ORANE LABS ORANE LABS ORANE LABS ORANE LThe Linux Environment NE LABS Unix is simple and coherent, but it takes a genius (or at any rate a programmer) to understand and appreciate the simplicity. ORANE LABS **B**5 — Dennis Ritchie ORANE LABS ORANE LABS ORANE LABS The Environment ORANE LABS SHC HT KANPUR SHC HT KANPUR This is mainly om concerned with the environment under 35 OR which programs are run. · Passing arguments to programs. Environment variables

The main topics of

discussion are:

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Temporary FilesFinding out time.

and computer.

· Getting information about user

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Program Arguments ORANE LABS ORANE LABS SI • When a Linux or UNIX program written in Cruns, it starts at UR the function main. For these programs, main is declared as www.oraint main(int argc, char *argv[]) labs.com where argc is a count of the program arguments and argv is an array of character strings representing the arguments themselves. SHC HT KANPUR For example, if we give the shell the following command, www.—\$myprog left right 'and center' abs.com – the program myprog will start at main with parameters: ORANE argc: 435 argv: {"myprog", "left", "right", "and center"} ORANE LABS ORANE LABS ORANE LABS ORANE LABS ORANE LABS #include <stdio.h> #include <stdlib.h> www.cint main(int argc, char *argv[]) nelabs.com ORANE LABS ORANE LABS for(arg = 0; arg < argc; arg++) { KANPUR if(argv[arg][0] == '-')www.oranprintf("option: %s\n", argv[arg]+1); com

ORAN printf("argument %d: %s\n", arg, argv[arg]); ORANE LABS

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exit(0);

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Output

\$./args -i -lr 'hi there' -f fred.c www.oranelabs.com

Option: i ABS ORANE LABS

Slioption: Ir PUR

argument 3: hi there

ORANE LABS Option: f ABS

SHargument 5: fred.c HT KANPUR

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getopt ORANE LABS

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Linux provides the getopt facility, which KANPUR supports the use of options with and without some

or values and is simple to use. as ORANE LABS

SIIC #include <unistd.h>IT KANPUR

— int getopt(int argc, char *const argv[], const char *optstring);

ORA_ extern char *optarg;

- extern int optind, opterr, optopt;

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getopt() parameters

- SI orgc: number of arguments passed SHO HT KANPUR
- www argv: The parameters passed com
- The *optstringis* simply a list of characters, each representing a single character option. If a character is followed by a colon, it indicates that the option has an associated value that will be taken as the next argument.
 - For example, the following call would be used to handle our preceding example
- www.o=getopt(argc, argv, "if:lr"); elabs.com

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Return results

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- The return result for getopt is the next option ANPUR character found in the argy array (if there is one).

 Call getopt repeatedly to get each option in turn.

 It has the following behavior:
- SIIC + If the option takes a value, that value is pointed to by PUR the external variable optarg.
- getopt returns -1 when there are no more options to
 process. A special argument, --, will cause getopt to ABS stop scanning for options.
- getopt returns? if there is an unrecognized option,
 www.or.which it stores in the external variable optopt.

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```
ww#include <stdio.h> m
  #include <unistd.h>
                                case '?':
  #include <stdlib.h>
                      \bigcirc RANE printf("unknown option: %c\n", \land RE
  int main(int argc, char *argv[])
                                  optopt);
                      SIIC IIT Ibreak; UR
SHC HT KANPUR
  int opt;
www.while((opt = getopt(argc, argv, orane labs.com
     ":if:lr")) != -1) {
  switch(opt) {
                                for(; optind < argc; optind++)
  case 'i':
                               printf("argument: %s\n", _ KANPUR
                                  argv[optind]);
wwcaserinelabs.com
                     www.oraneexit(0);om
  printf("option: %c\n", opt);
O break; E LABS
                                            ORANE LABS
  case 'f':
SUprintf("filename: %s\n", optarg); IT KANPUR
  break; nelabs.com
  case ':':
printf("option needs a value\n");
                                             DRANE LABS
  break;
    These are variables that can be used to control
www.the behaviour of shell scripts and other anelabs.com
or programs.
                      ORANE LABS
                                            ORANE LABS
SI You can also use them to configure the user's PUR
     environment. www.oranelabs.com

    you can examine environmen

                                            boot
     the shell prompt:
                                            /dev
         $ echo $HOME
                                             home
        /home/Ankur
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```

Jsing C Program ORANE A C program may gain access to environment variables using the putenv and getenvoranelabs.com or functions. ORANE LABS ORANE — char *getenv(const char *name) — int putenv(const char *string); L_ABS ORANE LABS ORANE LABS ORANE LABS Trying puteny and geteny SI. The first few lines after the declaration of main NPUR ensure that the program, has been called correctly with just one or two arguments: ORA#include <stdlib.h> RANE LABS ORANE LABS #include <stdio.h> #include <string.h> www.int main(int argc, char *argv[]) bs.com ORA LARS ORANE LABS char *var, *value; ORANE LABS SHC if(argc == 1 | argc > 3) {T KANPUR fprintf(stderr,"usage: environ var [value]\n"); oranglabs.com exit(1); DRANE LABS ORANE LABS ORANE LABS

Step 2 ORANE LABS ORANE LABS fetching the value of the variable from the ANPUR www environment, using getenv: com ORAvar = argv[1];ORANE LABS ORANE LABS if(value) printf("Variable %s has value %s\n", var, value); else printf("Variable %s has no value\n", var); ORANE LABS ORANE LABS ORANE LABS Step 3 labs.com Next, check whether the program was called with a second argument. If it was, you set the variable to the value of that argument by SII constructing a string of the form name=value and then calling putenv: PUR if(argc == 3){ char *string; value = argv[2]; string = malloc(strlen(var)+strlen(value)+2); ORANE LABS fprintf(stderr,"out of memory\n"); www.exit(1); elabs.com strcpy(string,var); ORANE LABS ORANE LABS strcat(string,"="); strcat(string,value); strcat(string,value); printf("Calling putenv with: %s\n",string); www.if(putenv(string)!=0) { fprintf(stderr,"putenv failed\n"); ORANE LABS ORANE LABS Offree(string); ABS exit(1);

Step 4 ORANE LABS ORANE LABS Finally, getting the new value of the variable by calling getenv once again: continue = getenv(var); ORANE LABS if(value) SHC HT KANPUR printf("New value of %s is %s\n", var, value); www.oranelabs.com www.oranelabs.com ORANI printf("New value of %s is null??\n", var); RANE LABS www.oranelabs.com ORANE LABS ORANE LABS ORANE LABS Sample Run ORANE LABS ORANE LABS SHC \$1./environ/HOMEIC HT KANPUR www.Variable HOME has value /home/Ankurww.oranelabs.com \$./environ Ankur ORANE LABS Variable Ankur has no value \$./environ Ankur hello Variable Ankur has no value Calling putenv with: Ankur=hello ORANE LABS New value of Ankur is hello \$./environ Ankur Variable Ankur has no value ORANE L ORANE LABS ORANE LABS

The environ Variable ORANE LABS ORANE LABS

SIIC IIT KANPUR

 This array of strings is made available to SIIC programs directly via the environ variable, KANPUR

www.which is declared as an elabs.com

ORA-#include <stdlib.h>NE LABS

- extern char **environ;

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ST#include <stdlib:h> SHC HT KANPUR

#include <stdio.h> extern char **environ;

ORANE LABS oint main() ABS

SHC HT KANPUR

char **env = environ;
www.oranelabs.com while(*env) {

wwexit(0);elabs.com

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Time and Date

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Times are handled using a defined type, a KANPUR www.time_t. This is an integer type intended to be seem or large enough to contain dates and times in LABS

seconds.

#include <time.h>

time_t time(time_t *tloc);

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ST#include <time.h> R #include <stdio.h>

#include <unistd.h>

#include <stdlib.h> int main()

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wwtimert the time; om

 $for(i = 1; i \le 10; i++) {$

O the_time = time((time_t *)0); ANE LABS printf("The time is %Id\n", the_time);
sleep(2);

www.oranelabs.com exit(0);

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Converting time into a readable format ORAL char *ctime(const time_t *timeval); ORANE LABS It takes a raw time value and converts it to a NPUR www.more readable local time.bs.com ORANE LABS ORANE LABS ORANE LABS ORANE LABS ORANE LABS ORANE LABS Example ORANE LABS ORANE LABS SI#include < time.h > IIC IIT KANPUR ww#include <stdio.h>vw.oranelabs.com O#include < stdlib.h>RANE LABS ORANE LABS SHINT main() PUR www.oranelabs.com time_t timeval; ORANE LABS ORANE LABS (void)time(&timeval); printf("The date is: %s", ctime(&timeval)); exit(0); ORANE LABS

Temporary Files

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Often, programs will need to make use of

OR temporary storage in the form of files. NE LABS

SIO These might hold intermediate results of a ANPUR www.computation or represent backup copies of abs.com files made before critical operations. ANE LABS

The serious issue here is that each temp file should have a new name.

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A unique filename can be generated ORANE Lby the tmpnam function are LABS

SII Syntax: PUR

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ORA— char *tmpnam(char *s); LAB5 ORANE LABS

SIP If the temporary file is to be used SHO HT KANPUR www.immediately, you can name it and open it at balloom the same time using the tmpfile function.

- #include <stdio.h>

LE *tmpfile(void);

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Example ORANE LABS ORANE LABS #include <stdio.h> int main() www.oranelabs.com char tmpname[L_tmpnam]; ORANE LABS char *filename; FILE *tmpfp; filename = tmpnam(tmpname); www.oprintf("Temporary file name is: %s\n", filename); www.oranelabs.com tmpfp = tmpfile(); ORANE LABS ORANE LABS $OR\Delta if(tmpfp)\Delta BS$ printf("Opened a temporary file OK\n"); else MANPUR www.perror("tmpfile"); exit(0);ORANE LABS ORANE LABS ORANE LABS ORANE LABS ORANE L

- When a user logs in to a Linux system, he or NPUR www she has a username and password.
- O• Once these have been validated, the user is ABS SIIC presented with a shell. KANPUR SIIC IIT KANPUR
- identifier known as a UID.
- Each program that Linux runs is run on behalf of a user and has an associated UID.
- Information can also be extracted from this UID

The sys/types.h header file • The UID has its own type — uid t— defined in sys/types.h. Normally, users usually have UID values larger SHE than: 100. IR www.#include <sys/types.h>nelabs.com #include <unistd.h> ORANE LABS uid_t getuid(void); char *getlogin(void); ORANE LABS ORANE LABS ORANE LABS The Password File ORANE LABS ORANE LABS All information pertaining to a logged in user, SIIC can be extracted from this file, barring the ANPUR www.password.m ORA#include <pwd.h>RANE LABS ORANE LABS struct passwd *getpwuid(uid_t uid); struct passwd *getpwnam(const char *name); ORANE LABS ORANE LABS ORANE LABS

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The password database structure, passwd

SI	IC IIT KANPUR	SHC	IIT KANPUR	SHC	IIT KANPUR
WY	passwd Member		Description		relabs.com
0	char*pw_name		The user's login name		E LABS
SI	uid_t pw_uid The		UID number		KANPUR
WV					relabs.com
0	gid_t pw_gid		The GID number		E LABS
SI	char*pw_dir		The user's home direct	tory	KANPUR
WV	char *pw_gecos		The user's full name		relabs.com
0	char *pw_shell		The user's default She	Н	E LABS

www.oranepw=getpwuid(uid); ranelabs.com Example printf("UID passwd entry:\n #include <sys/types.h> name=%s, uid=%d, gid=%d, home=%s, shell=%s\n", ORANE #include <pwd.h> pw->pw_name, pw->pw_uid, pw->pw_gid, pw->pw_dir, #include <stdio.h> #include <unistd.h> www.oranelapwc>pw_shell); oranelabs.com #include <stdlib.h> int main() ORANE pw=getpwnam("root"); LABS printf("root passwd entry:\n"); SHuid It uid; ANPUR printf("name=%s, uid=%d, wwgid_t gid;labs.com www.oranela**gid=%d, home=%s,**anelabs.com struct passwd *pw; shell=%s\n", uid = getuid(); 35 ORANE pw->pw_name, pw->pw_uid,\ RS pw->pw_gid, pw->pw_dir, gid = getgid(); SHC HT KApw->pw_shell); HT KANPUR printf("User is %s\n", exit(0);getlogin()); printf("User IDs: uid=%d, \bigcirc R /gid=%d\n", uid, gid); RANE ORANE LABS

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Host Information

- Just like UID, you can also get useful CHT KANPUR www.information.about the host machine.
- If the system has networking components LABS installed, you can obtain its network name ANDUR very easily with the gethostname function:

 #include < unistd.h>

int gethostname(char *name, size_t namelen);

- The gethostname function writes the machine's network name into the string name.
 - gethostname returns 0 if successful and -1

You can obtain more detailed information about the host computer from the uname

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system call:

— #include <sys utsname.h=""></sys>							
OF	Utsname	Member Description	RANE LABS				
SII	charsysname[]	The operating system name	IC IIT KANPUR				
ww	char nodename[]	The host name	vw.oranelabs.com				
OF	char release[]	The release level of the system	RANE LABS				
SII	char version[]	The version number of the system	IC IIT KANPUR				
WW	char machine[]	The hardware type	vw.oranelabs.com				

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Example #include <sys/utsname.h> ANE LABS ORANE LABS #include <unistd.h> #include <stdio.h> #include <stdlib.h> int main() ORANE LABS ORANE LABS SI char computer[256]; SIIC IIT KANPUR struct utsname uts; if(gethostname(computer, 255) != 0 || uname(&uts) < 0) { O fprintf(stderr, "Could not get host information\n"); \(\text{NE} \) \(\text{LABS} \) exit(1); wwprintf("Computer host name is %s\n", computer); woranelabs.com printf("System is %s on %s hardware\n", uts.sysname, uts.machine);