



# Solutions for Fifth Quiz

COSC 6360

Fall 2014



# First question

- According to the authors of Pergamum, what is the main disadvantage of using conventional disk arrays for archival storage applications?



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- According to the authors of Pergamum, what is the main disadvantage of using conventional disk arrays for archival storage applications?
  - ***Excessive power consumption.***



# Second question

- How can Pergamum intra-disk parity save energy?



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- How can Pergamum intra-disk parity save energy?
  - *Pergamum intra-disk parity allow Pergamum to recover from most irrecoverable read error without having to power up other devices.*



## Third question

- The authors of Xen claim that “[s]upport for full virtualization was never part of the x86 architectural design.” Give one example.



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- The authors of Xen claim that “[s]upport for full virtualization was never part of the x86 architectural design.” Give one example.
  - *The x86 instruction set includes instructions that can execute in both user and privileged mode with different semantics in each mode.*
  - *The POPF (Pop flag) instruction*



# Third question

- How does Xen solve that problem?





# Third question

- How does Xen solve that problem?
  - *Xen uses paravirtualization and requires the kernel of the virtual machines not to contain any instruction that can execute in both user and privileged mode with different semantics in each mode.*



# Fourth question

- Why does Xen use more than two protection levels?



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- Why does Xen use more than two protection levels?

- ***Because it has to prevent***

- ***User processes of each virtual machine from tampering with the kernel of their virtual machine***
- ***Kernel processes from each virtual machine to tamper with the hypervisor kernel and other virtual machines***



# Fourth question

- Which applications run at which level?
  - Ring 0:
  - Ring 1:
  - Ring 2:
  - Ring 3:



# Fourth question

- Which applications run at which level?
  - Ring 0: ***The hypervisor kernel***
  - Ring 1: ***The kernel of each virtual machine***
  - Ring 2: **--**
  - Ring 3: ***All user processes***



# Fifth question

- FAWN only stores a small fragment of the key of each item in its in-memory hash tables. What are the main advantage and the potential disadvantages of this approach?



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- FAWN only stores a small fragment of the key of each item in its in-memory hash tables. What are the main advantage and the potential disadvantages of this approach?
  - *The hash tables have lower RAM requirements which allows FAWN to lower its RAM energy footprint by having less of it.*
  - *Not storing the full key in RAM creates false key matches, which cause extra accesses to the secondary store.*



# Sixth question

- Why does FAWN associate with each physical node a set of disjoint virtual nodes?





# Sixth question

- Why does FAWN associate with each physical node a set of disjoint virtual nodes?
  - *Associating disjoint virtual nodes with each physical node distributes better the workload of a failed physical node as each virtual node will have a successor located on a different physical node.*