EKSAMEN / EXAM	TTM4100	10 06 2005

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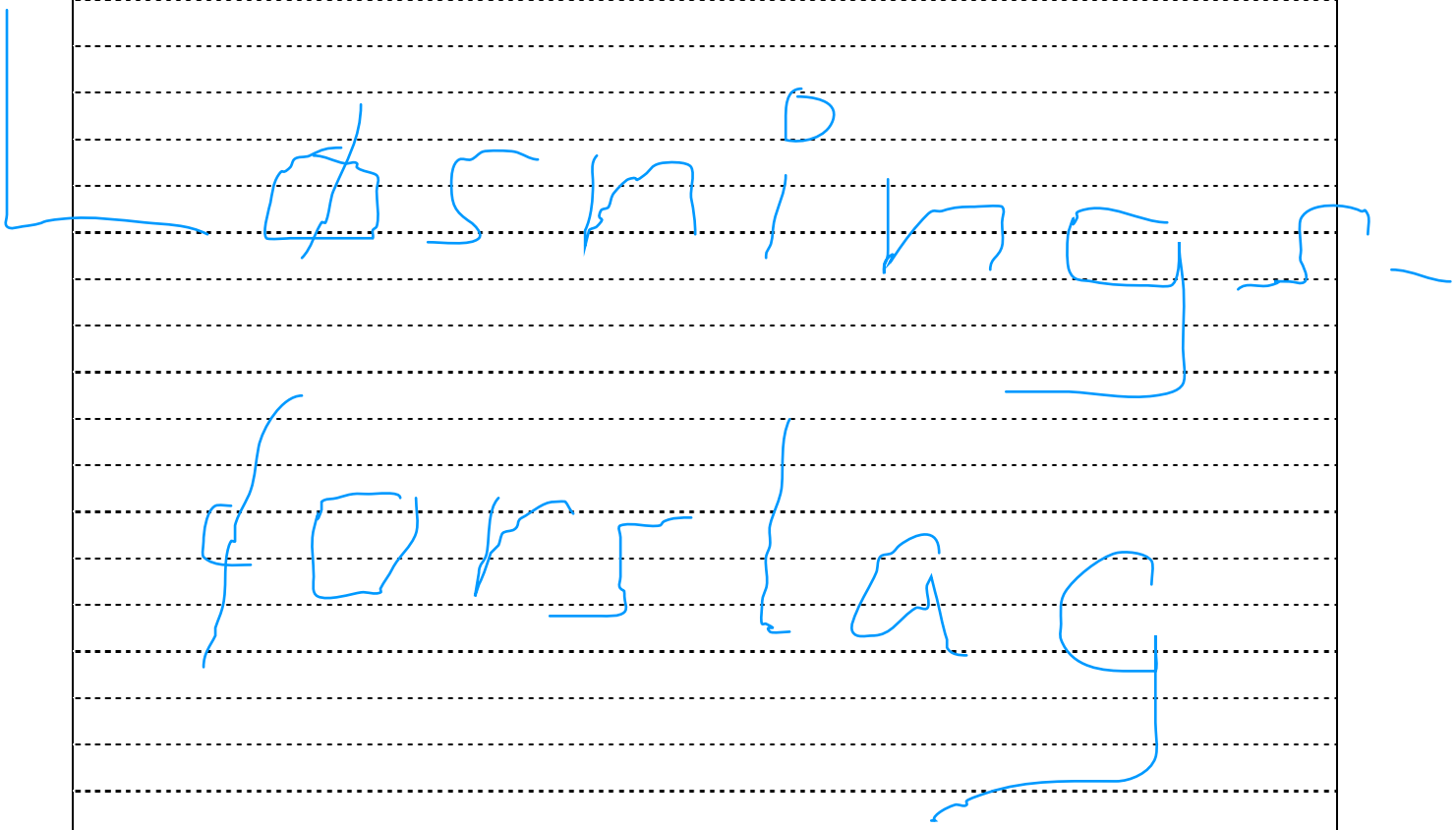
KOMMENTARER KOMMENTARAR COMMENTS



1. Switching

1.1 What is switching? Switching is the way the link transmission capacity and Node resources are allocated for the transfer of information.

1.2What is store-and forward switching? There is no reservation of transmission capacity in advance and the information sent from the sender will be queued in intermediate nodes if transmission capacity is not available.

1.3Define different store-and-forward switching principles used for network layer switching.

Message switching: The information units between the Hosts are sent large network information units stored on disc in intermediate nodes.

Packet switching based on datagram: The information units between the Hosts are fragmented and sent as independent medium size packets stored in memory in intermediate nodes. Each packet has a full address and an independent route can be applied for each packet.

Packet switching based on virtual circuit. The information units between the Hosts are fragmented and sent as dependent medium size packets stored in memory in intermediate nodes. A connection set up procedure is applied. Packet has a logical address and the same route is applied for all packets related to a session

Cell switching: The information is sent as very small information units cells (48+5 byes) optimized for low delay speech transfer. A connection set up procedure is applied and cell has a logical address. The same route is applied for all cells related to a session.

2. Protocol concepts

2.1 Define the concepts:

2.1.1 Protocol layer: A subsystem of a communication system with a certain hierarchical rank.

2.1.2 Protocol entity: An active unit within a layer handling a peer-protocol within a specific node or host

2.1.3 Protocol data unit (PDU): The information unit sent between peer-protocol entities

Service: The functionality offered from a protocol entity to a protocol entity in the layer above.

2.1.4 Service access point (SAP): A logical addressable point within a layer which an entity of the layer above can be connected to (or associated with).

2.1.5 Service primitive: The basic elements used to defined a service

2.2 Explain short the functionality of the layer 1, 2, 3 and 7 of the ISO/OSI seven layer reference model

2.2.1 Layer 1: The provision the transfer of logical bits between link layer entities.

2.2.2 Layer 2: Framing (i.e. making a logical structure of the sequence of bits transferred by the physical layer), error control, flow control and access control

2.2.3 Layer 3: The routing of information from a source Host to a destination Host.

2.2.4 Layer 7: The definition of concepts (data structures and operations) used by the application layer entities in their peer communication.

2.3 What is flow control?

Flow control is procedures for the receiver to limit the information flow from the sender.

2.4 What are the similarities and differences concerning flow control on layer 2 and layer 4?

Procedures are similar such as sliding window flow control. A link layer flow control is normally comprising 1 (or few) connections and the needed maximum buffers on the receiver can be adopted to the bit rate of the link. The number of connections on the transport layer, however, can be enormous and the dynamism related to each connection is high. The flow control on the transport layer must therefore be able to adapt fast to shortage of buffers in the receiving application layer.

2.5 Define the ISO/OSI service primitives for the transport and network service.

T-connect.req (T-Address-refs,)
T-connect.ind (T-Address-refs,)
T-connect.res (T-Address-refs,)
T-connect.cnf (T-Address-refs,)
T-data.req (T-Address-refs, data)
T-data.ind (T-Address-refs, data)
T-disconnect.req (T-Address-refs)
T-disonnect.ind (T-Address-refs)
N-connect.req (N-Address-refs,)
N-connect.ind (N-Address-refs,)
N-connect.res (N-Address-refs,)
N-connect.cnf (N-Address-refs,)
N-data.req (N-Address-refs, data)
N-data.ind (N-Address-refs, data)
N-disconnect.req (N-Address-refs)
N-disonnect.ind (N-Address-refs)
N-disconnect.res (N-Address-refs)
N-disonnect.cnf (N-Address-refs)
T-disconnect.res (T-Address-refs)
T-disonnect.cnf (T-Address-refs)

2.6 *Define the ISO/OSI protocol data units for the transport and network layer protocol.*

CR (T-Address-refs)
CC (T-Address-refs)
DT (T-Address-refs, data)
DR (T-Address-refs)
DC (T-Address-refs)

CR (N-Address-refs)
CC (N-Address-refs)
DT(N-Address-refs, data)
DR (N-Address-refs)
DC (N-Address-refs)

2. 7 Draw a signal sequence diagram in Figure 1 which illustrates the service primitives used between adjacent layers. Transport protocol data units carried in the network service primitive shall also be illustrated.

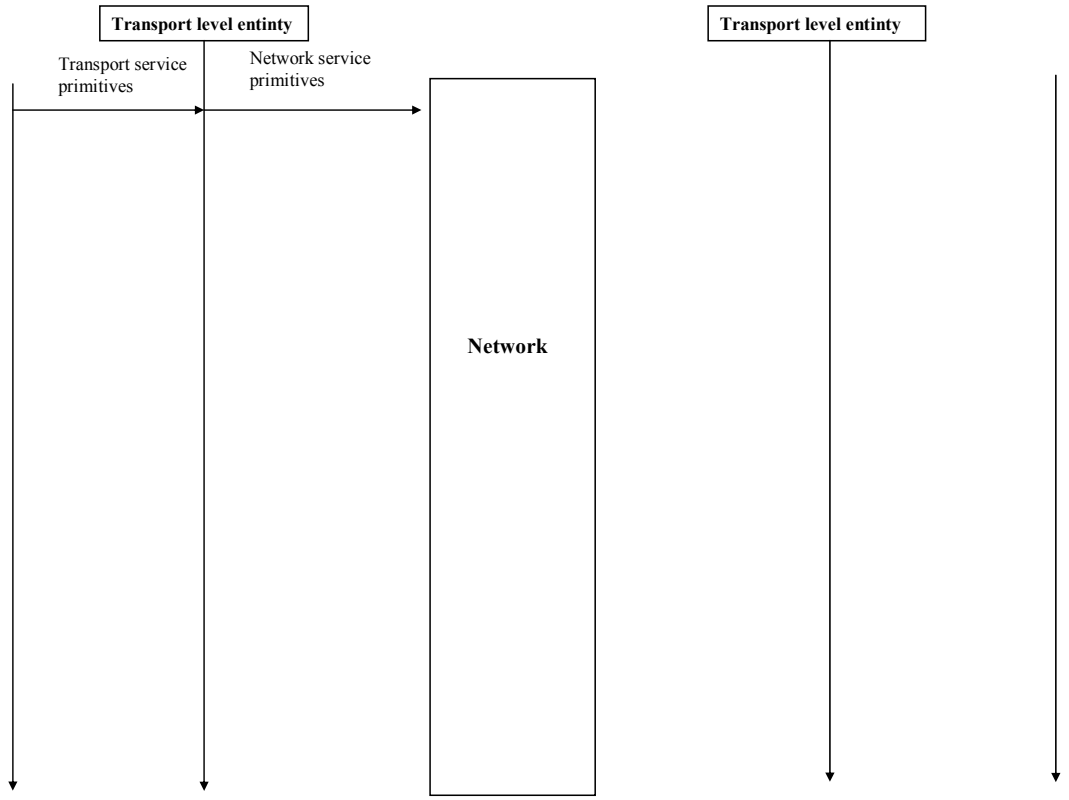
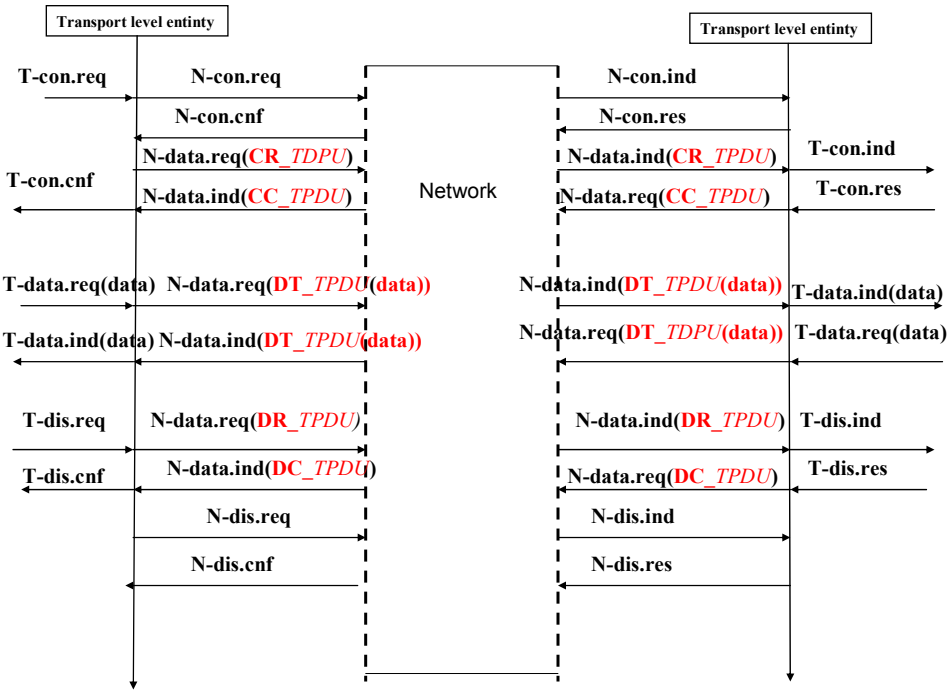


Figure 1



3. TCP service and protocol

3. 1 *Define the procedure calls used by the applications using the TCP service. For each of the service primitives, explain which of the following entities that is the initiator of the procedure call: the application client, the application server, the TCP client entity or TCP server entity?*

Connection-number = LISTEN(local-socket-address)
Connection-number = CONNECT(local-socket-address, remote-socket-adress)
status = SEND(connection-number,buffer-id, bytes)
status = RECEIVE(connection-number,buffer-id, bytes)
status = DISCONNECT(connection-number)
<bytes> = the number of bytes in <buffer-id> at sending and reception

LISTEN: Initiator: Application server
CONNECT: Initiator: Application client
SEND: Initiator: Application server or client
RECEIVE: Initiator: Application server or client
DISCONNECT: Initiator: Application server or client

3.2 *What are the elements of addressing involved for an application client that is making a TCP connection to a TCP server? How can the application client get the needed addresses?*

local-socket-address = IP address and local port address of the client application entity
remote-socket-address = IP address and local port address for the server application entity
IP addresses are provided by DNS by giving the logical DNS type of addresses used in the user application domain. Local port addresses are got from well know ports or dictionaries.

3.3 Discuss the problems and solutions related to connection release in TCP.

Symmetric release is needed to avoid loss of data. Symmetric release is not simple in environments where packets are lost. Three-way hand shake, timers and retransmission is needed at disconnection.

Normal procedure: DR(Sent by Host 1) –DR (Sent by Host 2) - DC (Sent by Host 1)
Case DC lost: Handled by disconnection by timeout in Host 2.
Case DR(sent by Host 2) lost: Handled by timeout in Host 1 and resending of DR(Sent by Host 1)
Case DR (Sent by Host 2) lost and all resending of DR(sent by Host 1) are lost: Disconnection by timeout in Host 1 and Host 2.
Case DR (sent by Host 1) lost and also the retransmissions are lost: Gives half open connection.

6 The network layer

Describe the Classless InterDomain Routing (CIDR) principle.

CIDR was introduced because of short-comings of IPv4. Basically, 32 bits give enough addresses, but the class division is far from optimum, it wastes millions of addresses. (Class A and C are useless, class B provides far too large address space for most organizations. However, it was not easy to foresee this when the division was designed). CIDR aims at utilizing the wasted addresses.
The class concept was dropped, and the remaining addresses can be given to organizations in blocks according to their needs. The intention was to balance the size and the processing complexity/time of the routing tables.
With CIDR the routing table becomes more complicated, also the forwarding of packets. A single routing table contains triplets (IP address, subnet mask, outgoing line). When a packet comes in, its destination IP address is first extracted. Then the routing table is scanned entry by entry, masking the destination address and comparing it to the table entry looking for a match. Different subnet mask lengths may give more than one match, in which case the longest mask is used. To speed up the address match process special algorithms and VLSI chip implementations are used. When an organization needs say 900 addresses, 1024 addresses are allocated together with a mask of 22 ‘1’ bits. The CIDR routing tables all over the world have to be updated with the allocated entries.

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3.3

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	A	B	C	D	E
4.1	☐	☒	☐	☐	☐
4.2	☐	☐	☒	☐	☐
4.3	☐	☐	☐	☐	☒
4.4	☐	☐	☒	☐	☐

	Sant True	Feil False
5.1	☒	☐
5.2	☒	☐
5.3	☐	☒
5.4	☐	☒
5.5	☐	☒
5.6	☐	☒
5.7	☐	☒
5.8	☒	☐
5.9	☐	☒
5.10	☐	☒
5.11	☐	☒
5.12	☐	☒
5.13	☒	☐
5.14	☐	☒
5.15	☒	☐

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	Sant True	Feil False
7.1.1	☐	☒
7.1.2	☐	☒
7.1.3	☒	☐
7.1.4	☒	☐
7.1.5	☐	☒
7.1.6	☐	☒
7.1.7	☒	☐
7.1.8	☐	☒

	Sant True	Feil False
7.2.1	☒	☐
7.2.2	☒	☐
7.2.3	☐	☒
7.2.4	☒	☐
7.2.5	☐	☒
7.2.6	☒	☐
7.2.7	☐	☒

	Sant True	Feil False
7.3.1	☐	☒
7.3.2	☐	☒
7.3.3	☐	☒
7.3.4	☐	☒
7.3.5	☒	☐
7.3.6	☒	☐

7.4

STEP	SEQUENCE NUMBER 1	2	3	4	5	6
Browser writes file to disk	☐	☐	☐	☐	☒	☐
Server gets file from disk	☐	☐	☒	☐	☐	☐
Establish TCP connection	☒	☐	☐	☐	☐	☐
Media player fetches file block by block and plays it	☐	☐	☐	☐	☐	☒
Send http GET request	☐	☒	☐	☐	☐	☐
File sent back	☐	☐	☐	☒	☐	☐

7.5

MESSAGE	SEQUENCE NUMBER 1	2	3	4	5	6	7	8	9
Data	☐	☐	☐	☐	☐	☐	☐	☐	☒
OK	☐	☐	☐	☐	☒	☒	☐	☐	☐
ACK	☐	☐	☐	☐	☐	☐	☒	☒	☐
INVITE	☒	☐	☐	☒	☐	☐	☐	☐	☐
REPLY	☐	☐	☒	☐	☐	☐	☐	☐	☐
LOOKUP	☐	☒	☐	☐	☐	☐	☐	☐	☐

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	A	B	C	D
8.1	☐	☐	☒	☐
8.2	☐	☒	☐	
8.3	☐	☐	☒	
8.4	☐	☐	☒	

	Sant True	Feil False
8.5.1	☐	☐
8.5.2	☐	☐
8.5.3	☐	☐
8.5.4	☐	☐

	Sant True	Feil False
8.6.1	☐	☐
8.6.2	☐	☐
8.6.3	☐	☐
8.6.4	☐	☐
8.6.5	☐	☐

	Sant True	Feil False
8.6.6	☐	☐
8.6.7	☐	☐
8.6.8	☐	☐
8.6.9	☐	☐
8.6.10	☐	☐