Collision free protocols

- Reservation Protocols
- Station have a unique address *0* ,…,*N-1*
- Bit mapped protocol:
  - Contention period – divide into *N* slots
- station *0* can only send a 1 bit in that slot.

Collision free protocols

- Station j announces that it has a frame to transmit by inserting a bit in slot j.
- After all N slots have passed by –
  - every station knows numerical order
  - Now transmit in Numerical order
    - no collision at all!

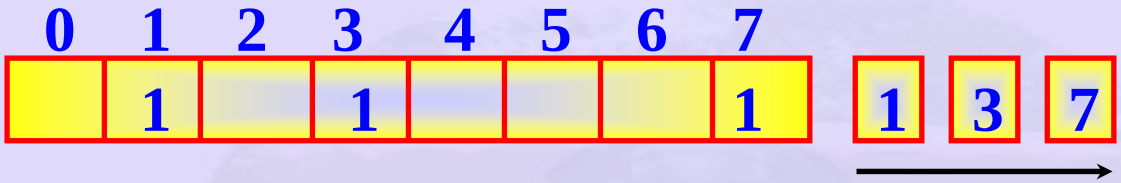
Collision free protocols

- After last ready frame transmitted –
  - an event generated
- New N bit contention period
- If a station misses
  - wait for next contention period

Collision free protocols

- After all stations have transmitted probability of having a frame to transmit middle of slot
  - wait 1 ½ contention period before transmitting
- Always 1 bit/station/frame transmitted is the overhead

Efficiency



$$High\ load\ U = \frac{d}{Nd + 1}$$

$$Low\ load\ U = \frac{d}{d + 1}$$

d – *frame size*

1 - *contention*

Contention Free Protocols

- Binary Countdown:
- Better than bit mapped protocols
- Use binary station addresses
- Each station broadcasts address
  - Example: 0010 0100 1001 1100

Contention Free Protocols

- All addresses same length
- Bits in each position from different stations are ORed
- Collision avoidance
  - arbitration rule
  - if high order bit position of station address overwritten by 1 give up!

Binary CountDown

1100 – gets access!

Next new cycle of contention start

Binary CountDown:Analysis

$$U = \frac{d}{d + \ln_2 N}$$

If the higher order bits of a station j address are 1, station j transmits continuously

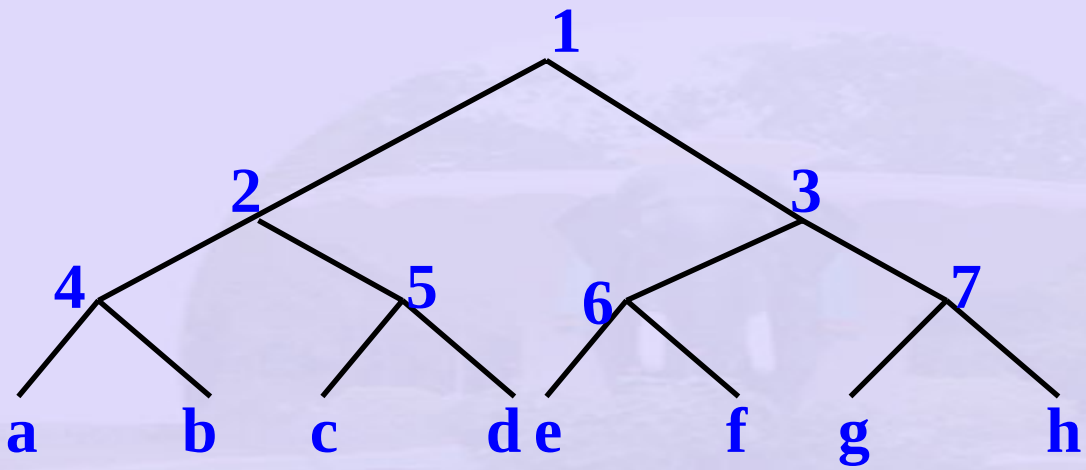
Limited Contention Protocols

- combine the properties of contention and collision free protocols
- contention at low load to provide low delay
- reservation at high load

Adaptive Tree Walk Protocol

- Adaptive TreeWalk Algorithm
  - low load
    - every body contends
  - collision –
    - reduces number of stations

Adaptive Tree Walk Algorithm



First contention all stations permitted to contend

- if collision then next slot only nodes under 2 can contend

- if success next slot – Nodes under 3

- if collision then nodes under Node 4

- if success next slots Nodes under 5

Adaptive Tree Walk Algorithm

- Depth first tree walk algorithm
- Heavy load do not start searching at top of tree
  - what level to start the search?
  - depends on number of ready stations

Adaptive Tree Walk Algorithm

- Each node at level i has N. 2^{-i} station under it.
- q ready stations – uniformly distributed **at level i $2^{-i}q$**
- **level at which search begins**
  - $2^{-i}q = 1$
  - $i = \log_2 q$