Solutions to the Fourth COSC 6360 Quiz for Fall 2012

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Consider a RAID level 6 array with ten disks.

Which fraction of the array space can be occupied by data? (5 points)
Answer

- Consider a RAID level 6 array with ten disks.
  - Which fraction of the array space can be occupied by data? (5 points)

- Each stripe contains 2 parity blocks and $10 - 2 = 8$ data blocks
- 80 percent
Consider a RAID level 6 array with ten disks.

How would you update a block $d$ and its corresponding parity blocks $p$ and $q$?
Answer

- How would you update a block $d$ and its corresponding parity blocks $p$ and $q$?
  - Read *old block* $d$, *old parity block* $p$ and *old parity block* $q$
  - Compute
    - $new\ p = old\ p \oplus old\ d \oplus new\ d$
    - $new\ q = old\ q \oplus old\ d \oplus new\ d$
  - Write $new\ d$, $new\ p$ and $new\ q$
LFS

What is the cost of a write in a log-structured file system, when its segment cleaner has to clean four segments to produce two clean segments? (10 points)
Answer

What is the cost of a write in a log-structured file system, when its segment cleaner has to clean four segments to produce two clean segments? (10 points)

- We use the formula Cost = 1/(1 − u) and note that u = 50 percent
- Cost is 4 disk accesses per new block being written
Answer (long way)

- When we clean up 4 segments, we must
  - Read the contents of the 4 segments
  - Write somewhere else the 2 segments containing live data
- The process gives us two clean segments that we can use later for new writes
- The total cost of these new writes is
  - 4 + 2 + 2 = 8
  - 4 disk accesses per block being written
Journaling file systems

- What are the main advantages and disadvantages of using the *data mode* in journaling file systems? (2×10 points)
Answer

What are the main advantages and disadvantages of using the data mode in journaling file systems? (2×10 points)

- **Advantage:** Safest solution
- **Disadvantage:** Slowest
Soft updates

- Which *dependency information* do *soft updates* maintain? (10 points)
Answer

- Which *dependency information* do *soft updates* maintain? (10 points)

- They maintain *dependency information* about cached pieces of metadata *at the directory entry level*
  - *This i-node must be updated before/after this directory entry*
NFS

- How can *non-volatile RAM* (NVRAM) improve the response time of an NFS server? (10 points)

- Is there a cheaper way to achieve the same result? (10 points) (Hint: just mention it)
Answer

- How can *non-volatile RAM* (NVRAM) improve the response time of an NFS server? (10 points)
  - NVRAM allows servers to respond to write requests without waiting for the completion of their own write requests

- Is there a cheaper way to achieve the same result? (10 points) (Hint: just mention it)
Answer

- How can non-volatile RAM (NVRAM) improve the response time of an NFS server? (10 points)
  - NVRAM allows servers to respond to write requests without waiting for the completion of their own write requests

- Is there a cheaper way to achieve the same result? (10 points) (Hint: just mention it)
  - Safe asynchronous writes
Why must NFS client requests be both *self-contained* and *idempotent*? (2×10 points)
Answer

Why must NFS client requests be both *self-contained* and *idempotent*? (2×10 points)

- They must be self-contained because NFS is *stateless* and keeps no record of previous requests
- They must be idempotent to allow clients to *resend* any request for which they did not get a reply