Wireless Ad Hoc Networks Lab 3

Network Simulator

NS3 Experiment (II) –

Part I: RTS & CTS、Part II: CW size

NS3 Experiment(II)

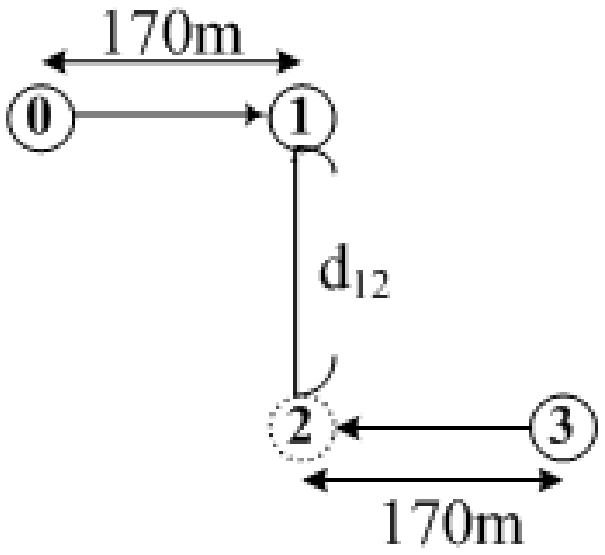
Part I: RTS & CTS

Introduction

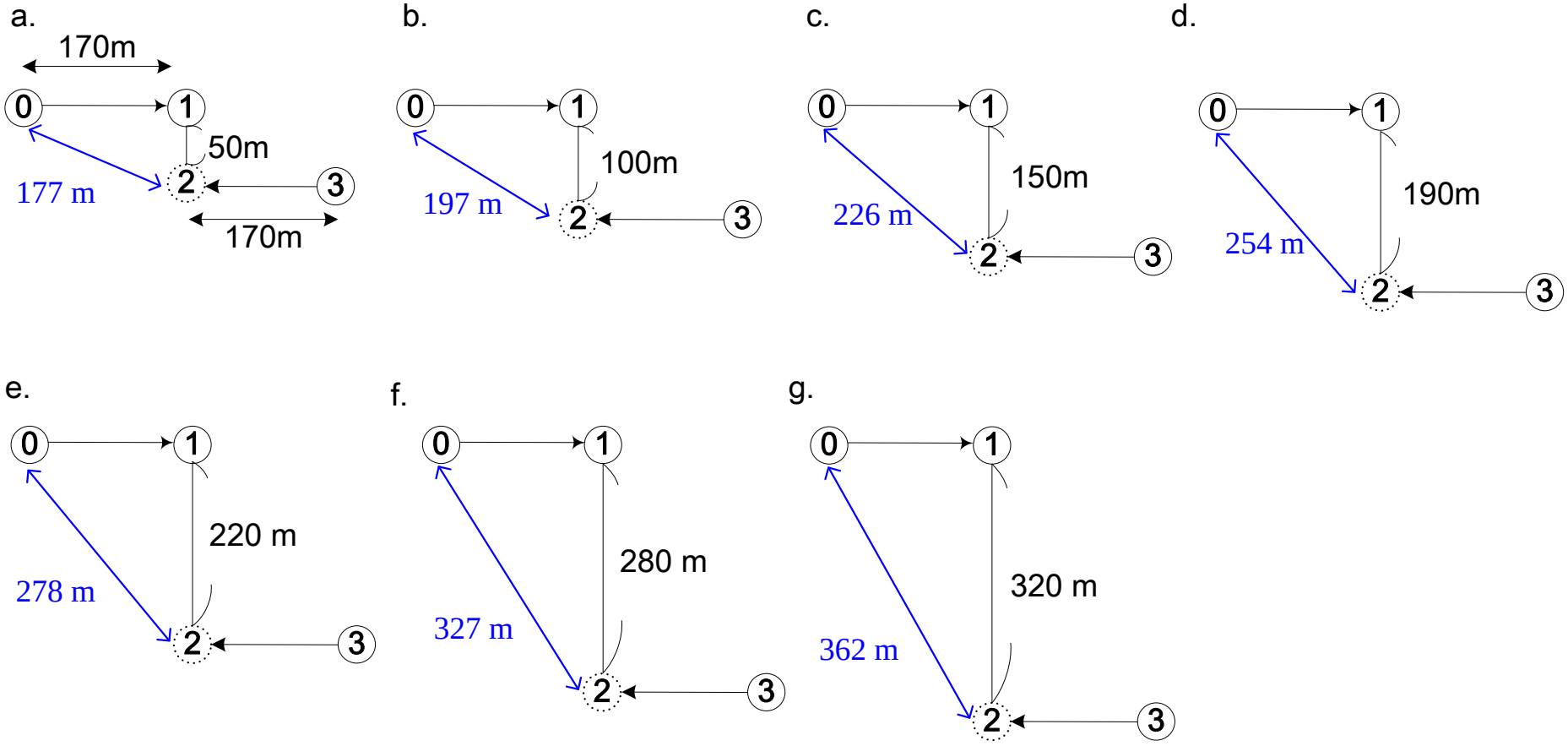
- Goal
  - To investigate the impact of hidden terminal problem in ad hoc network and familiar with RTS/CTS mechanism
- Modify **the .cc code** to meet the scenario we specified in the next slide
- Run simulation and write the analysis to compute
  - System throughput
  - Packet loss ratio

Simulation environment

- Set node distance
  - d_{01}=170m ; d_{23}=170m ;
  - Change d_{12} from **50 to 100, 150, 190, 220, 280, 320** (totally 7 scenario)



Simulation environment



Simulation environment – Wifi Channel

- CS_Threshold_dBm = ***value1***
- RX_Threshold_dBm = ***value2***
  - Set proper value for value1 and value2

- Carrier sensing range: 300m
- Transmission range: 200m

Simulation environment – Wifi Channel

- Two-Ray Ground Propagation:

$$P_r(d) = \frac{P_t G_t G_r {h_t}^2 {h_r}^2}{d^4 L}$$

- C function (TwoRayGround CS/RX Calculator) is provided
  - compute the receiving threshold

Simulation environment – Wifi Channel

- set RTS/CTS Threshold = ***value*** ??

- Q. How to set proper value to turn on RTS/CTS mechanism?

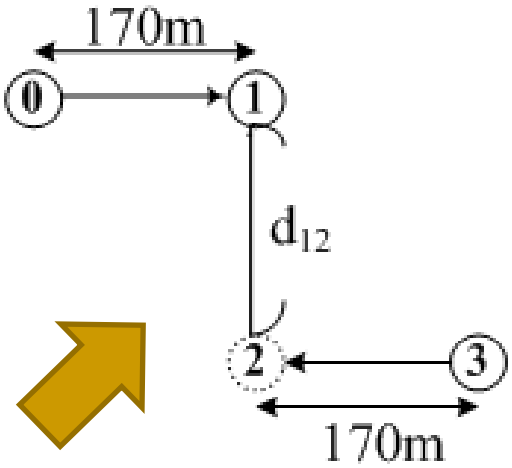
➔ RtsCtsThreshold = ??

Simulation environment

- Network scenario – part 1
  - Simulation time = 4
  - simulation area = 800(x)*800(y) (m2)
  - CSThresh= ***value***
  - RXThresh= ***value***
    - According to carrier sensing range 300m and transmission range 200m, set proper value
  - CWMin=20
  - CWMax=20
  - RTS/CTS Threshold= ***value***
    - turn on RTS/CTS mechanism

Simulation environment

- Network scenario – part 2
  - CBR packet size = 1024 (bytes)
  - CBR rate = 800kbps
  - CBR traffic
    - start at 1.0
    - stop at 3.0
  - Please Make sure flow configuration is correct!!

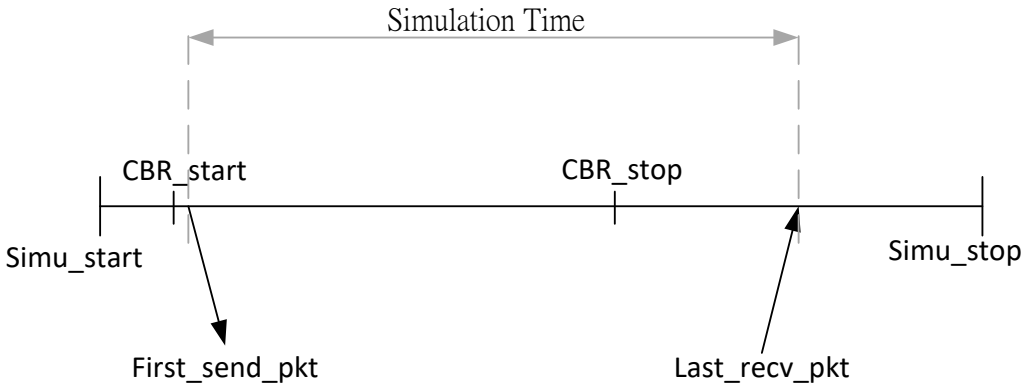


After Simulation

- Analysis
  - a. Average system throughput
  - b. Average packet loss ratio

Analysis

- a. throughput = $\frac{\text{total received data size (bytes) x 8 (bits)}}{\text{simulation time}}$
- b. packet loss ratio = $\frac{\text{\# total lost packets}}{\text{\# total packets sent}}$



NS3 Experiment(II)

Part II: CW size

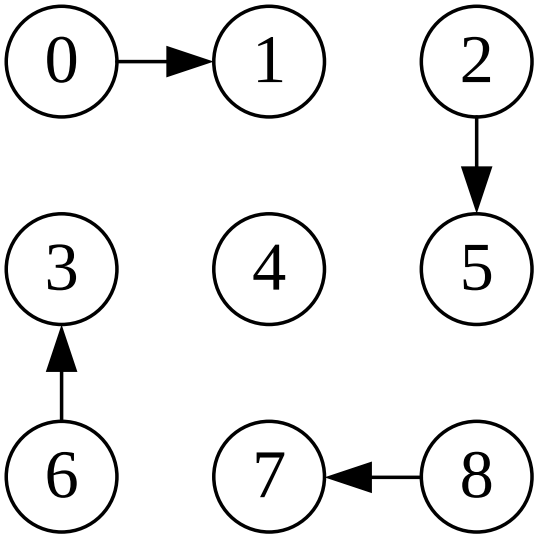
Backoff Mechanism

- This exercise is to investigate
  - the impact of **contention window size** on the performance of the IEEE 802.11 MAC protocol
- To reduce the collision probability
  - the IEEE 802.11 uses a backoff mechanism
  - that guarantees a time spreading of the transmissions
- DCF adopts a slotted binary exponential backoff technique

Backoff Mechanism

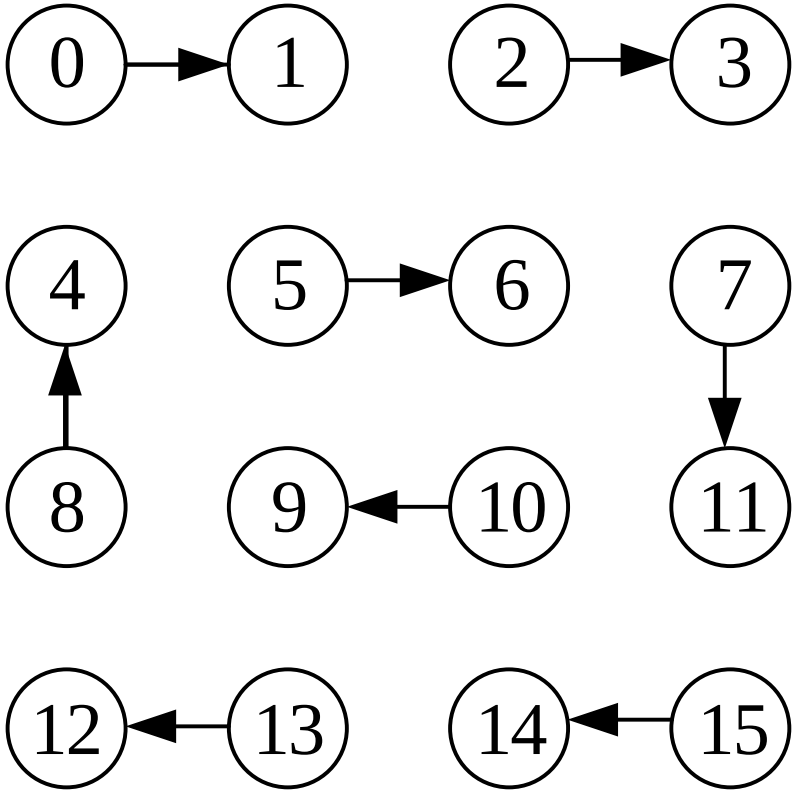
- Construct 3 grid topologies (3*3、4*4、5*5)
  - with nodes spaced by 40 (m)

- 3 x 3



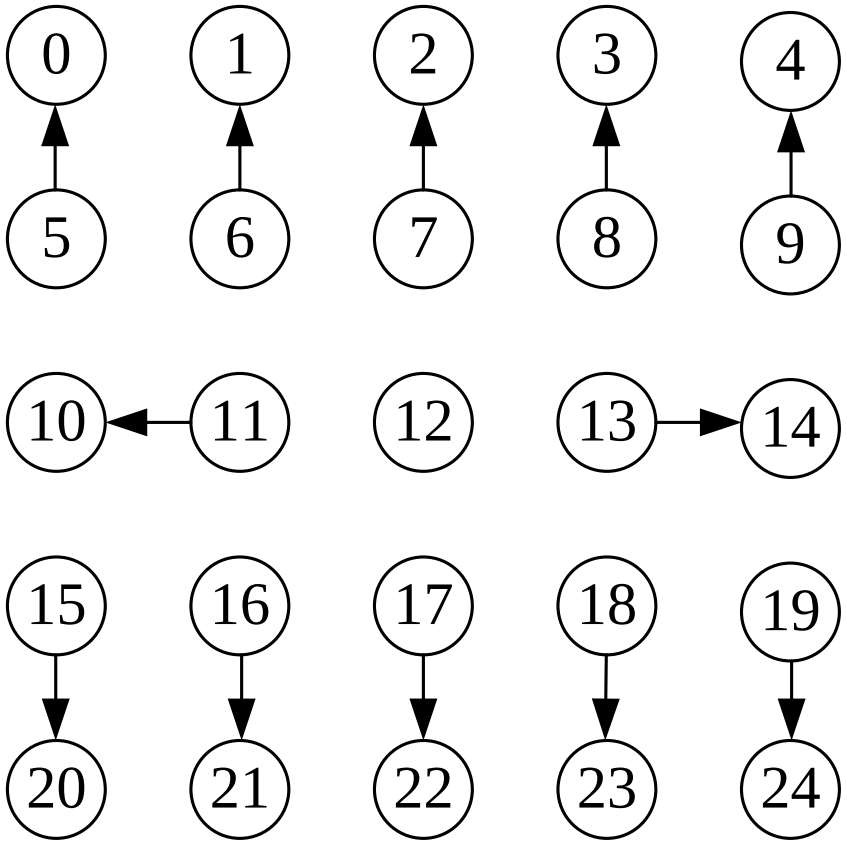
Backoff Mechanism

- 4 x 4



Backoff Mechanism

- 5 x 5



Backoff Mechanism

- Network scenario
  - Simulation time = 4
  - simulation area = 500m * 500m (m^2)
  - CWMin=CWMax=2
    - Change CW value to **2, 7, 15, 31, 63**
    - RTSThreshold= 100000 (Turn OFF RTS/CTS)

Backoff Mechanism

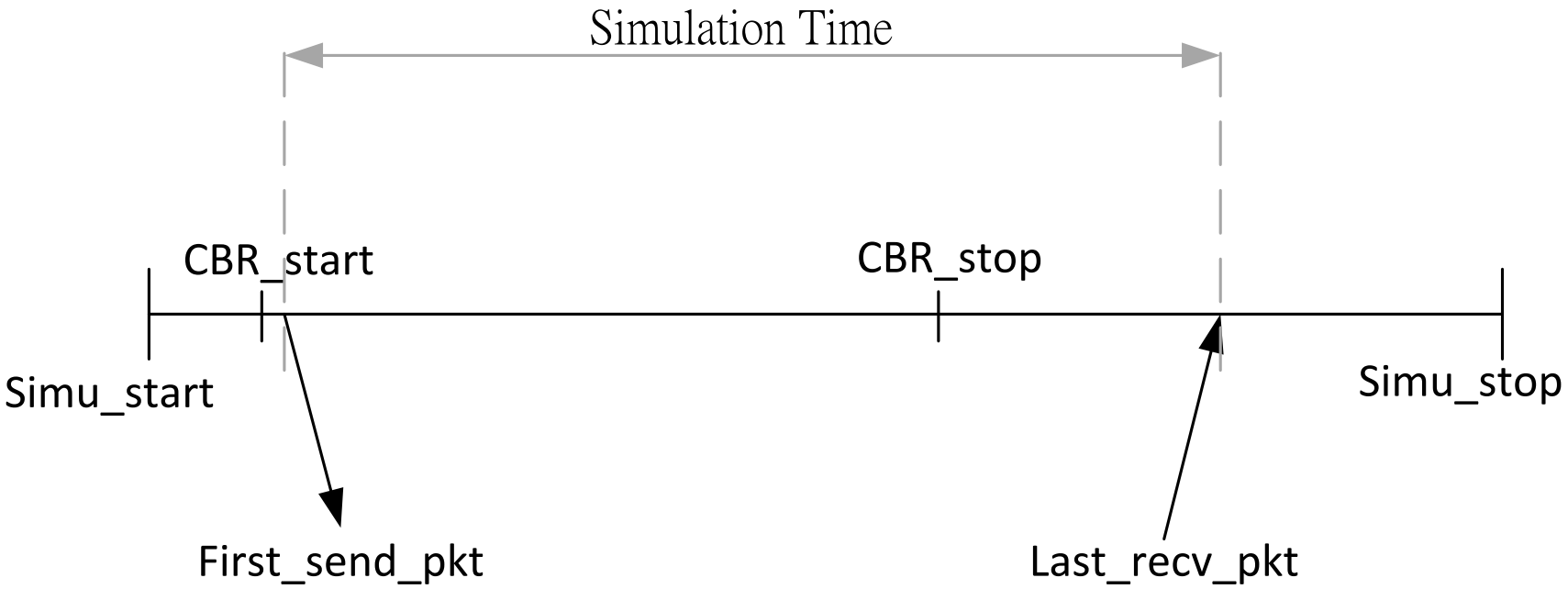
- Network scenario
  - Please make sure flow configuration as instructed!!
  - CBR packet size = 1024 (bytes)
  - CBR rate = 500kbps
  - CBR traffic
    - start at 1.0
    - stop at 3.0

Backoff Mechanism

- Network scenario
  - Run the program for
    - the three topologies (**3*3、4*4、5*5**)
    - six kinds of contention window size (**2, 7, 15, 31, 63**)
    - A total of 15 combinations.
  - NOTE：remember to change number of nodes & communication pair !!

Analysis

- a. System throughput
- b. total lost packets



Analysis

- System throughput
- Total lost packets
- $$\text{throughput} = \frac{\text{total received data size (bytes)} \times 8 \text{ (bits)}}{\text{simulation time}} \text{ (bps)}$$
- bps/1024/1024 = Mbps