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CS 312 – System Administration
HW 9 – RAID and Hard Drives
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1. What did RAID originally stand for, before it became "Redundant Array of Independent Disks?" (2 points)

   Redundant Array of Inexpensive Disks

2. How many drives are required, at a **minimum**, for each of these RAID levels (1 point for each correct answer): [1]
   a. RAID Level 0 **2 Drives**
   b. RAID Level 1 **2 Drives**
   c. RAID Level 4 **3 Drives**
   d. RAID Level 5 **3 Drives**
   e. RAID Level 6 **4 Drives**
   f. RAID LEVEL 1+0 (aka 10) **4 Drives**

3. What types of information are stored in these log files on a typical Linux system (3 points each): [2]
   a. /var/log/secure – **Logs of information related to authentication and authorization privileges (including failed logins).**
   b. /var/log/yum.log – **Logs of information about the packages installed using YUM**
   c. /var/log/messages – **Main log box. Logs of global system messages: startup, mail, cron, daemon, kern, auth and etc.**

4. What backup plan do you have for your files? Describe your file restoration plan in the event that your laptop goes missing. (10 points, full credit given for a few thoughtful and/or guilt-ridden on-topic paragraphs)

   These are my backup solutions I currently implemented.
   Cloud storage solutions:
   - **Box** (Hotmail, 50GB): old school work, other stuff I need that can be downloaded but hard to google at times.
   - **Box** (Gmail, 50GB): Android backups, anything android related goes in here.
   - **Onedrive** (15GB ish): Documents, anything in doc,docx,xls,xlsx,ppt,pptx etc goes in here because using Office Online is better than using formatting on Open Office (because I prefer to be on linux most of the times.)
   - **Google Drive** (Personal, no idea how big)**:** Publicly shared stuff, my high school graduation DVD was ripped and uploaded here because Google Drive can use YouTube video player on videos uploaded here (it was uploaded before the 10min limitation they used to have).
   - **Google Photos** (Personal, unlimited* technically): Everything, please don't hack me.
   - **Google Music** (Personal, also unlimited I think?): Music, audiobooks, heavily zipped "audio files" with .mp3 extension *cough cough*, and the rest of the music I've acquired over the years. Unfortunately, most of my K-pop, J-pop music was uploaded with wrong text-encoding, so the title of the music can be difficult to

distinguish between "ÆÄ½ºÅ" and "ÀÓÃ¢Á¤" (but when I listen to it, I feel it in my kokoro.)
- **Google Drive** (School, 1000TB): Normally used for whenever I need to dump the entire content of my ext hard drive on to somewhere, but don't have space for it.
- **Box** (School, 1000TB): Same as Google drive, but so far, I've only needed to use it for capstone.
- **Password:** I use a password manager obvs.
- **Bookmarks:** syncmarx, its cross-browser compatible, I use it to distinguish personal bookmarks and school's.
- **Github:** git commit –m "ALL YOUR CODES ARE BELONGS TO US." Also, ringtones, cv (resume), and dot-config files (**Bitbucket** for this one actually).

Offline storage solutions:
- **External Hard drive** (3.76TiB): On-going projects, android tools, music, videos, games, memes stash, ISO files needed for "repairing", eBooks I've acquired over the years, SWF games I've used to play, but don't want to go online because rip flash.
- **2 x NAS HDD** (2 x 4TB): I haven't set it up yet. RAID controllers are expensive than I initially expected.
- **Internal Solid States** (varies): Things that would normally be backed up online goes here. If all my working SSD's crash, only thing I'd lose would be dank memes and time.
- **Flash drives** (also varies): I have a **16GB** with Windows 10 install files handy just in case my friends ~~fucked up~~ ignored the Windows Update telling them to keep the laptop plugged… Couple **2GB** or **4GB** with various linux distros, most of which are deb based. **128GB** with fully running Ubuntu-Mate in case I need my personal stuff and I only have access to other computers.

5. Here's a few questions about Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T. or SMART).
   a. **Describe some of the limitations of SMART. (5 points)**

It can only detect predictable failures that comes from mechanical wear and gradual degradation. Unpredictable failures, such as manufacture defect or sudden mechanical failure are not predicted by SMART. The increased temperatures or the usage level of the drives have little or no correlation in drive failure rate, meaning some of the logging done to predict hard drive failure were pointless. [3]

According to field studies done at Google, [4]

> "A large proportion (56%) of the failed drives failed without recording any count in the 'four strong S.M.A.R.T. warnings' identified as scan errors, reallocation count, offline reallocation and probational count. Further, 36% of failed drives did so without recording any S.M.A.R.T. error at all, except the temperature, meaning that S.M.A.R.T. data alone was of limited usefulness in anticipating failures."

Other reasons why S.M.A.R.T. isn't so smart: 1. Incorrect thresholds, 2. Wrong evaluation methods, 3. Weight of attributes, 4. Lack of feedback, 5. Temperature, sensor problems, 6. Incorrect drivers, 7. Incorrect hardware or incorrect data, 8. Skynet [5]

b. Answer True or False for each of these sentences about SMART, generally speaking: (2 points for each statement correctly indicated as true or false):

i. If SMART says a drive is going bad, then it's going bad.

True – Time to back up. :'(

(But then again, you can never trust these machines and better be safe than sorry)

ii. If SMART says a drive is going bad, that it could still be OK.

True – but it's only as okay as Will Smith's dog on I am Legend.

iii. If SMART says a drive is OK, then it must be OK.

Nope – We're all destined to die.

iv. If SMART says a drive is OK, then it could still be going bad.

Yep – tear off that bandage quick. Even if you don't have cancer, you can still get hit by a bus tomorrow.

Sources:

1. https://www.wikiwand.com/en/Standard_RAID_levels#/Comparison
2. https://www.thegeekstuff.com/2011/08/linux-var-log-files/
3. https://www.wikiwand.com/en/S.M.A.R.T.
4. https://ai.google/research/pubs/pub32774
5. https://www.hdsentinel.com/smart/index.php