

Fall 2023

## **ECE 636 - COMPUTER NETWORKING LABORATORY**

Weiqi Liu

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## **ECE 636 Computer Networking Laboratory**

**Prerequisites:** ECE 637 or CS 656.

### **Course description and learning outcomes:**

This course provides students with hands on training regarding the design, troubleshooting, modeling and evaluation of computer networks. In this course, students conduct experiments in a real test-bed networking environment, and learn about network design and troubleshooting topics and tools such as: network addressing, Address Resolution Protocol (ARP), basic troubleshooting tools (e.g., ping, ICMP), IP routing (e.g., RIP), route discovery (e.g., traceroute), TCP and UDP, IP fragmentation and others. Students are also introduced to network modeling and simulation, and they have the opportunity to build some simple networking models using the OPNET modeling tool and perform simulations that help them evaluate their design approaches and expected network performance.

### **Textbook:**

1. Lab Manual for ECE636
2. Richard Stevens, "TCP/IP Illustrated, Vol. 1: The Protocols," Publisher: Addison-Wesley Professional (US Ed edition - 1994), ISBN: 0201633469
3. Larry L. Peterson and Bruce S. Davie, "Network Simulation Experiments Manual: Computer Networks, A System Approach," Publisher: Morgan Kaufmann (2<sup>nd</sup> Edition – October 2007), ISBN: 0123739748

### **OR**

Larry L. Peterson and Bruce S. Davie, "Network Simulation Experiments Manual: Computer Networks, A System Approach," Publisher: Morgan Kaufmann (1<sup>st</sup> Edition – May 2003), ISBN: 0120421712

**Course Coordinator: Professor Nirwan Ansari, ECEEC343**

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**Office Hour:** Vary every semester

**The NJIT Academic Honor Code will be strictly followed and any violations will be brought to the immediate attention of the Dean of Students.**

**Term project:** Each student is required to simulate his/her own network topology with multiple application traffics consisting of the following components: 1) design his/her own network using

OPNET Modeler, 2) configure the appropriate applications and profiles, and 3) obtain and analyze the network's performance statistics via simulations to study how different designs can respond to the need of services as well as resources provided by a company. The simulations can also show students how various designs of a network can affect the performance of the network.

**Grading:**

|                     |             |
|---------------------|-------------|
| <b>Lab reports:</b> | <b>82%</b>  |
| - Lab 1:            | 13%         |
| - Lab 2 :           | 13%         |
| - Lab 3:            | 13%         |
| - Lab 4:            | 11%         |
| - Lab 5:            | 15%         |
| - Lab 6:            | 17%         |
| <b>Project:</b>     | <b>15%</b>  |
| <b>Attendance:</b>  | <b>3%</b>   |
| <b>Total:</b>       | <b>100%</b> |

**Schedule (may be updated every year):**

| Week | Date | Experiments   | Reading assignment <sup>1</sup> | Report(s) Due      |
|------|------|---|---------------------------------|--------------------|
| 1    |      | Introduction (Part I)<br>Lab 1: Experiment with ARP   | Ch.4 & 7<br>[1] <sup>2</sup>    |                    |
| 2    |      | Lab 2: IP addressing and subnet masking<br>Lab 3: Troubleshooting Experiments with ICMP                                 | Ch.3& 6<br>[1]                  |                    |
| 3    |      | Lab 3: Troubleshooting Experiments with ICMP (Continued, if needed)<br>Lab 4: IP routing<br>Lab 5: Experiments with UDP | Ch.9 & 11<br>[1]                | Lab 1              |
| 4    |      | Lab 5: Experiments with UDP (Continued)   |                                 | Lab 2              |
| 5    |      | Lab 6: TCP experiments  | Ch.18 -20<br>[1]                | Lab 3              |
| 6    |      | Lab 6: TCP experiments (Continued)  | Ch.21 [1]                       | Lab 4              |
| 7    |      | Lab 7: Introduction to OPNET Modeler & Modeling and simulation Small Internetworks & M/M/1 Queue                        | Lab. 0 & 1<br>[2] <sup>3</sup>  | Lab 5              |
| 8    |      | Lab 8: OPNET-based experiment   |                                 |                    |
| 9    |      | Lab 8: OPNET-based experiment (Continued)   |                                 | Lab 6              |
| 10   |      | Lab 8: (Continued)<br>Lab 9 <sup>4</sup> : Exemplified Project: Modeling, Configuration and                             |                                 | Lab 9 - Report and |

|    |  |   |  |              |
|----|--|---|--|--------------|
|    |  | Performance Analysis of the Exemplified Lab Network using OPNET Modeler   |  | Presentation |
| 11 |  | Lab 9: Exemplified Project: Modeling, Configuration and Performance Analysis of the Exemplified Lab Network using OPNET Modeler (Continued) |  |              |
| 12 |  | Lab 10: Project (Continued)   |  |              |
| 13 |  | Lab 10: Project (Continued)   |  |              |
| 13 |  | Lab 10: Project (Continued)   |  |              |
| 14 |  | The project report dues   |  |              |
|    |  | Grade dues  |  |              |

Notes:

1. Students are strongly encouraged to read the related materials for each class.
2. [1] denotes the 2<sup>nd</sup> reference textbook, Richard Stevens, "TCP/IP Illustrated, Vol. 1: The Protocols."
3. [2] denotes the 3<sup>rd</sup> reference textbook, Larry L. Peterson and Bruce S. Davie, "Network Simulation Experiments Manual: Computer Networks, A System Approach."
4. Please note that the topology shown in Lab 8 manual is only an example, but NOT the project topology. Every student is required to model and simulate using DIFFERENT topologies, which have to be approved by the instructor. Details will be further discussed in class.