draft-levis-roll-protocols-survey-01

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Draft Goal

• To determine if one or more existing IETF protocols have the potential to 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 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
- draft-brandt-roll-home-routing-reqs-01

Intersection of shared requirements
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

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<th>Control Cost</th>
<th>Link Cost</th>
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</table>
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