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INTRODUCTION

1.1 Problem Statement

The application of network coding with parallel networks is an innovative application area. Communication in parallel networks is always in research for achieving low storage and communication cost. It is interesting to recognize that expansions within parallel networks are for achieving efficient communication and developing the practicable prospects of such networks [1, 2]. The communication in such networks thus revolves into higher communication and computational cost. Further, during parallel communication each node is either computing or communicating with other nodes. So during communication failure, reason for this failure and recovering data loss is unfeasible. It is required to resolve these problems for energy-efficient broadcasting.

The aim to implement algorithms on these networks is to achieve efficient communication and computation cost. The literature review reveals that active research on parallel networks development overcomes the issues of communication and computation cost on several networks. However, tradeoffs between networks still have disadvantages:

- High information size in communication between nodes.
- Exponential increase in communication and computation cost.
- Performance is inadequate.
- It does not provide failure recovery.
- Possibilities of data loss in communication.
- No generic communication approach.
- Provision for handling communication failure is not present.

We studied these disadvantages of parallel communication and resolved them. Advantages of proposed system are:
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- Limits the increase in communicating information size.
- Limits the increase in communication and computation cost.
- Performance is acceptable.
- Failure recovery approach with further communication advantage.
- Overcome the possibilities of data loss with provision of failure repair.
- Contour approach for generic communication.
- Communication failure recovery with generic approach.

We present an approach for multisource multicast in parallel networks by which faulty nodes, information size and communication complexity decreases with code length. This approach also achieves capacity asymptotically as given by max-flow min-cut bound of [1, 2]. Our analysis uses insights from network coding, which lead to an innovative application in parallel architectures. We have also given a generic coding method for different parallel networks, and showed how network coding affect the crisis issues of parallel communication. Taking different network set-ups, we have shown that linear network coding effectively reduces the chance of errors. Finally, we have proved that network coding is useful over routing approaches. The study suggests the nature and robustness of network coding can offer a significant advantage in feasibility of parallel architectures. We have also solved the problem of reliability in parallel communication and propose efficient approach for communication in such networks.

The robustness of a network depends on the way it manages the failures. In networks with huge data communication the chances of failures are high. Consequence of failure in parallel communication results in data loss, incomplete information delivery, communication errors, and high data recovery complexity. These problems require effective and robust solutions. Further it is required to have generic solution to the issues of the connection failure and minimum energy amount required to recover the data loss. This study considered the issues of data loss because of communication failure reasons and performed experiments for various failures. Later, we proposed an approach to handle the failures and recover data loss. The Contour approach proposed in this work has following main advantages:

- This approach reduces the data size at each communication step by performing XOR operation on the data set.
- Reduced data size.
The involvement of nodes in communication increases (processor utilization).
The rate of information transfer also increases.
The present applicability of Network Coded Contour approach makes the parallel architectures more practical.
Leads in developing an efficient communication approach for parallel architecture.

1.2 Contributions

We have proposed a novel application of Network Coding [1, 2] with parallel communication
We have studied and resolved the tribulations of parallel networks and optimized the utilization of processing unit. We have proposed a standard approach for these networks. We proved successively that applying this approach exponentially decreases the effect of faulty nodes, information size and communication complexity. Besides we considered the problem of parallel communication failure and examined based on proposed Contour approach of communication in parallel networks and network coding.

Further we studied several important contributions to the problem of parallel communication in various issues. This study gives many productive and important results for the problematic issues of parallel communication. We brief important contribution of the thesis in order of event in this section. At first, this thesis presents the problem of information size, faulty nodes and algorithmic complexity involved in parallel communication.

- LINEAR-CODE MULTICAST ON PARALLEL ARCHITECTURES:
  This research sets up Linear Network Coding (LNC) in the parallel environment. We considered some parallel architecture for proof and examined the results in a generic environment. This thesis develops an approach to remove the problems of parallel networks.

Energy involved in parallel architectures, i.e., the information rate, node involvement at each of communication, size of communicating data, storage at each node decides the efficiency of the architecture.
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XOR IN PARALLEL ARCHITECTURES:
In this work we examine the problem of broadcasting information to all nodes in 2D-Mesh architecture. We performed comparative analysis using network coding with traditional approaches of data communication. This resulted in increased rate of information and the involvement of nodes is higher. This research work proposes an approach of network coding in parallel communication, which reduces the storage requirement at each node and thus solves the problem of high data size to communicate in 2D-Mesh network.

Parallel network coding is a new communication model that takes advantage of the broadcast using characteristic of network coding for parallel architecture. Network coding has recently developed as an innovative model for optimization problems for high-scale computation between several nodes of these architectures.

PARALLEL ARCHITECTURE CODING: LINK FAILURE-RECOVERY MECHANISM:
In this work we evaluated chances of communication failure and proposed an efficient solution for such evolving circumstances. Communication failures are unavoidable and results in data loss. We proposed an approach which overcomes the data loss because of these failures. Using combination of network coding and buffering at an alternate degree of network nodes, this stipulation reduces. In this thesis, we researched this combination of network coding and node buffering for handling communication failures in the 2D-Mesh network. We presented analogous results for different cases of communication failures.

Finally, this thesis explains that with some comparative study on traditional approach and the proposed approach of data recovery, we gain a lower communication cost for failure using our approach.
**1.3 Outline of the Thesis**

The thesis is organized in seven chapters. CHAPTER 1 presents the Introduction of the research work. This introductory section discusses the research problems and describes the contribution of the author. CHAPTER 2 presents the background for the research in this thesis. This chapter states introduction of network coding principle and its applications. CHAPTER 3 presents efficient broadcasting in parallel networks using network coding approach. This chapter briefs the result for the work proposed in next chapter. CHAPTER 4 presents generic approach of network coding implementation over several parallel networks. This chapter presents an innovative application in parallel architectures. CHAPTER 5 presents the solution to the problem of high data size to communicate using 2D-Mesh network. CHAPTER 6 presents the combination of network coding and node buffering for handling communication failure in the 2D-Mesh network. CHAPTER 7 presents the failure detection using contour approach on network coded parallel networks. Finally, CHAPTER 8 concludes this thesis and presents the experimental results and simulations. Further this chapter presents the future extensions (scope) of research in this field.