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Mobile Networking

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Teaching Team and Resources

• Instructor:

– Mohammad Hossein Manshaei

- Teaching Assistants

 Mr. Adili & Mr. Nourbakhsh
- Course web page available at IVUT webcourse:

http://ivut.iut.ac.ir/bounce.php?course=1012

Course Contents

- I. Introduction to Mobile Networking
- 2. Fundamentals of Wireless Transmissions
- 3. Mobile/Wireless MAC Layer
- 4. IEEE 802.11
- 5. 802.11 MAC Layer Advance Features
- 6. 802.11b PHY Layer
- 7. 802.11a PHY Layer
- 8. More on 802.11 PHY Layers

- 9. Zigbee/Bluetooth/WiMax
- 10. Mobile Network Performance Analysis
- II. MANET Routing Protocols
- 12. Mobile Network Layer
- 13. Transport Layer over Wireless Networks
- 14. Cellular Networks
- 15. Satellite Communication
- 16. Wireless Security
- 17. New Advances

Network Structure

- network edge:
 - hosts: clients and servers
 - servers often in data centers

- access networks, physical media: wired, wireless communication links
- network core:
 - interconnected routers
 - network of networks



Internet Protocol Stack

- application: supporting network applications
 - FTP, SMTP, HTTP
- transport: process-process data transfer
 - TCP, UDP
- network: routing of datagrams from source to destination
 - IP, routing protocols
- *link:* data transfer between neighboring network elements

 Ethernet, 802.111 (WiFi), PPP
- physical: bits \Box on the wire \Box





I. Introduction to Mobile Networking

- History of Wireless Communications
 - Spectrum Allocation
- Mobile Devices
- New Mobile/Wireless Networks
 - Mobile Ad Hoc and Sensor Networks, RFID,
 VANET, ...
- Mobile Services
- Wireless System Development
- Research in Mobile Networking



2. Fundamentals of Wireless Transmissions

- Processing at the Transmitter and Receiver
- The Wireless Channel
 - Propagation Mechanisms
 - Path Loss
 - Slow and Fast Fading
 - Doppler Effect
 - Delay Spread
 - Noise
- Throughput Limit



3. Mobile/Wireless MAC Layer

- Introduction to Medium Access Control
- Wireless MAC: Main Challenges
- MAC Protocol Taxonomy
 - FDMA
 - CDMA
 - TDMA
- Comparison and Conclusion

4. IEEE 802. I I



- 802.11 History and Standardization
- 802.11 Architectures and Layers
- 802.11 Frame Format and Addressing
- 802.11 Mac Layer (CSMA/CA)

5.802.11 MAC Layer: Advance Features

- 802.11 Fragmentation
- 802.11 Point Coordination Function
- 802.11 MAC Management
 - Synchronization
 - Power Control
 - Roaming
 - Physical Data Rates Adaptation
- 802.11e: QoS in WiFi

6.802.11b PHY Layer

- PHY Layer Characteristics and Data Rates
- IEEE 802.11b PHY Layer
 - DSSS
 - Packet Format
 - CRC, Scrambler, and Descrambler
 - PLCP Transmission/Reception, CCA, and 11b
 Specification
 - FHSS
 - -IR
- Available Modulations and their Performances
 - DBPSK, DQPSK, and CCK

7.802.11a PHY Layer

- IEEE 802.11a Characteristics
- Available Data Rates and Modulations
 - Modulations Performance Analysis (BPSK, 4, 16, 64-QAM)
- PLCP Preamble and Header Format
- Convolutional Encoder and Punctured Coding
- PLCP Transmit and Receive Procedures
- OFDM in 802.11a
- 802.11a Channels and Timing Parameters

8. More on 802.11 PHY Layers

- IEEE 802.11g
- IEEE 802.11n
- IEEE 802.11ac
- IEEE 802.11p

9. Zigbee/Bluetooth/WiMax: More IEEE Standards

- Bluetooth
 - History and Introduction
 - IEEE 802.15.1
 - Application, Frequency, Architecture, and Protocol Stack
- IEEE 802.15.3
- IEEE 802.15.4
- WiMax 802.16





I O. Mobile Networks Performance Analysis

- Real Experimentations —HoE on IEEE 802.11b
- Analytical Models
 - -Bianchi's Model
- Simulations
 - -ns-2



NS₂



II. MANET Routing Protocols

- Topology-based protocols
 - Proactive (Always up-to-date routing information)
 - distance vector based (e.g., DSDV)
 - link-state (e.g., OLSR)
 - -Reactive (on-demand)
 - distance vector based (e.g., AODV)
 - source routing (e.g., DSR)

• Position-based protocols

- greedy forwarding (e.g., GPSR, GOAFR)
- restricted directional flooding (e.g., DREAM, LAR)
- Hybrid approaches



12. Mobile Network Layer

- Mobile IP
- Tunneling
- Mobile IP v6
- Host Identity Protocol



I 3. Transport Layer over Wireless Networks

- TCP over Mobile Networks
- I-TCP
- M-TCP
- Snooping TCP
- Performance Enhancing Proxies



14. Cellular Networks

I. Cellular Concepts

Cell Area, Signal Strength and Cell Parameters,
 Capacity of a Cell, Frequency Reuse, Cluster Forming,
 Co-channel Interference, Cell Splitting, Cell Sectoring

2. Cellular Standards

- IG, 2G, 3G standards (GSM, IS-95, GPRS, EDGE, CDMA2000, UMTS)
- LTE, Femtocell



15. Satellite Communications

- GEOS
- LEOS
- MEOS



16.Wireless Security

- GSM Security
- WiFi Security
- Bluetooth Security



17. New Advances

- UWB
- Cognitive Radio
- Delay Tolerant Networks (DTN)
- RFID
- Multimedia Service over Mobile Networks
- Directional and Smart Antenna



Organization

- Lectures
- Homework
 - Several homework with a few correction sessions
- Quiz
 - Several quizzes
- Project
- Final Exam

Exams and Grading

- Quizzes: 20%
- Homework: 10%
- Project: 15%
- Final exam: 60%

→Hence, 5% bonus

Projects Must be From



Important Dates (1393)

- Saturday Mehr 19th: First Proposal
- Saturday Mehr 26th: Notification (Accept/Reject/ Revision)
- Saturday Aban 3rd: List of Project Announcement
- Sunday Azar 23rd: Report Due

Textbook (I)

Introduction to Wireless and Mobile Systems 3rd edition. Dharma P. Agrawal - University of Cincinnati Qing-An Zeng - University of Cincinnati

CENGAGE Learning, 2011



Textbook (2)

Mobile Communications 2nd edition. Jochen Schiller

Addison-Wesley, 2003



Textbook (3)

Wireless Communications and Networks 2nd edition. William Stallings

Pearson, 2005



Textbook (4)

Mobile Wireless Communications 2nd edition

Mischa Schwartz Cambridge Press, 2005



Mischa Schwartz

CAMBRIDGE

Textbook (5)

Wireless Communications

Andrea Goldsmith Cambridge Press, 2005

