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]