ATMOS: A middleware for Transparent MOBILE ad-hoc networking Systems

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Outline

- Background & Problems
- ATMOS
  - Link Complement Layer
  - Implementation
- Discussion
Background

in developing countries

under disasters

difficult to maintain backup systems

difficult to distribute software

As investment increases, covered area will get larger

t

covered area

uncovered area

Traditional networks and MANETs will co-exist
Issues(1)

How to know whether the node is connected to a traditional network or a MANET?

DHCP
mDNS

MANET-specific protocols
Issues(2)

- It is difficult to maintain two protocol suites which are not compatible with each other

- We have been focusing on the reuse of existing software assets
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Link Complement Layer (1)

- Complements the ad-hoc nature of links in MANETs
- Shows the ethernet-like interfaces to the upper layers
Link Complement Layer(2)

Network Layer

Virtual NIF

Link Complement Layer

Link Layer

Neighbor Discovery, Routing, Forwarding
The structure of the Implementation

Applications

ATMOS Middleware

Operating System

TAP IF

NW IF

virtual network interfaces are made by the universal TUN/TAP device

Neighbor Discovery, Routing, Forwarding
Implementation Status

• The middleware
  • Implements a unicast routing module of DYMO[draft-ietf-manet-dymo-14]
  • Implements a multicast module of SMF[draft-ietf-manet-smf-05]
  • Runs on Linux and *BSD(including OSX)
Ex. Multicast Ping

The node with an IP address of 192.168.0.1 sends a ICMP echo request packet to multicast address of 224.0.0.1 (all-system-multicast) via its virtual network interface.
Multicast

- The packets to the multicast address are processed by the SMF module of ATMOS

- If the hash value of the packet header is already recorded, a node discards the packet; otherwise, it forwards it.
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the node which received the ICMP echo request packet replies to this packet by sending a ICMP echo response packet to the sender
Unicast (2/4)

• Since node 4 does not have a routing entry for Node 1
  • it searches for the route to node 1 by flooding DYMO Route Request (RREQ) messages
• The nodes that received the RREQ messages learn the route to node 4
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Unicast (3/4)

- Node 1 replied to the RREQ message by a sending Route Response (RREP) message.
- The nodes that received the RREP message learn the route to node 1.
- Bi-directional path between node 1 and node 4 has been established.
Virtual Link

Physical Link

- Node 1 replied to the RREQ message by sending a Route Response (RREP) message.
- The nodes that received the RREP message learn the route to node 1.
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Unicast (3/4)

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Unicast (4/4)

- the ICMP echo reply is forwarded through the established path.

ATMOS establishes L2 Tunnels between neighbors dynamically.
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Discussion

• Limitation of the adaptation

• Further researches direction
Limitation of the Adaptation

• Some existing applications are centralized

• Network partitioning can break these applications
Rooted MANET

• One or multiple root nodes, which have essential centralized services

• A node can join the network only if it has bidirectional connectivity to the root node
The Further Researches

• Evaluation of the quality of the connectivity to the root node
  • Connectivity
  • Stability: the number of paths to the root might help
  • Bandwidth: link quality metric, such as ETX/ETT, might help
Thank you for Listening!

Q & A
To multiple MANETs

Root Node A

Root Node B

Virtual NIF for RN A

Virtual NIF for RN B