S-72.423 Exercise 2. Solutions

Return your answer no later than on Tuesday 26.10.2004 at 16:00 into the course's P.O. box at the third floor of the E-wing.

Please, include the following information in your answers:
Please, include the following information in your answers:
- Your name (+ team member names)
- Your student number (+ team member student numbers)

It may be that you won't find answers to the questions straight from the lecture material. You may have to look for information from the textbooks and Internet. Good luck for information search!
To this exercise you may answer in English, Finnish or Swedish.

1. ISDN, SS7, ATM, SDH : True or False?

a) ISDN: For example Video-telephony is typical supplementary service.

FALSE

b) ISDN: Primary rate Access consist 32 digital B channels.

FALSE

c) Signalling: When using CAS, setting up a circuit switched connection is very fast.

FALSE

d) Common Channel Signaling (CSS) is divided into line and register signaling.

FALSE

e) When using common channel signalling (CCS), end-to-end signalling is possible after call setup.

TRUE

f) In SS7 link status signal unit contains signaling messages for link supervision.

TRUE

g) FISU means Fill-In Signal Unit.

TRUE

h) ACM – Address Complete Message is sent from USER B to USER A.

TRUE / FALSE

i) Charging of the call starts when ANM message is received at LE A.

TRUE

j) Signaling is needed when ATM's Permanent Virtual Circuits are established.

TRUE

k) ATM cells can be carried in an SDH virtual container (e.g. VC-4).

TRUE

2. Answer shortly:

a) How and why FISU can be used to monitor quality of signalling link?
b) Give an example of an IN (Intelligent Network) service where address translation is used.
c) In an ATM switch, ATM cells are transported from an incoming logical channel to one or more output logical channels. Describe how a logical channel is indicated.
d) Why and how is ATM Adaptation Layer 5 (AAL 5) used?

SOLUTIONS:

a) How and why FISU can be used to monitor quality of signalling link?

I) FISU has error checking -> Constant monitoring of link quality is possible and
II) The absence of signaling traffic means link failure.

b) Give an example of an IN (Intelligent Network) service where address translation is used.

For example Freephone (800) service. Please see
http://www.comlab.hut.fi/opetus/423/lect2004/03_423ss7.ppt, slide 72.

c) In an ATM switch, ATM cells are transported from an incoming logical channel to one or more output logical channels. Describe how a logical channel is indicated.

Answer:

Logical channel is indicated in ATM switch by combination of
- the number of physical link
- The identity of the channel: The virtual Path Identifier (VPI) and the virtual channel identifier (VCI)

d) Why and how is ATM Adaptation Layer 5 (AAL 5) used?

AAL 5 is used for variable bit rate transmissions, which are not time sensitive and they need no retransmission mechanisms
Applications: LAN emulation, IP transport, signalling transport)
WHY: It is simple and by using it, a large amount of data (for example an IP packet) can be transmitted in ATM cells.
HOW: The data is fitted with a post header and padded to be a multiple of 48 bytes. Then this is divided into (48 byte blocks) SAR-PDU's. The information of the last SAR-PDU's is included in last SAR-PDU's ATM cell header in PTI's field (PTI LSB = 1)

3. Let us assume that compressed digital speech with a bit rate of 14 kbit/s is sent over an ATM link (cell bit rate = 150 Mbit/s) using AAL 1.

a) What is the packing delay at the sending side of the ATM link when each ATM cell is fully packed?
b) Is there a similar delay at the receiving side of the ATM link?
c) What is the packing efficiency when the packing delay is not allowed to exceed 10 ms?
d) Explain briefly, how packing efficiency can be improved by using AAL 2.

SOLUTION:

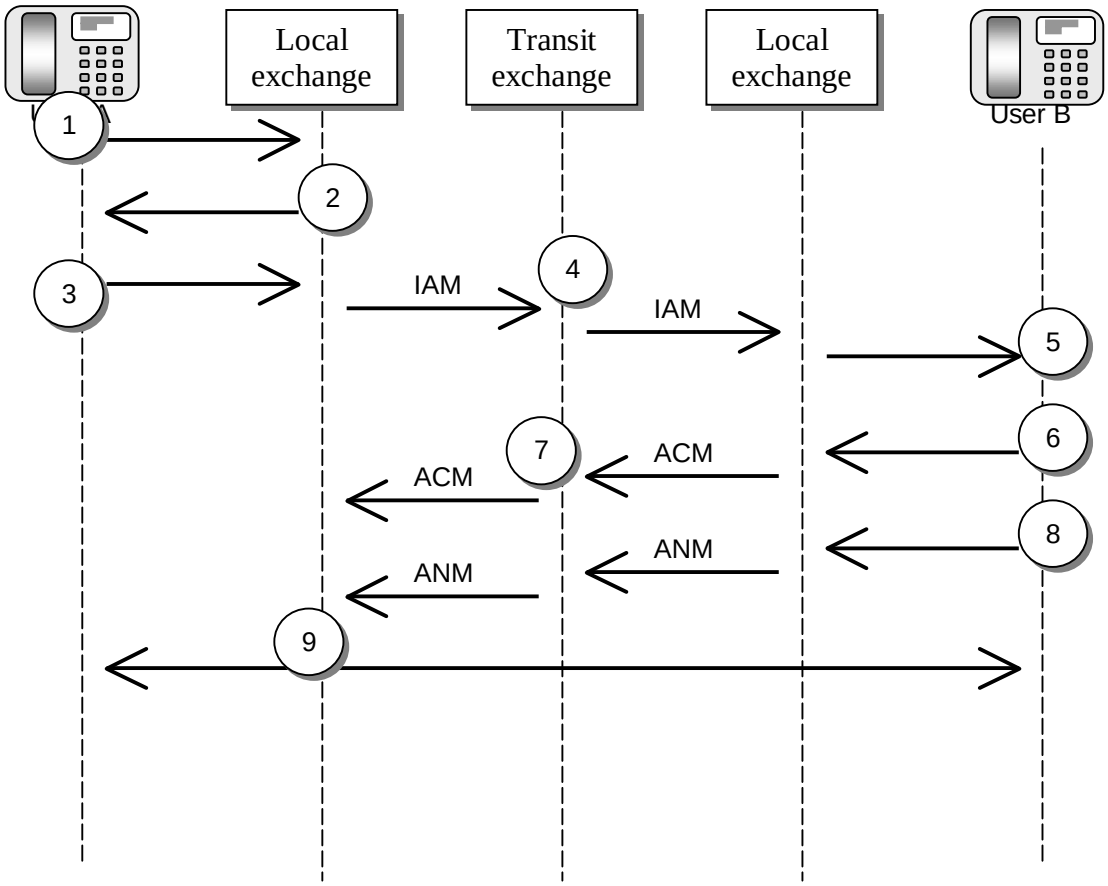
a) The payload of an ATM cell consists of a SAR-PDU containing 47 bytes of information plus a small header (1 byte). It takes 47 x 8 bits / 14000 bits/s = 26,857 ms to fill the ATM cell payload. Answer: packing delay = 26.9 ms.

b) Answer: NO. The information can be reassembled immediately as soon as the ATM cell has arrived.

c) 10 ms corresponds to 14000 bits/s x 0.01 s = 140 bits = 17,5 bytes. Answer: The packing efficiency is 17,5 bytes / 47 bytes = 37,2 % (in other words 62,8 % of the ATM payload is empty).
Discussion in tutorials: Should we send full bytes? -> In that case packing efficiency is 17/47 = 36,1 %.

d) When transmitting many low/variable bit rate signals between two end-points using ATM, AAL 2 provides low packetization delay and high bandwidth efficiency at the same time. Multiplexing of different signals into ATM cell payloads does this. -> no need for send almost empty cells to get low delay.

4. The figure below presents the signalling during the establishment of a circuit switched call from a subscriber behind an analogue line in the PSTN (User A) to a subscriber behind a digital ISDN line (User B). Your task is to shortly describe the numbered functions (in other words "what is going on") and why these functions are needed.



SOLUTION:

Answer:
1) User A picks up handset => off-hook detection at user A local exchange (sudden increase in current)
2) Exchange sends dial tone => user A hears that local exchange is "alive"
3) User A sends dialing information, for instance using DTMF (Dual Tone Multi-Frequency) signaling
4) Number analysis in the exchange => the exchange must know to which next exchange the IAM message should be sent
5) Q.931 SETUP message to user B => user B terminal starts alerting
6) Q.931 ALERTING message to user B local exchange
7) ISUP ACM message is sent in link-by-link fashion through the SS7 signaling network (no number analysis, only routing tables are used)
8) User B answers and Q.931 CONNECT message is sent to local exchange
9) After receiving the ISUP ANM message, the voice connection is "cut through" at user A local exchange. Usually charging of the call starts at this point (in Intelligent Network applications, other charging scenarios may exist).