
Storage Systems

Prof. Asadi

Assignment #1 - Due on Aban 2nd

Nima Mohammadi

nima.mohammadi@ut.ac.ir

1 SIMULATING RAID WITH SIMDISK

We base our work on synthraid5.parv configuration file which corresponds to a RAID5 8+1. I noticed that "Storage capacity per device" for generators has been set to 16448064, which seems to be wrong and outdated as the specifications for HP_C3323A states that block count for this model has been corrected "from 2056008 to 1743672". Apparently the former value had been used for synthraid5.parv.

I have tested two forks of DiskSim, one by Dirk Meister and the other by Western Digital. Meister's fork only runs on Linux, but I managed to run WD's fork on OS X as well. I found out that WD's fork has oddly limited the maximum number of reqs to 200000, hardcoded in src/disksim_simresult.h (+).

2 SYNTHETIC WORKLOAD

Three investigated *request sizes*, namely small, medium and large, were sampled from a normal distribution $\mathcal{N}(4, 2)$, $\mathcal{N}(16, 2)$ and $\mathcal{N}(64, 2)$, respectively.

For each configuration, two synthetic workload generators are incorporated with identical settings. Probability of local accesses is set to 30%. Of all requests, 66% of them are read accesses and 20% are sequential.

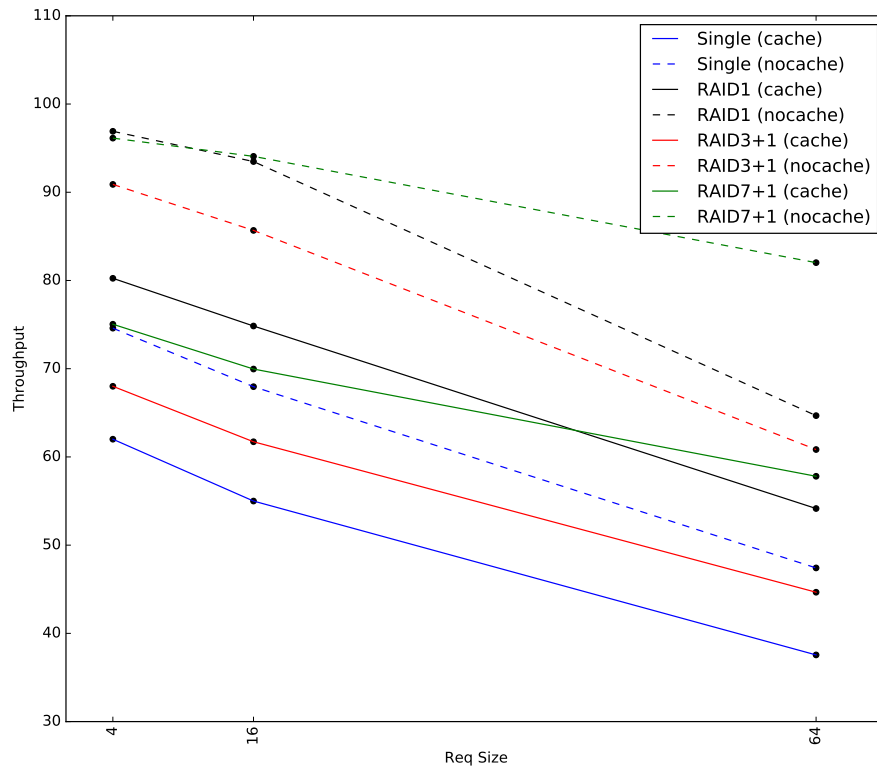


Figure 3.1: Throughput of various configurations reported by DiskSim

3 FIRST METRIC: THROUGHPUT

As for the first unit of measurement we opted the throughput of the system, reported under "*Overall I/O System Requests per second*" in DiskSim output log. How the throughput of these configurations is changed with respect to the req. size is depicted in Figure ??.

4 SECOND METRIC: AVERAGE RESPONSE TIME

We chose average response time, reported under "*Overall I/O System Response time average*" in DiskSim output log as the second criterion. How AvgRT of these configurations is changed with respect to the req. size is depicted in Figure ??.

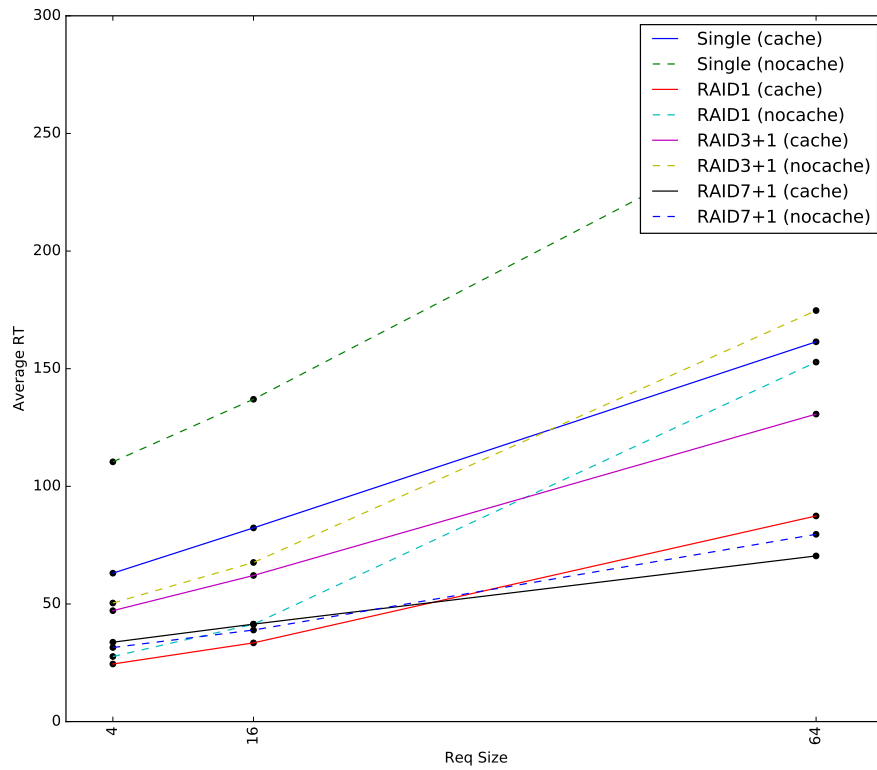


Figure 4.1: Average Response Time of various configurations reported by DiskSim

5 OBSERVATIONS

As shown by Figure ??, fastest Avg. RT for small requests belongs to RAID1, which comes to no surprise as this configuration omits any redundancy and makes use of a very simple controller which divides the loads on two disks. However, as expected, a RAID configuration with more data disks (i.e. RAID 7+1) outperformed RAID1 for requests of larger sizes. That is not the case for small req. sizes, probably due to the overhead of incorporating seven disks to acquire a rather small chunk of data. As for the worst case, the single disk scenario, and more specifically the configuration without caching, is without a doubt slower. Moreover, I can not come up with an explanation as to why RAID3+1 does not lie between the two other RAID configurations.

Disclaimer: My experiments showed inferior throughput for cases with a caching mechanism (i.e. disksim_cachemem) compared with no cache. I told this to Ms. Ahmadian and discussed it with Mr. Tarihi, who dissed DiskSim for its cache implementation. I have tested many possible scenarios, from increasing cache size, changing read and write schemes of cache,

enabling prefetching, changing replacement policy to changing the locality of the synthetic workload, but to no avail.

Regardless of throughputs of various configurations (Fig. ??) compared to each other, we can see that throughput of RAID7+1 has a less steep decline as the request size grows, compared to other schemes.

6 TABLES

Table 6.1: Throughputs

	Small Req.	Medium Req.	Large Req.
Single (cache)	62.007962	54.998343	37.556862
Single (nocache)	74.595594	67.961751	47.418344
RAID1 (cache)	80.245812	74.839183	54.152121
RAID1 (nocache)	96.909472	93.480399	64.680562
RAID3+1 (cache)	68.005914	61.719199	44.663290
RAID3+1 (nocache)	90.890062	85.674496	60.838577
RAID7+1 (cache)	75.039194	69.962464	57.806363
RAID7+1 (nocache)	96.135604	94.068864	82.021575

Table 6.2: Average Response Times

	Small Req.	Medium Req.	Large Req.
Single (cache)	63.087211	82.329793	161.435756
Single (nocache)	110.414437	137.002508	261.629921
RAID1 (cache)	24.477941	33.459932	87.410663
RAID1 (nocache)	27.666542	41.368288	152.808413
RAID3+1 (cache)	47.150294	62.105883	130.703169
RAID3+1 (nocache)	50.400269	67.642395	174.720636
RAID7+1 (cache)	33.742821	41.424422	70.416513
RAID7+1 (nocache)	31.485917	38.923116	79.612017