Use cases for DIS Modifications

draft-papadopoulos-roll-dis-mods-use-cases-00

Georgios Z. Papadopoulos

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Objective of the Draft

Identify Use Cases that prompt DIS modification

There are several drafts that request modifying the DIS:
• draft-ietf-roll-rpl-observations-03
• draft-thubert-roll-eliding-dio-information-04
• draft-ietf-roll-dis-modifications-01
Use Case: Node Joining DODAG

A smart meter being replaced in the field, while a RPL network is operating and stable.

- The meter will wait for the DIO which might take a long time if the Trickle timers have relaxed due to the steady state.
- If the meter sends a DIS, it will send in multicast, because it has no knowledge of its surroundings (inconsistency).
  - The receivers will reset their Trickle timer to the shortest period.
  - The DIOs will be sent in multicast, which will trigger energy expenditure at nearby nodes.
Potential Solution

• The DIS message may include:
  o The "No Inconsistency" flag set to prevent resetting of Trickle timer in responding routers.
  o The "DIO Type" flag set to make responding routers send unicast DIOs back.
  o A Response Spreading option based on the density of nearby routers.
  o A Metric Container listing the routing constraints that the responding routers must satisfy in order to be allowed to respond.
Use Case: Identifying Defunct DODAG

• A RPL node may remove a neighbor from its parent set for a DODAG for a number of reasons:
  • The neighbor is no longer reachable
  • The neighbor advertises an infinite rank in the DODAG

• However, a RPL node may fail to remove a neighbor:
  • The node may fail to receive the neighbor's DIOs advertising an increased rank or the neighbor's membership in a different DODAG
Use Case: Identifying Defunct DODAG

- Thus, a node would continue to consider itself attached to a DODAG even if all its parents in the DODAG are unreachable or have moved to different DODAGs.
- Such a DODAG can be characterized as being defunct from the node's perspective.
- If the node maintains state about a large number of defunct DODAGs, it may consume a considerable portion of the total memory in the node.
Potential Solution

• The DIS message has the "No Inconsistency" flag set to prevent resetting of Trickle timer in responding routers.
• A Solicited Information option to identify the DODAG in question.
  o I and D flags set
  o RPLInstanceID/DODAGID fields must be set to values identifying the DODAG.
• A Response Spreading option specifying a suitable time interval over which the DIO responses may arrive.
Use case: Adjacencies probing

*To reduce the control traffic overhead, RPL uses the Trickle timer to update configuration parameters.*

- However, in the absence of **regular traffic** or **L2 feedback**, the adjacencies cannot be tested and repaired if broken.
- RPL provides a mechanism in the form of unicast DIS to query a node for its DIO. A node receiving a unicast DIS must respond with a unicast DIO with Configuration Option.
- *This mechanism could as well be made use of for probing adjacencies.*
Discussion: Adjacencies probing

- Should the probing scheme be standardized (recommendations)?
  - frequency of probing depending on traffic conditions.
  - in some cases, it may be advantageous to send multicast DIO as probing response from the parent if it has several child nodes without resetting their trickle timers.
  - probing can happen in both directions, i.e., parent to child and child to parent.
Preliminary results on:
draft-ietf-roll-dis-modifications-01

Configuration setup:
• Cooja – Contiki NG
• Network of 10 nodes in grid topology
• RPL
• 6TiSCH Minimal
N + T flags + MC
N + T flags + MC + RS

![Graph showing mote IDs and data points for N + T flags + MC + RS]
Road Forward

• More Use Cases to be included in the draft?

• Opinions for the future of this use-cases draft?
  o to be included in the appendix of a solution draft?

• Regarding the solution draft, (single or multiple?) :
  o draft-thubert-roll-eliding-dio-information-04
  o draft-ietf-roll-dis-modifications-01
Thanks!