0203-686-01 Special Topic: Intel EM64T and VT Extensions Spring 2007

Course Synopsis:

This course explores some recently implemented extensions to the world's most popular microprocessor architecture, dubbed EM64T ("Extended Memory 64-bit Technology", also known as "Intel64") for Intel's enlarged (e.g., up to 1TB) virtual memory address-space with 64-bit integer arithmetical capabilities, eight extra 'general-purpose' registers, and VT-x ("Virtualization Technology") for the ubiquitous Intel x86 family of server, workstation, and laptop CPUs.

Throughout the course small software-component prototypes will be written using the GNU/Linux program development tools (including assemblers and C/C++ compilers). The course is open to graduate students in computer science (and to qualified undergraduates or non-degree students in cases where the Instructor has granted permission).

Planned topics include:

- Programming the PC's serial UART (for remote-access to new machines)
- Review of IA-32 architectural features utilized in application programming
- Support for multitasking operating systems: privilege-levels and protection
- Constructing the processor's 2-level, 3-level, and 4-level page-map tables
- New concepts of "canonical" memory-addresses and "compatibility" mode
- Enabling and then activating Intel's Extended Memory 64-bit Technology
- Model-Specific Registers (MSRs) and the new fast system-call mechanism
- Responding to peripheral-device interrupts, and to processor exceptions
- Multiple processors and the Advanced Programmable Interrupt Controller
- Initializing and querying the CPU's Virtual Machine Control Structures
- Using Linux kernel modules to provide the interface to a "Virtual Machine"

Students are assumed to be familiar with Linux or UNIX, and with programming in C/C++, and to be acquainted with the Intel x86 processor-family's registers, instruction-set, and assembly language.

Learning Outcomes:

- You will deepen your knowledge of standard 32-bit Intel Architectures.
- You will become acquainted with Intel's Dual-Core 64-bit capabilities.
- You will understand how CPU hardware features support "virtual" memory.
- You will get some practice in implementing a Virtual Machine Manager.
- You will increase your proficiency with using C and assembler language.
- You will acquire a background for understanding newest-generation CPUs.
- You will lay a foundation for pursuing some additional career options.

Instructor:

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Textbook and Reference:

Intel Architecture Software Developer's Manual (Intel Corporation)
- Volume I: Basic Architecture
- Volume II: Instruction-Set Reference
- Volume III: System Programmer's Reference

Classroom Facilitiy:

The course meets on Tuesdays and Thursdays, 7:30-9:15pm, in the Michael D. Kudlick Interactive Computer Classroom (HRN-235). Students will need to have individual computer accounts set up for access during these classes.

Exam Dates:

Midterm Exam I will be on Thursday, February 22.
Midterm Exam II will be on Tuesday, April 3.
Final Exam will be on Tuesday, May 15, 7:30pm.

Grading scheme:

Class Participation	20%
Programming Projects	30 %
Midterm and Final Exams	50%

NOTE: Unprofessional conduct, such as an abuse of USF computer privileges (unauthorized access), or a violation of academic integrity (plagiarism or fraud), will result in the student receiving a failing grade.