Link layer, LANs

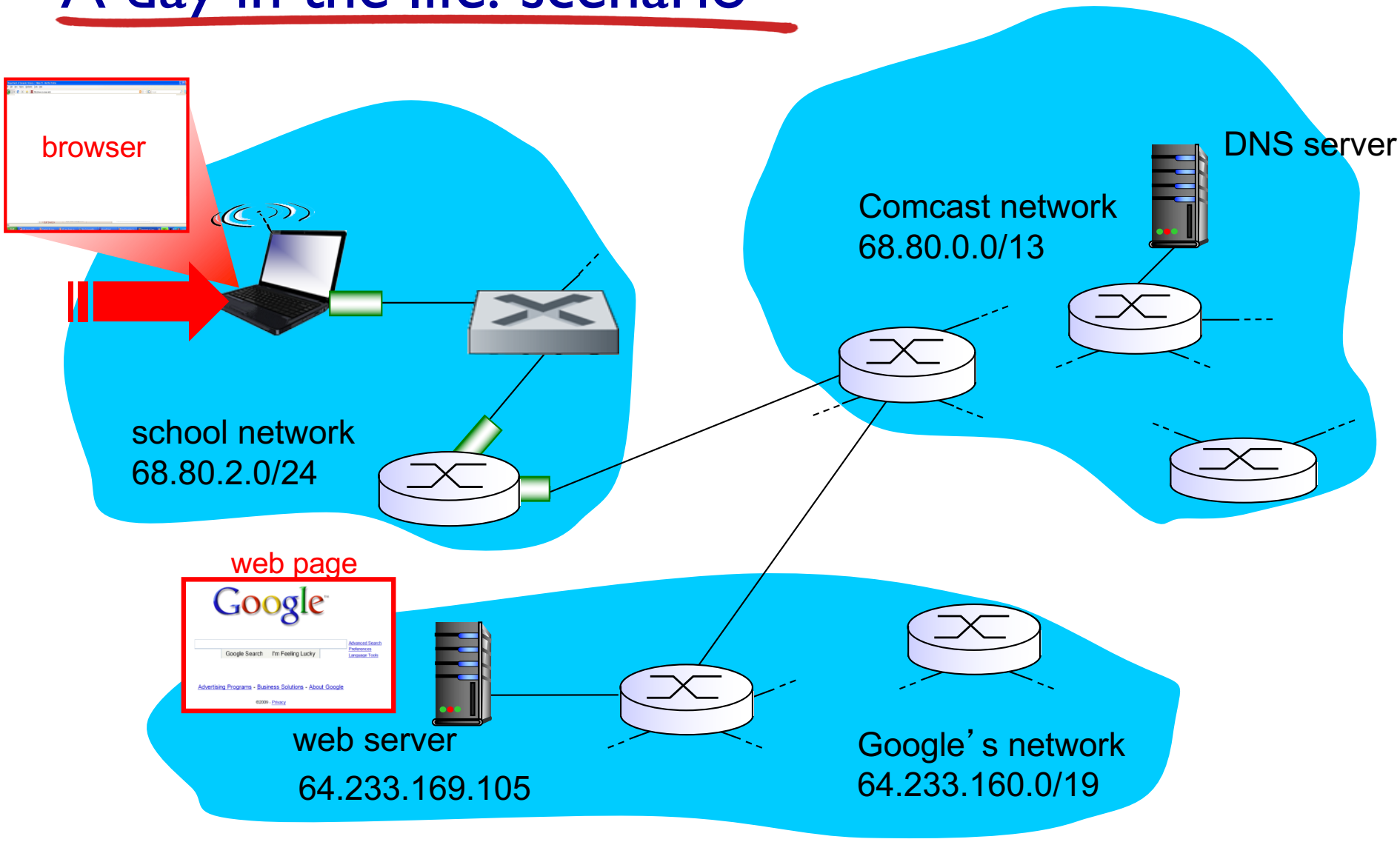
6.7 a day in the life of a web request

- a wrapup of what we learnt in this course

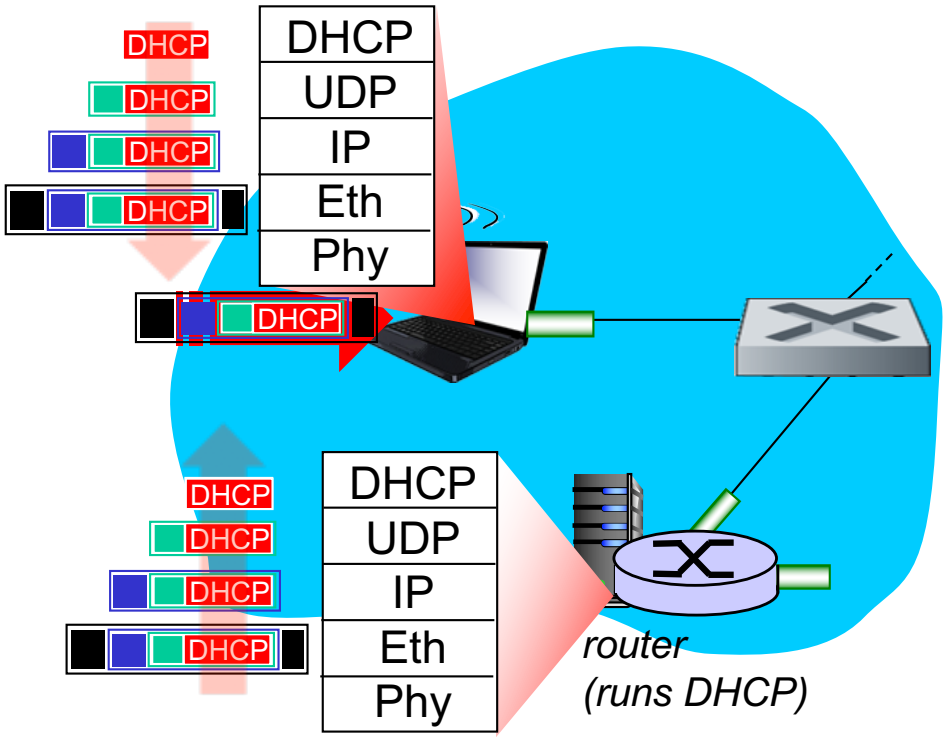
Synthesis: a day in the life of a web request

- journey down protocol stack complete!
  - application, transport, network, link
- putting-it-all-together: synthesis!
  - *goal:* identify, review, understand protocols (at all layers) involved in seemingly simple scenario: requesting www page
  - *scenario:* student attaches laptop to campus network, requests/receives www.google.com

A day in the life: scenario

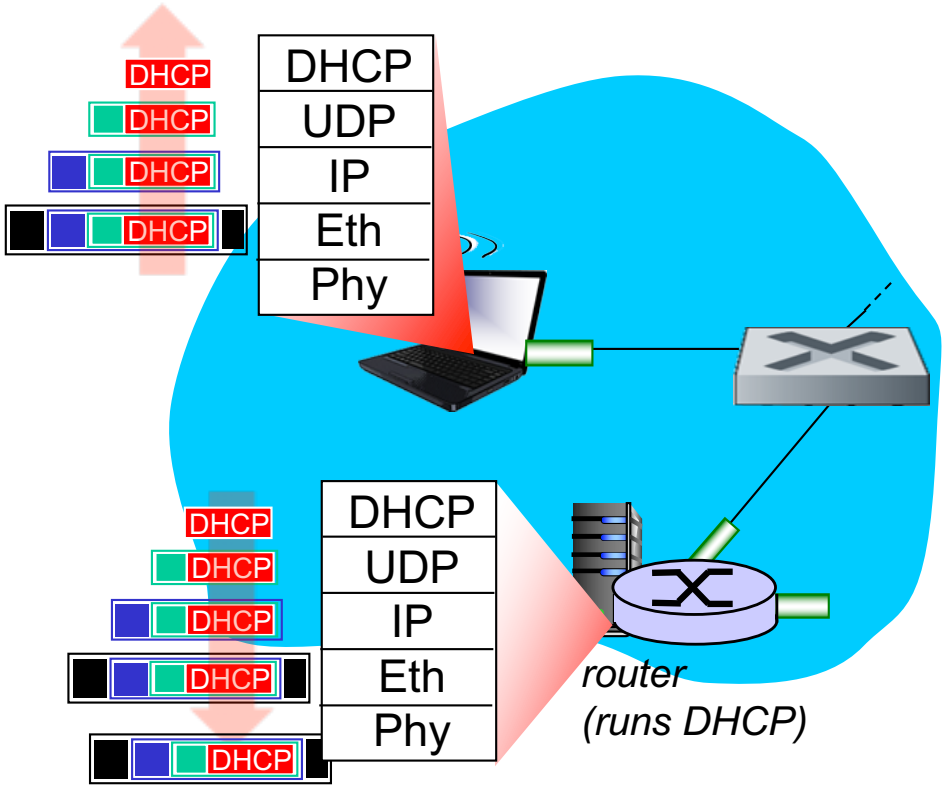


A day in the life… connecting to the Internet



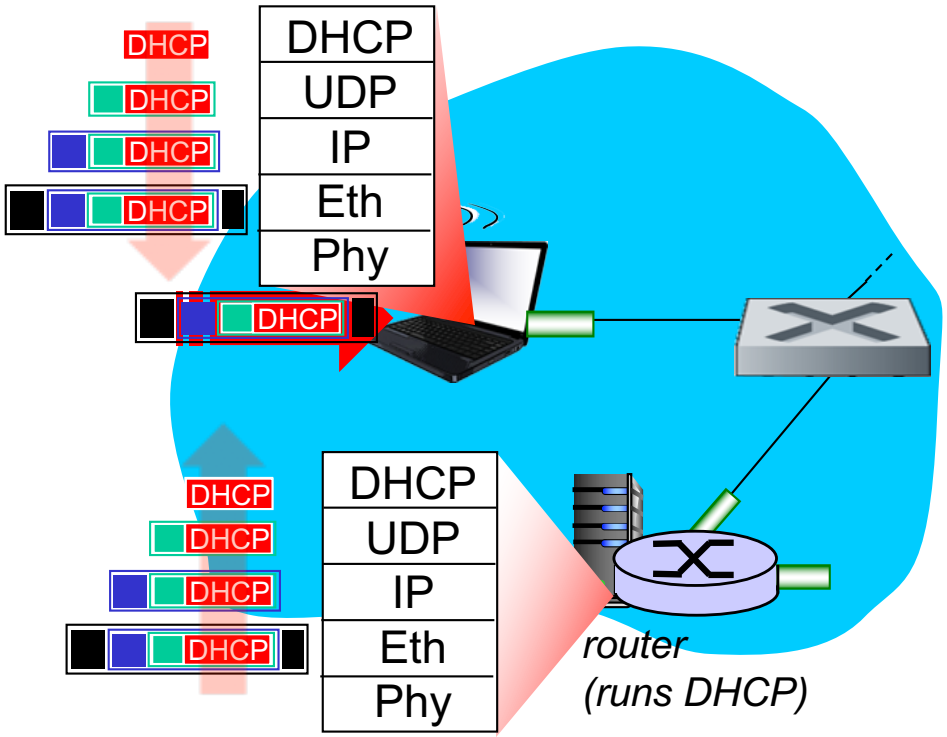
- connecting laptop needs to get its own IP address, addr of first-hop router, addr of DNS server: use *DHCP*
- DHCP Discover Message *encapsulated* in *UDP*, encapsulated in *IP*, encapsulated in *802.3* Ethernet
- Ethernet frame *broadcast* (dest: FFFFFFFFFFFF) on LAN, received at router running *DHCP* server
- Ethernet *demuxed* to IP demuxed, UDP demuxed to DHCP

A day in the life… connecting to the Internet



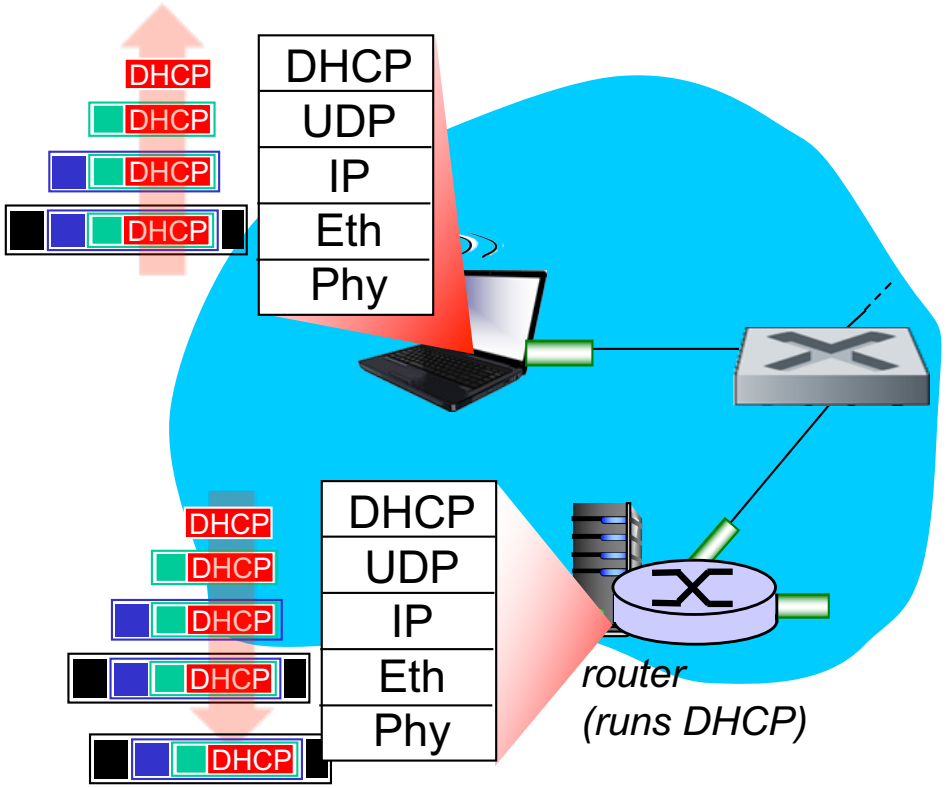
- DHCP server formulates *DHCP Offer* message containing client's IP address
- encapsulation at DHCP server, frame again broadcasted on LAN
- DHCP client receives DHCP Offer message

A day in the life… connecting to the Internet



- The client initiates DHCP Request message
- DHCP Request *encapsulated* in *UDP*, encapsulated in *IP*, encapsulated in *802.3* Ethernet
- Ethernet frame *broadcast* (dest: FFFFFFFFFFFF) on LAN, received at router running *DHCP* server
- Ethernet *demuxed* to IP demuxed, UDP demuxed to DHCP

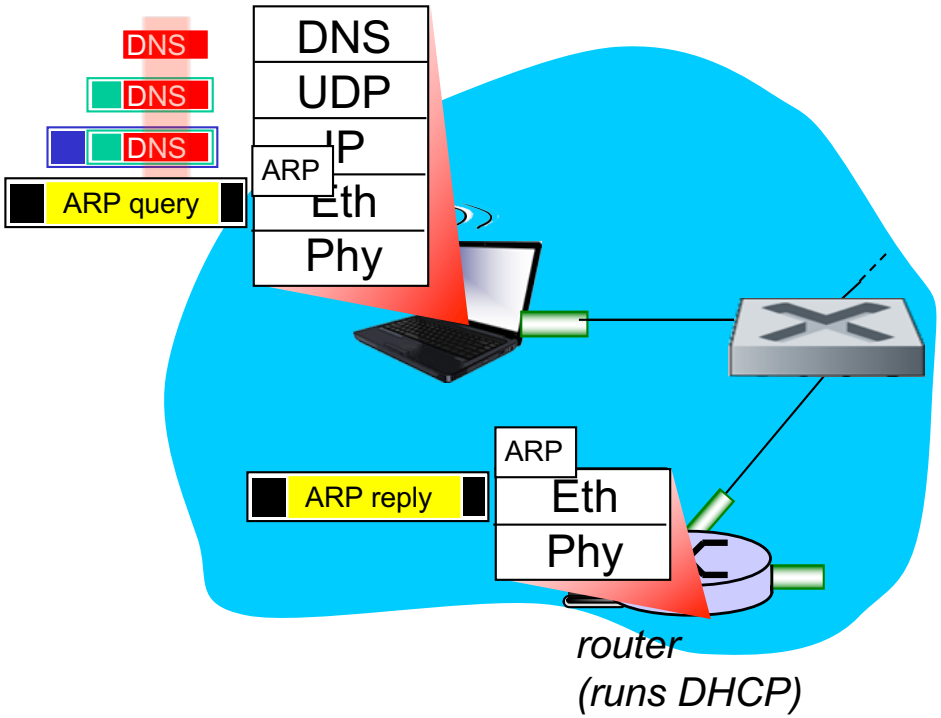
A day in the life… connecting to the Internet



- DHCP server formulates *DHCP ACK* containing client's IP address, IP address of first-hop router for client, name & IP address of DNS server
- encapsulation at DHCP server, frame broadcasted through LAN,
- DHCP client receives DHCP ACK reply

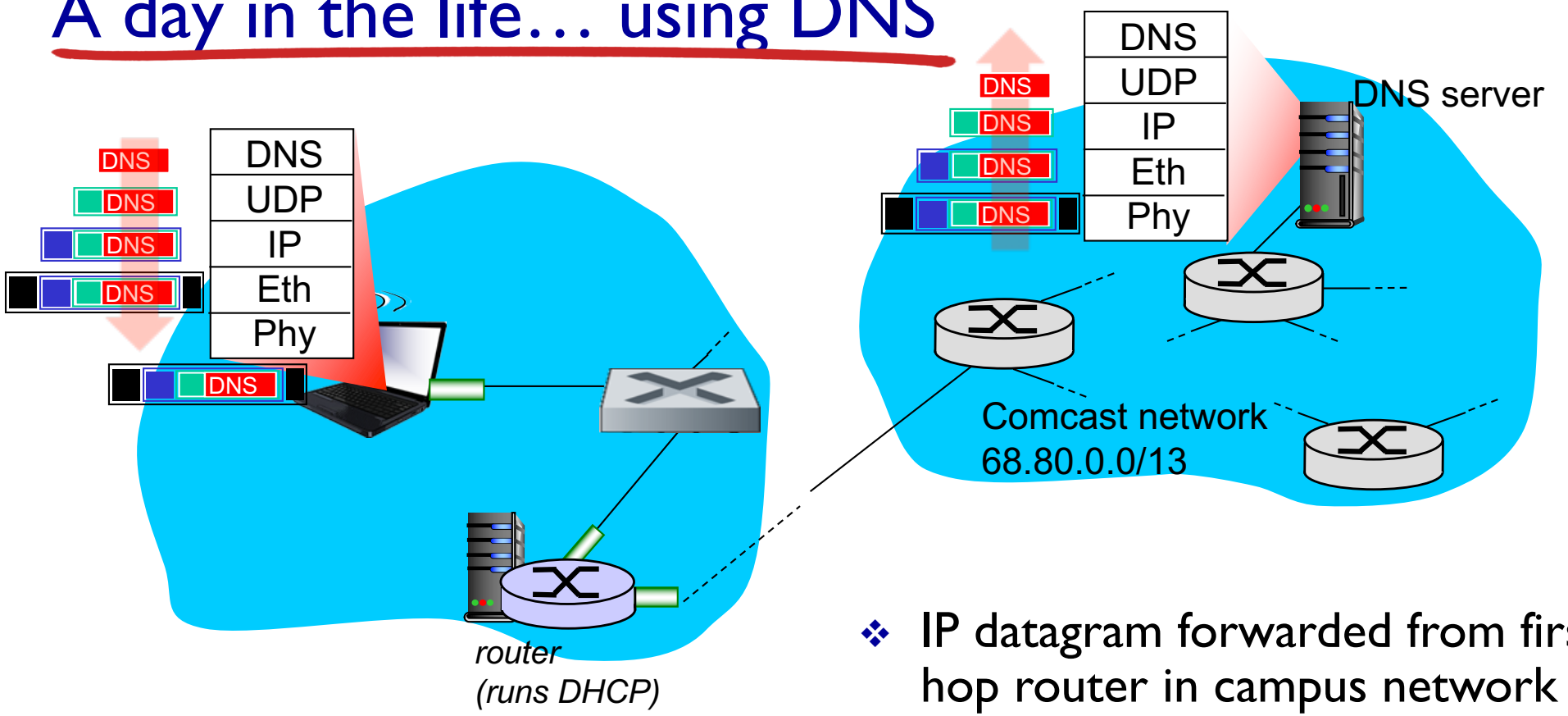
Client now has IP address, knows name & addr of DNS server, IP address of its first-hop router

A day in the life… ARP (before DNS, before HTTP)



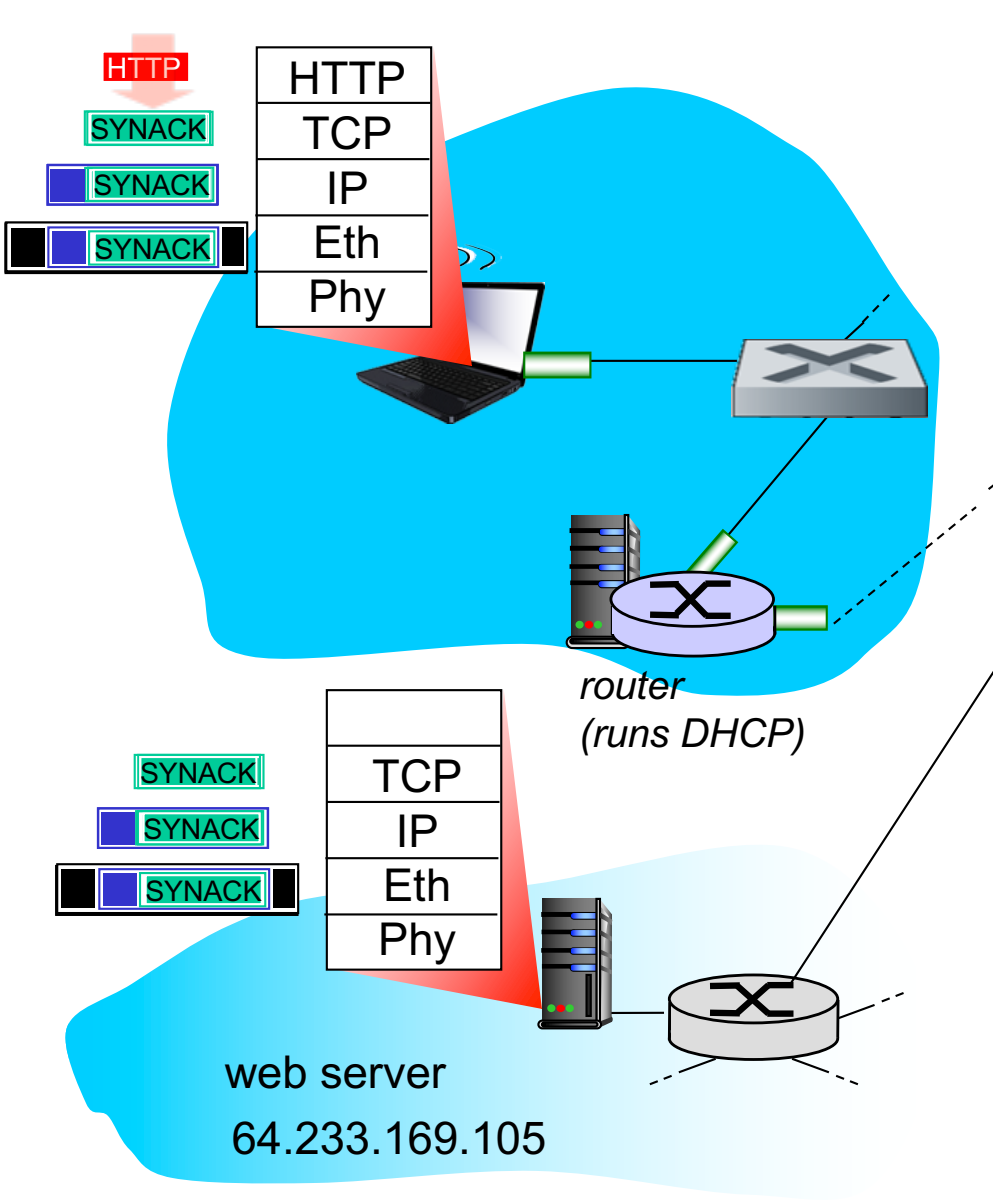
- before sending *HTTP* request, need IP address of www.google.com: *DNS*
- DNS query created, encapsulated in UDP, encapsulated in IP, encapsulated in Eth. To send frame to DNS server, need MAC address of first hop router: *ARP*
- *ARP query* broadcast, received by router, which replies with *ARP reply* giving MAC address of router interface
- client now knows MAC address of first hop router, so can now send frame containing DNS query

A day in the life… using DNS



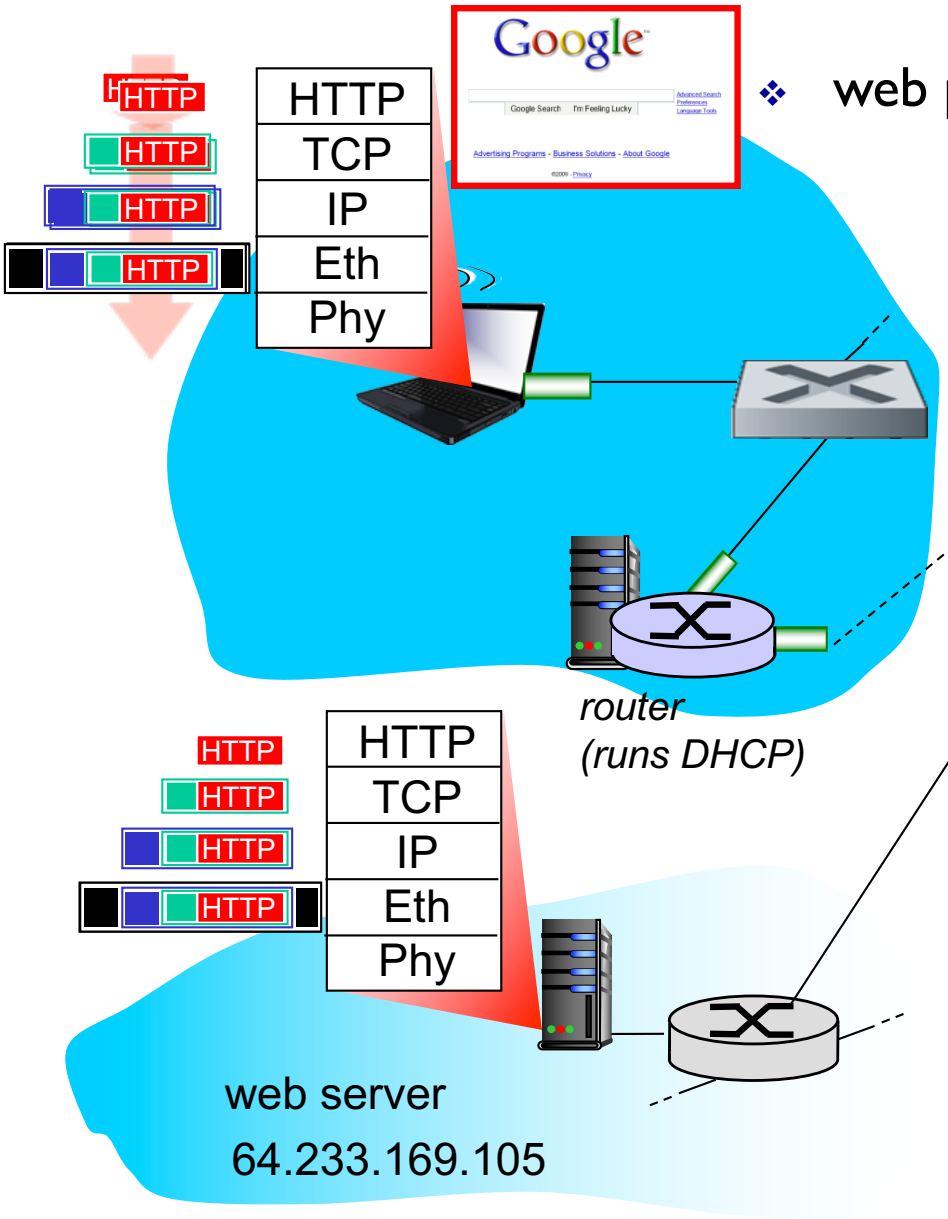
- IP datagram containing DNS query forwarded via LAN switch from client to first hop router
- IP datagram forwarded from first hop router in campus network into comcast network, routed (tables created by *RIP, OSPF, IS-IS* and/or *BGP* routing protocols) to DNS server
- demux'ed to DNS server
- DNS server replies to client with IP address of www.google.com

A day in the life…TCP connection carrying HTTP



- to send HTTP request, client first opens *TCP socket* to web server
- TCP *SYN segment* (step 1 in 3-way handshake) *inter-domain routed* to web server
- web server responds with *TCP SYNACK* (step 2 in 3-way handshake)
- TCP *connection established!*

A day in the life… HTTP request/reply



- web page *finally (!!!)* displayed

- *HTTP request* sent into TCP socket
- IP datagram containing HTTP request routed to www.google.com
- web server responds with *HTTP reply* (containing web page)
- IP datagram containing HTTP reply routed back to client