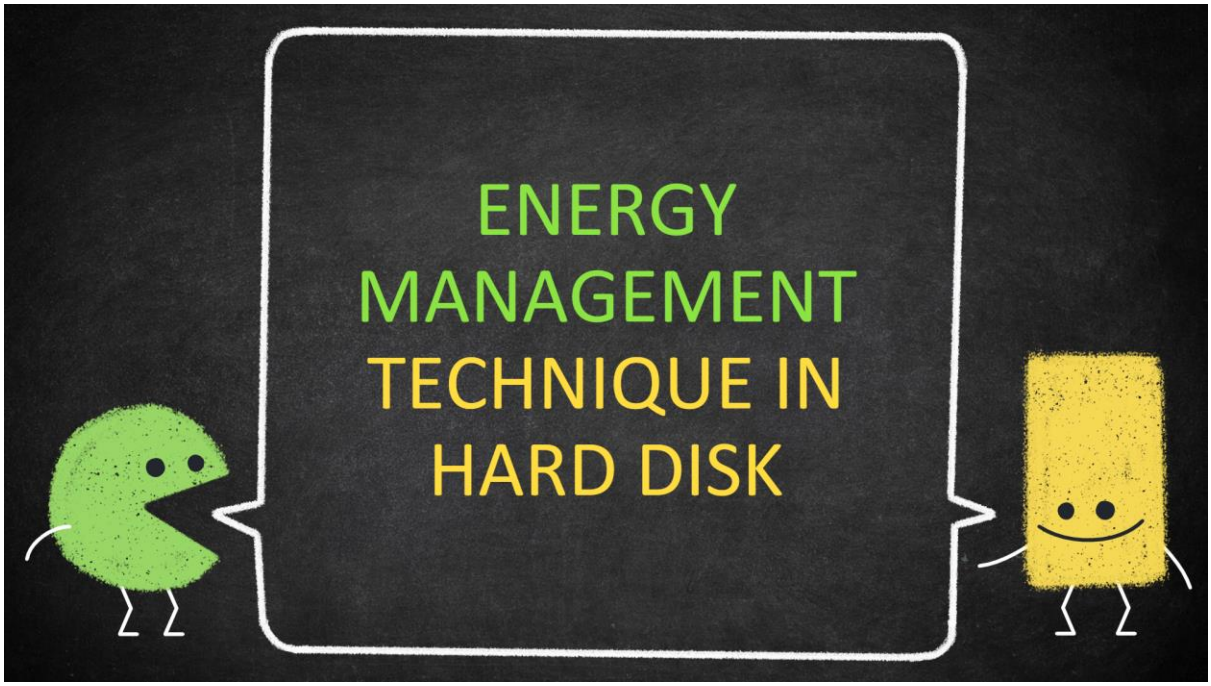
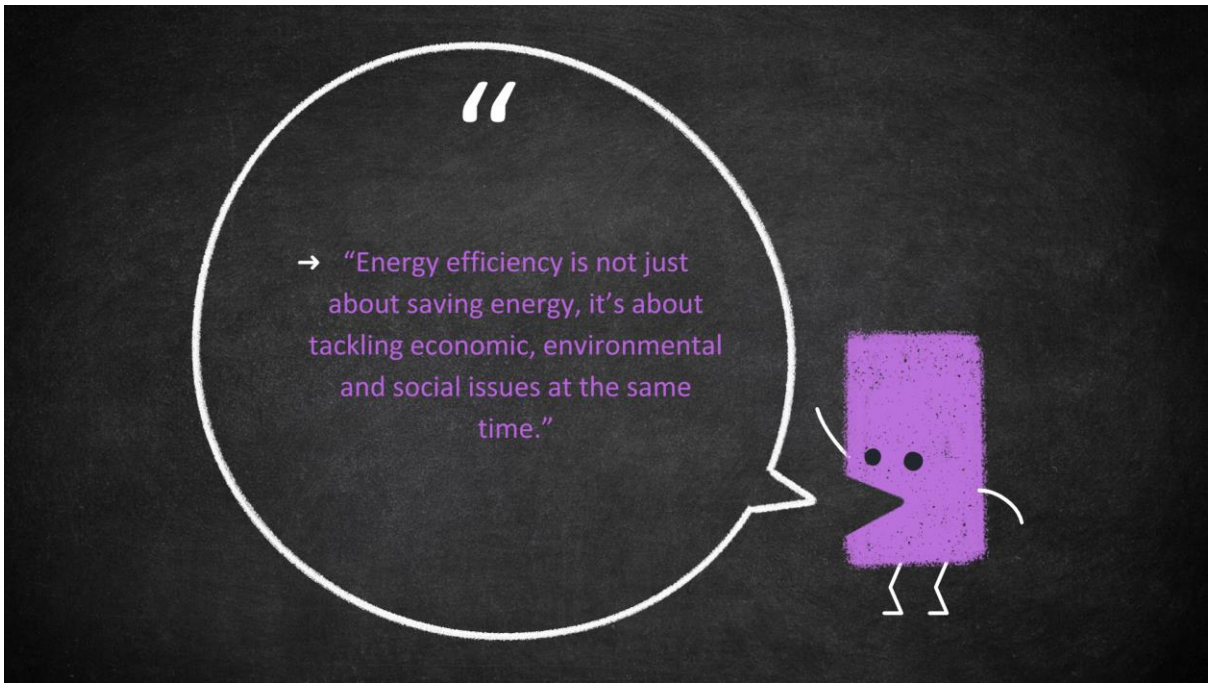
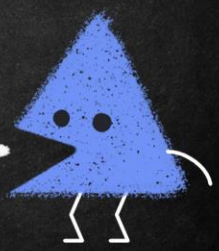

ENERGY
MANAGEMENT
TECHNIQUE IN
HARD DISK


“
→ “Energy efficiency is not just about saving energy, it’s about tackling economic, environmental and social issues at the same time.”

WHAT IS ENERGY MANAGEMENT?

- Energy management is a set of features that help reduce **power** consumption by placing monitors and **computers** into a low-**power** "sleep mode" after a period of activity. Simply touching the mouse or keyboard "wakes" the **computer** and monitor in seconds
- To reduce the energy consumption of hard disks, different techniques and methodologies are being adopted.



OBJECTIVES:

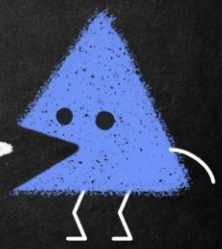
- ➜ The objective of the energy management is to achieve and maintain optimum energy procurement and utilization , throughout the organization.
- ➜ Main objectives are:

I. To minimize energy cost

II. Increase efficiency

III. Reduce carbon emission

IV. Find superior energy alternatives.

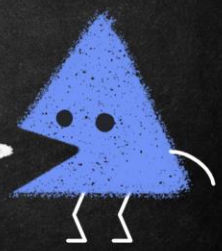


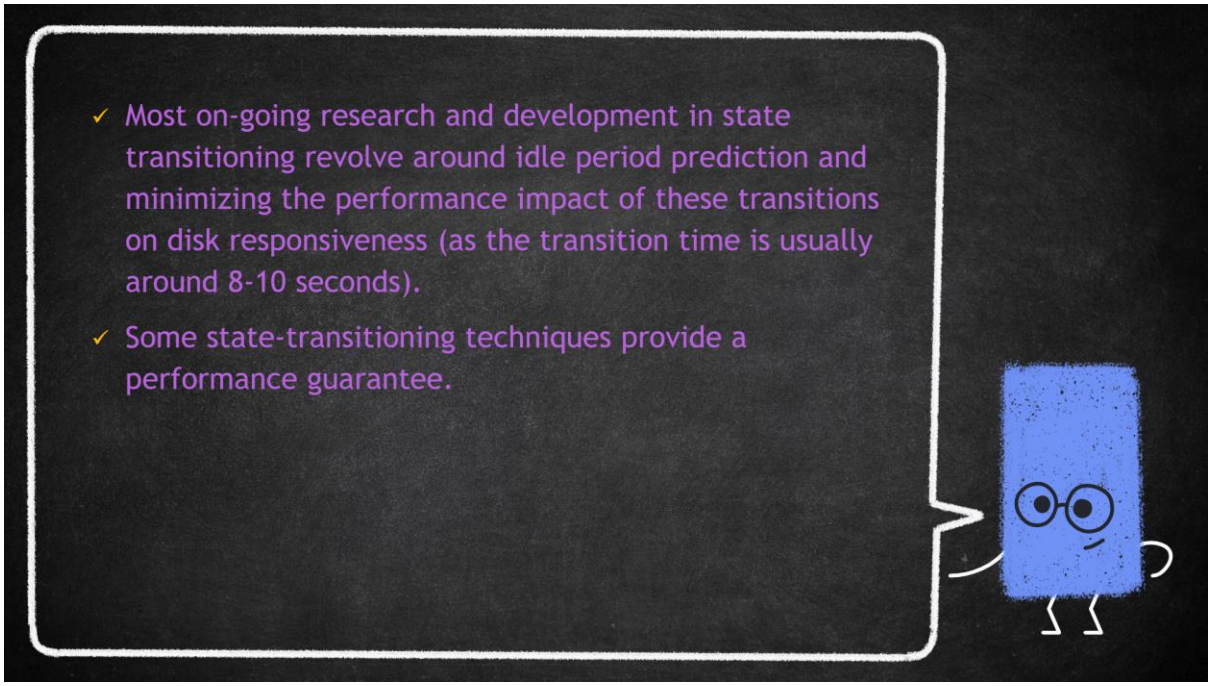
DIFFERENT WAY FOR ENERGY MANAGEMENT:

- ✓ State transitioning
- ✓ Caching
- ✓ Dynamic RPM
- ✓ Data centers and associated energy challenges
- ✓ Taking your progress at energy saving

State Transitioning :

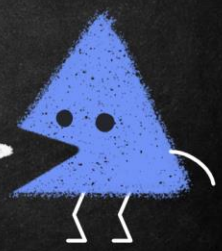
- Given that in a hard disk, the spindle motor consumes most of the power, state-transitioning techniques try to turn off the spindle motor or keep it in standby mode during idle periods.
- The disk transitions to standby or off mode if there is no request to be served.
- If the disk is already idled for the threshold time, it transitions to standby mode. If it stays in standby mode for another threshold of time without requests, it can further transition to off mode. In this approach, the historical information is used to predict the future access pattern.



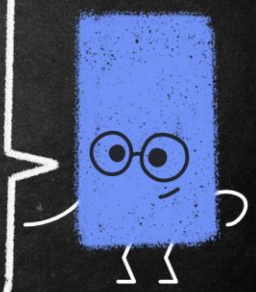

Most on-going research and development in state transitioning revolve around idle period prediction and minimizing the performance impact of these transitions on disk responsiveness (as the transition time is usually around 8-10 seconds).
Some state-transitioning techniques provide a performance guarantee.

Caching:

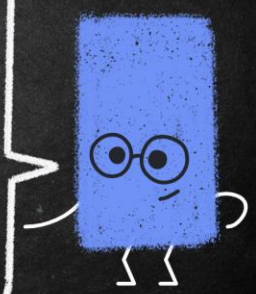
- In order to speed up access for both read and write requests, enterprise storage solutions typically have huge amounts of cache in conjunction with regular disks
- To make use of the cache to aid in disk power management, various techniques are recommended.
- These cache management techniques or algorithms aim to minimize disk power usage, either by minimizing disk access or by increasing the length of idle periods.



- One could in effect use huge caches to increase the idle periods of disks and in doing so can help more disks to transition to the sleep state, thereby improving energy efficiency.
- The cache management algorithms partition-aware least recently used and partition-based LRU are centred on this idea. PALRU classifies all disks based on access patterns into two classes - priority (disks with fewer cold misses and longer idle times) and regular - and maintains two separate LRU queues. At the time of an eviction decision, first the regular queue elements are chosen as victims. If the regular queue is empty, the algorithm chooses elements from the priority queue. PBLRU, however, differentiates between disks by dynamically varying the number of allocated cache blocks per disk. It divides the cache into multiple partitions (one per disk) and adjusts the size of these partitions periodically based on workload characteristics.

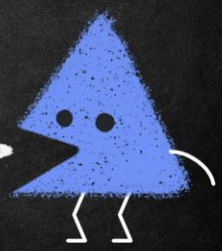


- ✓ Since write requests in enterprise storage devices almost never get written directly to target disks (they are cached instead), another technique is to use write offloading as a mechanism to conserve disk power usage
- ✓ Write offloading facilitates complete spin downs of volumes periodically, thereby aiding in significant power savings. By using write offloading, about 45-60% energy savings can be achieved in write-dominated application environments.

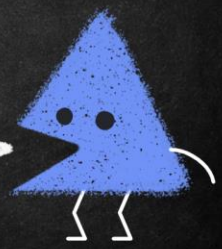


Dynamic RPM:

- Dynamic RPM in which the rotation speed of a hard disk is varied based on workload is another technique for hard disk energy management
- It assumes availability of multispeed hard disks, and power consumption increases with the speed of rotation.
- In dynamic RPM, the rotational speed of the disk is altered based on the desired response time of disks and the performance requirement. A fast response time that is greater than the specified or expected threshold is a waste of performance.

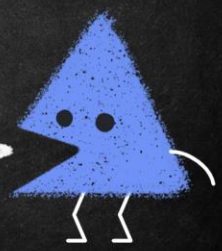


- The idea here is to limit this wastage of performance by switching the rotational velocity of the disk to a lower value that still yields acceptable performance.
- Practical implementation of this approach is limited by the feasibility of developing a single disk that can change speeds in a cost-effective manner, but simulation results reveal that a dynamic RPM scheme can yield a power savings of up to 60%.



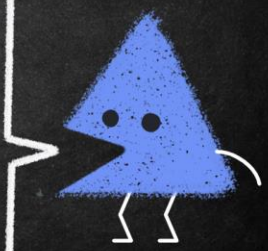
Taking your progress at energy saving:

- ✓ Disconnect your external devices.
- ✓ Use a smart strip, especially for **computers** you cannot turn off.
- ✓ Adjust your **computer's energy** settings.
- ✓ Shutdown and unplug your **computer** when not in use.
- ✓ Use a charger only when charging your laptop.
- ✓ Should you be in the market for a new PC, choose one that's **Energy** Star compliant
- ✓ *Adjust your computer's energy settings*

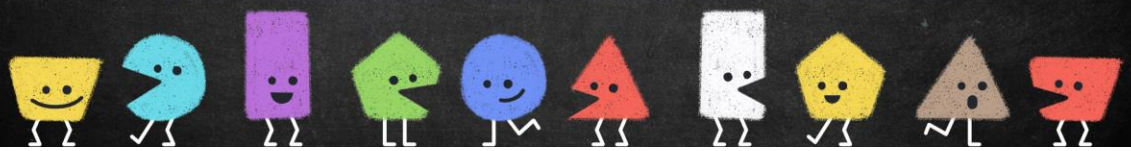


ADVANTAGES OF ENERGY MANAGEMENT:

- **Control power supply**
- Reduce **costs**. If anything, an EMS allows you to significantly reduce utility **costs** across the board, including heating, cooling, lighting, and water
- **Making informed decisions**
- **Detecting power quality problems**
- **Remote access**



NAMES:	ROLL NO
ASIR ANSARI	02
MANAV GUPTA	19
TUSHAR JANI	27
RISHI MISTRY	46
ARIF SHAIKH	80
FARAHAN SIDDIQUI	87
IMRAN RIZWAN SHAIKH	109




THANKYOU