Snapchat and the OSI model

Alexandra Nuttbrown

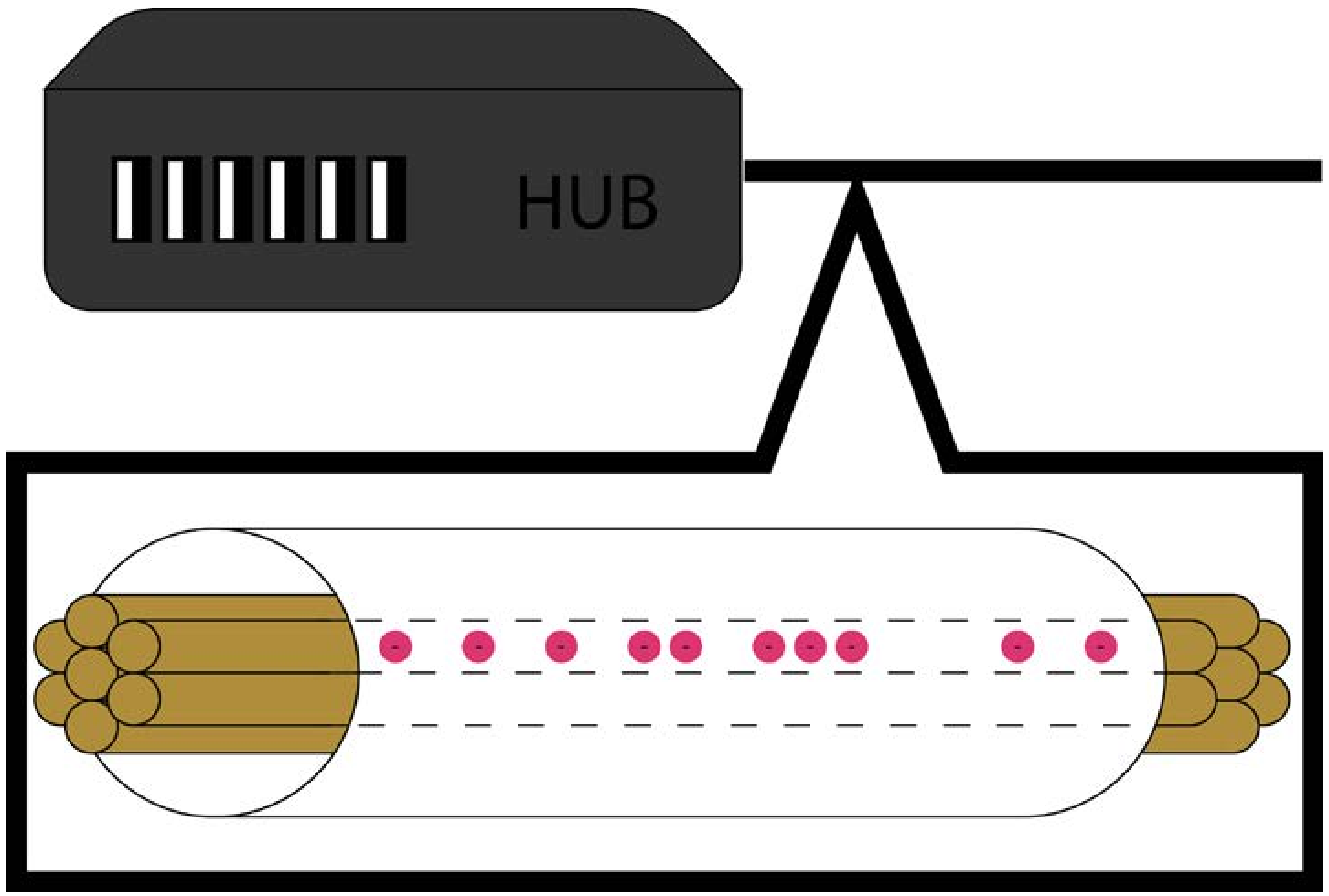
Snapchat is currently one of the most used mobile applications on the market — it ranks fourth actually, with 27 million downloads worldwide. Daily videos receive 10 billion views per day, and 9,000 photos, or "snaps," are shared on the app per second. 30% of millenials access Snapchat regularly, and users spend an average of 30 minutes per day on the app. With all these stats, it is safe to say Snapchat is a key component of the population's (especially millenials') communication today, and thus an interesting lens through which to consider the Open Systems Interconnection model.

The OSI model is a conceptual model which characterizes the communication functions of the web. Made up of seven conceptual layers, the model begins with the most basic, physical level involved in telecommunication, and runs up to the most abstract application level involved. This paper seeks to illustrate how Snapchat in particular functions within the OSI model.

1 Physical Layer

A user sees a cute dog, orders a tasty meal, or just wants to take another selfie. They want to share the moment with their friends, but it's not quite Instagram worthy so they open the Snapchat app on their phone instead and take the photo. After applying a cool filter and an oh-so-clever caption, they select which friends they want to share their snap with and tap "send."

At this moment, the image (and accompanying text) is translated into a series of bits, and enters the carrier wave of the wireless connection. On this level, the data, in the form of electrons, moves through copper wires and hubs. Hubs are hardware devices which receive data packets through a telecommunication link and forward them onto other connected telecommunication links. Hubs do not structure, organize, or translate the data, they simply receive and transmit it. Essentially, the physical layer consists of all the physical devices data travels through in order to reach its destination.



Example of the Physical Layer: the hub, which repeats the data it receives to other connected physical devices, through copper wires or fiber optics.

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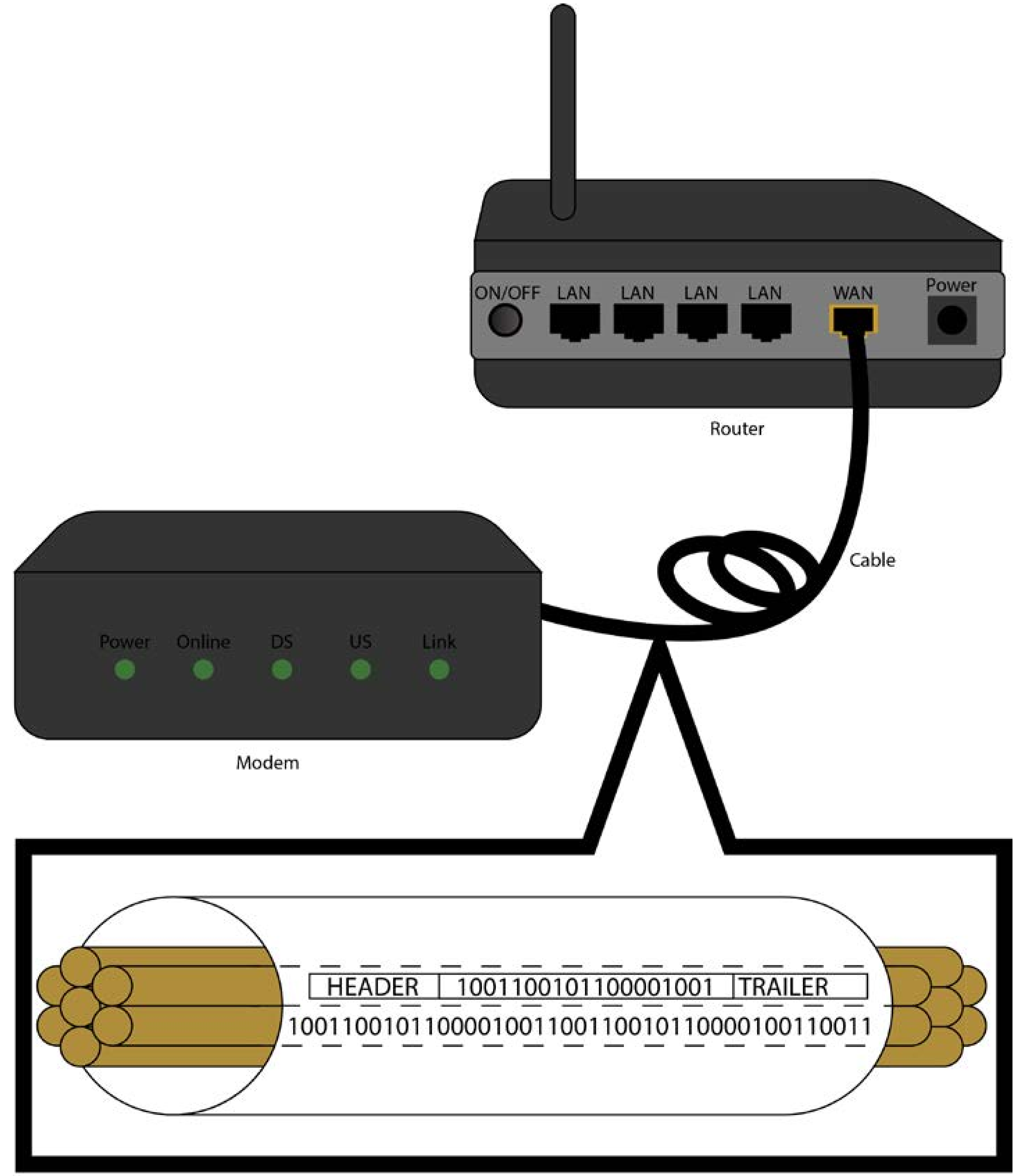
Data Link Layer

The next level, the Data Link Layer, provides node-to-node data transfer, also called "hops." A node is a device, such as a laptop, desktop computer, server, router, etc. This layer addresses, controls, and synchronizes the data flow over the physical network below it. Bits are organized into frames, which consist of a link layer header followed by a data packet, followed by a trailer.

In the case of Snapchat, this layer controls the flow of the bits (which make up your Snap) across the Physical Layer, from one node to the next. Thus, when the bits move from the user's phone, to the cell tower, to the cell phone provider's server, across multiple networks in the internet, to the Snapchat server, each transfer is considered a hop on the data link layer. In this layer, the user's Snap will travel across bridges and switches on the journey to the recipient's phone.



Bits at the Data Link Layer as they flow through the Physical Layer of devices.

Example of the Data Link Layer: bits, organized in packets, flow through cable wires from node to node.

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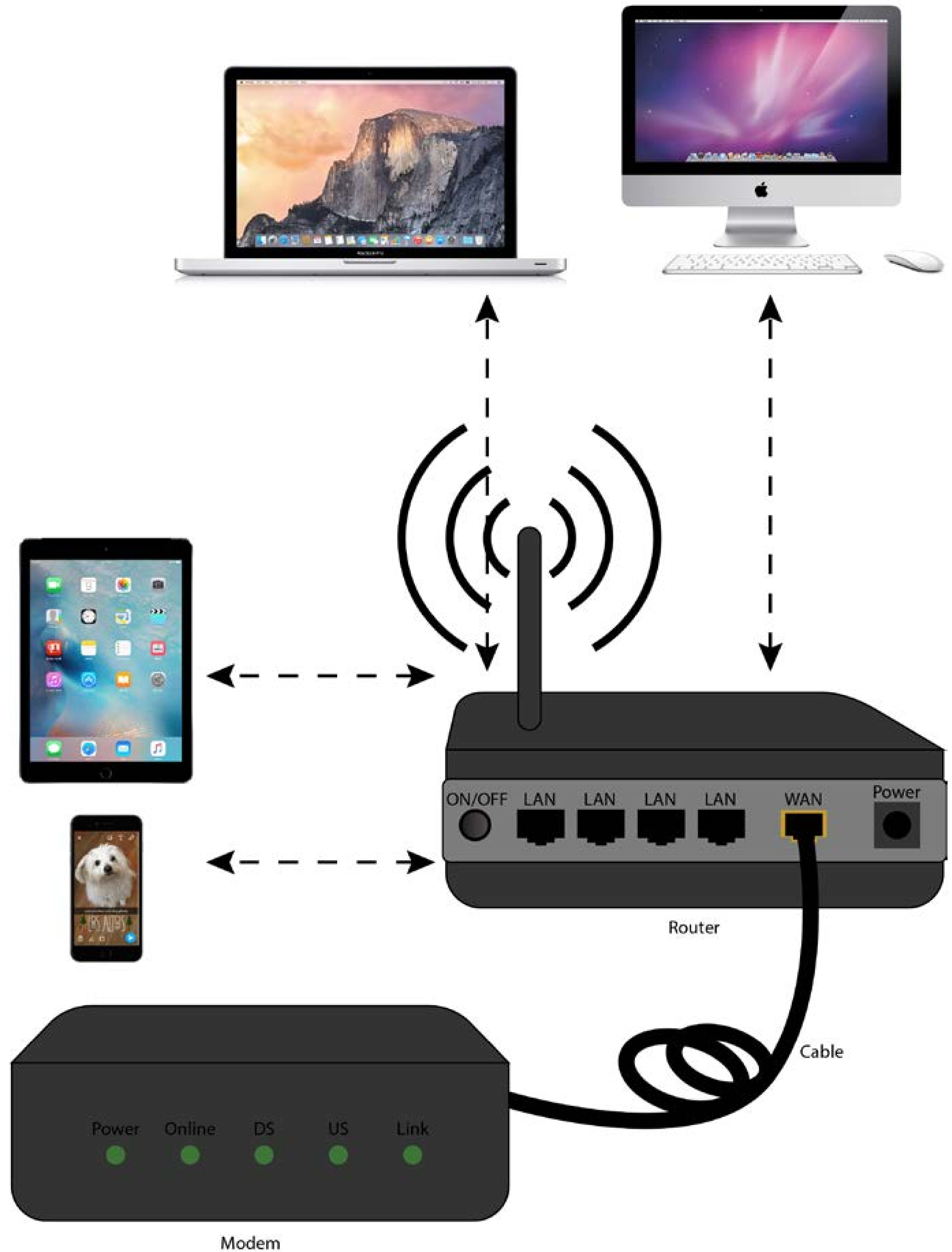
Network Layer

A network is a collection of devices, or nodes, which are all connected to a common router. The router is itself connected to a modem, which is connected to your internet provider (e.g. Comcast, Cox, etc.) by a physical cable. Each device has a physical machine address, called an MAC address, which identifies it. Each device on the Local Area Network also has a local IP address, which is assigned to it by the local router, and allows the device to communicate with outside devices. Messages may be routed through intermediary nodes, and if a message is too big it may be split into fragments at one node, before the fragments are sent independently to the next node, and finally reassemble at the destination device.

On this layer, the data packets move from the source device to the destination device, moving from node to node within LANs.

In the example of Snapchat, the Network Layer directs all the hops the user's Snap performs on the Data Link Layer across the internet.

(Page 5) Example of the Network Layer: All the devices in a user's home are connected in a network. A modem and router provide wifi internet access to those devices. Data moves from one node in the network to the following node, as directed by the network layer.
Note: Photos of Mac devices in schema sourced from Apple.com



4 Transport Layer

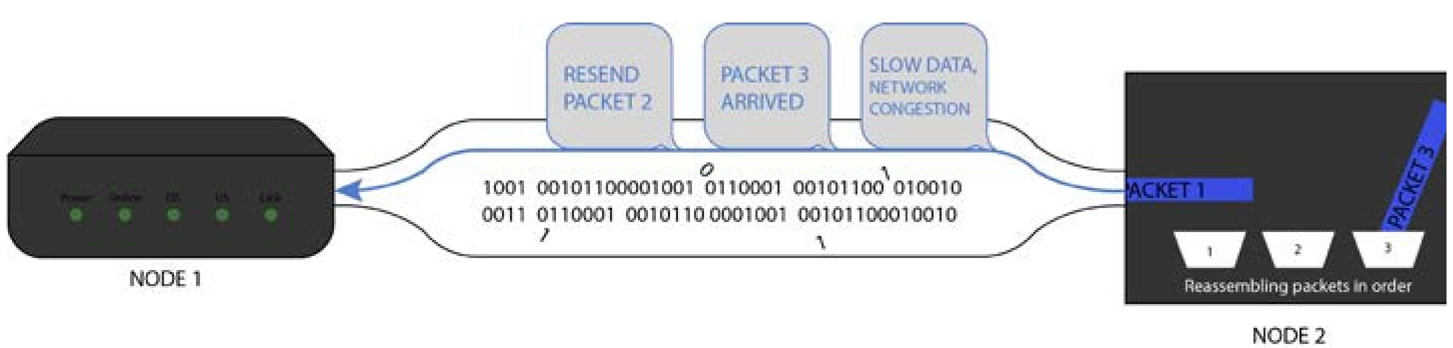
The transport layer is concerned with reliable delivery of packets, and employs mechanisms to check for errors in the delivery. TCP/IP (Transmission Control Protocol/Internet Protocol), a connection-oriented protocol, and UDP (User Datagram Protocol), a connectionless protocol, work on this level.

Like the Data Link Layer, the Transport Layer is concerned with flow control. However, where the Data Link Layer is simply concerned with the flow between two nodes, the Transport Layer focuses on the reliability of that transfer, through flow control, segmentation, and error control.

Occasionally packets are lost, duplicated, corrupted, or delivered out of order during transport (due to errors, network congestion, traffic load balancing, or other issues.) TCP will verify correct receipts, and use an error detection code to ensure data is uncorrupted. TCP can detect if packets are lost or corrupted, and will request them again. It also rearranges data that is delivered out of order. TCP also manages the rate of data transmission between nodes so that a receiving data buffer will not be overwhelmed with more data than it can support at one time.

TCP is valuable if all the packets are necessary for message comprehension. Thus, if a user sends a Snap with text, TCP is used to ensure that the recipient can see the whole image and read the whole caption.

UDP is a connectionless protocol, and does not send a confirmation receipt with data, thus it is less reliable than TCP as packets may be lost during transmission. However, because it does not perform error checking or correction, it is more efficient. This is a good system for video Snaps (especially without text captions), as not all the packets need to be delivered for comprehension.



5 Session Layer

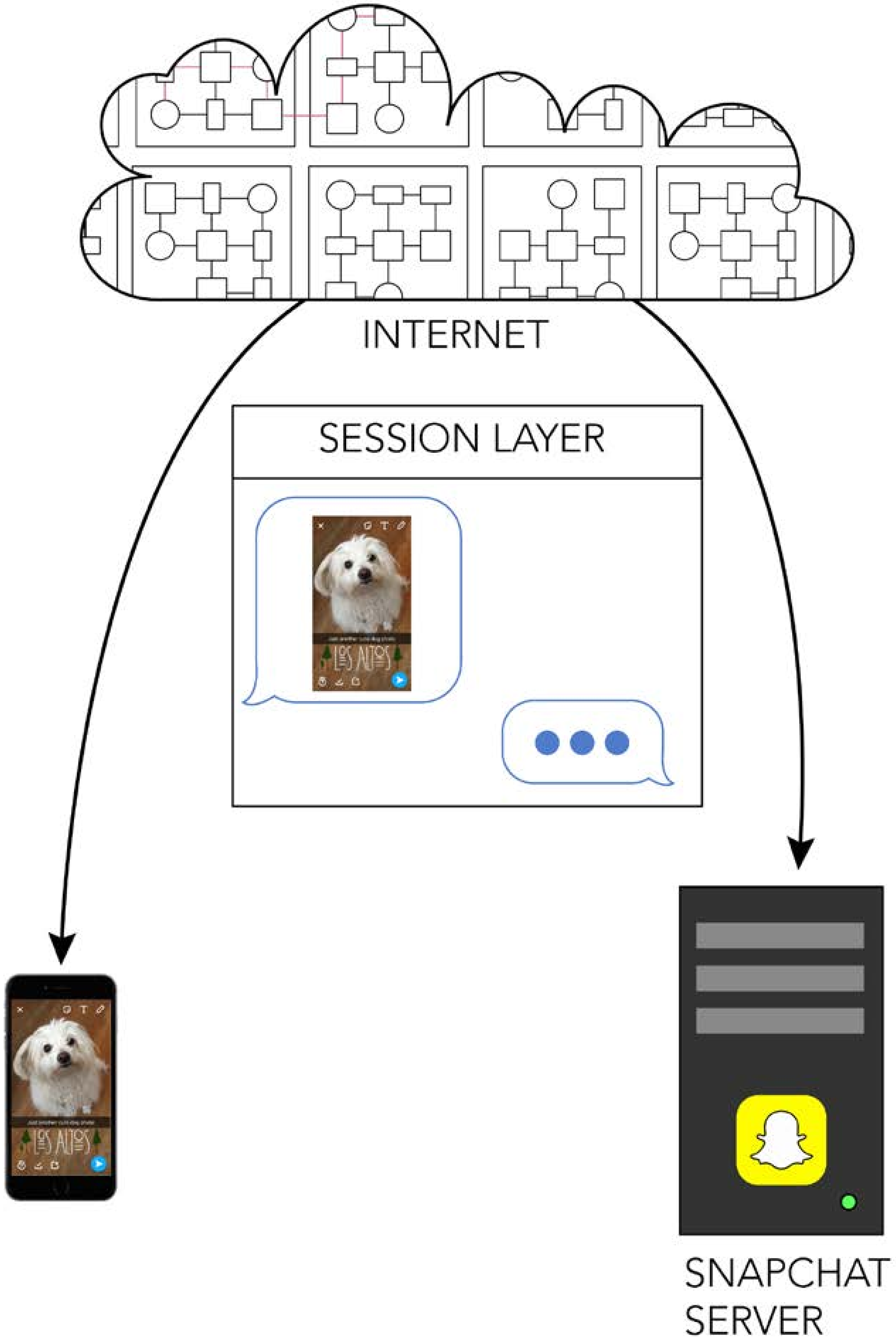
A session is a conversation between the server and client, essentially a continuous exchange of data between two nodes. Each time a user opens the Snapchat app on their phone, a session is opened, and when they close the app, that session is terminated. The Session Layer establishes, manages, and terminates the conversation between the Snapchat app on the user's phone and the Snapchat server.

The Session Layer is important for Snapchat's video chat feature. A session must be open between both users and the Snapchat server in order for the users to see each other during video conferencing. The session ensures that audio and video are synchronous.

The Session Layer is also involved when viewing a friend's Snap story, that is the series of Snaps that person has shared in the last 24 hours. The session established between the user's phone and Snapchat's server is what allows the user to request the friend's snap, and once it has been loaded, to view it.

(Page 6) Example of the Transport Layer: TCP sends receipts back to the origin node upon delivery of the data packets that make up the Snap. It also requests lost packets and organizes them upon arrival.

(Page 8) Example of the Session Layer: When a user opens Snapchat, there is a continuous dialogue of data between the app on the user's phone and the Snapchat server, going through the internet.



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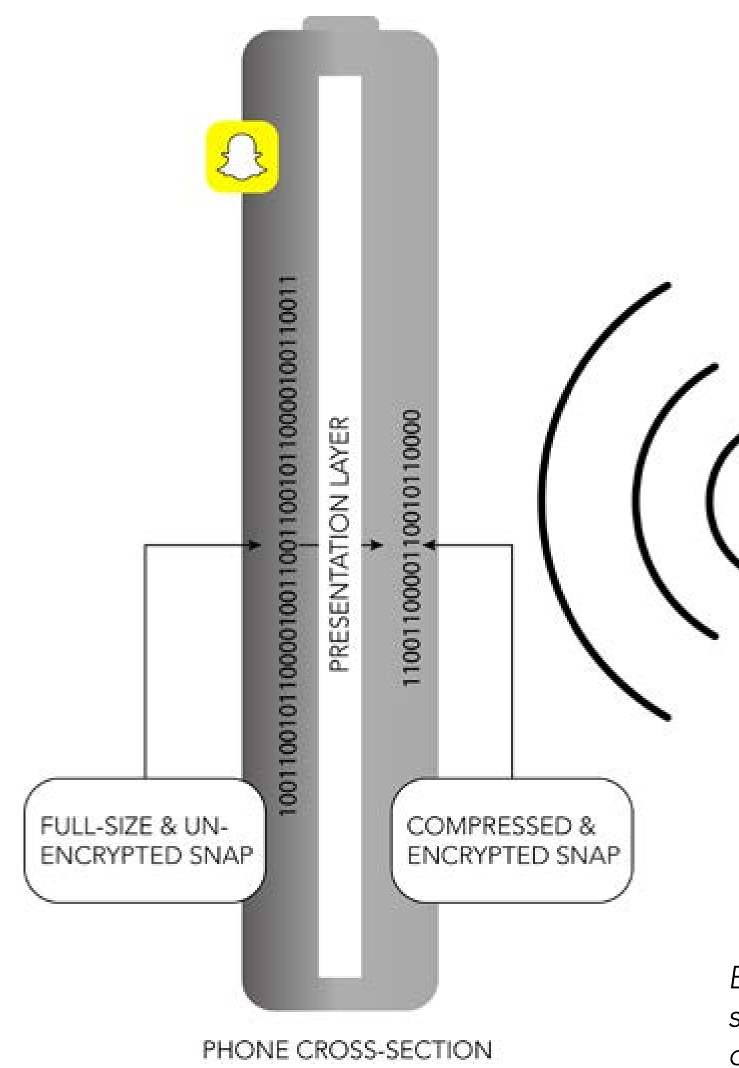
Presentation Layer

The Presentation layer translates, encrypts, and compresses data for the application layer above it. It translates data sent by one application system into a format readable by the application system on various platforms. This allows the Snap sent from a user's iPhone OS to be read by their friend's Android device.

This layer also supports security encryption. The Presentation Layer encrypts the user's Snap before it goes across a network, so that only the recipient, who has an encryption key, will be able to view it, and prying eyes will not be able to read the scrambled data as it flows through the network.

Lossless data compression also occurs on this layer, reducing the size of the Snap a user sends so that it can be viewed more quickly by the recipient, without compromising image quality.

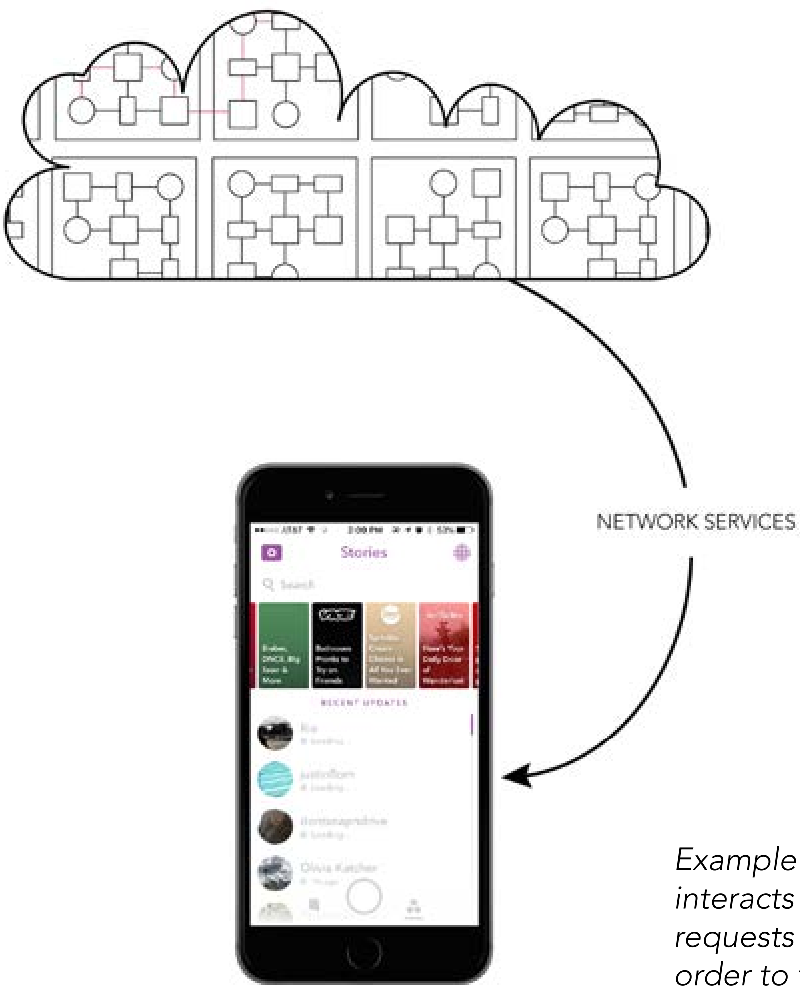


Example of the Presentation Layer: When a user sends a Snap, it is compressed and encrypted so it can travel swiftly and safely across the network.

7 Application Layer

The Application Layer, not to be confused with the "apps" we use on a daily basis, like Snapchat, Instagram, Safari, etc., implements the functions needed by the web application in use. It gathers all the web services needed by the application, and provides them directly to the user interface. This uppermost layer of the OSI model issues commands to lower layers in order to make use of their services.

When determining resource availability, the application layer must decide whether sufficient network resources for the requested communication exist. On this level, the application will load your friends' stories if it determines there are enough resources for them. Thus, when a user is on the "Stories" page of Snapchat, many of the stories have not loaded yet in order to conserve phone data and battery life. Tapping on an individual story sends a request to the server to load the story. During that user action, the application layer will determine if there are sufficient network resources for the requested communication.



Example of the Application Layer: When a user interacts with the Snapchat UI, the application layer requests network resources from the lower levels in order to fulfill the UI requests.