Graduate Operating Systems

Spring 2022

Working Set Model

• How much memory does a process need?
• Virtual memory & memory management
• Paging-in, paging-out
• Page replacement strategies
  – Metric: page traffic
  – Optimal
  – Random
  – FIFO
  – LRU
  – ATLAS Loop Detection
  – Belady: simple + “some” historical data
Working Set Model
Working Set Model

- Reference string: 7,0,1,2,0,3,0,4,2,3,0,3,0,3,2,1,2,0,1,7,0,1

- Illustrations showing page frames and reference strings for Optimal, FIFO, and LRU algorithms.
Working Set Model

• Working set of information $W(t, \tau)$
• Working set size $\omega(t, \tau)$
• Properties of working set:
  – Size (Figure 3)
  – Prediction
  – Reentry rate
  – $\tau$-sensitivity
• $\tau$ too small/large

Working Set Model

• In-core & use bits (Figure 5)
• if $D > m \Rightarrow$ Thrashing
• Policy if $D > m$, then suspend or swap out one of the processes
Working Set Model

Paper “WSCLOCK”

- Local vs. global replacement policies
- Dirty bit
- CLOCK algorithm
- Task isolation: WS vs. CLOCK
Paper “WSCLOCK”