



IKN
Institut für
Kommunikationsnetze

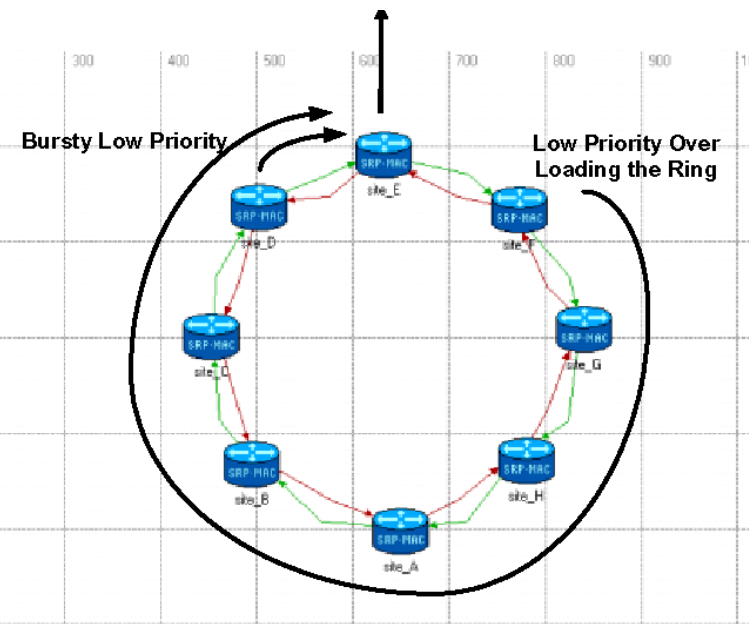
Performance Comparison of RPR MAC Proposals

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Vienna University of Technology, Austria

Overview

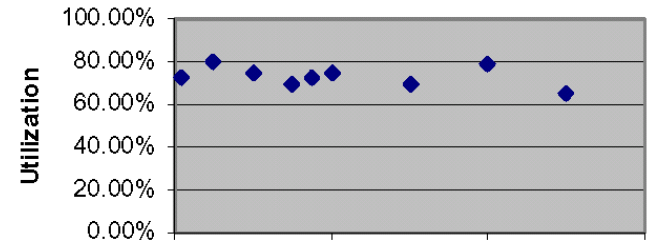
- Corner Case Scenarios
- Flow versus Node Fairness
- Other Scenarios
- Automated Test Case Generation and Verification
- Conclusion

Scenario 1, OC-12

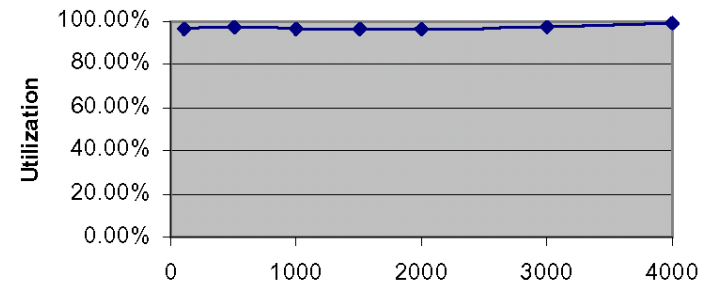


Gandalf

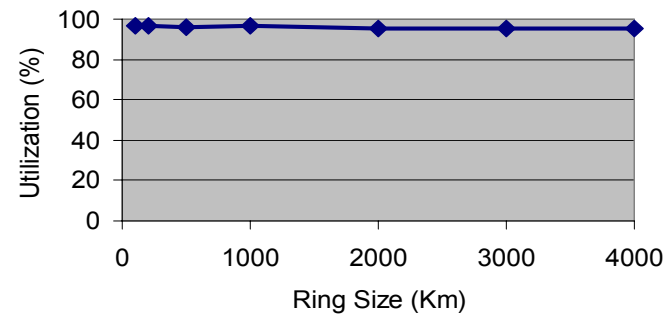
Low priority Bursty Traffic for OC-12



OC-12 Utilization



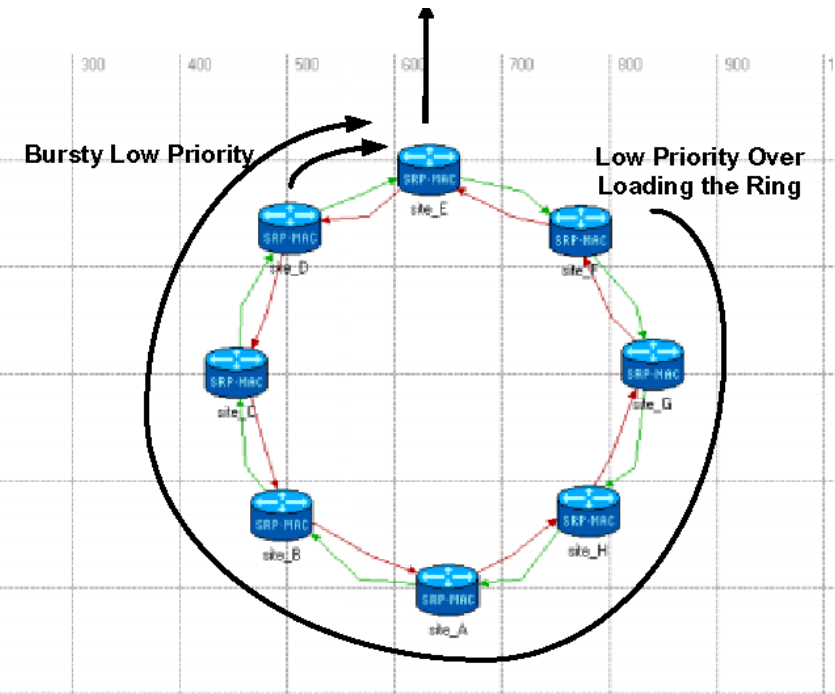
OC-12 Utilization



IKN

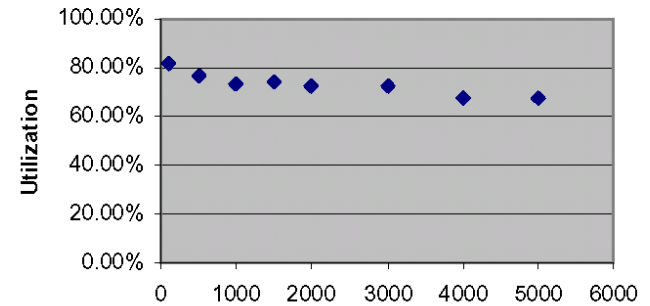
Alladin

Scenario 1, OC-48



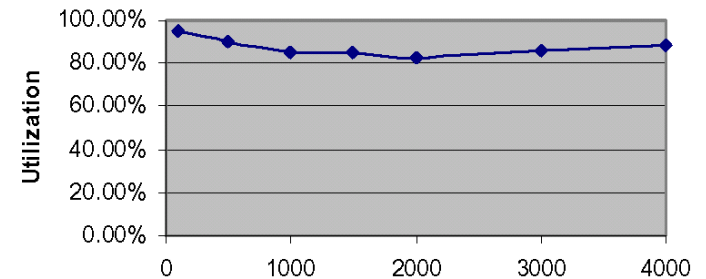
Gandalf

Low priority Bursty Traffic for OC-48



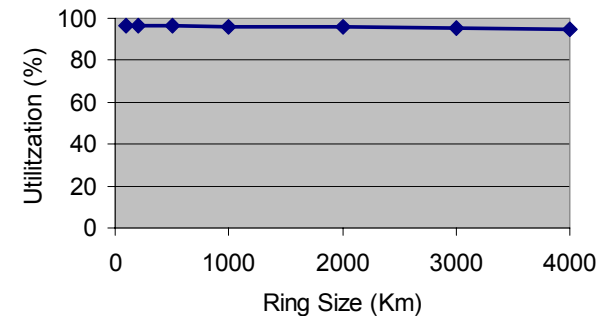
OC-48 Utilization

Alladin

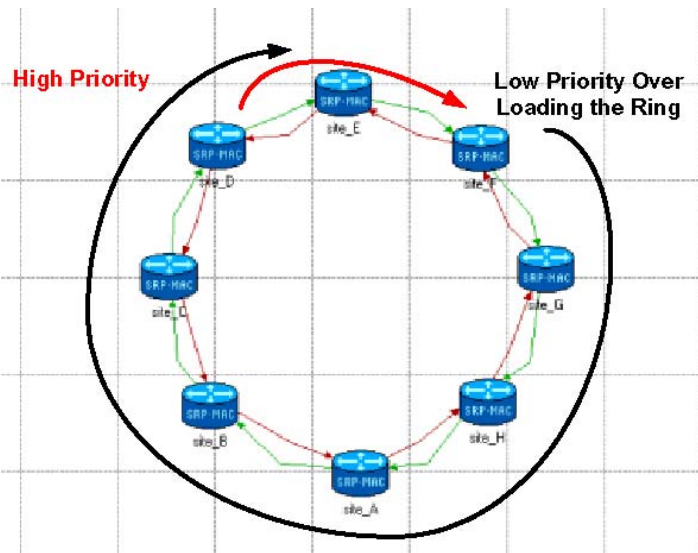


OC-48 Utilization

IKN



Scenario 3, OC-12

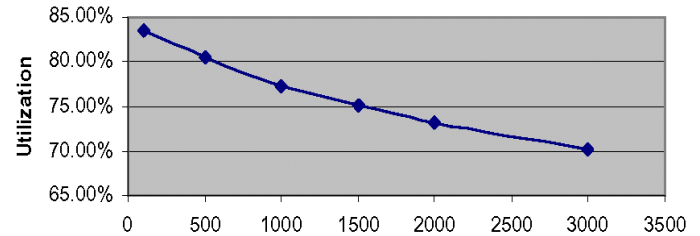


Gandalf

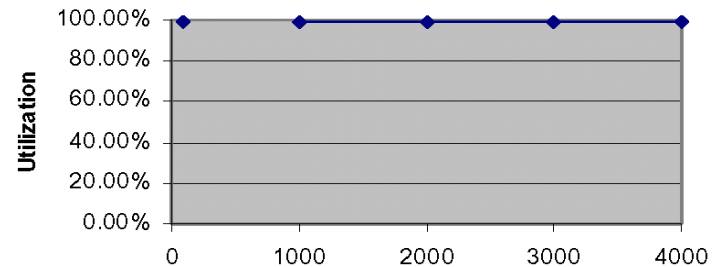
Alladin

IKN

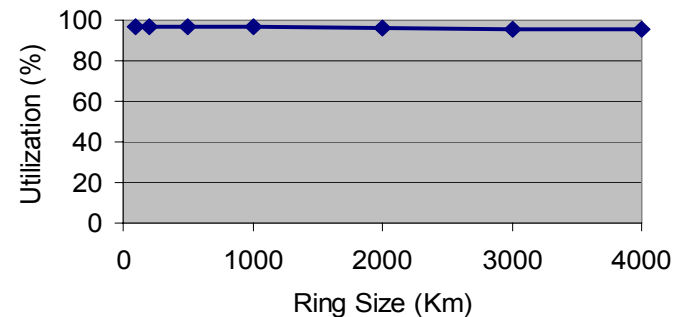
OC-12 Low Intensity High Priority



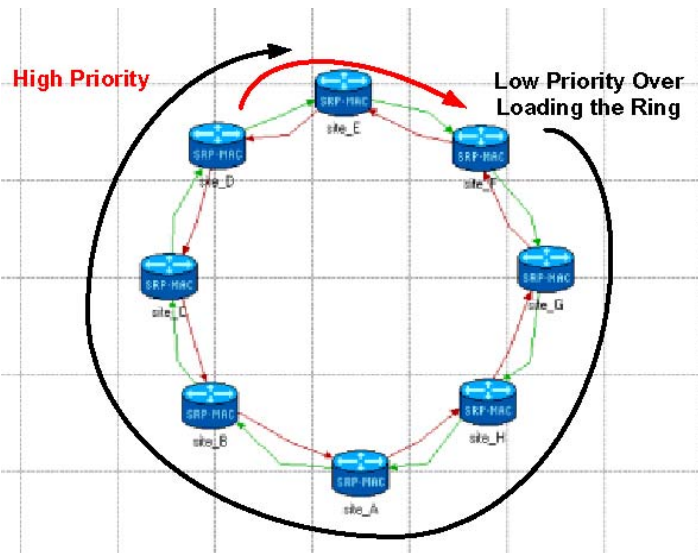
OC-12 Low intensity High priority



OC-12 Utilization

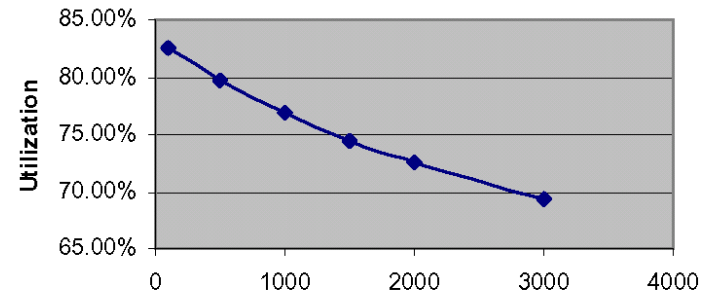


Scenario 3, OC-48

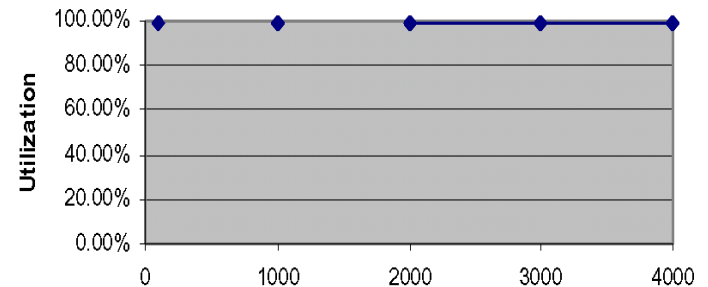


Gandalf

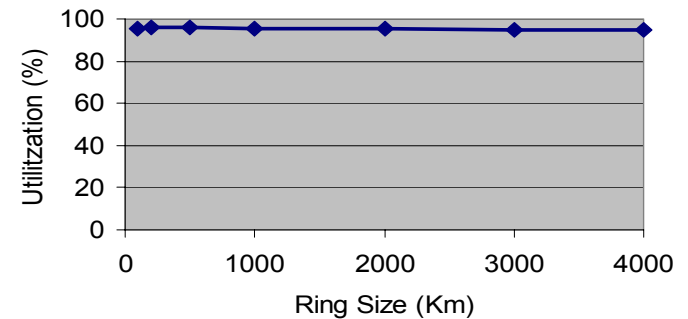
OC-48 Low Intensity High Priority



OC-48 Low intensity High priority



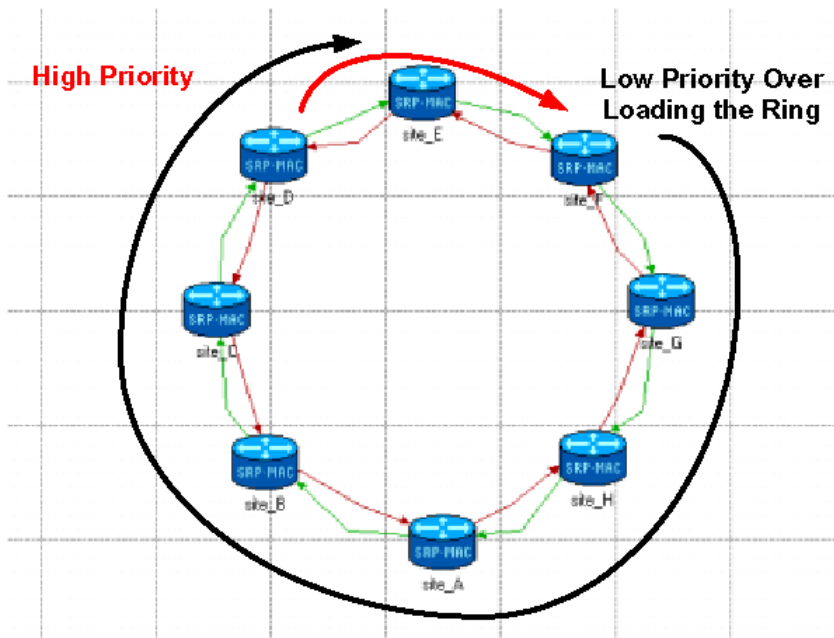
OC-48 Utilization



Alladin

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Scenario 4, OC-12

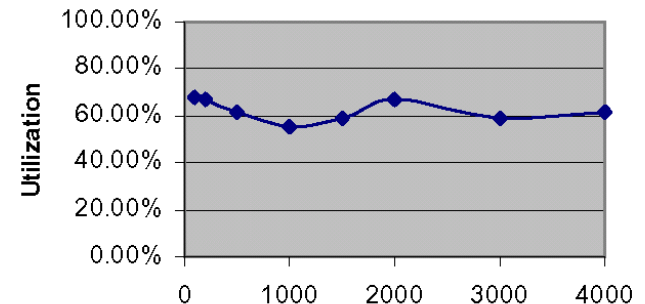


Gandalf

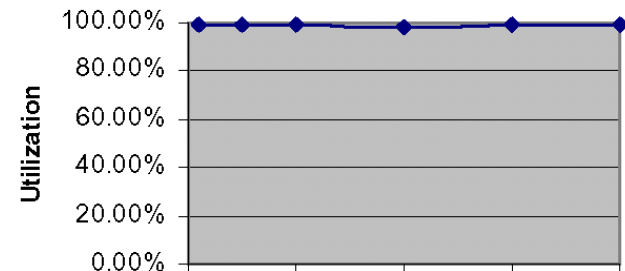
Alladin

IKN

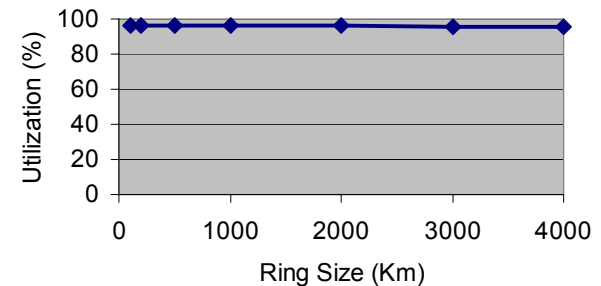
OC-12 (High Priority Oscillations)



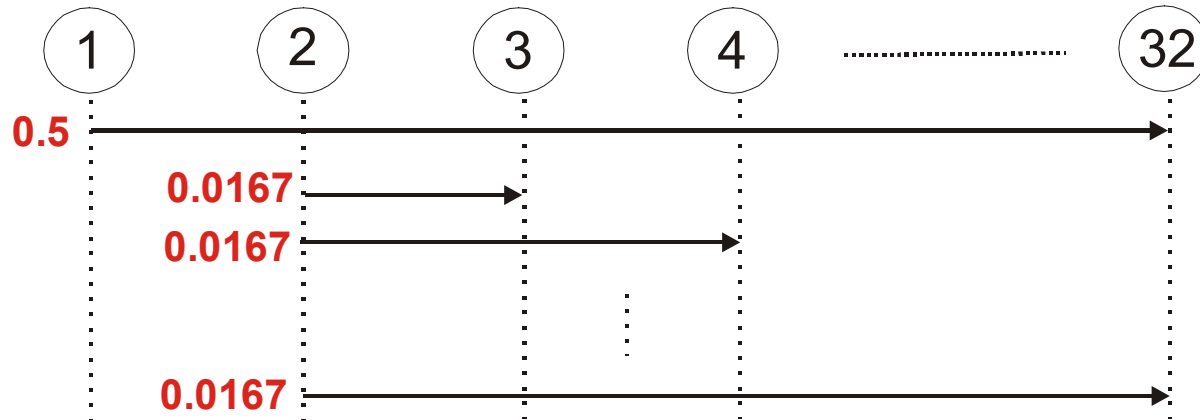
OC-12 (High Priority Oscillations)



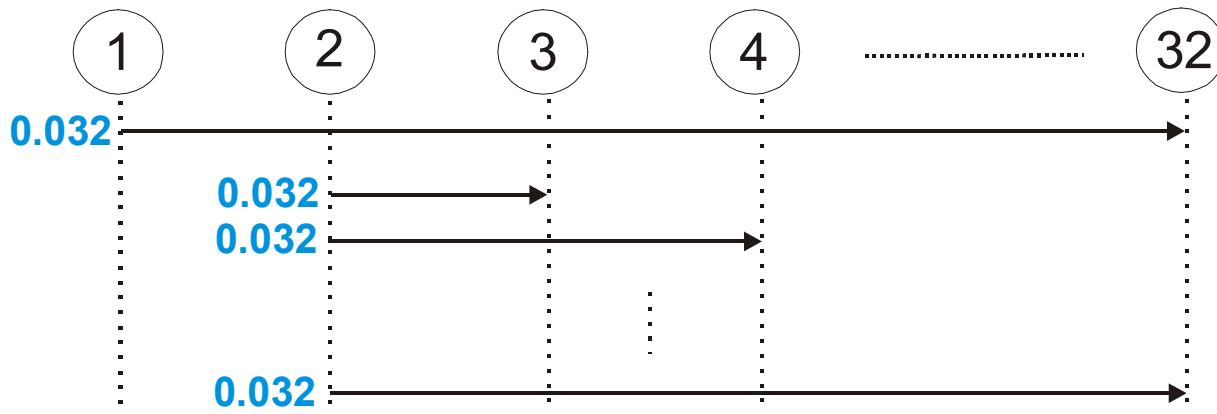
OC-12 Utilization



Flow vs. Node Fairness (1)

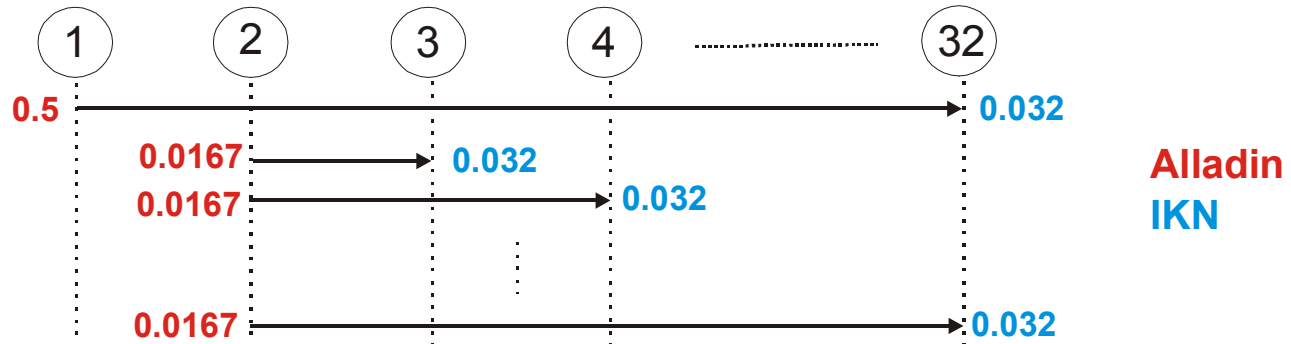


Alladin ($0.0167 = 0.5 / 30$)



IKN ($0.032 = 1 / 31$)

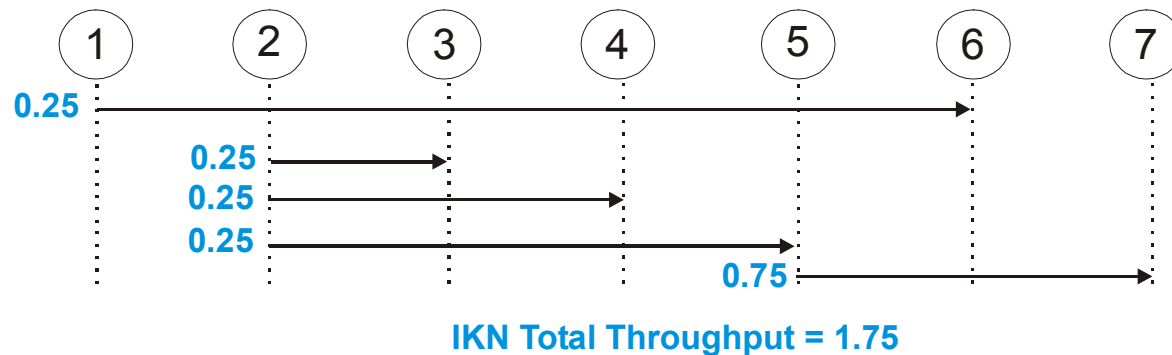
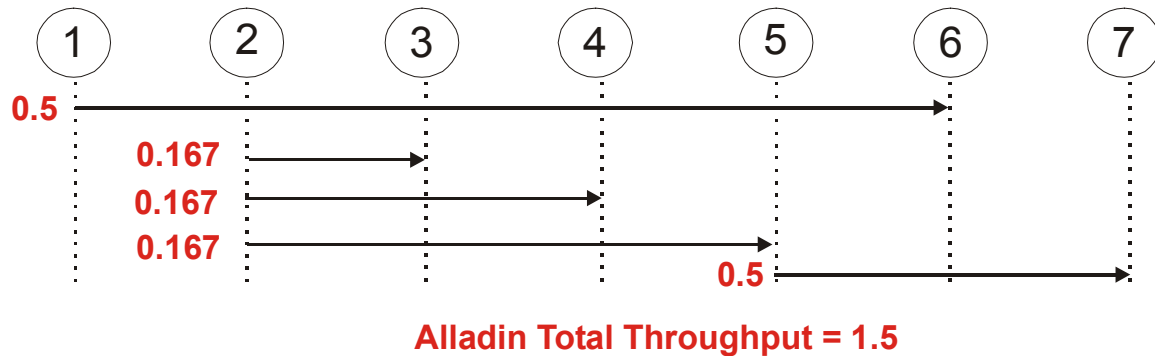
Flow vs. Node Fairness (2)



	New Customer rate for flow:	
	1 to x (with $x > 2$)	2 to x (with $x > 2$)
IKN	0.031	0.031
Alladin	0.25	0.0161

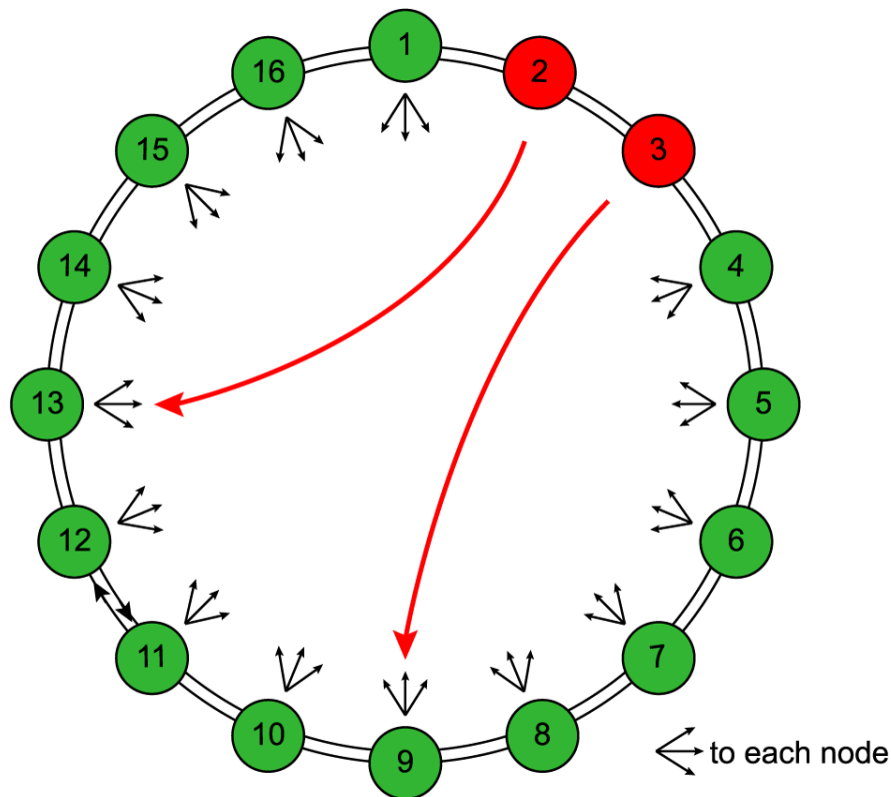
- With node fairness, two identical flows with different source nodes are treated differently, even if no bottlenecks exist between both sources.

Flow vs. Node Fairness (3)



- Flow fairness achieves higher throughput than node fairness

Dual-Ring – Traffic Scenario 1



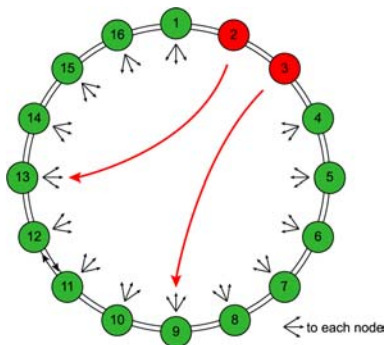
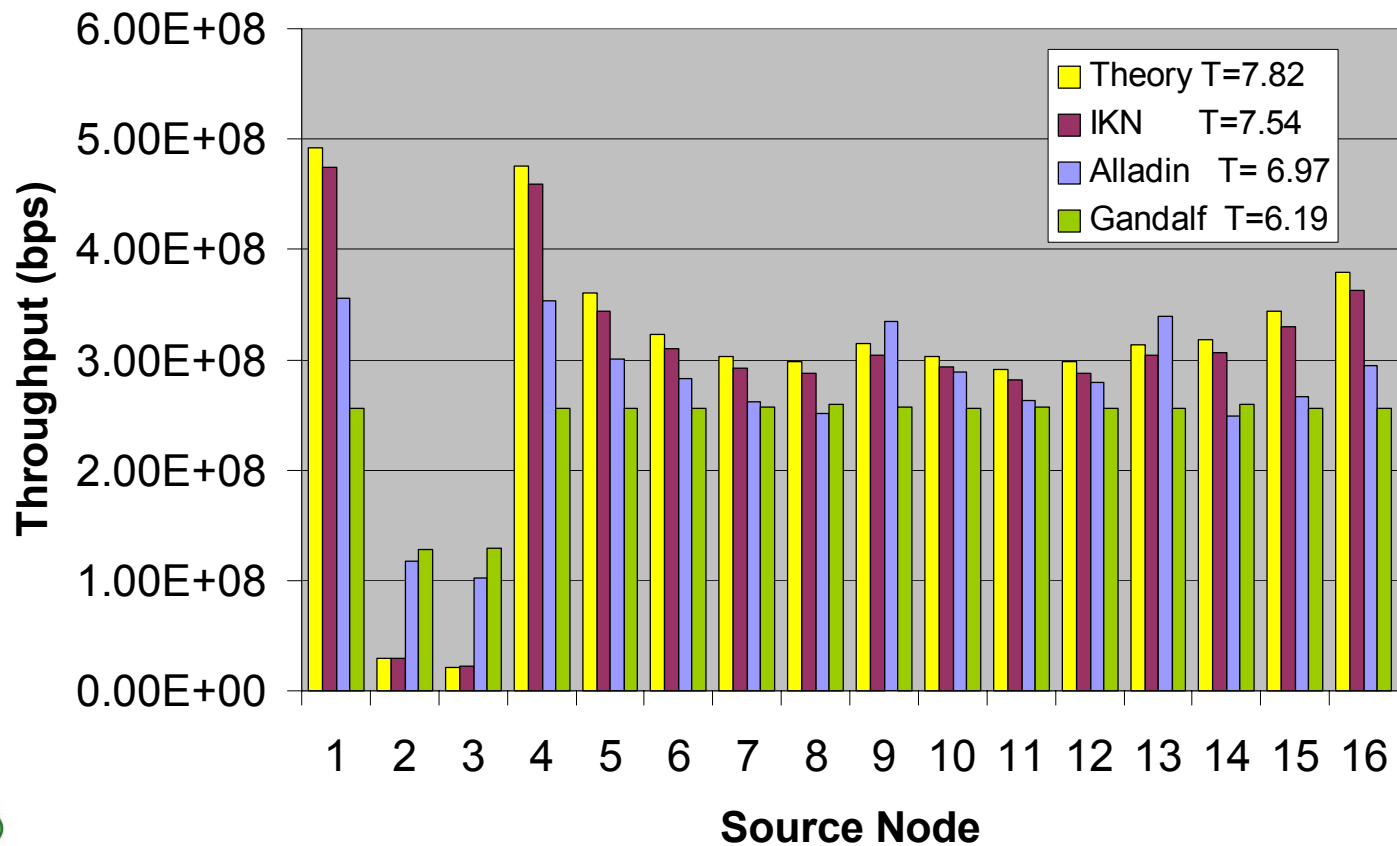
Uniform traffic
Saturated sources
16 nodes

Constant packet size
1500 bytes

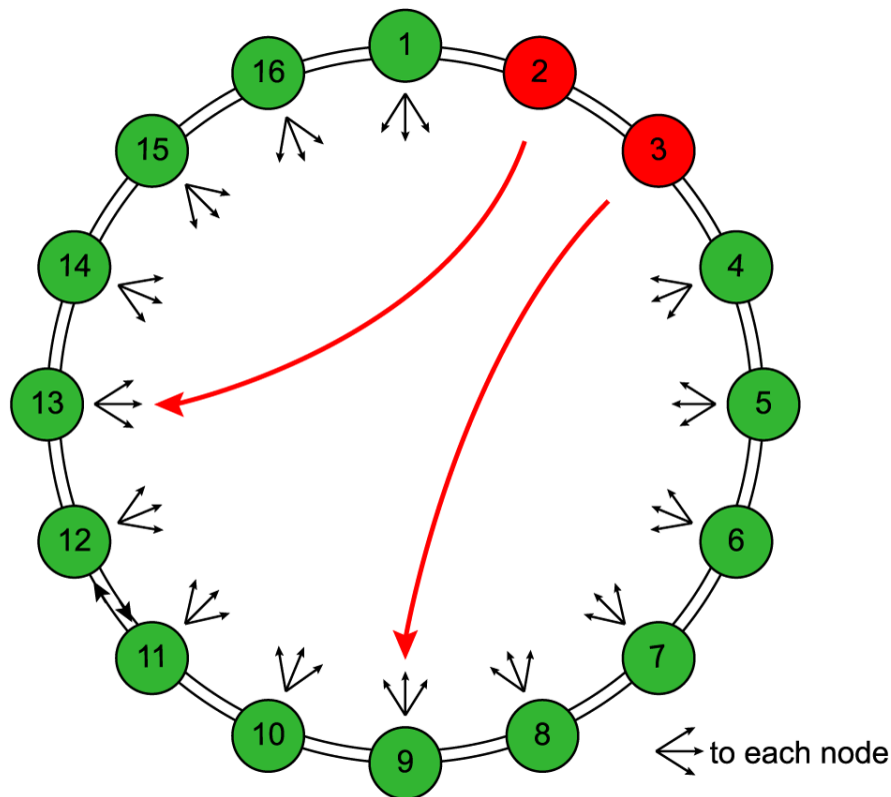
100km OC-12 Double Ring

Only Low Priority

Traffic Scenario 1



Dual-Ring – Traffic Scenario 2



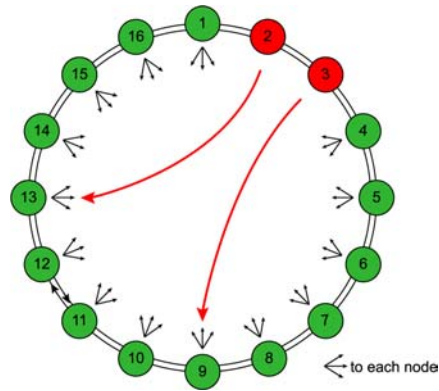
Uniform traffic
Saturated sources
16 nodes

Constant packet size
1500 bytes

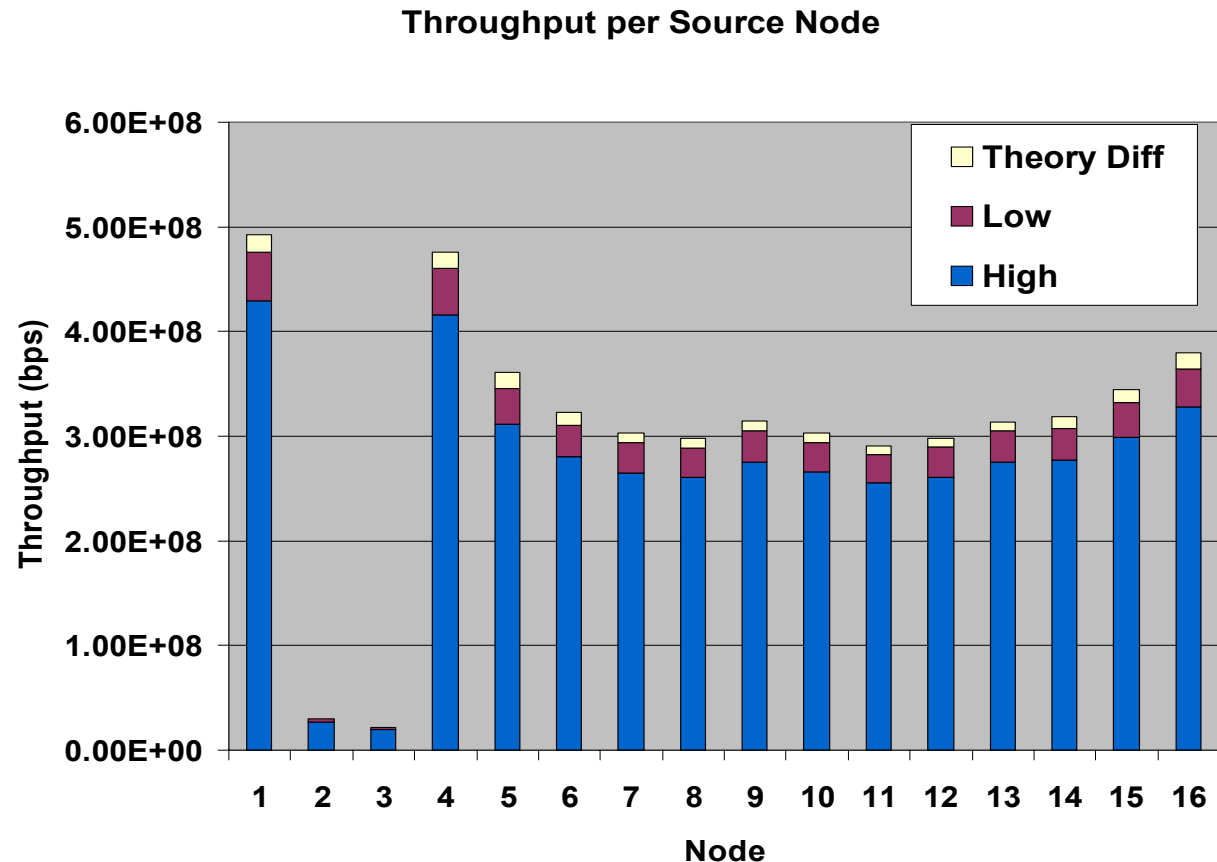
100km OC-12 Double Ring

High And Low Priority

Traffic Scenario 2, IKN results

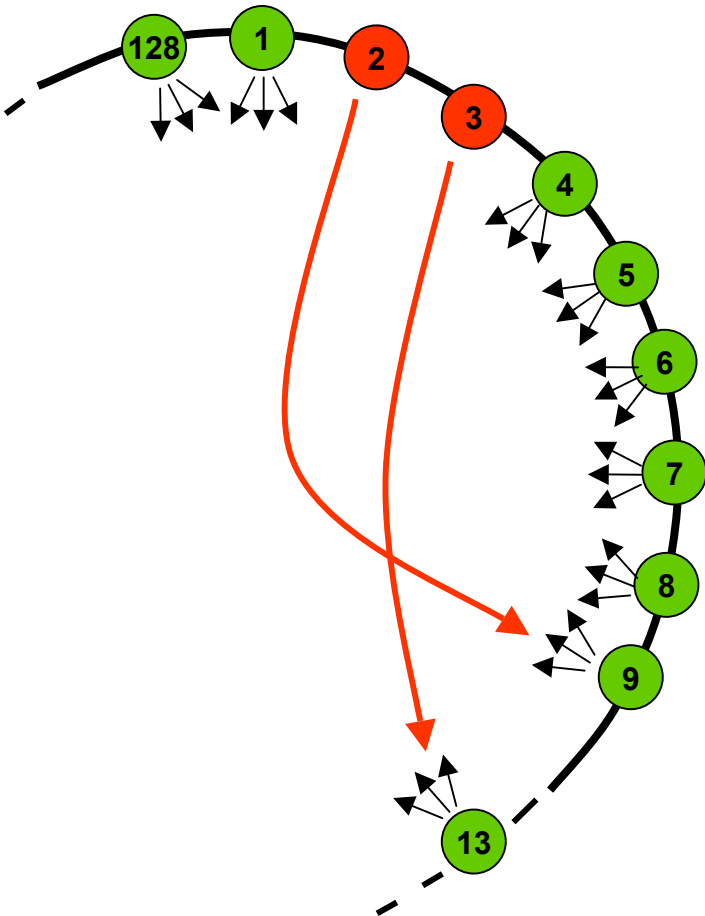


$$C' = 0.9 * C$$



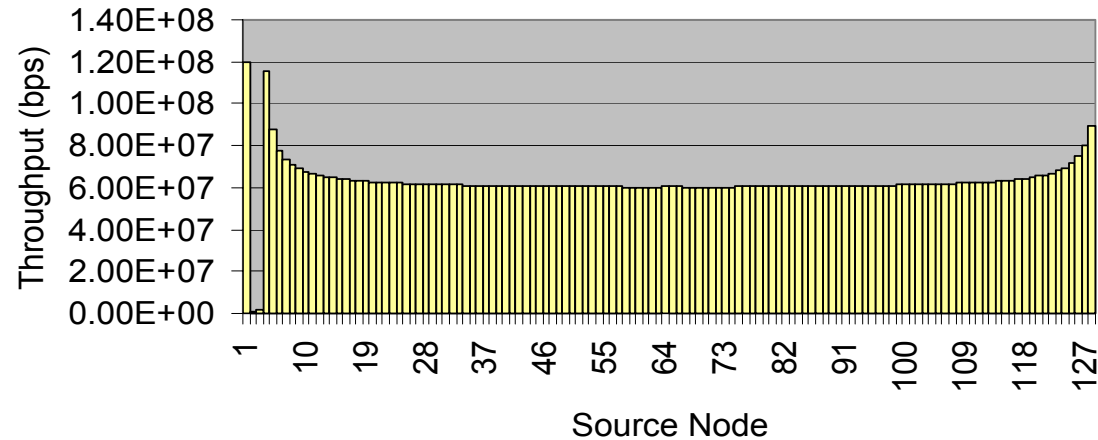
Alladin uses strict priority scheduling for different traffic classes. Therefore only high priority traffic arrives in this scenario.

Scenario 3, Double Ring, 128 nodes

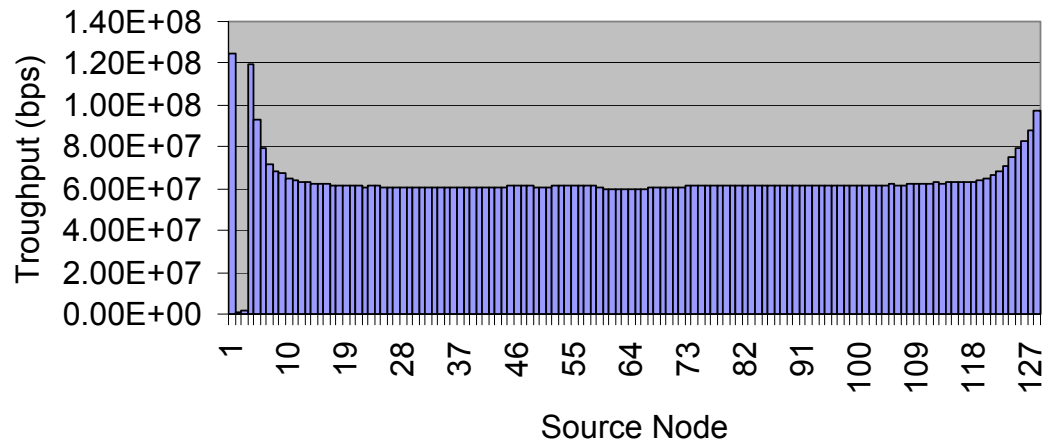


$126 \cdot 127 + 2 = 16004$
source-destination flows

Theoretical



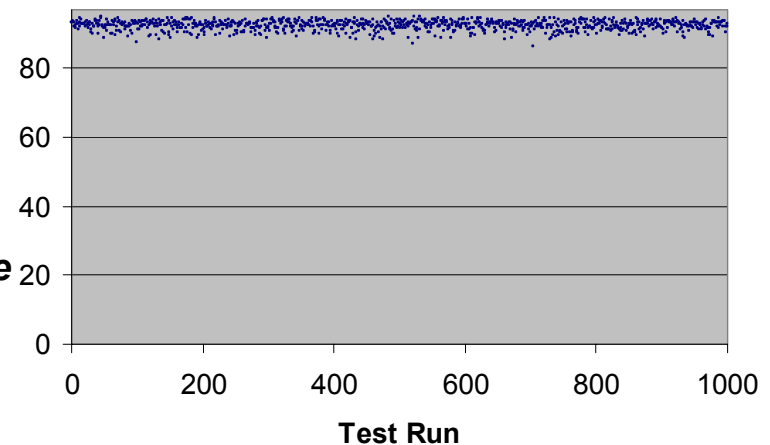
simulated IKN



Test Case Generation

- Automated Test Case Generation
 - To test the protocol design (fairness and performance)
 - Verification with theoretical values where possible
 - Verification based on the fairness principle
 - To test the protocol implementation
- Generation Parameters
 - Network size, number of flows, flow rates, priorities, source-destination distribution
- IKN fairness algorithm (with MAC protocol) is heavily tested

The test case results here are computed by selecting the source node that has the biggest difference with its theoretical value. (100 means no difference)



Conclusion

- Corner Cases:
 - IKN performance is constant and high (never below 95% utilization on bottleneck link)
- IKN fairness proposal outperforms other proposals
 - Because flow fairness is better than node fairness
- IKN fairness is very well tested