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ROUTING FOR MESH-OF-TREE IN MULTICLUSTER SYSTEMS BASED ON COMMUNICATION NETWORKS

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Abstract

It is increasingly important to understand the capabilities and potential performance of various interconnection networks. An analytical model for communication network in cluster systems have been widely reported. Several analytical models of interconnection networks of multi-cluster systems under uniform traffic pattern have been proposed in the literature. However, there has been hardly any work reported yet that deals with other important non-uniform traffic patterns in parallel applications. In this paper we propose a new analytical model based on Mesh-of-tree interconnection networks in the presence of traffic pattern generated by matrix-transpose permutation, which is an important communication operation in parallel applications such as matrix computation problems. The model is validated through comprehensive simulations, which demonstrated that the proposed model exhibit a good degree of accuracy for various system organizations and under different working conditions.

Index Terms— Cluster computing, bursty traffic, communication locality, Mesh of Tree, performance modeling.

I. INTRODUCTION

The communication network is a key component in cluster systems for achieving the high performance and the desirable Quality of service (QoS). Therefore, an efficient communication network for high performance multiprocessors must provide low latency memory access and message transmission

Multistage Interconnnection Network (MIN) are a type of indirect regular topology. All switches are identical and organized as a set of stages. Each stage is only connected to the previous and the next stage using regular connection patterns. As long as high degree switches are available, multistage networks (MINs) have become very popular.

In this paper, we propose a Mesh-of-Tree(MoT) topology to demonsrate that the communiation locality can relieve the degrading effects of bursty message arrivals on the network performance.The MoT topology has many properties that make it attractive for large scale interconnects and system area networks. The performance study of communication networks in cluster systems can be achieved by simulation experiments or analytical modeling.

The performance study of communication networks in cluster systems can be achieved by simulation experiments or analytical modeling. However, the simulation based approach is time-consuming and costly, especially for large-scale systems.

In contrast, analytical modeling can capture the essential features of the system, gain significant insights, and offer a cost-effective and versatile tool that can be used to investigate the system performance with different design alternatives and under various working conditions. Analytical models of communication networks in cluster systems have been widely reported. However, for the tractability and simplicity, the existing models are based on the assumptions that the network traffic follows the nonbursty Poisson arrival process and the message destinations are uniformly distributed. Recent measurement studies, have demonstrated that the traffic generated by real-world applications reveals the bursty nature in both the spatial domain (i.e., non-uniform distribution of message destinations) and temporal domain (i.e., bursty message arrival process).

Network Topology is the arrangement of various elements (links, nodes etc) of a computer. Essentially it is the topological structure of a network, and may be depicted physically or logically. Physical topology refers to the placement of the network's various components, including device location and cable installation, while logical topology shows how data flows within a network, regardless of its physical design. Distances between nodes, physical interconnections, transmissions rates, and/or signal types may differ between two networks, yet their topologies may be identical.

Each node sends messages to allow other nodes to detect it.

Once a node detects messages from another node (neighbor), it maintains a contact record to store information about the neighbor. Using socket all nodes are used to detect the neighbor nodes. This Model fits many application that gather data from environment as user specified rates.

II. EXISTING METHOD

The cluster systems must be constructed through efficient interconnection that supports the full bandwidth to provide the low-latency communication infrastructure.

The m-port n-tree, a popular example of fat-tree topologies has full bisectional Bandwidth and can offer a rich connectivity among nodes. Such an infrastructure enables to maintain communication paths between all source and destination nodes, which is critical for satisfying the performance requirements of cluster computing and communication systems.

Fig. 1 depicts the instances of the m-port n-tree topology that consists of 2*(m/2)^n processing nodes (PN) and (2n-1)*(m/2)^n-1 communication switches. Each switch has m communication ports that are connected with other switches or processing nodes. The root switches employ all communication ports to connect with their descendants or processing nodes. Other switches use half of the communication ports to connect with their descendants or processing nodes, and use the other half to connect with their ancestors.

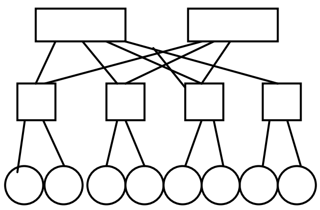

Fig:1 m-port n-tree topology

A. PROPOSED SYSTEM:

1) WIRELESS MESH NETWORK:

With the PulsAR radios you can deploy a Wireless Mesh Network in a "tree topology" where any radio in the mesh network can serve as an access point to other radios.

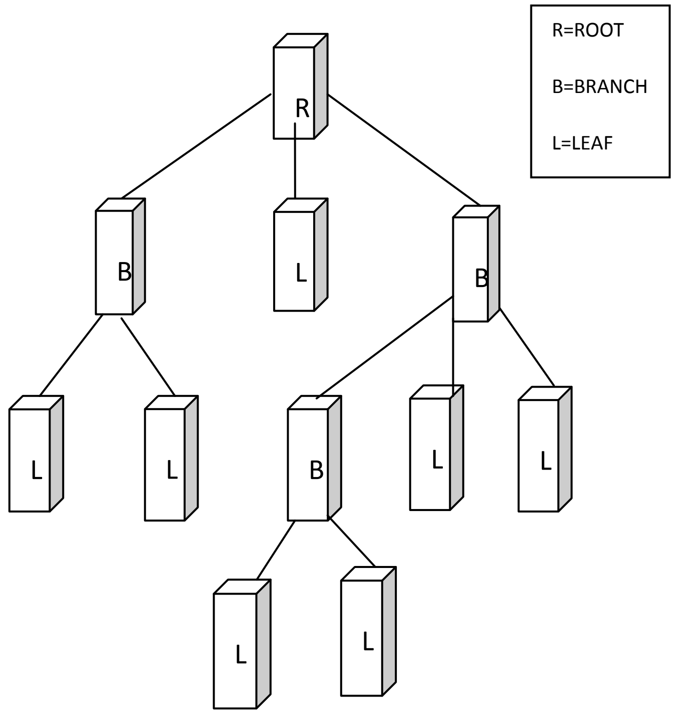

Fig:2 Wireless mesh network

2) ADVANTAGES:

This wireless mesh network gives you many advantages including:

- *Extended geographic coverage.*
- *Easy network expansion:* adding a new node to an existing network only requires line-of-sight to another node already in the network. And the new node now provides coverage for future *nodes* further downstream.
- *Long Links:* use a directional antenna to reach a far away parent. The radios come with a dual antenna port that lets you deploy a second antenna (typically an omni) to provide access to downstream nodes.
- *Automatic routing:* All LANs get bridged together by the radio network. The radios autonomously route your packets to the correct destination using the minimum number of hops.
- *Roaming:* combine the tree topology with our roaming feature to allow radios to change their access points if the link to the parent drops or is impaired.

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3) WIRELESS MESH-TREE TOPOLGY

In the wireless mesh tree topology you have three node types: one **root** node and multiple **branch** and **leaf** nodes.

The root node performs a similar function to the hub in a point-to-multipoint topology and can have up to 32 direct links to remote sites. You can configure each radio at the remote sites as either a leaf or a branch. A branch node, besides having a link to a parent (root or another branch), also operates as an access point for up to 32 additional remote nodes (children). Each of those nodes can again be configured as either a leaf or a branch. There is no limit to the number of levels in the tree. At any time you can upgrade a leaf node to become a branch.

A branch node has two independent RF configurations, one for the link with the parent, the other for the links with its children. You can set the link with the parent to use antenna A, and the link with the children to use antenna B. This allows you to deploy a directional antenna pointing at the parent node, while using an omni-directional or sectorial antenna for the links with the multiple children. This is not mandatory, you can configure a branch radio to use a single antenna if you wish.

4) WIRELESS MESH NETWORK FEATURES

The Afar Wireless Mesh Network has the following features:

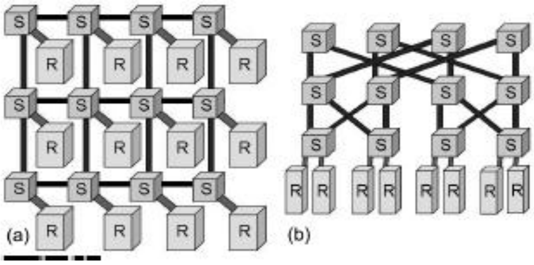
- There is no limit in the number of levels on the tree.
- Automatic association of new remote radios: just configure a new remote to receive on the transmit channel of the desired parent and it will automatically associate to the network (you can use the "network-id" feature to prevent unauthorized radios from attaching).
- Self-learning bridging algorithm: the radios automatically learn the addresses of your equipment attached on any of the LANs and route the packets using the minimal number of hops to reach their destination.
- Self-healing network: If a parent node goes down a branch continues to operate and pass data between its children. Once the parent recovers the branch automatically reattaches to the rest of the network. Or with roaming enabled the branch may attach to a different parent.
- Dual antenna root mode: You have the option of running the root with two antennas. This may be useful if your remotes are grouped geographically such that you can use two directional or sectorial antennas to cover each group.

5) COMPARISON OF MESH AND FAT TREE:

We compare the two most popular inter-connection topologies which are the Mesh and the Fat-Tree. These networks are compared considering the dynamic reconfiguration paradigm also with the net-work performances and the architectural constraints.

The following figure represents the interconnection of topologies:

a) Mesh-tree topology
b) Fat-tree topology



6) ADVANTAGES OF MESH-TREE OVER FAT-TREE TOPOLOGY:

- There is a unique path between each source and each destination.
- Packets between different sources and destinations will not interfere, unless the traffic is heavily unbalanced.
- Consume less routing resources than the Fat-Tree.
- MoT network provides competitive throughput and latency and has a clear advantage over Fat of Tree when the input traffic is high.
- Furthermore, if both of them are compliant with present FPGA specifications, the demonstration was made that a Fat-Tree is more adapted to the dynamic reconfiguration paradigm.
- It presents equal or higher network performances, a deadlock free optimal routing algorithm, and a material structure allowing to provide a constant bandwidth to every tasks everywhere into the network

B. PARAMETERS FOR SIMULATION:

- Queue/packet flow
- Link node (potential valid)
- Throughput and work load
- Energy consumptions

C. SOFTWARE REQUIREMENTS:

- Linux.
- C++ compiler for Linux
- TCL Compiler
- NS2.34

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D. HARDWARE REQUIREMENTS:

- Hard Disk: 20GB and Above
- RAM: 512MB and Above
- Processor: Pentium III and Above

III. CONCLUSION

In this paper, we have proposed a Mesh-of-Tree (MoT) topology based on multicluster system in communication networks. The MoT where the processing nodes in each row and column of the mesh are connected by a tree combines the advantage of both the mesh and tree architectures and has been shown to be attractive for large-scale parallel machines. It has the advantage to consume less routing resources than the Fat-Tree. It presents equal or higher network performances, a deadlock free optimal routing algorithm, and a material structure allowing to provide a constant bandwidth to every tasks everywhere into the network. It also demonstrates that the communication locality can relieve the degrading effects of bursty message arrivals on the network performance.

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