

On the Design of QoS aware Multicast Algorithms for Wireless Mesh Network

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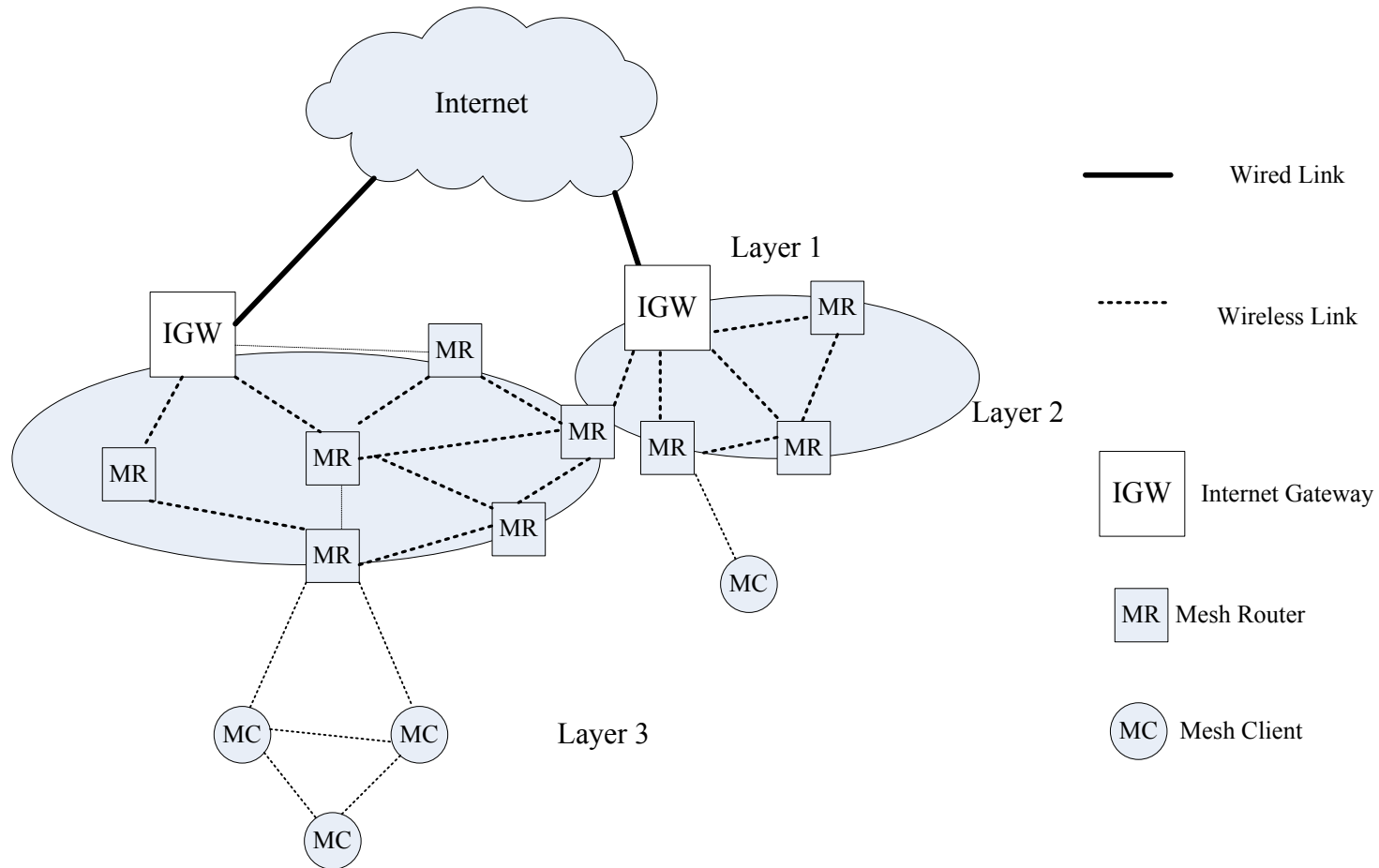
Outline

1. Introduction to Wireless Mesh Networks
2. Multicast and its Current state of art
3. Load Balancing
4. Proposed solution
5. Simulations
6. Conclusion and Future work

Wireless Mesh Networks

- Gateways, Mesh routers and Mesh clients.
- Nodes are less mobility, not energy constraint in WMN. Most of the traffic is expected to flow between the mesh clients and the backbone network via gateways.
- WMNs offer low-cost, easy-deployed, location independent and self-configured networks.
- Example: the “Cloud” WiFi mesh in London.

Wireless Mesh Network



Wireless Mesh Networks vs. Mobile Ad hoc Network

- MANET is a particular type of WMN.
- In MANET, nodes are mobile and energy constrained
- There is no node that is in charge for authentication or security services.

Multicast

- The aim of multicasting is to send information from the source sender to multiple receivers.
- The demand for multicast TV, video conference and online multicast based games are hugely increased.
- The existing MANET multicast routing protocols do not satisfy all the requirement of WMN.

Current state of the art

- There are many proposals on multicast in MANET such as MAODV , ODMRP, ADMR and ADAM. Most of these routing algorithms are demand driven routing due to the mobility and power nature of MANET.
- There are also some proposed multicast routing algorithms in WMN environments.
- Most of the existing wireless multicast algorithms select the path by using best hop count path.

Load balancing

- None of the above studies have clearly presented the key role of gateway and load balancing in achieving the QoS multicast communication of WMN.
- a load balancing network is defined as a network with no uneven traffic in any nodes.

Proposed solution

- We propose new load balancing aware algorithms with the aim of enhancing the QoS in the multicast communication over WMNs.
- Our algorithms are designed to support applications with high demand of instant communication and high bandwidth consumption.
- The proposed algorithm has been submitted to the IEEE/ACM-IPDPS Int. Conference, to be held in Rome, Italy, 25th to 29th May 2009

Proposed solution

We have three definition equations based on the definition of load balancing, multicast and wireless mesh network, $G=(V,E)$.

$$(1) \quad LB_i \rightarrow \overline{LB} \quad (i \in V)$$

$$(2) \quad LB(G) = \sum_{i \in V} LB_i \quad \text{and} \quad LB(M) = \sum_{i \in M} LB_i$$

$$(3) \quad \frac{LB(M)}{m} \rightarrow \frac{LB(G)}{n}$$

Proposed Solution

Based on the definition of WMN and multicast, we have:

Lemma 1: $h < l$

where h is the hop number of best hop count multicast and
 l is the hop number of best load count multicast

Lemma 2:
$$\overline{LB(N)} = \frac{LB(N)_{before} + \hat{\sigma} \times j}{i}$$

Theorem 1: best load count multicast achieves better load balancing than best hop count algorithm does.

Proposed Solution

Algorithm 1: source start multicast and receiver joins multicast group

Input: source s , MSR packet to be sent, source s , gateway g

1 s sends MSR to g

2 g records MSR in its multicast routing table

3 r sends MRQ-J towards its gateway

4 f add IFQ aggregation in the packet

5 g checks its routing table and chooses the route with smallest IFQ aggregation

6 g sends MRP to s

7 s add r to its multicast routing table

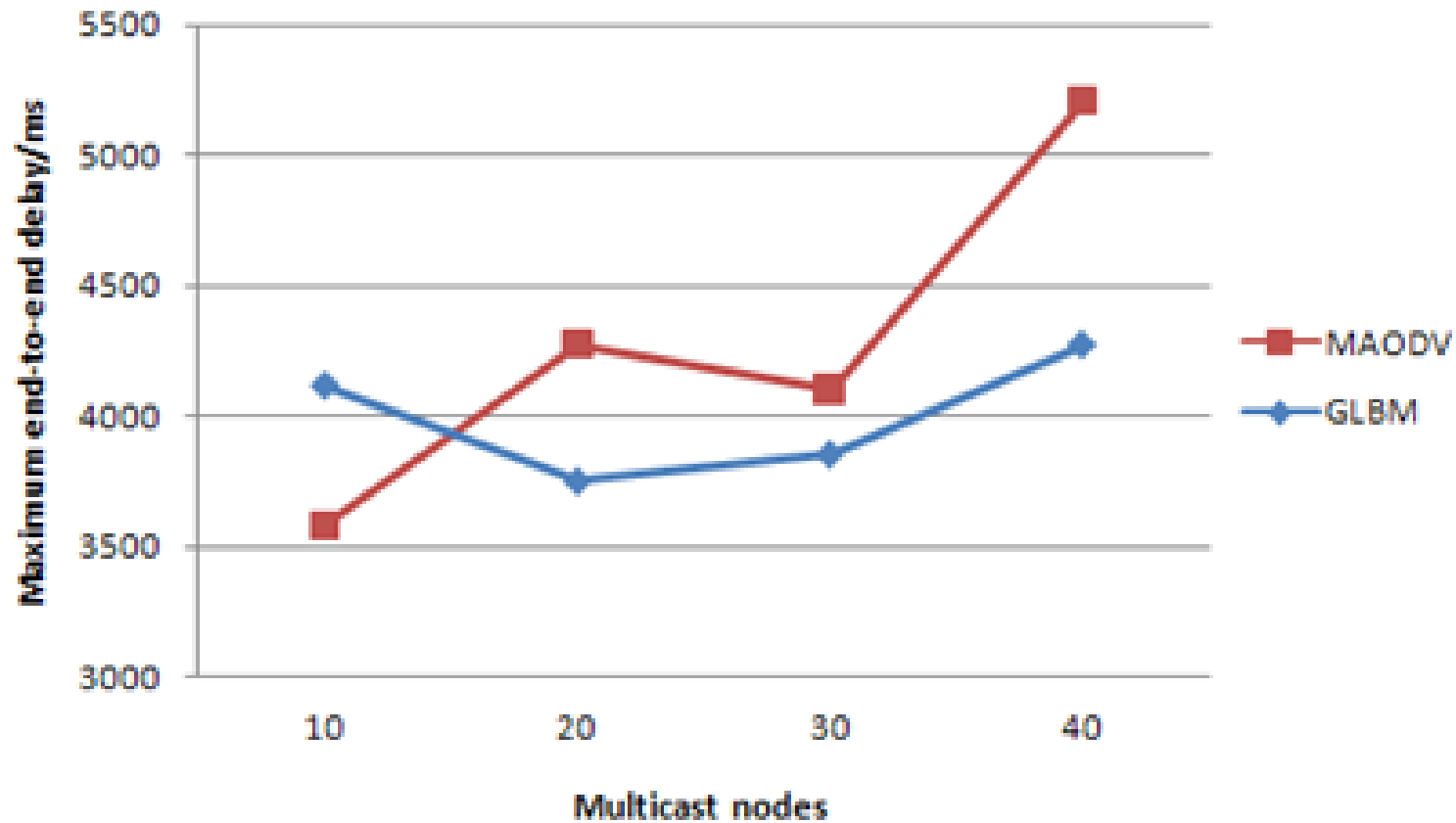
Simulation results

- We simulate the proposed algorithms using NS2 simulator. In the experiments, we intend to examine whether our multicast algorithm is suitable for the applications with large packet size and instant communication requirements.
- The *four metrics, throughput, cumulative sum of total generate packets, maximum end-to-end delay and jitter* are used in the experiments.

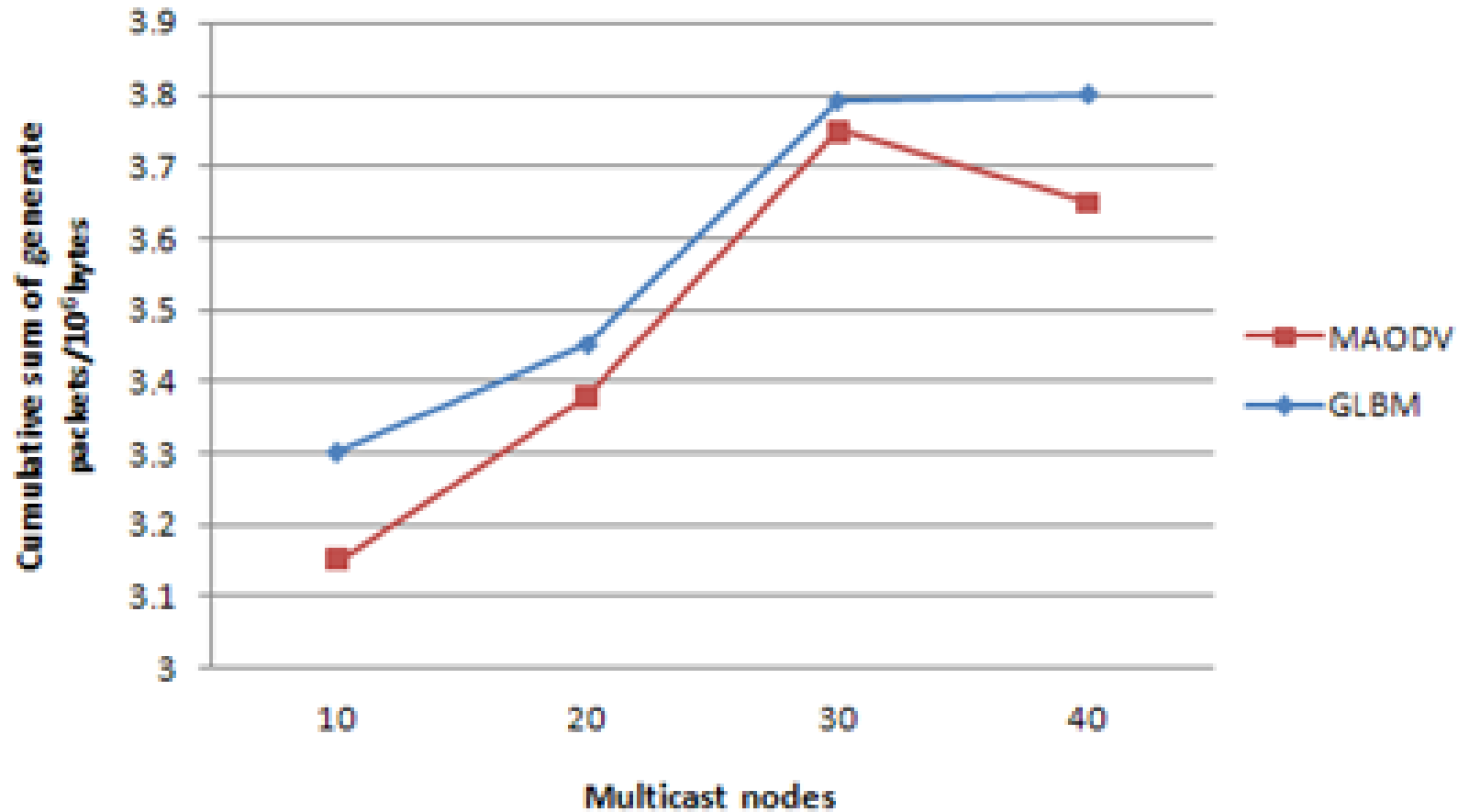
Simulation Environment

- We use NS2.
- 50 nodes uniformly distributed over a 1000 m × 1000 m area with two gateways.
- The multicast group size is varied from 10 to 40 members in 50 nodes.
- The multicast source sends CBR traffic Constant Bit Rate (CBR), consisting of 1024-byte packets with sending rate of 20 packets/second.

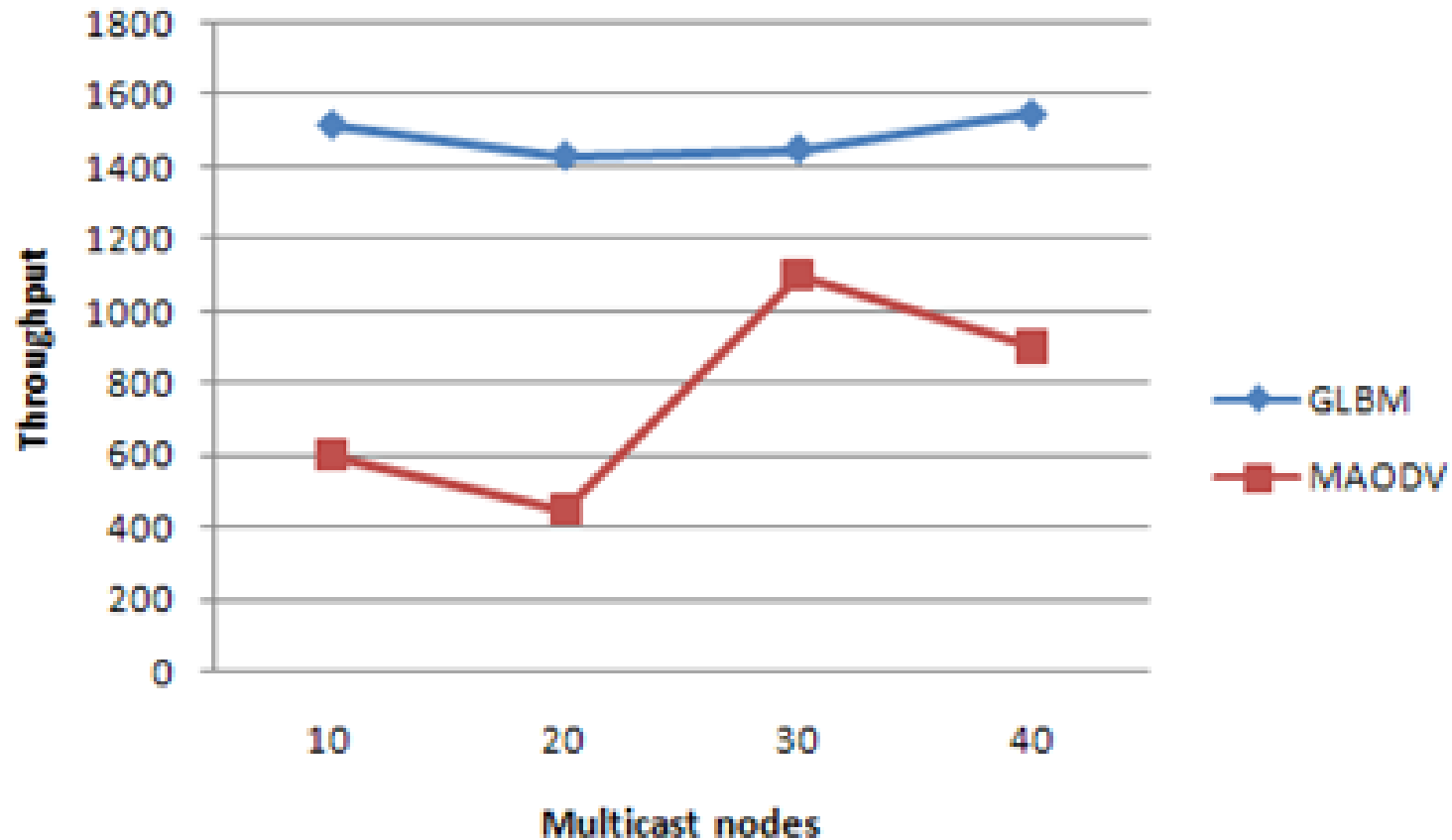
Simulation results



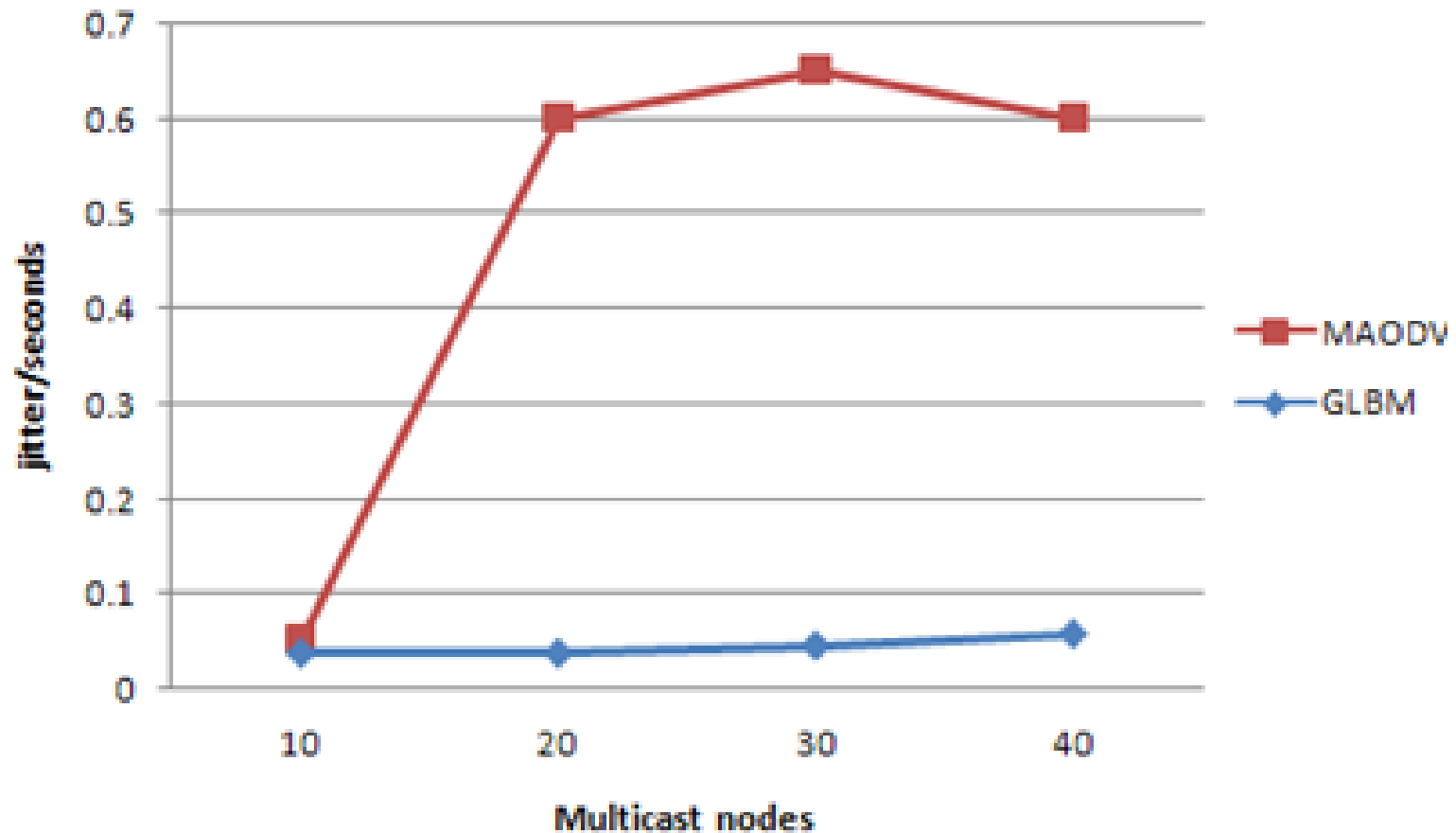
Simulation results



Simulation results



Simulation results



Conclusion and future work

- we focus on the design of the multicast algorithms which are suitable for the applications require large flow and high instant communication. The simulation results show our algorithms achieve better load balancing than MAODV [2].
- Based on the experimental results, the further improvement will be made to our algorithms by introducing different routing metrics.

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