

Streaming Technology



Web Technology

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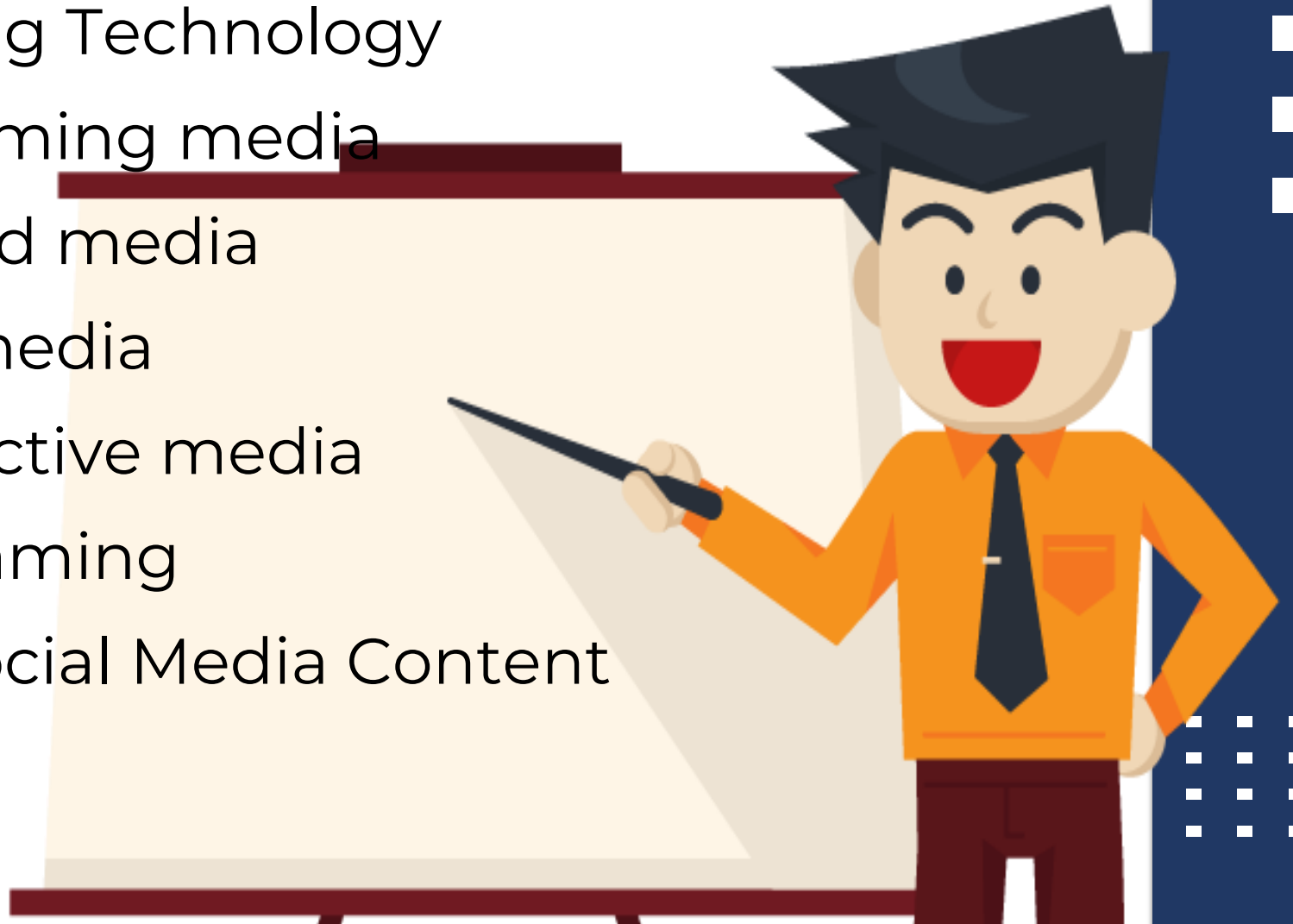
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Outline

1. What is Streaming Technology
2. Methods of streaming media
 - Streaming Stored media
 - Streaming live media
 - Real-time Interactive media
3. Protocol for Streaming
4. Livestreaming Social Media Content



What is Streaming Technology

“ Streaming is video/audio content that is sent over the Internet in a compressed form and is played instantly. ”

- ❑ **Streaming media** is multimedia that is constantly received and presented to an end-user, while being delivered by a provider.
- ❑ A user does not have to wait to download a file to play it. Because the media is sent in a continuous stream of data it can play as it arrives. Users can pause, rewind or fast-forward, just as they could with a downloaded file, unless the content is being streamed live.

Advantages

- ❑ It reduces download time.
- ❑ It provides steady service.
- ❑ Slower systems can take advantage of streaming technology.
- ❑ Provide service on demand.
- ❑ Makes it possible for users to take advantage of interactive applications like video search and personalized playlists.
- ❑ Allows content deliverers to monitor what visitors are watching and how long they are watching it.

Advantages

- ❑ Provides an efficient use of bandwidth because only the part of the file that's being transferred is the part that's being watched.
- ❑ Provides the content creator with more control over his intellectual property

because the video file is not stored on the viewer's computer. Once the video data is played, it is discarded by the media player.



#BLACKPINK #블랙핑크 #KILLTHISLOVE
BLACKPINK - 'Kill This Love' M/V

Disadvantages

- ❑ It is difficult to keep the service steady if the bandwidth is low.
- ❑ The maintenance of streaming server is relatively expensive.
- ❑ Packet loss may occur during the transmission.

Methods of streaming media

Methods of streaming media (audio/video).

- 1. Streaming stored media** refers to on-demand requests for compressed media files.
- 2. Streaming live media** refers to the broadcasting of radio and TV programs through the Internet.
- 3. Real-time Interactive media** refers to the use of the Internet for interactive media applications.

1. Streaming Stored Media

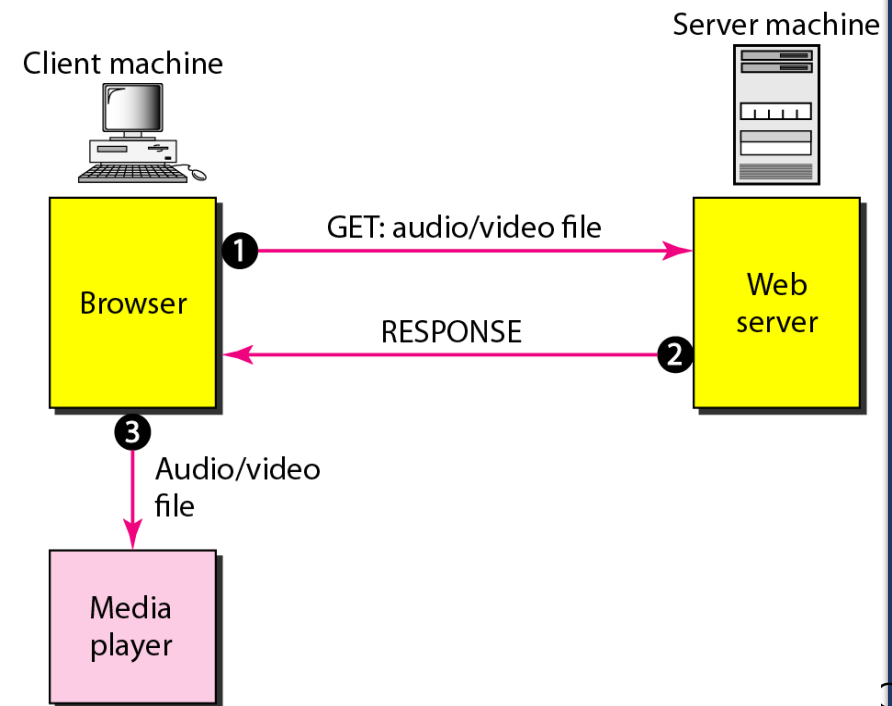
4 Approaches for streaming stored media (audio/video) by using.

- ☐ Web Server
- ☐ Web Server with a Metafile
- ☐ Media Server
- ☐ Media Server and RTSP

1. Streaming Stored Media

Using a Web Server

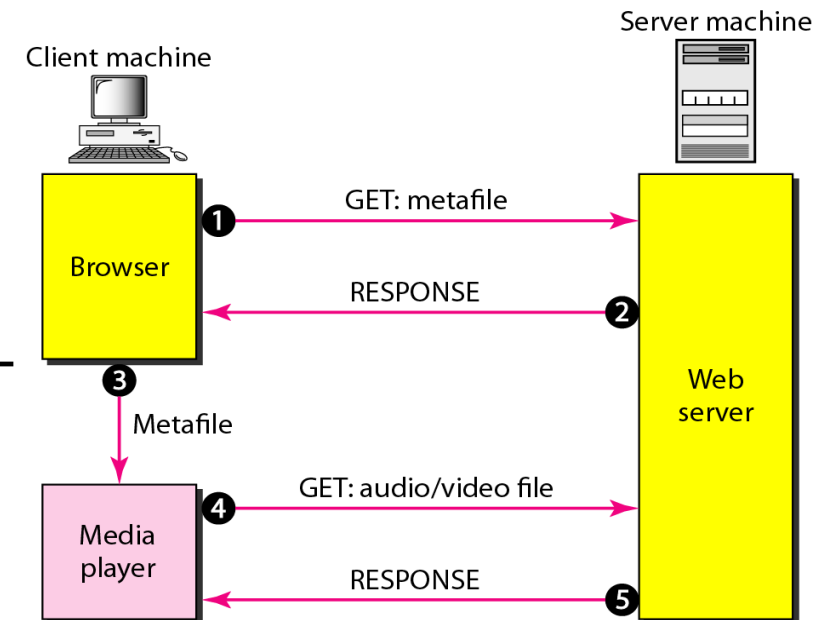
1. The client (browser) can use the services of HTTP and send a GET message to download the file.
2. The Web server can send the compressed file to the browser.
3. The browser can then use a help application, normally called a “media player”, to play the file. The file needs to download completely before it can be played.



1. Streaming Stored Media

Using a Web server with a metafile

1. The client accesses the Web server using the GET message.
2. The information about the metafile comes in the response.
3. The metafile is passed to the media player.
4. The media player uses the URL in the metafile to access the media file.
5. The Web server responds.



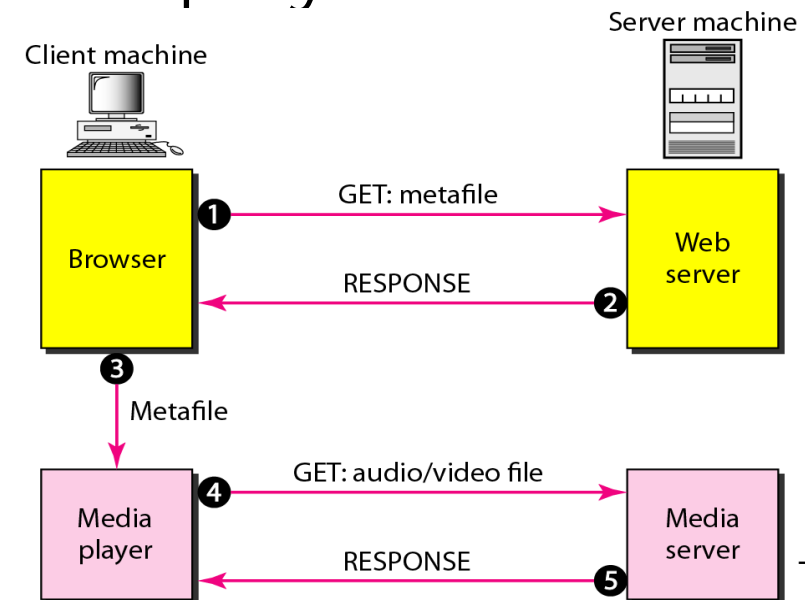
1. Streaming Stored Media

Using a media server

1. The client accesses the Web server using a GET message.
2. The information about the metafile comes in the response.
3. The metafile is passed to the media player.

4. The media player uses the URL in the metafile to access the media server to download the file by any protocol that uses UDP.

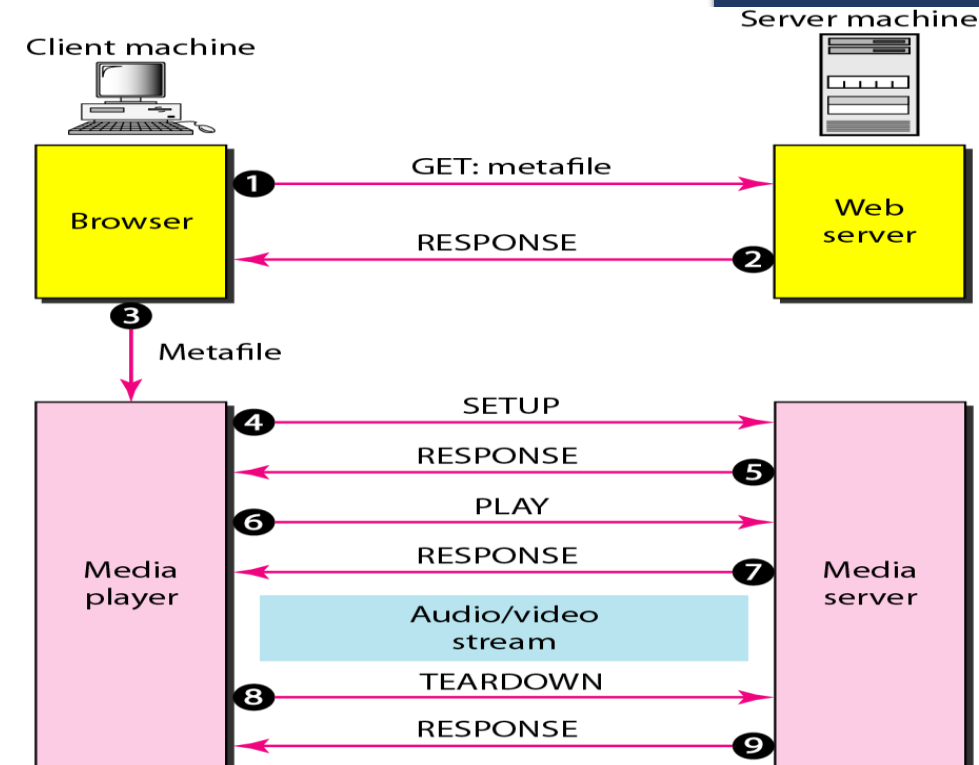
5. The media server responds.



1. Streaming Stored Media

Using a media server and RTSP

1. The HTTP client accesses the Web server using a GET message.
2. The information about the metafile comes in the response.
3. The metafile is passed to the media player.
4. The media player sends a SETUP message to create a connection with the media server.



1. Streaming Stored Media

Using a media server and RTSP (cont.)

5. The media server responds.
6. The media player sends a PLAY message to start playing (downloading).
7. The media file is downloaded using another protocol that runs over UDP.
8. The connection is broken using the TEARDOWN message.
9. The media server responds.

2. Streaming Live Media

- ❑ **Streaming live media** is like the broadcasting of audio and video by radio and TV stations. Instead of broadcasting to the air, the stations broadcast through the Internet.
- ❑ There are several similarities between streaming stored media and streaming live media. They are both sensitive to delay; neither can accept retransmission.

2. Streaming Live Media

- ❑ However, there is a difference.
 - the communication is unicast and on-demand.
 - the communication is multicast and live.
- ❑ Live streaming is better suited to the multicast services of IP and the use of protocols such as UDP and RTP.

3. Real-time Interactive Media

❑ **Real-time interactive media**, people communicate with one another in real time. The Internet phone or voice over IP is an example of this type of application. Video conferencing is another example that allows people to communicate visually and orally.

Characteristics of real-time media communication.

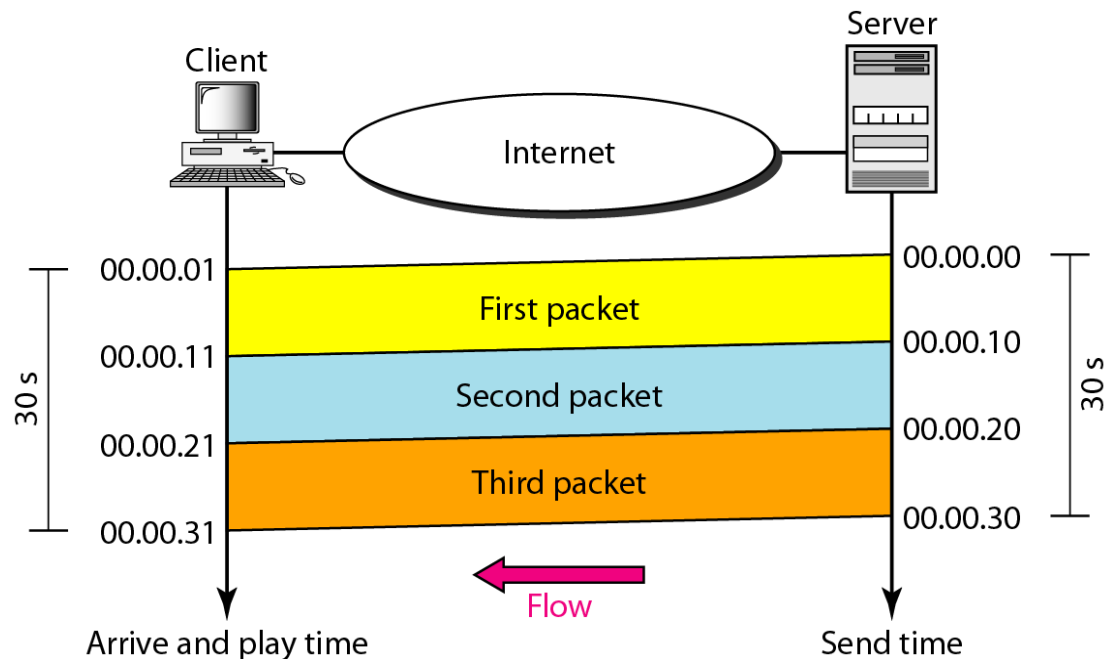
1. Time Relationship
2. Timestamp
3. Playback Buffer
4. Ordering
5. Multicasting
6. Mixing
7. Support from Transport Layer Protocol

3. Real-time Interactive Media

Characteristics of real-time audio/video communication.

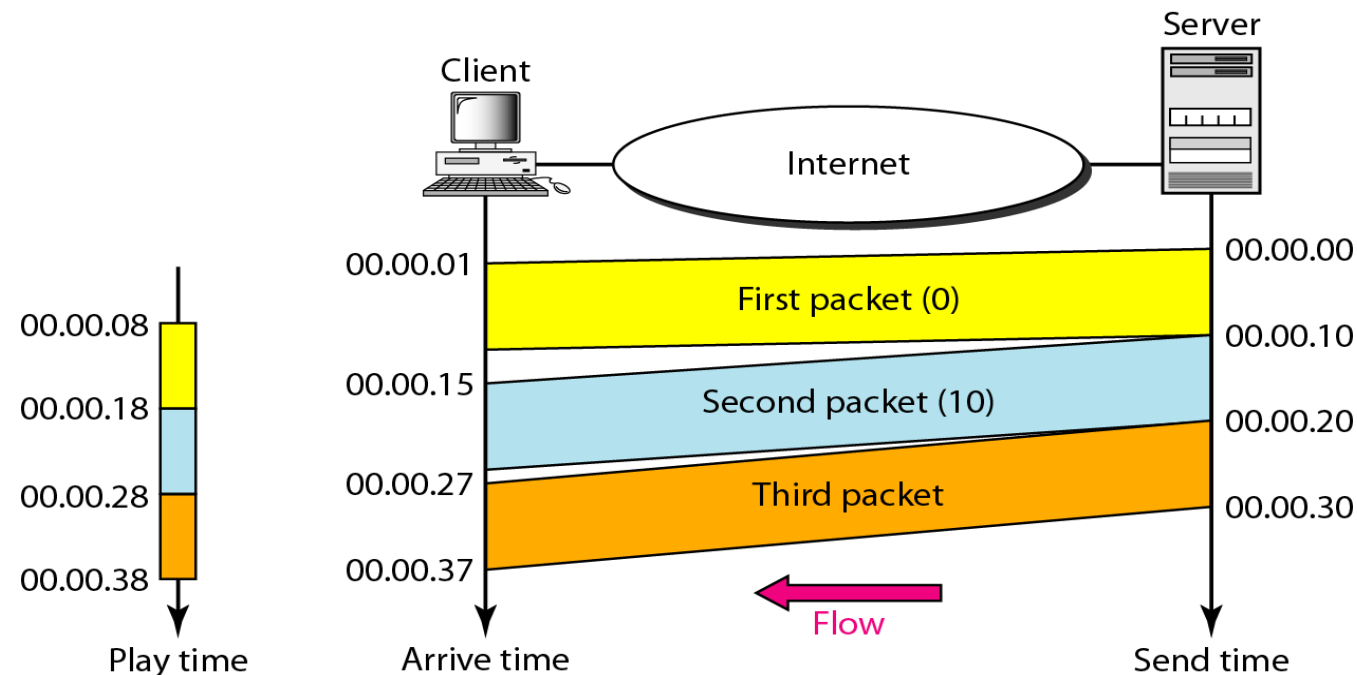
1. Time Relationship : Real-time data on a packet-switched network require the preservation of the time relationship between packets of a session.

There is a gap between the packets as the video is viewed at the remote site. This phenomenon is called **“jitter”**.



3. Real-time Interactive Media

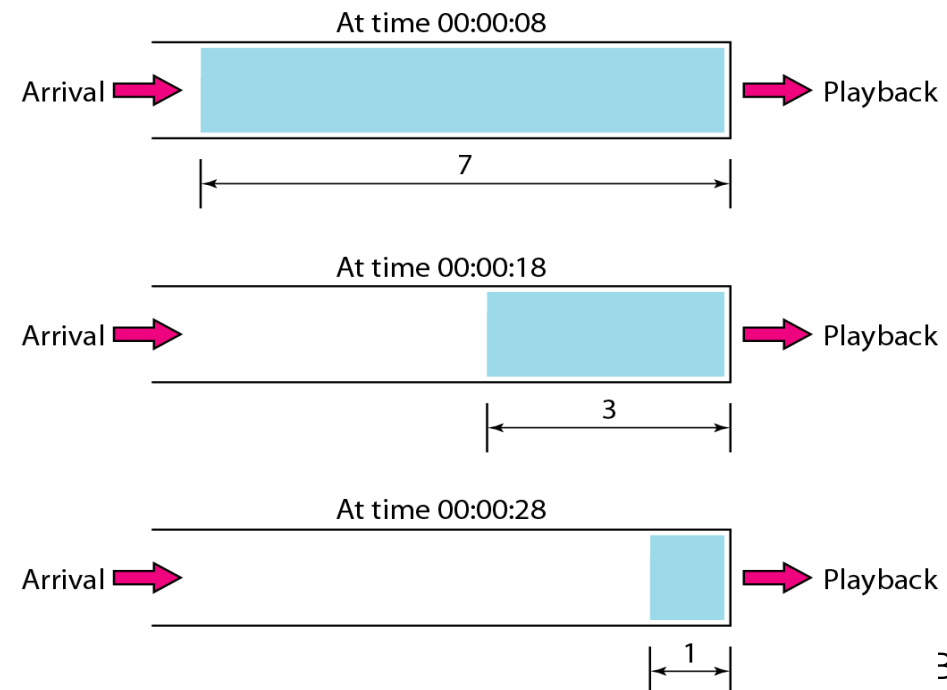
2. Timestamp : One solution to jitter is the use of a timestamp. If each packet has a timestamp that shows the time it was produced relative to the first (or previous) packet, then the receiver can add this time to the time at which it starts the playback.



3. Real-time Interactive Media

3. Playback Buffer : To be able to separate the arrival time from the playback time, we need a buffer to store the data until they are played back. The buffer is referred to as a playback buffer.

- A playback buffer is required for real-time traffic.
- A sequence number on each packet is required for real-time traffic.
- Real-time traffic needs the support of multicasting.



3. Real-time Interactive Media

- 4. Ordering:** This need a sequence number for each packet. The timestamp alone cannot inform the receiver if a packet is lost.
- 5. Multicasting:** Multimedia play a primary role in audio and video conferencing. The traffic can be heavy, and the data are distributed using multicasting methods. Conferencing requires two-way communication between receivers and senders.

3. Real-time Interactive Media

6. Mixing : Mixing means combining several streams of traffic into one stream. If there is more than one source that can send data at the same time (as in a video or audio conference), the traffic is made of multiple streams.

3. Real-time Interactive Media

7. Support from Transport Layer Protocol

- TCP is not suitable for interactive traffic. It has **no provision for timestamping**, and it **does not support multicasting**. However, it **does provide ordering (sequence numbers)**. One feature of TCP that makes it particularly unsuitable for interactive traffic is its error control mechanism.

3. Real-time Interactive Media

7. Support from Transport Layer Protocol (cont.)

- UDP is more suitable for interactive multimedia traffic.
- UDP supports multicasting and has no retransmission strategy.
- However, UDP has no provision for timestamping, sequencing, or mixing.
- A new transport protocol, Real-Time Transport Protocol (RTP), provides these missing features.



Protocols for Streaming

3

Transmissions protocols

In general there are two methods to deliver a media file on the Web: by a normal web server with the HTTP protocol, or by a dedicated server (streaming server) with the RTSP protocol or another similar streaming protocol.

- ❑ **HTTP protocol** based on TCP/IP, it was created to deliver text and images files, not streaming media files. The normal process of an HTTP request consists of the communication opening between the client (the browser) and the web server, the file request, the file delivering and the closing of the connection. There's no space to “play” a file.



Protocols for Streaming

- ❑ **RTP protocol** Layered on top of UDP, so there's no error handling or reliability. One-to-one or one-to-many transmission. Includes payload type identification, sequence numbering and time stamping (SMPTE timecode).
- ❑ **RTSP protocol** based on TCP for communication and usually layered on top of RTP, it is dedicated to streaming. By this protocol you can control the file time "duration", which can be played with different speed, can be controlled by the server, can be stopped and played again, and its playing can be changed at runtime depending on different parameters.

Protocols for Streaming

Data Plane

- ❑ Compressed media is packetized at the real-time transport protocol (RTP) layer
- ❑ RTP packetized streams are then passed to the UDP/TCP layer and IP layer
- ❑ IP packets are transported over the Internet

Control Plane

- ❑ Real-time control protocol (RTCP) and real-time streaming protocol (RTSP) packets are multiplexed at the UDP/TCP layer
- ❑ IP packets are transported over the Internet

Protocols for Streaming

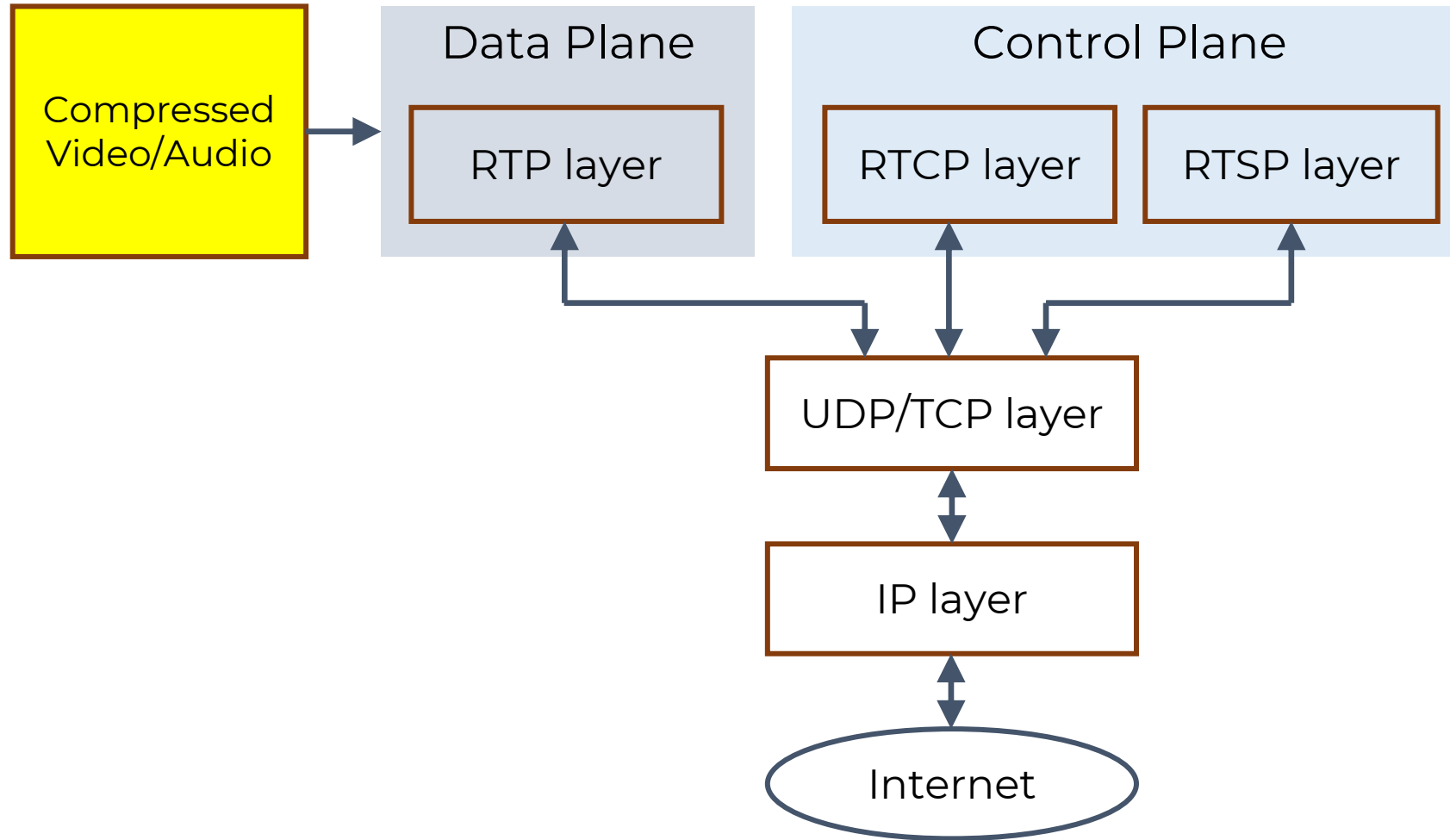


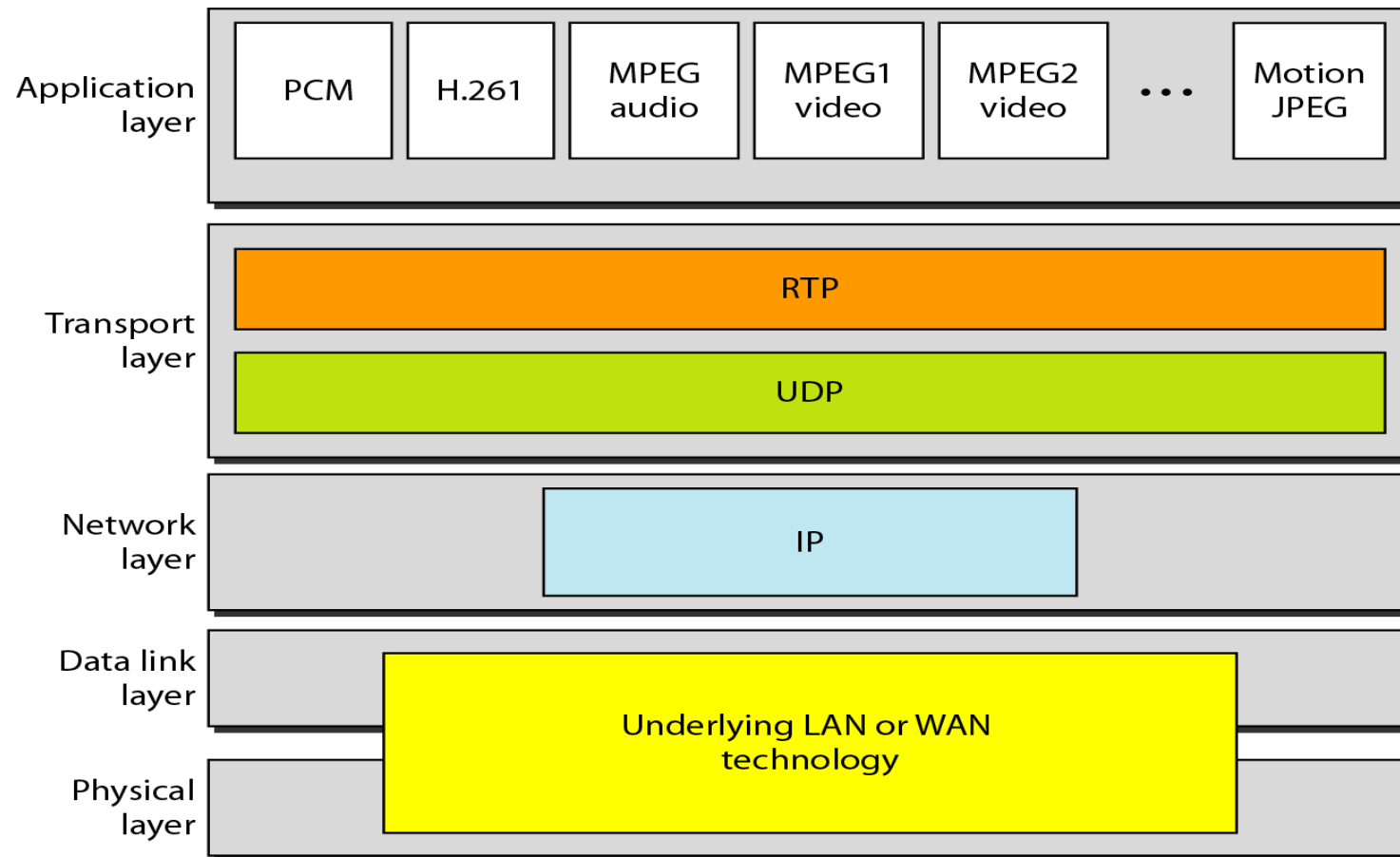
Figure : Protocol Stacks

Real-time Transport Protocol

- ❑ **Real-time Transport Protocol** (RTP) is the protocol designed to handle real-time traffic on the Internet.
- ❑ RTP does not have a delivery mechanism; it must be used with UDP.
- ❑ RTP stands between UDP and the application program.

Real-time Transport Protocol

- ❑ The main contributions of RTP are **time-stamping, sequencing, and mixing facilities.**



RTP packet header format

- ❑ The format is very simple and general enough to cover all real-time applications. An application that needs more information adds it to the beginning of its payload.

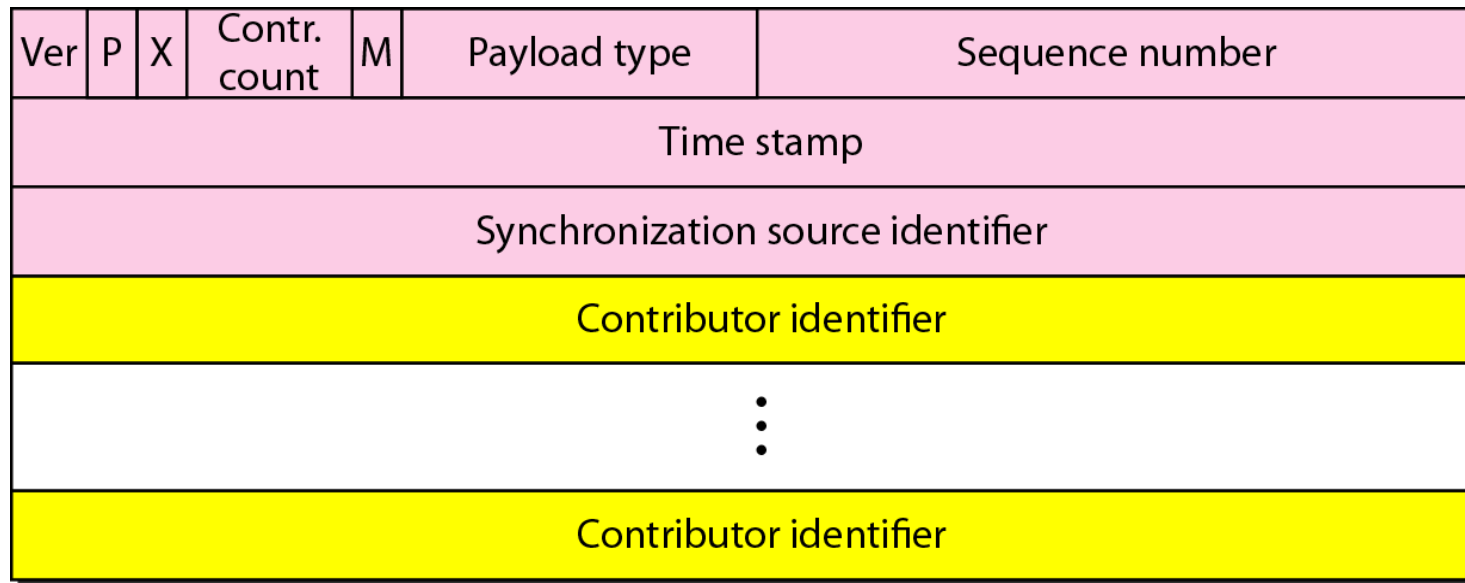


Figure: RTP packet header format

Real-time Transport Control Protocol

Real-time Transport Control Protocol (RTCP) is a protocol designed for defining basic functionality and packet structure. RTCP is a sister protocol of the Real-time Transport Protocol (RTP).

- ❑ RTCP provides out-of-band statistics and control information for an RTP session. It partners with RTP in the delivery and packaging of multimedia data but does not transport any media data itself.
- ❑ RTP allows only one type of message, one that carries data from the source to the destination. In many cases, there is a need for other messages in a session. These messages control the flow and quality of data and allow the recipient to send feedback to the source or sources.

Real-time Transport Control Protocol

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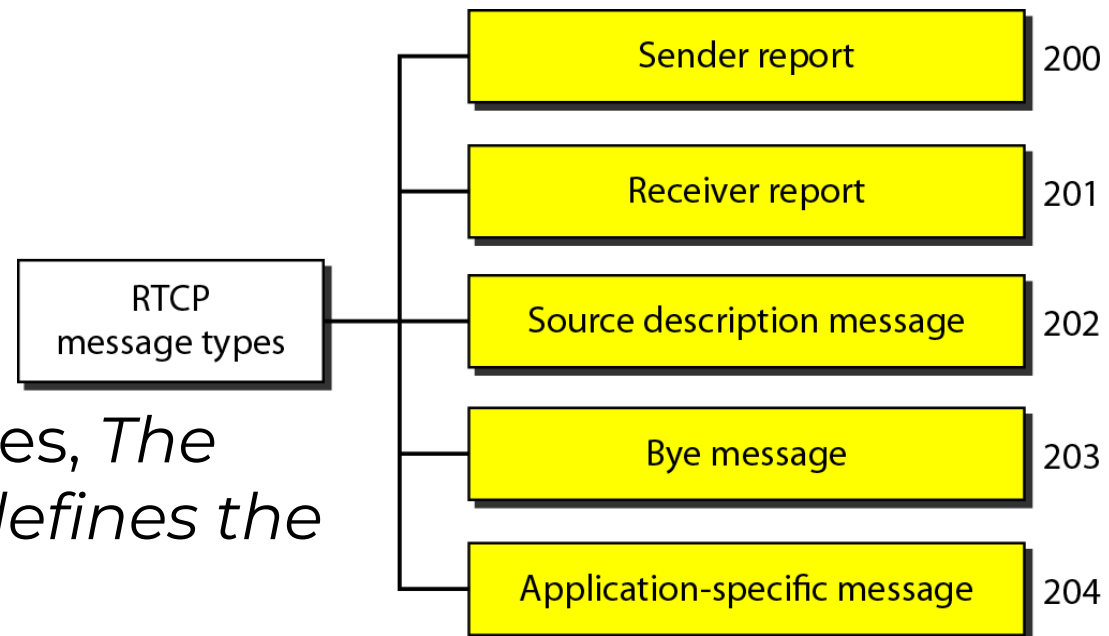


Figure : RTCP message types, *The number next to each box defines the type of the message.*

Real-Time Streaming Protocol

Real-Time Streaming Protocol (RTSP) is a network control protocol designed for use in entertainment and communications systems to control streaming media servers.

- ❑ The protocol is used for establishing and controlling media sessions between end points.
- ❑ RTSP allows a media player to control the transmission of a media stream for exchanging control information.

Real-Time Streaming Protocol

- ❑ RTSP is a framework for delivering and transmission of multicast data stream.
- ❑ Most RTSP servers use the Real-time Transport Protocol (RTP) in conjunction with Real-time Control Protocol (RTCP) for media stream delivery.

Benefits of Live Streaming

- ❑ **Live Interactive Experience:** The biggest advantage of live streaming is the ability for students to have a live interactive experience.
- ❑ **Better Learning Experience:** Learning from live streams is an entirely different experience compared to traditional classes.
- ❑ **Real-time and On-demand Live Streaming:** Live streaming enables educational institutes and platforms to provide real-time on-demand content to the audience.



Benefits of Live Streaming

- ❑ **Accessibility:** Accessibility has been one of the biggest benefits of live streaming. Anyone who has proper connection can connect and become a part of the community. Remote areas also get the benefit of livestreaming.
- ❑ **Learning about Viewers:** Online learning and live streaming has been made possible due to the advancement in technology. This technology also helps educators understand the students and their learning patterns.

Livestreaming Social Media Content

- ❑ The most of the major social media sites, like **Facebook** and **YouTube**, have been promoting new features and products that revolve around livestreaming.
- ❑ The social media companies drive the revenue and engage more with users, and there's now more live content functionality being rolled out all the time and more sites.
- ❑ The trend has spread far beyond social media. Livestreaming is being used in diverse situations such as online education, social work and so on.