

# **Communication Networks: Technology & Protocols**



**University of California  
Berkeley**

# Course Objectives & Structure



- Explain Internet and related networks
- Compare solutions, identify trends
- Technology:
  - Links (ADSL, Optical, Cable); LANs (Ethernet)
  - Routers, Switches
- Protocols:
  - Routing, Transport
  - Applications

# Today: Introduction



- Web
- Voice over IP

# Web



- Example
- Locating Resource: DNS
- Connection
- End-to-end
- Packets
- Bits
- Points to remember

# Web: Example



- Click -> get page
- page from local or remote computer
- link:  
<http://cnn.com>

specifies

- protocol (http)
- location (cnn.com)

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Address <http://www.cnn.com/>

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About.com's user survey Should all guns be outlawed? ☐ Yes ☐ No Go and Vote Paid Banner Ad [Click here to vote](#)

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August 18, 1999 -- Updated 3:59 p.m. EDT, 1959 GMT, @874 swatch internet time

**Stunned Turks dig for earthquake survivors**

LL Cool J: Beauty in 'abrasive' new film?

In Other News:

[Drug survey: Teen use down; young adults up](#)

[McCain picks up Sen. Thompson's endorsement](#)

# Web: Example



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The screenshot shows a web browser window with the address bar displaying <http://www.cnn.com/WORLD/europe/9908/18/turkey.quake.02/>. The browser's menu bar includes File, Edit, View, Go, Favorites, and Help. The toolbar contains buttons for Back, Forward, Stop, Refresh, Home, Search, Favorites, History, Channels, and Fullscreen. The page content includes a sidebar with the CNN logo and a navigation menu listing categories like WORLD, africa, americas, asia pacific, europe, middle east, U.S., LOCAL, POLITICS, WEATHER, BUSINESS, SPORTS, SCI-TECH, and NATURE. The main content area features the headline "Stunned Turks dig for earthquake survivors" with a sub-headline "Death toll nears 3,500, likely to rise more". It also includes a date "August 18, 1999", a timestamp "Web posted at: 2:34 p.m. EDT (1834 GMT)", and a section titled "In this story:" with a link "Papers blame contractors". A photograph shows rescue workers in orange uniforms digging through rubble, with a woman in a white headscarf looking on. A small "GAP PHOTO" credit is visible on the right side of the photo.

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File Edit View Go Favorites Help

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Address <http://www.cnn.com/US/9908/18/drug.use.survey.02/>

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**u.s. > story page**

## Drug survey: Teen use down; young adults up

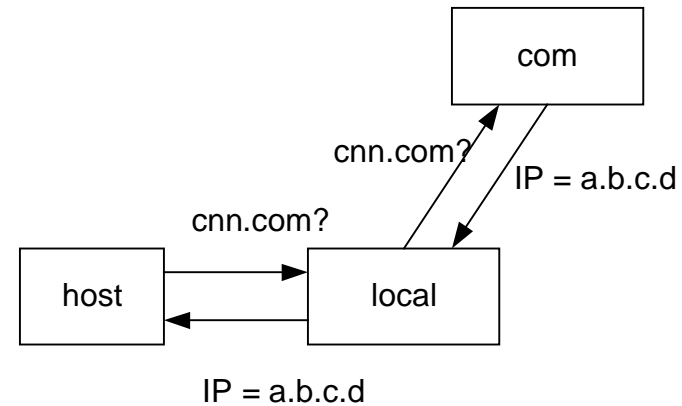
**August 18, 1999**  
Web posted at: 12:16 p.m. EDT (1616 GMT)

**In this story:**

- [Drug use by minorities up](#)
- ['Statistically significant decline'](#)
- ['Meth use a disaster'](#)

# Web: Locating Resource

- cnn.com is the **name** of a computer (and, implicitly, of a file in that computer)
- To find the address, the application uses a hierarchical directory service called the **Domain Name System**

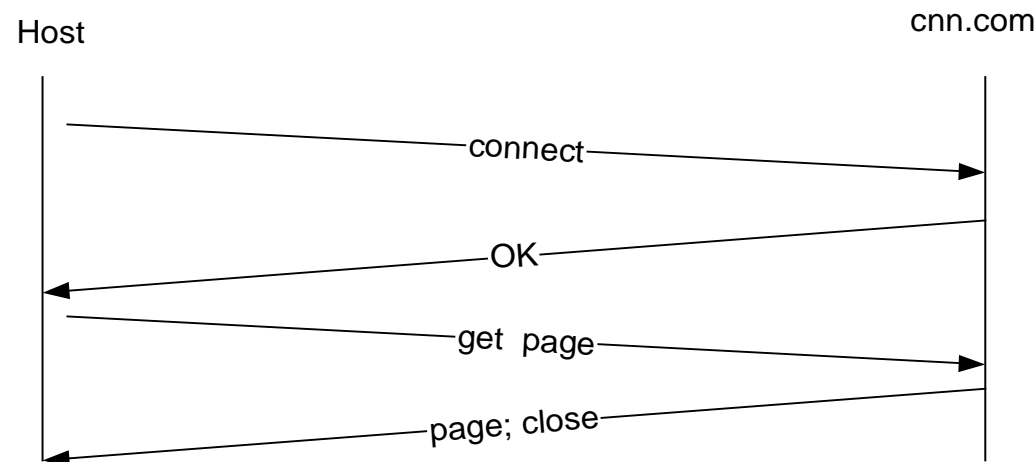




# Web: Connection



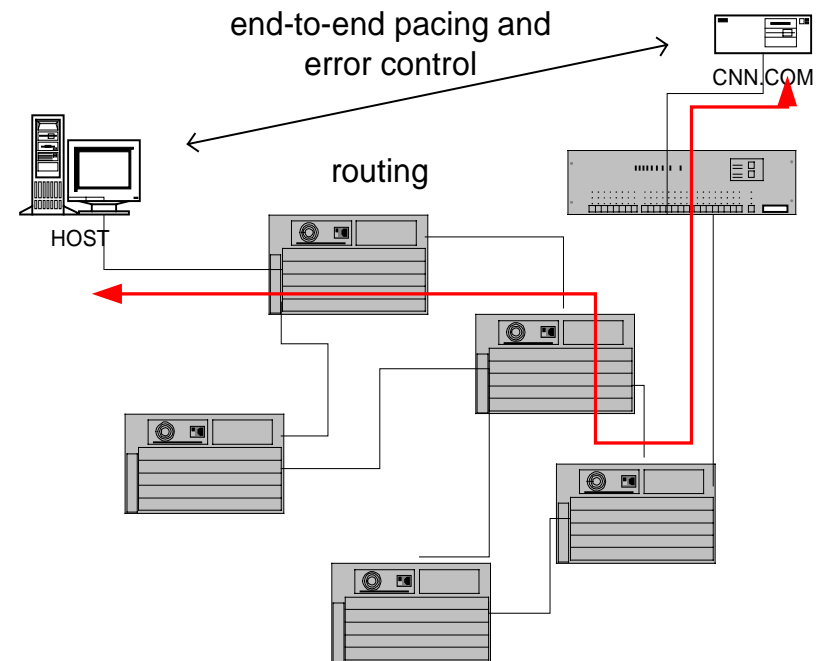
- The protocol (http) sets up a **connection** between the host and cnn.com to transfer the page
- The connection transfers the page as a byte stream, without errors: **pacing + error control**



# Web: End-to-end



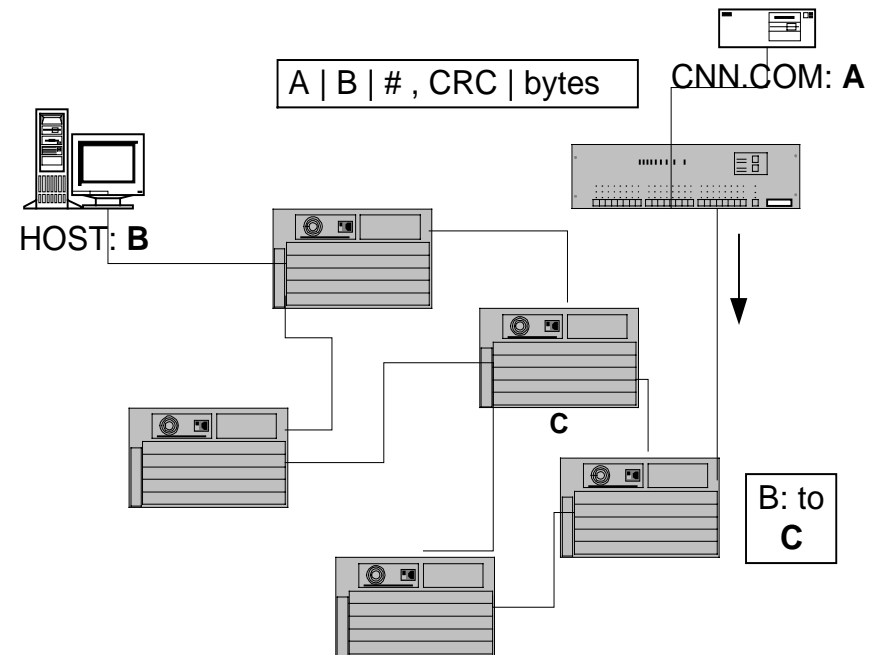
- The byte stream flows from end to end across many links and switches: **routing (+ addressing)**
- That stream is regulated and controlled by both ends: **retransmission** of erroneous or missing bytes; **pacing**



# Web: Packets



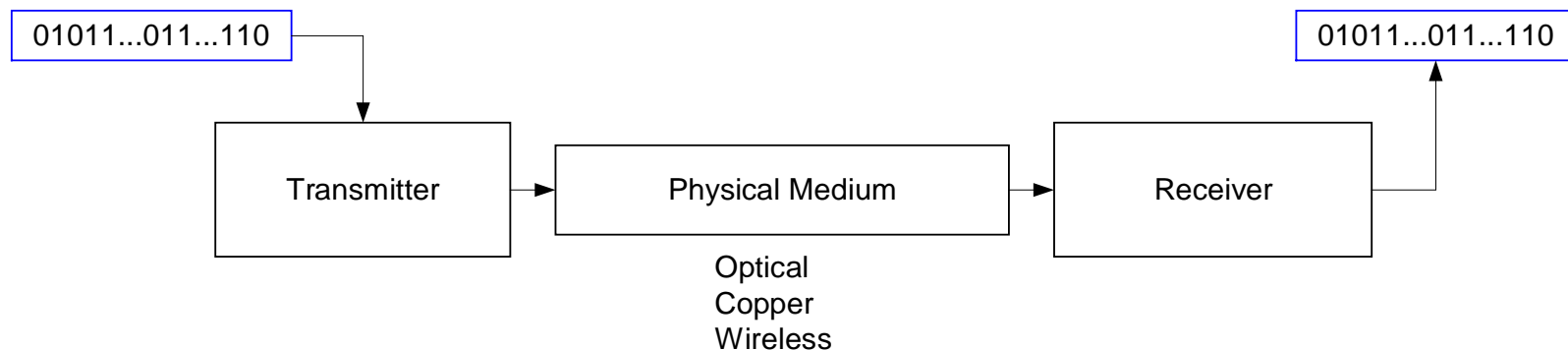
- The network transports bytes grouped into packets
- The packets are “self-contained” and routers handle them one by one
- The end hosts worry about errors and pacing:  
Destination sends ACKs  
Source checks losses



# Web: Bits



- Equipment in each node sends the packets as a string of bits
- That equipment is not aware of the meaning of the bits



# Web: Points to remember



## ■ Separation of tasks

- send bits on a link: transmitter/receiver [clock, modulation,...]
- send packet on each hop [framing, error detection,...]
- send packet end to end [addressing, routing]
- pace transmissions [detect congestion]
- retransmit erroneous or missing packets [acks, timeout]
- find destination address from name [DNS]

## ■ Scalability

- routers don't know about connections
- names and addresses are hierarchical



# Voice Over IP: VoIP



## ■ General Operations

# VoIP: General Operations

- Gateways must reproduce the signaling and voice
- Signaling: dialed digits, dial tone, ringing
- Voice: Packetize and absorb delay jitter
- Note: Routing problem

