

1. (1) Traditional monolithic operating systems offer many high-level resource abstractions, including process, virtual memory and file systems, dealing with resource management. On the other hand, exokernel allows applications to do their own resource management by themselves. Why do you think this application-level resource management can be beneficial? (5 points)

(2) In order to support application-level resource management, what should exokernel do ? (5 points)

2. In virtualization of x86 machines, de-privileging is considered as an effective technique to support virtualization.
 - (1) Explain what de-privileging means and how it works (5 points)

 - (2) It was difficult to implement the concept of de-privileging in traditional x86 machines (without hardware support on virtualization). Why was it difficult? (5 points)

3. Compare the memory address translation schemes used in full virtualization and in para-virtualization. (10 points)

4. (a) CloneCloud support computation offloading for mobile devices. Does CloneCloud support thread-level migration or method-level migration? Explain why you think that way. (5 points)

(b) When CloneCloud does computation offloading, what kind of information (data) should the migration manager on a mobile client send to server? (5 points)

5. In privacy research, it is important to understand what privacy is. Following questions are about the paper, Caché.
- (a) How does Caché define user's private information? (2 points)

 - (b) Caché proposes that _____ can represent less privacy leak. Fill in the blank, and briefly explain the reason. (3 points)

 - (c) There is generally trade-off between privacy protection and QOS of application. Why do you think this trade-off happen? Briefly explain with at least two examples. (5 points)