

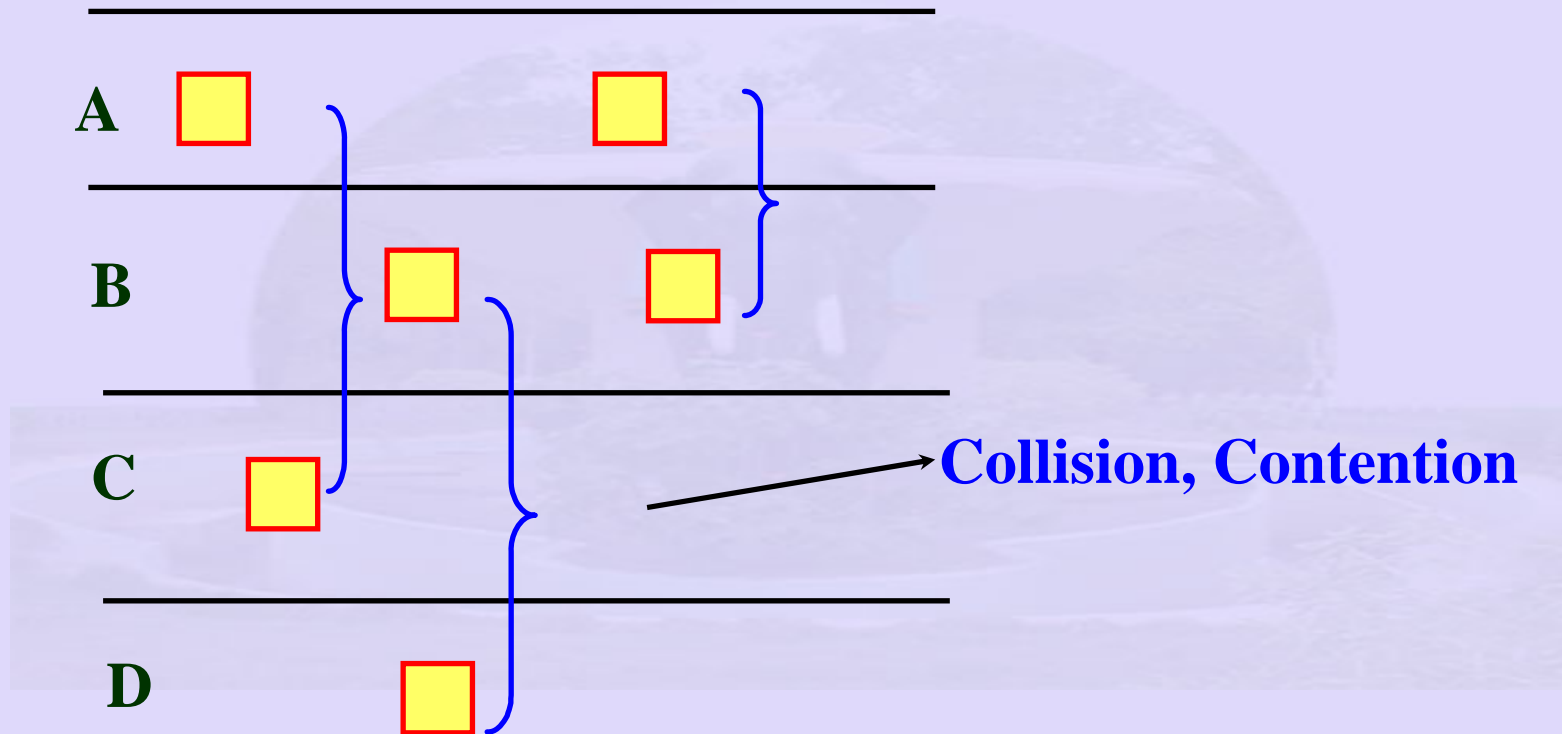
Multiple Access Protocols: ALOHA

- ALOHA
 - pure
 - slotted
- Basic idea: User transmit whenever they have data to send
- Collision detection:
 - use feed back property to determine collisions
- Originated as part of packet switched radio networks

ALOHA

- Very inefficient: 18%
 - Solution: Slotted ALOHA
- Slotted ALOHA
 - Time divided into Slots
 - Transmission only in slots
 - Efficiency : 36%

ALOHA



Collision Resolution: Wait random amount of time before retransmitting

ALOHA: Throughput



t – time required to send a frame

Throughput: maximised when frames across stations of same size

ALOHA: Efficiency

- population: infinite number of users generate frame (in a frame time)
 - S frames/frame time
 - Assume Poisson Distributed
 - $S < 1$ – only then possible to successfully transmit.
 - $S > 1$ – almost all frames suffer collision
 - G – number of attempts/frame

ALOHA: Efficiency

- Throughput: $S = GP_0$
 - P_0 – Probability that a frame does not suffer collision

- Low Load:
 $S \approx 0$
 $G \approx S$

Low Collisions, few transmissions

- High Load:

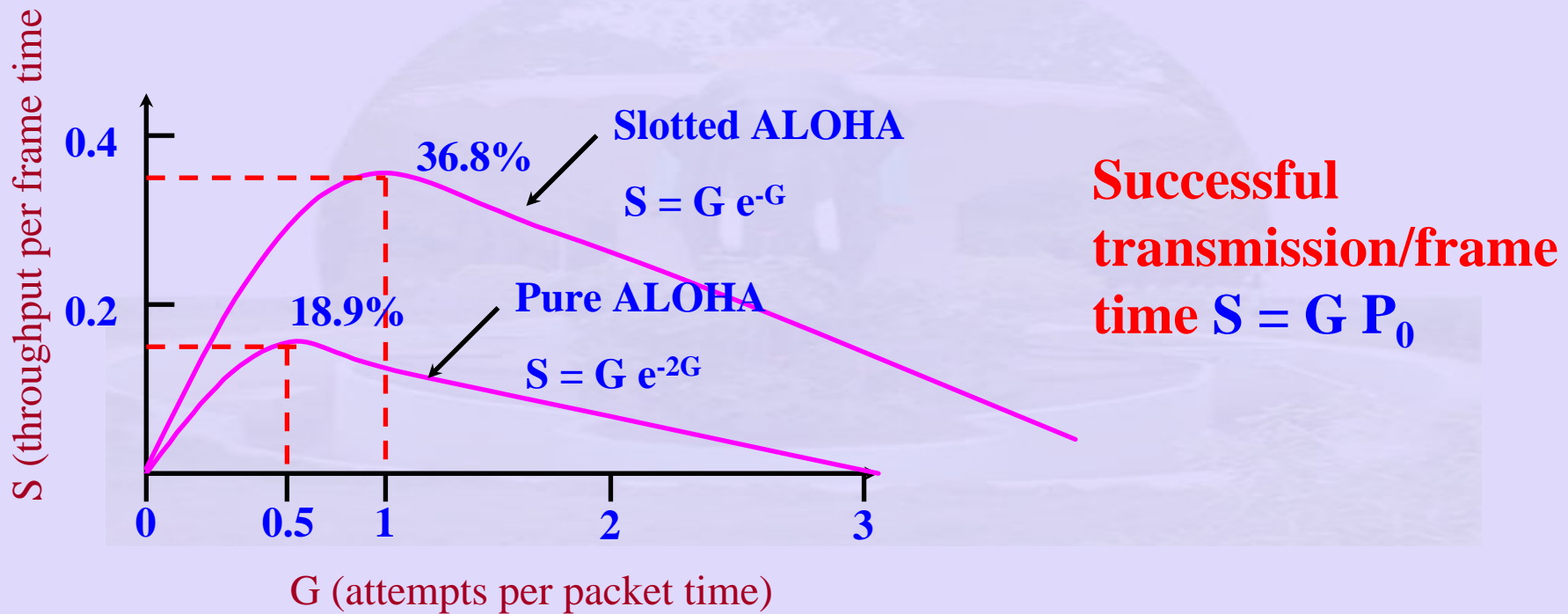
$$G > S$$

High Collisions, almost every frame collides

ALOHA-Analysis

- Probability of zero frames: e^{-G}
- In an interval two frames long –
 - number of frames generated is $2G$
- Probability that no other traffic – during vulnerable period
 - $P_0 = e^{-2G}$
 - $S = G e^{-2G}$
- Max Throughput: $G = 0.5$, $S = 1/2a$ (a is the propagation delay)

ALOHA: Throughput vs Load



Carrier Sense Transmission

- ALOHA: Utilisation very poor
 - need a better solution
- CSMA – Carrier Sense Multiple Access Protocols
- CSMA / CD – Additional overhead over CSMA –
 - once collision detected stop transmitting
- Ethernet Xerox Palo Alto Research

Carrier Sense Transmission

- All stations can detect when a station is idle / busy.
- Collision detection (CD)
 - collision a host listens as it transmits
 - knows when a collision has occurred (change in signal levels on the line)

Carrier Sense Transmission

- 1 (p) – persistent CSMA:
 - When station has data to send – listens
 - busy – then wait
 - idle – transmit
 - Collision occurs
 - wait random amount of time and then retransmit
- 1 (p) – persistent:
 - station transmits with a probability 1 (p) – when idle

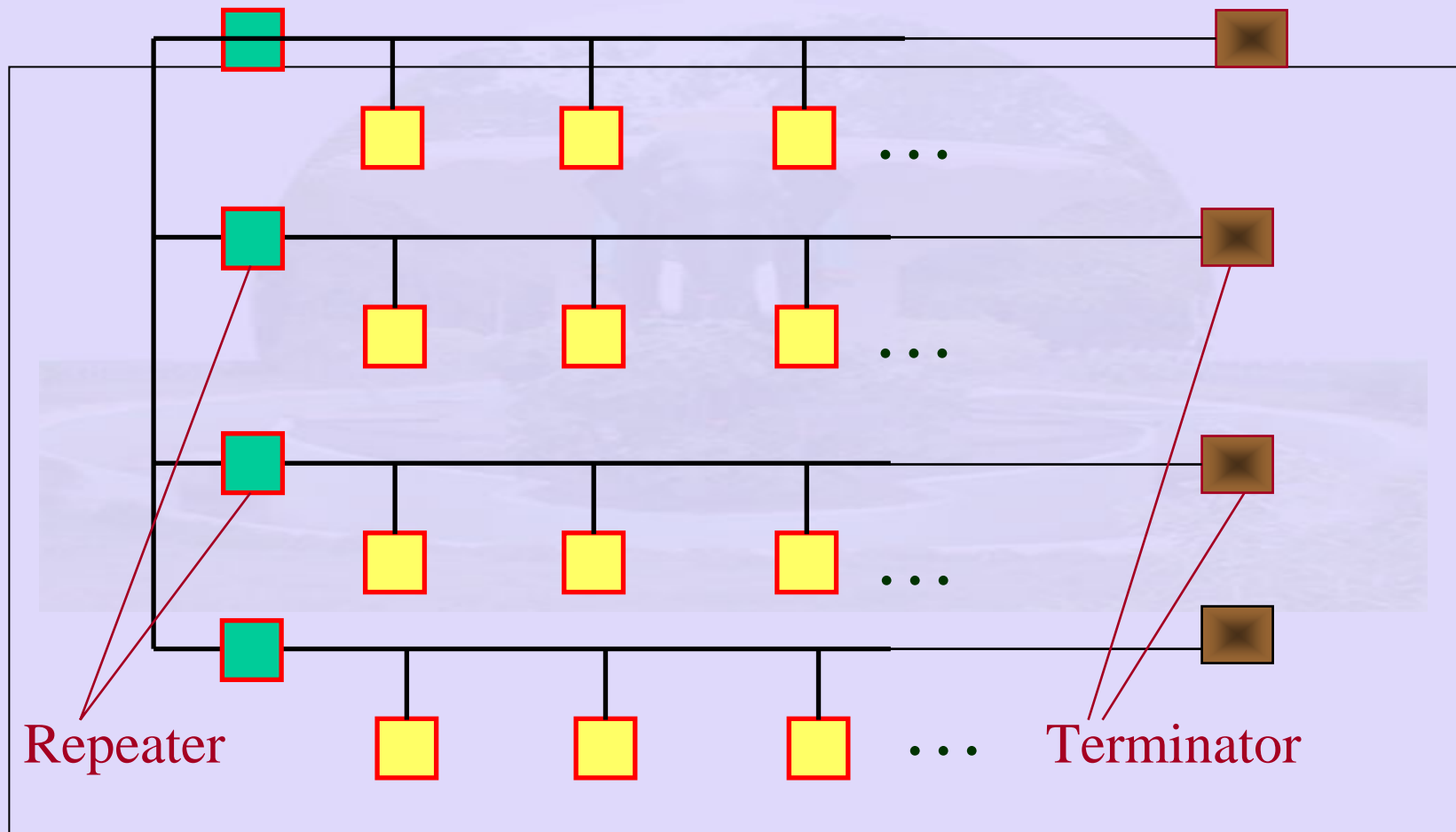
Carrier Sense Transmission

- Issues – propagation delays become worse with large a .
 - two stations back off for same time retransmit more collision

Ethernet: Miscellaneous

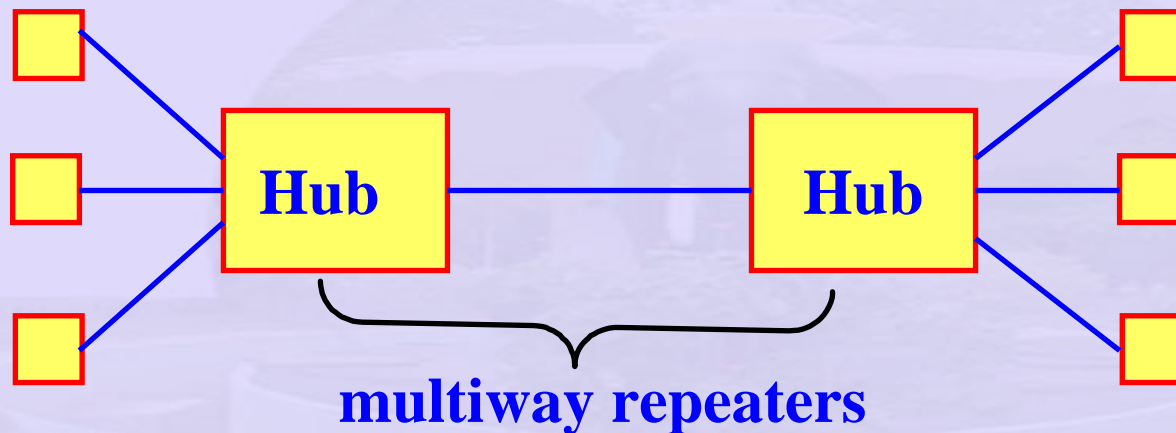
- Cable: 10/100 Base T
 - 10/100 Mbps
 - T – twisted pair
 - Splice T-joint in cable
 - Cables are connected to machines which connect to a hub
 - Maximum cable length from machine to hub
 - 100m
- Encoding: Manchester encoding

A Typical Ethernet LAN



Terminators attached at the end of each segment absorb the signal

Hub based communication



daisy chain a number of hosts

- almost like a star
- data transmitter on one segment received by every body else
- single channel multi access
- same collision domain