Understanding the OSI Model

This exercise gives you a brief overview of layered networking models. You will review the structure and function of the OSI model, and you will compare it to another layered model, the TCP/IP model. You will also see how the OSI model structure can be used to aid troubleshooting. You will apply these concepts to the lab activities that will take place in subsequent exercises.

To better understand this technology, also refer to your course material or use your preferred search engine to research this topic in detail.

Learning Outcomes

After completing this exercise, you will be able to:

- Explain the structure of the OSI model

Your Devices

You will be using the following devices in this lab. Please make sure these are powered on before proceeding.

- No devices are used in this exercise.

Task 1 - Reviewing the History and Structure of the OSI model

The Open Systems Interconnection (OSI) model was originally published in 1984 by the International Organization of Standardization (ISO) and the International Telecommunications Union (ITU-T). It was used to standardize networking protocols allowing interoperability of vendor equipment.

The OSI model defines seven layers:

OSI Model	
Layer 7	Application
Layer 6	Presentation
Layer 5	Session
Layer 4	Transport
Layer 3	Network
Layer 2	Data Link
Layer 1	Physical

Figure 1.1 Diagram of OSI Model: Seven layers of the OSI Model listed in hierarchical order

Several protocols have been developed based on this model, including X.25, Token Bus, IS-IS, and CLNP. Today, the OSI model is used primarily for teaching purposes as it has been largely superseded by the TCP/IP model.

Task 2 - Compare the OSI Model to the TCP/IP Model

Although the OSI model was developed to be used openly by all vendors, another model was adopted by the telecommunications industry. This is the TCP/IP model.

The original TCP/IP model was composed of four layers.

TCP/IP Model (Original)
Application
Transport
Internet
Link

Figure 1.2 Diagram of TCP/IP Model: Four layers of the original TCP/IP Model listed

Even though most networks today are based on the TCP/IP model, the layers of the OSI model are most often referenced rather than those of the TCP/IP model. For example, when using the term Layer 2, it is referring to the Data Link layer of the OSI model, where technologies such as MAC addresses and Ethernet function even though these function in Layer 1 of the TCP/IP model. Similarly, Layer 3 refers to IP addressing and routing, which is the Network layer of the OSI model even though this function occurs in the Internet layer or Layer 2 of the TCP/IP model. When referring to a layer, it is only the OSI model that is referenced.

The TCP/IP model maps to the OSI model according to the following diagram:

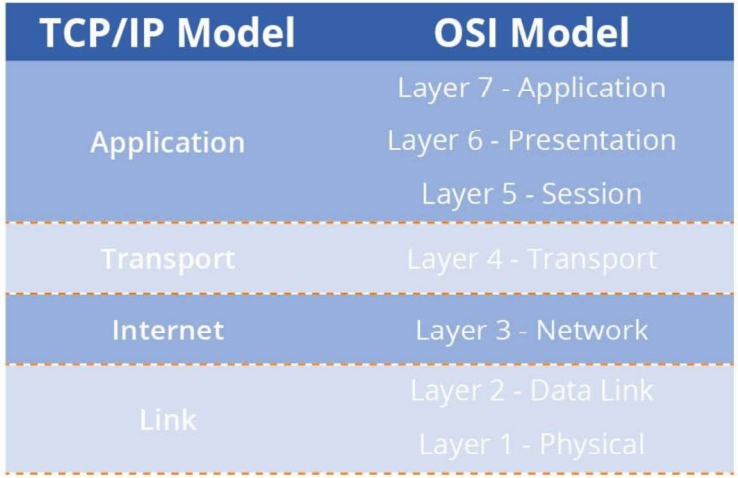

Figure 1.3 Diagram of TCP/IP and OSI Models: Original 4-layer TCP/IP Model mapped to the OSI Model.

Although this original model still remains the official layered model, some experts and professionals have accepted an updated version of the TCP/IP model with five layers that maps more appropriately to the OSI model. This updated TCP model, along with its mapping to the OSI model, can be seen below:

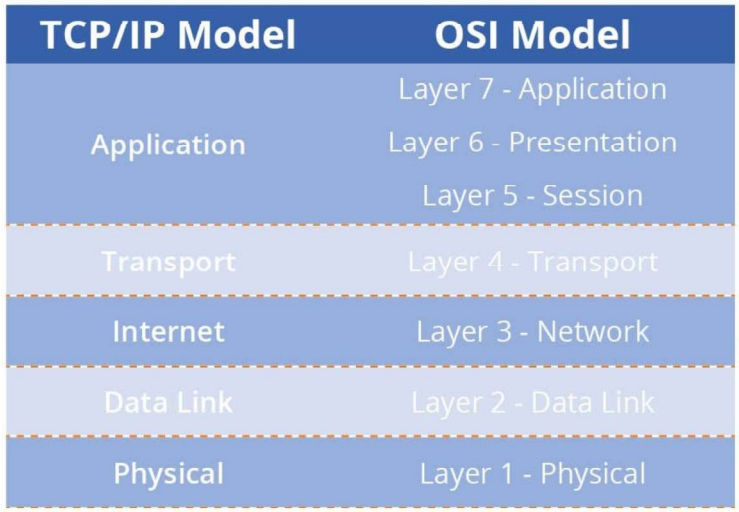

Figure 1.4 Diagram of TCP/IP and OSI Models: Updated 5-layer TCP/IP Model mapped to the OSI Model

Note that this updated TCP/IP is referenced here only for completeness and has not officially replaced the original TCP/IP layered model.

For the remainder of the lab, when referring to specific layers, it is the layers of the OSI model that will be referenced and not those of the TCP/IP models mentioned above unless explicitly stated.

Task 3 - Using the OSI Model to Implement Troubleshooting

The OSI model can be used to implement several different approaches to troubleshooting. These include the Top to Bottom and Bottom to Top approaches as well as the Divide and Conquer method. All these approaches reference the OSI model and indicate at what layer the troubleshooting will begin.

The Top to Bottom approach, as the name suggests, involves beginning at the top layer of the OSI model. That is, beginning with the Application layer and working your way down.

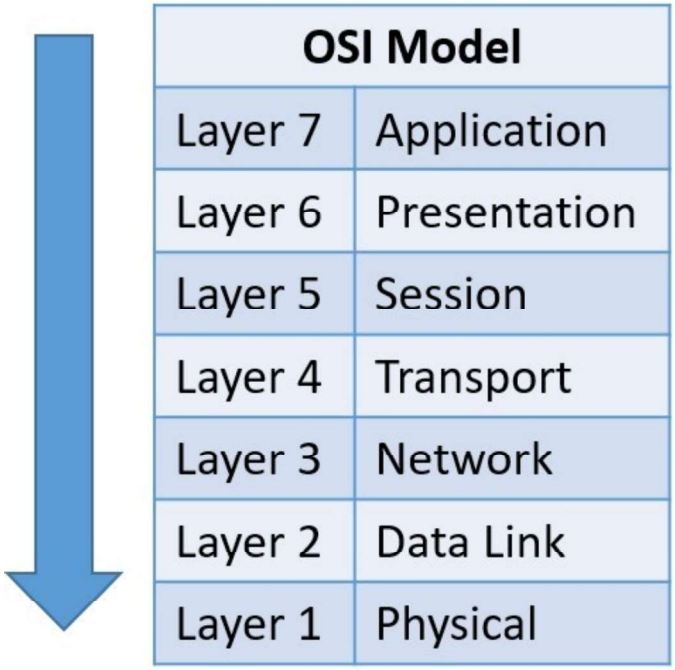

Figure 1.5 Diagram of OSI Model: Order followed to implement the Top to Bottom type of connectivity troubleshooting using layers of the OSI Model

An example of this would be to examine network connectivity by opening a web browser and attempting to connect to a web page. If this doesn't work, move down the layers and test that the appropriate ports in the Transport layer are open. Next, check IP connectivity with a ping. Continue until you reach the layer where the problem exists and solve it.

The Bottom to Top approach is much the same, but begins at the bottom of the OSI model and works its way up.

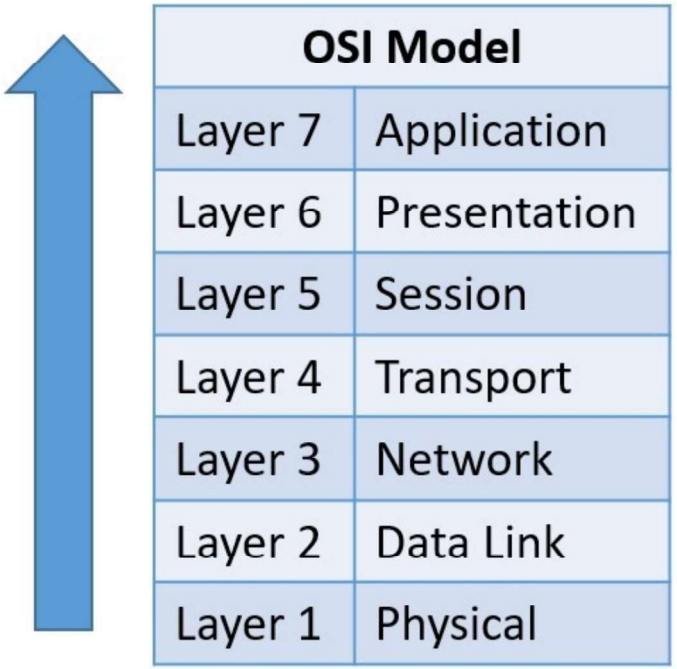

Figure 1.6 Diagram of OSI Model: Order followed to implement the Bottom to Top type of connectivity troubleshooting using the layers of the OSI Model

For example, on a PC without network connectivity, the first thing you can check the physical cable connectivity, as well as verify that the LEDs on the switch and the NIC are on. Next, you can check that the NIC is functioning and that the switch ports are configured correctly and are in working order. Thereafter, check IP connectivity using the ping command. Keep going up a layer until the problem is located and solved.

The Divide and Conquer approach begins at one of the middle layers and works either up or down from there.

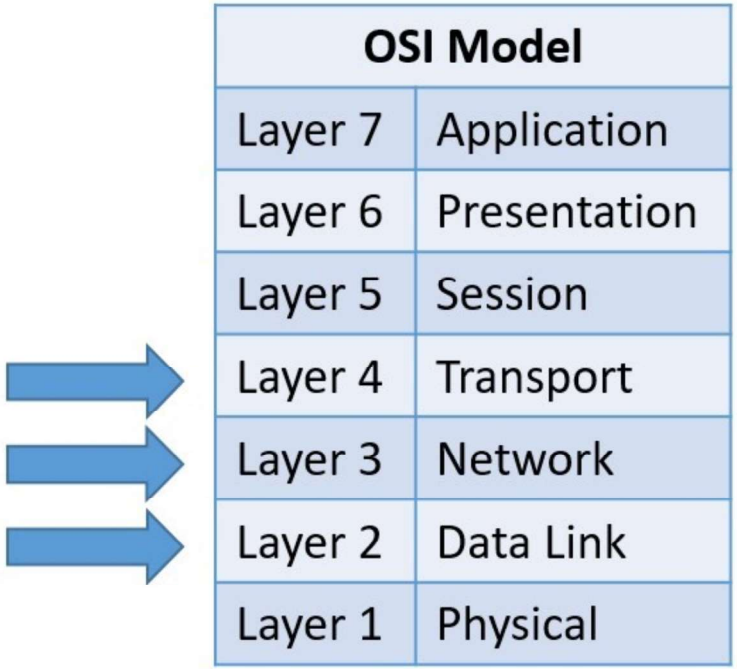

Figure 1.7 Diagram of OSI Model: Order followed to implement the Divide and Conquer type of connectivity troubleshooting using layers of the OSI Model

You can begin, for example, with a ping starting at Layer 3. If it doesn't respond, move down/up a layer until the problem is detected and resolved.

Continue onto the next Exercise to apply your knowledge of the OSI model to the network.

Keep all devices that you have powered on in their current state and proceed to the next exercise.