Isfahan University of Technology
Information Technology Fundamentals
Dr. Manshaei
Homework 1: Module 02 Networking
Deadline: Friday 17^{th} Farvardin, at 23 : 59

We only accept the homework **delivered via yekta (yekta.iut.ac.ir), before the deadline**.

1. Assume there are 3 users in CDMA network and each users are using their own code for the communication. User A's code is 1 -1 -1 1 1 -1 -1 1, B's code is 1 -1 1 -1 -1 1 -1 1 and C's code is 1 -1 -1 1 -1 1 1 -1.

- Check if all pairs of codes are orthogonal each other. Find the encoded bit stream for each user when user A transmits 0, B transmits 1, and C transmits 1.
- What is the composite signal of three users? Combined signal has been transmitted from Base station and user A is receiving signal and decode it.
- Show decoding process of user A. Combined signal has been transmitted from Base station and user C is receiving signal and decode it. Show decoding process of user C.

2. Explain the differences between CDMA and GSM technologies in terms of how they handle multiple users sharing the same frequency bands.

3. Compare and contrast the architecture and standards of 3G and LTE cellular networks. Highlight the key differences between the two generations.

4. Consider the scenario shown in the Figure 1, in which there are four wireless nodes A, B, C, D. the radio coverage of the four nodes is shown via the shaded ovals, all nodes share the same frequency.

- What happens if node A wants to send data to B and C to D, simultaneously?
- What happens if node A wants to send data to B and D to C, simultaneously?
- What happens If node A intends to send data concurrently to nodes B and D, how would the communication between the nodes be affected, especially with node C in close proximity to node D?

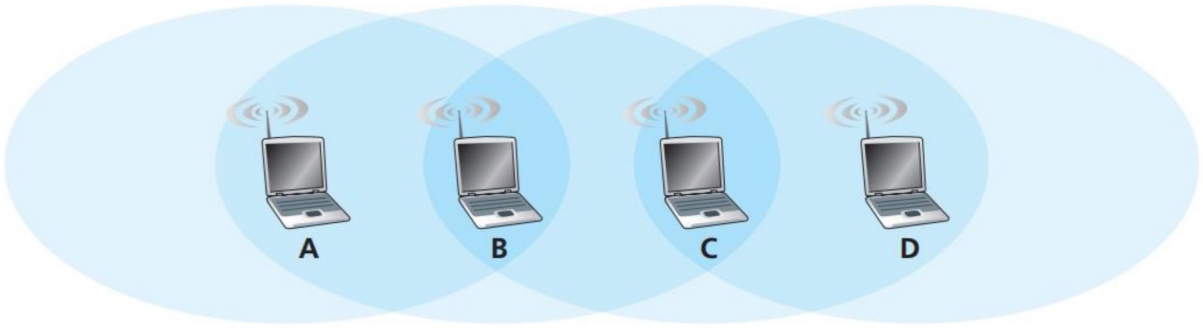

Figure 1: Position and coverage of wireless nodes

5. What are the main challenges associated with handling mobility in cellular networks? How can these challenges be addressed?

6. (Research Question) Explain the concept of MIMO (Multiple Input Multiple Output) technology in the context of wireless communication. How does MIMO enhance the performance of wireless networks in terms of data rate and reliability compared to traditional SISO (Single Input Single Output) systems?

7. Discuss the security considerations that need to be addressed when implementing wireless LANs based on IEEE 802.11 standards.

8. Consider the scenario shown in Figure 2. Suppose that the correspondent wants to send data to mobile node, and vice versa.

- Explain the packet flow in the aforementioned scenario. (for both direct routing and indirect routing)
- What would be the source and destination IP address in each stage? (for both direct routing and indirect routing)

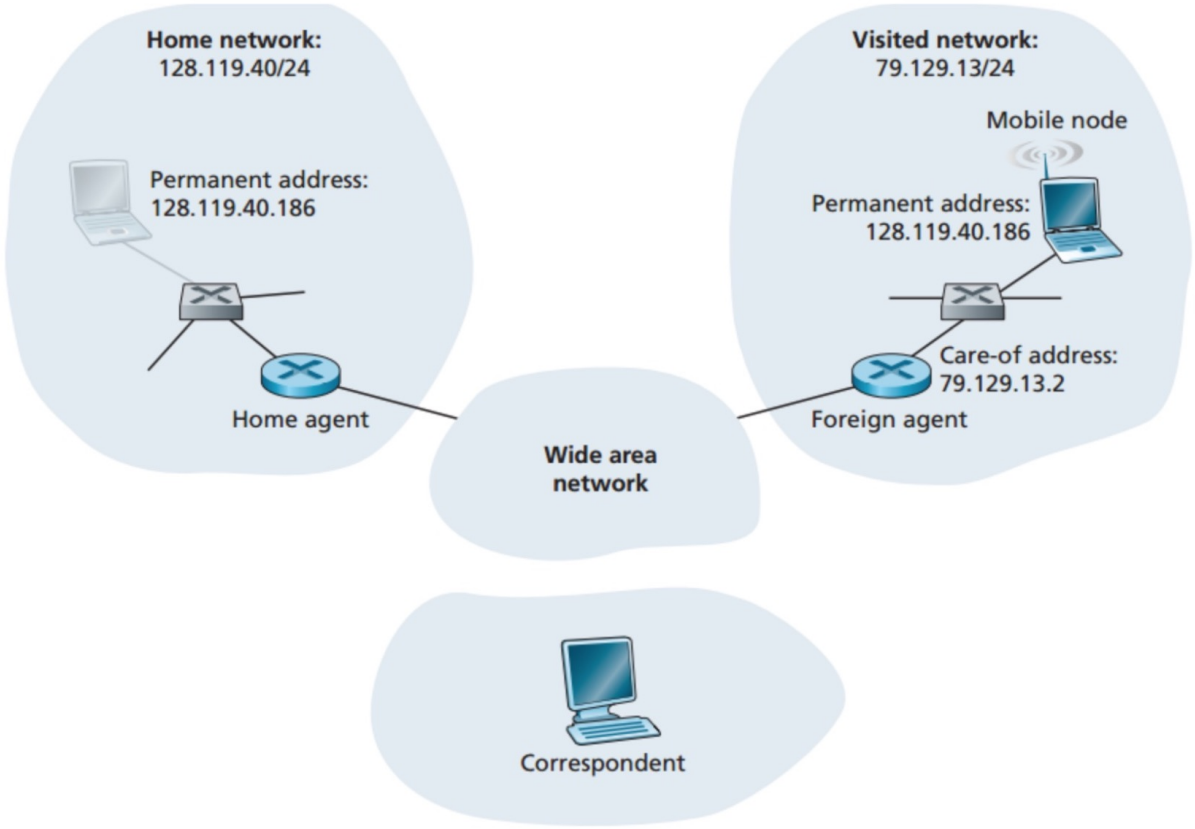

Figure 2: Scenario of mobility management