

Memory System Parameters:

L1 Cache - 0.5 ns access time - 95% hit rate

TLB - 1.0 ns to do a mapping - 90% hit rate

L2 Cache - 10 ns access time - 90% hit rate.

Memory - 100 ns access time - .01% fault rate for data accesses only (page table never faults)

Disk - 10 ms = 10,000,000 ns access time

L1 TLB	Page Tbl	Data	Probability	Time ♦
L2 Memory	L2 Memory			
H	-----	-----	.95 =	.95
M	H	----- H	.05*.90*.90 =	.0405
M	H	----- M ●	.05*.90*.10 =	.0045
M	M	H ----- H	.05*.10*.90*.90 =	.00405
M	M	H ----- M Res	.05*.10*.90*.10*.9999 =	.000449955
M	M	H ----- M Fault	.05*.10*.90*.10*.0001 =	.000000045
M	M	M Res H	.05*.10*.10*.90 =	.00045
M	M	M Res M Res	.05*.10*.10*.10*.9999 =	.000049995
M	M	M Res M Fault	.05*.10*.10*.10*.0001 =	.000000005
(Sum of the above = 1)				

- If a page's mapping is recorded in the TLB, it must have been referenced recently and can therefore be assumed to still be resident, so assume faults don't occur in this case

- ♦ Assume that when a miss occurs in a cache or TLB, the time is subsumed in time for the next level, and that when a page fault occurs the time to update memory when page is brought in is subsumed in the disk access time

$$\text{AMAT} = .95*.5 + .0405*11 + .0045*101 + .00405*21 + .000449955*110 + .000000045*10000010 + .00045*110 + .000049995*200 + .000000005*10000100 = 2.07 \text{ ns}$$