Operating System – CS-550-01
Assignment 3 – Page Faults Report
Author - Kenneth Peter Fernandes (B00813852)

1. Page faults on compute intensive application – (Sysbench):

- Following is the observation of the page faults while performing “sysbench” operation in Linux:
  a) Scatter plot table (Fault Address V/S Time):
     - In order to have a complete view of the table, I have inverted it.

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b) Fault Address label to Fault address mapping with the time of occurrence (Legends):

FAULT ADDRESS LABEL	FAULT ADDRESS	KERNEL TIME (ns)	KERNEL TIME SCALLED (ns)
00	140271636082688	4048461203934	0
01	140271636066304	4048461209038	5104
02	140271636070400	4048461214053	10119
03	140271636090880	4048461219052	15118
04	140271636099072	4048461227733	23799
05	140271636107264	4048461236205	32271
06	140271636115456	4048461244836	40902
07	140271636123648	4048461253358	49424
08	140271636131840	4048461262186	58252
09	140271636140032	4048461270815	66881
10	140271636148224	4048461279736	75802
11	140271636156416	4048461288204	84270
12	140271636164608	4048461297055	93121
13	140271636172800	4048461305549	101615
14	140271636180992	4048461314056	110122
15	140271636189184	4048461323659	119725
16	140271636197376	4048461332333	128399
17	140271636205568	4048461341059	137125
18	140271636221952	4048461357471	153537
19	140271636230144	4048461366185	162251
20	140271636238336	4048461374602	170668
21	140271636246528	4048461383417	179483
22	140271636254720	4048461392244	188310
23	140271636262912	4048461400774	196840
24	140271636271104	4048461409384	205450
25	140271636279296	4048461417889	213955
26	140271636287488	4048461426275	222341
27	140271636295680	4048461434650	230716
28	140271636303872	4048461443098	239164
29	140271636312064	4048461451616	247682

c) Kernel Time label to Kernel Time sample (Legends):

KERNEL TIME LABEL	KERNEL TIME (ns)
T00	0
T01	3538
T02	7076
T03	10614
T04	14152
T05	17690
T06	21228
T07	24766
T08	28304
T09	31842
T10	35380
T11	38918
T12	42456
T13	45994
T14	49532
T15	53070
T16	56608
T17	60146
T18	63684
T19	67222
T20	70760
T21	74298
T22	77836
T23	81374
T24	84912
T25	88450
T26	91988
T27	95526
T28	99064
T29	102602
T30	106140
T31	109678
T32	113216
T33	116754
T34	120292
T35	123830
T36	127368
T37	130906
T38	134444
T39	137982
T40	141520
T41	145058
T42	148596
T43	152134
T44	155672
T45	159210
T46	162748
T47	166286
T48	169824
T49	173362
T50	176900
T51	180438
T52	183976
T53	187514
T54	191052
T55	194590
T56	198128
T57	201666
T58	205204
T59	208742
T60	212280
T61	215818
T62	219356
T63	222894
T64	226432
T65	229970
T66	233508
T67	237046
T68	240584
T69	247682

- The scatter-plot table consists of Addresses labels on one axis which are sorted by time of page fault occurrence and on the other axis we have the page faults duration of 30 page-fault occurrences sampled in 70 values.
- Based the above observations, we can see that Page faults occur in continuous time-frame and the frequency of Page faults is high.
- If a process or application may cause continuous page faults, it might slow down the system drastically.

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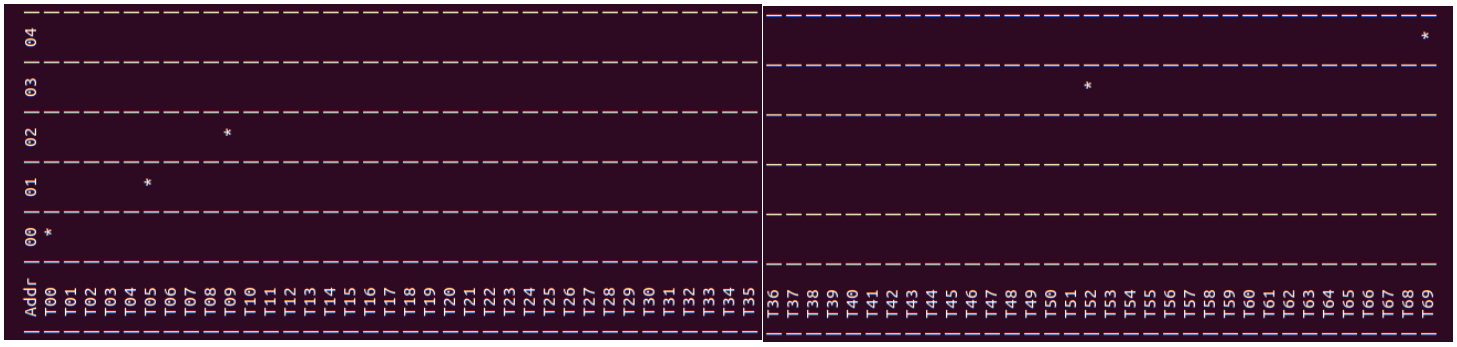
2. Page faults on network I/O intensive application – (iperf3):

- Following is the observation of the page faults while performing “iperf3” operation in Linux:
  a) Scatter plot table (Fault Address V/S Time):
  - In order to have a complete view of the table, I have inverted it



b) Fault Address label to Fault address mapping with the time of occurrence (Legends):

FAULT ADDRESS LABEL	FAULT ADDRESS	KERNEL TIME (ns)	KERNEL TIME SCALLED (ns)
00	139626110195176	7937063484862	0
01	139626110407984	7937063494038	9176
02	139626110353888	7937063501716	16854
03	139626110079232	7937063592513	107651
04	94827007549560	7937063630363	145501

c) Kernel Time label to Kernel Time sample (Legends):

KERNEL TIME LABEL	KERNEL TIME (ns)
T00	0
T01	2078
T02	4156
T03	6234
T04	8312
T05	10390
T06	12468
T07	14546
T08	16624
T09	18702
T10	20780
T11	22858
T12	24936
T13	27014
T14	29092
T15	31170
T16	33248
T17	35326
T18	37404
T19	39482
T20	41560
T21	43638
T22	45716
T23	47794
T24	49872
T25	51950
T26	54028
T27	56106
T28	58184
T29	60262
T30	62340
T31	64418
T32	66496
T33	68574
T34	70652
T35	72730
T36	74808
T37	76886
T38	78964
T39	81042
T40	83120
T41	85198
T42	87276
T43	89354
T44	91432
T45	93510
T46	95588
T47	97666
T48	99744
T49	101822
T50	103900
T51	105978
T52	108056
T53	110134
T54	112212
T55	114290
T56	116368
T57	118446
T58	120524
T59	122602
T60	124680
T61	126758
T62	128836
T63	130914
T64	132992
T65	135070
T66	137148
T67	139226
T68	141304
T69	145501

- Based on the above observation, iperf3 operation recorded few page faults, but after a certain interval, unlike the one in “sysbench” operation.

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3. Page faults on compute and I/O intensive application – (kcbench):

- Following is the observation of the page faults while performing “kcbench” operation in Linux:
  a) Scatter plot table (Fault Address V/S Time):
     - In order to have a complete view of the table, I have inverted it.

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b) Fault Address label to Fault address mapping with the time of occurrence (Legends):

FAULT ADDRESS LABEL	FAULT ADDRESS	KERNEL TIME (ns)	KERNEL TIME SCALLED (ns)
00	139964914337472	490882199569	0
01	94324653735152	490882218981	19412
02	94324653785296	490882220770	21201
03	94324653730976	490882222100	22531
04	94324653669408	490882223455	23886
05	94324653650800	490882224986	25417
06	94324653743888	490882226216	26647
07	94324653766784	490882227593	28024
08	94324653674912	490882228754	29185
09	94324653673264	490882230022	30453
10	94324653712784	490882231422	31853
11	94324653704160	490882232941	33372
12	94324653701376	490882234250	34681
13	94324653744576	490882235684	36115
14	94324653496560	490882236919	37350
15	94324653686560	490882238159	38590
16	94324653782064	490882239405	39836
17	94324653531024	490882241110	41541
18	94324653457536	490882242568	42999
19	94324653755664	490882243947	44378
20	94324653720176	490882245213	45644
21	94324653695216	490882246539	46970
22	94324653507344	490882247852	48283
23	94324653716768	490882249100	49531
24	94324653738664	490882251638	52069
25	94324653511360	490882252952	53383
26	94324653707680	490882254244	54675
27	94324653686992	490882255442	55873
28	94324653248976	490882256668	57099
29	94324653682128	490882257936	58367

c) Kernel Time label to Kernel Time sample (Legends):

KERNEL TIME LABEL	KERNEL TIME (ns)
T00	0
T01	833
T02	1666
T03	2499
T04	3332
T05	4165
T06	4998
T07	5831
T08	6664
T09	7497
T10	8330
T11	9163
T12	9996
T13	10829
T14	11662
T15	12495
T16	13328
T17	14161
T18	14994
T19	15827
T20	16660
T21	17493
T22	18326
T23	19159
T24	19992
T25	20825
T26	21658
T27	22491
T28	23324
T29	24157
T30	24990
T31	25823
T32	26656
T33	27489
T34	28322
T35	29155
T36	29988
T37	30821
T38	31654
T39	32487
T40	33320
T41	34153
T42	34986
T43	35819
T44	36652
T45	37485
T46	38318
T47	39151
T48	39984
T49	40817
T50	41650
T51	42483
T52	43316
T53	44149
T54	44982
T55	45815
T56	46648
T57	47481
T58	48314
T59	49147
T60	49980
T61	50813
T62	51646
T63	52479
T64	53312
T65	54145
T66	54978
T67	55811
T68	56644
T69	58367

- Based on the above observation, kcbench operation recorded a single page fault and then after a few nanoseconds, page faults occurred continuously showing a steep upward slope in the graph table.
- “sysbench” operation did not have a steep slope in graph table during page fault occurrence.
- Hence, this showed that page faults frequency is the highest when the when the system runs compute and I/O intensive application and can cause system to slow down.
- Kcbench: https://gitlab.com/knurd42/kcbench