

## COSC 6360: Operating Systems PAPERS ON THE SECOND FALL 2020 QUIZ

You are only responsible for the materials discussed in class as they are *summarized* in the handouts and discussed in the PowerPoint presentations. I expect you to understand these summaries and to be able to comment around them.

Always ask yourself *why* a specific technique was used and *which* problem it tried to solve.

### Virtual Memory

R. Rashid, A. Tevanian, M. Young, D. Golub, R. Baron, D. Black, W. Bolosky and J. Chew, "Machine-Independent Virtual Memory Management for Paged Uniprocessor and Multiprocessor Architectures," *IEEE Transactions on Computers*, C-37, 8 (1988), pp. 896-905.

- *The paper is somewhat hard to read. Start with the summary and the slides. Focus on:*
  - *The objectives of the system and its support for mapped files.*
  - *The notion of memory object and how it affected the design of the address map.*
  - *The address map on slide 15 of the PowerPoint presentation*
  - *The concept of inheritance.*
  - *The way Mach implements the UNIX **fork()** including its use of copy on write.*
  - *The Mach page replacement policy.*

J. Navarro, S. Iyer, P. Druschel and A. Cox, "Practical, Transparent, Operating System Support for Superpages," *Proc. 5<sup>th</sup> Symposium on Operating Systems Design and Implementation*, Dec. 2002.

- *Focus on the authors' choices for their reservation, fragment control, promotion, demotion and expulsion policies and skip the sections of the paper we did not discuss in class. **Do not go into the details outside of Section 4.***

### Kernel Issues

Silas Boyd-Wickizer, Austin T. Clements, Yandong Mao, Aleksey Pesterev, M. Frans Kaashoek, Robert Tappan Morris, Nikolai Zeldovich, An analysis of Linux scalability to many cores, *Proc 9th USENIX Conf. on Operating systems Design and Implementation (OSDI '10)*, pp. 1-16, Oct. 2010. (Slides)

- *Focus on the slides .We did not cover the whole paper.*

M. M. Swift, B. N. Bershad, H. M. Levy, "Improving the reliability of commodity operating systems," *ACM Trans. on Computer Systems*, 23(5), Feb. 2005.

- *You should understand the problem the authors want to solve and the way they implement their lightweight protection domains. Do not rely on the summary.*

### Distributed Systems Issues

Seth Gilbert, Nancy A. Lynch, Perspectives on the CAP Theorem, *IEEE Computer* 45(2): 30-36 (2012).

- *Focus on the practical results.*

## Review questions

1. How does the Mach virtual memory subsystem guarantee exclusive access to its data structures?
2. When do Navarro et al. suggest performing superpage speculative demotion? What is the purpose of this operation?
3. What can cause false sharing in a multicore system?
4. What is the main limitation of the way Nooks restarts extensions that failed?
5. What is the major limitation of the write all available/read any policy for distributed systems?

**Answers:** 1. It uses locks. 2. The authors suggest speculatively demoting a superpage each time its page referenced bit is reset. The purpose of this operation is identifying which base pages of the superpage are still active. 3. False sharing occurs when two distinct data items appear in the same cache line, they are accessed by two different threads and one of them is frequently updated. 4. It does not work for all extensions. 5. It does not guarantee consistency in the presence of network partitions.