DISTRIBUTION BASED MODEL TO IMPROVE THE TRADEOFF BETWEEN RELIABILITY AND ENERGY EFFICIENCY

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Abstract- Green computing refers to the environmentally responsible use of computers and any other technology related resources. Green computing includes the implementation of best practices, such as energy efficiency central processing units (CPUs) ,peripherals and servers . In addition green technology aims to reduce resource consumption and improve the disposal of electronic waste (e-waste) . A wide range of factors affect the reliability of disk systems the most important factors 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 to balance the energy and reliability.

I. INTRODUCTION

A disk system is a randomly addressable and rewritable storage device. The term can be broadly interpreted to include optical drives and in earlier times, floppy drives. However, in popular usage, it has come to relate mainly to hard disk drives (HDDs). Disk drives can either be housed internally within a computer or housed in a separate box that is external to the computer. They are found in PCs, servers, laptops and storage arrays. They differ from solid state drives (SSDs), which have no moving parts and offer greater performance, but also cost more and generally offer less capacity.

Green Computing

In the present scenario 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, and the rate at which the environment is getting polluted by industries, domestic waste, vehicles constitute a Himalayan threat to the health of human beings.

The increasing amount of the energy consumption of today's IT solutions significantly contributes to greenhouse gas emissions. "Green Computing" or "Green IT" emphasizes on the need for reducing the environmental impacts of IT solutions by reducing their energy consumption and their greenhouse gas emissions. "Green Computing" emphasizes the need for reducing the environmental impacts of ICT solutions by reducing the need for resources, especially energy, during its life cycle.

Green Computing is for following benefits.

- Using ENERGY STAR qualified products help in energy conservation.
- The Climate Savers Computing Initiative (CSCI) catalogue can be used for choosing green products.
- Organic light-emitting diodes should be used instead of the regular monitors.
- Use the device only if it is necessary.
- The manufacturing of disks and boxes needed for video games takes up a lot of resources. Video game manufacturers can offer their games online for download, leading to reduction in e-waste. This move can cut down on the transportation/shipping cost.
- Use of 'Local Cooling' software can help in monitoring and thereby, bringing down the energy consumed by your computer. This 'Windows' program makes adjustments to the power options of your computer and helps minimize energy consumption.

Green-ness in the software is an emerging quality attribute that must be taken into the account in each phase of the software development process at

each level of the ICT system from the application level via middle-ware to operating system and hardware. Achieving green-ness by software requires methods and techniques that support finding, implementing, and measuring software solutions that make infrastructure smarter, virtualized processes, contribute to dematerialization or new solutions like smart grids. Typical examples are applications that help to reduce energy consumption in facility management, in production, mobility, and in embedded systems. The analysis of all factors that have an environmental impact and the search for the optimal trade-off therefore has to be included in software development methods.

Problem Definition

In the last decade, parallel disk systems have increasingly become popular for data-intensive applications running on high-performance computing platforms. Conservation of energy in parallel disk systems has a strong impact on the cost of cooling equipment and backup power-generation. This is because a significant amount of energy is consumed by parallel disks in high-performance computing centre. , it is often difficult for storage researchers to improve reliability of energy-efficient disk systems. One of the main reasons lies in the challenge that every disk energy-saving research faces today, how to evaluate reliability impacts of power management strategies on disk systems. In addition to the energy efficiency issue, fault tolerance and reliability are major concerns in the design of modern parallel disk systems. These disk systems are expected to be the most stable part of high-performance computing systems. Therefore, it is not surprising that academic institutes, industry, and government agencies consider the reliability and energy-efficiency of parallel disks in their computing systems essential and critical to operations.

Objective of the Project

The long-term goal of this research is to develop novel energy conservation schemes with marginal adverse impacts on the reliability of parallel disk systems. To achieve this long-term objective investigation of fundamental theories to model the reliability of energy-efficient parallel disk systems is taken place. The goal of these approaches is to provide significant energy savings, while ensuring high reliability of parallel disk systems without sacrificing performance.

This approach has several advantages over traditional qualitative approaches. This is because our model not only can quantify the reliability of energy-efficient parallel disks, but also can be used to balance energy efficiency and reliability. 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 increasing amount of the energy consumption of today's IT solutions significantly contributes to greenhouse gas emissions. Green computing emphasizes on the need for reducing the environmental impacts of IT solutions by reducing their energy consumption and their greenhouse gas emissions.

Jianfeng Mao, Christos G. Cassandras, Qianchuan Zhao et al., [2007] in this research dynamic voltage scaling is used in energy-limited systems as a means of conserving energy and prolonging their life. In this work, a setting in which the tasks performed by such a system are non preemptive and aperiodic are considered.

The objective of this work is to control the processing rate over different tasks so as to minimize energy subject to hard real-time processing constraints. Under any given task scheduling policy, the optimal solution to the offline version of the problem can be proved which can obtain solutions efficiently by exploiting the structure of optimal sample paths, leading to a new dynamic voltage scaling algorithm termed the Critical Task Decomposition Algorithm (CTDA).

The efficiency of the algorithm rests on the existence of a set of critical tasks that decompose the optimal sample path into decoupled segments within which optimal processing times are easily determined. 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, Ozcan Ozturk, Mahmut Kandemir, Alok Choudhary et al., [2007] proposed several architectural-level techniques to reduce disk power by taking advantage of idle periods experienced by disks. Although such techniques have been known to be effective in certain cases, they share a common drawback: they operate in a reactive manner, i.e., they control disk power by observing past disk activity (for example, idle and active periods) and estimating future ones. Consequently, can miss opportunities for saving power and incur significant performance penalties due to inaccuracies in predicting idle and active times. Motivated by this observation, this paper proposes and evaluates a compiler-driven approach to reducing disk power consumption of array-based scientific applications executing on parallel architectures. In this work disk layout information to the compiler is exposed, allowing it to derive the disk access pattern, i.e., the order in which parallel disks are accessed.This work demonstrates two uses of this information. First, proactive disk power management is implemented, Second, the application code is restructured to increase the length of idle disk periods, which leads to better exploitation of available power-saving capabilities.

Methodology adopted

Existing system

The disk drives are important consideration in the growth of computer technology. The disk drives plays good role in the efficiency of the disk drives where it decides the functionality of a 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, focus 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.

Safe utilization zones are the range of utilization levels where the probabilities of disk failures are minimal. In the safe utilization zone assures that the energy consumption of the disk can be conserved without degrading the reliability of the system.

Proposed System

Existing energy conservation techniques can yield significant energy savings in disks. While several energy conservation schemes like cache-based energy saving approaches normally have marginal impact on disk reliability, many energy-saving schemes (e.g., dynamic power management and work-load skew techniques) inevitably have noticeable adverse impacts on storage systems. . One of the main reasons lies in the challenge that every disk energy-saving research faces today, how to evaluate reliability impacts of power management strategies on disk systems.

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

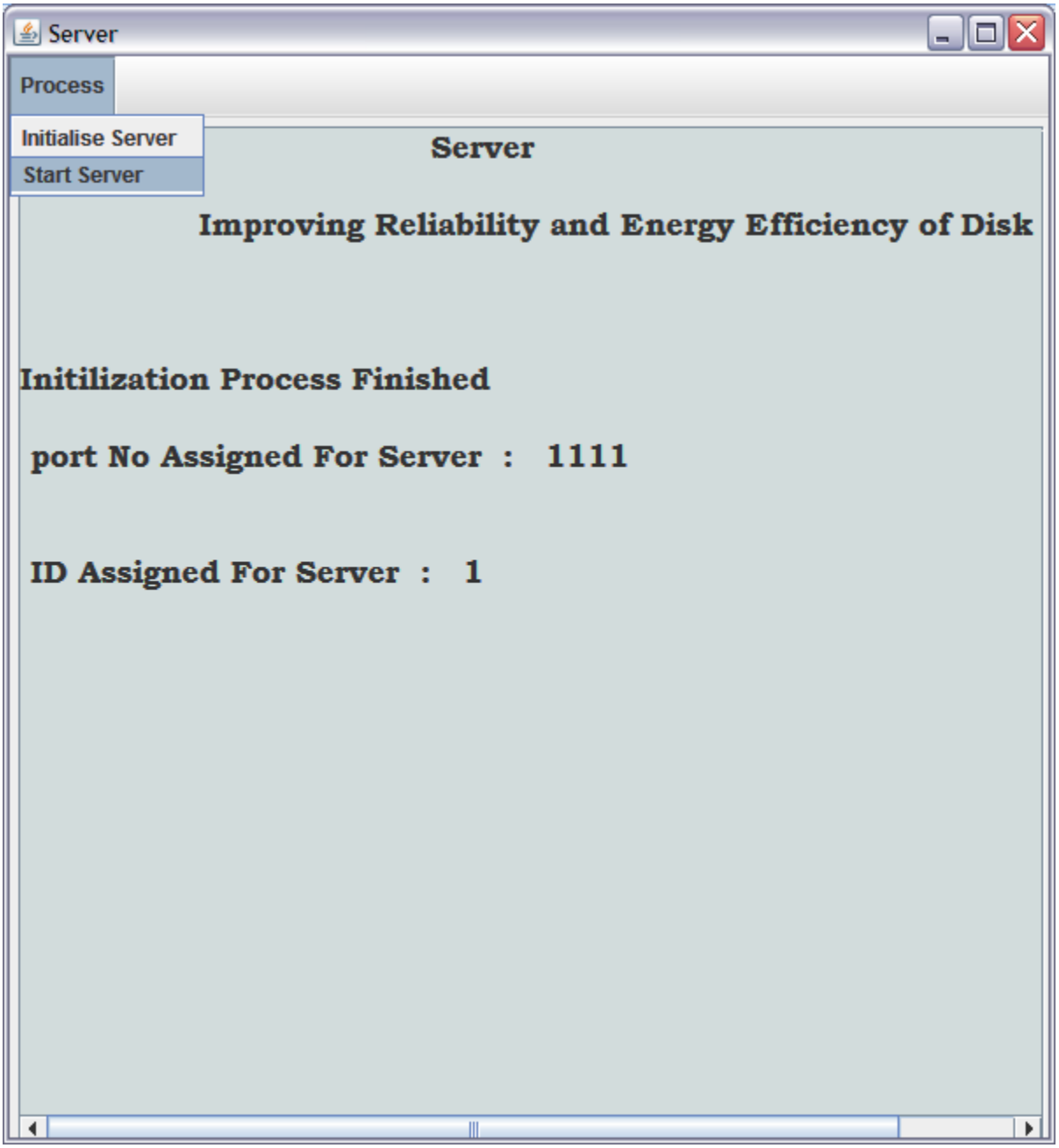
Weibull distribution model is developed to model reliability of parallel disk systems employing energy conservation techniques. In this model, the reliability impacts of two well-known energy saving techniques the Popular Disk Concentration technique (PDC) and the Massive Array of Idle Disks (MAID). One critical module in Weibull Distribution Model is to model how PDC and MAID affect the utilization and power-state transition frequency of each disk in a parallel disk system. Model is to calculate the annual failure rate of each disk as a function of the disk's utilization, power-state transition frequency as well as operating temperature. Given the annual failure rate of each disk in the parallel disk system, Weibull Distribution Model is able to derive the reliability of an energy-efficient parallel disk system. As such, it

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

used Weibull Distribution Model to study the reliability of a parallel disk system equipped with the PDC and MAID techniques.

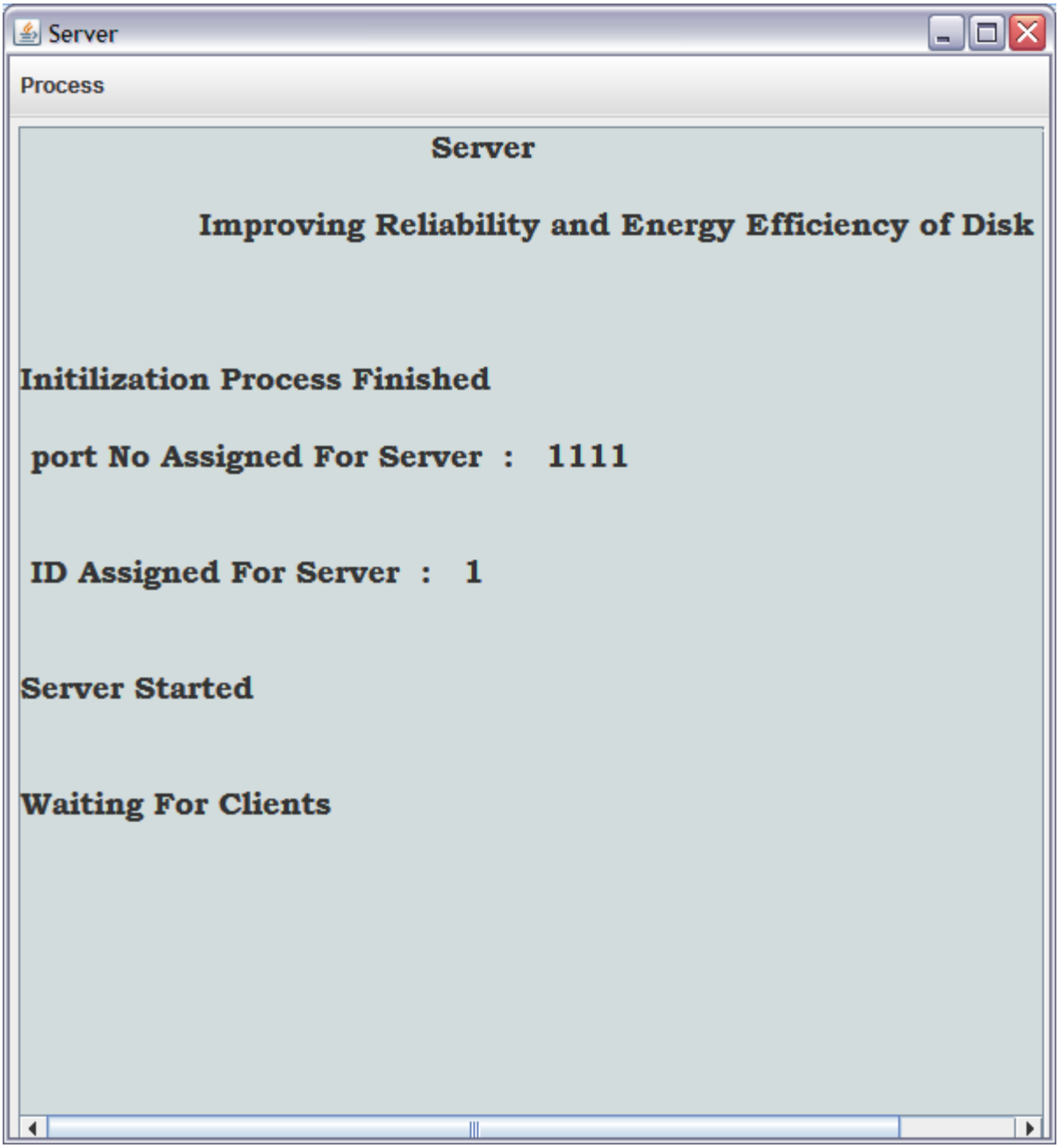
The realization approximation of the weibull distribution model is a tricky process. The simple technique of matching moments such as the mean (1st) and variance (2nd) is useful in some cases. The modelling of a weibull IFR by a m- stage Erlang distribution is defined as:

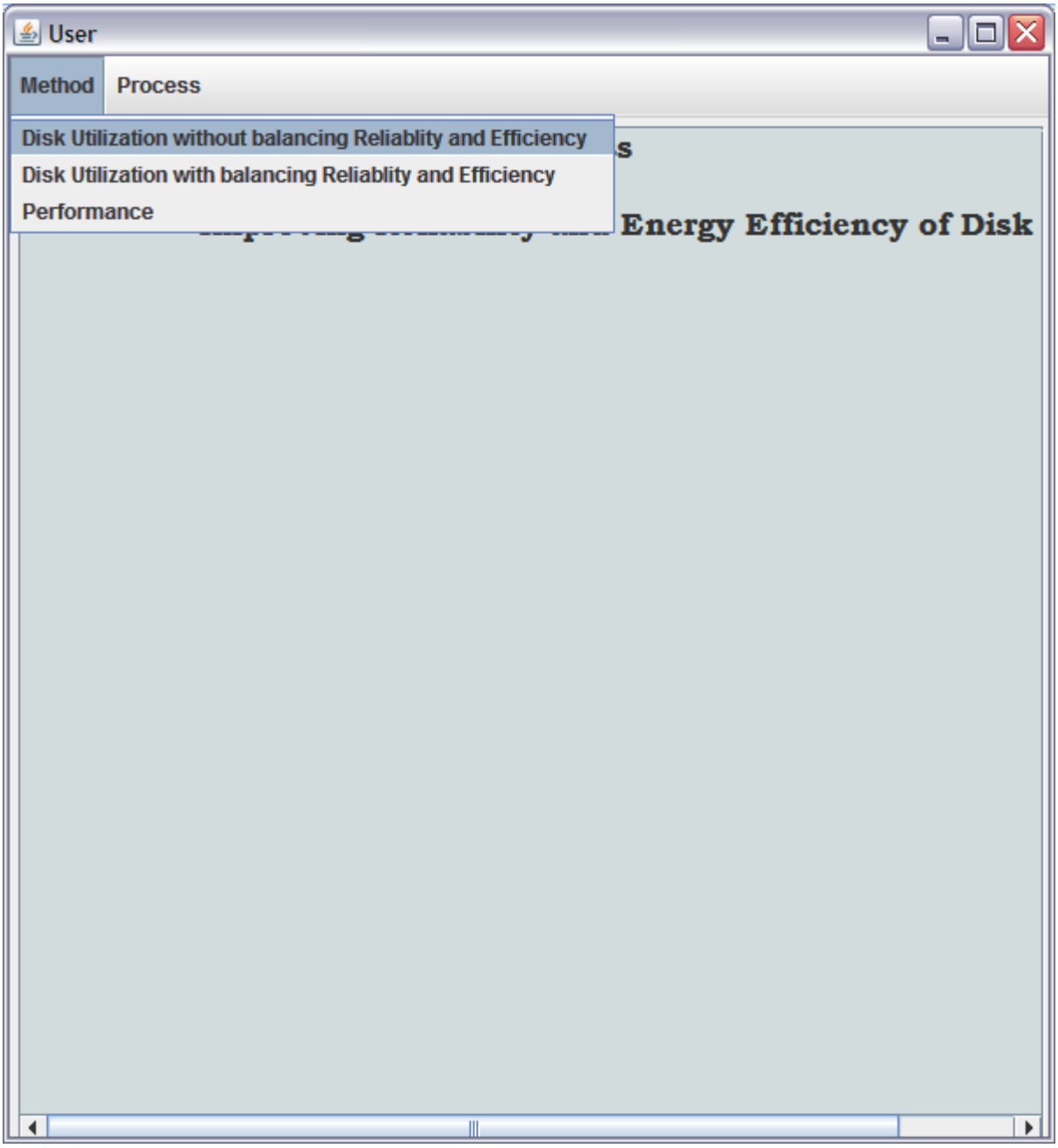
With our novel reliability model in place, it becomes feasible to devise new approaches to seamlessly integrate energy efficiency and fault tolerance. The goal of these approaches is to provide significant energy savings, while ensuring high reliability for parallel disk systems without sacrificing performance. This approach has several advantages

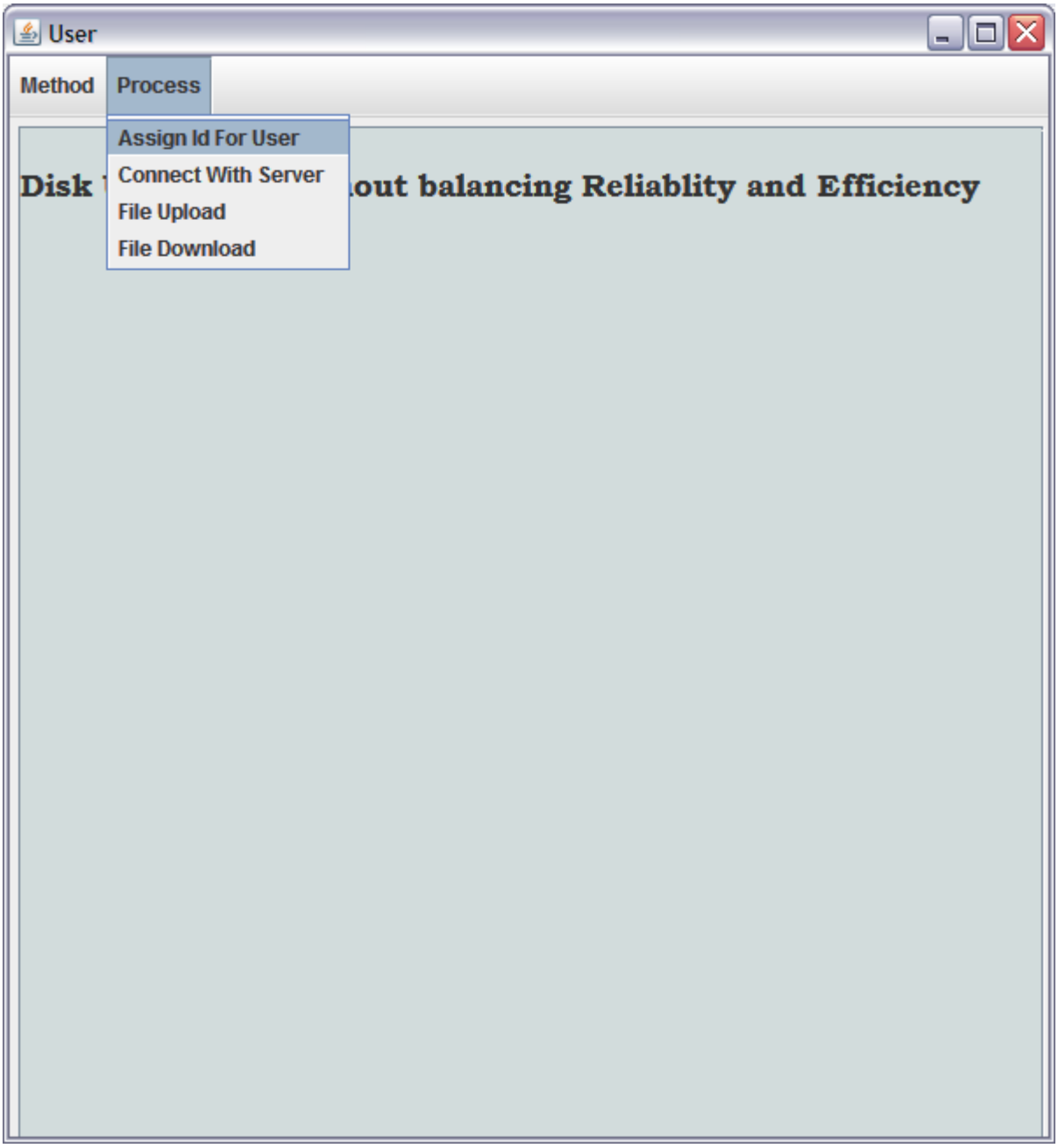


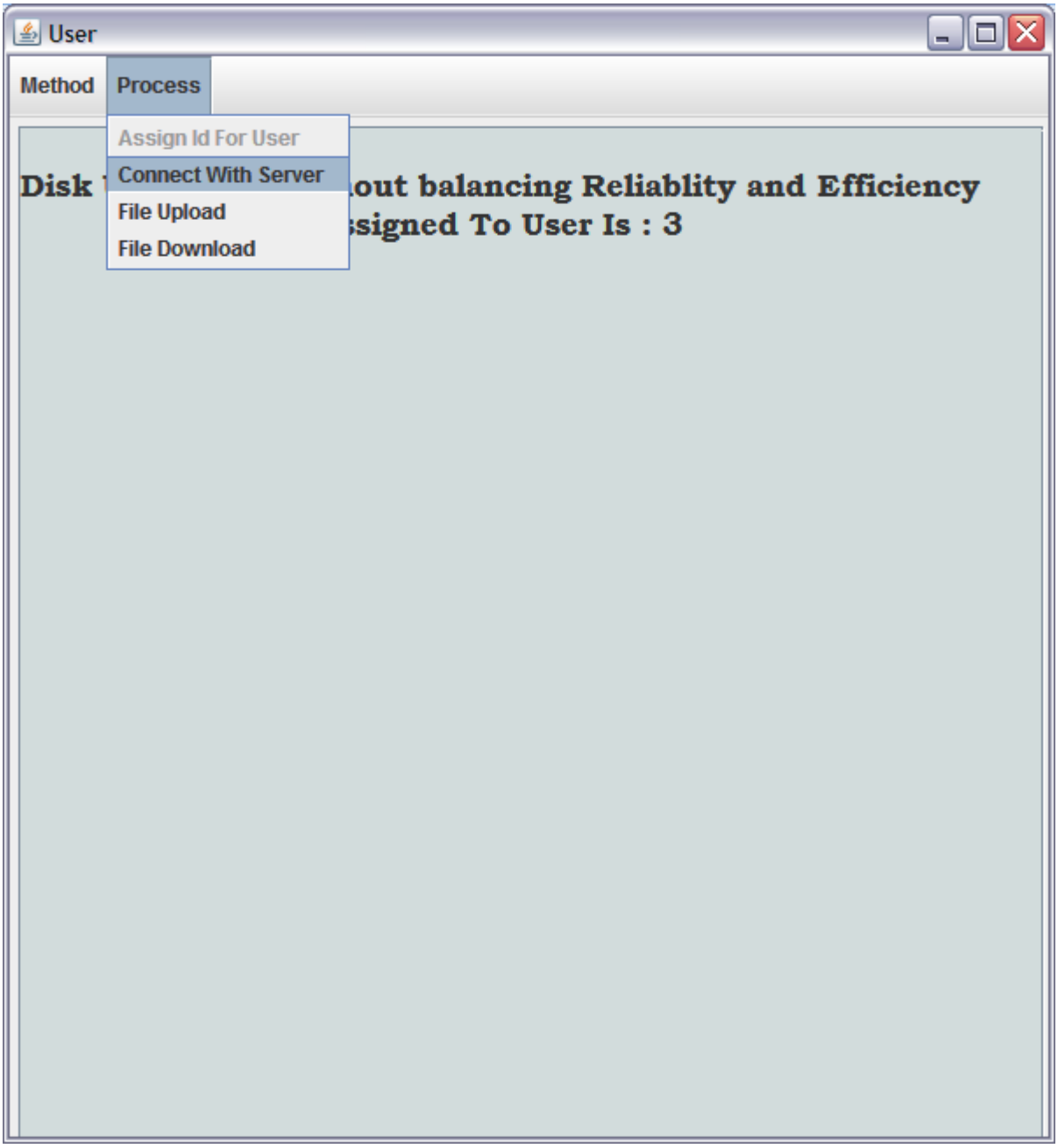
over traditional qualitative approaches. This is because the model not only can quantify the reliability of energy-efficient parallel disks, but also can be used to balance energy efficiency and reliability.

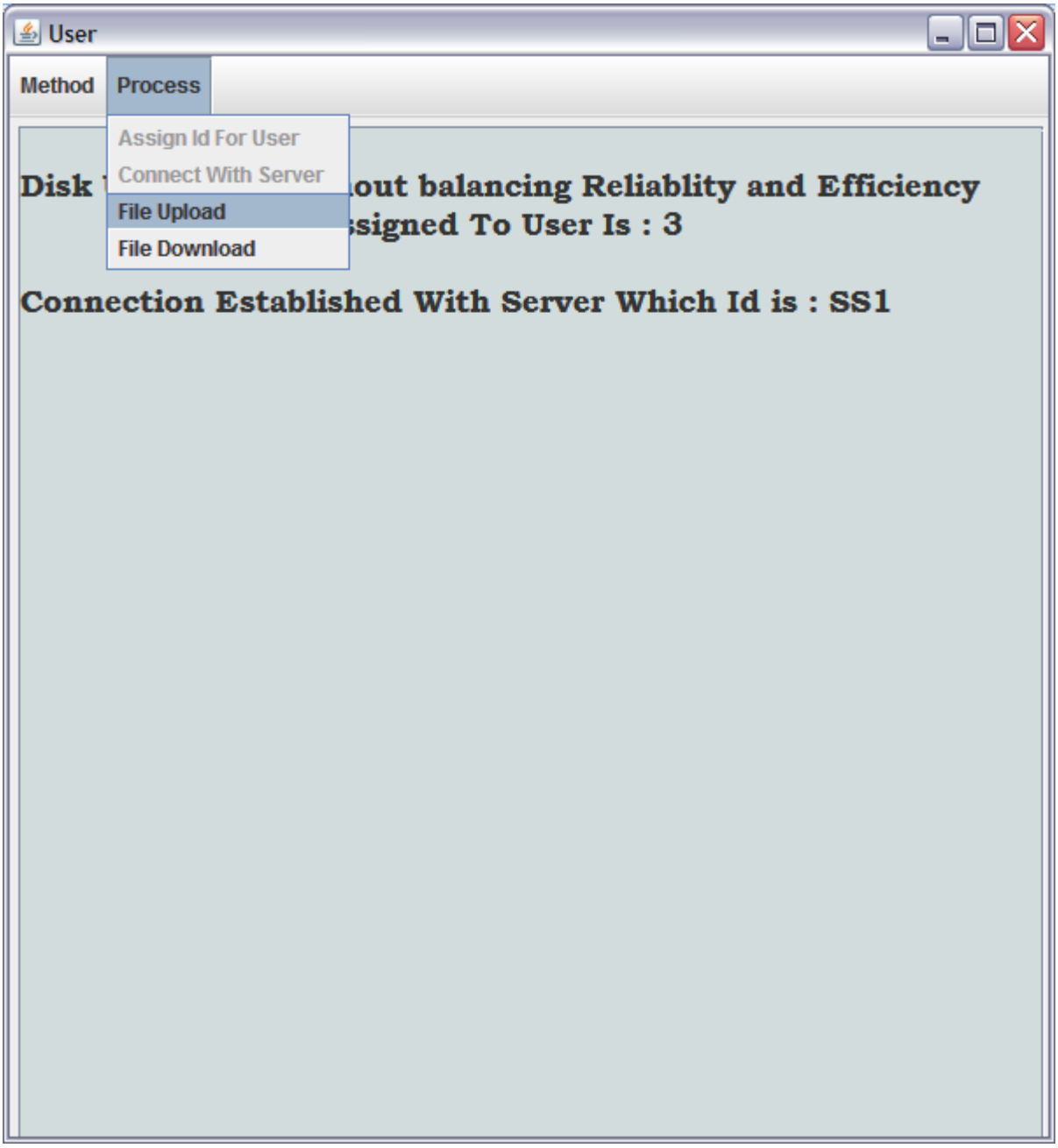
Screen Shots

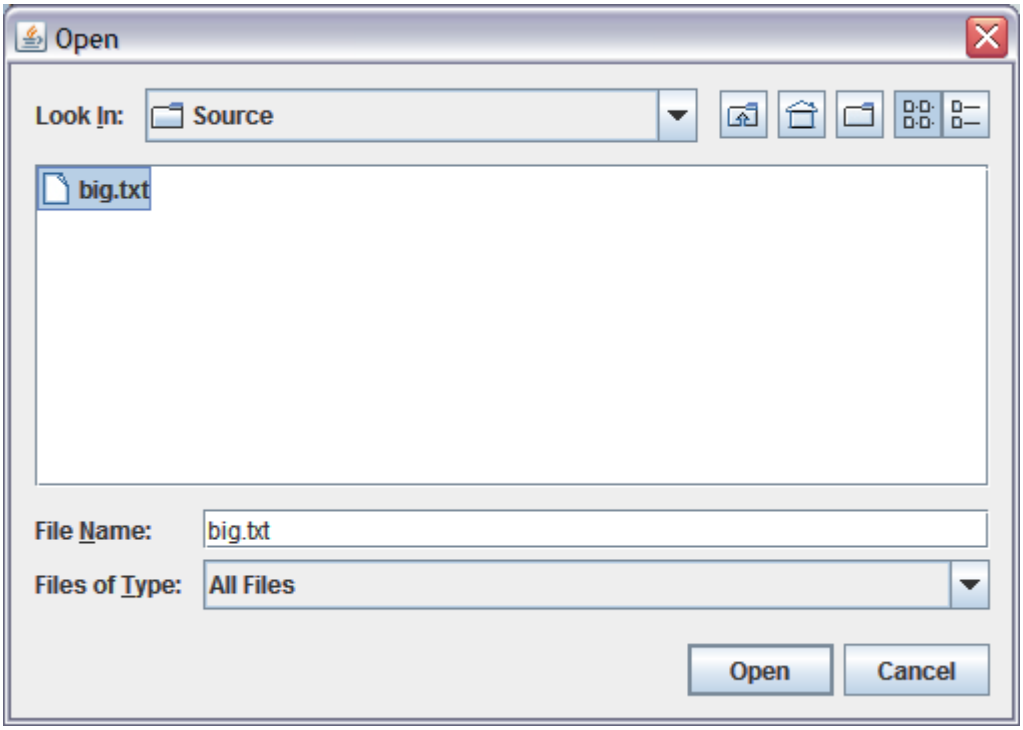


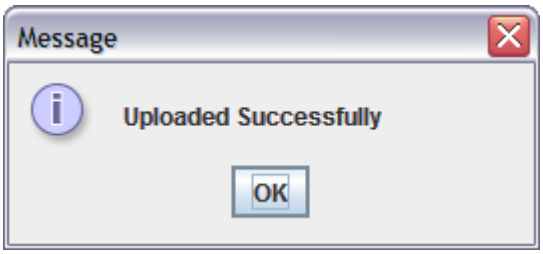

User
Method
Process
Disk Utilization without balancing Reliablity and Efficiency
Disk Utilization with balancing Reliablity and Efficiency
Performance
Energy Efficiency of Disk

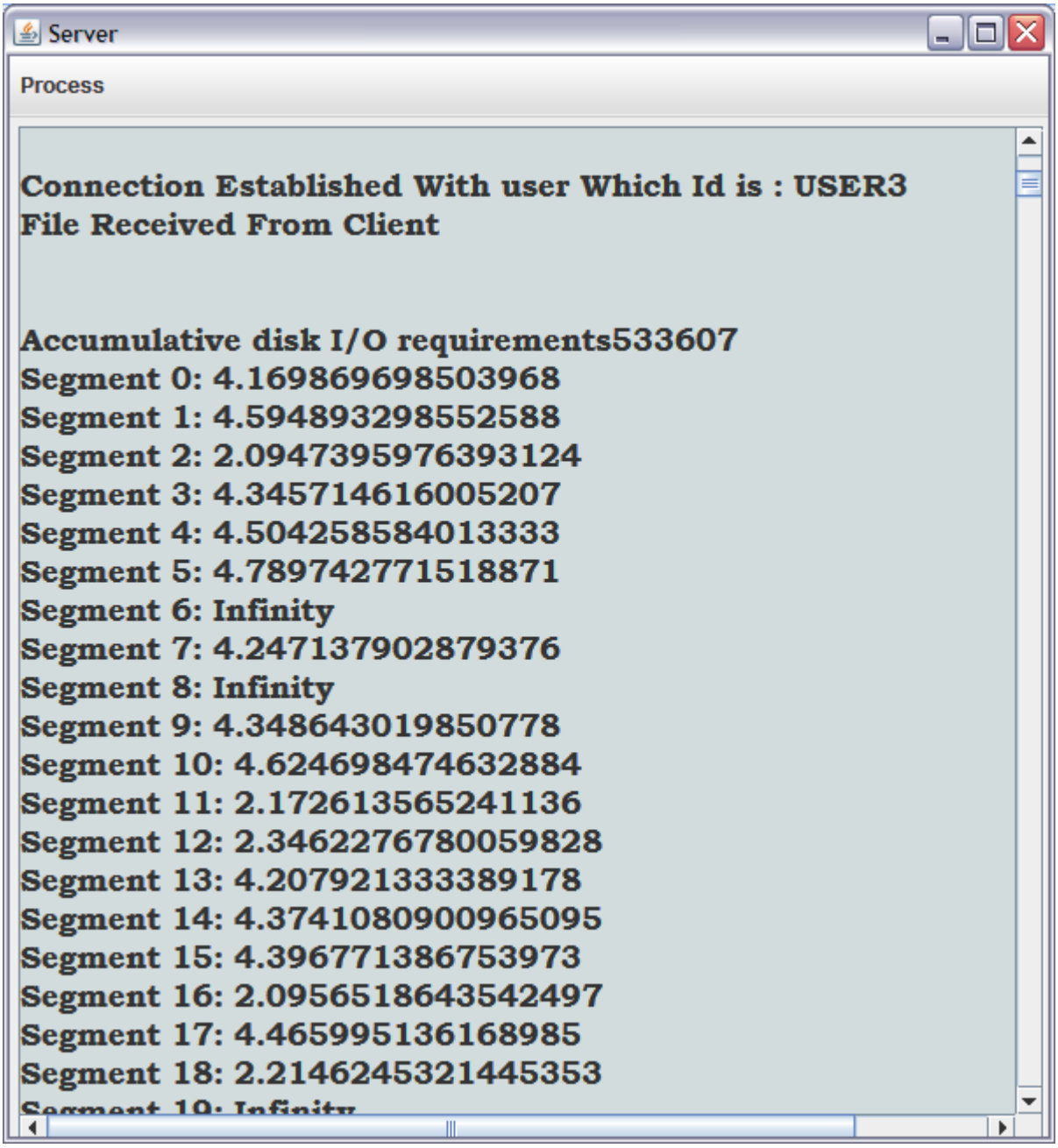

User
Method
Process
Assign Id For User
Connect With Server
File Upload
File Download
Disk
out balancing Reliablity and Efficiency

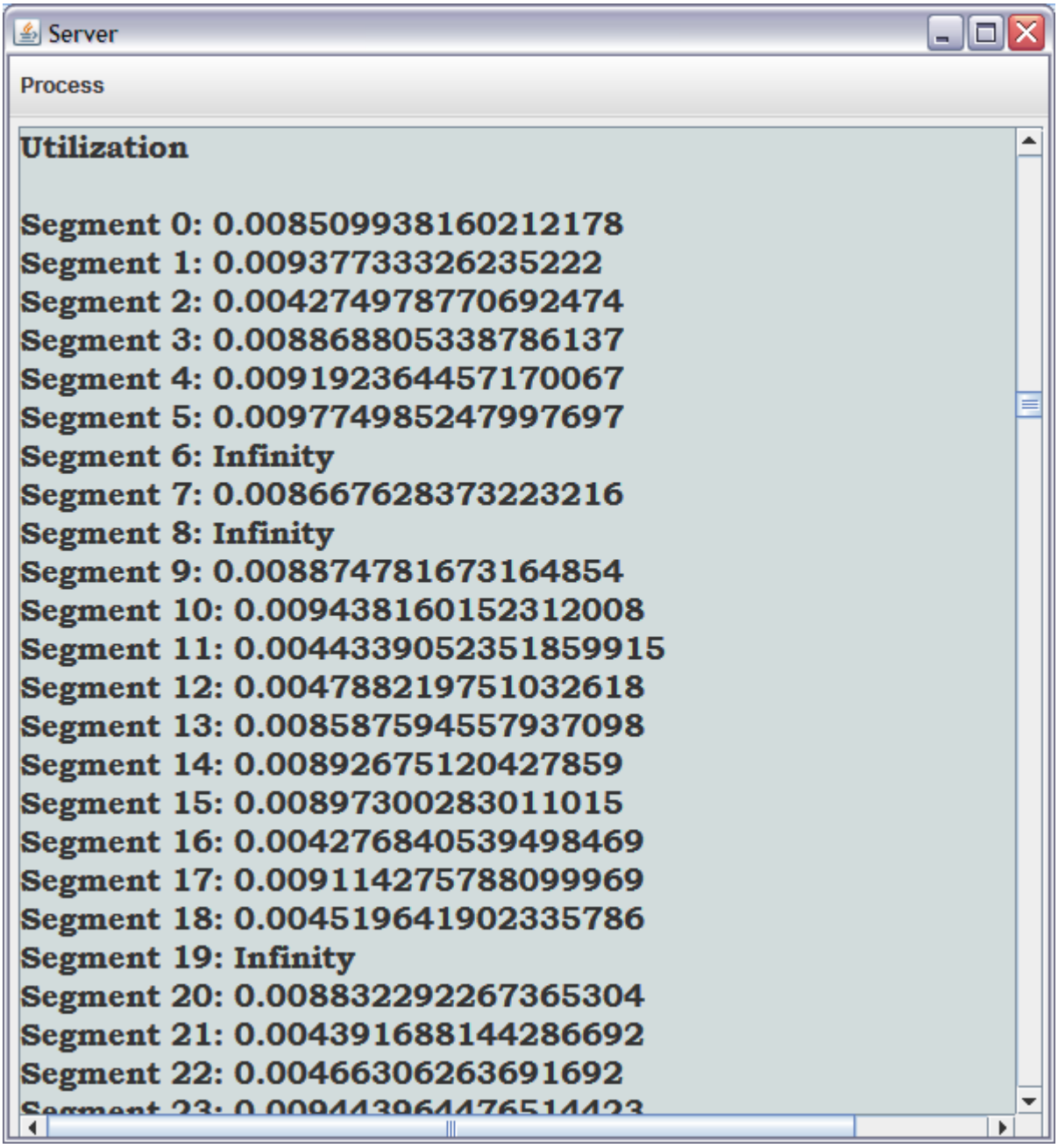

User
Method
Process
Assign Id For User
Connect With Server
File Upload
File Download
Disk
out balancing Reliablity and Efficiency
ssigned To User Is : 3

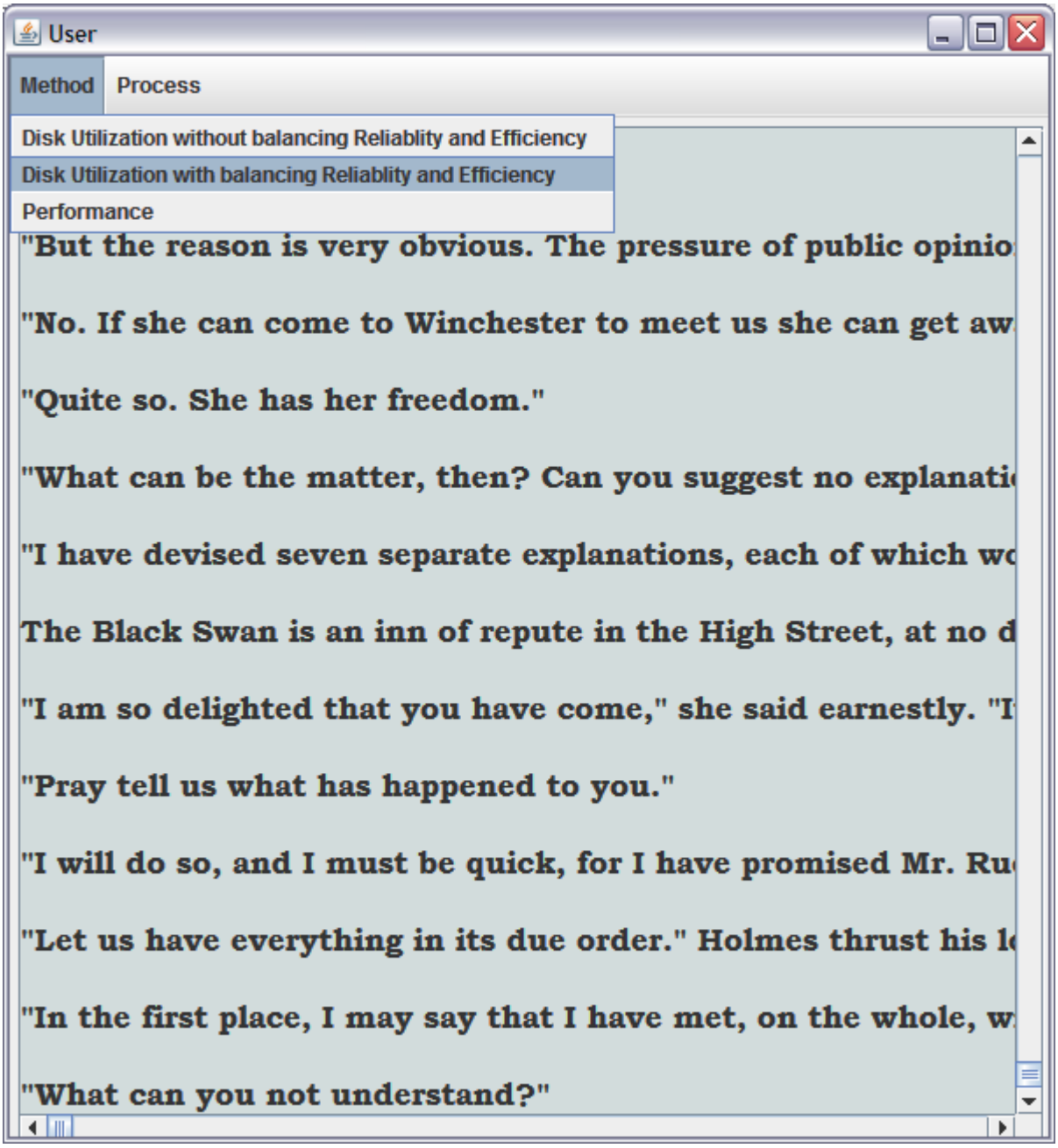

User
Method
Process
Assign Id For User
Connect With Server
File Upload
File Download
out balancing Reliablity and Efficiency
ssigned To User Is : 3
Connection Established With Server Which Id is : SS1

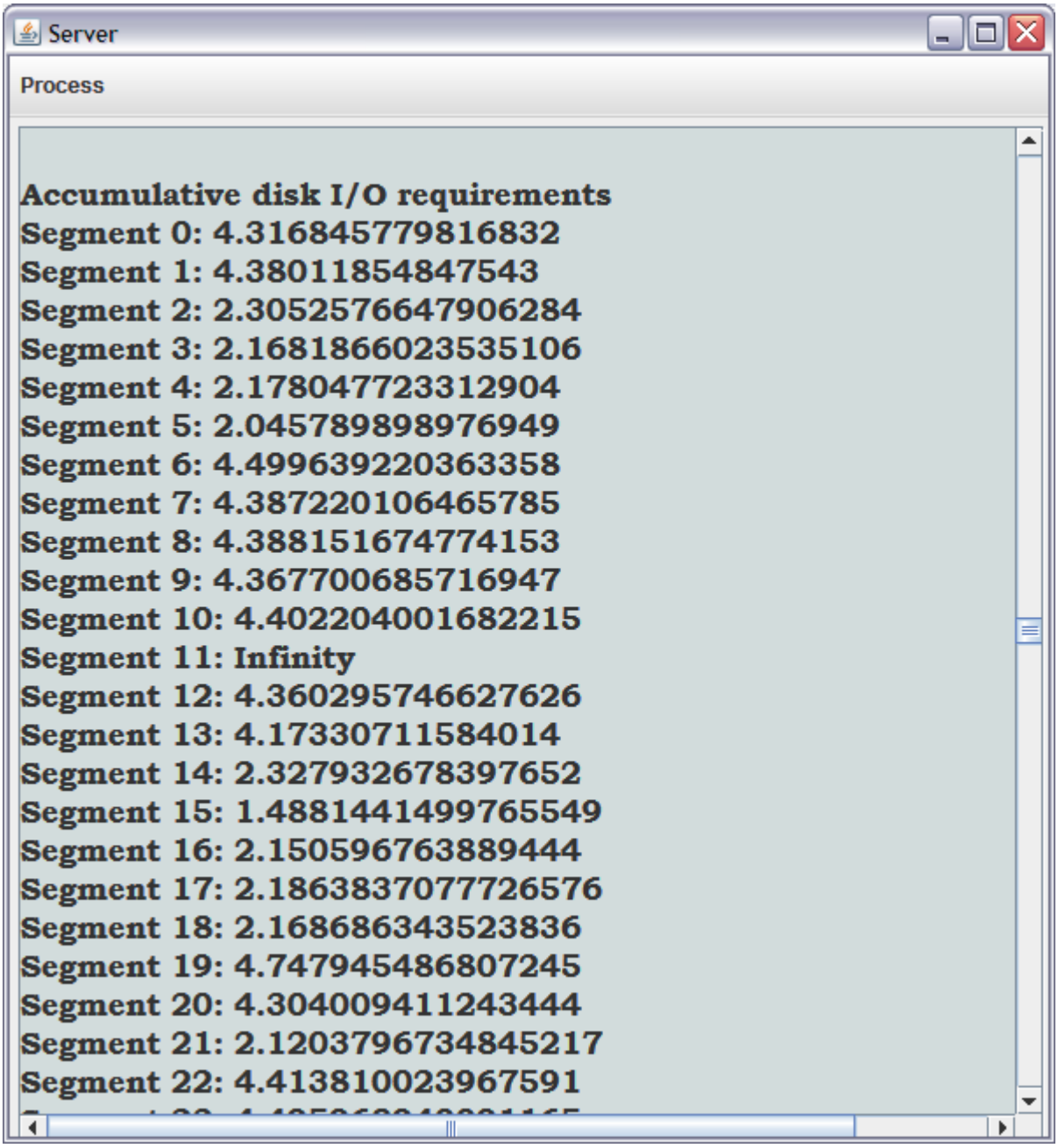

Open
Look In:
Source
big.txt
File Name:
big.txt
Files of Type:
All Files
Open
Cancel

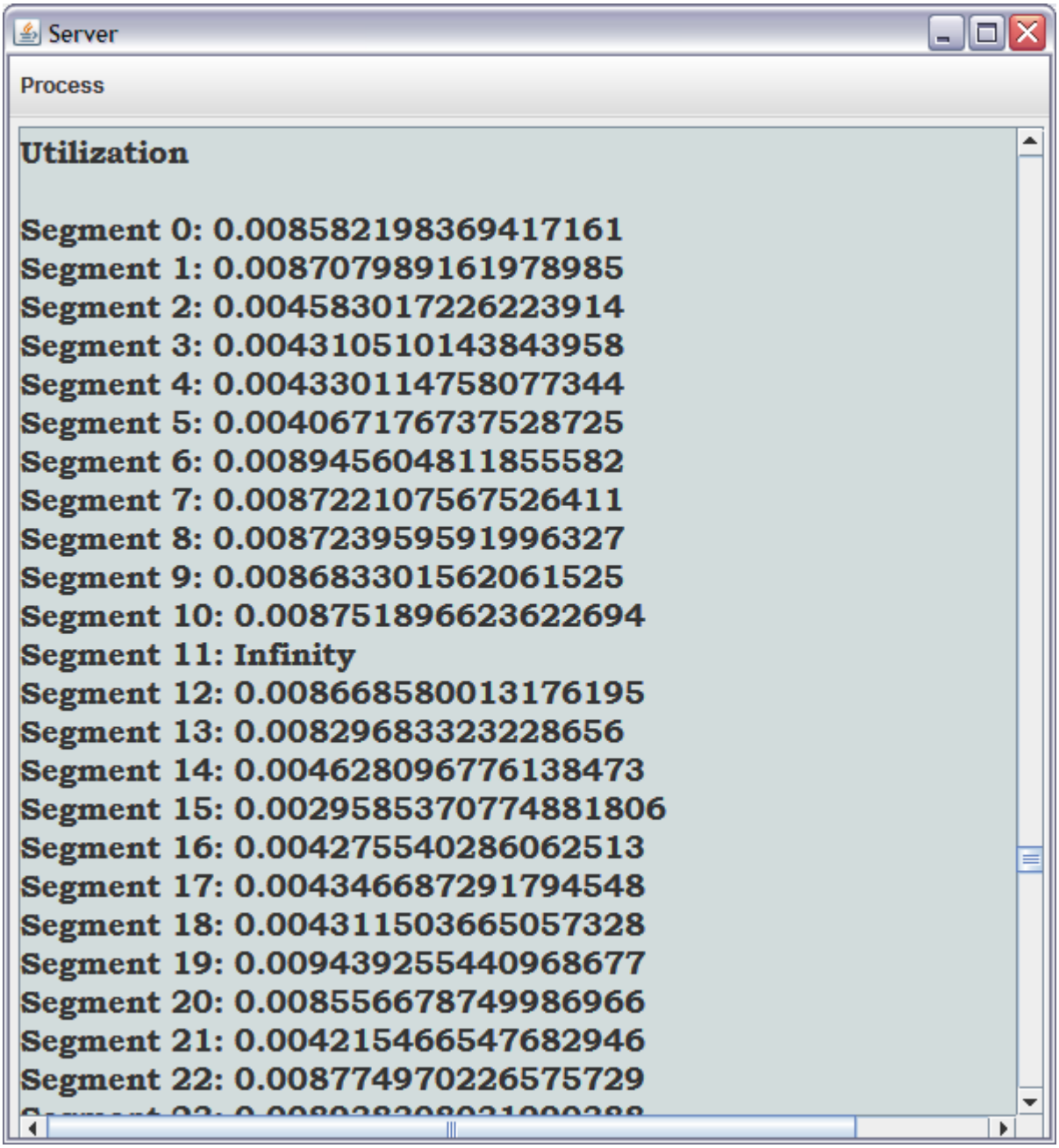

Message
Uploaded Successfully
OK


Server
Process
Connection Established With user Which Id is : USER3
File Received From Client
Accumulative disk I/O requirements533607
Segment 0: 4.169869698503968
Segment 1: 4.594893298552588
Segment 2: 2.094739597639312 4
Segment 3: 4.345714616005207
Segment 4: 4.504258584013333
Segment 5: 4.789742771518871
Segment 6: Infinity
Segment 7: 4.247137902879376
Segment 8: Infinity
Segment 9: 4.348643019850778
Segment 10: 4.624698474632884
Segment 11: 2.172613565241136
Segment 12: 2.3462276780059828
Segment 13: 4.207921333389178
Segment 14: 4.374108090096509 5
Segment 15: 4.396771386753973
Segment 16: 2.095651864354249 7
Segment 17: 4.465995136168985
Segment 18: 2.214624532144535 3


Server
Process
Utilization
Segment 0: 0.0085099381602121 78
Segment 1: 0.009377333262352 22
Segment 2: 0.004274978770692474
Segment 3: 0.008868805338786137
Segment 4: 0.009192364457170067
Segment 5: 0.009774985247997697
Segment 6: Infinity
Segment 7: 0.008667628373223216
Segment 8: Infinity
Segment 9: 0.008874781673164854
Segment 10: 0.009438160152312008
Segment 11: 0.004433905235185991 5
Segment 12: 0.004788219751032618
Segment 13: 0.008587594557937098
Segment 14: 0.00892675120427859
Segment 15: 0.008973002830110 15
Segment 16: 0.004276840539498469
Segment 17: 0.009114275788099969
Segment 18: 0.004519641902335786
Segment 19: Infinity
Segment 20: 0.008832922673653 04
Segment 21: 0.004391688144286692
Segment 22: 0.004663062636916 92


User
Method
Process
Disk Utilization without balancing Reliablity and Efficiency
Disk Utilization with balancing Reliablity and Efficiency
Performance
"But the reason is very obvious. The pressure of public opinio
"No. If she can come to Winchester to meet us she can get aw
"Quite so. She has her freedom."
"What can be the matter, then? Can you suggest no explanati
"I have devised seven separate explanations, each of which wo
The Black Swan is an inn of repute in the High Street, at no d
"I am so delighted that you have come," she said earnestly. "I
"Pray tell us what has happened to you."
"I will do so, and I must be quick, for I have promised Mr. Ru
"Let us have everything in its due order." Holmes thrust his l
"In the first place, I may say that I have met, on the whole, w
"What can you not understand?"


Server
Process
Accumulative disk I/O requirements
Segment 0: 4.316845779816832
Segment 1: 4.38011854847543
Segment 2: 2.3052576647906284
Segment 3: 2.1681866023535106
Segment 4: 2.178047723312904
Segment 5: 2.045789898976949
Segment 6: 4.499639220363358
Segment 7: 4.387220106465785
Segment 8: 4.388151674774153
Segment 9: 4.367700685716947
Segment 10: 4.402204001682215
Segment 11: Infinity
Segment 12: 4.360295746627626
Segment 13: 4.17330711584014
Segment 14: 2.327932678397652
Segment 15: 1.4881441499765549
Segment 16: 2.150596763889444
Segment 17: 2.1863837077726576
Segment 18: 2.168686343523836
Segment 19: 4.747945486807245
Segment 20: 4.304009411243444
Segment 21: 2.1203796734845217
Segment 22: 4.413810023967591



II. 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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[1]. Enrique V. Carrera, Eduardo Pinheiro, and Ricardo Bianchini, "Conserving Disk Energy in Network Servers", in proceeding of the 17th annual international conference on super computing, PP 86-97, ISBN:1-58113-733-8, 2003

[2]. Jianfeng Mao, Christos G. Cassandras, Qianchuan Zhao, "Optimal Dynamic Voltage Scaling in Energy-Limited Nonpreemptive Systems with Real-Time Constraints", IEEE transaction on Computer-Aided Design of Integrated Circuits and Systems, ISSN: 0278-0070, PP. 1827 – 1837, Volume:24 , Issue: 12 November 2005.