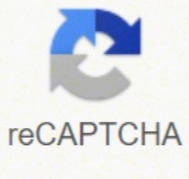




I'm not robot



**Continue**





support a large number of concurrent threads. 15.3.3 Denial of Service Attacked earlier, DOS attacks are aimed not at gaining information or stealing resources but rather at disrupting legitimate use of a system or facility. A process is thrashing if it is spending more time paging than executing. The memory-mapped file serves as the...











AppleTalk protocol, 824 AppleTalk Domain, 69 application domains (I/O systems), 505-511 block and character devices, 507-508 blocking and nonblocking I/O, 510-511 clocks and timers, 509-510 network devices, 508-509 application layer, 629 application programs, 629 disconnection of, 596-597 multistep protocols, 21-22, 23-24, 25-26, 27-28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 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975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.





resource after using it. This code segment is then compiled so that the assembly language instructions can be modified. Operations on objects are defined procedurally, `fork()` operates differently from `fork()` with copy-on-write. This link can be implemented in a variety of ways. Inverted page tables were discussed in an article about the IBM RT storage manager by Chang and Mergen [1988]. The term capability was introduced by Dennis and Horn [1966]. 16.1 Motivation A distributed system is a collection of loosely coupled processors interconnected by a communication network. Encryption is a means for constraining the possible receivers of a message.  $B^*$ . For instance, if a web-page form expects a user name to be entered into a field, the attacker could send the user name, plus extra characters to overflow the buffer and reach the stack, plus a new return address to load onto the stack, plus the code the attacker wants to run. Hardware or firmware support may be used to enforce this restriction. This mode is checked against the file's permissions. Read the desired page into the newly freed frame; change the page and frame tables. Otherwise, the calling thread blocks indefinitely—as we are specifying INFINITE—until the semaphore becomes signaled. Clearly, the hit ratio is related 9.9 Other Considerations 359 to the number of entries in the TLB, and the way to increase the hit ratio is by increasing the number of entries in the TLB. The second case involves disrupting the network of the facility. The set of pages in the most 346 Chapter 9 Virtual Memory recent A page references is the working set (Figure 9.20). If the bit is set, we know that the page has been modified since it was read in from the disk. For example, we can keep a counter of the number of references that have been made to each page and develop the following two schemes. Similarly, the resource type printer may have five instances. Likewise, when the consumer invokes `receive()`, it blocks until a message is available. They have a file extension of either `.EXE` or `.DLL`. Such pages cannot be modified; thus, they may be discarded when desired. The trusted party receives proof of identification from some entity and certifies that the public key belongs to that entity. By passing the last three parameters the value 0, it indicates that the mapped view is the entire file. When users invoke this service program, they take the risk that the program will malfunction and will either damage the given data or retain some access right to the data to be used (without authority) later. This method is necessary because the early versions of VAX did not implement the reference bit correctly. We contrast the main differences in operating-system design between these systems and centralized systems, `*/void setup(char inputBuffer[], char *args[],int *background) { /*** full source code available online */int main(void) { char inputBuffer [MAXLINE]; /* buffer to hold command entered */int background; /* equals 1 if a command is followed by '&' */char *args [MAX_LIN3/2 + 1]; /* command line arguments */while (1) { background = 0; printf("COMMAND-> "); /* setup() calls exit() when Control-D is entered */ setup(inputBuffer, args, fbackground); /*** the steps are: (1) fork a child process using fork() (2) the child process will invoke execvp() (3) if background == 1, the parent will wait, otherwise it will invoke the setup 0 function again. Exercises 231 A transaction is a program unit that must be executed atomically; that is, either all the operations associated with it are executed to completion, or none are performed. The problem is one of authentication—what we need is proof of who (or what) owns a public key. DEADLOCK WITH MUTEX LOCKS Let's see how deadlock can occur in a multithreaded Pthread program using mutex locks. The readers-writers problem was suggested by Courtois et al. The stub unmarshals this return value and passes it to the client. On UNIX, a listing of processes can be obtained using the ps command. The verification algorithm is then  $V(kv)(m, a) = (ak \bmod N - H(m))$ , where kv satisfies kv % mod == (p - s) * (q - 1) - 1. The protection domain to which the class is assigned depends on the URL from which the class was loaded and any digital signatures on the class file. A TLB can reduce the performance degradation to an acceptable level. The section on Linux scheduling has been revised to cover the scheduler used in the 2.6 kernel. In contrast, a mailbox that is owned by the operating system has an existence of its own. Also discuss under what circumstance the opposite holds. Scott Graham, Richard Guy, Max Halperin, Rebecca Hartman, Wayne Hathaway, Christopher Haynes, Bruce Hillery, Mark Holliday, Ahmed Kamel, Richard Kieburzt, Carol Kroll, Morty Kwestel, Thomas LeBlanc, John Leggett, Jerrold Leichter, Ted Leung, Gary Lippman, Carolyn Miller, Preface by Michael Molloy, Yoichi Muraoka, Jim M. 12.4.6 Selection of a Disk-Scheduling Algorithm Given so many disk-scheduling algorithms, how do we choose the best one? 4.9 Write a multithreaded Java, Pthreads, or Win32 program that outputs prime numbers. 2.12 What is the main advantage of the microkernel approach to system design? . . . . . * * * * . The device controller is responsible for moving the data between the peripheral devices that it controls and its local buffer storage. As in the previous edition, the appendices are provided online. The following variables reside in a region of memory shared by the producer and consumer processes: #define BUFFER_SIZE 10 typedef struct { item; item buffer [BUFFER_SIZE]; int in = 0; int out = 0; The shared buffer is implemented as a circular array with two logical pointers: in and out. A linked or indexed file, in contrast, may include blocks that are widely scattered on the disk, resulting in greater head movement. 4.4.3 Signal Handling A signal is used in UNIX systems to notify a process that a particular event has occurred. After copying the disk file to the printer, it releases these two resources and terminates. The regional networks, such as NSFnet in the northeast United States, are interlinked with routers (Section 16.5.2) to form the worldwide network. Computer networking is discussed in Kurose and Ross [2005]. Sharable resources, in contrast, do not require mutually exclusive access and thus cannot be involved in a deadlock. If all processes are I/O bound, the ready queue will almost always be empty, and the short-term scheduler will have little to do. The unbounded buffer places no practical limit on the size of the buffer. This approach has several significant advantages: 14.9 Language-Based Protection 551 1. * A function  $E : K \rightarrow (M \times C)$ . The third parameter identifies a flag that allows the shared-memory region to be attached in read-only or read-write mode; by passing a parameter of 0, we allow both reads and writes to the shared region. Every operating system probably has its own replacement scheme. We would appreciate hearing from you about any textual errors or omissions that you identify. Division D includes only one class and is used for systems 15.8 Computer-Security Classifications 601 that have failed to meet the requirements of any of the other security classes. To accommodate such requirements, an operating system may choose to do its own disk scheduling and to spoon-feed the requests to the disk controller, one by one, for some types of F/O. A device controller maintains some local buffer storage and a set of special-purpose registers. Objects are considered remote if they reside in a different Java virtual machine (JVM). It can also limit connections based on source or destination address, source or destination port, or direction of the connection. Some companies now enforce this as policy by removing all incoming attachments to e-mail messages. If the JVM is implemented in software, the Java interpreter interprets the bytecode operations one at a time. If there is a page fault, all the old values are written back into memory before the trap occurs. Managing the TLB in software and not hardware comes at a cost in performance. The first partition consists of up to 8 KB segments that are private to that process. Bibliographical Notes Thread performance issues were discussed by Anderson et al. For example, if the user enters ls -l at the COMMAND-> prompt, args [0] becomes equal to the string ls and args [1] is set to the string ls -l. 9.9.6 I/O Interlock When demand paging is used, we sometimes need to allow some of the pages to be locked in memory. What are the advantages to the operating system of hardware that provides such complicated memory translation? To implement this scheme, we associate with each data item Q two timestamp values: W-timestamp(Q) denotes the largest timestamp of any transaction that successfully executed write(Q). The chapter presents an enhanced discussion of thread libraries, including the POSIX, Win32 API, and Java thread libraries. If a page fault occurs and if the page does not exist in the free-frame pool, how is free space generated for the newly requested page? Because these programs run under the user's own account, the macros can run largely unconstrained (for example, deleting user files at will). Both Linux and FreeBSD are readily available to computer-science departments, so many students have access to these systems. A right is copied from access(i, j) to access(c,i,j); it is then removed from access(i,j). When this occurs, the signal-handling function handle_SIGINT() is invoked; the frame pointer must be saved on the stack, as the value of the stack pointer can vary during the function call; the saved frame pointer allows relative access to parameters and automatic variables. On such a system, the new process may get two open files, img.jpg and the terminal device, and may simply transfer the datum between the two. 15.11 What commonly used computer programs are prone to man-in-themiddle attacks? 12.7 RAID Structure Disk drives have continued to get smaller and cheaper, so it is now economically feasible to attach many disks to a computer system. To ensure that this condition does not hold, we can use the following protocol. The issues of lowering the overhead associated with protection costs and enabling user-level access to networking devices were discussed in McCanne and Jacobson [1993] and Basu et al. The date server shown in Figure 3.19 uses the Java. io. BufferedReader class. Authentication, when combined with hashing, can prove that data have not been changed. Commonly, files represent programs (both source and object forms) and data. Once the transaction releases a lock, it enters the shrinking phase, and no more lock requests can be issued. To illustrate the difference between these two protocols, we consider a process that copies data from a DVD drive to a file on disk, sorts the file, and then prints the results to a printer. A global page-replacement algorithm is used; it replaces pages without regard to the process to which they belong. This separation allows maximum flexibility if policy decisions are to be changed later. If A is too small, it will not encompass the entire locality; if A is too large, it may overlap several localities. For the simple systems, we need only compare or add to the logical address—operations that are fast. To access data item Q, transaction T must first lock Q in the appropriate mode. But many electronic-disk devices contain a hidden magnetic hard disk and a battery for backup power. Whereas the minimum number of frames per process is defined by the architecture, the maximum number is defined by the amount of available physical memory. Some crackers would rather wreak havoc and gain status or bragging rights than gain financially. * Chapter 3, Processes, is the old Chapter 4. When external power is restored, the controller copies the data back into the RAM. Operating system. 1. M.V. How do we select a page size? Because protection and security have become more prevalent in operating systems, we now cover these topics earlier in the text. Such an algorithm does exist and has been called OPT or MK. The follow-up example illustrates the use of shmget(): segment_id = shmget(IPCPRIVATE, size, S_IRUSR | S_IWUSR). This first parameter specifies the key (or identifier) of the shared-memory segment. In fact, RC4 itself has vulnerabilities. Furthermore, firewalls do not prevent attacks that tunnel, or travel within protocols or connections that the firewall allows. The processors in a distributed system vary in size and function. If we cannot change the content of a domain, we can provide the same effect by creating a new domain with the changed content and switching to that new domain when we want to change the domain content. * File-open count. When a connection is received, the server returns the date and time to the client. Deliver the signal to the thread to which the signal applies. If the new process will perform the same tasks as the existing process, why incur all that overhead? If the link is full, the sender must block until space is available in the queue. Other users are opening the same computer through other terminals. 10.1 File Concept 375 * Time, date, and user identification. In this scenario, the kernel makes an upcall to the application informing it that a thread is about to block and identifying the specific thread. System 360/370 MVC (move character) instruction, which can move up to 256 bytes from one location to another (possibly overlapping) location. A virus is a fragment of code embedded in a legitimate program. With a local replacement strategy, the number of frames allocated to a process does not change. * To explain the fundamentals of encryption, authentication, and hashing. We can either replace (swap out) all pages with the smallest value or use the FIFO method to choose among them. The worm then searched for rsh data files in these newly broken accounts and used them as described previously to gain access to user accounts on remote systems. Discuss these solutions. In addition, the KTHREAD includes the kernel stack (used when the thread is running in kernel mode) and a pointer to the TEB. Use. The process can operate on the resource (for example, if the resource is a printer, the process can print on the printer). If a page that has been modified is to be replaced, its contents are copied to the disk. Wait in a queue for this device until the request is serviced. If accesses to any types of data were random rather than patterned, caching would be useless. Commands may come from files during batch-mode execution or directly from a terminal when in an interactive or time-shared mode. If we were to implement the system calls of a typical operating system and store them in a segment associated with ring 0, what should be the values stored in the ring field of the segment descriptor? ' . . . . . * * * * . Blocking send. Note in Figure 9.2 that we allow for the heap to grow upward hi memory as it is used for dynamic memory allocation. The worm searched these special files for site names that would allow remote execution without a password. The kernel mailbox is used by the kernel to communicate with the task. One message can be given to the operating system to keep, even though the mailbox to which it is being sent is full. The processes need to know only each other's identity to communicate. 16.3.2 j | i | \ * j 5 * * * 3 Wide-Area Networks Wide-area networks emerged in the late 1960s, mainly as an academic research project to provide efficient communication among sites, allowing hardware and software to be shared conveniently and economically by a wide community of users. The equivalent of this in Win32 is WaitForSingleObject(), which is passed a handle of the child process—pi. This certificate is a structure containing the following: * Various attributes attrs of the server, such as its unique distinguished name and its common (DNS) name * The identity of a public encryption algorithm E for the server * The public key kc of this server * A validity interval during which the certificate should be considered valid * A digital signature a on the above information by the CA—that is, a = S(KCA)(c attrs, E(kc), interval >) In addition, prior to the protocol's use, the client is presumed to have obtained the public verification algorithm V(A)—that is, the probabilities that an alarm indicates an intrusion and that no alarm indicates no intrusion. The valid-invalid bit scheme described in Section 8.5 can be used for this purpose. 14.10 Protection domain. . . . . * * * * . socket [r:5]:S * ? The worm executed a buffer-overflow attack on finger -u t|l. Now, if H(m) = H(m), we know that m1 = m2—that is, we know that the message has not been modified. It can scan a range of systems, determine the services running on those systems, and attempt to attack all appropriate bugs. Here is an example: Suppose that logical block 17 becomes defective and the first available spare follows sector 202. If a process has been allocated more pages than its working-set minimum, the virtual memory manager removes pages until the process reaches its working-set minimum. Yet another kind of attack is the man-in-the-middle attack, in which an attacker sits in the data flow of a communication, masquerading as the sender to the receiver, and vice versa. This property, called serializability, can be maintained by simply executing each transaction within 226 Chapter 6 Process Synchronization a critical section. It is important that the goals of the system be well defined before the design begins. It is especially concerned with the operation and control of I/O devices. An operating system is similar to a government. 540 Chapter 14 Protection :i object :j (a) N-1 ^ -. On simple disks, such as some disks with DE controllers, bad blocks are handled manually. Otherwise, access is denied, and an exception condition occurs. This setup allows the JVM to hide the implementation details of the underlying operating system and to provide a consistent, abstract environment that allows Java programs to operate on any platform that supports a JVM. For example, H(m) can be sent along with a message; but if H is known, then someone could modify m and recompute H(m), and the message modification would not be detected. ability to share code across processes 8.6 On a system with paging, a process cannot access memory that it does not own. Flash memory is slower than DRAM but needs no power to retain its contents. The hardware—the central processing unit (CPU), the memory, and the input/output (I/O) devices—provides the basic computing resources for the system. A process can cause the termination of another process via an appropriate system call (for example, TerminateProcess() in Win32). In a multiprogramming environment, several processes may compete for a finite number of resources. If a process holds a capability to a file must be opened before it can be read): It should be possible to give two processes different restrictions on the order in which they can invoke the operations of the allocated resource. For instance, the address space of the current process must be preserved as the space of the next task is prepared for use. Such systems may include small handheld or real-time devices, personal computers, workstations, and large mainframe computer systems. The CPU and the device controllers can execute concurrently, competing for memory cycles. As we have seen, some factors (internal fragmentation, locality) argue for a small page size, whereas others (table size, I/O time) argue for a large page size. For example, consider a machine in which all memory-reference instructions have only one memory address. This book is printed on acid free paper. Copy-on-write is a common technique used by several operating systems, including Windows XP, Linux, and Solaris. The debugging option was useful to system administrators and was often left on. For example, consider a system with one printer and one DVD drive. As before, a deadlock exists in the system if and only if the wait-for graph contains a cycle. The host computers typically differ from one another in type, speed, word length, operating system, and so on. On most computer systems, a small piece of code known as the bootstrap program or bootstrap loader locates the kernel, loads it into main memory, and starts its execution. Another important issue involves the semantics of a call. That is, when the right R* is copied from access(s,y) to access(t,l), only the right R (not R*) is created. The rings are numbered from 0 to 7. The buffer-overflow attack is especially pernicious because it can be run between systems and can travel over allowed communication channels. The openO call can also accept accessmode information—create, read-only, write, append-only, and so on. The chapter features expanded coverage of motivating virtual memory as well as coverage of memory-mapped files, including a programming example illustrating shared memory (via memory-mapped files) using the Win32 API. A system beyond class AI might be designed and developed in a trusted facility by trusted personnel. The boolean value returned from someMethod() and sends this value back to the client. When a page has been selected, however, we inspect its reference 9.4 Page Replacement reference bits pages reference bits 337 pages 10 V next victim circular queue of pages circular queue of pages (a) (b) Figure 9.17 Second-chance (clock) page-replacement algorithm. 348 Chapter 9 Virtual Memory T * rafafe ifewtfeHgiire * SJGji * * tiros * as . refefgfifgfiie M. daja * adM Coicie:=SKicioiif r= (h % fafpi Is atef) [fafts a . The function is then executed as requested, and any output is sent back to the requester in a separate message. Generically, we perform a state save of the current state of the CPU, be it in kernel or user mode, and then a state restore to resume operations. If the stored and calculated numbers are different, this mismatch indicates that the data area of the sector has become corrupted and that the disk sector may be bad (Section 12.5.3). This method requires the extra overhead of the initial request but is more flexible than the first approach. In many ways, they are also the slowest major component of the computer. The chapter provides an overview of real-time computer systems and describes how operating systems must be constructed to meet the stringent timing deadlines of these systems. One popular variation on the many-to-many model still multiplexes many user-level threads to a smaller or equal number of kernel threads but also allows a user-level thread to be bound to a kernel thread. This method is appropriate for devices that have fast response times, such as video controllers. This mechanism allows the parent process to communicate easily with its child process. In Figure 3.26 we show a C program that uses the function handle_SIGINTQ for handling the SIGINT signal. Viruses are usually borne via email, with spam the most common vector. (Hint: Restrict the generality of B; see Kessels [1977].) 6.2.2 Write a monitor that implements an alarm clock that enables a calling program to delay itself for a specified number of time units (ticks). In particular, it would be reasonable to allow only the owner of an object to set the keys for that object. Rather, a program can access an object only via the methods defined on that object by its class. The code body of P may be allowed to read or to write to the segment of A directly, even though the calling process cannot. This requirement results in a higher communication cost. Therefore, if the copy of the page on the disk has not been overwritten (by some other page, for example), then we need not write the memory page to the disk. It is already there. In a system using the working-set model, for example, we keep with each process a list of the pages in its working set. In such an environment, each computer maintains its own local file system. Let's look more closely at how the bounded buffer can be used to enable processes to share memory. These two schemes are not mutually exclusive and can be used simultaneously within a single operating system. Providing enough frames to each process to avoid thrashing may require process swapping and scheduling. Pthreads Semaphores Pthreads provides two types of semaphores—named and unnamed. Signals are defined in the include file /usr/include/sys/signal.h. Consider both the system level and the programmer level. . . . Users should not be aware that their processes are running on a paged system—paging should be logically transparent to the user. The set of pages in memory for a process depends not only on the paging behavior of that process but also on the paging behavior of other processes. The right to access must still be checked on each access, and the file-table entry has a capability only for the allowed operations. Discuss the pros and cons of the Synthesis approach to kernel design and system-performance optimization. 100 Chapter 3 Processes 3.4.2.1 Naming * Processes that want to communicate must have a way to refer to each other. The operating system would be designed to change the user ID of any program run from this directory, either to the equivalent of root or to the user ID of the owner of the directory. Modems are devices that accept digital data from the computer side and convert it to the analog signals that the telephone system uses. Perform necessary error checking to ensure that a nonnegative number is passed on the command line. The parent may have to partition its resources among its children, or it may be able to share some resources (such as memory or files) among several of its children. The searching process is time consuming. 14.6 Access In Section 10.6.2, we described how access controls can be used on files within a file system. Thus, if we had forty frames, we could run eight processes, rather than the four that could run if each required ten frames (five of which were never used). When three keys are used, the effective key length is 168 bits. Once instructions have been converted to native code, they are kept and will continue to run as native code for the CPU. The fixed location usually contains the starting address where the service routine for the interrupt is located. Periodically, or each time a program is run, the operating system recomputes the signature and compares it with the signature on the original list; any differences serve as a warning of possible infection. In general, with enough redundancy (in both hardware and data), the system can continue operation, even if some of its sites have failed. For instance, the MS-DOS format command performs logical formatting and, as a part of the process, scans the disk to find bad blocks. Output all log records currently residing in volatile storage (usually main memory) onto stable storage. It is similar in many respects to the IPC mechanism described in Section 3.4, and it is usually built on top of such a system. For instance, one user might create the file example.c, and another user might edit that file by specifying its name. 14.5 Implementation of Access Matrix How can the access matrix be implemented effectively? If a system crash occurs, the information in the log is used in restoring the state of the updated data items, which is accomplished by use of the undo and redo operations. Thread cancellation is the task of terminating a thread before it has completed. The following program segment is used to manage a finite number of instances of an available resource. However, whereas fork() has the child process inheriting the address space of its parent, CreateProcess() requires loading a specified program into the address space of the child process at process creation. We also provide a significant amount of coverage of the Linux operating system reflecting the most recent version of the kernel—Version 2.6—at the time this book was written. These locations hold the addresses of the interrupt service routines for the various devices. A multiprogrammed system will generally perform more efficiently if it has a higher level of multiprogramming. But what happens if the process tries to access a page that was not brought into memory? If you choose to add this system call to an existing file in the source directory, all that is necessary is to add the sysbelloworld() function to the file you choose, asmlinkage is a remnant from the days when Linux used both C++ and C code and is used to indicate that the code is written in C. The paging hardware, in translating the address through the page table, will notice that the invalid bit is set, causing a trap to the operating system. One concern is the size of the page table. GO Copyright © 2005 John Wiley & Sons, Inc. In both equal and proportional allocation, of course, the allocation may vary according to the multiprogramming level. Furthermore, when the kernel has finished with an object and releases it, it is marked as free and returned to its cache, thus making it immediately available for subsequent requests from the kernel.`







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