

## Course Syllabus

### **TLEN 5830: Next Generation Networks** **Fall 2016 (9:30 – 12:15 p.m., Thurs., Rm. ECEE 283, 3 Credits)**

#### **Course Description and Objectives**

This course provides an in-depth immersion into the foundational theories and technologies of Software Defined Networking (SDN), Network Functions Virtualization (NFV) and emerging technologies for computer networks. Students will gain direct experience with real-world lab experiments and demonstrations, which will give them an advantage in the job market for this in-demand, constantly changing subject. Popular software and technologies in industry, such as Open vSwitch, OpenFlow, OpenDaylight, OpenStack, Floodlight, Ryu, ONOS, POX, Mininet, etc., will be used throughout the course to facilitate the understanding of how high-level software programs can control the behavior of the entire physical network. This course is essential in preparing students to apply their fundamental networking knowledge to the real world they will enter upon graduation.

In this class students learn the fundamentals of next generation network technologies, services, and tools used in industry to design, deploy, and troubleshoot next generation networks through the following key objectives:

- Understand the core technologies, theories, and dilemmas that face next generation network engineers in this field.
- Understand best practices about how to design, deploy, and troubleshoot next generation networks.
- Utilize multivendor, vendor neutral (bare metal), and commercial equipment (such as Arista, Brocade, Dell, HP, Pica8, and Raspberry Pi) to prepare for real-world scenarios in industry.

TLEN 5838 covers these topics and achieves these objectives through hands-on lab exercises built around real-world applications and theories presented in the lectures. The course is split into the following units of study:

- Introduction to SDN
- Control Plane and Data Plane
- OpenFlow Fundamentals
- SDN in Business and Key Players
- Cloud and Data Center Architecture
- Security
- Network Functions Virtualization

Students successfully completing this course should gain a much greater appreciation of the technologies and procedures required in designing, deploying, and troubleshooting next generation networks. The complex interactions among these aspects are shaping the future of

this critical sector of network engineering. The resulting understanding should enhance employment or promotion opportunities in the network engineering sector and enhance the student's ability to participate in the public discourse regarding the future of the next generation networks.

Upon successfully completing this course, the students will be able to expand upon the knowledge learned and apply it to SDN/NFV specific industry certifications, such as the ONF-Certified SDN Associate/Engineer. In the competitive job market, understanding the future of networking is necessary. The knowledge and skills gained from this course, when combined with the core ITP courses, will provide a well-rounded, highly desirable network engineer.

### **Instructor**

Dr. Levi Perigo  
Scholar in Residence | Professor of Network Engineering, Interdisciplinary Telecom Program  
levi.perigo@colorado.edu  
303-735-5131

### **Office Hours**

Time: Monday and Wednesday 10:00 – 10:45 a.m., as well as by appointment.  
Location: ECOT 312

### **Teaching Assistants - [tlen.5830-006@lists.colorado.edu](mailto:tlen.5830-006@lists.colorado.edu)**

Dewang Gedia: [dege7805@colorado.edu](mailto:dege7805@colorado.edu)  
Office Hours: Tuesday 2:00 p.m. – 3:00 p.m., DLC Lobby  
Vamsi Viswanadha: [Vamsi.Viswanadha@Colorado.edu](mailto:Vamsi.Viswanadha@Colorado.edu)  
Office Hours: Friday 3:30 p.m. – 4:30 p.m., DLC Lobby  
Sanjana Annapureddy: [Sanjana.Annapureddy@Colorado.edu](mailto:Sanjana.Annapureddy@Colorado.edu)

### **Course Prerequisites**

A thorough understanding of data internetworking, Linux, and programming, subject to instructor approval, is required.

### **Grading**

Pop Quizzes and Class Participation	10%
Homework Labs and Assignments	55%
Midterm	15%
Final (15%) & Final Project (5%)	20%

To do well in this course, you will need to be prepared for each class by being ready to discuss and engage in critical thinking on issues covered in the readings. Be forewarned: pop quizzes will often be given at the start of class on the assigned reading material for the class.

All labs, assignments, and homework are due based on the due date on the syllabus. No exceptions to deadlines for course work will be made. Classroom absence may be permitted either for an emergency or prior notification to the professor stating the date and reason for the classroom absence two weeks in advance.

## Grading Scale

100 – 93%	A
92 – 90%	A-
89 – 87%	B+
86 – 83%	B
82 – 80%	B-
79 – 77%	C+
76 – 71%	C
70 – 0%	C-

## Class Readings

There is not a required textbook for the course; however, students will be expected to have read the class readings noted in the course syllabus before attending the class.

### RECOMMENDED BOOKS:

Many of the readings will be posted on the Desire2Learn web site. To access Desire2Learn, go to: <https://learn.colorado.edu/>. You can login using your IdentiKey username and password. Once you login, click on the course name to go into the course<sup>1</sup>.

## Course Syllabus (Subject to Change)

Date	Topic, Reading, and/or Work Assignment
8/25/2016	Lecture: Introduction to Course Homework: <ul style="list-style-type: none"><li>• <b>Lab 0.0</b></li><li>• <b>Lab 0.1</b></li><li>• <b>Assignment 1</b></li></ul>
9/1/2016	Lecture: SDN Fundamentals Required Reading: Homework: <ul style="list-style-type: none"><li>• <b>Lab 1</b></li></ul>
9/8/2016	Lecture: OpenFlow Fundamentals: Part 1 Required Reading: Homework: <ul style="list-style-type: none"><li>• <b>Assignment 2</b></li><li>• <b>Lab 2</b></li></ul>

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<sup>1</sup> Please visit <http://oit.colorado.edu/d2l/students> to watch videos and learn more about using D2L. If you run into any problems using Desire2Learn, contact the help desk at: [help@colorado.edu](mailto:help@colorado.edu) or at (303) 735-HELP.

9/15/2016	Lecture: OpenFlow Fundamentals: Part 2 Required Reading: Homework: <ul style="list-style-type: none"> <li>• <b>Lab 3</b></li> </ul>
9/22/2016	Lecture: Mininet and Controllers: Floodlight, ODL, ONOS, Ryu, POX Required Reading: Homework: <ul style="list-style-type: none"> <li>• <b>Lab 4</b></li> </ul>
9/29/2016	In Class Lab
10/6/2016	Lecture: Midterm Review Homework: <ul style="list-style-type: none"> <li>• <b>Assignment 3</b></li> <li>• <b>Midterm Challenge Lab - (In-class)</b></li> </ul>
10/13/2016	Midterm Exam
10/20/2016	Lecture: Real World SDN and Key Players Required Reading: Homework: <ul style="list-style-type: none"> <li>• <b>Lab 5</b></li> </ul>
10/27/2016	Lecture: SDN Security Required Reading: Homework: <ul style="list-style-type: none"> <li>• <b>Assignment 4</b></li> <li>• <b>Lab 6</b></li> </ul>
11/3/2016	Lecture: SDN in the Cloud and Data Center Required Reading: Homework: <ul style="list-style-type: none"> <li>• <b>Lab 7</b></li> </ul>
11/10/2016	Lecture: Alternatives to SDN & Network Functions Virtualization (NFV) Required Reading: Homework: <ul style="list-style-type: none"> <li>• <b>Lab 8 (Due 11/30)</b></li> </ul>
11/17/2016	<b>Final Project Presentations</b> (in class) Homework: <ul style="list-style-type: none"> <li>• <b>Final Project Report</b></li> </ul>
11/24/2016	No class – Fall break

12/1/2016	Lecture: Final Review Homework: <ul style="list-style-type: none"><li>• <b>Challenge Lab</b> – (In Class)</li></ul>
12/8/2016	Final Exam
12/12/2016 (Finals Week)	Homework: <ul style="list-style-type: none"><li>• Final Lab Report Due (12:00 p.m. Noon)</li></ul> <b>Extra Credit Due</b> (12:00 p.m. Noon)