

Increasing File System Burstiness For Energy Efficiency

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Work in Progress Presentation

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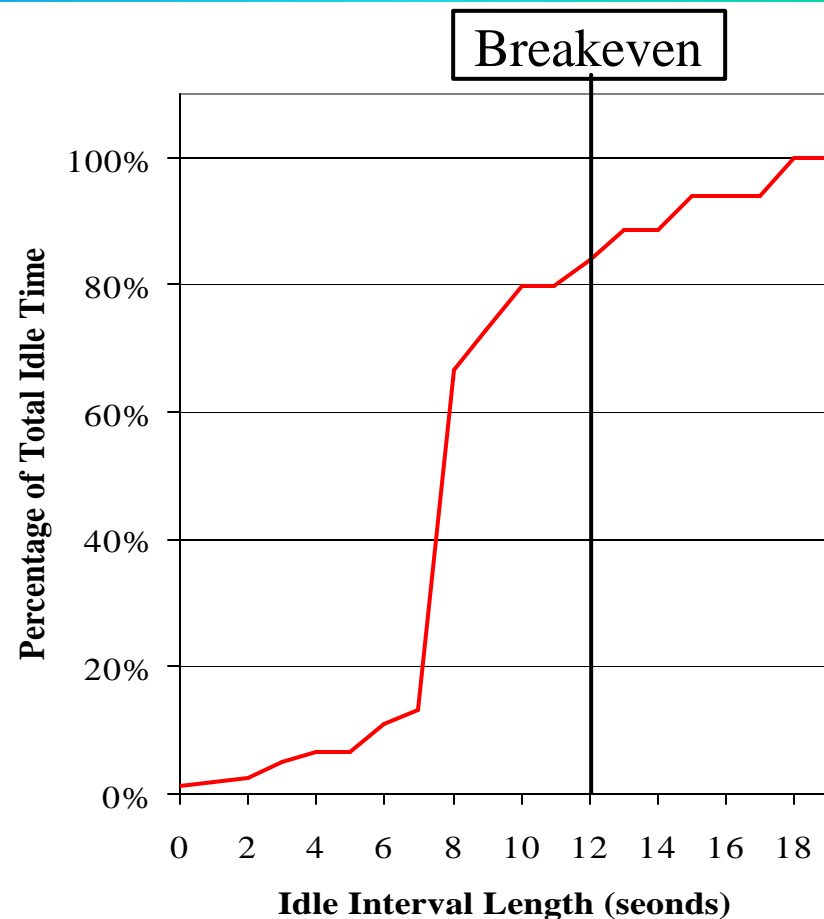
Power-Efficient Devices and Modern File Systems

- **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

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

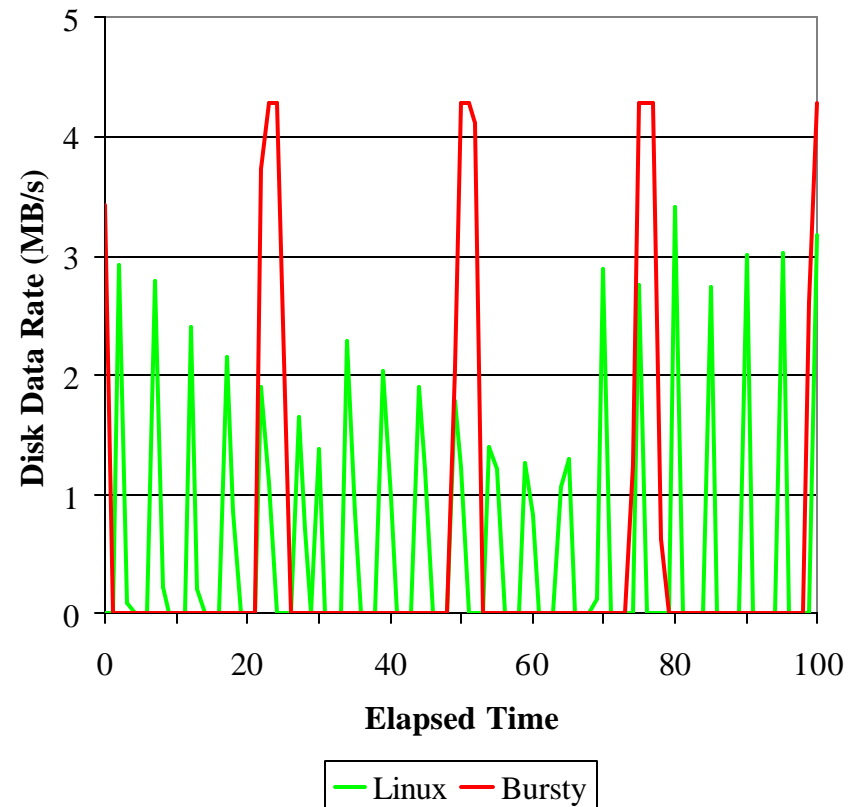


New Design Goal:

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

Disk Usage Pattern



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

Preliminary Results

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

Increasing File System Burstiness For Energy Efficiency

For more info visit:

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

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