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Refined Techniques for Collision Avoidance and Comparison of Different Algorithms

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ABSTRACT*:* Accurately estimating congestion for proper global adaptive routing decisions (i.e., determine whether a packet should be routed minimally or non-minimally) has a significant impact on overall performance for high-radix topologies, such as the Dragonfly topology. Prior work have focused on understanding near-end congestion i.e., congestion that occurs at the current router – or downstream congestion – i.e., congestion that occurs in downstream routers. However, most prior work do not evaluate the impact of far-end congestion or the congestion from the high channel latency between the routers. In this work, we refer to far-end congestion as phantom congestion as the congestion is not "real" congestion. Because of the long inter-router latency, the in-flight packets (and credits) result in inaccurate congestion information and can lead to inaccurate adaptive routing decisions. In addition, we show how transient congestion occurs as the occupancy of network queues fluctuate due to random traffic variation, even in steady-state conditions. This also results in inaccurate adaptive routing decisions that degrade network performance with lower throughput and higher latency. To overcome these limitations, we propose a history-window based approach to remove the impact of phantom congestion. We also show how using the average of local queue occupancies and adding an offset significantly remove the impact of transient congestion. Our evaluations of the adaptive routing in a large-scale Dragonfly network show that the combination of these techniques results in an adaptive routing that nearly matches the performance of an ideal adaptive routing algorithm.

KEYWORDS: Packets, Adaptive routing, Far-end congestion, Latency

I. INTRODUCTION

In this work, we focus on the impact of far-end congestion or the congestion that occurs at the far-end of the long channels that are connected to the current router, as shown in Figure 1. With the long-channel latency, there can be significant number of packets (and returning credits) that can be inflight and thus, far-end congestion is not necessarily properly represented with local information, such as the credit count. We refer to this as phantom congestion since the in-flight data (or credits) are not real congestion. We evaluate the performance impact of the phantom congestion and show how a proper history-window approach removes the impact of phantom congestion. In addition, transient congestion or the fluctuation of the congestion information from the queue occupancy values also impacts the adaptive routing decision. We show how using a proper offset and using the average of the queue values reduce the impact of transient congestion in adaptive routing.

II. RELATED WORK

The impact of far-end congestion is also discussed in Parker et al., similar to what is presented in this work. However, Parker et al. does not present any analysis on the impact far-end (or phantom) congestion. In addition, this work also describes the impact of transient congestion. To scale the router micro-architecture to high-radix, single-stage crossbar will not scale efficiently and hierarchical crossbar or a multi-stage network is necessary. These multi-stage switch organizations complicate how near-end congestion is determined and it remains to be seen how far-end congestion should be leveraged for such router micro-architecture .Analysis on obtaining optimal throughput on the Dragonfly has

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been also proposed. History information has been used in interconnection networks. Prior work, leverage network link utilization history for power optimization with dynamic voltage scaling. The prediction router uses history to predict the output channel usage to improve performance while ERAVC (Enhanced Reliability Aware Virtual channel Router) uses history information for regulating VC allocation. However, to the best of our knowledge, history information has not been used to remove the impact of inflight congestion for adaptive routing in large-scale networks. To overcome phantom congestion, we proposed using a sliding window approach to keep a history of packets that have been transmitted to accurately estimate far-end congestion.

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III. EXISTING SYSTEM

Network Congestion in data networking and queuing theory is the reduced quality of the services that occurs when a network is carrying more data including that it can handle. Typical effect include queuing delay , packet loss and blocking of new connection A consequences of the letter two effects is that an incremental increase in offered load either only to a small increase or even a decrease in network throughput.

Disadvantages of Existing System:

- Network Congestion is vast.
- Latency increases

IV. PROPOSED SYSTEM

Congestion is an important limiting factor in the performance of communication protocols in Networks-on-Chip architectures. An ideal congestion-aware routing algorithm should be able to efficiently collect , distribute, and utilize the local and non-local congestion informationFollowing is the architecture diagram of our system.

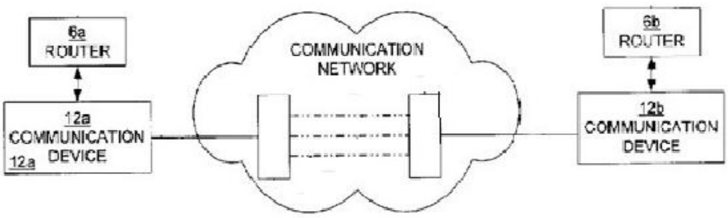

Fig. Architecture Diagram

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Advantages Of Proposed System:

- Optimize its own throughput
- Established better and secure network.
- To reduce the conjunction on large interconnect network.
- To improve the overall performance of large scale network.

Data Flow Diagram:

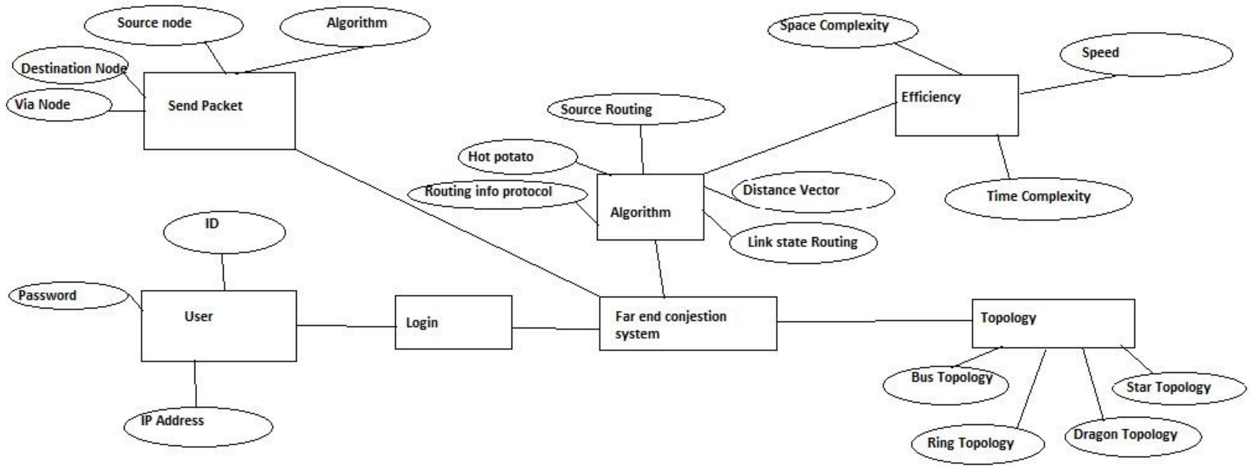

Fig. Dataflow Diagram

V. CONCLUSION

In this work, we identify the impact of far-end congestion that occurs in large-scale networks because of long latency between neighboring routers and the different length channels in the topology.The congestion at the far-end of the channel is not accurately represented at the near-end since in-flight packets (or credits) that are being transmitted do not represent true congestion.

VI. EVALUATION TABLE

Attributes	Existing system	Proposed system
Security	Less secure	Most secure

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Access	Fine-grained access is not provided	Fine grained access is provided
Speed	Low	High
Flexibility	Not flexible	Flexible

VII. OUTCOME

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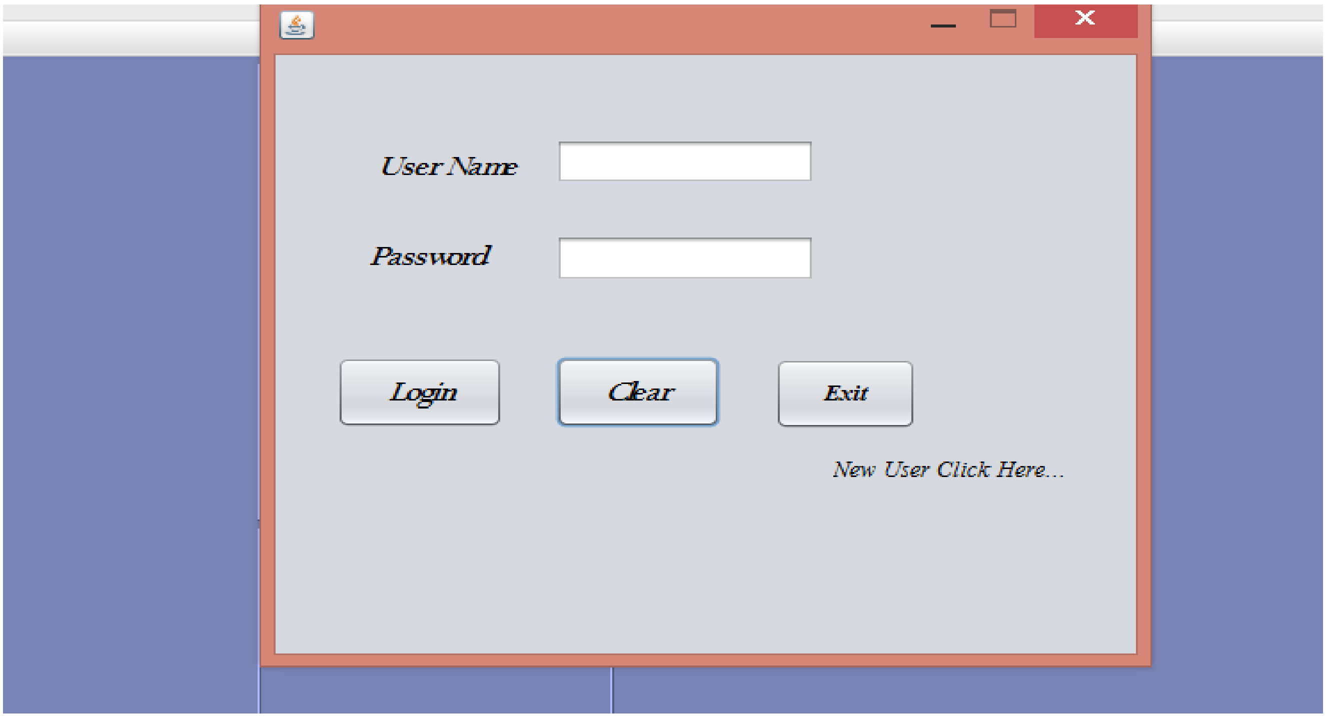

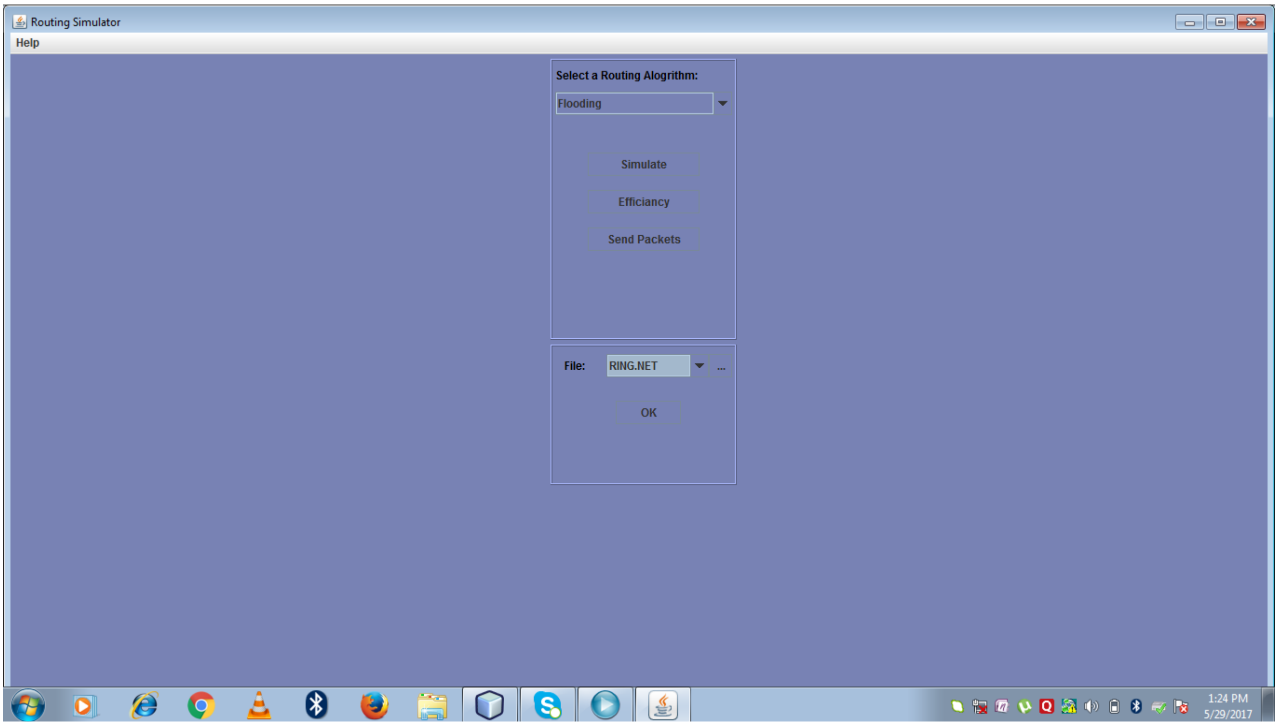

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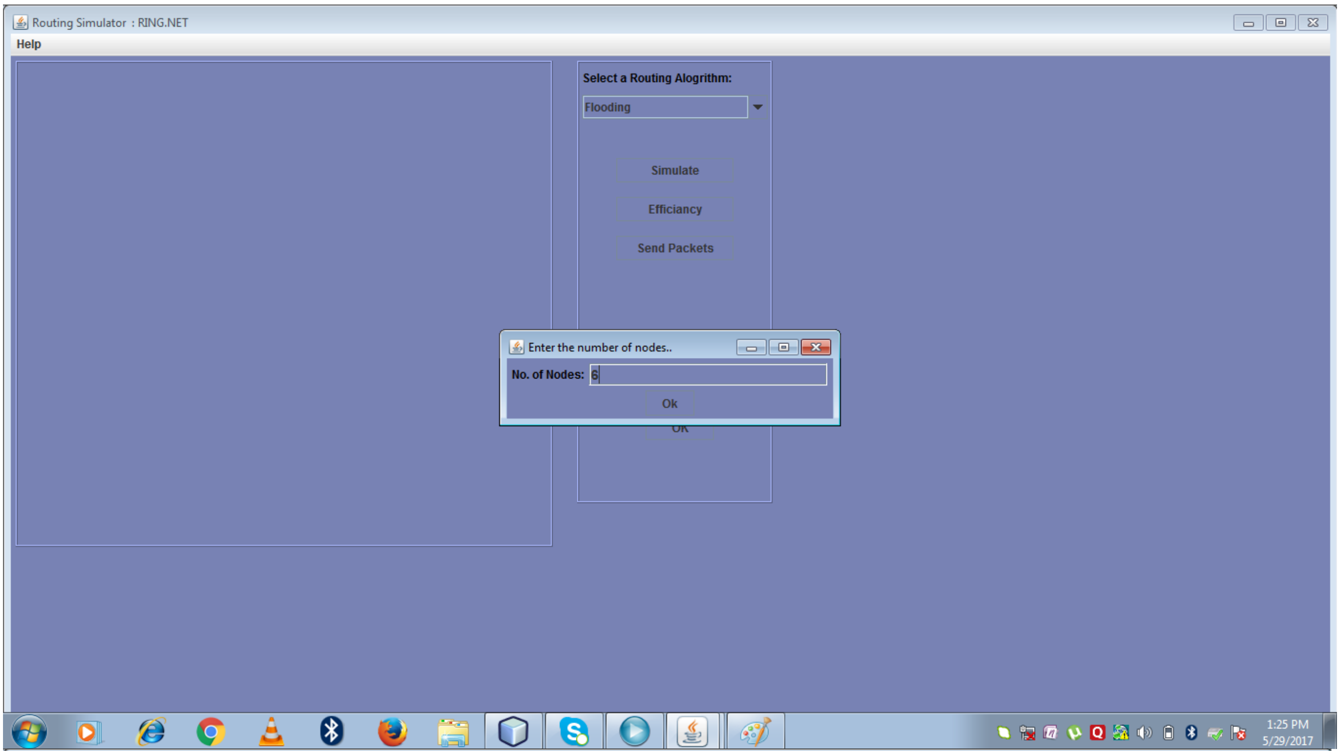

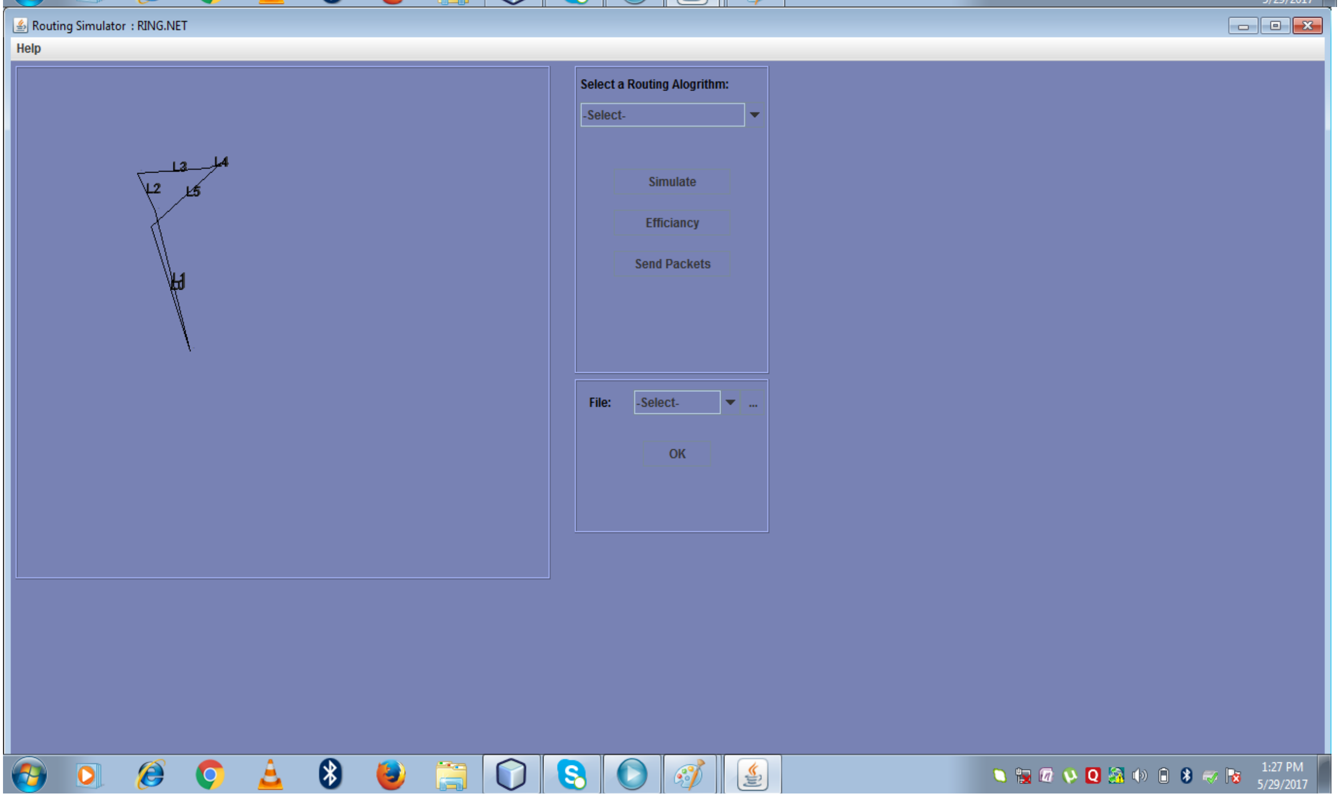

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