IGMP and MLD Optimizations in Wireless and Mobile Networks

draft-liu-multimob-igmp-mld-wireless-mobile-03

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Aims

- Optimize IGMP and MLD to meet wireless/mobile multicast network requirements:
  - Adaptive to link conditions
  - Minimizing group join/leave latency
  - Robust to packet loss
  - Reducing packet exchange
  - Avoiding packet burst
- Limit the changes within the protocol framework without introducing interoperability issues
- Possibly used in wired network where efficiency and robustness are required

New

* Added Hitoshi as author
* Added Suspend/Resume messages
* Cleaned it up a bit

Option List

* Switching between unicast and multicast Queries
* General Query supplemented with unicast Query
* Retransmission of General Query
* General Query suppression with no receiver
* Tuning response delay according to link type/status
* Triggering report and query quickly during handover
* Suspend/Resume

Switching Between Unicast and Multicast General Queries

- Switch between unicast and multicast General Queries according to actual network conditions
  - Unicast query each receiver when number of receivers is small; multicast query all receivers when the number is large
  - A switching threshold should be predefined
  - Explicit tracking is required to know the reception status

- Benefits
  - Take advantages of both unicast and multicast Queries
  - Unicast Query has less effect on non-members and helps to improve battery-saving

General Query Supplemented with Unicast General Query

- Send unicast Query to each non-respondent valid receivers after a round of General Query, presumably the number of non-respondent receivers is small
- Triggered at the end of the [Maximum Response Delay] after General Query, transmitted for [Last Member Query Count] times spaced by [Last Member Query Interval]
- Require explicit tracking to track reception status

- Benefits:
  - Improve robustness without influencing other receivers

Retransmission of General Query

- If after a General Query no response can be collected from all valid receivers, for the reasons e.g.:
  - All valid receivers leave the group silently
  - All responses of the receivers happen to be lost
  - The query fails to reach the other side of link to the receivers.
- Retransmit General Queries for [Last Member Query Count] times spaced by [Last Member Query Interval] before deciding to stop General Query totally
- Require explicit tracking to acquire the reception status

- Benefits
  - Improve robustness of General Query if there are valid members
  - Realize fast leave if all receivers quit.

General Query Suppression with no Receiver

- Suppress General Query if there is no valid multicast receiver on an interface:
  - When the last member reports its leave, by an explicit-tracking router checking its membership database, or by a non-explicit-tracking router getting no response after sending Group-(and-Source-) Specific Queries
  - When the (only) member on a PTP link leaves
  - When a router after retransmitting General Queries on startup fails to get any response
  - When a router previously has valid members but fails to get any response after several rounds of General Queries.
- Benefits
  - Eliminating unnecessary continuous General Queries has benefit for all terminal on the link for battery saving

Tuning Response Delay according to link type and status

- Tuning Maximum Response Delay according to link type and status, according to the expected number of responders, and link type/status:
  - If the expected number of reporters is large and/or the link condition is bad, select larger [Maximum Response Delay]
  - If the expected number of reporters is small and/or the link condition is good, select smaller Delay
  - If link mode is PTP, choose smaller Delay; or if link mode is PTMP or broadcast, configure larger Delay
- Benefits
  - By making balance between reducing message burst and leave latency to improve overall protocol performance

Triggering Reports and Queries during handover

* Access router triggers a multicast or unicast General Query as soon as it detects a new terminal on its link
* Terminal triggers a Report as soon as it detects its connection to a new network, if it is just in multicast reception state
* Benefits
  * Enable new access network acquire terminal's membership and deliver the content quickly, to help reducing disruption or performance deterioration

Suspend/Resume

- Original idea was proposed by C. Jelger and T. Noel in IEEE Wireless Comm., 2002.
- IGMP/MLD Suspend message requests an adjacent upstream router to suspend forwarding subscribed data while keeping the subscription state.
- IGMP/MLD Resume messages request upstream router to resume forwarding. The Resume Records, specified in the IGMP/MLD Resume message, will be the same as that of the Suspend Records the host sent.
- Benefits
  - Quick resuming of subscribed streams upon movement