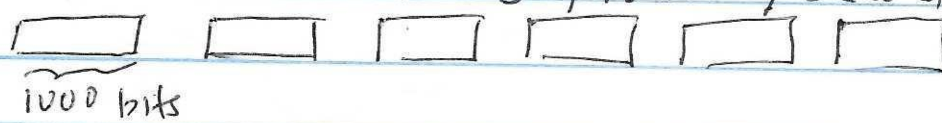
Notes 4

Channel Rate R. bits / second
Could also be frames / second
if we know frame size (assume always same)

Suppose all frames (or packets) are 1000 bits.
Suppose we can send $R = 6$ kilobits / second
Then we can send 6 frames / second



Throughput
Rate in bits / second or frames / second that transmitted information actually get through (ie. gets to sender).

For multiple access protocols we are concerned about the reduction due to collisions (and not headers or error checking)

For example, after accounting for collisions and thus retransmitted packets, only good data of 4 kilobits / seconds get through.
Throughput is 4 kilobits / second.

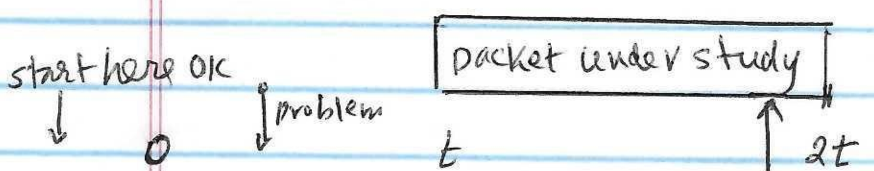
Note Normalized throughput is $\frac{\text{throughput}}{\text{channel rate}}$ $\frac{4\text{ kbs}}{6\text{ kbs}} = 2/3$
Normalized to 1 for max possible.

Abramson Analysis

Aloha, lots of stations are transmitting
Let a packet be of length L bits
Let t be the time to transmit 1 packet
which is L/R = packet transmission time = t (seconds)

If packets are sent at channel capacity
with no problems we have 1 packet / t seconds
This is the normalized traffic rate.

Packet vulnerable in fact to collision



Vulnerable to $0 \leftrightarrow 2t$ problem start here
vulnerable period is $2t$.

Generating traffic

Let G be the ("normalized") rate we are
generating traffic. G packets / t seconds.
Look at instead the vulnerable period of $2t$ sec.
So we are generating $2G$ packets / $2t$ seconds

We are particularly interested in
S : new traffic successfully transmitted

Poisson Distribution

A random variable X is Poisson distributed

if $P[X = k] = \dfrac{e^{-\lambda}\lambda^k}{k!}$ $\quad k = 0, 1, 2, \ldots$

λ is a parameter and sometimes (in the case of # of arrivals) is called the rate.
λ is also the mean of the distribution.

Abramson

Let G, the offered load be Poisson with rate $2G$ / $2t$ seconds.

That is $P[k \text{ transmissions in time } 2t]$

$$= \left\{ \frac{e^{-2G}(2G)^k}{k!} \right.$$

What about throughput S?

$$S = G\,P[0 \text{ transmissions in } 2t \text{ seconds}]$$

$$\therefore \; S = G e^{-2G}$$