RAIDsim manual
(last modified 8/23/06)

Program to simulate RAID configurations at a high level. Lets user specify probability of failure of a single real read action. Lets users simulate sequences of read actions.

Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>q</td>
<td>Exit the simulator</td>
</tr>
<tr>
<td>c</td>
<td>Clear the counts of good and bad reads</td>
</tr>
<tr>
<td>d</td>
<td>Enter a seed value for the random number generator (unsigned integer)</td>
</tr>
<tr>
<td>i</td>
<td>Set up RAID configuration parameters</td>
</tr>
<tr>
<td>p</td>
<td>Show RAID configuration parameters</td>
</tr>
<tr>
<td>f</td>
<td>Enter probability of failure for actual read</td>
</tr>
<tr>
<td>r</td>
<td>Run a list of read requests from specified file of sector numbers</td>
</tr>
<tr>
<td>x</td>
<td>Run a list of random sector reads – specify length of sequence</td>
</tr>
<tr>
<td>s</td>
<td>Show counts of good and bad reads</td>
</tr>
<tr>
<td>t</td>
<td>Toggle trace flag</td>
</tr>
</tbody>
</table>

Example run

Script started on Thu 17 Aug 2006 11:39:52 AM PDT
sh-3.00$ a.out
raidlevel: 0
sectors per actual disc: 100
number of actual discs: 4
RAIDsim: t
traceflag now TRUE
RAIDsim: x
Enter value for sequence length:10
virtual reading sector 183
actual read Disc 3 Sector 45
virtual reading sector 377
actual read Disc 1 Sector 94
virtual reading sector 193
actual read Disc 1 Sector 48
virtual reading sector 186
actual read Disc 2 Sector 46
virtual reading sector 249
actual read Disc 1 Sector 62
virtual reading sector 362
actual read Disc 2 Sector 90
virtual reading sector 290
actual read Disc 2 Sector 72
virtual reading sector 163
actual read Disc 3 Sector 40
virtual reading sector 140
actual read Disc 0 Sector 35
virtual reading sector 372
actual read Disc 0 Sector 93
RAIDsim: s
goodactualreads 10 badactualreads 0 goodvirtualreads 10 badvirtualreads 0
RAIDsim: c
RAIDsim: f
Enter value for failprob: 0.3
RAIDsim: x
Enter value for sequence length:10
virtualreading sector 11
actual read Disc 3 Sector 2
virtualreading sector 167
actual read Disc 3 Sector 41
virtualreading sector 182
actual read Disc 2 Sector 45
virtualreading sector 62
actual read Disc 2 Sector 15
virtualreading sector 67
actual read Disc 3 Sector 16
virtualreading sector 329
actual read Disc 1 Sector 82
virtualreading sector 22
actual read Disc 2 Sector 5
virtualreading sector 269
actual read Disc 1 Sector 67
virtualreading sector 193
actual read Disc 1 Sector 48
virtualreading sector 211
actual read Disc 3 Sector 52
RAIDsim: s
goodactualreads 6 badactualreads 4 goodvirtualreads 6 badvirtualreads 4
RAIDsim: q
RAIDsim ends
sh-3.00$ exit

Script done on Thu 17 Aug 2006 11:40:47 AM PDT

Some results over the same 10,000 random reads. A table entry shows the probability of a virtual read failure for given RAID configuration and probability of actual read failure. RAID 3 used 9 actual discs, all others 10. There were 100 sectors on each actual disc. Random number seed was 123. Extract from runs follows the table

<table>
<thead>
<tr>
<th>Failprob</th>
<th>RAID 0</th>
<th>RAID 10</th>
<th>RAID 3</th>
<th>RAID 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.0968</td>
<td>0.0089</td>
<td>0.2209</td>
<td>0.0600</td>
</tr>
<tr>
<td>0.05</td>
<td>0.0486</td>
<td>0.0031</td>
<td>0.0712</td>
<td>0.0179</td>
</tr>
<tr>
<td>0.02</td>
<td>0.0286</td>
<td>0.0005</td>
<td>0.0130</td>
<td>0.0030</td>
</tr>
<tr>
<td>0.01</td>
<td>0.0098</td>
<td>0.0000</td>
<td>0.0032</td>
<td>0.0009</td>
</tr>
</tbody>
</table>
RAIDsim: c
Counts cleared
RAIDsim: f
Enter value for failprob: 0.05
RAIDsim: d
Enter seed value: 123
RAIDsim: x
Enter value for sequence length: 10000
RAIDsim: s
goodactualreads 9514 badactualreads 486 goodvirtualreads 9514
badvirtualreads 486
RAIDsim: c
Counts cleared
RAIDsim: f
Enter value for failprob: 0.02
RAIDsim: d
Enter seed value: 123
RAIDsim: x
Enter value for sequence length: 10000
RAIDsim: s
goodactualreads 9794 badactualreads 206 goodvirtualreads 9794
badvirtualreads 206
RAIDsim: c
Counts cleared
RAIDsim: f
Enter value for failprob: 0.01
RAIDsim: d
Enter seed value: 123
RAIDsim: x
Enter value for sequence length: 10000
RAIDsim: s
goodactualreads 9902 badactualreads 98 goodvirtualreads 9902
badvirtualreads 98
RAIDsim: q
RAIDsim ends

Notes on the table:

(1) There is no redundancy in RAID 0 so we would expect the virtual failure rate to be approximately the same as the actual failure rate.

(2) Virtual reads fail in RAID 10 only if both actual reads (main disc and mirror) fail so virtual error rates are low. However, space utilization is only 50%.

(3) RAID 3 relies on successful reads of all 8 data discs. It can recover most of the time if only one of the 8 reads fails but not if 2 or more fail.

(4) RAID 5 error rates are higher than RAID 10 but space utilization is better.