PuRPLe: Predictive Reduction of Power and Latency

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Conflicting Goals

- *Traditionally, system designers have had to compromise between power consumption and performance*

- *Reducing power leads to increased latency*

- *For disks, we apply a spindown policy to reduce power, but pay a price to bring the disk back to active state*

An End to Conflict

- *By predicting disk accesses over a short interval, we can prefetch those accesses and shut down the disk for the remainder of this interval*

- *This leads to substantial power savings*

- *We also reduce the number of times we spin down the disk, which improves performance*
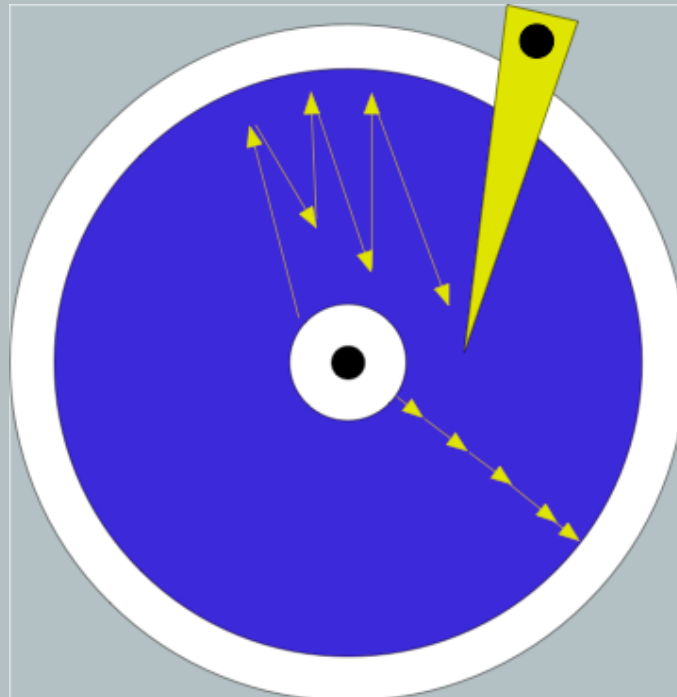
Disk Power Consumption

Average Power Consumption over Random Disk Block Range
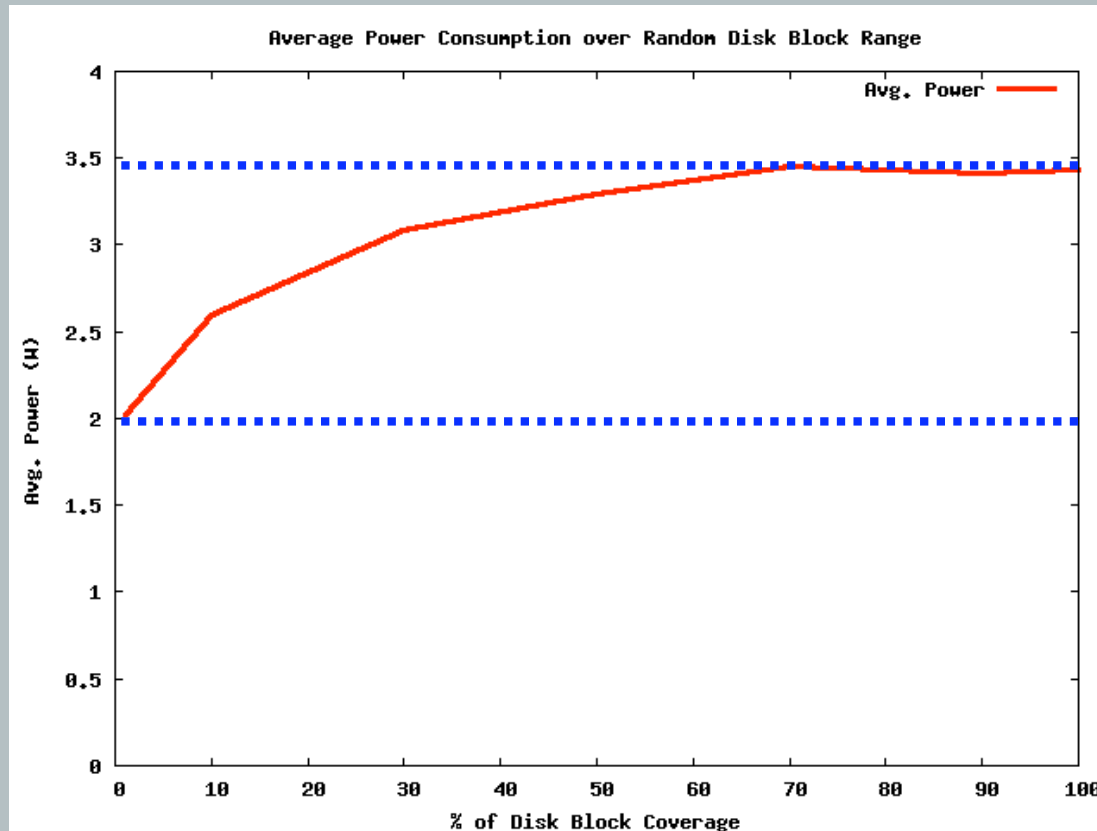
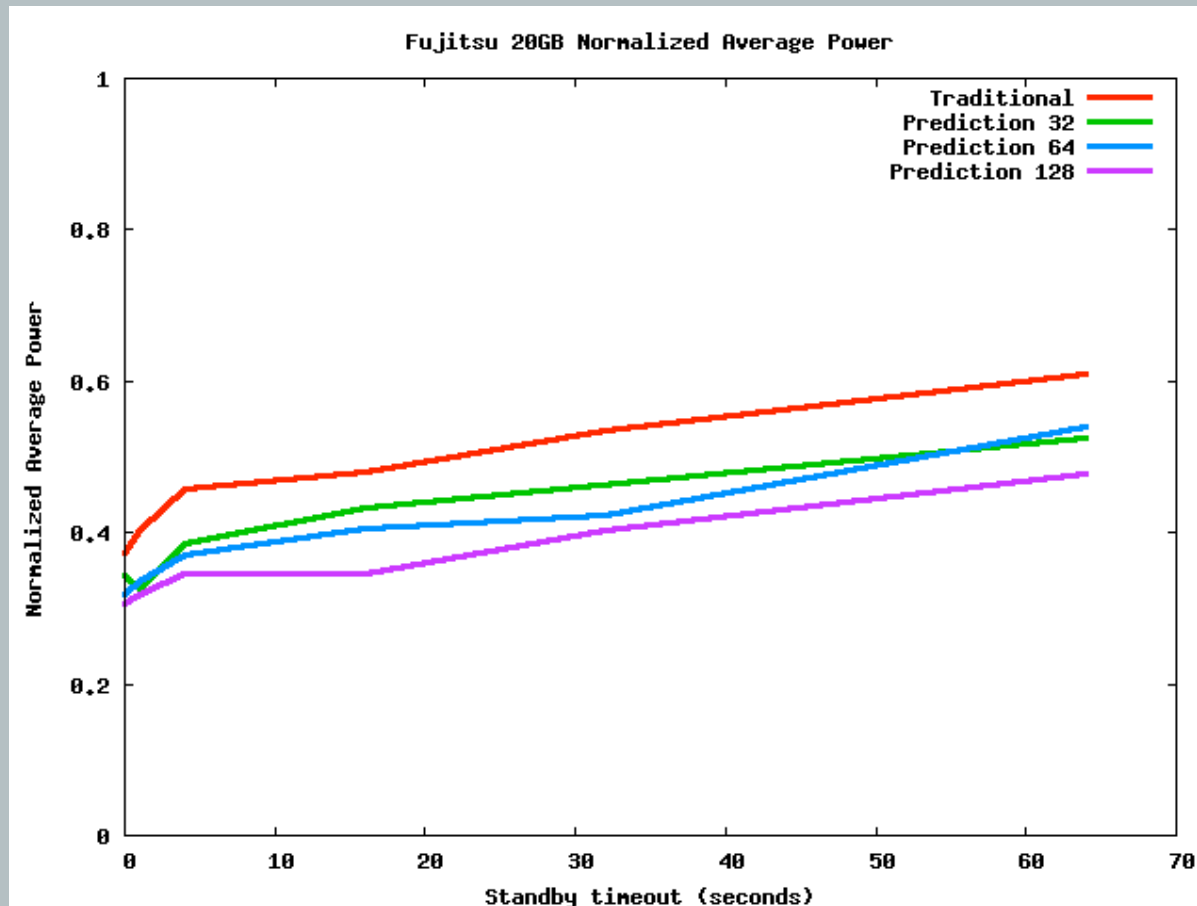⮝ *Accurate disk power measurements demonstrate that random arm movements can increase power consumption up to 40%*
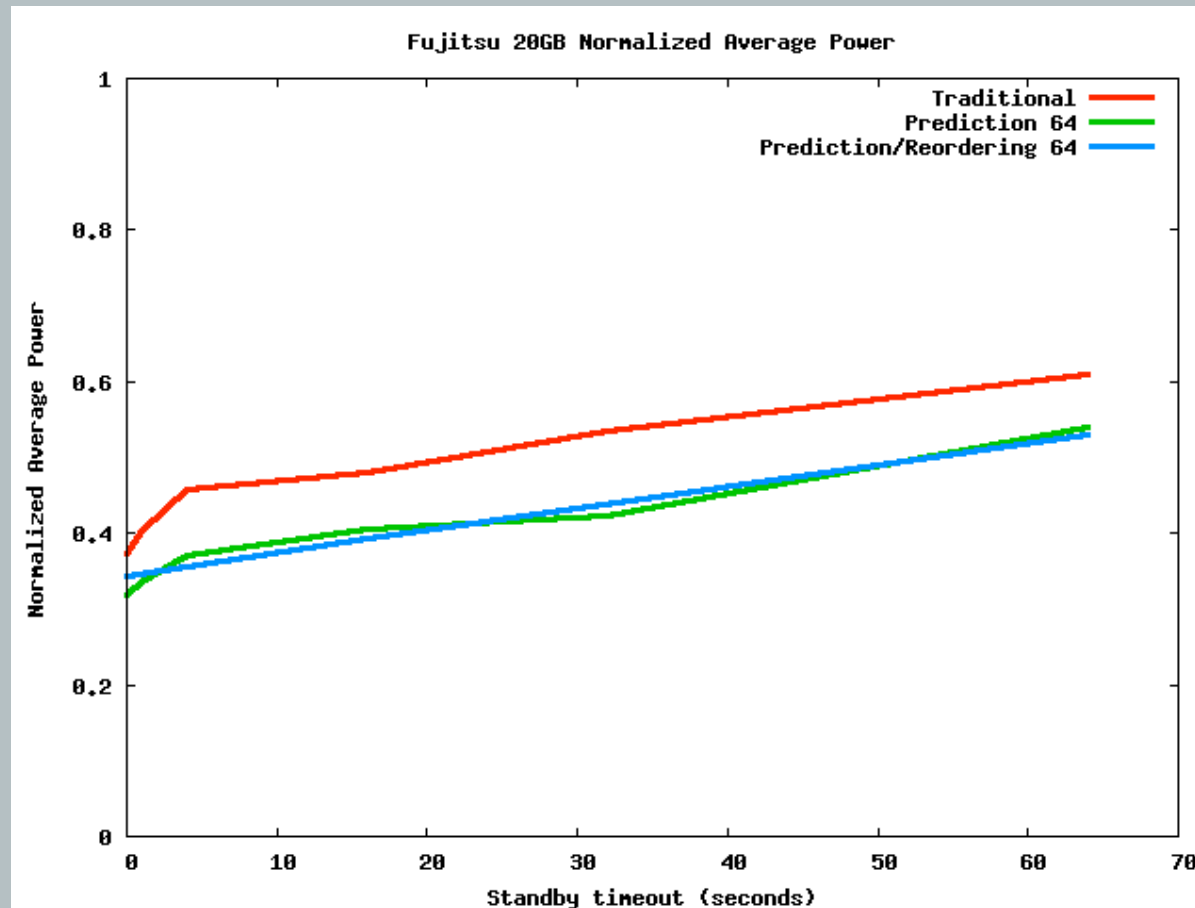
Reordering

- *We can reduce arm movements by simply reordering our accesses*
- *Reordering the access requests simulates effective layout changes*
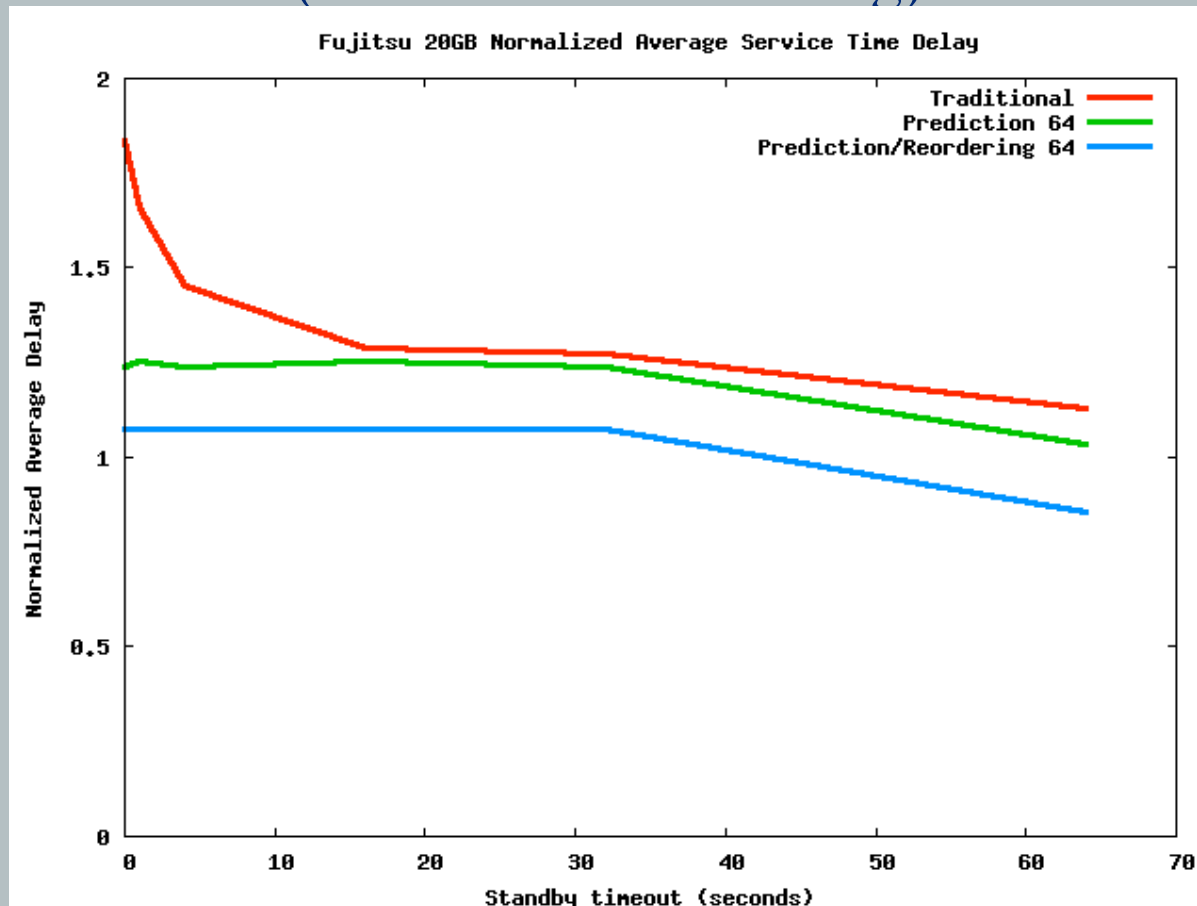
Prediction Effectiveness

Fujitsu 20GB Normalized Average Power

Prediction+Reordering

Latency Results
(Prediction+Reordering)

Summary

- *Power reduction and access latency need not be conflicting goals*
- *Prediction yields great power savings, and good access latencies*
- *Combining Prediction with Reordering further improves power consumption but really shines when we consider access latency, which it not only preserves, but improves*