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**Sheet 11**

**Problem 1)**

A)

In RAID 0, the system fails if one of the discs come to failure as the data is stored in only one of the discs and there is no copy of it on the other discs. Hence, the probability of failure of RAID 0 is equal to the probability of at least one of the n discs failing.

F0(p,n) =1- probability(no disc fails)

=1- ((1-p)^n)

B) In RAID 1, since the data is written on all n discs ,failure happens if both discs fail at the same time. Hence, the probability of failure of RAID 1 is equal to the probability of all n discs failing.

F1(p,n) = p^n

C) Assume we have 6 discs with failure probabilities of 0.1 and hence according to RAID 10 arrangement which gives us n/2 = 3 groups of discs arranged in RAID 1 to be arranged as RAID 0.

In this arrangement ,we lose our data if we lose both discs within the same group.

Hence, then probability of failure is equal to the probability of atleast one group failing.

In this specific case,

|  |  |
| --- | --- |
| A | A |
| B | B |

|  |  |
| --- | --- |
| C | C |
| D | D |

|  |  |
| --- | --- |
| E | E |
| F | F |

**Note: Each table represents one group, the groups are arranged together in RAID 0.**

* **Within each group the discs (columns in each table) are arranged in RAID 1**

F10(p,n) = 1- probability(no group fails)

probability(no group fails)= (1-(P)^2)^(n/2)

probability(no group fails)=(1-(0.1)^2)^(6/2)

F10(p,n) =1-0.97=0.03=3%

Hence, the general formula is F10(p,n) =1-(1-(P)^2)^(n/2).

D)Again, Assuming we have 6 discs and hence according to RAID 01 arrangement we will have two groups hence each group will have n/2 =3 discs.

We lose our data in this arrangement if BOTH discs carrying the same data from different groups fail.

In this specific case,

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A | C | E |  |  | A | C | E |
| B | D | F |  | B | D | F |

**Note: Each table represents one group, the groups are arranged together in RAID 1.**

* **Within each group the discs ( columns in each table) are arranged in RAID 0.**

F01(p,n) = probability(both group fails)

probability(both group fails)= (1-(1-P)^(n/2))^(2)

probability(no group fails)=(1-(1-0.1)^(6/2))^(2)=0.073=7.3%

F10(p,n) =7.3%

Hence, the general equation is,

F01(p,n)=(1-(1-p)^(n/2))^2

In this arrangement ,we lose our data if discs that carry similar data from both groups fail.

5)

Although both are similar in their performance and their storage capacity,I prefer to use the RAID 10 configuration as it has less probability of failure as compared to RAID 01 with the same number of discs and failure rates in the examples shown above.

**Problem 2)**

The volume group is created using the command

**sudo vgcreate vgo /dev/loop0 /dev/loop1 /dev/loop2**

which prints the confirmation of the creation (shown in red)

The sudo vgs (in green) command shows the size of the volume group which is 48MB

The sudo pvs command( in blue) shows the size contributions of /dev/loop0,/dev/loop1 and /dev/loop2 which is 16MB each as we can see from PSize. This shows that 4MB of space is used by each loop from the original 20MBText

Description automatically generated

B)Text

Description automatically generated

- From the figure above,the command shown by the blue arrow creates a logical volume of 20MB size.

- The command pointed by the green arrow creates a file system in lvo.

Text

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- From the above figure, the command **sudo mount /dev/vgo/lvo /mnt** mounts lvo on it.

-**sudo lvs** shows the size of the logical volume lvo.

- From the outcome of **sudo pvs**, we can see that 16MB and 4MB are used from loop 0 and loop 1 respectively (which make up the volume group) to give space given to lvo.

**-sudo df /mnt** shows that lvo is mounted on /mnt .

C)

Text

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Since we want to grow our file system lvo to 60MB,we will need to add more space from the volume group vgo.However,since vgo is only 48MB big, we will first extend it by adding loop4.Thus, vgo will have enough space to give for lvo.

From the above figure,

-command indicated by the green arrow extends the vgo by adding /dev/ loop4.

-command indicated by yellow arrow extends the lvo by 40MB.

-command indicated by blue arrow shows size of lvo which is now 60MB.

-command indicated by black arrow shows the size contributions of /dev/ loop0,/dev/ loop1,/dev/ loop2 and /dev/ loop4 (PSize) to lvo and how much is not used .

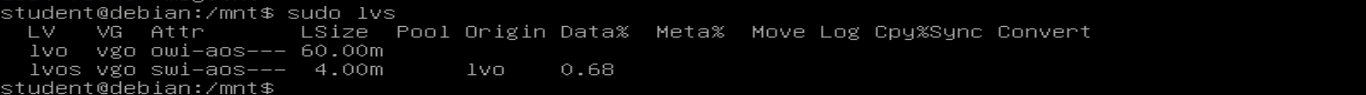
-command indicated by red arrow shows that lvo is mounted on /mnt .

D) Text

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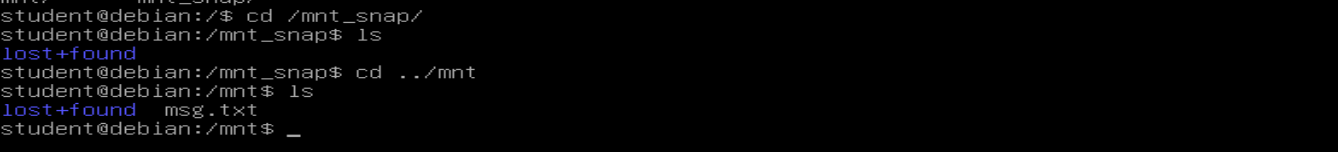
-As we can see from the above figure, the **sudo lvcreate -L 1m -s -n lvos /dev/vgo/lvo** command creates the snapshot logical volume lvos of lvo.

-I created a msg.txt in /mnt and wrote “I need to get full points for Homeworks”.



* We observe a change in the data% from the above picture from 0.29% to 0.68% after msg.txt was created as shown in the above picture.

However, msg.txt will not exist in the snapshot file system since the text file in lvo was created after the snapshot lvos was created as we can see from figure below.



E)

- As seen from the figure below, loop0 and loop1 are used to store the data that belongs to lv0r1 as PFree is zero.

A picture containing shape

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-The output of the **sudo lvs** command shows the size of lv0r1 and lv1r5 which are 12MB and 24MB respectively.

-The physical volume providing storage for lv1r5 are loop 2,3 and 4 as shown from fig below(PFree value went to 0) which is 16+16+16=48MB .

Text

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