Institut für
Kommunikationsnetze

Performance of the Darwin MAC Protocol

IEEE 802.17 Interim meeting,

Ottawa, May 6-9, 2002

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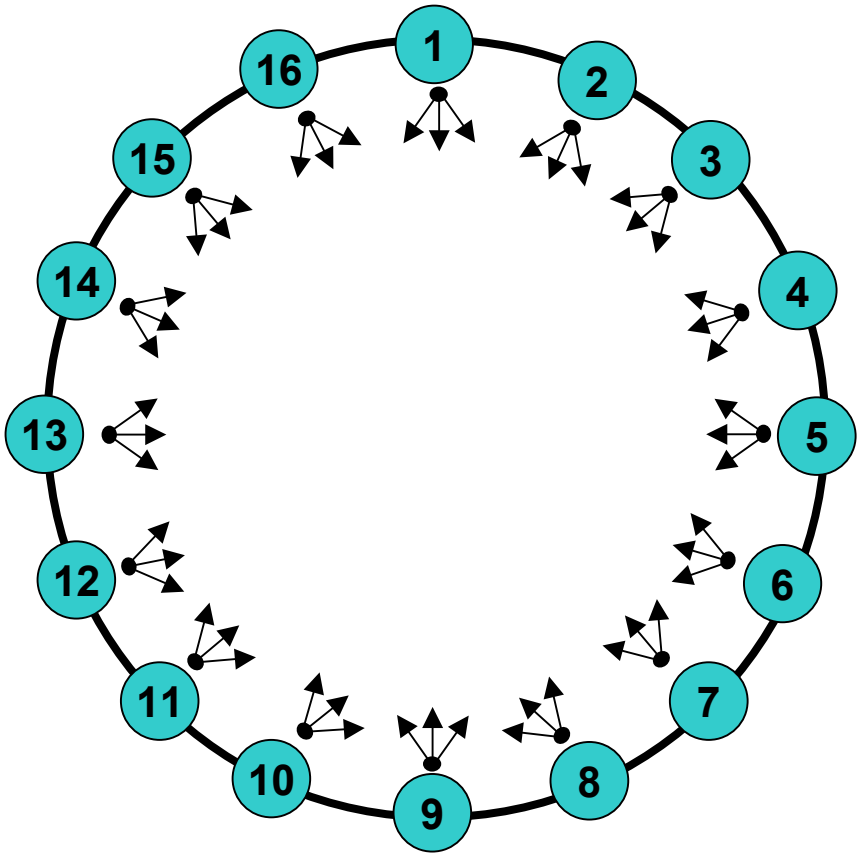
Overview

- Scenario 1
  - Uniform Traffic
- Scenario 2
  - Asymmetric Traffic
- Scenario 3
  - Multiple Priorities
- Random Test Scenarios
- Conclusion

Scenario 1

- Traffic
  - All nodes send low priority to all other nodes at a maximum rate
- Protocols
  - Darwin (single choke)
  - Compared with:
    - Gandalf (multi choke)
    - Cisco SRP
    - Alladin
    - IKN
  - Double Transit Buffer
- Simulation
  - Ring speed: OC-12
  - 2 seconds for all runs
  - All protocol parameters set to their defaults

1. Traffic Parameters



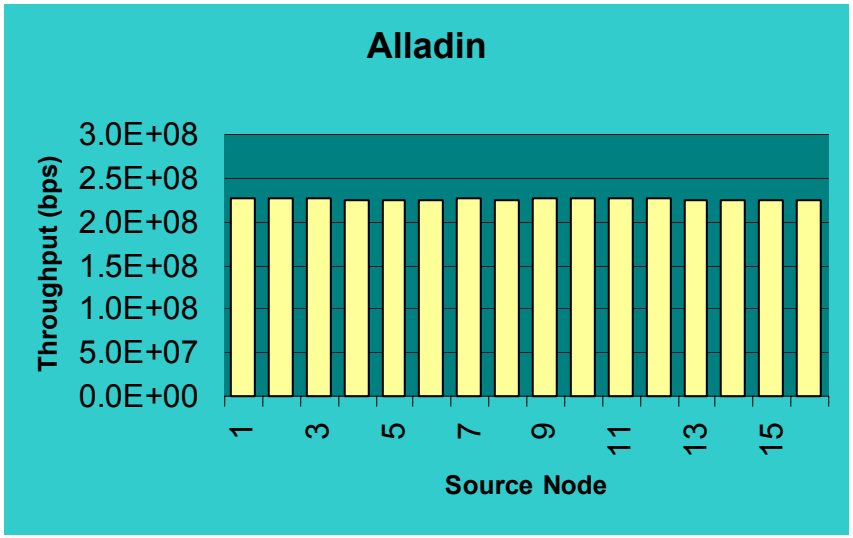
Double Ring, 100 km, OC-12

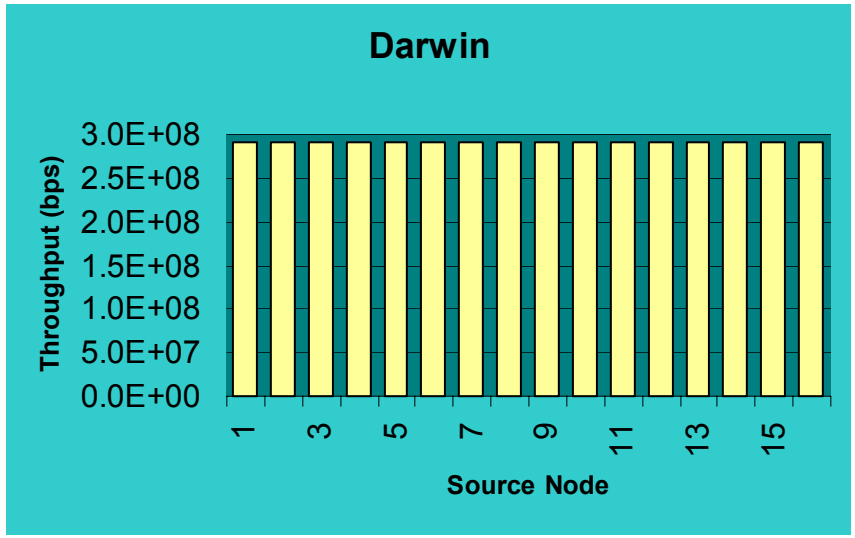
Only low priority packets

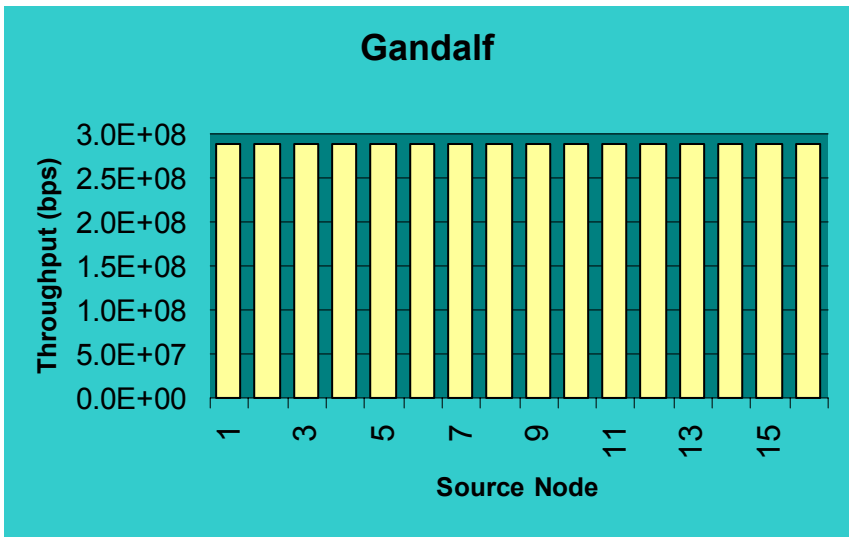
Uniform, all to all traffic at maximum possible rate

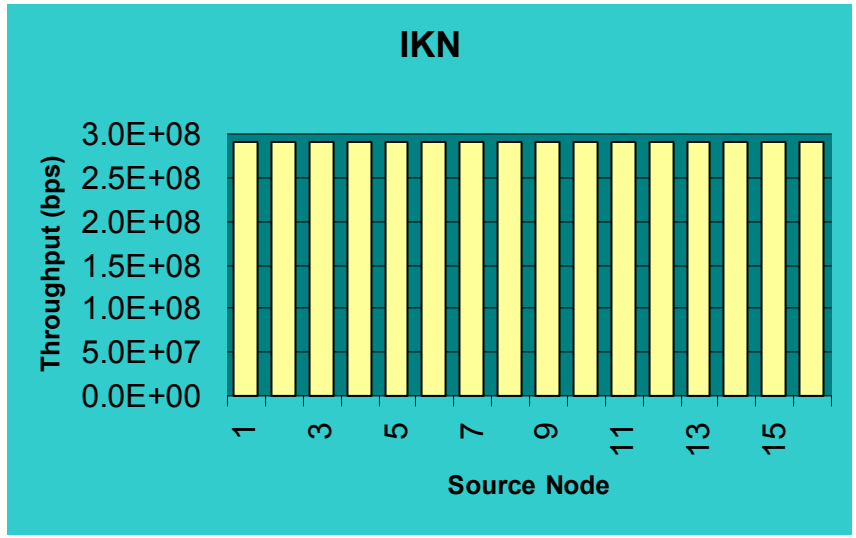
Packet Size: 1500 bytes constant

1. Throughput



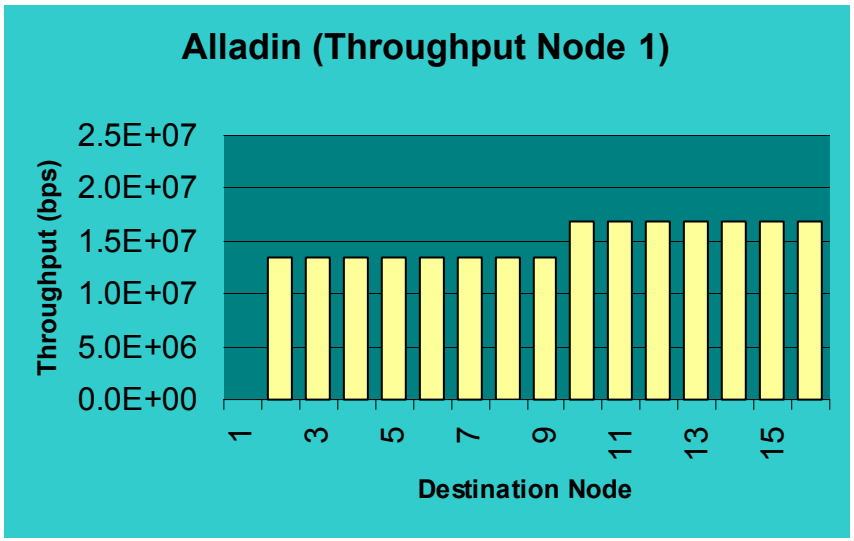


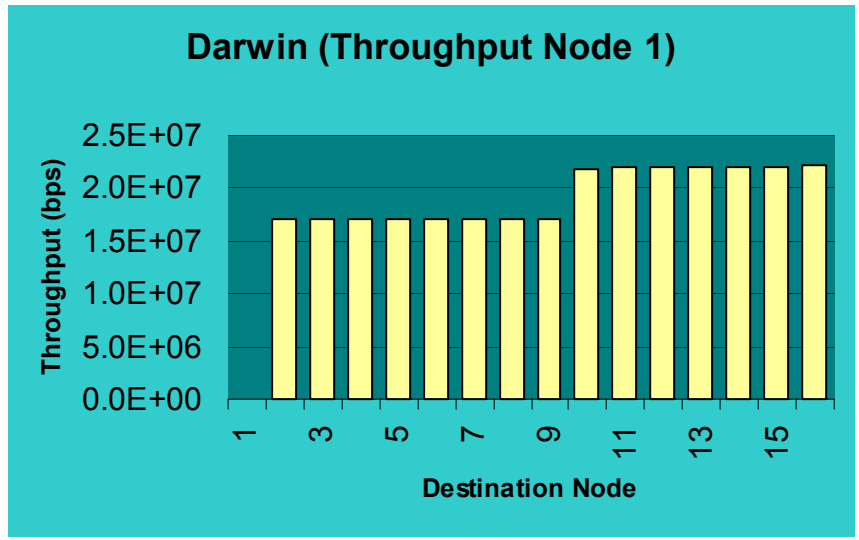


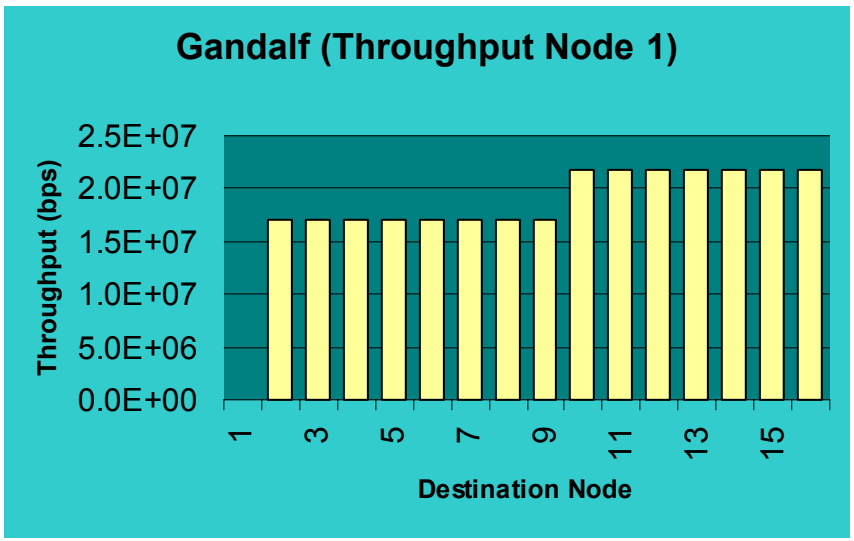


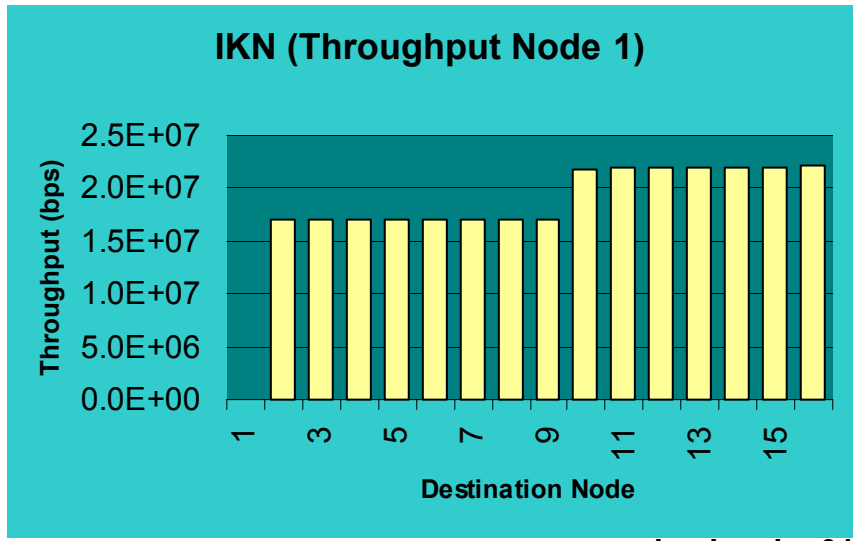
js_darwin_01.pdf

1. Throughput node 1









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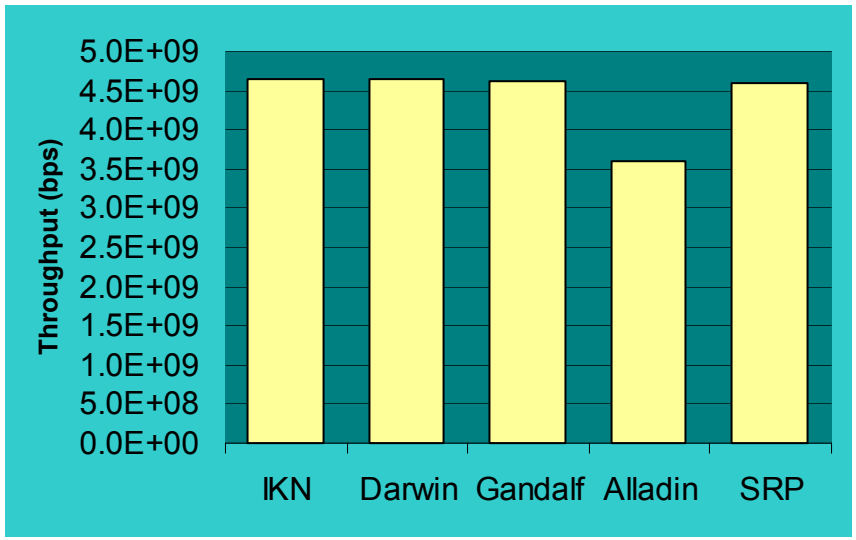
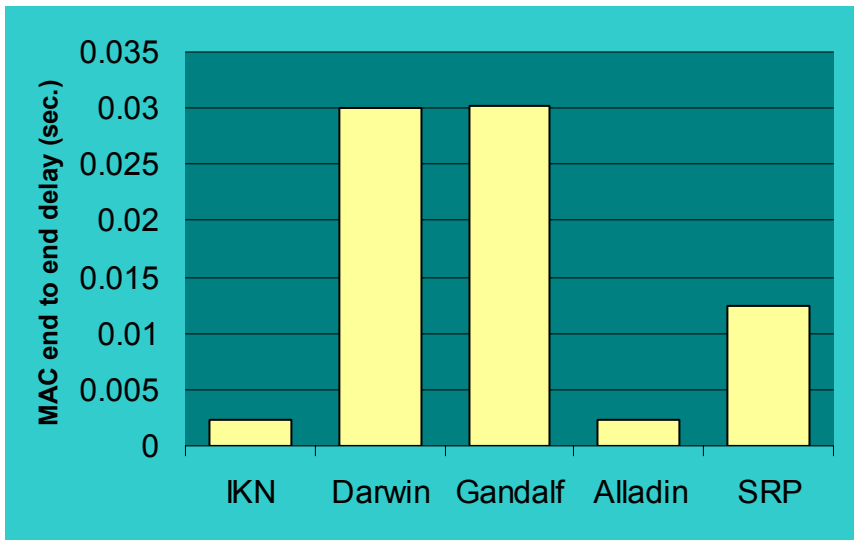
1. Comparison





- All protocols behave fair
- Equal throughput for all protocols, except for Alladin
- Delay for Darwin and Gandalf is more than 10 times higher than for Alladin and IKN

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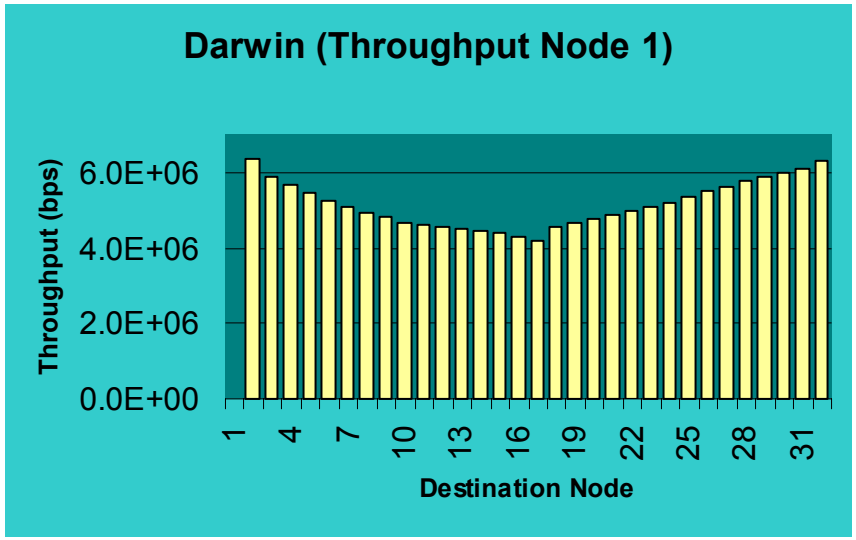
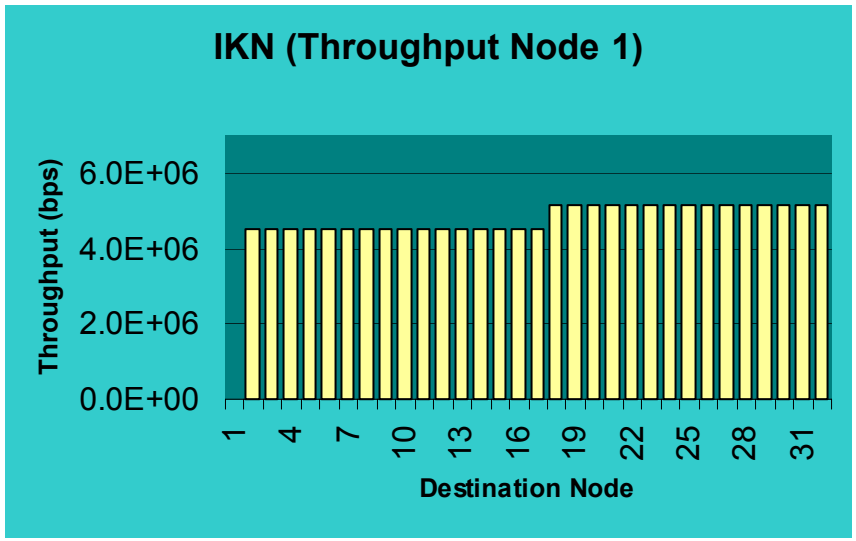
1. Throughput (32 Nodes)



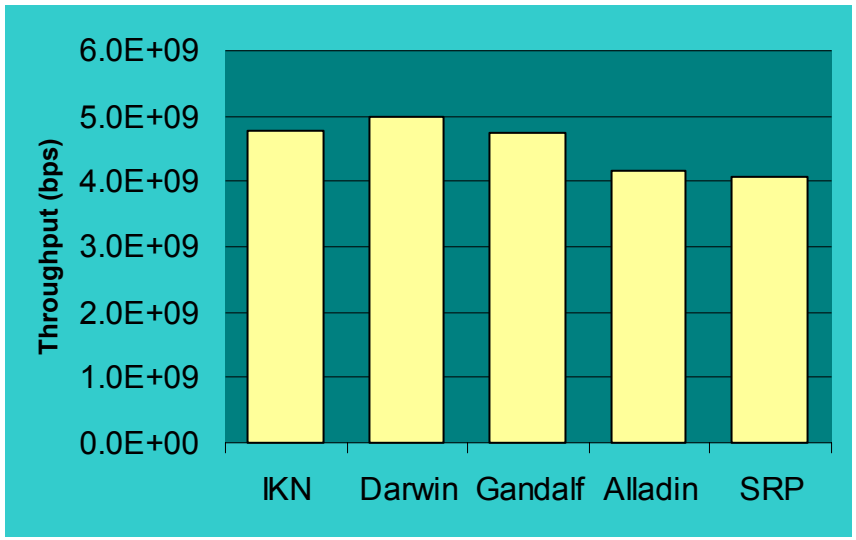
- With Darwin, all source nodes become a fair rate, however further away destinations are getting less throughput



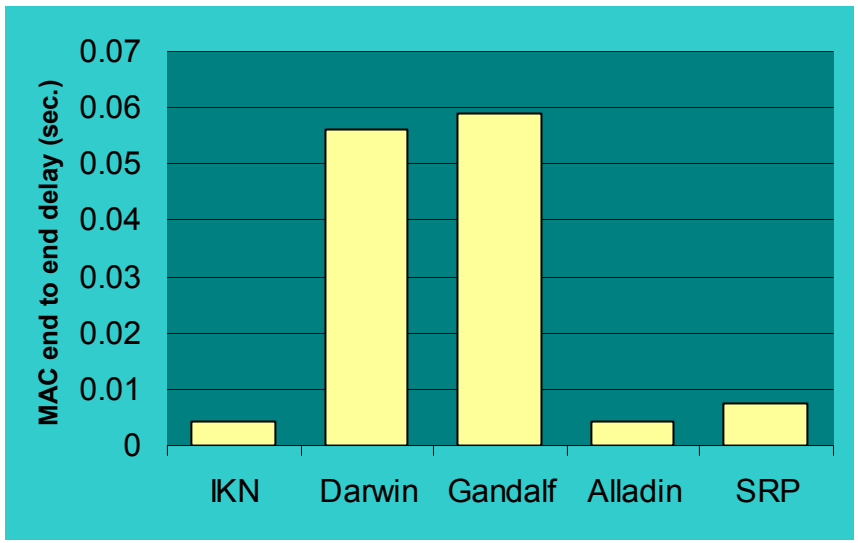
- IKN keeps its fair rate for all destinations

js_darwin_01.pdf

1. Comparison (32 Nodes)

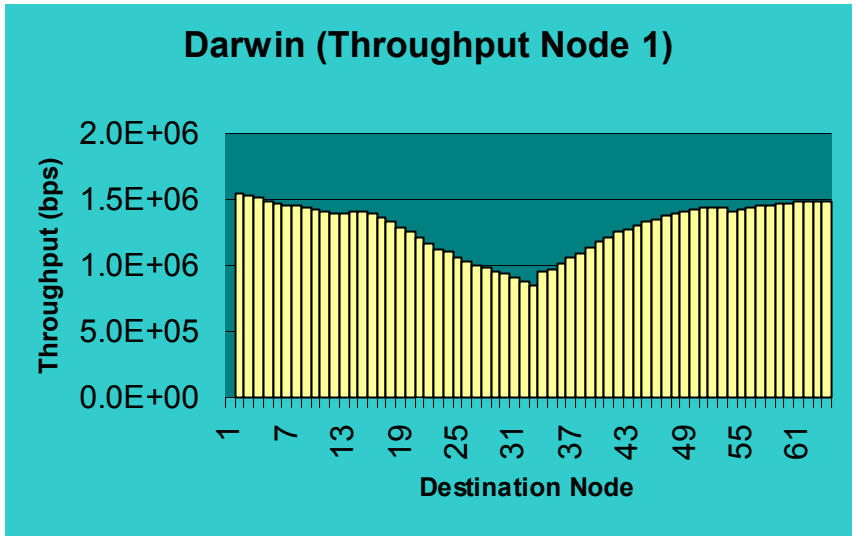


- Darwin has the highest total throughput, because it prefers packets with small hop counts (resulting in higher spatial reuse, but being unfair)

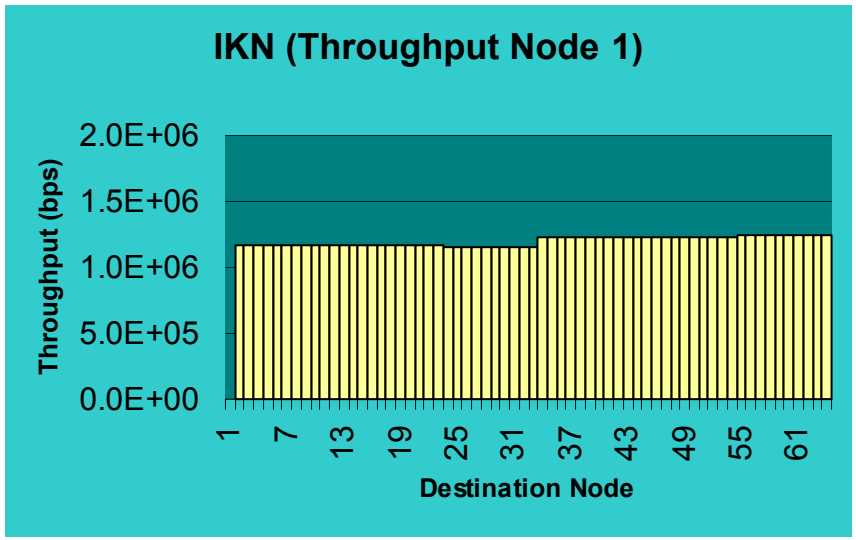


- Darwin and Gandalf both have a more than 10 times higher average delay than IKN and Alladin

1. Throughput Node 1 (64 Nodes)



- Effects are getting worse for larger rings



- IKN keeps its fair rates

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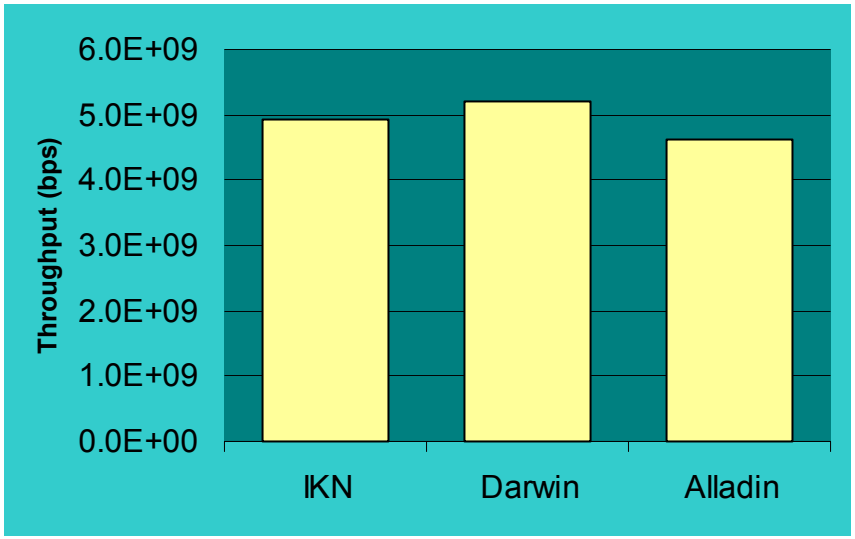
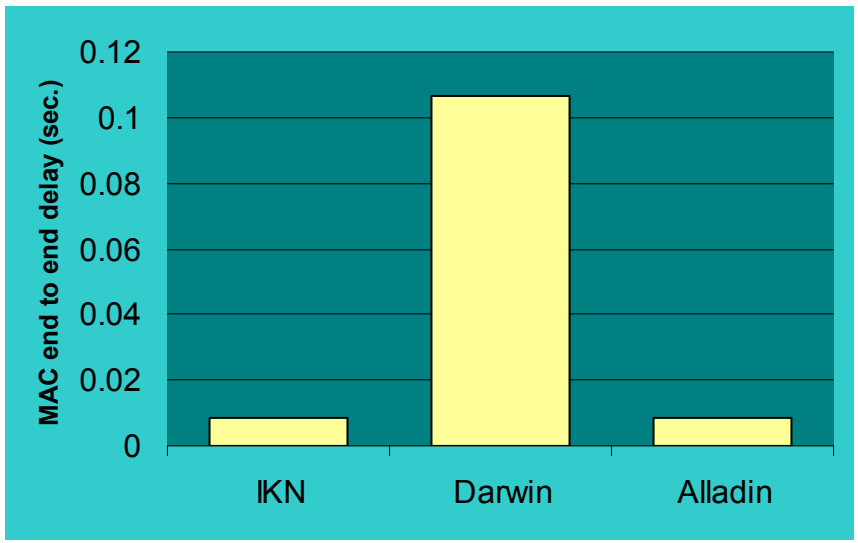
1. Comparison (64 Nodes)





- Relative small differences in throughput, but a big difference in delay

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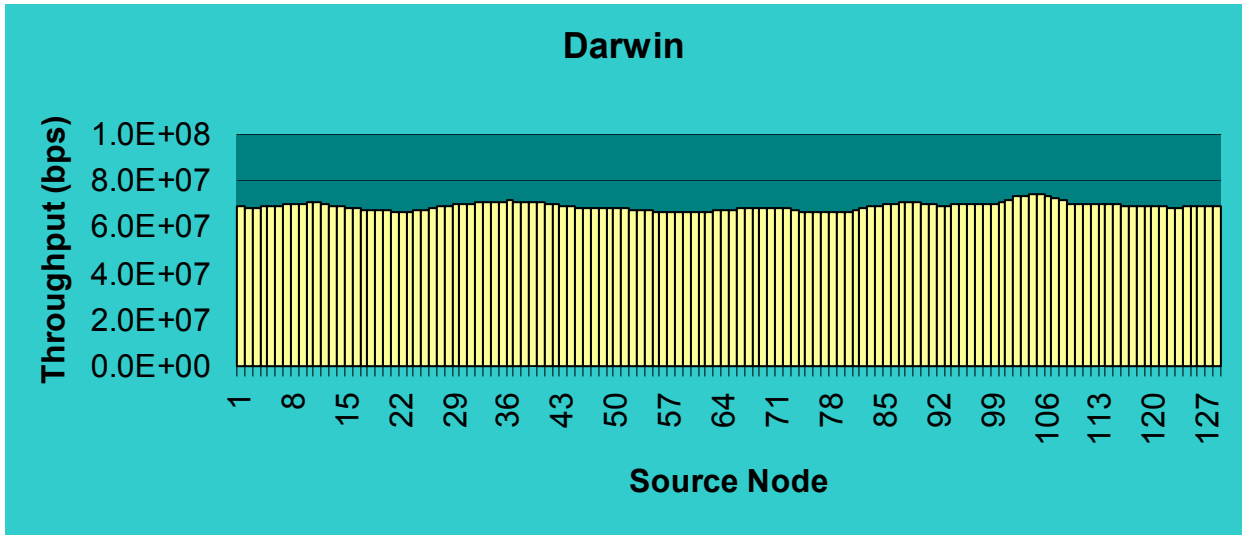
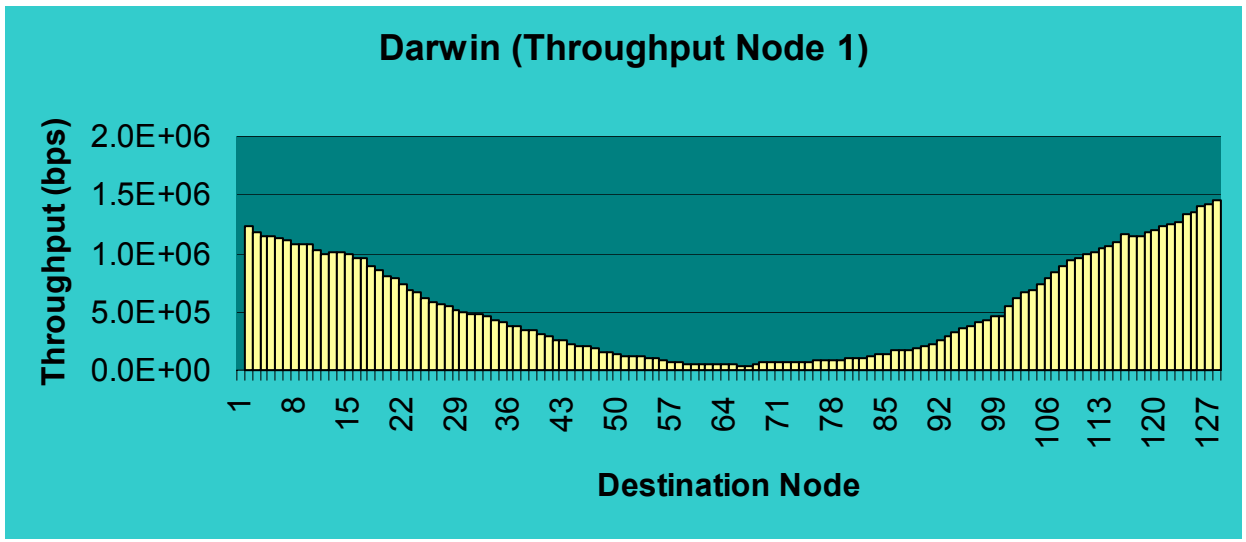
1. Darwin (128 Nodes)





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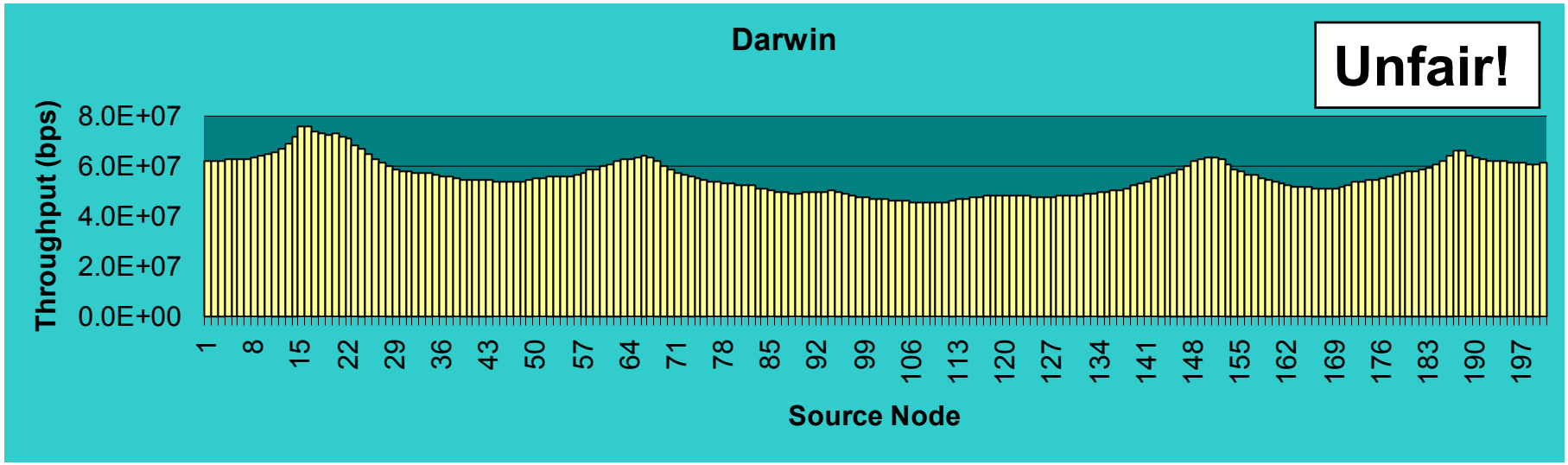
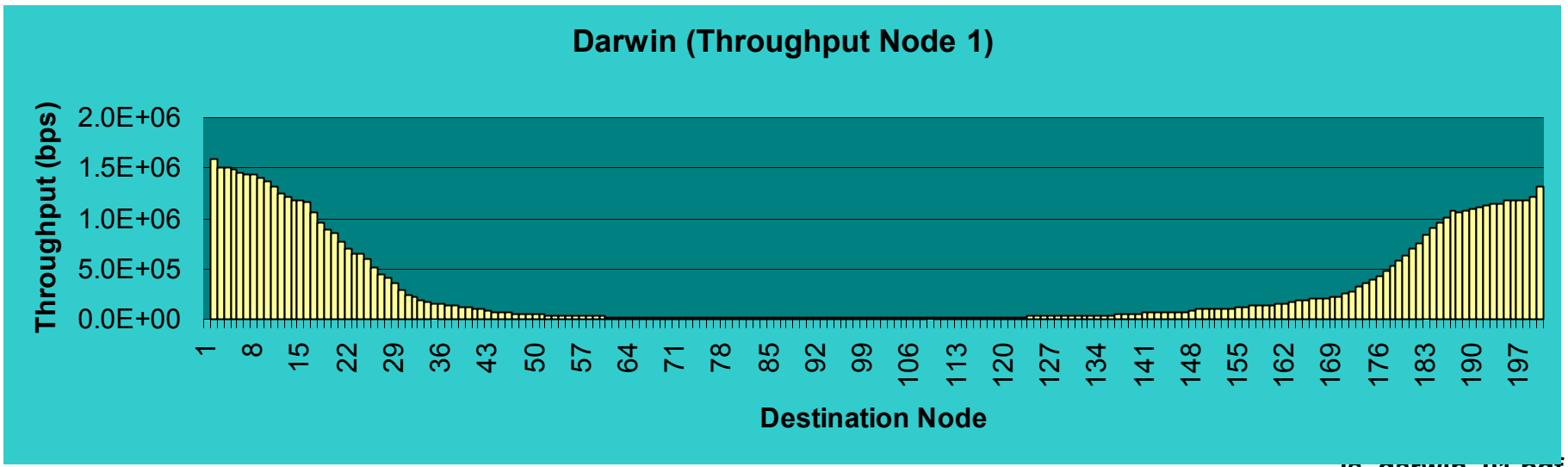
1. Darwin (200 Nodes)





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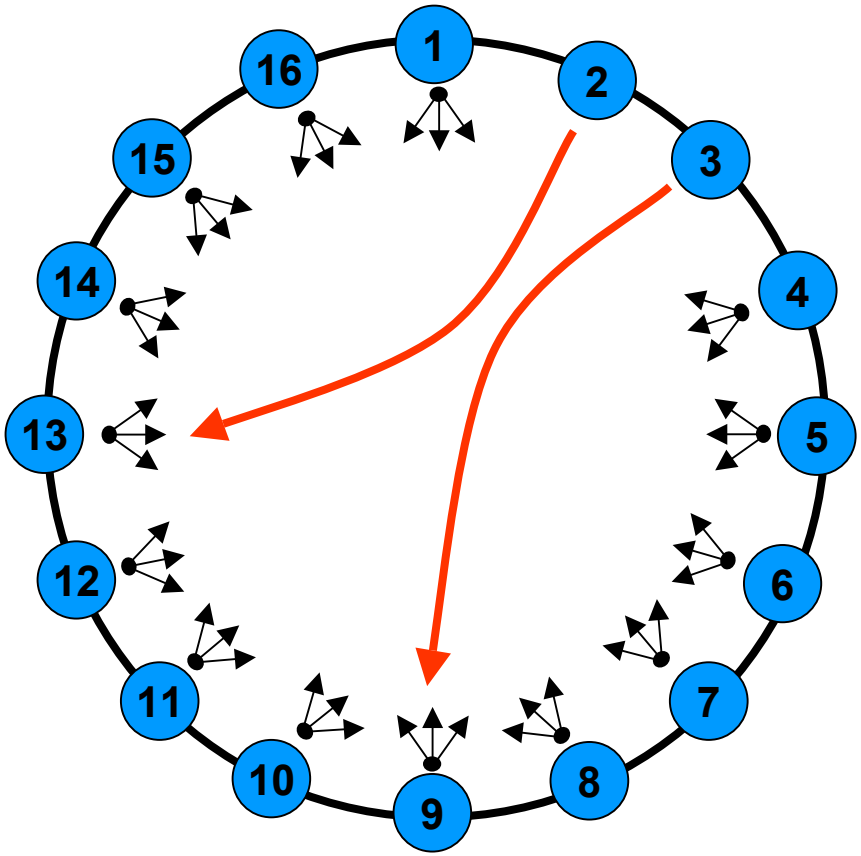
Scenario 2



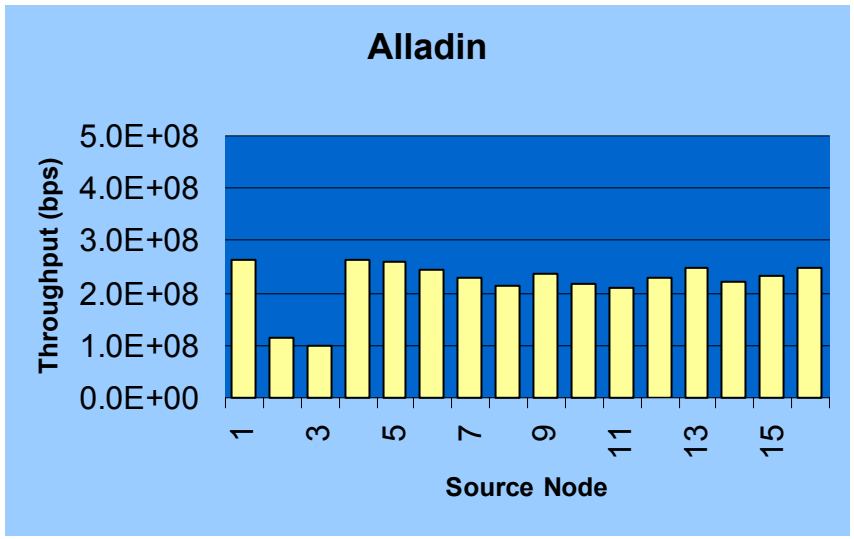
Double Ring, 100 km, OC-12

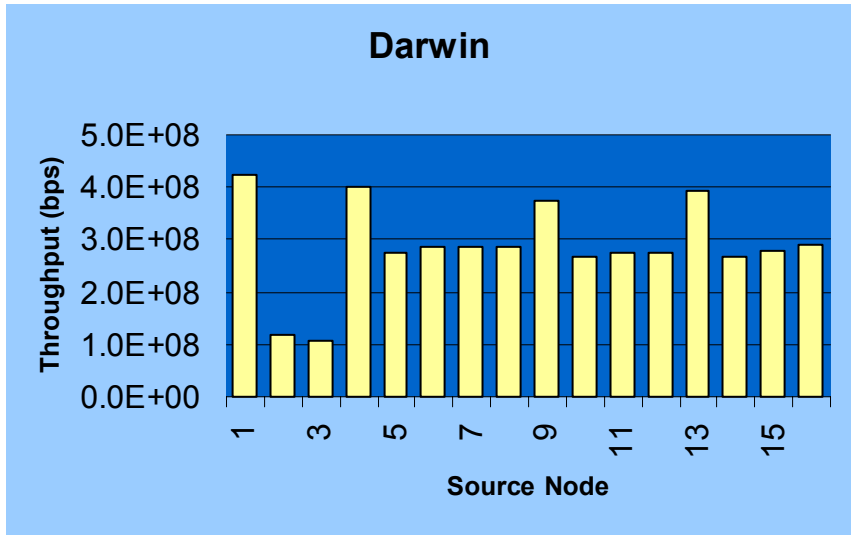
Only low priority packets

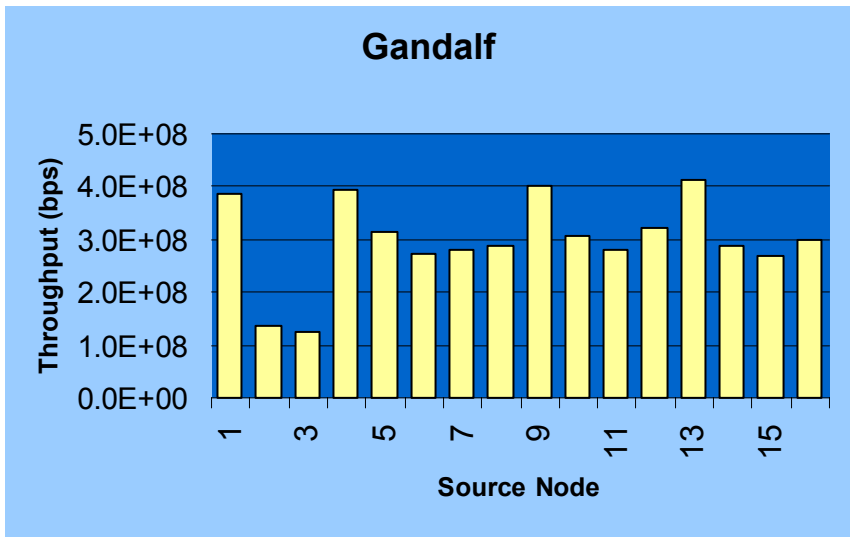
All to all traffic at maximum possible rate, except node 2->13 and 3->9

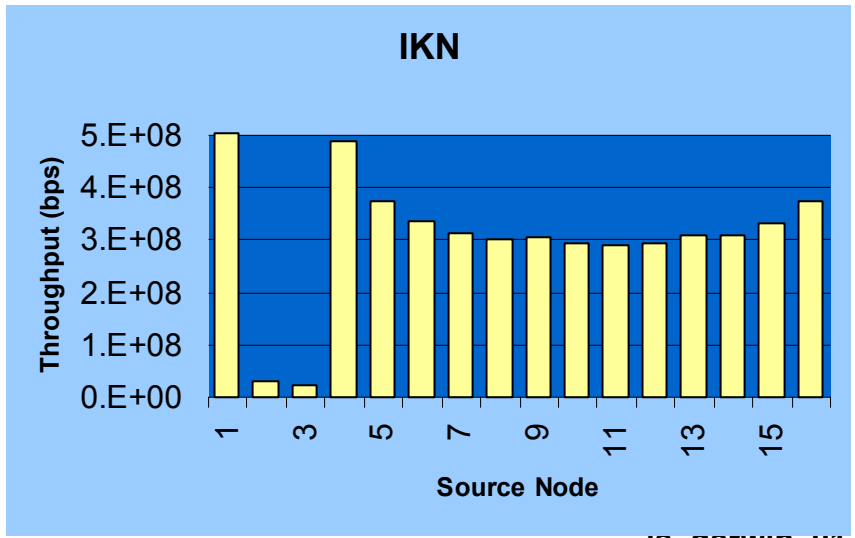
Packet Size: 1500 bytes

2. Throughput (16 Nodes)



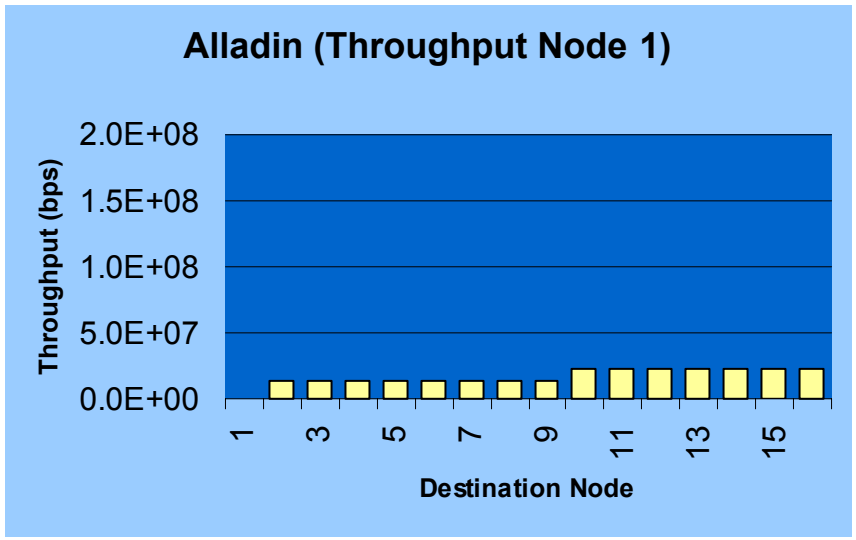


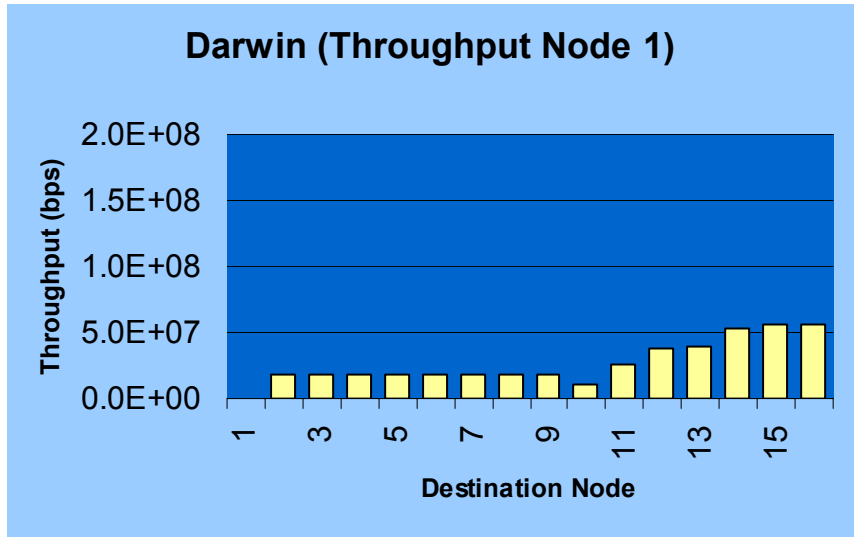


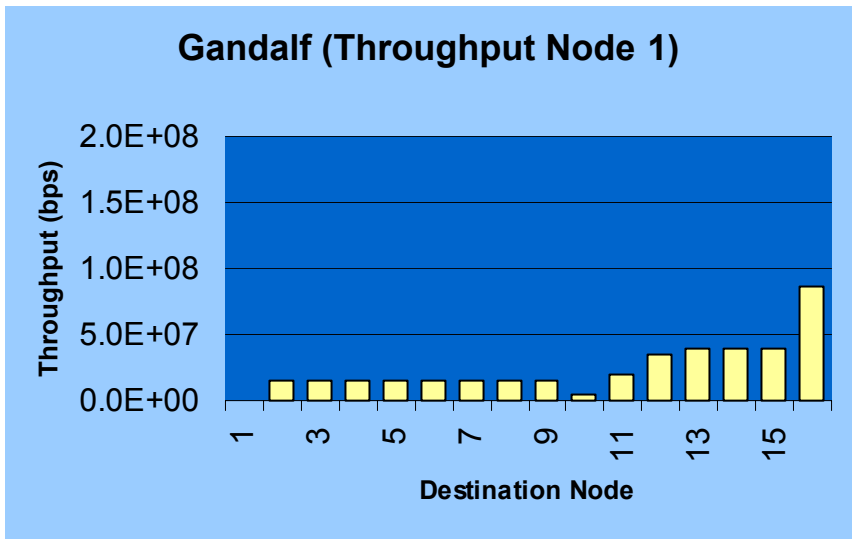


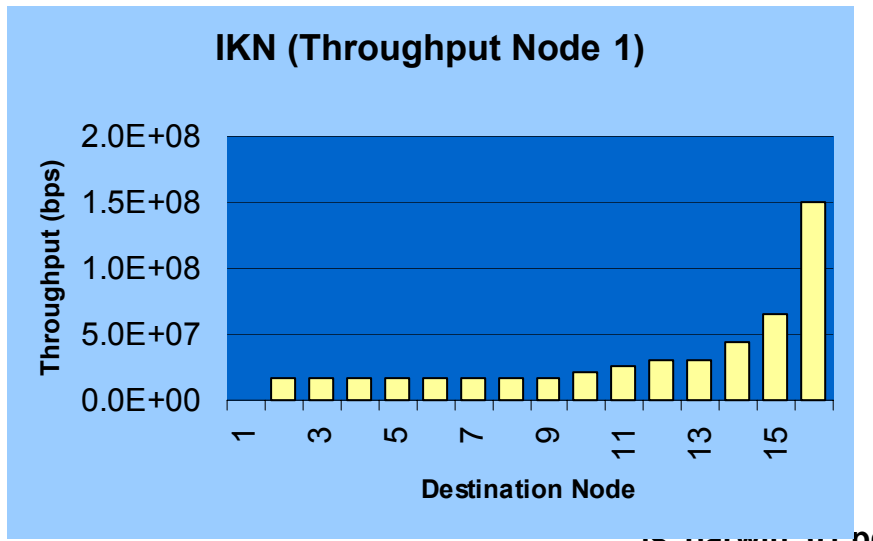
js_darwin_01.pdf

2. Throughput node 1 (16 Nodes)



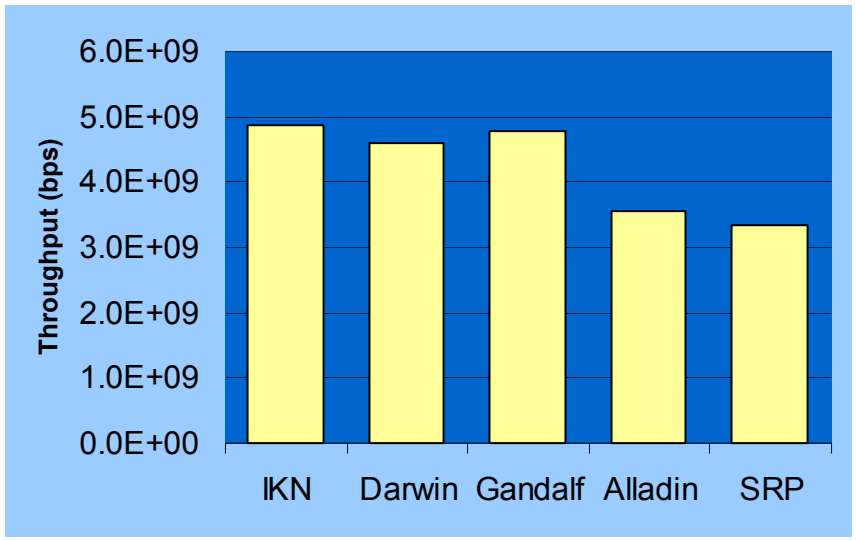




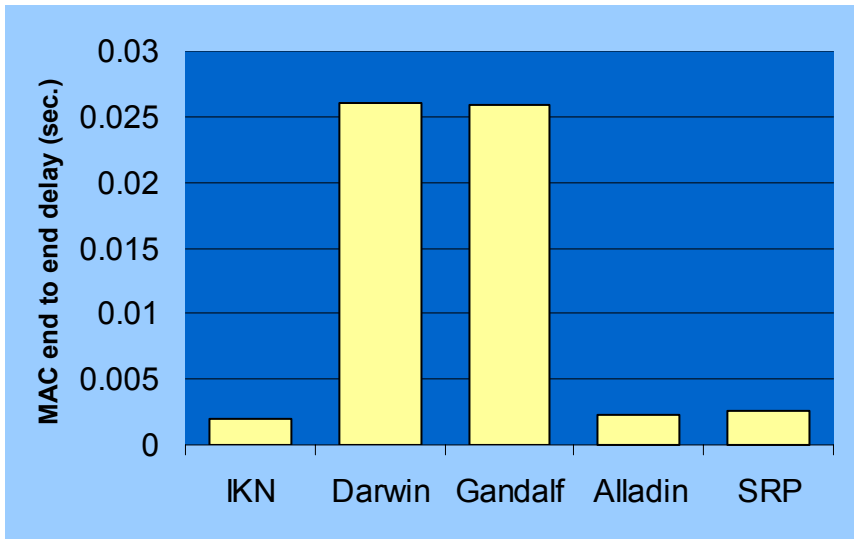


js_darwin_01.pdf

2. Comparison (16 Nodes)



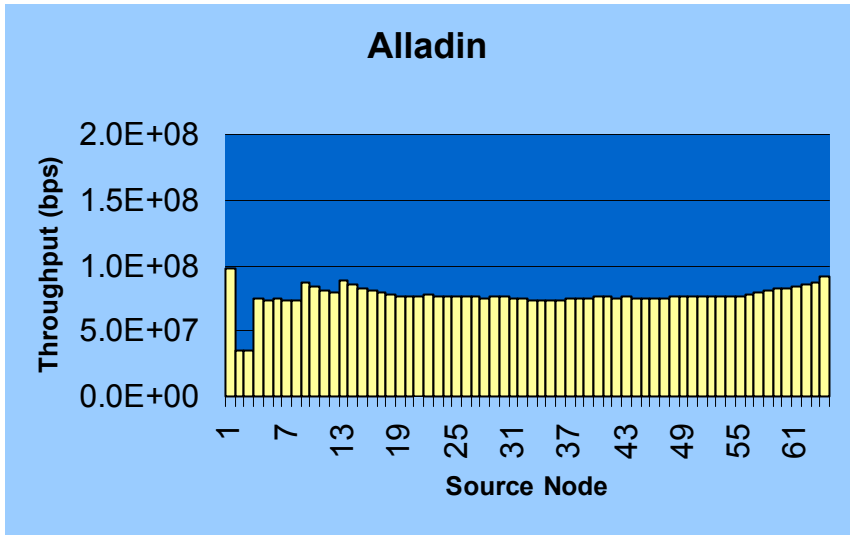
- IKN achieves the highest throughput *and* the lowest delay

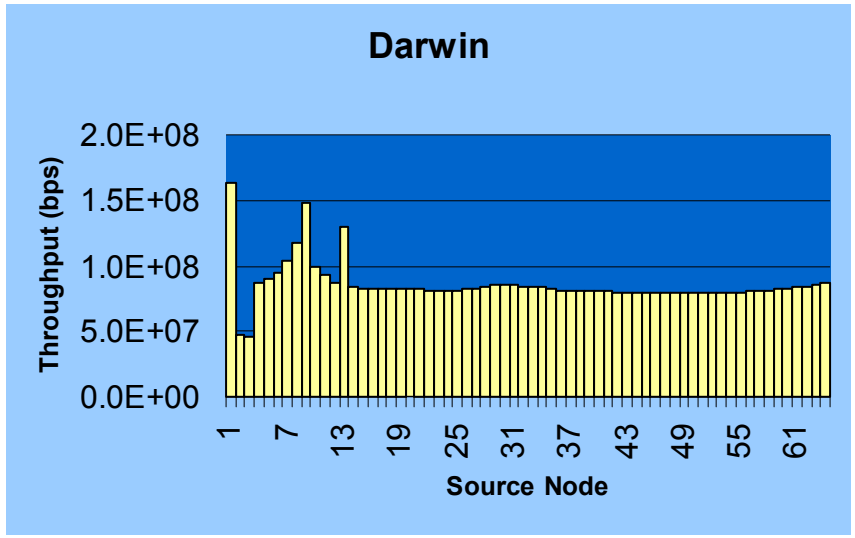


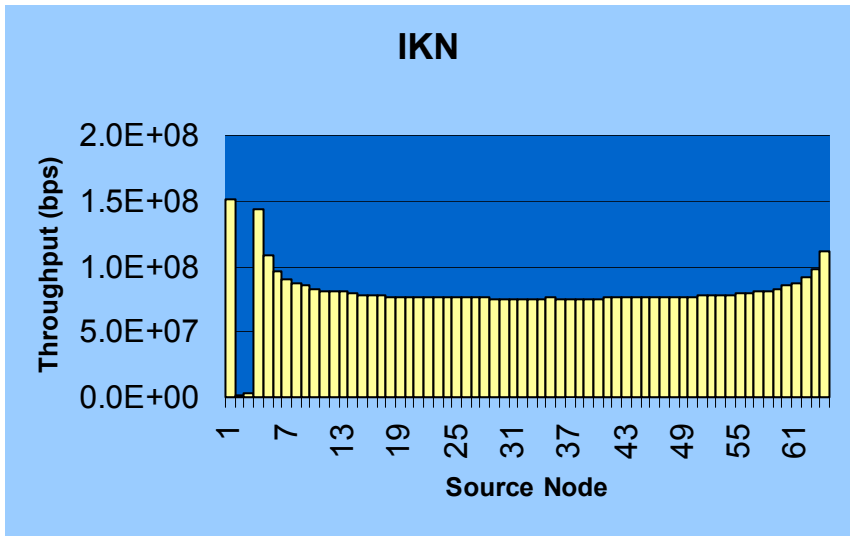
- Similar results as in scenario 1 (factor >10)

js_darwin_01.pdf

2. Throughput (64 Nodes)



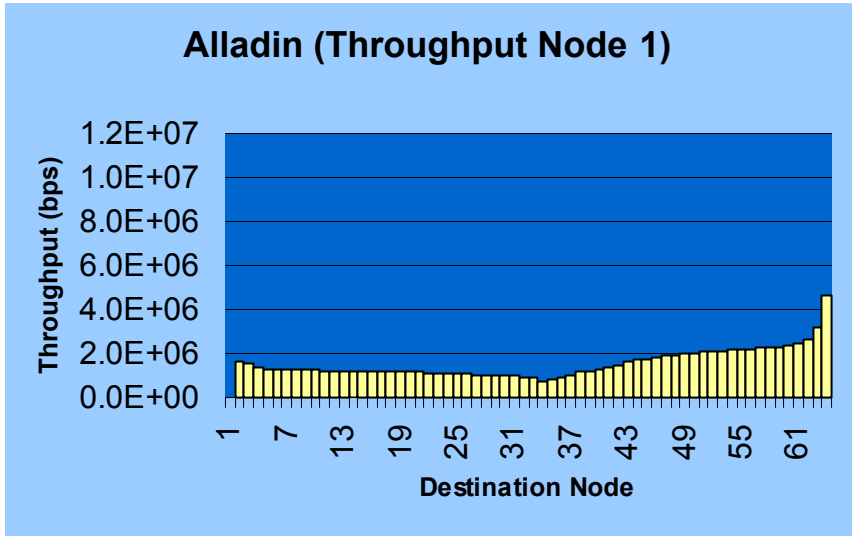


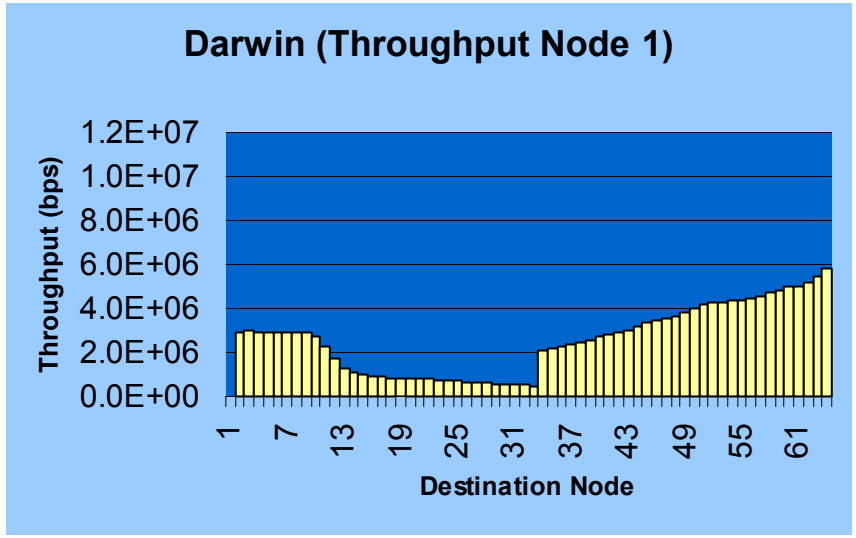


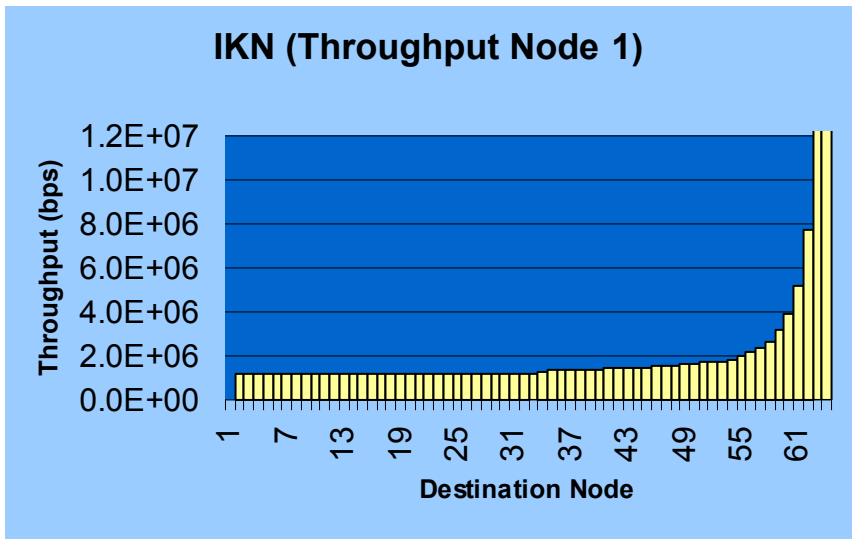
- Traffic scenario as before but now with 64 nodes

js_darwin_01.pdf

2. Throughput Node 1 (64 Nodes)



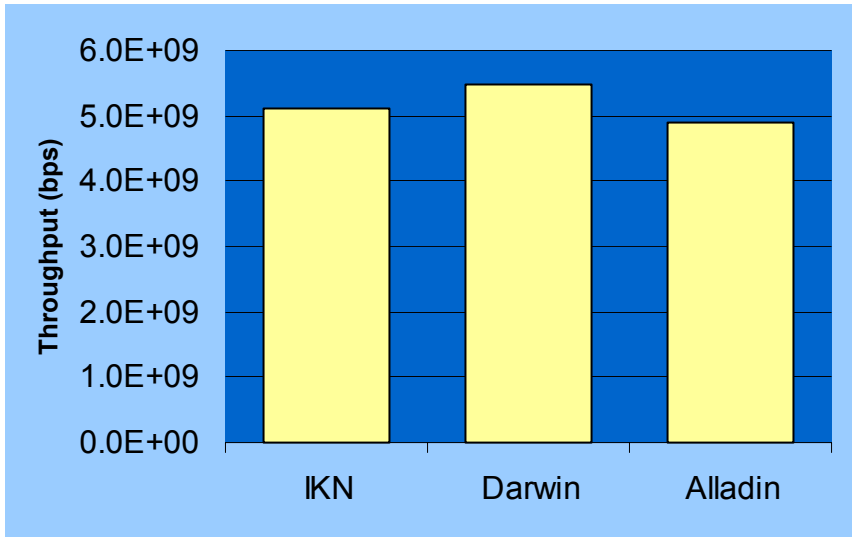


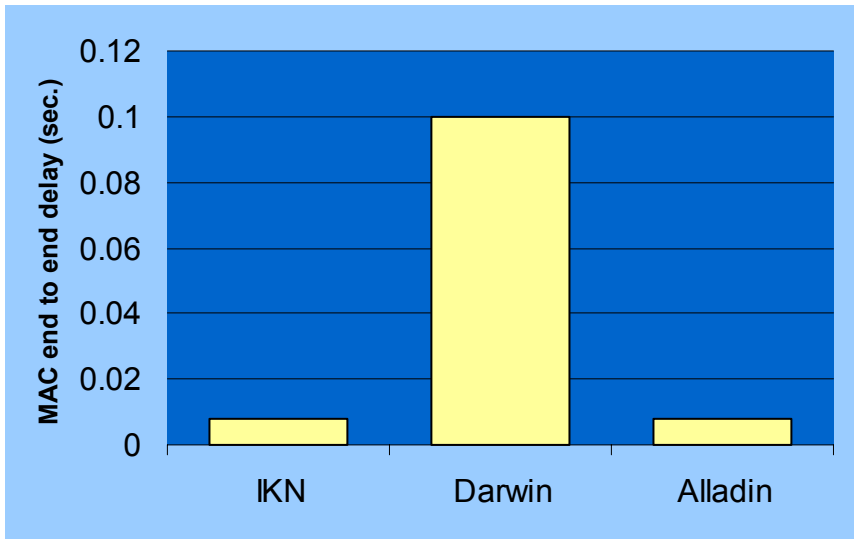


- Again, Darwin prefers the low hop flows; the left side of each graph (1..32) ideally should be a straight line like in IKN.

js_darwin_01.pdf

2. Comparison (64 Nodes)





- Darwin has the highest throughput, due to unfairness

js_darwin_01.pdf

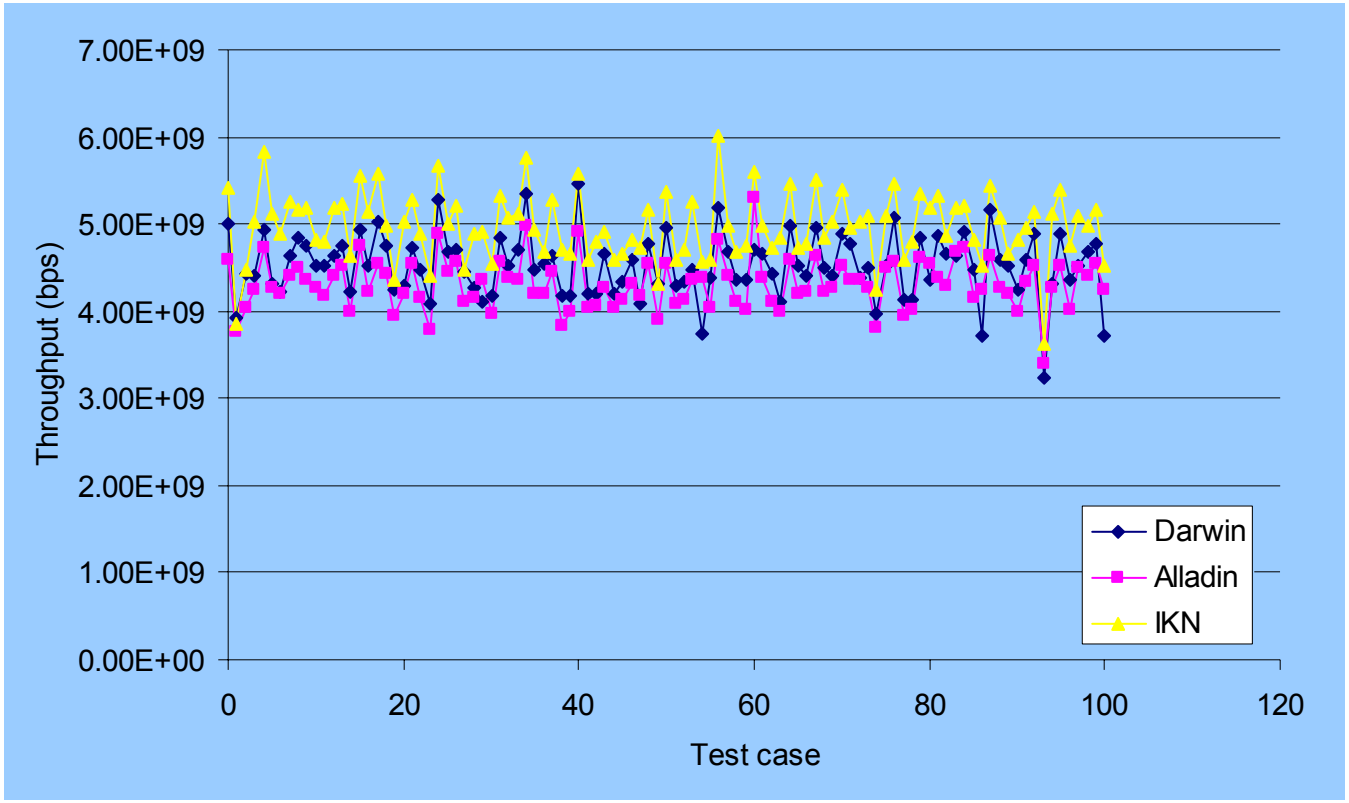
Scenario 3

- High and Low Priority
- TBD…

Random Tests

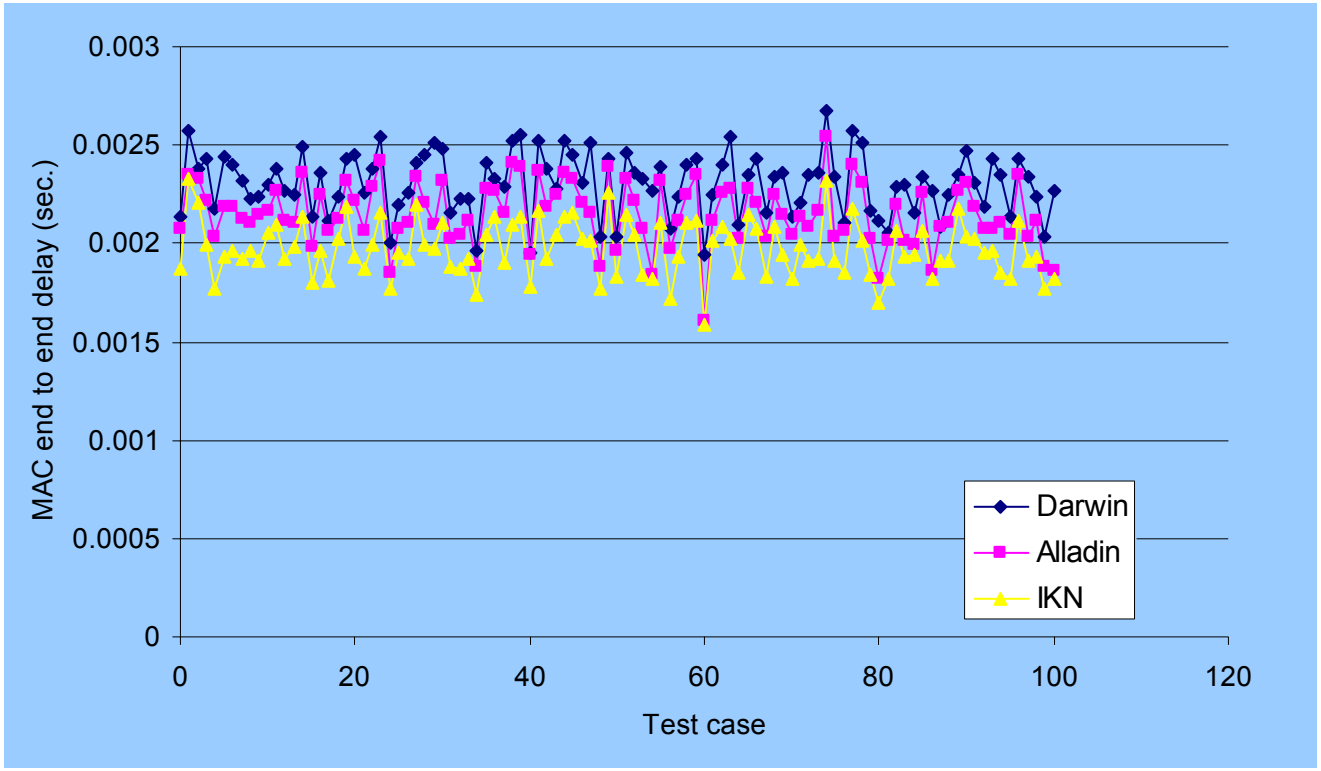
- Darwin, Alladin, Gandalf, SRP, IKN
- 16 Nodes
- 150 random flows (source and destination with different clustering settings)
- 100 test cases

Throughput



- IKN has the highest throughput in all tests, except for test case 2 and 50, where Darwin has the highest throughput.

MAC end to end delay



- IKN has the lowest delay in all cases

Conclusion

- Under high traffic load, starvation may occur for “far away” destinations. SRP and IKN do not have this problem.
- Unfairness in large networks
- Darwin has a high delay for low priority packets
- Darwin’s throughput is comparable with that of IKN, due to unfairness this comparison is however questionable