

# ECE8803: Software Defined Internetworking

**Instructor:** Henry Owen

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Office Hours: Monday 1:00 – 2:00

**Class web site:**

<https://t-square.gatech.edu>

**Computer requirement for this class:**

You will be using your personal laptops for the lab assignments. The computer that you use for this class must have the hardware capability to run virtual machines. To test to see if a windows computer has this capability see something like: <https://www.quora.com/How-do-I-enable-hardware-virtualization-in-Windows-10-and-how-do-I-resolve-the-following-error-message-in-Android-Studio-1-3-1> (Caution, I did not check to see if this site downloads malware to your computer, use your own judgement or another method to check if you have the hardware support you need to take this course).

The lab assignments are only written based upon a windows operating system running Virtual box. You may use OS X but the lab assignments will not contain OS X related instructions. You will need approximately 8 Gig of RAM on your computer. You will need approximately **20 gigabytes of disk space** to store up to approximately 8 different virtual machines which will run inside of virtual box (if you want to keep all the course materials). It is possible to only need 10 gigabytes of disk space (if you erase some course content during the semester) and you do not plan to work with these resources again in future projects/courses.

This class briefly reviews how the Internet works as well as reviewing traditional computer networking concepts and includes networking related programming as well as some hands on practical networking exercises. The course covers the pressure network security and data centers puts on traditional computer networking (as covered in the review part of the course) and introduces Software Defined Networking as the solution to future networking infrastructures and environments. The course hands on assignments consist of configuring and troubleshooting networks made up of Cisco and Juniper routers and switches as well as some Python network programming in a Linux environment. Several SDN assignments are also included which involve using Python SDN controllers. We will be working in a Linux virtual machine centric environment. You will be expected to learn fundamental python programming mostly on your own, please see the python programming reference books suggested below.

Note: You will have an assignment due the last week of classes.

**Text Books: None, class notes only**

**Suggested References:**

Computer Networking Basics and Review: J. F. Kurose, K. W. Ross, *Computer Networking, A Top-Down Approach Featuring the Internet*, 6<sup>th</sup> Ed, Addison-Wesley, 2013 ISBN 978-0132856201

Python Programming: Any online book that you prefer. Examples include:

<http://www.greenteapress.com/thinkpython/html/index.html>

<http://interactivepython.org/runestone/static/thinkcspy/index.html>

<https://www.codecademy.com/learn/python>

[http://www.pythonlearn.com/book\\_007.pdf](http://www.pythonlearn.com/book_007.pdf) (Especially Chapter 12 Networked Programs)

<http://learnpythonthehardway.org/book/>

**Grading:**

Research Paper in class presentation; class participation	10%
Assignments	30%
Midterm	30%
Final	30%

Test will be closed book and closed notes but you are allowed one side of an 8.5 x 11 inch hand written cheat sheet and a router command sheet that you create as appendix and turn in with the assignments. You should always bring a calculator to all exams in this class. Cell phones must be turned off and should not be placed on your desk. You are not allowed to use a computer during an exam.

**Academic Honesty:**

A copy of the Georgia tech Honor Code can be found at <http://honor.gatech.edu/content/2/the-honor-code> and the Georgia Tech student code of conduct at <http://www.policylibrary.gatech.edu/student-affairs/code-conduct>. You MAY NOT look at or use previously completed assignment solutions that others have developed, if you do so you are cheating. However, you ARE allowed to discuss the problems (and their solutions) with fellow students in the class this semester and with the instructor. All conduct in this course will be governed by the Georgia Tech honor code.

Each student will turn in their individual assignment report, but it OK to talk to others and help each other with the assignments. When you get help from another student (which is totally acceptable and encouraged) you must put in writing in your assignment report who helped you and what you got from them. You are not allowed to just copy another student's work, but you are allowed to see/discuss another student's solution/work in order to figure out something you may be stuck on.

**Software Tools:**

We will be using virtual box, and ubuntu in a "mininet capable" virtual machine image, and GNS3 on your own laptop. You may obtain the correct versions of the software from the class T-square web site.

**Tentative Lecture Topics:**

Review

- Principles of the Internet
- Network Layer
- Physical
- Router Architecture

Python Sockets Programming

- Client/server

Configuring Cisco routers and switches

- Cisco IOS

Configuring Juniper routers

- Junos

VLAN

Routing Protocols:

- BGP

Introduction to the Cloud Computing Network Control Plane

- Data Center Networking Basics
- Problem Solving with Traditional Design Techniques
- Virtual/Overlay Network Functional Architecture
- Virtual/Overlay Network Design and Implementation

SDN for Cloud Networks

- Software Defined Networking and Cloud
- Openflow
- Virtual Switching

- SDN Controllers
- Utility Computing and Cloud Networking
  - Utility Computing
  - OpenStack Virtual Networking
  - Network Functions Virtualization

**Laboratory Assignment Topics:**

- Setting up the virtual machine software and the GNS3 environment
- Python Sockets Programming
  - Client/Server
- Configuring Cisco routers and switches
  - Cisco IOS
- Configuring Juniper routers
  - Junos
- IP Address Configuration IPV4 and IPV6
  - Static routes
- Virtual Local Area Networks
  - Cisco and Juniper VLANS
- Routing Protocols
  - Border Gateway Routing Protocol
- Software Defined Networking
  - Firewall implementation
  - Load Balancing Implementation
  - Network Address Translation Implementation
  - Network Security with SDN: Address Resolution Poisoning prevention with SDN

Note: Much of the original course material comes from Anja Feldmann of TU Berlin (and her Internet Network Architectures research group) and from James Kempf of Ericson.

**Student-Faculty Expectations Agreement**

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

**Accommodations for Students with Disabilities**

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.