Chapter 2

Home Business Network Diagram

In this chapter, we will cover the following to World Class standards:

- **The tools for simple 2D Computer Aided Drafting (CAD)**
- **The Command Line and the Tray**
- **The Line command to draw a closed polygon**
- **The Line command to draw single line segment**
- **Object Snaps (Osnaps) for accurate graphical selecting**
- **Checking the drawing time**
- **The Dtext command to create single line text strings**
- **The Line command to draw network cables**
- **The Copy command to create a new entity at another location on the drawing**
- **The Fillet command to join network cables**
- **The Circle command**
- **The Arc command**

The Ribbon

The Home Business Diagram will familiarize us with the basic commands that an AutoCAD user will utilize every day. If we are familiar with previous editions of AutoCAD, we are probably familiar with toolbars, which house groups of similar tools together. AutoCAD 2009 introduced a feature which groups the tools at the top of the screen and uses tabs to cycle through them. AutoCAD 2013 continues to utilize the ribbon feature, but has an expanded amount of default tabs. They are Home, Insert, Annotate, Parametric, View, Manage, Output, Plug-ins, Online, and Express Tools.

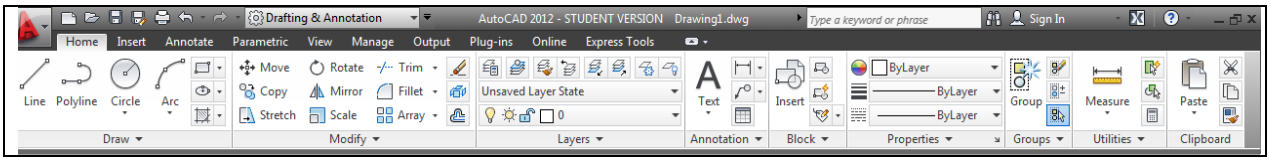


Figure 2.1 – The ribbon docked at the top of the screen

The Ribbon will be docked on the top of the screen as a default. Each ribbon tab contains panels that work like toolbars in that they further group similar tools. To change between different groups of panels, select the tab that corresponds to the panels and tools we need. To access standard file commands such as open, save, save as, etc., click the red A in the upper left hand corner of the screen and a drop-down menu will appear containing all of these options.

The Command Line and the Tray

We will see a text field below the drawing area. This is the command line. All of the actions that we do while drawing will be recorded here. We can also enter text here to execute a command or answer a command prompt, as happens very often during drafting. We can hit Enter or the spacebar to execute a command at the command line.

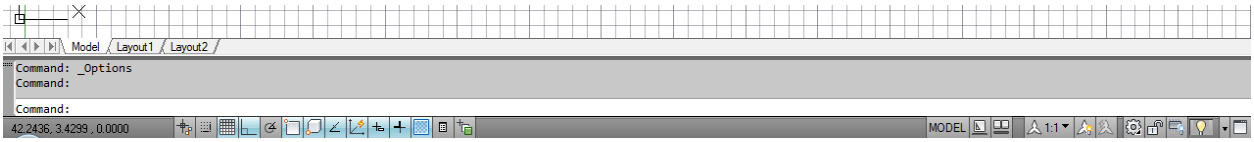


Figure 2.2 – The command line and the tray

The tray is located below the command line (Figure 2.2). It contains a number of options that we can toggle on or off by selecting the appropriate icon. For example, we will notice that the drawing area by default may have a grid displayed. If we wish to turn the grid off, just select the Grid Display icon. At any time we can hold the cursor over a tool or icon for a moment and the name of the tool will appear. If we continue to hold the cursor over some tools a more specific explanation will appear to help we understand what the tool does.

If we have Dynamic Input toggled on, the commands we enter with the keyboard will appear

under the cursor rather than at the command line. However, once we execute the command by hitting Enter it will appear at the command line as if we typed it there. We can toggle dynamic input on or off by select its icon on the tray. The pictures in all of these lessons will display the use of dynamic input.

Turn On Snap

We will want to use a simple Snap function to keep the network diagram looking neat so we type Snap at the command line and input 0.125. The cursor will appear to jump 1/8 inch each time we move the mouse.

Drawing our First Lines

Our first experience with the line command will be very simple. We will just be drawing a 1" by 0.625" rectangle. From the Ribbon, select the Line tool from the Draw panel under the Home tab. With the mouse, select a point at the lower left side of the graphic screen. While in the Line command, we can toggle the orthographic mode on by hitting F8 on the keyboard to keep the lines perfectly horizontal or vertical when drawing. Move the cursor to the right, type "1.0", and hit ENTER on the keyboard (Figure 2.3). To draw the vertical line, move the cursor upward, directing the line and type ".625" and ENTER (Figure 2.4). To draw the third line, move the mouse to the left, dragging the line and type "1.0" and ENTER (Figure 2.5). To close the rectangle, just type "c" and ENTER (Figure 2.7). Figure 2.6 displays the command line as it would appear throughout these actions.

Figure 2.3

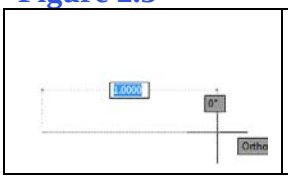


Figure 2.4

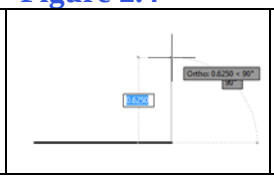


Figure 2.5

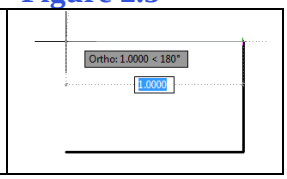


Figure 2.6 – Command line

Command: _line Specify first point
Specify next point or [Undo]: 1
Specify next point or [Undo]: 0.625
Specify next point or [Close/Undo]: 1
Specify next point or [Close/Undo]: c

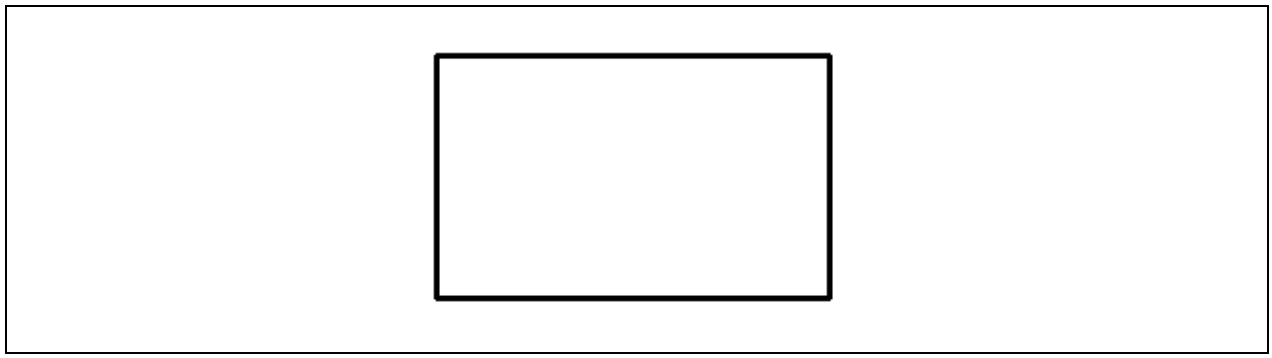


Figure 2.7 – The finished 1 x .625 rectangle.

Type “Time” at the Command Line and read the total time. When opening a new file we will train so that we can draw four lines in less than twenty seconds.

*** World Class CAD Challenge 202-01* – close this file by selecting File from the Menu Browser and then Close. Start a new file by selecting File and New. Draw the 1 x 0.625 rectangle in less than 20 seconds.**

Drawing lines using Object Snaps

Setting Object Snaps allows us to select precise points that relate to specific points of other entities. To set Object Snaps, right click on the Object Snap icon on the tray and select Settings from the menu. In the rectangular problem, we need to select the following Object Snap Modes: Endpoint for grabbing the ends of lines (recognized by a square when in the zone), Midpoint for grabbing the midpoint of a line (a triangle symbol), Center for grabbing the center of a circle or arc, Quadrant for snapping to the four points of a circle: north, east, south or west (a diamond symbol), Intersection to grab onto any intersection on the graphic screen (shown by an “x”), and Perpendicular for snapping to any object that is 90º from our first selection point (Figure 2.8).

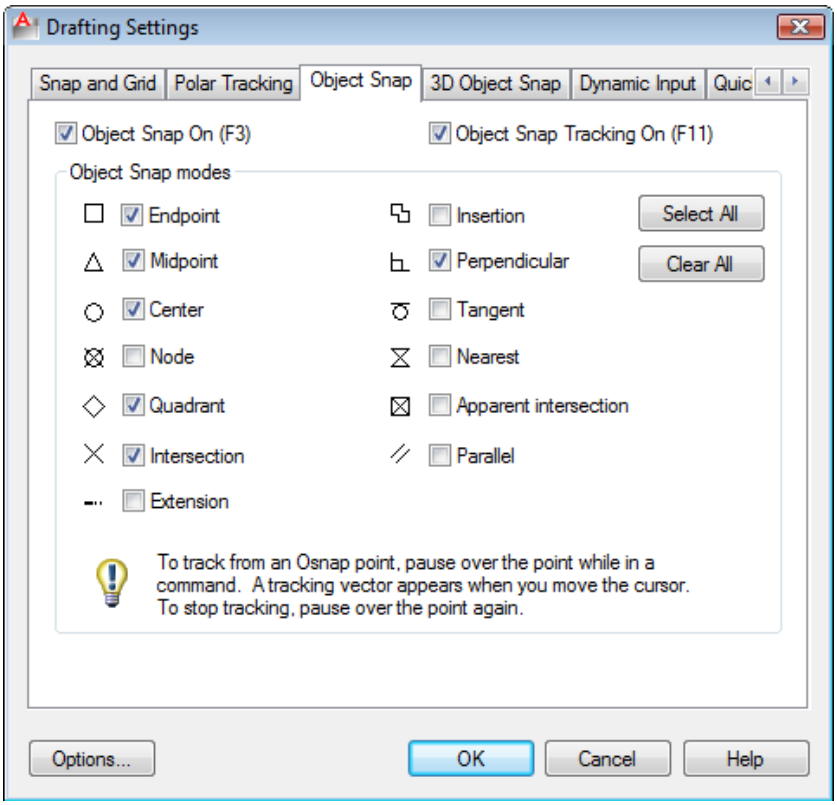


Figure 2.8 – The Object Snap settings tab on the Drafting Settings properties window

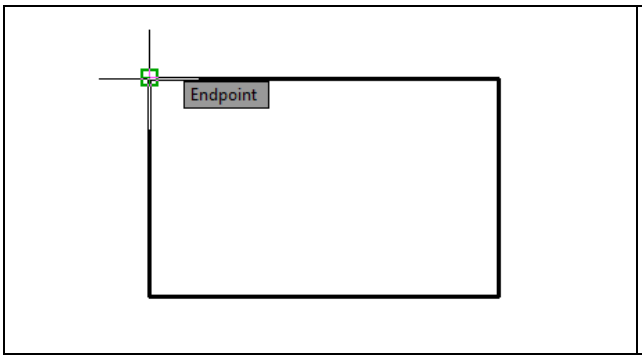


Figure 2.9 – Selecting the endpoint of a line

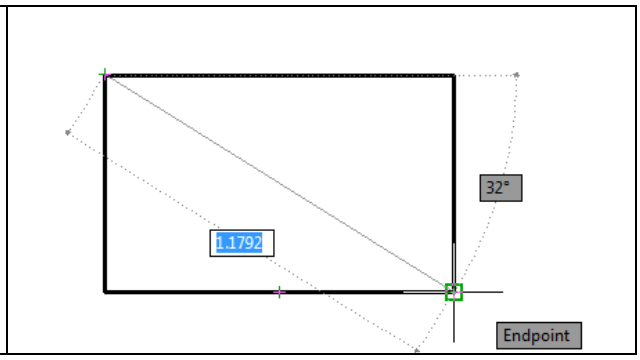


Figure 2.10 – Selecting another endpoint

The next line we will draw is a construction line dividing the rectangle. Now that the Object Snap Mode (referred from now on as OSNAP) is automatically set and turned on, select the line command a second time. Place the crosshairs, or aperture cursor, next to the upper left corner of the rectangle and the endpoint OSNAP symbol (square) should appear. Select it by clicking the left mouse button (Figure 2.9). Move the mouse to the lower right corner of the rectangle and when the square OSNAP symbol appears select the endpoint by clicking the left mouse button (Figure 2.10).

Using the Dtext Command

Now, we will type in Dtext at the command line and type J for justify. There are 14 options to pick but we need to choose M for middle. Then we select the midpoint (triangle OSNAP) of the diagonal line. We then type 0.125 for the text height and ENTER to accept 0 degrees for the rotation angle.

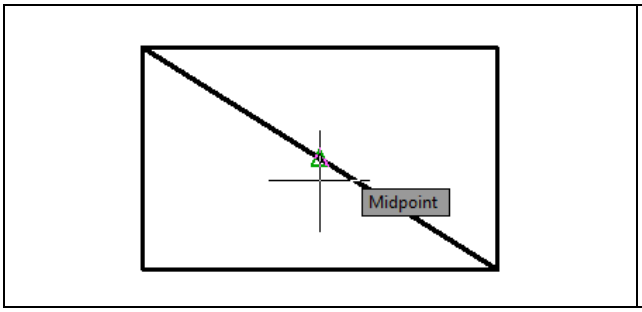


Figure 2.11 – Selecting the midpoint

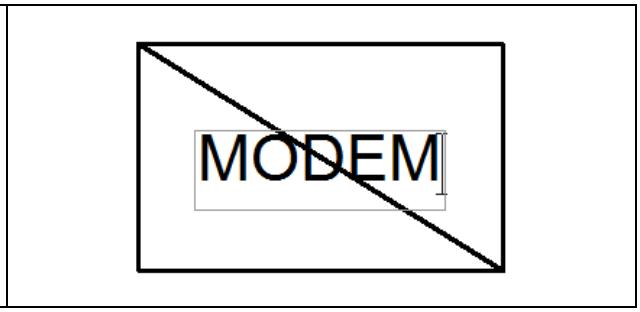


Figure 2.12 – Typing MODEM

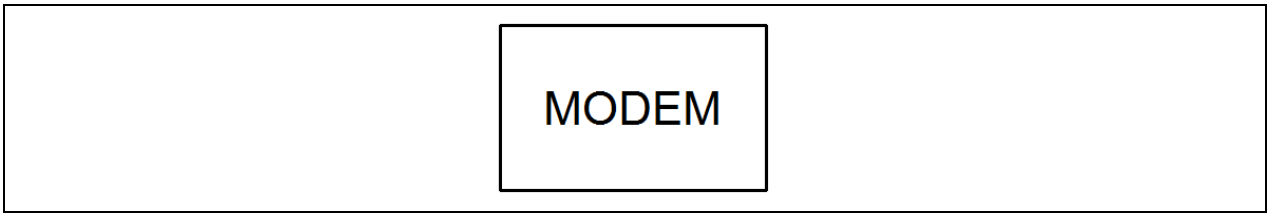


Figure 2.13 – The 1 x 0.625 rectangle with the word MODEM

*** World Class CAD Challenge 202-02 * - Close this drawing file. Create a New file and draw the five lines, four for the 1 x 0.625 rectangle box, a construction line and a line of text than 40 seconds. Continue this drill four times, each time completing the drawing under 40 seconds to maintain our World Class ranking.**

Draw a Network Cable

We will choose the Line command to draw a 1-inch line from the midpoint of the left side of the rectangle into the left portion of the graphical display. We will then learn to use our polar coordinates. To make an arrow, we turn off the F8 (Ortho) function and we can draw a line at 0.125 and 45 degrees as shown in figure 2.16. Press ENTER to end the Line command. We can draw the other section of the arrow at 0.125 and 45 degrees as shown in figure 2.17. Press ENTER to end the Line command.

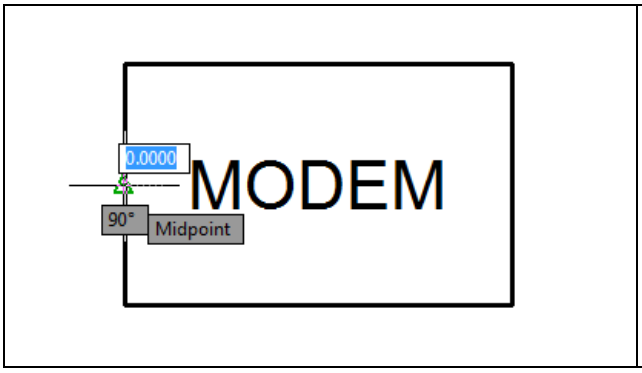


Figure 2.14 – Midpoint of the line

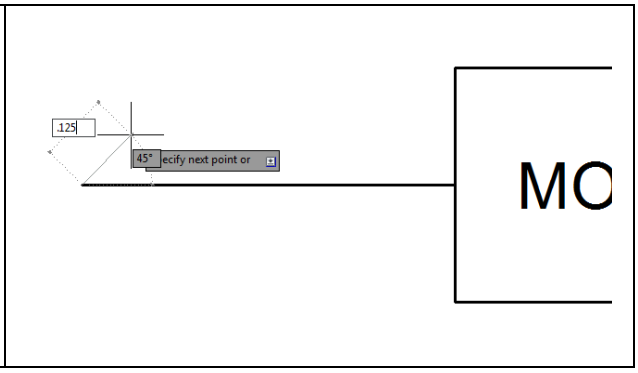


Figure 2.15 – 45 degree line

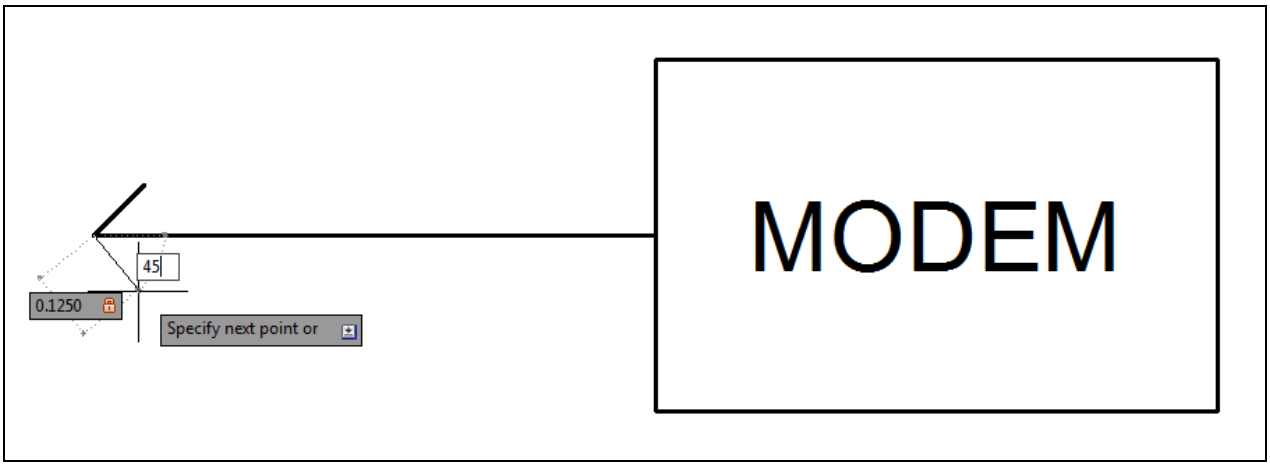
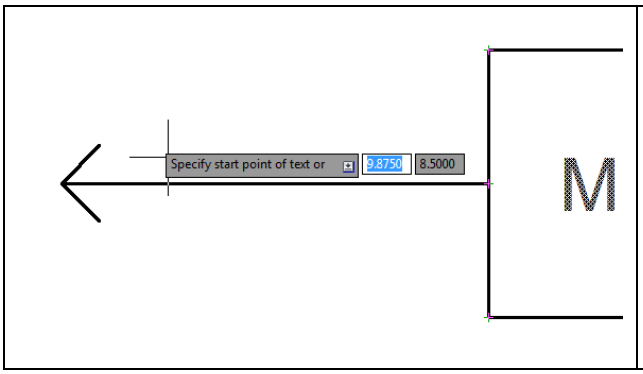


Figure 2.16 – Another 45 degree line

Using the Dtext Command

Now, we will type in Dtext at the command line and type J for justify. There are 14 options to pick but we need to choose M for middle. Then we select the midpoint (triangle OSNAP) of the diagonal line. We then type 0.125 for the text height and ENTER to accept 0 degrees for the rotation angle.



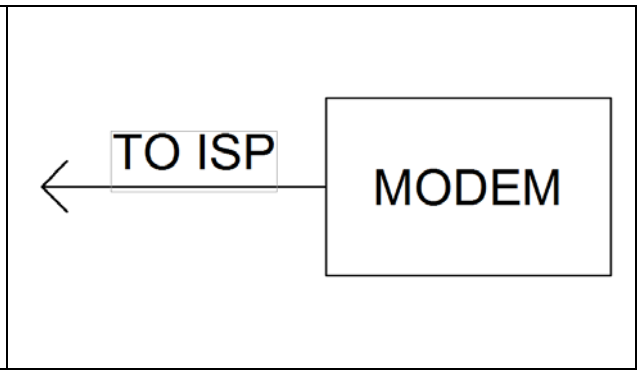


Figure 2.11 – Selecting the a starting point **Figure 2.12 – Typing TO ISP**

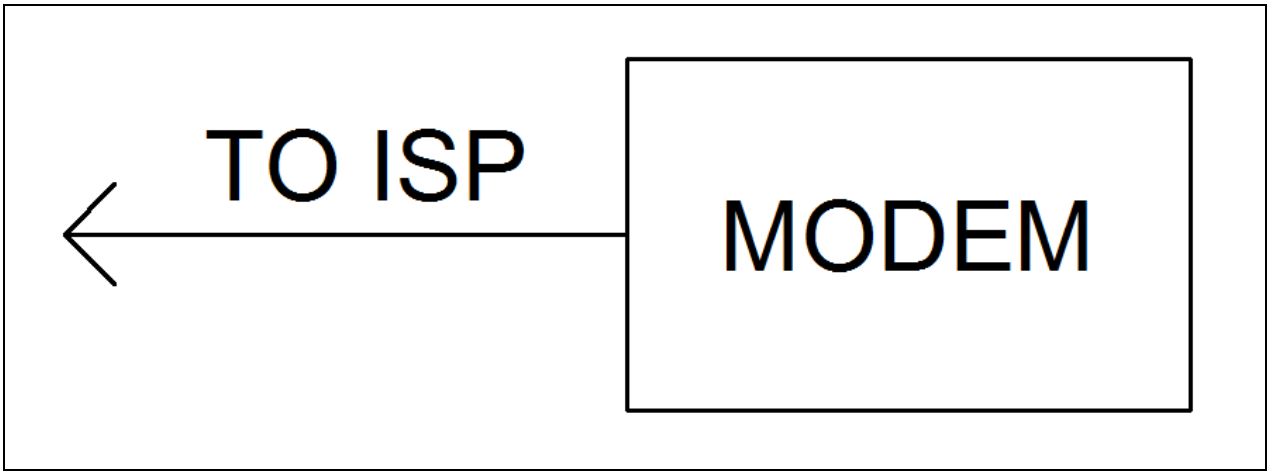


Figure 2.13 – The 1 x 0.625 rectangle with the word MODEM, arrow and TO ISP

*** World Class CAD Challenge 202-03 * - Close this drawing file. Create a New file and draw the seven lines, four for the 1 x 0.625 rectangle box, a construction line and a line of text than 60 seconds. Continue this drill four times, each time completing the drawing under 60 seconds to maintain our World Class ranking.**

Using the Copy Command to Expand the Network Diagram

The Copy command is located on the Modify panel under the Home tab. This command is separated into two parts: the first is the selection process and the second is the function of the command itself, in this case Copy. To copy an AutoCAD entity, such as a rectangle with text, select the Copy command on the Modify panel. The command line will prompt us to "Select Objects" (Figure 2.33). We can do this by selecting the entities with the pick box that now has replaced the aperture cursor or we can draw a window around the group as shown in figure 2.15. The command line will respond with "5 found," so hit ENTER to go the second part of the command. Now we need to "specify base point or displacement" on the graphical display. Pick any point away from any entities so that our Osnaps do not interfere with the movement. Once we pick a base point with the left mouse button, drag the rectangle and text to the right to show the desired direction of movement as shown in Figure 2.16. The Ortho setting is still on, so the movement will be at a perfect 0 degrees to the right. Type "3" and ENTER at the command line for the second point of displacement and the circle will move 3.0 units to the right of its previous position (Figure 2.16)

```
Command: _copy
Select objects: 5 found
Select objects:
Specify base point or displacement:
Specify second point of displacement or <use first point as displacement> 1.5
```

Figure 2.14 – The command line sequence for our first Copy command

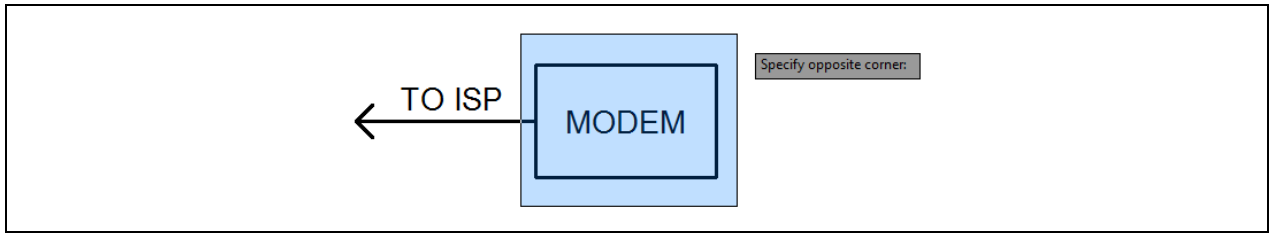
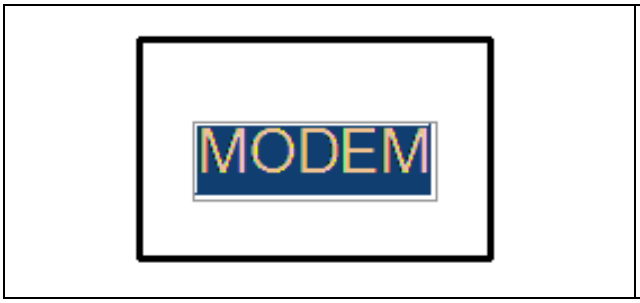


Figure 2.15 – Selecting the entities to copy

Figure 2.16 – Copy multiple entities to the right

Double click on the word MODEM on the rectangle on the right hand side and change it to ROUTER.



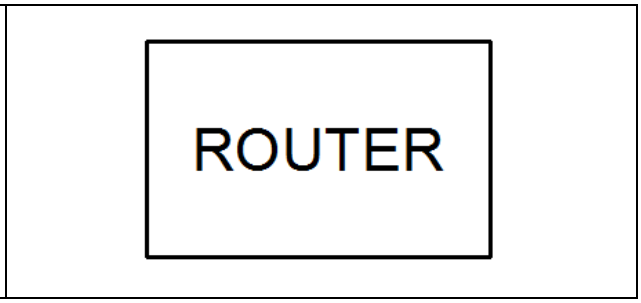


Figure 2.17 – Highlight the text **Figure 2.18 – Change the text**

We need to copy the Router rectangle, so we select the Copy command on the Modify panel. The command line will prompt us to "Select Objects". Again, we can do this by selecting the entities with the pick box that now has replaced the aperture cursor or we can draw a window around the group of entities. The command line will respond with "5 found," so hit ENTER to go the second part of the command. Now we need to "specify base point or displacement" on the graphical display. Pick any point away from any entities so that our Osnaps do not interfere with the movement. Once we pick a base point with the left mouse button, drag the rectangle and text to the right to show the desired direction of movement as shown in Figure 2.19. The Ortho setting is still on, so the movement will be at a perfect 0 degrees to the right. Type "3" and ENTER at the command line for the second point of displacement and the circle will move 3.0 units to the right of its previous position (Figure 2.19)

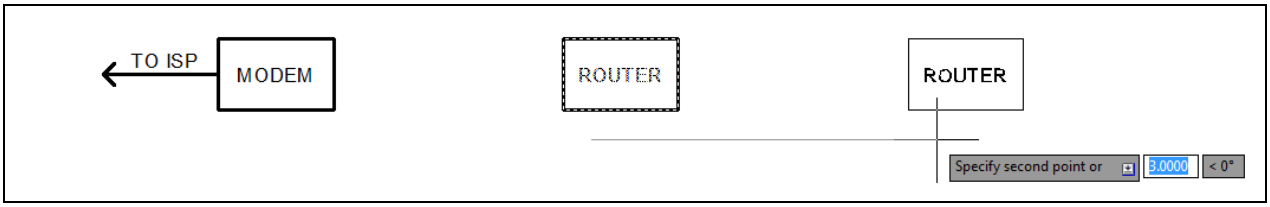
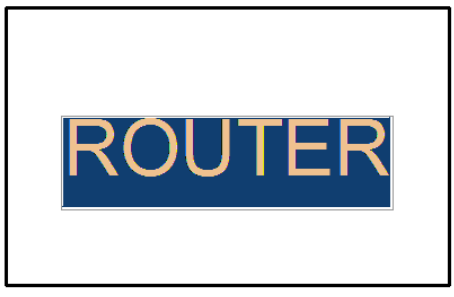


Figure 2.19 – Copy more rectangles

Double click on the word ROUTER on the rectangle on the right hand side and change it to SERVER.



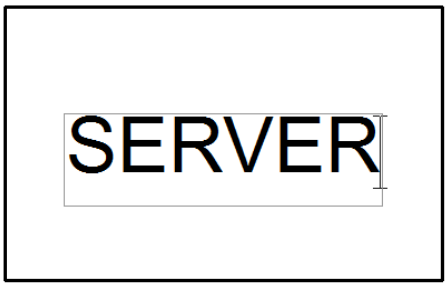


Figure 2.20 – Highlight the text **Figure 2.21 – Change the text**

We will then draw a line from the right midpoint of the MODEM rectangle to the left line of the ROUTER rectangle. We will draw another line from the right midpoint of the ROUTER rectangle to the left line of the SERVER rectangle.

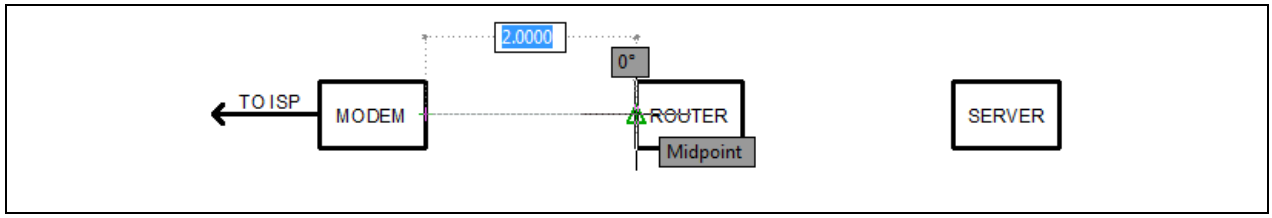


Figure 2.22 – Connect the MODEM to the ROUTER

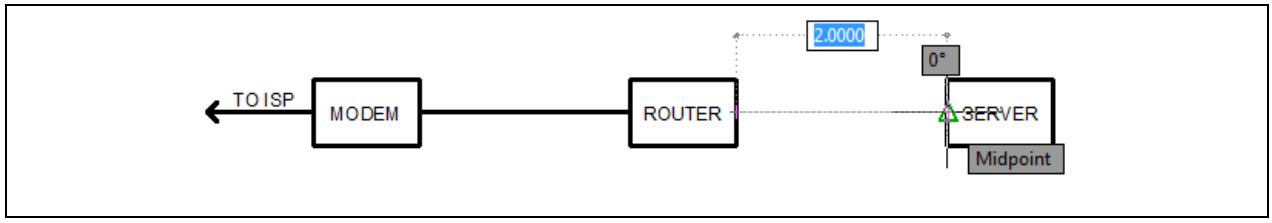


Figure 2.23 – Connect the ROUTER to the SERVER

We should have a wire number on both sides of the cables to help troubleshoot the network and we show the identification on the diagram. We use the Dtext command to snap the wire number 101 to the right of the MODEM and above the cable. We use the Copy command to duplicate the number on the other side.

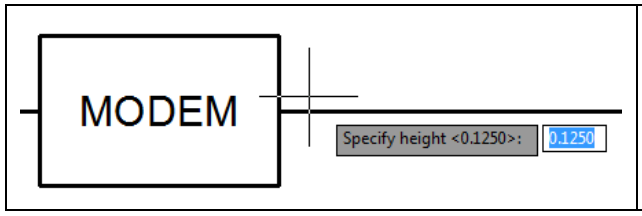


Figure 2.24 – Dtext starting point

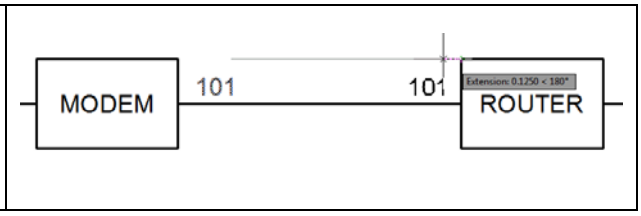


Figure 2.25 – Copy the wire number

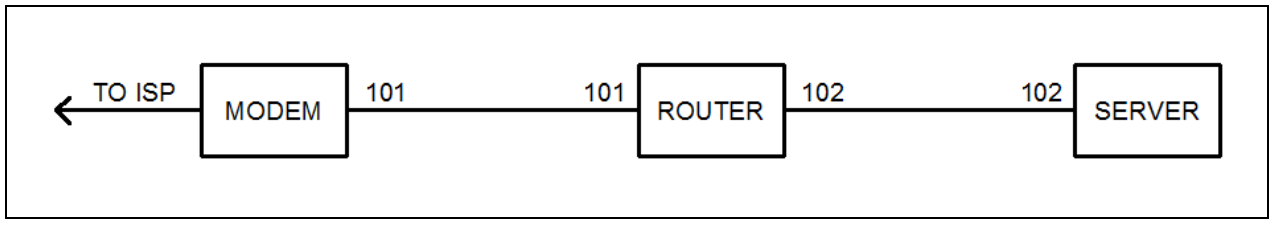


Figure 2.26 – Wire number from the ROUTER to the SERVER

*** World Class CAD Challenge 202-04 * - Close this drawing file. Create a New file and draw the diagram with three 1 x 0.625 rectangle boxes, lines representing cable and wire numbers in less than 125 seconds. Continue this drill four times, each time completing the drawing under 60 seconds to maintain our World Class ranking.**

Using the Copy Command to Duplicate Lines and Text

We need to copy the SERVER rectangle three times, so we select the Copy command on the Modify panel. The command line will prompt us to "Select Objects".

We can do this by selecting the entities with the pick box that now has replaced the aperture cursor or we can draw a crossing window around the group of entities from right to left. The command line will respond with "7 found," so hit ENTER to go the second part of the command.

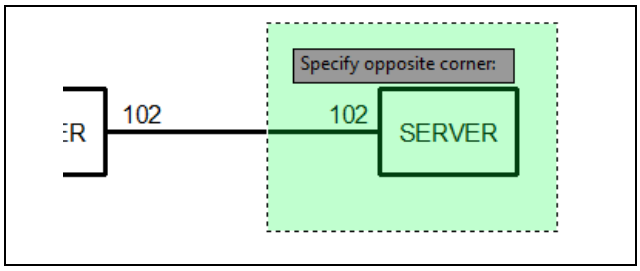


Figure 2.25 – Select the Entities

Now we need to "specify base point or displacement" on the graphical display. Pick any point away from any entities so that our Osnaps do not interfere with the movement. Once we pick a base point with the left mouse button, drag the rectangle and text to the right to show the desired direction of movement as shown in Figure 2.26. The Ortho setting is still on, so the movement will be at a perfect 270 degrees downward. Type "1.375" and ENTER at the command line for the second point of displacement and the circle will move 3.0 units down from its previous position (Figure 2.26)

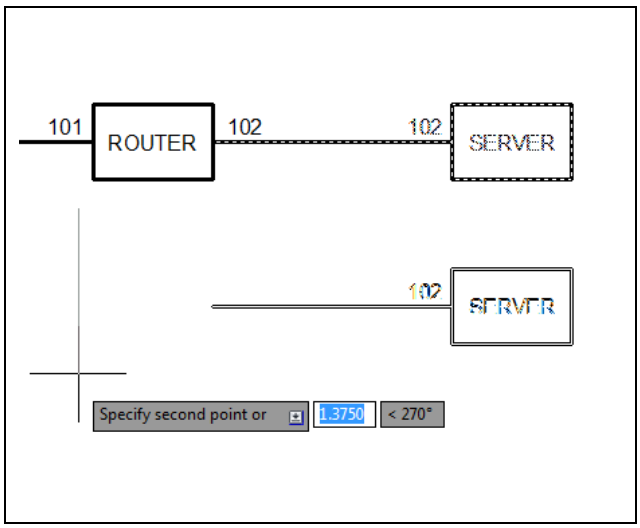


Figure 2.26 – Copy the entities

Without exciting the program, we repeat the picking of the second point of displacement two more times. The second selection is at 2.75 and the third one is at 4.125.

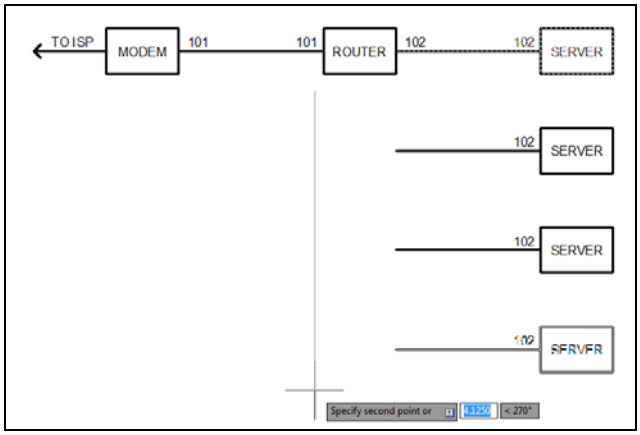


Figure 2.27 – Copy more entities

We should rename the rectangles to COMP 1, COMP 2 and COMP 3. We will also change the wire numbers to 103, 104 and 105.

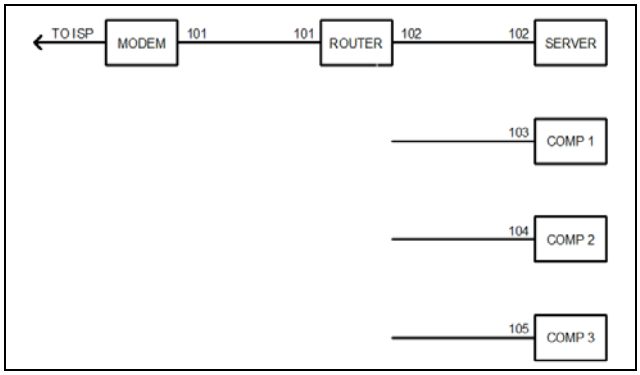


Figure 2.28 – Rename copied entities

We will draw three symmetrical lines with the Snap mode on from the bottom of the router. The lines do not need to connect with the computer's horizontal line because we will use the fillet function to merge the lines.

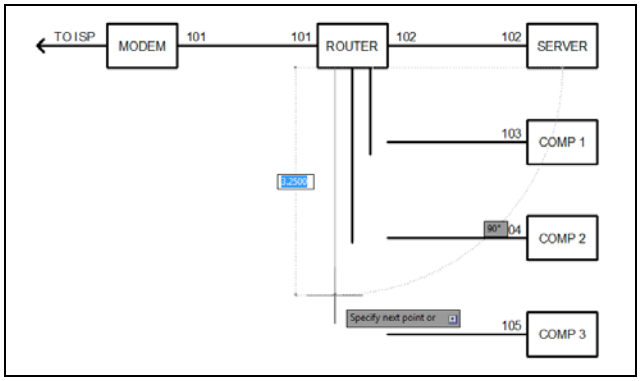


Figure 2.29 – Three lines from the router

Using the Fillet Command to Merge Lines

We need to join the vertical and horizontal lines to connect the Router to the Computers. We will select the Fillet command on the Modify panel. The command line will prompt us to "Select first object" as shown in figure 2.30. We will then choose the horizontal line as shown in figure 2.31. The radius is set for 0, so the line will come together in a perfect perpendicular corner. Repeat the process for the other two sets of lines.

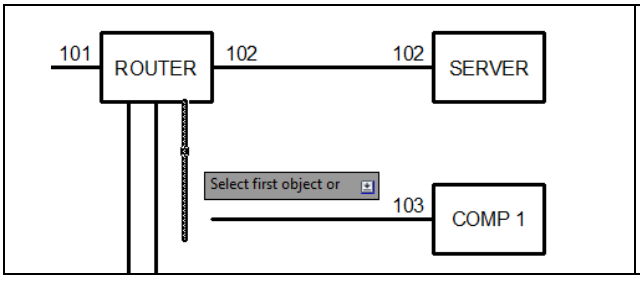


Figure 2.30 – First fillet pick

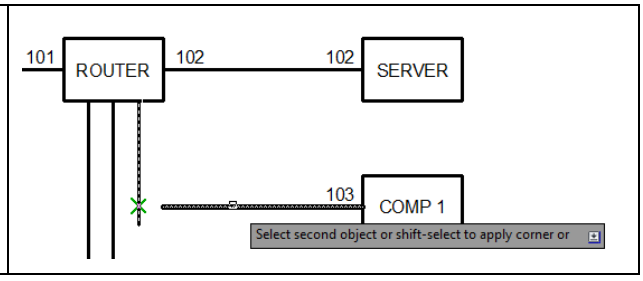


Figure 2.31 – Second fillet pick

We will copy the wire numbers to the left side as shown in figure 2.32.

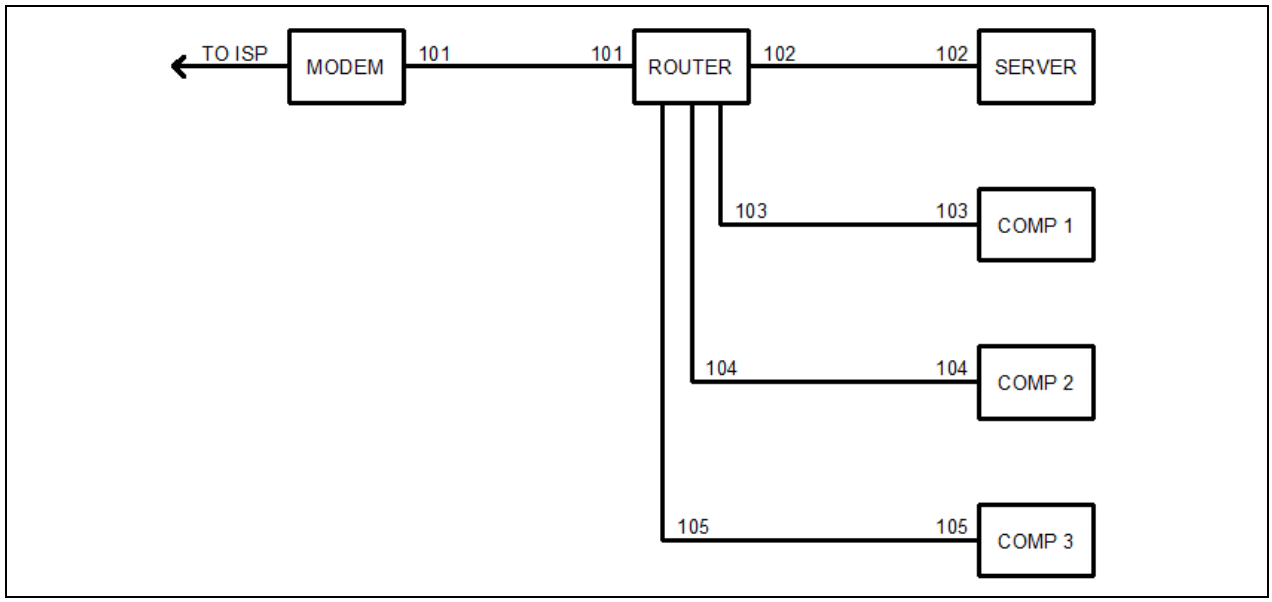


Figure 2.32 – The finished wired network

*** World Class CAD Challenge 202-05 * - Close this drawing file. Create a New file and draw the diagram with six 1 x 0.625 rectangle boxes, lines representing cable and wire numbers in less than 4 minutes and 20 seconds. Continue this drill four times, each time completing the drawing under 60 seconds to maintain our World Class ranking.**

Adding a Laptop to the Diagram

Now that we are done with the wired network, we will draw the wireless portion of the diagram. We will copy just the four lines of the server rectangle to 3.0 inches to the right. We will then copy the same rectangle with the text from the endpoint of the upper right corner of the server rectangle to the lower right corner of the new laptop rectangle.

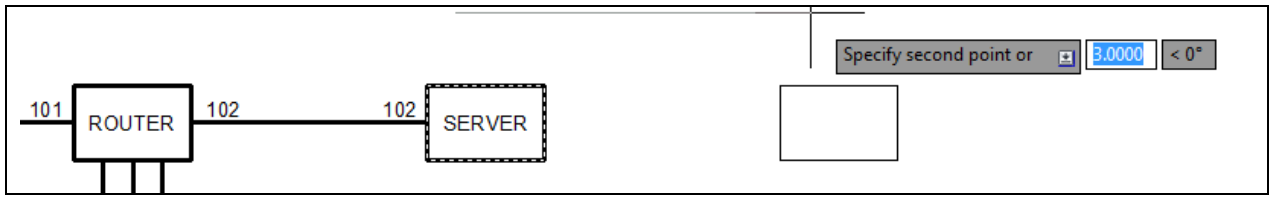


Figure 2.33 – Copy just the rectangle

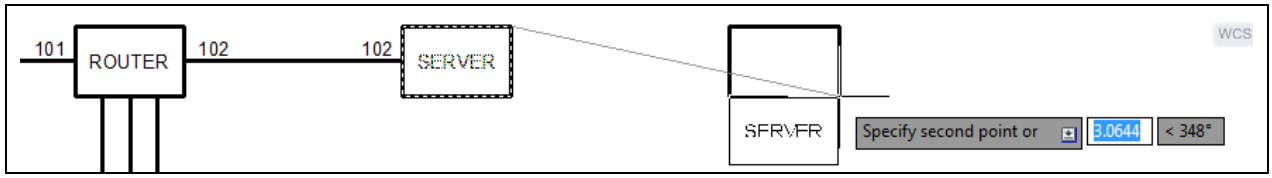


Figure 2.34 – Copy the text and rectangle

Double click on the word SERVER on the rectangle on the right hand side and change it to LAPTOP1.

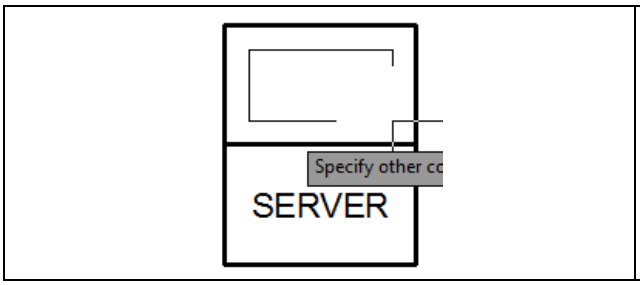


Figure 2.35 – Draw a LCD screen

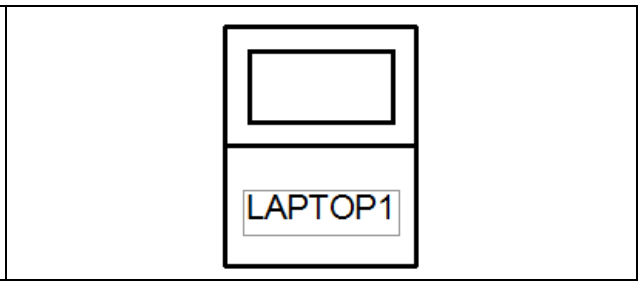


Figure 2.36 – Change text to LAPTOP1

Next, we draw a line to represent the antennae on the laptop. Do not use the Object Snap Mode by turning it off and select the line command. Place the crosshairs, or aperture cursor, next to the upper right corner of the rectangle a few snap jumps to the left. Select it by clicking the left mouse button (Figure 2.37). Move the mouse up 0.25 inches and pick the point and ENTER.

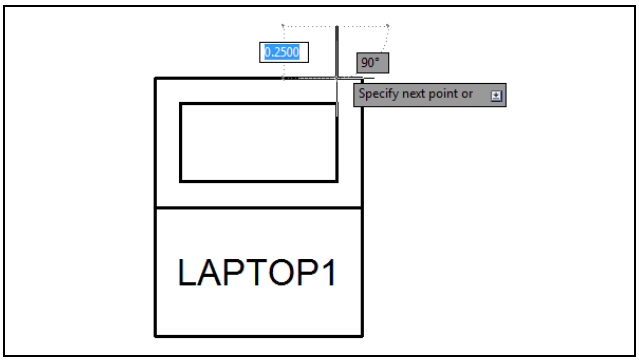


Figure 2.37 – Add antennae

We can draw a circle by selecting the Circle command on the Draw section of the AutoCAD ribbon. Pick the top of the line for the center point. Then, we pick D for diameter and we input 1/16 and enter.

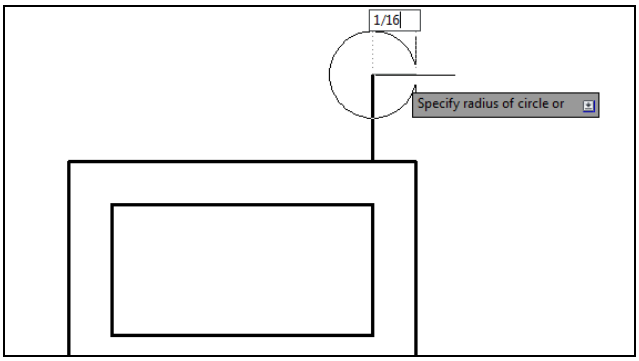


Figure 2.38 – Add a circle

We can draw a three-point arc by selecting the Arc command on the Draw section of the AutoCAD ribbon. Pick the right of the circle for the right point. Then, we pick a point above the circle and then the third point of the left of the circle as shown in the figure.

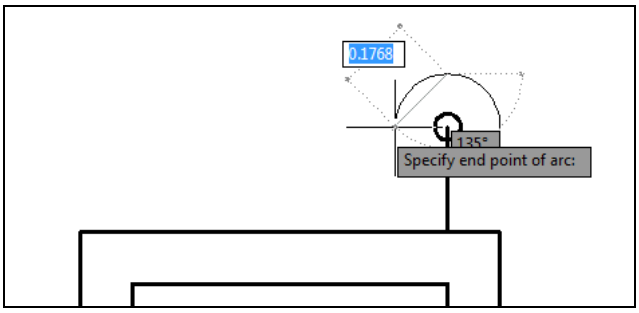


Figure 2.39 – Add an arc

We can draw another three-point arc by selecting the Arc command again on the Draw section of the AutoCAD ribbon. Pick to the right of the last arc. Then, we pick a point above the last arc and then the third point of the left of the last arc as shown in the figure.

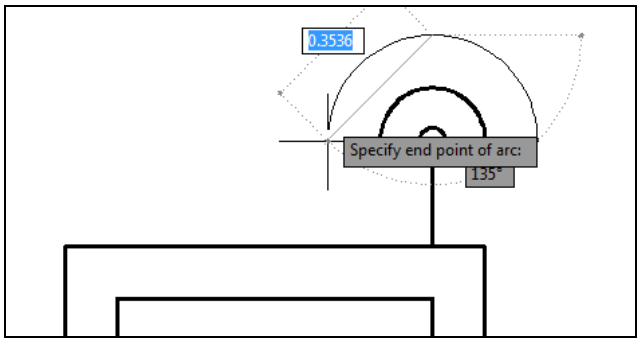


Figure 2.40 – Add a second arc

We need to copy the Laptop1 rectangle, so we select the Copy command on the Modify panel. The command line will prompt us to "Select Objects". Again, we can do this by selecting the entities with the pick box that now has replaced the aperture cursor or we can draw a window around the group of entities. The command line will respond with "14 found," so hit ENTER to go the second part of the command. Now we need to "specify base point or displacement" on the graphical display. Pick any point away from any entities so that our Osnaps do not interfere with the movement. Once we pick a base point with the left mouse button, drag the rectangle and text downward to show the desired direction of movement as shown in Figure 2.41. The Ortho setting is still on, so the movement will be at a perfect 0 degrees to the right. Type "3" and ENTER at the command line for the second point of displacement and the circle will move 2.75 units down from its previous position (Figure 2.41)

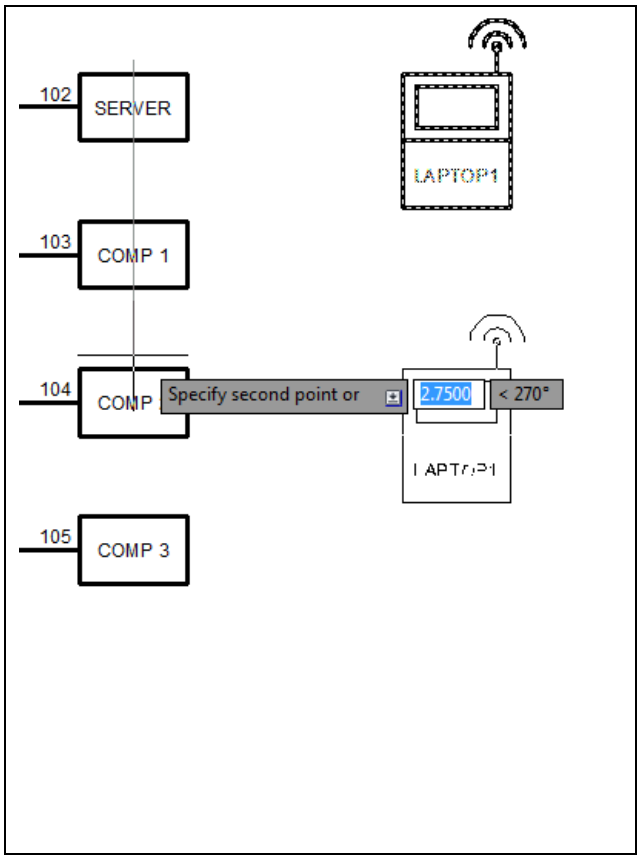


Figure 2.41 – Copy the laptop

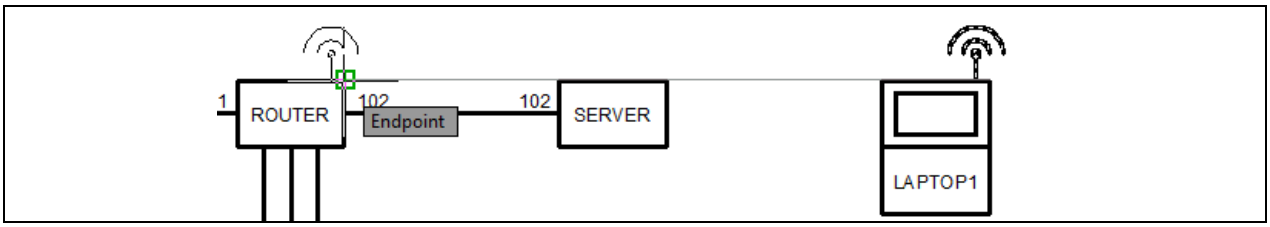


Figure 2.41 – Copy the antennae to the router

We copy the antenna from the laptop to the router picking the Copy command and the 4 entities

of the antennae and we choose the endpoint on the right side of the Laptop rectangle for the initial base point and the endpoint on the right side of the Router for the second point of displacement.

The finished diagram should look like Figure 2.42. The typical CAD student needs 10 to 12 hours of training and practice to achieve World Class standards.

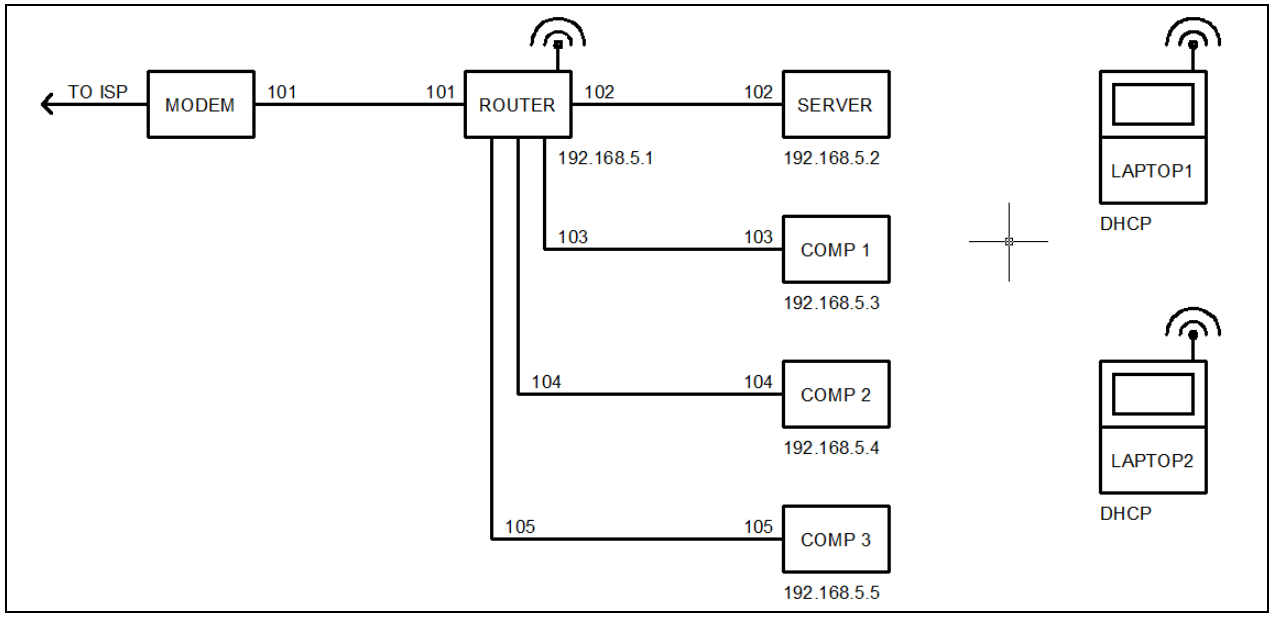


Figure 2.56 – The finished diagram with IP addresses

*** World Class CAD Challenge 202-06 * - Close this drawing file. Create a New file and draw the diagram with six 1 x 0.625 rectangle boxes, two laptops, lines representing cables, text for IP addresses and wire numbers in less than 10 minutes. Continue this drill four times, each time completing the drawing under 10 minutes to maintain our World Class ranking.**