Network Working Group
Request for Comments: 1770
Category: Informational

C. Graff
US Army CECOM

March 1995

IPv4 Option for Sender Directed Multi-Destination Delivery

Status of this Memo

This memo provides information for the Internet community. This memo does not specify an Internet standard of any kind. Distribution of this memo is unlimited.

Abstract

This memo defines an IPv4 option to provide a sender directed multi-destination delivery mechanism called Selective Directed Broadcast Mode (SDBM). The SDBM provides unreliable UDP delivery to a set of IP addresses included in the option field of an IPv4 datagram. Data reliability if required will be provided by the application layer. This approach was developed to support sender directed multi-destination delivery to sparsely populated groups with no additional control traffic. This approach will find application in the extremely bandwidth constrained tactical military environment, as well as in some commercial applications requiring sender control of data delivery.

Background

The Selective Directed Broadcast Mode (SDBM) is an integral part of the U.S. Army standard for tactical data communication networks as defined in MIL-STD-188-220() (Reference 1). The MIL-STD-188-220() defines a protocol architecture for the lower four layers of the ISO-OSI Reference model. The MIL-STD-188-220() is currently undergoing a reformatting to be consistent with other DoD standards that deal with IP networking. These efforts will provide tactical IP internetting of tactical Army broadcast radio networks, and will support fully IP compliant internetworking to other types of IP networks via commercial IP routers. It is the goal of the U.S. Army to move toward a fully IP compliant internetwork architecture for all tactical battlefield data communications. The Army does, however, have a critical need for a reliable, sender directed multi-destination data transfer capability that is not currently supported by the existing or emerging internet standards. The SDBM IP option was developed to meet this need. The required data reliability will be provided by incorporating an acknowledgement strategy at the application layer. It is hoped that this IP option, providing multi-destination capability not currently provided by the current and

emerging internet standards, will be embraced by the internet community and become an integal part of the IP family of protocols and be incorporated in commercial IP software products.

SDBM Format

The SDBM provides the ability for an application to explicitly list a set of intended IP destinations. This capability will be implemented as an option in the IP layer, as shown in Figure 1. This option field is variable in length, up to a maximum of 40 octets due to the limitation of the HLEN field as specified in STD 5, RFC 791 (Reference 2). Under this option 38 of the 40 octets would be used to contain the 2 octet control field and a maximum of 9 IP addresses.

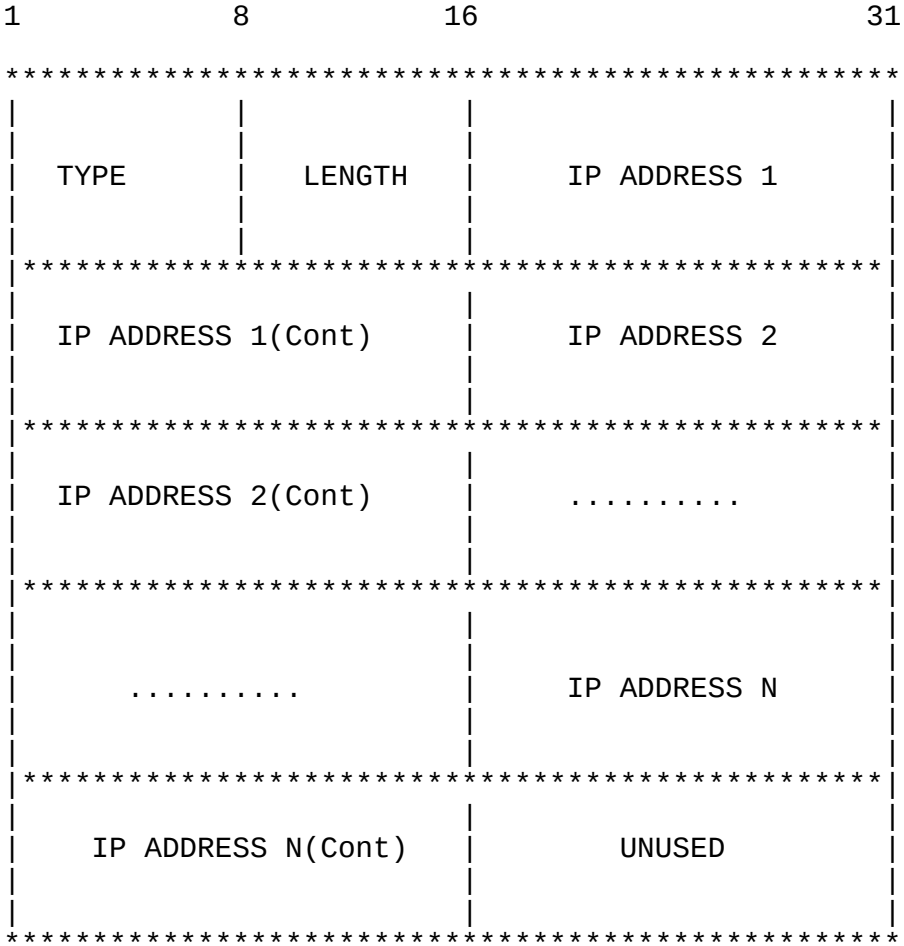

Figure 1 IP Option Field Layout

The TYPE field specifies the copy flag, class, and option number. The copy field indicates whether or not this option field is to be copied into each fragment if the IP datagram is fragmented. The class field and option number field are set to 0 and 21 respectively. The format of the TYPE field is shown at Figure 2.

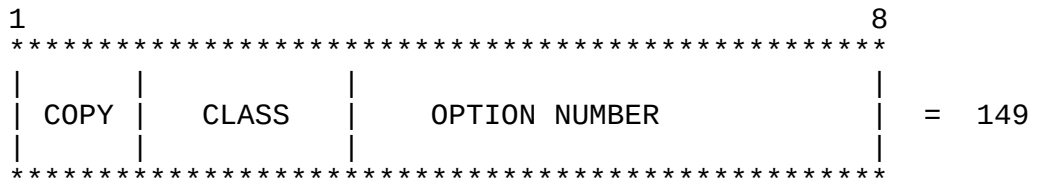

Figure 2 Type Field Layout

Since the IP multi-address list shall always be copied to all IP headers during fragmentation, the COPY bit should be set to 1.

Returning to Figure 1, the LENGTH octet indicates how many octets are in the option field. It is calculated as:

LENGTH = 2 + 4*(number of IP addresses)

The remaining octets contain the IP addresses of the specified destination hosts. Each IP address occupies 4 octets.

Transmission of SDBM datagrams

The procedures for a source host, transit router, and destination router are provided below. When a source host has a message to send to multiple destination hosts, it shall,

a. Group the destination host internet addresses by their network identifiers (Net IDs). If there are N distinct Net IDs, there will be at least N distinct directed broadcast packets. If there are more that 9 destination hosts on a single net, multiple directed broadcast datagrams must be sent to that net.

b. For each Net ID, form the directed broadcast address as defined in STD 3, RFC 1122 (Reference 3) for that network. The directed broadcast address is used as the destination address in the IP datagram and the source address is the address of the host sending the message.

c. Place the entire IP address for up to 9 destination hosts in the in the same net in the option field defined above. The total length of all IP options in a given datagram is limited to 40 octets as determined by the HLEN (Header Length) field which defines the

number of 32 bit words in the header. If other options are to be included in addition to the SDBM option, the number of addresses in the option field must be reduced accordingly.

d. The thusly formed datagram shall be transmitted and processed according to normal datagram handling procedures.

When a IP SDBM datagram encounters a transit router (router not connected to the destination network), the datagram shall be processed in accordance with normal IP datagram handling procedures. When encountering the destination router (the destination network is directly attached to the router), the destination router shall perform a, b or c below:

a. If the local subnet has a broadcast capability, broadcast to all hosts in the network and let the hosts perform address filtering.

b. If the local subnet does not support broadcast, form a local subnet packet for each destination host in the SDBM datagram and transmit into the network.

c. If the local subnet supports reliable layer 2 multi-address capability as provided by MIL-STD-188-220() networks, use a layer 2 multi-address frame to deliver the datagram to addresses found in the IP option field.

Reception of SDBM datagrams

In processing received SDBM datagrams, receiving hosts shall look inside the IP option field for their address. Processing shall continue only if the host’s IP address is found inside this option field. Thus the source host has explicit control over which hosts will process its datagrams. Since SDBM uses a broadcast address in its destination field, the SDBM can only be used with UDP (Reference 4) and not TCP (Reference 5) as the TCP supports only point-to-point connections and not point-to-multi-point.

Source for MIL-STD-188-220()

The above mentioned MIL-STD-188-220() may be obtained by contacting

US Army Communications Electronics Command
AMSEL-RD-SE-AIN-E (ATTN: Mr. Ted Dzik)
Fort Monmouth, NJ 07703

Comm: (908) 532-1780
Fax: (908) 532-3398
EMail: DZIK@ain3.monmouth.army.mil

Acknowledgements

The author wishes to acknowledge the major contributions to this work made by Mr. Dave Macauley of ATT and Ms. Barbara Denny of SRI International. Other contributions were made by members of the 188-220() committee.

References

(1) "MIL-STD-188-220() For Task Force XXI, Interoperability Standard for Digital Message Transfer Device Subsystems, 23 December 1994.

(2) Postel, J., "Internet Protocol - DARPA Internet Program Protocol Specification", STD 5, RFC 791, DARPA, September 1981.

(3) Braden, R., Editor, "Requirements for Internet Hosts -- Communication Layers" STD 3, RFC 1122, IETF, October 1989.

(4) Postel, J., "User Datagram Protocol", STD 6, RFC 768, USC/Information Sciences Institute, August 1980.

(5) Postel, J., "Transmission Control Protocol - DARPA Internet Program Protocol Specification", STD 7, RFC 793, September 1981.

Security Considerations

Security issues are not discussed in this memo.

Author's Address

US Army Communications Electronics Command
AMSEL-RD-ST-LA-L (ATTN: Charles Graff)
Ft. Monmouth, NJ 07703

Phone: (908) 544 3264
Fax: (908) 544 2150
EMail: bud@fotlan5.fotlan.army.mil