Multicast – Why Use It?
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Introduction

When multiple receivers are required to get the same data at approximately the same time, multicast is a more efficient way of delivering data than unicast.

A unicast packet has a single source IP address and a single destination IP address. Data will be delivered to a single host. A multicast packet has a single source IP, but it has a multicast destination IP address that will be delivered to a group of receivers. The advantage is that multiple hosts can receive the same multicast stream (instead of individual streams), thereby saving bandwidth.

For example: Let’s say that I want to download an instructional video called *How to Get a Raise in Two Weeks or Less* from an FTP server at work. I plan to do this at lunch time so that I can view the video while I eat my lunch. This would be a unicast delivery: A single receiver (me) and a single source, the server. Now let’s say that I tell 49 of my co-workers of my plan, and they decide that they would like to watch this video at lunch time as well. If we all downloaded this video individually, it would be a total of 50 unicast streams. It seems like a waste of bandwidth doesn’t it? If the compressed video takes approximately 1.5 mbps of bandwidth per stream, and you multiply that times 50, it would equal 75 mbps being consumed by one video! Wouldn’t it make better use of network resources if this video could be viewed as a multicast application and all 50 employees could watch the video stream at the same time? Instead of using 75 mbps of bandwidth, we would be using 1.5 mbps and accomplishing the same goal: We’d all be getting raises in two weeks or less!

How Do Hosts Become a Member of a Multicast Group?

Internet Group Management Protocol or, IGMP, is a protocol that allows hosts to dynamically join a multicast group. IGMP is an integral part of the Internet Protocol and there are 3 versions of IGMP. The host needs this protocol so that it can tell the router what specific multicast group it would like to join. The router will then
route multicast packets toward the LAN the receiver resides on. The host can also tell the router when it wants to leave the group by sending an IGMP leave message; that way, if there are no more hosts on a LAN segment that want the multicast traffic, the router can stop forwarding multicast packets to the LAN.

Multicast Routing

The router needs to have a multicast routing protocol implemented in order to be able to route multicast packets. There are several choices for routing multicast packets.

- DVMRP – Distance Vector Multicast Routing Protocol
- MOSPF – Multicast Open Shortest Path First
- PIM V2 – Protocol Independent Multicast

By far, the mostly widely used multicast routing protocol is PIM V2. Multicast routing works the opposite of unicast routing. While a unicast routing protocol makes routing decisions based on the destination IP Address, a multicast routing protocol routes based on the source IP address. It is interested in where the packet came from, not where the packet is going. This is because the destination address is not a unique address and will be routed everywhere there are receivers. The address range for multicast groups is from 224.0.0.0 to 239.255.255.255. The destination IP address in a multicast packet would be from this range.

Multicast routing uses distribution trees. With PIM you can implement source distribution trees or shared distribution trees. The Source Distribution Tree is called Dense Mode and is a push model. In other words, the multi-
Cast is delivered to the entire network and is “pruned” back if there are no receivers. For the most part, PIM Dense Mode is considered to be legacy.

The shared tree is called Sparse Mode and is a pull model. The multicast only gets forwarded when it is specifically requested. This request is originated by the IGMP join from the receiver and is then passed up the tree via the multicast routers. In addition, Sparse Mode has a rendezvous point (RP). The RP is a “meeting place” for sources and receivers. All routers know where the RP is so that they can register sources to it, and edge routers with receivers can build a shared tree toward it. The multicast data then gets forwarded down the shared tree away from the RP and toward the receivers.

**Switching Multicast Frames at Layer 2**

Layer 2 switches also need to be multicast aware. IGMP Snooping can be configured on your switches so that the switch can “snoop” the IGMP packets to the router to see which hosts have joined what groups. Remember, IGMP is a protocol between the host and the router. One way for the switch to know which hosts have joined a group, is for the switch to actually look into the IGMP packets. This is called IGMP Snooping. Once a switch has snooped the IGMP packets, it will only forward frames to the appropriate hosts (those who have joined the group) and not flood the frame out all ports except the port it came in on.

As you can see, your entire network needs to be multicast aware. The hosts need to be able to join a multicast group using IGMP, the routers need to be able to route the multicast packets using a multicast routing protocol, and the layer 2 switches have to be able to snoop the IGMP packets to see which hosts have joined what groups.

Multicast becomes a good option when you have applications where multiple receivers must receive the same data at the same time and when all of the above components of multicast have been implemented end-to-end in your network.
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About the Author

Carol Kavalla’s background includes teaching at Rockland Community College in New York, managing networks and being a consultant for the NYS small business development center.

For the last eight and a half years Carol has taught for Global Knowledge and is certified to teach nine Cisco Courses: ICND1, ICND2, CCDA, BSCI, BCMSN, TCN, ICMI, BGP, and ARCH.

She also has a consulting firm in Charleston, South Carolina where she works with small companies (100-200 nodes) installing, configuring routers and switches, and troubleshooting network problems.