

2004 Paper 8 Question 5

Advanced Systems Topics

A *distributed shared virtual memory* (DSVM) programming model is often used on cluster computers because it can allow multi-threaded applications to be distributed across a set of machines without needing to be re-written.

- (a) Describe the implementation of DSVM using a centralized page manager. Your answer should identify:
- (i) What data structures are maintained by the page manager.
 - (ii) What happens when a machine performs a read operation to a page.
 - (iii) What happens when a machine performs a write operation to a page. [8 marks]
- (b) Someone observes that the centralized page manager may form a *bottleneck* and a *single point of failure*. Do you agree with these observations? [2 marks]
- (c) Sketch the implementation of a scalable spin-lock for use on shared-memory multiprocessor machines. You may assume the existence of an atomic *compare-and-swap* operation. [5 marks]
- (d) Do you think that your spin-lock design would be appropriate for use on a DSVM system? Either explain why it will perform well, or suggest an alternative implementation which would be appropriate. [5 marks]