JETTISON: EFFICIENT IDLE DESKTOP CONSOLIDATION WITH PARTIAL VM MIGRATION

Motivation

- Offices are laden with personal computers
- Desktops spend most time idle (>50%)
- Idle desktops not powered off
  - Always-on network applications, e.g. VoIP, IM
  - Remote Access
- Idle PCs use 60% of peak power

Approach and Challenge

- Encapsulate desktop environment in virtual machines (VMs); Consolidate idle VMs in shared server and suspend desktop to low power

Challenge

- VM migration is slow
  - 40 s for single VM with 4 GiB of memory
- VM migration does not scale with users
  - 15 minutes latency with 300 users

Partial VM Migration

- Migrate only memory and disk state accessed by idle VM
- When missing state is required, migrate on-demand
- Desktop microsleeps when partial VM autonomous

Insights

- Idle desktop accesses small fraction of state
  - 165 MiB of memory and about 1 MiB of disk
- State requests are bursty, allowing desktop to sleep in interim

Microsleep

- Desktop uses more power entering/leaving sleep state than at idle
- Microsleep only practical when request interarrival longer than breakeven time: \( l > t_b \)
- Estimate future inactivity with wait time \( t_w \)
- Compute \( t_w \) that minimizes energy waste \( E_{\text{waste}} \), given distribution of interarrivals

\[
\min E_{\text{waste}}(t_w) = t_w E_i + p(l < t_b + t_w) E_{\mu}
\]

- Prefetch pages with spatial or temporal locality

Energy Savings

- 78% energy saving in an hour
- 91% in 5 hours

Migration Performance

- Consolidation: 242 MiB of memory and 0.50 MiB of disk
- Reintegration: 114.68 MiB of memory and 6.81 MiB of disk

Migration latencies

- Consolidation: 3.78 s
- Reintegration: 4.11 s

Migration Sizes

- Consolidation: 242 MiB of memory and 0.50 MiB of disk
- Reintegration: 114.68 MiB of memory and 6.81 MiB of disk

Fig 1: VM reintegration latency
Fig 2: Expected energy waste as function of \( t_w \)
Fig 3: Annual ($US) saving estimates in New York (price of $0.186/kWh)
Fig 4: Migration sizes for VMs with 4 GiB of memory

Fig 5: Annual ($US) saving estimates in New York (price of $0.186/kWh)
Fig 6: Migration sizes for VMs with 4 GiB of memory