SRI AKILANDESWARI WOMEN'S COLLEGE, WANDIWASH

MOBILE COMPUTING

Class: II. M. Sc Computer Science

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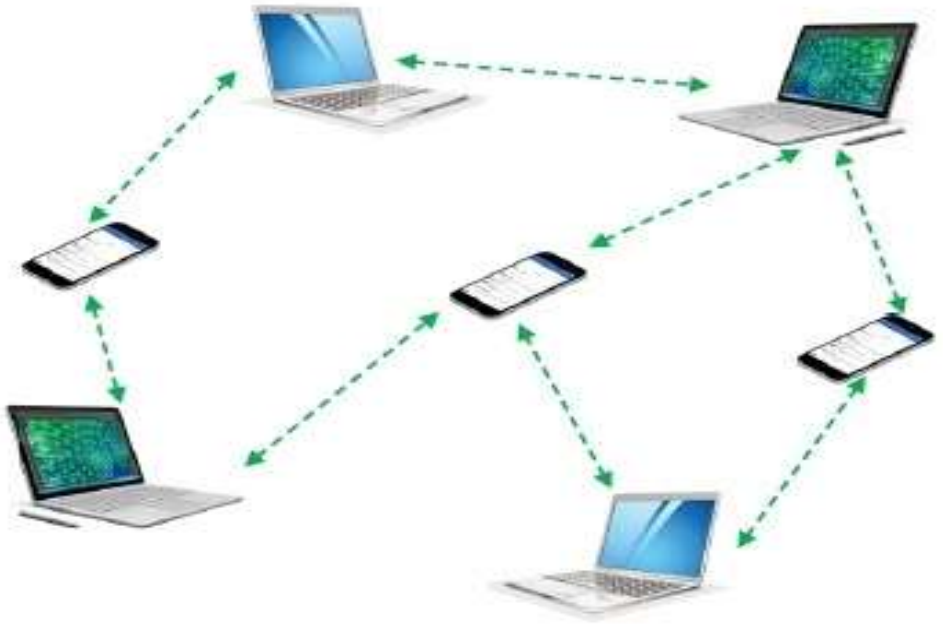
UNIT–IV

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

Ad-Hoc Basic Concepts

- An ad hoc network is one that is spontaneously formed when devices connect and communicate with each other.
- The term ad hoc is a Latin word that literally means "for this," implying improvised or impromptu.
- Ad hoc networks are mostly wireless local area networks (LANs). The devices communicate with each other directly instead of relying on a base station or access points as in wireless LANs for data transfer co-ordination.
- Each device participates in routing activity, by determining the route using the routing algorithm and forwarding data to other devices via this route.

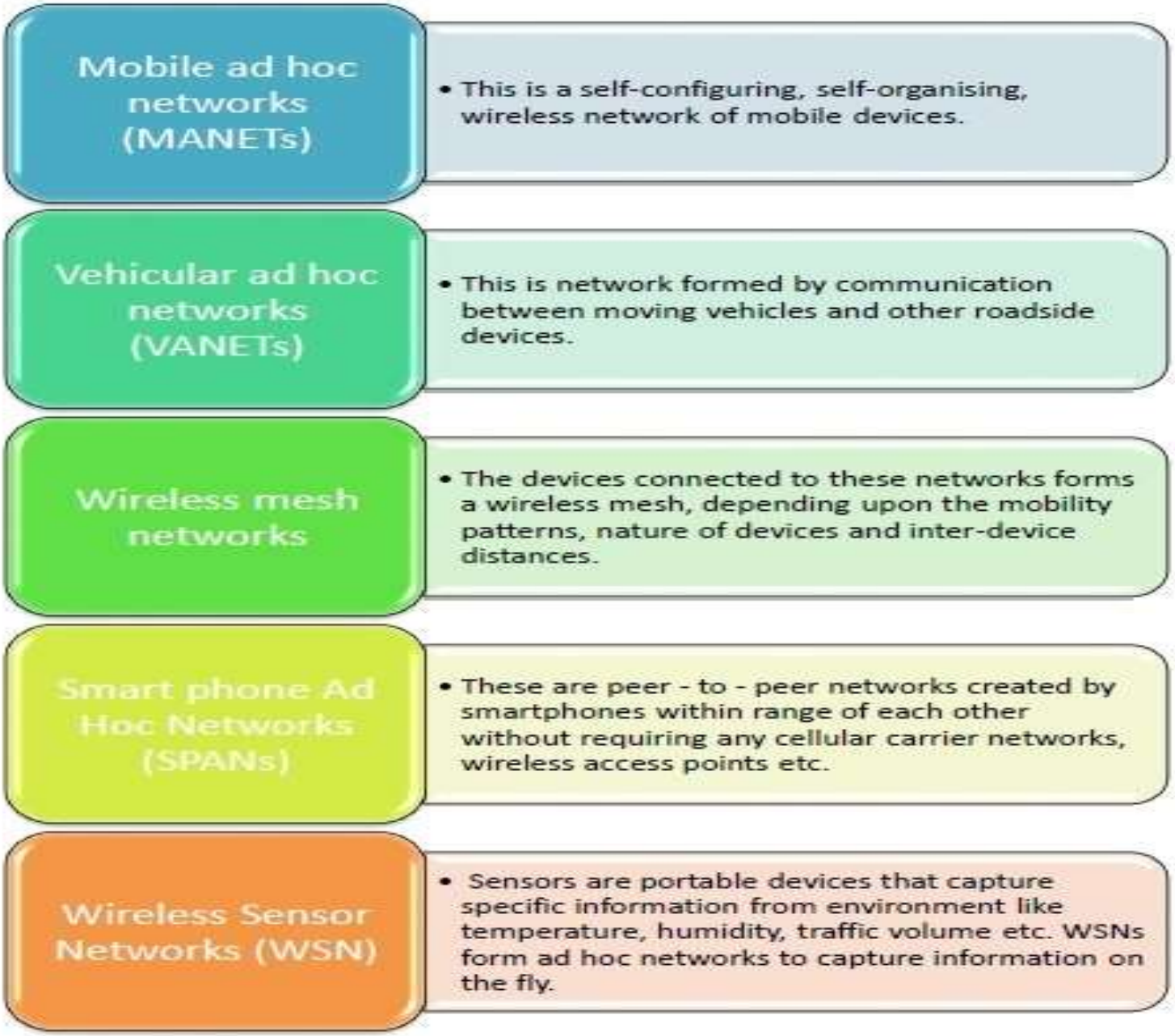
Ad-Hoc Basic Concepts



Classifications of Ad Hoc Networks

- Ad hoc networks can be classified into several types depending upon the nature of their applications.

- The most prominent ad hoc networks that are commonly incorporated are illustrated in the diagram below −


Mobile ad hoc networks (MANETs)
• This is a self-configuring, self-organising, wireless network of mobile devices.
Vehicular ad hoc networks (VANETs)
• This is network formed by communication between moving vehicles and other roadside devices.
Wireless mesh networks
• The devices connected to these networks forms a wireless mesh, depending upon the mobility patterns, nature of devices and inter-device distances.
Smart phone Ad Hoc Networks (SPANs)
• These are peer - to - peer networks created by smartphones within range of each other without requiring any cellular carrier networks, wireless access points etc.
Wireless Sensor Networks (WSN)
• Sensors are portable devices that capture specific information from environment like temperature, humidity, traffic volume etc. WSNs form ad hoc networks to capture information on the fly.

Ad-Hoc Basic Concepts

- A wireless ad hoc network (WANET) is a decentralized type of wireless network.

- The network is ad hoc because it does not rely on a pre existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks.

- Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity.

Ad-Hoc Basic Concepts

- In addition to the classic routing, ad hoc networks can use flooding for forwarding data.

- Wireless mobile ad hoc networks are self-configuring, dynamic networks in which nodes are free to move.

- Wireless networks lack the complexities of infrastructure setup and administration, enabling devices to create and join networks "on the fly" - anywhere, anytime.

Ad-Hoc Basic Concepts

- A wireless ad-hoc network, also known as IBSS - Independent Basic Service Set, is a computer network in which the communication links are wireless.

- The network is ad-hoc because each node is willing to forward data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity.

- This is in contrast to older network technologies in which some designated nodes, usually with custom hardware and variously known as routers, switches, hubs, and firewalls, perform the task of forwarding the data.

Ad-Hoc Basic Concepts

- Minimal configuration and quick deployment make ad hoc networks suitable for emergency situations like natural or human-induced disasters, military conflicts.

- The earliest wireless ad-hoc networks were called "packet radio" networks, and were sponsored by Defense Advanced Research Projects Agency (DARPA) in the early 1970s.

- Bolt, Beranek and Newman Technologies (BBN) and SRI International designed, built, and experimented with these earliest systems.

Ad-Hoc Basic Concepts

- Experimenters included Jerry Burchfield, Robert Kahn, and Ray Tomlinson of later TEN-EXtended (TENEX), Internet and email fame.
- Similar experiments took place in the Ham radio community.
- It is interesting to note that these early packet radio systems predated the Internet, and indeed were part of the motivation of the original Internet Protocol suite.
- Later DARPA experiments included the Survivable Radio Network (SURAN) project, which took place in the 1980s.

Ad-Hoc Basic Concepts

- It is a type of MHWNs.
- Nodes in the network are mobile in general.
- The wireless hosts in such networks, communicate with each other without the existing of a fixed infrastructure and without a central control.
- A mobile ad-hoc network can be connected to other fixed networks or to the Internet.
- Most of the Ad-Hoc networks use the allocated frequencies for the Industrial, Scientific and Medical (ISM) band.

Ad-Hoc Basic Concepts

- Ad-hoc networks have several advantages over the traditional networks, like: Ad-hoc networks can have more flexibility.

- It is better in mobility. It can be turn up and turn down in a very short time.

- It can be more economical. It considered a robust network because of its non-hierarchical distributed control and management mechanisms.

Ad-Hoc Basic Concepts

- There are lots of applications for Ad-Hoc networks, like: Group of people with laptops and they want to exchange files and data without having an access point.
- Sharing the internet Connected to the internet
- Incase if we need to exchange information and the network's infrastructure has been destroyed. It is suitable for military communications at battlefield where there is no network infrastructure.

Cellular VS Ad-Hoc Networks

- Infrastructure networks. Fixed, pre-located cell sites and base station. Static backbone network topology. Relatively caring environment and stable connectivity. Detailed planning before base station can be installed. High setup costs. Large setup time.
- Infrastructureless networks. No base station, and rapid deployment. Highly dynamic network topologies. Hostile environment and irregular connectivity. Ad-Hoc network automatically forms and adapts to changes. Cost-effective. Less setup time.

CHARACTERISTICS

- An ad hoc wireless network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized control.

- Ad hoc wireless networks were traditionally of interest to the military. Throughout the 1970s and 1980s DARPA funded much work in the design of ad hoc packet radio networks;

CHARACTERISTICS

- Current research in ad hoc wireless network design is focused on **distributed routing**.

- Every mobile host in a wireless ad hoc network must operate as a router in order to maintain connectivity information and **forward packets** from other mobiles.

CHARACTERISTICS

- Ad hoc networks require a **peer-to-peer architecture**, and the topology of the network depends on the location of the different users, which changes over time.

- In addition, since the propagation range of a given mobile is limited, the mobile may need to enlist the aid of other mobiles in forwarding a packet to its final destination.

- Thus the end-to-end connection between any two mobile hosts may consist of **multiple wireless hops**.

- It is a significant technical challenge to provide reliable high-speed end-to-end communications in ad hoc wireless networks given their **dynamic network topology, decentralized control, and multihop connections**.

CHARACTERISTICS

- Ad hoc wireless networking is experiencing a resurgence of interest because of new applications and improved technology.

- These networks are now being considered for many commercial applications, including in-home networking, wireless LANs, nomadic computing, and short-term networking for disaster relief, public events, and temporary offices.

- Both the IEEE 802.11 and HIPERLAN Type 1 wireless LAN standards support ad hoc wireless networking within a small area, and wider area networks are currently under development.

APPLICATIONS

- Mobile ad hoc networks (MANETs)
  - Vehicular ad hoc networks (VANETs)
  - Smartphone ad hoc networks (SPANs)
  - iMANETs
  - Wireless mesh networks
  - Army tactical MANETs
  - Air Force UAV Ad hoc networks
  - Navy ad hoc networks
  - Wireless sensor networks
  - Ad hoc home smart lighting
  - Ad hoc street light networks
  - Ad hoc network of robots
  - Disaster rescue ad hoc network
  - Hospital ad hoc network
  - Data Monitoring And Mining

VANET

- VANET is an application of MANET that uses moving vehicle as node to create mobile network.

- Recently, with the development of vehicle industry and wireless communication technology, vehicular ad hoc networks are becoming one of the most promising research fields.

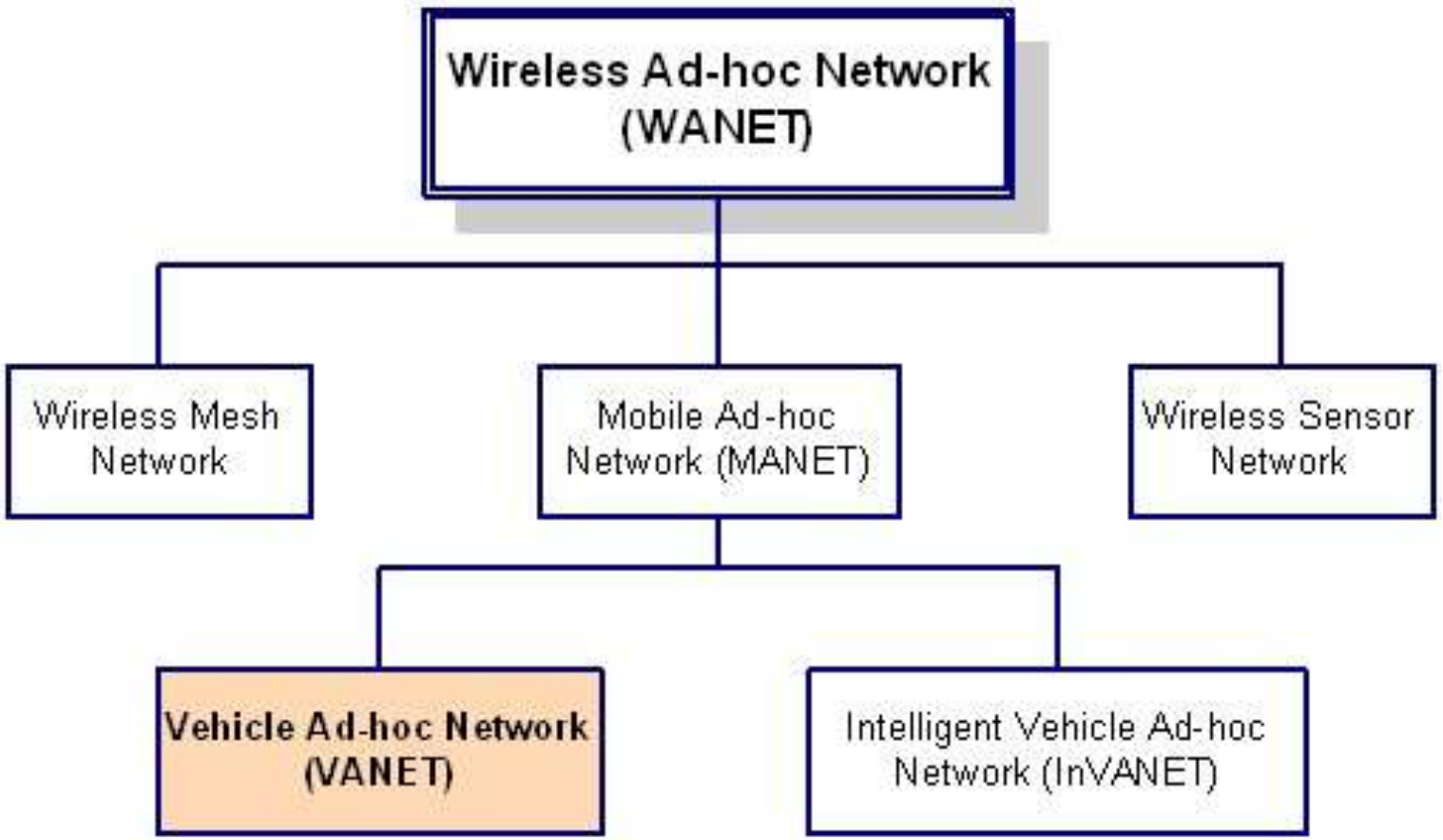
- VANETs which use vehicles as mobile nodes are a subclass of mobile ad hoc networks (MANETs) to provide communications among nearby vehicles and between vehicles and nearby roadside equipment but apparently differ from other networks by their own characteristics.

VANET

- Specifically, the nodes (vehicles) in VANETs are limited to road topology while moving, so if the road information is available, we are able to predict the future position of a vehicle;

- what is more, vehicles can afford significant computing, communication, and sensing capabilities as well as providing continuous transmission power themselves to support these functions .

ADHOC TYPES


Wireless Ad-hoc Network (WANET)
Wireless Mesh Network
Mobile Ad-hoc Network (MANET)
Wireless Sensor Network
Vehicle Ad-hoc Network (VANET)
Intelligent Vehicle Ad-hoc Network (InVANET)

VANET

- VANET turns every participating vehicle into a wireless router or node, allowing vehicles approximately 300m to 1 km of each other to connect and, in turn, create a network with a wide range.

- VANET enables communication among the vehicles and roadside infrastructures. It makes transportation systems more intelligent.

- Since the movement of vehicles are restricted by roads, traffic regulations we can deploy fixed infrastructure at critical locations.

VANET

- The primary goal of VANET is to provide road safety measures where information about vehicle's current speed, location coordinates are passed with or without the deployment of infrastructure.

- Apart from safety measures, VANET also provides value added services like email, audio/video sharing etc

- The best example of VANET is Transport System of any travel agency or any company which is joined internally

COMPONENTS OF VANET

- The major components of a VANET are :
  - On-Board Unit (OBU)
  - Road Side Unit (RSU)
  - Trusted Authority (TA)

VANET-OBU

- OBUs are installed in vehicles to provide wireless communication capability.
- While RSUs are deployed on intersections or hotspots as an infrastructure to provide information or access to the Internet for vehicles within their radio coverage.
- The Authority user is responsible for installing the secure parameters in the OBU to authenticate the user

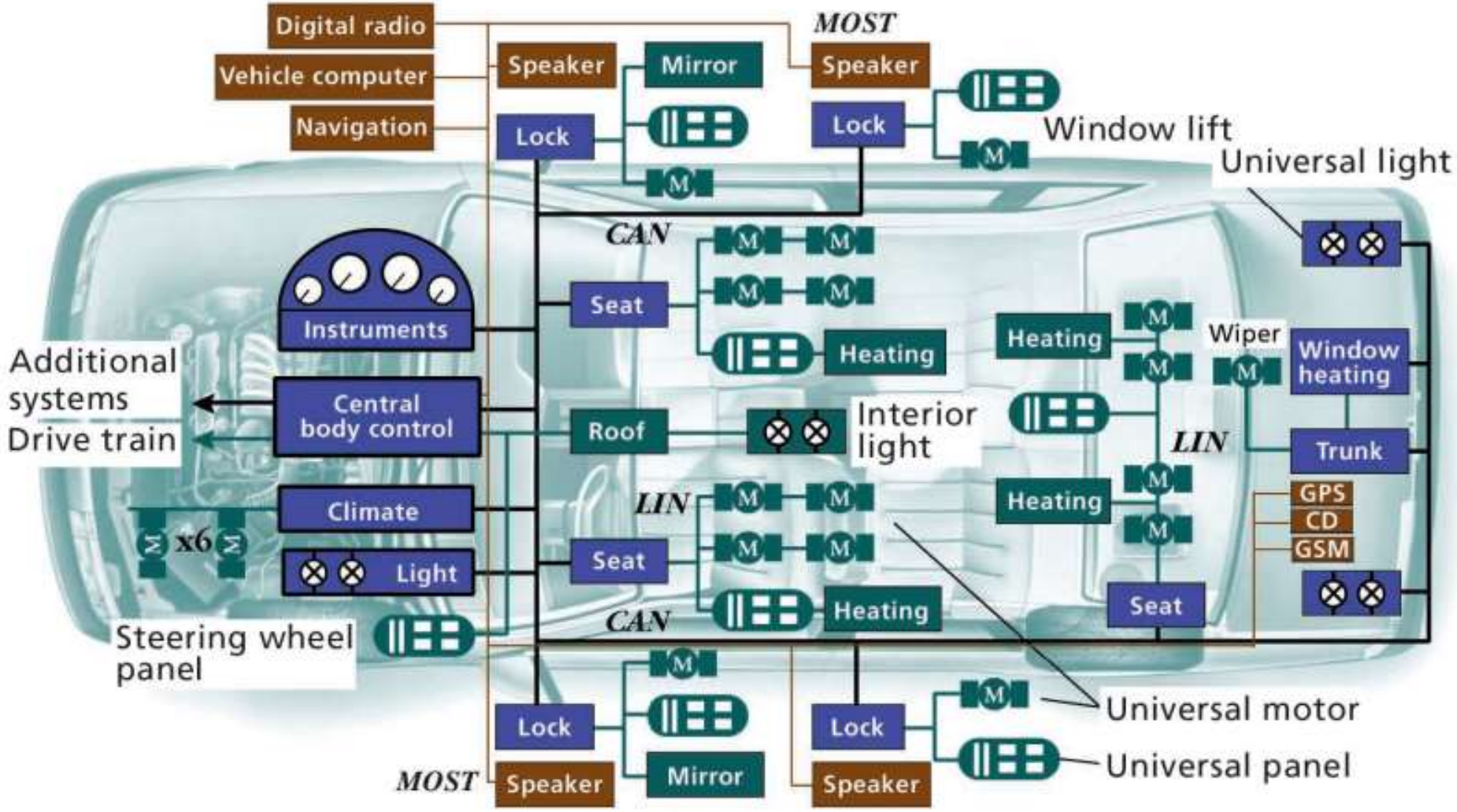
VANET - COMMUNICATION

- VANET vehicular communication are of three types:
  - Vehicle-to-Vehicle communication (V2V)
  - Vehicle-to-Infrastructure communication (V2I)
  - Infrastructure-to-Infrastructure communication (I2I)

VANET- APPLICATION

- VANETs applications enable vehicles to connect to the Internet to obtain real time news, traffic, and weather reports.

- VANETs also fuel the vast opportunities in online vehicle entertainments such as gaming and file sharing via the Internet or the local ad hoc networks.



CAN Controller area network
GPS Global Positioning System
GSM Global System for Mobile Communications
LIN Local interconnect network
MOST Media-oriented systems transport

MANET

- MANET consists of number of mobile devices that are connected together to form a network, without any support from an existing internet infrastructure or any other fixed network station.
- It is autonomous system of nodes connected by wireless links.
- In MANET the network topology may change dynamically in an unpredictable manner since there is no fixed infrastructure and the nodes are free to move, but each node have limited transmitting power.
- MANET's are basically peer-to-peer, multi-hop wireless network in which packets are transmitted in store.

VANET

- VANET is similar to MANET in terms, that is also do not need any infrastructure for data transmission.
- VANET play important role in aspect of safe driving, intelligent navigation, emergency and entertainment applications .
- It can be defined as an intelligent component of transport system as vehicle are able to communicate with each other as well as roadside base station, which are located at critical points of the road
- Example :-Intersection and Construction Sites.

MANET	VANET
Production cost of MANET is cheap as compared to VANET	Much Expensive
Mobility of MANET is low as it make bit difficult for network enables the serving networks to locate a mobile subscriber's point.	High Mobility, as serving networks to locate a mobile subscriber's point is easy.
Change in network topology orientation is slow.	Frequent and very fast change of network topology.
Sparse node density.	Node density is frequent variables
MANET HAVE 100 Kps bandwidth available.	VANET bandwidth is 1000 Kps.
It ranges Upto 100 m	500 m range available in VANET.

MANET	VANET
MANET node lifetime depends on power resources.	Depend on lifetime vehicle
MANET have medium reliability.	High reliability of VANET.
Movement of the nodes affects the operation of a MANET as node movement MANETs need to rely on robust routing protocols. And this MANET have random node movement.	Regular, moving pattern of nodes.
Attribute Based addressing scheme.	Location Bases addressing scheme.
Position acquisition is obtained using Ultrasonic.	VANET maintain position acquisition by using GPS, RADAR.

SECURITY

- Security is the most often cited concern with wireless networks
- Wireless networks pose unique security problems
- Power computation constraints are often higher in wireless networks, making security requirements different Security in Ad-Hoc Networks

Attacks on Ad-Hoc Networks

- Place of disclosure: Location disclosure Attacks that target Confidentiality requirements of the ad hoc network.
- A black hole: Attack malicious node and enters false answers route to route requests it receives
- Wormholes: It involves co-operation between the two malicious nodes that participate in the network to appear one attacker.
- Denial of Service: Specific instances of denial of service attacks include the routing table overflow and the sleep deprivation torture.

Why Security Required

- Data confidentiality: keep data secret
- Data integrity: prevent data from being altered
- Data freshness: data must be recent
- Data availability: data should be available on request
- Data authentication: confirmation that data or request came from a specific, valid sender Security in Ad-Hoc Networks

Security Challenges

- **Vulnerability of channels** Messages can be overheard and fake messages can be introduced into the network
- **Vulnerability of nodes** Nodes do not usually reside in physically protected places
- **Lack of infrastructure** Special networks should operate independently of any fixed infrastructure.
- **Dynamic Topology** The permanent changes of topology require sophisticated routing protocols Security in Ad-Hoc Networks

UNIT V

- MOBILE PLATFORMS AND APPLICATIONS:
- Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Mobile Device Operating Systems

- A mobile operating system (OS) is software that allows smartphones, tablet PCs (personal computers) and other devices to run applications and programs.

- A mobile OS typically starts up when a device powers on, presenting a screen with icons or tiles that present information and provide application access.

- Mobile operating systems also manage cellular and wireless network connectivity, as well as phone access.

MOBILE OS

- Most mobile OS present as a graphical display of buttons, icons, windows, and tiles that you can touch or interact with to perform various tasks.

- This visual architecture is the backbone of the operating system. Without the OS, the device would be a series of command prompts and inscrutable computer code.

- The mobile operating system manages the hardware and makes it possible for smartphones, tablets, and wearables to run apps and other programs in a user-friendly way.

MOBILE OS

- A mobile OS also manages mobile multimedia functions, mobile and internet connectivity, touch screen controls, Bluetooth connectivity, GPS navigation, cameras, speech recognition, and more.

- Most operating systems are not interchangeable. For example, if you have a Samsung phone, which runs the Android OS, you cannot use it to run Apple iOS, which is the operating system used to run iPhones, iPads, and iPod Touches.

MOBILE OS

- **Apple's iOS:** Incredibly popular operating system from Apple, running devices such as the iPhone, iPad, iPod Touch, and Apple TV.

- **Google's Android:** Google's mobile device operating system, powering devices from several device manufacturers.

- **Microsoft's Windows Phone:** A newer operating system from Microsoft that ships on devices from a variety of vendors.

- Windows Phone 7 represents a complete redesign of Microsoft's previous operating system, Windows Mobile 6.5.

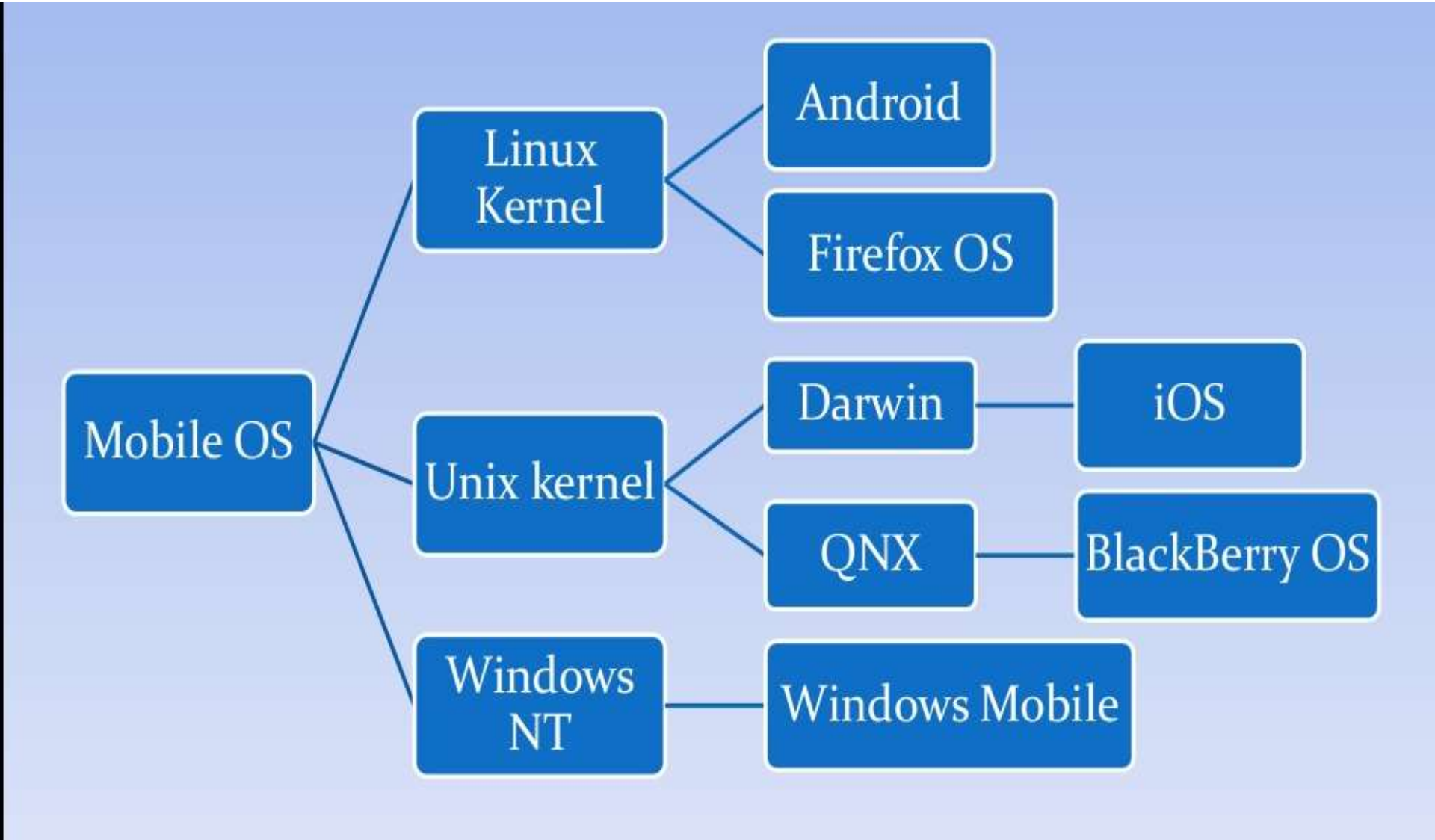
MOBILE OS

- **Research In Motion's Blackberry:** A long-standing favorite in the enterprise due to security and manageability features.

- The iOS and Android platforms have increased in popularity in recent years and have become alternatives to Blackberry in many enterprises.

- **Nokia's Symbian:** Open-source operating system managed by Nokia. In 2011, Nokia announced that it would begin building devices based on the Microsoft Windows Phone operating system, rendering the future of Symbian questionable.

MOBILE OS


Mobile OS
Linux Kernel
Android
Firefox OS
Unix kernel
Darwin
iOS
QNX
BlackBerry OS
Windows NT
Windows Mobile