IETF ROLL RPL

- A. Baltas
- C. Moustakakis

RPL (routing protocol for low power and lossy networs)

- Uses IPv6
- RPL organizes a topology as a Directed Acyclic Graph (DAG) that is partinioned into one or more Destination Oriented DAGs (DODAGs)
- There can be different instances over a network
  - a node can belong to more than one instance
- RPL works on two different layers
  - packet processing and forwarding
  - routing optimazation

- RPL can bind a subnet together with a common prefix (a device that has internet access) and to route within that subnet
- To identify and maintain a topology, four values are used
  - RPLInstanceID
  - DODAGID
  - DODAGVersionNumber
  - Rank
- A RPL instance may comprise
  - A single DODAG with a single root
  - Multiple uncoordinated DODAGs with indepented routes

- a single DODAG withe a virtual root that coordinates LLN sinks (with the same DODAGID) over a backbone network
- a combination of above

RPL traffic flow

- RPL supports 3 traffic flows
  - multipoint to point (can be nodes to root)
  - point to multipoint (can be root to nodes)
  - point to point (P2P)
- A flow can be
  - upward (to roots – network) or
  - downward (from roots to nodes)
    - there are 2 modes of downward traffic
      - non-storring: the packet will travel all the way to the DODAG root and then will be send downward to the destination

- storring: the packet can be forwarded downward by a common ancestor (parrent)

- RPL uses Destination Advertisement Objects (DAO) messages to establish a downward route

Joining /Detaching a DODAG and Rank movement

- Upward route discovery allows a node to join a DODAG by discovering neighbors that are members of the DODAG
- A node is allowed to move upward with no consequences. A loop MAY occur if a node try to move downward
- If a node needs to move down a DODAG while its rank is increased it MAY poison its routes

  poisoning can also occur if

  - a node advertises a Rank of INFINITE_RANK
  - a node has a node with Rank of INFINITE_RANK in its parent set

- If a node detaches, he becomes root of its own floating DODAG and should immediatly advertise this new situation
- If a node joins a DODAG as Leaf, it can NOT extend the DODAG connectivity

Sequence Counters

- DODAGVersionNumber
  - ► can only be increment by root. Upon increment a repair sequence occurs where it creates new paths
- DAOSequence
  - ►utilized in DAO messages and DAO ACK messages
- Path sequence
  - ►used to differntiate newer routes. A leaf node must advertise its incremented path sequence number upon path update or upon parent change

RPL Security

- 3 Security options
  - unsecured
  - pre-installed key
    - using a pre-installed key that enable the nodes to process and generate secure RPL messages
  - authenticated
    - nodes can join as Leaves using only the pre-installed key. Joining as a router requres obtaining a key from an authenticated authority