Definition:**Files**:/RegularFiles:/cannot/insert/delete/from/middle;/multiple/processes/work/on/file/same/time,/flags/are/used/to/test/and/set;/inumber/index/into/an/array/of/inodes/type/of/file,/number/of/links,/owner/id/and/group/id,/three/sets/of/permission,/size,/time/access,/modification/,/status/change,/pointers/to/disk/blocks/containinf/file’s/contents;**Directories/and/Symbolic/Links**:/allow/names/to/be/used,/almost/always/used/to/access/a/file./table:/name/>/inumber;/directory/occupy/an/inode/and/have/data/relative/path/starts/with/current/dir,/system/keeps/track/of/inumber/of/current/dir;/absolute/path/begins/with///and/starts/with/root;/kernel/reserve/inumber/for/root,/when/file/system/is/first/constructed./Program/can/not/write/a/dir/as/two/column/is/directly/used/by/kernel/and/might/mess/up/the/whole/system./Program/manipulates/a/directory/by/using/system/calls,/legal/writing/actions/are/to/add/or/remove/a/link.;/two/or/more/links/may/refer/to/same/file./No/ambiguous/when/accessing,/inode/keeps/link/count/for/removing/a/link/;/multiple/links/to/a/file/using/inumber/only/work/if/links/in/same/file/system,/symbolic/links/put/path/of/file/to/be/linked/to/in/the/data/part/of/an/actual/file,/no/read/or/write/but/use/system/calls.Special/file/typically/points/to/device;/block/and/character;/big/block/for/cache,/character/for/direct/access/and/highperformance./Special/file/has/inode,/but/no/data/instead,/a/device/number./**Program,/processes,/and/threads**:/**Program**,/collection/of/instruction/and/data/that/is/kept/in/a/regular/file/marked/executable/in/inode;/contents/obey/rules/established/by/the/kernel;/program/into/textfile/>/object/file/with/machinelanguage/translation;/linker/is/used/to/bind/object/file/with/libraries/**Process**,run/a/program;three/segs/instruct/user/data/sys/data;/**Threads**/tracked/by/kernel:/separate/flow/of/control/through/instructions,/start/with/one/threadprocess/not/detect/shared/instruc/Process:inheritance,/threads:/equal/Signal:/sent/by/kernel,/process,/another/process/or/user;/segmentationviolation/signal/by/kernel;/‘abort’/is/sent/by/process/to/terminate/with/a/core/dump;/termination/signal,/sent/by/another/process;/ctrlc/sent/by/user/ProcessID,/process/groups,/session:/pid/unique;/process/record/its/parent/id;/parent/id/set/fix/num/if/parent/terminated;/initialization/process/has/all/orphan/processes./Related/processes/are/organized/into/process/group;/process/groups/are/further/organized/into/sessions;/session/has/one/sessionleader,/process/group/has/one/processgroup/leader;/Unix/shell/creates/one/session/per/login,/form/a/separate/process/group/for/the/processes/in/a/pipeline;/kernel/allows/any/number/of/sessions/per/login/as/long/as/hierarchy/is/maintained;/session/have/controlling/terminal/opened/by/session/leader,/become/controlling/process;/job/control:/one/process/per/group/,/move/process/groups/back/and/forth,/background/process/suspended/until/moved/to/foreground;/closing/a/terminal/will/terminate/all/user’s/processes/in/that/group/unless/otherwise/specified**.Permissions**:uid/positive/int/first/process/created/and/descended/from/the/shell/inherit/this/userID,/user’s/login/groupID=group/ID/of/login/shell,inode/keeps/owner/userid/and/owner/groupid;/three/sets/of/three/permission(rwe);/permission/stored/as/octal/number:/Interprocess/communication:/Shared/file/offsets:/one/process/could/position/the/file/offset/to/some/fictitious/location/in/a/file,/second/process/figured/out/where/it/points;/Signals:/one/process/send/to/anotherProcess/tracing:/parent/control/the/execution/of/its/childFiles:/common/form/of/interprocess/communication,/eg./One/process/vi/to/write,/another/process/python/to/run;Semaphore:/is/a/counter/that/prevents/two/or/more/processes/from/accessing/the/same/resource/at/the/same/time**Filelock**:/a/special/semaphore,/prevents/two/or/more/processes/accessing/the/same/segment/of/a/file;message/queueShared/memoryfastest/interprocess/communication**Sockets**:AVOID/EXCESSIVE/SYSTEM/CALLS/;**FILEI/O**;Standard:0in/1out/2error/bits/operation/for/permission/Open:path/flag/offset/fd(lowest)/create:flag(/O\_CREAT|O\_RDWR/owener=effect/or/dirids/fileLock:O\_EXCL,mutext,MAXTRIES/umask:set/get/permission/mask/return/old/one/unlink/remove/link/reduce/i/node/count/tmpfile://6Xs/unique/name/ec\_neg1/**File/offset/and/O\_APPEND**:sequential/read/write/lseek/find/new/offset/multi/proces/go/to/end/**Write:**transfer/to/buffer/and/return/can/not/order/detect/error/write/until/read/**errorRead:**read/ahead/efficient/**close:**mark/as/reuseable/delete/if/last/closed/**User/Buffered/I/O**:/STRUC/BUFIO/transfer/to/kernel/when/full/Lseek/system/call:/set:pos/cur:cur+pos/end/end+pos/**Pread/pwrite**:/like/read/and/write/with/lseek/file/offset/isn’t/setp;/O\_APPEND/doesn’t/affect/pwrite;/avoid/offset/changed/by/other/proces/lseek/between/gap.Readv/and/writev/pointer/to/data/size/cheaper/than/multiple/write/system/call//**Synchronized/I/O**:bypass/kernel/buffering/Synchronized/vs/Synchronous:/Synchronized/I/O/means/that/a/call/to/write/doesn’t/return/until/the/data/is/flushed/to/the/output/device./(normally,/write/will/return/leaving/data/in/kernel/buffer);/Synchronous/I/O/means/that/read/doesn’t/return/until/data/is/available,/and/write/doesn’t/return/until/the/data/has/been/at/least/written/to/the/kernel/buffer./I/O/calls/(read/write,/pread,/readv,/writev)/**Buffer/Flushin**g/sync(void)flush/all/buffe;/fsync/particular/file/fdatasync/force/out/except/info/seg/flas/arrange/implicit/fsync/call/via/open/flags;/O\_SYNCfsync//writeO\_DSYNC,/implicit/fdatasync/O\_RSYNC/cause/read,/write/synchronization,/used/with/O\_SYNC/or/O\_DSYNC/inode/is/updated/in/a/synchronized/manner/**Truncate/and/ftruncate**://truncate(const/char/\*path,/off\_t/length);/ftruncate(int/fd,/off\_t/length)**Special/File/I/O**:/on/top/of/block/I/O/system//uffer/cache./Block/I/O/is/accessed/via/a/block/special/file/sequence/of/blocks/divided/to/volume/**Low/level/access**:/0/1/not/used/2/for/root/Statvfs/with/path/and/fstatvfs/with/fd./total/space/in/byte/=/f\_blocks/\*/f\_frsize;/only/two/flags/to/indicate/how/file/system/is/mounted:/ST\_RDONLY/:/read/only,/ST\_NOSUID:/setuserI/Do/nexecution/and/setgroupIDonexecution./**mounting/unmounting**/connecting/disconnecting/need:/device/number/directories/to/connect/to/**mount/umount**/fails/with/EBUSY/if/in/use;/umount2/with/flag/to/force/the/unmount;**Hard/and/Symbolic/Links**:/hardlink:name/and/an/inumber;/link/create/additional/hard/links/to/nondir;/all/links/are/equal;/must/have/write/permission/in/dir./Newpath/must/not/exist/**Rename**:/rename;/If/new/path/exists,/remove/it/with/unlink/or/rmdirLink(oldpath,/newpath)/even/if/oldpath/is/a/dir/(only/need/write/permission,/doesn’t/have/to/root)Remove/oldpath/with/unlink/or/rmdirIf/newpath/exists,/both/need/to/be/files/or/both/dirIf/newpath/exists/and/is/dir,/has/to/be/empty;/doesn’t/apply/to/oldpath/as/is/moved/into/newpathCreate/**Symbolic/Links**:/small/file/to/keep/pathsymlink.unlink/readlink/keep/derefenrencing/**Pathname**\_PC\_PATH\_MAX/pathGetcwd:/getcwd(char/\*buf,/size\_t/bufsize)/**Metadata**:/Stat,/fstat/and/lstat:/i/node/contains/a/file’s/metadataStat:/get/file/info/by/path,/lstat:/get/file/info/by/path/without/following/symbolic/link,/fstat:/get/file/by/file/descriptorStruct/stat:/device/ID/is/a/number/that/uniquely/identifies/a/mounted/file/system/atime/read/mtime/wrie/ctime/inode/changed/(status)/fstat/useful/for/pipe/socket/st\_mode/for/file/type(1st)/perimission(9.in/3/groups/)**getpwuid/**password/file**getgrgid/**group/id/**DIR**mkdir/rmdir/**change/inode/**chmode/fchmode(fd)/chown(path)/fchown(fd)/lchown(symboliclink)//**Processes&Threads/Envieonment:**/arguments/and/environments;/C/use/two/arrays/to/point/with/NUL/terminated,/aslo/counter/of/arguments;argc/doesn’t/include/NULL;\*\*environ/(global/array/of/environment/strings)=>strict/name=value/format;/getenv(char\*/var)/find/environ/var/or/null/if/not;/if/updated,/subsequential/process/will/have/new/ptr;won’t/affect/other/processes;putenv(string)/add/change;setenv(char/var,char/val,int/overwrite)/chage/add/to/env;unsetenv(char/var)/remov/env/var;modify/or/set/new/ptr/(if/not/long/enough);functions/not/valid/if/modified/environ/otherwise;setenv(if/overwrite/is/nonzero,/cover/value,if/var/doesn’t/exist,/create/new)**IMPLEMENT;/EXEC**:/process/is/executation/ecvironment/with/data;/program/is/file/with/instruction/and/data;exec/starts/new/process,fork/clone/one;/used/together;execl/path/is/executable/by/effective/userID,/last/element/of/array/of/char/pointers/must/be/NULL;/if/retaining/an/attribute/or/resource/isn’t/meaningful,/it’s/reset/to/default;**execAB**(A:l(direct/list),v(array),/B:p(path)/e/(environment));/**execl**/execute/file/with/argument/list;/other/can/put/argument/in/an/array/instead/of/listing/them/(if/arg/number/not/known),searching/for/prog/w//path,/manually/passing/environ/pointer;/execlp,execvp/execute/program/or/scrip/file/with/arg;/#!/Pathname/>/interpreter;**fork**/creates/process/but/no/program;/after/fork/return,/both/parent/and/child/receive/the/same/return,parent/processID/child/0;child/created/by/fork/inherits/most/attributes/from/its/parent;**different**:processID,/only/thread/with/fork/,same/file/description/but/different/descriptor/child/accumulated/exec/time/is/0;fork/is/expensive,**virtual/memory**/copy/on/write/collection/of/pages/copy/each/page/when/trying/to/write/efficient/with/dynamic/allocation/hardware;vfork/child/parent/share/same/data/segment/don’t/use;**system**/run/command/does/a/fork/followed/by/an/exec/passing/command/arg/as/a/shell/command/line/**exit/**four/ways/for/termination:/call/exit/call/\_exit,/receive/terminal/signal,system/crash;\_exit/and/\_Exit(fromC)/exactly/same,exit(fromC)/does/\_exit/and/higherlevel/clean/up;ec/macro/error/checking/functions/registered/atexit/sideeffects:all/open/file/descriptors/closed/if/session/leader/session/loses/controlling/terminal/parent/process/not/notified/**wait/waitpid/waitid/**waits/for/a/child/process/to/change/state/then/retrieves/that/processes’s/status;waitpid(pid,statusp,options)/pid/>0child/process/with/that/process/ID/minus1/for/any/child/process;0/for/any/child/process/in/the/same/process/group/as/calling/process;<minus1/wait/for/any/child/process/in/the/process/group/whose/process/gid/is/minus/pid;waitpid/returns/child/Pid/because/childproc/mathcing/pid/changed/status;only/child/created/by/fork/can/be/waited/for;one/return/for/each/child;waitpid/block/if/nochild/changes/state/no/child/matching/pid/return/error;wait(statusp)/inappropriate/for/large/because/wait/for/all/children;**waitid/**gets/id/and/keep/waitable/**signal,termination,waiting:**parent/receiving/child/signal/by/going/over/one/by/one/or/use/sigaction/flag;**user/and/group/id:**getuid/geteuid/getgid/getegid/getpwuid/getgrgid/**setting/user/and/group/ids:**kernel/keeps/original/euser/egroup/that/were/set/by/the/last/exec;rules:other/than/exec/no/process/can/explicitly/change/real/userID/or/SavedID;ordinary/change/to/savedid;superuser/change/to/any/id/while/change/savedid;exec/cause/real/and/e/diff/process/can/go/back/and/forth;seteuid/setugid/for/ordinary/setuid/setgid/for/superuser;**getpid,getppid**;InterprocessCommunication**Pipe:**create/communication/channel/**PIPE\_BUF**/as/buf/size/of/the/pipe;**system/call/act/differently**/write:sequential,block/if/no/space/no/parital/write(if/size/smaller/than/buf);read:sequential;close:free/up/file/des/when/all/writing/file/desc/closed/used/as/end/of/file;fstat/determine/the/file/descriptor/is/open/to/a/pipe;**dup&dup2**/dup/takes/lowest/open/file/descriptor/dup2/can/specify;**FIFO:**pipes/only/works/if/two/processes/related;combined/features/of/a/regular/file/and/a/pipe;FIFO/opened/for/readig/open/waits/until/it/is/also/opened/for/writing/allow/synchronize/before/actual/data/use/O\_NONBLOCK/for/only/read/**mkfifo**(\*path,perms)/opend/twice/for/read/and/write;read/write/a/whole/buffer/size;/can’thave/multiple/reader/has/to/copydata/writer/blocks/for/too/big/data;/



