COP 5614 - Graduate Operating Systems

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Course web page: https://moodle.cis.fiu.edu/v3.1/course/view.php?id=1608
Class time: Tuesday & Thursday 12:30pm to 1:45pm
Office hours: Tuesday 10:30am – 12:00 pm, Thursday 10:30 am – 12:00 pm, or by appointment.
Class room: Engr & Comp Sci 136

Overview:
Welcome to graduate operating systems! We will cover an exciting range of materials from the broad field of operating systems, including basic operating system structure, file systems and storage servers, memory management techniques, process scheduling and resource management, threads, distributed and peer-to-peer systems, and a few other "hot" topics. By tracing the key ideas of today's most popular systems to their origins in research, the class highlights key developments in operating system design over the last two decades and illustrates how insight has evolved to implementation.

The course will center around four basic entities: **reviewing operating system concepts**, **a warm-up project**, **reading and critiquing research papers**, and **a final project**. During the first half of the semester, you will review the basic operating system concepts on the textbook, finish an independent project just to get warmed up. Then, you will have a comprehensive midterm exam. During the second half of the semester, you will read related research papers and work on your final project, which is the real meat of the class: a mini research project on the topic of your choice. Though we will provide a pool of available projects and provide some suggestions, you are strongly encouraged to come up a topic of your own. More details will be available.

Reviewing Operating System Concepts:
Textbook: Andrew S. Tanenbaum, Herbert Bos. Modern Operating Systems (4th Edition), ISBN-13: 978-0133591620.

- Operating system structuring
- Synchronization, communication and scheduling in parallel systems
- Memory management techniques
- File systems and storage servers

- Distributed systems, their communication mechanisms, distributed objects and middleware
- System support for internet-scale computing and cloud computing

Reading and Critiquing Research Papers (To Be Updated):

1. L. Hu, K. Schwan, H. Amur, and X. Chen, "ELF: Efficient Lightweight Fast Stream Processing at Scale," in *2014 USENIX Annual Technical Conference (USENIX ATC 14)*, 2014, pp. 25–36.

2. M. Zaharia, T. Das, H. Li, T. Hunter, S. Shenker, and I. Stoica, "Discretized Streams: Fault-tolerant Streaming Computation at Scale," in *Proceedings of the Twenty-Fourth ACM Symposium on Operating Systems Principles*, 2013, pp. 423–438.

3. T. Harter, B. Salmon, R. Liu, A. C. Arpaci-Dusseau, and R. H. Arpaci-Dusseau, "Slacker: Fast Distribution with Lazy Docker Containers," in *14th USENIX Conference on File and Storage Technologies (FAST 16)*, 2016, pp. 181–195.

4. D. Shue, M. J. Freedman, and A. Shaikh, "Performance Isolation and Fairness for Multi-tenant Cloud Storage," in *Proceedings of the 10th USENIX Conference on Operating Systems Design and Implementation*, 2012, pp. 349–362.

5. Dirk Merkel. Docker: lightweight Linux containers for consistent development and deployment. *Linux Journal*, Issue 239, March 2014.

6. Jun Zhu, Zhefu Jiang, and Zhen Xiao. Twinkle: A Fast Resource Provisioning Mechanism for Internet Services. In *INFOCOM*, 2011 Proceedings IEEE, pages 802–810. IEEE, 2011.

7. R. Nathuji, A. Kansal, and A. Ghaffarkhah, "Q-clouds: Managing Performance Interference Effects for QoS-aware Clouds," in Proceedings of the 5th European Conference on Computer Systems, 2010, pp. 237–250.

Final Project:

- The real meat of the course.
- The goals of the project are:
    1. Let you try your hand at conducting systems research.
    2. Provide a lot of feedback on writing, posing a question, designing an experiment, presenting research.
    3. Help you become better systems researchers.
- About the size of a conference paper.
- May be completed in groups -- size of project should reflect the size of the group
- Every paper should pose and answer a research question.
- Six phases (note that phases 1 and 2 are due at the same time):

1. Proposal
2. Research Plan
3. Project meetings with me
4. First Draft
5. Project Presentation
6. Final Paper

- Evaluated on:
  1. Methodology
  2. Quality of results
  3. Quality of presentation (both oral and written)
  4. Ability to place work in the context of existing work

The project list is not yet available.

The Final Project is The Main Focus of The Course:

You are expected to perform work which could eventually be suitable for publication in a major operating systems conference. In general, people should work in groups of size three to four. I will provide some suggestions for you to pick from, although you are encouraged to think of a project on your own, which I can then help to refine. Project write-ups will be similar in format to a conference submission, and all will be entered into a class-wide mini-conference. Every group will present their paper in class. The best papers will receive some kind of rewards. More details are forthcoming.

Assignments:

Every group will hand in a project proposal, a project progress draft and a final paper for the project. Details and due dates will be posted in the Moodle course system. Project deliverables must be submitted through the Moodle system. All class-related questions should be sent to the TA's email or me with a subject line starting with the keyword "[COP-5614]".

Grading:

5% Mini-individual Project
30% Midterm exam (written)
10% Project proposal (written)
10% Project progress draft (written)
30% Final paper (written)
10% Project presentation (oral)
5% Class participation

Important Deadlines:

September 1: Turn in your group members to TA deadline
September 9: Each group fills in a meeting slot to discuss project proposal with Dr.Hu deadline
October 9: Project proposal deadline

November 9: Project draft deadline
December 9: Final paper deadline

Policy on Make-up examinations, Projects and Assignments:
All work must be submitted on the due date and time as posted in the Moodle system. No late work will be accepted. Make-up exams are not available, but in the case of extreme hardship must be arranged in advance.

Class Attendance:
If you are in section U01, class attendance is absolutely necessary. Inevitable absence must obtain prior approval from the instructor. Attendance will be checked randomly throughout the semester, and your class participation grade will be 5% * the percentage of your attendance. If you are in other sections, your class participation grade will be determined by how active you are in non-real-time class discussion (e.g., in Moodle discussion forums).

Academic Misconduct:
http://www.fiu.edu/~oabp/misconductweb/1acmisconductproc.htm
Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

The Following University Policies Also Apply:

- code of academic integrity: http://www.fiu.edu/~oabp/misconductweb/2codeofacainteg.htm
- sexual harassment: http://bot.fiu.edu/files/Reg%20104.%20Sexual%20Harassment%209-1208%20(Final).pdf
- services for students with disabilities: http://drc.fiu.edu/index.php?name=student_resources