Wireless Mesh Networks

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1.   INTRODUCTION

Definition of wireless mesh networks (WMNs) and unique properties. How WMN differ from wireless LAN (WLAN) and *ad hoc* networks. Current and expected application areas. What are the major issues pertaining to WMN.

2.   MODELING AND CAPACITY

Modeling is typically done by connectivity and interference graphs, though this has limitations, and cannot easily capture many effects, including the broadcast nature of the MAC and intermittent connectivity. Capacity is currently calculated in various ways, including the Gupta and Kumar theoretical capacity analysis, the clique model, and the collision domain models. We will focus on the latter two, as they are the most practical at given a rule-of-thumb estimate of network capacity. We will also discuss routing protocols and metrics, as the actual capacity is often deeply related to these choices. After this portion of the tutorial, attendees should be able to model a WMN and estimate its carrying capacity. Also, they will be familiar with the major routing protocols and metrics used in WMN.

3.   MULTI-RADIO AND MULTI-CHANNEL SYSTEMS

Single-channel networks are severely limited in both capacity and delay. Multi-channel systems offer higher capacity, but only multi-radio multi-channel systems can offer the parallelism necessary to reduce the delay. We discuss here approaches to multi-radio systems, their advantages and their limitations. We describe practical issues involved, based on our experiences at Waterloo. After this section, attendees should understand the advantages of multi-channel systems, and the difficulties in realizing them, including problems of interference, routing, and channel assignment.

4.   CONGESTION CONTROL, LOAD BALANCING, FAIRNESS AND QUALITY OF SERVICE

WMN have significant congestion control and fairness problems. Excess load drives throughput down, while short-hop routes starve long-haul routes. Further, while most extant WMN have multiple gateways, they tend to operate as multiple single-gateway networks. Quality of service is largely lacking. In this portion of the tutorial we will describe the technical problems and current approaches to these issues. After this section attendees should understand congestion causes and fairness problems unique to WMN, as well as some of the proposed solutions.

5.   DEPLOYMENT ISSUES

Practical deployment experience shows that simple models, while useful, are largely wrong. Metrics for routing need to take into consideration expected throughput based on network measurement. Self-organization is critical, but currently lacking. In this section attendees will get an appreciation for what is required to take the ideas of WMN and implement them in real systems.

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