

TAMU-RPL

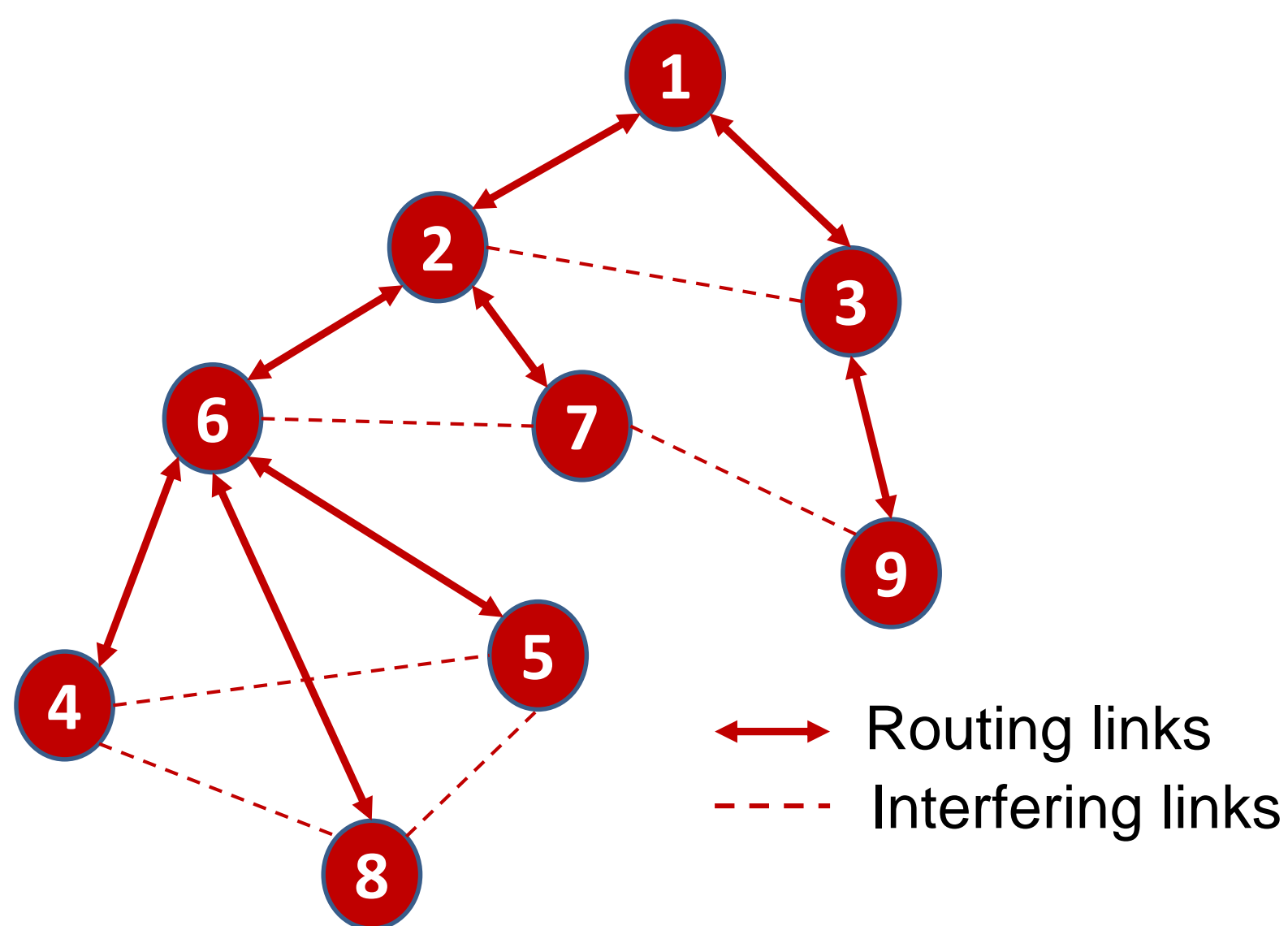
Thompson sampling-based Multi-channel RPL

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Routing Protocol for Low-Power and Lossy Networks

- *De facto* protocol for LLNs based on 6LoWPAN
- **Distance-vector protocol**
- Destination Oriented Directed Acyclic Graphs (DODAGs)
- **Objective Function (OF)**
 - Calculates **DAGRank** (distance to sink node)
- Default OF
 - **Minimum Rank with Hysteresis (MRHOF)**
 - DAGRank based on ETX



DAGRank calculation

$$Rank(N) = Rank(P) + \left((3 \times \widehat{ETX}) - 2 \right) \times 256 \quad (1)$$

MRHOF based on ETX

Problem:

- ETX estimation requires unicast packets
- Nodes just keep an accurate estimate with preferred parent
- Very slow adaptation to dynamic environments

Solution:

Multi-armed bandit model
Exploration-exploitation tradeoff

Thompson sAmpling-based MUlti-channel RPL (TAMU-RPL)

Future works

- Implementation in testbed
- Convert model to Bernoulli trials
- Create adaptive **schedules** for **energy saving**

MAB model

- One **arm** to each **stable neighbor**
- Number of acknowledged packets is **Binomial**(p)
- Prior distribution **Beta**
- Posterior distribution:

$$Beta \left(1 + \sum_{i=1}^n x_i, 1 + \sum_{i=1}^n N_i - \sum_{i=1}^n x_i \right) \\ = Beta(1 + S_n, 1 + F_n) \quad (2)$$

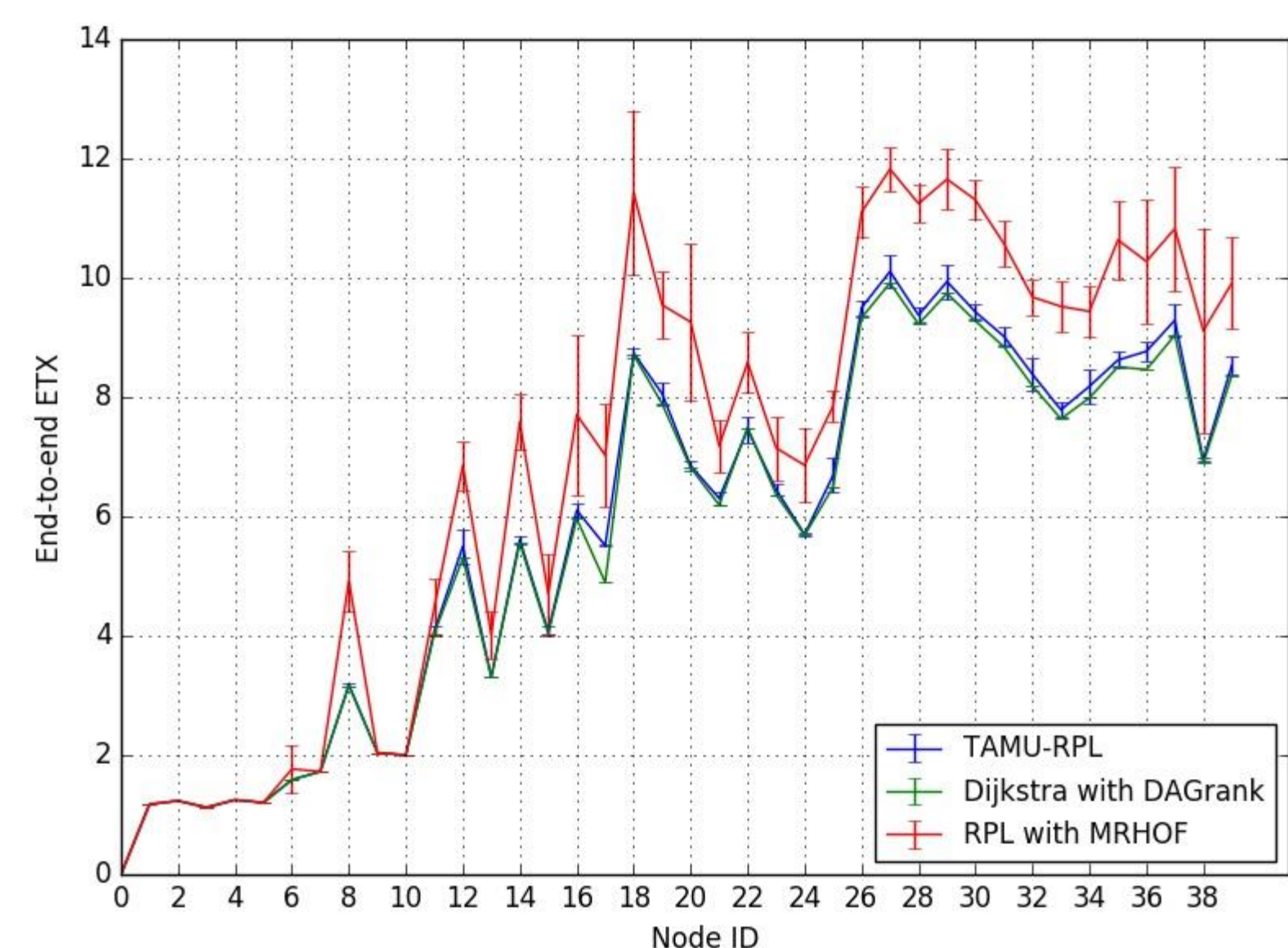
Algorithm

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For each  $t = 1, 2, \dots$ ,
   $L$  = list of stable neighbors
  For each neighbor  $i$  in  $L$ 
    Independently sample
       $\theta_{i,t} \sim Beta(1 + S_{i,t-1}, 1 + F_{i,t-1})$ 
    Set  $\widehat{ETX}_i = \frac{1}{\theta_{i,t}}$ 
  End for
  Select preferred parent
  that minimizes (1)
  Update  $S_{N_t,t}$ 
  Update  $F_{N_t,t}$ 
End for
    
```

Preliminary results

Static network (one PRR trace)



Dynamic network (28 PRR traces)

