# IP Multicasting: A Strategic Tool for Rich, Efficient Business Communications

## Multicast Technology Improves Network Efficiency

The advanced multimedia capabilities now available on the desktop PC make it possible to communicate live with audio, video and data, and to distribute and receive multimedia information. The PC network provides a ready infrastructure for carrying this traffic and delivering multimedia communications capability.

Leveraging a company's existing network to support such multimedia capabilities can create a significant competitive business advantage. It enables employees to communicate more effectively, perform work more quickly using interactive data, and reduce the lost productivity and travel expense inherent in large, off-site meetings.

As companies deploy more complex and sophisticated multimedia applications, the corresponding demand on corporate networks increases. Most network administrators would agree that a reliable and efficient PC network is essential to their company's success in today's competitive marketplace. And, leveraging the network to keep employees informed and in touch makes equally sound business sense.

The pressing challenge that network administrators face is creating an environment that supports sophisticated, real-time and interactive business communications at the desktop—while at the same time ensuring that rich video and audio streams can't and won't hamstring essential network operations and application performance. The challenge is even more imposing in complex internetwork environments, where multimedia packets may need to traverse multiple backbone subnets to reach recipients at client workstations.

Multicast technology is a key solution to the potential problem of overloading network bandwidth because it melds the advantages of unicast and broadcast technologies. Unicast technology generates an individual stream of information for each person who wants to receive it. If there are multiple receivers of the information, the network must carry an identical copy of the stream for each recipient.

Broadcast technology, on the other hand reduces the bandwidth by sending one copy of the stream to every node, but the information is delivered to all nodes, regardless of whether they want to receive it.

Like broadcast technology, multicast technology also sends a single stream of information over the LAN, whether the number of recipients is 10 or 1,000. But the multicast stream has the critical advantage of being targeted to specific nodes that request the data. Thus, only those users interested in the information receive the stream, and the stream is blocked at the LAN adapters of all other workstations.

This efficiency makes multicast technology appropriate for distributing a range of business-related video content, including company-wide meetings, management presentations, interactive conferences, financial briefings, training programs and industry news bulletins.

## Multicast Protocols Conserve LAN Bandwidth

Most traffic on a LAN consists of packets that are associated with individual client PCs. If multimedia content were distributed via this method, each additional client would demand its own copy of the multimedia packets—leading quickly to LAN saturation. Multicast protocols, by contrast, utilize special addresses that refer to a number of receivers, i.e., a multicast group.

By definition, a multicast protocol enables a group of recipients to receive an individual packet. Examples of multicast protocols include the multicast capability in the Media Access Control (MAC) layer of the IEEE 802.3 Ethernet* standard and the multicast capability in the IEEE 802.5 token ring standard.

The multicast protocol uses a destination address to identify a multicast packet. This allows a single packet of video to be sent to a set of destinations on the wire simultaneously.

Unlike broadcast LAN packets, which must be examined and, if necessary, discarded, by every client on the network, multicast packets are filtered at the PC's LAN adapter. Unless the

LAN adapter is programmed to accept multicast packets, the workstation will not be affected by multicast traffic.

An equally important benefit of multicast addressing is minimizing the impact of video and audio on network bandwidth. For example, with multicast technology and Intel Indeo® video compression, a channel of digital video, audio and screen images can be distributed at an average of 500Kbps—just 5 percent of the bandwidth of today's common 10Mb Ethernet LANs.

## Two Types of Multicasting

Network administrators can choose to deploy either of two types of multicasting technology, MAC-layer multicasting and Internet Protocol (IP) multicasting. The simplest way to distinguish them is in terms of the seven-layer OSI (Open Systems Inter-connection) reference model, the well-known hierarchical framework for implementing communications protocols. (See Figure 1.)

### MAC-layer Multicasting

As the diagram shows, MAC-layer multicasting occurs at the second-to-lowest level, known as the data link layer. At this layer, data is transmitted from node to node in frames—for example, Ethernet frames or token ring frames.

Because MAC-layer multicasting is topology-specific by nature, multicast transmissions that employ this protocol are restricted to Ethernet-only or token ring-only segments. A network administrator who needs to multicast over a larger area—for example, multiple buildings—must manually configure routers and bridges to forward messages to other subnets.

### IP Multicasting

IP multicasting occurs at the next level up in the OSI framework, the network layer. It involves a routable protocol that is independent of the physical and data link layers, allowing transmissions to move from one physical medium to another or from one data link to another. Internetwork forwarding of IP multicasts is handled by multicast routers, which dynamically determine the packet flows (and gates) based on the recipients who request the packets.

This makes IP multicasting a more efficient technology, as well as much better suited to distributing information across large, heterogeneous internetworks.

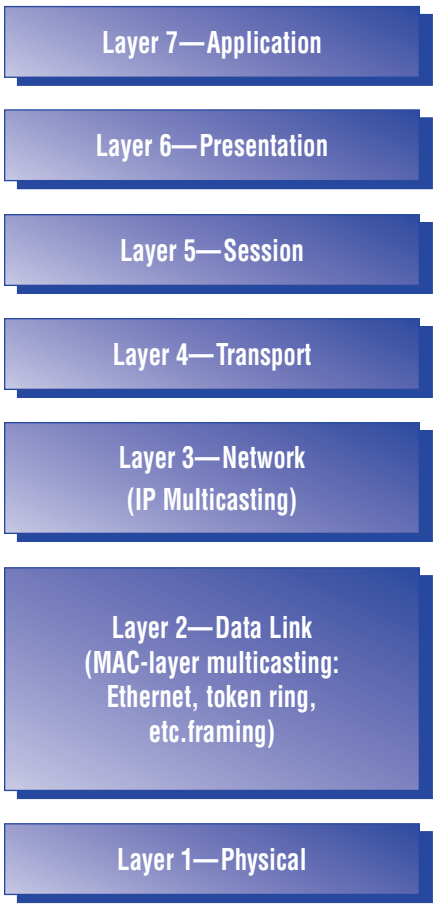


**Figure 1.** OSI Reference Model Protocol Stack

## The Benefits of IP Multicasting

Of the two types of multicasting, IP multicasting is the more flexible and powerful technology. It improves on MAC-layer multicasting and offers a number of specific advantages for network administrators and the companies they serve. These advantages include:

- Simplified management
- More flexible control over the network
- Increased network efficiency
- The safety of a widely accepted standard
- Media independence

In light of these benefits, IP multicasting is quickly becoming the prevalent technology.

### Simplified Management

IP multicasting is inherently easier to manage than MAC-layer multicasting. Assume, for example, that a network administrator wants to allow multicast

traffic to flow from one subnet to another subnet. With MAC-layer multicasting, each of the routers situated between the originator and destinations must be manually configured to enable bridging of MAC-layer packets. Typically, the route has to be determined on an ad hoc basis, because it depends on which nodes may need to be connected to other nodes for a particular purpose.

Using IP multicasting instead eliminates the need to manually enable the routers, because routers that support IP multicasting are self-configuring. When an individual end user requests access to distributed video content, routers that support IP multicast communicate with each other and configure themselves accordingly, so that traffic originating elsewhere is redirected to include the new destination workstation.

Thus, once the software that enables IP multicasting is installed on client workstations, and the routers on the internetwork support IP multicasting, the traffic that needs to flow from one node to another in the network does so automatically. In that sense, IP multicasting manages itself.

### More Flexible Control Over the LAN

IP multicasting ensures that network administrators maintain a high level of control over the network. A case in point is configuration options, which make it possible to disallow packets on certain network segments. For example, the Time To Live (TTL) mechanism of the IP protocol may be used to accomplish this.

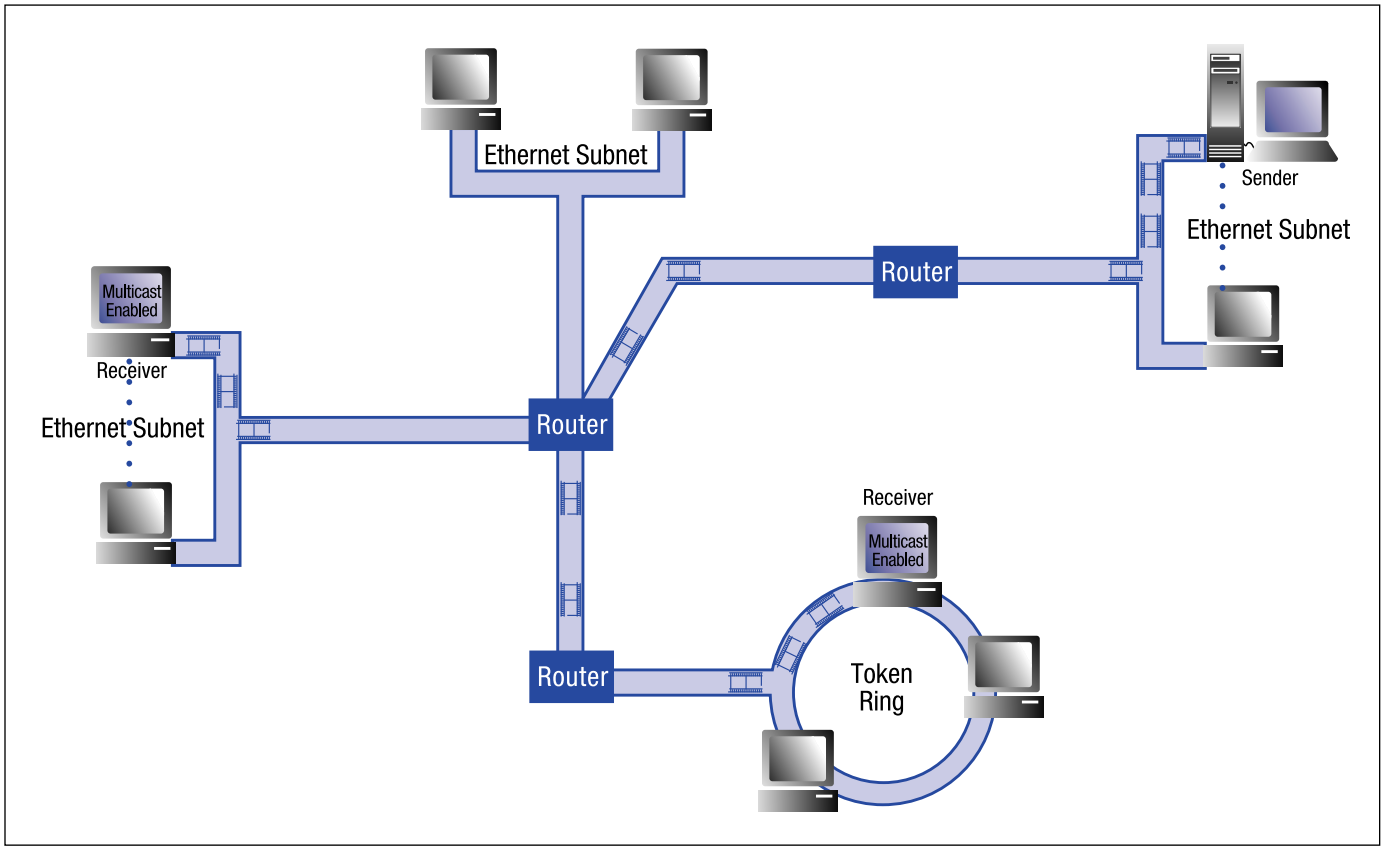


**Figure 2.** IP multicast routing is efficient and dynamic, passing the data stream to subnets of different topologies and automatically "pruning" subnets on which there are no recipients

**Greater Efficiency**

With IP multicasting, traffic flow from the originator of a message to destination workstations is dynamic and efficient, re-routing as necessary to encompass additional workstations when users request access. This is a marked improvement over the static and potentially inefficient nature of MAC-layer multicasting.

With MAC-layer multicasting, for example, when a route is established for traffic to move from one subnet to another, packets are routed to the subnet even if no users on it have asked to receive the multicast. In contrast, IP multicast traffic is routed to the subnet only if users on that segment have specified that they want to be included in the group of recipients. IP multicast-enabled routers automatically "prune" subnets where no users are tuning in to the multicast, so that messages efficiently bypass any segments with no known recipients.

**A Standards-Based Approach**

IP multicasting offers the reliability and safety advantages of a technology that is based on a broadly accepted industry standard. The IP multicasting standard was defined in 1989 by the Internet Engineering Task Force (IETF)—the same body that sets enterprise Internet standards—as an extension of the widely deployed Internet Protocol (IP). The standard has been gaining commercial acceptance for approximately a year as an increasing number of industry leaders move to embrace IP multicasting technology.

**Media Independence**

Another advantage of IP multicasting over MAC-layer multicasting is the support for multiple topologies. This can be a key benefit in light of today's heterogeneous network environments. Once a company upgrades to IP multicasting, it is no longer tied to individual physical media. For instance, if a company operates with multiple Ethernet subnets and a token ring subnet, IP multicast traffic can flow among them freely.

## Enabling the Infrastructure for Deployment

Deployment of IP multicasting requires just two changes to the existing infrastructure, keeping risks to a minimum for network administrators. In addition, IP multicasting is well-understood by router vendors, who will support companies ready to deploy the technology. The necessary steps are as follows.

The first requirement is a router platform that supports IP multicasting. All leading router vendors today offer support for this functionality, making it a worthwhile consideration in any hardware purchasing decision. If, on the other hand, a company's existing routers are adequate, they can be upgraded via software or firmware to support IP multicasting functionality. Technicians must upgrade all routers in the specified network to support users who will receive multicast packets.

The second requirement for deploying IP multicasting is a network stack on the client side. This software must be installed on any workstation where a user wants access to IP multicasts.

Intel is working specifically with two vendors who offer proven stacks support for IP multicasting. One option available is FTP Software's OnNet 1.2 and 2.0 TCP/IP stack (for Windows* 3.1 and Windows 3.11 environments). Another option is Microsoft's TCP/IP stack, which is included with its new Windows 95 operating system. With the release of Windows 95 and the integration of IP multicasting support into the desktop operating system, this technology is likely to become a familiar part of the desktop tool set of the future.

One other consideration that deserves mention with regard to deployment of IP multicasting is the issue of inter-domain routing. In virtually all cases, network administrators will already have resolved the matter of compatible inter-domain routing protocols, since the identical issue is inherent in unicast traffic.

Briefly stated, however, network administrators just need to make sure that inter-domain routing protocols are uniform across the enterprise, or that they will interoperate via translators

or configuration. Having systems administrators in various sites agree on protocols at the time of multicast deployment helps ensure that routers in subsets of the domain can communicate with each other for pruning.

Any additional questions or concerns relating to inter-domain routing protocols can be referred to a company's chosen router vendor.

## Flexible Product Support for Multicasting

Current Intel products that implement multicasting technology support both MAC-layer multicasting and IP multicasting. At present, those products include CNN at Work[SM], which enables companies to deliver live news to networked PCs, and ProShare™ Presenter, which enables companies to transmit real-time, interactive audio and video presentations over the LAN.

Because these two products offer a choice of MAC-layer multicasting or IP multicasting technology, companies can opt to deploy the products on existing networks without having to upgrade their routers, or they can take advantage of the greater benefits that IP multicasting technology offers. A key influencing factor in the decision will be how companies have chosen to manage their networks.

Ultimately, as IP multicasting becomes more widely deployed in the networking industry, Intel plans to standardize all of its multicast-capable products on this preferred technology.

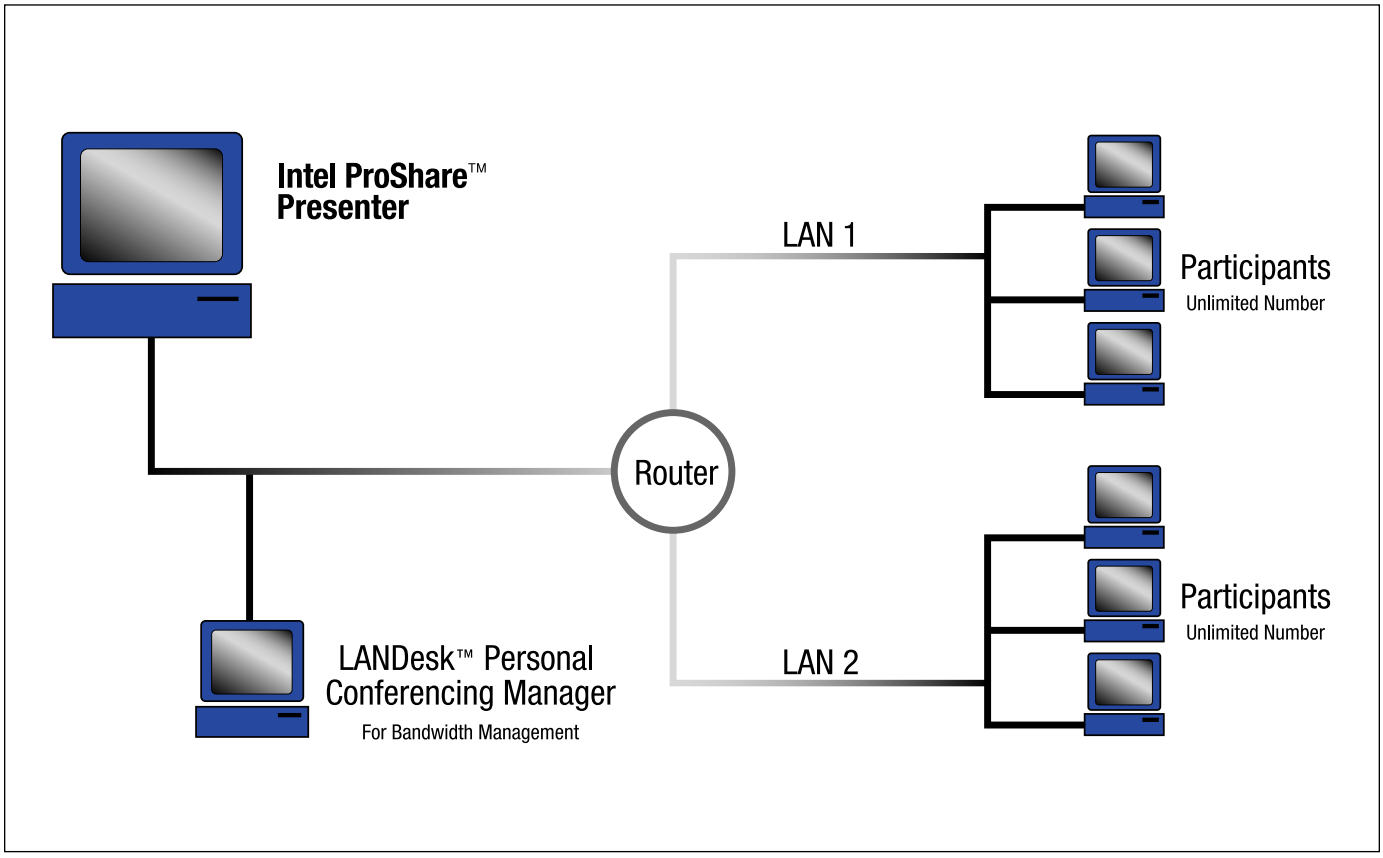


**Figure 3.** Intel's ProShare Presenter uses IP multicast technology to distribute real-time, interactive multimedia presentations across the enterprise LAN, at an average of 500Kbps regardless of the number of participants.

## Product Support Numbers

| **World Wide Web** | **http://www.intel.com/comm-net/proshare/index.html** | |
|---|---|---|
| | **Phone** | **FaxBack** |
| **North America** | 800-538-3373 | 800-525-3019 |

## FaxBack* Documents

| **Name** | **Document No.** |
|---|---|
| **ProShare™ Presenter Data Sheet** | 7802 |
| **LANDesk® Personal Conferencing Data Sheet** | 8153 |