Graduate Operating Systems

Fall 2018

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: \(7,0,1,2,0,3,0,4,2,3,0,3,0,3,2,1,2,0,1,7,0,1\)

- Optimal
- FIFO
- LRU
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

![Diagram showing the relationship between page fault rate and number of frames.]

- Increase number of frames
- Upper bound
- Lower bound
- Decrease number of frames

Paper “WSCLOCK”

- Local vs. global replacement policies
- Dirty bit
- CLOCK algorithm
- Task isolation: WS vs. CLOCK