

On the possibility of turning an arbitrary graph into a complex network, using rewiring mechanisms

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Abstract—The abstract goes here.

Index Terms—Computer Society, IEEE, IEEEtran, journal, LATEX, paper, template.



1 INTRODUCTION

2 RELATED WORK

3 METHODS

3.1 General operation

- Frequency of use of dynamic links during the exploration phase (f_e).
- Frequency of visits to candidate nodes during the exploration phase (f_n).

3.2 Initial conditions

3.2.1 Initial graph

3.2.2 Coordinator election

As is explained in the following section, the coordinator node have two tasks: 1) to count the number of cycles of the rewiring mechanism, and 2) to coordinate the start and end of each cycle phase.

3.2.3 Compass routing

3.2.4 Initial parameters

- 20 tracer packets.
- length of dynamic links.
- Vectors f_e, f_n

3.3 Rewiring mechanism

The rewiring mechanism is a distributed process that is executed in a determined number of cycles. The coordinator node starts each cycle spreading notification messages through a PI algorithm. Each cycle consists of the following four phases:

3.3.1 Exploration

Each node starts its exploration phase when it receives a notification from the coordinator node. During this phase, each node sequentially sends twenty tracer packets to arbitrary destination nodes. Packets are routed applying compass routing. Destination nodes respond to a tracer packet with an acknowledgment packet containing the path followed by the tracer packet. When a node receives an acknowledgment packet, it updates its vectors f_e and f_n . A node finishes its exploration phase when it has received acknowledgments packets for its twenty tracer packets.

3.3.2 Exploration synchronization

This phase starts when the coordinator node has finished its exploration phase. Then it starts a PIF algorithm to spread messages asking if the rest of nodes have finished its exploration phase. When the coordinator node receives an acknowledgment from all the nodes in the network, it starts a PI algorithm to spread messages notifying that nodes must start its rewiring phase.

3.3.3 Rewiring

Each node starts its rewiring phase when it receives a notification from the coordinator. Then, the notified node uses the information in its vectors f_e and f_n to take a rewiring decision according to one of the following rules:

- **Rule 1.** A node rewires its least used dynamic link (according with f_e) to the most visited node (according to f_n).
- **Rule 2.** A node rewires its least used dynamic link (according with f_e) to the first node at distance 2 from it, which is the first node in f_n .

3.3.4 Rewiring synchronization

Analogous to the *Exploration Synchronization phase*, this phase starts when the coordinator node has finished its rewiring phase. Then it starts a PIF algorithm to spread messages asking if the rest of nodes have finished its rewiring phase. When the coordinator node receives an acknowledgment from all the nodes in network, it checks

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Manuscript received April 19, 2005; revised August 26, 2015.

if all cycles have been completed. If so, the rewiring mechanism finishes. Otherwise, the coordinator node updates the cycle counter and starts a PI algorithm to spread messages notifying that the cycle has finished and nodes must start the *Exploration phase* of a new cycle.

4 RESULTS

4.1 Topological properties of the resulting graphs

4.1.1 Average clustering coefficient

4.1.2 Centrality distributions

- Degree centrality
- Betweenness centrality
- Closeness centrality

4.1.3 Distance metrics

- Average path length
- Diameter

4.1.4 Community metrics

- Modularity
- Number of communities

4.2 Robustness against failures

- Average clustering coefficient
- Number of connected components
- Proportion of the largest connected component
- Diameter of the largest connected component
- Average path length of the largest connected component

John Doe Biography text here.

4.3 Robustness against attacks

- Average clustering coefficient
- Number of connected components
- Proportion of the largest connected component
- Diameter of the largest connected component
- Average path length of the largest connected component

5 DISCUSSION

6 FUTURE WORK

- Impact of the initial graph
- Impact of the number of the routing algorithm
- Impact of the number of exploration packets
- Determine the number of exploration packets
- Epidemic spreading

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APPENDIX A

PROOF OF THE FIRST ZONKLAR EQUATION

Appendix one text goes here.

APPENDIX B

Appendix two text goes here.

ACKNOWLEDGMENTS

The authors would like to thank...

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