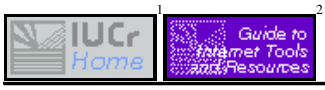

MBONE: Internet Teleconferencing

The Multicast Backbone (MBONE) is designed to enable live, multiparty, multimedia communication on the Internet. It is an infrastructure for supporting efficient one−to−many communication over the Internet. Established in 1992 and now with software at version 6.0, the MBone has quickly grown to reach more than 2500 networks in 25 countries. The availability of the MBone has catalyzed the development of many new Internet applications, especially real−time, multimedia applications such as audio/video teleconferencing, remote teaching, distributed interactive simulation, and 'Internet Radio/TV'.

Multicasting

Classical communication of packets on the Internet is by *unicasting*. A packet at one node is transmitted and then received by one other node which then retransmits it along the path to the destination. For transmitting a packet to a group by multicasting, at each intermediate node where the packet is received, the packet is transmitted to several adjoining nodes which in turn transmit the packet to several adjoining nodes. In IP multicasting on the Internet

- each group is identifed by a single IP multicast address,
- groups may be of any size,
- members of groups may be located anywhere in the Internet,
- members of groups can join and leave at will and
- senders need not be members,

which makes it very similar to a radio−frequency channel.

Mbone

The MBONE (Multicast BackbONE) is an infrastructure for delivering IP multicast packets. It is a virtual network, overlaid on the Internet. Modern installations of hosts or routers allow for IP multicasting but older installations only allow unicasting. To overcome this difficulty *tunnels* are used which allow multicast packets from one multicast net to be encapsulated into a unicast packet for transmission across a point to point link to another multicast net.

At the beginning of 1996 there were about 3000 MBONE subnets worldwide compared with 500 in Jan. 1994 and 1500 in Jan. 1995. At the same time, Sun (Solaris 2.x), SGI (Irix), Intel x86 (MS Windows 95, FTP Software, BSDI, NetBSD, FreeBSD and Linux), Apple (Open Transport), NeXT (NeXTSTEP), Proteon, Alantec, Cisco, Bay, 3Com were all shipping IP−multicasting compatible products whereas patches were available for Sun (SunOS 4.x), DEC (Ultrix, OSF−1), HP (HP−UX) and IBM (AIX) platforms.

New Applications enabled by the MBone

The introduction of MBone gave rise to a flurry of activity in application software development to take advantage of the multicast technology. The associated software product is given in [] and the originating institution within ()s.

- AudioVisual teleconferencing [vat, vic(LBL), nevot(UMass), ivs(INRIA), nv(PARC),] of which vat and nv are the most popular
- Shared 'Whiteboard' [wb(LBL)] is a means of remote participants sharing the same whiteboard space.
- conference management [sd (LBL) for session directory, mmcc (ISI)]

[1] http://www.iucr.ac.uk/iucr−top/welcome.html
[2] int.index.html

- scientific data dissemination: [telemetry (Woods Hole), imm (UHawaii)]
- distributed interactive simulation: [NPSnet (NPS), games]

MBone is moving from an experimental to a production service but much development is still necessary.

Further information on MBONE and related topics

- Steve Deering[3] gave a talk on MBONE at CERN, Geneva on 16th Feb. 1996. The postscript slides of the presentation[4] are available.
- MICE[5], its successor MERCI[6] and its MICE/MBONE software[7]
- Zero−paper conference[8]
- Survey of Video conferencing[9]
- Internet Telephony[10]

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[3] http://sandbox.xerox.com/deering
[4] ftp://parcftp.xerox.com/pub/net−research/mbone/mbone−talk−dec95.ps
[5] http://www−mice.cs.ucl.ac.uk/mice/mice.html
[6] http://www−mice.cs.ucl.ac.uk/mice/merci/
[7] http://www−mice−nsc.cs.ucl.ac.uk/mice−nsc/mcast_software.html
[8] http://sgline.epfl.ch/mbone/mbone.html
[9] http://www2.ncsu.edu/eos/service/ece/project/succeed_info/dtvc_survey/survey.html
[10] http://www.vocaltec.com/
[11] int.index.html
[12] ../ahdf/Howard.Flack.html