Announcements

- Homework 4 due today
- Midterm - 10/29, 6:15 or 8:00 in Physics 203

The Future of an Illusion Film Series
7:00 p.m., Paresky Auditorium

The special-effects team of Jeff Kleiser and Diana Walczak, who now operate Synthespian Studios in North Adams, have been producing ground-breaking work in computer animation for 30 years. Among the films they've contributed to are: Tron, Stargate, Clear and Present Danger, Mortal Kombat Annihilation, The Fantastic Four, X-Men and X-Men United. The evening will include demonstration of their most recent work: 'youthanizing' Bruce Willis in Surrogates.

CSCI 12 Computer Animation Production

This course will introduce the stages of computer animation production including design, storyboarding, modeling, texturing, rigging, animation, lighting and compositing. The course will consist of lectures in which the field of computer animation will be explored from an historical context, using video examples. In addition, students will partipate in actual production projects on an intern level, and learn how software development initiatives are applied to solve real-world production problems. Evaluation will be based on active participation in lecture and projects as well as a final project.

Prerequisites: strong interest in computer animation and graphics.
Enrollment limit: 8. Preference will be given to students with background in Computer Science or Studio Art.

JEFF KLEISER (Instructor)


NAT· MDCCC XXXIII
OB· MDCCC XCVI
ALFR· NOBEL

The Nobel Prize in Physics 2009

"for groundbreaking achievements concerning the transmission of light in fibers for optical communication"

"for the invention of an imaging semiconductor circuit – the CCD sensor"

Charles K. Kao

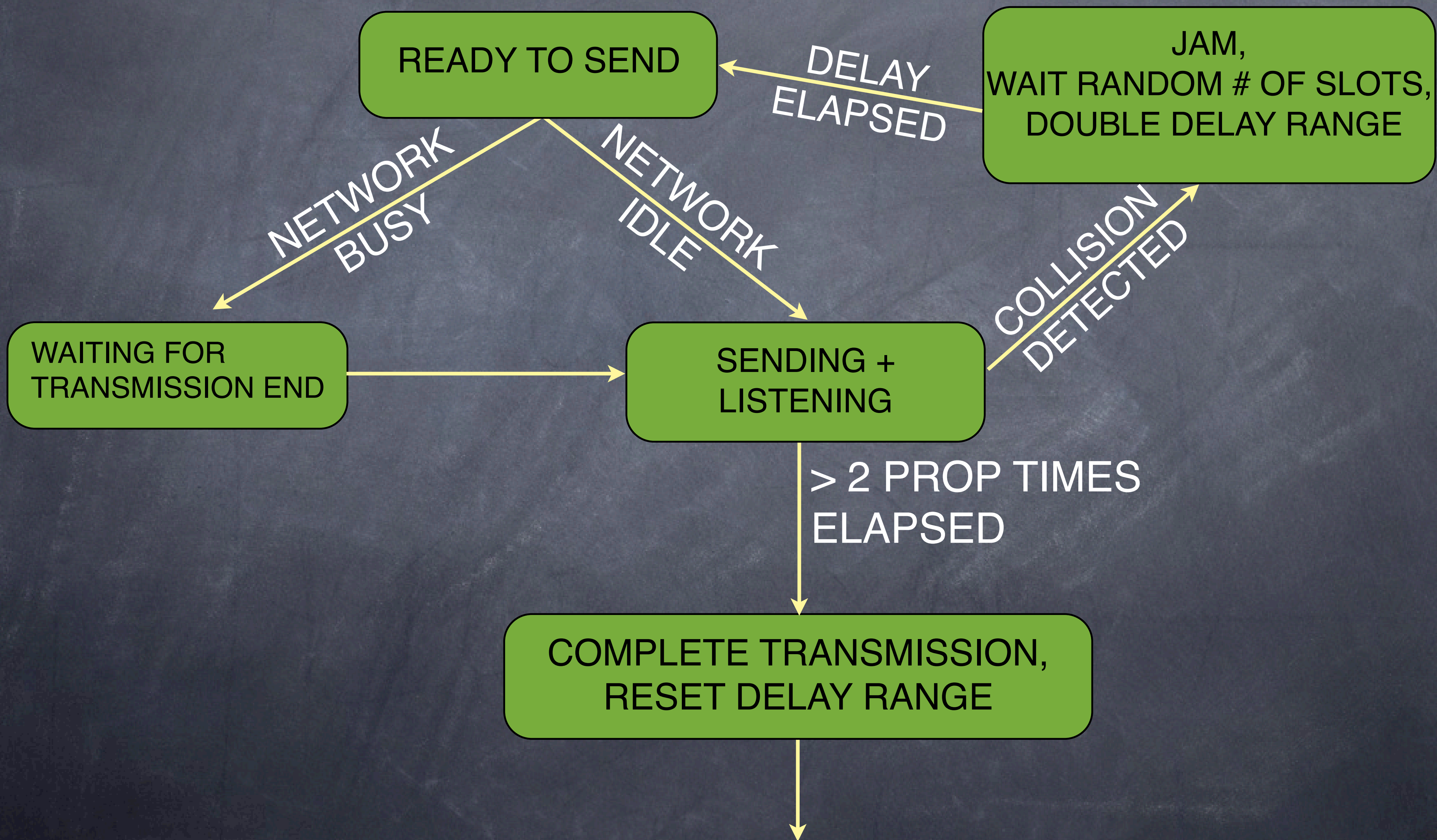
Willard S. Boyle

George E. Smith

Today's Plan

- Ethernet Performance
  - Expected Efficiency
  - Probabilistic estimation of collision frequency

ETHERNET TRANSMISSION ALGORITHM



Metcalfe and Boggs Say...

$$\text{Efficiency} = \frac{P/R}{W \times T + P/R}$$

$$= \frac{\text{Time spent doing useful work}}{\text{Time spent}}$$

P = expected/average packet size

R = transmission rate (M & B call it C)

W = expected # of slots between transmissions

T = expected length of a contention slot

Metcalfe and Boggs Say...

$$\text{Efficiency} = \frac{P/R}{W \times T + P/R}$$

$$= \frac{\text{Time spent sending a packet}}{\text{Time spent colliding and then sending}}$$

P = expected/average packet size

R = transmission rate (M & B call it C)

W = expected # of slots between transmissions

T = expected length of a contention slot

Metcalfe and Boggs Say...

$$\text{Efficiency} = \frac{P/R}{W \times T + P/R}$$

$$= \frac{1}{\frac{W \times T}{P/R} + 1}$$

P = expected/average packet size

R = transmission rate (M & B call it C)

W = expected # of slots between transmissions

T = expected length of a contention slot

Metcalfe and Boggs Say...

$$\text{Efficiency} = \frac{P/R}{W \times T + P/R}$$

$$W = \frac{1 - A}{A}$$

$$A = \frac{Q}{Q}\left(1 - \frac{1}{Q}\right)^{(Q - 1)}$$

P = expected/average packet size
R = transmission rate (M & B call it C)
T = expected length of a contention slot
W = expected # of slots between transmissions
A = Probability exactly one computer sends in a slot
Q = number of computers trying to send

Expectations

Given F: outcome → value

$$Expected(\ F\ ) = \sum_{\text{all outcomes}} Prob(\ outcome\ ) \times F(\ outcome\ )$$

Probability Principles

1. The probability that something won't happen is 1 minus the probability that it will happen.

2. The probability of two events both happening is the product of their separate probabilities if the events happen (or don't happen) independently.

Sum of Series

$$\sum_{i=0}^{\infty} R^i \times i = \frac{R}{(1-R)^2}$$

Metcalfe and Boggs Say...

$$W = \frac{1 - A}{A}$$

A = Probability that exactly 1 computer attempts a transmission in a given slot

Expectations

Given F: outcome → value

$$Expected(\ F\ ) = \sum_{\text{all outcomes}} Prob(\ outcome\ ) \times F(\ outcome\ )$$

Expected Contention Slot

Outcomes: { success in slot 0, success in slot 1, success in slot 2, ... }

F(success in slot i) = i (slots wasted)

W = Expected # of slots wasted =

$$\sum_{\text{all } i} Prob(\text{ success in slot } i \text{ }) \times i$$

Probability Principles

1. The probability that something won't happen is 1 minus the probability that it will happen.

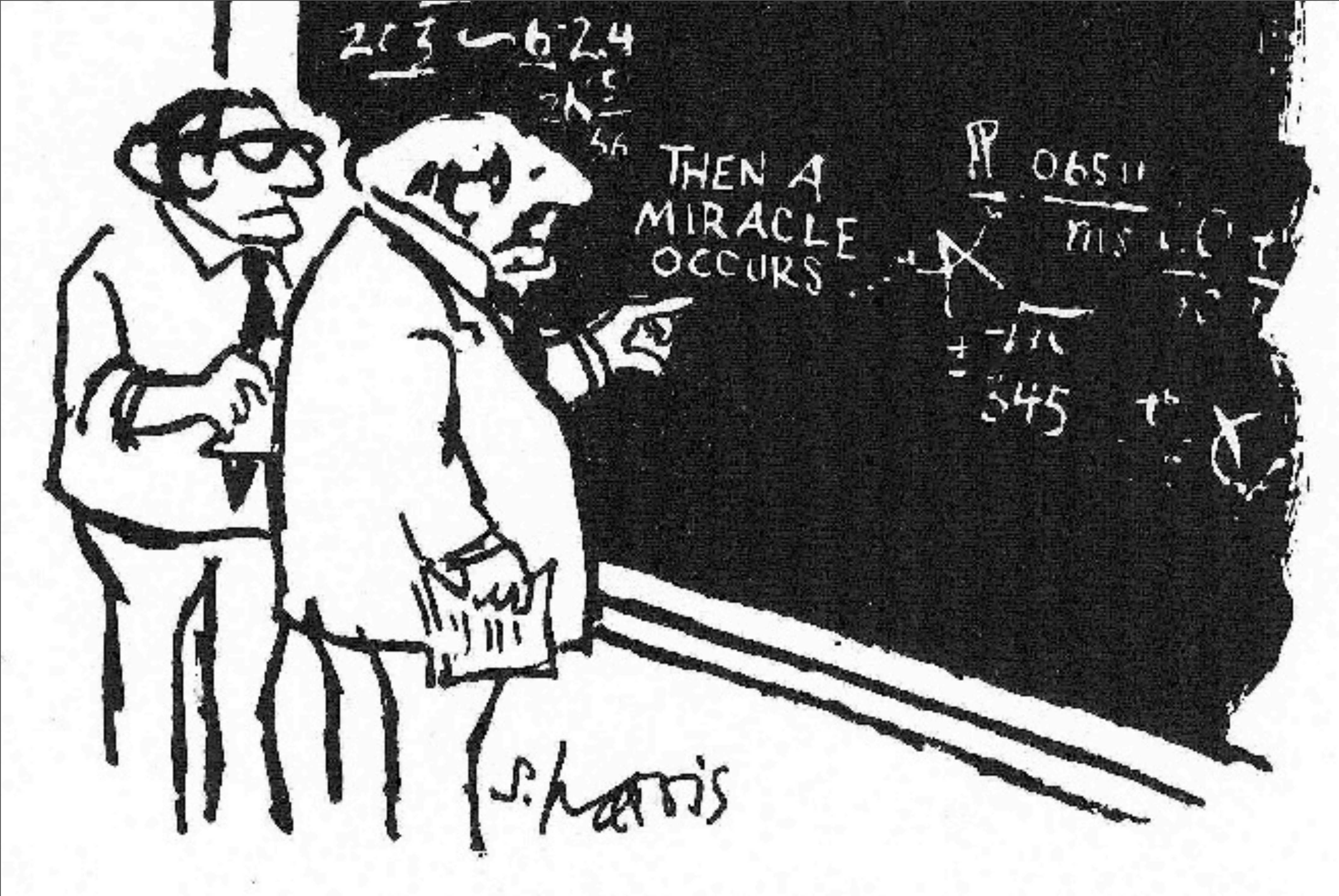
2. The probability of two events both happening is the product of their separate probabilities if the events happen (or don't happen) independently.

Expected Contention Slots

$W = Expected\ \#\ of\ slots\ wasted$

$$= \sum_{\text{all } i} Prob(\ success\ in\ slot\ i\ ) \times i$$

$$= \sum_{i=0}^{\infty} A \times (1 - A)^{i} \times i$$



"I think you should be more explicit here in step two."

Mathematical Miracles

$$\sum_{i=0}^{\infty} R^i \times i = \frac{R}{(1 - R)^2}$$

$$\sum_{i=0}^{\infty} R^i = \frac{1}{(1 - R)}$$

$$\sum_{i=0}^{\infty} R^i - \sum_{i=1}^{\infty} R^i = (1 - R) \sum_{i=0}^{\infty} R^i = 1$$

Expected Contention Slots

$$W = \sum_{i=0}^{\infty} Prob(\text{ success in slot } i\text{ }) \times i$$

$$= A \sum_{i=0}^{\infty} (1 - A)^i \times i$$

$$= \frac{A\,(1 - A)}{(1 - (1 - A))^2} = \frac{(1 - A)}{A}$$

Metcalfe and Boggs Say...

$$A = \left(1 - \frac{1}{Q}\right)^{(Q - 1)}$$

A = The probability that exactly one computer begins to transmit in a given slot

Q = The number of computers with a message to transmit

Slippery Slots

Probability a particular computer tries to send $\approx \frac{1}{S}$

S = The number of backoff slots the computer is currently using

Synchronized Slots

Probability a particular computer sends alone $\approx \frac{1}{S} \left(1 - \frac{1}{S} \right)^{(Q - 1)}$

S = The number of backoff slots all of the computer all currently using!!!

Q = The total number of computers that are trying to send

Probability of Success

Probability some lucky computer sends alone $\approx \frac{Q}{S} \left(1 - \frac{1}{S} \right)^{(Q - 1)}$

S = The number of backoff slots all of the computer all currently using!!!

Q = The total number of computers that are trying to send

But Metcalfe and Boggs Say...

$$A = \left(1 - \frac{1}{Q}\right)^{(Q - 1)}$$

A = The probability that exactly one computer begins to transmit in a given slot

Q = The number of computers with a message to transmit

Thinking Optimistically

$$\frac{dA}{dS} \approx \frac{N}{S^3}(Q - S)\left(1 - \frac{1}{S}\right)^{(Q - 2)}$$

S = The number of backoff slots all of the computer all currently using!!!

Q = The total number of computers that are trying to send

Probability of Success?

$$A \approx \frac{Q}{S}\left(1 - \frac{1}{S}\right)^{(Q - 1)}$$

$$< \frac{Q}{Q}\left(1 - \frac{1}{Q}\right)^{(Q - 1)}$$

S = The number of backoff slots all of the computer all currently using!!!

Q = The total number of computers that are trying to send

The Bottom Line

N = Q	P = 4K	P = 1K	P = 512	P = 48
1	1	1	1	1
3	0.99	0.94	0.89	0.44
5	0.98	0.94	0.88	0.41
10	0.98	0.93	0.87	0.39
128	0.98	0.93	0.86	0.37