

ENHANCING THE PERFORMANCE OF MOBILE AD HOC NETWORKS WITH THE AID OF TRANSPARENT AD HOC NETWORK GATEWAYS

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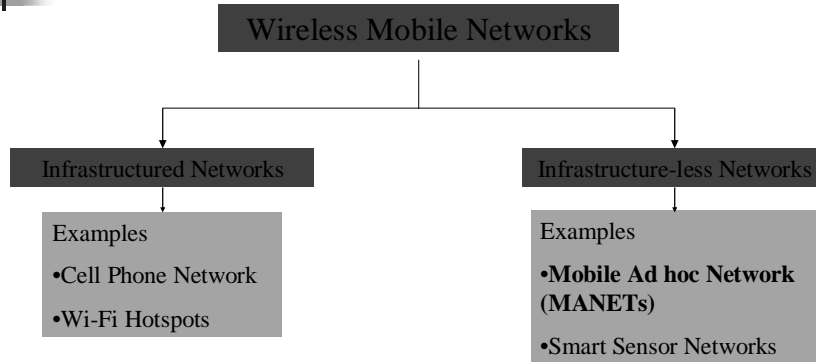
Cleveland State University

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Outline

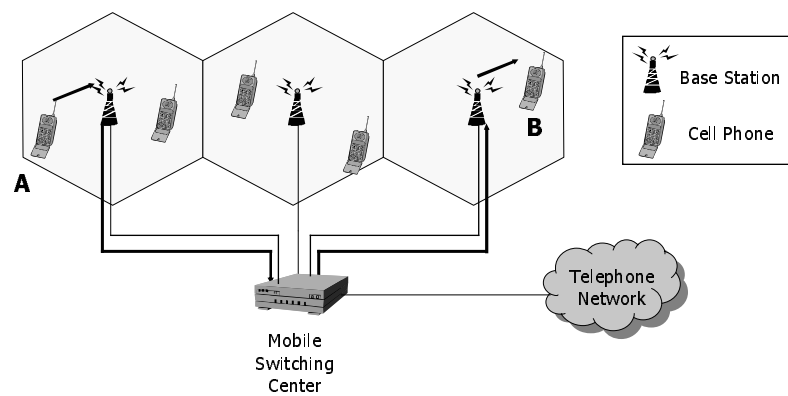
- Wireless Mobile Networks
- Motivation
- MANET Routing
- Scalability of MANET Routing
- Our Proposed Scheme
- Simulation setup and results
- Observations and Conclusions

Wireless Mobile Networks



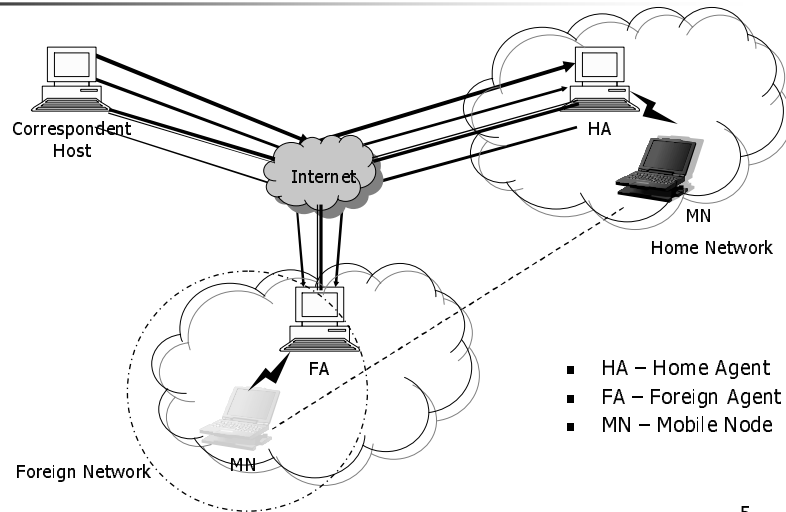
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Infrastructured Cellular Networks



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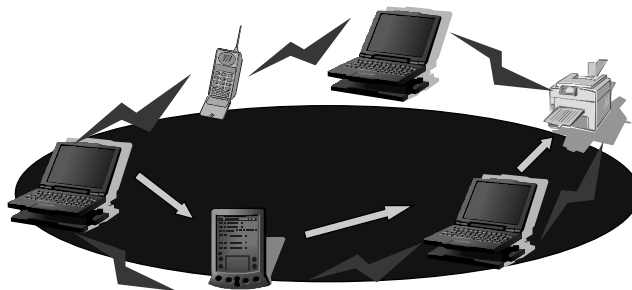
Infrastructured Networks – Mobile IP



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Infrastructure-less Networks

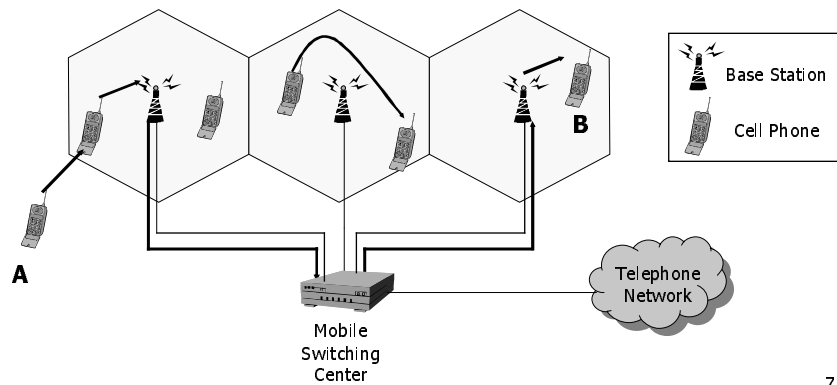
- Networks formed on the fly.
- No centralized base stations.
- Special routing protocols



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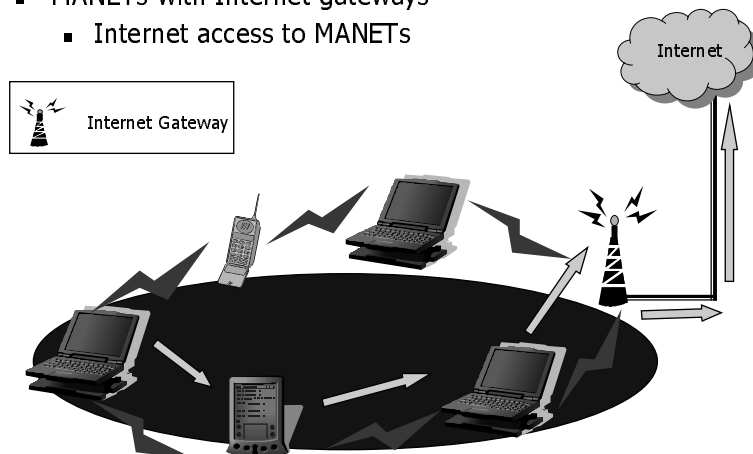
Hybrid Networks

- Extending base station services



Hybrid Networks

- MANETs with Internet gateways
 - Internet access to MANETs



Infrastructured MANETs

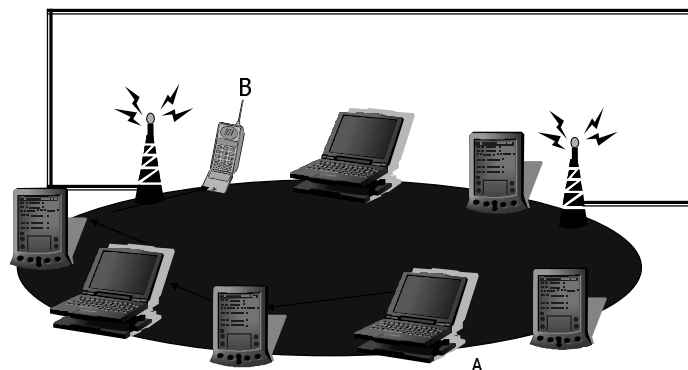
- Utilize Internet based gateways – Infrastructured MANETs

Mobile IP Foreign Agent as Gateway Router (Seamless Roaming Supported) (Nodes running both, the Mobile IP software as well as the MANET routing protocol gain Internet access)		
Implementation	Special Features	Routing Protocol
Simulation/Real	Special FA RREP packet is introduced.	Ad Hoc On-Demand Routing Protocol
Simulation in Network Simulator-2	MIPMANET Cell Switching Algorithm:	Ad Hoc On-Demand Routing Protocol
Simulation in Network Simulator-2	Duplicate Address Detection:	Ad Hoc On-Demand Routing Protocol
Real implementation on OS/2 and AIX	Implementation of the Route Manager Program:	Modified Version of Routing Information Protocol

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Infrastructured MANETs

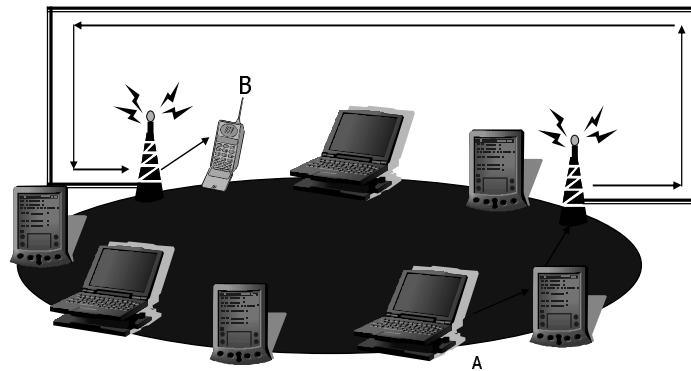
- Exploit Infrastructured MANETs
 - Aim to facilitate communication between MANET nodes.



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Infrastructured MANETs

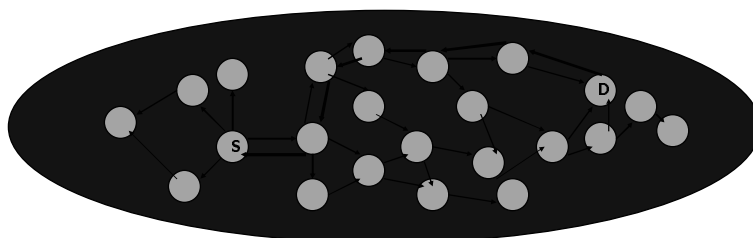
- Exploit Infrastructured MANETs
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Ad hoc On-Demand Distance Vector (AODV)

Source node broadcasts an RREQ in search destination for a destination

Destination node replies with an RREP



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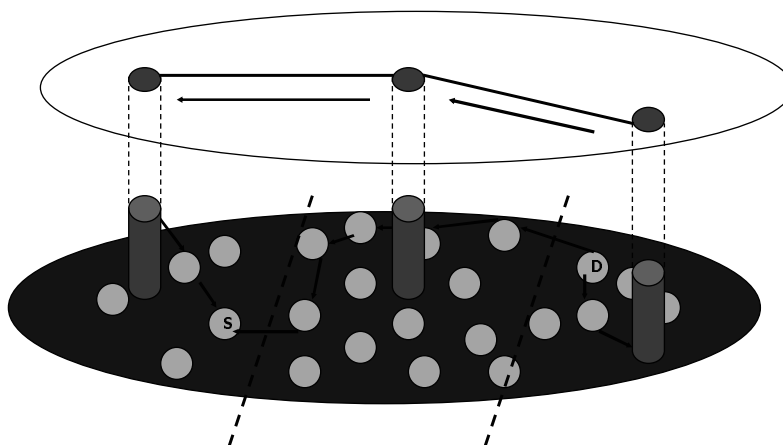
Scalability of MANET Routing

- Increase in network size (number of nodes) drastically affects the performance of MANETs because of
 - Increased path length (high delay)
 - Burden on intermediate nodes (reduced throughput)
 - Increased collisions (large packet drop)

To overcome the above drawbacks we propose the Transparent Ad hoc Network Gateway or TANGs

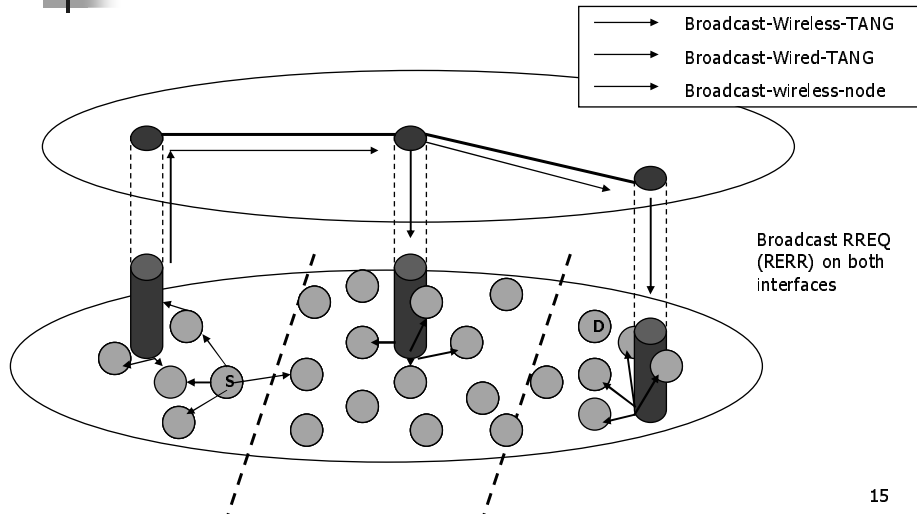
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Our Proposed Scheme: TRANSPARENT AD HOC NETWORK GATEWAYS (TANG)



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TANG Operation



Advantage of TANGs

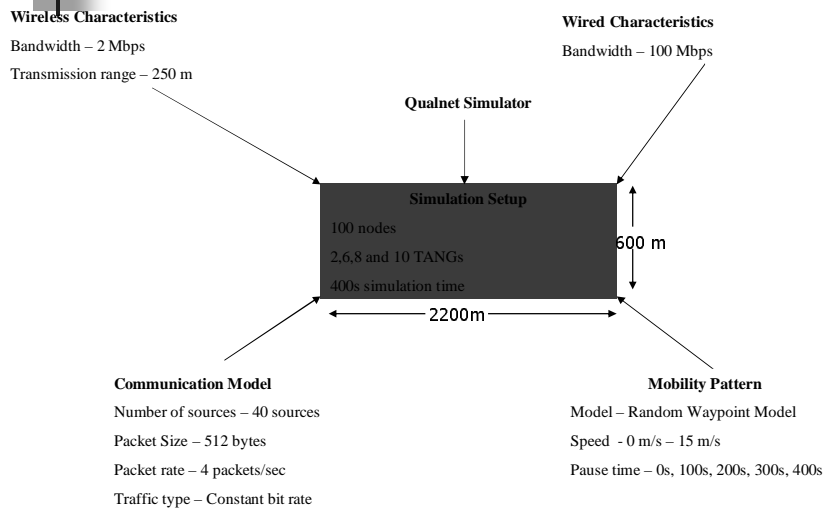
- MANET nodes are
 - not aware of TANGs
 - not aware of the logical partitions in the MANET

Performance Analysis

- Simulation Emphasis
 - Impact of number of TANGs
 - Scalability
- Performance Metrics
 - Throughput: Number of packets delivered
 - End-to-End delay
 - Packet delivery ratio: # of packets delivered/# of packets originated
 - Routing overhead: RREQ and RERR packets

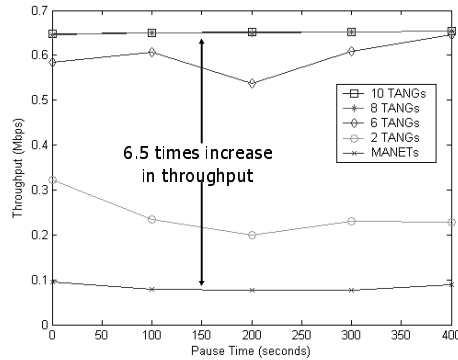
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Simulation – Impact of number of TANGs



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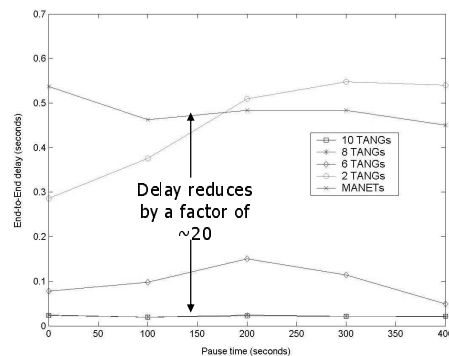
Throughput Graph



- Intermediate nodes burdened
- Increases in congestion: A lot of spurious link failures
- Backbone network exploited

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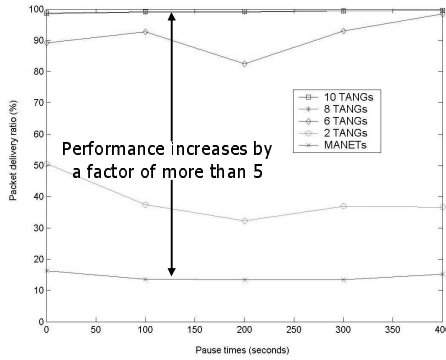
Delay Graph



- Time required for network-wide search reduces
- Reduced hop count – less delay

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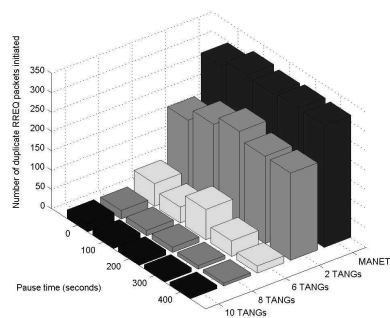
Packet Delivery Ratio



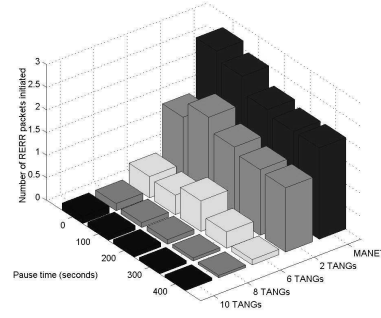
- High network Congestion - Number of collisions increases

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AODV Routing Overhead



Number of duplicate RREQ packets initiated



Number of RERR packets initiated

- Additional overhead causes overall degradation in MANETs.

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Observation

- Increase in number TANGs: Improves performance but after a threshold value does not significantly impact the performance
- Under high network congestion an infrastructured MANET performs significantly better than a pure MANET.
- TANGs are not bottlenecks
- An infrastructured MANET with TANG scales much better than a pure MANET.

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Conclusion

- The introduction of the proposed TANG into a network significantly improved the overall performance of the MANET under high network congestion and varying number of nodes.

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