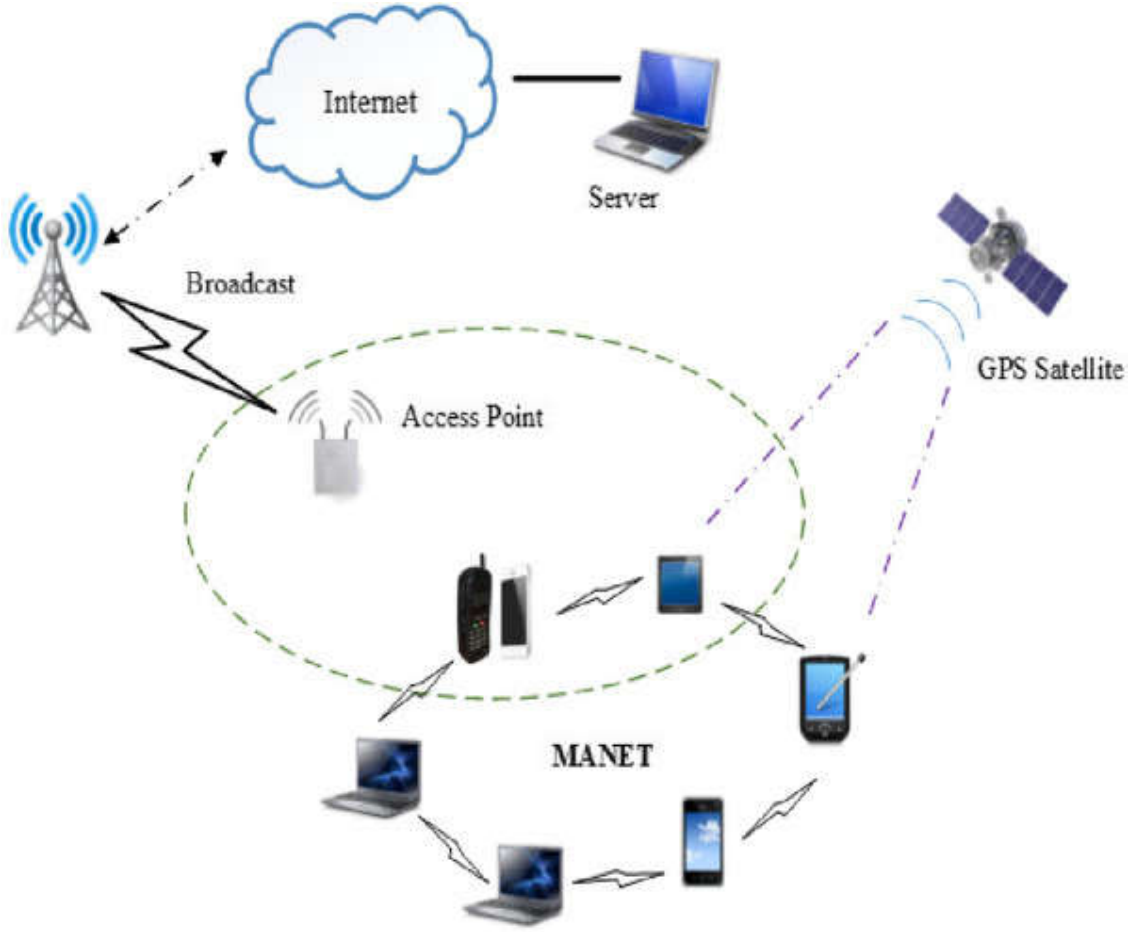
MANET ARCHITECTURE MODEL

INTRODUCTION: A Mobile Ad Hoc Network (MANET) is a continuously self configuring, infrastructure-less network of mobile devices connected without wires. Ad Hoc is Latin & means “for this purpose” Each device in a MANET is free to move independently in any direction and will 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. Such networks may operate by themselves or may be connected to the larger internet. They may contain one or multiple & different transceivers between nodes. This results in a highly dynamic autonomous topology.

Characteristics of MANETs

- In MANET, each node act as both host and router. That is it is autonomous in behavior.
- Multi-hop radio relaying- When a source node and destination node for a message is out of the radio range, the MANETs are capable of multi-hop routing.
- Distributed nature of operation for security, routing and host configuration. A centralized firewall is absent here.

- The nodes can join or leave the network anytime, making the network topology dynamic in nature.
- Mobile nodes are characterized with less memory, power and light weight features.
- The reliability, efficiency, stability and capacity of wireless links are often inferior when compared with wired links. This shows the fluctuating link bandwidth of wireless links.
- Mobile and spontaneous behavior which demands minimum human intervention to configure the network.
- All nodes have identical features with similar responsibilities and capabilities and hence it forms a completely symmetric environment.
- High user density and large level of user mobility.
- Nodal connectivity is intermittent.

MANET ARCHITECTURE

The architecture of Mobile Ad-hoc Network (MANET) is shown in figure 2. The network architecture is grouped into main three categories:

• Enabling technologies;

• Networking;

• Middleware and applications

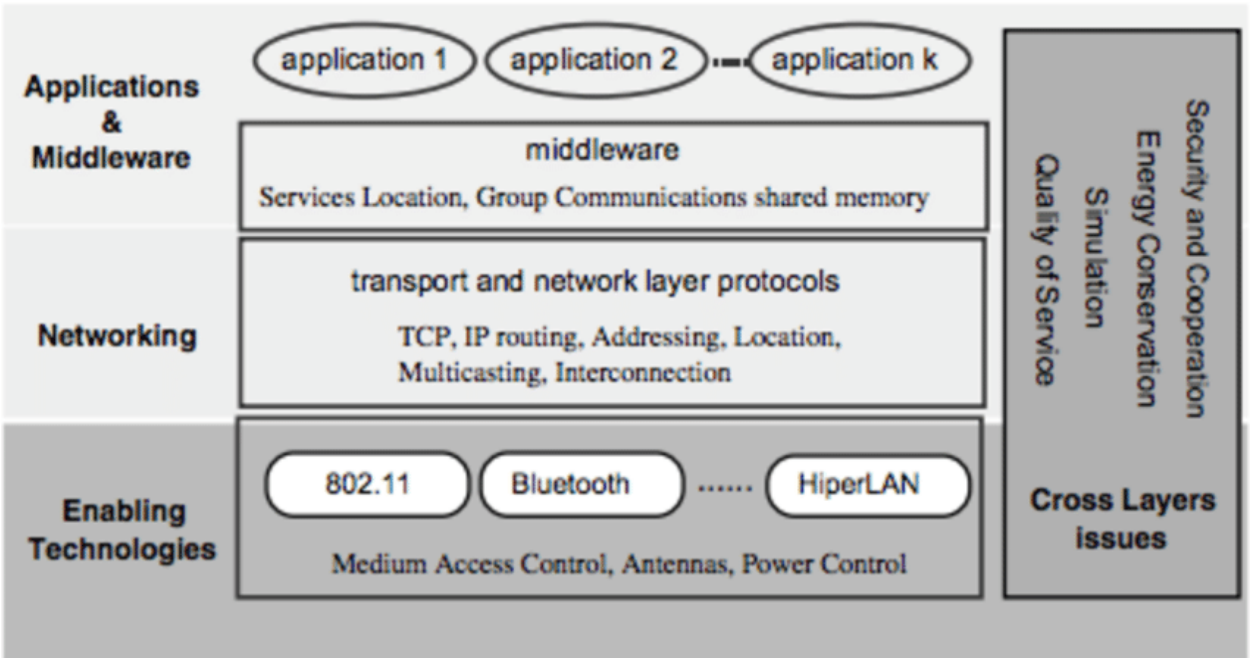


Figure: A simple MANET architecture

A. Enabling Technology: Depending on their coverage area, these technologies are classified into several classes: Body (BAN), Personal (PAN), Local (LAN), Metropolitan (MAN) and Wide (WAN) area networks.

A **body area network (BAN)** is strongly connected with wearable computers. A wearable computer distributes on the body its components like as head mounted displays, microphones,

earphones, etc., and the BAN provides the connectivity among these devices. With respect to the human body range, t he communicating range of a BAN is 1–2 m.

The **Personal area networks (PAN)** connect the mobile devices which are carried by users to other mobile and stationary devices. A PAN communicating range is typically up to 10 m.

Wireless LANs (WLANs) support 100–500 m communication range for a single building, or a cluster of buildings. Wide- and Metropolitan-area (WAN-MAN) ad hoc networks are mobile multi-hop wireless networks that face many challenges which are still to be solved (e.g., addressing, routing, location management, security, etc.), and their availability is not on immediate horizon.

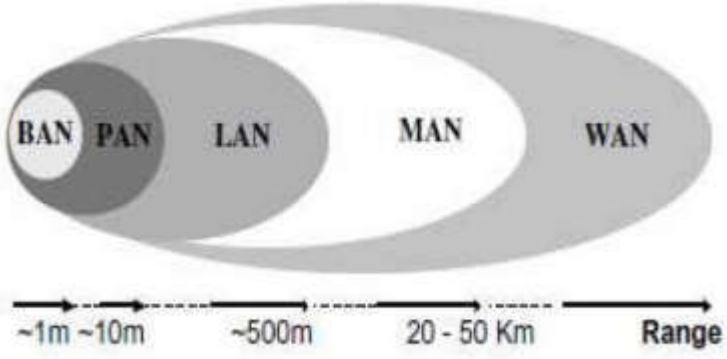


Fig. 3. Ad hoc networks Taxonomy

B. Networking: In MANET, most of the main functionalities of the Networking protocols need to be re- designed for the self organizing, dynamic, volatile, peer-to-peer communication environment. The main target of networking protocols is to use the one-hop transmission services which are provided by the enabling technologies to construct end-to-end (reliable) delivery services, from a sender to one (or more) receiver(s). In case of establish an end-to-end communication; the sender needs to locate the receiver within the network. The main aim of a location service is to dynamically map the logical address of the (receiver) device to its current location in the network.

C. Middleware & Applications: The introduction of new technologies like as the WiFi, Bluetooth, IEEE 802.11, WiMAX and HyperLAN greatly facilitates the deployment of ad hoc technology, and new ad hoc networking applications appeared mainly in specialized fields such as emergency services, disaster recovery and environment monitoring. In addition, MANET flexibility makes this technology attractive for several applicative scenarios like, for example, in personal area networking, home networking, law enforcement operation, search and- rescue operations, commercial and educational applications, sensor networks. Mobile ad hoc systems currently developed adopt the approach of not having a middleware, but rather rely on each application to handle all the services it needs.

A MANET ARCHITECTURAL MODEL PRESERVING THE INTEGRITY OF IP ARCHITECTURE

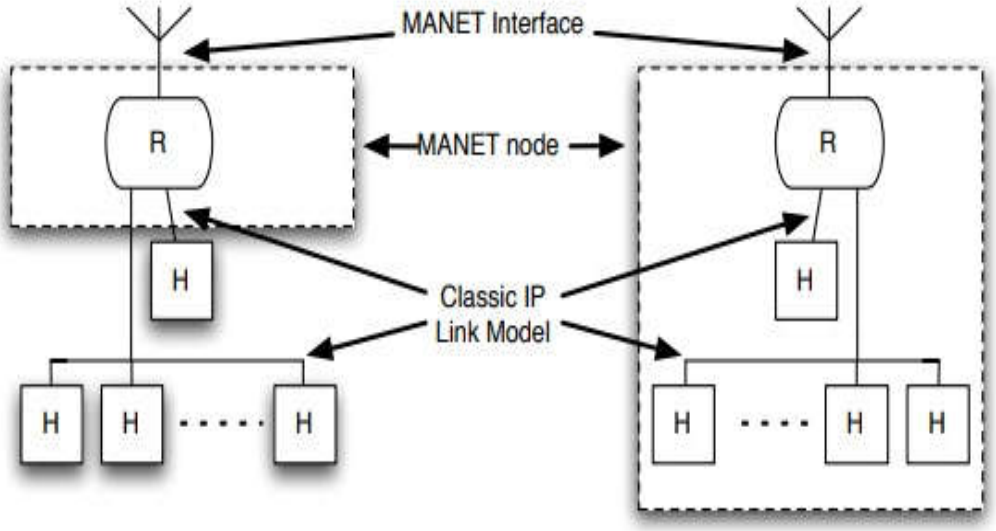


Figure: MANET node model: the router (R) has on the top a MANET interface, and is connected, on the bottom, to hosts (H) via classic IP links.

1. MANET Node Morphology

   This architectural model considers MANET nodes as routers with hosts attached, as illustrated in figure 7. These attached hosts may be ”external” (i.e. attached to the router via other network interfaces) or ”internal” – however the important observation to make is, that the links between these hosts and the router are classic IP links, behaving as described in section 2. This implies that, from the point of view of the hosts, and the applications running on these hosts, connectivity is via a classic IP link. Hosts, and their applications, are not exposed to the specific characteristics of the MANET interfaces and are connected to the MANET via a router, which has one or more MANET interfaces. This is symmetric with how hosts on an Ethernet, such as illustrated in figure 1 are not exposed to the intricacies of what type of connectivity the router has beyond the Ethernet.

   Since the hosts in figure 7 are connected to a classic IP link, these hosts are configured and behave as hosts in any other network, and the links to which they are connected have properties identical to those of any other classic IP link.

2. **Addresses and Prefixes If the MANET**

   router is delegated a prefix p::, this prefix can be assigned to the classic IP link(s), and hosts can be assigned addresses from within this prefix, and configured with this prefix as illustrated in figure 8. Specifically, the MANET interface(s) of the router are not configured with this prefix, for the reasons explained in section 4: the MANET interface(s) is not on the same ”link” as the other interfaces with addresses from within this prefix, and so direct communication without crossing a router is not possible. The configuration of MANET interfaces is detailed below.

3. MANET Interface Configuration & Properties

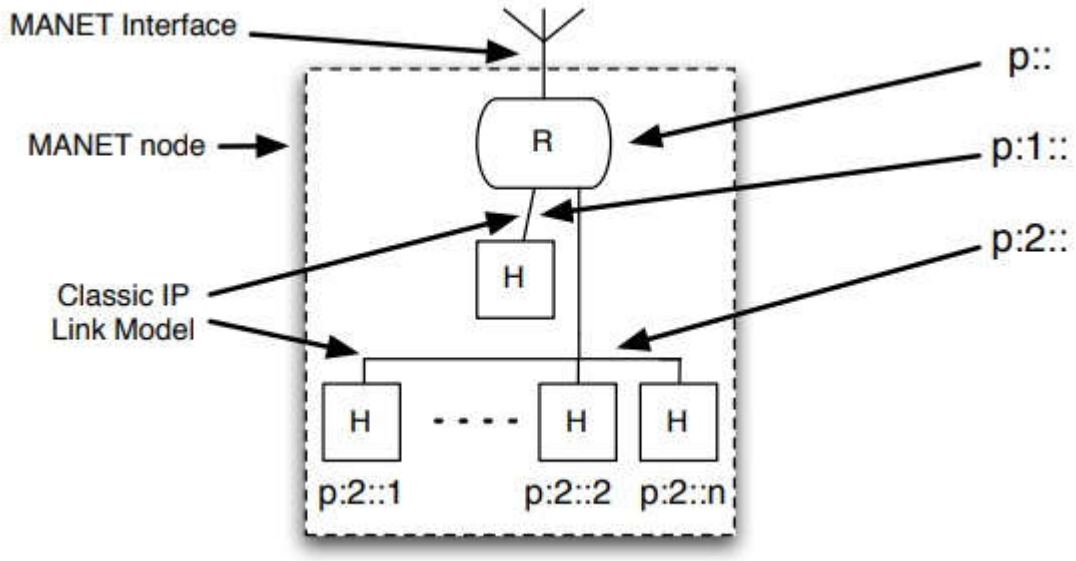


Figure: MANET node and prefixes: the MANET router (R) is delegated a prefix p::, which it assigns to the classic IP links to which the hosts (H) are attached.

MANET specific behaviors are exclusively exposed to the MANET interface(s) of the routers. This includes MANET routing protocols and interface and link characteristics (asymmetric neighborhoods, semi-broadcast interfaces, fuzzy neighbor relationships, topology dynamics etc.) The following characteristics deserve particular mention, since they distinguish MANET interfaces and the MANET link model from the classic IP link model: Unique Prefixes MANET interfaces must be configured with unique prefixes, i.e. such that no two MANET interfaces are configured such that they appear within the same IP subnet. Some common ways to achieve this are:

1) Unnumbered interfaces (IPv4) ;
2) Link-Local Addresses (IPv6);
3) 128 (IPv6) or/32 (IPv4) prefixes.

However it is worth noting that prefix lengths shorter than 128 (IPv6) or 32 (IPv4) are possible on the MANET interface, so long as the prefixes are unique to a single MANET interface.

Link Local Multicast/broadcast Scope

On a MANET interface, a Link Local multicast or broadcasts reach MANET interfaces of neighbor nodes only, regardless of their configured addresses. A Link Local multicast or broadcast on a MANET interface is, thus, a ”neighbor cast”, and is not forwarded nor assumed to be received by all nodes within a MANET.

4. MANET Network View

Following the architecture described in the above, a configured MANET with routers and hosts, looks as in figure 9: the inner white cloud represents where MANET interfaces and links form a MANET – and the outer gray cloud represents where the classic IP link model as described in section 2 is assumed.

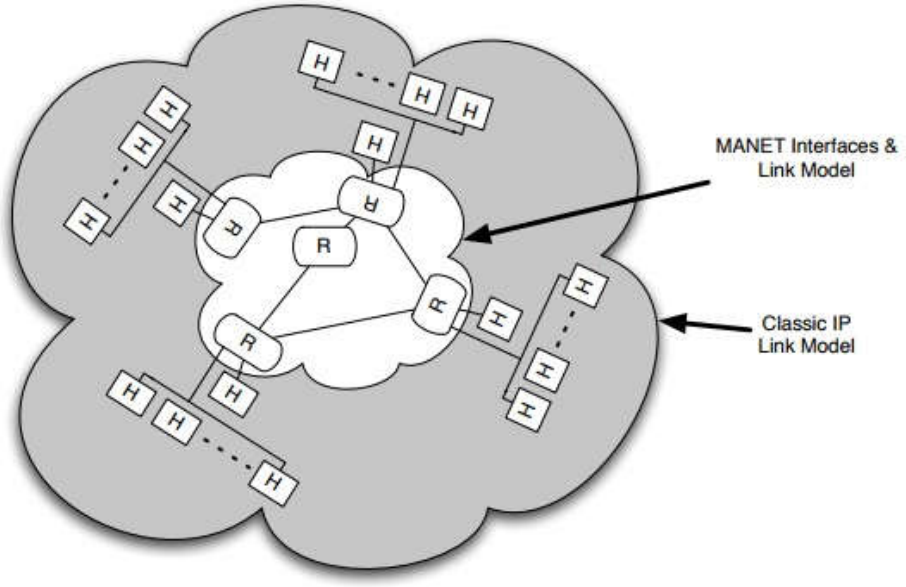


Figure 9: MANET Network Model: the inner white cloud is where MANET interfaces and links for a MANET are found and MANET specific protocols apply. The outer gray cloud represents where the classic IP link model (and regular applications/protocols) applies.

CONCLUSION

In this paper we have discussed a new wave in the field of information technology: MANET. We have seen the advancement in the field of internet due to wireless networking technologies. It gives rise to many new applications. In the past few decades, we have seen the advancement in wireless networks. The emerging capabilities of mobile devices have given a new direction to the internet, which decreases the cost and allow us to use infrastructure wireless networks and infrastructure less wireless networks (i.e. Mobile Ad hoc Wireless Network). We have also described its architecture, advantages and some issues. There is no doubt that MANET is development trend for the future.

Prepared By:

1) Partha Pratim Paul
Reg no: 14-1-5-059

2) Bishal Paul
Reg no: 14-1-5-066