

Please write readably and answer in English.

There are three classes of questions: (a) expecting (relatively) short answers, (b) expecting more elaborate answers, and (c) a small design task. The questions are marked accordingly.

Questions:

1. [6p, a] Which functions does RTP provide?
2. [6p, b] a) Assume you receive an offer containing the following SDP message. What are the semantics of this offer?

```
v=0
o=jdoe 2890844526 2890842807 IN IP4 10.47.16.5
s=-
c=IN IP4 10.47.16.5/127
t=0 0
m=video 51372 RTP/SAVP 31
a=crypto:1 AES_CM_128_HMAC_SHA1_80\
    inline:d0RmdmcmVCspeEc3QGZiNWpVLFJhQX1cfHAWJSoj|2^20|1:32
m=audio 49170 RTP/SAVP 0
a=crypto:1 AES_CM_128_HMAC_SHA1_32 \
    inline:NzB4d1BINUAvLEw6UzF3WSJ+PSdFcGdUJShpX1Zj|2^20|1:32
a=crypto:2 AES_CM_128_HMAC_SHA1_80 \
    inline:udhf9843yiuhrfkuyf834yhkwhkjew3uhkjhdew8kjhwhkw|2^20|1:32
```

- b) How would you answer if you do not understand secure AVP?
 - c) Which SDP extension(s) could help making the call succeed nevertheless if the calling party would also be happy with non-secure media.
3. [6p, a] How does the SDP offer/answer exchange in SIP differ from the session setup in RTSP?
 4. [6p, a] What is a self-signed certificate? What can it assure? Describe two weaknesses.
 5. [6p, b] Describe three challenges for the signaling and/or the real-time media exchange (using RTP) in RTCweb.
 6. [6p, b] What is the purpose of ICE? Outline its operation.
 7. [6p, a] Describe conceptually how *adaptive* media streaming using HTTP works.
 8. [12p, c] Assume a multimedia (audio + video) multicast IPTV channel delivered to your set-top box in your home (and assume it's not encrypted so that it could be played on any player). Assume further that you have a well-defined multicast address on which the *electronic program guide (EPG)*, i.e., the mapping between multicast addresses and port numbers and channel names is available.

You would like to create a *slingbox*-style service, by means of which you can access (and change) the multicast IPTV channel from anywhere in the country so that the media stream gets forwarded to your mobile device. Describe an architecture that would allow you retrieving. Remember that you cannot multicast across the Internet and that you do not want to open your home network accidentally to random people. Consider also that your DSL uplink capacity will likely be less than the media bit rate of the IPTV stream and that, depending on where you are, your path capacity may be even lower.
 - a) Which components do you need? Where are they located? Which functions do the components provide?
 - b) Which protocols do you use where and why? Do you need any new ones (if so, for which functions)?
 - c) How do you ensure security?

(Note: there are many possible solutions).