Conference or Workshop Item

Title: Optimisation of routing protocols for Wireless Mesh Networks (WMNs) to achieve higher quality of service for real time applications

Creators: Dravid, R. and Al-Sherbaz, A.


Version: Presented version

http://nectar.northampton.ac.uk/4785/
Optimization of Routing Protocols for Wireless Mesh Networks (WMNs) to Achieve Higher Quality of Service for Real-Time Applications

Rashmi Dravid
School of Science & Technology
rashmi.dravid@northampton.ac.uk

Dr. Ali Al-Sherbaz
School of Science & Technology
ali.al-sherbaz@northampton.ac.uk

Application: Disaster Management

- Research addresses ‘Response Phase’ of disaster management cycle

Project Objectives

- Evaluate performance of existing WMN routing protocols for their suitability and limitations with respect to:
  - Diverse Wireless Technologies
  - Platforms and Standards
- Optimise existing WMN routing protocols to improve energy efficiency by:
  - Modelling Node Behaviour
  - Adapting routing algorithms to be less computationally intensive.
  - Adapting routing and data forwarding on paths that consume less energy.
  - Supporting Quality of Service (QoS) for service differentiation

WMNs: Disaster Application

- Research in context of an active research project - iSurvival-Collaborative Mobile Network System for Disaster Management[1].
- Wireless Mesh Networks (WMN) are set-up using smart mobile devices in the disaster area (Figure 2)
  - Facilitate exchange of information between disaster victims and first responders in the absence of conventional (GSM, 3G, GPS...) communication networks.

Challenges: Disaster Application

- Limited Battery Life of Mobile Devices
  - Optimised and ‘Green’ routing algorithms are important to minimize transmission energy consumption for each communication request and help prolong network survivability.
- QoS (Quality of Service) Support
  - Communication traffic from disaster area using Smart mobile devices may have a mix of voice, video, image and text data. Routing algorithm need to be optimised to support traffic differentiation.

References


Node Behaviour

Five state Finite State Machine (FSM) proposed to model node behaviour:

1. Idle State: The node is in a steady state with respect to its routing database.
2. Discovery: Node is finding neighbours by sending ‘hello’ messages.
3. Maintain: Node is updating its routing database etc.
5. Forward: Forwarding control/data packets from other nodes. Node in forwarding state could be in any of the above four states and yet forwarding data/routing information from other nodes.

OLSR Performance: 22 node MANET Network:

- Smart Mobile devices that set-up wireless mesh networks with other such devices in the disaster area also serve as routing nodes.
- Performance evaluation and optimisation of existing MANET routing protocols in terms of energy requirements for:
  - Route Discovery,
  - Route update and maintenance,
  - Routing and Forwarding data,
  - Support for Traffic differentiation
- Some examples of well known MANET protocols: AODV, OLSR, DSR...

Methodology

- Simulate proposed FSM model (Fig. 3) for MANET protocols to study the state behaviour of a mobile node by varying:
  - Node density, Area size, node mobility and other parameters
  - Compute energy consumption of nodes in different states
  - Optimise algorithm for energy efficient routing protocol/s to support service differentiation
  - Mathematical analysis of routing process using Markov chain/FSM to validate experimental results

OLSR Performance:

- OLSR (Optimised Link State Protocol) uses MPRs (Multi Point Relays) to reduce overhead of control traffic.
- OLSR provides better support for QoS due to low connection latency.
- Existing solution for QoS routing with OLSR, called QOLSR based on MPR selection
- Simulation below demonstrates MPR behaviour in routing convergence for varying node density.

Simulation

- OLSR (Optimised Link State Protocol) uses MPRs (Multi Point Relays) to reduce overhead of control traffic.
- OLSR provides better support for QoS due to low connection latency.
- Existing solution for QoS routing with OLSR, called QOLSR based on MPR selection
- Simulation below demonstrates MPR behaviour in routing convergence for varying node density.