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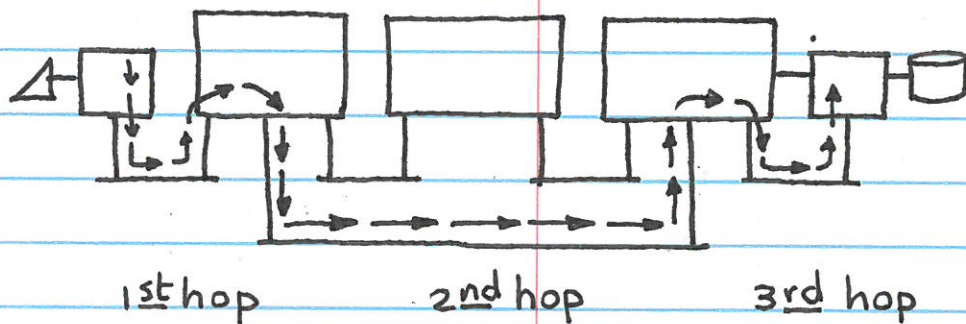
Outline
of
CS 356: Computer Networks

Mohamed Gouda

Architecture of Internet

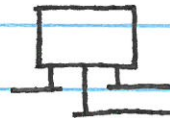
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- computers + subnetworks:



- types of computers:

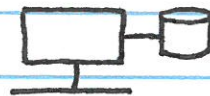
- router:



- client host:



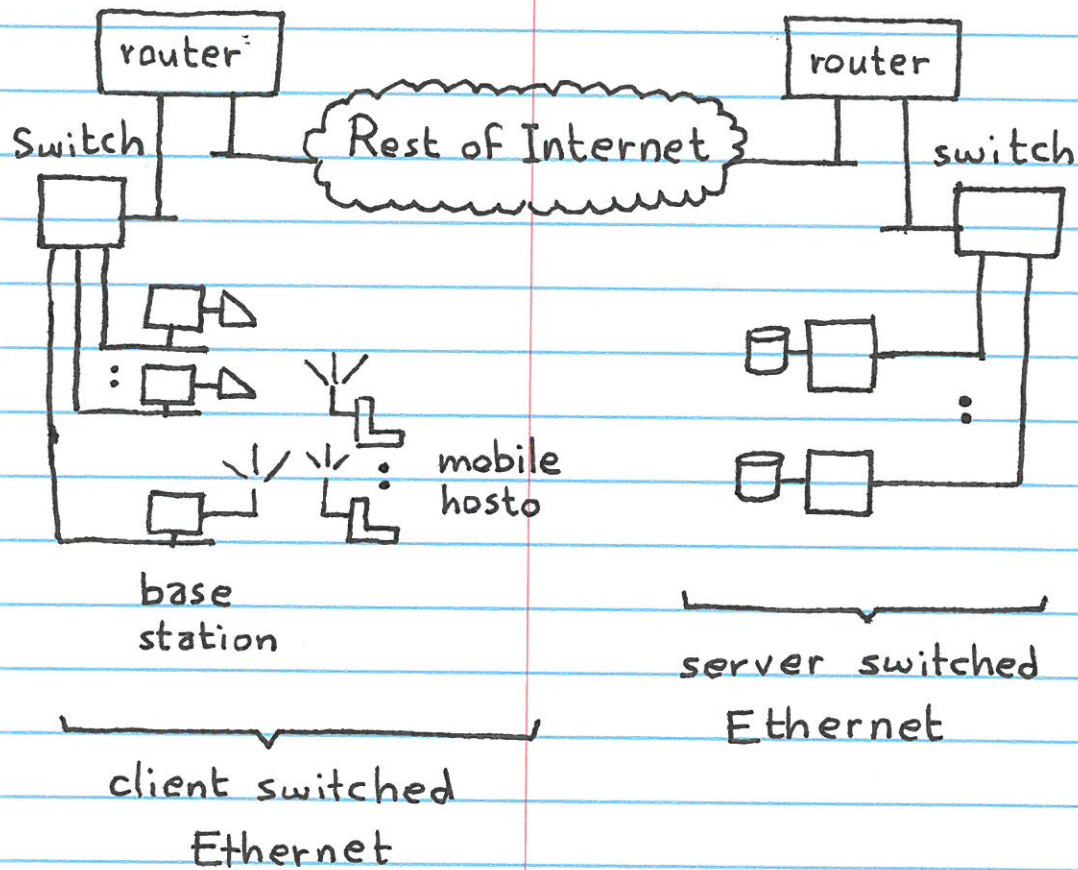
- server host:



- types of subnetwork technologies:

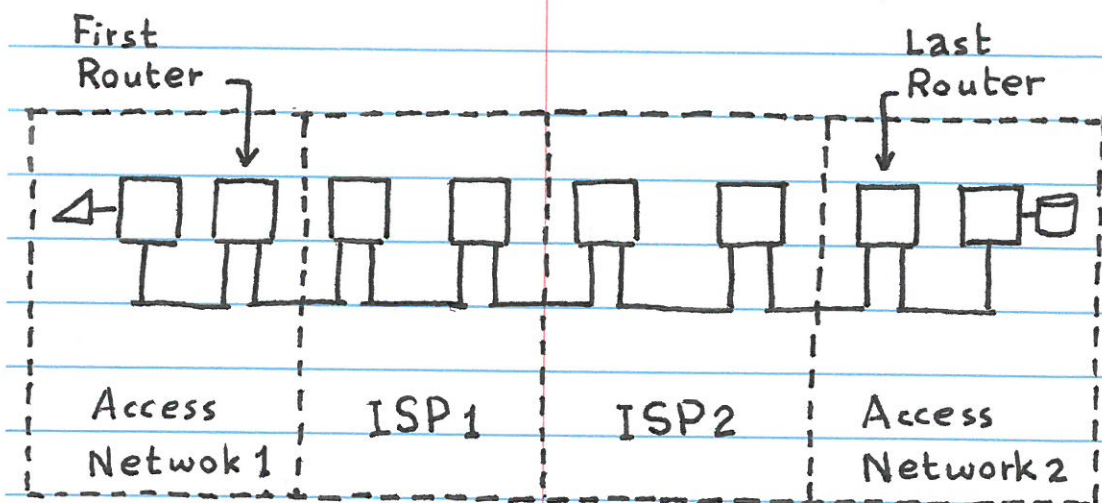
- LANs (switched Ethernets)
- wireless LANs
- phone lines
- TV cables
- satellite links

Example: Enterprise Network 2



Internet Service Providers (ISPs) 3

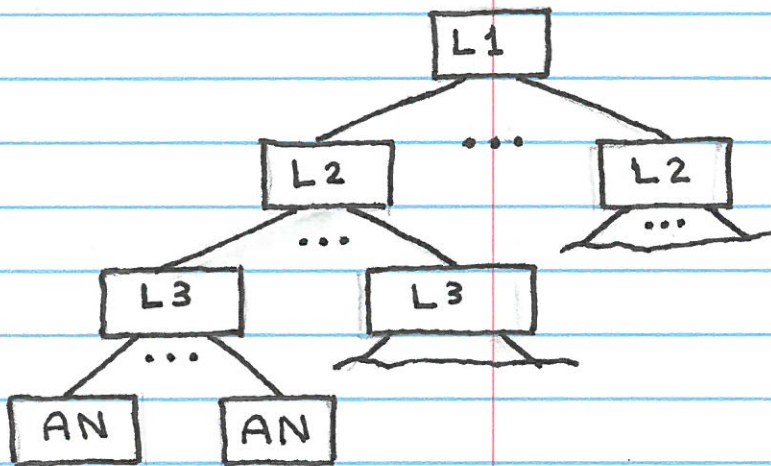
- to navigate a msg from a first router to a last router, the msg needs to go through a sequence of ISPs.
- each ISP is a set of inter-connected routers
- the ISPs are organized in a tree of 3 levels.



The ISP Tree

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- has 4 levels:
 - L1: Tier-1 ISP
 - L2: Regional ISPs
 - L3: Local ISPs
 - L4: Access Networks (ANs)



- if L_i ISP is connected to $L_{(i+1)}$ ISP
then L_i ISP is a provider for $L_{(i+1)}$ ISP
and $L_{(i+1)}$ ISP is a customer for L_i ISP

ISP Tree Is Not Perfect

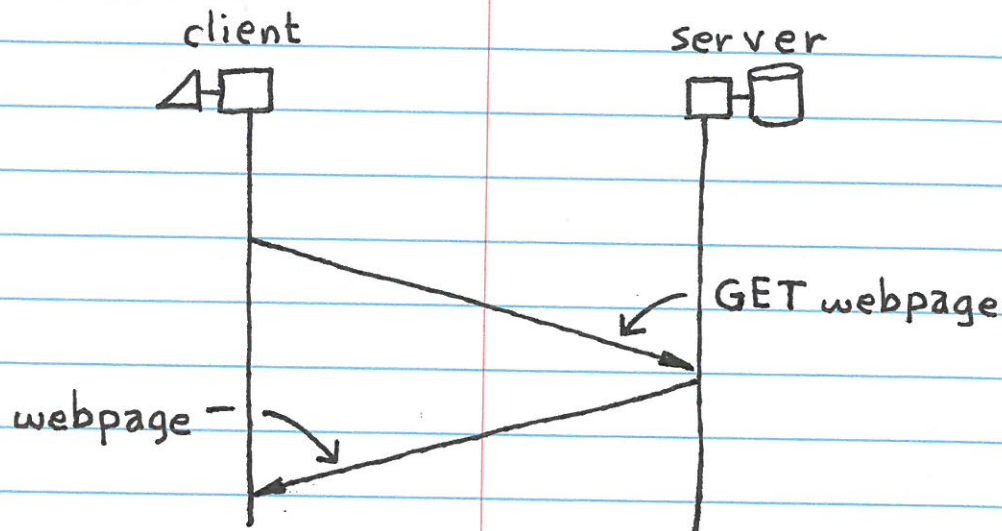
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- there is a dozen Tier-1 ISPs: AT&T, Sprint, NTT
- there are multiple regional ISPs for same region
- multihoming:
an ISP in level i can be connected to 2 or more ISPs in level $(i-1)$
- peering:
two Access Networks can be connected on settlement-free basis
- shortcut:
an Access Network or an ISP in level 3 can be connected directly to Tier-1 ISP

Network Protocols

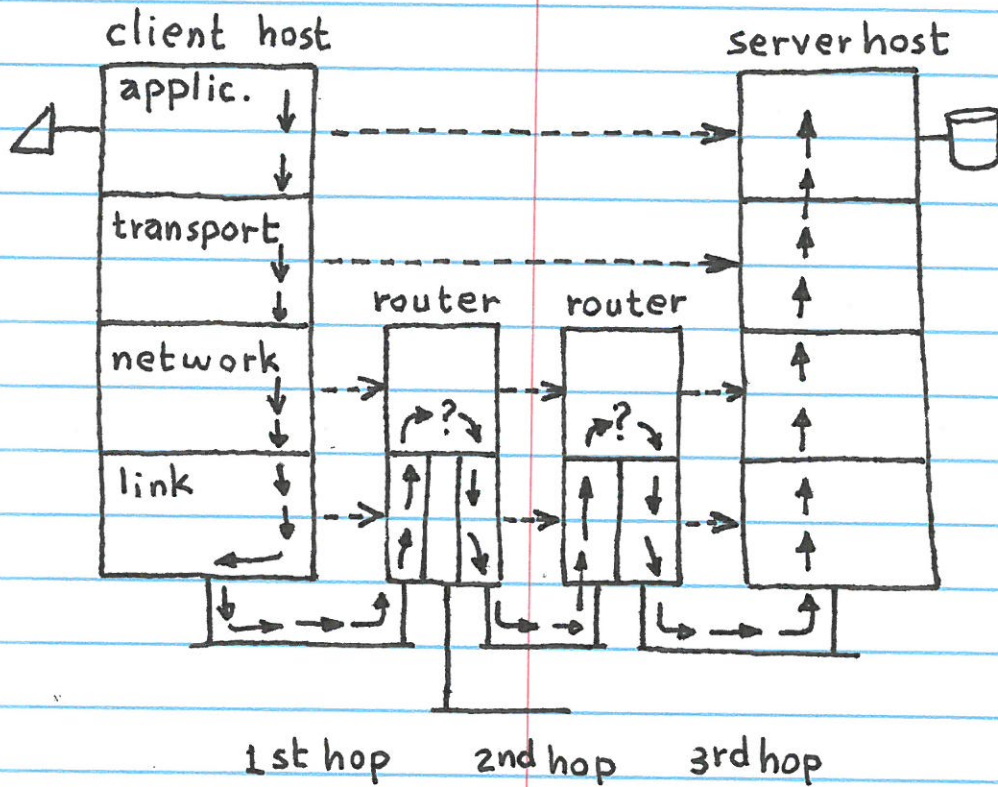
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- example:



- A network protocol specifies:
 - formats of exchanged msgs
 - order in which msgs are sent and rcvd
 - actions that need to be executed when a msg is sent or rcvd

Four Protocol Layers in Internet 7



- 2 types of communications:

-----> virtual

→ → → → physical

Functions of Protocol Layers in Internet

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- application layer:

allows human user to execute desired applications, e.g. web, email, ...

- transport layer:

ensures that communication between original src and ultimate dst satisfies some end-to-end properties, e.g. reliable data transfer, flow control, ...

- network layer:

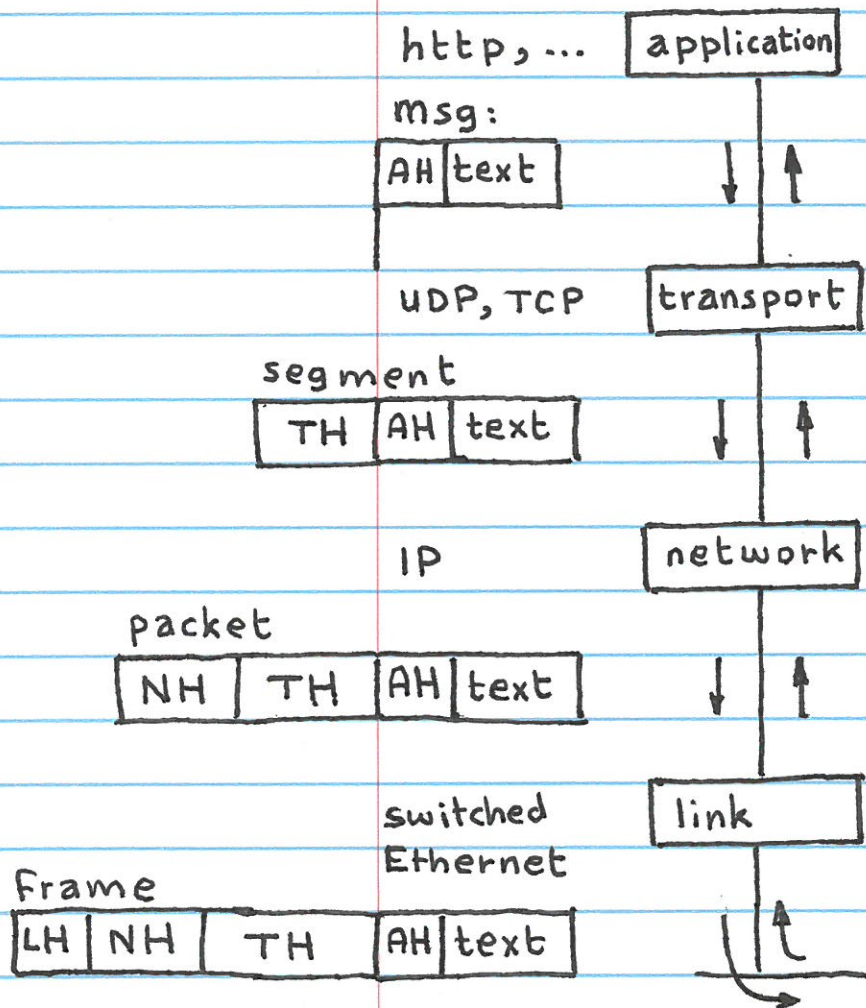
routes a msg through several hops from original src and ultimate dst

- link layer:

transmits a msg one hop from one computer to another over one subnetwork

Msg Encapsulation

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AH : application header

TH : transport header

NH : network header

LH : link header