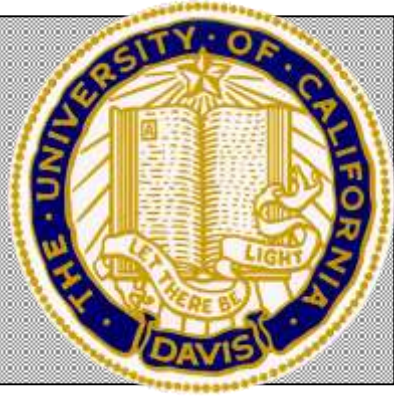

Routing Algorithms & Issues in Wireless Routing Techniques

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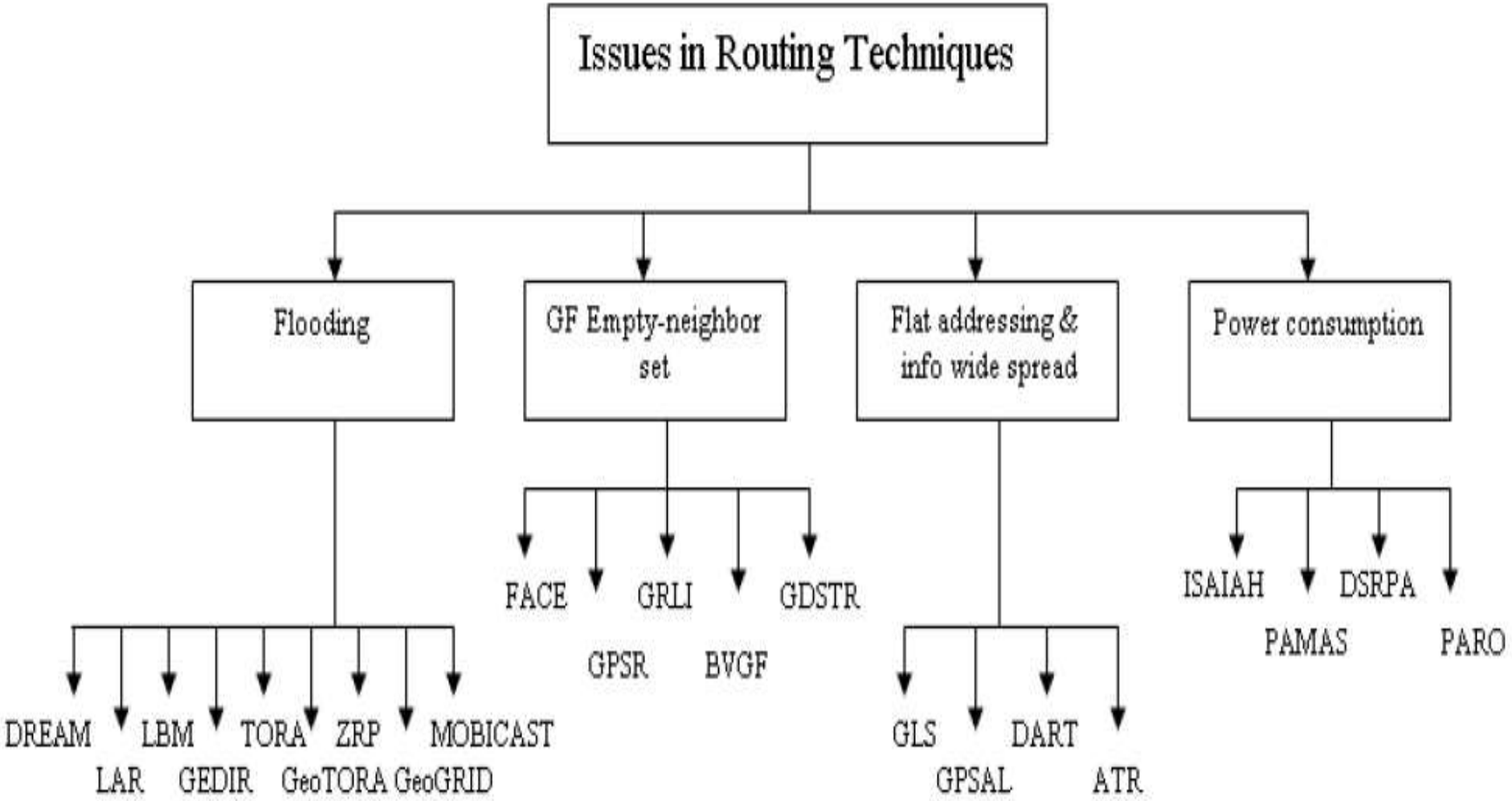
Introduction

- Developing routing algorithm for a wireless network should consider the distinct wireless-physical characteristics

- New techniques can be used to avoid issues:
  1. large flooding area
  2. GF empty neighboring set
  3. difficult process to collect information
  4. large energy consumption


Issues in Routing Techniques
Flooding
GF Empty-neighbor set
Flat addressing & info wide spread
Power consumption
FACE
GRLI
GDSTR
GPSR
BVGF
ISAIAH
DSRPA
PAMAS
PARO
DREAM
LBM
TORA
ZRP
MOBICAST
LAR
GEDIR
GeoTORA
GeoGRID
GLS
DART
GPSAL
ATR

Flooding

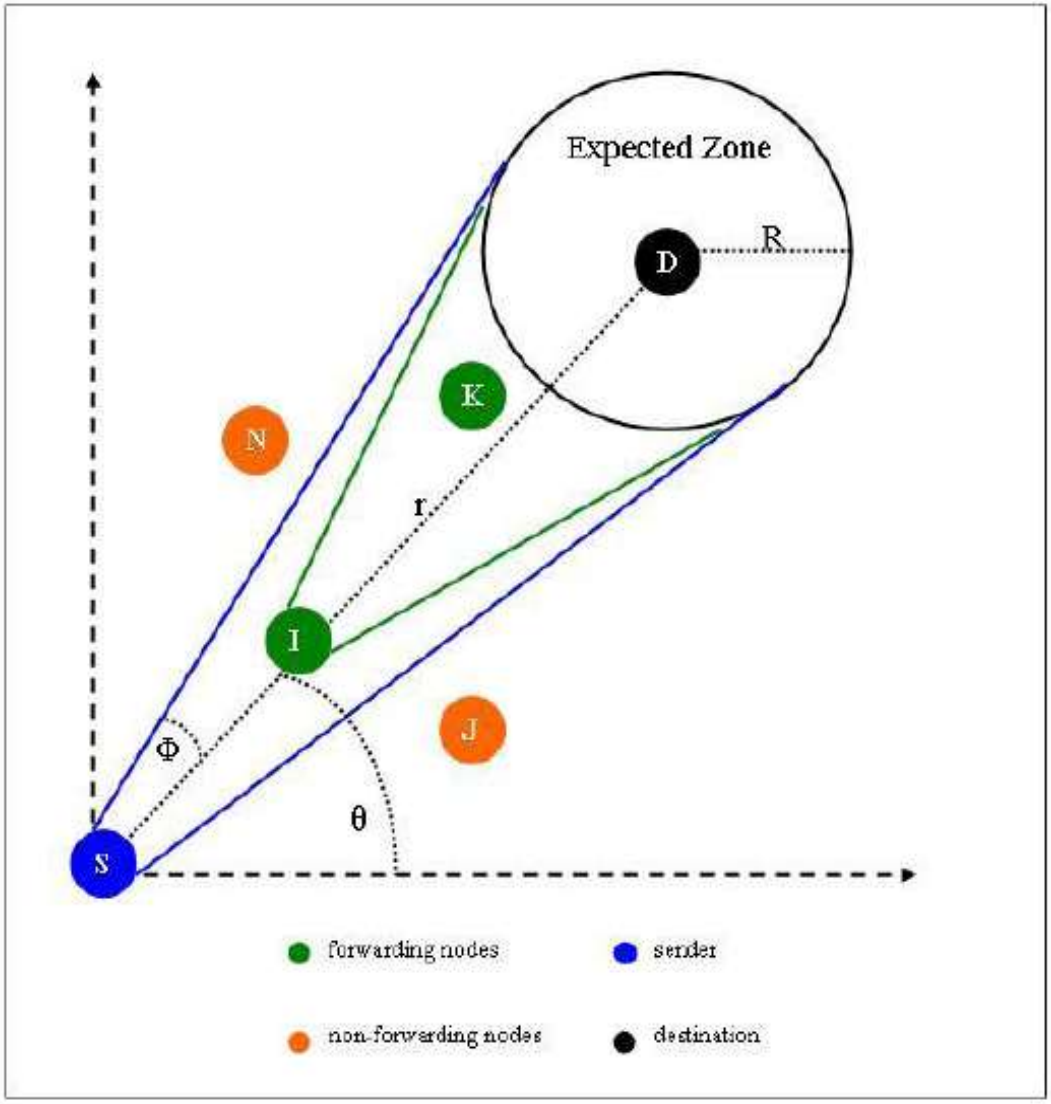
- Flooding is a routing technique that is used during the route-discovery phase or as a recovery method to deliver a message from a source to a destination
- A source broadcasts a RRQST to all of its neighbors (nodes within node S's transmission range) looking for node D
- A neighbor node (N) (representing any intermediate node) checks if the RRQST is sent to itself; if not, node N broadcasts the data packet to node N's neighbors
- This process is repeated until the RRQST reaches node D
- To avoid Duplicate transmissions, A sequence number is used for each packet

Flooding

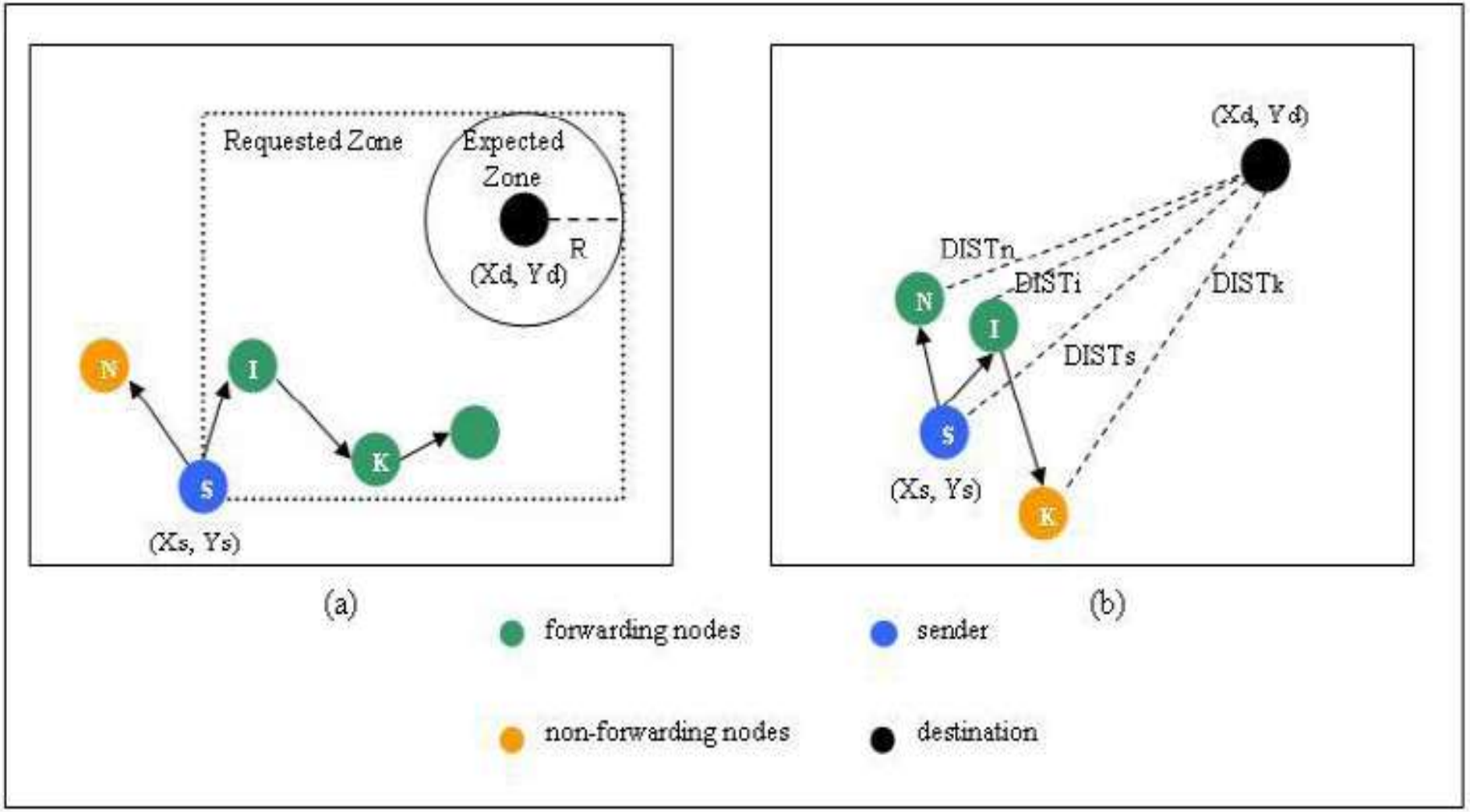
- Flooding is a reliable technique (packets are delivered with high probability)
- Flooding guarantees that, from any node, all other nodes in the network are reachable
- Packet overhead and inefficient bandwidth utilization are two of the main disadvantages of flooding-based routing

Distance Routing Effect Algorithm for Mobility (DREAM)

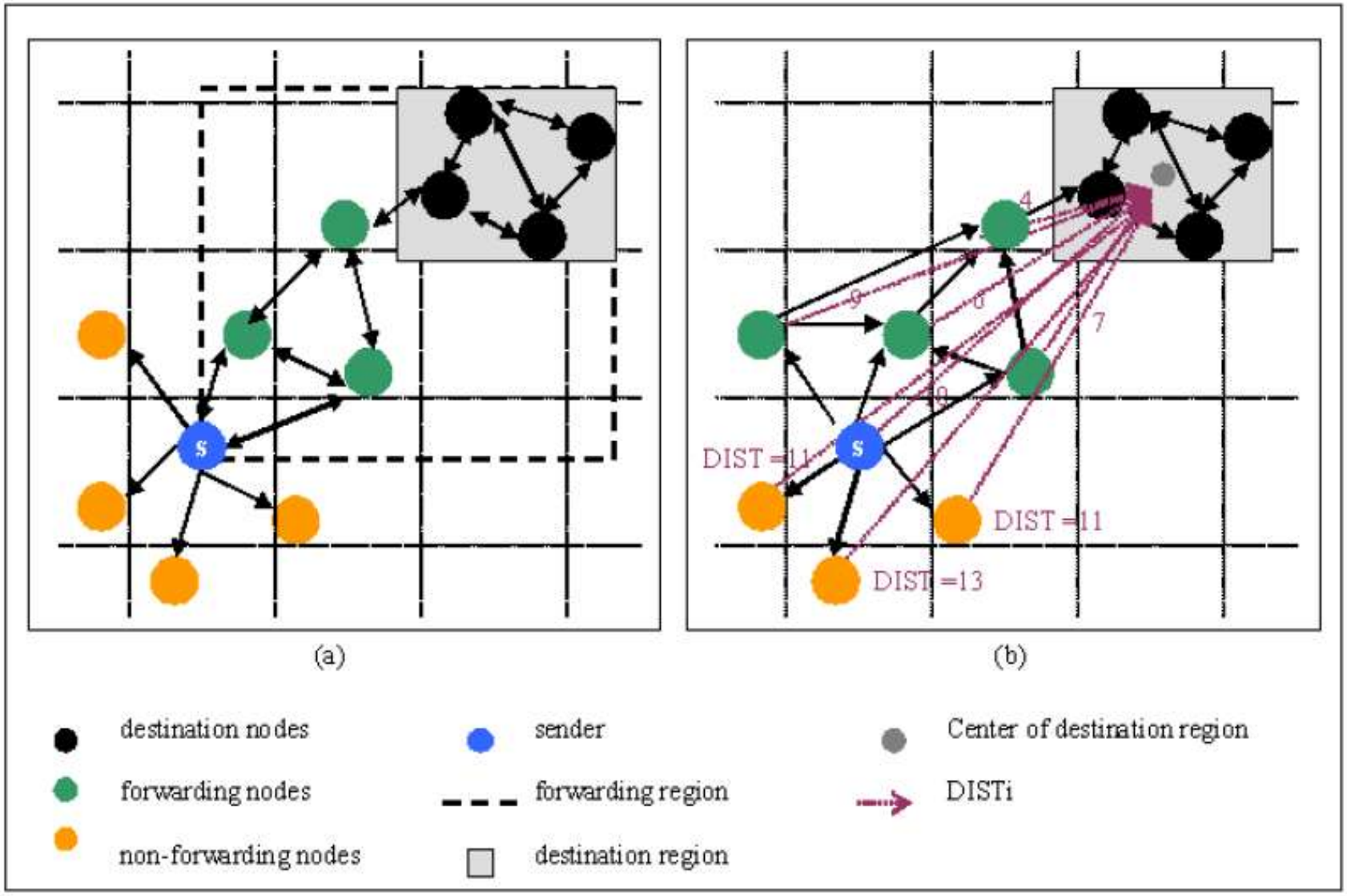
- DREAM reduces the flooding-area size by limiting the number of neighbors who can forward a RRQST
- range [θ-Φ, θ+Φ]



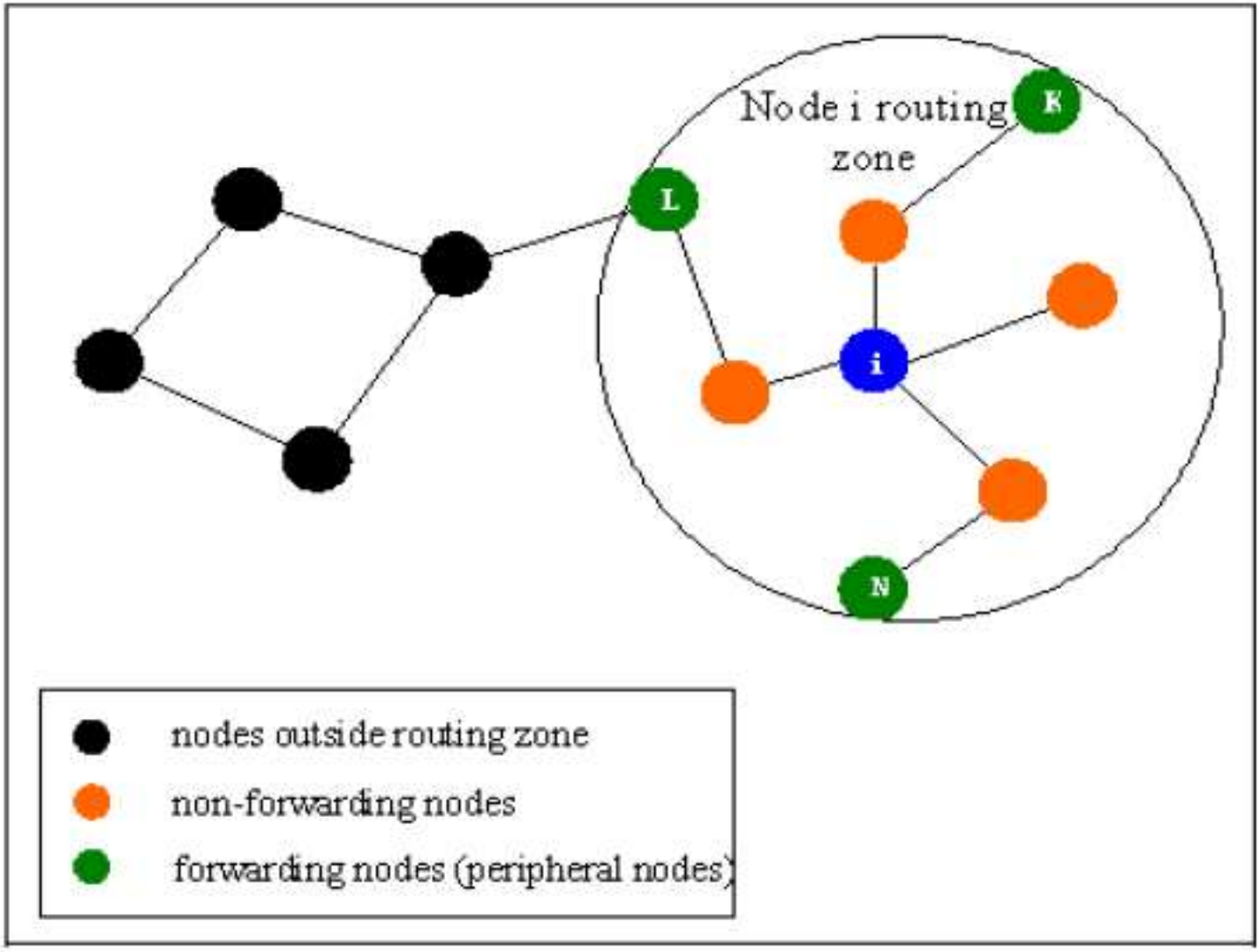
Location-Aided Routing (LAR)



Location Based Multicast (LBM) & Geographical Grid (GeoGRID)



Zone Routing Protocol (ZRP)



Greedy Forwarding (GF) Empty-Neighbor Set

- GF is one of the techniques on which single-path routing relies
- Source forwards a packet to the geographically-closest neighbor towards the destination among its neighbors
- This procedure is repeated at each intermediate node until the destination is reached
- Unlike flooding, GF forwards the data packet to a single neighbor instead of broadcasting it to all neighbors

Greedy Forwarding (GF) Empty-Neighbor Set

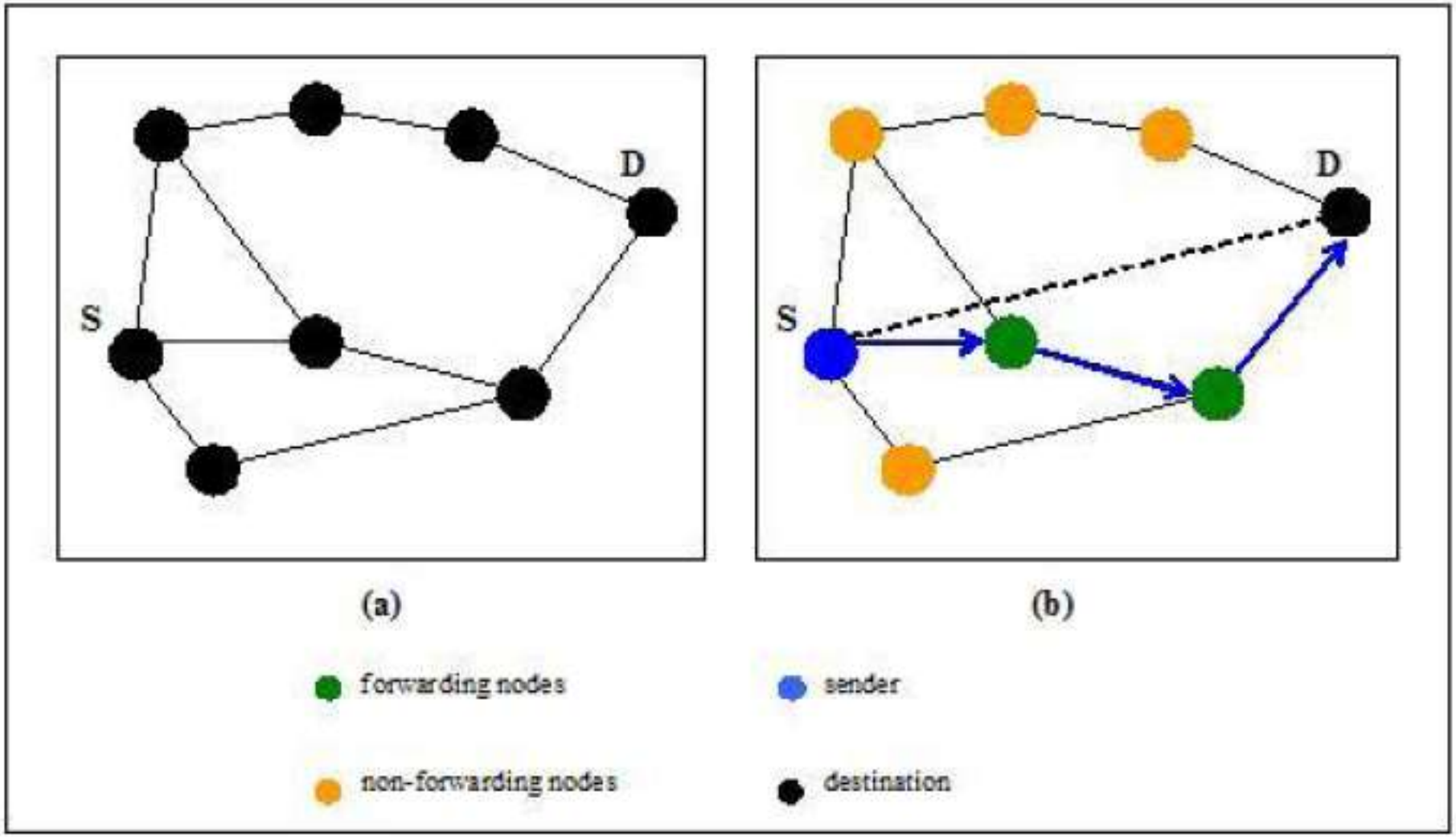
- What is a node cannot find any neighbor which is closer to the destination than itself?

  → the forwarding process reaches a dead end

  `***GF empty-neighbor-set problem***'

- GF backup techniques are needed to recover

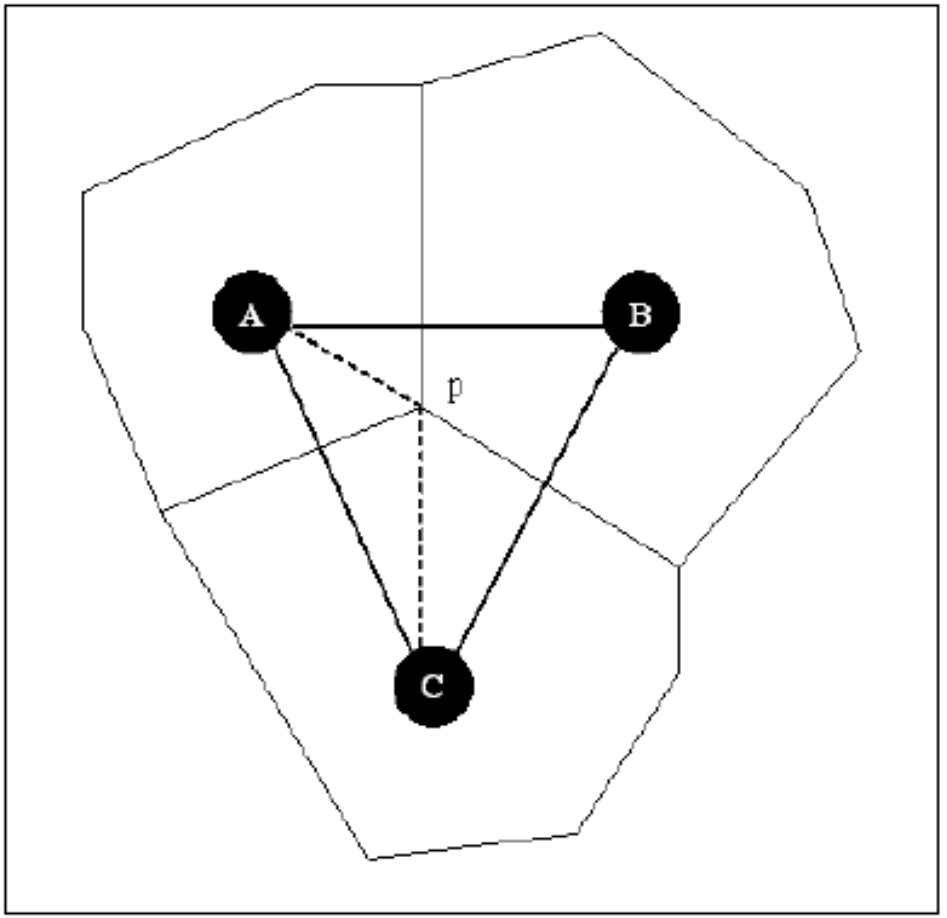
FACE & GPSR Routing Protocols



GPSR starts with GF, FACE is used to recover.

Bounded Voronoi Greedy Forwarding (BVGF)

- Node i forwards a packet, a neighbor j is eligible as the next hop only if the line segment joining the source and the destination intersects Vor(j)
- When there are multiple eligible neighbors that are equally closest to the destination, the routing node randomly chooses one among them as the next hop



For voronoi vertex (P) there are 3 regions Vor(u), Vor(w), and Vor(v).

Flat Addressing & Wide Spread of Information

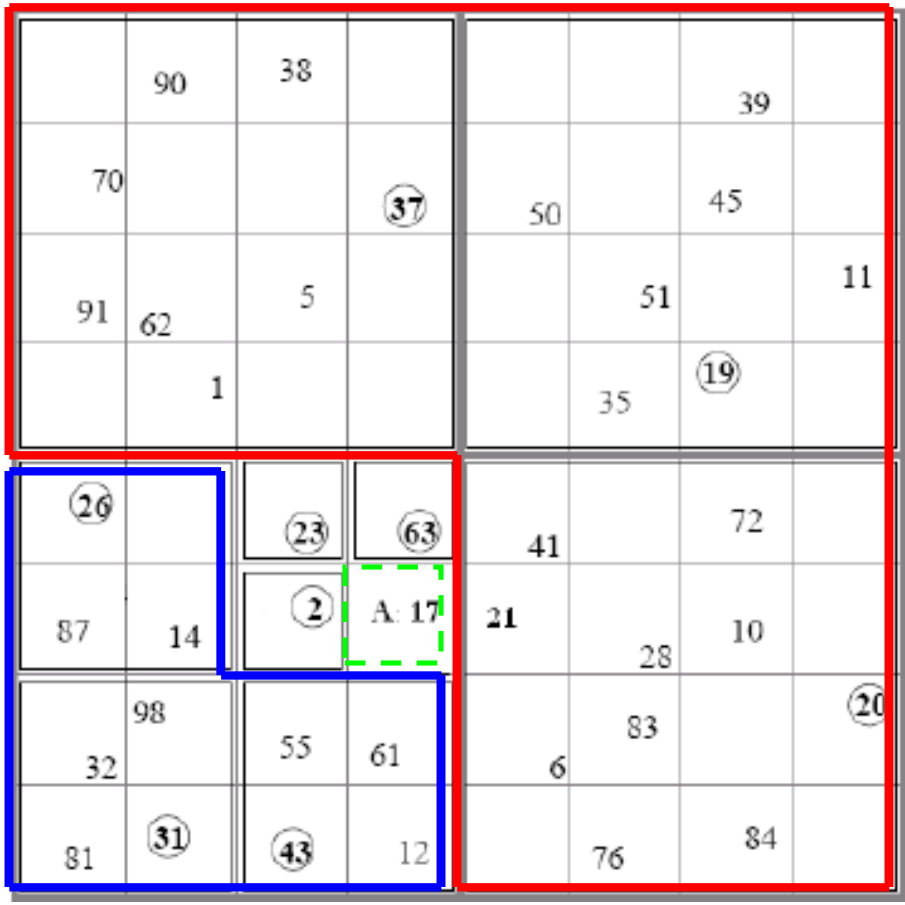
- The limitation of each node's wireless coverage may cause a lack of information at some nodes about the structure of the network
- Information-gathering process is an important phase of any routing approach
- A structural overview of a wireless network and a structured addressing scheme are significant to accelerate the routing process
- New techniques are proposed to provide structural references which have the updated information of several nodes in the network
- Scalability is the main advantage of such RAs

Grid Location Service (GLS)

- Each node maintains its current location in a small number of nodes called the **location servers**
- Consult the destination's location servers when need to send packets to get the destination location
- The process of recruiting the location servers for each node is very similar to the process of finding the consulting server for the destination
- After consulting the server the sender use the forwarding mechanism to send the data

Grid Location Service (GLS)

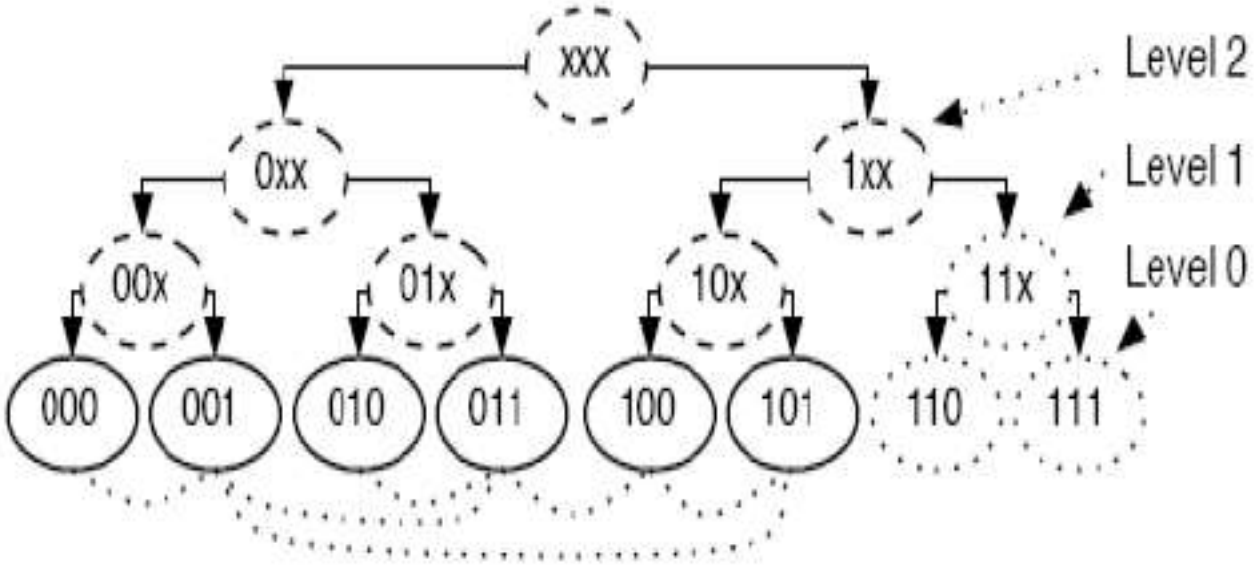
- **A's strategy is to recruit nodes with IDs "close" to its own ID to serve as its location servers**
- **We define the node *closest* to A in ID space to be the node with the *least ID greater than* A.**
- **The ID space is considered to be circular, 2 is closer to 17 than 7 is to 17.**
- **A node chooses three location servers for each level of the grid hierarchy.**
- **A recruits three servers in order-1 squares, three servers in order-2 squares, and three servers in order-3 squares.**
- **In general from each order-i select 3 servers.**



Dynamic Address Routing (DART)

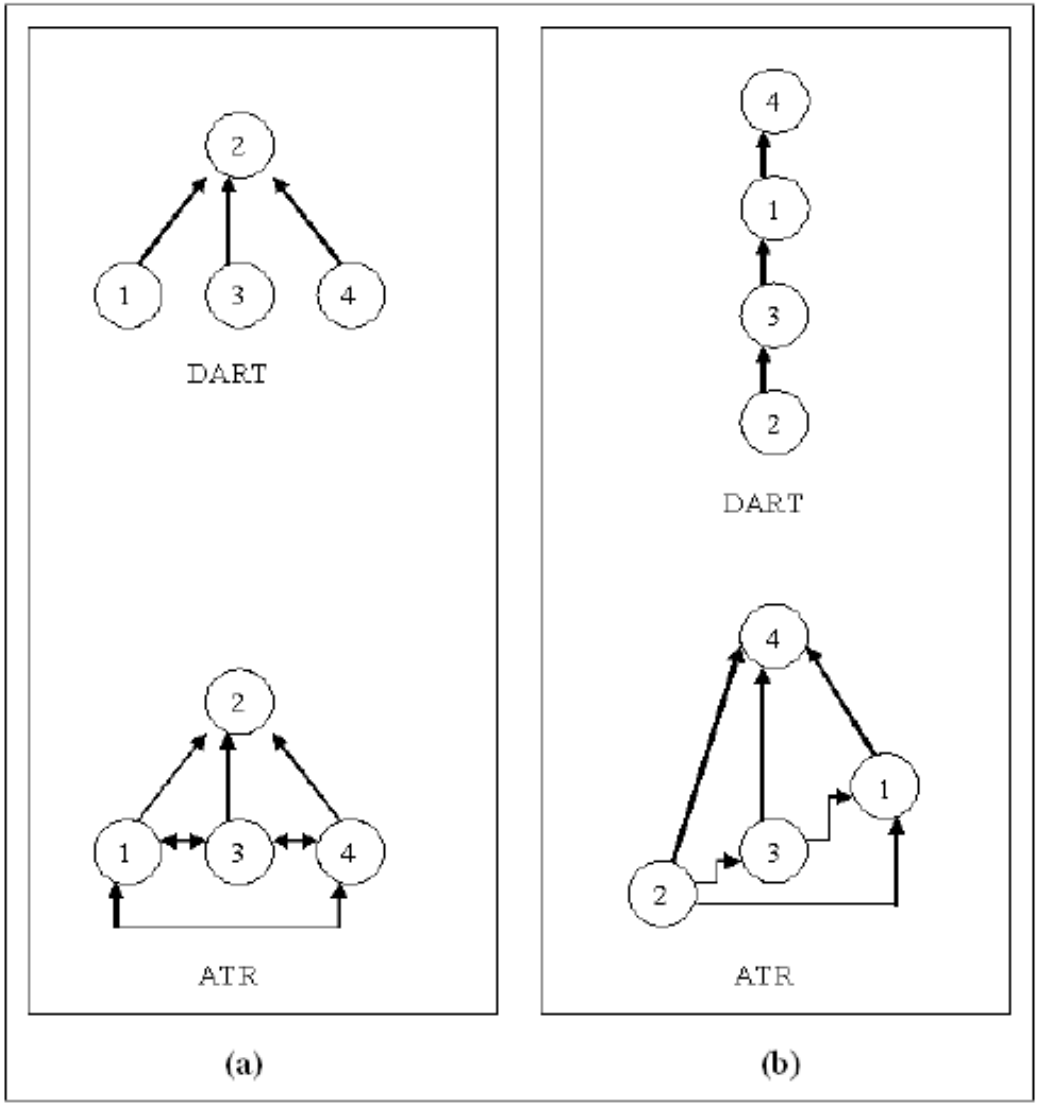
DART implicitly includes the node's location information within the node's address by splitting the address of a node into two separate parts:

- A static but unique node identifier, which is equivalent to the current IP addresses
- A dynamic routing address, which is related to the current node's location in the network topology



Augmented Tree-based Routing (ATR)

- ATR is the multi-path version of DART
- Redundant paths are established from any intermediate node towards the destination node to increase the flexibility and reliability of a network



Power Consumption

- Infra-Structure AODV for Infrastructured Ad-Hoc networks (ISAIAH)
  - AODV with routes pass through BSs not end users
- Power-Aware Multi-Access Protocol with Signaling Ad-Hoc Networks (PAMAS)
  - Power off nodes that are inactive for a certain amount of time
- Dynamic Source Routing Power-Aware (DSRPA)
  - Nodes with fresh batteries are used more frequently in routing
- Power-Aware Routing Optimization Protocol (PARO)
  - Increases number of hops to reduce per-hop transmission power

Conclusion

- We discussed different routing algorithms which differ on their purposes and techniques to capture the properties of the wireless environment

- based on the network characteristics, the matching routing algorithm can be selected

  - if ***scalability*** has priority in a network with high density of node, then GLS or DART is a good choice

  - if the objective is to have a ***fault-tolerant*** network, then ATR can be considered as a routing solution because ATR support multiple routing paths

  - LBM and GeoGRID are the ***multi-casting*** variations of LAR

  - for ***power*** saving, PAMAS considers a node's activities to power off the least-active nodes

Conclusion

- In some cases, we found similarities and differences between the routing algorithms to serve the same purpose

  - DREAM is similar to LAR from a structural point of view, the differences between DREAM and LAR mainly lie on the concept or definition of the forwarding area

- the ***simplicity*** of an applied routing algorithm is an important property to consider while selecting the proper routing algorithm