Final Project

Technical Evaluation of an Operating System

Submitted to

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By

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Organizational Profile:

Top Secret, Inc(TSI) is an organization which is based on Operating systems. TSI main domain is in manufacturing embedded Operating systems mainly for secure terminals that control ingress/egress control systems. All these are implemented for wall street firms, making camera systems for drone aircraft, mainly for government organizations and making alarm systems for government organizations. Even though TSI is known for their brisk reaction time and very solid operation, regardless they require the most recent and extraordinary innovation to offer their clients. For instance, TSI's working framework doesn't bolster more than one program running at once or more than one processor on a physical gadget.

Organizational Challenges and requirements:

Since the TSI OS does not bolster running more than one program at once this is an enormous issue for the BO framework. "In a multiprogramming framework, there are at least one projects stacked in principle memory which are prepared to execute" (Tolmie, 2013). TSI realized that their clients just expected to run one program at time, their sensor input program, however the BO framework at TSI will need to run numerous projects on the double, whether it be running reinforcements, RDP, changing gathering strategies, joining spaces, booking redesigns and much, a great deal more. The test that TSI confronts at this moment that keeping in mind the end goal to deal with the greater part of their BO undertakings they can't run every program simultaneously, their OS can just run one program at once. Multithreading is not something TSI can offer so they utilize open-source programming to expel multithreading usefulness which implies TSI keeps on

running in the wrong bearing. They are purchasing old equipment to bolster single-center processors and utilizing open-source programming to point of confinement what their clients can do. Rather, they ought to overhaul innovation and pushing ahead rather than in reverse. We'll investigate an answer for these issues soon, however until further notice we're attempting to decide the most serious issues and difficulties of TSI's future. So, since the TSI working framework is not supporting more than one processor they are finding old single center processors. Considering the name of the organization, Top Secret Inc., one may figure they have a decent security framework set up, yet that is a long way from reality. At the point when TSI is taking a shot at top mystery caution frameworks for government establishments they ought to have the capacity to examine the measure of assurance accessible through efforts to establish safety, however they can't. Subsequently anybody that can login to TSI central command can likewise login to any TSI server in the back office.

Gadget drivers are a major test for TSI because their designers compose custom gadget drivers for every client as opposed to having a standard organization for all clients. This make issues when designers need to roll out improvements and repairs because every client has diverse format, and moreover, when those engineers leave the organization it will be troublesome for recently procured designers to get adjusted. So also, TSI doesn't have a decent adaptation to non-critical failure because the framework doesn't perceive issues and alter them unless it's particularly set up with a custom reaction. Since TSI is working with clients of such extraordinary gauge they must chip away at efforts to establish safety first. Cisco clarifies organize security as, "your IT accomplice ought to clarify that system security alludes to any exercises intended to ensure your system. These

exercises ensure the ease of use, unwavering quality, trustworthiness, and wellbeing of your system and information.

Operating Systems Functionality and Management:

The basic functionality required for an operating system include Multi Programming and Multi Processing. Multi programming is a form of parallel processing in which process keep running until it gets access to any I/O device at a point where another process is already chosen to run, so that the cup will not be idle waiting for the process to run. Whereas Multiprocessing has an indistinguishable idea from multiprogramming. The fundamental distinction, other than more CPUs, is projects run speedier with having numerous processors working as one. The element will help with dispensing memory and decrease the ideal opportunity for multiprogramming. Without this element, it will diminish execution inside the business and at last be expensive. Hence effective Multi programming and Multi processing supported functionalities must be included in the new OS for TSI organization. Implementation and maintenance of multi programming is solely dependent on the priority or the order of the tasks, a programmer sets. Hence multi programming task is to complete those set of prioritized tasks until all the processes are executed in the queue list. TSI Organization has their own inbuilt operating system which does not permit to execute multiple programs at a time or implementing multi processors on a physical device. Whereas multi-processing involves another Processor to be installed. Therefore, the TSI Operating System should be redesigned in such a way that it supports multi processors to increase the overall system performance.

OS Maintenance:

Even though the developers strive to make the operating systems design stable and reliable to the maximum possible extent, personal care also must be taken to keep the operating system and the personal computer to maintain its speed. The basic considerations to be taken care to maintain operating systems to the mark include regular backups of the data and the software, Hard Disk health check frequently, Security procedures to be followed to maintain the system from malware and keeping all the systems upgradations up to date.

Hardware Requirements:

The basic hardware requirement for an OS to work effectively is the system architecture. Though each OS is designed to work on different architectures, it must be recompiled to work with the new design. TSI should ensure that that latest OS they choose should be an architecture independent Operating System. Few software applications require external peripheral devices. Hence TSI Operating Systems hardware requirements include the support of any extensive peripheral devices such as CD-ROM drives, Network devices, printers etc. The processing power of the CPU is also another critical element to be considered in the Hardware Compatibility List (HCL). The processing power of the CPU should meet the requirements of the TSI organization. The CPU should be finalized based on its processing speed. Intel Pentiums are the most popularized processors with high processing and clock speed.

Support and Functionality:

An Operating system requires process management, memory management, storage management and I/O services. Regarding the process management an OS should perform the basic tasks such

as creating and deleting both the system and user processes, deadlock avoidance, safeguarding that each process has available resources and are not interfering with other system processes. Whereas when Memory management is considered it should support the functionalities such as allocating and deallocating the memory as per the usage, keeping track of all the memory blocks in use and the programs using it, controlling the movement of blocks of memory in and out accordingly based on the requirement. An effective Operating system should also take the responsibility of file management and mass storage. Creating and deleting the files and frequent back up of the files should be done to ensure the data safety and for mass storage management it should check the disk space allocation and disk scheduling.

For an effective I/O management by the Operating System, several components must be taken into consideration such as

- Ensuring the availability of the drivers for specific hardware devices
- Basic device drivers interface
- Memory management components that include buffering, caching and spooling

Architectural Issues:

Several architectural plans are in implementation for the multi-processor systems. The basic used architectural structures are the tightly coupled systems and the loosely coupled systems. A tightly coupled system is a multi-processor system with common shared memory. This architecture does not prevent each processor from having its own memory space. This architecture also provides a separate memory for the cache for each CPU and in addition there is a global memory for every

CPU to access it. Therefore, the common information can be shared by all the CPU's by storing the data in the global memory space. An alternative architecture is the distributed memory configuration or the loosely coupled system in which each processor has the separate private memory space. Loosely coupled systems are effective to use where the interactions between the tasks are very low. Tightly coupled architectures are a bit expensive when compared to the loosely coupled systems. But then considering the efficiency it is reasonable for TSI organization to choose tightly coupled multiprocessor architecture rather than loosely coupled system.

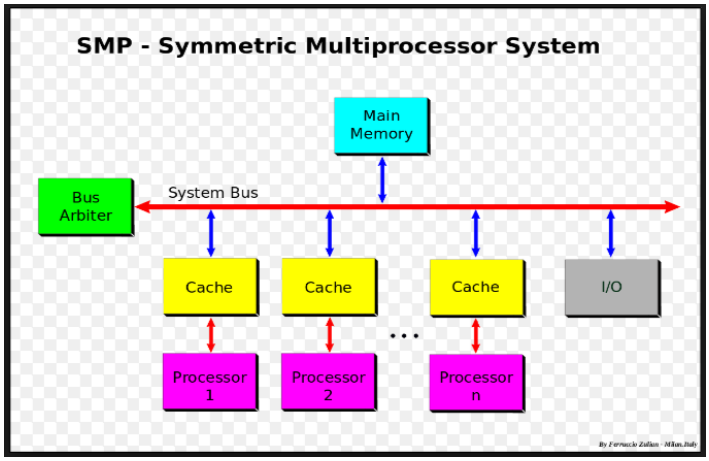

Fig.1. Tightly coupled architecture

Responsiveness to Organizational Requirements:

Process Management and its responsibilities are an integral part of modern day operating systems. The basic functions of the Operating System with respect to process management are

- Managing the processes, Threads and resources
- Enabling the processes to share information

- Protect the resources form other processes
- Maintain the synchronization between the processes

To achieve an effective process management, the Operating System must maintain a separate data structure for each process which indicates the resource allocation. Operating systems that support process management are generally considered to be Multi-Tasking Operating Systems.

Software Tools:

Deadlock is a scenario in which two computer programs need the same resource, but then they are preventing each other from accessing the resource which results in discontinuing the execution of both the programs. This leads to the Deadlock situation.

Identifying Deadlock situations

The process of identifying the deadlocks generally involve detecting the resources and processes that are involved in the deadlock. To detect the deadlocks the allocation of processes against each resource available must be identified. The instant remedy to overcome deadlock includes temporarily terminating the processes until the system is free of deadlock.

Deadlock Avoidance:

Most of the Deadlock prevention algorithms use of graphs which do not effectively use and allocate the resources. Hence aiming to identify the deadlock scenarios and avoiding them is the best way to eliminate deadlocks. This can be achieved by the prior analyzation of the resources and their usage by the processes, the availability of the resources, the allocation of the resources and the future request and release of the resources by the processes. In the resource allocation

graph if there are no repetitive cycles in the graph it implies that there are no deadlock scenarios present.

Support:

Multiprocessing has an indistinguishable idea from multiprogramming. The fundamental distinction, other than more CPUs, is projects run speedier with having numerous processors working as one. Multi-Processing refers to the hardware i.e. the CPU units rather the software (the programs for execution). Application of multi processors is more efficient for the system. Multi-processing helps any system to execute tasks at a faster rate when compared to the system which has only single processor for execution. Even if there is a breakdown of one CPU the execution doesn't stop since other CPU units continue to work. TSI Organization has their own inbuilt operating system which does not permit to execute multiple programs at a time or implementing multi processors on a physical device. Whereas multi-processing involves another Processor to be installed. Therefore, the TSI Operating System should be redesigned in such a way that it supports multi processors to increase the overall system performance.

Memory Abstraction:

It can be described as an abstraction layer between the execution programs and the memory. Basically, it is the layer between the two programs and handles the communication between them. So, none of the system knows how the other system works. It provides an Application Program Interface (API) making it easier to develop codes for multiple hardware and software platforms. An example like memory abstraction is a web application performing data operations to store it

the database, this allows the application only to send the data to store and is not bothered about where it is being stored.

Assess Activity:

Memory Management is responsible for the efficient use of system memory and avoids the clash of memory usage among various processes. With the application of Virtual Memory in TSI systems the system crashing will reduce. Virtual Memory controls the programs from interfering with the memory units of other programs by allocating them a separate address space which results in bringing down the number of system crashes. Internal fragmentation will be reduced with memory management but the disadvantage is that there still exists the external fragmentation and it involves cost effective algorithms which increase the overall maintenance cost. It also has the drawback if segments are unequally divided since unequal segment sizes does not support swapping.

Techniques:

Memory Management techniques include Fixed partitioning, Dynamic partitioning, simple paging, simple segmentation, Virtual memory paging and virtual memory segmentation out of which the preferable techniques are the dynamic partitioning and simple paging. In Dynamic partitioning, Partitions are created dynamically, so that each process is loaded into a partition of the same size as that of the process. This technique reduces internal fragmentation and makes most efficient use of the main memory. In simple paging technique, Main memory is divided into several equal-size blocks. Each process is also divided into many equal-size pages of the same length as frames.

A process is loaded by loading all its pages into available frames. Thought his technique reduce the risk of external fragmentation, there is a minimal occurrence for the internal fragmentation to exist.

Hardware-Software Interface:

The fundamental procedures for performing I/O techniques are

- Programmed I/O where the CPU is strictly tied to the I/O until it is finished.
- Interrupt-driven I/O per character transfer
- DMA (Direct Memory Access) a memory controller mechanism program monitored by the OS to exchange data at great speed between main memory and the I/O device.

  The Operating System is responsible for choosing and managing the right technique for each specific I/O to deliver the best overall performance.

File Systems:

It is the method that depicts how the Operating System stores, maintains and retrieves files. A file system is an integral part of the Operating System, that controls and manages the files on disks. A successful filesystem must be able to multiplex the use of storage units among many concurrent processes, manages internal synchronization for all processes, enforce security by allowing data access only authorized users and provide a standard set of interface routines to upper layers of the operating system and user programs. Therefore, a file system must perform all these tasks with minimal impact on system performance.

Context Switching and I/O Interrupt Handling:

Context-switching involves stopping the execution of one thread on a CPU and starting the execution of another thread. Context switch generally require that the entire process be transparent to the threads themselves, and so, to implement a context switch, the scheduler must back up most of the things. Therefore, when the scheduler decides to run the same thread again, the state of the CPU elements is restored from the backup copy.

Security Models:

The fundamental concepts in computer and information security is the security model, which outlines how security is to be applied. It is nothing but a "blueprint. A security policy outlines how data is retrieved and what level of security is required. A security model is a statement that outlines the requirements necessary to properly support and implement a certain security policy. If a security policy dictates that all users must be identified, authenticated, and authorized before accessing network resources, the security model might lay out an access control matrix that should be constructed so that it fulfills the requirements of the security policy. If a security policy states that no one from a lower security level should be able to view or modify information at a higher security level, the supporting security model will outline the necessary logic and rules that need to be implemented to ensure that under no circumstances can a lower-level subject access a higher-level object in an unauthorized manner. A security model provides a deeper explanation of how a computer operating system should be developed. Information security is made up of the following attributes:

• Availability: Prevention of loss of access to resources and data

• Integrity: Prevention of unauthorized modification of data

• Confidentiality: Prevention of unauthorized disclosure of data

Recommended Techniques:

Security for any software is essential and without security we can't process any information. If our system is not secured, then there are many chances to steal all the information that we save on out system. When we look at TSI company, it has low security maintained. When we look at log in system, network systems it has poor security. Having this kind of security doesn't help to attracts customers as it doesn't make any sense for a company which main business is to create OS. Security for any network has multiple benefits that helps in aiding the overall progress. TSI can increase their business market by delivering the customers, high security applications. A secured network implies which can spot out and filter the threats that tries to degrade its performance. The security administrators must gain an overall knowledge of the TSI application networks to secure their applications because misconceptions in the functioning of their applications could lead to delay in security management or installations. Not only installing the secured networks but frequent assessments and evaluations would help in creating a better secured system.

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