**Day and Time based IP Multicast**
**draft-akhunger-tod-multicast-00**

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Abstract

   This document specifies enhancement to the Internet Group Management
   Protocol, IGMPv3.  IGMP is the protocol used by IPv4 systems to
   report their IP Multicast group memberships to neighboring Multicast
   routers.  This enhancement for IGMP adds support for "specifying day,
   time and duration with Multicast reports", that is, the ability for a
   system to report interest in receiving traffic for a particular
   Multicast address at a particular day, time and for a specific
   duration.  This information may be used by intermediate routers and
   switches to ensure providing better Quality of Service.  Also

specifying such information in a consolidated packet may help reduce
signaling load on the multicast routers.

**[1](#). Introduction**

The Internet Group Management Protocol (IGMP) is used by IPv4 systems
(hosts and routers) to report their IP Multicast group memberships to
any neighboring Multicast routers.  Typical applications for the
protocol include video streaming , enterprise wide broadcasts,
training etc.  These applications are going to require huge bandwidth
and thus guarantying QoS would be a challenge.  Also zapping
requirements for applications like video streaming, leads to a lot of
burden on the nodes for signaling.  Multicast applications and
business models are evolving and it becomes important to provide
maximum flexibility to service providers through protocol support.One
such initiative could be to provide option where in some scenarios,
the IGMP hosts/proxies may be able to define some of their
subscriptions in advance, helping the intermediate routers to
distribute signaling load and manage QoS in a better way.  This
propsal allows the hosts to specify the day, time and duration for
each multicast session, when the host wants to receive traffic for
particular multicast group address.  In such scenario, even though
the IGMP hosts would have specified their choice of multicast groups
for particular time and duration in advance, they are still allowed
to change their pre stated subscriptions at that time and choose to
receive packets for some other multicast address by giving a new
join, but service providers can charge them extra for doing so.  The
solution being proposed is interoperable with existing IGMP versions
as these fields are optional.

2.  **Motivation**

   The importance of bandwidth management is going to realized much more
   seriously, with the success of Multicast traffic and resulting
   applications.  Also the load of zapping will start becoming visible
   when millions of people start swapping channels using applications
   like Multicast video streaming.  The fact that many users are
   accustomed to watching some programmes on TV in a periodic manner and
   they at times, are well aware of what they are going to wish to view
   well in advance.  Or the fact that Broadcasts and trainings are
   mostly scheduled for a particular time of day and duration - makes
   one think whether this special characteristic of multicast traffic
   patterns can be utilized to provide better bandwidth management and
   signaling response time for Multicast applications.  Also there has
   to be realization that the resources used by a host, who changes
   channels too often is too high, than a user who knows what he/she
   wants to see well in advance.  Thus the network provider has the
   authority to get extra revenue for this additional resource usage.
   We could think of a business model wherein users can be given a
   discount for telling their preferences in advance and these
   preferences could be in terms of [ GA, Src, Time of Day, Duration]
   type of tuples.

3.  Applicability

   A sample scenario could be that in a network a service provider asks
   all possible IGMP users to submit their preferences by Saturday or
   Sunday, for the forthcoming week.  So these new fields of time of day
   and duration are only accepted in IGMP messages - for these two days
   from hosts and this cycle repeats every week.  The users already have
   the Guide to what all is going to be available on what all multicast
   channnels at what time in the coming week and they make a choice and
   send that list across to the multicast provider through Enhanced IGMP
   Join message.  The Multicast Service provider now has a lot of time
   to process these requests and decide on the most efficient routes for
   the traffic flow.  By knowing "most likely" traffic pattern for the
   next week - now the Service providers are in a position for guiding
   customers who are still looking for scheduling their multicast
   sessions - about the best possible times where they can gurantee fast
   and reliable data transfer.  Only one Enhanced IGMP Message will be
   accepted from a host during one collection cycle period [ Saturday/
   Sunday in this example].  Any changes in preference will have to be
   done by indiviual join for multicast traffic at the intended time of
   reception.

4.  Implications on Quality of Service

   Service Providers can plan to route the traffic in better once they
   have information in advance - for example they can have a knowledge
   about what the traffic pattern is going to be in next one week ,
   based on inputs from subscribers - they can decide on thier options
   for providing quality service more efficiently.  Network operators
   may configure routes manually as per traffic needs displayed by the
   advance information, or the Routing Protocol path computation
   algorithms may also undergo a change to utilize this information.
   Knowing the traffic patterns in advance doesnt only allow efficient
   usage of resources but can help the service providers offer premium
   services with QoS SLAs

5.  Implications on signaling load

   This enhancement allows service providers to have the subscription
   information in advance for a period , which could be decided by the
   network provider - it could be a day , it could be week or whatever.
   IGMP Host sends the list of subscriptions that for period and the
   network devices have a lot of time to process such information
   completely - thus the load of signaling is less.  Also because many
   subscriptions are going to be consolidated in a message - the total
   number of packets for join will reduce.  Another advantage is that
   the duration is alrfeady specfied at the time of join - thus an
   explicit leave is not necssary, removing some more extra protocol
   traffic.  Also this feature allows an extra pricing on users just
   browsing through various channels thus leading to extra revenue
   generation proportional to amount of signaling load generated by
   users on network devices.

## 6.  Message Formats

   The following sections highlight the message formats

### 6.1.  Membership Query Message

   Membership Queries are sent by IP Multicast routers to query the
   Multicast reception state of neighboring interfaces.  Queries have
   the following format, which is same as defined by IGMPv3

```
       0                   1                   2                   3
       0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      | Type = 0x11  | Max Resp Code |           Checksum            |
      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      |                         Group Address                        |
      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      | Resv  |S| QRV |     QQIC      |     Number of Sources (N)     |
      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      |                       Source Address [1]                     |
      +-                                                            -+
      |                       Source Address [2]                     |
      +-                              .                             -+
      .                              .                              .
      .                              .                              .
      +-                                                            -+
      |                       Source Address [N]                     |
      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
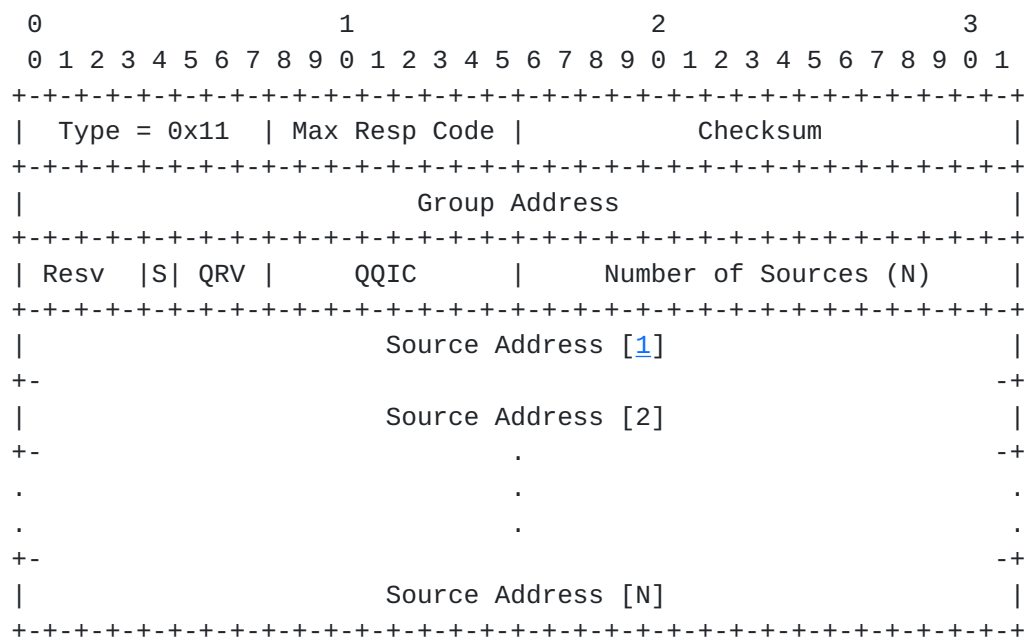
### 6.2.  Membership Report Message

```
                     0                   1                   2
3
                     0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    | Type = 0x22  |    Reserved   |            Checksum            |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |            Reserved           |   Number of Group Records (M) |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |                                                               |
                    .                                                               .
                    .                        Group Record [1]                       .
                    .                                                               .
                    |                                                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |                                                               |
                    .                                                               .
                    .                        Group Record [2]                       .
                    .                                                               .
                    |                                                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |                               .                               |
                    .                               .                               .
                    |                               .                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |                                                               |
                    .                                                               .
                    .                        Group Record [M]                       .
                    .                                                               .
                    |                                                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |            Reserved           |   Number of session Time (N)  |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    .                                                               .
                    .                         Session Time 1                        .
                    .                                                               .
                    |                                                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    .                                                               .
                    .                               .                               .
                    .                               .                               .
                    |                               .                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    |                                                               |
                    .                                                               .
                    .                         Session Time N                        .
                    .                                                               .
                    |                                                               |
                    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where each Group Record has the following internal format:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Record Type  | Aux Data Len |     Number of Sources (N)     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Multicast Address                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Source Address [1]                       |
+-                                                            -+
|                     Source Address [2]                       |
+-                                                            -+
.                            .                                 .
.                            .                                 .
.                            .                                 .
+-                                                            -+
|                     Source Address [N]                       |
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                              .
.                       Auxiliary Data                         .
.                                                              .
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where each Session Time Information has the following internal
format.

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Reserved                  |      Group Record Number       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   TimeZone    |            Year             |     Month       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Show Day    |  Show Hour  | Show Minutes| Show Seconds      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Duration Day  |  Dur Hour   | Dur Minutes |  Dur  Seconds     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The fields in this enhanced Report include the following information

Number of Session Time

This indicates the number of session for which information is
included in the message

TimeZone

This is used to identify the timezone when host has shown interest to
receive traffic

Year, Month

Indicates year and month for receiving multicast traffic for that
group

Show day, hour, minutes, seconds

This indicates the day and time of day when the host wishes to
receive multicast traffic for this group.  These timings have to be
wihin Cycle period.

Duration Day, hour, minutes, seconds

This indicates the duration for which Host wishes to receive the
multicast traffic for this group.

## 6.3.  Compatibility with earlier versions

This enhancement in no way tries to rule out any of the features
possible with earlier IGMP versions.  Even if a user utilizes the new
"Session Time" information option - IGMP host still has the
flexibility to change the preference of channel at the time by giving
a leave and a join - however this enhancement allows the service
provider to charge them extra - for using such privilege.

## 6.4.  Security Considerations

The data provided in enhanced multicast joins is very sensitive as it
nearly highlights a person's proposed schedule to some extent - thus
it is important that it is passed in a secure manner.  Thus
Encryption and authentication mechanisms must be employed on the
Enhanced IGMP messages.

## 7.  References

[1]  Cain B., Deering S., Kouvelas I., Fenner B., and A.
     Thyagarajann, "Internet Group Management Protocol, Version 3".

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