ITE6006 Wireless Networks

L	T	P	J	C
3	0	2	4	5

Pre-requisite.: Nil

Objectives:

- To learn about different types of wireless and mobile systems
- To understand the various layers in wireless network
- To have in-depth knowledge in routing in a secured network

Expected Outcomes:

On completion of this course, the students will be able to

- Design, implement and evaluate a wireless network, process, component, or program to meet desired needs.
- An ability to choose different MAC, routing protocols for the desired need.
- An ability to use techniques, skills and simulation tools.

Module	Topics	L Hrs	SLO
1	**Fundamentals of wireless communication**: Electromagnetic spectrum; Characteristics of wireless channel; Modulation techniques; Multiple access techniques, Antennas, Radio Propagation Mechanisms-Spread Spectrum	6	6
2	**Fundamentals of wireless LANs, PANs, WANs,** MANs: IEEE 802.11, HIPER-LAN standards; Bluetooth; HomeRF; Cellular concept and architecture, WLL, UMTS, 2G/3G Versus LTE, Next Generation Mobile Networks.	7	6
3	**Wireless Internet**: Mobile IP; TCP over wireless; Wireless application protocol; Optimizing Web over wireless. Wireless devices service technologies- SMS, USSD and VXML.	5	7
4	**Ad hoc wireless networks** : Issues and challenges in intrastructure-less networks; MAC protocols; Routing protocols; Multicast routing protocols; Transport and security protocols; Quality of service provisioning; Energy management.	7	6
5	**Hybrid wireless networks**: Architectures and routing protocols for hybrid wireless networks; Load balancing schemes; Pricing schemes for multihop wireless networks	6	6
6	**Sensor Networks**: Issues and challenges in wireless sensor networks: Architectures and routing protocols; MAC protocols; Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.	7	6
7	**Application Layer**: Mobile computing platforms -Energy efficiency of apps	4	17
8	Expert Talk on Recent Advancement in Wireless Networks	3	6
	Total Lecture Hours # Mode: Flipped Class Room, [Lecture to be videotaped], Use of physical and computer models to lecture, Visit to Industry, Min of 2 lectures by industry experts	**45**	

TextBook:

1. C. Siva Ram Murthy, B. S. Manoj, "Ad Hoc Wireless Networks – Architecture and Protocols", Pearson Education, 2010.

Reference Book:

1. Asoke K. Talukder, Roopa R.Yavagal, Mobile Computing-Technology, Applications and Service Creation, Tata McGraw Hill, 2010
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of wireless sensor Networks - theory and practice", John Wiley & Sons, 2010.
3. Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", John Wiley & Sons, 2010.

Challenging Exercises

1 Analyze the effects of mobility with 9 nodes in wireless transmissions on reliable transport protocol. Design a scenario based on the following properties:

   i. The first 4 nodes are in subnet 1 and other 4 nodes belong to subnet 2 and one node should be in both subnets
   ii. Source is in subnet 1 and the destination is in subnet 2
   iii. Give mobility to both source and destination.

2. Scenario for Cellular Network consists of 4 MSs , 1 BS,1 SC,1 gateway, 1 aggregated node. All MS communicate with BS via radio interface. BS connects to SC, SC connects to gateway and gateway connects to aggregated nodes. Use Cellular Abstract APP, Abstract Cellular MAC and Abstract Physical Model. Analyze the statistical results.

3. To test how Dot11e (MAC 802.11e) protocol operates in following ad hoc network scenario. Node 1 2, 3, 4, 5 & 6 are all QSTAs. Node 2 is sending CBR packet to 5

   6 1

   2 5

   3 4

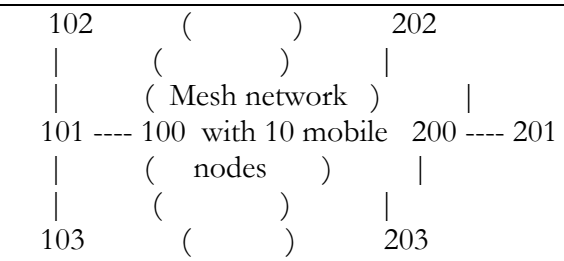
4. To test how Dot11e (MAC 802.11e) protocol operates in Multichannel and QIBSS mode(QoS enabled) for the following scenario. Node 1 3, 4 are in one Qos enable Wireless Subnet. Node 2 5,& 6 are in other Qos enable Wireless Subnet. Node 1 and 2 are QAP. and they are in a separate wired subnet.Node 4 is sending CBR packet to 6

   3 5

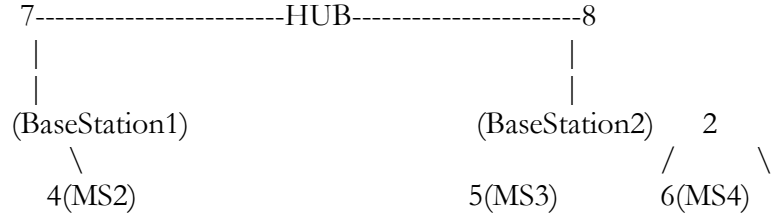
   1 -------- 2

   4 6

5. Illustrate a mesh network as a wireless inter-connects between non-wireless subnetworksfor the following scenario. The mesh has two points of inter-connectivity with wired subnets and forms a wireless link between them. Besides the two portals, the mesh consists of 10 MPs that are mobile using random way-point movement. Application traffic is a mix of CBR and FTP/Generic between wired nodes. Routing protocol is BellmanFord.

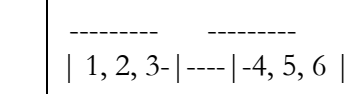


6. To demonstrate how to create and run a simple wireless/wired combined scenario in 2D/3D GUI, and analyze the performance for the following scenario.

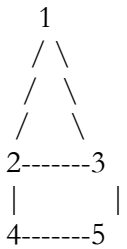


7. In this scenario, 2 WiFi access points and 4 WiFi mobile terminals are deployed. Mobile terminal (MS1) moves from the area covered by access point 1 (BaseStation1) to the area covered by access point 2 (BaseStation2) and then return to the area covered by access point 1(BaseStation1). There is One CBR traffic from MS1 to MS3. When MS1 moves, association/reassociation and handover are happened between the two APs.

8. To show how to configure multiple wireless channels and specify channels for individual subnets using listening and listenable channel masks for the following scenario. Node 1, 2, 3 are in one subnet using wireless channel 0. Node 4, 5, 6 are in one subnet using wireless channel 1 Node 3 and 4 are in the third subnet using wireless channel 2. Here, node 3 and node 4 have 2 dual interfaces and connect subnet 1 and subnet 2.



9. Normal AODV test for 5 nodes in the following wireless scenario. CBR is used to send 10 data segments of 1460B from node 1 to node 4.



10. Tests destination sequence number update when new path is found to the same destination for the following scenario.

simulation starts with the following topology:

1-----2-----3

mobility results in the following topology:

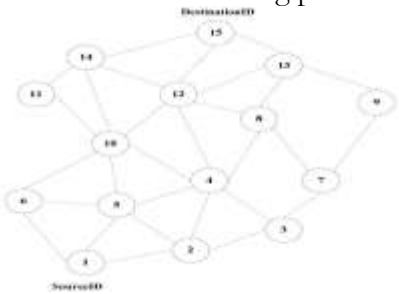
3-----1-----2

Node 1 sends a packet to Node 3 before mobility and another one is after mobility. The packet initially goes to Node 3 via Node 2, but after mobility, a route error is generated by node 2.

11. To Test 802.11 Power Saving mode implementation in ad hoc mode for the following scenario. Node 1 thru 6 are connected through a wireless subnet and forms an IBSS. Here, IBSS supports PS Mode. Node 2 is sending CBR packets to Node 5. Node 3 is sending CBR packets to Node 6.

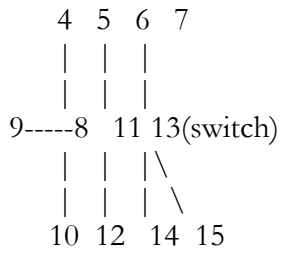
```
        6   1
        |   |
        |   |
        |   |
 2-----[wireless-subnet]-----5
        |   |
        |   |
        |   |
              6     4
```

12. Design the following network scenario with the following. Transfer CBR packets from 1 to 15 and analyze and check your results with routing information. Use static routing and follow the routes given
    i. Route 1: 1→5→ 10→12→15
    ii. Route 2: 1→2→4→8→13→15
13. Design the following network scenario with the following. Transfer CBR packets from 1 to 15. Use DSR routing protocol and analyze and check your results with routing information.



14. Analyze the performance of AODV and DSR routing protocols with 25 nodes and 50 nodes. Use FTP/GEN application to transfer 200 packets of size 2000 bytes. Which protocol performs better in the above scenario?
15. To test the functionality of IEEE 802.16 when running with multicast and unicast applications for the following scenario. 1 wireless subnets (192.0.0.0) has 5 nodes (3 to 7) with node 3 as base station (BS) and rests as MS. Node 13 is a switch. A MCBR flow is from node 1 to multicast group 225.0.0.1. The multicast group includes nodes {7 9 10 12 14}- MCBR 1 225.0.0.1 0 512 1S 50S 3M. A CBR flow is from node 9 to node 1 - CBR 9 1 0 512 1S 50S 3M PRECEDENCE 5. A CBR flow is from node 10 to node 15 - CBR 10 15 0 512 1S 50S 3M PRECEDENCE 7. OSPFv2 and MOSPF are unicast routing and multicast routing protocols respectively. The unicast and multicast packets should be successfully received by their destinations.

```
1 (MCBR src)
|
|
2
|
|
3 (BS)
```



Compiled by : Prof.Nadesh R.K & Dr.UshaDevi G