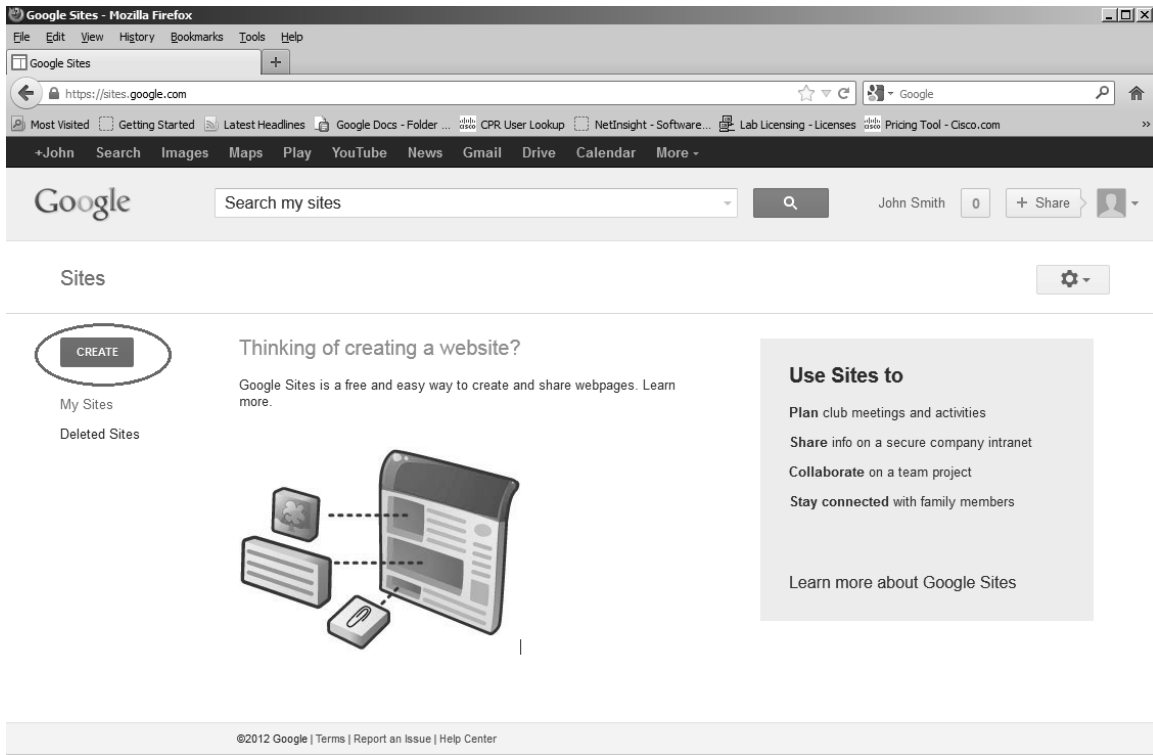
Step 3:   **Name your new wiki site.**

In the **Name your site** field, type in a name for your new wiki site. You will need to come up with a unique name for your site that has not been used by any other Google user. Google also requires that you enter the code (displayed at the bottom of the screen) to prevent automated scripts, called web robots, from creating multiple sites. After you have entered your site name, click the **CREATE** button. If someone has used your site name already, you are prompted to enter another name.
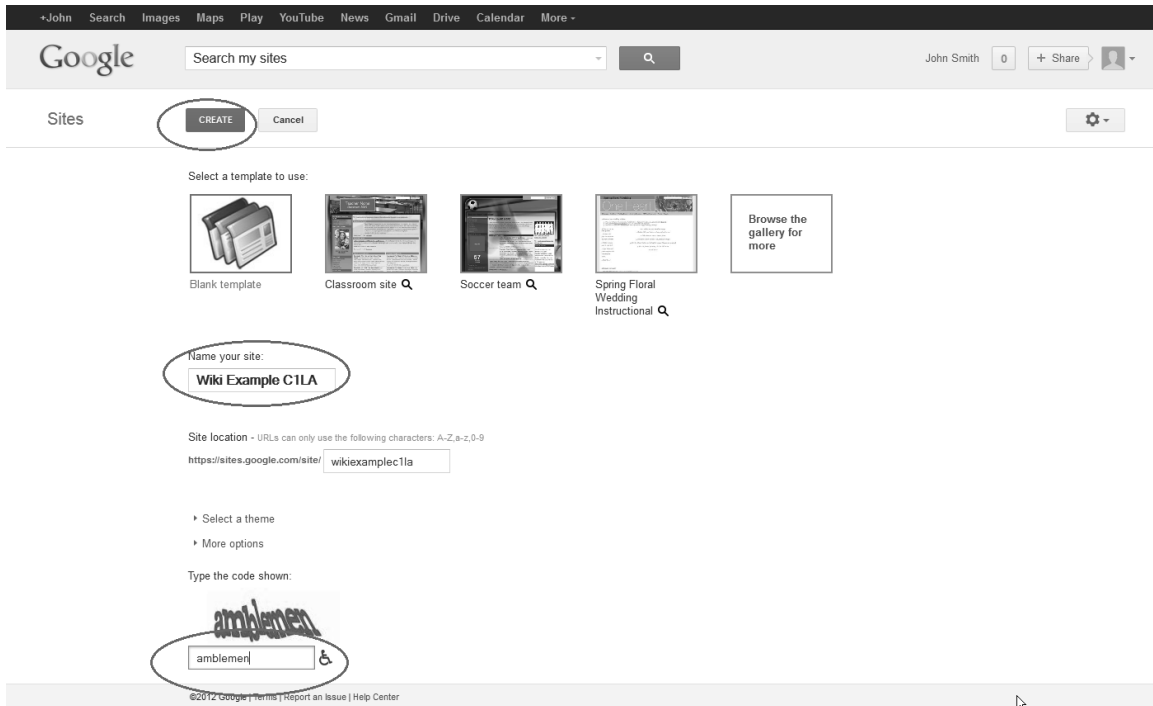
Step 4:   **Edit the look of your new wiki site.**

a.   Google has provided templates for you to change the look of your new wiki site. Click the **More** drop-down menu, and then click **Manage site**.
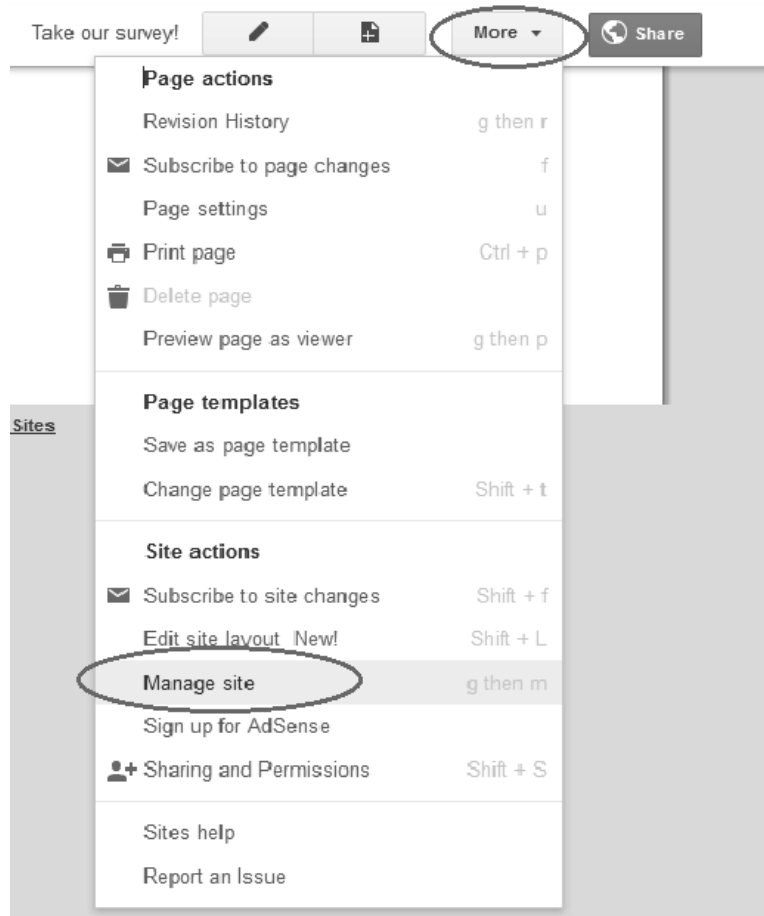
b.   Click **Themes** at the bottom of the left sidebar.
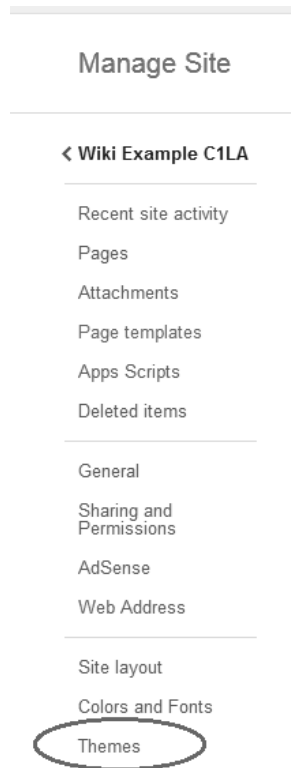
c. Select a theme that appeals to you and click **SAVE**.
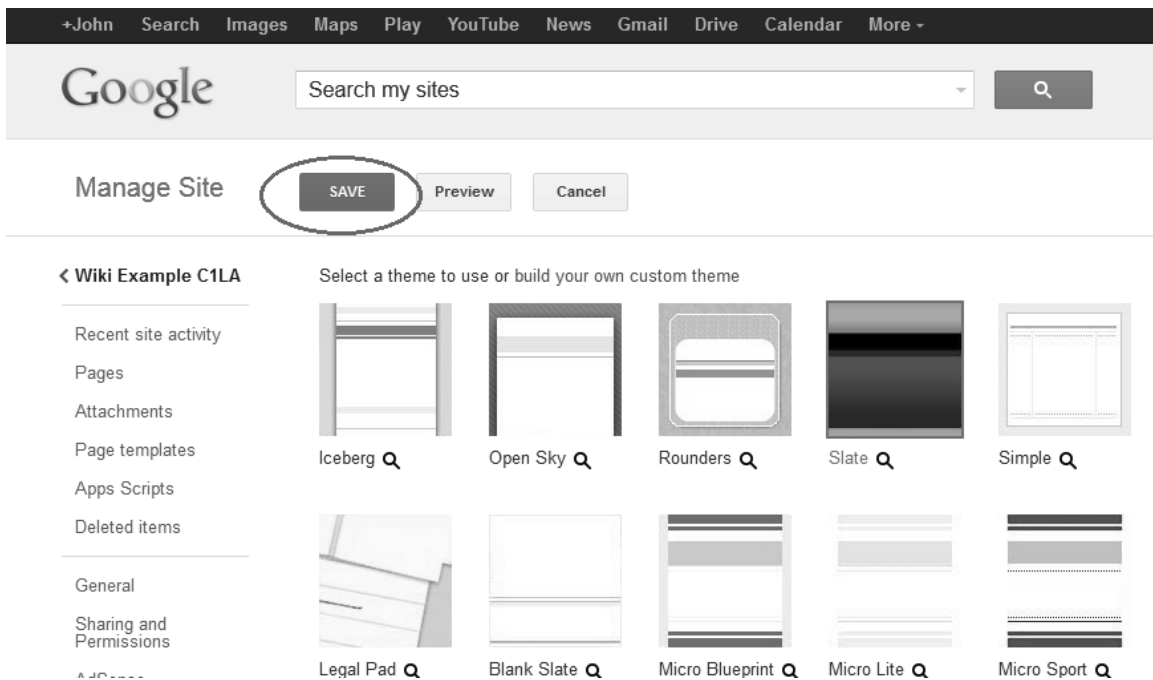
d. After you have saved your theme selection, click your site name under **Manage Site**.

Step 5:   **Update the Home page.**

a. The Home page is the first page that everyone sees when they come to your wiki site. You can edit the content of this page by clicking the edit button. From here, you can add text, pictures, or anything else to show on this page.

b. Click **Save** after you make your changes. This takes you out of page edit mode.

Step 6:   **Create a wiki page.**

a. To create a new page that you and your visitors can use to make posts, click the new page icon.
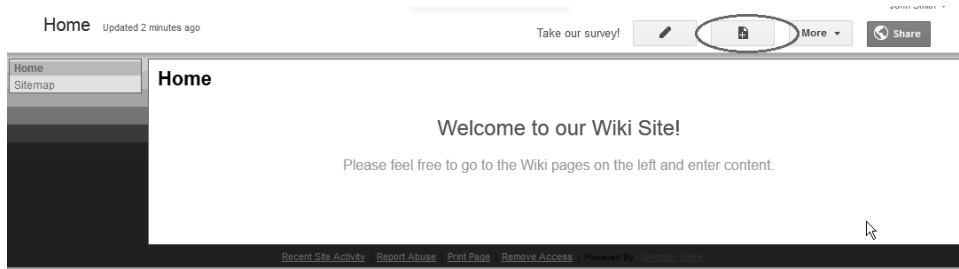
b. In the **Name your page** field, enter a page name. In the example below, the name Routers is used as the topic for this page.
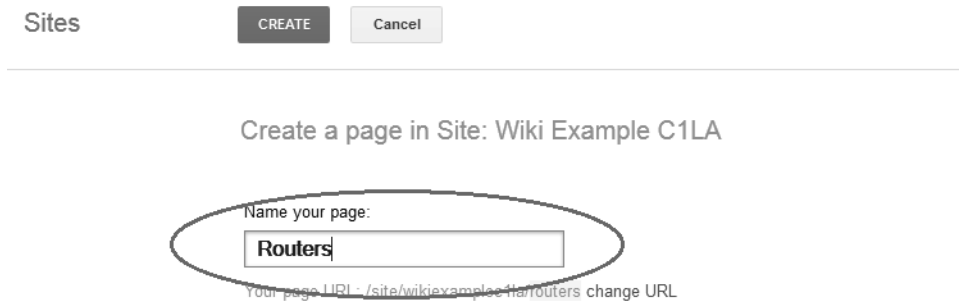
c. Click the **Web Page** drop-down menu and select **Announcements**. Google uses this term to indicate a wiki page.
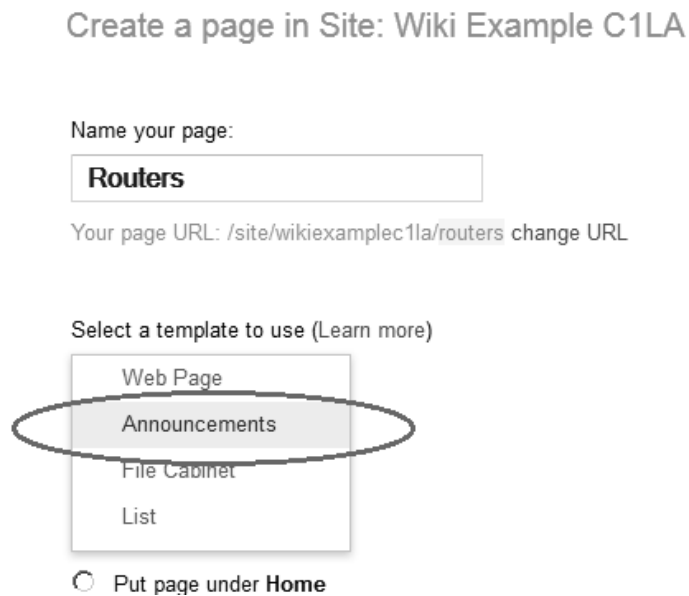
d. Click **CREATE** to create your new wiki page.

e. Your new wiki page, called Routers, displays and has a **New post** menu option that allows information to be added to the page. (Notice that the left sidebar has a new link to allow your site visitors access to this page.)
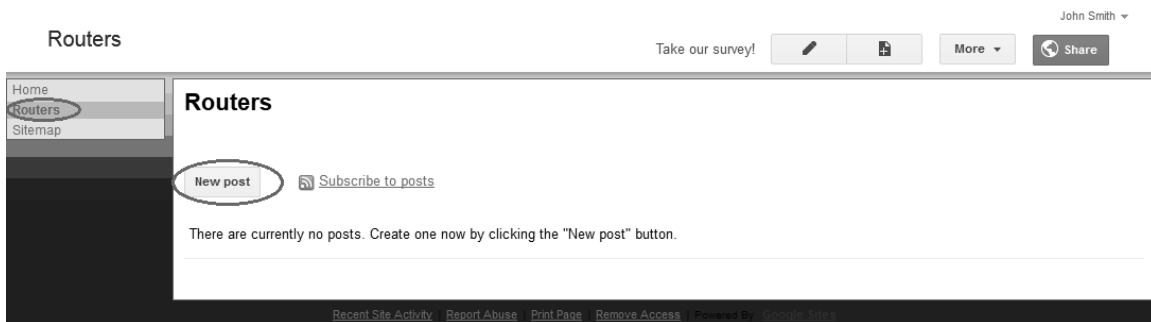
Step 7:   **Share your web site.**

A wiki site is not really a wiki site unless other people can contribute. There are a number of ways to share your new site. In this example, we will show you how to share your site to designated people who have Gmail accounts.

a. On your wiki site, click **Share**.
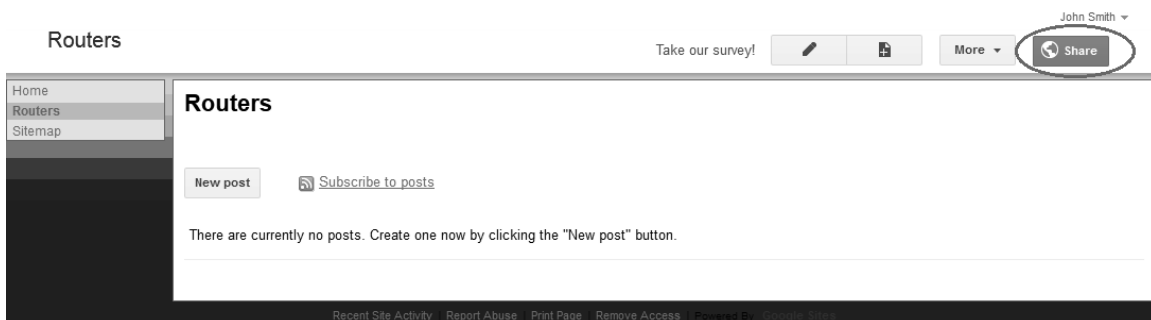
b. Add a name, email address, or group who you grant access to this site.
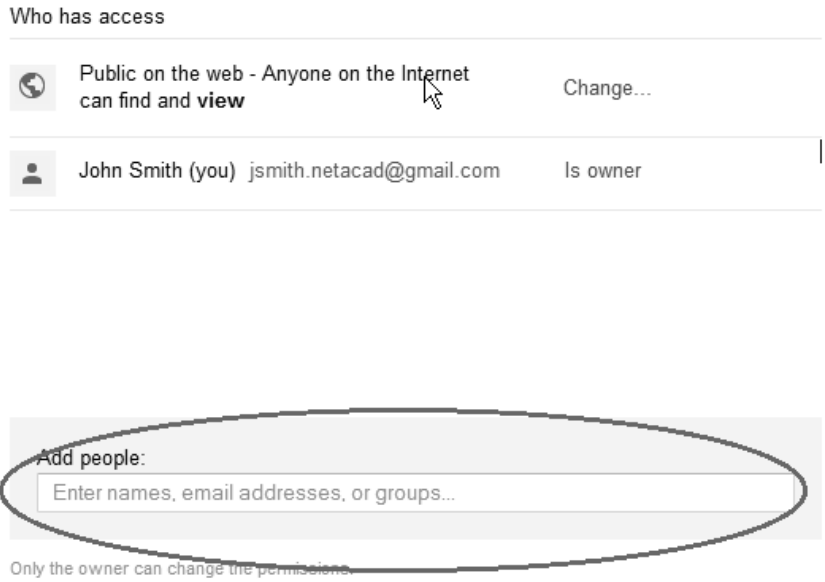
Who has access

Public on the web - Anyone on the Internet can find and **view**   Change...

John Smith (you) jsmith.netacad@gmail.com   Is owner

Add people:
Enter names, email addresses, or groups...

Only the owner can change the permissions.

c.   As soon as you start entering information into the **Add people** box, the box provides more options. The **Can edit** drop-down menu allows you to choose the document privileges (Can edit, Can comment, Can view) for the people you add. You can also specify how to notify these people of this document (**Send a copy to myself** or **Paste the item itself into the email**). Click **Share & save**.

Add people: Choose from contacts

janedoe@gmail.com   Can edit ▾

☑ Notify people via email - Add message

Share & save   Cancel   ☐ Send a copy to myself
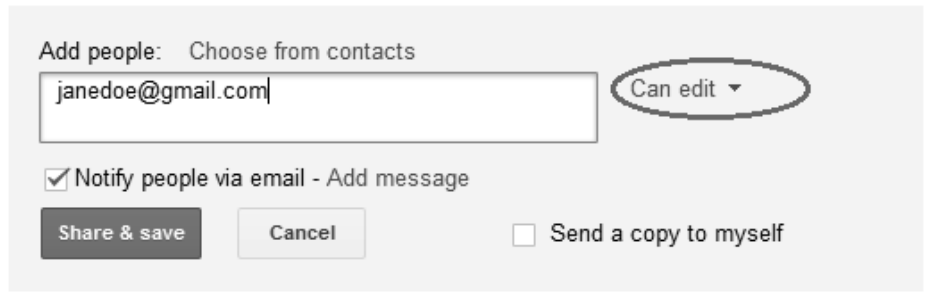
d.   Click **Share & save** to save **your sharing settings**.

Add people: Choose from contacts

janedoe@gmail.com   Can edit ▾

☑ Notify people via email - Add message

Share & save   Cancel   ☐ Send a copy to myself
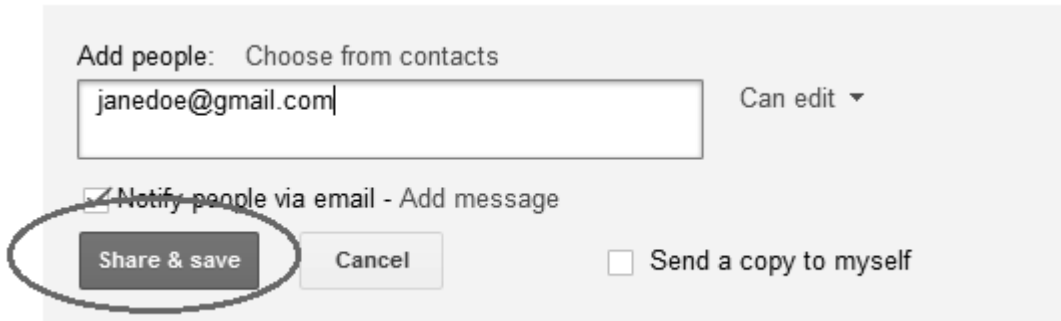
e.   The **Manage Site** page displays the people who have access to your site. Click your site name to return to your home page.

Step 8:   Provide the URL of your site.

You can provide your URL to your new site by adding your site name to the end of the Google site URL, as shown here: http://sites.google.com/site/(sitename).

Step 9:   Find additional information.

You can find a quick overview of how a wiki works at http://www.youtube.com/watch?v=-dnL00TdmLY.

Other examples of wikis and their web sites include:

- Wikipedia — http://www.wikipedia.org/
- Atlassian Confluence (a popular business wiki) — http://www.atlassian.com/software/confluence/
- Wikispaces (another free wiki) — http://www.wikispaces.com/

Reflection

1. Can you think of other collaboration tools used in the business world today?

   _____

2. What collaboration tools do you see as useful to a network administrator?

   _____

1.2.1.3 Lab — Researching Converged Network Services

Objectives

Part 1: Survey Your Understanding of Convergence

Part 2: Research ISPs Offering Converged Services

Part 3: Research Local ISPs Offering Converged Services

Part 4: Select Best Local ISP Converged Service

Part 5: Research Local Company or Public Institution Using Convergence Technologies

Background / Scenario

Convergence in the context of networking is a term used to describe the process of combining voice, video, and data communications over a common network infrastructure. Converged networks have existed for some time, but were only feasible in large enterprise organizations because of the network infrastructure require-ments and complex management required to make them work seamlessly. Technology advances have made convergence readily available to large, medium, and small businesses, as well as for the home consumer.

In Part 1, you will describe your current understanding of convergence and any experience you have with it.

In Part 2, you will research which providers have this service, regardless of geographical location, using the predefined form included in the lab.

In Part 3, you will research which local ISPs in your area offer converged services for end-user consumers, using the predefined form included in the lab.

In Part 4, you will select the ISP you like best for home use and list the reasons why.

In Part 5, you will find a local company or public institution using convergence technologies in their business, using the predefined form included in the lab.

Required Resources

Device with Internet access

Part 1: **Survey Your Understanding on Convergence**

Step 1: **Describe convergence as you understand it and give examples of its use in the home.**

Write a definition of convergence and list some examples.

_____

_____

_____

_____

_____

_____

_____

Part 2: **Research ISPs Offering Converged Services**

In Part 2, you research and find two or three ISPs who offer converged services for the home, regardless of geographical location.

Step 1: **Research various ISPs that offer converged services.**

List some of the ISPs that you found in your search.

_____

Step 2: **Fill in the following form for the ISPs selected.**

Internet Service Provider	Product Name of Converged Service

Part 3: **Researching Local ISPs Offering Converged Services**

In Part 3, you research and find two or three local ISPs who offer converged services for the home in your geographic area.

Step 1:   **Research various ISPs that offer converged services.**

List some of the ISPs that you found in your search.

_____

Answers will vary based on geographic location.

Step 2:   **Fill in the following form for the ISPs selected.**

Internet Service Provider	Product Name of Converged Service	Cost per Month	Download Speed

Part 4:   **Select Best Local ISP Converged Service Offering**

Select your top choice from the list of local ISPs that you selected and give reasons why you chose that particular one.

_____

_____

_____

_____

_____

_____

Part 5:   **Research Local Company or Public Institution Using Convergence Technologies**

In Part 5, you research and locate a company in your area that currently uses convergence technologies in their business.

Step 1:   **Research and find a local company using convergence.**

In the following table, list the company, industry, and convergence technologies used.

Name of Company	Industry	Convergence Technologies

Reflection

1. What are some of the advantages of using convergence technologies?

_____

_____

_____

2. What are some of the disadvantages of using convergence technologies?

_____

_____

_____

1.3.3.3 Lab — Mapping the Internet

Objectives

Part 1: Test Network Connectivity Using Ping

Part 2: Trace a Route to a Remote Server Using Windows Tracert

Part 3: Trace a Route to a Remote Server Using Web-Based and Software Tools

Part 4: Compare Traceroute Results

Background

Route tracing computer software is a utility that lists the networks data has to traverse from the user's originating end device to a distant destination network.

This network tool is typically executed at the command line as:

tracert <destination network name or end device address>

(Microsoft Windows systems)

or

traceroute <destination network name or end device address>

(Unix and similar systems)

Route tracing utilities allow a user to determine the path or routes as well as the delay across an IP network. Several tools exist to perform this function.

The **traceroute** (or **tracert**) tool is often used for network troubleshooting. By showing a list of routers traversed, it allows the user to identify the path taken to reach a particular destination on the network or across internetworks. Each router represents a point where one network connects to another network and through which the data packet was forwarded. The number of routers is known as the number of "hops" the data traveled from source to destination.

The displayed list can help identify data flow problems when trying to access a service such as a website. It can also be useful when performing tasks such as downloading data. If there are multiple websites (mirrors) available for the same data file, one can trace each mirror to get a good idea of which mirror would be the fastest to use.

Two trace routes between the same source and destination conducted some time apart may produce different results. This is due to the "meshed" nature of the interconnected networks that comprise the Internet and the Internet Protocols ability to select different pathways over which to send packets.

Command-line-based route tracing tools are usually embedded with the operating system of the end device.

Other tools, such as VisualRoute™, are proprietary programs that provide extra information. VisualRoute uses available online information to graphically display the route.

This lab assumes the installation of VisualRoute. If the computer you are using does not have VisualRoute installed, you can download the program using the following link:

http://www.visualroute.com/download.html

If you have any trouble downloading or installing VisualRoute, ask your instructor for assistance. Ensure that you download the Lite Edition.

VisualRoute Lite Edition	Windows XP\2003\Vista\7	4.0Mb	Download
	Mac OS X (dmg) 10.3+, universal binary	2.0Mb	Download

Scenario

Using an Internet connection, you will use three route tracing utilities to examine the Internet pathway to destination networks. This activity should be performed on a computer that has Internet access and access to the command line. First, you will use the Windows embedded tracert utility. Second, you will use a web-based traceroute tool (http://www.subnetonline.com/pages/network-tools/online-traceroute.php). Finally, you will use the VisualRoute traceroute program.

Required Resources

1 PC (Windows 7, Vista, or XP with Internet access)

Part 1: **Test Network Connectivity Using Ping**

Step 1: **Determine whether the remote server is reachable.**

To trace the route to a distant network, the PC used must have a working connection to the Internet.

a. The first tool we will use is ping. Ping is a tool used to test whether a host is reachable. Packets of information are sent to the remote host with instructions to reply. Your local PC measures whether a response is received to each packet, and how long it takes for those packets to cross the network. The name ping comes from active sonar technology in which a pulse of sound is sent underwater and bounced off of terrain or other ships.

b. From your PC, click the **Windows Start** icon, type **cmd** in the **Search programs and files** box, and then press Enter.

c. At the command-line prompt, type **ping www.cisco.com**.

```
C:\>ping www.cisco.com

Pinging e144.dscb.akamaiedge.net [23.1.48.170] with 32 bytes of data:
Reply from 23.1.48.170: bytes=32 time=56ms TTL=57
Reply from 23.1.48.170: bytes=32 time=55ms TTL=57
Reply from 23.1.48.170: bytes=32 time=54ms TTL=57
Reply from 23.1.48.170: bytes=32 time=54ms TTL=57

Ping statistics for 23.1.48.170:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 54ms, Maximum = 56ms, Average = 54ms
```

d. The first output line displays the Fully Qualified Domain Name (FQDN) e144.dscb.akamaiedge.net. This is followed by the IP address 23.1.48.170. Cisco hosts the same web content on different servers throughout the world (known as mirrors). Therefore, depending upon where you are geographically, the FQDN and the IP address will be different.

e. From this portion of the output:

```
Ping statistics for 23.1.48.170:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 54ms, Maximum = 56ms, Average = 54ms
```

Four pings were sent and a reply was received from each ping. Because each ping was responded to, there was 0% packet loss. On average, it took 54 ms (54 milliseconds) for the packets to cross the network. A millisecond is 1/1,000th of a second.

Streaming video and online games are two applications that suffer when there is packet loss, or a slow network connection. A more accurate determination of an Internet connection speed can be determined by sending 100 pings, instead of the default 4. Here is how to do that:

```
C:\>ping -n 100 www.cisco.com
```

And here is what the output from that looks like:

```
Ping statistics for 23.45.0.170:
    Packets: Sent = 100, Received = 100, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 46ms, Maximum = 53ms, Average = 49ms
```

f. Now ping Regional Internet Registry (RIR) websites located in different parts of the world:

For Africa:

C:\> **ping www.afrinic.net**

```
C:\>ping www.afrinic.net

Pinging www.afrinic.net [196.216.2.136] with 32 bytes of data:
Reply from 196.216.2.136: bytes=32 time=314ms TTL=111
Reply from 196.216.2.136: bytes=32 time=312ms TTL=111
Reply from 196.216.2.136: bytes=32 time=313ms TTL=111
Reply from 196.216.2.136: bytes=32 time=313ms TTL=111

Ping statistics for 196.216.2.136:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 312ms, Maximum = 314ms, Average = 313ms
```

For Australia:

```
C:\> ping www.apnic.net
```

```
C:\>ping www.apnic.net

Pinging www.apnic.net [202.12.29.194] with 32 bytes of data:
Reply from 202.12.29.194: bytes=32 time=286ms TTL=49
Reply from 202.12.29.194: bytes=32 time=287ms TTL=49
Reply from 202.12.29.194: bytes=32 time=286ms TTL=49
Reply from 202.12.29.194: bytes=32 time=286ms TTL=49

Ping statistics for 202.12.29.194:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 286ms, Maximum = 287ms, Average = 286ms
```

For Europe:

```
C:\> ping www.ripe.net
```

```
C:\>ping www.ripe.net

Pinging www.ripe.net [193.0.6.139] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 193.0.6.139:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

For South America:

```
C:\> ping lacnic.net
```

```
C:\>ping www.lacnic.net

Pinging www.lacnic.net [200.3.14.147] with 32 bytes of data:
Reply from 200.3.14.147: bytes=32 time=158ms TTL=51
Reply from 200.3.14.147: bytes=32 time=158ms TTL=51
Reply from 200.3.14.147: bytes=32 time=158ms TTL=51
Reply from 200.3.14.147: bytes=32 time=157ms TTL=51

Ping statistics for 200.3.14.147:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 157ms, Maximum = 158ms, Average = 157ms
```

All these pings were run from a computer located in the U.S. What happens to the average ping time in milliseconds when data is traveling within the same continent (North America) as compared to data from North America traveling to different continents?

_____

What is interesting about the pings that were sent to the European website?

_____

Part 2:   **Trace a Route to a Remote Server Using Tracert**

Step 1: **Determine what route across the Internet traffic takes to the remote server.**

Now that basic reachability has been verified by using the ping tool, it is helpful to look more closely at each network segment that is crossed. To do this, the **tracert** tool will be used.

a. At the command-line prompt, type **tracert www.cisco.com**.

```
C:\>tracert www.cisco.com

Tracing route to e144.dscb.akamaiedge.net [23.1.144.170]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dslrouter.westell.com [192.168.1.1]
  2    38 ms    38 ms    37 ms  10.18.20.1
  3    37 ms    37 ms    37 ms  G3-0-9-2204.ALBYNY-LCR-02.verizon-gni.net [130.8
1.196.190]
  4    43 ms    43 ms    42 ms  so-5-1-1-0.NY325-BB-RTR2.verizon-gni.net [130.81
.22.46]
  5    43 ms    43 ms    65 ms  0.so-4-0-2.XT2.NYC4.ALTER.NET [152.63.1.57]
  6    45 ms    45 ms    45 ms  0.so-3-2-0.XL4.EWR6.ALTER.NET [152.63.17.109]
  7    46 ms    48 ms    46 ms  TenGigE0-5-0-0.GW8.EWR6.ALTER.NET [152.63.21.14]

  8    45 ms    45 ms    45 ms  a23-1-144-170.deploy.akamaitechnologies.com [23.
1.144.170]

Trace complete.
```

b. Save the tracert output in a text file as follows:

Right-click the title bar of the Command Prompt window and choose **Edit** > **Select All**.

Right-click the title bar of the Command Prompt window again and choose **Edit** > **Copy**.

Open the **Windows Notepad** program: **Windows Start** icon > **All Programs** > **Accessories** > **Notepad**.

To paste the output into Notepad, choose **Edit** > **Paste**.

Choose **File** > **Save As** and save the Notepad file to your desktop as **tracert1.txt**.

c.   Run **tracert** for each destination website and save the output in sequentially numbered files.

```
C:\> tracert www.afrinic.net
```

```
C:\> tracert www.lacnic.net
```

d.   Interpreting **tracert** outputs.

Routes traced can go through many hops and a number of different Internet Service Providers (ISPs), depending on the size of your ISP and the location of the source and destination hosts. Each "hop" represents a router. A router is a specialized type of computer used to direct traffic across the Internet. Imagine taking an automobile trip across several countries using many highways. At different points in the trip you come to a fork in the road in which you have the option to select from several different highways. Now further imagine that there is a device at each fork in the road that directs you to take the correct highway to your final destination. That is what a router does for packets on a network.

Because computers talk in numbers, rather than words, routers are uniquely identified using IP addresses (numbers with the format x.x.x.x). The **tracert** tool shows you what path through the network a packet of information takes to reach its final destination. The **tracert** tool also gives you an idea of how fast traffic is going on each segment of the network. Three packets are sent to each router in the path, and the return time is measured in milliseconds. Now use this information to analyze the **tracert** results to www.cisco.com. Below is the entire traceroute:
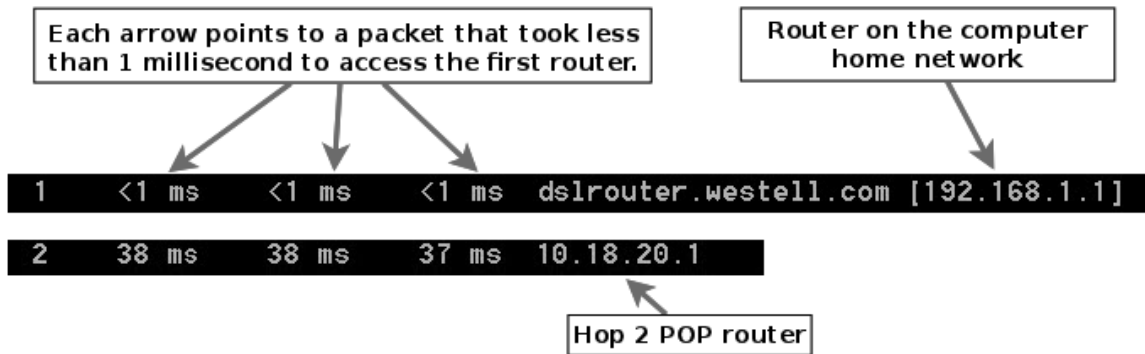
```
C:\>tracert www.cisco.com

Tracing route to e144.dscb.akamaiedge.net [23.1.144.170]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dslrouter.westell.com [192.168.1.1]
  2    38 ms    38 ms    37 ms  10.18.20.1
  3    37 ms    37 ms    37 ms  G3-0-9-2204.ALBYNY-LCR-02.verizon-gni.net [130.8
1.196.190]
  4    43 ms    43 ms    42 ms  so-5-1-1-0.NY325-BB-RTR2.verizon-gni.net [130.81
.22.46]
  5    43 ms    43 ms    65 ms  0.so-4-0-2.XT2.NYC4.ALTER.NET [152.63.1.57]
  6    45 ms    45 ms    45 ms  0.so-3-2-0.XL4.EWR6.ALTER.NET [152.63.17.109]
  7    46 ms    48 ms    46 ms  TenGigE0-5-0-0.GW8.EWR6.ALTER.NET [152.63.21.14]

  8    45 ms    45 ms    45 ms  a23-1-144-170.deploy.akamaitechnologies.com [23.
1.144.170]

Trace complete.
```

Below is the breakdown:

Each arrow points to a packet that took less than 1 millisecond to access the first router.

Router on the computer home network

```
1    <1 ms    <1 ms    <1 ms    dslrouter.westell.com [192.168.1.1]
```

```
2    38 ms    38 ms    37 ms    10.18.20.1
```

Hop 2 POP router

In the example output shown above, the tracert packets travel from the source PC to the local router default gateway (hop 1: 192.168.1.1) to the ISPs Point of Presence (POP) router (hop 2: 10.18.20.1). Every ISP has numerous POP routers. These POP routers are at the edge of the ISP's network and are the means by which customers connect to the Internet. The packets travel along the Verizon network for two hops and then jump to a router that belongs to alter.net. This could mean that the packets have traveled to another ISP. This is significant because sometimes there is packet loss in the transition between ISPs, or sometimes one ISP is slower than another. How could we determine if alter.net is another ISP or the same ISP?

e. There is an Internet tool known as whois. The whois tool allows us to determine who owns a domain name. A web-based whois tool is found at http://whois.domaintools.com/. This domain is also owned by Verizon according to the web-based whois tool.

```
Registrant:
        Verizon Business Global LLC
        Verizon Business Global LLC
        One Verizon Way
         Basking Ridge NJ 07920
        US
          domainlegalcontact@verizon.com  +1.7033513164 Fax: +1.7033513669

    Domain Name: alter.net
```

To summarize, Internet traffic starts at a home PC and travels through the home router (hop 1). It then connects to the ISP and travels through its network (hops 2-7) until it arrives at the remote server (hop 8). This is a relatively unusual example in which there is only one ISP involved from start to finish. It is typical to have two or more ISP involved as displayed in the following examples.

f. Now examine an example that involves Internet traffic crossing multiple ISPs. Below is the tracert for www.afrinic.net:

```
C:\>tracert www.afrinic.net

Tracing route to www.afrinic.net [196.216.2.136]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  dslrouter.westell.com [192.168.1.1]
  2    39 ms    38 ms    37 ms  10.18.20.1
  3    40 ms    38 ms    39 ms  G4-0-0-2204.ALBYNY-LCR-02.verizon-gni.net [130.8
1.197.182]
  4    44 ms    43 ms    43 ms  so-5-1-1-0.NY325-BB-RTR2.verizon-gni.net [130.81
.22.46]
  5    43 ms    43 ms    42 ms  0.so-4-0-0.XT2.NYC4.ALTER.NET [152.63.9.249]
  6    43 ms    71 ms    43 ms  0.ae4.BR3.NYC4.ALTER.NET [152.63.16.185]
  7    47 ms    47 ms    47 ms  te-7-3-0.edge2.NewYork2.level3.net [4.68.111.137
]
  8    43 ms    55 ms    43 ms  vlan51.ebr1.NewYork2.Level3.net [4.69.138.222]
  9    52 ms    51 ms    51 ms  ae-3-3.ebr2.Washington1.Level3.net [4.69.132.89]

 10   130 ms   132 ms   132 ms  ae-42-42.ebr2.Paris1.Level3.net [4.69.137.53]
 11   139 ms   145 ms   140 ms  ae-46-46.ebr1.Frankfurt1.Level3.net [4.69.143.13
7]
 12   148 ms   140 ms   152 ms  ae-91-91.csw4.Frankfurt1.Level3.net [4.69.140.14
]
 13   144 ms   144 ms   146 ms  ae-92-92.ebr2.Frankfurt1.Level3.net [4.69.140.29
]
 14   151 ms   150 ms   150 ms  ae-23-23.ebr2.London1.Level3.net [4.69.148.193]

 15   150 ms   150 ms   150 ms  ae-58-223.csw2.London1.Level3.net [4.69.153.138]

 16   156 ms   156 ms   156 ms  ae-227-3603.edge3.London1.Level3.net [4.69.166.1
54]
 17   157 ms   159 ms   160 ms  195.50.124.34
 18   353 ms   340 ms   341 ms  168.209.201.74
 19   333 ms   333 ms   332 ms  csw4-pk1-gi1-1.ip.isnet.net [196.26.0.101]
 20   331 ms   331 ms   331 ms  196.37.155.180
 21   318 ms   316 ms   318 ms  fa1-0-1.ar02.jnb.afrinic.net [196.216.3.132]
 22   332 ms   334 ms   332 ms  196.216.2.136

Trace complete.
```

What happens at hop 7? Is level3.net the same ISP as hops 2-6, or a different ISP? Use the whois tool to answer this question.

_____

What happens in hop 10 to the amount of time it takes for a packet to travel between Washington D.C. and Paris, as compared with the earlier hops 1-9?

_____

What happens in hop 18? Do a whois lookup on 168.209.201.74 using the whois tool. Who owns this network?

_____

g.   Type **tracert www.lacnic.net**.

```
C:\>tracert www.lacnic.net

Tracing route to www.lacnic.net [200.3.14.147]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dslrouter.westell.com [192.168.1.1]
  2    38 ms    38 ms    37 ms  10.18.20.1
  3    38 ms    38 ms    39 ms  G3-0-9-2204.ALBYNY-LCR-02.verizon-gni.net [130.8
1.196.190]
  4    42 ms    43 ms    42 ms  so-5-1-1-0.NY325-BB-RTR2.verizon-gni.net [130.81
.22.46]
  5    82 ms    47 ms    47 ms  0.ae2.BR3.NYC4.ALTER.NET [152.63.16.49]
  6    46 ms    47 ms    56 ms  204.255.168.194
  7   157 ms   158 ms   157 ms  ge-1-1-0.100.gw1.gc.registro.br [159.63.48.38]
  8   156 ms   157 ms   157 ms  xe-5-0-1-0.core1.gc.registro.br [200.160.0.174]

  9   161 ms   161 ms   161 ms  xe-4-0-0-0.core2.nu.registro.br [200.160.0.164]

 10   158 ms   157 ms   157 ms  ae0-0.ar3.nu.registro.br [200.160.0.249]
 11   176 ms   176 ms   170 ms  gw02.lacnic.registro.br [200.160.0.213]
 12   158 ms   158 ms   158 ms  200.3.12.36
 13   157 ms   158 ms   157 ms  200.3.14.147

Trace complete.
```

What happens in hop 7?

_____

Part 3:   **Trace a Route to a Remote Server Using Web-Based and Software-Tools**

Step 1:   **Use a web-based traceroute tool.**

a.   Using http://www.subnetonline.com/pages/network-tools/online-tracepath.php to trace the route to the following websites:

www.cisco.com

www.afrinic.net

Capture and save the output in Notepad.

How is the traceroute different when going to www.cisco.com from the command prompt (see Part 1) rather than from the online website? (Your results may vary depending upon where you are located geographically, and which ISP is providing connectivity to your school.)

_____

_____

Compare the tracert from Part 1 that goes to Africa with the tracert that goes to Africa from the web interface. What difference do you notice?

_____

_____

Some of the traceroutes have the abbreviation asymm in them. Any guesses as to what this means? What is its significance?

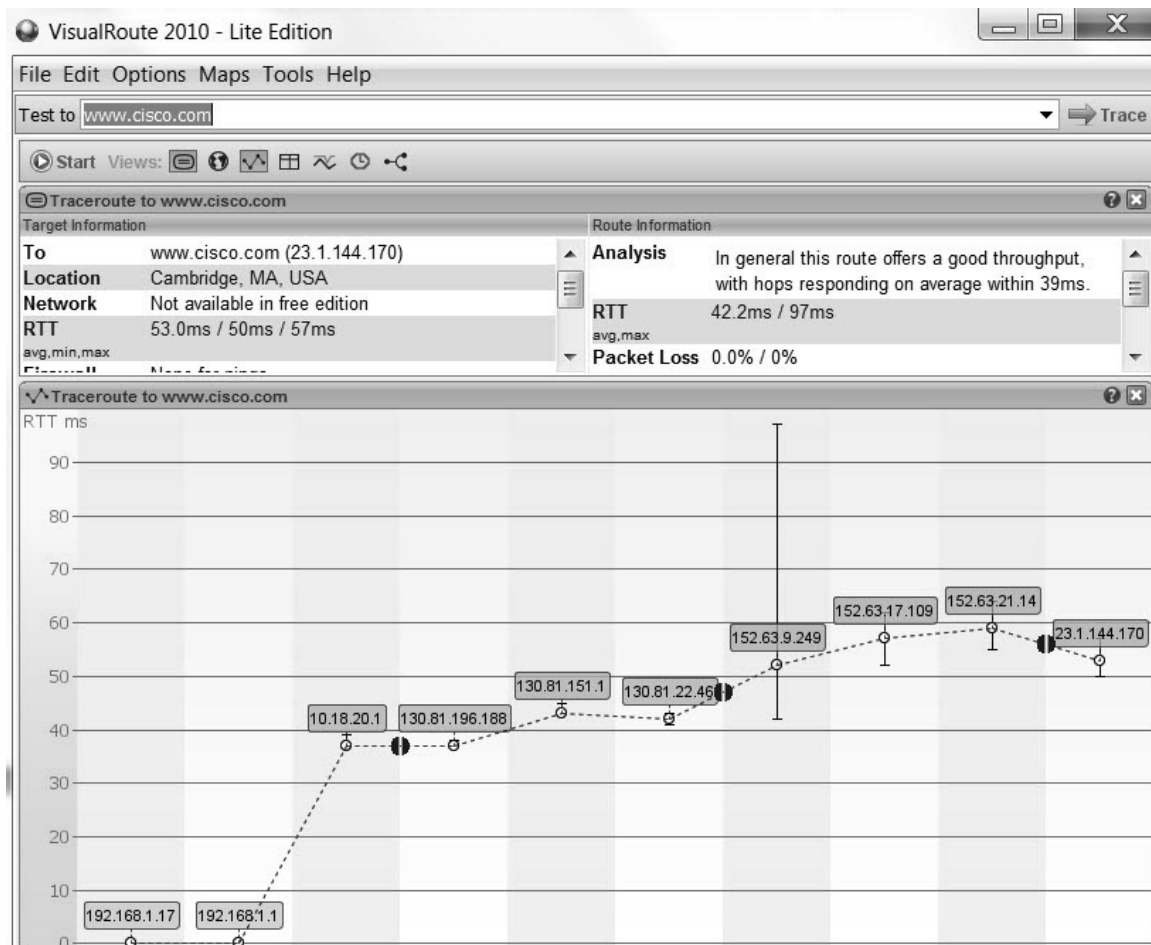_____

_____

Step 2: **Use VisualRoute Lite Edition**

VisualRoute is a proprietary traceroute program that can display the tracing path results graphically.

a. Please download the VisualRoute Lite Edition from the following link if it is not already installed:

http://www.visualroute.com/download.html

If you have any trouble downloading or installing VisualRoute, ask your instructor for assistance. Ensure that you download the Lite Edition.

b. Using VisualRoute 2010 Lite Edition, trace the routes to www.cisco.com.

c. Record the IP addresses in the path in Notepad.

VisualRoute 2010 - Lite Edition

File Edit Options Maps Tools Help

Test to www.cisco.com   ▼ ⇨ Trace

▶ Start Views: 🖵 🌐 〽 ⊞ 〜 🕓 ⌁

☰ Traceroute to www.cisco.com   ❓⊠

Target Information		Route Information	
To	www.cisco.com (23.1.144.170)	Analysis	In general this route offers a good throughput, with hops responding on average within 39ms.
Location	Cambridge, MA, USA		
Network	Not available in free edition	RTT	42.2ms / 97ms
RTT	53.0ms / 50ms / 57ms	avg,max	
avg,min,max		Packet Loss	0.0% / 0%

〽 Traceroute to www.cisco.com   ❓⊠

RTT ms

- 90
- 80
- 70
- 60   152.63.17.109   152.63.21.14
- 50   152.63.9.249   23.1.144.170
    130.81.151.1 130.81.22.46
- 40 10.18.20.1 130.81.196.188
- 30
- 20
- 10
    192.168.1.17 192.168.1.1
- 0

Part 4: **Compare Traceroute Results**

Compare the traceroute results to www.cisco.com from Parts 2 and 3.

Step 1: **List the path to www.cisco.com using tracert.**

Step 2: **List the path to www.cisco.com using the web-based tool on subnetonline.com.**

Step 3: **List the path to www.cisco.com using VisualRoute Lite edition.**

Did all the traceroute utilities use the same paths to www.cisco.com? Why or Why not?

_____

_____

_____

Reflection

Having now viewed traceroute through three different tools (tracert, web interface, and VisualRoute), are there any insights that using VisualRoute provided that the other two tools did not?

_____

_____

_____

1.4.3.6 Lab — Researching IT and Networking Job Opportunities

Objectives

Part 1: Research Job Opportunities

- Identify the current networking jobs that are in demand.

- Explain the value of Cisco certifications in the job market.

Part 2: Reflect on Research

- Identify current hiring trends in IT/networking.

- Identify future networking career certifications and skills.

- Identify additional networking career paths.

Background / Scenario

Jobs in Information Technology (IT) and computer networking continue to grow. Most employers require some form of industry standard certification, degree, or other qualifications from their potential employees, especially those with limited experience. The Cisco CCNA certification is a known and established entry level networking certification that is respected in the industry. There are additional levels and kinds of Cisco certifications that one can attain, and each certification may enhance employment opportunities as well as salary range.

In this lab, you will do some targeted job searching on the web, to find what types of IT and computer networking jobs are available; what kinds of skills and certifications you will need; and the salary ranges associated with the various job titles.

Required Resources

- Device with Internet access

Part 1: **Research Job Opportunities**

In Part 1, you will use a web browser to visit the popular job listing web sites monster.com and salary.com.

Step 1: **Open a web browser and go to a job listing website.**

In the URL address bar type in http://monster.com and press Enter.

Note: For job listings outside of the US, use the following link to search for your country:

http://www.monster.com/geo/siteselection/

Step 2: **Search for networking related jobs.**

a. Type the word *Network* in the Job title box. Notice that the website offers context sensitive suggestions based on the keywords provided. Either click on, or finish typing the words, *Network Administrator* and click the **SEARCH** button (see image below).

b.   Notice the search results:

c. Now focus your search by adding terms to the keywords field box. Try terms like Cisco CCNA, CCNP, CCNA Security, CCNA Voice, etc.

d. Now try refining your search by adding in different geographical locations. Did you find jobs in the locations you entered?

_____

e. Try searching a different website. Go to http://salary.com and click the **Job Search** menu bar button.

    Note: For salary listings outside of the US, use the following link to search for your country:

    http://www.payscale.com/rccountries.aspx

f. Now add a search term like *Information Technology* to the job title field box and click **Submit**.

g. In the image below, note the large number of matching search results. There are also easy to use tools for refining your search, in the column to the left.
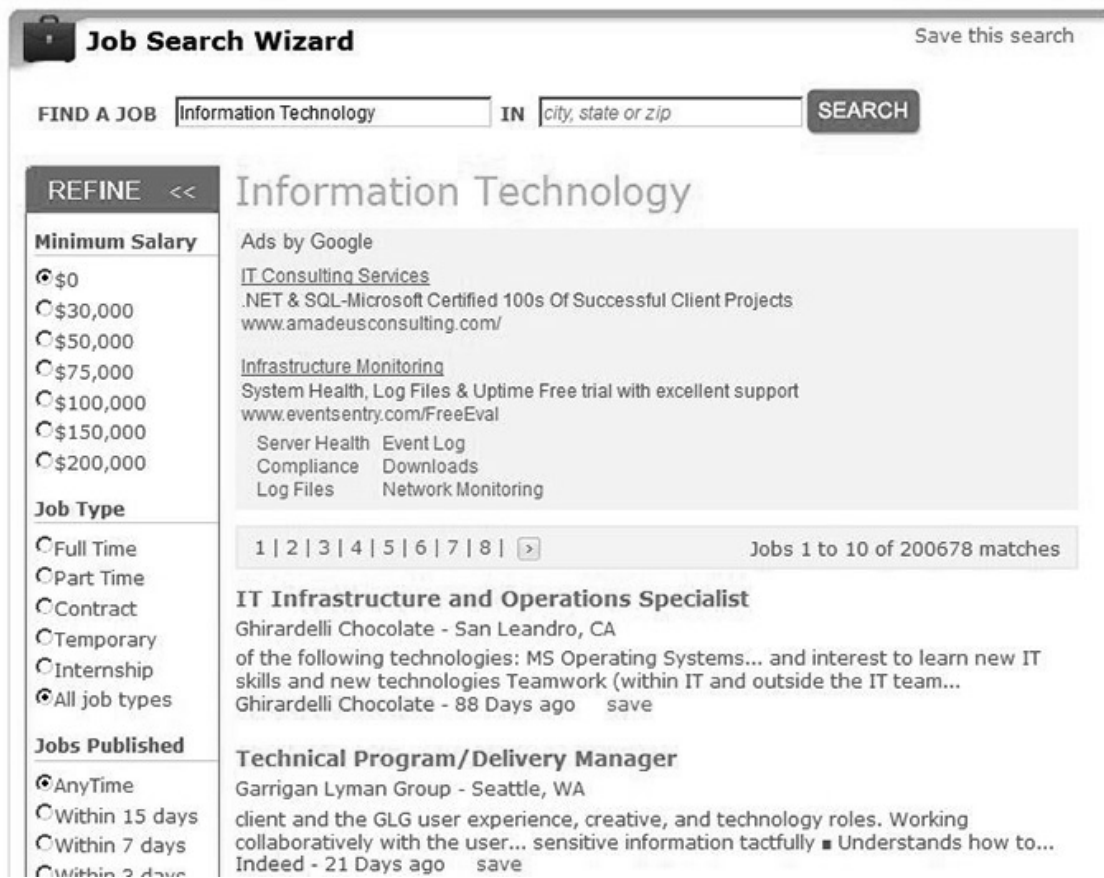
h. Spend some time searching for jobs and looking through the search results. Take note of what skills are required for different job titles and the range of starting salaries.

Part 2: **Reflect on Research**

In Part 2, you answer questions based on your research findings.

a. What job titles did you search for?

_____

_____

b. What skills or certifications were required?

_____

_____

c. Did you find any jobs that you previously did not know existed? If so, what were they?

_____

_____

d. Did you find any jobs that you are interested in? If so, which ones and what skills or certifications do they require?

_____

_____

_____

1.5.1.1 Class Activity — Draw Your Concept of the Internet Now

Objectives

Identify the common components of a network.

In this activity, you will illustrate how concepts from Chapter 1 are applied to show how network devices connect to and throughout the Internet. After reflecting on your home or small-business topology, you will become familiar with using the device icons and knowledge needed to visualize network connectivity through the remaining network courses.

Background / Scenario

In this activity, you will use the knowledge you have acquired throughout Chapter 1, and the modeling activity document that you prepared at the beginning of this chapter. You may also refer to the other activities completed in this chapter, including Packet Tracer activities.

Draw a map of the Internet as you see it now. Use the icons presented in the chapter for media, end devices, and intermediary devices.

In your revised drawing, you may want to include some of the following:

• WANs

• LANs

• Cloud computing

• Internet Service Providers (tiers)

Save your drawing in hard-copy format. If it is an electronic document, save it to a server location provided by your instructor. Be prepared to share and explain your revised work in class.

Required Resources

- Beginning of chapter modeling activity drawing
- Packet Tracer (may be optional if students sketch their own drawing)
- Paper and pencils or pens

Reflection

1. After completing Chapter 1, are you more aware of the devices, cabling, and physical components of a small-to-medium size network? Explain your answer.

_____

Modeling Activity Graphic Representation