

Networking / Video Conferencing

PORLAND STATE
UNIVERSITY

Admin

□ PA2

- ◊ Source Code – Friday Night, MIDNIGHT
- ◊ Write-up – Monday Nov. 23, 2015
 - Instead of output (3) on assignment:
 - Print a couple of images that you ran through your system to verify it works (should not be the ones given to you)
 - Use different quantization levels, compress, and decompression. Convert to GIF and add to hardcopy

□ HW 5

- ◊ On website
- ◊ Due Mon. Nov. 23, 2015

PORLAND STATE
UNIVERSITY

Rate monotonic

$$\frac{T_1}{C_1} \geq \frac{T_2}{C_2}$$

$$① \quad \left\lfloor \frac{T_2}{T_1} \right\rfloor C_1 + C_2 \leq T_2$$

$$\frac{T_2}{C_2} \geq \frac{T_1}{C_1}$$

$$② \quad C_1 + C_2 \leq T_1$$

$$\frac{T_2}{C_1} \geq \frac{T_1}{C_2}$$

$$③ \quad \left\lfloor \frac{T_2}{T_1} \right\rfloor C_1 + \left\lfloor \frac{T_1}{T_2} \right\rfloor C_2 \leq \left\lfloor \frac{T_2}{T_1} \right\rfloor T_1 = T_2$$

Anytime ② is true ① is true

If ① true, ② may not be

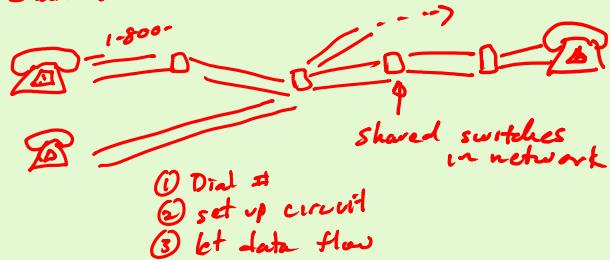
PORLAND STATE
UNIVERSITY

Multimedia Delivery Mechanisms

Two types

Circuit switched networking

channels are allocated (guaranteed)



① Dial #

② set up circuit

③ bt data flow

Shared switches in network

Packet-switch network

Everything is a packet

Network forwards packets one @ a time

IP network

PORLAND STATE
UNIVERSITY

Internet Properties and Components

Packet-based networking - every packet independent
Delivery of each packet not guaranteed
Similar to mail system.

Layered

Application	Browsers	MS Word
Appl. protocols	SMTP, HTTP	
Transport	TCP, UDP	
Internet Protocol	IP, ICMP	← Routing
Physical layer	802.11, Ethernet	

Two components: HOST & ROUTERS

PORLAND STATE
UNIVERSITY

Internet Hosts

Need to be uniquely addressable
(in order to route a packet directly to it)

32-bit address

Dotted decimal notation

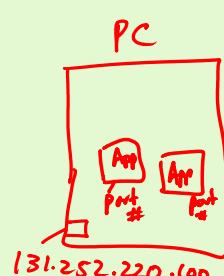
131.252.220.100

Within each host, applications
use port #'s for comm.

SSH 22

HTTP 80

SMTP 25



IP Addr / Port # pair for communicating
between applications

HOST-HOST 2 pairs src/dest

PORLAND STATE
UNIVERSITY

Transport Protocols - UDP

Minimal packet service for IP
Datagram packets
No guarantee of delivery
to application



Just has source IP / Port
 Dest IP / Port
 length
 checksum

PORLAND STATE
UNIVERSITY

Transport Protocols - TCP

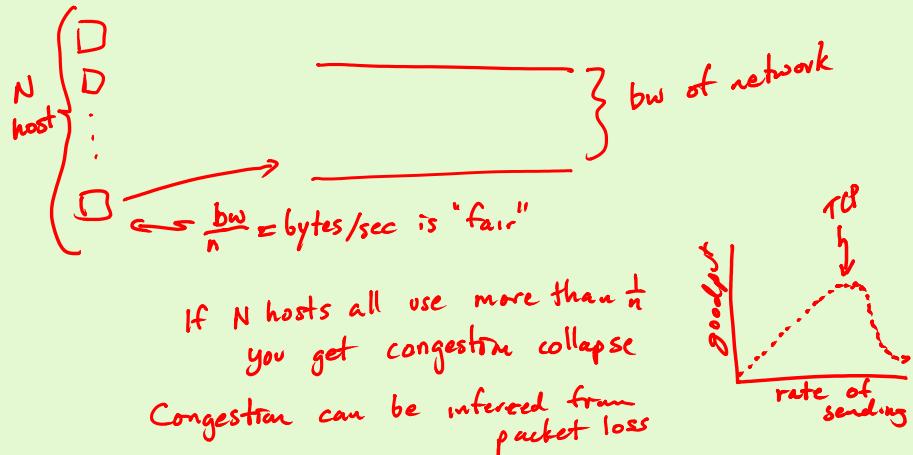
connection oriented service

Brings a reliable service to the Internet:

- ① Reliable (error-free) ← retransmissions/
time-outs
- ② In-order delivery ← buffers + has
seg. # to keep in
order
- ③ Flow control = maximize bw to the
application but don't overrun
the host or network
- ④ Network congestion sensitivity →

PORLAND STATE
UNIVERSITY

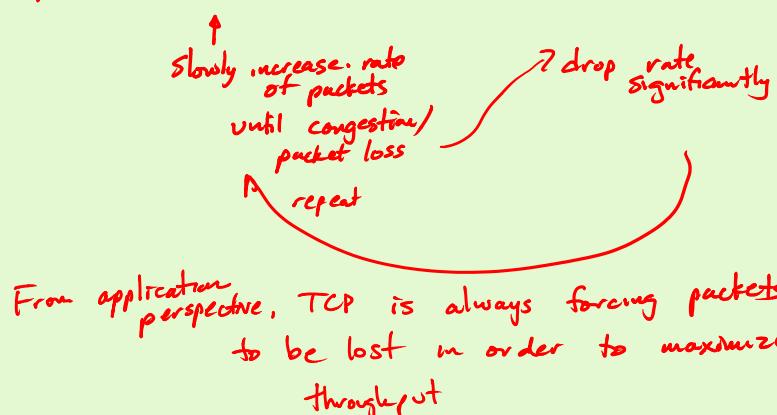
TCP – maximizing rate



PORLAND STATE
UNIVERSITY

TCP – maximizing rate

AIMD - additive increase, multiplicative decrease



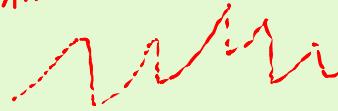
PORLAND STATE
UNIVERSITY

Problems with AIMD and Multimedia

MPEG - CBR or VBR



AIMD / TCP



TCP sawtooth

will need to adjust variable stream
into variable bw

PORLAND STATE
UNIVERSITY

Application Protocols

HTTP - hypertext transfer protocol

Multimedia specific protocols

RTP - real-time protocol

- UDP + timestamps, seq. #s for

RTCP

packet loss /
reordering

control protocol

QoS parameters for feedback

Both use UDP.

↑
Typically aiming for
5% loss

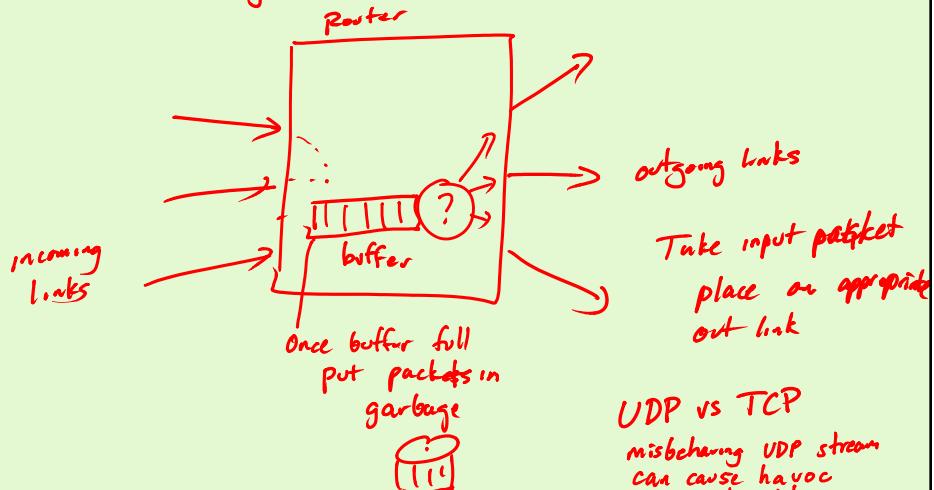
↑
basically how you
do network friendly

PORLAND STATE
UNIVERSITY

Routers

Goal: deliver packets from A to B

Congestion:



UDP vs TCP

misbehaving UDP stream
can cause havoc
in network!

PORLAND STATE
UNIVERSITY

Access Technologies

Wireless

Cellular

802.11 ~~xx~~

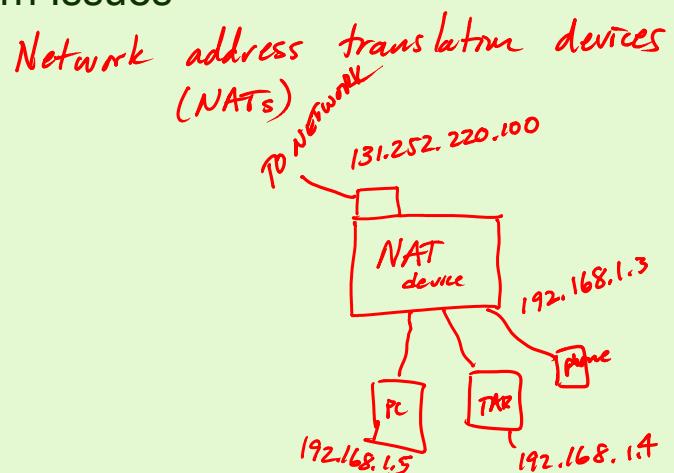
Wired

Ethernet = CSMA/CD

None of these provide guarantees

PORLAND STATE
UNIVERSITY

Modern Issues



PORLAND STATE
UNIVERSITY

Video Conferencing

PORLAND STATE
UNIVERSITY

Video Conferencing

- Under what conditions can you guarantee bw to a MM app?

Issues? Access medium cellular/ 802.11 shared
PC's display, disk, memory

You end-to-end \rightarrow Display \rightarrow PC \rightarrow Net \rightarrow PC \rightarrow Display \rightarrow Camera

- What transport protocol do you use? UDP? TCP?

UDP

- + send what you want
- + low latency
- bad for network (possibly)
- need to implement congestion, some reliability

TCP

- + reliable
- delay may be bad
- more variable bw

PORLAND STATE
UNIVERSITY

Video Streaming Landscape

Reservations

NO \rightarrow IP

YES

Live

Skype
NetMeeting
Video is tightly coupled w/ network

Just set output bit rate



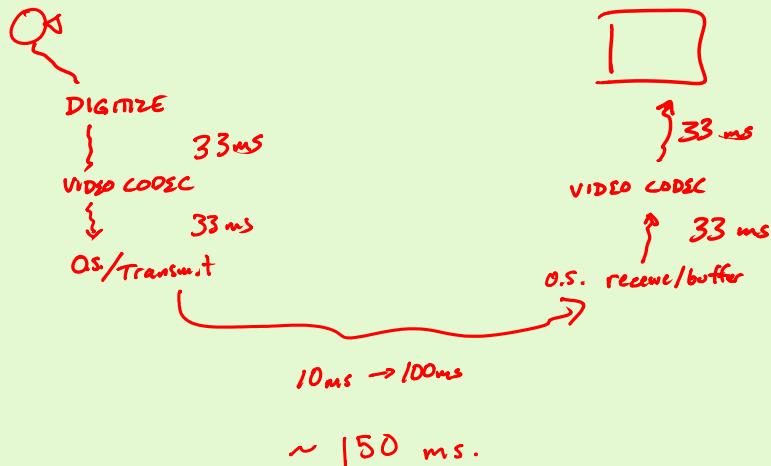
Stored

Youtube / Netflix
Adapt over longer periods of time

Adaptation to a fixed target

PORLAND STATE
UNIVERSITY

A Typical Video Conferencing System



PORLAND STATE
UNIVERSITY

Performance Requirement

Latency - time between acquisition + display
one-way, round-trip

Literature:

Telephony: 100ms RT

MM: ~250ms one-way as being "acceptable"

CSCW: 400ms one-way

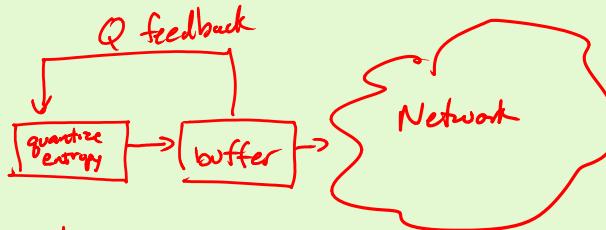
! computer supported collaborative work

PORLAND STATE
UNIVERSITY

Video Bit Rate Scaling

Live best-effort streaming

Provide best video by adapting the way to network



-) for live streaming Q is much more variable

-) sometimes Q will not be enough.

How does one scale media data?

PORLAND STATE
UNIVERSITY

Video Bit Rate Scaling

Temporal scaling - simply reduce frame rate

Easy to do @ encoding

Harder to do in network or other layer

I P P P P P I P P P P ..

Interactive streaming usually has no B-frame

Best to drop \Rightarrow no dependency on it

This one you would like to be

next but: m.r. get screwed up

drift errors \Leftarrow m.r. that are reconstructed but off a little

PORLAND STATE
UNIVERSITY