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(54) Title: MULTICAST ROUTER CONTROLLER SYSTEM

(57) Abstract: The present invention provides a controller that clusters the receivers and then reduces the forwarding states per cluster so as to offer a better performance of multicast routers by reducing the amount of total traffic injected into the network by each multicast session. The controller system enables the router to support a large number of receivers without compromising the memory size.

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MULTICAST ROUTER CONTROLLER SYSTEM

Field of Invention

The present invention relates to multicast routing methods for routing multicast data. In particular, the present invention relates to a multicast router controller system.

Background of Invention

Routers are physical devices that join multiple wired or wireless networks together. Technically, a wired or wireless router is a Layer 3 gateway, meaning that the wired/wireless router connects networks (as gateways do), and that the router operates at the network layer of the OSI model.

A multicast router also known as mrouter on the other hand is a router program that distinguishes between multicast and unicast packets and determines how they should be distributed along the Multicast Internet. Using an appropriate algorithm, an mrouter tells a switching device what to do with the multicast packet.

When a router is forwarded a packet that is not destined for that router, the router must either deliver it to the destination host or to another router.

If the destination network matches a network to which the router is attached, the router forwards the packet to the destination host by addressing the packet to the destination host's physical address. The router performs a direct delivery to the destination.

Conversely, if the destination network is not directly attached, the router forwards the packet to an intermediate router. The intermediate router chosen is based on the forwarding address of the optimal route in the routing table. The router forwards the packet by addressing the packet to the intermediate router's physical address. The router performs an indirect delivery to the next router in the path to the destination.

In large group communications applications, the intermediate router suffers from the explosion of multicast forwarding states as the number of subscribers increase, which create an adverse effect on the flow of the entire network.

Therefore there arises a need to improve the performance of the intermediate routers in terms of the number of receivers that is supported.

Summary of Invention

It is an objective on the present invention to improve the scalability of performance of the existing intermediate multicast routers in terms of the number of supported receivers.

Brief Description of Drawings

Figure 1	Clustering stage of the receivers based on their IPv4/IPv6 addresses using hash algorithm
Figure 2	Cluster 2 routes of figure 1 tree with reverse path forwarding traffic;
Figure 3	Matrix representation of cluster 2 routes
Figure 4	Matrix after dropping the duplicated routes showing packet replication at routers to 7 receivers for Cluster 2
Figure 5	Multicast forwarding states reduction at routers for cluster 2.

Detailed Description

The preferred embodiments of the present invention are described herein with reference to the figures. However, the figures only represent the examples of the preferred embodiment of the present invention and do not narrow the scope of invention.

The controller for multicast router of the present invention improves the scalability of the network so that the number of subscribers that is supported by the router is increased without affecting the memory size. This is achieved by a method of clustering subscribers based on their IP addresses, and analyzing for each cluster the reverse path forwarding traffic injected from the subscribers for that cluster towards the multicast

source. A method is also provided to decrease the number of forwarding states saved in each multicast forwarding table. In Figure 1, a clustering operation of the subscribed receivers is illustrated. Hash algorithm is used for clustering. Any receiver wanting to participate in a multicast session and receive the traffic should send a message indicating their intention to affiliate to the nearest router which collects and manage all the requests and route them upstream in the direction of the multicast source. Based on this reverse path, the multicast source will forward the traffic along the tree in the direction of the receiver. The size of the multicast forwarding table (MFT) saved in routers increase as the number of receivers increase because all the states should be maintained for the route to be followed correctly. In the present invention additional replication states are eliminated from the intermediate routers and the necessary states are saved in edge routers. This enables the routers to support more nodes or subscribers with the same memory size, simultaneously increasing the scalability of the network.

The controller also provides a method to reduce the number of forwarding states at routers according. The reduction is achieved one per cluster and based on the join messages received from the receivers and routed by the nearest router as illustrated in Figure 2.

The method of eliminating the additional replication states is described further herein. In a conventional system as illustrated in Figure 3, the routing path of each receiver is written in a row of the matrix. The number of rows represents the number of receivers per cluster. The columns of the matrix represent the hops. The join message informs the source of a new participating receiver want to subscribe and receive the traffic. After doing the required security check, the receiver is assigned a cluster and a branch for it will be added to the multicast delivery tree.

However, in the present invention as illustrated in Figure 4, the duplication as described in Figure 3 is eliminated. The reduced matrix maintains the necessary forwarding states at edge routers. The elimination includes the extra state at core routers.

The MFT comprises of the reduced states developed in the present invention is as illustrated in Figure 5.

The approach taken by the controller system in the present invention can also be used in multicast broadcast service for WiMAX mesh.

Claims

1. A method using a multicast router controller system for increasing the number of subscribers in a multicast session comprising of

clustering a plurality receivers;

analysing a reverse path forwarding traffic data injected from said clustered receivers towards a multicast source; and

reducing a traffic flow between intermediate routers via a traffic control program from said reverse path forwarding data.

2. The method as claimed in Claim 1, wherein said subscribed receivers are clustered according to said receivers' IP addresses.

3. The method as claimed in Claim 2, wherein the IP addresses are IP v4/ IP v6 address.

4. The method as claimed in Claim 1, wherein said traffic control program performing the following steps,

obtaining data from a plurality of joined messages relating to a traffic along a reverse path forwarding route;

assigning a cluster for a receiver based on its IP address;

dealing each of said assigned cluster having joined messages separately;

transmitting a collected data from different said receivers per said cluster to a central matrix;

arranging said data of said receiver in a row of said matrix;

analysing said data in said matrix to generate a control program for multicast forwarding table;

transmitting said generated control program to a correct router;

installing said generated control program in said router; and

operating said router according to a new control system.

5. The method as claimed in Claim 4, wherein the IP addresses are IP v4/ IP v6 address

6. The method as claimed in Claim 4, wherein said central matrix is a matrix hop-by-hop.

7. The method as claimed in Claims 4, wherein a duplication data encountered per hop is deleted during analysis of said data in said matrix.

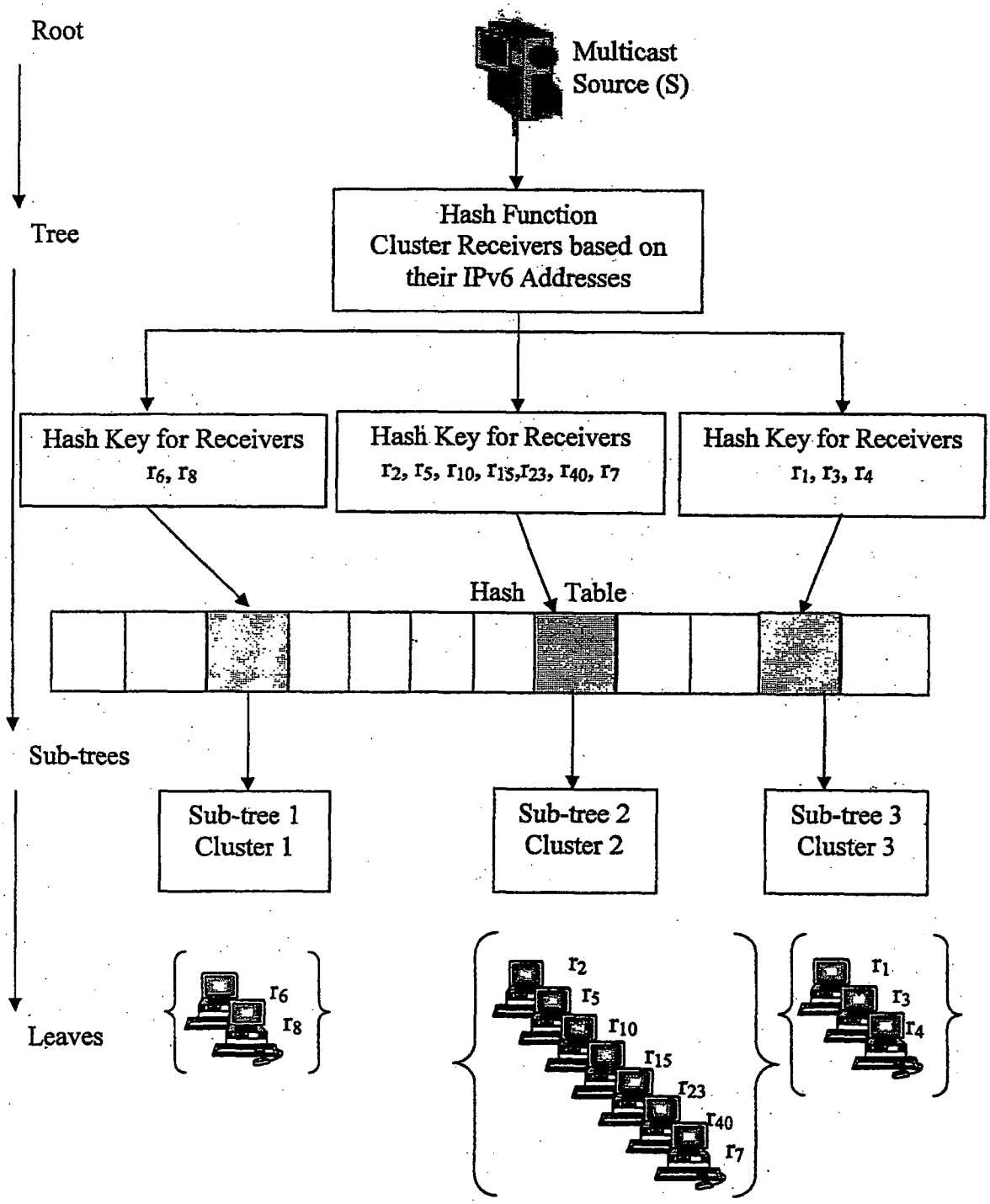
Root
Multicast Source (S)
Tree
Hash Function Cluster Receivers based on their IPv6 Addresses
Hash Key for Receivers r6, r8
Hash Key for Receivers r2, r5, r10, r15, r23, r40, r7
Hash Key for Receivers r1, r3, r4
Hash Table
Sub-trees
Sub-tree 1 Cluster 1
Sub-tree 2 Cluster 2
Sub-tree 3 Cluster 3
Leaves
r6
r8
r2
r5
r10
r15
r23
r40
r7
r1
r3
r4

Fig.1

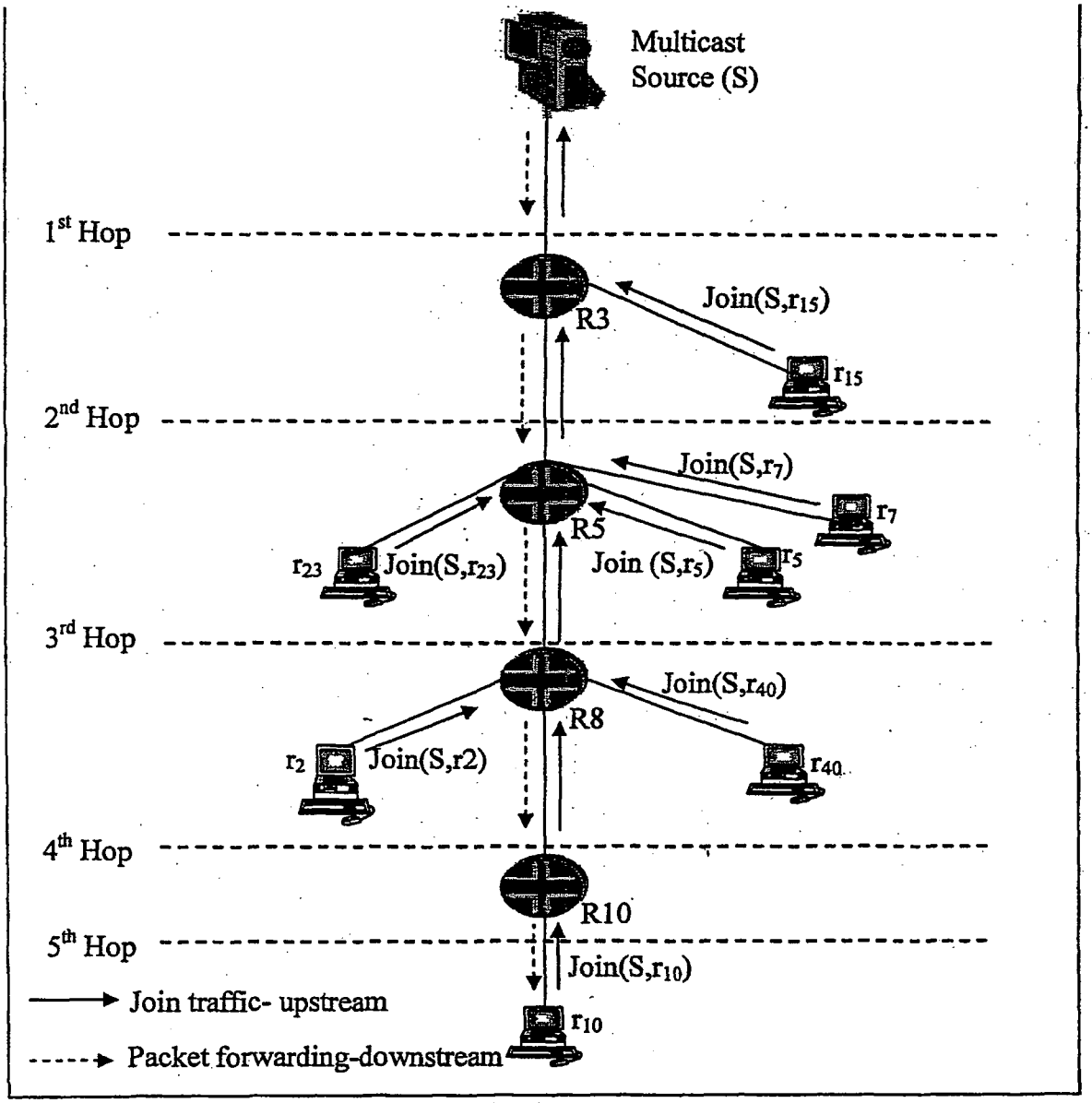
Multicast
Source (S)
1st Hop
R3
Join(S,r15)
r15
2nd Hop
Join(S,r7)
r7
R5
r23
Join(S,r23)
Join (S,r5)
r5
3rd Hop
Join(S,r40)
R8
r2
Join(S,r2)
r40
4th Hop
R10
5th Hop
Join(S,r10)
r10
Join traffic- upstream
Packet forwarding-downstream

Fig. 2

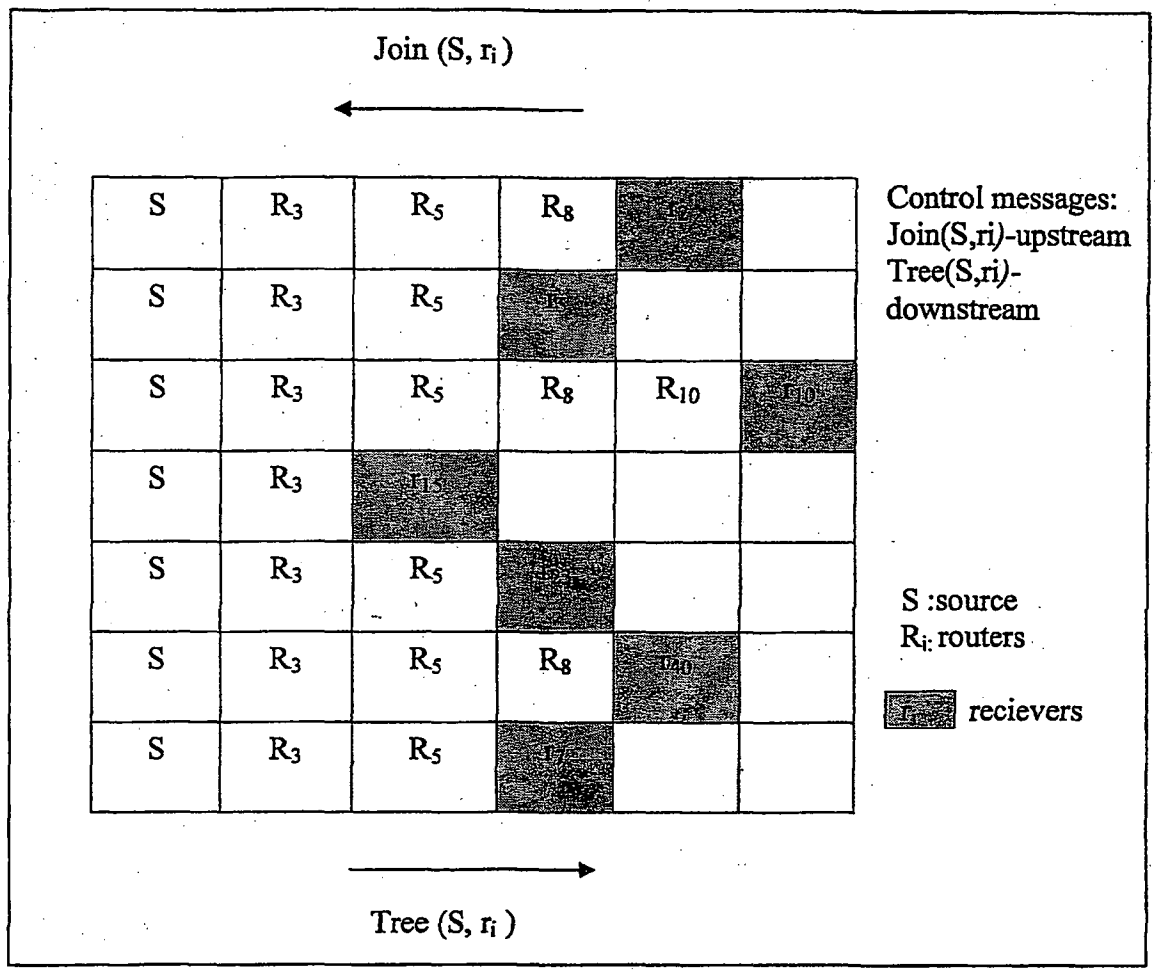
Join (S, r_i)
S
R_3
R_5
R_8
R_{10}
Control messages:
Join(S,ri)-upstream
Tree(S,ri)-downstream
S :source
R_i: routers
recievers
Tree (S, r_i)

Fig.3

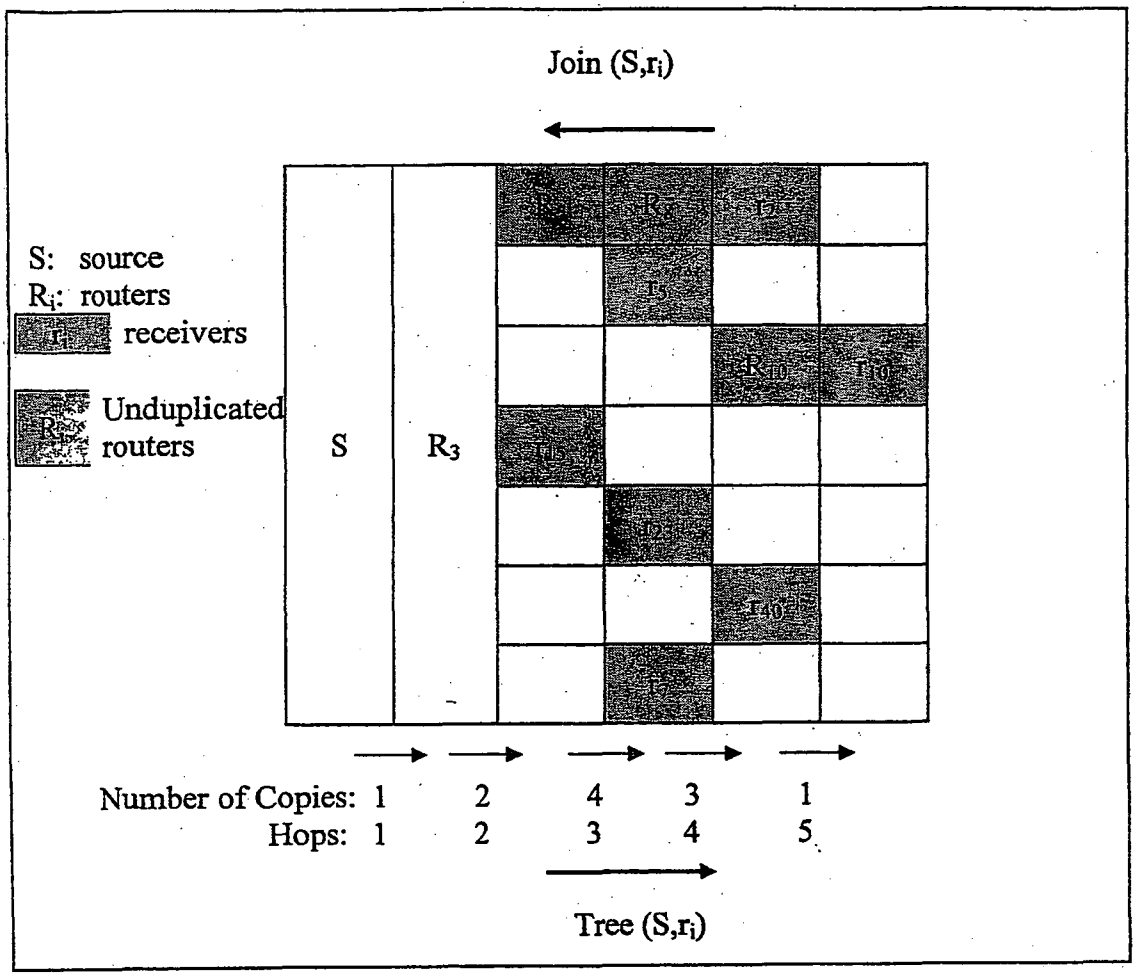
Join (S,ri)
S: source
Ri: routers
receivers
Unduplicated routers
S
R3
Number of Copies: 1 2 4 3 1
Hops: 1 2 3 4 5
Tree (S,ri)

Fig. 4

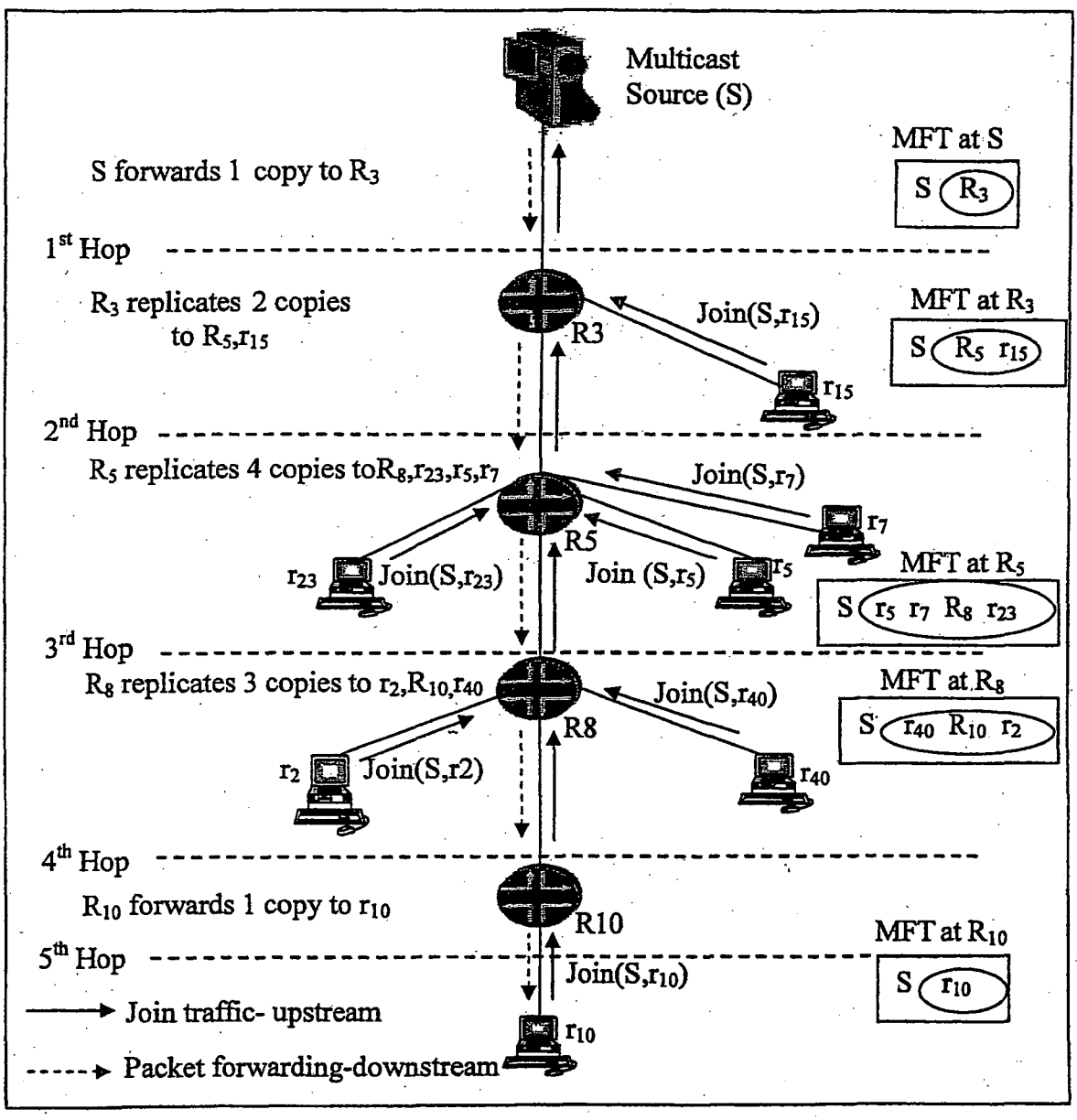
Multicast
Source (S)
MFT at S
S R3
S forwards 1 copy to R3
1st Hop
R3 replicates 2 copies
to R5,r15
Join(S,r15)
R3
r15
MFT at R3
S R5 r15
2nd Hop
R5 replicates 4 copies toR8,r23,r5,r7
Join(S,r7)
r7
R5
r23
Join(S,r23)
Join (S,r5)
r5
MFT at R5
S r5 r7 R8 r23
3rd Hop
R8 replicates 3 copies to r2,R10,r40
Join(S,r40)
MFT at R8
S r40 R10 r2
R8
r2
Join(S,r2)
r40
4th Hop
R10 forwards 1 copy to r10
R10
MFT at R10
5th Hop
Join(S,r10)
S r10
Join traffic- upstream
r10
Packet forwarding-downstream

Fig. 5