Graduate Operating Systems

Fall 2017

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

CPU

logical address

page number

frame number

TLB

TLB hit

physical address

physical memory

page table

Working Set Model

logical memory

page table

valid-invalid bit

frame

physical memory
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)
- Processor demand $D$; memory demand $m$

- 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”