

# Wireless Communication and Security for Mobile Ad-Hoc Network

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**Abstract:** A wireless ad hoc network is a decentralized type of network that does not depend on pre existing infrastructure like routers or access points. Rather it has the accessibility to associate with other ad hoc network devices that exist within the link range. Internet based ad hoc network is an emerging technology that supports self organizing and networking infrastructures. It enables an autonomous system of nodes which can operate in isolation. It provides secured, trusted, secured, anonymous, efficient and economical communication between unknown devices. Ad hoc networks are designed to operate in widely varying environment from forward-deployed temporary military settlements, battlefields and broadband internet services in rural regions.

**Keywords:** Ad-hoc wireless networks, mobile ad-hoc network, multi hop mobile ad-hoc, Bluetooth ad-hoc network for voice, routing protocol, anti-jamming.

## 1. Introduction

An ad-hoc network is a local area network that is built spontaneously as devices gets connected. Wireless ad-hoc networks do not require any fixed equipment such as routers, switches, access points, base stations and cables. In Latin, ad-hoc literally means “for this”, meaning “for this special purpose”. An ad-hoc network typically refers to any set of networks where all devices have equal status on a network. Each node participates in routing by forwarding data for other nodes. It improves the scalability of networks compared to wireless managed networks. Nodes communicate with each other through radio signals. Packets which are transmitted may include file transfer, e-mails and Web and real-time traffic as remote monitoring, video conferencing and VoIP (voice over IP). Ad hoc networking enables wireless devices to interact with each other when access to internet is unavailable. It enables wide range of powerful applications where central nodes cannot be relied on pre existing infrastructures. Wireless communication should be possible without routers, base stations and Internet Service Providers. An ad hoc network might consist of several home computing devices and mobile nodes that are powered by batteries. The routers are free to move randomly that changes the network’s topology unpredictably. Such a network may be connected to larger internet.

## 2. Ad Hoc Wireless Network

It is a collection of two or more devices equipped with wireless communications and networking capabilities. It is self organizing and allows spontaneous formation and deformation of mobile networks. It supports peer-to-peer and peer-to-remote communications. Everyone knows that wireless networking is liable to suffer from eavesdropping

attack. But it is extremely deceptive to take this as the only security concern. This paper investigates the security issues that are characterized by many principals acting as network peer. The problems that are faced in wireless ad hoc network are no fixed base station concept, very hard to avoid packet collisions and limited power capacity and bandwidth.

The performance of TCP degrades in ad hoc network because it has to face new challenges like lossy channels, hidden and exposed stations, path asymmetry, network partitions, route failures and power constraints. The flow control and the congestion control are the two important mechanisms that decides the bit rate of TCP connection. Both the mechanisms are similar in the sense that both prevent the connection from sending at an excessive rate.

The basic purpose of flow control is to prevent a fast sender from overwhelming a slow receiver. The main causes of errors in wireless channel are signal attenuation, Doppler shift and multipath fading.



Figure 1: A Model Of Wireless Ad-hoc Network

### 3. Ad Hoc Path Asymmetry

Path asymmetry in ad hoc network may appear in several forms like bandwidth asymmetry, loss rate asymmetry and route asymmetry.

#### 3.1 Bandwidth Asymmetry

Satellite suffers from large bandwidth asymmetry because of the reasons of power, mass and volume, as well as the fact that for space scientific missions, most of the data originates at the satellite and flows to the earth. However the return link is generally not used for data transmission. In ad hoc network, the degree of bandwidth asymmetry is not very high. The asymmetry results from the use of different transmission rates.

#### 3.2 Loss Rate Asymmetry

This type of asymmetry takes place when the backward path is significantly more lossy than forward path. This asymmetry is due to the fact that packet loss depends on local constraints that can vary from place to place. Loss rate may also produce bandwidth asymmetry.

#### 3.3 Route Asymmetry

Unlike the previous two asymmetries, route asymmetry implies that distinct paths are used for TCP data and TCP ACKs. This increases routing overheads and packet losses in case of high degree of mobility because when nodes move using distinct forward and reverse route increases the probability of route failures. However this is not the case of networks having low degree of mobility.

### 4. Improving TCP Performance in Multi Hop Mobile Ad hoc Network

The first two problems are the main causes of TCP performance degradation in MANET's and the other two problems are the main causes of TCP performance degradation in SANET's. Based on these four problems, the aim to improve TCP performance are regrouped in four sets. The proposals are classified as cross layer proposal and layered proposals. Cross layer is again divided as evolutionary approaches and revolutionary approaches. If the routing layer experiences routing failure, it sends feedback to TCP. On receiving the notification, the TCP enters into freezing state and stops sending packets. After the route is established, TCP goes to normal state. Layered concept is primarily used in wired network.

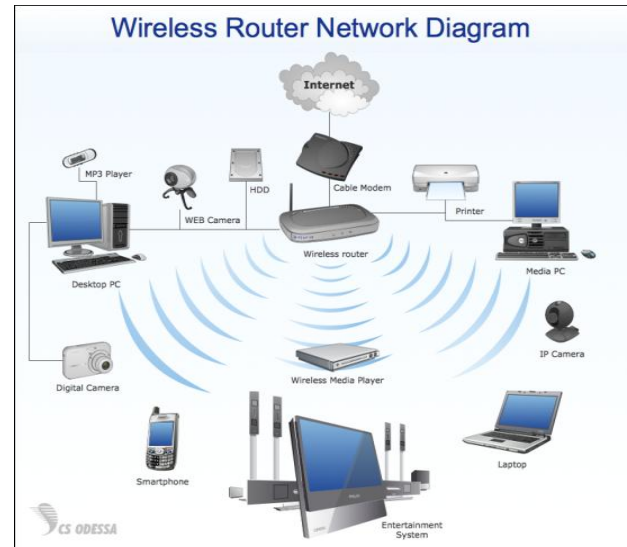


Figure 2: Wireless Router Network Diagram

### 5. Mobile Ad Hoc Network

A mobile ad hoc network is a continuously self configuring, infrastructure-less network of mobile devices connected without wires. Each device in a MANET is free to move independently in any direction and will therefore change its links to other devices frequently. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Here the topology changes very frequently as nodes may join and leave the network. A variety of routing algorithms for multi hop ad hoc networks have been proposed. Routing protocols are mainly divided as proactive and reactive routing protocols.

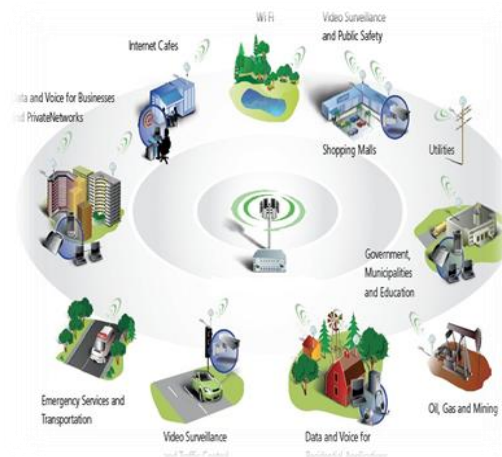


Figure 3: Wi Fi Communication

Mobile ad hoc networks have special characteristics such as high connectivity and mobility. New modifications to existing ones are required to facilitate P2P data sharing and dissemination over MANET.

### 6. Bluetooth Based Ad Hoc network for Voice

Bluetooth is a wireless technology standard for exchanging data over short distance. It replaced the cables connecting portable or fixed devices while maintaining high level of

security. It used UHF radio waves in bandwidth of 2.4-20485 GHz. Each interface can have 7 simultaneous connections. This technology was originally designed for short range personal area network, but its widespread use opened the door to new form of exploitation.



Figure 4: Bluetooth Communication

When Bluetooth is used as a physical layer for a MANET, we come across several constraints like connected-oriented nature of Bluetooth, no broadcast capability, restricted number of connections, etc. To overcome these problems, a new protocol Bluetooth Scattering routing (BSR) has been developed. It is a reactive routing protocol that keeps additional information on the state of links and tries to avoid long delays.

## 7. Intrusion Detection in Mobile Ad Hoc Network

An intrusion detection system is a device or software application that monitors network or system activities and produces reports to a management station. It involves runtime gathering and analysis of data from system operation. The main focus is on the behavior as it is more efficient and light weight. On the basis of behavior, it is broadly categorized as: anomaly detection, signature or misuse detection and specification based detection. In signature based, data is matched against known attack characteristics while in anomaly based, the normal behavior of system is compared with the actual activity of the system. In specification based, the correct behavior of critical objects are manually distracted and crafted, which are now compared with the actual behavior of objects.

## 8. Location Based Routing Protocol

When a source node wants to transmit a packet, the address of destination is received first, and then the header is attached to it. Due to the movement of destination node, the multi hop path may diverge from its true location and the packet would be dropped even if it has been delivered to the neighbourhood of final destination. To deal with such issue, additional check has been introduced. At each hop, the node that transmits the packet checks the range of destination node. This is susceptible to MAC collision. If a packet with same ID is received, it is discarded.

## 9. Anti Jamming Metrics

Earlier, several metrics were proposed to evaluate the effectiveness of a jammer. To reduce the impact of jamming, dynamic control channel allocation strategy has been adopted where each cluster establishes its own channel and maintains it. By varying the temporal frequency allocation, the impact of long range jamming can be reduced. This would also reduce the delay and communication overhead channel re-establishment process.

## 10. Security

In this type of network, security is not a single layer issue but a multi layered one. On network layer, the attacks are endangered. Some of the attacks that come across are Black hole, Gray hole and Sybil attack. Due to such threats on network layer, it is not advisable to transmit information via single path as it can be easily lost or hacked. To avoid this, sender may send multiple copies through multiple disjoint paths. But this also increases the risk of leakage of information. This threat can be reduced by using shared cryptography. In this section, a copy of original data is kept which is termed as share. Here some bits are present and some bits are missing. It transmits different shares of information via multiple disjoint paths at multiple time intervals. This reduces the risk of leakage of information and also reduces chance of network level attacks.

## 11. Conclusion

When a packet is received, the data link layer of a node measures its bandwidth along with channel busyness ratio. The receiver sends this information along with acknowledgement packet to the sending node, which is enclosed by link and physical layer headers. This will result in advent of new applications and services like forwarding of data cannot be done without the use of routing algorithm. The problem of control-channel jamming in multi channel ad hoc network was addressed. This proposal can work at an actual environment.

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