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Distribution Based Model to Improve the Tradeoff between Reliability and Energy Efficiency

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ABSTRACT

The green computing is environmentally responsible for all computers and any other technology related resources .Green computing by implementation, includes energy efficiency central processing units (CPUs) ,peripherals and servers. *In addition green computing is also used to control energy consumption and improve the disposal of electronic waste (e-waste) .disk drives increases more power , one of the most critical issues of designing modern disk systems is data reliability. The factors that affect the reliability of disk systems is the disk utilization and ages.*

In the existing work a novel approach called safe utilization zone is introduced to obtain reliability. The energy consumption is obtained by integrating the existing energy consumption algorithm with the novel algorithm. In the proposed work, a novel approach to mixed read/write workloads is introduced.

This approach is used to achieve the trade-off between reliability and energy-efficiency and to balance the energy and reliability.

Keywords *- energy efficiency; energy consumption; data reliability; disk utilization; safe utilization zone; balance*

INTRODUCTION

A disk system is randomly addressable and rewritable storage device it also includes optical drives and in earlier times it includes floppy drives. By regular usage Disk drives are housed in a separate box internally within a computer which is external. At the start of the computer age, all of the engineering tasks involving computing technology focused on hardware: the design and debugging of electronic circuits, the organization of logical devices, and the machinery of printers, disk drives and other elements, and the operation of complicated systems. Programmers began to develop an engineering discipline for software only as they began to appreciate the problems of

describing, coding, and delivering software systems.

Green Computing

Green computing is not only ethical and obligatory, but it is a profitable, feasible and ultimate solution. There is a strong need for a mega-trend in the future to save the environment because the rate at which the oil, gases, fauna are being used for power generation. The increasing amount of energy consumption in IT solutions contributes to greenhouse gas emissions. Green computing of IT solutions is by reducing the energy consumption and the greenhouse gas emission.

Green Computing has following advantages.

- Using ENERGY STAR that qualifies products to conserve energy.
- The Climate Savers Computing Initiative (CSCI) catalogue has been used for green products.
- Instead of regular monitors Organic light-emitting diodes is used.
- It uses only necessary device.

Software green-ness is an emerging quality attribute it must be taken from the application level. In the development process at each level of ICT system is via middleware to operating system and hardware.

Problem Definition

In Parallel disk systems on high-performance computing platforms the popular data intensive applications are running. By conservation of energy in parallel disk systems the cost of cooling equipment cost and backup power-generation are the strong impacts. In high-performance computing centre the parallel disk consumes significant amount of energy, to improve energy efficient disk systems with reliability it is often difficult for storage researches. On disk systems the power management strategies mainly shows how to evaluate reliability impacts of power management these are the main challenges that energy saving research faces today. In energy efficiency issue the design of modern parallel disk systems includes major concerns like fault tolerance and reliability. The most stable part of this disk system is high-performance computing system.

Objective of the Project

The goal of this project is to model the energy-efficient parallel disk systems with reliability and energy conservation schemes and reliability with marginal adverse impacts on parallel disk systems. To provide high reliability and significant energy savings, to parallel disk systems without sacrificing the system performance is the main goal of this approach.

Over traditional qualitative approaches this method has several advantages. This is because the model not only quantify the energy-efficiency and reliability of parallel disks, but also be used for the purpose to balance reliability and energy efficiency . For implementing a virtual file system, it supports reliability models for energy efficiency disk systems and also develops a prototype technique that improves reliability of parallel storage systems equipped with energy-saving strategies.

Literature survey

Software engineering is the study and application of engineering to the design, development, and maintenance of software. The energy consumption contributes to greenhouse gas emissions in today's IT solutions. Green computing is the main purpose of reducing the environmental impacts of IT solutions by reducing the energy consumption and the greenhouse gas emissions.

Jianfeng Mao, Christos G. Cassandras, Qianchuan Zhao et al., [2007] in this research dynamic voltage scaling is used to limit the energy conserving systems to prolong computers life. A setting of tasks performed by such a system are non preemptive and aperiodic are considered. The processing rate is controlled by different tasks of this work is mainly used to minimize energy subject to hard real-time processing constraints. The optimal solution to the offline version of the problem is proved by exploiting the structure of optimal sample paths under any given task scheduling policy, leading to a new dynamic voltage scaling algorithm termed the Critical Task Decomposition Algorithm (CTDA).

The optimal processing times are easily determined by the critical tasks that decompose the optimal sample path into decoupled segments it is done by efficiency of the algorithm. The algorithm is also readily extended to an online problem where task arrivals and deadlines are not known in advance, but tasks are assumed to arrive within a given interval. The key to the low complexity lies in the fact that a simple procedure can be developed to detect these critical tasks.

Seung Woo Son, Guangyu Chen, OzcanOzturk,MahmutKandemir,AlokChoudhary et al., [2007] in this research the architectural-level techniques are used to take advantage of idle periods experienced by disks that is to reduce disk power. This paper it proposes and evaluates the reduction in disk power consumption of array-based scientific applications executing on parallel architectures by using compiler driven approach. In this work disk layout information to the compiler is exposed, and allowed to derive the disk access pattern, i.e., the order to which the parallel disks are accessed. This work demonstrates two uses of this information. First, proactive disk power management is implemented, Second, the length of idle disk periods are increased and the application code has been restructured, in which it leads to better exploitation of available power-saving capabilities.

Existing system

The reliability and energy conservation of the disk systems are the most prominent factor which affects the system functionality. By improving reliability and energy conservation of the disk drives, the system functionality can be improved considerably. In the existing work, the reliability is achieved by implementing the safe utilization zone with the consideration of only the read intensive I/O operations. And energy conservation is reached by integrating the existing energy consumption techniques with the safe utilization zone technique. The reliability aware energy consumption is achieved by introducing the disk failure model which is based on safe utilization zone in the existing work. This safe utilization zone approach, focuses on achieving the reliability of a disk based on disk utilization and its age. The energy conservation was achieved by integrating the already existing energy consumption techniques with it. The probabilities of disk failures are minimal in the utilization of safe utilization zones. In the safe utilization zone it assures that the energy consumption can be conserved in a disk without degrading the reliability of the system.

Proposed System

In existing method energy savings in disks yields with energy conservation techniques. While several energy consumption techniques like cache-based energy saving approaches on disk reliability have marginal impact, many energy-saving techniques (e.g., work-load skew and dynamic power management and techniques) inevitably have noticeable adverse impacts on storage systems normally. How to evaluate reliability impacts of power management strategies on disk systems is the challenge that every disk energy-saving research faces today. In the proposed work, the trade-off between the reliability and energy efficiency is balanced to achieve the better trade-off and reliability. The reliability models proposed in existing work is focused on read-intensive I/O activities. In the proposed work a novel approach for achieving reliability and energy efficiency is proposed for mixed read/write workloads.

Tradeoffs between Reliability and Energy-Efficiency is used to Balance the Energy and Reliability

Weibull distribution is used to model the parallel disk systems employing with energy conservation and reliability techniques. Energy saving techniques that is the Popular Disk Concentration technique (PDC) and the Massive Array of Idle Disks (MAID) are the two well known reliability impacts taken in this model. The utilization and power-state transition frequency of each disk in a parallel disk system affects the PDC and MAID this is one of the critical module in Weibull distribution model. This model is used to calculate each disk annual failure rate as a function of the disk's utilization, operating temperature as well as power-state transition frequency. Given each disk annual failure rate in the parallel disk system, the energy-efficient parallel disk system including reliability is derived in weibull distribution model.

The realization approximation of the weibull distribution model is a tricky process. The simple technique of matching moments such as the mean

(1st) and variance (2nd) is useful in some cases. The modelling of a weibull IFR by a m- stage Erlang distribution is defined as:

$$E(t, M, \lambda) = 1 - \sum_{k=0}^{M-1} ((\lambda(\lambda^k / k!)e^{-\lambda t}$$

It becomes feasible to devise new approaches to seamlessly integrate energy efficiency and fault tolerance with the reliability model.

Table 1: Disk utilization

Measurements	Unbalanced	Balanced
Reliability rate	60.9	80.5
Failure rate	10	5
Energy efficiency rate	40.8	60.9

The above table shows that the existing work as unbalancing and proposed work as balanced and thus shows the results of each parameters. These graph points are plotted on the number of process taken. The disk that is utilized for plotting graph is server to client (one-one)

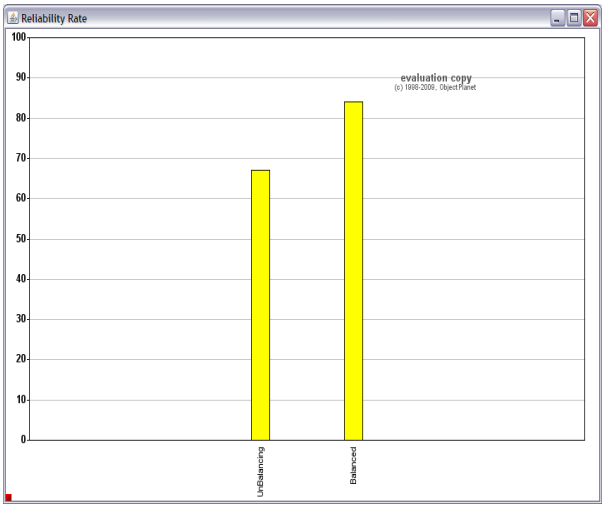

Fig 1: Reliability rate

Reliability rate

Reliability is "the probability of a device performing its intended function under given operating conditions and environments for a specified length of time." Using this definition, the probability of a device working for 100 hours and the reliability of a device designed to work for 100 hours are two ways to make the same statement.

To compute the reliability of a device or a system of devices in the useful life phase the exponential formula is used. It has roots in the Poisson formula. Instead of np, the product l t is used. The exponential is the Poisson formula with x = 0. Reliability means the probability of zero failures in the specified time interval.

$$P(x) = \frac{e^{-np}(np)^x}{x!} = \frac{e^{-\lambda t}(\lambda t)^x}{x!}$$, for x = 0, P(0) = $e^{-l}t$ = Reliability

Reliability of a single device = R = $e^{-\lambda t}$ The result comparison for reliability rate between the balanced and unbalanced reliability and energy efficiency system are given as follows:

Failure Rate

The failure rate can be defined as the following: The total number of failures within an item population, divided by the total time expended by that population, during a particular measurement interval under stated conditions. The failure rate of an individual disk can be calculated by using the following equation

$$F = \alpha \times F_{base} \times \tau + \beta \times F_{freq}$$

- F_{base} =Baseline failure rate derived from disk utilization
- τ = Temparature factor
- F_{freq} = Power-state transition frequency
- α , β = Coefficient values

The result comparison for failure rate between the balanced and unbalanced reliability and energy efficiency systems are given follows.

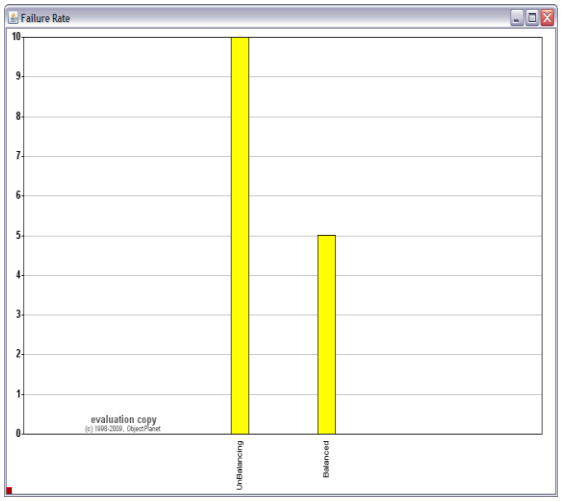

Fig 2: Failure rate

Energy Efficiency Rate

The total amount of energy consumed over a processing of disk system. The energy efficiency will depend on the disk utilization and reliability of the system. The overall energy efficiency rate of the disk systems is shown below: The figure below shows the comparison between the energy efficiency rate between the existing system and proposed system

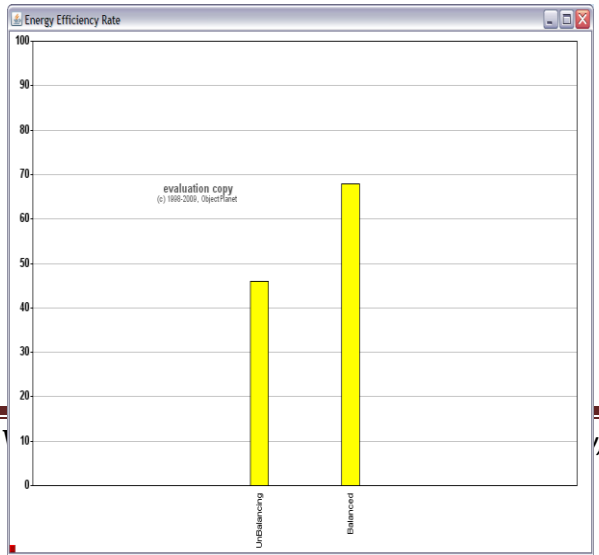

Fig 3: Energy efficiency rate

CONCLUSION

Reliability and energy efficiency is the most important factors to improve the performance of the systems. In the existing work, Safe utilization zone is implemented which is used to obtain the reliable and energy efficient model for the disk utilization system. In the existing work, the reliability of the system is improved considerably by considering the two most important factors called disk utilization and age. This work only concentrates on the reliability and energy conservation improvement over the read intensive application. In future work, the reliability and energy consumption is improved for both read/ write intensive I/O applications. This is achieved by finding the trade-off between the both reliability and energy efficiency of the systems. In order to maintain the utilization level of disk systems effectively weibull distribution network is used.

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