



# Video Streaming

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## Program:

- **Module 1:**

- What is streaming?
- Video and Internet
- Transmissions protocols

- **Module 2:**

- Shooting, Capturing, Editing, Serving, Playing;
- Technologies;
- Resources and case studies;



# What is streaming?

## Streaming concept

Streaming was first introduced by **RealNetworks** some years ago.

It consists of a technique for **making video, audio and other multimedia available quickly via the Internet.**

The advantage of streaming is that it can enable easier access to multimedia resources.

Another possibility is the integration of video and audio with other web-based applications, such as chat and other real-time collaboration tools.



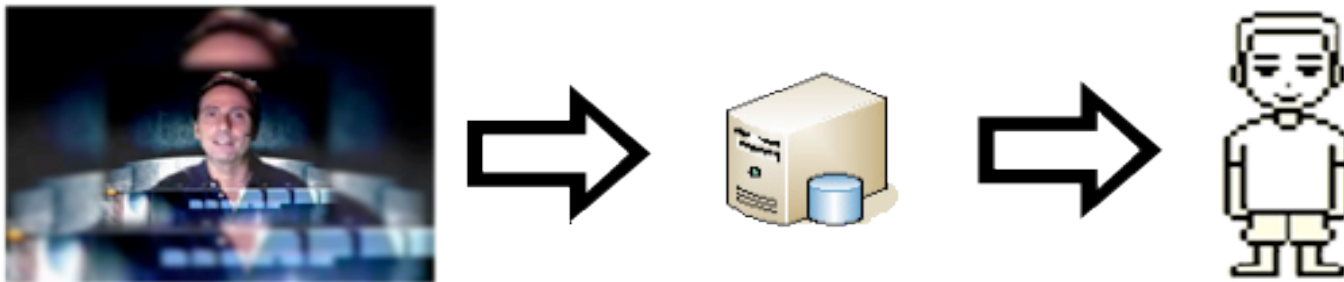
realONE

# What is streaming?

Streaming vs. downloading

## What Is The Difference Between Downloading and Streaming?

When you **download** a video, you have to copy the entire file to your hard disk before you can play it.



# What is streaming?

Streaming vs. downloading 2

## What Is The Difference Between Downloading and Streaming?

When the video is **streamed**, there is a small wait as the stream 'buffers' but there is no need to save the file.

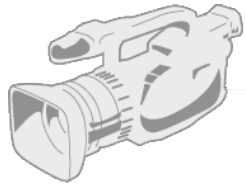
**Streaming** is the act of sending media files (audio and/or video) over the Internet from one computer to another computer so that **the media plays as it is being delivered**.





# What is streaming?

## Streaming categories



### **Live**

When an event is delivered via the Internet **at the same time** it is happening.

Example: live concerts, live radio, videoconferences.



### **On Demand**

When the event is recorded on a digital support and saved in a server and **after** made accessible by Internet users.

Example: video clips, movies trailers.



# Recap of Streaming Media

- Why using this technology?
  - To overcome limitations of WWW.
- What is streaming media?
- Streaming is not
  - Download all before playback is able
  - Media created with software like Macromedia Flash.
- Major streaming formats
  - Microsoft Windows Media
  - Real Networks
  - Apple Quicktime



# Streaming Video

- Progressive streaming
  - Download a compressed video file to your hard drive via HTTP over the Internet
  - Use standard web server
  - Quality is better than real-time streaming
- Real-time streaming
  - Don't need to download the entire video before playing
  - Require a special streaming server





# Why Streaming Media?

- No waiting for complete downloads.
- Streamed files are not written to disk.
- Presentation of live events is possible.
- Enhance static web pages.

# Video and Internet

Possible applications

Internet radio

Internet tv

E-commerce website

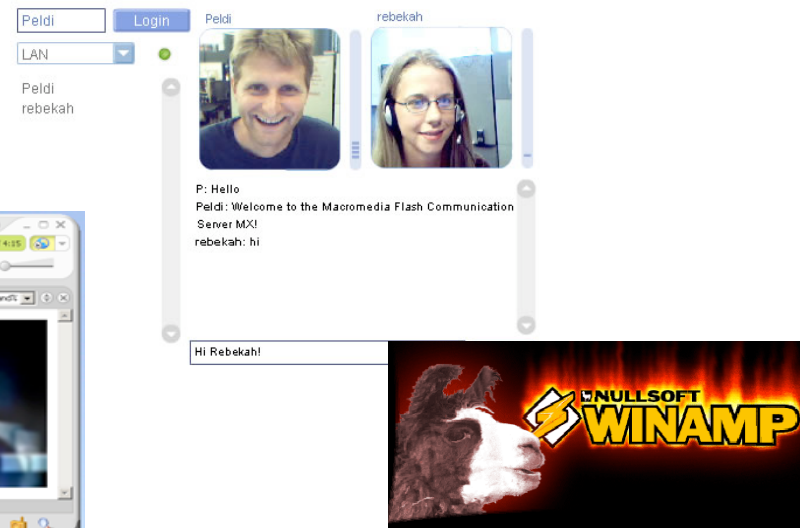
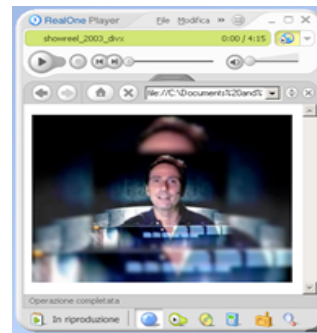
Training video

Video conference

Remote presence

Classroom setting

Realtime collaboration



**Audio + video + animation = multimedia**

**mouse + keyboard + user = interaction**



**RIA**

Rich

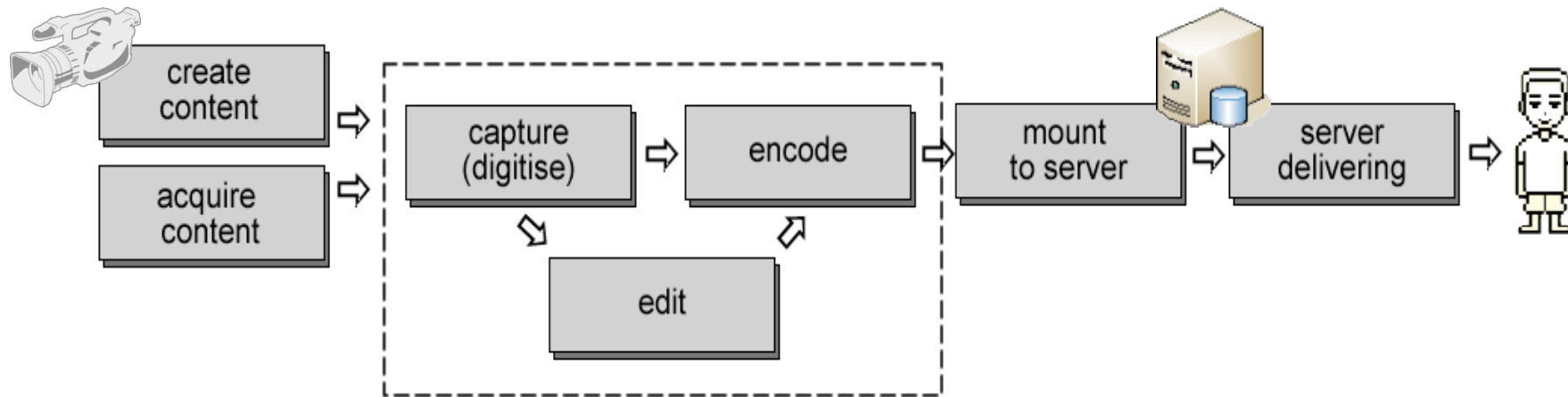
Internet

Applications

# Video and Internet

How does streaming work?

## The streaming media development process



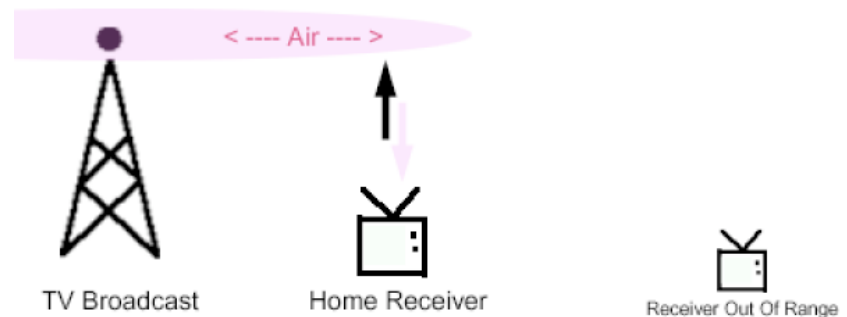
# Video and Internet

How does streaming work?

## How Is Streaming Different From Broadcasting?

### Delivery of broadcast TV:

- Broadcast “blankets” the area with its signal (persistent);
- TVs are standardized by region. Every TV knows how to receive TV Broadcast;
- Any TV can “reach up and grab” broadcast signal and pulls it down to set;
- broadcast doesn’t reach every “air” is (line of sight);
- TVs outside the broadcast line of sight can’t grab signal



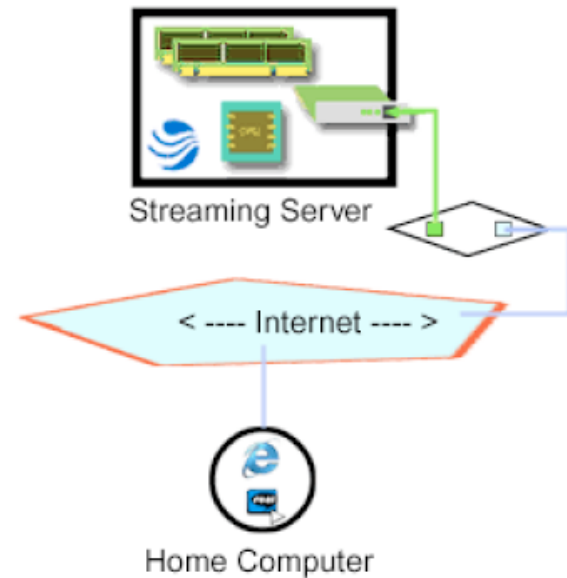
# Video and Internet

How does streaming work?

## How Is Streaming Different From Broadcasting?

### Delivery of streaming video:

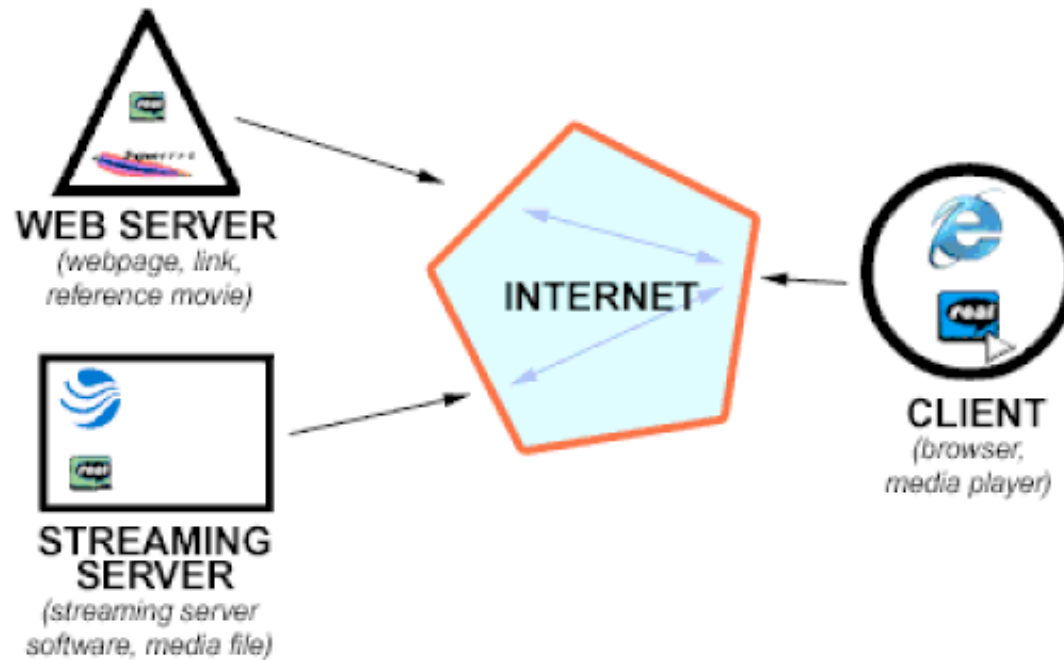
- server only sends signal out to computers which want it (signal is not persistent);
- computer media players are not compatible with one other;
- computer must request video stream. Media player must be compatible;
- No physical barriers: stream can reach anywhere on the Internet;
- Computers must meet minimum bandwidth requirements



# Video and Internet

How does streaming work?

## Streaming media playback in theory



## ■ Web bandwidth

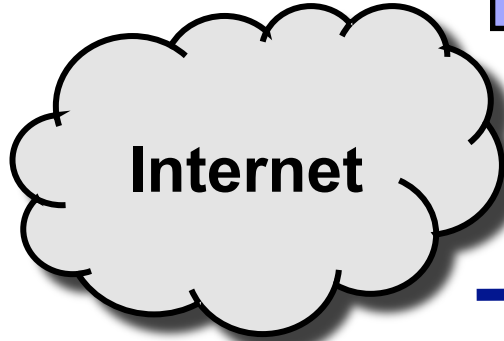
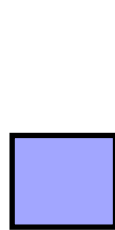
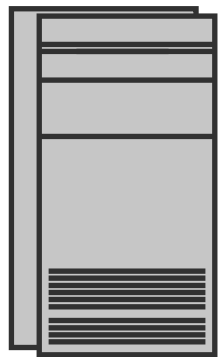
Connection	Rated	Typical throughput	Safe bets
28.8 modem	28.8 Kbps	2.4 KB/second	2 KB/second
56K modem	53 Kbps	4.8 KB/second	4 KB/second
Dual ISDN	128 Kbps	12 KB/second	10 KB/second
DSL	384 Kbps	35 KB/second	30 KB/second
T1	1.54 Mbps	150 KB/second	50 KB/second
Cable modem	6 Mbps	300 KB/second	50 KB/second
Intranet/LAN	10 Mbps	350 KB/second	35 KB/second
100base-T LAN	100 Mbps	500 KB/second	50 KB/second

*Kbps = kilobits per second • Mbps = megabits per second • KB/second = kilobytes per second*

Source: <http://www.adobe.com/products/aftereffects/pdfs/AdobeStr.pdf>

# Internet Media Streaming

Media Server



DSL

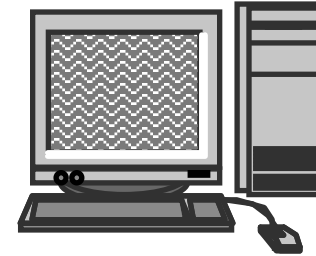


56K modem



wireless

Streaming client



Best-effort packet network

- low bit-rate
- variable throughput
- variable loss
- variable delay

## Challenges

- **compression**
- **rate scalability**
- **error resiliency**
- **low latency**





# 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 (Real Time Streaming 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.

## **RTP protocol**

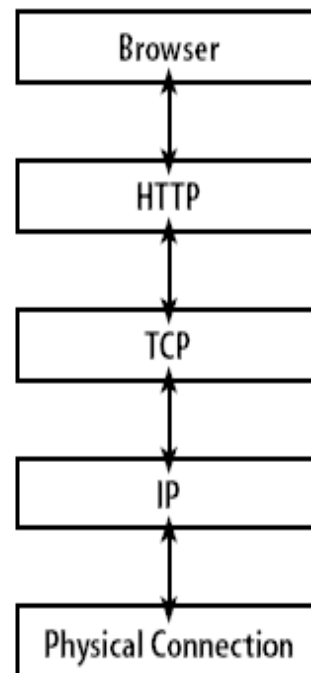
Layered on top of UDP, so there's no error handling or reliability. One-to-one or one-to-many (original goal) transmission. Includes payload type identification, sequence numbering and time stamping (SMPTE timecode).

## **RTSP protocol**

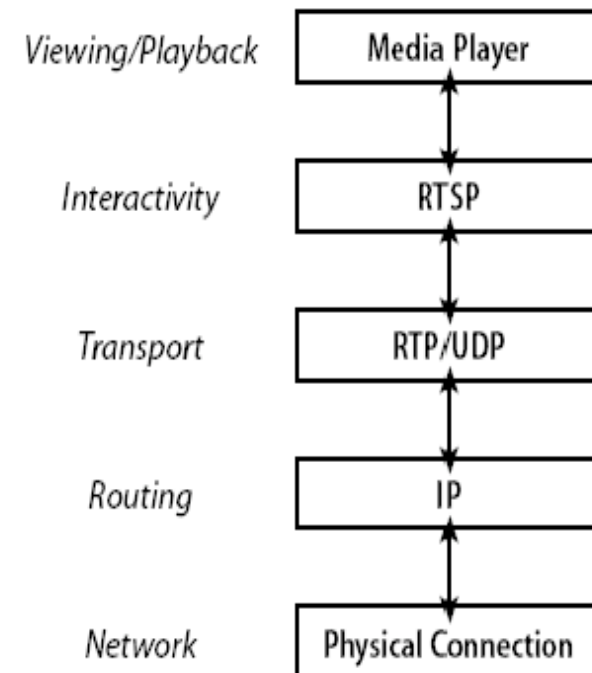
based on TCP for communication and usually layered on top of RTP, it is dedicated to streaming. By this protocol you can control the file time "duration", which can be played with different speed, can be controlled by the server, can be stopped and played again, and its playing can be changed at runtime depending on different parameters.

- RTP is one way stream, RTSP enables control of streaming media (two way, like HTTP)

Viewing a Web page



Experiencing Streaming Media





# Transmissions protocols

- RTSP (Real Time Streaming Protocol)  
high priority on continuous streaming rather than on absolute document security
- RTMP (Real Time Messaging Protocol)  
Is a proprietary protocol developed by Adobe Systems used with Macromedia Flash Media Server to stream to the Adobe Flash Player client.
- MMS (Microsoft Media Server).  
This server cluster is able to handle up to 30,000 20k streams concurrently



# Transmissions protocols

- TCP
- UDP

- **RTSP (RealTime Streaming Protocol)**

- Real Networks
  - QuickTime
  - Windows Media (default)

- **MMS (Microsoft Media Server)**

- Microsoft
  - MMSU/MMST
  - MSBD (Media Stream Broadcast Distribution)

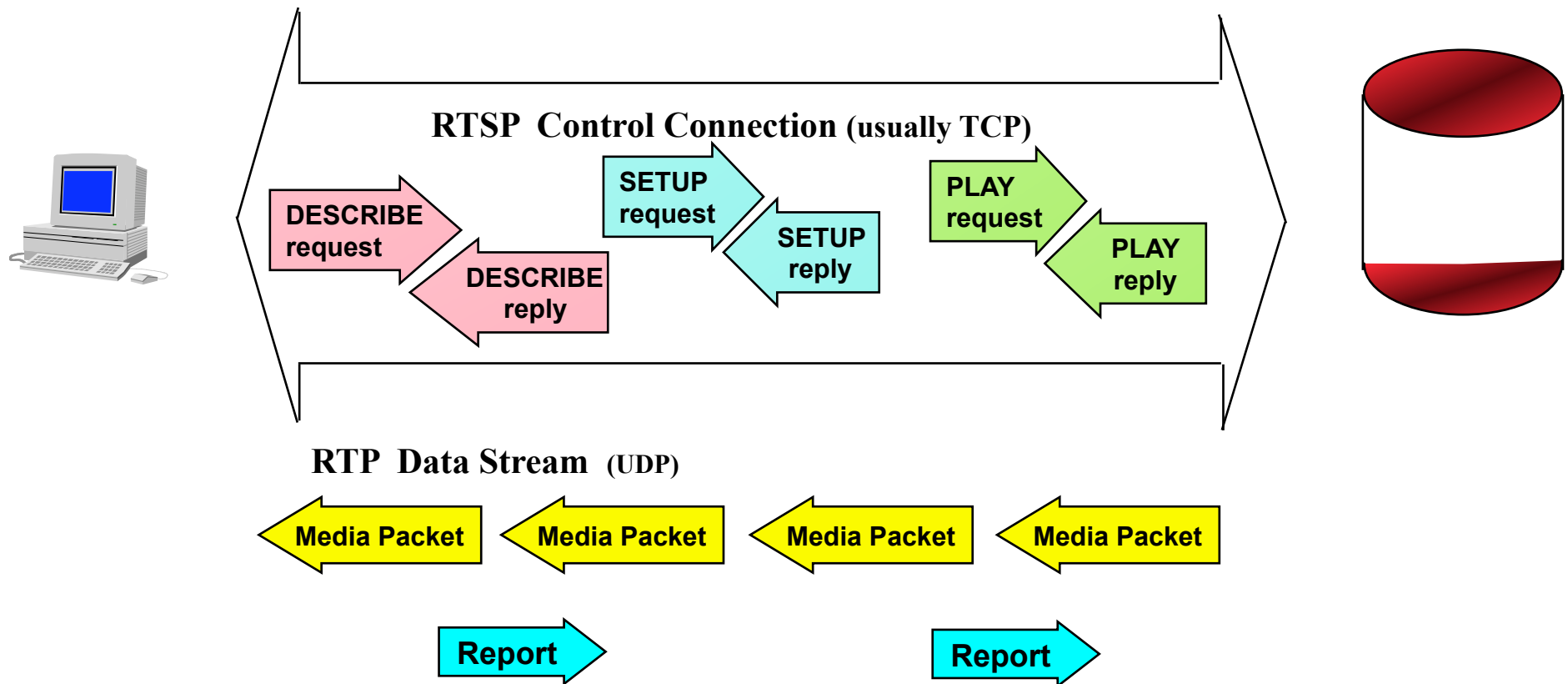
- **RTMP (Real Time Messaging protocol )**

- Macromedia Flash

- **HTTP**

- slower
  - transparent to firewall
  - lack of streaming functionalities

# RTSP / RTP

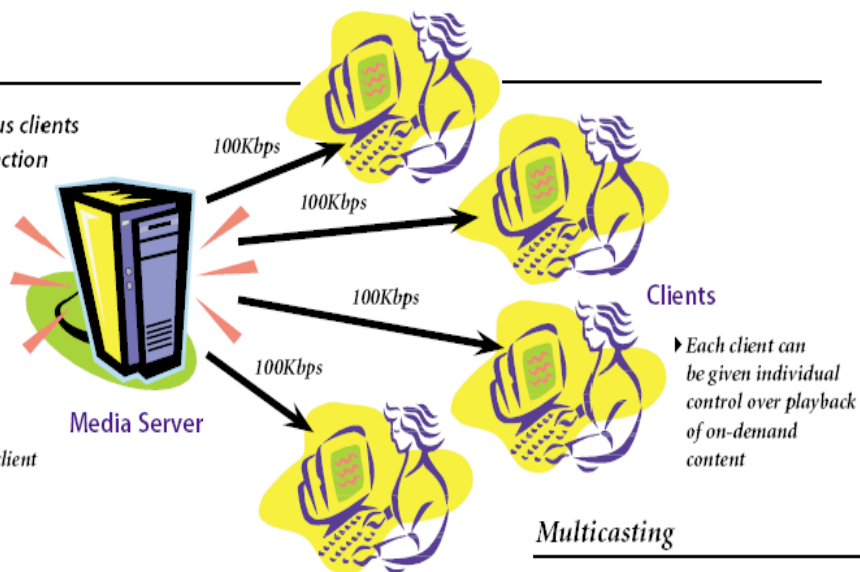


# Unicast vs. Multicast

## 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

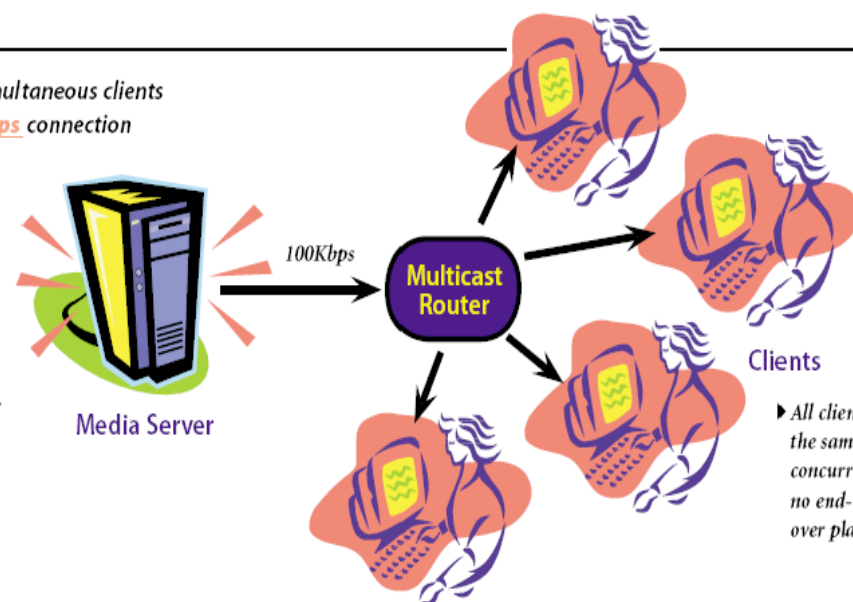


▶ Each client can be given individual control over playback of on-demand content

## Multicasting

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

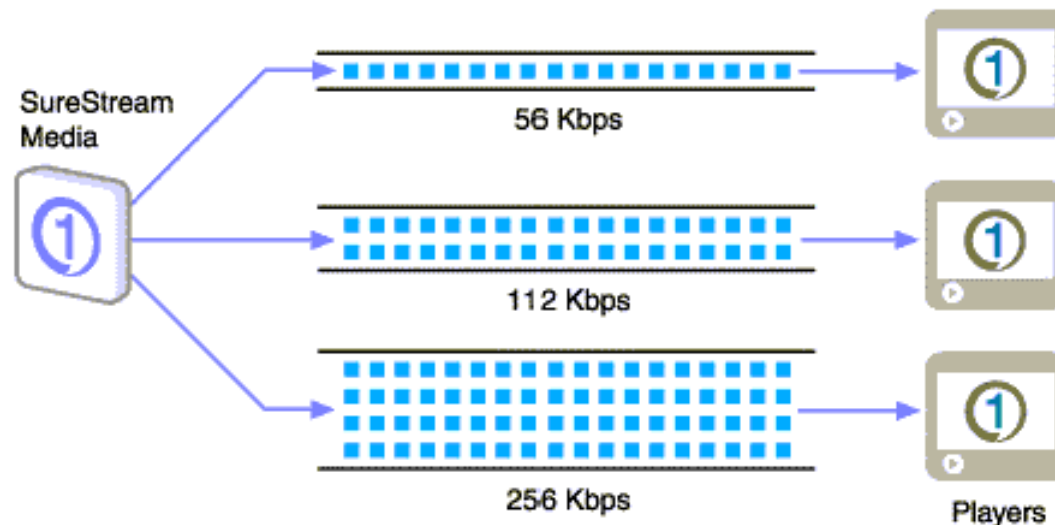
- ▶ Best for live or scheduled media
- ▶ Each client gets the same stream
- ▶ Conserves CPU processing power and bandwidth at server



▶ All clients playback the same content concurrently, with no end-user control over playback

# Multiple Bit Rate Encoding

- Combine several different streams into a single file
- The appropriate bit rate stream is automatically selected





# The development process

## Content planning 1

- Narrative

like conventional film and television, video streaming is all about telling stories.

- What is special about streaming?

unlike conventional film, some media are often displayed and used with other web resources such as web pages, animation, and messaging, which enrich the user experience. In addition, in digital media there is less emphasis on sequential narrative

- Scripts and storyboards

What you have to say (script) and what do you want to show (storyboard)





# The development process

## Content planning 2

-Shooting video for streaming

How you actually shoot your subject depends on the subject and how you intend to use the video.

Some tips to consider for a single lecturer for example:

- Composition
- Timing
- Movement
- User-orientation

# The development process

## Content planning 3

-Preparing for filming

Live broadcasts

Location

Shooting the subject  
close up

Shooting for streaming  
keep it simple !

Simple background

Tips for shooting

even lighting

not too much action or camera movement

The presenter



# The development process

## The equipment

Video camera  
Tripod  
Microphone  
Lights  
Capture card  
Computer  
Encoding software  
Streaming server



Shaky camera:  
troubles  
for the  
encoder



# The development process

## **Capturing the video**

What computer hardware will you need?

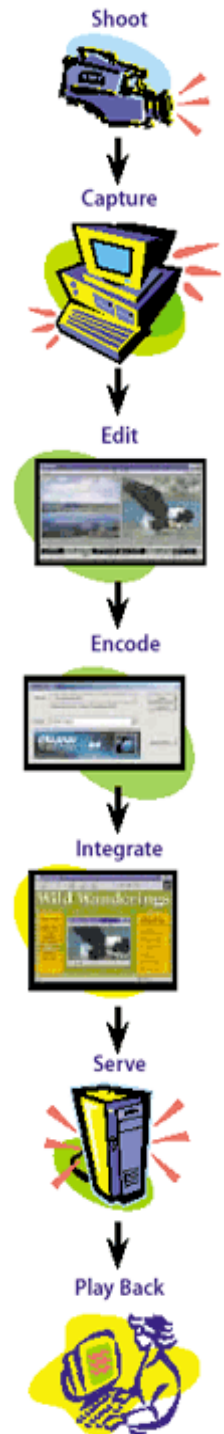
Capturing from digital

Capturing from analogue

What software will I need?

# Capturing Video

- Get all data to the computer digitally.
- Use highest possible quality settings.
- 25 fps for video and 16-bit for audio is suitable.





# Capturing Video tips

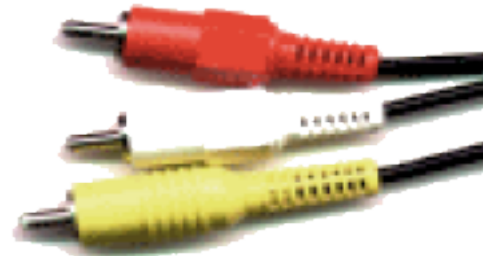
- Resize the frame at 4:3 ratio when digitizing it
  - Keep width and height multiple of 16, for the codec
  - Eventually crop some pixels before resizing, to keep aspect ratio
- Deinterlace



# The development process

## Alternatives to filming

- Existing video material resources
- Audio only
- Screen capture software
- Macromedia Flash





# The development process

## Editing

-Editing tips for streaming

Save an original copy

File formats

deinterlace: it's frame not field !

Crop the film

multiple of 16x16

Reduce the picture size.

Do not use too many special effects

titles outside of video frame

Keep the clips short

Avoid background sounds such as music or talking

Enhance the audio signal





# The development process

- **Encoders and players**

- Encoding, two main questions:

What media player will be used (e.g. Windows Media Player, RealOne media player, Flash)?

What Internet connection speed will be available?

There is usually the option of delivering different quality of streams to users with different connection speeds.

- Use the multiple bit rate encoding features of the streaming encoder



# Edit

- Adobe Premiere – tool for digital video editing
  - Put clips together
  - Make transitions
  - Add effects
  - Adding sound
- Compose a video production for streaming



# Some Advices :

- Don't add too much effects (transitions, dissolves, 3D-text etc.)
- Sometimes video sequences could be replaced with slow-motion or still images
- Make titles large and simple
- Audio



# Integration With SMIL

- SMIL let you choreograph rich media presentations
- SMIL is to streaming servers what HTML is to web servers
- You bring together your presentations using SMIL
- RealNetworks supports SMIL in its player
  - Also IE  $\geq$  5.5 supports SMIL in HTML files



# Technologies



realONE.





# Technologies

## ■ Real Networks

- RealPlayer
- RealProducer
- RealServer
- Helix OpenSource

## ■ Microsoft (WMT)

- WindowsMediaPlayer
- WindowsMediaEncoder
- WindowsMediaServer

## ■ Apple Quicktime

- Quicktime Player
- QuickTimeStreaming Server
- Darwin OpenSource

## ■ Macromedia Flash

- Flash Player
- Communication Server Mx



- Macromedia/Adobe uses On2 VP6 or Sorenson codec for Flash video (FLV)
- Flash video does also real streaming
- Note: Google Video/YouTube use Flash video (and also all the other video sharing services: the player is embedded in the web page)



# Streaming Server

- To use real time streaming you must use specific streaming servers.
- To upload data to a streaming server, you must save the data in a data type format that the server is able to stream.
- For example, SMIL -file.





# Streaming Server...

- Microsoft, Real networks and Apple also provide streaming servers.
- Streaming servers for real time streaming do not use the same protocols as an ordinary HTTP server.



# Pros of Streaming Servers

- Can broadcast and multicast (one stream to many users)
- Doesn't leave a copy of the users hard drive (if the user does not use streaming capture programs...)
- Bandwidth usage can adjust to conditions



# Cons of Streaming Servers

- The data that get lost in the transmission get lost forever
- Playback or data can be delayed or disrupted because the data rate gets bigger than the bandwidth
- Firewalls may not allow streaming files pass



# Streaming Media Today

- Is used for movie trailers
- Live broadcasting



# The Future

- If the user has a fast connection, streaming media is a practical way for broadcasting multimedia
- The future for streaming is bright
- Entire movies can probably be streamed
- The technology will be improved
- Distance courses by streaming media