

# Ch 6

## Multimedia Distribution



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# Lecture scopes

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- ☐ Review
- ☐ Networked Media and Components
- ☐ Whole Components :
  - ☐ Server Resource : Media Server
  - ☐ Network Resource : Protocol
  - ☐ Client Resource : Device and Media Player
  - ☐ Communication : Unicast, Broadcasting, Multicast
  - ☐ Hypermedia (misal : hypertext, XML, SMIL : HTML & XHTML, User Interface, Vector Graphics, Voice)
  - ☐ Media Format
  - ☐ Media : Streaming and Interactive
    - ☐ Internet Radio
    - ☐ Video on demand
    - ☐ Internet Protocol based Television (IP-TV) / digital TV,
    - ☐ Video Conferencing, VOIP ?
    - ☐ Multimedia courseware.

# I. Review

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- ☐ Design and Producing
- ☐ Compression Techniques
- ☐ Multimedia Database
- ☐ **Networking Multimedia/Networked Multimedia/Distributed Multimedia/Networked Media**
  - Deliver : Internet (Network)
  - Media Types : Real Time/Non Real-Time
  - Consideration of Network Parameters
  - QoS
- ☐ **Multimedia Distribution/Delivery to Internet (Network)**

## II. Networked Media Components

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- ❑ The term “Networked Media” implies that *all kinds of media including text, image, 3D graphics, audio and video are produced, distributed, shared, managed and consumed on-line through various networks, like the Internet, Fiber, WiFi, WiMAX, GPRS, 3G and so on, in a convergent manner*
- ❑ The technology of networked media consists of *three main components:*
  - the server,
  - the network, and
  - the client machine

## II. Networked Media Components

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- ❑ These three components must work in tandem to deliver good Web multimedia to the desktop.
- ❑ It makes no difference how high-end your video server and network are if your users are running low-end desktop machines that cannot handle the demands of playback.

# III. Whole Components

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## 3.1. Components :

### 3.1.1. Server Resource :

- *Hardware and Software (Media Store : Web Server, Web Server with Metafile, Using a Media Server with Metafile, Using a Media Server and RTSP)*

### 3.1.2. Network Resource : Hardware and Software (Protocol)

### 3.1.3. Client Resource : *Hardware and Software* (Web Browser, Media Player (with or without Media Player tool.....))

→ **Authoring Tools**

### 3.1.4. Including : *Encoder/decoder components (Review Compression)*

## 3.2. Data exchange procedures/communications:

- **Unicast, Multicast, broadcast**

## 3.3. Developing Tool:

- **Hypermedia (SMIL)**

## 3.4. Media : Format and Source

- **Media Source : *Streaming and Interactive media***

## 3.1. Components : Server Resource

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### 3.1.1. Server Resources

#### ■ Media :

- Streaming Media :
  - Standard Server (Web Server)
  - Media Server
- Interactive Media

### 3.1.2. Network Resource : Protocol

### 3.1.3. Client Resource : Media Player (Format)



## **3.1.1. Server Resources :**

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### **A. Streaming Media :**

- **Standard Server (Web Server)**
- **Media Server**

### **B. Interactive Media**

## 3.1.1. Streaming Server

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- ☐ **Standard Server**
- ☐ **Media Server**

# A1. Standard Server

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## ☐ Standard Server :

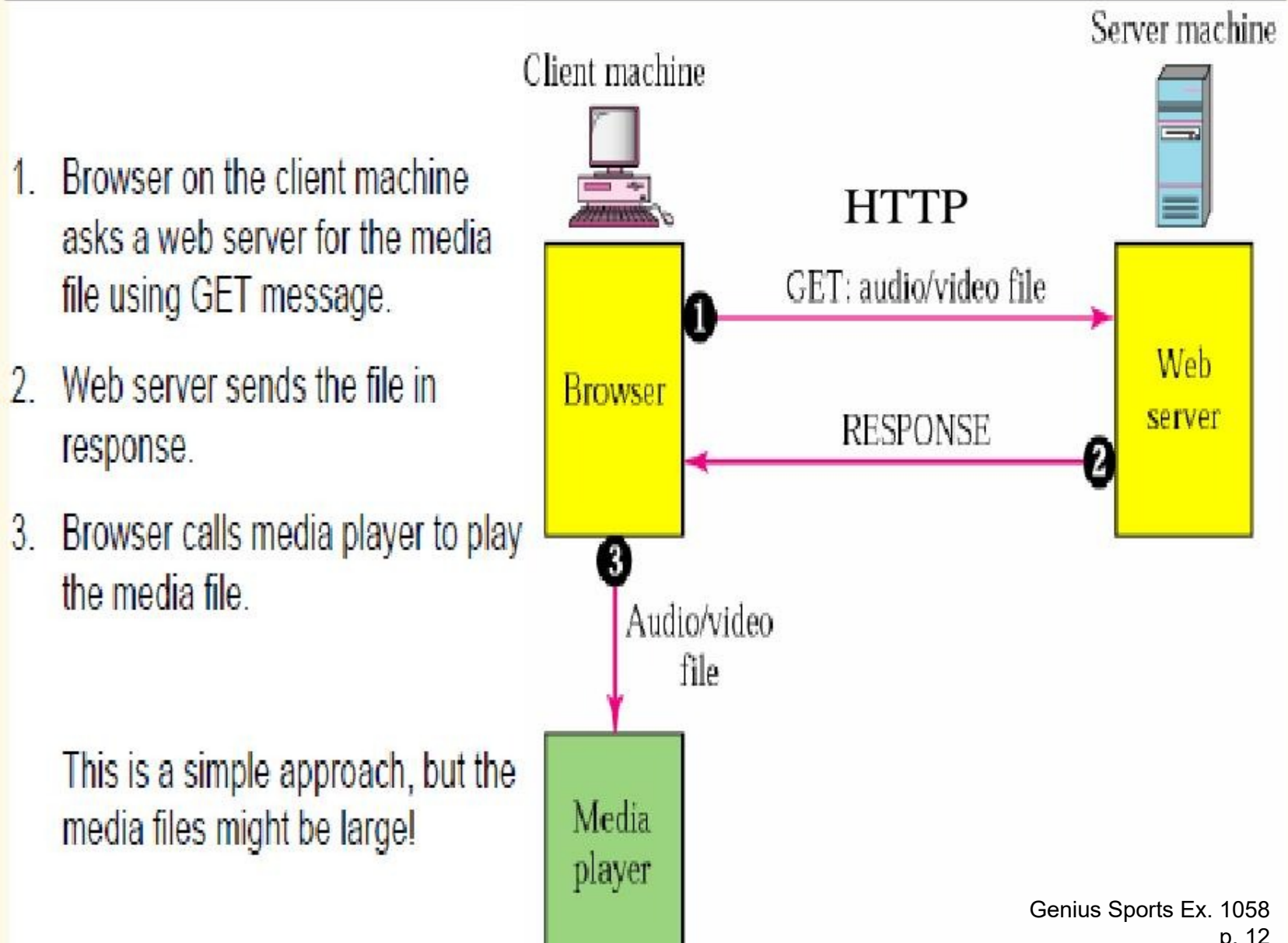
- ☐ Web Server (Apache) : progressive download/HTTP streaming/fast start streaming
- ☐ Allows users to watch or listen to media as it is downloaded from a standard web server
- ☐ Works best for short-form media where file size is limited.
- ☐ Ensures high-quality playback regardless of users' Internet connection speed, although users with slower connections will wait longer before media starts to play.

## A2. Web Server/Progressive Download

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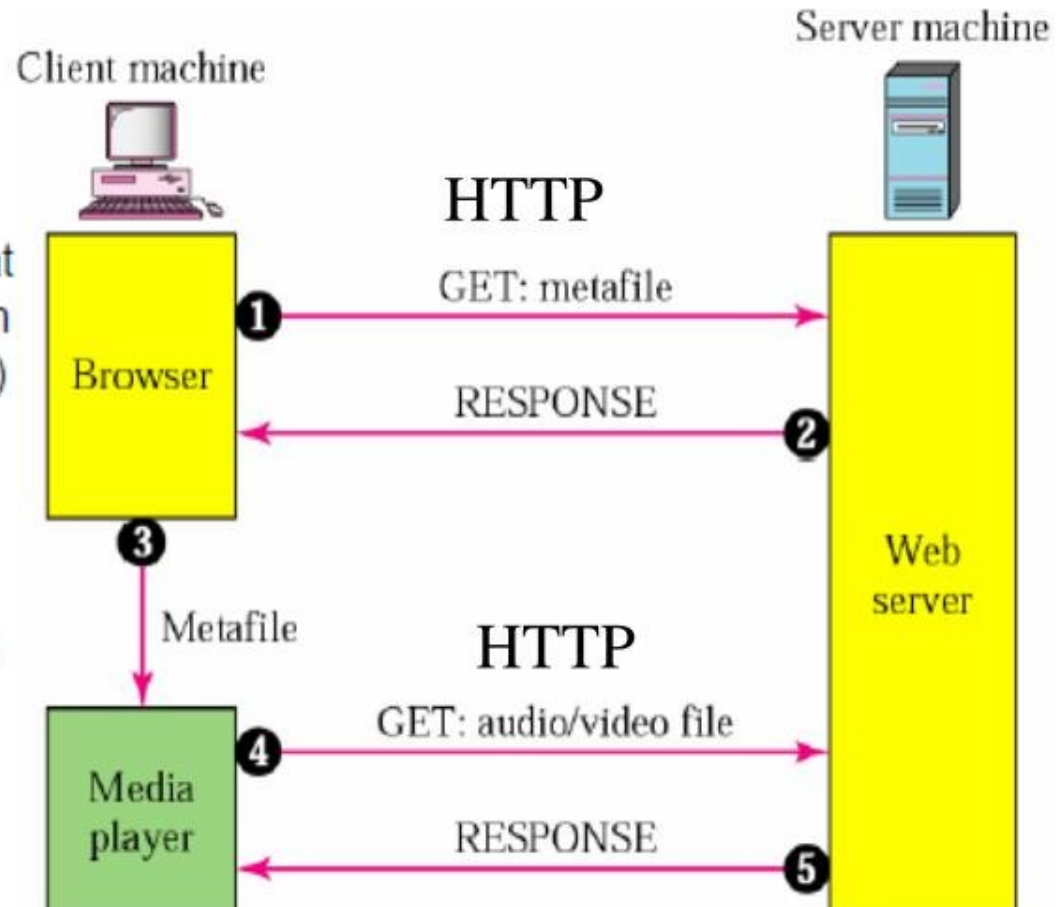
- ❑ If We want to view only the last few minutes of a long clip you must wait for the entire clip to download.
- One solution to both of these problems is to split longer media segments into smaller chunks. This reduces the demands on the client machine and allows users more direct access to the material they want.

## A3. Web Server Mechanism



## A4. Web Server with Metafile Mechanism

1. Browser on the client machine asks a web server for the media file using GET message.
2. Web server sends the **metafile** that holds all the necessary information about the request media file (URL) in response.
3. Browser calls media player and passes on the metafile.
4. Media player sends a request to a web server.
5. The request media file is sent in response.



**The media file is sent using TCP protocol which is not convenient for streaming applications.**

## B. Media Server/Streaming Server

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- ☐ Media Server/Streaming Server/**true streaming/hinted streaming**
- ☐ A media server is a device that simply stores and shares media (meaning digital videos/movies, audio/music, and picture files)
- ☐ It can *allow several different devices to be called Media Servers.*
- ☐ It may be
  - A simple Network Attached Storage,
  - A Home theater PC (HTPC) running Windows XP Media Center Edition,
  - A MediaPortal or MythTV, or
  - A commercial web server that hosts media for a large web site.

## B. Media Server/Streaming Server

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- ☐ **Streaming Server delivers media in real time over the Internet or mobile devices, from modem to broadband rates to HD rates.**
- ☐ **Using the open standard Real-Time Transport Protocol/Real-Time Streaming Protocol (RTP/RTSP), no file is ever downloaded to a viewer's hard drive.**
- ☐ **Media is played, but not stored, by the client software as it is delivered.**
- ☐ **Preferable for webcasts of live events, Internet radio and TV channels.**



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## ❑ Media Server :

- QuickTime Streaming Server
- Adobe Flash Media server
- RED5
- MythTV, an open source HTPC and PVR software for Linux, with a built-in UPnP AV MediaServer.
- Windows Media Connect from Microsoft - free UPnP AV MediaServer and control point (server and client) for Microsoft Windows
- More detailed :
  - [http://en.wikipedia.org/wiki/UPnP\\_AV\\_MediaServers](http://en.wikipedia.org/wiki/UPnP_AV_MediaServers)
  - [Http://en.wikipedia.org/wiki/List\\_of\\_streaming\\_media\\_systems](http://en.wikipedia.org/wiki/List_of_streaming_media_systems)

# B1. Web Server vs Streaming Server

## Web server pros

- ▶ No special server software needed; just use your Web server
- ▶ Media gets through no matter how slow the connection, because lost packets are retransmitted until they are received
- ▶ With fast connections, media plays as it downloads, so it seems like streaming to the audience
- ▶ End-user gets to keep a copy of the file to play and/or share
- ▶ No problems with firewalls

## Web server cons

- ▶ Can't transmit live feeds
- ▶ Can't broadcast or multicast
- ▶ No flexibility for end-user—e.g. end-user cannot skip “chapters”—audience must download file in its entirety, from beginning to end
- ▶ Leaves a copy of the media file on the end-user's hard disk, risking unauthorized alteration and/or redistribution

## Streaming server pros

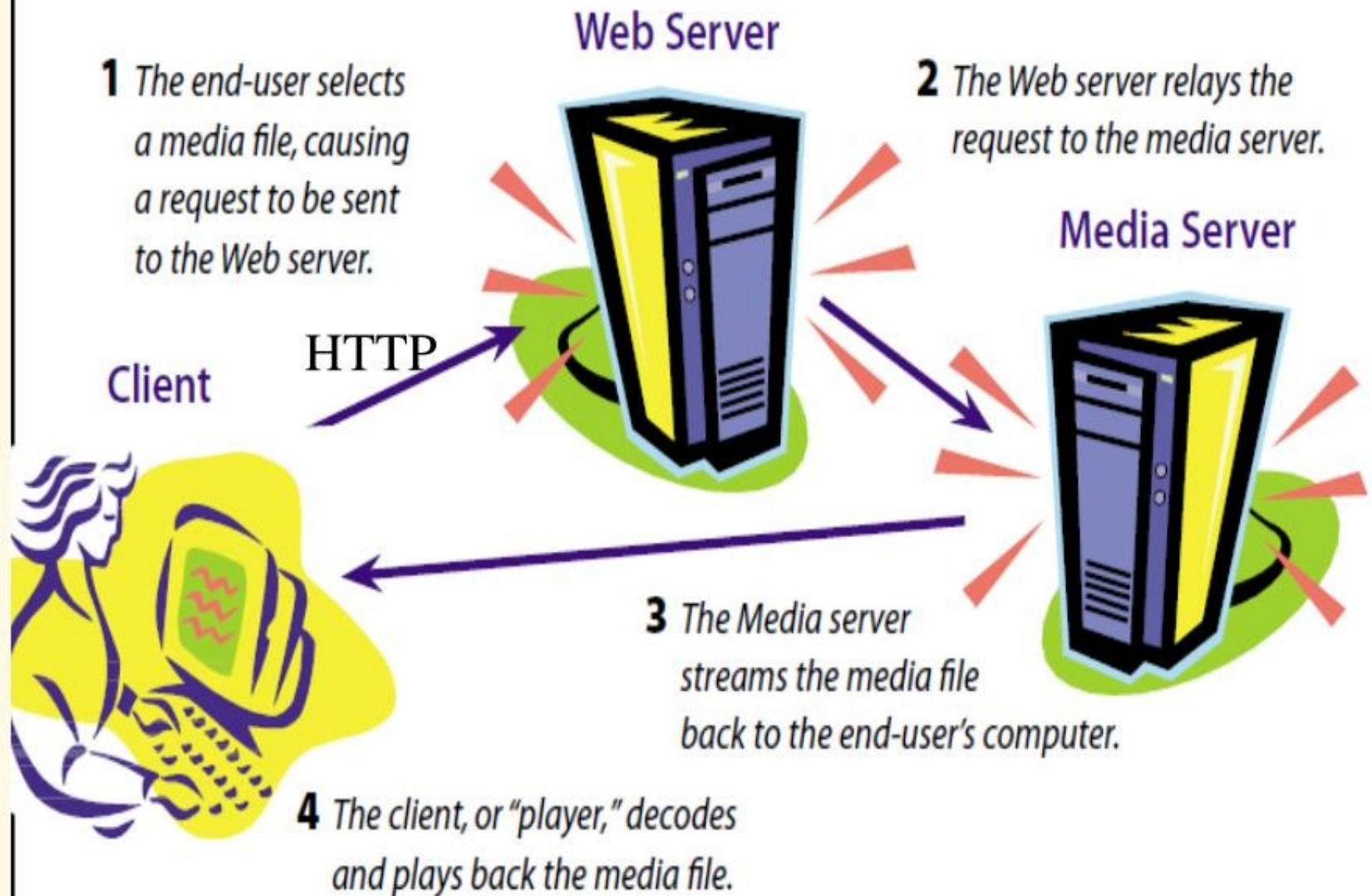
- ▶ Only way to transmit live feeds
- ▶ Broadcasts and multicasts (one stream to many viewers)
- ▶ VOD (video on-demand) files can provide flexible access for end-users
- ▶ Doesn't leave a copy of the movie on the viewer's hard disk
- ▶ Does not use up space on end-user's hard disk
- ▶ Bandwidth usage can adjust to conditions

## Streaming server cons

- ▶ Requires a streaming server
- ▶ Playback may be disrupted or delayed if data rate exceeds connection speed or available bandwidth
- ▶ Media typically loses some data in transmission, and lost packets are gone for good
- ▶ Firewalls may not allow streaming files to pass

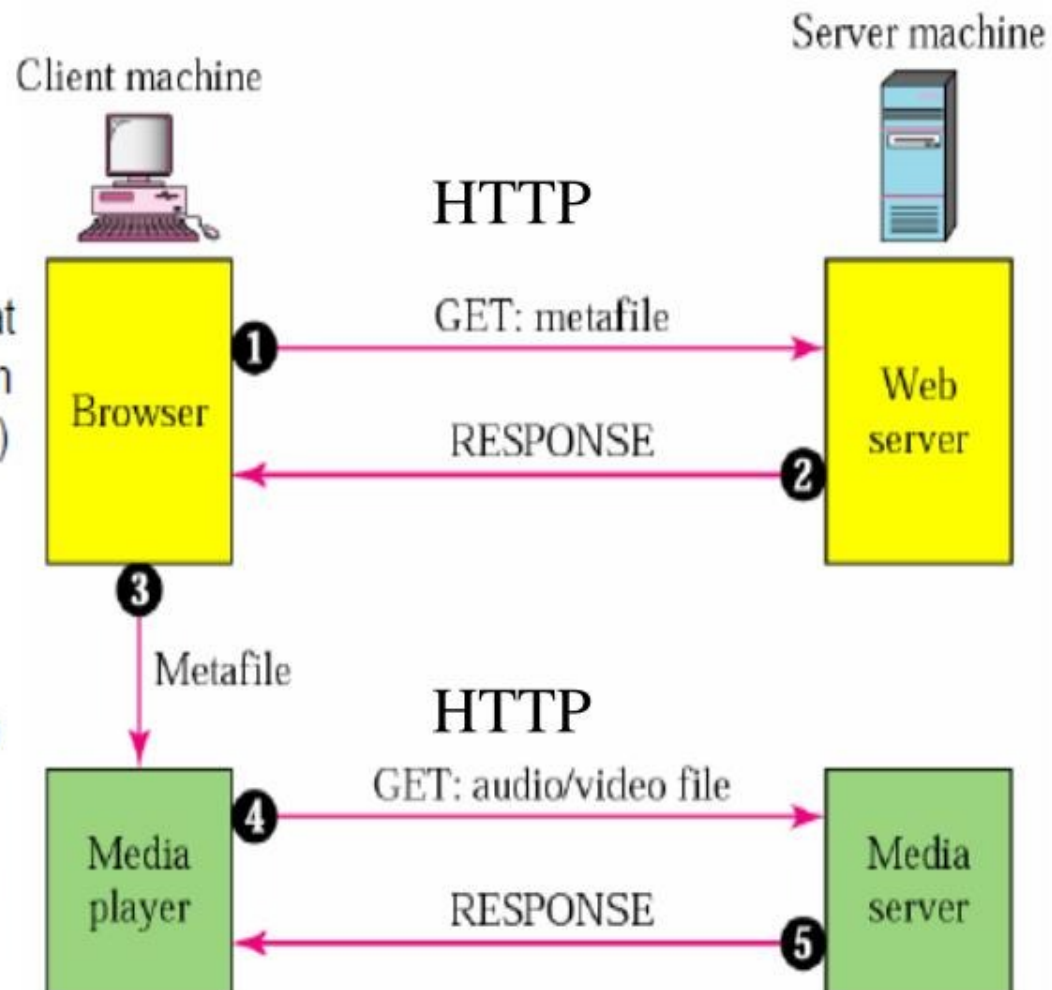
|                                    | Streaming                                                                                 | (Progressive) Download                                                               |
|------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Server                             | Streaming server is required                                                              | Standard web server is sufficient                                                    |
| Network layer protocol used        | UDP/IP                                                                                    | TCP/IP                                                                               |
| Application layer protocol used    | RTP/RTSP                                                                                  | HTTP                                                                                 |
| Packet loss                        | Packet loss acceptable                                                                    | No packet loss                                                                       |
| Time performance                   | Real time. The delivered media duration is the same as original                           | Packets may be retransmitted, leading to slower delivery times                       |
| Delivery quality                   | Some packets may be discarded, to meet time and/or bandwidth constraints                  | High-quality delivery guaranteed, no data is lost or discarded                       |
| User connection                    | Can match the user's bandwidth                                                            | File is delivered without regard to the user's bandwidth                             |
| Playback                           | File starts playing immediately                                                           | Playback begins when all of (in progressive: enough of) the file has been downloaded |
| Effort                             | More burden on service provider (requires server, multiple bit-rate versions and formats) | More burden on the end user (hard drive space, connection speed)                     |
| Firewalls                          | May not play behind some firewalls                                                        | Bypasses most firewalls                                                              |
| Storage                            | No files are downloaded to the user's PC                                                  | Files are downloaded to the user's PC                                                |
| VCR functionalities                | Yes (for streaming of pre-recorded material)                                              | No                                                                                   |
| Zapping of internet radio channels | Smooth                                                                                    | Not possible                                                                         |

## B2. Web Server-Media Server Mechanism



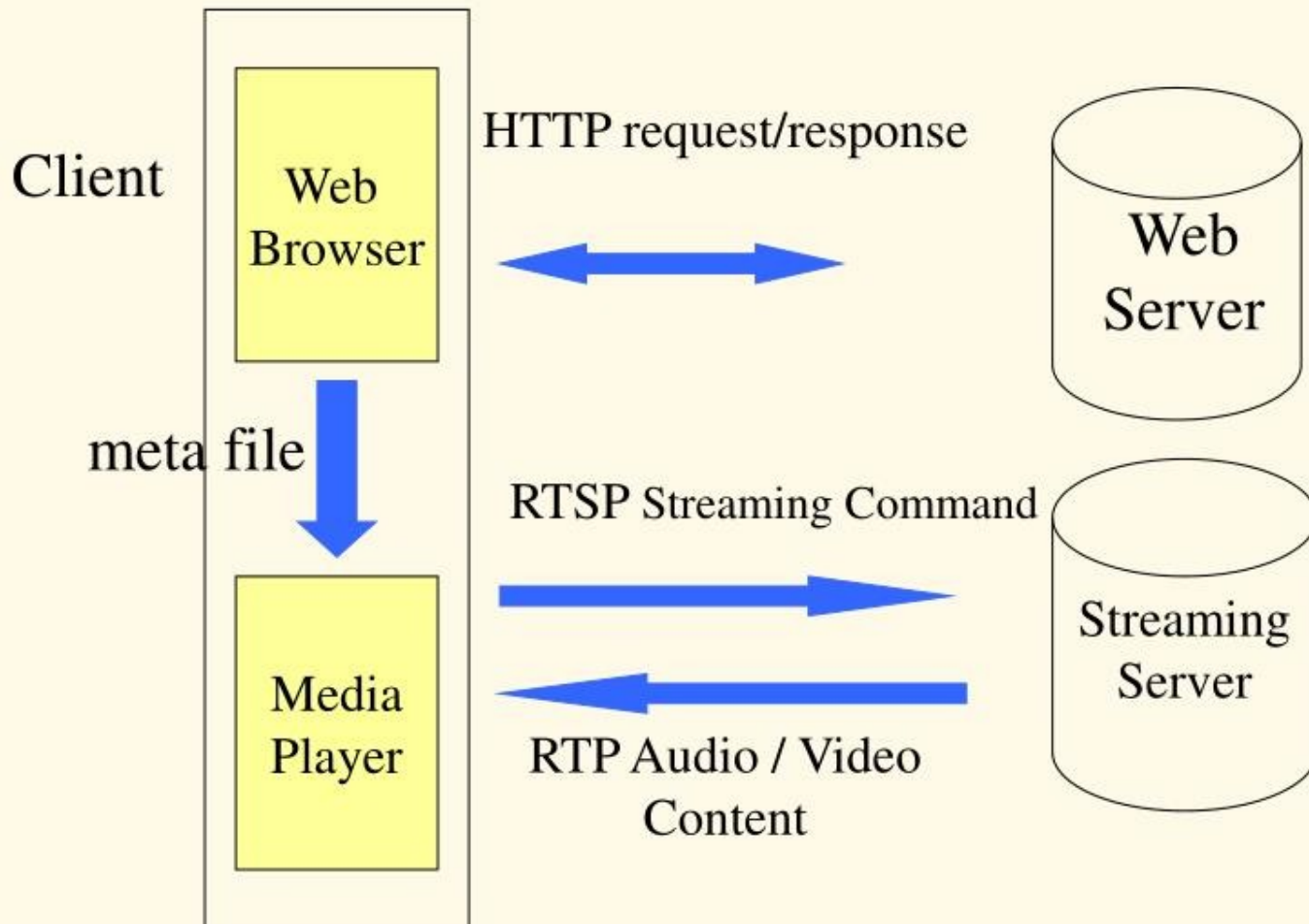
# B3. Media Server with Metafile Mechanism

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3. Browser calls media player and passes on the metafile.
4. Media player sends a request to a **media server**.
5. The request media file is sent in response.



Media server can use any of the transport protocols to transfer the media file to the user.

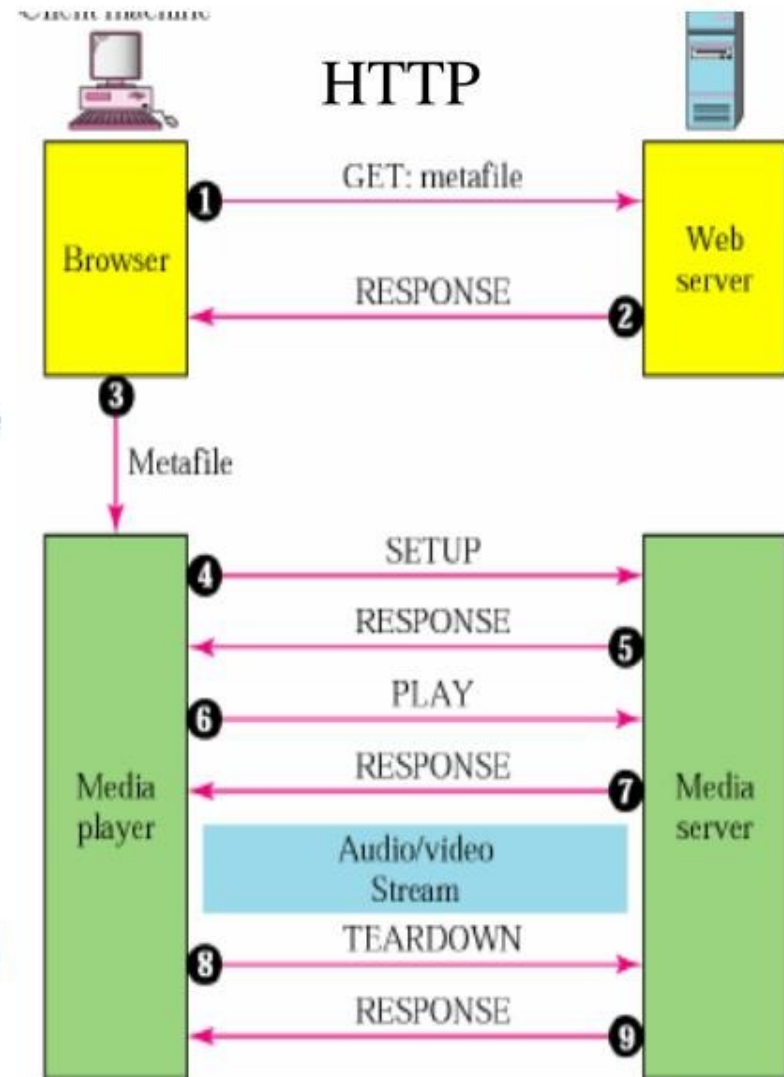
## B4. Web Server with RTSP



HTTP is insufficient for user interaction. With streaming server audio/video file can be sent over UDP,

## B4. Web Server with RTSP

1. Browser on the client machine asks a web server for the media file using GET message.
2. Web server sends the **metafile** that holds all the necessary information about the request media file (URL) in response.
3. Browser calls media player and passes on the metafile.
4. Media player sends a SETUP message a **media server** to initialize the connection.
5. The media server responds.
6. Media player sends a PLAY message to start playing the file.
7. The media is downloaded using a higher-level protocol above UDP.
8. The connection is broken using TEARDOWN message.
9. Response to confirm the end of the session.





## 3.1.2. Network Resource : Protocols

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☐ **RTSP**

☐ **RTP**

# A. RTSP

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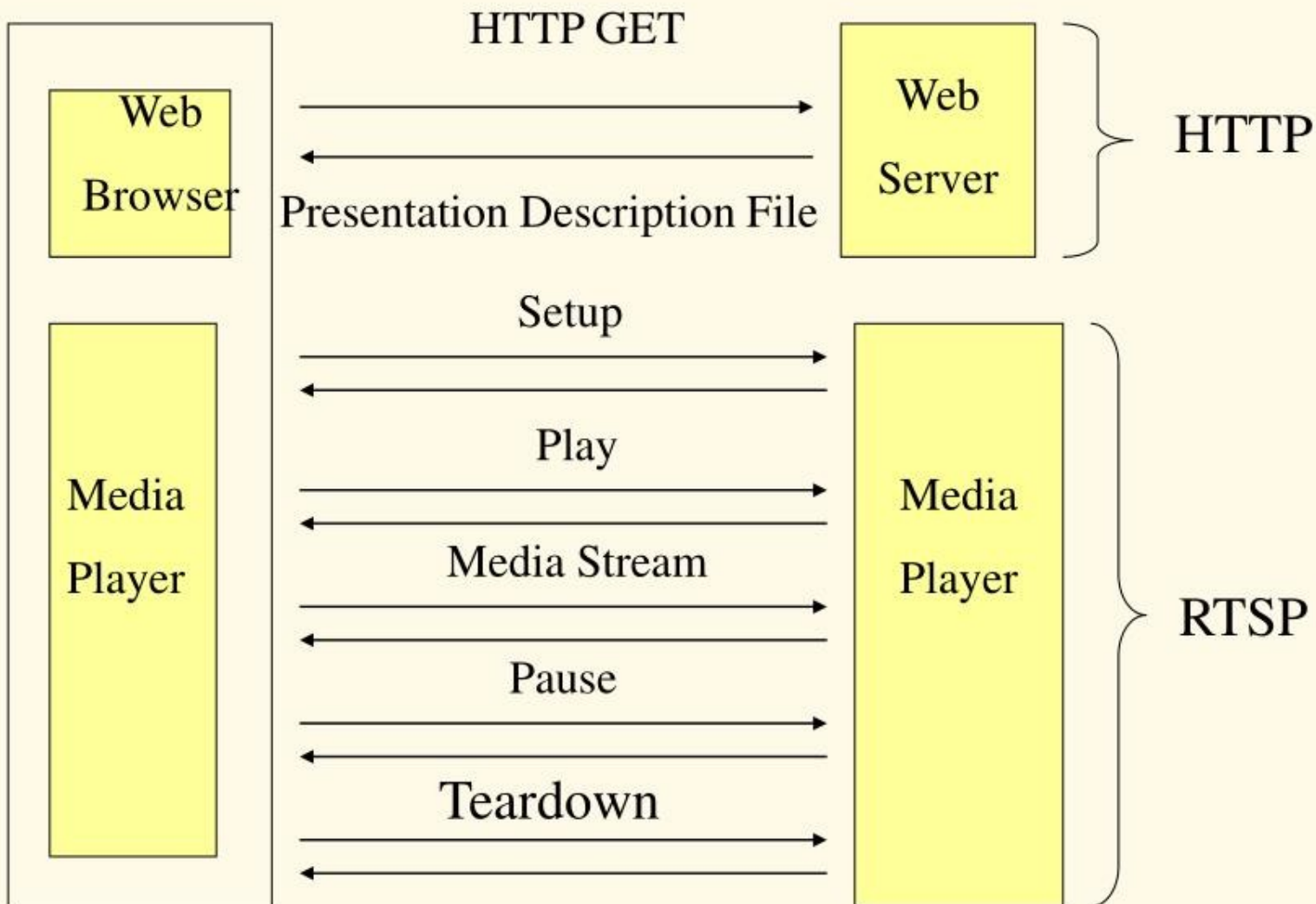
- ❑ RTSP is a industry standard Internet application level protocol
- ❑ RTSP is a framework for delivering and transmission of multicast data stream
- ❑ RTSP is a protocol that allows a media player to control the transmission of a media stream for exchanging control information

# A1. RTSP Features

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- ☐ RTSP works in the conjunction with RTP to deliver streaming audio & video content
- ☐ RTSP maintains a server state during transmission unlike HTTP
- ☐ Client-Server architecture
- ☐ Overcome the limitations of HTTP
- ☐ RTSP enhance HTTP functions
- ☐ RTSP provides the synchronization of events

## A2. RTSP Operation



## A3. RTSP Message Format

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|                       |
|-----------------------|
| <b>Start Line</b>     |
| <b>Message Header</b> |
| <b>.....</b>          |
| <b>Message Header</b> |
| <b>CRLF</b>           |
| <b>[message body]</b> |

Request-Line

|               |           |                    |           |                     |             |
|---------------|-----------|--------------------|-----------|---------------------|-------------|
| <b>Method</b> | <b>SP</b> | <b>Request-URI</b> | <b>SP</b> | <b>RTSP-Version</b> | <b>CRLF</b> |
|---------------|-----------|--------------------|-----------|---------------------|-------------|

Status-Line

|                     |           |                    |           |                      |             |
|---------------------|-----------|--------------------|-----------|----------------------|-------------|
| <b>RTSP-Version</b> | <b>SP</b> | <b>Status Code</b> | <b>SP</b> | <b>Reason Phrase</b> | <b>CRLF</b> |
|---------------------|-----------|--------------------|-----------|----------------------|-------------|

Header

|                   |          |                    |             |
|-------------------|----------|--------------------|-------------|
| <b>Field-name</b> | <b>:</b> | <b>field-value</b> | <b>CRLF</b> |
|-------------------|----------|--------------------|-------------|

## B. RTP

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- ❑ RTP is used to transmit real-time data
- ❑ RTP encapsulate segments

| Payload Type | Sequence number | Timestamp | Synchronization source identifier | Misc |
|--------------|-----------------|-----------|-----------------------------------|------|
|--------------|-----------------|-----------|-----------------------------------|------|

## 3.1.3. Client Resources

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### ☐ ***Hardware and Software***

- A. Used with/or not Web Browser : Opera, IE, Mozilla, etc**
- B. Media Player : Client software (windows media player, flash player, Netmeeting)**



## 3.2. Communication

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- ☐ **Broadcast**
- ☐ **Unicast**
- ☐ **Multicast**

# A. Broadcasting

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- ☐ A single stream is transmitted to all clients on the network.
- ☐ To understand what broadcast means, one need only think about our traditional use of the term “broadcast media,” where the network is a cable or satellite system, or the airwaves, and the clients are television or radio receivers.
- ☐ Because only a single stream is transmitted, all the clients that are “tuned in” experience the same portion of the media program, at the same time, whether the program is live or pre-recorded.

## B. Unicast

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- ❑ A unicast is a one-to-one “narrowcast,” in which each end-user gets a separate stream—even if they are experiencing the same media simultaneously.
- ❑ Because they each get their own stream, end-users *can be given options for controlling the media, such as the ability to pause the stream, replay portions, or to jump to a different part of the program.*
- ❑ This type of control is, however, only possible with pre-recorded content made available on-demand, and this flexibility comes at the expense of both server capacity and bandwidth—every end-user must be served and sent a discrete stream.

## B. Unicast

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- ❑ In a unicast, each client initiates its own stream, generating many one-to-one connections between client and server.
- ❑ Although this can result in heavy network traffic, unicast is the most reliable technique for delivery over the Internet, since no special network transport is required.

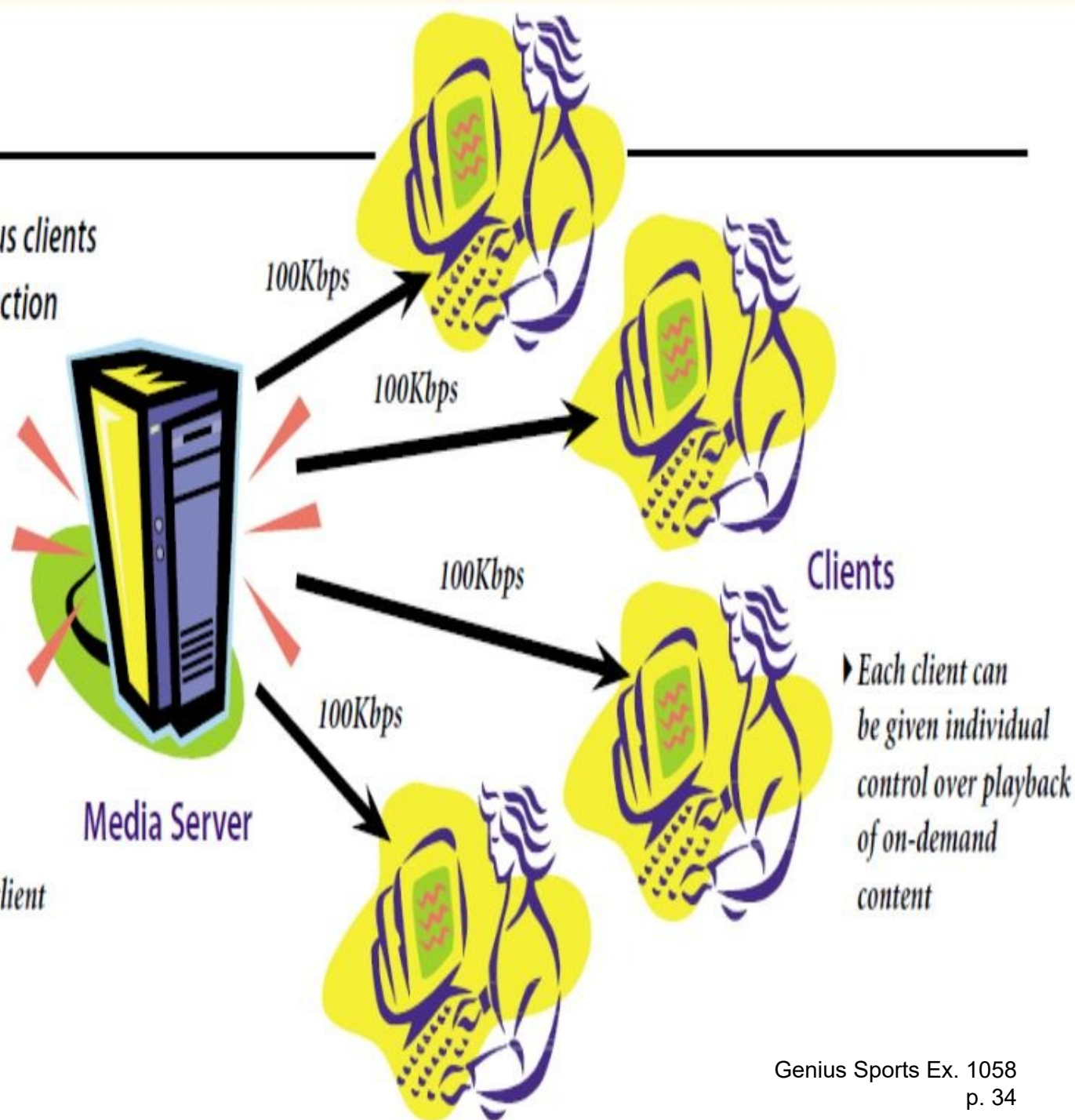
# Unicasting

4 x 100Kbps simultaneous clients  
requires **400Kbps** connection  
from server

► Best choice for  
on-demand media

► Each client gets a different  
stream, even if they are  
watching the same movie

► Heavier load (CPU and  
bandwidth) on server per client



► Each client can  
be given individual  
control over playback  
of on-demand  
content

## C. Multicast

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- ❑ Multicasting, or “IP multicasting,” is also considered a narrowcast strategy, and it is designed to conserve both server processing capacity and bandwidth.
- ❑ The server transmits only one stream, which is replicated by special routers throughout the network, to be distributed to groups of multiple end-users.
- ❑ Multicasting does not allow the same flexibility for the end-user as does unicasting—every end-user must experience the same content concurrently.

# C. Multicast

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- ☐ In a multicast, each client tunes in to the same stream, much as a radio tunes in to an FM broadcast.
- ☐ The single multicast stream is sent to a group address, which can be accessed by many client computers simultaneously.
- ☐ This minimizes network congestion because it uses a fixed amount of bandwidth, regardless of the number of client connections.
- ☐ However, multicast delivery requires special network capabilities: The network must be multicast enabled for content distributed within a contained private network; or it must have access to the multicast backbone

# Multicasting

4 x 100Kbps simultaneous clients  
requires **100Kbps** connection  
from server

- ▶ Best for live or scheduled media
- ▶ Each client gets the same stream
- ▶ Conserves CPU processing power and bandwidth at server

