BAD - why a TLB is needed to make paged VM practical!

MEM. ACCESSES ARE USED for EACH DATA ACCESS!
\[
\text{Aug.\ time} = p(\text{Hit}) \times (\text{Hit time}) + p(\text{Miss}) \times (\text{Miss time})
\]

Expected value of a Random variable

\[
T_{\text{time}} = \text{time (in nanoseconds) to access one word of memory}
\]

\[
A_e = h \times \text{Time}_{\text{Hit}} + (1-h) \times \text{Time}_{\text{Miss}}
\]

Goal: we want \( A \) to be \( 2 + \frac{1}{\text{coverage}} \)

Regular hit time
prob. 16

the R bit (reference or used bit) is needed to implement a common page replacement strategy.

Blocksize

Block = unit of allocation in cache systems

HW caches called "block"

Paging systems: the block is called "page"
Fragmentation  Used parts

A contiguous memory resource (disk or HW RAM)

External fragmentation: lots of small holes (of unused space) add up to enough space for me, but there is no big enough contiguous region for my request.

One solution: Compacting

Bad because it changes the addresses of allocations (but one level of indirection fixes that.)