Telematics Homework #9

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Classes of Multimedia Applications

 Q: Name and characterize three classes of multimedia applications. Add one example for each class.



Classes of Multimedia Applications (cont'd)

Stored streaming

- Media already present (stored) at the source
- Streaming: Media is transmitted to the client in time for playout
- Client can already begin playout before all the data is transmitted
- Interactivity: VCR-like functionality (e.g. pause, rewind, forward, ...)
- ∘ Example: YouTube, Hulu



Classes of Multimedia Applications (cont'd)

• Live streaming

- Media is streamed while it is being produced
- Streaming: Media is transmitted while being recorded, small gaps (tens of seconds) possible
- Client can begin playout as soon as enough buffered data is available
- Interactivity: Forward skipping not possible, other functions (pause, rewind, ...) possible
- Example: ffn.de, zattoo.com



Classes of Multimedia Applications (cont'd)

- Real-time interactive streaming
 - Media is streamed while it is being produced (at multiple sources)
 - Streaming: Media needs to be transmitted immediately (real-time)
 - Client must playout media as soon as possible (e.g. audio should have < 400ms end-to-end delay)
 - $_{\circ}~$ Interactivity: Live audio/video interaction
 - Example: Skype, Google Talk



UDP vs. TCP

 Q: Discuss the usage of UDP vs. TCP to stream multimedia.

UDP

- Unreliable, no retransmissions
 - \rightarrow Error recovery has to be handled on application level (if time permits)
- $_{\circ}$ Oblivious to network congestion
 - \rightarrow Sending rate = encoding rate
- $_{\odot}\,$ Difficulties to pass firewalls/NATs



UDP vs. TCP (cont'd)

• TCP

- Reliable data transfer
 - \rightarrow Retransmissions occur (and introduce delay) whether application likes it or not
- $_{\circ}$ Yields to network congestion
 - \rightarrow Sending rate <= encoding rate
- Passes more easily through firewalls/NATs



UDP vs. TCP (cont'd)

∘ UDP

- Well suited for media with short playout delay (no time for retransmissions anyway)
- Not well suited if reliable data transfer is important
- \circ TCP
 - Suited for media with long playout delay
 - Easier to pass firewalls/NATs with



Buffering

- Q: Assume a multimedia application streams data with a constant bit rate of 1Mbs. The network delay is between 0 and 2 seconds. How long does a client have to wait before it can begin to playback the stream and how much data does it have to buffer.
- The client has to wait 2 seconds and buffer
 2Mb at most





- Q: What is the purpose of RTSP? Explain briefly how it works.
- The Real Time Streaming Protocol (RTSP) is a control protocol for media streams
- It transmits commands such as play, pause, fast forward, ...
- It does not transmit the media itself (other protocols such as RTP do that)





 Q: Illustrate how a voice call is established using the Session Initiation Protocol.



SIP (cont'd)





Thank you

Any questions?

