San José State University
Computer Engineering Department
CMPE283 – Virtualization Technologies, Spring 2017

Course and Contact Information

Instructor:	Mike Larkin
Office Location / Hours	After class or by appointment
Email:	Michael.Larkin@sjsu.edu
Class Days/Time:	Section 1 : Monday 1800h-2045h Section 2 : Tuesday 1800h-2045h
Classroom:	Section 1 : ENGR 341 Section 2 : ENGR 339
Prerequisites:	CMPE272 or instructor consent

Prerequisites and Co-requisites

To be successful in this course you should be familiar with computer architecture and operating systems, and have at least some basic knowledge of the C programming language (most examples and assignments in this class will use C as the language of instruction). Successful completion of an undergraduate course in operating systems/computer architecture would most likely be sufficient (or equivalent industry/personal experience). It is **your** responsibility to ensure you have the appropriate prerequisite courses or experience.

Course Description

Virtualization concepts, components and infrastructure, hardware and software virtualization, virtual machine life cycle management, virtualization services, case studies on various open source and commercial virtualization products.

Course Learning Outcomes

The objective of this course is to teach you how virtualization technologies work. Since virtualization as a concept is very broad, we will focus primarily on virtualization of systems (operating systems/hardware systems) and less on ancillary virtualization concepts like network and storage virtualization.

The course is composed of several parts, of roughly equal duration:

- Review of system architectures and operating system construction (x86)
- Virtualization core concepts and architecture layering
- System virtualization

- Other ancillary concepts (virtualization on other platforms)

The middle portion of the course will be very low-level. Different approaches to virtualization will be discussed, with benefits and drawbacks of each approach being detailed. You will learn how each of these architectures/approaches are designed (in detail), including analysis of code for each.

Upon successful completion of this course, students will be able to:

1. Demonstrate knowledge of different system-level virtualization technologies
2. Demonstrate knowledge of the technological limitations associated with virtual machines, and how some of these limitations can be addressed
3. Be able to design a well-performing virtualized environment, taking into consideration performance characteristics of different design choices

Course Handouts / Materials

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the Canvas learning management system course website. You are responsible for regularly checking with the messaging system through MySJSU/Canvas to learn of any updates, as I may or may not announce new material being uploaded.

Required Texts/Readings

Recommended reading materials and assignments to be posted weekly or as needed. There is no assigned textbook for this class.

Course Assignments and Grading

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf.

Grade points are accumulated from several areas: Three pop quizzes (30 points total, **no make-up quizzes**), mid term exam (80 points), and the final exam (100 points). Final course grades will be available on or after the dates listed in the SJSU course catalog for grade availability.

Points	**Grade**
210-195	A
194-189	A-
188-180	B+
179-174	B
173-168	B-
167-159	C+

158-153	C
152-147	C-
146-140	D+
139-132	D
131-126	D-
0-125	F

Various bonus points may or may not be offered during the semester (no guarantees or promises).

Grades are not subject to a curve other than the table shown above.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

University Policies

General Expectations, Rights and Responsibilities of the Student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU's policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See University Policy S90–5 at http://www.sjsu.edu/senate/docs/S90-5.pdf. More detailed information on a variety of related topics is available in the SJSU catalog, at http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Consent for Recording of Class and Public Sharing of Instructor Material

University Policy S12-7, http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor's permission to record the course and the following items to be included in the syllabus:

- "Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only.

- "Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent."

Academic integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at http://www.sjsu.edu/senate/docs/S07-2.pdf requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sjsu.edu/studentconduct/.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) at http://www.sjsu.edu/aec to establish a record of their disability.

Accommodation to Students' Religious Holidays

San José State University shall provide accommodation on any graded class work or activities for students wishing to observe religious holidays when such observances require students to be absent from class. It is the responsibility of the student to inform the instructor, in writing, about such holidays before the add deadline at the start of each semester. If such holidays occur before the add deadline, the student must notify the instructor, in writing, at least three days before the date that he/she will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed. See University Policy S14-7 at http://www.sjsu.edu/senate/docs/S14-7.pdf.

Course Schedule

The following is an approximate course schedule. Deviations to this schedule will be announced in class.

Date (Mon)	Date (Tue)	Topic
1/30	**1/31**	**Class overview and green sheet. History of Virtualization** History of Virtualization, the P&G virtualization theorem
2/6	**2/7**	**No Class**
2/13	**2/14**	**System and machine architectures** The typical x86-based machine architecture
2/20	**2/21**	**System and machine architectures** Memory and Paging
2/27	**2/28**	**System and machine architectures** Devices
3/6	**3/7**	**System and machine architectures** Cont'd
3/13	**3/14**	**Virtualization core concepts**

		Hardware assisted virtualization (instruction trapping, emulation)
3/20	**3/21**	**Midterm Exam**
3/27	**3/28**	**Spring Break – No Class**
4/3	**4/4**	**Virtualization core concepts** Hardware assisted virtualization (memory)
4/10	**4/11**	**Virtualization core concepts** Hardware assisted virtualization (advanced topics)
4/17	**4/18**	**Virtualization extra concepts** I/O MMUs and device I/O virualization
4/24	**4/25**	**Virtualization extra concepts** Performance
5/1	**5/2**	**Virtualization extra concepts** Resource management
5/8	**5/9**	**Case Studies** Xen, KVM, Virtualization on ARM
5/15	**5/16**	**Case Studies** Cont'd
5/22	**5/23**	**Final Exam** **5:15PM-7:30PM**