Journal of Computer Science

Original Research Paper

Multicast Node Communication Using Virtual Queue with Process Scheduling

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Article history
Received: 27-02-2014
Revised: 08-07-2014
Accepted: 06-09-2014

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Abstract: Multicast technique is used to transmit node data from one source node to many destination nodes simultaneously and establish a communication in the network. In multicasting communication, node network packet collision occurrence is a frequent problem in real time network system. The node packet collision avoidance using virtual queue with process scheduling is discussed in this study and proposed central queue process scheduling and intermediate leader node avoids traffic and congestion avoidance between node packets in this research work. The results are discovered reliable path for node network approach using node location to receive an accurate and shortest path of destination nodes.

Keywords: Virtual Queue Acknowledgement, Multicast Node Network, Process Scheduling

Introduction

The multicasting network is multi-hop relaying in which messages are sent from the source node to the destination node by relaying through the intermediate nodes. In multi-hop wireless networks, communication between two end nodes is carried out through a number of intermediate nodes whose function is to relay information from one node point to another. The focused on multicast networks, in which relaying nodes are in general mobile and communication needs are primarily between nodes within the same network. It is a dynamic autonomous wireless network formed by node with wireless communication capability, where each node carries out basic operation routing and packet forwarding. All nodes are connected dynamically in an arbitrary manner, where no default router available and potentially every node behaves as a router (must be able to forward traffic on behalf of others) as well as an end host. Frequent changes in node network topology and features in multicast network leads to communication disturbance like packet collisions i.e., network colliding allowing intermediate nodes to combine packets before forwarding. If network having the ability to analyze the direction on which packets would send without collision which improves the throughput of the system.

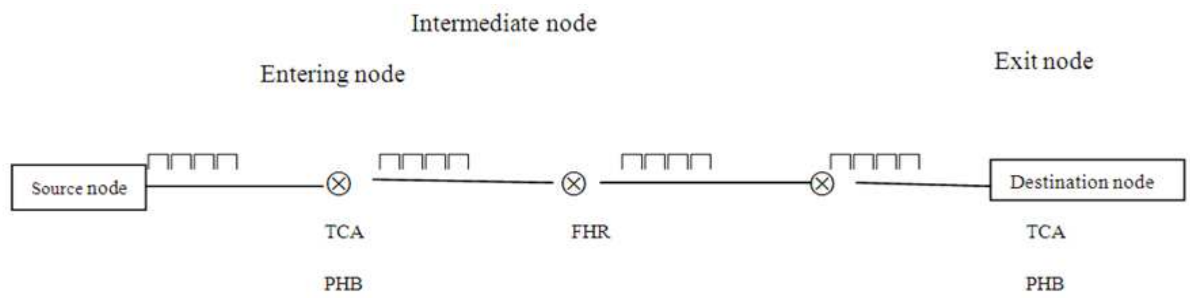
Previous Work

Faritha and Ramachandran (2012) proposed efficient bandwidth estimation management for VoIP concurrent multipath transfer. The multiple paths for packet dispersion are computed using grouping-based multipath selection and bandwidth on each path is elected based on west wood approach. Dongmei and Guangzhi (2008) proposed bandwidth management technique for multiprotocol label switched networks to assign and contribute to the bandwidth among many switched backup paths. It distributed nodes to estimate the shared bandwidth. Dimitrova *et al.* (2011) presented to compare the performance of different packet schedulers for different uplink transmission in a node network with relaying and measure the performance to use the received power at the base station, instantaneous data rates and mean flow transfer times. Amir *et al.* (1998) proposed an efficient packet scheduling algorithm. It also presented Packetized Dynamic Batch Co-Scheduling

(P-DBCS) for a heterogeneous network processor system, which is capable of scheduling variable length packets among heterogeneous processors to ensure both load balancing and minimal out-of-order packet delivery. (Ganjali *et al*., 2005) proposed switching versus packet switching in input-queued switches. Mekkittikul and McKeown (1996) proposed a starvation-free algorithm for Achieving 100% throughput in an input-queued switch. Asati (2010) proposed a novel algorithm for collision avoidance in wireless ad hoc networks. It avoids collision and retransmitted data in ad-hoc multicast wireless network. Tutuncuoglu and Yener (2011) proposed optimum transmission policies for battery limited energy harvesting nodes. It reduces the packet collision multicast node transmission. Bama *et al*. (2009) proposed receiver selection technique in scheduling with optimal throughput for grid networks and random geometric networks. Vidhyavathi and Prabhakar (2013) proposed a two tier authentication scheme of multicast traffic for large scale ad-hoc networks. Coppi *et al*. (2012) proposed network coding aware queue management inmulti-rate wireless network. Huang *et al*. (2011) presented a low-complexitycross-layer fixed-routing algorithm to guaranteeorder-optimal average end-to-end delay for few of the capacity region. Jiang and Walrand (2010) proposed a distributed algorithm for throughput and utility maximization in wireless networks.

Virtual Queue Acknowledgement for Process Scheduling

The node network requires effective transmission between node data without packet loss. The network process service model ensures the packet loss reduction, maintain Quality of Service (QoS), reduce delay of packets, accuracy in path. The packet transmission model enter the nodes from source with intermediate nodes using TCA, FHR and attain to destination nodes along with packet data is shown in Appendix 1. The network analyzer should able to differentiate packets like audio and video and would be done by Traffic Control Agreement (TCA) at entering and exit nodes. Entering node is nearer to source and Exit node is nearer to destination. These two nodes act as core routers in which most of the transmission requirements could be fulfilled. Generally routers provide specific type of service/treatment to the packets i.e., queuing, scheduling and prioritization. These will be discussed in further section. The basic router classification is as shown in Fig. 1.



Appendix 1 System model of packet transmission

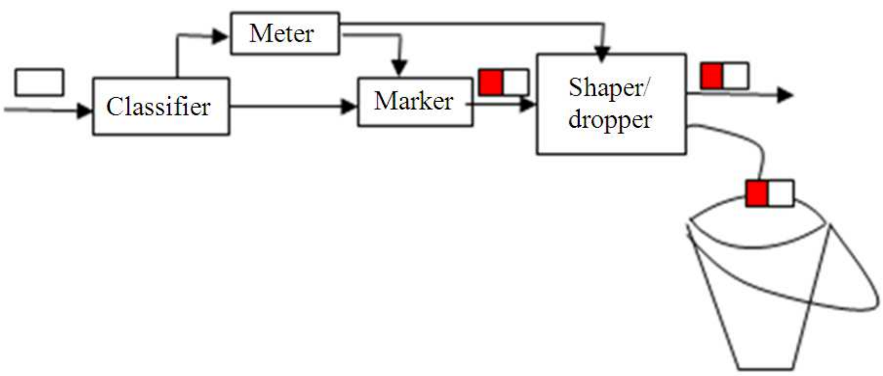


Fig. 1. Router processing control

Differential Service Traffic Condition

Classifier for Scheduling

It is the first process inside the router which is used to differentiate the different types of packets. If we provide one sensor in the classifier we may achieve better QoS as most of the process has to be completed at this stage. Using MPLS network load balancing and link utilization, the packet loss rate can be minimized up to some extent. Virtual queues are maintained in all output ports to avoid queuing delay and HOL blocking. QoS provisioning is very important task for these real time applications. This is because of IP network inherently suffer from network impairments such as-packet loss, packet delay, packet delay variation (jitter).

Per Hop Behavior Performances

Per Hop Behavior (PHB) placed at the o/p of Classification. It relates to resource allocation for flow of:

- Resource allocation is typically B.W
- Queuing/Scheduling mechanisms

FIFO/WFQ/MWRR/MPRR:

- PHB also includes determining a packet drop policy
- Congestion avoidance scheme

Primary technique is RED/WRED:

- Minimize packet delay/Jitter by controlling queue size
- Sorting algorithm provides prioritization to the packets. Highest priority packets would be on right side and lowest priority packets are on left side medium sized packets are in between these packets

According to sorting algorithm:

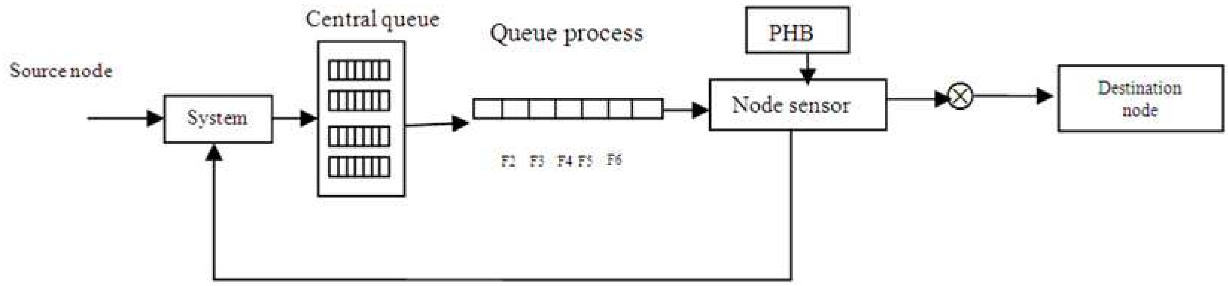
- Select N number of packets
- I selected in middle
- N<I are on right side
- N>I are on left side

Scheduling in Real Time Environment

A scheduling algorithm defines how tasks are processed by the scheduling system. In general terms, for a real-time scheduling system, each task is assigned with a description, deadline and an identifier in the algorithm. The scheduler traces the accepted task according to a scheduling algorithm. A real-time scheduling algorithm can also be classified as static or dynamic. The different models can be implemented using a dynamic scheduling algorithm; A task deadline can be assigned according to the task priority (earliest deadline) or it assigns completion time for each task by subtracting the processing time from the deadline. Deadlines and the required task execution time must be known to ensure the effective use of the processing elements execution times. Scheduling in classifier with virtual queue is as shown in Fig. 2, the scheduled virtual packets and real packets will be sent to the PHB before going to meter. Provision of sensor in PHB almost reduces the packet delay delivery, it drops the packet which is taking time greater than the allocated time and it also sends request to exit node as it contains data. From Fig. 2 we can understand that virtual queue will always send packets parallel to real queue packets, then the sensor easily remembers and retrieve the dropped packet without any delay, with in these duration (retrieved packet from virtual queue) it may request acknowledgement from the exit node so, from this we can say that waiting period can be reduced and simultaneously throughput also increases. It reduces the work period of meter; meter can smoothly forward the packets to the marker as shown in Appendix 2. The central queue perform good at the time of selecting the path for transmission. All the scheduled packets will come to central queue and then traffic free path is being shown to the packets:

- Central queue access queues from the scheduler
- The traffic free paths could be selected

Query message sent to the intermediate leader node from the central queue, which always monitors the traffic at the receiver to avoid collisions and sends clear to send message to entering node if it finds no traffic at the receiver. If intermediate leader node finds receiver is busy it sends busy signal to the entering node. The proposed central queue and intermediate leader node avoids network collision and it also reduces transmission delay time. The interaction between central queue and intermediate leader node is shown in Fig. 3.



Appendix 2 Scheduling with central queue authority

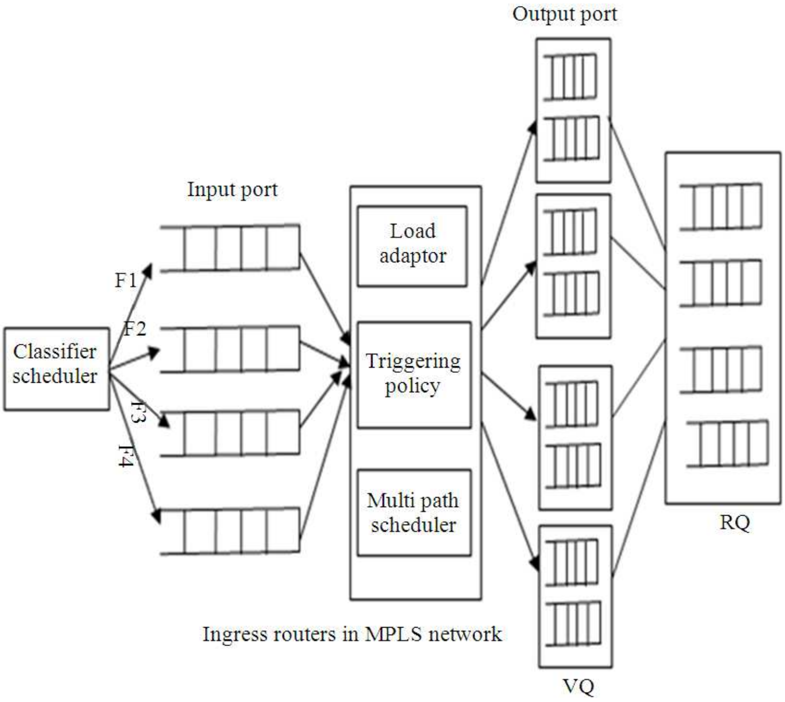


Fig. 2. Classifier flow with virtual queue and real queue

Generally for completion, each task follows below functions: 1. Ready state 2. Waiting state 3. Running state 4. Blocked state. When Inter Mediate Leader node (IML) finds receiver busy, on the request of central queue it sends some specific waiting time to the central queue.

When IML node identifies receiver in idle state, it sends signal to central queue to inform ready state of receiver. Even after sending waiting/busy signal, if any transmission from central queue continued, then immediately the particular transmission is automatically blocked by IML node and also sends retransmission time period/waiting time period to central queue. The decision of IML node reduces the confusion to central queue about transmission of packets, it also reduces the packet drop rate with providing specific time acknowledgement to central queue which eventually increases throughput of the system. The packet transmission from entering node to exit node via IML node shown in Fig. 4. IML node also provides priority path to the received packets, it selects different path to higher priority packets and seeks another path to lowest priority packets.

Policing for Token Bucket Algorithm

- Uses the token bucket scheme
- Policing used at the o/p of Metering
- Tokens are added to the bucket at the committed rate
- Depth of bucket determines the burst size
- Packets arriving with sufficient tokens in the buckets are said to conforms
- Packets arriving with insufficient tokens in the buckets are said to be nonconformity

Shaping for Smooth Transmission

Smoothens the traffic but increase overall latency. Shaper/dropper having two inputs one from marker and other from meter. It gives final touch to packet scheduling for smooth transmission. Sensor and virtual queue scheduling at classifier helps in smooth packet transmission and there will be less chance of getting non confirming packets to the shaper/dropper. whether the source sending their packets at the agreed rates or not i.e., if classifier sends packets which are above the limits, we need to measure whether packets are sent at defined rates or not. If the received packets are above limit, meter does not forward the packets instead it will send packets to classifier. Meter also connected directly to shaper/dropper, it would assess whether the packets conformed and non conformed and it forwards the confirmed packets and drops the non conformed packets.

Meter in Router

Metering is the tool which is used for inform the node about complaints of the traffic to the rate that have been specified. Metering uses token bucket algorithm. It checks

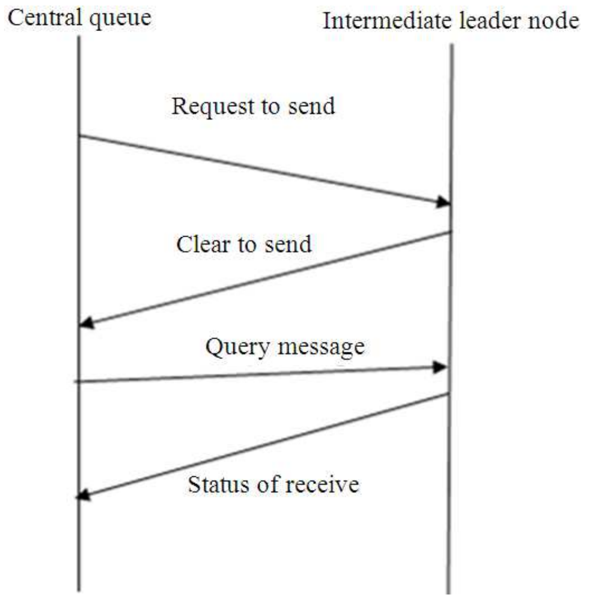


Fig. 3. Interaction between central queue and intermediate leader node

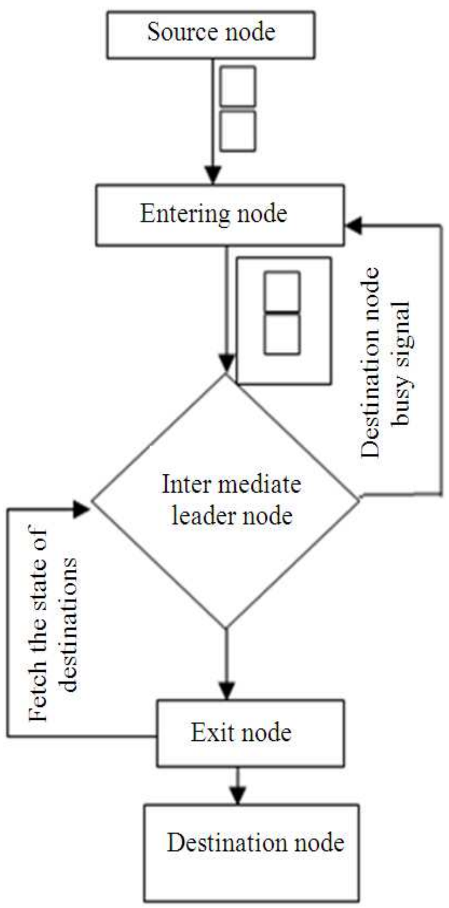


Fig. 4. Flow chart of transmission from source node to destination node

Enter Nodes and Exit Nodes in Differential Service Network

Entering node is placed nearer to source node; packet scheduling performance smoothened by entering node. Sensor at classifier sends request to exit node to inform availability of data. Intermediate nodes were placed between entering node and exit node, act like a buffer elements for transmission of packets. Exit node is nearer to destination node, it will look after higher priority packets first and lowest priority packets last. IML node sends identity of packets information to exit node, exit node preserve identity addresses into lookup table of routing protocol. Therefore exit node easily identifies priority transmission of packets. For Real time applications, rate of monotonic scheduling is easy way to differentiate priority among packets. Process with shortest period is given highest priority. The utilization bound test allows schedulability analysis by comparing the calculated utilization for that number of tasks:

$$\frac{C_1}{T_1}+\frac{C_2}{T_2}+\ldots+\frac{C_n}{T_n} \leq U(n) = 1$$

If this equality satisfies, all of the tasks meet their deadline. If the total utilization calculates to greater than 100%, the system will have scheduling problems.

Utilisation Bound Test

Assumes rate of monotonic priority assignment:

- Task with smaller period is assigned higher priority
- Guaranteed to be schedulable if test succeeds:

$$U(n) = \sum_{i=1}^{n} \frac{C_i}{T_i} \leq 1$$

Results

Multicasting for Node Queue Process in Network

The multicasting node queue process is depicted for differentnodes given for a source node to place the destinationnodes.

Discussion

Figures are showing automatic node arrangement. Total 36 nodes are available in multicast network, where few nodes are arranged as a connected network, which has North West (NW) and North East (NE) regions and have different types of nodes as shown in Table 1.

Table 1. Nodes chosen in different regions with node types

Node	Region	Node type
8	NW	Corner node
13	NW	Normal node
23	NW	Boundary node
18	NE	Boundary node
28	NE	Boundary node

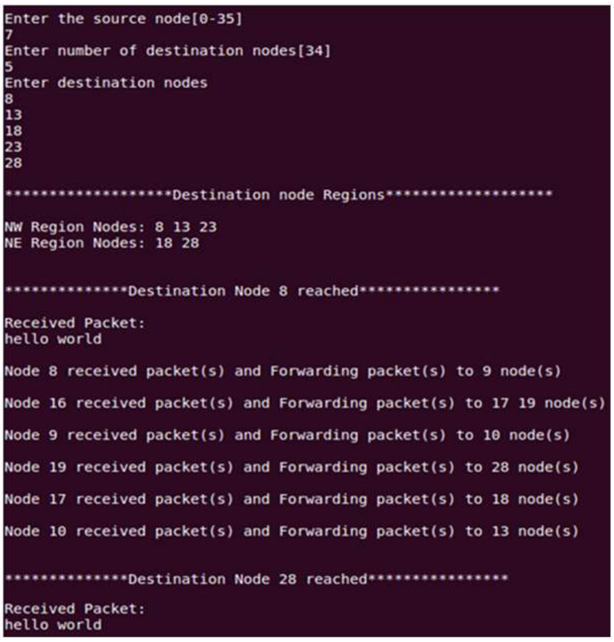


Fig. 5. Experimented source nodes to destination node regions transmitted packet

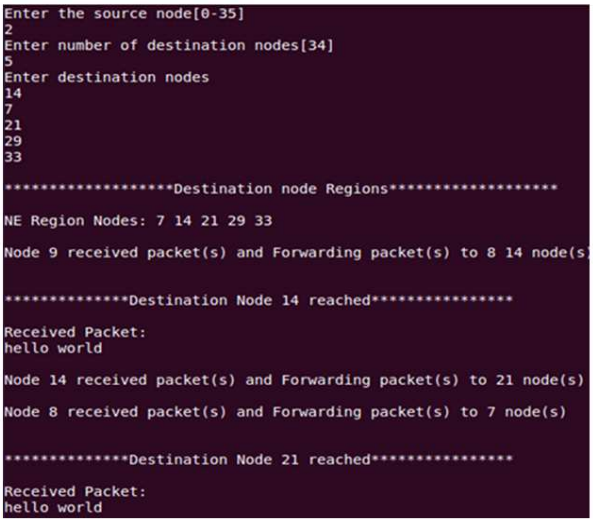


Fig. 6. Experimented source nodes to destination node regions transmitted packet

The source node to destination node regions transmitted data packets to the proper path is shown in Fig. 5 and some nodes are decided for NW region and NE region. It represented a proper path which is used to transmit data packets in a proper channel.

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Conclusion

In this study, virtual acknowledgement, central queue and intermediate leader node ensures effective transmission of node packets without any delay constraint in networks. Central queue selects better transmission path scheduled packets and avoid intermediate leader nodes to reduce traffic congestion in the network and improve the throughput of the network. In this study results node multicasting process is used which determine the shortest and reliable path for transmission of nodes between source node to destination nodes with region based approach in the network avoid collisions.

Funding Information

The authors have no support or funding to report.

Author's Contributions

All authors equally contributed in this work.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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