Announcements

Operating Systems
@
CSE.UNSW

THE UNIVERSITY OF
NEW SOUTH WALES

Systems Courses

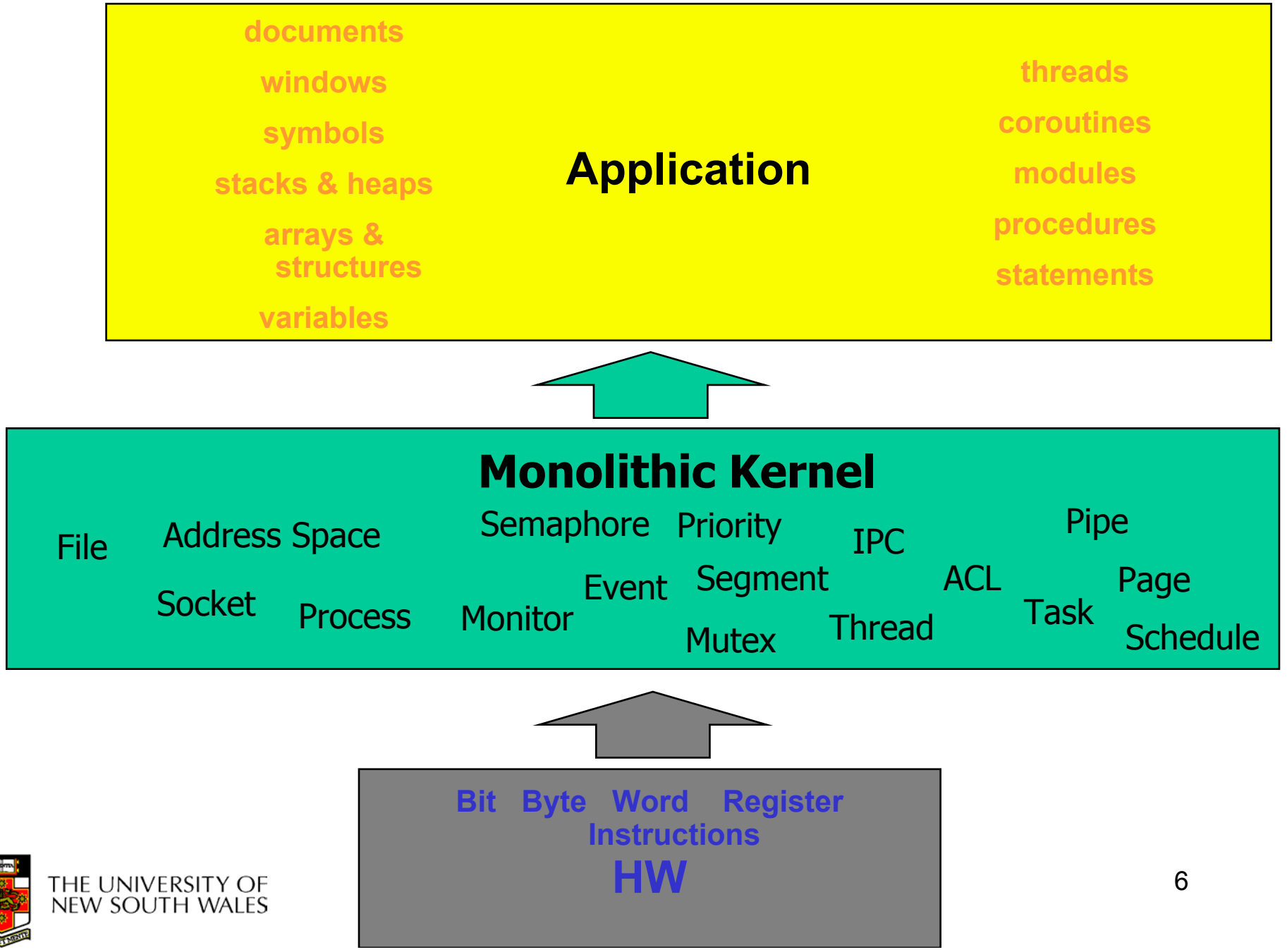
- COMP9242 Advanced Operating Systems
  - In-depth coverage of OS implementation issues
  - Learn what makes OS fast and what makes them slow
  - Learn how the OS deals with multiprocessors, caches, ...
  - Write your own OS
- In S2/2005 taught by Prof. Gernot Heiser and Kevin Elphinstone

Research

- Mungi & Iguana
  - A Single Address Space OS
- L4
  - Fast Microkernel
  - User-level system servers
- Linux
- Gelato
  - Linux on Itanium

L4 Microkernel

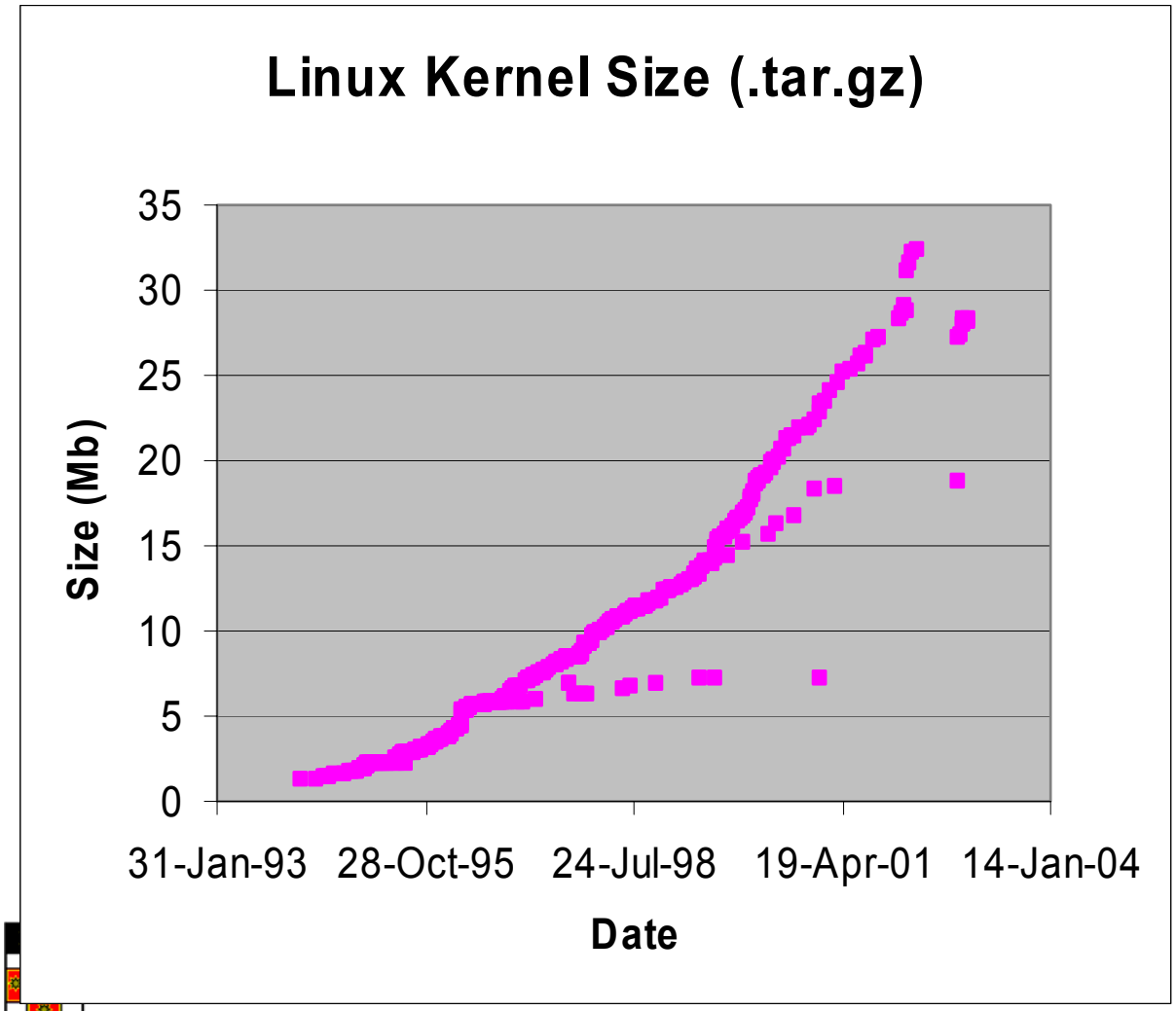
- Background


documents
windows
symbols
stacks & heaps
arrays & structures
variables
Application
threads
coroutines
modules
procedures
statements
Monolithic Kernel
File
Address Space
Socket
Process
Monitor
Semaphore
Priority
Event
Segment
Mutex
IPC
Thread
ACL
Pipe
Task
Page
Schedule
Bit Byte Word Register
Instructions
HW

Monolithic Kernels - Advantages

- Kernel has access to everything, potentially:
  - All optimizations are possible
  - All techniques/mechanisms/concepts are implementable
- Can be extended by simply adding more code to the kernel

Linux Kernel Evolution

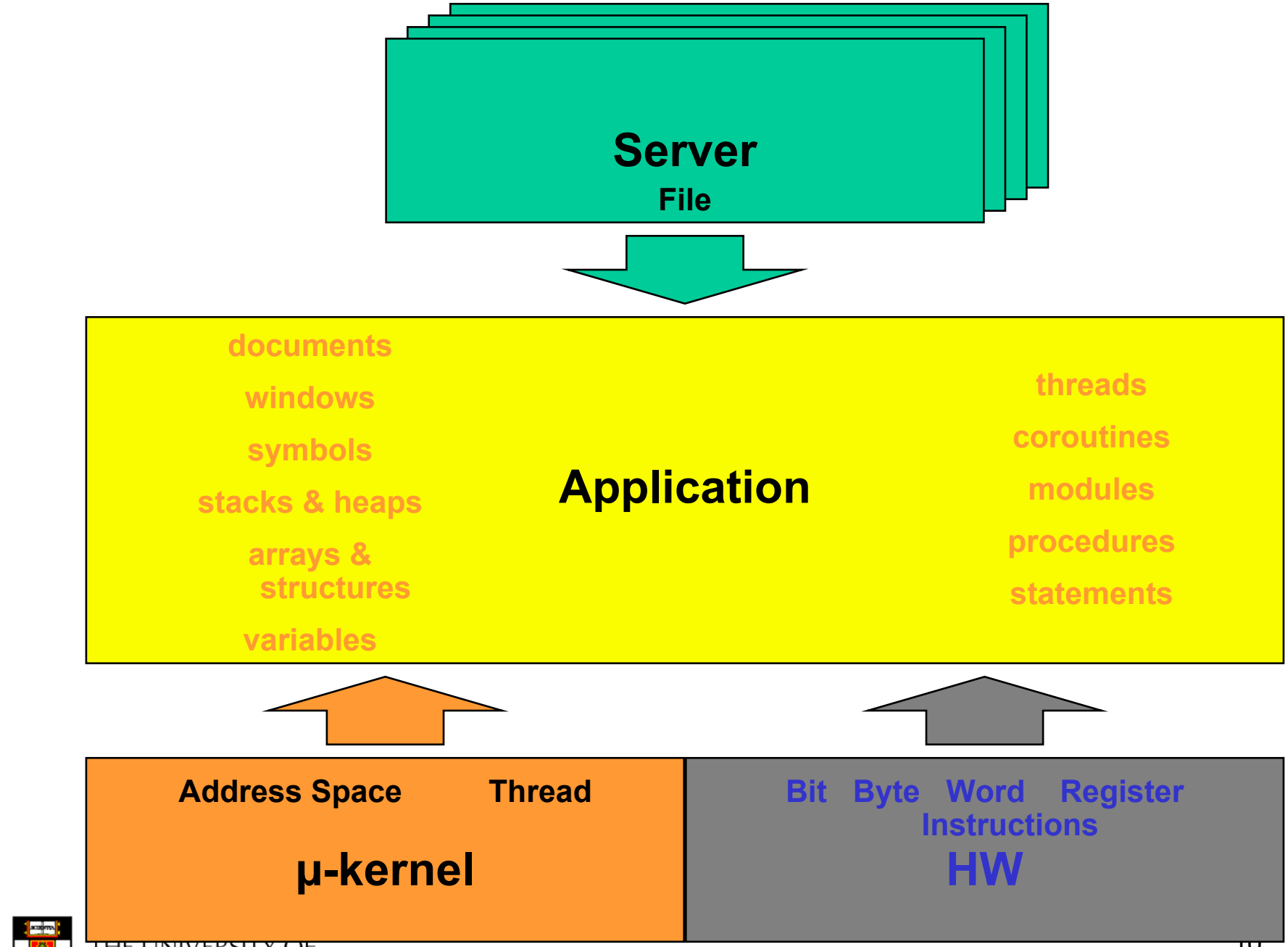


For reference:

Linux 2.4.18 = 2.7 million lines of code

Approaches to tackling complexity

- Monolithic approaches
  - Layered Kernels
  - Modular Kernels
  - Object Oriented Kernels
- Alternatives
  - Extensible Kernels
  - Microkernels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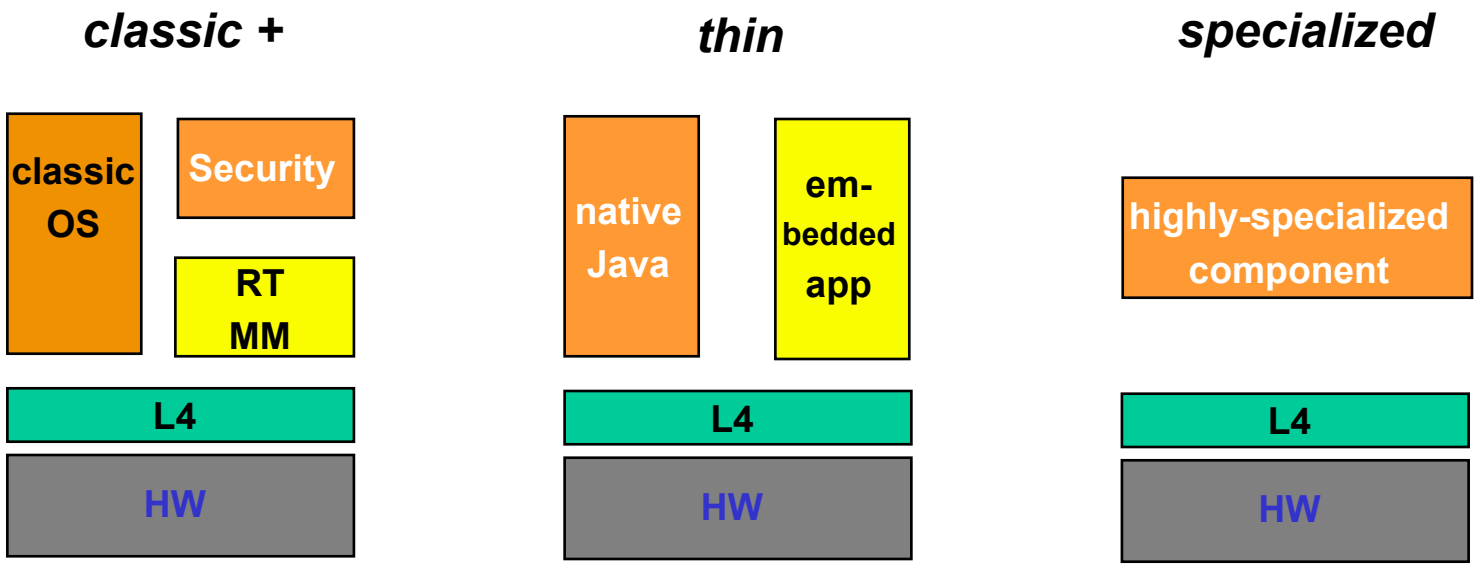

classic +
classic OS
Security
RT MM
L4
HW
thin
native Java
em-bedded app
L4
HW
specialized
highly-specialized component
L4
HW

Research Areas

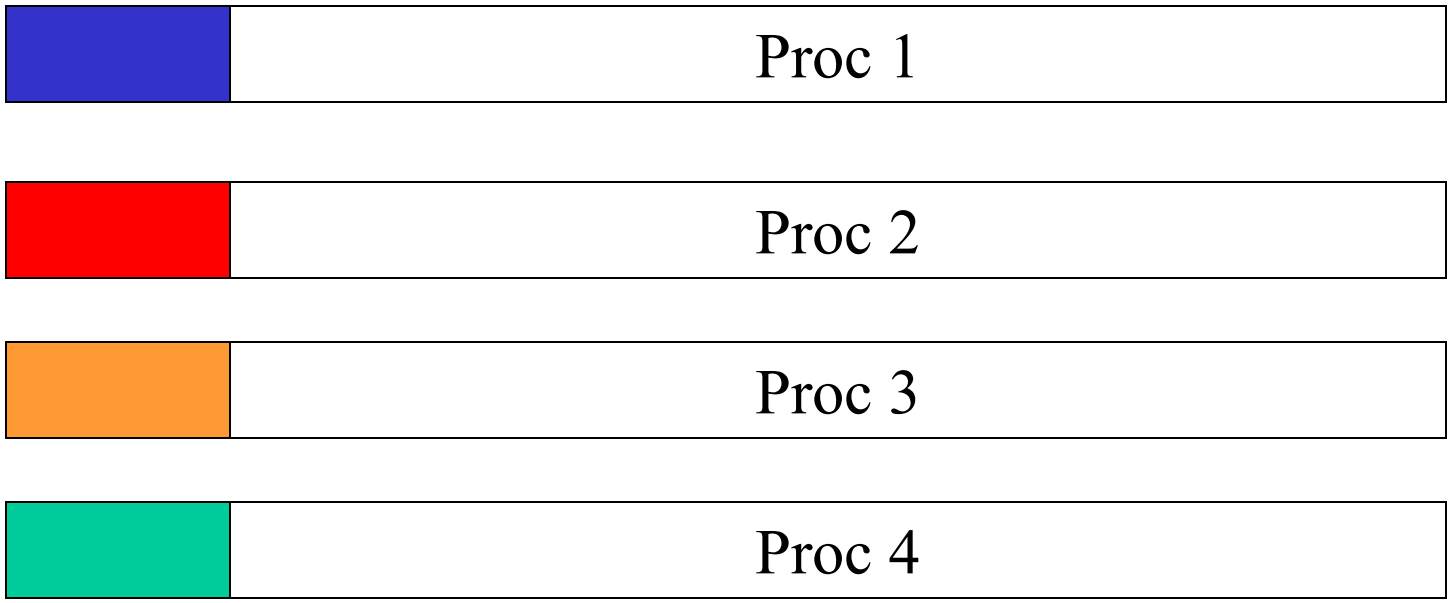
- A Multiserver Operating System
- User-level device drivers
- Multiheaded Linux
- Pistachio (University of Karlsruhe, Germany, UNSW)

Mungi Single-Address-Space OS

- Background

Tradition Operating System

- Multiple Address Spaces
  - Inhibits sharing

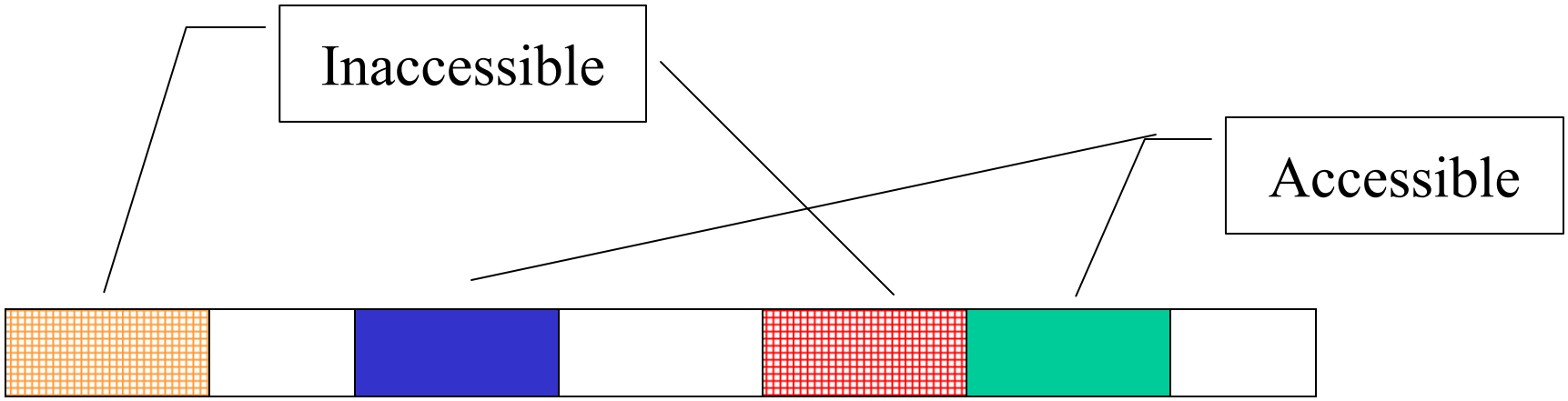


Single Address Space System

- All processes share one large address space
- Encourages sharing and efficient distribution
  - Pointers valid in all processes

Single Address Space System

- Can still enforce protection



Research Projects

- working on distributed high-performance platform
  - Posix interface and applications
  - VM system and persistence
  - high-performance disk I/O
  - distribution
  - Compiling, Linking,
  - IDL compiler & object support
  - device drivers
  - thread model

Linux

- Linux-based projects
  - SASOS techniques for IA-64 Linux
  - Superpages in IA-64 Linux
  - Pthreads, kernel tuning, large file systems,

Why am I telling you this?

Does the following Interest you?

- Gaining in-depth experience in OS research
- Working on a very challenging projects
- Collaborating closely with active researchers
- Getting a high thesis mark
- International travel
- Fame and fortune

Prerequisites

- Keen interest in OS
- Demonstrable background/ability in OS
- Sharp Intellect
- Committed to working on a project

Still Interested?

- Check out

http://www.disy.cse.unsw.edu.au/

NICTA Formal Methods

COMP4161

Advanced Topics in Software Verification - S2-2005

Gerwin Klein (UNSW) and Micheal Norrish (ANU)

- ➜ industrial grade theorem proving
- ➜ theory background + practical application
- ➜ shared video lecture UNSW/ANU (local lecturer always present)
- ➜ topics: higher order logic, lambda calculus, term rewriting, induction principles, decision procedures, proofs about programs

`http://www.cse.unsw.edu.au/~kleing/teaching/comp4161/`

- ➜ enrolment starting this week

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Sun Microsystems

- Seeking 3rd year OS students
  - we are looking to attract bright students who are looking to really extend themselves for 12 months paid, full time work experience working with the best.
  - this person will need to have superior communication skills, very strong technical skills and a particular interest in Operating Systems. That interest should also be an advanced technical understanding down to the kernel!
  - this will mean exposure to Cisco, Citrix, Oracle, SAP and more

On-line Course Survey

- The on-line course survey will be available
- Please make time to do it
- Awarded 2 bonus marks to everyone who completes the survey.

- See the class web site for the URL

Final Exam

- Thursday, 30th June, 8:45 – 11:00
- Two Hours
- No examination materials allowed
  - Uni calculators will be provided

Exam Format

- 5 questions
  - 3 should be answered in separate books
  - 1 must be ***answered on the exam paper*** itself.
  - 1 must be answered on the multiple choice answer sheet provided
  - 80 Marks in total

Exam Format

- Q1 is multiple choice (26 marks)

  You will receive one mark for each correct classification, and lose one mark for each incorrect classification. You gain zero marks for each answer left unclassified. The overall mark for this question will not be negative, i.e. the minimum mark is zero.

Exam Format

- Q2..Q5, roughly:
  - half working out a solution to a problem
  - half written answers to a question

For written answers

- Be clear and concise (get to the point quickly)
  - Long, rambling answers will be penalised

Sample Question

- Name four disk arm scheduling algorithms and describe an advantage or disadvantage of each of them.

- Sample Marking Scheme (out of 8)
  - 2 Marks for each algorithm (1 for the name, 1 for the pro/con)

Reasonable answer

- FCFS, SSTF, SCAN, C-SCAN
- FCFS does not take into account head position, may move head excessively, especially in the case of concurrent applications accessing disk (deteriorates to random)
- SSTF reduces head movement by choosing request with shortest seek time first, but may result in starvation of distant requests (e.g if a request is always available nearby)
- SCAN better than FIFO, and avoids starvation, but does not take advantage of sequential locality on the down scan
- C-SCAN like SCAN, except avoids disk access on the down-scan and hence improves support for sequential locality

Dumb answers

- FIFO, Clock, EDF, and Two-level scheduling
  - Don’t just as add acronyms you can remember

Dumb answers

- Disk arm scheduling algorithms are used to move the head backward and forward on the disk. We can use many different algorithms to decide and some are better than others. One algorithm include first-come first served. It moves the arm to the location on disk in the order the request arrive in, it is bad cause it has overheads. Sometimes requests will be to inside of disk and outside of disk and arm will move far making disk slow. Moving the disk arm is bad.
- SSTF is where disk scheduler chooses block that is closest to disk head and goes there. It is better as is does not move the arm a long way, but has overheads too but not as many as FCFS. It is slow because we must search list of disk requests find the closest one. May cause CPU starvation if we spend to much time searching list and no other programs can run

Answer the question!!!

- Don't repeat the question, we set the exam, we know what it is!!!!
- Don't just write what you know (or don't know) about the topic area
  - You make us have to search for the real answer.
  - You may be correct, but say a lot of unrelated incorrect stuff.
- Don't contradict yourself
  - X is better/faster/more efficient than Y, and later Y is better than X
- Marks are awarded for stating WHY an answer is correct.
  - Demonstrates understanding

Exam Content

- For structure and style, look at the sample exam from past years.
- For content, the tutorial questions are a reasonable *guide*.

The questions attempt to examine understanding rather than particular implementations

- Don't expect
  - "Describe OS/161's exception handling on a timer interrupt"
- But you may get
  - "Describe (in general) a feasible sequence of events that occur in response to a timer interrupt that results in the current process being pre-empted and a new task running"

Examinable Content

- All Lectures, Tutorials, Assignments.

Consultations

- **To be announced**

Past Exam Available RSN