Efficient Flooding Scheme Based on 1-hop Information in Mobile Ad Hoc Networks

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Outline

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  - Computing minimal forwarding nodes
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Introduction

- Flooding is one of the most fundamental operations in MANET.
- Pure flooding
  - Collision--Broadcast storm
  - Consume a lot of energy resource

Related work(1/4)

- Three categories of the existing flooding scheme :
  - no need of neighbor information
  - 1-hop neighbor information
  - 2-hop or more neighbor information

Related work(2/4)

- no need of neighbor information
  - Pure flooding
    - Message overhead
  - Pure probability flooding
    - Message overhead V.S reliability

Related work(3/4)

- 1-hop neighbor information
  - Edge Forwarding

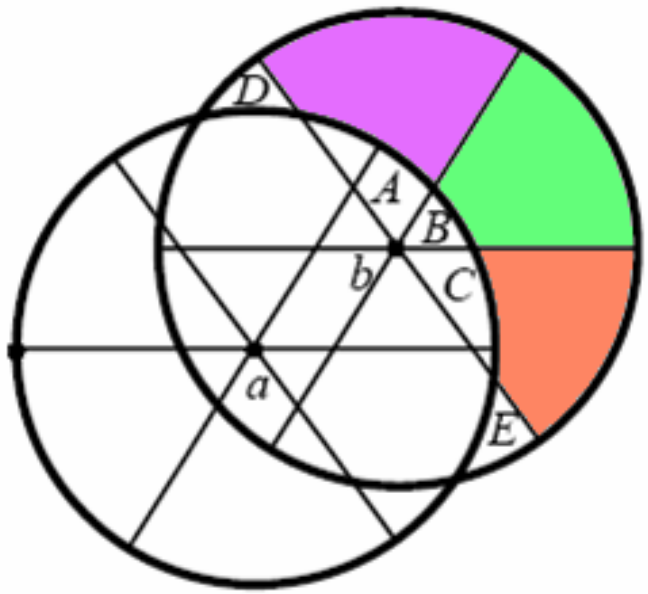

Fig. 1. Example of Edge Forwarding.

Related work(4/4)

- 2-hop or more neighbor information
  - Minimal connected dominating set(MCDS)
    - NP Complete!!
    - Cost overhead, especially for mobility.

Efficient flooding scheme(1/4)

- System assumption
  - The same transmission range R.
  - The network is connected.
  - Each node has a unique ID. --Priority!!
  - Each node has its geographic location.

Efficient flooding scheme(2/4)

- System model
  - Arc format : (starting angle , center , ending angle)

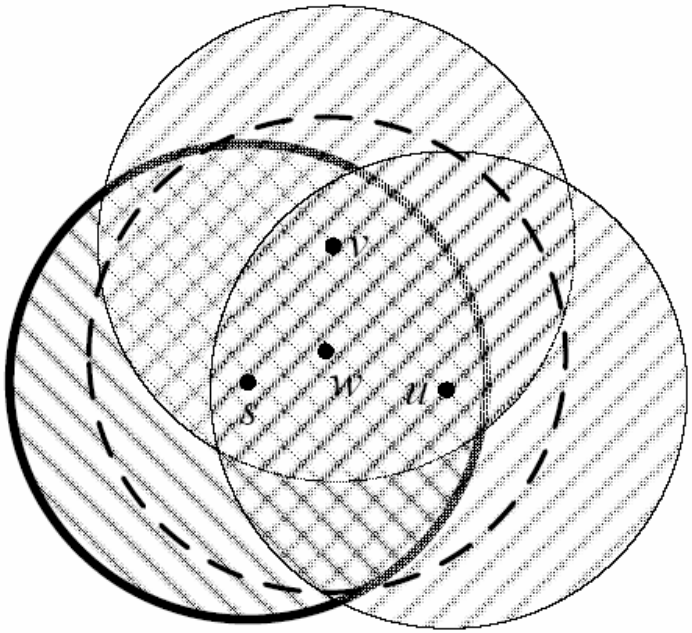

Fig. 2. Neighbor's area of node *s*.

Efficient flooding scheme(3/4)

- Computing minimal forwarding nodes
  1. Sorting arcs in non-descending order according to starting angle.
  2. Merge these arcs by two-way merge sort.
     - O(nlogn)

Efficient flooding scheme(4/4)

- B[]=u merge v={od , db , ba , ac , co}

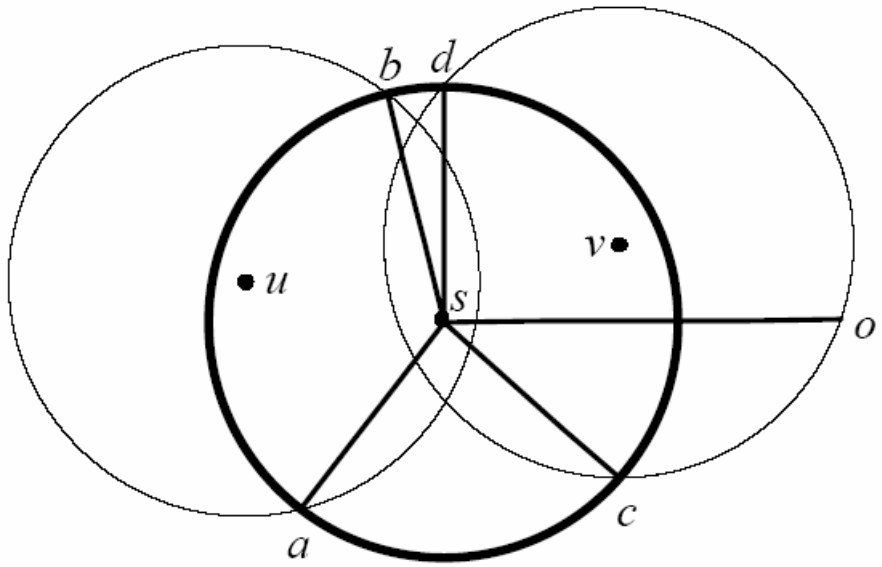

Fig. 4. Example of arcs.

Forwarding node optimization

$$\{s\} \cup \{v \mid v \in (F(s) \cap N(u)) \text{ and } id(v) \leq id(u)\}.$$

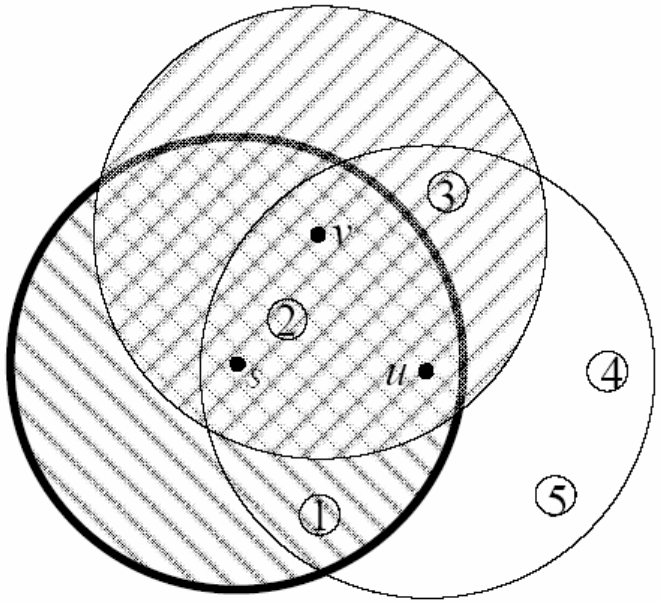

Fig. 7. An example of optimizing *F(u)*.

Old F(u) = {1,2,3,4,5}

New F(u) = {4,5}

Simulation

TAB. 1. SIMULATION PARAMETERS.

Parameter	Value
Simulator	*ns*-2 (version 2.28)
MAC Layer	IEEE 802.11
Data Packet Size	256 bytes
Bandwidth	2 Mb/s
Transmission Range	100~300 meter
Number of Node	200~1000
Size of Square Area	200,000~1,000,000 meter^2
Number of Trails	100

Number of node from 200 to 1000

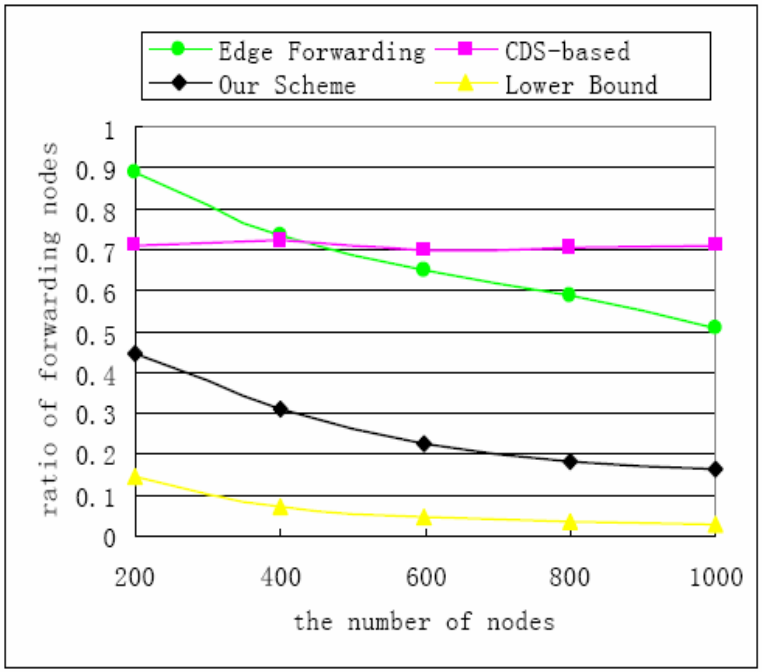

Fig. 8. Ratio of forwarding nodes VS. the number of nodes.

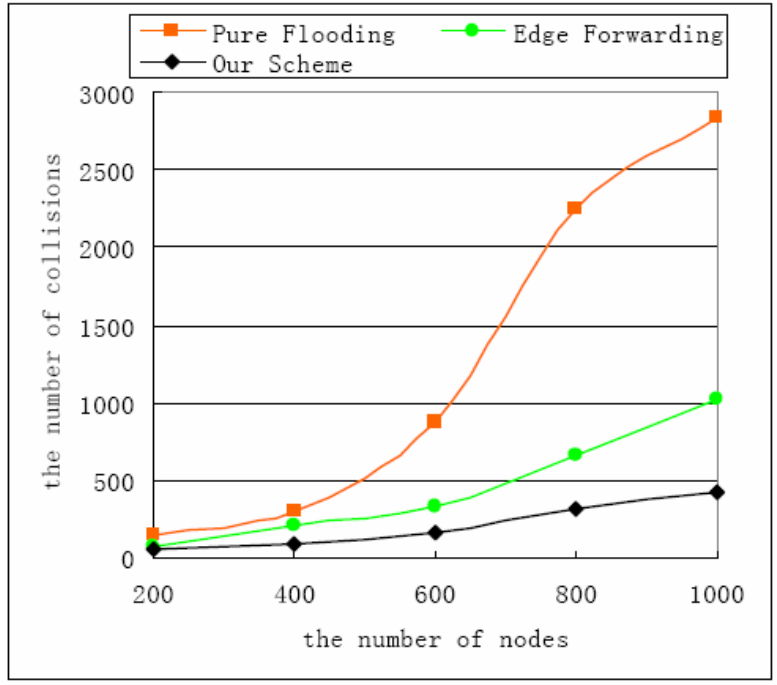

Fig. 9. The number of collisions VS. the number of nodes.

Transmission range from 100 to 300m

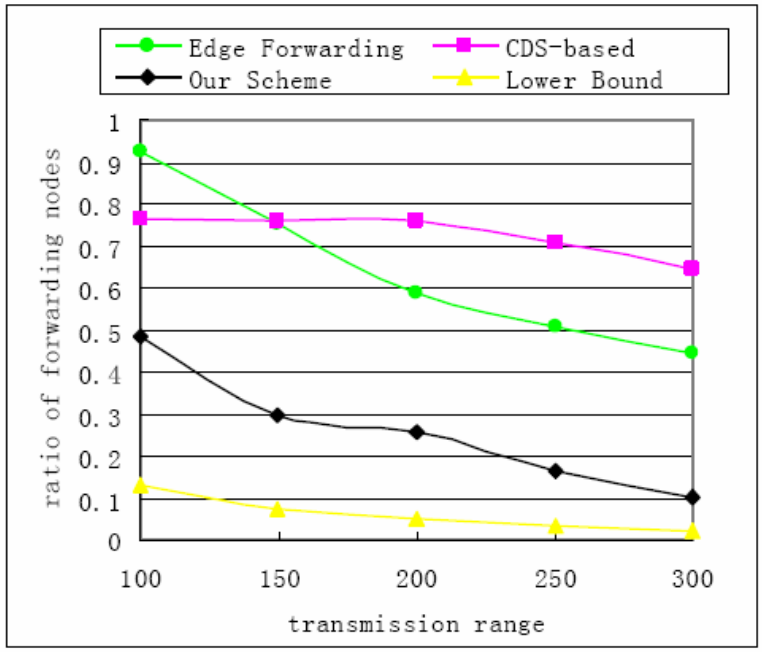

Fig. 11. Ratio of forwarding nodes VS. transmission range

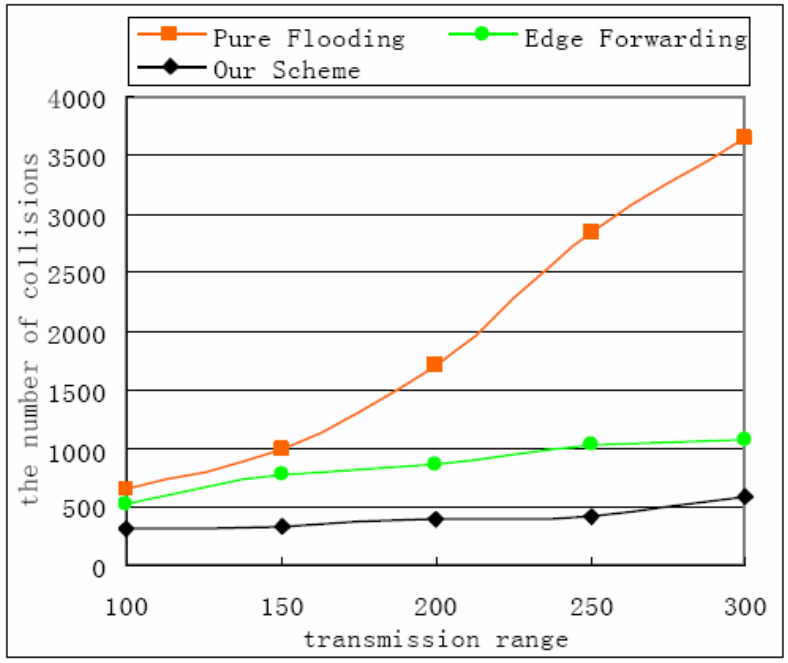

Fig. 12. The number of collisions VS. transmission range.

Conclusion

- The efficient flooding scheme uses only 1-hop neighbor information.
- This scheme achieves the local optimality in terms of:
  1. The number of forwarding nodes is the minimal.
  2. The time complexity O(nlogn) is lowest.

Discussion

- In reality, is the transmission shape a circle?
- PPF V.S Efficient flooding scheme
- PPF (Pure Probability Flooding)
  1. No need of neighbor information
  2. Nearly 100% delivery for some conditions
- Efficient flooding scheme
  1. 1-hop neighbor information
  2. 100% delivery