

Q.1 Which of the following is not the key difference between VANET and MANET.

- a. The high relative speed of mobile node
- b. Limited Redundancy
- c. Self-Organizing
- d. Rapid topology changes

Answer: C

Q.2 Which of the following is a key requirement of VANET?

- a. Mobility
- b. Scalability
- c. Fairness
- d. All of the above

Answer: D

Q.3 What is Routing in VANET?

- I. Convention, or standard, controls how nodes decide which way to [route](#) packets between computing devices.
 - II. Packet communication between nodes either directly or through intermediate nodes without fixed infrastructure.
- a. Only I
 - b. Only II
 - c. Both I and II
 - d. Neither I nor II

Answer: C

Q.4 In VANET network source nodes initiate the route discovery when it needs to send the packet. This type of routing is called

- a. OLSR
- b. DSDV
- c. ZRP
- d. AODV

Answer: AODV

Q.5 Which of the following is the characteristic of VANET?

- a. Static Topology
- b. Wired communication
- c. Fixed infrastructure
- d. Mobility Modeling and Prediction

Answer: D

Q.6 The routing protocols are classified based on

- a. Routing information update mechanism
- b. Protocol Routing topology

- c. Utilization of specific resources
- d. Processing Utilization

Answer: D

Q.7 The first protocol designed for the ad hoc network?

- a. The wireless routing protocol(WRP)
- b. Destination sequenced distance-vector routing (DSDV)
- c. Optimized Link State Routing (OLSR)
- d. Dynamic source routing protocol (DSR)

Answer: B

Q.8 In the AODV routing protocol the route is discovered when

- a. When the network is established
- b. While packet in transmission
- c. Determine if and when needed
- d. Pre-selected route followed

Answer: C

Q.9 Select the correct option for VANET characteristics

- I. Topology: Variable, Nodes join and leave the network very frequently
- II. Connection life: short, depending on the road infrastructure condition
- III. Connectivity: Permanent, end to end connectivity assured
- IV. RSU provides connectivity between two vehicle nodes.
 - a. All the options are correct
 - b. Only I, II and III
 - c. Only I, II and IV
 - d. Only I, II

Answer: C

Q.10 Which of the following is the driver-oriented applications of VANET

- a. Incident management and collision avoidance
- b. Tourist information
- c. Packet route selection
- d. Road traffic and safety information

Answer: D

Q. 11 A ad hoc network is called VANET only when

- a. Vehicle to infrastructure is possible
- b. The driver gets the traffic information in real-time
- c. Vehicle to Vehicle communication is possible
- d. Vehicle to Roadside sensor communication is possible

Answer: C

Q.12 Which of the following is not a communication technology used in VANET

- a. Dedicated Short Range Communication

- b. Wireless Access on Vehicular Environment
- c. IEEE 802.11p
- d. None of the Above

Answer: D

Q.13 Explain the application of VANET where an accident happened at a road junction and information is broadcasted in the nearby vehicles.

Answer: Different answers are possible.

Q.14 Explain different types of radio access technologies with their advantages and disadvantages.

- **DSRC** (Dedicated Short Range Communications)- short range wireless technology
 - ASTM Standard E2213-03, based on IEEE 802.11a
 - name of the 5.9 GHz Band allocated for the ITS communications
 - DSRC standards suite is based on multiple cooperating IEEE standards
- **IEEE 802.11p** - includes DSRC
 - based on ASTM Standard E2213-03- developed for vehicular communications
- **WAVE** (Wireless Access in Vehicular Environments)
 - mode of operation used by IEEE 802.11 devices to operate in the DSRC band
 - the core design aspects of DSRC is Wireless Access in Vehicular Networks (WAVE) corresponding to IEEE 1609.1/.2/.3/.4
- **DSRC Devices**
 - IEEE 802.11 systems using the WAVE mode of operation in the DSRC band
- **IEEE P1556**
 - WAVE – IEEE P1609 – Layer 3-7 (OSI)
 - DSRC: IEEE 802.11p, ASTM 2213

Q.15 Define three components of the VANET.

Answer: Road Side Unit (RSU), On-Board Unit (OBU), and Application Unit (AU)

- **RSU- Road Side Unit**
- **OBU On-board Unit**
- **AU - Application Unit**
- Typically
 - RSU hosts applications that provides services
 - OBU is a peer device that uses the services
- The applications may reside in the RSU or in the OBU (provider/user model)
 - **OBU**
 - set of sensors *to collect* and *process* the information
 - sending information as messages to other Vs or RSUs
 - **Vehicle:** may host $n \geq 1$ AUs that use the applications offered by the provider, supported by OBU connection capabilities
- The RSU can also connect to the Internet or to another server which allows AU's from multiple vehicles to connect to the Internet

- **OBU basic requirements and responsibilities :**
 - A RF antenna + wireless channel (communication -other OBUs and RSUs)
 - Software to run a specific VANET network stack
 - Data forwarding on behalf of other OBUs
 - **Control functions:**
 - routing, network congestion, control, data security, and IP mobility
 - A user I/F to exchange information with the end user, or a connection with a device that has a user I/F
 - A mechanism to generate safety messages to be shared with other OBUs and RSUs
 - these messages can come
 - directly from the user
 - or from automatic processing of sensory data

- **On-Board Unit (OBU)** (*Ref [13] Saini*)
 - HW device mounted on the vehicle
 - It communicates with other OBUs and RSUs (~router)
 - **Typical structure:**
 - transceiver, RF antenna
 - processor
 - read/write memory
 - user interface
 - A *Vehicle Control Unit (VCU)* coordinates with the OBU to collect/disseminate vehicular statistics.
 - Other OBU I/Fs: (e.g. USB and Bluetooth), to connect to other devices on the vehicle, for example: laptops, smartphones and PDAs
 - GPS sensor
 - A **network stack** runs on the processor to provide the abstraction of VANET

■ **RSU- Road Side Unit**

- antenna, processor, and read/write memory
- wireless and wired I/Fs to communicate with OBUs, other RSUs and the Internet
- It can extend the coverage area of OBUs through data forwarding
- **RSUs are installed** (optimization multi-criteria problem!)
 - along the roads, mainly near intersections and gas stations
 - locations of high vehicle density
- **Main functionalities of an RSU**
 - RF , high power, and long-range antenna
 - Support access to wired channels, (coax, cable or optical fiber cable, with Ethernet-like protocols)
 - Network stack to run a VANET specific network, link and L1 protocols
 - Forwarding data packets to OBUs in its range and other RSUs
 - Aggregation of safety information from OBUs through safety applications and alarming incoming OBUs
 - GW to provide Internet connectivity to OBUs
- **Standards to be supported:** IEEE 802.11p, and all four IEEE 1609 protocols