Engineering studies in IT - umiędzynarodowiony program studiów
prowadzonych przez Wydział Matematyki i Informatyki UAM w Poznaniu
Nr projektu POWR.03.03.00-IP.08-00-MPK/16

OPERATING SYSTEMS

Learning module description

GENERAL INFORMATION

1. Module title: Operating systems
2. Module code: DSOP LI0-E
3. Term: winter
4. Duration: 30h lectures + 30h laboratories
5. ECTS: 6
6. Module lecturer: Krzysztof Dyczkowski
7. E-mail: chris@amu.edu.pl
8. Language: English

DETAILED INFORMATION

1. Module aim is to familiarize students with basic concepts, data structures and algorithms of modern operating systems. During the lecture students will learn theoretical basics of operating systems. Presented are techniques for managing the basic hardware resources of the computer - processor, memory, virtual and I / O devices. The issue of concurrency, multiprocessing and synchronisation are discussed. It discusses the organization of file systems with examples of specific implementations. Issues related to the virtualization of operating systems and their security are discussed. Throughout the lab, students gain hands-on skills in operating, configuring, and system programming of modern operating systems.
2. Pre-requisites in terms of knowledge, skills and social competences (where relevant):

SYLLABUS:

Week 1: Introduction to the operating systems subject. Basic definitions and concepts, functions of operating systems, Unix from the user point of view, concepts and commands concerning file systems (file, directory, mounting, file permissions).

Week 2: Unix from the user point of view - continued; concept and commands concerning processes (process def., ps command, signals, descriptors, stdin/out, parent/child process, foreground/background process, pipes, links), bash shell - short overview.

Week 3: Installation and configuration of the Linux system, system boot, basic system and network services.

Week 4: Unix from the programmer point of view: a brief overview of system functions; Unix from the administrator point of view: files from /etc directory, run levels, configuration of basic services.

Week 5: History of operating systems development (motivation of the idea of multiprogramming and time sharing); classification of operating system architectures (monolithic, layered, with micro-kernels etc); hardware assumptions (bus, controller, port, interrupt, DMA, ...), architecture x86 .

Week 6: Processes and threads management (process state diagram, PCB queues, schedulers: SJF, RR); issues of multiprocessor systems.

Projekt współfinansowany przez Unię Europejską ze środków
Europejskiego Funduszu Społecznego w ramach
Programu Operacyjnego Wiedza Edukacja Rozwój

Week 7: File systems (file attributed, directories, hard and soft links to files and its implementations); file system implementations: list block allocation, FAT, index block allocation; kernel data structures concerning file systems (including discussing the VFS idea); concrete linux and window file systems discussion: ext2/3/4, xfs, ntfs; network file systems: CIFS/SMB, SSHFS, NFS ; linux (lvm2) and windows volumes; RAID.

Week 8: Support for input/output devices, block and character special files, hardware and software drivers, principles of input/output subsystem operations; layered structure of device drivers (file systems and networks), data structures concerning input/output subsystem in linux kernel (descriptor table, file struct table, inode struct table), unusual i/o operations (asynchronous, nonblocking, select() function, etc); network support (network interfaces); USB devices support.

Week 9: Concurrency, process synchronization: semaphores, binary semaphores, monitors, concurrency problems (critical sections, producer/consumer, readers and writers, n-philosophers, etc).

Week 10: Different kinds of memory in a computer system, memory hierarchy, cache; hardware protection; overview of an operating system components.

Week 11: Memory management, also including: creating of programs, shared/dynamic libraries, process memory allocation and what problems it implies; different methods of memory management: shift register, paging, segmenting, solutions in x86 processors and successors, virtual memory, victim frame search algorithms (FIFO, LRU).

Week 12: Virtualization: the concept and types of virtualization, the concept of a hyperwizor, a review of virtualization software.

Week 13: Security of a computer system, standards, permissions, login and user account protection, cryptographic protection, network security, authorization modules (PAM).

Week 14: Overview of LINUX and Android Architecture.

Week 15: Overview of Windows Architecture.