OS 2

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1 Simple page table vs AArch64 page table

The simple page table implementation uses a large page size (64 MiB) and thus suffers from a lot of internal fragmentation The AArch64 page table implementation uses a small page size (16 Kib) and does not have that problem. Were not for the hierarchical page table structure however, the AArch64 implementation would have used a lot of additional memory just for allocating the page table and its entries. A clear disadvantage of this implementation though is the long access time caused by the table walk and the frequent page faults caused by the small page size but the amount of memory saved makes it worth it. This is illustrated with the following example.

Although it has fewer page faults, the amount of memory needed just to allocate the page table for the simple implementation is a huge waste in comparison to the arch64. In the simple table, every additional page also comes with a large amount of internal fragmentation. It is safe to say that the arch64 table is a lot more efficient memory wise, but has an acceptable decrease in access time.

	aarch				simple			
nProcesses	1	2	3	4	1	2	3	4
context switches	2	275	412	549	2	275	412	549
page faults	53	53	53	53	3	3	3	3
bytes allocated	98304	114688	131072	147456	16777216	33554432	50331648	67108864
pages allocated	59	60	61	62	4	5	6	7

Figure 1: Statistics aarch64 vs simple implementation

	32 entries					64 entries			
nProcesses	1	2	3	4		1	2	3	4
hitrate	99.9479	918707	99.4625	99.6738		99.9611	99.9794	99.9465	99.9673
line evictions	39	1016	9615	10479		0	125	896	991
	128 entries					256 entries			
nProcesses	1	2	3	4		1	2	3	4
hitrate	99.9611	99.9851	99.9802	99.9883		99.9611	99.9851	99.9856	99.9918
line evictions	0	9	227	249		0	0	2	7

Figure 2: TLB different TLB entries and nProcesses

2 Effectiveness of the TLB

As expected, the effectiveness of the TLB largely depends on the size of the TLB. This isn't always feasible however because of hardware constraints, but it is demonstrated below that a larger TLB size will increase the hitrate, lower the line evictions, and subsequently speed up the access time.