

# Department of Atomic Energy

## Network Routing Protocol For Infrastructureless Gateway Devices In Man-made Emergency Situations

A Mobile Adhoc Network (MANET) protocol based on device geographical location information is conceptualized to serve as a gateway device. Problem is coding, simulation and testing of scalability. The conceptualized MANET protocol shall establish the source to destination path similar to zone routing protocols (ZRP). The path to destination is referred at source, in terms of the geological zones therefore allowing movement of intermediate mobile devices across path without disturbing the path. The devices get assigned new zone automatically using the GPS. The simulation scenario shall be source node in searching a path to friendly destination device, exchange data (hello) and drop the link.

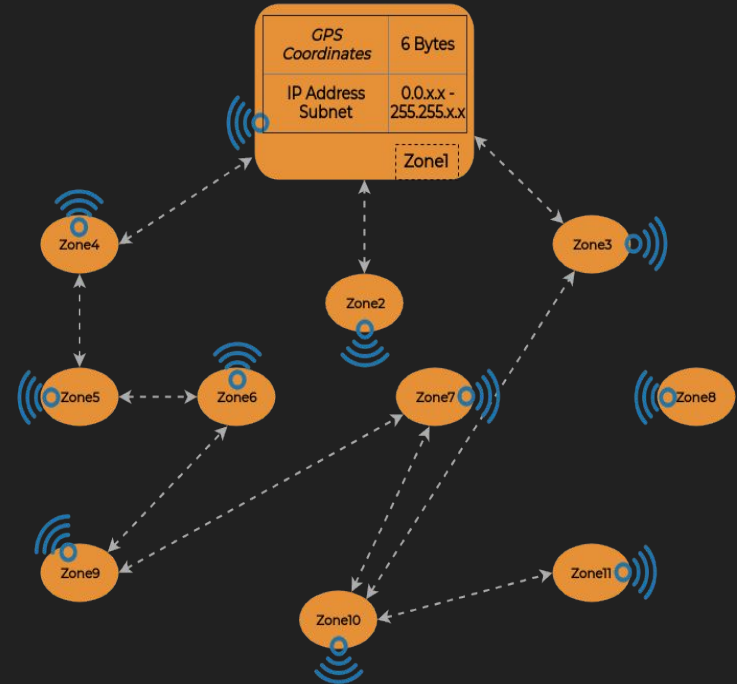
**Team:** CodePlay

**Team Leader:** \*\*\*\*

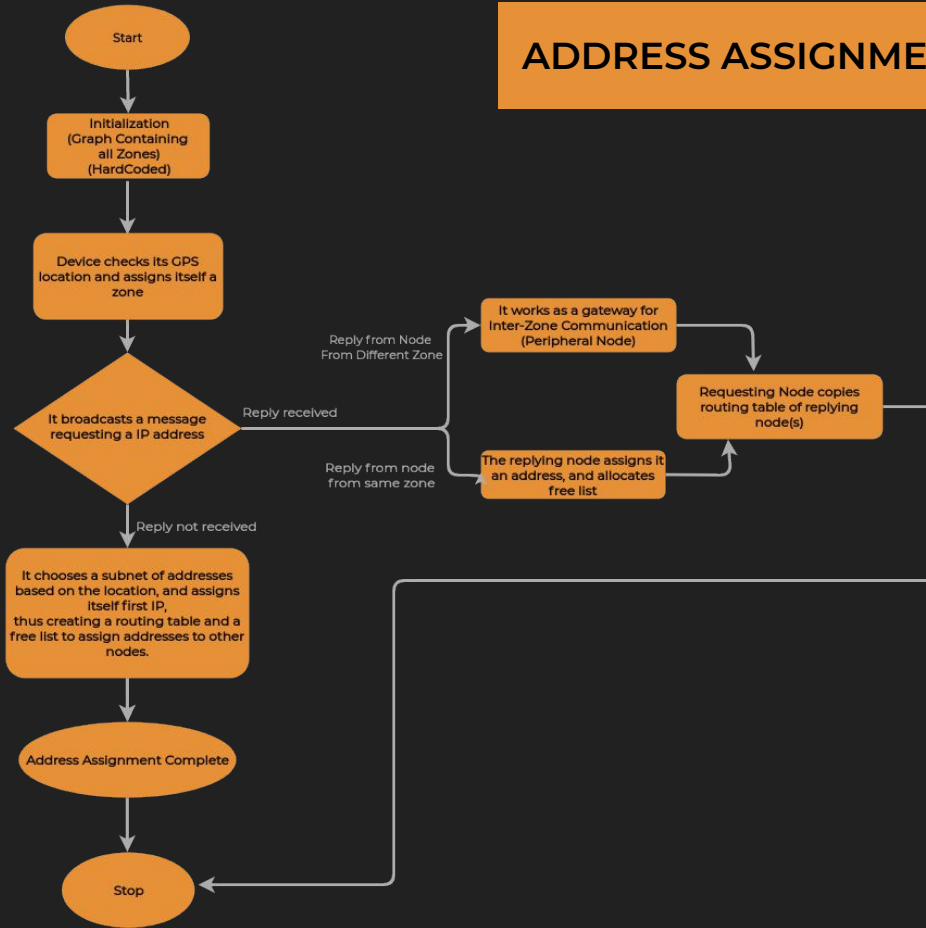
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# An Ad-Hoc Networking Protocol for Emergency Situations

As a solution, a protocol is to be designed, based on Zone Routing Protocol. The ZRP, by default uses a fixed zone radius using number of hops between nodes. We modify the existing protocol, to cater fixed GPS based zones. A graph showing proximity between zones, called as ZoneGraph, is hardcoded into the protocol. This ZoneGraph is used for route determination of data transmission. If the best route is unavailable, due to absence of enough nodes in a zone, another path can be determined, with the help of ZoneGraph.



## ADDRESS ASSIGNMENT (*Initialization*)



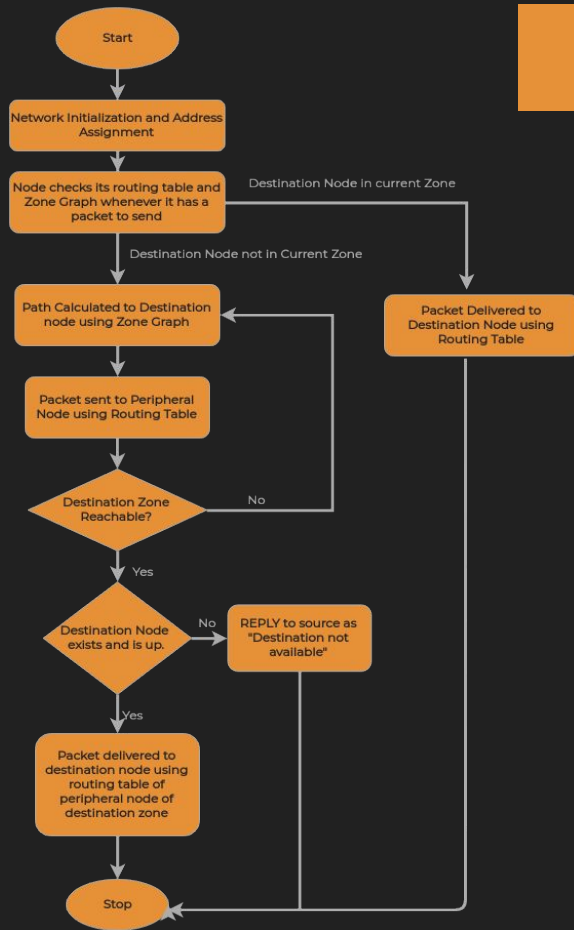
- We assume that the MANET starts with a single node, we call this node initiator node and configuration of this node as manet initialization. The initiator refers ZoneGraph to infer IP address subnet of the zone to which it belongs.
- After MANET initialization everytime a requester requests an IP address, one of the existing MANET nodes i.e. an *allocator* within range of requester initiates address allocation process. If allocator has non-empty free\_ip set, it allots second half of the addresses from the set to the requester (analogous to buddy system) otherwise it performs exhaustive search for a free ip address.
- It is to be decided if the requester can work as normal node or peripheral node based on its proximity to nodes of other zones

### 1. Address Assignment Flowchart

## Route Discovery

- Whenever a node has a packet to send, it checks whether the destination is in the zone itself.
- Then it determines the best possible path to the destination, using the ZoneGraph.
- Similar to ZRP, 3 types of packets are defined:
  1. **REQUEST:**  
Request an Interzone source route to the destination host specified in Destination Address
  2. **REPLY:**  
Response to a request packet; includes the source route to the destination host specified in Destination Address.
  3. **FAILURE:**  
Destination node not found.

## 2. Route Discovery Flowchart



## Differentiation:

- Existing protocols rely on routing using nodes. But node mobility changes network topology. As a result, in a network of mobile nodes, those protocols cannot be used. The proposed protocol uses Zones for route determination. As zones are fixed, host mobility has no effect on route.
- Due to modular design, both ipv4 and ipv6 can be implemented in the protocol, with little modification. Other protocols rely heavily upon either ipv4 or ipv6
- Low overhead due to balance between proactive and reactive methods, and as a result, highly scalable.
- Broadcasting a message to a particular zone is made possible. (Geocast)

## Use Cases

1. During emergency situations, softwares, which have this protocol underlying, can be used to create city-wide MANETs with 1000s of nodes.
2. In industries having huge geographical span (Power Plants, Oil and Gas Industries etc), different zones can be predetermined, and encoded into the software, which is to be used in emergency situations.
3. Relief providers like Police, NDRF etc, can use similar softwares, for communication when other infrastructure dedicated devices are unavailable, even during transit.

## Limitations/Barriers/Stoppers

1. When there is no node in a zone, the zone and other subsequent zones are unreachable until a new node becomes a part of zone.
2. Fragmentation of nodes within a zone may occur.

## Technology Stack

1. Protocols
  - Zone Routing Protocol (ZRP)
  - Ad-Hoc On Demand Distance Vector (AODV)
  - Internet Control Message Protocol (ICMP)
2. Algorithms
  - Bellman Ford Algorithm
3. Network Simulator - 3
4. GNU Plot