CS 168 Introduction to the Internet: Architecture and Protocols
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Discussion 3: Internet and Sockets

1 True or False

(1) The third layer of the network stack is the transport layer.

Solution: False. The network stack is as follows: L_1 = physical layer, L_2 = datalink layer, L_3 = network, L_4 = transport, L_7 = application.

(2) Layering in the network stack is an example of the end-to-end principle.

Solution: False. While the end-to-end principle is about what layer functionality should be implemented, layering is a lesson in modularity and abstraction, breaking the functions of the data plane into smaller problems. For example L_3 deals with connecting subnets to each other while L_4 deals with the reliability of flows.

(3) We implement all the same layers in both the host and routers.

Solution: False. In the hosts we implement layers 1;2;3;4; and 7 but in a router we implement layers 1;2; and 3 because we don't handle reliability or applications in the network. Information at layers 4 and 7 are unneeded for packet forwarding.

(4) The operating system (OS) supports logical ports while a router only has physical ports.

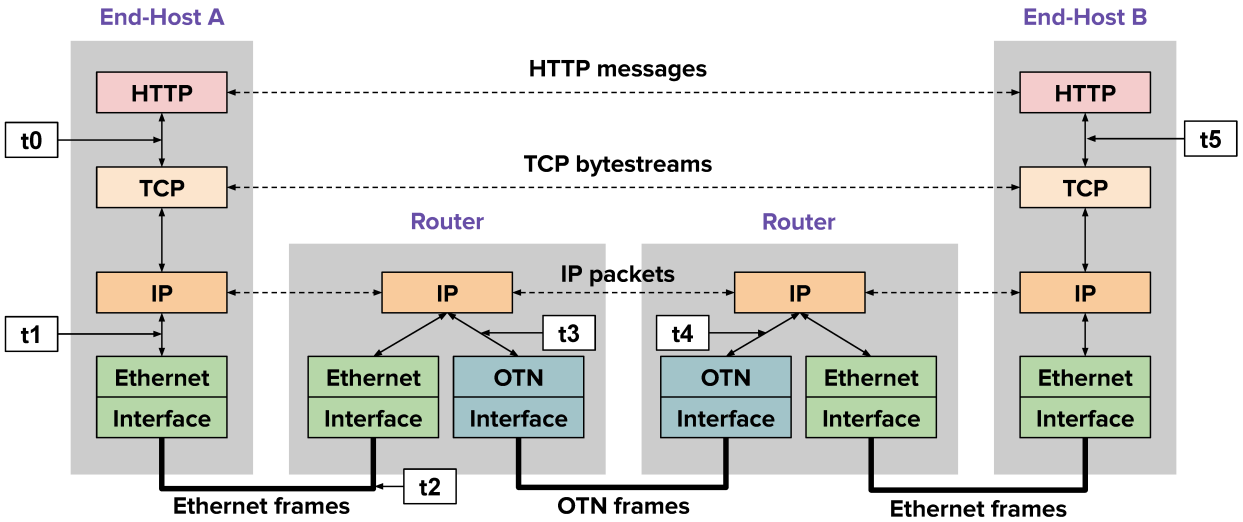
Solution: True. A host's OS can create a logical port when using a sockets API in the transport layer while a router cannot.

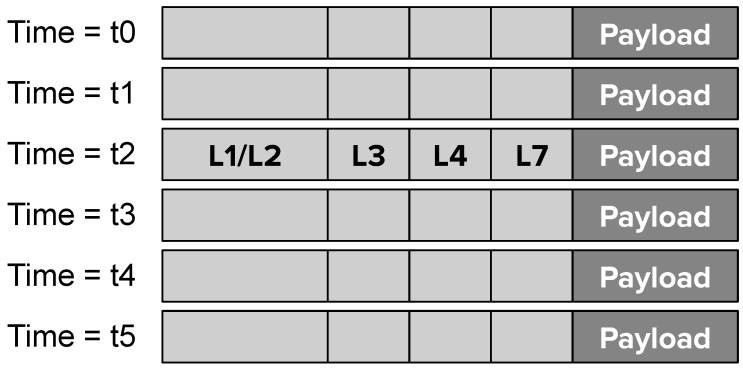
(5) Layers 4 and 7 are used for forwarding in switches/ routers.

Solution: False. There's no need to handle reliability or applications in the network, which means L_4, L_7 are not needed.

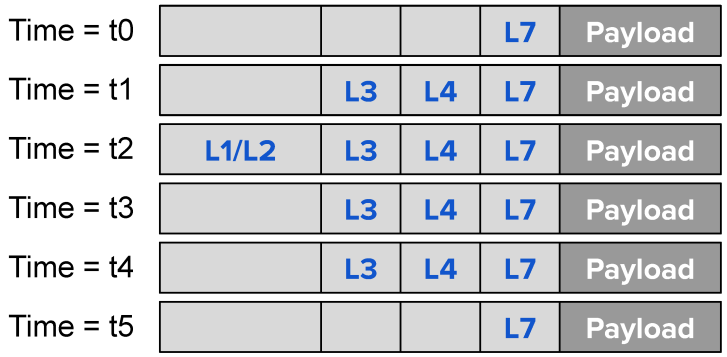
2 Protocol Diagram

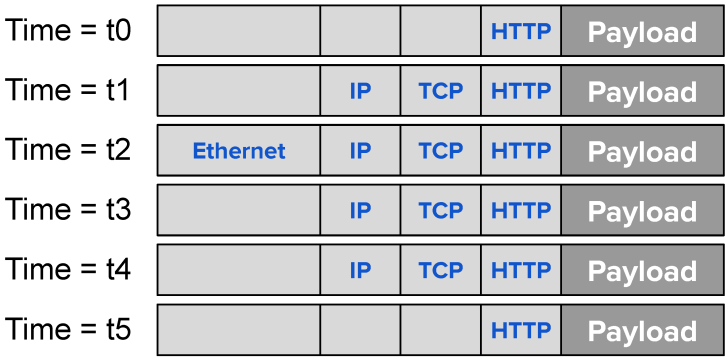
Refer to the figure below, which is similar to the one from Lecture 3. In this example, Host A sends one packet to host B at time t = 0. In this question, we explore how the packet header changes as the packet traverses different layers and protocols of the network. At each time step, fill in the empty blocks to describe which headers are attached to the payload. The packet headers are provided at time t = 2 for reference.


End-Host A
End-Host B
HTTP messages
HTTP
HTTP
t0
t5
TCP bytestreams
TCP
TCP
Router
Router
IP packets
IP
IP
IP
IP
t1
t3
t4
Ethernet
Interface
Ethernet
Interface
OTN
Interface
OTN
Interface
Ethernet
Interface
Ethernet
Interface
t2
Ethernet frames
OTN frames
Ethernet frames


Time = t0
Payload
Time = t1
Payload
Time = t2
L1/L2
L3
L4
L7
Payload
Time = t3
Payload
Time = t4
Payload
Time = t5
Payload

Solution:


Time = t0
L7
Payload
Time = t1
L3
L4
L7
Payload
Time = t2
L1/L2
L3
L4
L7
Payload
Time = t3
L3
L4
L7
Payload
Time = t4
L3
L4
L7
Payload
Time = t5
L7
Payload


Time = t0
HTTP
Payload
Time = t1
IP
TCP
HTTP
Payload
Time = t2
Ethernet
IP
TCP
HTTP
Payload
Time = t3
IP
TCP
HTTP
Payload
Time = t4
IP
TCP
HTTP
Payload
Time = t5
HTTP
Payload