Evaluation on Multiple Criterion Heuristic Algorithms for Multicast Connections in Packet Networks

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Outline

1. Motivation
2. Proposed solutions
   - Routing algorithms
   - Measurement techniques
3. Selected results
   - Small networks
   - Large networks

Problem Description

- Connecting a transmitter with one or more receivers,
- securing Quality of Service guarantees,
- elliminate resources redundancy.

Multicast routing implementation in practice

- Standardized protocols based on hardware support,
- application layer solution (software routing).

The research goals

- Introduction of new effective algorithms,
- define dependable algorithm evaluation techniques.

Outline

MLARAC algorithm

- Lagrangian Relaxation based,
- uses linear algebra for heuristic approximation,
- different variants of the algorithm have been proposed.

MLARAC - Lagrangian Relaxation

- Selection of initial approximations of the results optimized against all the criteria,
- evaluation of the Lagrangian cost of the approximation in the space of the linear combination of the particular metrics.

MLARAC - Linear Algebra

- Each of the approximations is assigned a hyper-plane in the multi-dimensional cost space,
- new approximation is found at the intersection of all the hyperplanes.

MLARAC - Variants

- Most expensive non blocking criterion,
- minimal sum of gradients,
- random selection.

RenDezvouz Point (RDP) algorithm

- Non-linear cost aggregation,
- concurrent execution of multiple Dijkstra's algorithm instances,
- different variants of the algorithm have been proposed.

RDP - Cost Aggregation

$$m_{aggr}(t) = max\left\{\frac{m_1(t)}{c_1}, \frac{m_2(t)}{c_2}, \ldots\right\}$$

RDP - Concurrent Dijkstra's algorithms

- Information shared between instances,
- only one instance progresses at a time,
- common condition checked after each step.

RDP - Variants

- Quasi-exact,
- heuristic.

Outline

Topology selection

- Waxman method,
- Barabasi-Albert method,
- INET method.

Simulation parameters selection

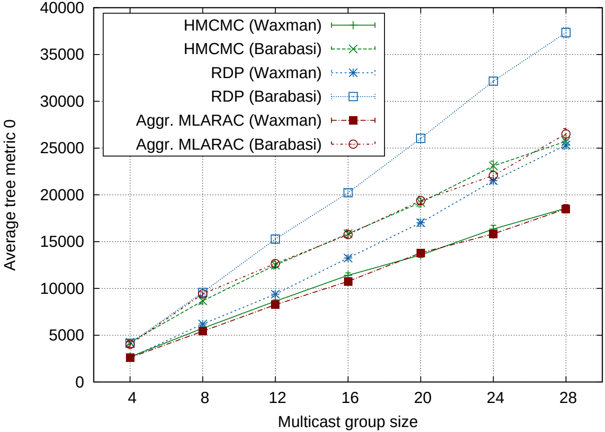
- Statistical parameters of the graphs,
- selection of the node groups to be connected (different methods, sizes),
- selection of the constraints for the optimization problem

Simulation result evaluation

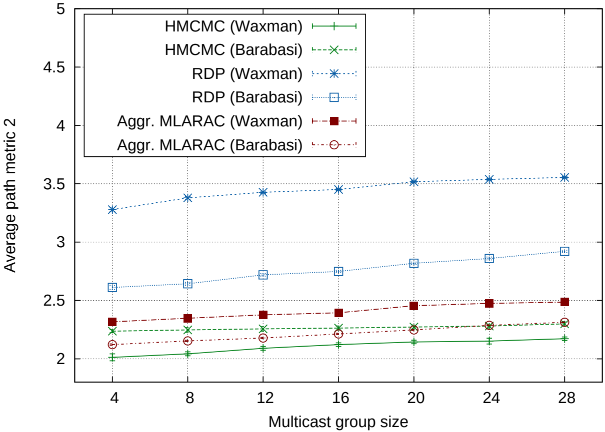
- Average metrics of the result structures,
- success rate,
- resource drainage simulation.

Outline

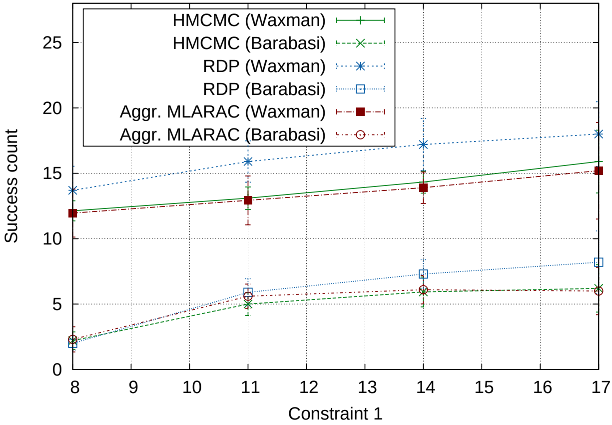
Avereage metric 0



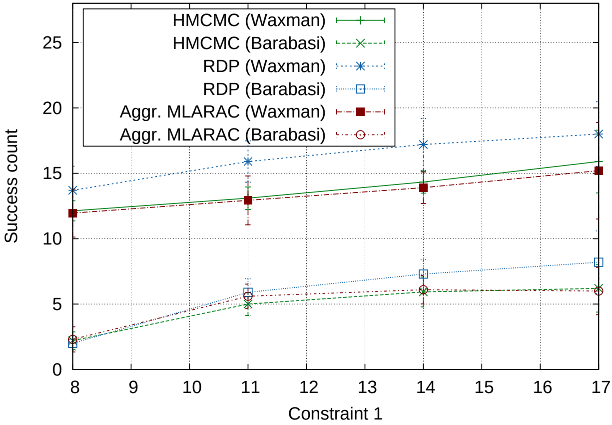
Avereage metric 2



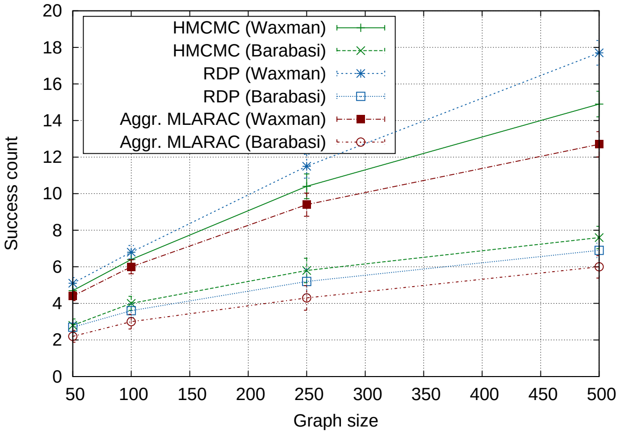
Success rate in function of constraints



Success rate in function of participant group size



Success rate in function of graph size



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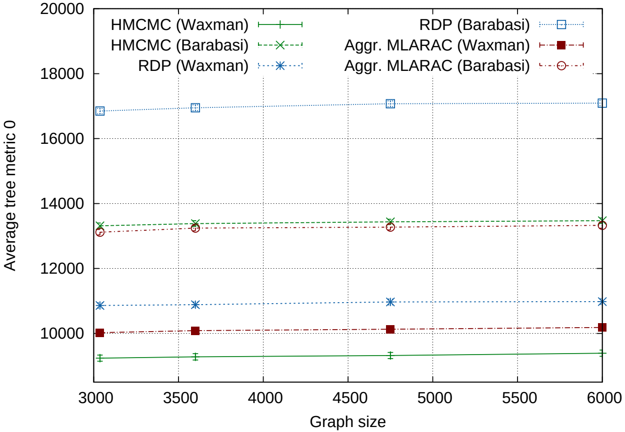
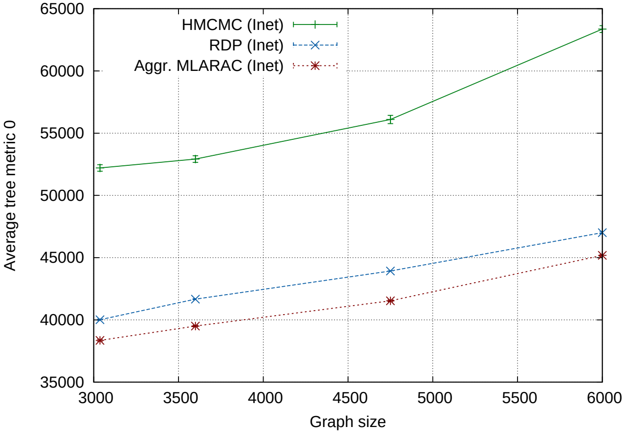
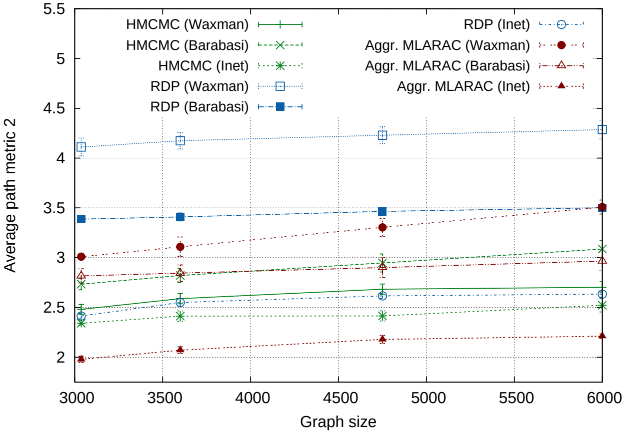
Average metric 0 (Waxman and Barabasi-Albert



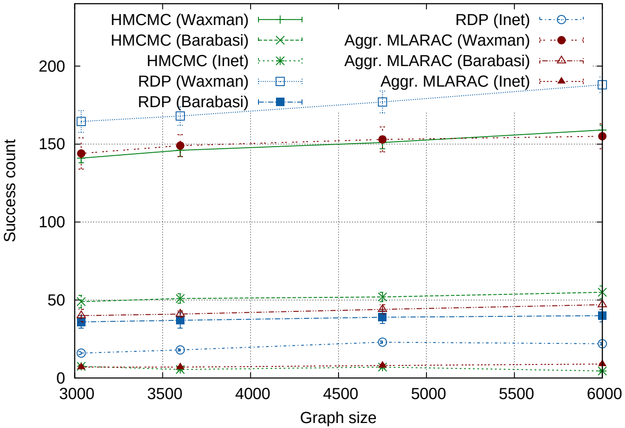
Average metric 0 (INET)



Average metric 2



Success rate



Summary

- New multiple criterion multicast algorithms have been proposed,
- new algorithm evaluation and comparison techniques have been introduced,
- innovative simulation tuning technique have been presented.

References I

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