Graduate Operating Systems

Spring 2022

Paper “Superpages”

• Small pages vs. large pages
• TLB coverage (how large should it be?)
• Hardware-imposed constraints
  – Page sizes supported by hardware
  – Contiguous in physical and virtual address space
  – Starting address must be multiple of its size
  – TLB uses single set of reference/dirty/protection bits for page
Paper “Superpages”

• Relocation-based allocation
  – When is relocation needed?
• Reservation-based allocation
  – What is the problem with this approach?
• Fragmentation control: “contiguity as a resource”
• Promotion
  – Challenges: who/when to promote
• Demotion
  – Challenge: how do we know which “sub pages” are used
• Eviction
  – Challenge: dirty bits

• Proposed solution: reservation-based approach
• Buddy allocator
• Multi-list reservation scheme
• How to choose superpage size?
  – Dynamically-sized objects
  – Fixed-size objects
Paper “Superpages”

• Preempting reserved (unused) frames
• Coalescing of available memory regions
• Incremental promotions
  – Cascading promotions possible
• Speculative demotions
  – E.g., due to eviction; to next-smaller size
  – Probabilistic demotions

• Dirty superpages
  – Demote clean superpages when writing occurs
• Population map
  – Keeps track of allocated base pages
• Wired page clustering
Paper “Superpages”