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IP Multicast Backgrounder

How IP Multicast helps alleviate network congestion and paves the way for next-generation network applications

Scope Of This Document

This document provides an executive introduction to IP Multicast. It presents the basic concept, highlights its benefits, and provides suggestions for getting started. Whether you are a user of TCP/IP-based technologies or are a vendor interested in implementing or taking advantage of IP Multicast within your product or service, this document will help you.

Introduction to IP Multicast

The web has proven itself as a communications tool in my organization — what’s next?

Most of the widely-used traditional Internet applications, such as web browsers and email, operate between one sender and one receiver. In many emerging applications, one sender will transmit to a group of receivers simultaneously. These important applications will help increase your organization’s ability to communicate and collaborate, leveraging more value from your network investment. Examples are the transmission of corporate messages to employees, video and audio conferencing for remote meetings and telecommuting, replicating databases and web site information, live transmission of multimedia training and university courses, communication of stock quotes to brokers, updates on the latest election results, collaborative computing, transmission over networks of live TV or radio news and entertainment programs, and many others.

Yes, I’m hearing requests for some of these capabilities from my users, especially for multimedia. But how can networks handle it?

These new applications are compelling the need for advances in traffic handling to overcome bottlenecks. IP Multicast is an efficient, standards-based solution with broad industry support. IP Multicast is an extension of IP, the internetworking protocol that is used on the Internet. With IP Multicast, applications send one copy of the information to a group address, reaching all recipients who want to receive it. Without multicasting, the same information must be either carried
over the network multiple times, one time for each recipient, or broadcast to everyone on the network, consuming unnecessary bandwidth and processing, and/or limiting the number of participants. IP Multicasting involves groups of receivers that participate in multicast sessions; only those receivers in a group actually receive the traffic for that group’s session. IP Multicast technologies address the needed mechanisms at different levels in the network and internetworking infrastructure to efficiently handle group communications. Under development since the early 1990’s by leading researchers and the industry, IP Multicast is an important advance in IP networking.

**Comparison of point-to-point unicast and multicast data flow**

Three copies of the same data (D) are sent point-to-point as D1, D2 and D3 to Receivers 1, 2, and 3 in a shared conferencing application. These are “unicast” transmissions, sent point-to-point from one sender to one receiver.

One copy of the same data (D) is multicast to Receivers 1, 2, and 3 in a shared conferencing application. Note the bandwidth savings locally and across the networks — imagine the bandwidth savings for 100’s of recipients.
IP Multicast Benefits

Multicast sounds like a good technical solution. But what are the business benefits?

There are economic benefits—cost savings in network and server resources—and the value-added of new types of applications enabled by multicasting that are not feasible using unicast transport. If your organization is already taking advantage of cost-effective Internet technologies for internal and external communications, and your users are looking forward to using multicast applications, your network engineers should pursue IP Multicast.

One of the most important benefits is that IP Multicast enables a network planner to proactively manage network growth and control costs. IP Multicast is cost-effective compared to other engineering alternatives for increasing LAN and WAN capacities. Upgrading your network infrastructure to support IP Multicast will enable your organization to more quickly take advantage of multicast applications and minimize their impact on your network capacity and response times. IP Multicast is designed to scale well as the number of participants and collaborations expand, so adding one more user doesn’t amount to adding a corresponding amount of bandwidth. Multicasting also results in a greatly reduced load on the sending server, which no longer has to support many sequential or concurrent unicast sessions. This benefit can be just as significant as the bandwidth savings.

Many multicast applications like those described above increase productivity—and without IP Multicast they might not even be feasible. IP Multicast can immediately help alleviate network congestion caused by existing applications that are inefficiently transmitting to groups of recipients. IP Multicast allows corporate users to access content and services not previously available because these application would have consumed too much resources on the network. Furthermore, multicasting enables the simultaneous delivery of information to many receivers. This is a significant benefit for applications involving the delivery of news and financial information such as stock ticker feed applications.

Finally, IP Multicast will work in concert with other new IP protocols and services, such as Quality of Service requests to support real-time multimedia.

IP Multicast in Use

Tell me about corporate experiences with IP Multicast.

Intel deployed IP Multicast on a 4,000 node Oregon site in early 1996. Intel employees regularly use IP Multicast conferencing software to follow events such as
conferences or executive presentations and product launches from their desktops. The deployment was the last phase of a multicast project which started two years ago with the deployment of MAC layer multicast.

**Toys R Us, Inc.** uses IP Multicast file transfer software to send software updates to 900 store locations. Before using IP Multicast, the files had to be sent over its VSAT (very small aperture terminal) nationwide network one file at a time. Because this used up so much bandwidth, it had to be performed at night. During testing, Toys R Us found that it took 6 hours to transfer a 1M-byte file to 250 clients using the current system, while the same transfer using IP Multicast file transfer took 4 minutes. The software is designed to improve product availability in the stores. A Toys R Us representative believes the system paid for itself immediately.

**Microsoft** used a phased-deployment approach to multicast-enable its corporate network. Buildings were brought on line one by one until it was determined that the test phase was complete. IP Multicast was then fully deployed throughout the campus and to remote locations. Microsoft launched an IP Multicast network service in the fall 1996 to send information to over 5,000 Puget Sound area seats. Microsoft employees use IP Multicast software to listen to live executive speeches from industry events and other live broadcasts. Content includes local radio stations, MSNBC, the BBC and other events. This provides an excellent corporate communications vehicle direct to people at their desktops. Cost savings include reducing employee travel to industry and company events.

**What about IP Multicast on the Internet?**

The MBONE (Multicast Backbone) is a virtual network layered on top of the physical Internet to support routing of IP Multicast packets. It has been in existence for about 5 years. It originated in an effort to multicast audio and video from the Internet Engineering Task Force (IETF) meetings. Technical meetings and also NASA space shuttle launches, a Rolling Stones concert, and many other live meetings and performances have since been multicast over the MBONE.

![Number of hosts on the MBONE](image-url)
The MBONE is an experimental, cooperative volunteer effort spanning several continents. Research and testing of multicast protocols and services have been conducted extensively on the MBONE. The number of participating sites has grown rapidly as a result of interest and utility.

The MBONE is an overlay network based on an experimental and volunteer effort. It currently has limited use in commercial environments since it restricts the bandwidth available to IP Multicast and only a small fraction of companies have access to it. However, it has already validated the strengths of IP Multicast.

**IP Multicast Applications and Development**

Tell me more about uses of IP Multicast.

Demand for multimedia, combining audio, video and data streams over a network, is rapidly increasing. Users are clamoring for it. Some of the more popular uses of multimedia are real-time interactive applications, such as desktop video and audio conferencing, collaborative engineering, shared white boards, transmission of university lectures to a remote audience, and animated simulations. Even when data compression is used, multimedia applications require lots of bandwidth.

IP Multicast will help in the realization of the full potential of these exciting new applications. For example, consider the transmission of a corporate presentation to workers within a company. Using unicast transmission it would be possible to support only a small numbers of recipients, because transmission of multiple copies of the multimedia stream would quickly strain the available network bandwidth. On the other hand, with IP Multicast it would be easy to support thousands of recipients, each sitting at his or her own desk.

Another important type of multimedia application involves the transmission of stored data streams. Examples include updates of kiosks and web caches, video server to video server updates, corporate announcements to employees, etc. IP Multicast will enable these applications to scale to very large numbers of recipients.

Although multimedia applications are bandwidth intensive, non-multimedia applications that involve the transfer of large databases of information will also benefit immensely from IP Multicast. Examples of real-time applications of this type include stock/commodities quotes and trading information, and shared white boards. Non-real time applications include multicast file transfer and web caching.
Are there tools for software developers?

If you are a vendor, or have in-house applications serving some of the functions described above, you’ll want to consider upgrading them to support IP Multicast. IP Multicast can help you advance to next-generation products. It is also a win for your users because it helps address their concerns about bandwidth-intensive applications.

Most implementations of TCP/IP on major operating system platforms support IP Multicast. Contact your platform and TCP/IP software vendors for more information on their programming interfaces. Some vendors also license high-level development kits and middleware solutions to help developers more quickly implement IP Multicast solutions.

Evaluation and Implementation

What should we do next?

IP Multicast has broad industry backing and is supported by many vendors of network infrastructure elements such as routers, switches, TCP/IP stacks, network interface cards, desktop operating systems and application software. If you have recent network equipment and software from the leading vendors, you can likely enable or upgrade to IP Multicast at low cost. Your vendors and network service provider(s) can explain features and help you estimate these upgrade costs. You can also obtain information about the technologies, products and services from the IP Multicast Initiative described below.

A phased approach to evaluating and deploying IP Multicast is recommended. Intranet deployment is recommended prior to WAN deployment.

A network analysis will be needed to forecast usage profiles and elucidate categories of benefit and cost. The opportunity cost of being unable to run multicast applications because of network congestion, thereby limiting productivity, should be considered in this analysis.

Plans for WAN deployment should consider several alternatives. For example, satellite data networks can be used for commercial deployment of multicast-based applications over a WAN. In a trial (or in operational use), the entire network need not be simultaneously enabled for IP multicast. Transitional approaches can be used. One example is tunneling which enables IP Multicast traffic to traverse non IP Multicast-enabled network segments. This has already proven useful in the evolution of the MBONE.
A testbed evaluation from both the LAN and WAN perspectives is highly recommended, preferably in-house, or at a vendor’s facility. Staff training in IP Multicast network administration and diagnosis may be helpful.

When possible, choose IETF standards-based products designed for native IP Multicast. Your network engineers can direct the evaluation and determine which IP Multicast protocols and features should be tested and deployed. Important considerations are supported standards, interoperability with other network infrastructure elements at all sending and receiving nodes and intermediate routers, and performance for typical usage scenarios.

More information

I’d like our engineers to get started. Where can they get more technical information?

There are many technical aspects of IP Multicast that were not discussed here. The IP Multicast Initiative web site at www.ipmulticast.com has a technical resource center which provides more background and in-depth information. The web site also offers a product and services directory and lists members of the IP Multicast Initiative who can be contacted for information and assistance.

The IP Multicast Initiative provides marketing and educational services to promote the creation, use and deployment of multicast products and solutions. Supported by a growing number of the most important vendors in the IP Multicast arena, the Initiative and its services are managed and provided by Stardust Technologies, Inc.

For more information about the Initiative and membership, contact Stardust Technologies at 408-879-8080 or visit the Initiative web site.