

# Communication Networks 2

## Exercise 8 - Streaming



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### Problem 1 RTP / RTCP

What does RTP/RTCP stand for and how do the 2 protocols interact? What is RTP used for? Why is there no retransmission mechanism integrated in RTP?

Solution:

RTP stands for *Real-Time Transport Protocol*, RTCP is short for *Real-Time Transport Control Protocol*. RTP is used for the actual data transfer, while RTCP is used to control that data transfer. If a packet is missing, the best action for the destination to take is to approximate the missing value by interpolation. Retransmission is not a practical option since the retransmitted packet would probably arrive too late to be useful.

RTP can be used for:

- Voice over IP Telephony: delivery of voice communication over IP networks
- Video teleconferencing: transmission of video and audio to a set of receivers
- Mixing of different multimedia streams
- Profile and Protocol Translation

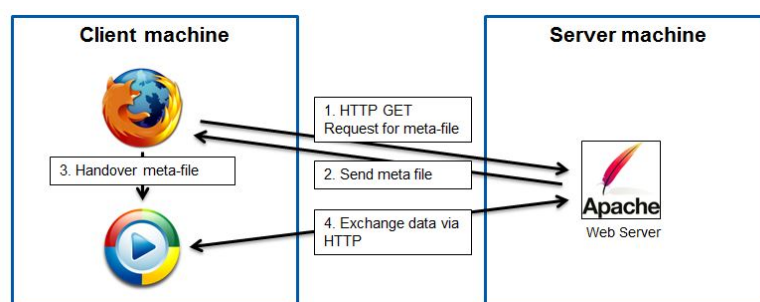
### Problem 2 Traditional Download VS. Streaming

What is the main idea behind streaming of media content? How does HTTP Streaming work?

Solution:

While streaming the relevant media file is downloaded in a lot of little pieces and the playout starts as soon as the playout buffer is filled.

HTTP Streaming: 1) User clicks on link (HTTP GET Request for meta-file), meta-file send back  
2) Browser determines suitable application based on content type, start corresponding player, handover meta file  
3) Media Player sends HTTP-GET message, receive media content in response



### Problem 3 Playout Schedule

Fill out the playout graphic below by completing the following steps:

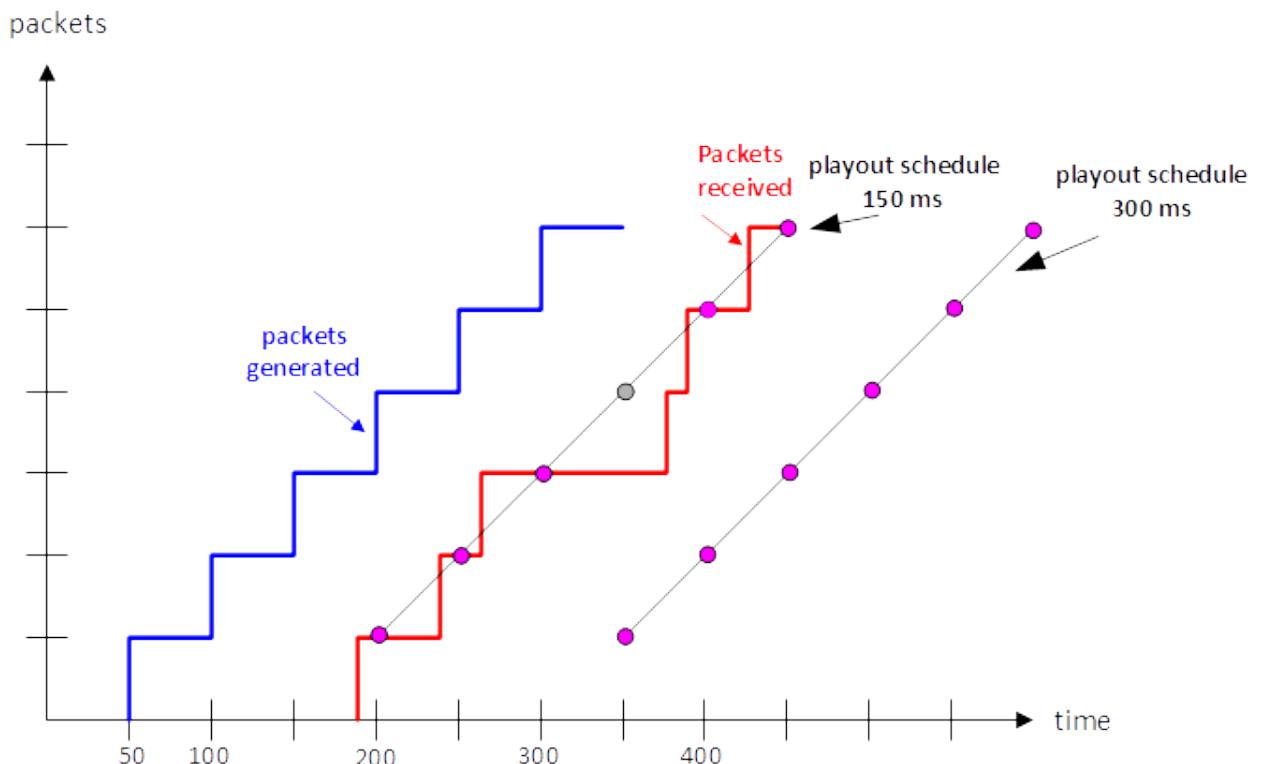
- Packages are generated every 50ms starting at 50ms, add these to the graph
- The delay for the packets is given in the table below. Add the times at which the packets are received to the graph. *Note: It might be helpful to first fill out the table below.*
- There are two playout schedules to be considered in this task, one with a fixed delay of 150ms, the other with a fixed delay of 300ms. Add their representation to the graph.

With the help of the playout graphic, answer the following questions:

- Are all packets received in time for both playout schedules?
- Assuming a fixed playout delay of 300ms, what kind of user experience would you expect given no packet loss?
- What is the main difference between a fixed playout delay and an adaptive playout delay?

Solution:

Packet #	Send At	Delay (ms)	Receipt
1	50	139	189
2	100	139	239
3	150	115	265
4	200	177	377
5	250	140	390
6	300	128	428



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- No, packet 4 is not in time for the 150ms playout delay.
  - A fixed playout delay of 300ms will lead to a non-ideal user experience as the delay will be perceived by most users.
  - Instead of using a fixed value for the playout delay, the adaptive playout delay changes its value depending on the network conditions (by dynamically estimating the average delay) and the contents of the packet (the start of a talk spurt is handled differently).

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#### **Problem 4 SIP**

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What are the 5 facets of SIP?

Solution:

- a) User location: Determination of the end system to be used for communication
- b) User availability: Determination of the willingness of the called party to engage in communications
- c) User capabilities: Determination of the media and media parameters to be used
- d) Session setup: "ringing", establishment of session parameters at both called and calling party
- e) Session management: including transfer and termination of sessions, modifying session parameters, and invoking services

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#### **Problem 5 Speech Quality**

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What are the two basic approaches to measuring Speech Quality? Give an example for both approaches.

Solution:

- Survey based: The perceived quality of speech is surveyed across a number of people. *Mean Opinion Score (MOS)* for example averages over the effort required to understand the meaning on a scale of 1 to 5.
- Differential based: The difference between source and destination signal is calculated, for example in *Perceptual Evaluation of Speech Quality (PESQ)*.

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#### **Problem 6 Recovery from packet loss**

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Name and explain the three options to recover from packet loss you know.

Solution:

- FEC simple: Create one redundant chunk by XORing  $n$  original chunks. If only one chunk is lost, it can be restored.

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- FEC 2nd scheme: Every chunk contains a lower version of the previous chunk. In case of non-consecutive packet loss, the receiver can fill out the lost packet with a lower quality version, concealing the loss.
  - Interleaving: Chunks are spread across packets, with every packet containing pieces of several chunks. If a packet is lost, only a small part of all chunks is missing, which can be concealed.
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### Problem 7 RTP

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Which of the following Transport Protocols is typically used by RTP?

Solution:

- ☐ (A) IP  
☒ (B) UDP  
☐ (C) TCP  
☐ (D) SCTP  
☐ (E) SIP
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### Problem 8 RTP-Cont.

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RTP provides means for :

I: reservation and checksums

II: synchronization of media streams

III: real-time compression of data

IV: splitting of media streams in PDUs

Solution:

- ☐ (A) Only I  
☐ (B) I and IV  
☐ (C) II and III  
☐ (D) Only III  
☒ (E) II and IV
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### Problem 9 RTP Header

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Which of the following fields are part of the RTP header?

I: CSRC Count

II: Urgent Pointer

III: Checksum

IV: Congestion Window

V: Timestamp

Solution:

- ☐ (A) Only I  
☐ (B) II and V  
☐ (C) II and III
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- ☐ (D) IV and V  
☒ (E) I and V

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### Problem 10 RTCP

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RTCP **does not** provide :

Solution:

- ☐ (A) quality control  
☐ (B) periodic control packets  
☒ (C) cryptographic mechanisms  
☐ (D) a participant list  
☐ (E) sender reports

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### Problem 11 RTSP

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Which of the following statements are true?

- I: RTSP assumes a state-full server.  
II: Both an RTSP server and client can issue requests.  
III: RTSP maintains a connection between client and server.  
IV: RTSP acts as a "network remote control" for multimedia servers.  
V: RTSP defines how media streams are split up in packets.

Solution:

- ☐ (A) I, II, III  
☒ (B) I, II, IV  
☐ (C) I, II, V  
☐ (D) I, III, IV  
☐ (E) II and III

see: <http://tools.ietf.org/html/rfc2326>