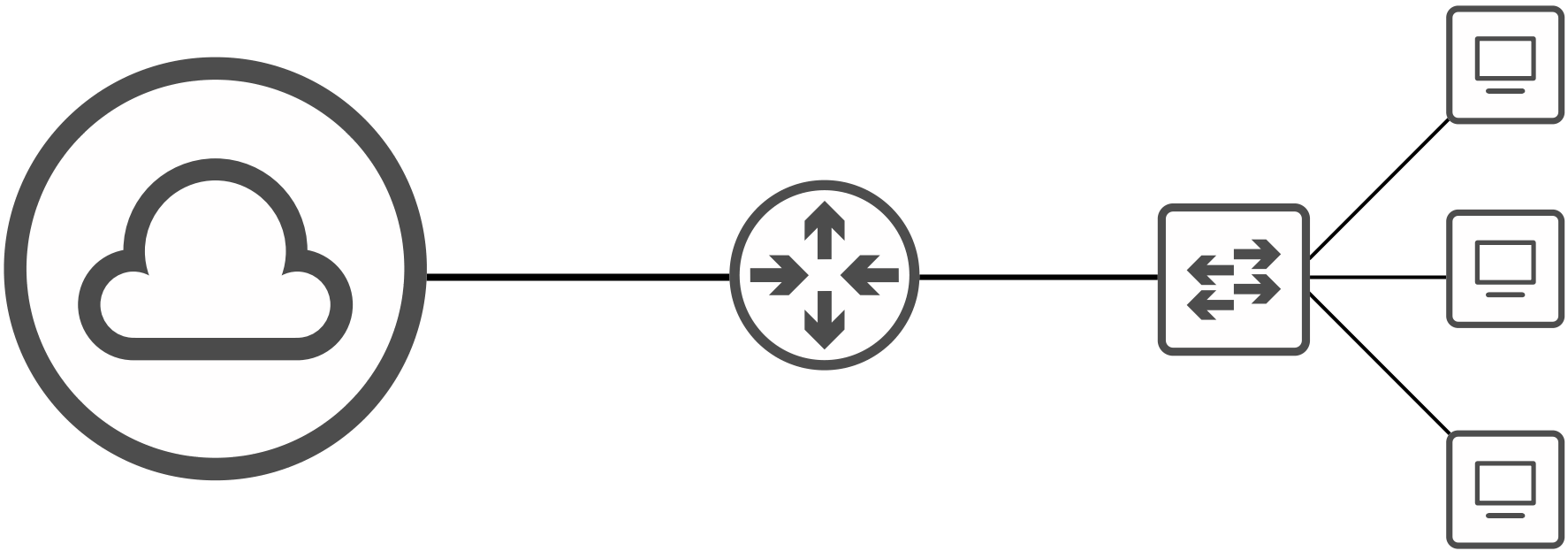
Jeremy's IT Lab

CCNA 200-301 Day 3

OSI MODEL & TCP/IP SUITE



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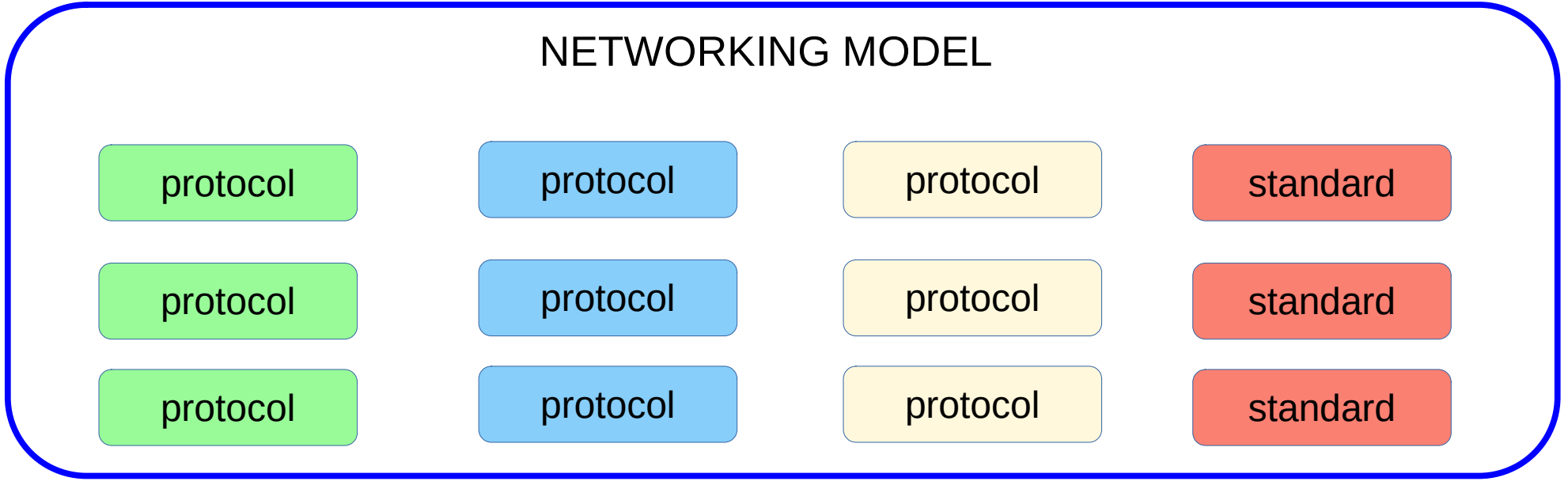
What is a networking model?

Networking models categorize and provide a structure for networking protocols and standards.

logical

A set of rules defining how network devices and software should work.



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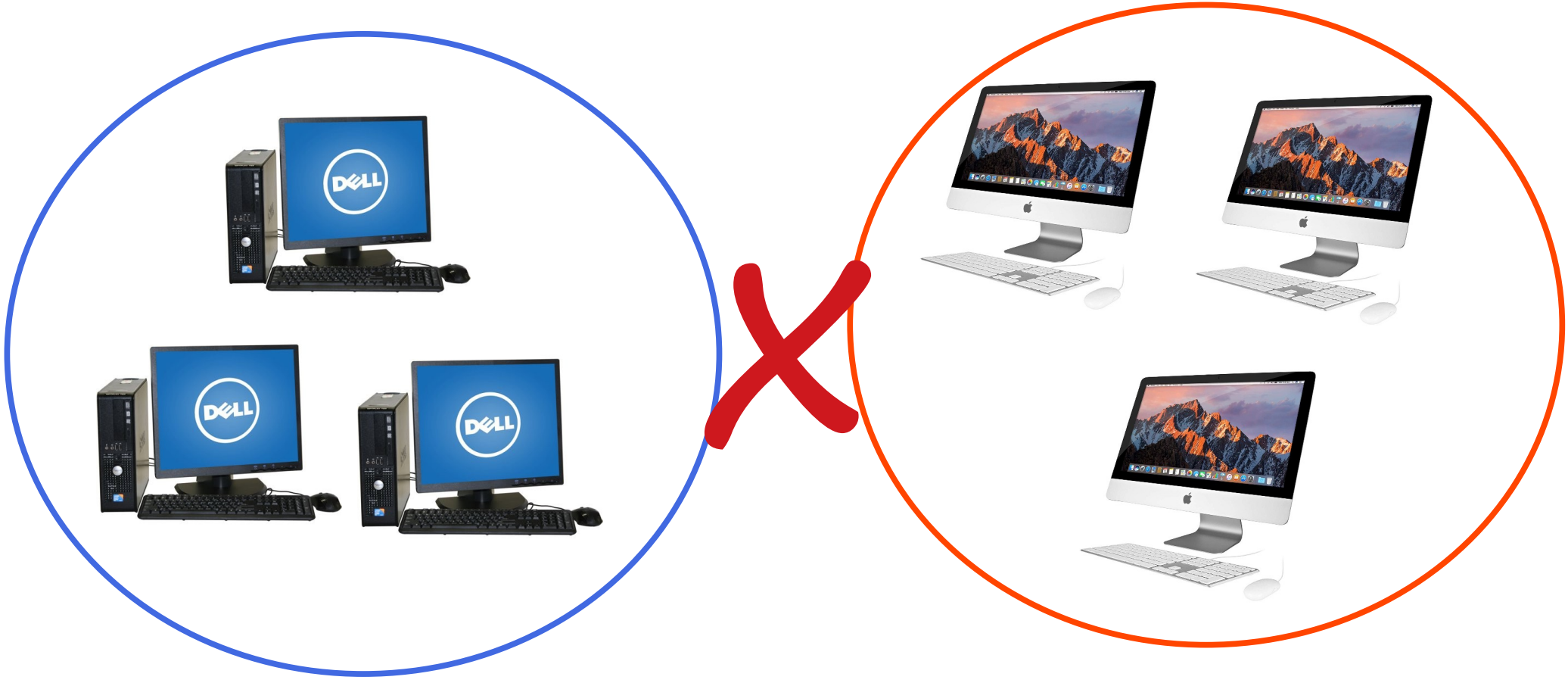
Networks without standardization



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OSI Model

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

- 'Open Systems Interconnection' model
- A conceptual model that categorizes and standardizes the different functions in a network.
- Created by the 'International Organization for Standardization' (ISO).
- Functions are divided into 7 'Layers'.
- These layers work together to make the network work.

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OSI Model – Application Layer

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

- This layer is closest to the end user.
- Interacts with software applications, for example your web browser (Brave, Firefox, Chrome, etc)
- HTTP and HTTPS are Layer 7 protocols (https://www.cisco.com)

Functions of Layer 7 include:

- Identifying communication partners
- Synchronizing communication

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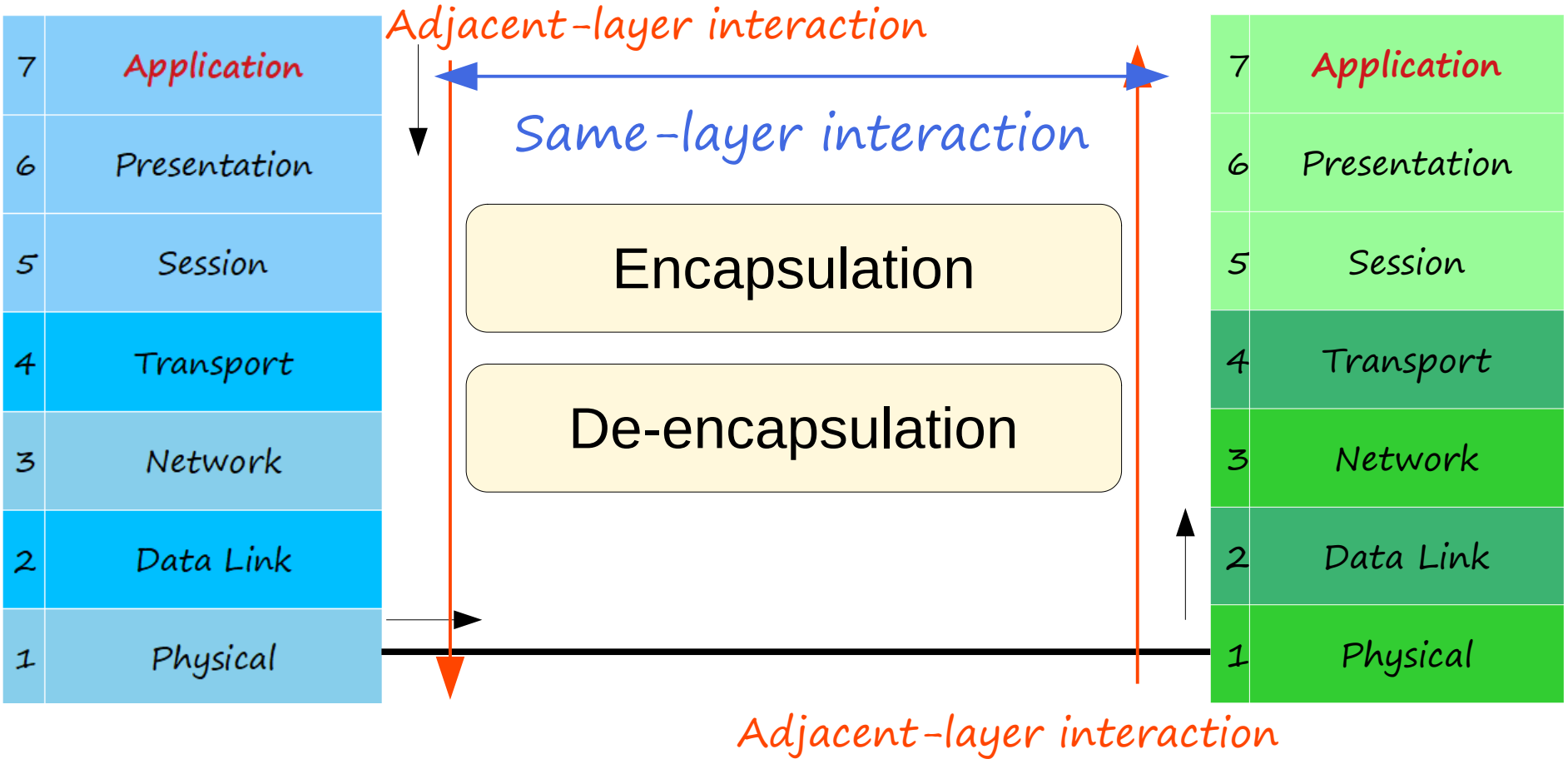
OSI Model – Application Layer



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OSI Model – Presentation Layer

7	Application
6	**Presentation**
5	Session
4	Transport
3	Network
2	Data Link
1	Physical

- Data in the application layer is in 'application format'.
- It needs to be 'translated' to a different format to be sent over the network.
- The **Presentation** Layer's job is to translate between application and network formats.
- For example, encryption of data as it is sent, and decryption of data as it is received.
- Also translates between different Application-Layer formats.

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OSI Model – Session Layer

7	Application
6	Presentation
5	**Session**
4	Transport
3	Network
2	Data Link
1	Physical

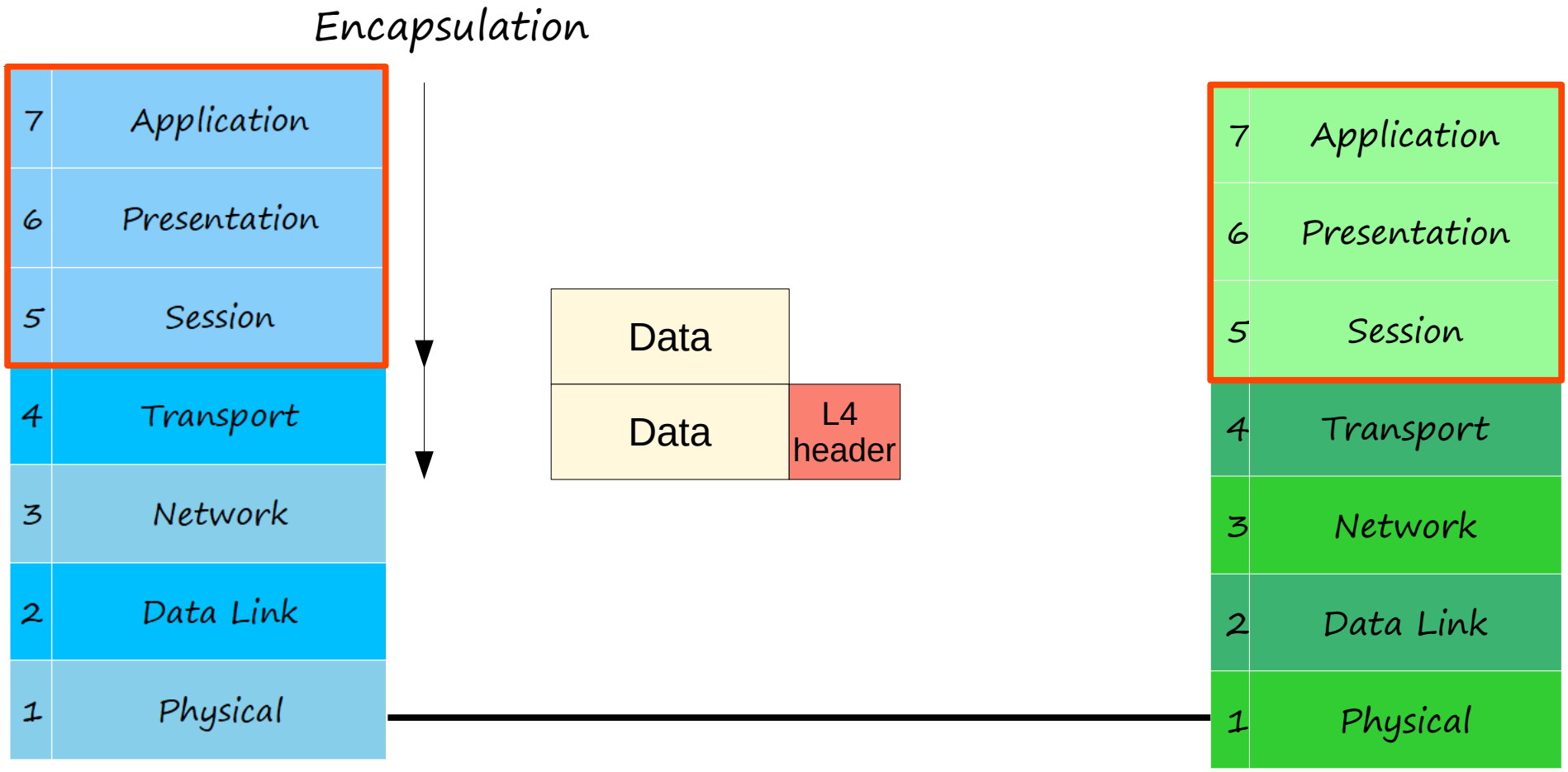
- Controls dialogues (sessions) between communicating hosts.
- Establishes, manages, and terminates connections between the local application (for example, your web browser) and the remote application (for example, YouTube).

OSI Model – The Upper Layers

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

- Network engineers don't usually work with the top 3 layers.
- Application developers work with the top layers of the OSI model to connect their applications over networks.

OSI Model – The Upper Layers



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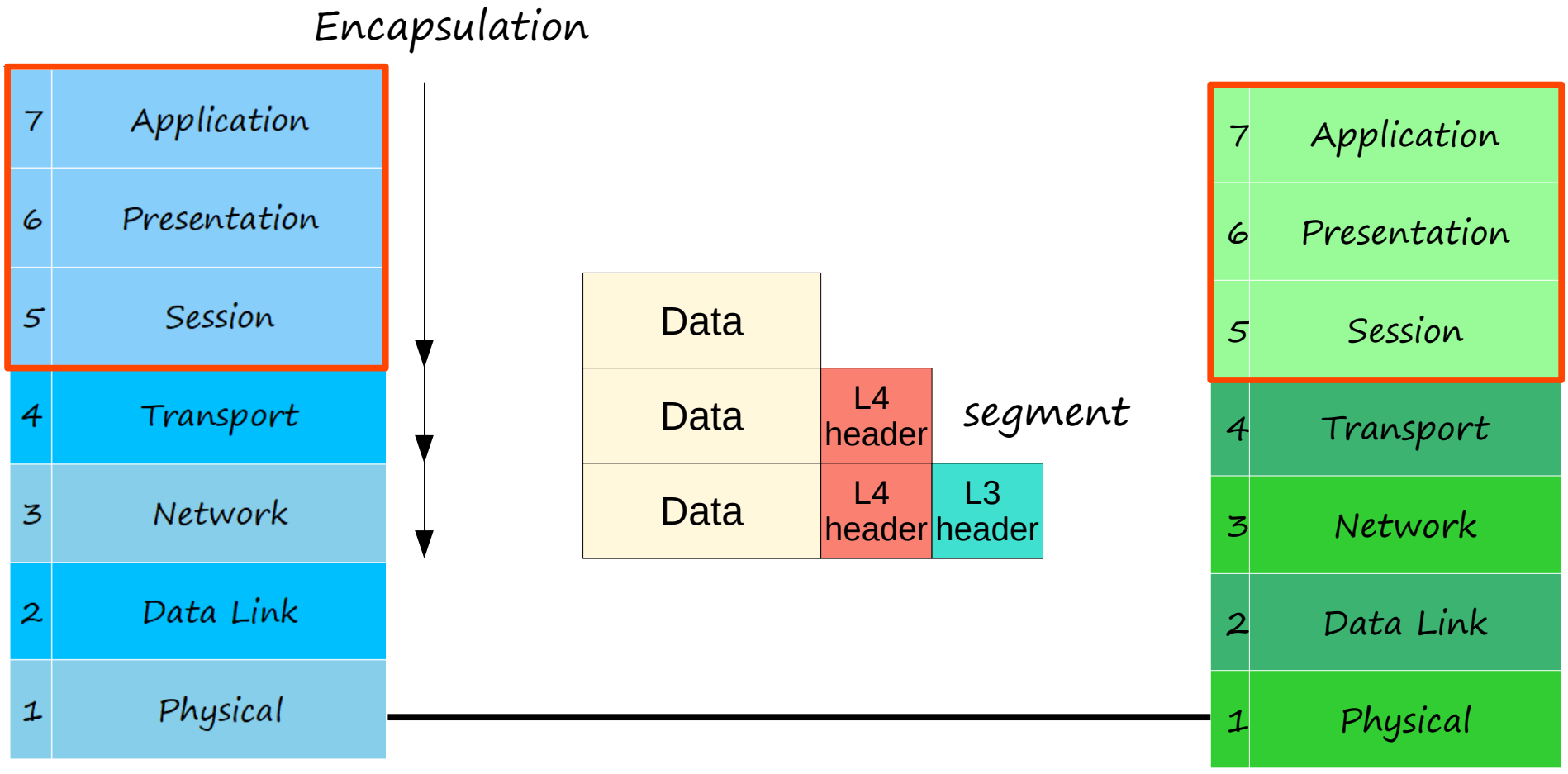
OSI Model – Transport Layer

7	Application
6	Presentation
5	Session
4	**Transport**
3	Network
2	Data Link
1	Physical

- Segments and reassembles data for communications between end hosts.
- Breaks large pieces of data into smaller segments which can be more easily sent over the network and are less likely to cause transmission problems if errors occur.
- Provide **host-to-host** communication.

OSI Model – Encapsulation



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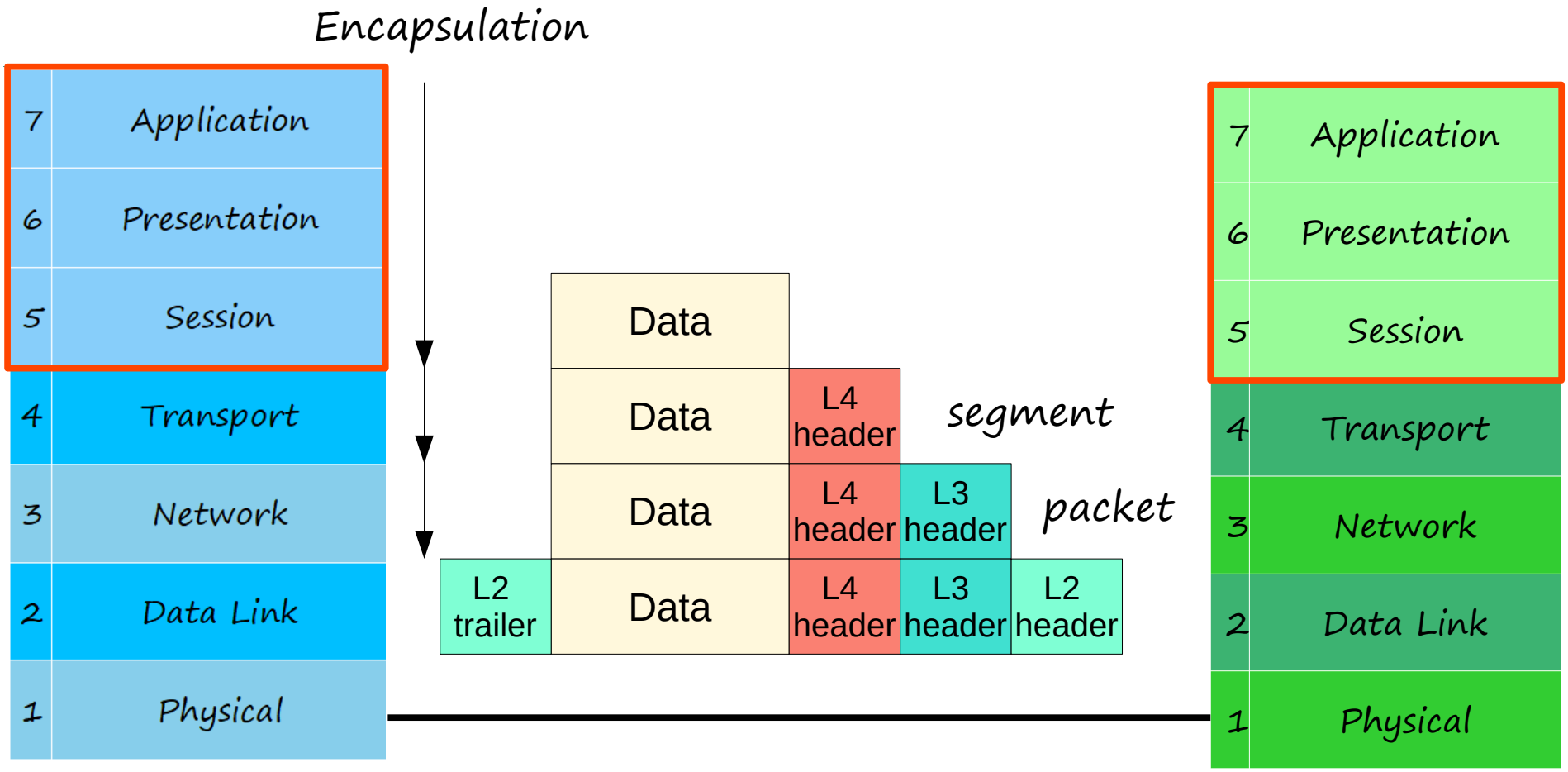
OSI Model – Network Layer

7	Application
6	Presentation
5	Session
4	Transport
3	**Network**
2	Data Link
1	Physical

- Provides connectivity between end hosts on different networks (ie. outside of the LAN).
- Provides logical addressing (IP addresses).
- Provides path selection between source and destination.
- Routers operate at Layer 3.

OSI Model – Encapsulation



OSI Model – Data Link Layer

7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	**Data Link**
1	Physical

- Provides node-to-node connectivity and data transfer (for example, PC to switch, switch to router, router to router).
- Defines how data is formatted for transmission over a physical medium (for example, copper UTP cables)
- Detects and (possibly) corrects Physical Layer errors.
- Uses Layer 2 addressing, separate from Layer 3 addressing.
- Switches operate at Layer 2.

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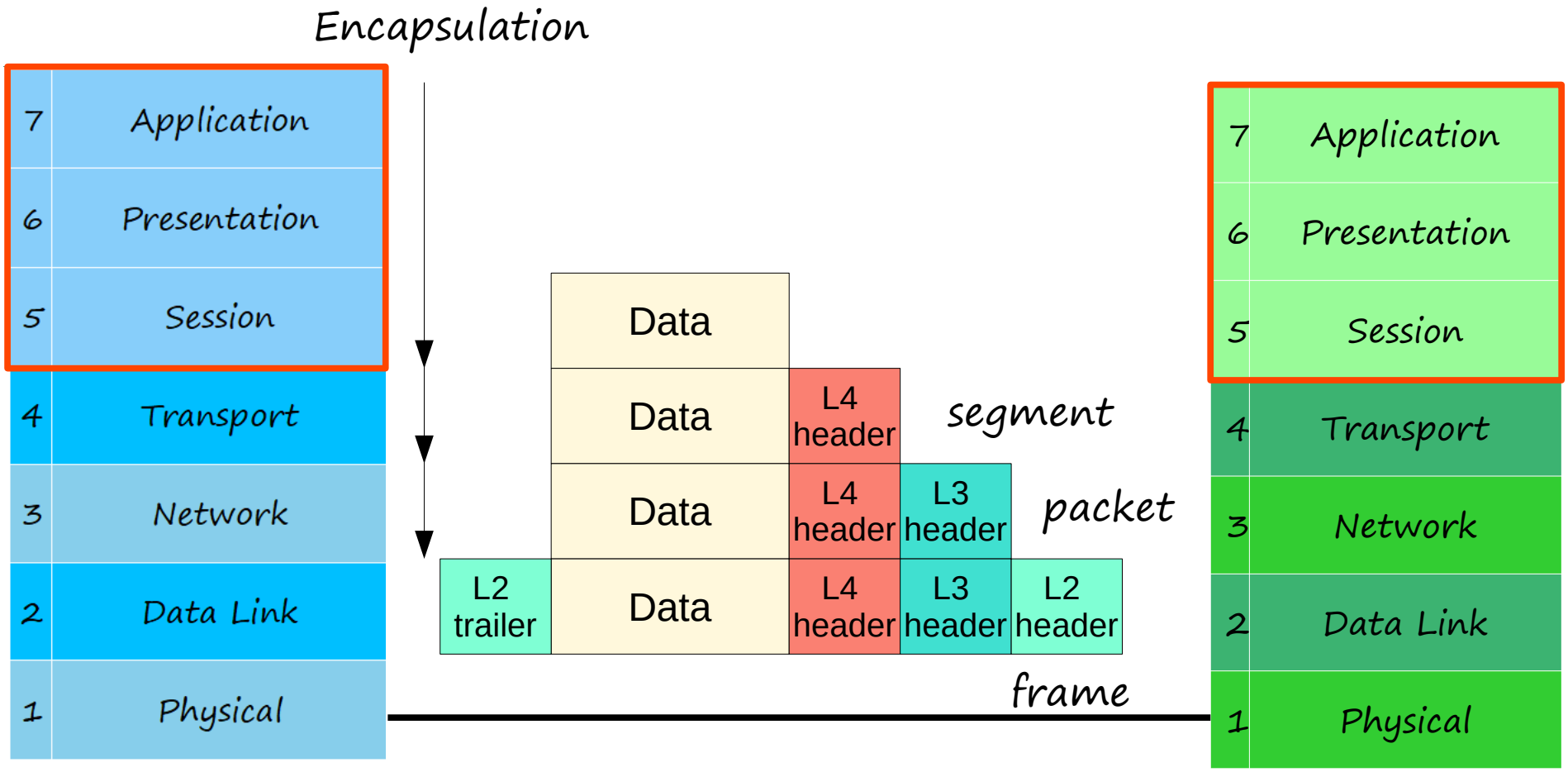
OSI Model – Encapsulation



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OSI Model – Physical Layer

7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data Link
1	**Physical**

- Defines physical characteristics of the medium used to transfer data between devices.
- For example, voltage levels, maximum transmission distances, physical connectors, cable specifications, etc.
- Digital bits are converted into electrical (for wired connections) or radio (for wireless connections) signals.
- All of the information in Day 2's video (cables, pin layouts, etc.) is related to the Physical Layer.

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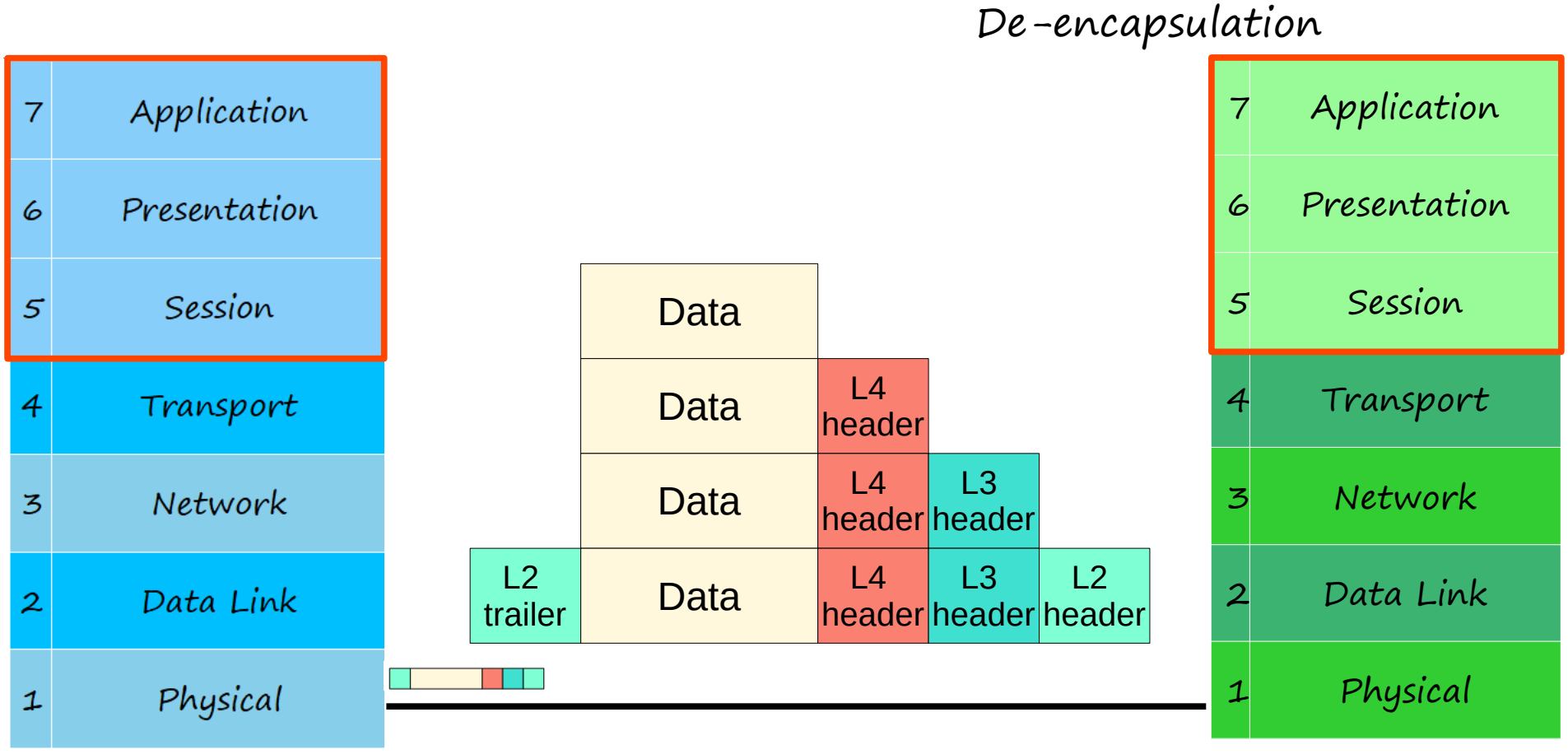
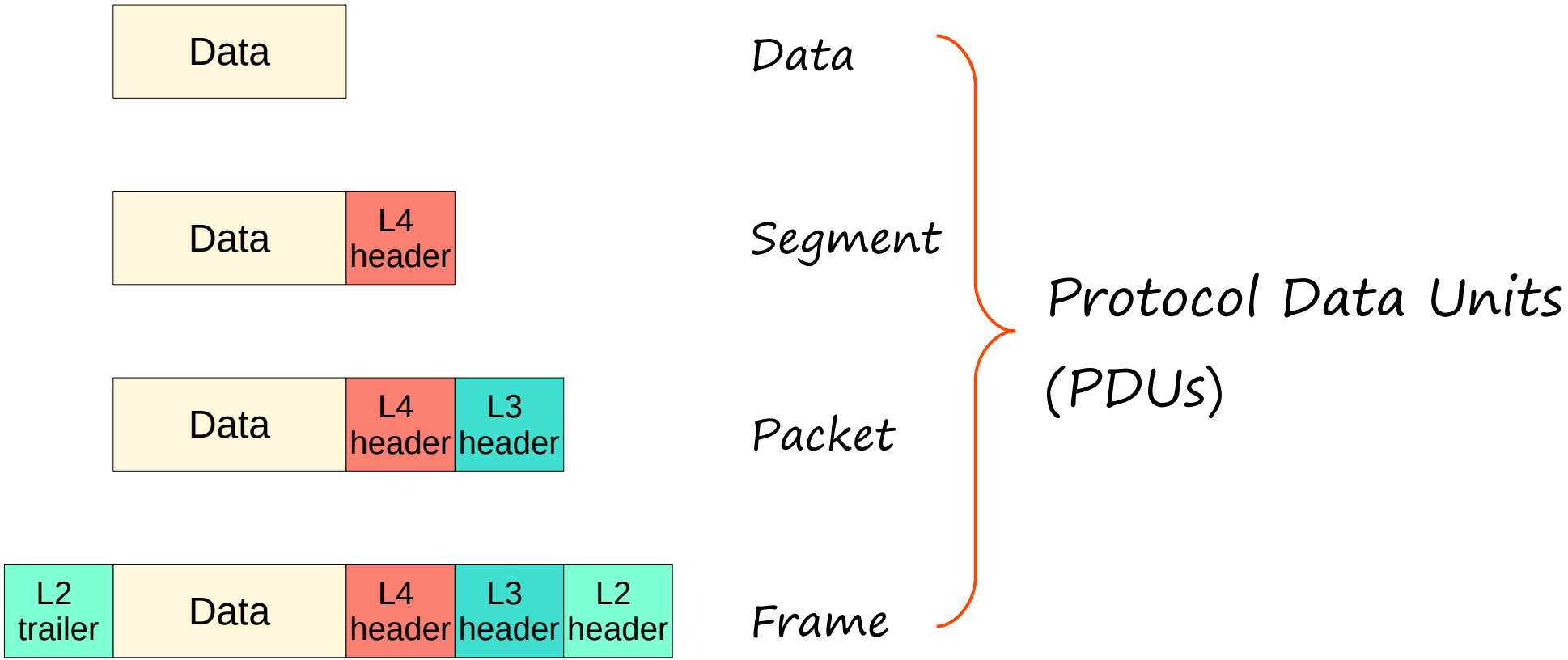
OSI Model – Encapsulation



OSI Model – PDUs



Layer 1 PDU = Bit

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OSI Model - Acronyms

7	Application	All	Acronyms
6	Presentation	People	Pointless
5	Session	Seem	Students
4	Transport	To	Teach
3	Network	Need	Not
2	Data Link	Data	Do
1	Physical	Processing	Please

TCP/IP Suite

- Conceptual model and set of communications protocols used in the Internet and other networks.
- Known as TCP/IP because those are two of the foundational protocols in the suite.
- Developed by the United States Department of Defense through DARPA (Defense Advanced Research Projects Agency)
- Similar structure to the OSI Model, but with fewer layers.
- This is the model actually in use in modern networks.
- NOTE: The OSI model still influences how network engineers think and talk about networks.

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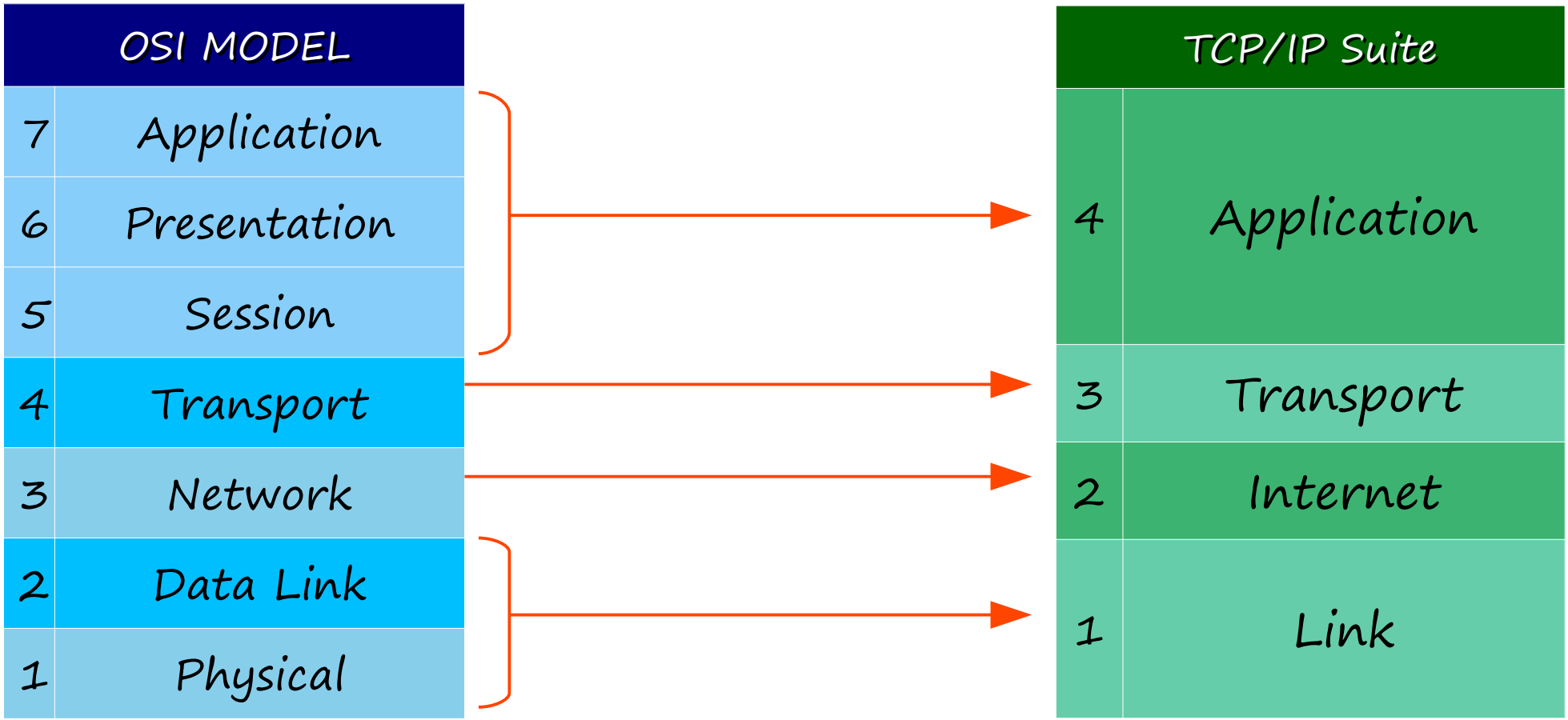
OSI vs TCP/IP

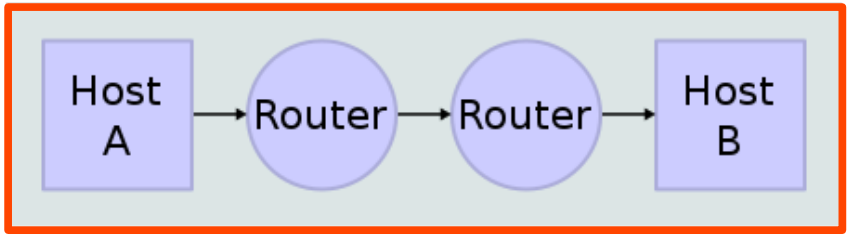


TCP/IP Suite

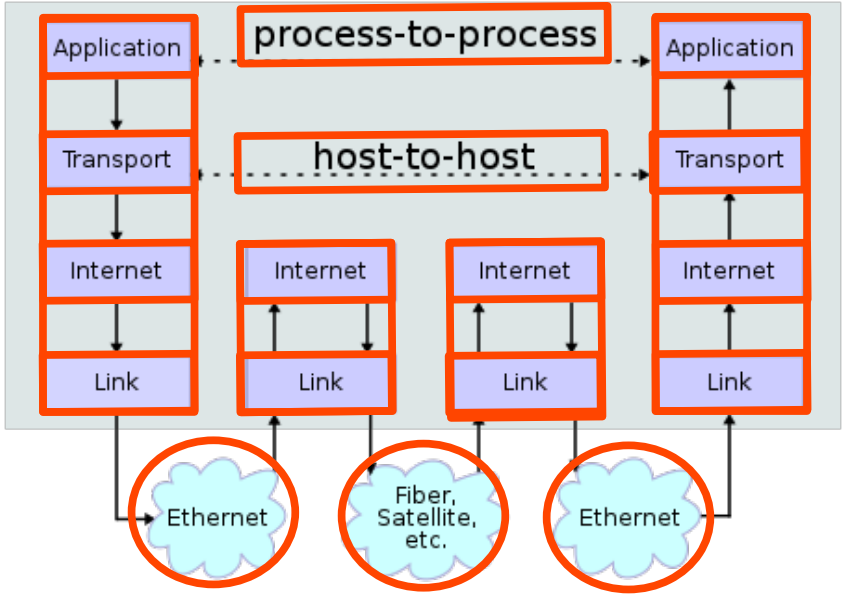
RFC 1122, Internet STD 3 (1989)	Cisco Academy[31]	Kurose,[32] Forouzan[33]	Comer,[34] Kozierok[35]	Stallings[36]	Tanenbaum[37]	Arpanet Reference Model (RFC 871)	OSI model
Four layers	*Four layers*	*Five layers*	*Four+one layers*	*Five layers*	*Five layers*	*Three layers*	*Seven layers*
"Internet model"	"Internet model"	"Five-layer Internet model" or "TCP/IP protocol suite"	"TCP/IP 5-layer reference model"	"TCP/IP model"	"TCP/IP 5-layer reference model"	"Arpanet reference model"	OSI model
Application	Application	Application	Application	Application	Application	Application/Process	Application
							Presentation
							Session
Transport	Transport	Transport	Transport	Host-to-host or transport	Transport	Host-to-host	Transport
Internet	Internetwork	Network	Internet	Internet	Internet		Network
Link	Network interface	Data link	Data link (Network interface)	Network access	Data link	Network interface	Data link
		Physical	(Hardware)	Physical	Physical		Physical

TCP/IP Suite

Network Topology



Data Flow



Quiz Question 1

HTTP data sent from a YouTube web server is displayed via your web browser. This is an example of what?

a) Adjacent-layer interaction
b) Same-layer interaction
c) Encapsulation
d) De-encapsulation

Quiz Question 1

✗) Adjacent-layer interaction

Adjacent-layer interaction refers to interaction between **different** layers of the OSI model.

In this case, both YouTube's web server and your web browser are operating at Layer 7 using HTTP.

Quiz Question 1

~~A~~) Encapsulation, ~~d~~) De-encapsulation

Although encapsulation and de-encapsulation of data surely happened many times as the data was sent from YouTube's web server to your web browser, they are not descriptions of the interaction between YouTube and your browser.

Quiz Question 1

★b) Same-layer interaction

Same-layer interaction refers to interaction between the same layer on different hosts, in this case the application layer of YouTube's web server and the browser on your PC.

The concept of same-layer interaction allows you to 'ignore' the other layers involved and focus on interactions between a single layer on different devices.

Quiz Question 2

HTTP data has been encapsulated with three separate headers and one trailer. What is the appropriate name for this PDU?

a) Packet

b) Segment

c) Frame

d) Data

Quiz Question 2

~~a~~) Packet

Packet refers to the OSI Layer 3 PDU. It would have two headers (Layer 4 header, Layer 3 header) and no trailer.

Quiz Question 2

~~A~~) Segment

Segment refers to the OSI Layer 4 PDU. It would have one header (Layer 4 header), and no trailer.

Quiz Question 2

~~A~~) Data

Data refers to the upper-layer data before being encapsulated. It would have no headers or trailer.

Quiz Question 2

★c) Frame

Frame refers to the OSI Layer 2 PDU. It has three headers (Layer 4, Layer 3, and Layer 2 headers) and one trailer (Layer 2 trailer).

Quiz Question 3

Which layers of the OSI model are most relevant to the role of a network engineer?

a) Transport – Network – Data Link - Physical

b) Transport – Network – Data Link

c) Network only

d) Application – Presentation - Session

Quiz Question 3

~~A~~) Transport – Network – Data Link

Although these layers are very relevant to the duties of a network engineer, the physical layer is missing.

Quiz Question 3

A) Network only

Although the Network layer is very relevant to network engineers, it is not the only one.

Quiz Question 3

~~d~~) Application – Presentation – Session

These layers of the OSI model are not generally relevant to the role of a network engineer. They are relevant to application developers.

Quiz Question 3

★a) Transport – Network – Data Link - Physical

These lower four layers of the OSI models are all very relevant to the role of a network engineer.

Quiz Question 4

The Link layer of the TCP/IP Model is equivalent to what layer, or layers, of the OSI Model?

a) Transport - Network

b) Network – Data Link

c) Data Link

d) Data Link - Physical

Quiz Question 4

~~a~~) Transport – Network

The OSI Transport layer is equivalent to the TCP/IP Transport layer, and the OSI Network layer is equivalent to the TCP/IP Internet layer.

Quiz Question 4

~~a~~) Network – Data Link

~~b~~) Data Link

The OSI Network model is equivalent to the TCP/IP Internet layer.

The OSI Data Link layer is equivalent to part of the TCP/IP Link layer, but it is not totally equivalent.

Quiz Question 4

★ d) Data Link – Physical

The combined functions of the OSI Data Link and Physical layers are equivalent to the TCP/IP Link layer.

Quiz Question 5

Which layer of the OSI model provides host-to-host communications?

a) Application
b) Network
c) Transport
d) Data Link

Quiz Question 5

a) Application

The Application layer provides process-to-process communications, not host-to-host.

Quiz Question 5

~~b~~) Network

~~d~~) Data Link

The Network and Data Link layers do not provide end-to-end, host-to-host communications.

Quiz Question 5

★ c) Transport

The Transport layer provides host-to-host communications.