draft-levis-roll-protocols-survey-01

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Draft Goal

- To determine if one or more existing IETF protocols have the potential meet ROLL requirements.
  - If yes, we need to focus on those protocols to examine their use and applicability in ROLL application domains.
  - If no, we can learn what mechanisms are effective for meeting ROLL requirements and discuss need to a define a new protocol (re-charter).
- Authorship changed from Levis, Culler, Vasseur to Levis, Tavakoli, Dawson-Haggerty.

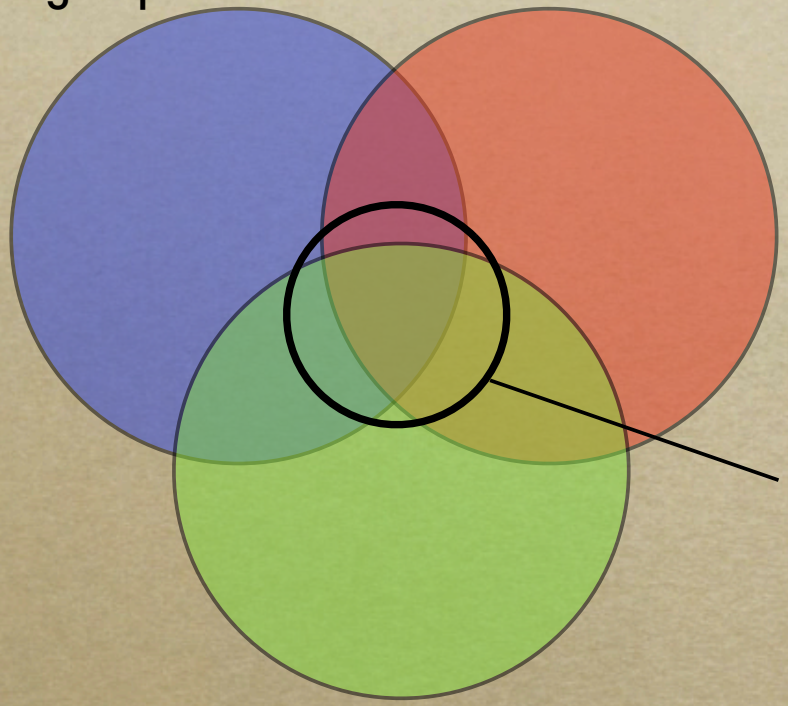
Approach

- Examine current ROLL application requirement drafts
  - Distill a set of common requirements across application domains
  - Establish a minimalist set of criteria
- Examine current IETF routing protocols
  - In RFCs or I-Ds that are on a working group's agenda
  - Evaluate these protocols in terms of ROLL criteria

Deriving The Criteria

draft-ietf-roll-indus-routing-reqs-00

draft-dohler-roll-urban-routing-reqs-01



Intersection of shared requirements

draft-brandt-roll-home-routing-reqs-01

Necessary but not Sufficient

- Focusing on a small intersection of requirements allows us to simplify the evaluation.
- Derived from MUSTs and SHOULDs in drafts.
- Meeting the criteria of these requirements is necessary but not sufficient.
  - Necessary: a protocol must meet this criteria to be useful in any of the application scenarios.
  - Not sufficient: each domain can add additional requirements which a protocol might not meet.

Five Criteria

- Table scalability: how does the routing table size scale?
- Loss response: how expensive is it when links come and go?
- Control cost: how does the control overhead scale?
- Link cost: can the protocol consider link properties?
- Node cost: can the protocol consider node properties?

Evaluation

- Each criterion has three possible values
  - Pass: protocol meets this criterion
  - Fail: protocol cannot meet this criterion
  - ?: protocol could meet the criterion, but how to do so is unclear
- Formal terms
  - N: the number of Nodes in the network
  - D: the number of unique Destinations in the network
  - L: the size of a node's Local neighborhood (density)

Table Scalability

- Refers to how a node's routing table size scales in terms of the number of Nodes, number of unique Destinations, and size of Local neighborhood
- Affects memory requirements, which impacts energy
- Need to scale to large networks
- Cannot directly control size of neighborhood

Fail: Table scales with O(N) or O(L)
- Scaling with O(D) can pass

Loss Response

- The communication cost of an actively used link experiencing high loss (being marked dead, etc.)
- Determines energy cost of network dynamics
  - Number of links in use can scale with N, so simple floods can be $O(N^2)$

Fail: Loss response scales with O(N)
- Scaling with O(1) or O(D) can pass

Control Cost

- The communication cost of maintaining the routing topology.
- Protocols should not waste energy maintaining unused state.

Fail: Control traffic is unbounded in relation to data rate (e.g., fixed periodic beacons).

- Bounded or tied to data traffic passes

Link Cost

- Whether a protocol can consider the fact that different wireless links may have different "costs" to them, e.g., due to packet loss rates.
  - Critical for supporting variable bit rate link layers
  - Critical for loss properties of wireless
  - Constraint-based routing

Fail: Protocol has no way to distinguish link costs (e.g., only hopcount)

- Supporting link metrics passes.

Node Cost

- Whether a protocol can consider the fact that not all nodes are equal and choose routes based on node properties, such as energy or capacity.
  - Includes constraint-based routing

Fail: Protocol has no way to distinguish node properties.

- Supporting node properties passes.

Candidate Protocols

- OSPF (RFC2328, RFC2740)
- OLSRv2 (RFC3626, I-D.ietf-manet-olsrv2)
- TBRPF (RFC3684)
- RIP (RFC2453, RFC2091)
- AODV (RFC3561)
- DSDV
- DYMO[-low] (I-D.ietf-manet-dymo)
- DSR (RFC4728)

Summary

Name	Table Size	Loss Response	Control Cost	Link Cost	Node Cost
OSPF	fail	fail	fail	pass	fail
OLSRv2	fail	fail	fail	pass	pass
TBRPF	fail	pass	fail	pass	?
RIP	fail	fail	fail	?	fail
AODV	pass	?	pass	fail	fail
DSDV	fail	fail	fail	?	fail
DYMO[-low]	pass	fail	pass	fail	fail
DSR	fail	?	pass	fail	?

Conclusion

- Provide a simple summary of application requirements and whether existing protocols meet them
  - Criteria may evolve slightly as application drafts mature
  - We can refine the summary table on the mailing list
- Looking for feedback on methodology
  - Criteria
  - Protocols
- Working group adoption
  - Item of current charter