

Beyond Physical Memory: Policies

- When there is not much memory free the OS has to start paging out pages to make room for actively used pages.
- The replacement policy contains the information to decide which pages to evict.

Cache Management

- Main memory can be viewed as a cache for virtual memory pages in the system.
- The goal of a replacement policy is to minimize the number of cache misses for main memory.
 - Also to maximize cache hits.
- Knowing the number of cache hits and misses allows the calculation of the average memory access time (AMAT) for a program.
 - $AMAT = (P_{hit} \cdot T_M) + (P_{miss} \cdot T_D)$
 - T_M is the cost of accessing memory.
 - T_D is the cost of accessing disk.
 - P_{hit} probability of a hit.
 - P_{miss} probability of a miss.

22.2 Optimal Replacement Policy

- The optimal replacement policy leads to the fewest number of misses overall.
- Replacing a page that will be accessed furthest in the future is the optimal policy.
- Cold start misses occur when the cache is empty in the beginning.

22.3 FIFO

- Some early systems used FIFO replacement.
- FIFO is noticeably worse than the optimal replacement policy.

22.4 Random

- Picks a random page to replace in memory.
- Randoms performance depends on how lucky it is.

22.5 LRU

- We can use history as a guide for replacement.
- Frequency can be used for historical information.
 - If a page has been accessed many times it should not be replaced.
- Recency can also be used.
 - The more recently a page has been used the more likely it is to be used again.
- Both policies are examples of the principle of locality.
 - Says the programs tend to access certain code sequences and data structures.

22.9 Dirty Pages

- When a page has been modified it has to be written to disk to evict it.
- Referred to as dirty.
 - the modified bit is referred to as the dirty bit.
 - Set at any time a page is written.

22.10 Other VM Policies.

- The OS has to decide when to bring a page into memory.
 - Called page selection.
 - Most OS's use demand paging.
 - bring a page into memory when it is accessed.
 - The OS could use prefetching and guess when the page will be accessed.
- Many OS's tend to collect a number of pending writes in memory and write them together at one time.
 - called clustering.

22.11 Thrashing

- Thrashing is when the system is constantly paging.
- Some OS systems would decide not to run a subset of processes if it was constantly paging.
 - Known as admission control
- Some versions of Linux run an out of memory killer.
 - when memory is oversubscribed a daemon chooses a memory intensive process and kills it.