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

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Example citation: Dravid, R. and Al-Sherbaz, A. (2012) Optimisation of routing protocols for Wireless Mesh Networks (WMNs) to achieve higher quality of service for real time applications. Poster presented to: *3rd Annual Grace Hopper Celebration of Women in Computing India (GHCI), Bangalore, India, 12-14 December 2012.*

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

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Application: Disaster Management

- Research addresses 'Response Phase' of disaster management cycle

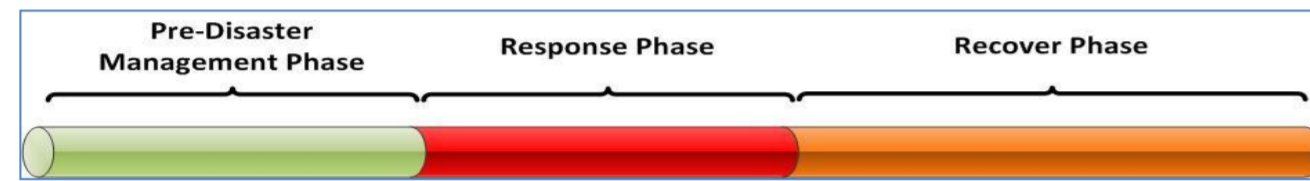


Figure 1: Three major stages in disaster management cycle

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

[1] [iSurvival: a collaborative mobile network system for disaster management](#). 13th International Federation for Information Processing (IFIP) WG 5.5 Working Conference on Virtual Enterprises, PRO-VE 2012, Bournemouth, UK, 01-03 October 2012.

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

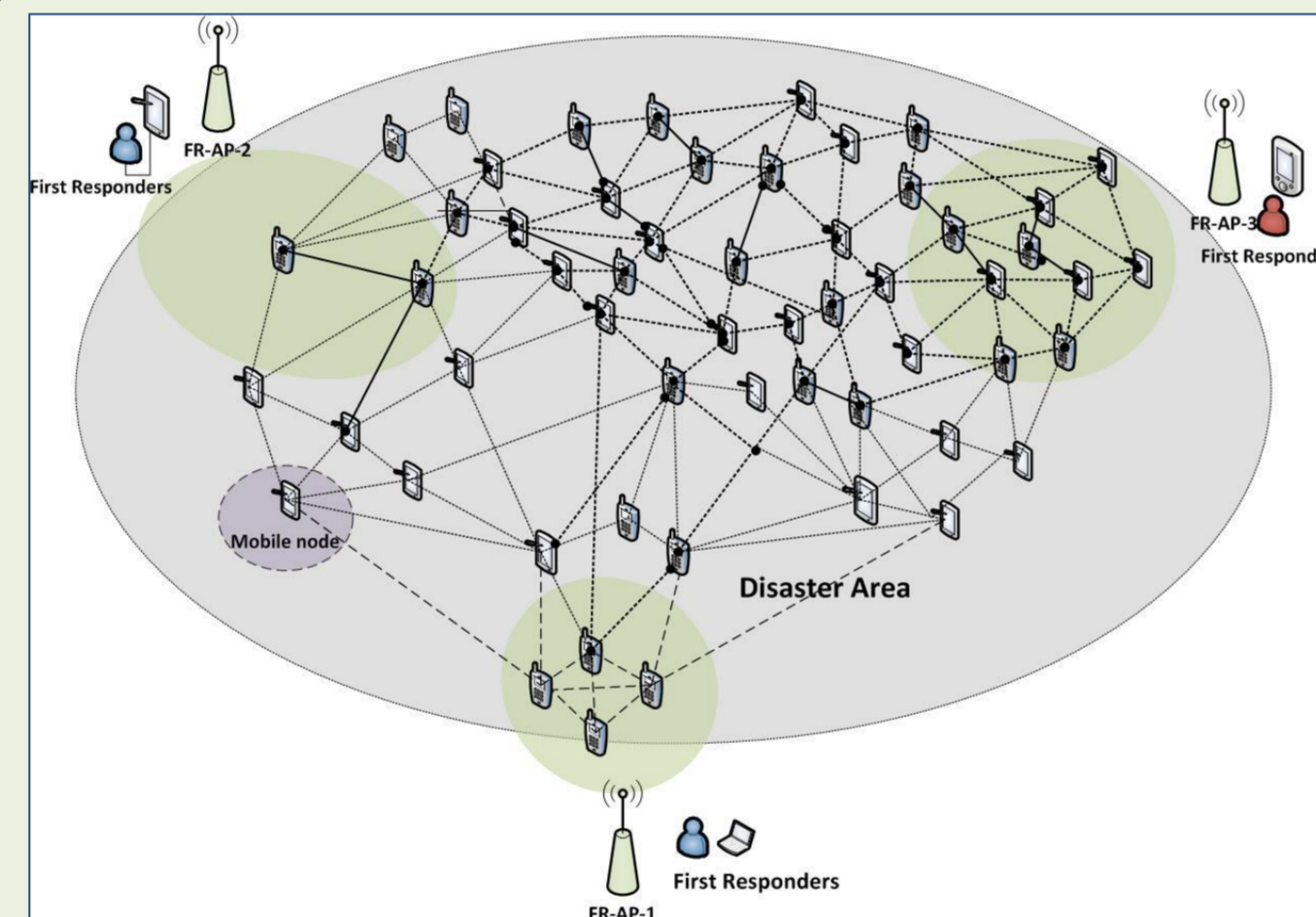


Figure 2: WMNs set-up using smart phones in disaster area

WMN Routing

- 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,..

Node Behaviour

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

- Idle State:** The node is in a steady state with respect to its routing database.
- Discovery:** Node is finding neighbours by sending 'hello' messages.
- Maintain:** Node is Updating its routing table etc.
- Comm. (Communicating):** Node actively engaged in data transfer with other nodes..
- 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.

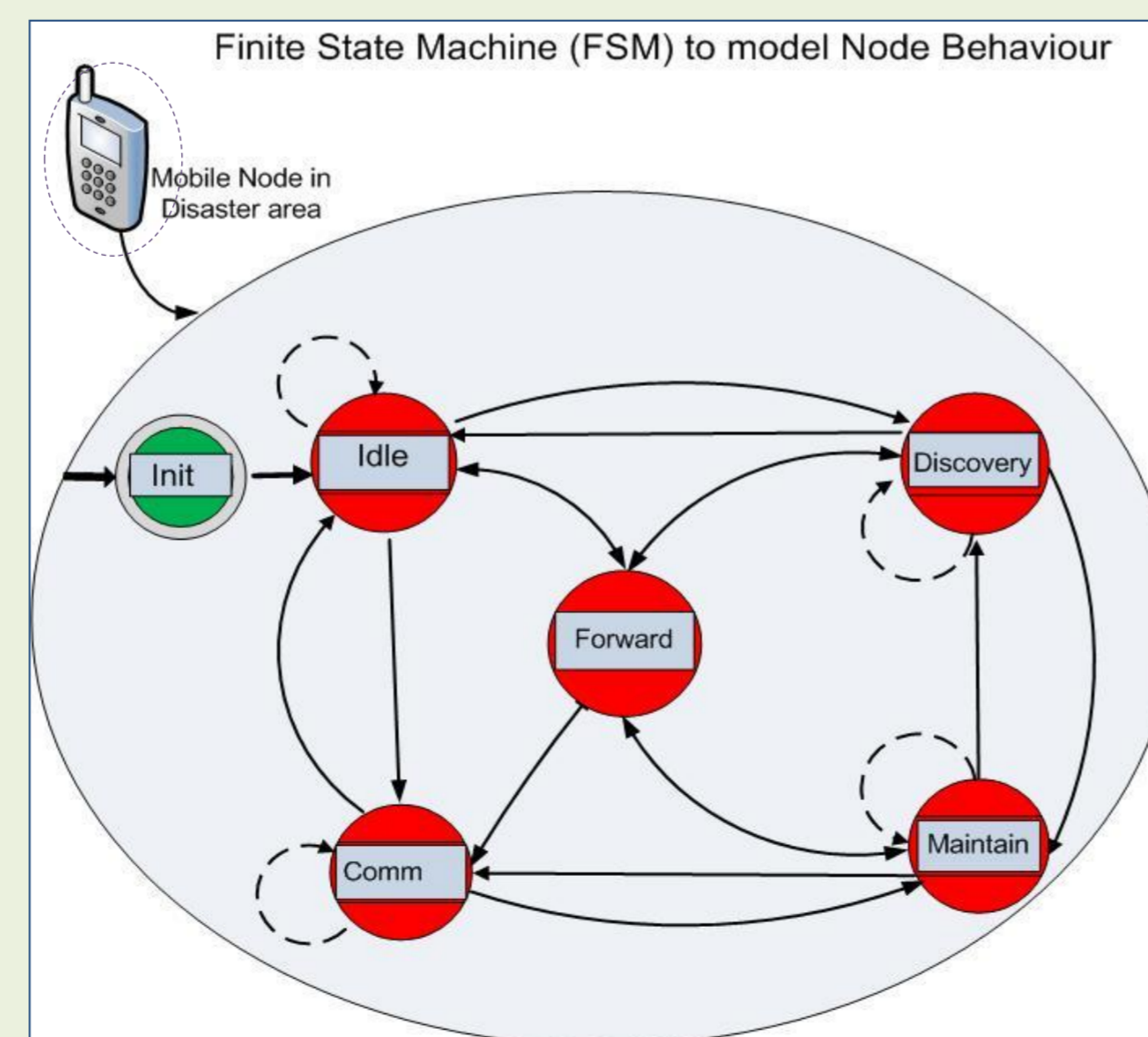


Figure 3:FSM (Finite State Machine) to Model Node behaviour

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

Simulation

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

