

# Title: Introduction to HPC and Research Computing (For CSCI 5306 Computer Network)

## Revised Course Description

This course provides exposure to advanced topics in computer networks including recent research findings in this field. The topics include: internetworking, Internet concept, Client-server model for applications, Network and internet management. Also, this course covers recently emerging protocols and technologies such as: Virtualization and Software Defined Networks (SDNs), IPv6, wireless networks, Secure Socket Layer, and Transport Layer Security.

The course integrates also hands on labs about the usage of High-Performance Computing (HPC) in computer networks and other computing disciplines. The goal is to allow students to use such resources in their other courses or future research or experiments.

## Implementation Schedule

- I have already tried implementing examples of such labs using open test beds such as Geni.net, CloudLab, and Xsede or Access. I am using also other open test beds such as Orbit, Deterlab and Emulab. Each lab has its own learning curve and issues. Every semester I am teaching CSCI 5306, I try different modules of those testbeds.
- I didn't try HPC open testbeds except this semester, in particular Chameleon Cloud from TACC and ACES from TAMU. This is in particular as I got credits from those two labs. I am planning to add more of HPC hands on using the different available testbeds and based on students' feedback and also based on availability of credits from those labs, I will choose which experiments and labs to use. Major barrier I imagine is the continuous availability of credits, but as we started our own CAMSA local cluster, I hope this will make offering such HPC labs more consistent.

## Sample HPC/Gateways Exercise

- In the past I used existing public materials from testbeds such as Geni.net, XSEDE, Deterlab, etc. Additionally, I provide samples of my own experience implementing those experiments and my own feedback to previous students.
- There is one particular gateway I used and like this year is (ChameleonCloud shared experiments portal):  
(<https://www.chameleoncloud.org/experiment/share/>)
- The portal focuses on an idea that I liked (which is reproducibility). This allows students to submit their feedback and experience.
- I am planning also to utilize the new TAMU cluster ACES (<https://portal-aces.hprc.tamu.edu/pun/sys/dashboard>)  
I am a member of SWEETER grant with TAMU with the aim of enabling the spread of usage of HPC resources across A&M system and the region.

## Resource Needs/List

- While I currently have some credits for me and my students to use some HPC resources. I am not sure if this will be persistent as it depends on successfully submitting and getting grants.
- We just started our own cluster, CAMSA, my main needs are related to education materials that can :
  - Be simple as much as possible and
  - Work the way it is describe and
  - Focus on the users not the technical perspectives and finally and most important
  - Customized based on the different researchers disciplines that can show them how they can use and utilize HPC resources in their own fields.

## Gateway Community Mentor Syllabus Suggestions

Mentors' suggestions:

Elijah: I suggest including the following resources:

- [https://docs.olcf.ornl.gov/training/training\\_archive.html](https://docs.olcf.ornl.gov/training/training_archive.html) : HPC training resources from the OLCF.
- <https://www.alcf.anl.gov/support-center/training-assets>

A couple of prerequisites to an HPC oriented class to include:

- Introduction to programming in C/C++/Fortran etc.
- Shared and Distributed Memory programming i.e. OpenMpi and MPI programming

## Datasets

- <https://towardsdatascience.com/> (requires an account)
- Kaggle datasets and codes
- Github repositories
- <https://medium.com/>
- <https://huggingface.co/datasets>
- XSEDE/ACCESS HPC Exercises

## Possible Expansions

My big goal is to expand this beyond this one course to offer introductory HPC course that can be available to all TAMUSA faculty, students and staff. As director of HPC computing and also champion in our campus, this is one of my main goals to achieve in the next year.

The main goal is to create a course that can be flexible in the time/duration from 1 to 16 weeks (1. Adding more training and modules, and 2: Produce customized modules to the different disciplines).

## Resources / Science Gateways

- <https://access-ci.org/>
- (In particular chameleoncloud is a great resource for education materials,  
(<https://www.chameleoncloud.org/experiment/share/>)
- <https://hprc.tamu.edu/>, leveraging SWEETER grant that I am part of and their new ACES cluster.
- <https://www.hpc.temple.edu/mhpc/hpc-technology/>

## Use Cases

- Teaching this course materials for students in computer networks class or more specialized classes (e.g. cloud computing, research computing )
- Teaching this course to the broad HPC candidate users community focusing on users perspectives and without spending much time on the technology, architecture, HPC tools, etc.

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Your feedback  
is welcome!

