

## Increasing File System Burstiness For Energy Efficiency

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## Power-Efficient Devices and Modern File Systems

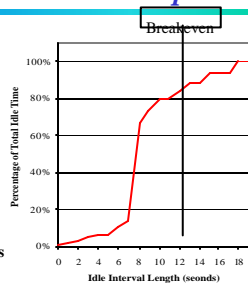
- **Power-Efficient Devices:**
  - Support low power modes
  - Save energy by exploiting idle time
  - Require long idle intervals (**tens** of seconds)
  - Remain in low power state for a min. period: **breakeven** point
- **Modern file systems:**
  - Maximize throughput
  - Minimize latency
- **What about energy?**
  - Idle times: too short to exploit
  - Even under light workload

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## Example: mp3 playback Disk Idle Time Distribution Graph

- 300 sec. Playback time
- 291 sec. Disk Idle Time
- 66%: shorter than 8 seconds
- 12% only: longer than 12 second breakeven time

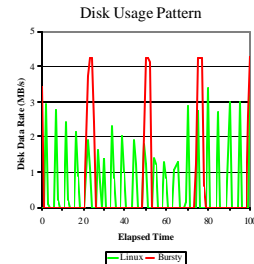
- **Sustainable disk bandwidth:**
  - 4.2MB/s: much larger than 16KB/s required for mp3 playback



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## New Design Goal: Increase Burstiness

- **Maximize energy efficiency**
  - Increase idle interval length to allow a power state transition
  - Operate at max disk bandwidth when disk active
  - Decrease number of transitions



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## Energy-Efficient File System Design Guidelines

- **Aggressive prefetching**
  - Use hints to improve accuracy
- **Bursty Periodic Update**
  - Increased variance in time-to-stable-storage
- **Scheduling Algorithms**
  - Embody device power characteristics
  - Coordinate I/O activities across running applications
- **Urgency-based disk scheduling**
  - To mitigate effects of disk congestion

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## Preliminary Results

- **Up to 55% savings in total disk energy**
  - Compared to best power management policy
  - Based on trace-driven simulation

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For Energy Efficiency***

**For more info visit:**

<http://www.cs.rochester.edu/~papathan/research/BurstyFS/>

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