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RESEARCH UNIVERSITY
EXCELLENCE INITIATIVE
Ministry of Science and Higher Education

Connectionless Streaming of Multimedia Content

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Introduction – What Is Media Streaming in Practice?

- *"Multimedia that is constantly received by and presented to an end-user while being delivered by a provider"*
- Providing **multimedia information** (usually: on request)
- **Transmission of compressed multimedia data** over the **Internet**

Streaming Technology

Two Types of Access to Streaming Media

Live (Broadcasting)

» Video **captured** on **server**

» All users watching same video

» Example: **live** concert streaming

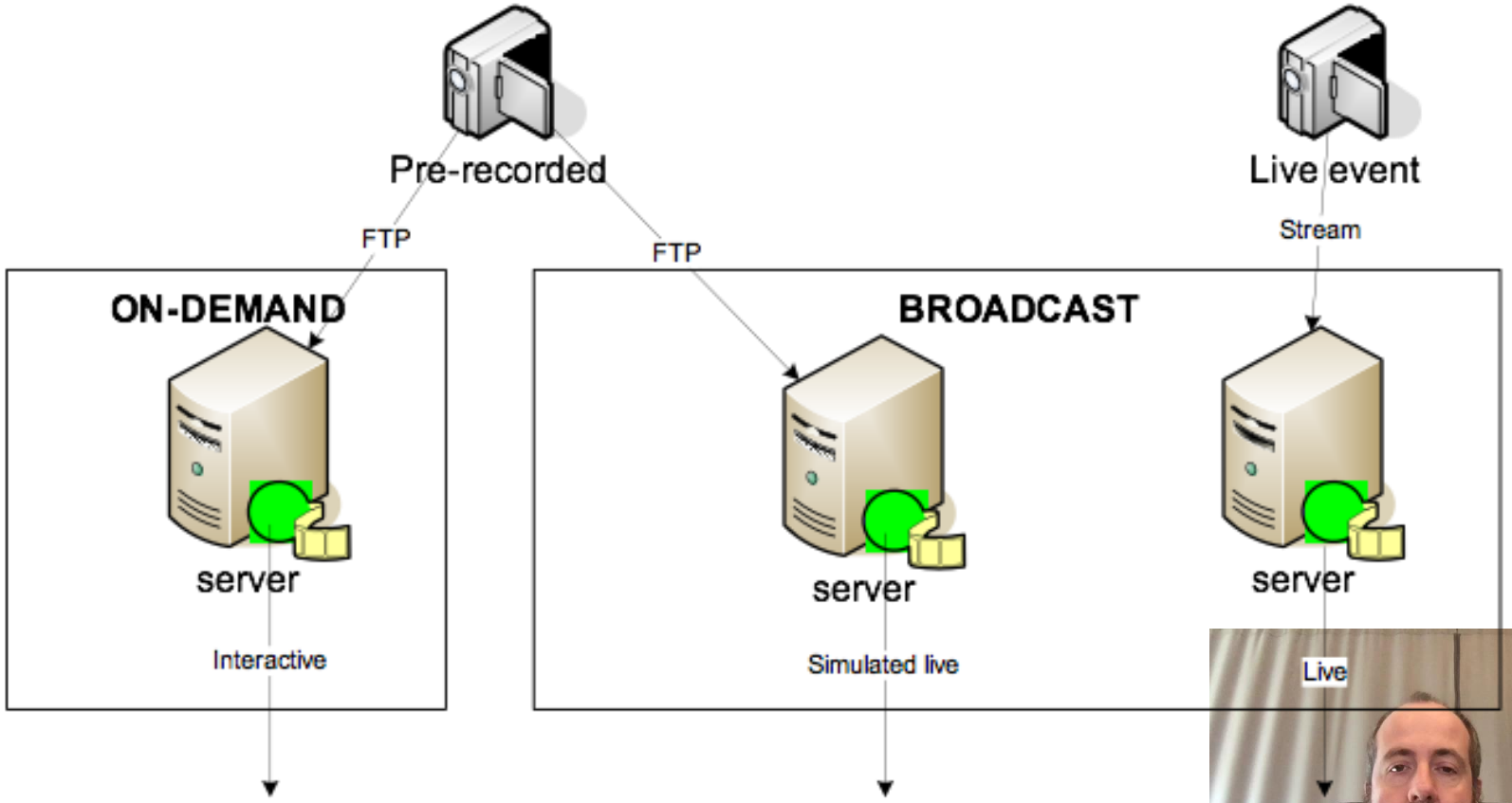
On Request (on Demand)

» Video **stored** on **server**

» Each user choose video to watch

» Example: **VOD** movie streaming

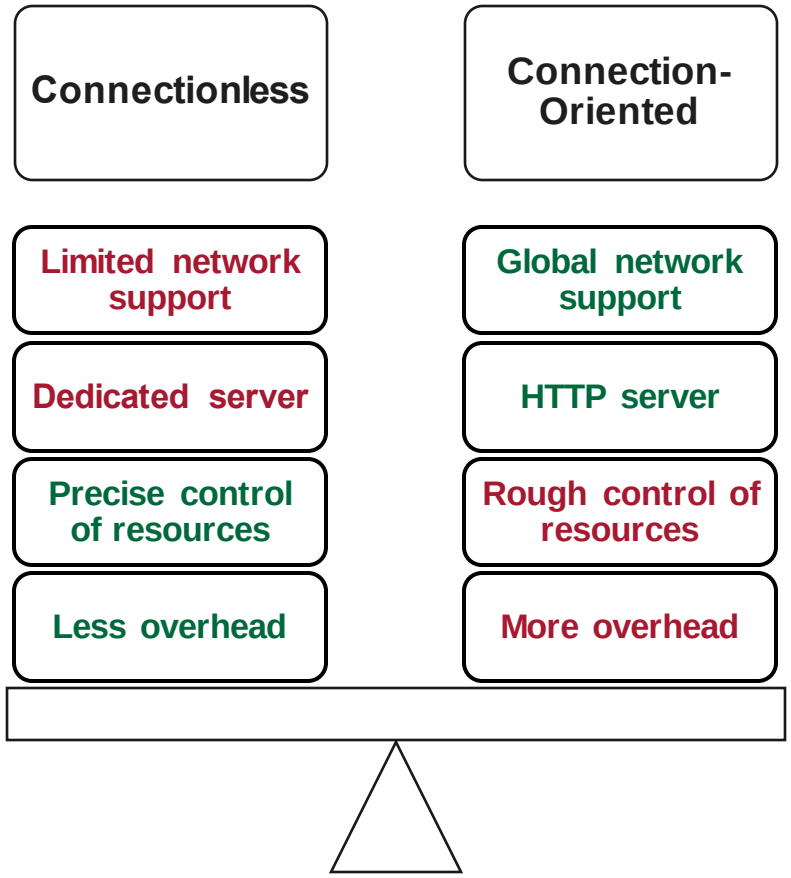
Serving:
Live Broadcasting & On-Demand



What Do We Actually Expect from „Video Service”?

- What happens when you click?
  - Download
  - Playback
- How advanced control?
  - Only ▶ (“Play”)
  - Full media controls:
    - ▶ (“Play”)
    - □ (“Pause”)
    - □ (“Stop”)
    - ◀◀ (“Rewind”)
    - ▶▶ (“Fast forward”)
- And if we have excess bandwidth?
  - Download „in advance”
  - Reallocation of resources to other users
- And if network, will not handle this?
  - Wait until buffered
  - We accept breaks in transmission

Communication?



Introducing Real-Time Streaming Protocol (RTP)

- Transport layer **protocol** for real-time streaming media…
- Not a standalone protocol
- Requiring another transport protocol to combine with:
  - Theoretically: any transport protocol
  - Practically: used only with **User Datagram Protocol (UDP)**
- Inheriting **UDP** features, including support for both **Unicast** and **Multicast** transmissions
- **UDP+RTP** – good multimedia transport protocol
- **RTP** header located between **UDP** header and **UDP** payload **(but not another network layer!)**

RTP and Quality of Service (QoS)

- No guarantee for **QoS** in **RTP**
- QoS guarantees through cooperation with other protocols, such as:
  - **Real-Time Streaming Protocol (RTSP)**
  - **Session Initiation Protocol (SIP)**
  - **H.323**
  - **Resource Reservation Protocol (RSVP)**
- Their task: to establish a connection before data can be transmitted using the RTP

RTP Limited “Real-Time”

- **Does not** reserve resources
- **Does not** guarantee QoS for real-time services, including:
  - Packet delivery (at all)
  - Scheduled packet delivery (even in lower layers do guarantee)
  - Ordered packet delivery
- **But extends UDP** with information on:
  - Type of transmitted data
  - Timestamp
  - Serial number (of packet)

RTP Sequential Number

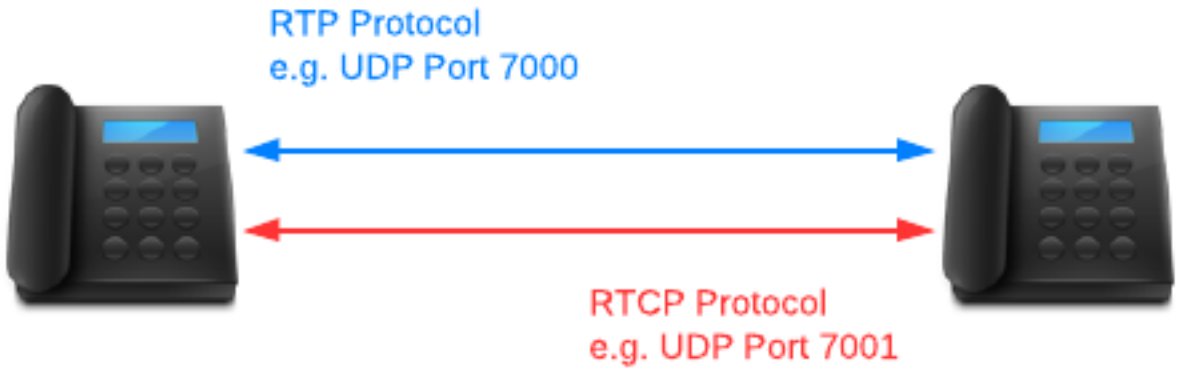
- Sending packet order **possible** to reconstruct at receiver
- **Possible** to correctly localize packet in stream (e.g., without decompressing video frames)

Applications of RTP

- Multipoint audio/video-conferencing (primary application)
- **Voice over IP (VoIP)**
- **Video on Demand (VoD)**
- Other applications of audio/video
- Distributed simulations
- Games
- Monitoring
- Other applications having access to real-time data

RTP Control Protocol (RTCP)

- *Not to be confused with **Real Time Streaming Protocol (RTSP)***
- **RTP** transport controlled by **RTCP**
- Main additional functionality by **RTCP** – QoS monitoring for volumes of data transports
- **RTP** and **RTCP** working simultaneously



Real Time Streaming Protocol (RTSP)

Application layer **protocol** to control **streaming media server**

„Network remote control” for **multimedia servers** and more

Negotiating:

- Communication (**Unicast**, **Multicast**…)
- Transport protocols (**UDP**, **RTP**, **HTTP**…)
- Codecs…

Syntax similar to **HTTP**, but supports states

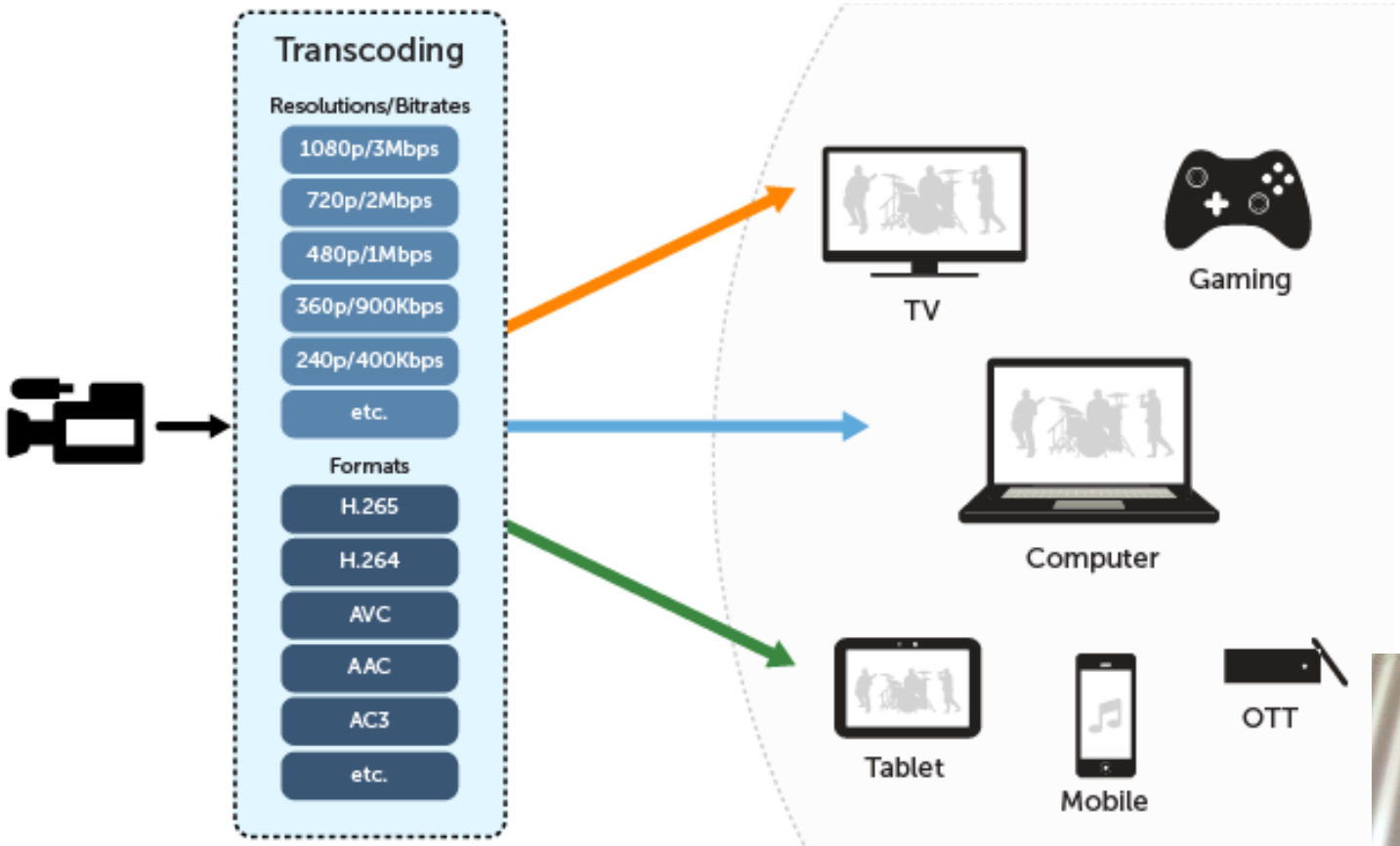
Transporting Content to Various User Devices

- TV sets
- Set-top boxes
- Video game consoles
- Computers
- Tablet computers
- Smartphones
- Smartwatches

Transcoder

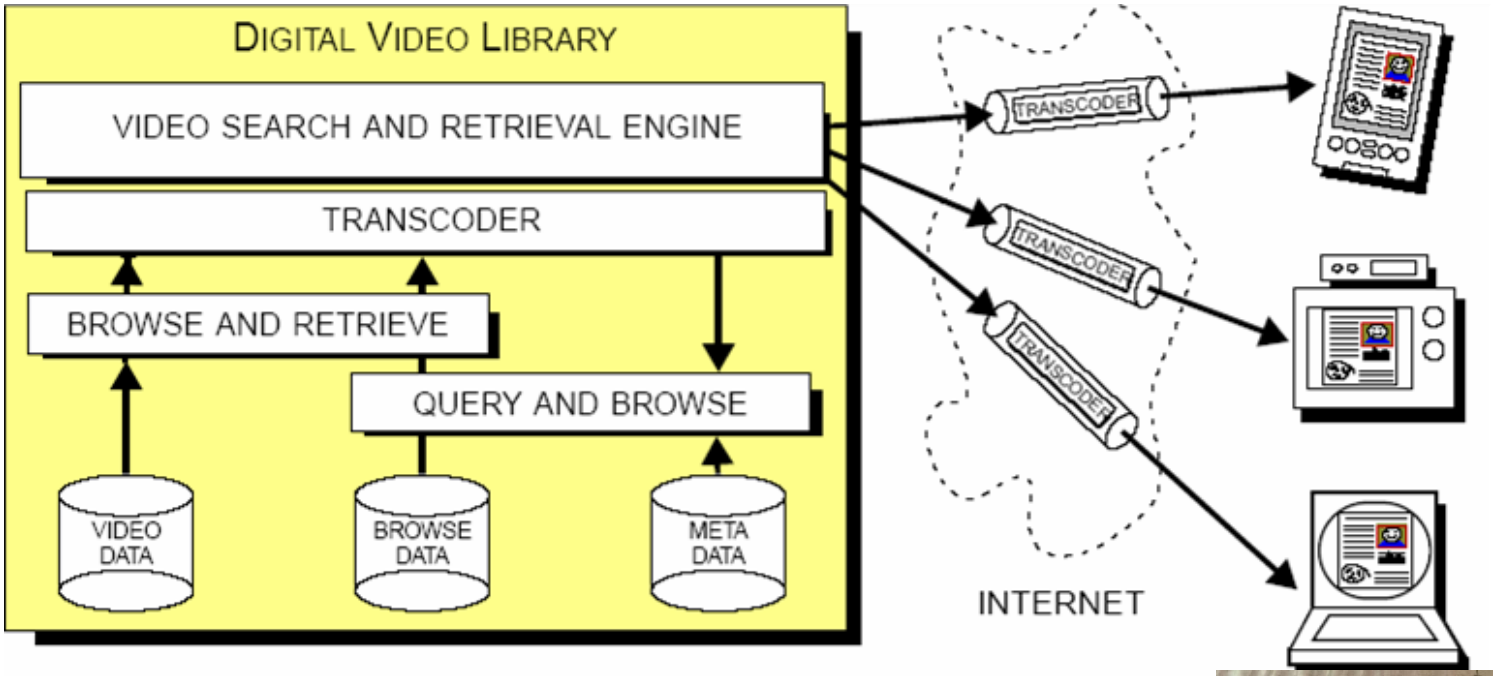
- Various technical limitations for:
  - **Screen size and type**
  - **Processor**
  - **Memory for buffering**
  - **Communications**
  - **Power source**
- **No** universal digital video signal directly available for all kinds of devices
- Solution: **transcoder**

Transcoding for Live Video Streaming



Source: Wowza Media Systems

Transcoding Architecture



Based on: J. R. Smith, "Digital video libraries and the Internet"