



# Module 2 - Networking

Session 7 - Layers 5 & 6, Session and Presentation Layers

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YOUR GATEWAY TO CYBERSECURITY SKILLS AND CAREERS

Welcome to Cyber Aces, Module 2! A firm understanding of network fundamentals is essential to being able to secure a network or attack one. This section provides a broad overview of networking, covering the fundamental concepts needed to understand computer attacks and defenses from a network perspective.

# SANS CYBER ACES ONLINE TUTORIALS

YOUR GATEWAY TO CYBERSECURITY SKILLS AND CAREERS

## 1. Introduction to Operating Systems

- 01. Linux
- 02. Windows

## 2. Networking

## 3. System Administration

- 01. Bash
- 02. PowerShell
- 03. Python

This training material was originally developed to help students, teachers, and mentors prepare for the Cyber Aces Online Competition. This module focuses on the basics of networking. This session is part of Module 2, Networking.

The three modules of Cyber Aces Online are Operating Systems, Networking, and System Administration.

For more information about the Cyber Aces program, please visit the Cyber Aces website at <https://CyberAces.org/>.

## Module 2 - Networking

- Introduction
- Layer 1 - Physical
- Layer 2 - Data Link
- Layer 3 - Network
  - Addressing & Masking
  - Routing
  - Communication
- Layer 4 - Transport
- Layer 5 - Session
- Layer 6 - Presentation
- Layer 7 - Application
  - Intra-Layer Communications

In this short section, we'll provide a brief introduction to the Session Layer and the Presentation Layer.



## Session Layer



The Session Layer creates and terminates unique connections between applications

TCP implements some Session Layer functionality itself

- TCP maintains state using sequence numbers

Session Layer functionality is often implemented at the Application Layer

- Web applications use HTTP cookies to maintain sessions (though HTTP itself doesn't support sessions)

Sessions are important. The session layer provides flow control to unique connections between applications. The session layer creates and terminates application connections. TCP implements some session layer functionality itself (since it maintains connection states using sequence numbers). Many common TCP/IP protocols implement session layer services as part of the Application layer rather than creating a separate layer. For example, HTTP is often referred to as a "stateless" protocol because it has no concept of a session. HTTP by itself is incapable of identifying a series of requests as part of a single session; it is left to the application developer to use a web application such as PHP or .NET to add session tracking through the use of session cookies. The lack of session layer functionality in the HTTP protocol has led to many compromised web accounts.



## Presentation Layer

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The Presentation Layer establishes a standard way to encode data between layers

It provides format independence for data

Character encoding (i.e., UTF-8) and encryption are Presentation Layer functions

- MIME is an important protocol at this layer

Like the Session Layer, most Presentation Layer functionality is implemented in the Application Layer

The Presentation Layer is used by applications to establish a standard way of encoding data. More generally, the Presentation Layer is responsible for providing independence from data formats for Application Layer protocols. For example, encryption of data will often occur as part of the Presentation Layer, as would handling of character encoding (such as UTF-8). MIME (Multipurpose Internet Mail Extensions) is a Presentation Layer protocol that defines the formatting of e-mail messages, particularly multi-format messages and attachments. However, like the Session Layer, most common TCP/IP protocols implement Presentation Layer functions as part of the Application Layer protocol. For example, HTTP can handle character encoding.



## Other Networking Models

Kurose, <sup>[21]</sup> Forouzan <sup>[22]</sup>	Comer, <sup>[23]</sup> Kozierok <sup>[24]</sup>	Stallings <sup>[25]</sup>	Tanenbaum <sup>[26]</sup>	RFC 1122 <sup>[2]</sup> , Internet STD 3 (1989)	Cisco Academy <sup>[27]</sup>	Mike Padlipsky's 1982 "Arpanet Reference Model" <sup>[28]</sup> (RFC 871 <sup>[29]</sup> )	OSI model
Five layers	Four+one layers	Five layers	Five layers	Four layers	Four layers	Three layers	Seven layers
"Five-layer Internet model" or "TCP/IP protocol suite"	"TCP/IP 5-layer reference model"	"TCP/IP model"	"TCP/IP 5-layer reference model"	"Internet model"	"Internet model"	"Arpanet reference model"	OSI model
Application	Application	Application	Application	Application	Application	Application/Process	Application Presentation Session
Transport	Transport	Host-to-host or transport	Transport	Transport	Transport	Host-to-host	Transport
Network	Internet	Internet	Internet	Internet	Internetwork		Network
Data link	Data link (Network interface)	Network access	Data link	Link	Network interface	Network interface	Data link
Physical	(Hardware)	Physical	Physical				Physical

The OSI model is not the only networking model; however, it is the one most commonly referred to. Most of the other models lump the Presentation and Session layers into the Application layer. Most often, the OSI layers 5 and 6 are implemented and included in the Application Layer.

Above image taken from: [https://en.wikipedia.org/wiki/Internet\\_protocol\\_suite](https://en.wikipedia.org/wiki/Internet_protocol_suite)



## Tutorial Complete!



This concludes Module 2 - Layers 5 & 6

- We've learned about the Session and Presentation layers

In the next module, we'll learn about Layer 7, the Application Layer

This concludes the discussion about Layer 5 and 6, the Session and Presentation layers. In the next tutorial we'll discuss Layer 7, the Application Layer.

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