Routing in Multi-Radio , Multi-Hop Wireless Mesh Networks

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Outline

- ☐ Introduction
- ☐ The MR-LQSR Protocol
- ☐ Simulation Result
- ☐ Conclusion

Introduction

- There is no standard routing protocol which be made in ad hoc networks

- Source routing mechanism

- The MR-LQSR is a routing protocol with the metric

- The goal of the *metric* is to choose a high-throughput path between a source and a destination

Introduction

- ☐ Our metric assigns weights to individual links based on Expected Transmission Time (ETT)

- ☐ The ETT is a function of the loss rate and the bandwidth of the link

Introduction

- ☐ Define of ETX
  - ■ Expect Transmission Count [15]

$$p = 1 - (1 - p_f) * (1 - p_r)$$

  - ■ p denote the probability that the packet transmission from X to Y is not successful

$$s(k) = p^{k-1} * (1 - p)$$

  - ■ s(k) denote the probability that the packet will be successfully delivered after k attempts

Introduction

☐ Define of ETX

$$\mathrm{ETX} = \sum_{k=1}^{\infty} k * s(k) = \frac{1}{1-p}$$

■ The expected number of transmission required to successfully deliver a packet from X to Y is denoted by ETX

$$\mathrm{ETT} = \mathrm{ETX} * \frac{S}{B}$$

■ S: size of the packet
■ B: bandwidth

The MR-LQSR Protocol

- ☐ MR-LQSR (Multi-Ratio Link-Quality Source Routing)
  - ■ assigns a weight to the links a node has with its neighbor
  - ■ Uses the link weights to find a good path for a given destination
- ☐ We assume that if a node has multiple radios , they are turned to different , non-interfering channels .

The MR-LQSR Protocol

- ☐ Our path metric is called Weighted Cumulative ETT(WCETT)

$$WCETT = \sum_{i=1}^{n} ETT_i$$

- ☐ For a path consisting of n hops

$$X_j = \sum_{\text{Hop i is on channel j}} ETT_i \quad 1 \le j \le k$$

- ☐ Xj is the sumof transmission times of hops on channel j

The MR-LQSR Protocol

$$\text{WCETT} = (1 - \beta) * \sum_{i=1}^{n} \text{ETT}_i + \beta * \max_{1 \le j \le k} X_j$$

☐ The first term is the sum of transmission times along all hops in the network. This reflects the total resource consumption along this path

☐ The second term reflects the set of hops that will have the most impact on the throughput of this path.
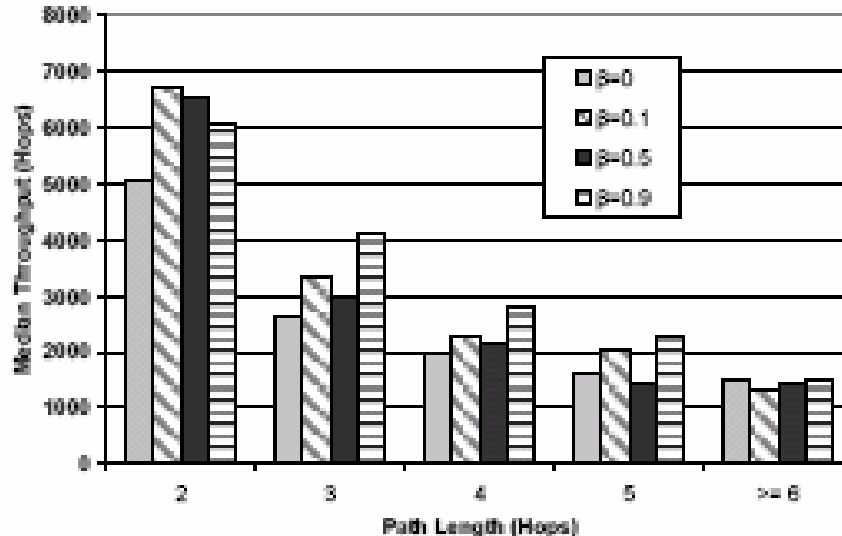
The MR-LQSR Protocol
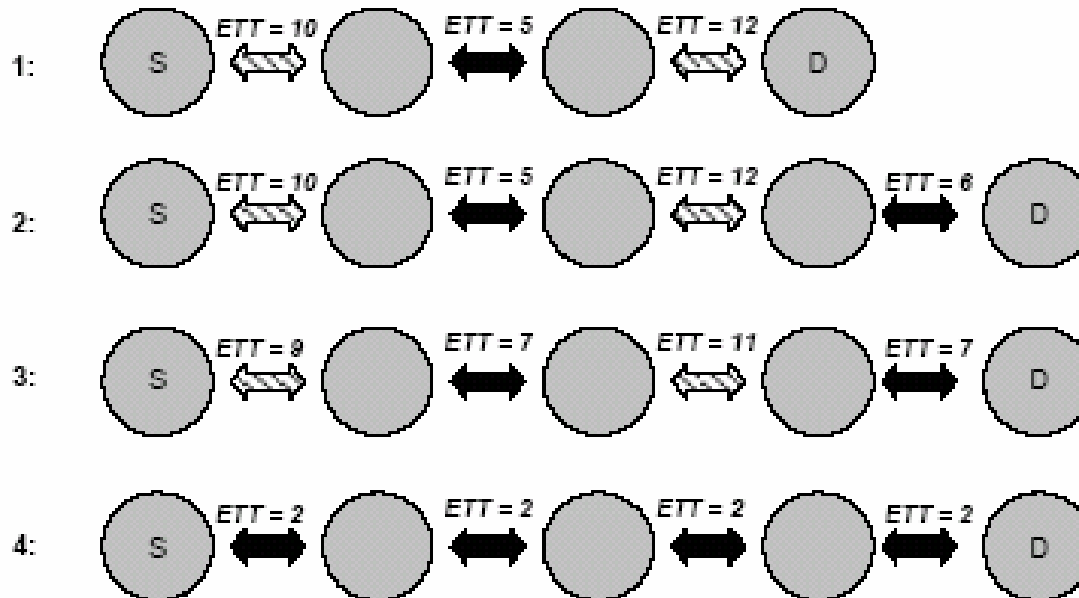
Path	Sum	Max	WCETT $(\beta = 0.9)$	WCETT $(\beta = 0.1)$
1	27	22	22.5	26.5
2	33	22	23.1	31.9
3	34	20	21.4	32.6
4	8	8	8	8

The MR-LQSR Protocol

	$\beta = 0$	$\beta = 0.1$	$\beta = 0.5$	$\beta = 0.9$
Throughput (Kbps)	2726	2939	2989	2897
Path Length (Hops)	3.1	3.9	3.0	4.0
CDI	0.23	0.25	0.47	0.47

- β can be seen as offering a tradeoff between maximizing the throughput of a single flow and the consuming fewer global resource
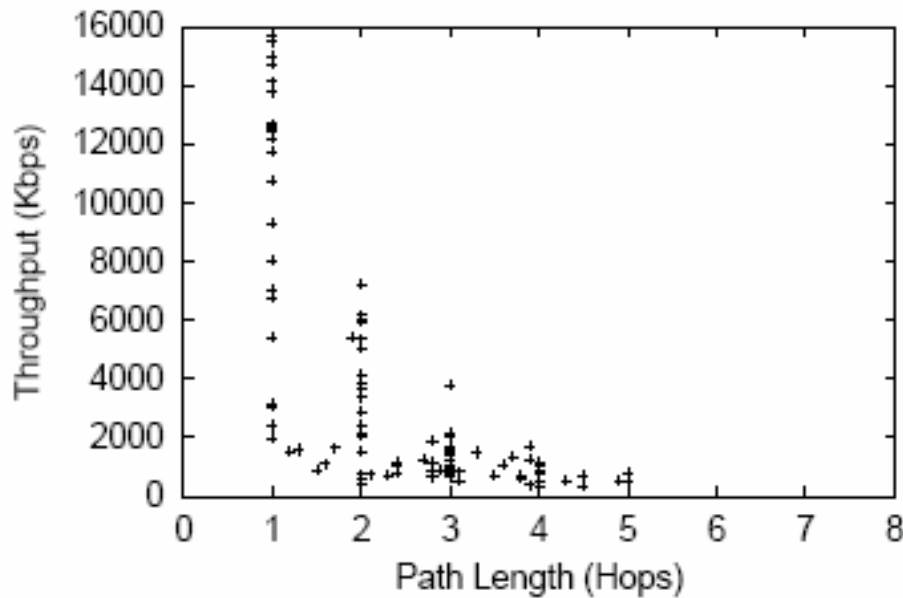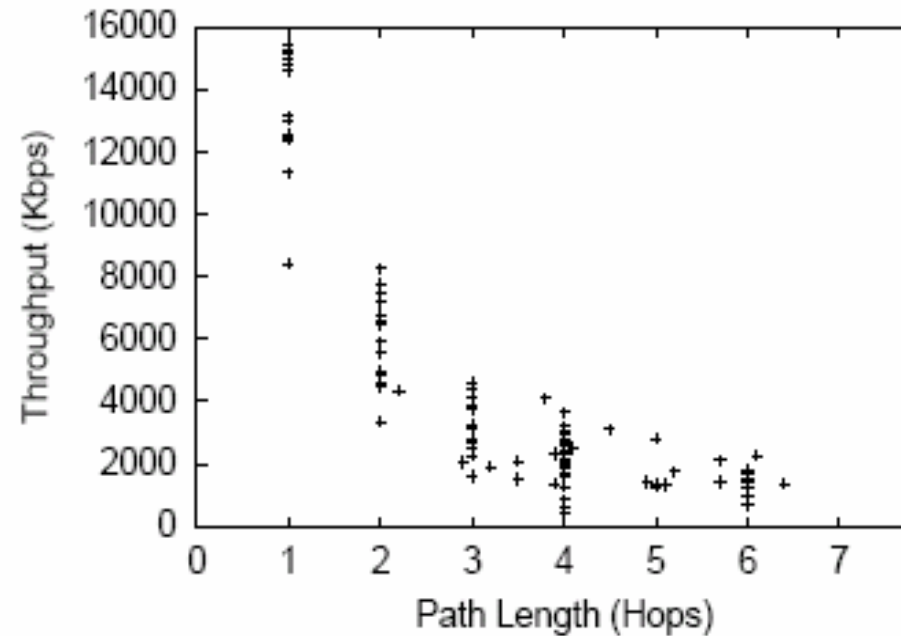
Simulation Result
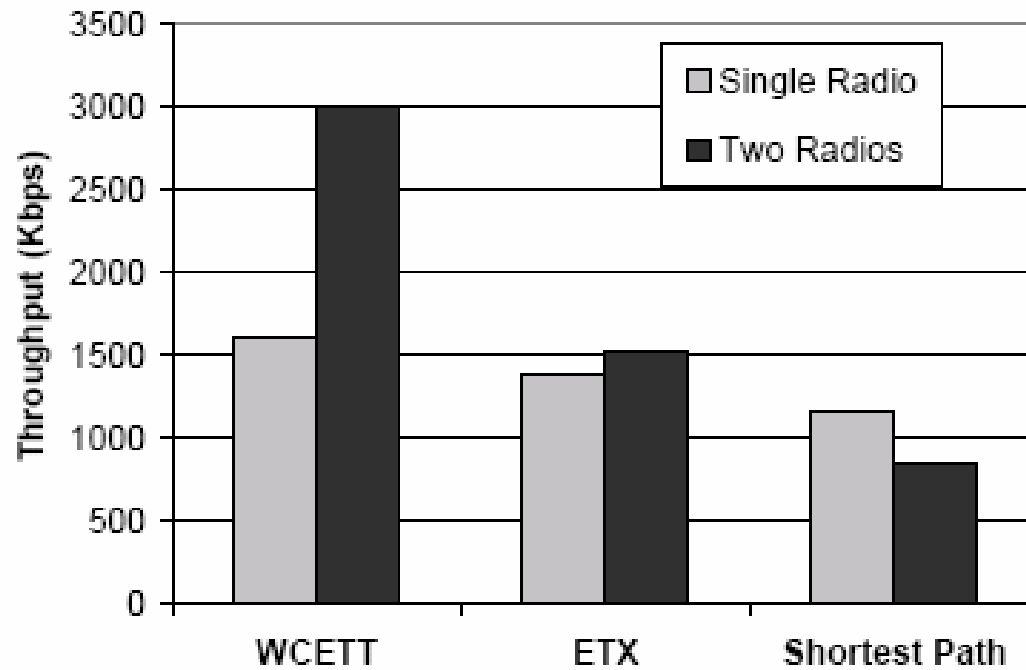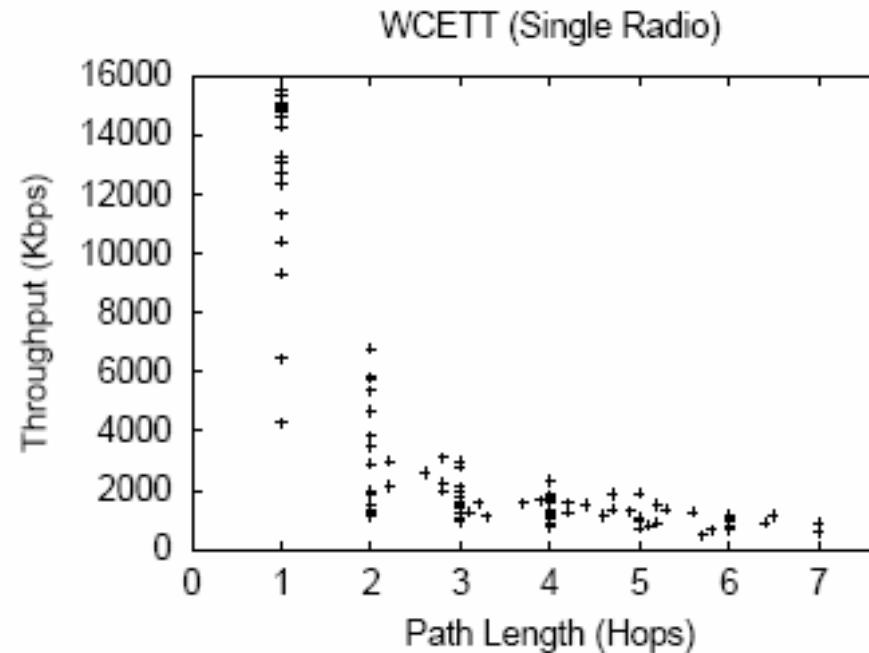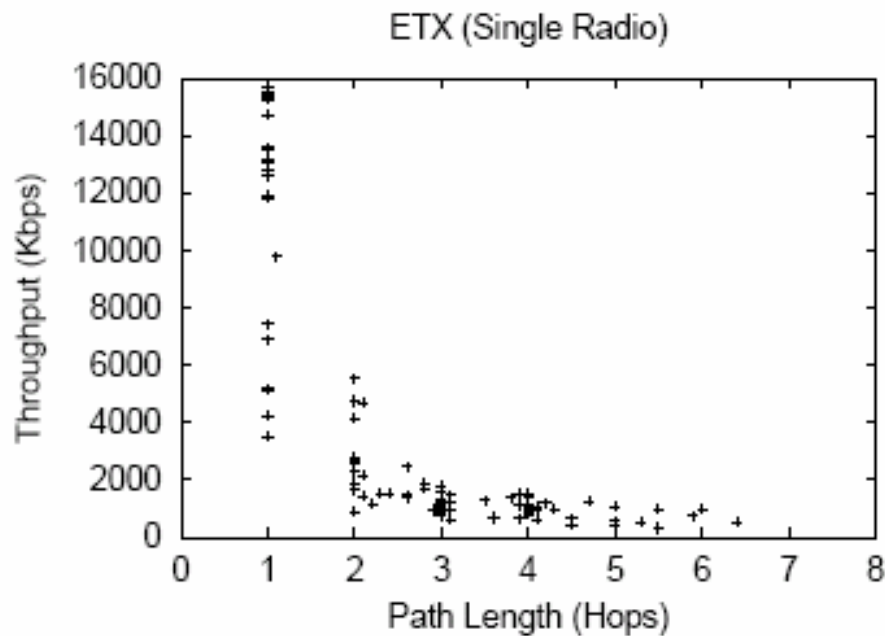
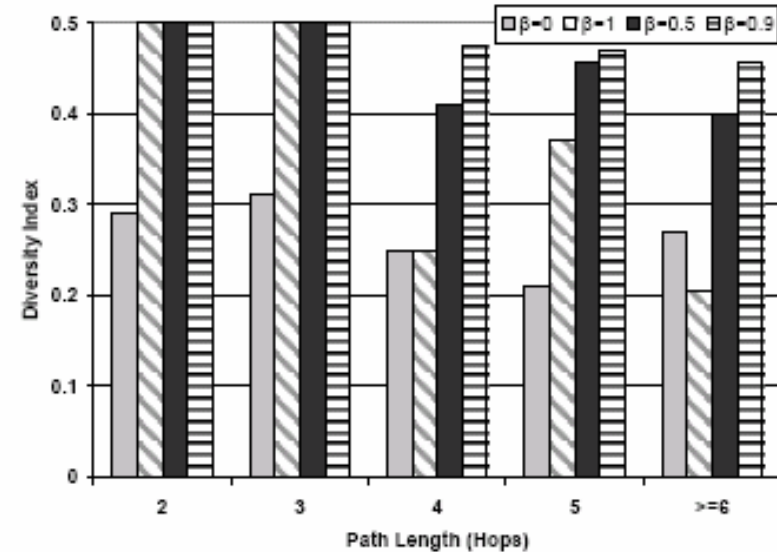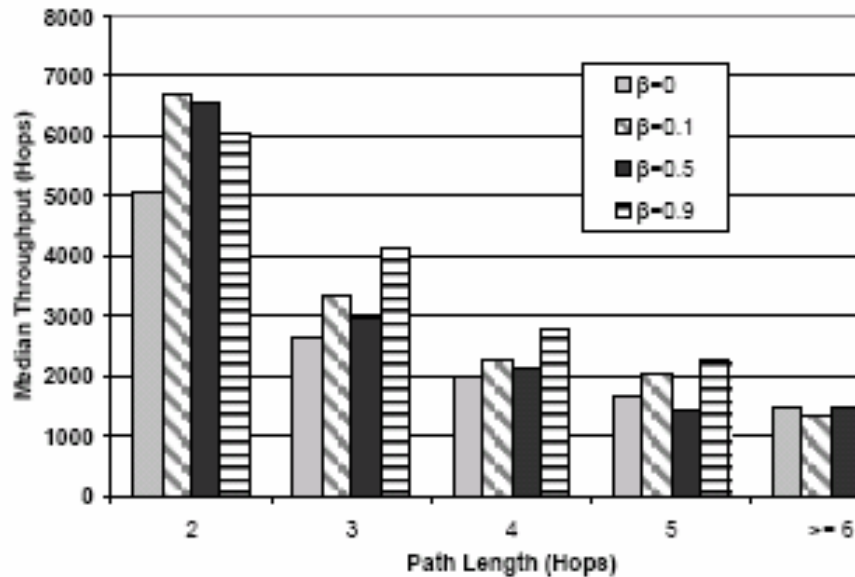# Simulation Result
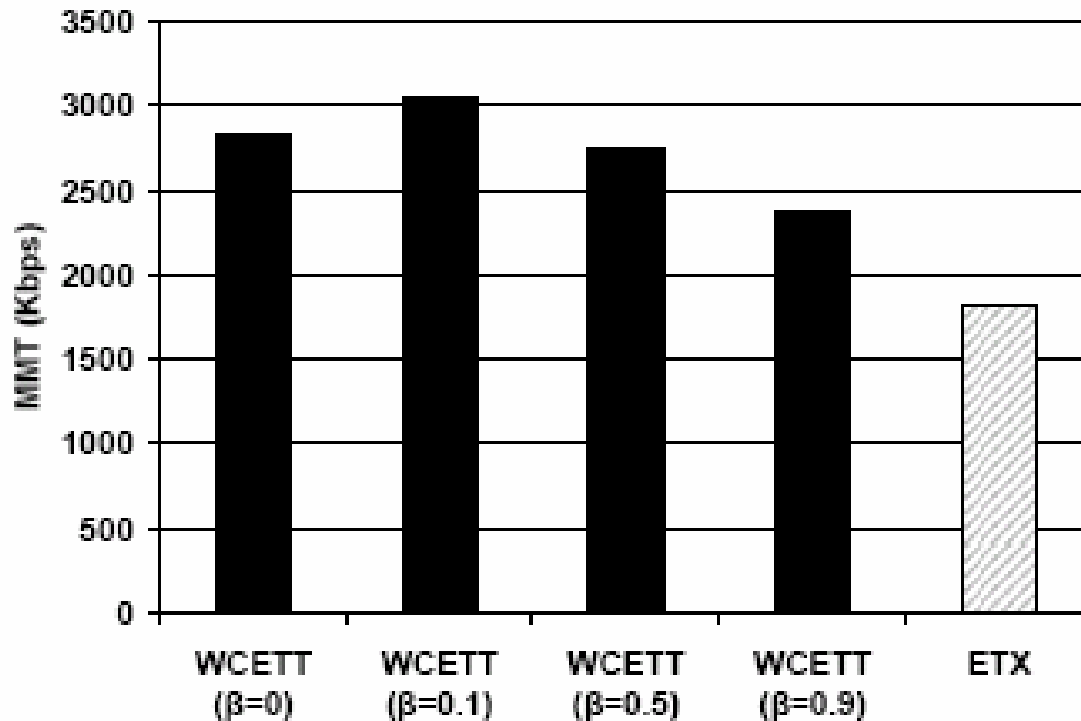
Simulation Result

ETX (Two radios)

WCETT (Two radios)

Simulation Result

Simulation Result

Conclusion

- ☐ A routing protocol MR-LQSR with a new metric WCETT is implemented
- ☐ WCETT allows us to tradeoff channel diversity and path length by changing the value of the control parameter β